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Status of Pond-breeding Amphibians in Northern Idaho and Northeastern Washington, USA

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Abstract.—**Landscape-level occurrence data are needed for effective amphibian conservation and substantial data gaps exist for pond-breeding amphibians in the Idaho Panhandle and northeastern Washington, USA. To fill those gaps, we conducted dip-net surveys for pond-breeding amphibians at 433 sites across a 21,775 km² study area from 2013–2014. Prior to our surveys, six native species were thought to occur in this area: Columbia Spotted Frogs (*Rana luteiventris*), Long-toed Salamanders (*Ambystoma macrodactylum*), Sierran Tree Frogs (*Hyliola sierra*), Western Toads (*Anaxyrus boreas*), Northern Leopard Frogs (*Lithobates pipiens*), and Wood Frogs (*Lithobates sylvaticus*). Non-native American Bullfrogs (*Lithobates catesbeianus*) were also known to occur. We detected amphibians at 69% (n = 290) and breeding activity at 54% (n = 232) of the 433 sites surveyed. We detected four native species: Columbia Spotted Frogs at 47% of sites (n = 204), Long-toed Salamanders at 36% of sites (n = 158), Sierran Tree Frogs at 20% of sites (n = 88), and Western Toads at 5% of sites (n = 23). We detected non-native American Bullfrogs at 23 (5%) sites. We did not detect Wood Frogs or Northern Leopard Frogs. We reviewed historical observations and examined corresponding literature and museum specimens and determined Northern Leopard Frogs are native to our study area but are likely extirpated. We also determined historical Wood Frog records were misidentified as Columbia Spotted Frogs and no substantive evidence exists that Wood Frogs are native to our study area.**

Key Words.—inventory; landscape; lentic; monitoring; museum specimen; pond; state wildlife action plan

Introduction

Data from landscape-level inventories are an important component of amphibian conservation programs globally (Cushman 2006) and in the Pacific Northwest of North America (Olson et al. 2009). A lack of such data is a common obstacle to effectively addressing a wide range of management issues including accurate distribution maps, disease management, habitat management plans, and developing accurate lists for species of concern (Bland 2017; Guralnick et al. 2018; Jetz et al. 2019). Pond-breeding amphibians in the Idaho Panhandle and northeastern Washington, USA, are a good example of a data-deficient taxonomic group. For a 21,775-km² portion of the region (Fig. 1), only 522 incidental and standardized observations of pond-breeding amphibians were available in the Idaho Fish and Wildlife Information System (IFWIS) database between 1892 and 2012 (https://idfg.idaho.gov/data), and only 10 records were available in the VertNet database for our study area (www.vertnet.org). In 2013, when we initiated our study, the composition of pond-breeding amphibians was thought to consist of six native and one non-native species (Idaho Department of Fish and Game [IDFG] 2005; Washington Department of Fish and Wildlife [WDFW] 2005). Columbia Spotted Frogs (*Rana luteiventris*), Long-toed Salamanders (*Ambystoma macrodactylum*), Sierran Tree Frogs (*Hyliola sierra*; Duellman et. al. 2016), and Western Toads (*Anaxyrus boreas*) were considered extant and native. Northern Leopard Frogs (*Lithobates pipiens*) and Wood Frogs (*Lithobates sylvaticus*) were considered native, but the last observation of these species was recorded in 1955 and 1970, respectively (https://idfg.idaho.gov/data). Non-native American Bullfrogs (*Lithobates catesbeianus*) were known to occur but the extent of their range was unknown (https://idfg.idaho.gov/data).

We used Idaho and Washington state wildlife action plans (IDFG 2005; WDFW 2005) to guide the development of a field assessment of this group. From 2013–2014, we conducted pond-breeding amphibian surveys at 433 sites across the landscape spanning the Idaho Panhandle and northeastern Washington. Our first

