CHAPTER 3. Amphibians - Multi-species Baseline Initiative

Lucid, M.K., L. Robinson, and S.E. Ehlers. 2016. Multi-species Baseline Initiative project report. 2010-2014. Idaho Department of Fish and Game, Coeur d'Alene, Idaho, USA.

Introduction

Amphibian populations have been declining world-wide for decades (Houlahan 2000) as a result of pathogens, climate change, environmental pollution, ultraviolet-b exposure, and invasive species (Bridges and Semlitsch 2000, Cushman 2006, Kiesecker et al. 2001, Stuart et al. 2004). Amphibians have relatively low vagilities (Bowne and Bowers 2004, Cushman 2006), often have narrow habitat requirements (Cushman 2006), and declines can occur rapidly in seemingly pristine environments (Stuart et al 2004). The majority of amphibian research and monitoring is conducted on a site specific level. But to address the threats to amphibian populations, landscape level monitoring and conservation programs for both common and rare species are needed (Cushman 2006).

Prior to the beginning of the MBI project, the Idaho Fish and Wildlife Information System (IFWIS) contained 868 amphibian observations from the Idaho portion of the study area consisting of 77% (n = 671) incidental and 23% (n = 197) standardized survey observations. Standardized amphibian surveys in portions of the Multi-species Baseline Initiative (MBI) study area have occurred sporadically since at least the mid-1990s (Beck et al. 1998). The first standardized surveys available in IFWIS were conducted in 2002 [Beck et al. (1998) data are not included in the IFWIS database]. The first incidental IFWIS observations occurred in the 1800s.

Only six of these 868 IWFIS observations were of Northern leopard frogs (*Rana pipiens*). The most recent Northern leopard frog observation in the Idaho portion of the study area occurred in 1955 (IFWIS, accessed April 3, 2016). Although this species is one of the most widely distributed amphibians in North America, it has been declining in the western portion of its range since the 1960s (Gibbs et al 1971, McAllister et al 1999). Because a standardized amphibian survey or monitoring program never existed in our study area, we are forced to wonder if this species was historically common and widely distributed throughout the study area or if it occurred patchily or in small numbers. What happened to this species since it was last detected over 50 years ago? This knowledge is lost for Northern leopard frogs but opportunity remains for currently common species such as Columbian spotted frogs (*Rana luteiventris*). Here we present the first step in the path toward a regional amphibian monitoring program.

MBI was funded to conduct surveys for five amphibians classified as Species of Greatest Conservation Need (SGCN). Northern leopard frogs, wood frogs (*Rana sylvatica*), and Coeur d'Alene salamanders (*Plethodon idahoensis*) are SGCN listed in the 2005 Idaho State Wildlife Action Plan (I-SWAP). Tiger salamanders (*Ambystoma tigrinum*) and western toads (*Anaxyrus boreas*) are SGCN listed in the 2005 Washington State Wildlife Action Plan (W-SWAP). All but Coeur d'Alene salamanders breed in ponds. Therefore we focused our efforts primarily on potential pond breeding habitat. To obtain the maximum data return for our survey effort, we tested new and existing techniques to develop protocols which enable detection of rare and common amphibians and other co-occurring species.

In addition to native species occurrence data, we designed our protocols to detect potential physical and biological threats to native amphibians. At all wetlands, we recorded bullfrog (*Rana* *catesbeianus*) detections and fish presence, and at a subset of wetlands, we collected micro-climate data (water temperature, air temperature, and relative humidity) and sampled for chytrid fungus (*Batrachochytrium dendrobatidis;* BD).

In order to set the stage for landscape level amphibian monitoring and conservation strategies, we set out with the following goals: 1) develop distribution maps of target SGCN, 2) develop distribution maps of other pond breeding amphibians and other species found at ponds, 3) develop distribution maps of potential biological threats to native pond breeding amphibians (e.g., bullfrogs, BD, and fish), 4) determine micro-climate associations for pond breeding amphibians, 5) assess the proper phylogenetic clade and taxonomic classification for western toads in our study area, and 6) provide information on current phenological patterns of pond breeding amphibians.

Methods

Study Design

We stratified our 22,975 km^2 study area into 920, 5x5 km sampling cells and attempted to conduct a pond survey in each Idaho and Washington cell (n = 849). We did not conduct surveys in 68 (8%) cells because we were either unable to gain access to private lands or we were unable to identify a potential wetland (Map 3-1). To increase our sampling effort, we added 21 additional cells in the Saint Joe and Coeur d'Alene Mountains. This left us with a total of 870 cells we attempted to conduct amphibian surveys in. Of those 870 Idaho and Washington cells we successfully conducted surveys at 826 sites within 802 cells between April 22 and September 17 in 2013 and 2014. Of the 826 sites, 665 were publicly owned and 161 were privately owned. Our survey sites were selected in four ways in the following order of preference: 1) from the National Wetland Inventory [NWI (U.S. Fish and Wildlife Service, 2013)] (n = 559), 2) visually selected from maps (n = 74), 3) technicians on the ground (n = 59), and from the Wetlands Assessment Tool (WAT) (n = 134) (Table 3-1).

We defined a pond as a lentic body of water ≤500 meters in perimeter. We attempted to survey 870 wetlands consisting of one pond in Idaho (n = 800) and Washington (n = 70) cells.

Terrestrial invertebrate survey plots were chosen prior to wetlands. Terrestrial plots were primarily randomly chosen with bias to roads and trails or random Forest Inventory and Analysis (FIA) plots (see Chapter 2 for details). We selected the wetland nearest the terrestrial survey plot in an effort to improve field efficiency. If more than one terrestrial plot occurred in a cell, we preferentially selected the FIA terrestrial plot over the basic terrestrial survey plot.

Wetland photographs are archived on IDFG servers.

Site Selection (Table 3-1) -

2013 - The majority of wetlands were selected using NWI http://www.fws.gov/wetlands/Data/State-Downloads.html, Accessed April 3, 2013), which is based on aerial imagery, collateral data sources, and field work (U.S. Fish and Wildlife Service, 2013). We then used ArcGIS 10.1 (Environmental Systems Research Institute, Redlands, CA) to clip the wetland layer to the Idaho Fish and Game (IDFG) Region 1 shapefile and calculated a perimeter for all of the wetlands in the Idaho Panhandle. We removed any wetland with a perimeter ≥ 500 meters. If a small enough wetland was not available, we made exceptions up to 700 meters in perimeter. We also removed wetlands that were categorized as "Riverine."

We then generated the centroid coordinates for each wetland and produced a point shapefile based on those coordinates. In Geospatial Modeling Environment (http://www.spatialecology.com/gme/, Accessed January 21, 2013) we used the "Distance to Points" function to produce a list of the 4 closest wetlands to the terrestrial survey site. We eliminated any wetlands outside the cell of interest then selected the closest wetland classified as a pond. If a pond was not available, we preferentially selected an emergent wetland followed by a forested-shrub wetland. We preferentially selected wetlands on public land if available.

The NWI did not cover all of the study area, in particular, Shoshone County. We used a variety of digital (National Hydrography Dataset, IDFG Region 1 Lakes.shp, GoogleEarth) and non-digital (Forest Service Maps, private landowners) sources to find additional ponds.

After the first two steps, we were left with 151 cells in which we had yet to identify a pond, primarily in the Saint Joe and Coeur d'Alene Mountains. In an attempt to identify ponds in these 151 cells, we used WAT, which was developed by Chris Murphy (IDFG) and models wetland locations based on NWI and gap analysis. To select wetlands using WAT, we eliminated any polygons which were > 500 meters in perimeter. Wetlands were displayed as either squares or polygons with a more 'natural' appearance but no other information such as wetland type was available about the polygons. We selected the 'natural' appearing polygon closest to the terrestrial survey location.

2014 - There were 208, mostly privately owned, un-surveyed cells remaining to be surveyed. We had already identified wetlands within these cells. However, we modified the wetland identification methodology and re-ran the selection process for these cells in order to: 1) increase our success in identifying ponds (over other types of sites) prior to field visits and 2) to prioritize private ponds or wetlands which had higher likelihood of gaining access permission. As in the 2013 method, the NWI dataset was utilized and wetlands with a perimeter ≤ 500 meters were selected. Wetlands categorized as "Riverine" were eliminated. We converted the filtered shapefile into a .kmz and then visually confirmed the presence of a wetland in Google Earth. In cells with no digitized source of wetland information, we visually scanned Google Earth for any sign of ponds or wetlands in the Landsat image. Wetlands identified using this method were digitized for inclusion in the overall survey shapefile. Because access to privately owned wetlands was dependent on landowner permission, we prioritized private wetlands with publically available landowner contact information. We did not use WAT in 2014.

Of the 826 sites we surveys we found ponds at 338 (41%) NWI selected sites, 6 (0.73%) WAT model selected sites, 29 (4%) sites field-selected by technicians and 60 of other selection type sites (7%). Overall, we successfully detected ponds at 433 (52%) of 826 sites visited. (Table 3-1)

Table 3-1. Data sources used to identify wetlands.

Data Source	# Surveys	Wetland Type					
		Pond/Lake[a]		Other Wetlands[b]		Dry Sites[c]	
		#(%)		#(%)		#(%)	
National Wetland Index	559	338	(40.92)	133	(16.10)	88	(10.65)
Wetland Assessment Tool	134	6	(0.73)	100	(12.11)	28	(3.39)
National Hydrography Dataset(Shoshone County)	26	18	(2.18)	7	(0.85)	1	(0.12)
Region 1 Lakes layer	7	6	(0.73)		(0.00)	1	(0.12)
Forest Service Map	5	3	(0.36)	1	(0.12)	1	(0.12)
Google Earth™	34	32	(3.87)	2	(0.24)		(0.00)
Private Landowner	2	1	(0.12)		(0.00)	1	(0.12)
Technician Selected in Field	59	29	(3.51)	27	(3.27)	3	(0.36)
Total Wetlands	826	433	(52.42)	270	(32.69)	123	(14.89)

[a] Includes ponds, beaver ponds, lakes, emergent wetlands, puddles, vernal pools, wet meadows
[b] Includes streams, channels near streams, puddles, springs, road ditches
[c] Includes any wetland or non-wetland site that did not have any water

Obtaining Private Land Access - The majority of privately owned wetlands surveyed in 2013 were either located on timber properties (for which we obtained access through a MOU) or were properties for which IDFG had existing access. In 2014, however, 83% (*n* = 247) of wetlands surveyed were privately owned. We used a variety of resources to determine land ownership. During February of 2014, we sent initial contact letters to landowners asking for permission to access their property to conduct amphibian surveys (Appendix III-c). We provided a postage paid card with which the landowner could respond either granting or denying access to their property. Landowners who did not return the postcard were contacted by telephone in April 2014. Landowners granting access were called prior to the field survey and provided with written survey results in January 2015.

Of the 265 privately owned wetlands we requested access to, we were granted access to 161 (61%). Of the 193 postcards we sent, 53 (27%) were returned, the majority of which (*n* = 41) granted access. Follow-up calls yielded access to an additional 43 wetlands (Table 3-2).

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Table 3-2. Number of publicly and privately owned wetlands surveyed. Success obtaining access to privately held wetlands

	# (%)			
	Cells (*n* = 802)		Surveys (*n* = 826)	
Completed in 2013	641	(80)	659	(80)
Public wetlands	599	(75)	617	(75)
Private Wetlands	42	(5)	42	(5)
Private Individual	11	(1)	11	(1)
Business/Industry	31	(4)	31	(4)
Completed in 2014	161	(20)	167	(20)
Public Wetlands	48	(6)	48	(6)
Private Wetlands (see below)	113	(14)	119	(14)
Cells with no wetland identified	51	(6)		
Cells with no access	17	(2)		
Wetland Selection 2014				
	# (%)			
Private Wetlands Identified in 2014	247			
1st Attempt access request (postcard)	193			
Total Returned	53	(27)		
Access granted	41	(21)		
Access denied	12	(6)		
2nd Attempt Access request (phone call)	98			
Access granted	43	(44)		
Access denied	42	(43)		
Unable to contact landowner	13	(13)		
Postcard returned after phone call	26[a]	(60)		
Business/Industry Access Requests	30			
Access granted	21	(70)		
Access denied	9	(30)		

[a] Three people returned a card denying access after saying yes on the phone

Ponds vs. Other Survey Sites - Our goal was to survey for pond breeding amphibians. However, only 433 (52%) surveyed sites met 'pond' criteria (lentic water body ≤500 m diameter). It was often not possible to determine from maps if a site was a pond, different type of wetland, or a dry site.

Field Methods
At each survey site we conducted a dip net survey or timed search for amphibians. We recorded observations of amphibian life stages as well as opportunistic species. We deployed water temperature data loggers at 131 ponds. At 50 ponds we deployed air temperature and relative humidity data loggers. We sampled fully formed spotted frogs for BD at 153 (18%) ponds.

Environmental DNA vs. Dip Netting Field Assessment - When we proposed this project, we initially planned to use environmental DNA (eDNA) techniques (e.g. Pilliod 2012) to detect amphibians. In 2012 we conducted a field trial to compare the eDNA technique to traditional dip net larval surveys (Heyer et al 2014). We determined we would need to collect eDNA at a minimum of three locations per pond to assess amphibian species composition. Because we could test for only four species at one time using eDNA, at least six laboratory tests would have been necessary to survey each pond. Using eDNA was therefore cost prohibitive and we made the decision to use traditional dip netting, a cheaper and more efficient technique for our purposes (Appendix III-d).

Dip Net Surveys (tissue sampling and photos) - At each pond ≤500 meters in perimeter (*n* = 354), we conducted a full perimeter dip net survey. At ponds and lakes >500 meters in perimeter (*n* = 60), we conducted a dip net survey along a section of shoreline either 100 m (2013) or 500 m (2014) long (Table 3-9). We used 12" deep, 3/16" mesh dip nets (Forestry Suppliers, Jackson, MS; Appendix III-a) and sampled all microhabitats along the shoreline. Technicians visually estimated 50 m shoreline sections and counted each amphibian species by life stage (egg, no legs, 2 legs, 4 legs and tail, or fully formed; Table 3-5). Exact quantities were recorded for 0-10 individuals per section. If there were more than 10 individuals per section, quantities were estimated by order of magnitude to the nearest 10, 100, or 1000.

Dip net survey on private land.

Timed Search Surveys - When we were unable to find a pond or lake at an assigned site (n = 412), observers conducted a 30 minute timed visual encounter search for amphibians (*n* = 412). Non-pond sites included stream channels, emergent wetlands, puddles, dry meadows, and talus fields; observers classified conditions as wet (*n* = 302) or dry (*n* = 110) (Table 3-1) and recorded opportunistic observations of target plants, mammals, reptiles, and insects as they conducted the amphibian timed search.

