Great Basin Spadefoot (*Spea intermontana*) Auditory Surveys in the Cariboo Region of British Columbia, 2007

by

Hamish Nicolson
Ecosystems Biologist
Ministry of Environment
100 Mile House

and

Roger Packham, RPBio
Senior Ecosystems Biologist
Ministry of Environment
100 Mile House

Ministry of Environment

December, 2008

Abstract
We conducted auditory surveys to further document the distribution of Great Basin Spadefoot (*Spea intermontana*), Western Toad (*Bufo boreas*), Wood Frog (*Rana sylvatica*), Pacific Chorus Frog (*Pseudacris regilla*), and Columbia Spotted Frog (*Rana luteiventris*) populations in the Cariboo Region. Surveys were conducted by Ministry of Environment (MoE) biologists, BC Conservation Corps (BCCC) employees, members of the Canoe Creek Indian Band (CCIB), and volunteers. We conducted a total of 330 auditory surveys to detect calling male Great Basin Spadefoots and other amphibians at 202 different sites between May 2 and July 7, 2007. Sixty-one of 202 sites surveyed had 1 or more target amphibian species present. We detected spadefoots at 45 sites, including 6 ponds with other species present. Spadefoots were detected calling from May 02, to June 27, 2007. We estimated the number of spadefoots detected at a single site between 1 and 25 individuals. We also detected Western Toads, Wood Frogs, and Pacific Chorus Frogs during this period. We did not detect Columbia Spotted Frogs on any surveys.

Keywords: Great Basin Spadefoot (*Spea intermontana*), auditory call survey, Cariboo Region, distribution.

Table of Contents

List of Figures

List of Tables

List of Appendices

Introduction

The Great Basin Spadefoot (Anura: Pelobatidae: *Spea intermontana*, Cope 1883) is broadly distributed across arid grassland regions of western North America. The species range extends from British Columbia south to the Colorado River, west to the Sierra-Nevada and Cascade ranges, and east across the Rocky Mountain divide (Jones et al. 2005). In British Columbia, the species is known to occur in the Okanagan, Similkameen, Kettle, Granby, Fraser, Thompson, and Nicola valleys (B.C. Southern Interior Reptile-Amphibian Recovery Team 2007). Prior to surveys conducted in the Cariboo in 2006, spadefoots were only thought to exist in the above drainages at low to mid-elevations (Figure 1). The Cariboo Region is the known northwest distribution limit of the species range, where they generally occupy habitats >1000m above sea level.

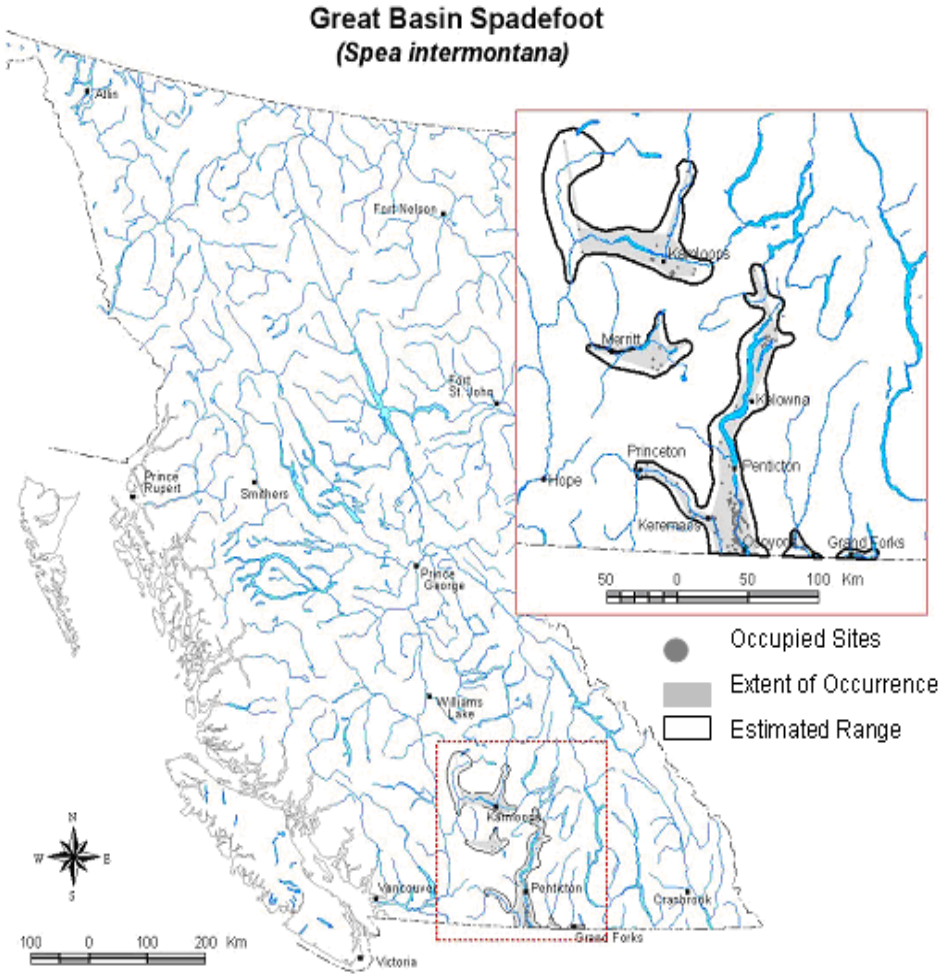


Figure 1. Known distribution of the Great Basin Spadefoot in British Columbia prior to 2006 (B.C. Southern Interior Reptile-Amphibian Recovery Team, 2007).

Spadefoots breed in a wide variety of temporary and permanent water bodies, but appear to prefer small ephemeral pools (COSEWIC 1998, 2007; Jones et al. [eds.] 2005). Seasonally wetted margins of wetlands and larger water bodies may also provide suitable breeding habitat. Key features of breeding sites include: retention of water until tadpoles have metamorphosed (April to end of June in British Columbia); warm shallow areas for

egg-laying and larval development; and the absence of predatory fish (COSEWIC 1998, 2007; Sarell, 2004). Extremely alkaline water bodies with a pH >10 appear to be unsuitable (COSEWIC 1998, 2007).

Suitable semi-arid terrestrial habitat is required year round for spadefoot foraging, estivation, and hibernating (COSEWIC 1998, 2007). Principal features of terrestrial habitat include: abundant invertebrate prey; loose, deep, and friable (crumbly) soils for burrowing; and burrows to provide shelter (COSEWIC 1998, 2007; Sarell 2004). Furthermore, habitat connectivity between aquatic breeding sites and terrestrial habitats is required to allow seasonal migrations among breeding sites to permit dispersal, colonization of new sites, and persistence of populations across the landscape (Semlitsch 2000, 2002).

The Great Basin Spadefoot was designated nationally as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2001 (Ovaska 2006). Spadefoots are on the British Columbia Blue List (indigenous species or subspecies of special concern in British Columbia) (B.C. Southern Interior Reptile-Amphibian Recovery Team 2007). Great Basin Spadefoots are designated as a priority 1 species under Goal 2 of the Conservation Framework. Goal 2 aims to prevent species and ecosystems from becoming at risk.

The Cariboo Region contains hundreds of potential spadefoot breeding sites with suitable terrestrial habitat and connectivity between adjacent water bodies. These sites range from ephemeral pools and wetlands to larger water bodies and lakes in semi-arid grassland habitat and open Lodgepole pine forest. Cariboo grasslands support abundant invertebrate, rodent, and mammal communities, including red-listed badger (*Taxidea taxus jeffersonii*).

Male spadefoots, toads and frogs have distinct species specific mating calls during their breeding period. Preliminary auditory surveys conducted in the Cariboo Region in 2006 (Verkerk et al. 2006) detected spadefoots at 12 of 18 sites near Meadow Lake and Alberta Lake, approximately 25 km west of 70 Mile House, BC. The objective of our 2007 auditory surveys was to further document the distribution of Great Basin Spadefoot, Western Toad (*Bufo boreas*), Wood Frog (*Rana sylvatica*), Pacific Chorus Frog (*Pseudacris regilla*), and Columbia Spotted Frog (*Rana luteiventris*) populations in the Cariboo Region, BC by surveying ponds over a larger geographic area.