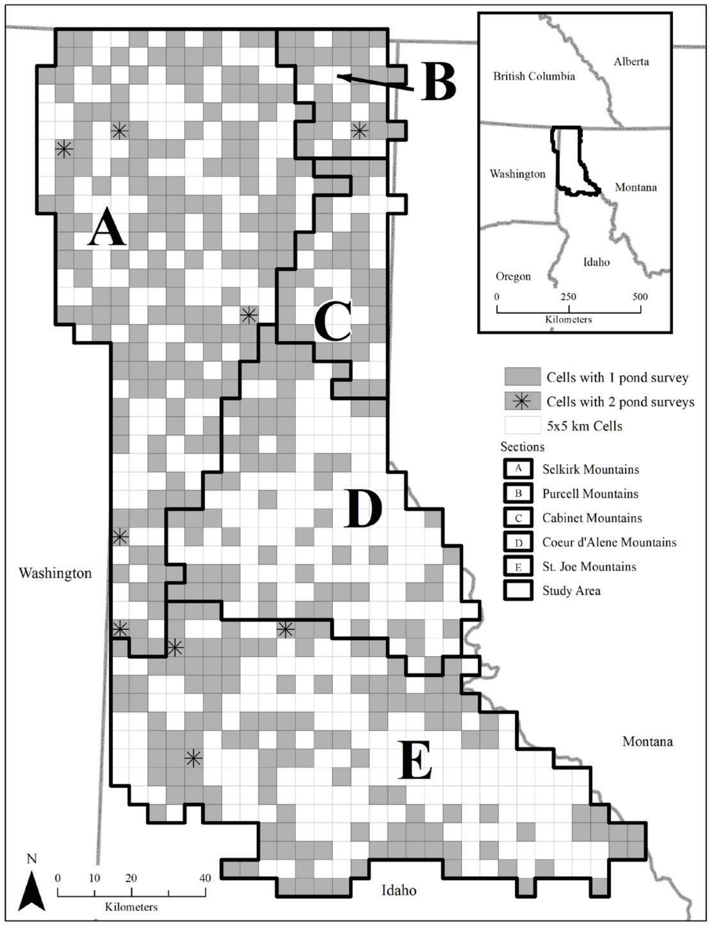

Figure 1. The study area in northern Idaho and northeastern Washington, USA, included 802 5 × 5 km cells (square polygons). We surveyed 433 ponds in 424 of these cells. In nine of the survey cells, we surveyed two ponds instead of one (*). The five sections are named for the mountain ranges contained within them as follows.

objective was to assess the occurrence and distribution of pond-breeding amphibians across our study area. In the event we did not detect a species in the study area, our second objective was to determine if that species is native to this area by examining written records and museum specimens.

Materials and Methods

Study site.—Our study area consists of a 21,775 km^2 area centered on the Idaho Panhandle and includes adjacent northeastern Washington, USA. It is comprised of portions of the Selkirk, Purcell, West Cabinet, Coeur d' Alene, and Saint Joe mountains (Fig. 1). We divided our study area into sections that comprised each mountain range along with portions of their adjacent valleys. Elevations range from 530 to 2,350 m. The climate is characterized by mild summers and wet, moderately cold winters (Lucid et al. 2018). This heavily forested area is dominated by a diverse mix of conifer species and portions of each mountain range are classified as Inland Temperate Rainforest (DellaSala et al. 2011).

Sampling design and site selection.—We stratified our study area into 802 5 × 5-km cells and attempted to conduct an amphibian survey at a lentic water body in each cell. We prioritized surveying small (≤ 500 m in width) lentic water bodies. In cells where lentic water bodies of this size were not available, and a larger lentic water body was available, we surveyed a 500-m shoreline section of the latter. Because comprehensive spatial layers of lentic waters were not available for our study area, we identified potential survey locations by referencing three sources of georeferenced lentic water data and followed this with field visits to confirm that the site met our site criteria. If the field visit resulted in finding a site meeting our criteria, we conducted a survey and included the results in this study.

We identified potential survey sites in each cell of our study area using the following approaches in order of preference: (1) we queried the National Wetland Inventory (NWI; http://www.fws.gov/wetlands/Data/State-Downloads.html); (2) we visually selected from digital (National Hydrography Dataset, IDFG Region 1 Lakes.shp, GoogleEarth, Google, Mountain View, California, USA) or non-digital (U.S. Forest Service maps, private landowners) maps; (3) we used output from an unpublished wetlands modelling tool, and (4) if field technicians determined potential sites did not meet our criteria, they identified and surveyed survey sites while traveling in the field. Once potential sites were identified in a cell, we selected survey sites by generating a shapefile that included the perimeter of each potential site and its centroid and used the distance to points function in Geospatial Modeling Environment (http://spatialecology.com) to determine the closest pond that was in the same cell as a randomly selected site from an ongoing study of terrestrial invertebrates. We used this approach to conserve the use of field personnel and improve sampling efficiency. The terrestrial invertebrate sites were either randomly generated Forest Inventory and Analysis plots (U.S. Forest Service) or randomly generated within a 50- to 150-m radius buffer around roads and trails (see Lucid et al. 2018 for details). Therefore, the terrestrial invertebrate survey sites were either randomly generated or random but biased to roads and trails. We visited 559 sites from the NWI, 74 sites that we visually selected from maps, 74 sites that technicians identified while travelling in the field, and 134 sites from the unpublished model. This resulted in our visiting 841 sites. We were able to locate 373 lentic water bodies that were ≤ 500 m in width and 60 larger lentic water bodies where we surveyed 500 m of shoreline. Because the majority of water bodies surveyed were small (≤ 500 m in width), we refer to all the surveyed waters henceforth as ponds. Although our intent was to survey one pond per cell, there were nine cells where we surveyed two ponds because time and resources allowed additional surveys (Fig. 1). In total we selected 433 sites, which fell within 424 survey cells in a stratified random fashion. Although we used inconsistent criteria, our selection methods combined with our large sample size and stratified sample ensure our survey sites are representative of the study area.

We conducted surveys in 2013 (n = 279) and 2014 (n = 154). We based survey year primarily on land ownership with a focus on publicly owned sites in 2013 and privately-owned sites in 2014. We conducted surveys at 132 privately owned sites and chose to focus on them in the second year to allow adequate time to obtain permission to access private property.

Field methods.—We conducted all surveys between 22 April and 17 September in 2013 and 2014. We surveyed low elevation sites early in the season and surveyed higher elevation mountain and alpine areas as snow melted and permitted access to those locations. At each water body ≤ 500 m in width (n = 373), we conducted a dip-net survey of the entire perimeter. At sites > 500 m in width (n = 60), we surveyed a 500-m section of shoreline clockwise from the point the site was accessed. We used a D-frame dip net 30.5 cm deep and 0.48 cm mesh (Forestry Suppliers, Jackson, Mississippi, USA) and sampled all microhabitats up to a depth of 1 m along the shoreline. The time we spent surveying and number of sweeps per pool were a function of water body size and no effort was made to record catch per unit effort. We visually estimated 50-m shoreline sections and counted each amphibian species by egg, larva, or fully metamorphosed individual. We defined breeding activity as the detection of eggs, larvae, or an emergence of metamorphs.

