

# AMPHIBIAN AND REPTILE INVENTORY AND MONITORING GRAND TETON AND YELLOWSTONE NATIONAL PARKS



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## ♦ INTRODUCTION

This is a report of the results of amphibian surveys conducted in Yellowstone (YELL) and Grand Teton (GRTE) national parks and the J.D. Rockefeller Memorial Parkway (JODR) in the summer of 2002. Work was financially supported by the USGS Amphibian Research and Monitoring Initiative (USGS-ARMI) and the National Park Service Inventory and Monitoring Program (NPS-I&M). YELL and GRTE provided multiple forms of logistic support including permits, boat transport, loan of radios, and field crew lodging. This report is intended to satisfy the NPS-I&M contract requirement for an annual and cumulative progress report. An initial progress report was prepared last year (Patla and Peterson 2002); a final report will be

submitted to NPS by February 2004. This report will be provided to the GRYN I&M office, YELL and GRTE, and ARMI. For more information, contact Chuck Peterson ([petechar@isu.edu](mailto:petechar@isu.edu)).

This report contains three sections covering the three project components: systematic surveys, targeted species surveys, and the Lodge Creek Columbia Spotted Frog monitoring site. Each section includes background information, methods, results and discussion. An updated list of herpetofauna species follows the targeted species section. A relational database submitted on a CD with this report provides data documenting sampling events and findings. We also are providing digital photographs of sites visited and voucher photos, and ArcView GIS themes depicting the locations of sites

and amphibian/reptile records.

*Systematic amphibian surveys and mid-level monitoring*

## ✦ BACKGROUND

The main focus of field work in 2002 was the survey of potential amphibian breeding habitat in randomly-selected watershed units across YELL and GRTE. This task is referred to as systematic surveys in our Greater Yellowstone (GRYN) study plan (Patla & Peterson 2001), and mid-level monitoring in our USGS-ARMI proposal (Peterson & Corn 2002). This survey project was initially designed and implemented as a pilot study in 2000 under the USGS Amphibian Research and Monitoring Initiative (ARMI) (Patla 2001). In 2001 and 2002, it was funded jointly by the NPSI& M and USGS-ARMI, with the majority of funding supplied by USGS-ARMI. Surveys of this type will continue in 2003 if ARMI funds are available and our monitoring proposal is selected for funding. Funding already awarded by GRYN-I&M for 2003 will support surveys in a single watershed unit.

The main purpose of this project is to identify the location of active amphibian breeding sites. The surveys document species presence distribution, and the abundance of breeding sites across the parks, including areas that have not been previously sampled or have been under-sampled due to remoteness. Results provide a baseline for monitoring amphibian population trends as indicated by the net gain or loss of breeding populations over time. For inventory purposes under the NPS-I&M program, records of reptiles and amphibians at sites other than breeding sites were also collected. All amphibian species in the Greater Yellowstone Ecosystem (GYE) are pond-breeding species, dependent on shallow, quiet water for egg deposition and larval development (Koch & Peterson 1995). Careful searches of these habitats during an appropriate time frame (egg deposition to metamorphosis) are thus likely to reveal the presence of amphibians if they occur in an area. Some reptiles of the GYE (i.e., the two gartersnake species) also frequent wetlands. The amphibian surveys thus also serve to document the presence of these species and any reptile species encountered en route to survey areas.

## ✦ METHODS

To select watershed units and wetlands for sampling in 2002, we implemented the following procedures. Using GIS (ArcView 3.2), we partitioned YELL into 10 rectangular blocks (sampling frames) and GRTE into 5 blocks. Within each sampling frame, we randomly selected a watershed unit for survey from a set of hierarchically nested drainage catchments provided by the USGS Elevation Derivatives for National Applications (EDNA) Project (<http://edna.usgs.gov>) and the EROS Data Center (Alisa Gallant). These catchments are generally a few square kilometers in size, similar to or smaller than the hydrological units (HUC 7th level) that we used for surveys in 2000 and 2001. If the selected catchment contained fewer than 10 potential amphibian breeding sites (ponds and wetlands), adjacent catchments were added until 11-50 wetland sites were included, constituting the watershed unit targeted for survey. Within the units, we identified potential amphibian breeding habitat (ponds, lakes, and wetlands) using topographic and National Wetland Inventory (NWI) maps. NWI sites with water regimes other than "temporarily flooded" and "saturated" were deemed potential amphibian breeding habitat. The coordinates of these pre-identified sites were loaded into GPS units to ensure positive identification of sites while in the field and for navigation purposes. Field crews were instructed to visit all pre-identified areas and to conduct surveys at any other sites encountered within the watershed unit that had potential habitat for pond-breeding amphibians: ponds, pools in moist or wet meadows, beaver impoundments, stream oxbows and backwaters. Surveys of all potential habitat were conducted where possible; sub-sampling was used in large blocks of habitat such as extensive wet meadows or flooded areas. In some watershed units, surveys were concentrated in the portion of the area where wetlands were clustered; due to time and safety constraints, field crews were instructed not to visit isolated wetlands at the far ends of watershed units lacking trails.