Study Area

The study area is located near 70 Mile House in the Cariboo Region of British Columbia. The study area is located in the Central Interior Ecoprovince, Fraser Plateau Ecoregion, Cariboo Basin and Fraser River Basin Ecosections, in the Interior Douglas-fir biogeoclimatic zone (Meidinger and Pojar 1991). Most survey sites were located west of 70 Mile House and Highway 97 in the vicinity of Alberta and Meadow Lakes. Surveys were also conducted southeast of Clinton near Loon Lake, and west of the Fraser River near Churn Creek (Figure 2).

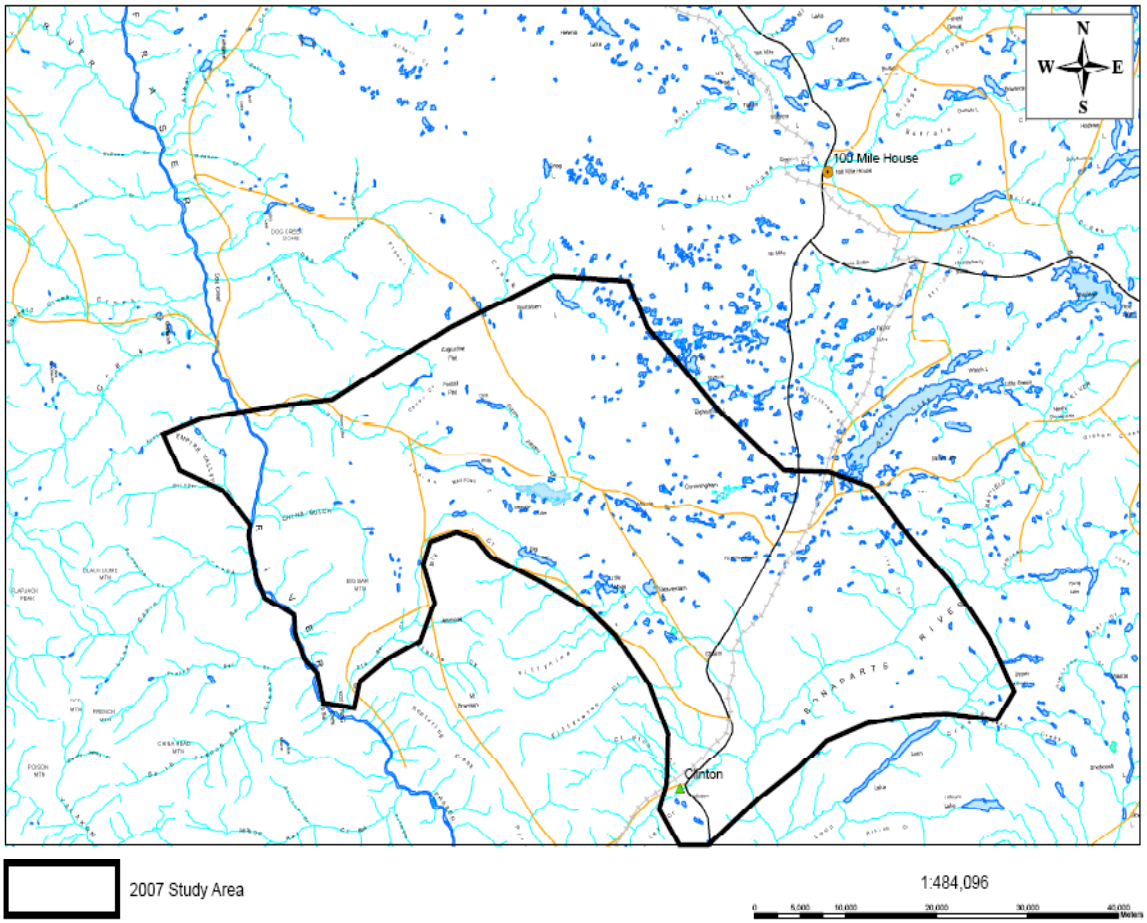


Figure 2. Study area overview of the 2007 Great Basin Spadefoot auditory survey, Cariboo Region, B.C.

Methods

We used auditory surveys to detect the presence of spadefoots and other amphibian species. Surveys were conducted by B.C. Ministry of Environment (MOE) biologists, BC Conservation Corps (BCCC) employees, members of the Canoe Creek Indian Band (CCIB), and volunteers. We provided surveyors with an information package containing: 1) a spadefoot information brochure, 2) a CD recording of spadefoot, toad and frog calls for the Cariboo, 3) an Excel spreadsheet for recording survey results, and 4) map sheets (TRIM digital base map 1: 20,000) for areas to be surveyed.

To identify species, surveyors familiarized themselves with the mating calls of 5 target species: Great Basin Spadefoot, Western Toad, Wood Frog, Pacific Chorus Frog, and Columbia Spotted Frog. To verify identifications, volunteers carried with them the spadefoot, toad and frog call CD and CD player on field surveys.

The study area contains hundreds of potential spadefoot breeding ponds. We selected survey sites based on 3 main criteria: 1) ponds adjacent to grassland habitats; 2) sites providing a broad distribution across 1:20,000 mapsheets to maximize the area surveyed to determine distribution; and 3) sites located close to roads when possible for ease of survey access. To describe weather conditions at the time of survey, we recorded: 1)

cloud cover (%); 2) precipitation (Y/N); 3) recent rainfall in the last 24/48 hrs (Y/N); and 4) approximate temperature (degrees Celsius).

We commenced auditory surveys at least 30 minutes after sunset determined by the Environment Canada website. Upon arriving at a survey site, we waited 5 minutes prior to beginning a survey to reduce the effect of disturbance caused by our approach. We surveyed ponds for a minimum of 5 minutes. For each survey we estimated the number of amphibians detected using a calling index (Gartshore et al. 1992). We assigned abundance codes of 0 to 3 {abundance code 0 = no amphibians can be seen or heard; abundance code 1 = individuals can be counted (estimate number), calls not overlapping; abundance code 2 = some individuals can be counted (estimate number), other calls overlapping; abundance code 3 = full chorus, calls continuous and overlapping} to each site surveyed. We recorded all data on Amphibian Auditory Survey forms (Appendix 1). We marked clearly on maps all ponds surveyed with the corresponding survey number from the Amphibian Auditory Survey Form, to cross reference data forms to maps. We used GIS analysis to create a minimal convex polygon, and counted the number of wetland polygons within the area to determine the total number of potential spadefoot breeding sites in the study area.

Data management

We recorded UTM coordinates for the centroids of all ponds surveyed using iMapBC (version 2.1.5) GIS mapping software. We also assigned each site a unique number from 1 to 202 for identification purposes. We entered all survey data into an Excel spreadsheet directly from field data forms, and checked data files against the field data forms to ensure transcription accuracy. We generated an overview map of the study area; an overview map of the study area with all species and null detections (Appendix 2); individual maps for each species indicating detections at all survey sites (Appendices 3-6); and an individual map of all null detections at survey sites (Appendix 7).

Results

We conducted a total of 330 auditory surveys at 202 different sites to detect calling spadefoots, toads and frogs. We surveyed 187 (6%) of an estimated 3,169 available wetland polygon units within the 261,708 ha (minimal convex polygon) study area. We conducted surveys on 31 separate dates from May 2 to July 7, 2007, and detected spadefoots over 14 dates; 11 in May and 3 in June (Table 1). Spadefoots were detected calling from May 02, to June 27, 2007. We also detected Western Toads, Wood Frogs, and Pacific Chorus Frogs during this period. We detected spadefoots on 63 of 330 surveys (19%). We classified 42 of 63 spadefoot detections (67%) as abundance code 1, 18 (29%) as abundance code 2 and 3 (5%) as abundance code 3 (Table 2). We conducted between 1 and 8 surveys at each site (median = 4.5) (Figure 3; Table 3). Spadefoots were detected in 41 ponds (91%) during the first call survey, in 3 ponds (7%) not until the second call survey, and in 1 pond (2%) not until the fifth survey.

Table 1. Survey detection dates by species for amphibian surveys in Cariboo Region, BC 2007.

Date (YYYY-MM-DD)	Great Basin Spadefoot	Western Toad	Wood Frog	Pacific Chorus Frog	Columbia Spotted Frog
2007-05-02	✓	0	✓	0	0
2007-05-14	✓	✓	✓	0	0
2007-05-18	0	0	0	✓	0
2007-05-19	0	0	0	✓	0
2007-05-22	✓	0	0	0	0
2007-05-23	✓	0	0	0	0
2007-05-24	✓	0	0	0	0
2007-05-25	0	0	0	✓	0
2007-05-26	✓	0	0	✓	0
2007-05-27	✓	0	0	0	0
2007-05-28	✓	0	0	0	0
2007-05-29	✓	✓	0	✓	0
2007-05-30	✓	✓	0	0	0
2007-05-31	✓	0	0	✓	0
2007-06-01	0	0	0	✓	0
2007-06-06	0	✓	0	0	0
2007-06-07	✓	0	0	0	0
2007-06-15	✓	0	0	0	0
2007-06-18	0	✓	0	0	0
2007-06-19	0	✓	0	0	0
2007-06-27	✓	0	0	0	0
	14	6	2	7	0

Table 2. Number of detections of 5 target amphibian species by abundance class in Cariboo Region, BC 2007.