We modified dichotomous keys from Corkran and Thoms (2006) with information from Werner et. al. (2014) and Storm et al. (1995) to develop a dichotomous field guide specific to the seven species thought to occur in our study area. This guide aided trained wildlife technicians and biologists to identify specimens in the field. We archived species location data in the IFWIS.

Verifying historical records.—To verify historical observations of Wood Frogs and Northern Leopard Frogs, we queried IFWIS to determine which observations had available literature or museum specimens. We requested and examined museum specimens to confirm the species designation of each specimen and had a taxonomic expert confirm our identification. The IFWIS database indicated museum specimens were housed at six collections: Charles R. Conner Museum (CRCM), Los Angeles Country Museum (LACM), Slater Museum of Natural History (SMNH), Smithsonian Museum of Natural History (SNMNH), and the University of Idaho Museum (UIM). Specimens were available for all records except for two historical Wood Frog observations. In those two cases our review was limited to available literature (Dumas 1957). The most recent year that either species in the IFWIS database was observed was 1970. Therefore, we considered all available observations to be historical.

The four Wood Frog records from the IFWIS indicated specimens had been curated at the LACM and UIM. We queried both collection databases and found records of three additional specimens at LACM for a total of seven historical Wood Frog observations in Idaho from 1955, 1956, and 1970. The specimen archived at UIM had been lost (Charles Peterson, pers. comm.) and another specimen lacked a corresponding museum voucher. We obtained the five remaining specimens from LACM and three co-authors (A. DeLima, J. Neider, and M. Lucid) examined them. We also sent these specimens to David Green (McGill University, Montreal, Quebec, Canada) for confirmation of our determination (for details see Appendix).

Table 1. Detection of any life stage of pond-breeding amphibian species by study area section and study area (total) in northern Idaho and northeastern Washington, USA. The abbreviations NSS = number of sites surveyed and NSD = number of sites where any native amphibian species was detected (percentage). Percentages are of the number of sites surveyed per section or study area. Species are coded as follows: Columbia Spotted Frog (*Rana luteiventris*; RALU), Long-toed Salamander (*Ambystoma macrodactylum*; AMMA), Sierran Tree Frog (*Hyliola sierra*; HYSI), Western Toad (*Anaxyrus boreas*; ANBO), and American Bullfrog (*Lithobates catesbeianus*; LICA). The first four species are native.

			Species Detected n (%)				
Study Area Section	NSS	NSD (%)	RALU	AMMA	HYSI	ANBO	LICA
Cabinet Mountains	35	23 (66%)	19 (54%)	10 (29%)	3 (9%)	2 (6%)	2 (6%)
Coeur d'Alene Mountains	61	39 (64%)	23 (38%)	29 (48%)	14 (23%)	1 (2%)	0 (0%)
Saint Joe Mountains	137	95 (69%)	73 (53%)	59 (43%)	23 (17%)	0 (0%)*	6 (4%)
Purcell Mountains	26	18 (69%)	9 (35%)	11 (42%)	5 (19%)	1 (4%)	1 (4%)
Selkirk Mountains	174	123 (71%)	82 (47%)	49 (28%)	43 (25%)	18 (10%)	14 (8%)
Total	433	298 (69%)	204 (47%)	158 (36%)	88 (20%)	22 (5%)	23 (5%)

Six Northern Leopard Frog records were in the IFWIS database. Eleven additional records (and specimens) were available at CRCM, SMNH, and SNMNH. These 17 historical records were collected from 1892–1955. Specimens were available for 15 of those observations. We borrowed all 15 specimens, and A. DeLima, J. Neider, and M. Lucid examined them (for details see Appendix).

Results

We detected amphibians at 69% at the 433 sites surveyed (Table 1; Fig. 1), and breeding activity at 54% of them (Table 2). We detected four native amphibian species: Columbia Spotted Frogs (47% of sites), Long-toed Salamanders (36%), Sierran Tree Frogs (20%), and Western Toads (5%). We detected non-native American Bullfrogs at 5% of sites. We detected breeding activity for all five species. We did not detect Wood Frogs or Northern Leopard Frogs. We detected one (30% of sites, n =132) or two (31% of sites, n = 134) species at most sites where amphibians were detected. We detected three species at fewer sites (5% of sites, n = 23), and all four native species at only one water body: Playa Lake, Washington, in the Selkirk Mountains section (Fig. 1). We also detected breeding activity of all four native species at Playa Lake but did not detect American Bullfrogs.

Columbia Spotted Frogs and Long-toed Salamanders were well distributed across the study area (Fig. 2). Sierran Tree Frogs were also well distributed except for the eastern portions of the Coeur d'Alene and Saint Joe mountains (Fig. 2). We detected Western Toads primarily in the northern portion of the study area with the majority (77%, n = 17) occurring in the Selkirk Mountains (Table 1). The remainder of the northern detections were in the Coeur d'Alene (5%, n = 1), Purcell (9%, n = 2), and West Cabinet (9%, n = 2) mountains. We did not detect Western Toads at any pond in the Saint Joe Mountains; however, we detected larvae at a single stream site in that range (Fig. 2). The four native amphibians were detected at a wide range of elevations (mean = 1,059 m; range, 524–1,958 m) whereas we found American Bullfrogs more commonly in low elevation valleys (mean = 654 m; range, 538–882 m; Table 3).