Surveys followed standard amphibian visual encounter methodology (Thoms et al. 1997). Field crews walked the perimeters of water bodies and transects through shallow ponds and wetlands. Long-handled dip-nets were used to sweep the water for amphibian larvae. At sites with restricted visibility



Table 1. List of watershed units, sites visited and surveyed, and species found since 2000.

"Sites occupied" compiles the number of sites where at least one amphibian was observed.

"Breeding" &amp; "Non" columns list the number of active breeding sites per species &amp; the number of other sites where the species was observed.

Year	Park	Unit	ID	Number of sites visited	Sites Surveyed (suitable)	Sites occupied	Tiger Salamander		Boreal Toad		Boreal Chorus Frog		Columbia Spotted Frog	
							Breeding	Non	Breeding	Non	Breeding	Non	Breeding	Non
2000	YELL	Specimen	29	54	37	16	0	1	0	0	5	1	5	9
2000	YELL	Amica	292	19	10	6	0	0	0	0	5	0	0	2
2001	YELL	Amica	292	6	6	5	0	0	0	0	0	0	2	3
2000	YELL	Buffalo Meadows	302	30	17	17	2	0	0	0	7	3	6	6
2001	YELL	Buffalo Meadows	302	17	10	9	5	1	0	0	6	1	6	3
2000	YELL	Hayden	245	54	54	45	9	6	0	5	28	9	7	15
2001	YELL	Pleasant Valley	91	31	16	11	0	0	0	0	1	1	4	5
2001	YELL	Upper Duck Cr	167	10	8	4	1	0	1	1	5	1	0	1
2001	YELL	Grebe Lake	170	50	47	40	0	1	0	0	25	9	6	4
2001	YELL	Frost Lake	238	36	29	17	0	0	0	0	0	0	6	11
2001	YELL	Nez Perce	259	44	26	12	2	0	2	0	3	1	3	7
2001	YELL	Pelican	271	30	17	11	1	0	0	0	9	0	5	4
2001	YELL	Chipmunk	494	19	12	5	0	0	0	0	0	2	0	5
2001	JODR	Polecat	2	37	20	10	0	0	0	2	0	2	2	5
2001	GRTE	Upper Moose	23	12	10	0	0	0	0	0	0	0	0	0
2001	GRTE	Emma Matilda	54	25	15	10	2	0	0	0	5	1	3	4
2001	GRTE	Leigh moraine	66	15	9	9	2	0	0	0	7	1	1	1
2001	GRTE	Stewart Draw	122	16	9	5	0	0	0	0	2	0	3	2
2001	GRTE	Kelly Warm Spr*	718											
2001	GRTE	Gros Ventre R**	15											
2002	YELL	Boundary Cr	1092	28	22	20	1	1	4	1	7	6	1	0
2002	YELL	Delusion South	1207	16	9	9	2	3	0	0	9	0	1	0
2002	YELL	Falls River	1436	36	25	16	0	0	0	0	5	1	10	4
2002	YELL	Fawn	214	32	20	14	2	1	2	7	3	6	5	4
2002	YELL	Hayden	245	50	44	43	14	3	0	7	36	4	9	4
2002	YELL	Slough Cr	271	28	15	8	2	0	0	0	0	3	2	3
2002	JODR	Steamboat	221	21	17	12	1	0	3	7	1	3	2	4
2002	GRTE	Cottonwood	679	13	11	2	0	0	0	0	1	1	1	1
2002	GRTE	Granite	1	12	12	0	0	0	0	0	0	0	0	0
2002	GRTE	Bearpaw	437	25	13	9	2	0	0	0	3	1	5	0
<b>2002 Totals</b>				261	188	133	24	8	9	22	65	25	36	20

Kelly Warm Spr\*: 4000 m of ditches surveyed. No amphibians except bullfrogs at Kelly Warm Spring and downstream in canal

Gros Ventre R\*\*: 900 m of river shores surveyed. No amphibians found.

due to vegetation or turbidity, field crews made regular net-sweeps (every 2 or 3 steps). Data collected in the field included location recorded with a GPS, time spent searching, species observed (specifying life stages and numbers of each), weather, habitat descriptors, water temperature, pH and conductivity. Sites were also documented with drawings and photos, and species were documented with photographs of the various life stages. In 2002, we used personal digital assistants (PDAs) to record data in four tables (Locations, Survey Data, Animal Observations, and Capture Data). The PDAs were programmed using forms software (Pendragon Forms 3.2), in consultation with USGS Rocky Mountain ARMI personnel (Sarah Street and Blake Hossack). Data from the PDAs were downloaded directly into a Microsoft Access database.

Survey work was conducted mainly by two-

person field crews (crew leader Matt Chatfield; technicians Haley Cooper, Gunnar Carnwath, and Cody Lockhart; project supervisor Debra Patla). One watershed unit was completed by volunteers (Char and Dave Corkran and Ann Harvey), with the project supervisor. Field work began on June 5 and ended by August 5. In 2002, about 18% of the sites were re-surveyed to collect data on detectability of species. Most revisits were conducted within about 1 week of the initial survey.