Species	No. in abundance Class 1	No. in abundance Class 2	No. in abundance Class 3
Great Basin Spadefoot	42	18	3
Western toad	7	0	2
Wood frog	3	0	0
Pacific Chorus Frog	12	0	0
Columbia Spotted Frog	0	0	0

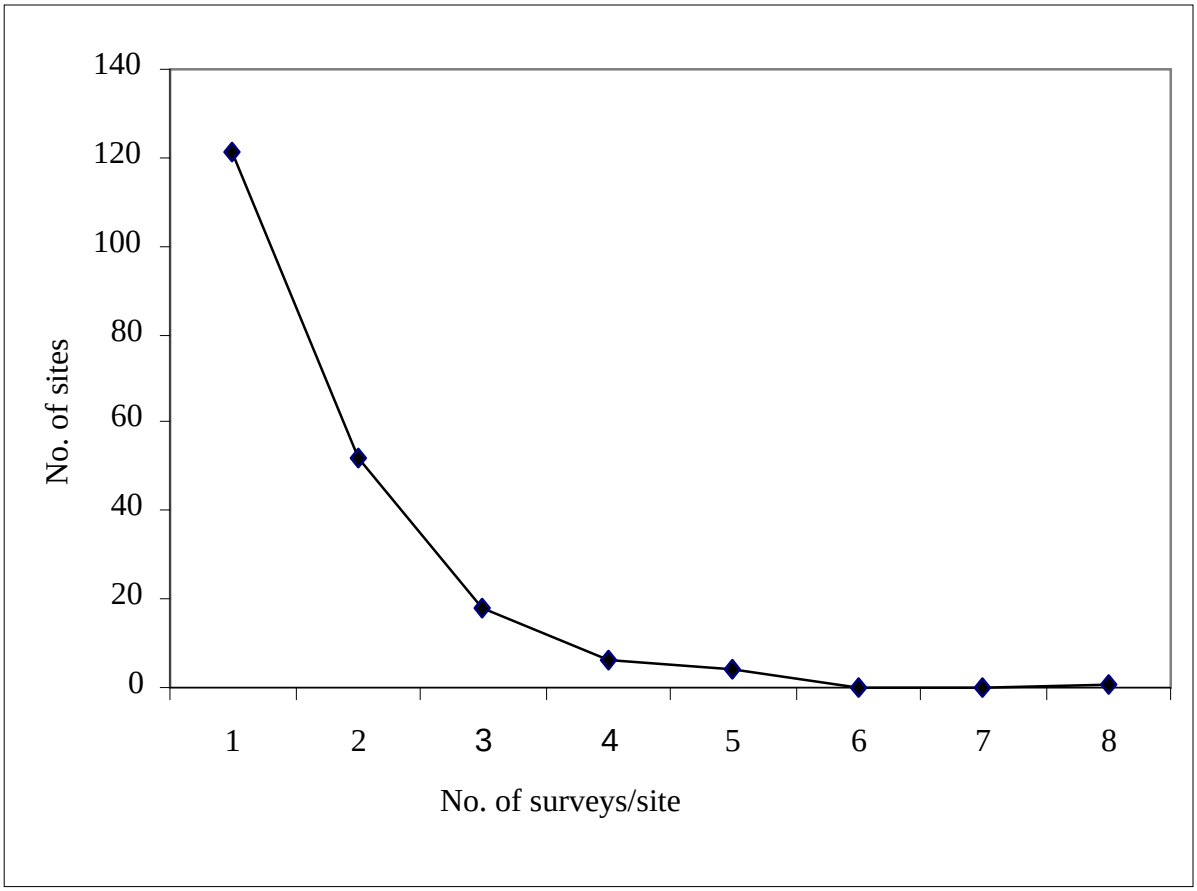


Figure 3. Frequency distribution of the number of auditory surveys conducted at each site.

Table 3. Survey detections for amphibian surveys in the Cariboo Region, BC 2007.

Species	No. sites	% of sites	No. of detections	% of total detections	No. of days	% of all surveys
Great Basin Spadefoot	45	22	63	19	14	45
Western Toad	8	4	9	3	6	19
Wood Frog	3	1	3	9	2	6
Pacific Chorus Frog	12	6	12	4	7	22
Columbia Spotted Frog	0	0	0	0	0	0

Our 2007 surveys documented spadefoots at a wide range of sites. We documented spadefoots breeding in habitats ranging from ephemeral wetlands and pools (Appendices 8 & 9), to the shallow waters and margins of permanent water bodies and lakes (Appendix 10). We detected 1 or more of 5 target amphibian species at 61 of 202 sites surveyed (30%). Of these 61 sites we identified 39 with only spadefoots, 6 with spadefoots and other anurans, and 16 with other anurans and no spadefoots (Table 4). We did not detect Columbia Spotted Frogs. We identified spadefoots at (n=6) multiple-species breeding ponds. We detected spadefoots at 45 of 202 (22%) sites surveyed. We estimated the number of spadefoot individuals detected at a single pond between 1 and 25.

Table 4. Species composition for 61 sites with amphibians detected.

Species	No. of detection sites
Great Basin Spadefoot	39
Great Basin Spadefoot and Western Toad	4
Great Basin Spadefoot, Western Toad & Wood Frog	1
Great Basin Spadefoot & Wood Frog	1
Western Toad	3
Wood Frog	1
Pacific Chorus Frog	12
Columbia Spotted Frog	0
Total	61

Discussion

The recovery goal for Great Basin Spadefoots in British Columbia is to "ensure that there is sufficient, secure, habitat distributed throughout the historic range to maintain a self-sustaining population, or populations, in each major watershed" (B.C. Southern Interior Reptile-Amphibian Recovery Team 2007). The previous extent of known occurrence of spadefoots in British Columbia was 30,770 km^2. Spadefoots were known to occupy an area of 221 km^2, at an estimated 235 sites (Ovaska 2006). We documented 45 sites where spadefoots were calling during the breeding period in our 2007 surveys. Eight of the 45 sites were originally located in 2006; therefore, 37 new breeding sites were located in 2007. This is a 16 % increase in the number of known spadefoot locations in British Columbia. We surveyed 6 % of the potential wetland polygons in our study area and detected spadefoots at 22 % of all sites surveyed. Theoretically this suggests that there may be hundreds of additional spadefoot sites within the study area.

We recorded spadefoots at 3 sites near the Canoe Creek Indian Band Reserve east of the Fraser River in the area known as Long Run. These results extend the known spadefoot distribution beyond the immediate vicinity of Alberta Lake and Meadow Lake. Connectivity of populations between these areas should be a priority for investigation in 2008. Spadefoots were not recorded at 11 sites surveyed west of the Fraser River in the vicinity of Churn Creek.

Spadefoots breed from early April through to June, and usually wait for rainfall before breeding (Matsuda et al. 2006). Our first survey was conducted on May 02, and last survey on July 07, 2007. We recorded spadefoots calling from May 2 until June 27, 2007. Therefore, it is likely that spadefoots began calling earlier in the spring, before our first survey.

Site 135 (Appendix 8) is a roadside ephemeral pool. Ephemeral sites which fill with water and dry up annually are preferred habitat for breeding spadefoots (Hallock 2005; Sarell 2004). We surveyed this site 5 times between May 31 and June 27, but only detected spadefoots on the second survey on June 7, 2007 (abundance class 3; no. individuals estimated = 15). Site 135 contained water during all surveys; however by late August the site was dry, as were many other sites where spadefoots were recorded. To ensure successful breeding, sites must retain sufficient water for a period of at least 6 weeks from mid-April to late May (B.C. Southern Interior Reptile-Amphibian Recovery Team 2007). Verification of metamorphosis should be a priority at these sites.