Temporal Surveys - In temperate mountain environments amphibians tend to distribute breeding activity temporally along elevational gradients and some species may take more than one summer breeding season to complete metamorphosis. Determination of phenological patterns allows both the ability to develop study-area-specific development timeframes to inform amphibian survey protocols and provides baseline knowledge for which to compare potential comparative phenological changes over time during climate change. To delineate current phenological patterns and assess amphibian detectability across the survey season, we conducted temporal surveys at 7 ponds in 2014. We selected ponds from the 2013 survey season which had high species diversity (2-4 species per pond) and provided the maximized pond sample size for each species (3-5 ponds per species). Pond elevations ranged from 538-1,763 m. Beginning May 29, 2014, we conducted full perimeter dip net surveys at approximate 20-day intervals throughout the season until larval amphibians had fully metamorphosed, were no longer detected, or an active dispersal was detected during the survey. This resulted in 6-7 surveys per pond with higher elevation ponds receiving more surveys.

Temporal surveys began in early June 2014. Amphibians were not detected until July at high elevation ponds like W1188.

Table 3-3. Temporal Wetland Locations

Wetland ID	Elevation	Latitude	Longitude
W1057	538	***48.90364**	**-116.38901**
W1001	630	48.30135	-116.42580
W930	643	48.29160	-116.55321
W67	899	48.87775	-117.00529
W48B	1070	48.77481	-117.04884
W148	1711	48.65950	-116.59918
W1188	1763	48.37906	-116.13732

* **Bold** locations are fuzzed within 500 meters.
All other locations are precise.

Water Temperature Data Loggers - We originally planned to deploy a water temperature monitor at all survey ponds. However, quality data loggers cost more than anticipated and we chose instead to monitor fewer ponds with higher quality data loggers. We modified Isaak et al.'s (2013) stream temperature water monitoring protocol slightly and in 2013, deployed one Onset® HOBO® TidbiT® v2 Submersible Temperature Loggers (MA, USA) in 131 ponds. In 2014, we deployed 3-4 loggers in different locations in the seven temporal ponds to compare variability in temperature readings throughout the pond. See chapter 5 for further details and results.

Air and Relative Humidity Data Loggers - At 50 ponds, we co-located HAXO8 LogTag® Transit HAXO-8 Temperature and Relative Humidity Data Loggers (UT, USA) with water temperature data loggers. HAXO-8 loggers were placed in a radiation shield according to Holden et al. (2013) and attached to the north side of a conifer tree >30 cm in diameter within 100 meters of the pond. See Chapter 5 for more details and results.

Photographs and Tissue Samples - We captured 2 individuals of each amphibian species detected in addition to 2-3 fully formed spotted frogs. We held each animal individually in plastic zip top bags with water in a shady location until sampling occurred. We placed each animal in a plastic 'photo booth' (small plastic terrarium with marked measurements) to take a ventral, lateral, and dorsal photograph (2014 only). We then used scissors to collect a toe or tail clip from each animal. We wiped scissors with bleach between individuals to destroy residual DNA on scissors. We preferentially selected fully formed individuals and when sampling them, clipped the second or third toe from the back foot in order to avoid adversely affecting nuptial pads on front feet. When only larval specimens were captured we removed a small portion of tail tissue.

Amphibians were placed in 'photo booths' (small plastic terrariums) and lateral, dorsal, and ventral photographs were taken.

BD Sampling - We selected spotted frogs to test for BD for 2 reasons: 1) we expected spotted frogs or long-toed salamanders (*Ambystoma macrodactylum*) to be the most commonly detected species in our study area and 2) spotted frogs carry heavier BD zoospore loads than long-toed salamanders (Goldberg et al. in prep). This maximized our chances of detecting BD and producing the most accurate BD distribution map in our study area.

In 2013 we sampled only designated 'intensive' sites. In 2014 we sampled spotted frogs for BD at all wetlands where fully formed individuals were detected. We sampled up to 3 spotted frogs at each sampling site. We used buccal swabs (MW fine-tipped plastic DrySwab; Medical Wire and Equipment, Wiltshire, England) to swab the underside of the animal back and forth 15 times (30 total swipes). New vinyl gloves were used to handle each animal. Swabs were stored in 95% ethanol until extracted. We sent swabs to the San Diego Zoo Amphibian Disease Laboratory where they used PCR to determine the number of BD zoospores for 3-8 replicates of each sample. We use the mean number of zoospores detected in all replicates of each sample to quantify the BD present on each animal.

Swabbing spotted frog (*Rana luteiventris*) for BD testing.

Animal Handling, Hygiene, and BD Decontamination - When we arrived at the wetland, we dug a small hole at least 100 feet from the wetland and washed our hands with biodegradable soap over the hole. We did not use sunscreen or bug spray during sampling in order to keep hands free of chemicals. Except spotted frogs (which were handled with gloves for BD sampling), we handled fully formed amphibians with wet bare washed hands. We observed tadpoles in plastic zip-top bags or 'photo booths' and did not handle them unless necessary for tissue sampling.

After each survey, we cleaned mud, snails, and plants from equipment with stiff brush at the site. We rinsed the net in the wetland. When back at the field vehicle we sprayed all equipment (e.g., boots, waders, and dip nets) with a 10% bleach solution. We allowed equipment to dry while traveling to next site.

Opportunistic Observations - We created a list of easily identifiable species (including reptiles, mammals, invasive plants, native plants, and bumblebees) which observers might encounter at survey sites. We provided training in species ID and a field identification guide. Observers noted visual and audio detections of opportunistic species while at the survey site. Bumblebees were photographed for later verification. If fish were observed in the wetland, observers recorded species if known. See Chapter 6 for additional detail and results.

Sample Handling and Storage

Amphibian tissue samples were placed in coin envelopes and dried in the field. BD samples were stored in 95% ethanol. Samples were stored at room temperature at a climate controlled storage unit. Photographs were labeled and archived on IDFG servers.

General Taxonomy

Taxonomy was conducted in the field by paid wildlife technicians and biologists. Each staff member completed an amphibian identification training course. We modified dichotomous keys from Corkran and Thoms (2006) with information in Amphibians and Reptiles of Montana

(Werner et. al, 2014) and Storm et al. (1995). Ten specimens were identified in the field as salamander (*n* = 9) or wood frog (*n* = 1) and tissue samples from these individuals were sent to the University of Idaho for genetic confirmation of species ID. Sections of 16SRNA, D-loop, or ND2 were sequences and a BLAST (http://blast.ncbi.nlm.nih.gov/) search was performed to determine which species each sequence represented.

Western Toad Taxonomy
We used dried toe or tail clips collected from extracted DNA and sequenced a 269 base pair section of the mitochondrial cytochrome oxidase (COI) gene. We accessed GenBank to obtain sequences of the same region from additional toads representing the major clades identified by Goebel et al. (2009). We used PAUP* (Swofford 2002) to build a Neighbor-Joining tree from maximum likelihood distances calculated using a HKY+I model. The work described in this paragraph was performed or supervised by Dr. Jack Sullivan at the University of Idaho and we are grateful for his assistance.

Verifying Historic Specimens
In 2012 we reviewed the IFWIS database for historic wood frog and northern leopard frog observations. We visited each location where a wood frog had been reported in Idaho (*n* = 4) and each location where a leopard frog had been reported in the Idaho Panhandle IDFG administrative region (*n* = 6). We conducted a visual inspection, timed search, or dip net survey at these locations. Survey type was dependent on conditions at sites (privately owned, developed since report was made, etc). All locations had poor accuracy and were estimated to be within 5 miles of the original collection site.

We queried museum collection databases to confirm IFWIS records and searched for additional records. We requested collection loans of all available museum specimens and specimens were examined by taxonomic experts.

Results and Discussion
Microclimate and opportunistic species results are detailed in Chapters 5 and 6 respectively.

Summary
We detected amphibians at 48% (*n* = 397) of 826 sites surveyed. We detected amphibians in 49% (*n* =390) of 802 cells surveyed (Table 3-4). We identified 9 amphibian species representing 7 families and 7 genera. We detected amphibians at 70% (*n* = 303) of ponds, 33% (*n* = 89) of other wetlands, and 4% (*n* = 5) of dry sites surveyed (Table 3-4). Most commonly detected were spotted frogs (47% of ponds), long-toed salamanders (36% of ponds) and Pacific tree frogs (*Pseudacris regilla*) (20% of ponds). The maximum number of species detected in one pond was 4. (Map 3-2). Playa Lake, WA was the most diverse and the only pond to host 4 species of breeding amphibians (spotted frogs, long-toed salamanders, tree frogs, and western toads). We detected 1 of 4 target SGCN amphibians. We provide evidence the 3 of the undetected species were either extirpated (leopard frog) or never occurred (wood frog and tiger salamander) in the Idaho and Washington portion of the study area. We occasionally detected rocky mountain tailed frogs (*Ascaphus montanus*) (*n* = 33 cells) and Idaho giant salamanders (*Dicamptodon aterrimus*) (*n* = 2 cells) at mostly non-pond survey sites (Map 3-12). Our results should not be considered a comprehensive survey for these 2 species.

Table 3-4. Detections by species and wetland type.

Species	# Detections (% of wetland type)							
	Ponds/Lakes (*n* = 433)		Other Wetlands (*n* = 270)		Dry (*n* = 123)		Total (*n* = 826)	
All Species	302	(70)	90	(33)	5	(4)	397	(48)
Wood Frog[a]	0		0		0		0	
Northern Leopard Frog[a]	0		0		0		0	
Western Toad[a]	22	(5)	3	(1)	0		25	(3)
Columbia Spotted Frog[a]	205	(47)	35	(13)	2	(2)	242	(29)
Pacific Tree Frog	88	(20)	12	(4)	2	(2)	102	(12)
Long-toed Salamander	158	(36)	10	(4)	0		168	(20)
American Bullfrog	23	(5)	2	(1)	0		25	(3)
Tiger Salamander[a]	0	(0)	0	(0)	0		0	(0)
Non-target species[b]	22	(5)	42	(16)	1	(1)	65	(8)
Total Detections	518		104		5		627	

[a] Species of Greatest Conservation Need

[b] Includes Rocky Mountain tailed frog[a], Idaho giant salamander[a] and unidentified species

We detected tree frogs consistently throughout the mountain ranges in our study area except the Coeur d'Alene Mountains where they were only found on the fringes (Map 3-8). This mirrors the pattern seen in marten and other mammals described in chapter 4. The IFWIS database does not contain records of tree frogs nor are we aware of pre-MBI amphibian surveys in the Idaho Coeur d'Alene Mountains as we define the range geographically (but see Beck et al. 1998 for close proximity surveys). However, tree frogs have been reported at locations immediately adjacent to the Idaho Coeur d'Alene's since 2009 (http://fieldguide.mt.gov, Accessed April 2, 2016). We currently lack the data necessary to determine if tree frogs were extirpated from the Idaho Coeur d'Alene's or if they are not native to the mountain range.

Pacific tree frog (*Pseudacris regilla*) in the West Cabinet Mountains.

Left: Rocky mountain tailed frog (*Ascaphus montanus*)
Right: Idaho giant salamander (*Dicamptodon aterrimus*)

Temporal Surveys
In this section we define pond survey sites by elevation as low (<1,100 m) or high (>1,100 m). This criteria is based on timing of 2014 detected amphibian activity in temporal ponds (n = 7). We classified ponds as low elevation (n = 5) if amphibians were detected during both June visits. We classified ponds as high elevation (n = 2) when amphibians were not detected until the July 8-10 visit (Table 3-12).

Most tree frog detections occurred from June 1-June 29 indicating an early burst of breeding. BL tadpoles were detected at the higher elevation tree frog pond (48B) during the August 13 survey. This species was not detected at all at low elevation pond 1001 until NL tadpoles were detected during the September 3 survey. Long-toed salamanders were detected consistently at all three ponds where they occurred until the August 13 survey. They were detected in LEGS phase during the 3 September survey at the highest elevation salamander pond 48B. Bullfrogs were detected consistently across the survey period from June 1 to September 3 (Tables 3-5, 3-6, 3-7, and 3-11).

Long-toed salamander (*Ambystoma macrodactylum*)

Table 3-5. Amphibian life stages.

Code	Life Stage
EGG	egg
NL	no legs
BL	2 legs
LEGS	4 legs and a tail
AJ	fully formed

Table 3-6. Reliable breeding detection dates of pond amphibians at low (< 1,100 m) and high (> 1,100 m) elevation sites between June 1-September 25, 2014.

Western Toad < 1100 m	1 June-13 August
Western Toad > 1100 m	9 July-3 September
Spotted Frog < 1100 m	17 June-13 August
Spotted Frog >1100 m	29 July-3 September
Long-Toed Salamander	1 June-13 August
Tree Frog <1000 m	1 June-29 July
Tree Frog > 1000 m	1 June-29 July
Bullfrog	1 June-3 September

Western toads and spotted frogs were detected at low elevation sites from June 1 to August 13 and dispersed between August 13 and September 3. These species were not detected at high elevation sites until the July 9 survey. Spotted frogs were not detected at high elevation sites during the September 25 survey and western toads appeared ready to disperse (indicated by masses of near completely metamorphosed toadlets) by the September 25 survey. Although breeding was delayed by about 4 weeks at higher elevations, spotted frogs at both low and high elevation sites completed their life cycle in approximately 10 weeks. This suggests the spotted frog breeding cycle occurs later at higher elevations but is not shortened. However, western toad breeding at high elevation sites was delayed by approximately 6 weeks and life cycles appeared to be shortened at high elevations being completed in 8 weeks, which is 2 weeks shorter than their lower elevation western toad counterparts (Table 3-14).

Western toad (*Anaxyrus boreas*) eggs, tadpoles, and toadlet. Temporal surveys tracked amphibian development at 7 ponds for the 2014 breeding season.

Our temporal surveys generally mirrored patterns we saw in the larger dataset and July 9-July 29 was the portion of the season in which we detected all species across all elevations. This window would be the most productive to conduct multi-species surveys across elevational gradients. However, our approach of beginning with low elevation surveys in early June, surveying higher elevations in early July (or when snow melt allows access), and finishing surveys by early September also appears to have been effective. For landscape scale multi-species pond breeding amphibian surveys in our study area we recommend completing low elevation surveys during June and July and high elevation surveys between mid-July and early September.

Table 3-7. Developmental stage (see Table 3-5 for abbreviations) of amphibians detected at temporal wetlands. Dates are accurate within 1 day. Actual survey dates occurred +/- 1 day indicated in this table.

	1-Jun	17-Jun	9-Jul	29-Jul	13-Aug	3-Sep	25-Sep
Western Toad							
WT EGG	■						
WT NL		■	■	■			
WT BL				■	■	■	
WT LEGS				■	■	■	
WT AJ	■		■		■	■	■
Spotted Frog							
SF EGG							
SF NL		■	■	■			
SF BL			■	■	■	■	
SF LEGS			■		■	■	■
SF AJ	■	■	■	■	■	■	■
Long-toed Salamander							
LTS EGG	■	■	■				
LTS NL	■	■					
LTS BL			■				
LTS LEGS	■	■	■	■	■	■	
LTS AJ	■						
Pacific Tree Frog							
TREE EGG	■						
TREE NL	■	■	■		■		
TREE BL		■	■	■	■		
TREE LEGS			■				
TREE AJ	■		■				
Bull Frog							
BF EGG			■				
BF NL	■						
BF BL	■	■					
BF LEGS			■	■	■		
BF AJ	■		■	■	■	■	

Beginning surveys in June does have the drawback of missing the early and probably biggest breeding period of tree frogs from April-May. However, we consistently detected larval stages of this species throughout June. Additionally, conducting surveys in June rather than April-May allows for the collection of tree frog tadpoles which are much easier to identify than the eggs which would be detected more often in the April-May window. Tree frog detections occurred less frequently as the summer progressed and our late season surveys were less likely to detect tree frogs. Nevertheless, we detected larvae in various stages of development for most of the summer and early NL tadpoles as late as mid-August. The early burst of tree frog breeding is followed by production of occasional egg clutches throughout the summer.