The field crew was lodged at Utah Dorm at Lake, which provided a central location for operations. Much of the work in 2002 was conducted in remote backcountry areas. YELL and GRTE granted camping permits and multiple forms of assistance in planning and implementing backcountry work. YELL and GRTE rangers provided boat transport across Yellowstone and Jackson Lakes and



several nights of use of backcountry cabins at Fawn Creek Pass and lower Berry Creek.

## ◆ RESULTS AND DISCUSSION

Survey data are contained in a relational database submitted with this report. Please see Appendix 1 for information concerning the 2002 database. Digital photographs of sites visited and voucher photos of amphibians and reptiles are also included on the CD submitted with this report; Survey and Observation tables in the database provide the photo identification number linking photos to subjects. ArcView GIS themes documenting the locations of sites and amphibian/reptile records are also submitted with this report.

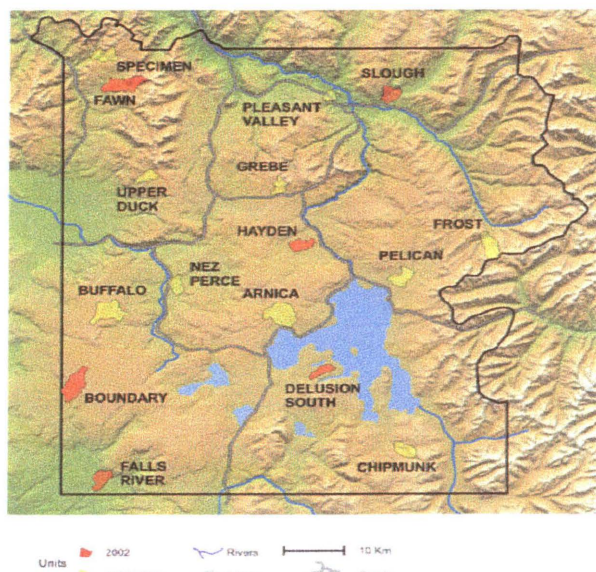


Figure 1. Watershed units surveyed for amphibian breeding populations in Yellowstone National Park since project implementation in 2000. Unit names were assigned based on main drainages or features of units. See Table 1 for survey results.

Considering all 3 years of this project (2000-2002), systematic or mid-level surveys have been conducted in 25 randomly-selected watershed units, with wide distribution across the parks (Fig 1 and 2; Table 1). In 2002, we conducted surveys in 10 watershed units: 6 in YELL, 3 in GRTE, and 1 in JODR. Surveys were not completed in two of the units (Delusion South and Cottonwood), where we were not able to reach all the pre-identified sites within the appropriate time frame. Table 1 displays the number of sites visited per watershed unit and the number of sites where surveys were conducted.

Surveys were conducted only at sites where there was surface water that could provide amphibian breeding habitat (water temperatures below 35-40° C). A substantial number of areas pre-identified as potential amphibian habitat were found to be unsuitable because they were dry (a few were too hot); unsuitable areas constituted 29% of the pre-identified sites, averaged over the 3 years. Drought in northwest Wyoming over the past few years very likely has reduced the number of suitable breeding sites, but the effects of the drought probably vary among watershed units in terms of impacts on amphibian habitat.

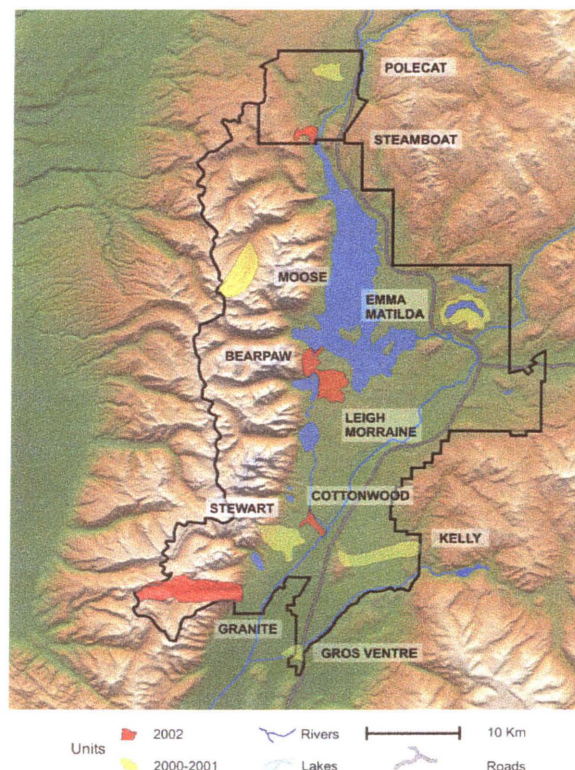


Figure 2. Watershed units surveyed for amphibian breeding populations in Grand Teton National Park and the JD Rockefeller Memorial Parkway since project implementation in 2000. Unit names were assigned based on main drainages or features of the units. See Table 1 for survey results.