Auditory call surveys are widely used to detect breeding anurans. However, this method is not without limitations. Some species are more likely to be detected than others. Thus, detections may be biased towards species that call loudly and frequently, like spadefoots and Pacific Chorus Frogs. Such species may even drown out the calls of others (Ministry of Environment, Lands and Parks, 1998). We did not detect Columbia Spotted Frogs during the 2007 surveys. Columbia Spotted Frogs breed from early April to mid-May in the southern interior, often before surface ice has completely melted off breeding ponds (Matsuda et al. 2006). Our first survey was conducted on May 2; therefore, we could have missed Columbia Spotted Frog breeding events. Breeding Columbia Spotted Frogs may also go undetected by auditory surveys because their calls are low in pitch and volume, and consequently have little carrying power (Matsuda et al. 2006). Furthermore, their breeding period is relatively short, lasting a maximum of 2 weeks (Matsuda et al. 2006). At the northern extent of their range, breeding activity regularly continues throughout daylight hours, and can be finished in days (Matsuda et al. 2006). It is possible that we may have missed these events in our surveys.

We only detected Wood Frogs during the first 2 survey dates in early May. Similar to Columbia Spotted Frogs, Wood Frogs initiate breeding early in spring, often before all surface ice on breeding ponds has melted. They can breed at temperatures just above freezing (Matsuda et al. 2006). In the southern part of their range, breeding activity occurs for a few weeks throughout daylight hours, and in the north is over within a few days (Matsuda et al. 2006). It is probable that the 2 Wood Frog detections in early May were recorded at the end of their breeding period.

We modeled our 2007 inventory auditory survey protocols on Inventory Methods for Pond-breeding Amphibians and Painted turtle (Ministry of Environment, Lands and Parks 1998). This document recommends a minimum of 3 - 5 visits per site, and survey times of 3 minutes, based on work by Shirose et al. (1995), who reported that the number of detections of new species declines rapidly after the first minute of an auditory survey. At the time of publication, these protocol recommendations were in accordance with the

North American Amphibian Monitoring Program (NAAMP) guidelines. The lack of consistent replicate surveys in our 2007 inventory does not permit confident conclusions about spadefoot absence. Sites documented as having spadefoots "not present" are questionable. These sites should rather be considered "possible" spadefoot locations until a more thorough inventory, with repeated site surveys can be undertaken.

Pierce and Gutzwiller (2004) examined the relationship between survey duration and detection efficiency in anuran call surveys, and report that cumulative detection efficiency was significantly greater for 15 minute survey periods (94 %) compared to 5 minute periods (77 %). Furthermore, they found that detection efficiency did not increase appreciably from 15 minute periods over longer time durations up to 30 minutes. If longer survey durations of 15 minutes can capture 94 % of species present, then fewer surveys per site may be possible. These results should be taken into consideration when designing future inventories.

Recommendations

The results of our inventory will assist directing future spadefoot recovery efforts, addressing knowledge gaps, and assessing the species status in B.C. We recommend several improvements to our 2007 inventory protocols for the 2008 field season.

In 2008, effort should be made to search for population connectivity between the Cariboo and Thompson Regions. Specifically, future inventories should survey south of 2007 sites to determine if spadefoots in the south Cariboo are an isolated population from the remainder of the provincial distribution. Genetic data may be used to augment this information.

Recent studies report that survey periods of longer duration have greater efficiency and precision (Pierce and Gutzwiller 2004). Considering this, we recommend that future surveys are a minimum of 15 minutes in duration to increase detection probabilities. To assess the efficiency of survey time durations, surveyors should use a stop watch when they begin each survey and record time elapsed between survey start and the first call heard.

We did not consider the effect of moonlight when choosing survey dates for our 2007 inventory. Pierce and Gutzwiller (2007), state that moonlight is an important influence on frog calling behaviour. On clear nights with strong moonlight, frogs are less likely to call due to increased risk of predation. To optimize survey conditions, the presence of moonlight should be factored into spadefoot survey planning.

To determine when breeding males initiate and end calling, the 2008 inventory should begin surveys earlier and end later in the year than our 2007 surveys. Spadefoots, Wood Frogs, and Columbia Spotted Frogs may all initiate breeding in early April before surface ice has completely melted off breeding ponds (Matsuda et al. 2006). Furthermore, breeding activity for these species is often short, occurring a period of weeks, or even days (Matsuda et al. 2006). Therefore, to establish spadefoot calling periods regular surveys at a selection of known active breeding sites should begin early in the spring and continue as long as spadefoots are detected calling.

Ephemeral water bodies are the preferred habitat for breeding spadefoots (Hallock 2005; Sarell 2004). Dependent on water temperature, spadefoots require an average of 6 weeks for metamorphosis of tadpoles to toadlets (Matsuda et al. 2006). Dip-net surveys should be conducted from mid May to early July to determine if metamorphosis occurs at ephemeral sites.

Habitat protection, through the establishment of Wildlife Habitat Areas (WHAs) on crown land, should include pond complexes within different drainages and watersheds, throughout the known spadefoot range in the Cariboo. Semlitsch (2008) recommends that population-level management and conservation efforts, for adult and juvenile pond-breeding amphibians remaining near their natal wetland, may be effective when focused on spatial scales of < 1 kilometer. However, it is important that these conservation areas contain a large portion of the adult breeding population. Furthermore, such areas must contain all habitat types required over the different life stages of individuals, including foraging, over-wintering, summer, and breeding habitat (Semlitsch 2008).

Acknowledgments
Thanks are extended to high school students Michael Packham and Daryl Morgan for preparing and assembling volunteer survey packages. For survey assistance in the field we thank the Ducks Unlimited and B.C. Conservation Corps crew: Katharine VanSpall (supervisor), Mike Carlson, Lacey Loewen, Amy Leeming and Melissa Vaughn. Thanks to CCIB members: Melvin Louis, Larry Emile, Carol Emile, and Tony Boston. We are also indebted to the many volunteer surveyors for their generous help: Julie Steciw, Erin O'Brien, Marie Betcher, Joel Kline, Julie Bliss, Pat Robinson, Dennis Graf, Drew, Nolan, and Tanya Buis, Joanne McLeod, Tom Hughes, Garth Davidson, Perry Callies, Chris Nowotny, Kirsty and Philip Robbins, Audrey and Nils Hoeg, and Les French. We also wish to thank Gilbert Capot-Blanc for coordinating CCIB surveys funded by IRF. Thanks to Joanne McLeod and Paragon Mapping Inc (2004) for GIS mapping. Special thanks to John Youds, Julie Steciw, Purnima Govindarajulu and Julie Bliss for preliminary edits to the manuscript. We are also grateful to Eric Lofroth, who contributed editorial assistance and guidance for this report.

Literature Cited

B.C. Southern Interior Reptile-Amphibian Recovery Team. 2007. Recovery Strategy for the Great Basin Spadefoot (*Spea intermontana*) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 20pp.

Committee on the status of Endangered Wildlife in Canada (COSEWIC). 1998. Status report on the Great Basin Spadefoot Toad *Spea intermontana* in Canada. Prepared by R.J. Cannings for COSEWIC, Ottawa, ON.

Committee on the status of Endangered Wildlife in Canada (COSEWIC). 2007. COSEWIC assessment and update status report on the Great Basin Spadefoot *Spea intermontana* in Canada. Committee on the status of Endangered Wildlife in Canada. Ottawa. Vii +34pp. (www.sara.registry.gc.ca/status/status_e.cfm).

Gartshore, M.E., Oldham, M.J., van der Ham, R. and F.W. Schueler. 1992. Participants Manual. Amphibian Road Call Counts. Ontario Task Force on Declining Amphibian Populations. Ont. Field Herpetologists 29pp.

Hallock, L. 2005. Great Basin Spadefoot. Pp. 158 – 161 in L.L.C. Jones, W.P. Leonard, and D. H. Olson (editors). Amphibians of the Pacific Northwest. Seattle Audubon Society, Seattle, WA.

Jones, L. C., Leonard, W. P., and D. H. Olson, eds. 2005. Amphibians of the Pacific Northwest. Seattle Audubon Society, Seattle, WA.

Matsuda, B. M., Green, D. M., and P. T. Gregory (authors). 2006. Amphibians and Reptiles of British Columbia. Royal BC Mus., Victoria, BC.

Meidinger, D., and J. Pojar. 1991. Ecosystems of British Columbia. British Columbia Ministry of Forests, Victoria, B.C. 330 pp.

Ministry of Environment, Lands and Parks, Resource Inventory Branch for the Terrestrial Ecosystems Task Force Resources Inventory Committee. 1998. Inventory Methods for Pond-breeding Amphibians and Painted turtle, Standards for Components of British Columbia's Biodiversity No. 37.

Ovaska, K. 2006. Update COSEWIC Status Report on Great Basin Spadefoot *Spea intermontana*. Committee on the Status of Endangered Wildlife in Canada.