We determined that the five museum specimens from four localities (Appendix) catalogued as Wood Frogs (*L.*

Table 2. Detection of breeding activity (i.e., eggs, larvae, or metamorphs present) of pond-breeding amphibian species by study area section and study area (total) in northern Idaho and northeastern Washington, USA. The abbreviations NSS = number of sites surveyed and NSD = number sites where breeding by any native amphibian species was detected (percentage). Percentages are of the number of sites surveyed per section or study area. Species codes are defined in Table 1. The first four species are native.

			Breeding Detected n (%)				
Study Area Section	NSS	NSD (%)	RALU	AMMA	HYSI	ANBO	LICA
Cabinet Mountains	35	16 (46%)	9 (26%)	11 (31%)	3 (9%)	2 (6%)	1 (3%)
Coeur d'Alene Mountains	61	34 (56%)	13 (21%)	18 (30%)	12 (20%)	1 (2%)	0 (0%)
Saint Joe Mountains	137	77 (56%)	47 (34%)	58 (42%)	22 (16%)	0 (0%)	3 (2%)
Purcell Mountains	26	16 (62%)	6 (23%)	10 (38%)	6 (23%)	0 (0%)	1 (4%)
Selkirk Mountains	174	89 (51%)	47 (27%)	50 (29%)	35 (20%)	12 (7%)	8 (5%)
Total	433	232 (54%)	122 (28%)	147 (34%)	78 (18%)	15 (3%)	13 (3%)

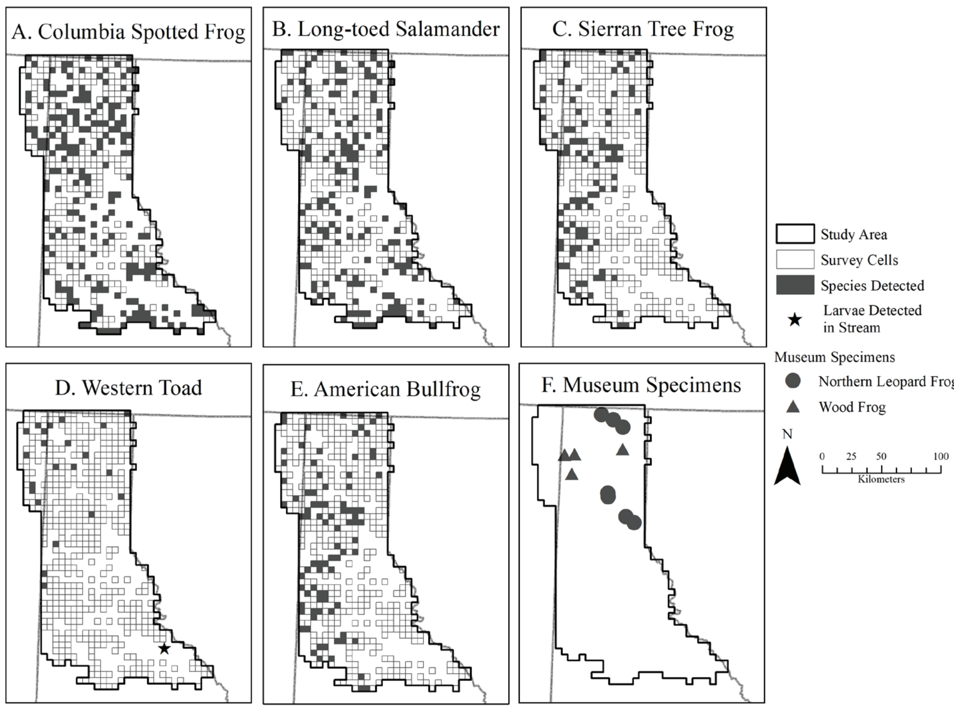

Figure 2. (A-E) Location of cells with pond-breeding amphibian species detected during surveys in northern Idaho and western Washington, USA, 2013–2014, and (F) collection localities of museum specimens examined. The star symbol indicates the stream site (which was not one of the 433 surveyed ponds) where we detected Western Toad (*Anaxyrus boreas*) larvae.

sylvaticus) should be re-classified as Columbia Spotted Frogs (*R. luteiventris*) based on specimens having: (1) rosettes of dorsal spots, (2) upturned eyes, (3) white jaw stripe, and (4) rounded head outline as described in Corkran and Thoms (1996). David Green (pers. comm.) examined the five specimens and agreed with our determination (Figs. 3 and 4). Our review of the two historical Wood Frog observations that lacked corresponding museum specimens (Dumas 1957) indicated one observation was likely misidentified and should be classified as *L. sylvaticus* while the other does not have enough descriptive information to provide taxonomic insight. Dumas (1957) described one of the records (from 1956) as “intermediate in character between *R. sylvatica* and *R. pretiosa”* (we treat *R. sylvatica* as *L. sylvaticus* and *R. pretiosa* is now classified as *R. luteiventris* in our study area). His account went on to describe 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 uncharacteristic of *L. sylvaticus* but is characteristic of mature *R. luteiventris* (Corkran and Thoms 1996). Therefore, we determined this animal was most likely *R. luteiventris*, not *L. sylvaticus*.