We visited a total of 261 wetland sites in randomly selected watershed units in 2002; 188 of these contained surface water and were surveyed. Of these 188 sites, 133 (nearly 71%) were occupied by at least one species of amphibian (Tables 1 and 2). The total number of different sites visited during the 3 years is roughly 500 (Table 2). Some sites in the Buffalo Meadows unit and most sites in Hayden Valley were re-visited in subsequent years. A more precise enumeration of sites will be included in next year's final report.



The number of breeding sites found each year per species, and the percent of surveyed wetlands that hosted breeding by each species are provided in Table 2. Breeding sites are identified by the presence of eggs, larvae, or recent metamorphs. The most abundant species in 2002, in terms of numbers of breeding sites, was the Boreal Chorus Frog, breeding in 35% of wetlands surveyed; followed by Columbia Spotted Frog (19%), Tiger Salamander (13%), and Boreal Toad (5%). In all 3 years, relative abundance of the species in terms of the numbers of active breeding sites has remained consistent, with the Boreal Chorus Frog as the most abundant species, and Boreal Toad as the least (Table 2).

Table 2. Summary of survey results from 2000 through 2002: watershed units, potential amphibian breeding habitat sites surveyed, numbers of breeding sites per species per year, and the percentage of surveyed sites where species bred

Year	Number of watershed units	Number of sites surveyed	Tiger Salamander		Boreal Toad		Boreal Chorus Frog		Columbia Spotted Frog	
			Breeding sites	Percent	Breeding sites	Percent	Breeding sites	Percent	Breeding sites	Percent
2000	4	118	11	9.3%	0	0.0%	45	38.1%	18	15.3%
2001*	14	234	13	5.6%	3	1.3%	63	26.9%	41	17.5%
2002	10	188	24	12.8%	9	4.8%	65	34.6%	36	19.1%
Total	28	**540								
Mean			16	9.3%	4	2.0%	58	33.2%	32	17.3%
Standard deviation				0.036		0.029		0.067		0.020

\*not including Gros Ventre & Kelly Warm Spring units

\*\* Includes some sites (about 50) that were surveyed more than 1 year

Our methodology focuses on identifying breeding sites because changes in the number of breeding sites are thought to best illustrate amphibian population trends (Green 1997). Numbers of breeding sites are used for the monitoring index that is being implemented by ARMI, the proportion of area occupied (PAO) (McKenzie et al. 2002). Focusing on breeding sites also minimizes the problem of variable conspicuousness among adults of the four species; e.g., Columbia Spotted Frogs bask in sunlight along the edges of water bodies and are often encountered during these types of surveys, while chorus frogs disperse to upland areas after breeding, where they are infrequently seen.

Detectability and PAO estimates for the 2002 survey data are in progress. PAO methodology, as being developed and implemented by USGS-ARMI and collaborators, provides a statistical framework and associated software for assessing changes in site occupancy. Because it allows for analysis of how site variables (e.g., maximum water depth, vegetation type) or sampling variables (e.g., weather, date, time of day) affect detection probability, PAO is a considerable advance over simply enumerating changes in the number of breeding sites as a way to determine trends. Multiple revisits of sites are necessary to obtain estimates of detection probability, which are then used to estimate PAO for each species. In 2002, we conducted revisits

of 18% of the surveyed sites; revisits were limited so that we could meet our I&M goal of extensive surveys in remote portions of the parks where amphibian occurrence was not previously documented.

Results of past 3 years of surveys provide the first systematically-collected data set with which to assess the current distribution and relative abundance of amphibian species in YELL and GRTE. Study areas have been distributed across the parks (Fig. 1 and 2) but note that four zones are relatively under-sampled: the northeast and southeast portions of YELL; and areas adjacent to the Snake River and west of Jackson Lake in GRTE. Table 3 lists the watershed units and indicates which species bred or occurred in each of the units. This assessment indicates that two species, Columbia Spotted Frog and Boreal Chorus Frog, are very widespread, occurring (respectively) in 92% and 88% of the surveyed units, and documented as breeding in (respectively) 80% and 72% of the units. Spotted frogs were not found in only 2 watershed units, both in upper watersheds on the east slope Tetons. Chorus frogs were not found in the same 2 units plus one other on the far eastern edge of YELL. Tiger salamanders were documented in well over half of the watershed units surveyed (60%), with active breeding sites found in 52% of the units. Boreal Toads have the spottiest distribution, occurring in less than one third of the units (28%), with breeding sites found in 20% of the units. All four species were found in 6 (24%) of the units. Occurrence and distribution patterns will be analyzed in more detail next year in our final report.

#### Targeted Species Surveys

### ◆ BACKGROUND

Under our study plan for the NPS-GRYN inventory project, targeted species and repeat historic surveys are included to document the presence of amphibian and reptile species that were known to have occurred in the network parks based historic records, are expected to occur based on habitat and regional occurrence, or which have uncertain status. In 2002, targeted surveys were conducted for the amphibian species Boreal Toad, Northern Leopard Frog, and spadefoot; and for the reptile species Northern Sagebrush Lizard, Bullsnake, Valley Gartersnake, and Eastern Yellow-Bellied Racer.