Columbia spotted frog (*Rana luteiventris*)

Wood Frogs (Map 3-11)

The potential occurrence of wood frogs in northern Idaho has been a curiosity for naturalists and natural resource professionals since Dumas (1955) first reported the capture of a single specimen in 1955. Nearly 6 decades later we were funded to determine the status of this species under the guidance of the I-SWAP. Through a combination of visiting historic observation sites, examining museum specimens, reviewing published literature, and conducting extensive field surveys we conclude wood frogs are not native to, and were never extant in, northern Idaho or northeastern Washington and historic records are erroneous. We support this conclusion as follows:

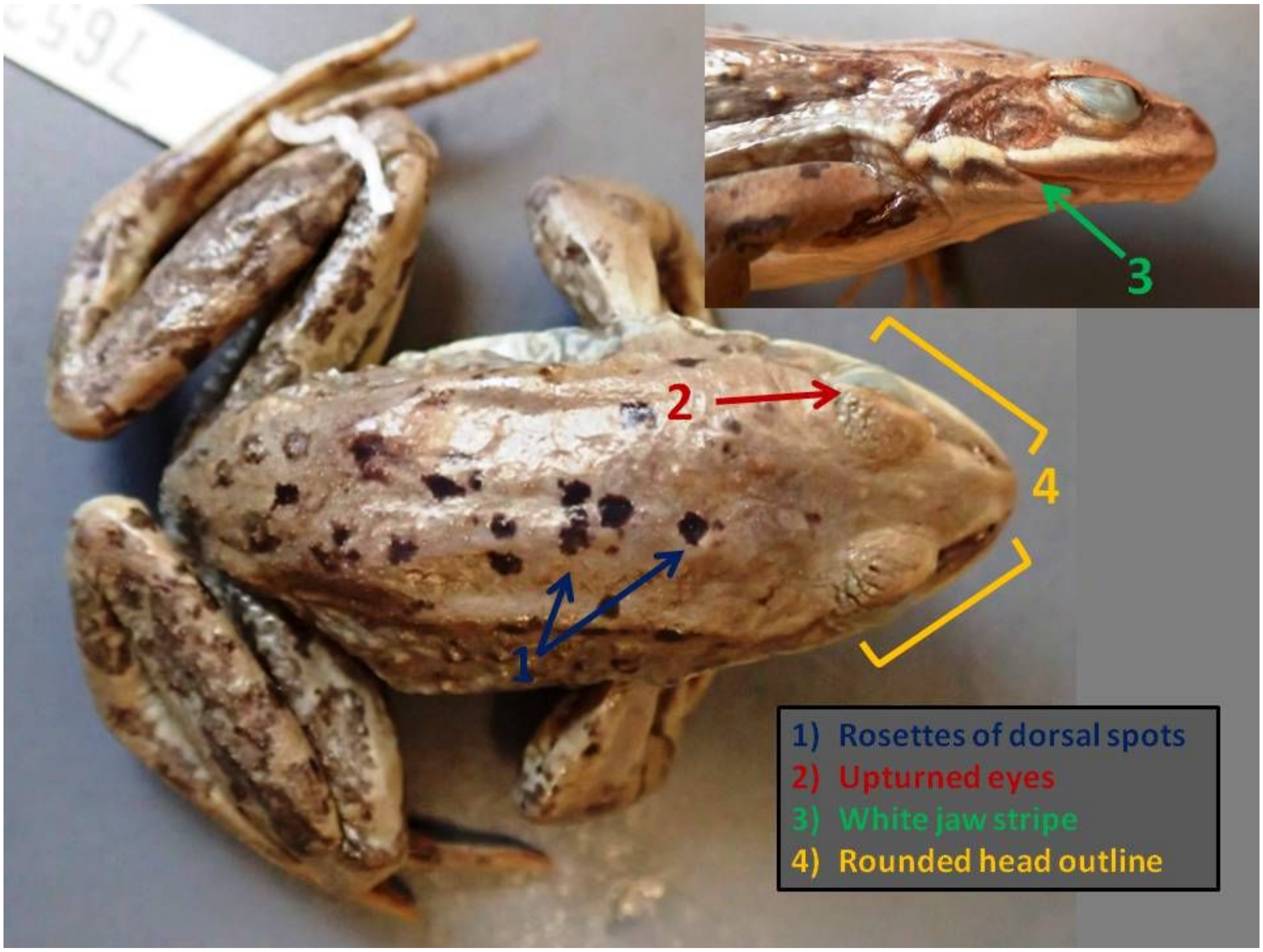

Figure 3-1. Museum specimen LACM76527 with characters used to re-classify it from *R. sylvatica* to *R. luteiventris*.

Genetic analysis revealed the 1 specimen our field crew morphologically identified as wood frog was actually a tree frog. This is not surprising as observers inexperienced with wood frogs commonly make this mistake in northern Idaho.

The 4 IFWIS wood frog records indicated specimens had been curated at the Los Angeles County (LACM) and University of Idaho Museums (UIM). We queried both collection databases and found records of 3 additional specimens at LACM for a total of 7 historic wood frog observations in the state of Idaho from 1955, 1956, and 1970. The sample archived at UIM had been lost and one observation did not have a corresponding museum record. The 5 remaining specimens were archived at LACM. We obtained all 5 LACM specimens. Dr. David Green (McGill University) examined the specimens and classified each as *R. luteiventris* based on the following characters: 1) rosettes of dorsal spots, 2) upturned eyes, 3) white jaw stripe, and 4) rounded head outline (Corkran and Thoms 1996, Dr. David Green, personal communication) (Figure 3-1).

Dumas (1957) reported collecting 2 female wood frog specimens from the northern Idaho Panhandle in 1955 and 1956. The 1956 specimen was collected from, "a small pond by the Kootenai River approximately one mile west of Bonners Ferry, Boundary County, Idaho.".

Dumas provides no more detail in his report other than, "pattern and coloration were typical of the species [wood frog]". The specimen was archived at the UIM and subsequently misplaced. Therefore, it was not available for examination.

The 1955 Dumas specimen was collected 2 miles east of Coolin, Idaho and, to our knowledge, not archived in a museum. However, Dumas does provide more character details describing it as intermediate in character between *R. sylvatica* and *R. pretiosa* (*R. pretiosa* is now classified *R. luteiventris*). He describes the "undersides of the hind legs and toes and the lateral margins of the abdominal region" as orange-pink. This orange-pink ventral coloration would be inconsistent with *R. sylvatica* classification but is a character of mature *R. luteiventris* (Corkran and Thoms 1996).

The only other Idaho *R. sylvatica* records are from July 6 and 8, 1970. Because we examined these specimens and determined they represent *R. luteiventris*, we are left with only Dumas's (1957) 2 records as potential markers of this species' historic occurrence in Idaho.

If wood frogs were a native Idaho species, they would exist disjunctly from the majority of their conspecifics within their vast North American range (Muths et al. 2005). This is not unusual for this species as disjunct populations are thought to occur in Oklahoma, Missouri, and Arkansas (Muths et al. 2005). Regardless, the only occurrence record we cannot definitively dispute is Dumas (1955) for which he provides no description of identifying characters. We do not believe this single record provides adequate evidence that this species ever occurred naturally within the political bounds of the state of Idaho or northeastern Washington east of the Pend Oreille River. We conclude wood frogs are not native to Idaho or northeastern Washington east of the Pend Oreille River.

Northern Leopard Frogs (Map 3-7)

We conclude northern Leopard frogs are native to at least the northern portion of our study area and were likely extirpated from the Idaho and northeastern Washington portions of the study area. We support this conclusion as follows:

We found 11 historic records of *R. pipiens* in our study area in addition to the 6 IFWIS records for a total of 17 historic records in the study area from 1892-1955. Specimens were available for 15 of the observations. We examined the 15 specimens identified each as *R. pipiens* based on the following characters: 1) light dorsolateral folds, 2) smooth dark oval dorsal patches, and 3) long legs (lower leg >1/2 snout to vent length) (Corkran and Thoms 1996) (Figure 3-2).

Confirmed leopard frog detections occurred sporadically in the Idaho Panhandle from the late 1800s to 1955. Historic northern Idaho occurrence records spanned from near the Canadian border south to Lake Cocolalla. These confirmed records indicate *R. pipiens* is a native species which occurred, at a minimum, in the northern portion of our Idaho study area. We did not detect this species during our extensive Idaho and Washington surveys. Because 60 years have passed since the last confirmed leopard frog detection, we conclude this species is likely extirpated from the Idaho and Washington portions of the study area.

MBI surveys detected breeding populations of non-native bullfrogs within 16 km of the CWMA, where bullfrogs are not currently known to be extant. The potential northward expansion of bullfrogs may pose an additional threat to the native leopard frog colony. A collaborative trans-boundary working group was formed which will be important in addressing bullfrog expansion issues and facilitating potential leopard frog re-colonization of northern Idaho.

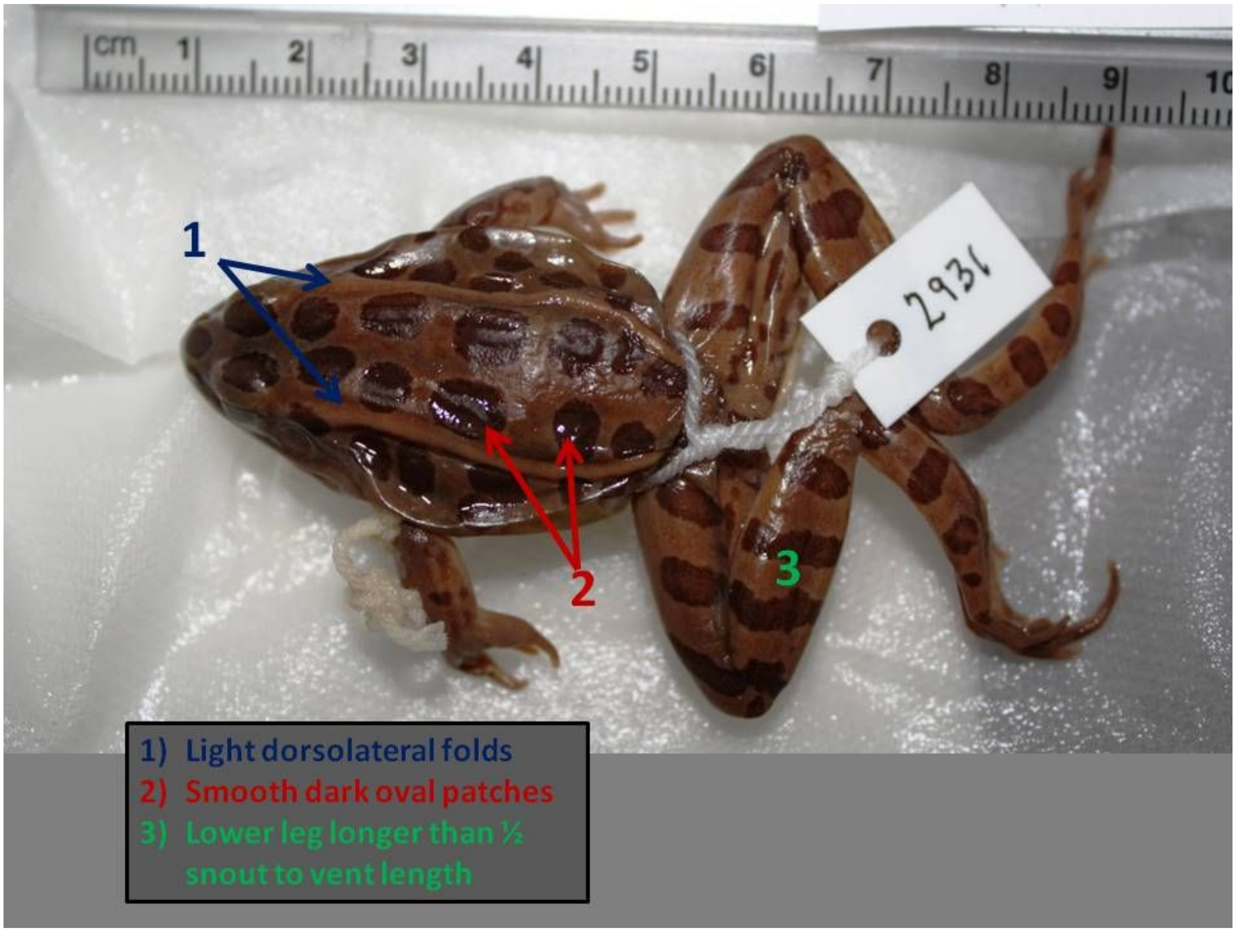

Figure 3-2. Museum specimen PSM2931 with characters used to confirm museum classification of *R. pipiens*.

Western Toads (Map 3-6)
We detected western toad breeding activity at 62% (n = 16) of the 26 sites where we detected toads. Toad detections occurred primarily north of Interstate-90 with a majority of detections in the Selkirks (Map 3-6). Toads were not detected in the Coeur d'Alene Mts. and were only detected at 1 location in the Saint Joe Mts.

The Sullivan Lab at University of Idaho successfully generated sequences from 47 individual toads representing 17 survey sites. MBI sequences formed 7 groupings within the Goebel et al. (2009) Northwest Clade (Fig. 3-3). The Goebel et al. (2009) northwest coastal and central sub-clades formed independent clades in our analysis. However, Goebel et al. (2009) middle rocky mountain and northern sub-clades were not supported by our analysis. The 7 MBI sub-clades were well distributed across the study area.

Western toads do not breed exclusively in ponds. They breed in many small bodies of water such as puddles or ruts in roads and can experience reproductive bursts after disturbance events (Dr. Chuck Peterson, personal communication). Although we targeted ponds for inventory, we did survey a substantial number of other wetland types, and we expected to find toads to be more numerous in the southern portion of the study area. Our survey protocol, that focuses only on the edges of ponds, may have resulted in fewer detections. For example, the wet meadows near W1247 (Copper Lake, ID) are a major toad breeding site. The observer followed the protocol to survey the shore of the pond but did not explore the nearby wetlands. Therefore, breeding activity was not detected, although a single adult toad was documented. This suggests we may have missed breeding activity at sites where we detected only fully formed toads.

