METHODS

The primary objective of this study was to survey, during the spring and summer of 1997, as many known wetland or riparian sites as possible, to document the presence or absence of northern leopard frogs. It was recognized that while the presence of an amphibian species at a particular site may be easily detected, the interpretation of absence poses difficulties, in that absence may merely reflect detection biases (some species are easier to detect than others); surveyor experience; temporary, localized extinctions; or low population numbers due to marginal habitat and/or lack of or delayed breeding in a given year (Fellers 1997). Historic and recent leopard frog observations were provided courtesy Dr. C. Peterson, Intermountain Herpetological Database, Biology Department, Idaho State University, Pocatello. Several long-term residents of Burley and Rupert, Idaho were also questioned during the course of the study regarding their knowledge of historic or current leopard frog locations and perceptions of habitat or population trends and threats.

Surveys were conducted using the Visual Encounter Survey method (M. Crump and N. Scott, Jr. *in* Heyer et al. 1994). Observation data were recorded on an Amphibian and Reptile Observation Form (C. Peterson, Intermountain Herpetological Database, Idaho State University, Pocatello); site and water chemistry data were recorded on an Amphibian Survey Data Sheet (U.S. Fish and Wildlife Service, Fort Collins, CO. Version 2/7/92). In general, personnel slowly walked and/or waded survey sites, systematically working all or a portion of the area, visually scanning for amphibians. Survey effort was timed, to allow conversion to man-minutes per frog, to permit comparison of results with subsequent surveys. Specific survey areas were also noted and sketched on the data sheet.

Data recorded included date, time, observer, species, developmental stage (adult, juvenile, tadpole etc.), numbers observed, behavioral and descriptive notes, locality, legal description, county, land status, elevation, predominant vegetation, substrate, air temperature, cloud cover, and wind speed. Photo vouchers were made of some specimens.

Water samples were taken at survey sites in undisturbed areas approximately 3.28 ft (1.0 m) from shore, or at specific amphibian sites (flooded shallows etc.) if disjunct from a discrete water feature. Water parameters estimated included temperature, pH, color, turbidity, and electrical conductivity. Conductivity was measured using a Model 532 M1 Electrical Conductivity Meter, by Myron L Company; pH was estimated to the nearest 0.1 unit using a pHTestr 2 by Oakton [1].

Based on a widely-observed empirical relationship characteristic of a broad range of fresh waters, an approximate range for the concentration of dissolved solids in mg/L was estimated as 0.6 to 0.7 the electrical conductivity of the sample (D. Kotansky, Hydrologist, BLM, Idaho Falls, pers. comm.). For example, a water sample with an electrical conductivity reading of 100 umhos/cm

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[1] Product names are mentioned for the reader's convenience only and do not imply endorsement by the author, the Bureau of Land Management, or the U.S. Government.

was assumed to reflect a dissolved solids concentration of 60-70 mg/L.

Survey sites were plotted on USGS 1:24,000 topographic maps. Observation forms and applicable photo vouchers were submitted to Dr. C. Peterson, Intermountain Herpetological Database, Biology Department, Idaho State University, Pocatello. Photographs were also taken of each site, for future reference.

In May 1997, we also solicited assistance from the community through an article in a local newspaper describing the study, and concerns over the status and trend of northern leopard frog populations. The article, featured in the weekly "Outdoors" section of the paper, was accompanied by a large close-up photo of a northern leopard frog, and resulted in several tips of potential leopard frog locations. Four long-time residents also provided insightful observations of apparent declines or disappearances of frogs from irrigation canals since the 1960's.

RESULTS AND DISCUSSION

Between April 22 and September 2, 1997, we visited 30 sites (Appendix A, Table 2). See also Appendix B, Maps 1-20. Two or more visits were made to several locations, including McClenden Springs Pond, Raft River Exclosure, Gifford Spring ponds, Murtaugh Lake, Camp Holly Marsh, and Trapper Creek.