Table 3. Species distributions among watershed units surveyed.

Breed: eggs, larvae, or recent metamorphs present; Non: adults or juveniles only; either: species present either breeding or non-breeding.

Watershed Units Surveyed	Number of amphibian species detected	Tiger Salamander			Boreal Toad			Boreal Chorus Frog			Columbia Spotted Frog		
		Breed	Non	either	Breed	Non	either	Breed	Non	either	Breed	Non	either
Specimen	3		x	x				x	x	x	x	x	x
Arnica	2							x		x	x	x	x
Buffalo Meadows	3	x	x	x				x	x	x	x	x	x
Hayden	4	x	x	x		x	x	x	x	x	x	x	x
Pleasant Valley	2							x	x	x	x	x	x
Upper Duck Cr	4	x		x	x	x	x	x	x	x		x	x
Grebe lake	3		x	x				x	x	x	x	x	x
Frost Lake	1										x	x	x
Nez Perce	4	x		x	x		x	x	x	x	x	x	x
Pelican Cr	3	x		x				x		x	x	x	x
Chipmunk Cr	2								x	x		x	x
Polecat	3					x	x		x	x	x	x	x
Upper Moose Cr	0												
Emma Matilda	3	x		x				x	x	x	x	x	x
Leigh morraine	3	x		x				x	x	x	x	x	x
Stewart Draw	2							x		x	x	x	x
Boundary Cr	4	x	x	x	x	x	x	x	x	x	x		x
Delusion South	3	x	x	x				x		x	x		x
Falls River	2							x	x	x	x	x	x
Fawn	4	x	x	x	x	x	x	x	x	x	x	x	x
Slough Cr	3	x		x					x	x	x	x	x
Steamboat	4	x		x	x	x	x	x	x	x	x	x	x
Cottonwood	2							x	x	x	x	x	x
Granite Cr	0												
Bearpaw	3	x		x				x	x	x	x		x
totals		13	7	15	5	6	7	19	18	22	21	20	23
Percent of watersheds (n=25)		52%	28%	60%	20%	24%	28%	76%	72%	88%	84%	80%	92%

## ★ METHODS

### *Amphibians*

Searches for spadefoots were conducted on Fairy Creek downstream of Fairy Falls; previous possible observations of this species are reported in Koch and Peterson (1995). Searches for leopard frogs were conducted in the String Lake area, where leopard frogs historically occurred (Koch & Peterson 1995). Two of the watershed-based surveys were conducted in or near areas where leopard frogs have been reported but not confirmed, the Bearpaw-Trapper lakes area in GRTE, and Falls River basin in southwest YELL. The Falls River field crew spent two extra days in the area to search 12 wetland sites in Bechler Meadows for leopard frogs. For Boreal Toads, the focus of targeted surveys is to determine if previously identified breeding sites remain occupied and active. In 2002, we visited 15 previously active breeding sites.

### *Reptiles*

Visual encounter surveys were conducted in suitable habitat at selected areas: Yellowstone River

Trail near the northern boundary of YELL, Washburn Hot Springs, and the Lone Star Geyser area. The Yellowstone Institute amphibian/reptile course field trip searched Norris Geyser Basin and the Stevens Creek area.

## ★ RESULTS AND DISCUSSION

### *Amphibians*

No spadefoots or leopard frogs were found during surveys in 2002. Spadefoots thus remain unconfirmed in the GYE. Leopard frogs were documented by museum collection in the 1950s in GRTE and one individual was documented (with photograph) near Flagg Ranch in 1995. There are no historical or recent documented observations of leopard frogs in YELL; however, their presence on the Henry's Fork of the Snake River suggests that they could possibly occur in southwest YELL. Leopard frogs have either been extirpated from GRTE or are extremely rare. Leopard frogs are sometimes confused with spotted frogs; any sightings in the Parks should be documented with photos or collection. Searches for breeding sites should be



Table 4A. Boreal Toad breeding sites in YELL, results of targeted surveys in 2002.

Breeding site name and location	UTM-northing	UTM-easting	Dates of visits in 2002	Active in 2002?	Largest number of egg masses or tadpoles seen	Largest number of metamorphs seen	Comments
Daly Creek 1	4989466	490745	7/10	yes	6 tadpoles		Breeding site found in 1997 and not revisited since.
Daly Creek 2	4990008	490285	7/10	no			Breeding site found in 1997 & not revisited since. Not a full survey but spotted frogs & salamanders were found.
Fan Creek	4980087	499518	7/23	no			Active breeding site in 1999. Main breeding area is upstream in closed zone.
Lamar-Soda Butte confluence	4968492	563684	8/7	yes	4000 tadpoles	2000	Site found during road survey project
Paintpot Toad Pool-Gibbon Meadow	4949114	520830	5/29, 6/12	yes	3 egg strings; 500 tadpoles		Tadpoles disperse downstream in small creek
Alum Cr.-Hayden Valley	4946396	539938	7/3	yes	3,000-5,000 tadpoles		Tadpoles scattered out along several hundred m of Alum Cr
Nez Perce Creek	4936350	517104	7/28	no			Tadpoles found here in 2001, not sure if this is a breeding site.
Mary Mountain trailhead	4934795	514776	5/21, 7/2, 7/28	yes	1 egg string, <300 tadpoles	2	Site found during 2001 survey
Tangled Creek	4932096, 4932200	515215, 514954	7/2	yes	10,000-12,000 tadpoles	450	Surveyed both sides of road
Indian Pond-north of Yellowstone Lake	4933621	553518	5/12, 5/29, 6/4, 7/4, 7/31, 9/3	yes	7 egg strings, >10,000 tadpoles	55	Water levels in lake very low but more tadpoles than previous years.
South Entrance, east of river	4886900	527250	8/3, 9/11	yes	<50 tadpoles	75	Visits too late
S. Entrance, west of river, horse corral area	4886560	526710	5/28, 6/14, 7/1, 9/14	no	0	0	Spotted frogs and chorus frogs tadpoles