Western toad (*Anaxyrus boreas)*

Our geographical sampling was less broad continentally but more intense locally than Goebel et al. (2009). DNA sequences from our study area fell within the Northwest clade and support toads in our study area being considered part of the Northwest clade (Goebel et al. 2009). We found less support for the sub-clades identified by Goebel et al. (2009). The middle rocky mountain

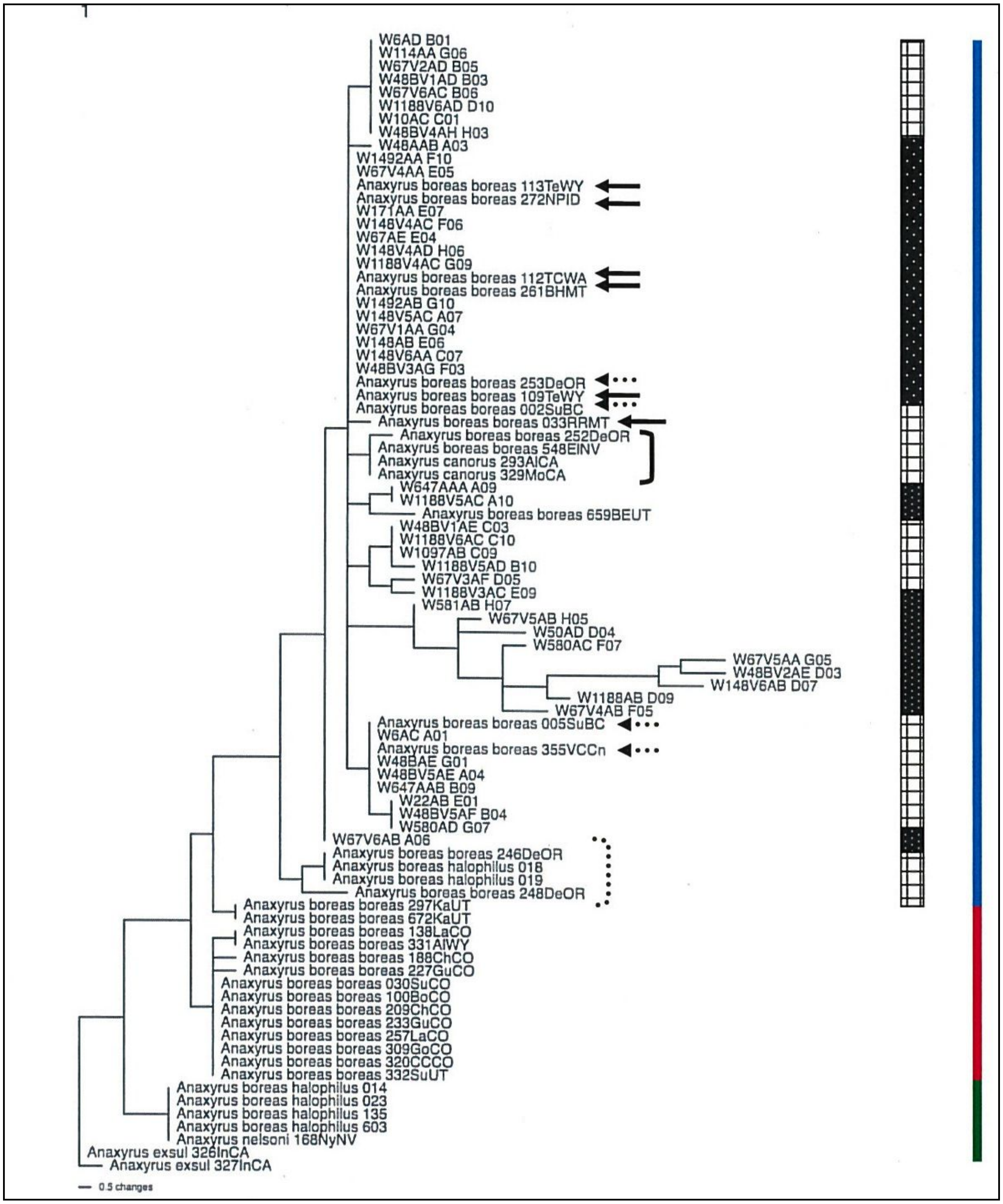

Figure 3-3. Neighbor-joining tree showing relationship of MBI toad tissues (sample name starts with W) with Goebel et al. (2009) toad samples (sample name starts with *Anaxyrus*). Black and white bar indicates MBI sub-clades. Colored bar indicates Northwest (blue), East (red), and Southwest (green) clades identified by Goebel et al. (2009). Arrows and brackets indicate Goebel et al. (2009) Northwest sub-clades: Middle Rocky Mountains (solid arrow), Central (solid bracket), Northern (dashed arrow), and Coastal (dashed bracket).

and northern sub-clade sequences showed no independence from our MBI sequences. Although the central clade did form an independent clade, it showed little independence from the MBI sequences. The coastal clade did show independence from MBI samples (Figure 3-3).

We found no evidence of genetic structure of toad populations within our study area. This is supported by our clades being well distributed across the study area and mountain ranges. The one toad population we found in the Saint Joe Mountains (W1492), which was separated from all other samples by a dearth of toad detections in the Coeur d'Alene's, phylogenetically groups with toads from the Selkirks and Cabinets. The one Cabinet population we detected is well represented among 5 of our 7 sub-clades. This suggests two possibilities: 1) We did not detect toads which were present between the southern and northern portions of our study area or 2) there has been a recent decline in toad populations in the central and southern portion of our study area.

Regardless, all toads examined in our study area appear to be appropriately assigned to *A. boreus* and show no evidence of distinct evolutionary lineages to be prioritized for conservation.

Tiger Salamanders (Map 3-5)
Our field crews identified 9 tiger salamander specimens from 5 sites. However, genetic analyses confirmed each of the 9 specimens were long-toed salamanders. We are aware of two historic records of this species in our study area. Dr. Gordon D. Alcorn was reported to have taken several 7-8 inch larvae from Lake Chatcolet, Idaho on April 19, 1936 (Slater 1937). To our knowledge these specimens were not archived in a museum. Based on this record and reports from other areas in Idaho, Slater and Brown (1941) postulated the species occurred statewide. D. Gayman was reported to have collected one specimen from Black Lake, ID on July 4, 1966 (IFWIS, accessed April 3, 2016). We were unable to locate the D. Gayman specimen which was purportedly submitted to a museum at the University of Idaho. Adjacent to our study area, tiger salamanders have historically been reported from Medical Lake, WA and Colville, WA (Slevin 1928). Based on the lack of unverifiable historic specimens and our non-detection of this species we conclude this species is likely not native to our study area.

Potential Threats to Native Amphibians (BD, Bullfrogs, and Fish) (Maps 3-3, 3-9, 3-13)
We detected BD on spotted frogs at 80% (n = 123) of 153 wetlands sampled. Of the 399 spotted frogs tested, 65% (n = 261) tested positive, 29% (n = 115) negative, and 6% (n = 23) equivocal. The median zoospore count was 1.3 ranging from 0.03 to 5023. BD is well distributed across the landscape and was detected more frequently later in the survey season. BD was detected less frequently at mid-elevation sites than low or high elevation sites (Map 3-3, Appendix III-b).

Western toads and bullfrogs were detected more often in ponds with fish than without. Spotted frogs, tree frogs, and long-toed salamanders were detected more often in ponds without fish (Table 3-8). Comprehensive fish surveys were not conducted; observers simply noted any fish observations during the course of the survey. Therefore, fish likely occurred at some sites where they were not detected.

Table 3-8. Amphibian detections in ponds with and without opportunistic fish detections.

	# Detections		
Species	All Pond/Lakes Surveyed	Ponds with fish detected (n=93)	Ponds with no fish detected (n=310)
All Species	302	48	233
Western Toad	22	8 (9%)	12 (4%)
Columbia Spotted Frog	205	36 (39%)	147 (47%)
Pacific Tree Frog	88	10 (11%)	77 (25%)
Long-toed Salamander	158	9 (10%)	139 (45%)
American Bullfrog	23	7 (8%)	16 (5%)

BD was well distributed across the study area occurring at a majority of sites and on a majority of frogs at very low intensities (Map 3-3, Appendix III-b). The patterns we found are similar to Goldberg et al. (*In Prep*) who tested spotted frogs for BD in a study area which overlapped the southern portion of the MBI study area. The zoospore levels we detected were very low-intensity and generally too low to be likely to cause deformities (Allan Pessier, personal communication). Climate change is expected to alter conditions favorably for BD while at the same time improving conditions for bullfrogs (Goldberg et al. *In Prep*) which are known to be resistant carriers of the fungus. Monitoring programs should continue over time to assess the status of BD and the distribution of bullfrog populations in the study area.

American bullfrog (*Rana catesbeianus*)

Conclusions

Our wetland surveys represent the first comprehensive inventory of pond breeding amphibians in the Idaho Panhandle and adjoining mountain ranges. This baseline inventory sets the stage for long term monitoring which is needed to assess changes in species abundance and distribution over time.

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Tables and Maps

Table 3-9. Wetland surveys by survey and wetland type.

Wetland Type	Full Perimeter		100-meter		500-meter		30-minute Timed Search		Total Survey	
	#	(%)	#	(%)	#	(%)	#	(%)	#	(%)
Pond/Lake[a]	187	(23)	35	(4)	2	(0)	20	(2)	244	(30)
Natural Pond/Lake	24	(3)			1	(0)			25	(3)
Ephemeral Natural Pond	5	(1)							5	(1)
Modified Natural Pond	6	(1)			1	(0)			7	(1)
Constructed Pond	65	(8)			2	(0)			67	(8)
Beaver Pond	5	(1)							5	(1)
Puddles	4	(0)					20	(2)	24	(3)
Emergent Wetland	32	(4)					38	(5)	70	(8)
Channels near Stream	11	(1)	1	(0)			38	(5)	50	(6)
Stream	1	(0)	16	(2)			190	(23)	207	(25)
Meadow	10	(1)	1	(0)			34	(4)	45	(5)
Dry-No wetland	1	(0)					70	(8)	71	(9)
Other[b]	3	(0)	1	(0)			2	(0)	6	(1)
Total	**354**	(43)	**54**	(7)	**6**	(1)	**412**	(50)	**826**	

[a] Category could include natural, ephemeral, modified, and constructed ponds. Used primarily in 2013.

[b] Includes rivers, vernal pools, road ditches, forested wetlands, and springs

Table 3-10. Western toad detections by wetland site. Temporal sites were surveyed once in 2013 and repeatedly in 2014.

Wetland ID	Survey Date	Breeding Detected?	Abundance**	Latitude	Longitude
W6	08/19/13	No	10	48.6670	-117.271367
W10	08/08/13	Yes	1000	48.8378	-117.260317
W22	07/02/13	No	2	48.3094	-117.095367
W35	07/25/14	No	2	48.9130	-117.16507
W48A	08/30/13	Yes	300	48.7425	-117.06126
W48B	Temporal	Yes	2000	48.7741	-117.04978
W50	07/12/14	Yes	100	48.8341	-117.04068
W580	07/25/13	Yes	4	48.3937	-117.17862
W581	06/27/13	Yes	100	48.4412	-117.20027
W67	Temporal	Yes	1600	48.8779	-117.00529
W76	07/18/13	No	2	48.5630	-116.94733
W96	07/21/13	Yes	1000	48.9293	-116.84659
W109	08/13/13	Yes	3	48.7791	-116.77924
W114	07/05/13	No	2	48.9968	-116.82925
W121	08/15/13	Yes	2	48.5705	-116.72315
W148	Temporal	Yes	600	48.6597	-116.59933
W171	08/10/13	No	2	48.8316	-116.43779
W645	06/15/14	Yes	1000	***47.6795**	**-117.02486**
W647A	06/13/14	No	4	**47.7892**	**-116.97322**
W731	06/04/14	No	3	47.9824	-116.89313
W964	06/18/13	Yes	100	48.2373	-116.49515
W1057	Temporal	No	2	48.9036	-116.38901
W1097	06/22/13	Yes	2	48.5709	-116.32872
W1188	Temporal	Yes	400	48.3778	-116.13695
W1247	08/08/13	No	2	48.9938	-116.10632
W1492	08/22/13	Yes	100	47.2369	-115.63681

* **Bold** locations are fuzzed within 500 meters. All other locations are precise.

**If >10, abundance indicates an estimate in the 10s, 100s, or 1000s.

Table 3-11. Bullfrog detections by wetland site. Temporal sites were surveyed once in 2013 and repeatedly in 2014.

Wetland ID	Survey Date	Breeding Detected?	Abundance**	Latitude	Longitude
W156	7/2/2014	Yes	20	***48.4948**	**-116.47588**
W645	6/15/2014	Yes	10	**47.6795**	**-117.02486**
W652	6/3/2014	No	20	**48.0063**	**-116.99474**
W653	6/3/2014	No	5	**48.0333**	**-117.02763**
W656	6/13/2013	Yes	40	48.1740	-117.01009
W657	7/1/2014	Yes	4	**48.1955**	**-117.03132**
W691	7/11/2014	Yes	70	**47.9948**	**-116.98153**
W711	7/15/2014	Yes	50	**47.1016**	**-116.85449**
W802	6/16/2013	Yes	6	47.4789	-116.73676
W814	8/20/2013	No	2	**48.0045**	**-116.72745**
W838	8/14/2013	No	15	47.3375	-116.61890
W839	8/20/2013	Yes	10	47.3558	-116.68524
W854	8/24/2013	No	6	**48.0542**	**-116.70102**
W856	6/3/2014	No	1	**48.1397**	**-116.71170**
W908	7/25/2014	No	4	**47.2940**	**-116.53454**
W909	6/28/2014	No	5	**47.3295**	**-116.49332**
W930	Temporal	Yes	200	48.2916	-116.55319
W931A	6/4/2014	Yes	600	**48.3028**	**-116.56934**
W968	6/13/2014	Yes	10	**48.4169**	**-116.51068**
W1001	Temporal	Yes	100	48.3015	-116.42539
W1005	7/1/2014	No	1	**48.4698**	**-116.46614**
W1043	6/29/2014	No	2	**48.2793**	**-116.37933**
W1044	6/18/2013	Yes	8	48.3322	-116.38375
W1057	Temporal	Yes	2000	**48.8989**	**-116.38508**
W1147	6/14/2014	Yes	2	**48.6183**	**-116.36089**

* Bold locations are fuzzed within 500 meters. All other locations are precise.

**If >10, abundance indicates an estimate in the 10s, 100s, or 1000s.

Table 3-12. Detections of amphibians by life stage [EGG (eggs), NL (no legs), BL (beginning legs), LEGS (4 legs and tail), AJ (fully formed adult or juvenile)] during 2014 temporal wetland surveys Dates are within 1 day of actual survey date.