Pierce, B. A., and K. J. Gutzwiller. 2004. Auditory Sampling of Frogs: Detection Efficiency in Relation to Survey Duration. J. Herpetology 38(4):495-500.

Pierce, B. A., and K. J. Gutzwiller. 2007. Interobserver Variation in Frog Call Surveys. J. Herpetology 41(3):424-429.

Sarell, M. 2004. Great Basin Spadefoot *Spea intermontana*. In Accounts and Measures for Managing Identified Wildlife – Accounts V. 2004. Ministry of Water, Land and Air

Protection, Victoria, BC. 7pp.

Semlitsch, R. D. 2000. Principles of management for aquatic breeding populations. J. Wildl. Manage. 64:615-631.

Semlitsch, R. D. 2002. Critical elements for biologically based recovery plans of aquatic-breeding amphibians. Conservation Biology 16:619-629.

Semlitsch, R. D. 2008. Differentiating Migration and Dispersal Processes for Pond-Breeding Amphibians. J. Wildl. Manage. 72(1):260-267.

Shirose, L. J., Bishop, C. A., Green, D. M., MacDonald, C. J., Brooks, R. J., and N. J. Helferty. 1995. Validation Study of a Calling Amphibian Survey in Ontario. Abstract of paper presented at the second NAAMP conference, Toronto, ON.

Verkerk, P., Janzen, M., and R. Packham. 2006. Preliminary Great Basin Spadefoot Toad Survey in the Alberta and Meadow Lakes Areas of the 100 Mile House Forest District, 2006. Unpublished report for the Ministry of Environment.

APPENDIX 1. Spadefoot Inventory Surveyor Methods Handout

Cariboo Great Basin Spadefoot Toad Auditory Survey

Introduction

Thank you for participating in this auditory survey. Your effort to determine the distribution of Great Basin Spadefoot toads (and other toads and frogs) in the Cariboo is greatly appreciated. From the initial work conducted in 2006 we know that spadefoot toads inhabit at least 11 ponds in the Alberta Lake area and suspect that spadefoots are much more widely distributed. The purpose of this survey is not to determine the total extent of the distribution of spadefoots but rather to expand the known distribution and complete future work, pending securement of funding.

Please familiarize yourself with the information provided. The information package received should contain: 1) a CD with the possible toad and frog calls for the Cariboo, 2) Excel spreadsheets for recording survey results, 3) brochure with information on spadefoot toads, 4) map(s) for the area to be surveyed and, 5) general location and road maps.

Safety

As the auditory surveys are best completed at least one half hour after dusk and may take a couple hours to complete you are encouraged to complete the survey with a partner for safety purposes. There are several camp sites close to the study area such as Beaverdam Lake Recreation site, Green Lake and Big Bar Lake Provincial Parks and Meadow Lake Regional Park, so you might want to consider making a weekend out of your survey to make the trip more safe and enjoyable.

Please make sure you have a cell phone or satellite phone with you and that someone else knows where you are going and when you expect to return home.

Equipment List

4X4 truck is recommended; full tank of gas
Maps (1:20,000 and location)
GPS (datum set to NAD83 UTM)
Clipboard
Amphibian survey forms
Pencils
CD with Cariboo toad and frog calls
CD player
Raincoat
Cell/Sat phone
Flashlight and/or head lamp and extra batteries
Compass (declination 20.5°east)
Watch

Methods

Toad and Frog Calls

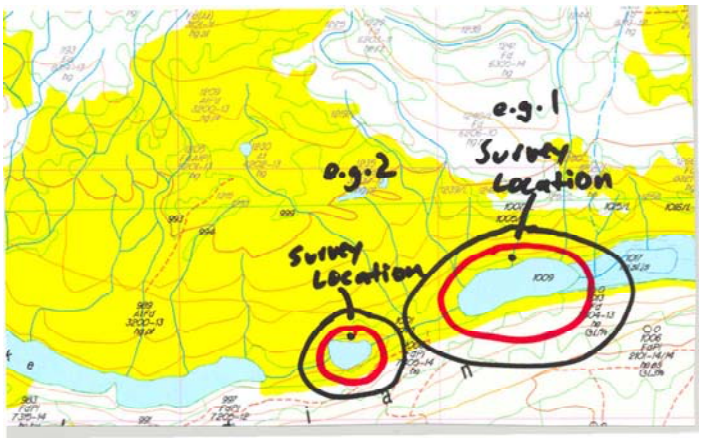
Auditory surveys for toads and frogs are conducted by becoming familiar with the mating calls of males which can be heard during the breeding period. Male toads and frogs of each species have a distinct call. The species which may be heard include spadefoot, Western Toad, Pacific Chorus (tree) Frog, Wood Frog, and Columbia Spotted Frog. Please ensure you can identify each call from the CD and take along a CD player so you can verify the calls heard.

Selected Ponds for Auditory Surveys

Within the study area, certain 1:20,000 maps contain hundreds of potential breeding ponds for spadefoot toads. To determine rough distribution several ponds on each map have been selected for surveys. The ponds selected for the surveys are circled on your maps in **red** marker (see Fig. 1). The ponds chosen for the surveys were located close to roads, where possible, but you may also have ponds that are not close to roads. You are encouraged to complete surveys at all the ponds identified on your map(s) but any effort is appreciated. If you decide to do only a portion of the ponds selected please pick the ponds that are in complexes (several ponds together) as these ponds are more likely to provide habitat for spadefoots. If you locate spadefoots at a pond then no further visits to that pond are required. If you do not locate spadefoots at selected ponds then ideally you will visit that pond again at a later date. Provincial survey methods for amphibians recommend a minimum of three auditory surveys for ponds where amphibians are not previously detected. Again, any effort is appreciated.

Please conduct auditory surveys on any other ponds of interest, and in particular, as many ponds on your map(s) as possible, even if not circled in red. The more ponds surveyed the better. The ponds surrounded by grasslands (yellow on 1:20,000 maps) are more likely to contain spadefoots than ponds surrounded by forest. Please clearly mark on your map(s) all the ponds surveyed with a corresponding survey number (see below) from your Amphibian Auditory Survey Form, to allow for cross reference. If you survey a pond but don't have a map for that area please record UTM of survey location and compass bearing towards pond surveyed or any other information to help identify pond location.

Fig. 1 Examples of Ponds Selected for Survey (in red), Ponds Surveyed, Survey Numbers and Survey Locations



Reconnaissance Trip to Survey Ponds

You are encouraged to do a reconnaissance trip out to the ponds to be surveyed prior to actually doing the survey. A reconnaissance trip will hopefully make your survey more efficient, enjoyable and safe. The reconnaissance trip could be done on the same day as your survey but just earlier in the day.

Timing of Survey

In the Cariboo, auditory surveys for calling male spadefoot toads, and other toads and frogs, are best completed from early May to mid June, at least a half hour after sunset and preferably during a prolonged precipitation event occurring on a warm day. The last 2 weeks of May and the first week of June are probably optimal.

Completing the Amphibian Survey Forms

Please see the examples e.g. 1 and e.g. 2 on the amphibian survey form to see how to fill out each field.

Survey Number- give each pond surveyed a survey number (from survey reporting form and record that number on the map (see Fig. 1) to provide a cross reference.

Date- self explanatory

Mapsheet # - the map(s) number for pond being surveyed.

Polygon # - the map polygon numbers of the ponds surveyed taken from the 1:20,000 map (some ponds are numbered and some aren't). If the pond isn't numbered then please record the compass bearing from the survey location toward the pond being surveyed and record in the comments column. Please circle all ponds surveyed and provide survey number from survey reporting form, as shown in Fig. 1.

Your Location (UTM NAD83) - Accurate survey locations are critical to the success of this project. Please record your location of where you stand in UTM NAD83 by GPS (if possible) when you conduct your auditory survey. Also please mark the location of where you conduct the survey on the map (see Fig. 1). The distance, from which you will be able to hear amphibians calls will depend on the number of animals calling

however, you should be able to hear calls from over 50m from the ponds edge.

Time Start and Time End- record the time you start and end the survey. Upon arrival at each site, a 2-minute period of silence should precede surveys to minimize effects of disturbance. Listen for calling amphibians for a 5-minute listening period.

Species- use species codes at bottom of form. If more than one species is heard record each species on a different line on form.

Abundance Codes- see abundance codes on bottom of form. If the number of amphibians is determinable please provide the number of individuals in the comments column.

Water in Pond- is there water in the pond being surveyed? Y or N.