Table 4B. Boreal Toad breeding sites in GRTE and JODR, results of targeted surveys in 2002.

Breeding site name and location	UTM-northing	UTM-easting	Dates of visits in 2002	Active in 2002?	Largest number of egg masses or larvae seen	Largest number of metamorphs seen	Comments
Snake River Pit, south of Flagg Ranch, JODR	4881832	525393	5/30, 7/31, 8/8	yes	6 egg strings	1600	100 dead metamorphs on last visit--exposure? Massive restoration project in progress.
Colter Bay, GRTE	4861223	528408	6/7	no			Breeding site by picnic area is dry
Lower Schwabacker Landing, GRTE	4840158	526583	5/15, 6/20, 8/8, 10/20	yes	<2,000 tadpoles	<10	Site continues to expand due to beavers

conducted in the vicinity (within at least 0.5 km) of any documented sightings of adults or juveniles.

Boreal Toads are of special concern because of potential declines in the GYE, devastating chytrid disease outbreaks in Colorado, and the discovery of this disease in 2000 on the National Elk Refuge in Jackson Hole. In 2002, we visited 12 previously-

identified Boreal Toad breeding areas in YELL (Table 4A), and 3 areas in GRTE/JODR (Table 4B). Ten of the 15 sites were active. Seven sites were revisited one to several times, revealing successful 8 hatching and/or development to metamorphosis. The four inactive sites in YELL were not identified as major breeding sites by previous work. The one inactive site in GRTE (Colter Bay) was affected by low



water levels of Jackson Lake due to drought and reservoir draw-downs.

#### *Boreal Toad status*

Survey and monitoring work since 2000 establishes that Boreal Toads are the least abundant of the GYE's native, wide-ranging amphibian species. The existing data do not provide evidence for ongoing declines, based on the persistence of toads in a number of areas documented since the early 1990s and the discovery of several previously unknown breeding sites. Targeted surveys of the past few years indicate that several known major breeding areas (e.g., Tangled Creek, Alum Creek, Soda Butte, South Entrance) remain active and successful, although recruitment may be highly variable. Breeding has also been consistent at some apparently small breeding sites, such as Gibbon Meadow, Indian Pond, and the Snake River Quarry. Some sites where tadpoles or metamorphs were observed in previous years were inactive in 2002 (e.g., Fan Creek, Nez Perce Cr); however, further searches of the watersheds are necessary to determine if toads are breeding at other sites in the vicinity. For example, the inactive toad breeding at Fan Creek may be an intermittently-active satellite of the breeding area identified upstream on east Fan Creek in 1999.

Since 2000, 22 toad breeding localities have been documented in YELL, JODR, and GRTE combined (Figure 3). Breeding localities are defined using the southern Rocky Mountain Boreal Toad Conservation Plan and Agreement's definition of one or more breeding sites separated by no more than 0.8 km (Loeffler 2001). This represents 16 breeding populations, using the conservation plan's definition of a population as one or more breeding localities within a common second or third order drainage separated by no more than 8 km. Three new population centers were discovered in 2002: Fawn Creek in northwest YELL, Boundary Creek in southwest YELL, and Snake River above Jackson Lake in the JODR. Portions of YELL where toads are either scarce or under-sampled include the northeast, southeast, and the Shoshone-Lewis-Heart Lake area. In GRTE, toads appear to be rare or absent from the east slope Teton drainages away from the Snake River and Jackson Lake. Also, toads appear to be much less abundant on the Snake River below the dam than the section of Snake River above Jackson Lake, but more surveys are needed to test this hypothesis.