Wetland ID	Elevation	1-Jun	17-Jun	9-Jul	29-Jul	13-Aug	3-Sep	25-Sep
Western Toad								
W1057	538	0	0	0	0	0	0	~
W1001	630	0	0	0	0	0	0	~
W930	643	0	0	0	0	0	0	~
W67	899	EGG/AJ	NL	NL	BL	LEGS/AJ	AJ	AJ
W48B	1070	EGG	NL	NL	NL	BL/LEGS	0	~
W148	1711	0	0	AJ	NL	BL/LEGS	BL	0
W1188	1763	0	0	AJ	NL AJ	BL/LEGS	BL/LEGS	0
Tree Frog								
W1057	538	0	BL	LEGS/AJ	0	0	0	~
W1001	630	0	0	0	0	0	NL	~
W930	643	NL	NL/BL	NL/BL/LEGS	BL	0	0	~
W67	899	EGG AJ	0	NL	0	0	0	~
W48B	1070	EGG	0	NL	BL	BL	0	~
W148	1711	0	0	0	0	0	0	0
W1188	1763	0	0	0	0	0	0	0
Bullfrog								
W1057	538	AJ	0	EGG/AJ	AJ	AJ	AJ	~
W1001	630	NL/BL	BL	LEGS/AJ	AJ	LEGS/AJ	0	~
W930	643	NL/AJ	BL	AJ	LEGS/AJ	LEGS/AJ	AJ	~
W67	899	0	0	0	0	0	0	~
W48B	1070	0	0	0	0	0	0	~
W148	1711	0	0	0	0	0	0	0
W1188	1763	0	0	0	0	0	0	0
Spotted Frog								
W1057	538	AJ	0	LEGS	0	AJ	AJ	~
W1001	630	0	0	0	0	0	0	~
W930	643	0	0	0	0	0	0	~
W67	899	0	0	0	0	0	AJ	AJ
W48B	1070	AJ	NL/AJ	NL/BL/LEGS	BL/AJ	BL/LEGS/AJ	AJ	0
W148	1711	0	0	AJ	NL/AJ	BL/AJ	AJ	0
W1188	1763	0	0	AJ	NL/AJ	BL/AJ	BL/LEGS/AJ	LEGS
Long-toed Salamander								
W1057	538	0	0	0	0	0	0	~
W1001	630	0	0	0	0	0	0	~
W930	643	LEGS	LEGS	LEGS	LEGS	LEGS	0	~
W67	899	EGG/NL	LEGS	LEGS	LEGS	LEGS	0	~
W48B	1070	EGG/NL/AJ	EGG/NL	EGG/BL	LEGS	LEGS	LEGS	~
W148	1711	0	0	0	0	0	0	0
W1188	1763	0	0	0	0	0	0	0

Table 3-13. Historic records of wood frog and northern leopard frog from the Idaho portion of the MBI study area.

IFWIS #	Museum #	Museum	Specimen Status	Database Spp.	MBI Spp.	Identifier	Life Stage	Field ID	MBI ID	Field Observer	Latitude	Longitude	Reference
81925	LACM76527	LAC	Photographed	*R. sylvatica*	*R. luteiventris*	Green, D.	Adult	6-Jul-70	12-Mar-15	Howell, D.B.	48.63477	-116.99098	Peterson 1999
NA	LACM76528	LAC	Photographed	*R. sylvatica*	*R. luteiventris*	Green, D.	Juvenile	6-Jul-70	12-Mar-15	Howell, D.B.	48.63477	-116.99098	www.portal.vertnet.org
NA	LACM76529	LAC	Photographed	*R. sylvatica*	*R. luteiventris*	Green, D.	Adult	6-Jul-70	12-Mar-15	Howell, D.B.	48.63477	-116.99098	www.portal.vertnet.org
81924	LACM76532	LAC	Photographed	*R. sylvatica*	*R. luteiventris*	Green, D.	Juvenile	8-Jul-70	12-Mar-15	Howell, D.B.	48.64013	-116.87786	Peterson 1999
NA	LACM76533	LAC	Photographed	*R. sylvatica*	*R. luteiventris*	Green, D.	Juvenile	8-Jul-70	12-Mar-15	Howell, D.B.	48.64013	-116.87786	www.portal.vertnet.org
81922	UIM246	UI	Lost	*R. sylvatica*	NA	NA	NA	14-Apr-56	12-Mar-15	Dumas, P.C.	48.69287	-116.33095	Dumas 1957
81923	NA	NA	NA	*R. sylvatica*	NA	NA	NA	2-Aug-55	12-Mar-15	Dumas, P.C.	48.49244	-116.90220	Dumas 1957
82269	CRCM48-25	CRCM	Photographed	*R. pipens*	*R. pipens*	DN[b]	Adult	30-Jul-47	8-Feb-14	Jones, G.	48.13921	-116.17637	Peterson 2000
82266	USNM39706	SNMNH	Not Verified	*R. pipens*	NA	NA	NA	1-Jul-1896	NA	Unknown	48.25113	-116.31445	Peterson 2001
82264	USNM20922	SNMNH	Not Verified	*R. pipens*	NA	NA	NA	20-Sep-1892	NA	Unknown	48.29212	-116.55162	Peterson 2002
82268	PSM2931	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Adult	11-Sep-39	8-Feb-14	Slater, J.R.	48.32579	-116.49292	Peterson 2003
82273	PSM2924	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Adult	11-Sep-39	8-Feb-14	Slater, J.R.	48.91255	-116.44860	Peterson 2004
82273	PSM2927	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Adult	11-Sep-39	8-Feb-14	Slater, J.R.	48.91255	-116.44860	Peterson 2005
82270	NA	NA	NA	*R. pipens*	*NA*	NA	Larva[a]	17-Jun-55	NA	Keating, J.	48.10842	-116.62265	Peterson 2006
NA	PSM2931	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Adult	11-Sep-39	8-Feb-14	Slater, J.R.	48.32780	-116.47660	www.portal.vertnet.org
NA	PSM2932	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Adult	11-Sep-39	8-Feb-14	Slater, J.R.	48.32780	-116.47660	www.portal.vertnet.org
NA	PSM10775	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Adult	11-Sep-39	8-Feb-14	Slipp, J.W.	48.85917	-116.33526	www.portal.vertnet.org
NA	PSM10770	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Adult	19-Aug-39	8-Feb-14	Slipp, J.W.	48.35550	-116.48195	www.portal.vertnet.org
NA	PSM10767	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Adult	19-Aug-39	8-Feb-14	Slipp, J.W.	48.18326	-116.26907	www.portal.vertnet.org
NA	PSM10773	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Adult	11-Sep-39	8-Feb-14	Slipp, J.W.	48.95035	-116.58417	www.portal.vertnet.org
NA	PSM10769	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Adult	19-Aug-39	8-Feb-14	Slipp, J.W.	48.35550	-116.48195	www.portal.vertnet.org
NA	PSM10771	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Adult	19-Aug-39	8-Feb-14	Slipp, J.W.	48.35550	-116.48195	www.portal.vertnet.org
NA	PSM10772	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Adult	19-Aug-39	8-Feb-14	Slipp, J.W.	48.35550	-116.48195	www.portal.vertnet.org
NA	PSM10774	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Juvenile	11-Sep-39	8-Feb-14	Slipp, J.W.	48.85917	-116.33526	www.portal.vertnet.org
NA	PSM10768	SMNH	Photographed	*R. pipens*	*R. pipens*	DN	Adult	19-Aug-39	8-Feb-14	Slipp, J.W.	48.35550	-116.48195	www.portal.vertnet.org

[a] Life stage not confirmed by MBI

[b]DeLima A., Neider J.

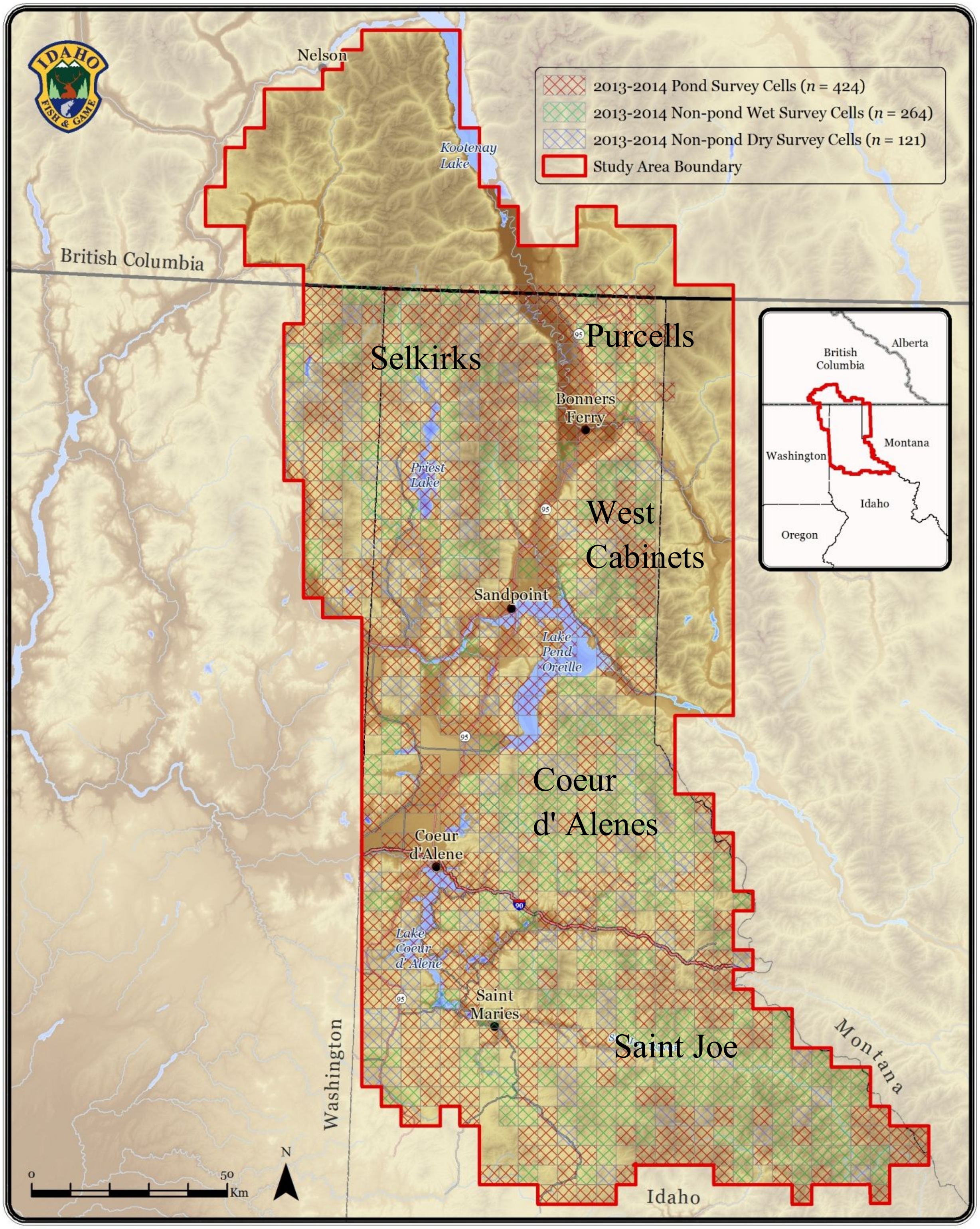
LAC: LA County Museum, UI: University of Idaho Museum, CRCM: Charles R. Conner Museum, SNMNH: Smithsonian National Museum of Natural History, SMNH: Slater Museum of Natural History

Table 3-14. Development of western toads (WT) and spotted frogs (SF) at high and low temporal wetlands. Development stages: EGG (eggs), NL (no logs), BL (beginning legs), LEGS (4 legs and tail), D (animals not detected or in process of dispersing when surveyed). Dates are accurate within 1 day.

	1-Jun	17-Jun	9-Jul	29-Jul	13-Aug	3-Sep	25-Sep
WT <1,100m	EGG	NL	NL	BL/LEGS	LEGS	D	
WT >1,100m			AJ	NL	BL	BL/LEGS	D
SF <1,100m	ADULTS	NL	NL/BL	BL	BL/LEGS	D	
SF >1,100m			AJ	NL	BL	BL/LEGS	LEGS/JUVYS
W67 (899m)							
WT EGG	1000s	0	0	0	0	0	0
WT NL	0	100s	30s	0	0	0	0
WT BL	0	0	0	1000s	0	0	0
WT LEGS	0	0	0	0	3000s	0	0
WT AJ	2	0	0	0	0	2	1
SF EGG	0	0	0	0	0	0	0
SF NL	0	0	0	0	0	0	0
SF BL	0	0	0	0	0	0	0
SF LEGS	0	0	0	0	0	0	0
SF AJ	0	0	0	0	0	1	1
W48B (1,070m)							
WT EGG	1000s	0	0	0	0	0	~
WT NL	0	2000s	1	1000s	0	0	~
WT BL	0	0	0	0	1000s	0	~
WT LEGS	0	0	0	0	100s	0	~
WT AJ	0	0	0	0	0	0	~
SF EGG	0	0	0	0	0	0	0
SF NL	0	5	30s	0	0	0	0
SF BL	0	0	30s	70s	9	0	0
SF LEGS	0	0	0	0	10s	0	0
SF AJ	8	50s	10s	8	7	1	0
W148 (1,711m)							
WT EGG	0	0	0	0	0	0	0
WT NL	0	0	0	200s	0	0	0
WT BL	0	0	0	0	500s	50s	0
WT LEGS	0	0	0	0	0	0	0
WT AJ	0	0	3	0	0	0	0
SF EGG	0	0	0	0	0	0	0
SF NL	0	0	0	1	0	0	0
SF BL	0	0	0	0	1	0	0