The other record reported by Dumas (1957) was of a female Wood Frog specimen collected from the northern Idaho Panhandle in 1956 from "a small pond by the Kootenai River approximately one mile west of Bonners Ferry, Boundary County, Idaho." Dumas (1957) 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 (Charles Peterson, pers. comm.). Therefore, we are unable to provide insight as to the accuracy of this observation. For the Northern Leopard Frog, we determined the 15 museum specimens from 10 locations that were catalogued as this species (Appendix) were correctly identified as *L. pipiens* based on the following characters: (1) light dorsolateral folds, (2) smooth dark oval dorsal spots, and (3) long legs (lower leg > 1/2 snout-to-vent length) as described in Corkran and Thoms (1996; Fig. 4).

Table 3. Mean, median, minimum, and maximum elevations of sites where we detected any life stage of pond-breeding amphibian species across all 433 sites surveyed in northern Idaho and northeastern Washington, USA. Species codes are defined in Table 1.

	Elevation (m)			
Species	Mean	Median	Minimum	Maximum
RALU	1,121	945	534	1,923
AMMA	1,081	901	538	1,958
HYSI	838	792	538	1,823
ANBO	1,197	1,074	657	1,832
LICA	654	673	538	882
All Sites	1,020	867	534	1,978

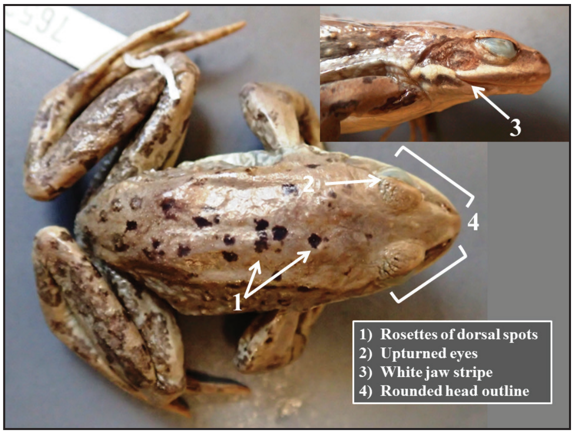

Figure 3. Museum specimen LACM76527 with characters used to re-classify it from Wood Frog (*Lithobates sylvaticus*) to Columbia Spotted Frog (*Rana luteiventris*). (Photographed by Amanda DeLima).

Figure 4. Museum specimen PSM2931 with characters used to confirm museum classification of Northern Leopard Frog (*Lithobates pipiens*). (Photographed by John Neider).

Discussion

Columbia Spotted Frogs and Long-toed Salamanders were both well distributed across the landscape. When we began the study, our perception was that Sierran Tree Frogs were widespread in the study area, so we were surprised we did not detect this species more frequently. In our study area, however, Sierran Tree Frogs concentrate the majority of breeding activity in mid-April and metamorphs tend to leave sites by early summer (Schaub and Larsen 1978). Because 60% (n = 258) of our surveys occurred after 30 June, it is possible we did not detect this species at higher elevations because snow prevented sampling these sites until mid to late summer. Regardless, the lack of detections in the eastern portion of the Coeur d'Alene Mountains is similar to a low detection rate of arboreal mammals in this range (Robinson et al. 2017; Lucid et al. 2019; Lucid et al. 2020). Most of our Western Toad detections were made in the northwestern portion of the study area. Although we did not detect this species during surveys in the Saint Joe Mountains, we did incidentally detect breeding of this species in this mountain range. The northwesterly skewed distribution of Western Toads was surprising as this species is widespread throughout both Idaho and Washington https://digitalatlas.cose.isu.edu/bio/amph/anurans/bubo/bubofra.htm. Western Toads are thought to be declining across portions of their range due to threats including disease, habitat loss, and climate change (e.g., Carey et al. 2005; Gerber et al. 2018) and additional surveys in the future would provide important insight into population trends. Non-native American Bullfrogs threaten native amphibian populations by acting as predators and competitors and vectors of disease (Cushman 2006). Although currently restricted to lower elevations in our study area, continued monitoring would help determine if this species experiences an elevation shift associated with climate change.

If Wood Frogs were native to Idaho, their range would be disjunct from much of their North American range (Muths et al. 2005). This is not unusual for this species as disjunct populations occur in several locations outside of their primary range (Muths et al. 2005). Regardless, the only occurrence record we cannot definitively dispute is the 1956 specimen collected by Dumas (1957) that was subsequently lost. Dumas (1957) did not provide a description of identifying characters for this specimen. This single, weakly supported observation is likely insufficient to provide 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. Furthermore, absence of Wood Frogs from our study area is supported by our study results. Until further evidence to the contrary arises, it is prudent to consider Wood Frogs as not being native to Idaho or northeastern Washington east of the Pend Oreille River.

Verifiable Northern Leopard Frog detections occurred sporadically in the Idaho Panhandle from 1892–1955. Historical northern Idaho occurrence records spanned from near the Canadian border south to Cocolalla Lake. By confirming the identity of museum specimens as *L. pipiens*, we conclude that this native species historically occupied at least the northern portion of our study area in Idaho. The combination of lack of detections during our extensive 2013–2014 survey and the 60 y that have passed since the last verifiable observation in 1955 suggests Northern Leopard Frogs are likely extirpated from the Idaho Panhandle and northeastern Washington east of the Pend Oreille River.