Cloud Cover- approximate percent of sky covered by clouds.

Precip- is it currently raining? Y or N.

Recent Rain 24/48 hrs- if it isn't currently raining has it rained in the last 24 or 48 hrs?

Approx. Temp Celsius- current approximate air temperature.

Comments-insert whatever comments you think may be useful…use as many lines as necessary or attach additional notes linked to the survey number.

Results

Once you have finished completing your surveys please drop off the survey forms and the map(s) to Roger Packham at the Ministry of Environment office either in Williams Lake or 100 Mile House by June 30, 2007. Digital submission of your results via email with Excel attachment would be appreciated. Maps and forms can also be mailed to:

Roger Packham

MOE

Box 1600

100 Mile House, BC

V0K 2E0

Once all the results are compiled a copy of the report will be provided to all participants by late fall.

Questions/comments

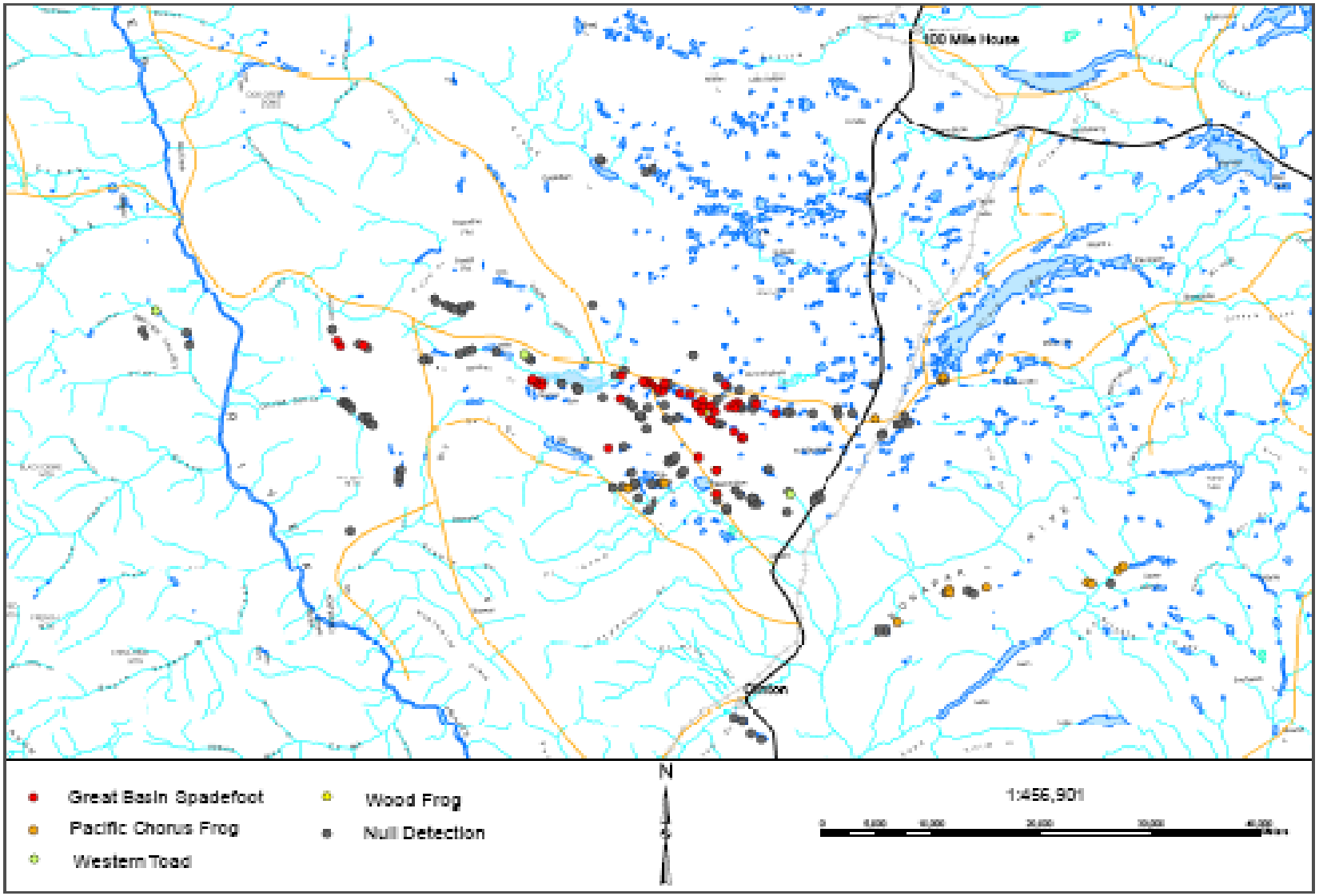
I can be reached at 250-395-7853 or by fax at 250-395-7883 or by email at roger.packham@gov.bc.ca in case you have questions or comments.

Thanks again for your assistance in determining the distribution of spadefoot toads, and other toads and frogs, in the south Cariboo.