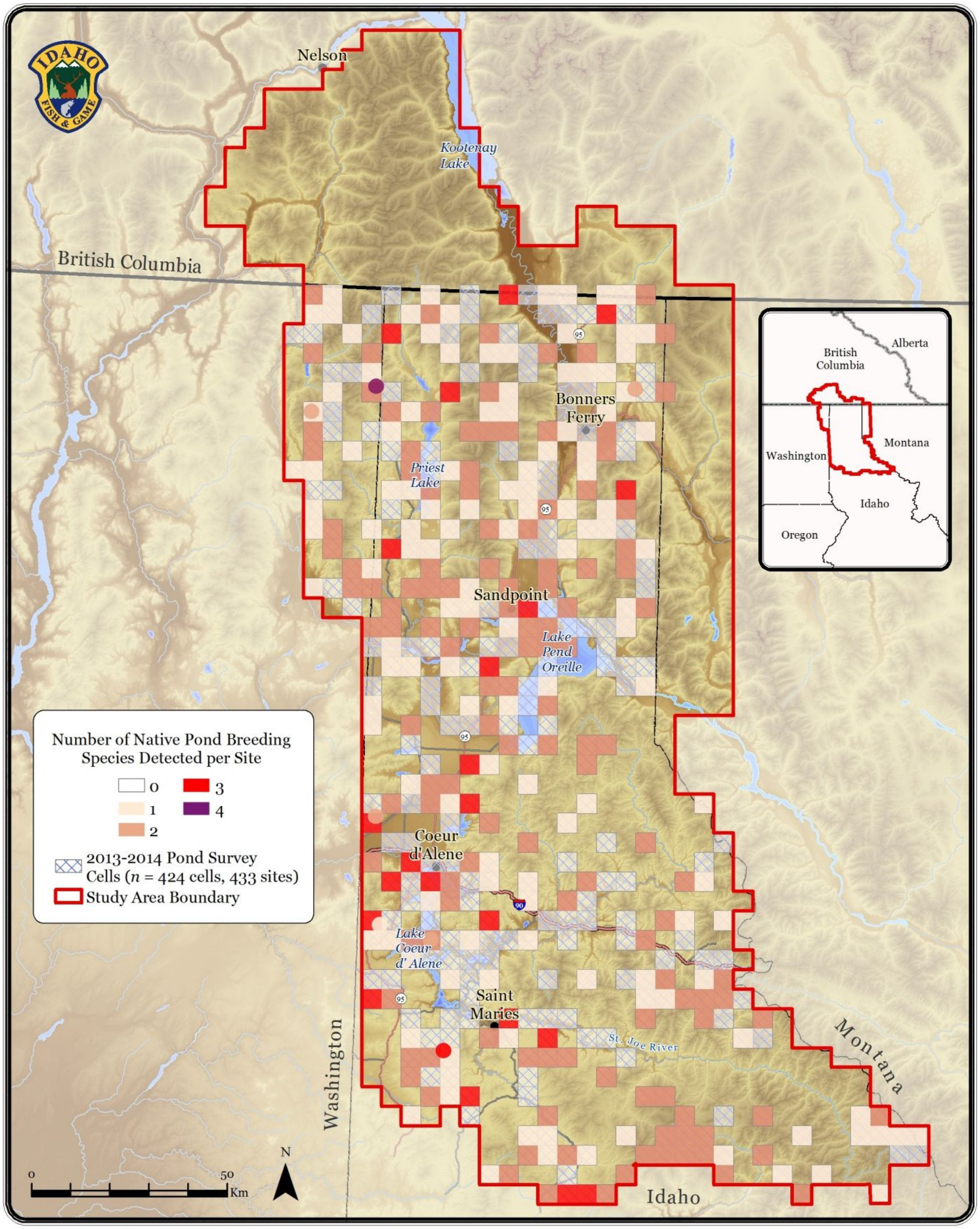
SF LEGS	0	0	0	0	0	0	0
SF AJ	0	0	4	4	3	1	0
W1188 (1,763m)							
WT EGG	0	0	0	0	0	0	0
WT NL	0	0	0	200s	0	0	0
WT BL	0	0	0	0	100s	50s	0
WT LEGS	0	0	0	0	0	20s	0
WT AJ	0	0	10	1	0	0	0
SF EGG	0	0	0	0	0	0	0
SF NL	0	0	0	60s	0	0	0
SF BL	0	0	0	0	60s	10s	0
SF LEGS	0	0	0	0	0	3	8
SF AJ	0	0	10s	10s	6	10s	10s

Multi-species Baseline Initiative: Wetland Survey Overview



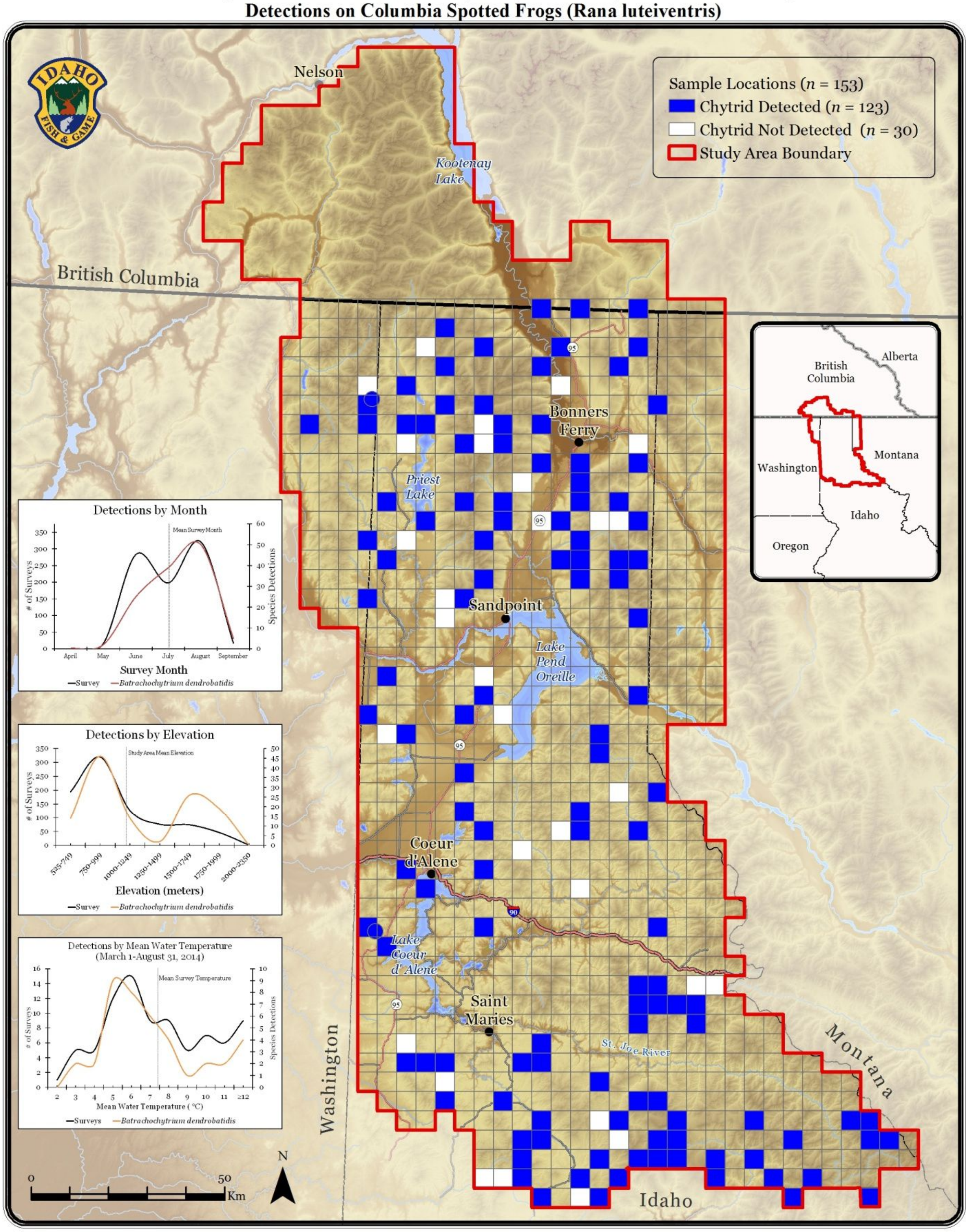
Map 3-1. 802 5x5 km cells surveyed for amphibians in 2013 or 2014. Legend numbers add up to >802 because multiple sites were surveyed within some cells.

Multi-species Baseline Initiative: Native Pond Breeding Amphibian Species Richness



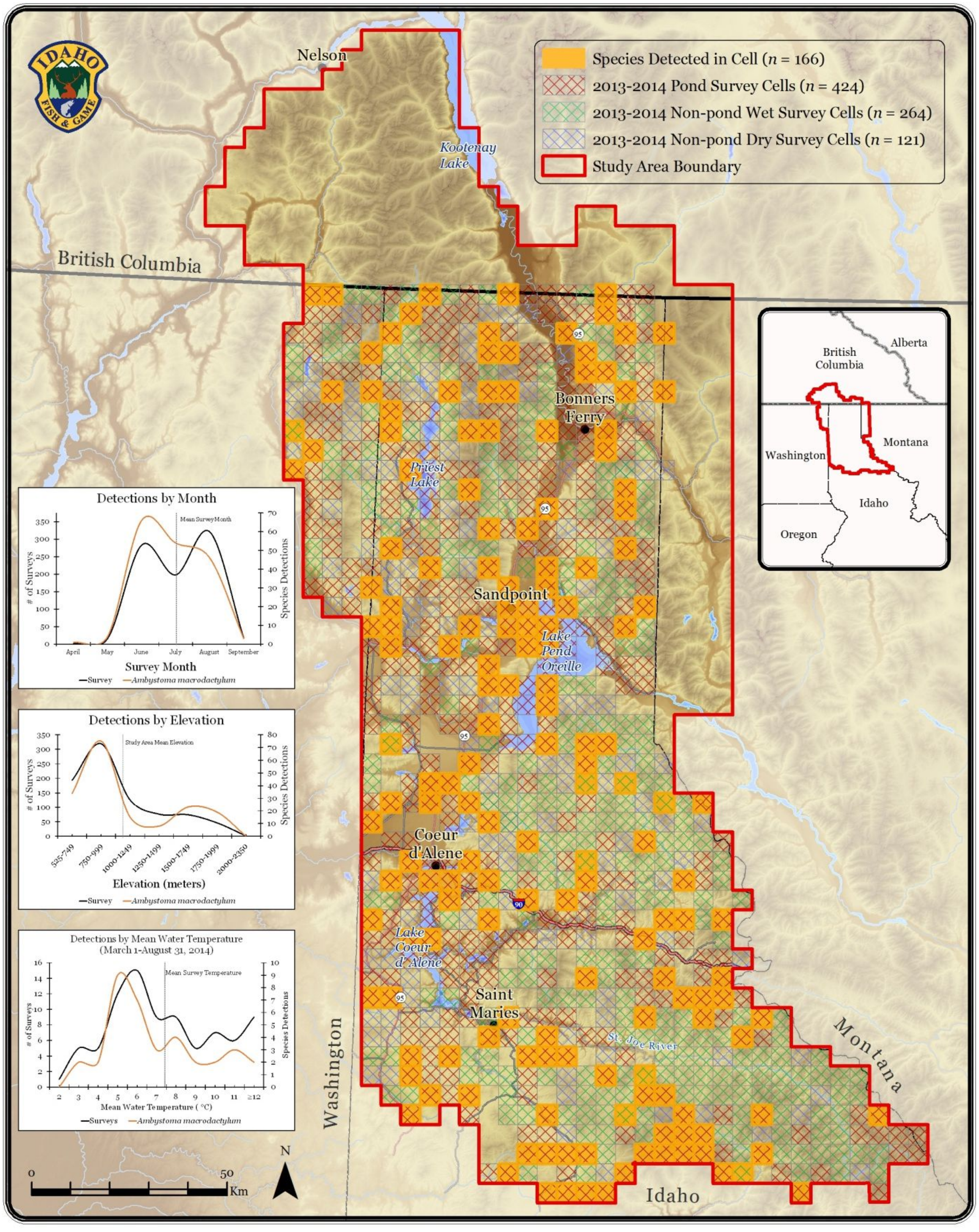
Map 3-2. Number of amphibian species detected during 2013-2014 surveys.

Multi-species Baseline Initiative: Chytrid (Batrachochytrium dendrobatidis)
Detections on Columbia Spotted Frogs (Rana luteiventris)



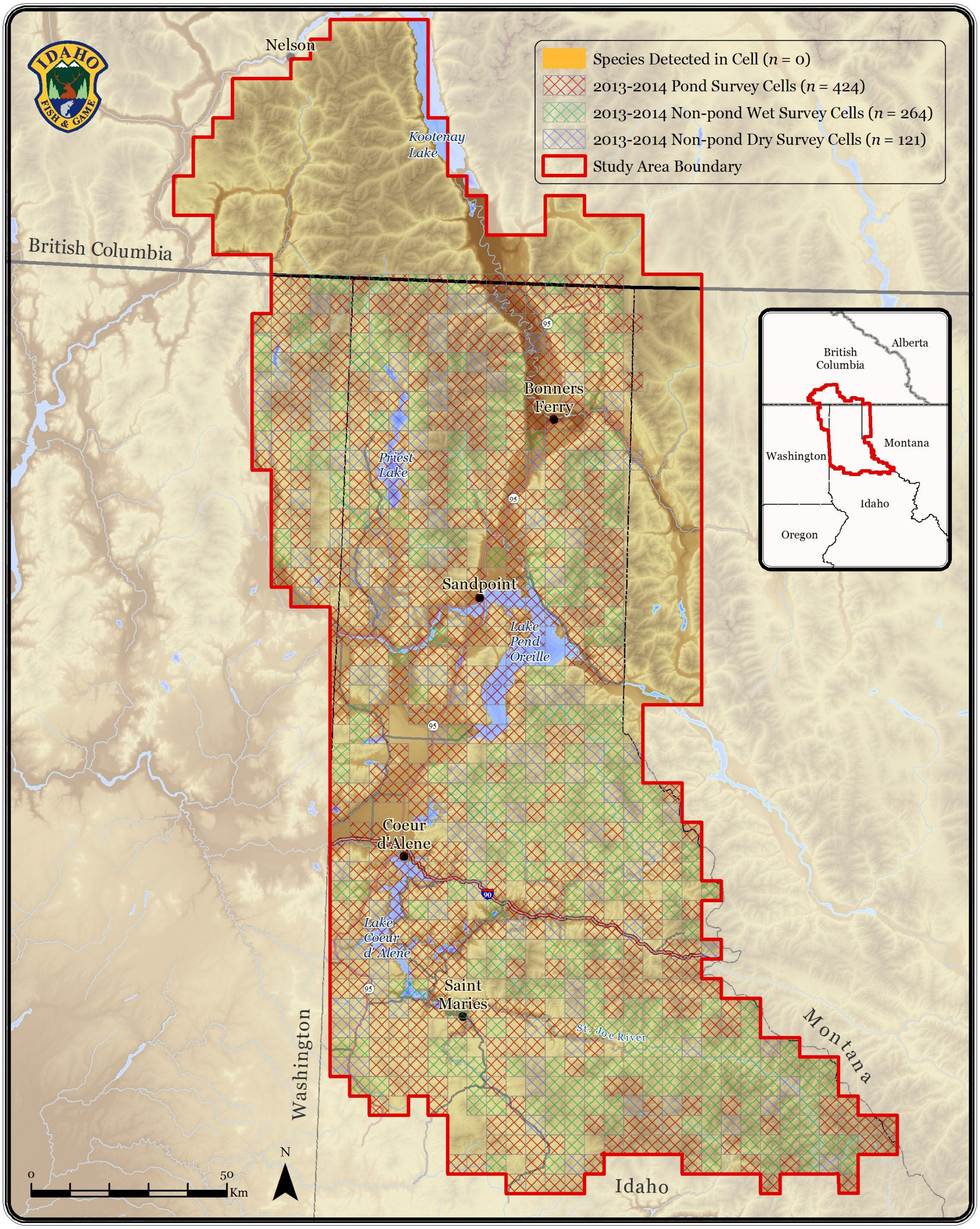
Map 3-3.