We documented five amphibian species, including the northern leopard frog (*Rana pipiens*), Pacific chorus frog (*Pseudacris regilla*), boreal chorus frog (*Pseudacris triseriata maculata*),

Great Basin spadefoot "toad" (*Scaphiopus intermontanus*) and a neotenic tiger salamander (*Ambystoma tigrinum*). Incidental sightings were also made of western skinks (*Eumeces skiltonianus*) and wandering (western terrestrial) garter snakes (*Thamnophis elegans*). A single tadpole, tentatively identified as a western toad (*Bufo boreas*), was briefly observed at Wilson Reservoir; however further surveys are needed to confirm the presence of this species.

Mr. O. Murphy, Burley, reported observing what he believed to be a northern leopard frog near the confluence of Trapper and Squaw Creeks on the Sawtooth National Forest in southwestern Cassia County in 1996. We were unable to confirm the species' presence during the two visits made to the area during this study (Table 2 Items 29,33; Map 14). Follow-up surveys are recommended.

Northern Leopard Frog:

Locality Records: Within the perimeter of the Snake River Resource Area, we documented adult northern leopard frogs at the western end of Murtaugh Lake in Twin Falls County; eight sites along Lake Walcott and the Snake River in Cassia and Blaine Counties; and at a wetland 0.6 miles east of Gifford Spring near the Snake River in Power County (Table 2).

Based on Intermountain Herpetological Database records as of 12 September 1997, northern

leopard frogs had not been previously reported at Murtaugh Lake (Table 2, Items 9,14; Map 6) or at the marsh east of Gifford Springs (Table 2, Item 34; Map 4). In 1995, S. Bouffard (USFWS) documented northern leopard frogs at six locations along the shore of the Snake River and Lake Walcott on the Minidoka National Wildlife Refuge (Table 1). In the current study, we re-surveyed two of these sites (MND-16 and MND-25) and also encountered adult leopard frogs (Table 2, Item 26; Map 13 and Item 35; Map 11). We also documented the species at six new sites along Lake Walcott and the Snake River. These included two small bays along the south shore of Lake Walcott/Snake River (Table 2, Items 23,24,25; Map 11); Raft River mouth (Item 31, Map 16);"Six Mile Hole" (Item 37; Map 17); Blue Lake (Item 38 Map 17); and a small bay along the northeast shore of Lake Walcott (Table 2 Item 36; Map 12).

In late July 1997, a fisherman anonymously reported observing numerous leopard frogs in sloughs along the Snake River west of the Burley-Paul Bridge, but we were unable to obtain landowner permission to formally confirm the sighting.

In the Malad Resource Area, we documented adult northern leopard frogs at Daniels Reservoir (Oneida County) and juveniles at Hawkins Reservoir (Bannock County). See Table 2 Items 40-43 and Maps 19-20. Sightings of northern leopard frogs at Daniels Reservoir have not been previously recorded in the Intermountain Herpetological Database. In 1994, J. Kumm and C. Trost encountered the species in the backwaters of Hawkins Reservoir (Table 1).

Land Status: Of the ten leopard frog sites within the perimeter of the Snake River Resource Area, six lie within the administrative jurisdiction of the U.S. Fish and Wildlife Service's Minidoka National Wildlife Refuge along Lake Walcott and the Snake River; three lie within BLM's Snake River Resource Area lands or straddle the Snake River Resource Area/Minidoka National Wildlife Refuge boundary; the Murtaugh Lake locality is privately owned (Table 3).

In the Malad Resource Area, lands surrounding Daniels Reservoir, and harboring leopard frogs, are privately owned. Leopard frog sites at Hawkins Reservoir occurred on both BLM and private lands (Table 3).

Habitat: Bulrushes (*Scirpus acutus*) and cattails (*Typha* sp.) were the predominant vegetation species at 5 of the 14 discrete leopard frog sites (Table 3). Near the Raft River mouth, leopard frogs were easily observed as they rested atop floating mats of dead bulrushes. Other leopard frog sites were characterized by dense stands of various rushes (*Juncus* spp.), spikerushes (*Eleocharis* spp.) and/or sedges (*Carex* spp.). The backwaters of Hawkins Reservoir (Item 43; Map 20) were dominated by cocklebur (*Xanthium* sp.) and *Potentilla* sp. Use of cocklebur-dominated riparian sites by leopard frogs has also been reported in Washington state (Leonard et al. 1993).