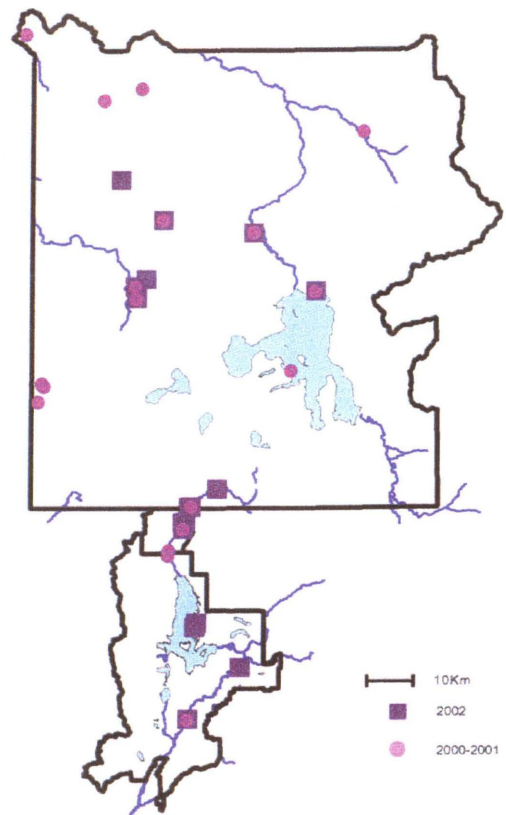


Figure 3. Boreal Toad active breeding sites, 2000-2002

With regards to habitat associations, "hotspots" of the GYE for toads in terms of clusters of (or very large) active breeding sites are the upper Snake (YELL-JODR), Tangled Creek (YELL), and Alum Creek (YELL) areas, all of which are thermally influenced. However, toads also breed abundantly at some sites that have no apparent thermal influence, such as the Lamar-Soda Butte confluence. Successful toad breeding occurs primarily at sites with water of high conductivity (Hawk 2000). Toads are confined to lower elevations than the other wide-ranging GYE amphibian species, with most breeding sites below 2500 m (Figure 4). Distribution and habitat data collected since project implementation provide a good basis for further analysis of habitat associations.

Following are questions that are thought to be important for determining Boreal Toad status in the GYE:

1. In areas and main drainages of the parks where there are few or no toad records, are toads absent, or has survey effort been insufficient?

2. Of the known breeding populations, how many can be considered viable? The southern Rocky Mountain conservation plan uses the following criteria for viability, which could also be applied to the GYE:



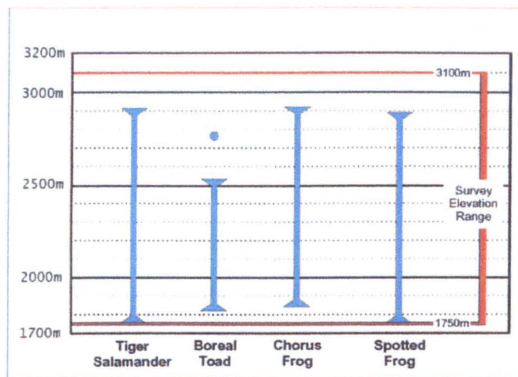


Figure 4. Elevation ranges of amphibian breeding sites in the GYE. Boreal Toads have a relatively restricted range. Only two toad breeding sites have been found above 2400 m (8,000 ft), one at 2530 m and one at 2770 m. Both of these sites had few tadpoles.

Documented breeding activity and recruitment in at least 4 out of the past 10 years (or reliable observations of toads including at least one sub-adult age class in the locality during at least 2 of those 4 years); OR, an average observed total of at least 20 breeding adults at the breeding locality, producing an average of at least 4 viable egg masses per year, and the number of breeding adults observed has remained stable or increased over a period of at least 10 years; AND, the population faces no known, significant, and imminent threat to its habitat, health, and environmental conditions (Loeffler 2001).

3. Are declines in progress in some areas but not apparent given our coarse level of monitoring?
4. How are management activities affecting existing toad populations and their habitat? Two known concerns are the major reclamation project at Snake River quarry near Flagg Ranch and the reservoir draw-downs of Jackson Lake.
5. Are breeding populations (size and distribution) being affected by disease? Is chytrid disease present or widespread in the parks?
6. Will the New Zealand mud snail infestation negatively affect toads and their breeding sites?
7. Do habitat associations (e.g., elevation range, water chemistry) suggest hypotheses about factors that may limit toad abundance and distribution? What are the research priorities?

## Reptiles

Figure 5 displays the locations of reptile observations obtained during targeted reptile surveys and incidentally during amphibian surveys. The most widespread reptile species is the Intermountain Wandering Gartersnake, which was documented at 44 sites in YELL, GRTE, and JODR in 2002. All observations occurred between 1750 m (5740 ft) and 2330 m (7640 ft) elevation. The Valley Gartersnake was recorded at 5 sites, clustered in two areas: the southwest corner of YELL and near the southern border of JODR, elevation 1940 m (6360 ft) to 2070 m (6800 ft). Valley Gartersnakes were documented in these two areas historically (1950s and 1970s) but recent records prior to 2002 are scarce. Bullsnares were observed at two sites near the Yellowstone River in northern Yellowstone, elevation 1650 m (5420 ft). No Rubber Boas were observed or reported to us in 2002. Northern Sagebrush Lizards were observed at 12 sites, in Norris Geyser Basin (1 site, 2000 m elevation) and near the Yellowstone River at 1650 m elevation. No reptiles were found in surveys of the Washburn Hot Springs area, where Rubber Boas and Northern Sagebrush Lizards were recorded in the 1970s. In a search of the Lone Star Geyser area, where a Valley Gartersnake was reported in 1992, only one Intermountain Wandering Gartersnake was found.