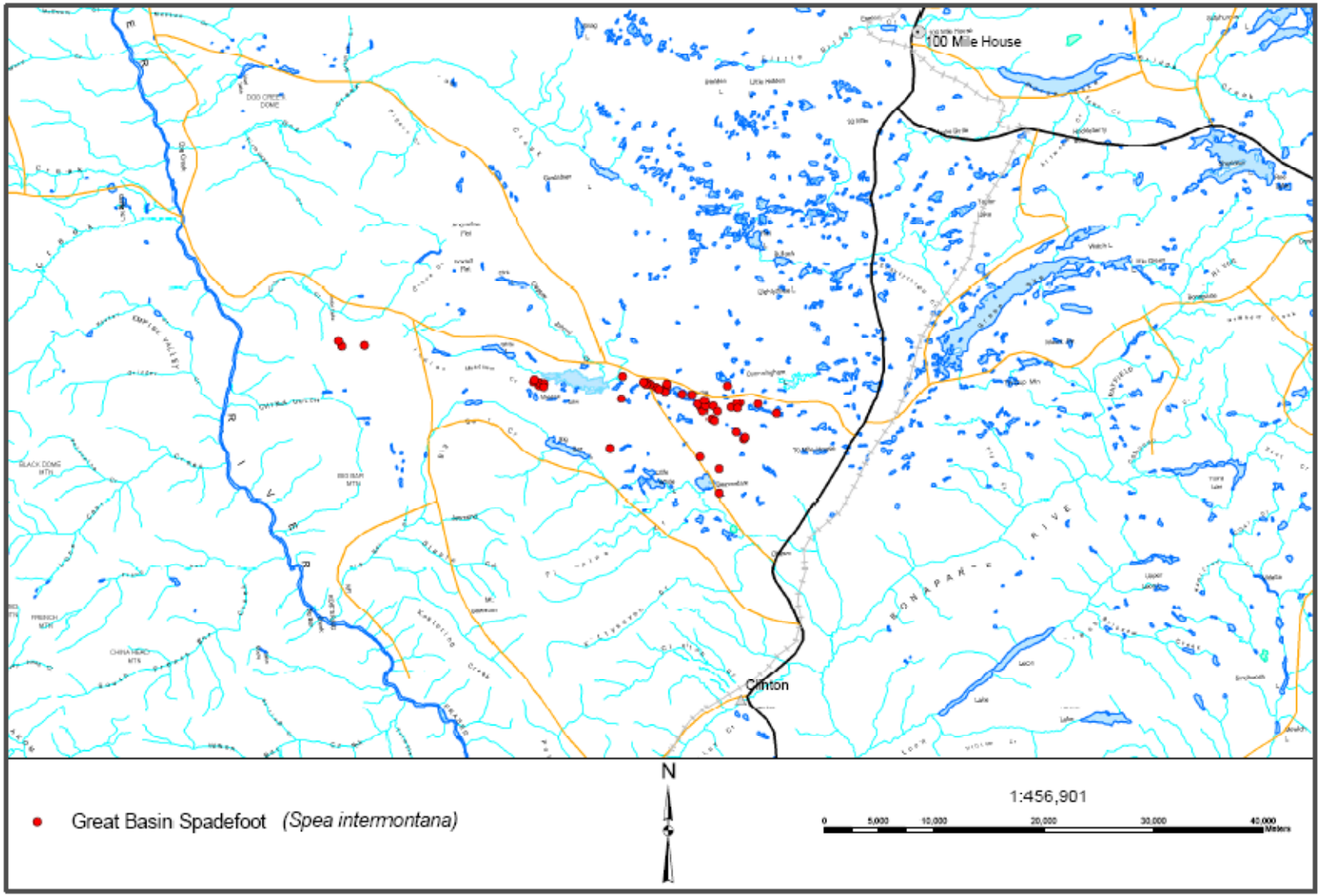
Sincerely,

Roger Packham: Senior Ecosystem Biologist

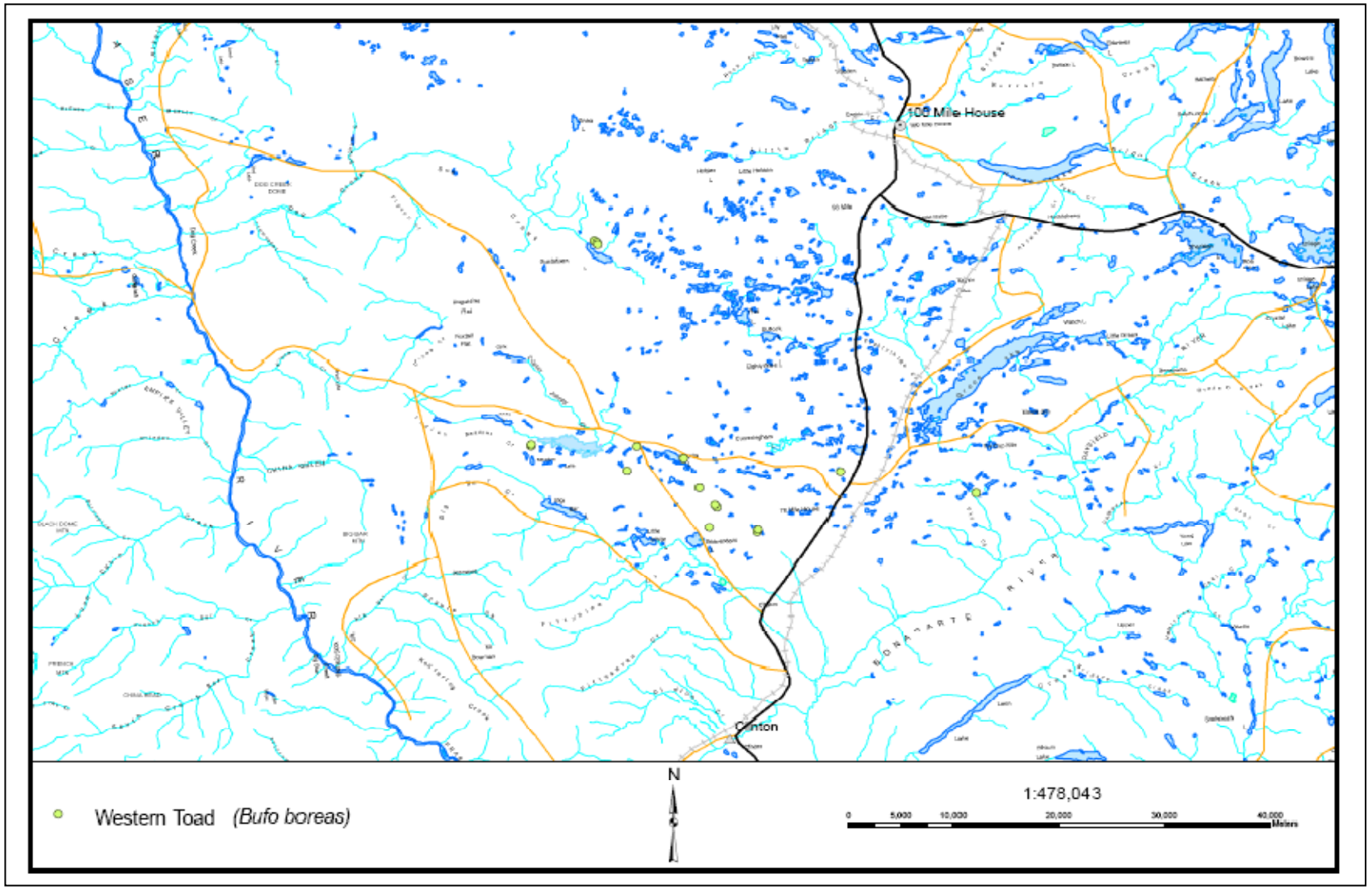
APPENDIX 2 Survey detection results for Great Basin Spadefoot, Western Toad, Wood Frog, Pacific Chorus Frog and null detections from the 2007 Great Basin Spadefoot auditory survey, Cariboo Region, B.C.



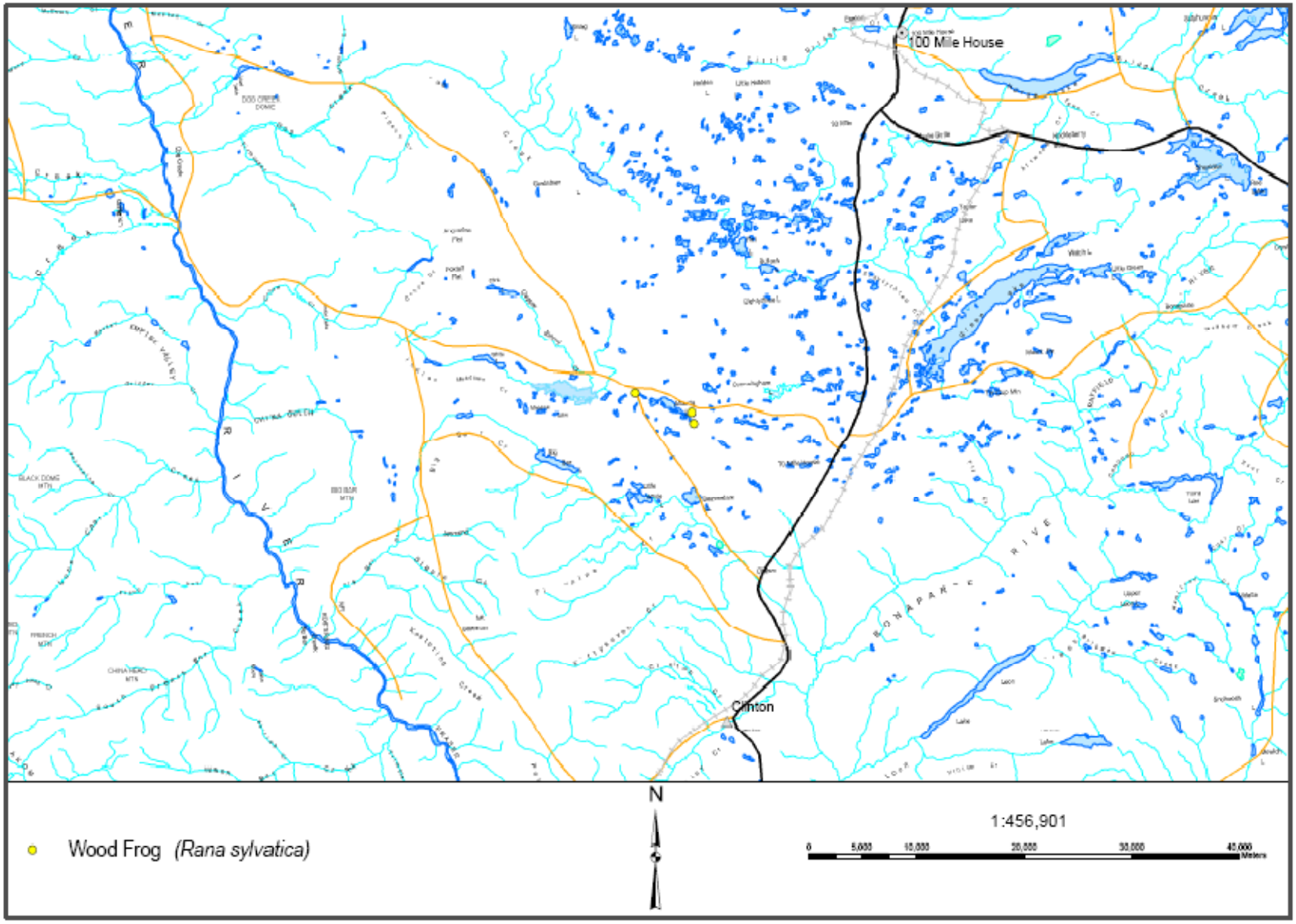
APPENDIX 3. Great Basin Spadefoot detection locations from the 2007 Great Basin Spadefoot auditory survey, Cariboo Region, B.C.