Conclusions and conservation actions.—Species inventories are a fundamental data type that are underrepresented in the peer-reviewed literature (Guralnick et al. 2018). A lack of basic inventory data leads to a host of conservation challenges, most notably inefficiencies in determining which species should be targeted for conservation action (Bland et al. 2017). Publishing inventory data provides scientific support for data sets along with making a broader audience aware of data availability.

Several key findings of this study have already been used to inform and implement conservation actions, including the development of the 2017 Idaho State Wildlife Action Plan (SWAP; IDFG 2017). Wood Frogs, which were listed as a Species of Greatest Conservation Need (SGCN) in the 2005 SWAP (IDFG 2005), were removed from Idaho species occurrence lists and subsequently not ranked as a SGCN in 2017 (IDFG 2017). Verifying Northern Leopard Frogs native status and mapping historical verifiable observations allowed the development of more specific conservation goals for this species such as a feasibility analysis for species recovery (IDFG 2017). It also led to the inclusion of this species in a climate adaptation habitat restoration project (https://idfg.idaho.gov/bees2bears). The detection of American Bullfrogs near the international border led to a collaboration between the Idaho Department of Fish and Game and the British Columbia Ministry of the Environment to control this species to protect a Northern Leopard Frog colony that occurs approximately 15 km outside of our study area in British Columbia, Canada (Lucid, M. 2017. International effort slows invasive bullfrogs, IDFG. Available from https://idfg.idaho.gov/blog/2017/11/international-effort-slows-invasive-bullfrogs [Accessed 12 September 2020]). The geographically disproportionate distribution and detection rates of Western Toads resulted in a recommendation for a statewide survey of historical breeding locations to determine population trends (Lucid 2017, *op. cit*.).

Developing these actions was an important first step in the application of our data set to conservation; however, making our data set available to the broader scientific community will further enable its incorporation into programs that address the urgent need for monitoring rapidly changing abundance and distribution of these species (Jetz et al. 2019). Although Columbia Spotted Frogs, Sierran Tree Frogs, and Long-toed Salamanders appear relatively well distributed in our study area, we lack the insight of past inventories to infer population trends. By publishing our dataset, we provide a baseline that will aid documenting changes in status and distribution of these species in this region.

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Literature Cited

Bland, L.M., J. Bielby, S. Kearney, C. Orme, J.E. Watson, and B. Collen. 2017. Toward reassessing data-deficient species. Conservation Biology 31:531–539.

Carey, C.Y., P.S. Corn, M.S. Jones, L.J. Livo, E. Muths, and C.W. Loeffler. 2005. Factors limiting the recovery of Boreal Toads (*Bufo boreas*). Pp. 222–236 *In* Amphibian Declines: The Conservation Status of United States Species. Lannoo, M. (Ed.). University of California Press, Berkeley, California, USA.

Corkran, C.C., and C.R. Thoms. 1996. Amphibians of Oregon, Washington, and British Columbia. Lone Pine Publishing, Edmonton, Alberta, Canada.

Cushman, S.A. 2006. Effects of habitat loss and fragmentation on amphibians: a review and prospectus. Biological Conservation 128:231–240.

DellaSala, D.A., P. Alaback, L. Craighead, T. Goward, P.C. Paquet, and T. Spribille. 2011. Temperate and Boreal Rainforests of inland northwestern North America. Pp. 82–110 *In* Temperate and Boreal Rainforests of the World. DellaSala, D.A. (Ed.). Island Press, Washington, D.C., USA.

Duellman, W.E., A.B. Marion, and S.B. Hedges. 2016. Phylogenetics, classification, and biogeography of the treefrogs (Amphibia: Anura: Arboranae). Zootaxa 4104:1–109.

Dumas, P.C. 1957. *Rana pretiosa* Le Conte in Idaho. Copeia 1957:150–151.

Gerber, B.D., S.J. Converse, E. Muths, H.J. Crockett, B.A. Mosher, and L.L. Bailey. 2018. Identifying species conservation strategies to reduce disease-associated declines. Conservation Letters 11:1–10.

Guralnick, R., R. Walls, and W. Jetz. 2018. Humboldt Core - toward a standardized capture of biological inventories for biodiversity monitoring, modeling and assessment. Ecography 41:713–725.

Idaho Department of Fish and Game (IDFG). 2005. Comprehensive Wildlife Conservation Strategy. Idaho Department of Fish and Game, Boise, Idaho, USA. 529 p.

Idaho Department of Fish and Game (IDFG). 2017. State Wildlife Action Plan. Idaho Department of Fish and Game, Boise, Idaho, USA. 1,458 p.

Jetz, W., M.A. McGeoch, R. Guralnick, S. Ferrier, J. Beck, M.J. Costello, M. Fernandez, M, G.N. Keil, C. Merow, and C. Meye. 2019. Essential biodiversity variables for mapping and monitoring species populations. Nature Ecology & Evolution 3:539–551.