Multi-species Baseline Initiative: Long-toed Salamander (*Ambystoma macrodactylum*) Detections



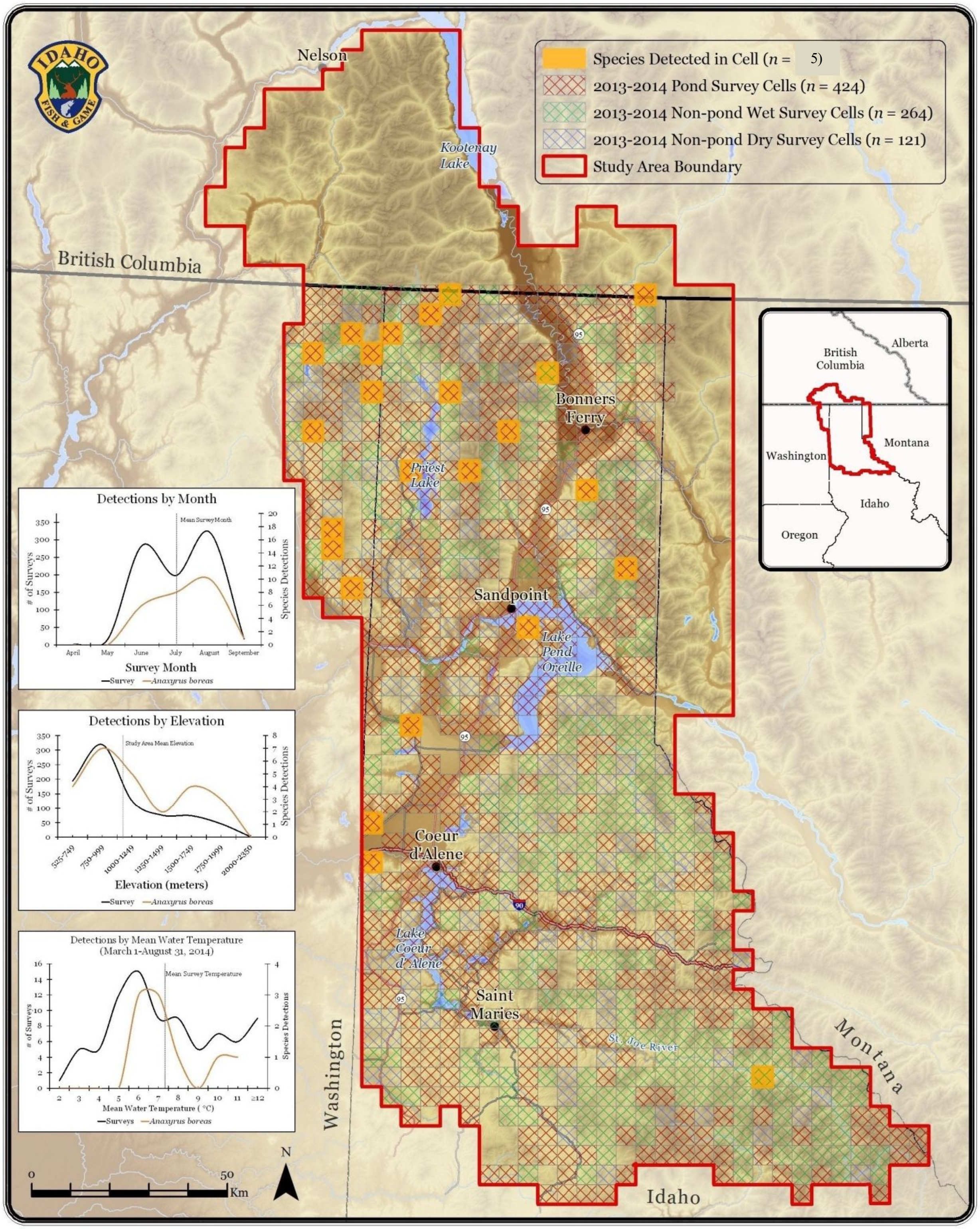
Map 3-4.

Multi-species Baseline Initiative: Tiger Salamander *(Ambystoma tigrinum)* Detections



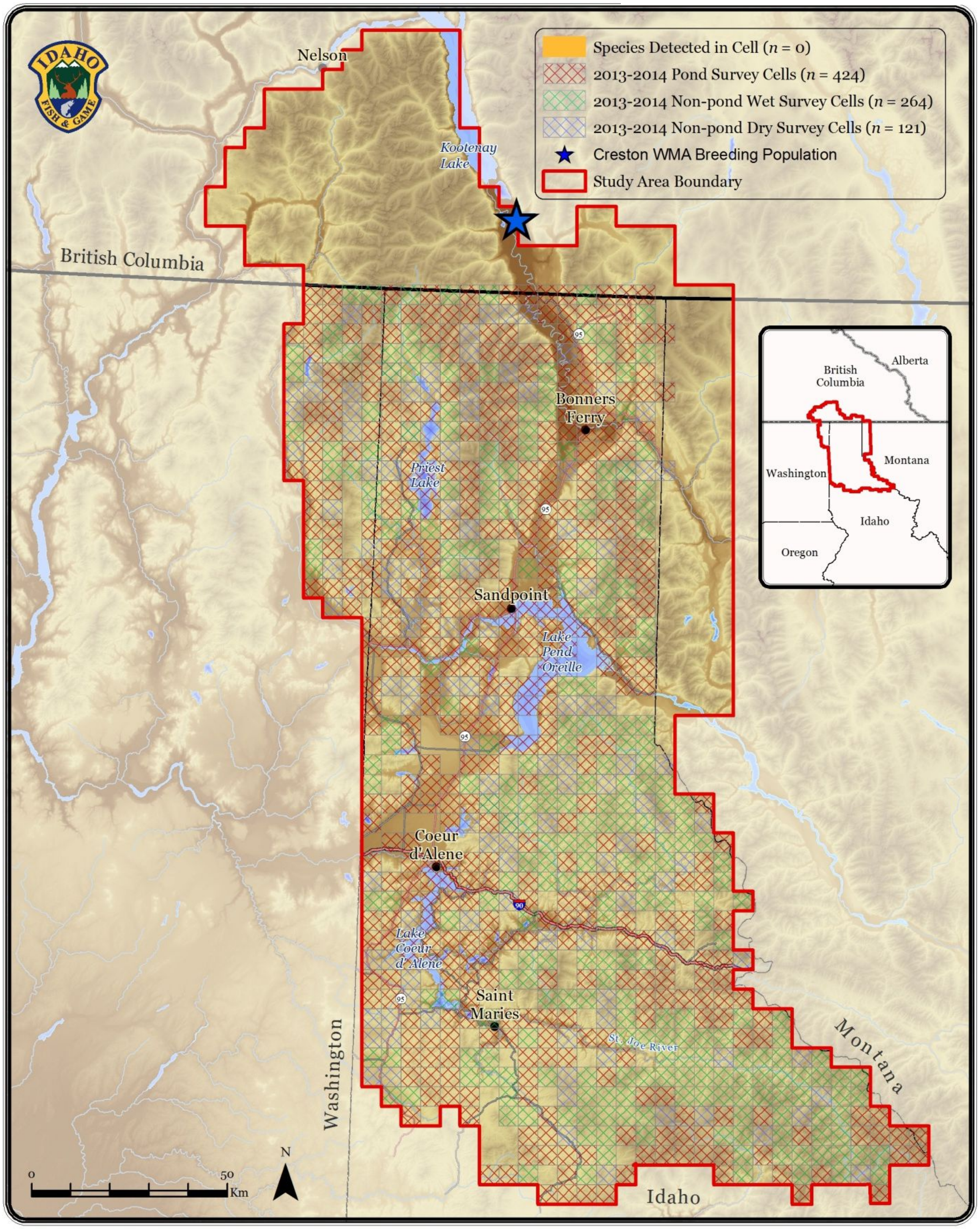
Map 3-5.

Multi-species Baseline Initiative: Western Toad (*Anaxyrus boreas*) Detections



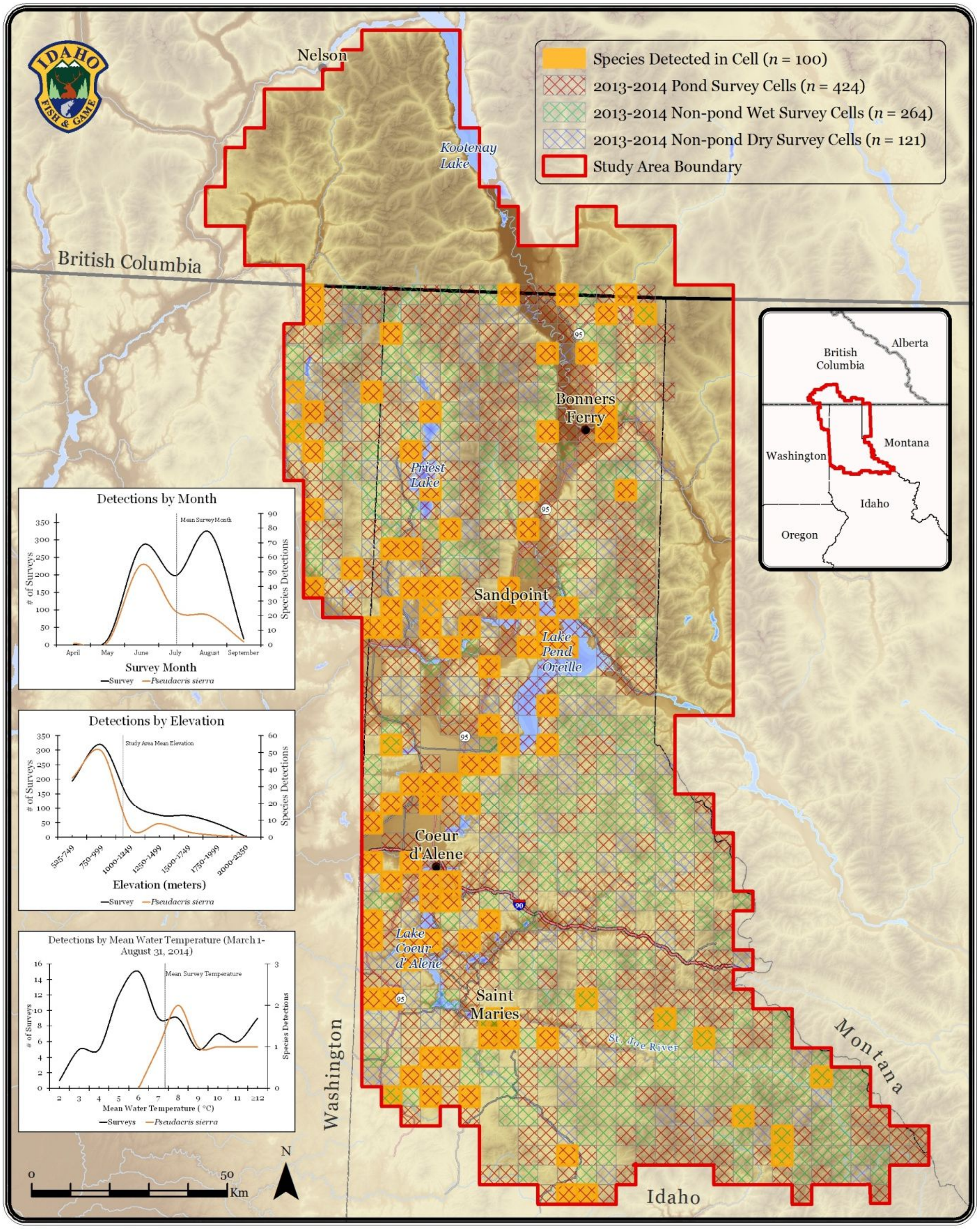
Map 3-6.

Multi-species Baseline Initiative: Northern Leopard Frog *(Rana pipiens*) Detections



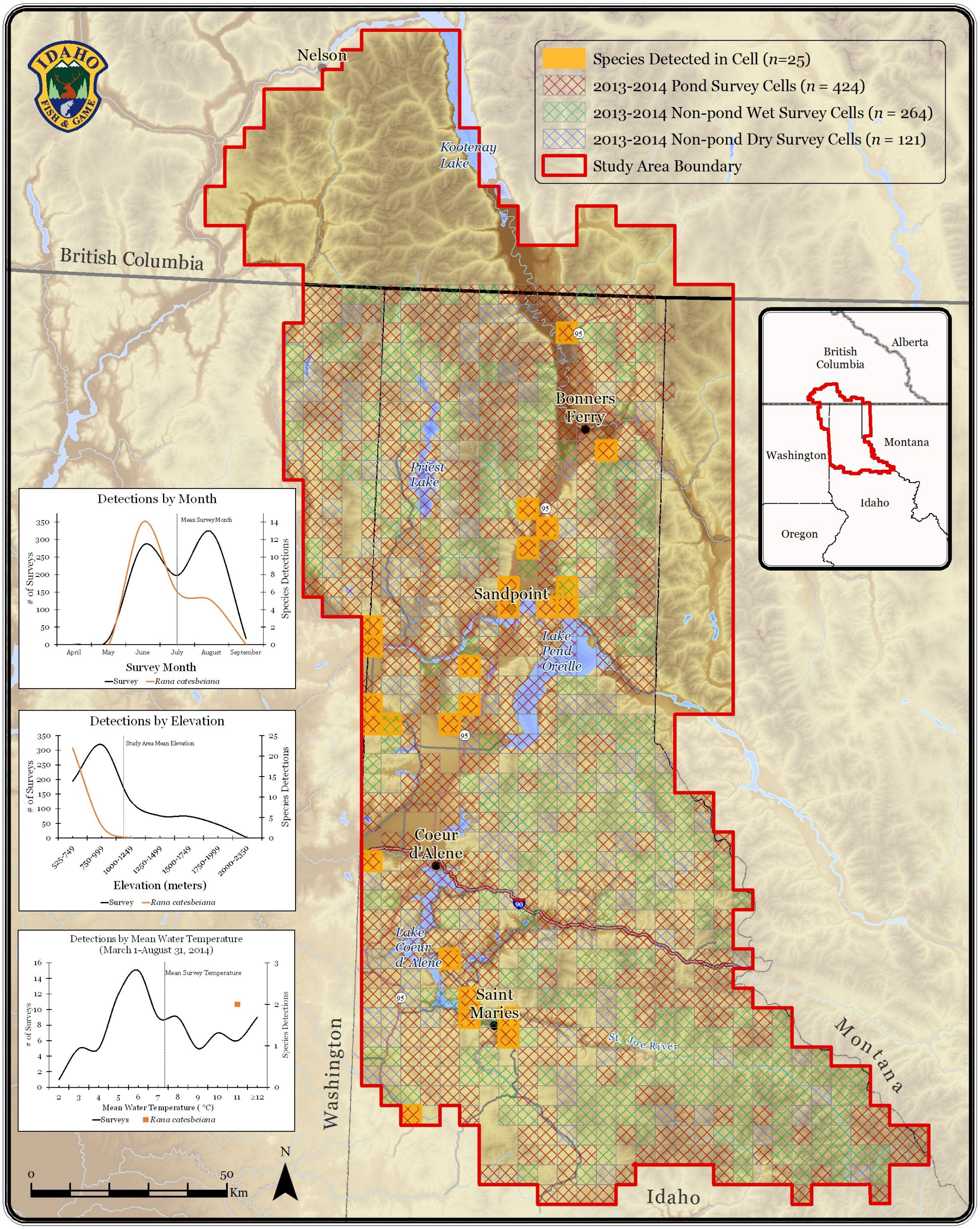
Map 3-7.