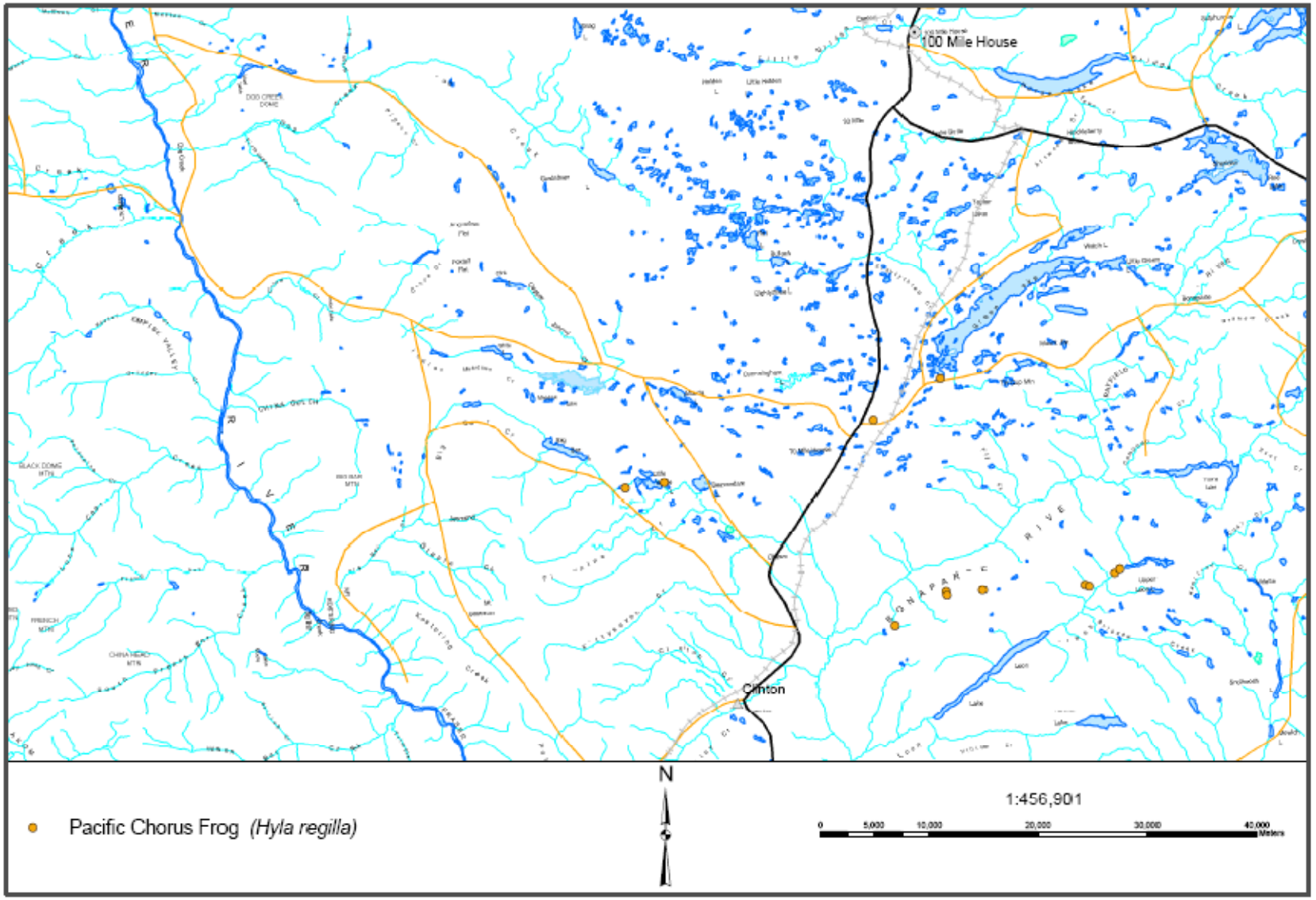
APPENDIX 4. Western toad detection locations from the 2007 Great Basin Spadefoot auditory survey, Cariboo Region, B.C.



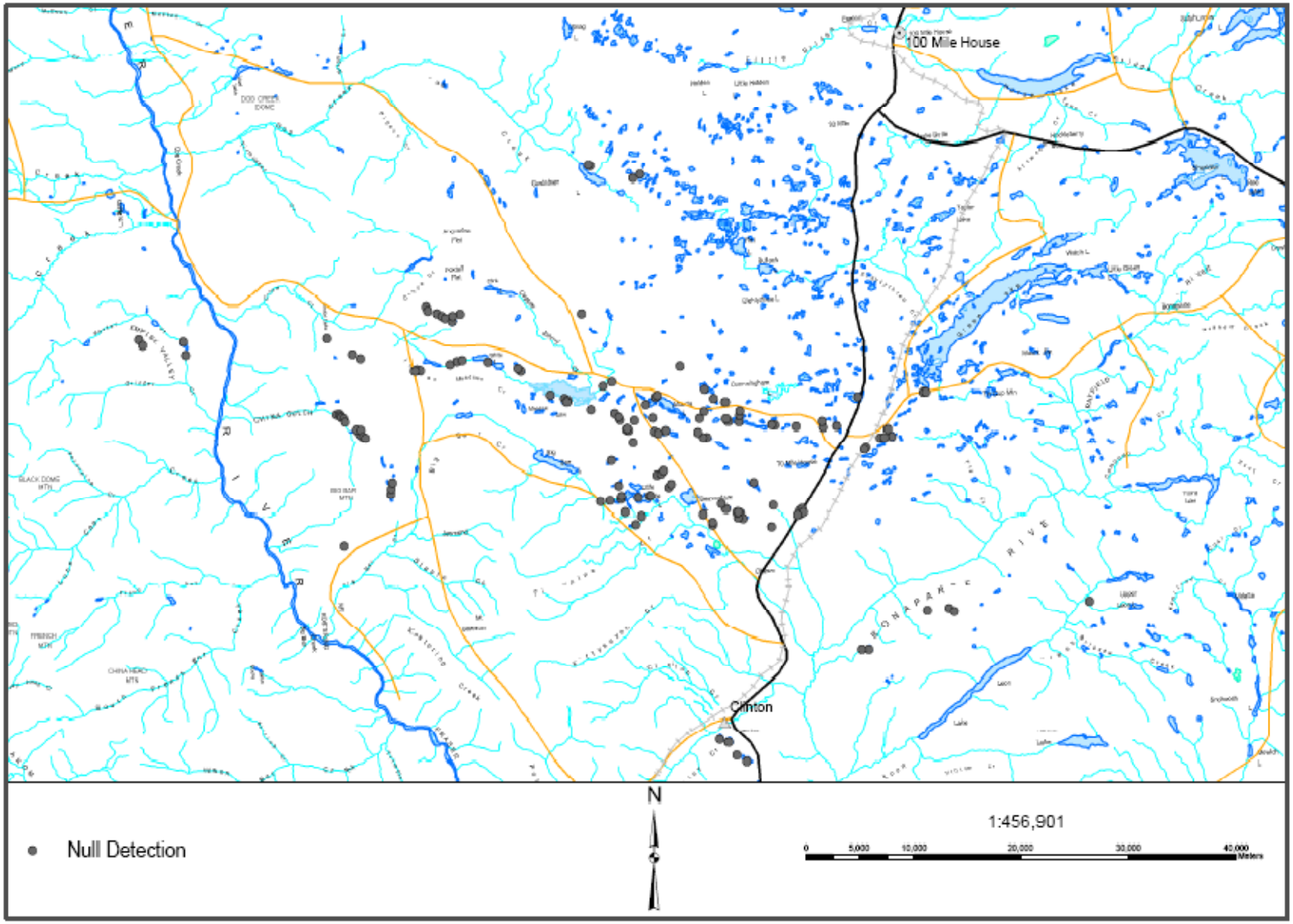
APPENDIX 5. Wood frog detection locations from the 2007 Great Basin Spadefoot auditory survey, Cariboo Region, B.C.



APPENDIX 6. Pacific Chorus Frog detection locations from the 2007 Great Basin Spadefoot auditory survey, Cariboo Region, B.C.



APPENDIX 7. Null detection locations from the 2007 Great Basin Spadefoot auditory survey, Cariboo Region, B.C.



APPENDIX 8. Site #135 (UTM: 592732; 5690256; map sheet 92P032), an ephemeral pool. Photo taken Oct. 04, 2007.

APPENDIX 9. Site #66 (UTM: 597703; 5680285; map sheet 92P023). Photo taken Oct. 04, 2007.

APPENDIX 10. Site #127 (UTM: 587958; 5684874; map sheet 92P032). Photo taken Oct. 05, 2007.