Lucid, M.K., S. Cushman, L. Robinson, A. Kortello, D. Hausleitner, G. Mowat, S. Ehlers, S. Gillespie, L. Svancara, J. Sullivan, et al. 2020. Carnivore contact: a species fracture zone delineated amongst genetically structured North American marten populations (*Martes americana* and *Martes caurina*). Frontiers in Genetics 11:735. https://www.frontiersin.org/articles/10.3389/fgene.2020.00735/full

Lucid, M.K., S. Ehlers, L. Robinson, and S.A. Cushman. 2018. Beer, brains, and brawn as tools to describe terrestrial gastropod species richness on a montane landscape. Ecosphere 9:12. https://doi.org/10.1002/ecs2.2535.

Lucid, M.K., A. Rankin, J. Sullivan, L. Robinson, S. Ehlers, and S. Cushman. 2019. A carnivores' oasis? An isolated Fisher (*Pekania pennanti*) population provides insight on persistence of a metapopulation. Conservation Genetics 20:585–596.

Muths, E., S. Rittman, J. Irwin, D. Keinath, and R. Scherer. 2005. Wood Frog (*Rana sylvatica*): A Technical Conservation Assessment. U.S. Department of Agriculture, Forest Service, Rocky Mountain Region, Lander, Wyoming, USA.

Olson, D.H., D.T. Ashton, B.A. Bancroft, A.R. Blaustein, W. Bosworth, R.B. Bury, P.S. Corn, W.C. Gilgert, P. Govindarajulu, L. Hallock, et al. 2009. Herpetological conservation in northwestern North America. Northwestern Naturalist 90:61–96.

Robinson, L., S.A. Cushman, and M.K. Lucid. 2017. Winter bait stations as a multispecies survey tool. Ecology and Evolution 7:6826–6838.

Schaub, D.L., and J.H. Larsen. 1978. The reproductive ecology of the Pacific Treefrog (*Hyla regilla*). Herpetologica 34:409–416.

Storm, R.M., W.P. Leonard, H.A. Brown, R.B. Bury, D.M. Darda, L.V. Dirrer, and C.R. Peterson. 1995. Reptiles of Washington and Oregon. Seattle Audubon Society, Seattle, Washington, USA.

Washington Department of Fish and Wildlife (WDFW). 2005. Washington State Wildlife Action Plan. Washington Department of Fish and Wildlife, Olympia, Washington, USA. 682 p.

Werner, J.K., B.A. Maxwell, P. Hendricks, and D.L. Flath. 2014. Amphibians and Reptiles of Montana. Mountain Press Publishing Company, Missoula, Montana, USA.

Michael Lucid is co-owner of Selkirk Wildlife Science. He was a Wildlife Diversity Biologist with the Idaho Department of Fish and Game (IDFG) from 2009–2020. He was a Principle Investigator for the Multi-species Baseline Initiative, which was a collaborative effort led by IDFG. He was also a Principle Investigator for the Idaho Panhandle Bees to Bears Climate Adaptation Project (B2B), which was a collaborative effort led by IDFG and the Yellowstone to Yukon Conservation Initiative. Michael received an M.S. in Biology from Idaho State University, Pocatello, USA. He is a 2017 Wilburforce Fellow in Conservation Science.. (Photographed by Lacy Robinson).

Lacy Robinson is co-owner of Selkirk Wildlife Science. She spent 8 y with IDFG as a Senior Wildlife Research Biologist. She was a Principle Investigator for the Multi-species Baseline Initiative and the Idaho Panhandle Bees to Bears Climate Adaptation Project. She received an M.S. degree in Wildlife Ecology from the University of Maine, Orono, USA. (Photographed by Michael Lucid).

Andrew Gygli has been herping since age 10 and professionally for a decade throughout the American West. He spent 2 y working as a Senior Wildlife Diversity Technician on the Multi-species Baseline Initiative. He received his M.S. from the University of Wyoming, Lander, USA, where he constructed a framework to optimize species detectability, statistical power, and cost-effectiveness for using multiple survey methods in long-term amphibian monitoring programs. He has since worked on recovering the endangered Wyoming Toad (*Bufo baxteri*) and hopes to continue working with imperiled species. (Photographed by Lucy Diggens).

John Neider received a B.S. in Wildlife and Fisheries Resources from West Virginia University in Morgantown, USA. His diverse experience including terrestrial gastropods, forest carnivores, and landscape-level human-associated disturbance has segued into understanding and managing the effect that social parameters and human cultural influence have on natural landscapes. He spent 2 y working as a Senior Wildlife Diversity Technician on the Multi-species Baseline Initiative. John is currently exploring these effects within the private sector, owning and operating North Idaho Fine Gardening in Sandpoint, Idaho, USA. (Photographed by Amanda DeLima).

Amanda DeLima received her B.S. in Natural Resources from the University of Massachusetts, Amherst, USA. Her extensive field, laboratory, and public relations experience with the federal government, multiple state and county agencies, and several non-governmental organizations developed her focus in wetland ecology and management and the organisms within these systems. Amanda spent 2 y working as a Senior Wildlife Diversity Technician on the Multi-species Baseline Initiative. She is currently applying her experience in conservation and natural resources management to the Bonner County Planning Department, Sandpoint, Idaho, USA. (Photographed by John Neider).

Shannon Ehlers is a Wildlife Biologist for the Kootenai Tribe of Idaho, USA. Previously she was a Research Biologist with the Missouri Department of Conservation, USA. Shannon worked for the Idaho Department of Fish and Game (IDFG) as a Wildlife Research Biologist when she was the Field Coordinator for the Multi-species Baseline Initiative. She received an M.S. degree from the University of Akron, Ohio, USA. (Photograph courtesy of IDFG).