National Wetland Inventory (NWI) maps describe seven of the 14 leopard frog sites as Palustrine Emergent Seasonally Flooded Wetlands (Table 4). Other sites included Palustrine Unconsolidated Bottom Permanently Flooded Wetlands; and Lacustrine Littoral Unconsolidated Shore Seasonally Flooded Wetlands. Two sites at Hawkins Reservoir were not classified. Most

leopard frog sites were associated with large, relatively deep bodies of water including Murtaugh Lake, bays or marshes along the Snake River and Lake Walcott; and Daniels and Hawkins Reservoirs.

Water Chemistry: The primary intent of this survey was to document leopard frog localities, and secondarily, to describe generic habitat characteristics and estimate selected water chemistry attributes to facilitate long-term monitoring of specific sites (Table 5).

Mean water temperature at leopard frog sites was 79° F (range 62°-79°); and pH averaged 8.7 (range 7.5-9.5). Estimates of Total Dissolved Solids, estimated as a function of electrical conductivity, varied considerably. Values ranged from a low of 126-147 mg/L at a small bay on the north shore of Lake Walcott (Table 5 Item 36; Map 12) to 1620-1890 mg/L at a shallow alkali pond east of Gifford Spring (Table 5 Item 34; Map 4). Midpoints for these estimates averaged 333.2 mg/L (SD=432.3) across the 13 discrete sites where water samples were taken.

Weather: Survey efforts extended across several months (April to early September, thus air temperatures varied considerably, averaging 76° F at leopard frog sites (range 66°-86°)(Table 5).

Survey Effort: Daniels and Hawkins reservoirs yielded the greatest number of individual leopard frog observations in the shortest timeframe relative to other sites surveyed in 1997 (Table 6). In August, we observed 26 leopard frogs in 50 total man-minutes of survey effort at Daniels Reservoir (1.9 man-minutes/frog) and 21 juvenile leopard frogs in 50 man-minutes at Hawkins Reservoir (2.4 man-minutes/frog). In contrast, survey effort/frog was considerably greater during visits to other sites earlier in the season. For example, at Murtaugh Lake, we observed 2 adult leopard frogs in 246 man-minutes on 21 May 1997 (123 man-minutes/frog). At the mouth of the Raft River, we documented 2 adults in 224 man-minutes, or 112 man-minutes per frog. As surveys were conducted across several months, direct comparison of search effort between sites must be interpreted with caution, and may not reflect true population differences.

Six separate diurnal visits were made throughout the 1997 season to the Snake River Resource Area's Raft River riparian exclosure on the upper Raft River(Map 2). Specifically, the site was surveyed on April 22 and 30; May 20; June 4 and 26; and September 2). Despite a total of 521 man-minutes of survey effort along the river and adjacent wetlands, no amphibians were noted, although J. Tharp documented 12 leopard frogs at the site in September 1992.

Historical Notes: Several long-time residents of Cassia and Minidoka Counties, Idaho provided information on apparent declines or disappearances of frogs over the past several decades. Mr. O. Murphy, Burley, recalled that "frogs" were abundant in a local agricultural drain ditch seventy years ago. As a youth in the late 1960's, D. Thompson, Heyburn, commonly observed and captured leopard frogs on mats of aquatic moss associated with local irrigation canals and ditches. Mr. P. Bradfield, Rupert, also recalled that frogs were once abundant in such systems, and surmised that they disappeared when chemicals were introduced to control aquatic vegetation. This conclusion is corroborated by M. Vaughn, Rupert, who recalled that prior to the early

1960's, when control of aquatic vegetation was accomplished by mechanical means, leopard frogs were commonly encountered in ditches and canals. In the mid to late 1960's, however, he recalls observing dead or dying leopard frogs shortly after the application of chemicals, including xylene and Acrolein.

Currently, aquatic vegetation is still routinely controlled in irrigation ditch systems with the above chemicals, in addition to copper sulfate (M. Etcheverry, Idaho Div. Env. Qual., pers. comm.). All are known to be toxic to aquatic organisms including frogs, and are applied only to closed systems. Alternative chemicals are being considered; reversion to mechanical control methods, which stir sediments and other aquatic debris, would not be compatible with modern sprinkler irrigation systems (R. Bingham, Burley Irrigation Dist., pers. comm.).