Multi-species Baseline Initiative: Pacific Treefrog (*Pseudacris regilla*) Detections



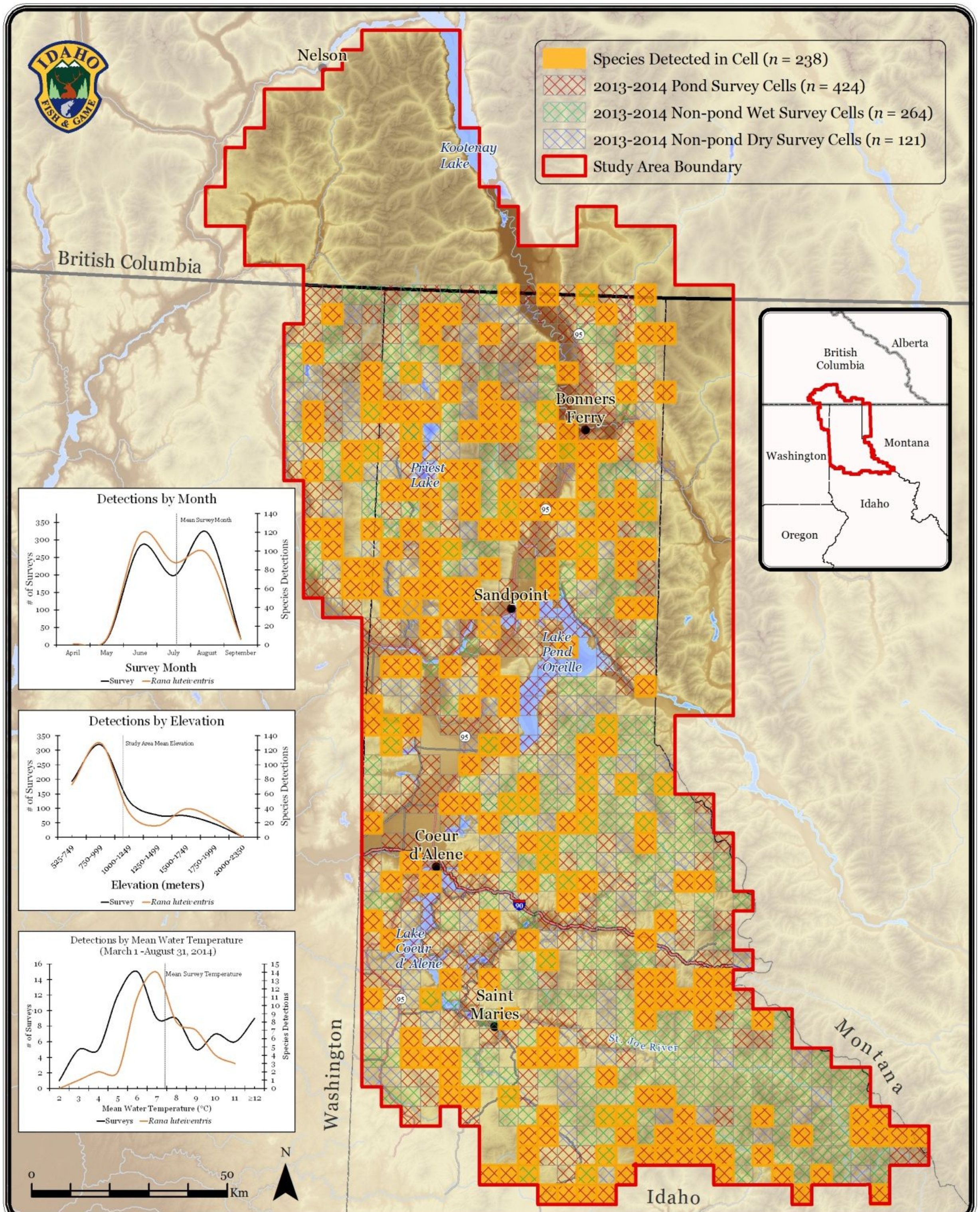
Map 3-8.

Multi-species Baseline Initiative: American Bullfrog (*Rana catesbeiana*) Detections



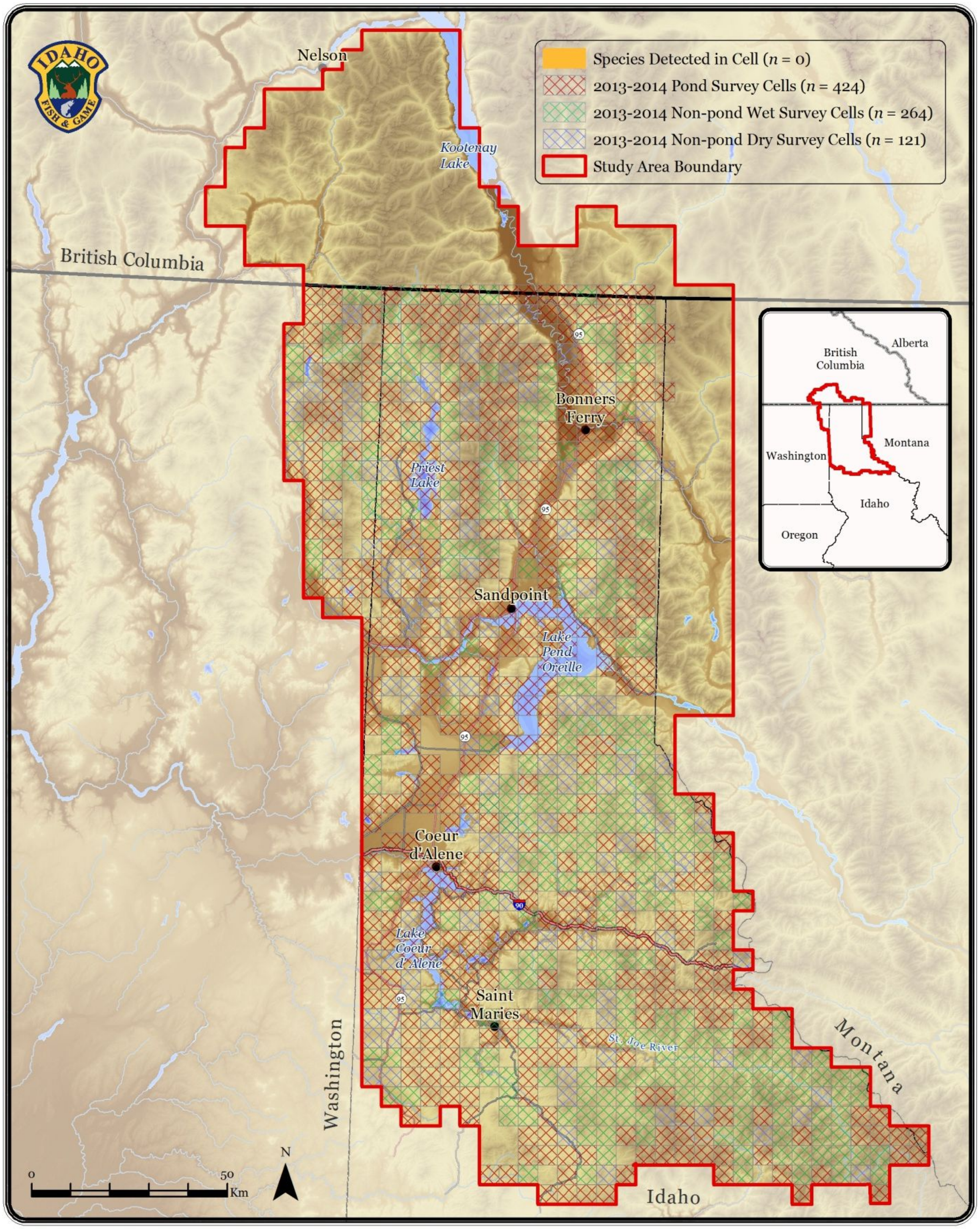
Map 3-9.

Multi-species Baseline Initiative: Columbia Spotted Frog (*Rana luteiventris*) Detections



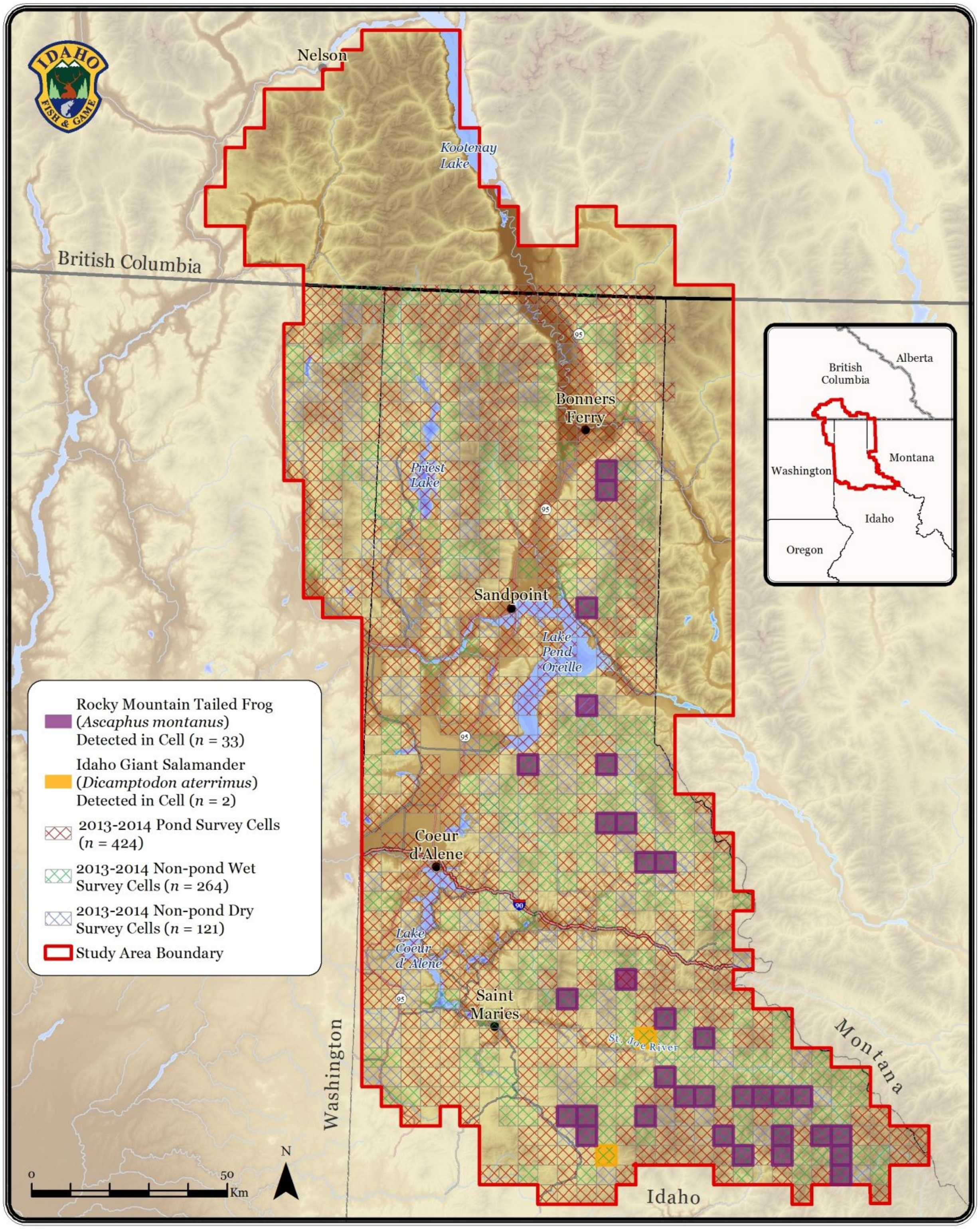
Map 3-10.

Multi-species Baseline Initiative: Wood Frog (*Rana sylvatica*) Detections



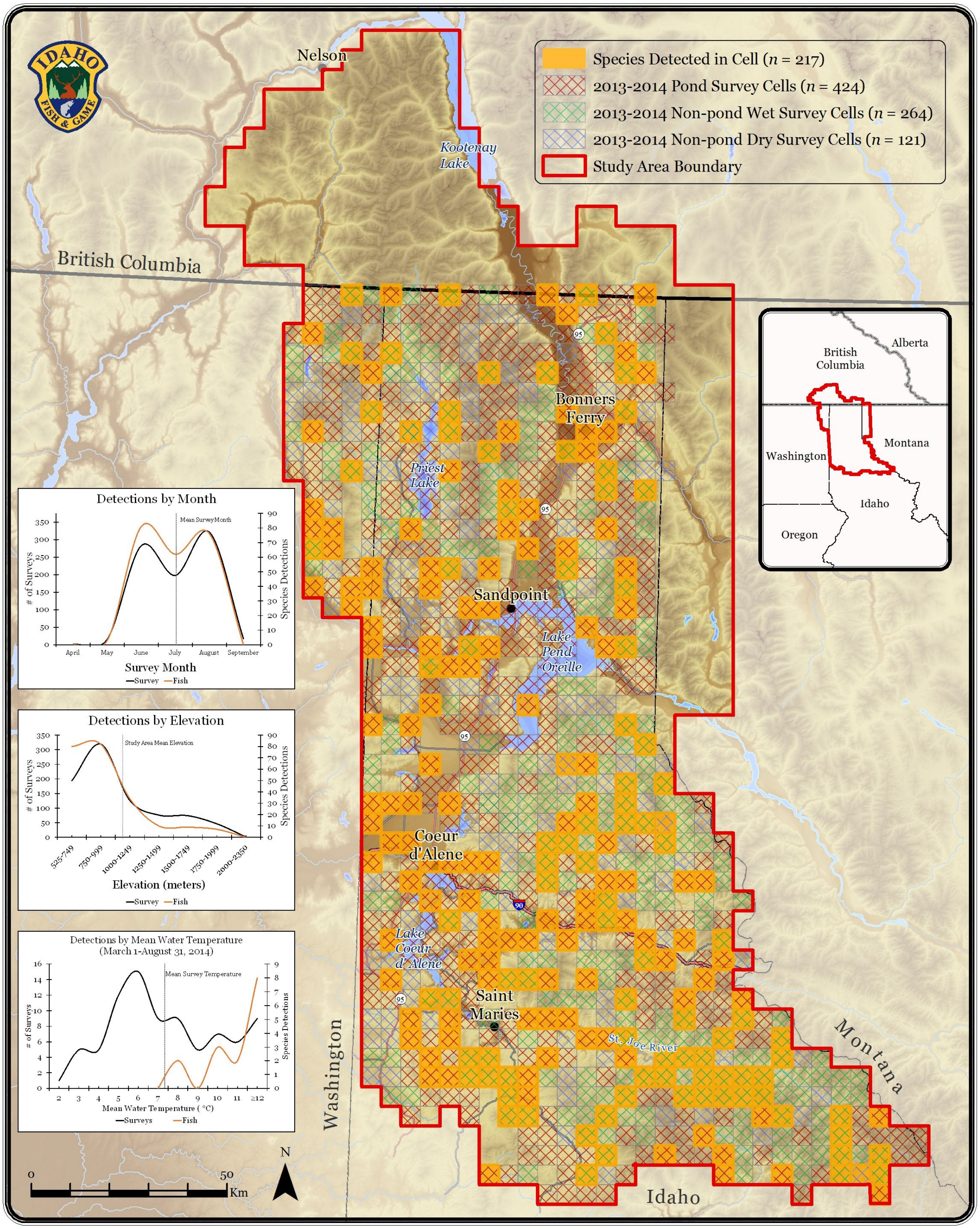
Map 3-11.

Multi-species Baseline Initiative: Stream Amphibian Detections



Map 3-12.

Multi-species Baseline Initiative: Fish Detections



Map 3-13.