Appendix Table. Below is a list of museum specimens we examined catalogued as Wood Frog (*Lithobates sylvaticus*) or Northern Leopard Frog (*Lithobates pipiens*) from the Idaho portion of the study area. We determined all specimens catalogued as Wood Frog (*L. sylvaticus*) should be reclassified as Columbia Spotted Frogs (*Rana luteiventris*). Museums specimens were borrowed from: Los Angeles County Museum (LACM), University of Idaho (UI), Charles R. Conner Museum (CRCM), Smithsonian Museum of Natural History (SNMNH), and Slater Museum of Natural History (SMNH). Specimen status includes Photographed (Photo.; by authors), Lost (by the museum), and Not Verified (NV; no specimen was collected). IFWIS (Idaho Fish and Wildlife Information System Database) # indicates reference number in the IFWIS database. Database Sp. indicates the identification of the species in the IFWIS prior to this study. This Study Sp. indicates the classification we believe the species should be given. The abbreviations *R.* stands for *Rana* and *L.* stands for *Lithobates*. Identifier (Ident.) indicates the final person who examined the specimen for this study: either David Green (DG) or Amanda DeLima, John Neider, and Michael Lucid (DNL). This StudyID indicates the date a specimen was collected. Identifier examined the specimen and determined appropriate taxonomic classification. Field Observer is the individual who collected the sample on the Field ID date. The abbreviation NA stands for not applicable because the IFWIS# or the specimen itself was not available. The source of latitude and longitude are the museum location associated with each specimen. Field observers are abbreviated as follows: D.B. Howell (DBH), Phillip C. Dumas (PCD), G. Jones (GJ), James R. Slater (JRS), J. Keating (JK), John.W. Slipp (JWS), and Unknown (U).

IFWIS #	Museum #	Museum	Specimen Status	Database Sp.	This Study Sp.	Ident.	Life Stage	Field ID	This Study ID	Field Obs.	Latitude	Longitude
81925	LACM76527	LACM	Photo.	*L. sylvaticus*	*R. luteiventris*	DG	Adult	6 July 1970	12 March 2015	DBH	48.63477	-116.99098
NA	LACM76528	LACM	Photo.	*L. sylvaticus*	*R. luteiventris*	DG	Juvenile	6 July 1970	12 March 2015	DBH	48.63477	-116.99098
NA	LACM76529	LACM	Photo.	*L. sylvaticus*	*R. luteiventris*	DG	Adult	6 July 1970	12 March 2015	DBH	48.63477	-116.99098
81924	LACM76532	LACM	Photo.	*L. sylvaticus*	*R. luteiventris*	DG	Juvenile	8 July 1970	12 March 2015	DBH	48.64013	-116.87786
NA	LACM76533	LACM	Photo.	*L. sylvaticus*	*R. luteiventris*	DG.	Juvenile	8 July 1970	12 March 2015	DBH	48.64013	-116.87786
81922	UIM246	UI	Lost	*L. sylvaticus*	NA	NA	NA	14 April 1956	12 March 2015	PCD	48.69287	-116.33095
81923	NA	NA	NA	*L. sylvaticus*	NA	NA	NA	2 August 1955	12 March 2015	PCD	48.49244	-116.9022
82269	CRCM48-25	CRCM	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	39 July 1947	8 February 2014	GJ	48.13921	-116.17637
82266	USNM39706	SNMNH	NV	*L. pipiens*	NA	NA	NA	1 July 1896	8 February 2014	U	48.25113	-116.31445
82264	USNM20922	SNMNH	NV	*L. pipiens*	NA	NA	NA	20 September 1892	NA	U	48.29212	-116.55162
82268	PSM2931	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	11 September 1939	8 February 2014	JRS	48.32579	-116.49292
82273	PSM2924	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	11 September 1939	8 February 2014	JRS	48.91255	-116.4486
82273	PSM2927	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	11 September 1939	8 February 2014	JRS	48.91255	-116.4486
82270	NA	NA	NA	*L. pipiens*	NA	NA	Larva	17 June 1955	NA	JK	48.10842	-116.62265
NA	PSM2931	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	11 September 1939	8 February 2014	JRS	48.3278	-116.4766
NA	PSM2932	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	11 September 1939	8 February 2014	JRS	48.3278	-116.4766
NA	PSM10775	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	11 September 1939	8 February 2014	JWS	48.85917	-116.33526
NA	PSM10770	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	19 August 1939	8 February 2014	JWS	48.3555	-116.48195
NA	PSM10767	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	19 August 1939	8 February 2014	JWS	48.18326	-116.26907
NA	PSM10773	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	11 September 1939	8 February 2014	JWS	48.95035	-116.58417
NA	PSM10769	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	19 August 1939	8 February 2014	JWS	48.3555	-116.48195
NA	PSM10771	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	19 August 1939	8 February 2014	JWS	48.3555	-116.48195
NA	PSM10772	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	19 August 1939	8 February 2014	JWS	48.3555	-116.48195
NA	PSM10774	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Juvenile	11 September 1939	8 February 2014	JWS	48.85917	-116.33526
NA	PSM10768	SMNH	Photo.	*L. pipiens*	*L. pipiens*	DNL	Adult	19 August 1939	8 February 2014	JWS	48.3555	-116.48195