Pacific Chorus Frog:
Adult Pacific chorus frogs were documented at a small un-named spring and at two neighboring spring-fed ponds in southern Twin Falls County (Table 2, Items 7 and 17; Map 5) and at Deadeye Reservoir in western Cassia County (Table 2, Item 20; Map 8). Plant species were generally dominated by *Juncus* spp., although watercress (*Nasturtium officinale*) predominated at one site (Table 3 Item 17). The three sites were characterized as Palustrine-Emergent wetlands (Table 4). Water temperature averaged 65° F (Range 56°-75°); Water pH averaged 8.1 (range 7.9-8.4) (Table 5).

Boreal Chorus Frog:
We documented adult boreal chorus frogs at several sites across the Snake River Resource Area including Murtaugh Lake in Twin Falls County (Table 2 Items 10,15; Map 6); Peterson's Island, Cassia County (Table 2 Item 22; Map 10); and at three localities in Minidoka County including a sub-irrigated wetland adjacent to the Main Northside Canal (Table 2 Item 3; Map 3); Camp Holly Marsh (Table 2 Items 11,19,28; Map 7), and at King Spill (Table 2 Item 18; Map 7). Four of the five sites were dominated by cattails (Table 3). Four of five sites were classified as Palustrine-Emergent, Seasonally or Temporarily flooded wetlands (Table 4). Water temperature at three sites for which data were collected averaged 68° F (range 62°-74°). Water pH averaged 8.9 (range 8.7-9.0) (Table 5).

Great Basin Spadefoot Toad:
We documented Great Basin spadefoot toad eggs and tadpoles at lower McClenden Springs pond in Cassia County (Table 2 Items 1 and 13 respectively; Map 1). This site is a spring fed, man-made pond. Vegetation was dominated by rushes or rush-like emergent vegetation (Table 3). The pond is classified as a Palustrine-Unconsolidated Bottom Semipermanently Flooded, Excavated wetland (Table 4). During the two visits to the site, water temperature ranged from 59°-64° F; pH, measured during the first visit, was 8.3 (Table 5).

Western Toad:
During the single visit to Wilson Reservoir in Jerome County, the only amphibian noted during 45 man-minutes of search effort was a single black tadpole (Table 2 Item 39; Map 18). The tadpole

was observed only briefly, before it escaped into flooded woody vegetation. Based on available references (Nussbaum et al. 1983; Peterson and Fabian 1997), the tadpole tentatively appeared to be that of a western toad. Additional follow-up surveys at Wilson Reservoir are warranted to verify the species' presence.

Tiger Salamander:
A single dead 10.5 inch long neotenic tiger salamander was found floating in approximately 1.0 ft of water along the eastern shore of North Cottonwood Reservoir in Twin Falls County (Table 2 Item 30; Map 15). The species has not been previously documented at this site, based on Intermountain Herpetological Database records. In the Pacific Northwest, tiger salamanders have been used as fish bait (Leonard et al. 1993), thus it is conceivable that this individual was introduced. Further surveys are warranted to confirm the species' presence. At the North Cottonwood locality, plant communities adjacent to shore were relatively diverse, including a small stand of cottonwoods (*Populus* sp.), rushes/sedges, cattails, and sagebrush-grass. Associated wetlands were classified as Palustrine Emergent, Seasonally Flooded(Table 4). water temperature was 72° F; pH 9.8 (Table 5).

Incidental Reptile Observations:
We documented two reptile species of interest during this survey. Wandering garter snakes (=western terrestrial) were noted at an abandoned beaver pond at the upper end of the North Fork of Cold Creek in Cassia County (Table 2 Item 21; Map 9).

Western skinks were noted approximately 0.6 miles east of Gifford Springs in Power County (Table 2 Item 5; Map 4) and 0.5 miles NNE of Rock Cabin Spring in southern Twin Falls County (Table 2 Item 16; Map 5).