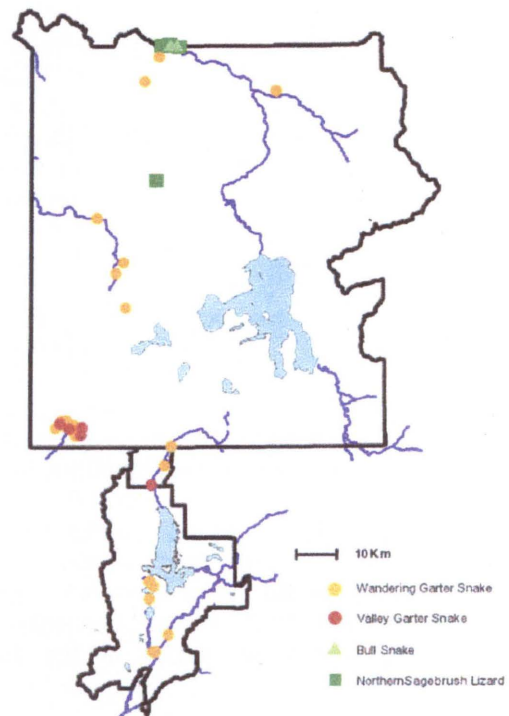


Figure 5. Reptile observations in 2002.



Updated List of Amphibian Species

Notes on rare or unverified species are from Peterson and Koch (1995).

Names provided here have been verified or updated as needed based on Crother (2001) [www.herpllit.com/SSAR/circulars/HC29/names.html].

Subspecies names are given in parentheses; e.g. Western Toad is the species name; Boreal Toad is the subspecies that occurs in the GYE.

## \* Amphibian species detected in 2002

GRTE

\*(Blotched) Tiger Salamander (*Ambystoma tigrinum melanostictum*)

\*Western (Boreal) Toad (*Bufo boreas boreas*)

\*Boreal Chorus Frog (*Pseudacris maculata*)

\*Columbia Spotted Frog (*Rana luteiventris*)

\*American Bullfrog (*Rana catesbeiana*) Introduced species at Kelly Warm Springs.

Northern Leopard Frog (*Rana pipiens*) Present historically in the String-Leigh Lake area; not detected in 2002 nor in previous surveys of this project.

JODR

\*(Blotched) Tiger Salamander (*Ambystoma tigrinum melanostictum*)

\*Western (Boreal) Toad (*Bufo boreas boreas*)

\*Boreal Chorus Frog (*Pseudacris maculata*)

\*Columbia Spotted Frog (*Rana luteiventris*)

Northern Leopard Frog (*Rana pipiens*) Documented with a photo in 1995 near Flagg Ranch; not detected in 2002 nor in previous surveys of this project.

YELL

\*(Blotched) Tiger Salamander (*Ambystoma tigrinum melanostictum*)

\*Western (Boreal) Toad (*Bufo boreas boreas*)

\*Boreal Chorus Frog (*Pseudacris maculata*)

\*Columbia Spotted Frog (*Rana luteiventris*)

Northern Leopard Frog (*Rana pipiens*) Unconfirmed report from Bechler Meadows in 1992. Presence of this species has not been verified in YELL.

Plains Spadefoot (*Spea bombifrons*) OR Great Basin Spadefoot (*Spea intermontana*). One historical report (1889) and one more recent report (1982). Presence of this species has not been verified in YELL.

Updated List of Reptile Species

Notes on rare or unverified species are from Peterson and Koch (1995).

Names provided here have been verified or updated as needed based on Crother (2001)

[www.herpllit.com/SSAR/circulars/HC29/names.html].

Subspecies names are given in parentheses; e.g. Common Sagebrush Lizard is the species name; Northern Sagebrush Lizard is the subspecies that occurs in the GYE.

## \* Reptile species detected in 2002

GRTE

Common (Northern) Sagebrush Lizard (*Sceloporus graciosus graciosus*).

Rubber Boa (*Charina bottae*)

Gophersnake (*Pituophis catenifer*). One roadkill reported at Gros Ventre Junction. Otherwise, presence of this species has not been verified in GRTE.

Common (Valley) Gartersnake (*Thamnophis sirtalis fitchi*)

\*Terrestrial (Intermountain Wandering) Gartersnake (*Thamnophis elegans vagrans*) **Common name was recently changed from Wandering Garter Snake to Intermountain Wandering Gartersnake.**

JODR

\*Terrestrial (Intermountain Wandering) Gartersnake (*Thamnophis elegans vagrans*)

\*Common (Valley) Gartersnake (*Thamnophis sirtalis fitchi*)

YELL

\*Common (Northern) Sagebrush Lizard (*Sceloporus graciosus graciosus*)

Greater Short-horned Lizard (*Phrynosoma hernandesi*). **Name recently changed from (Eastern) Short-horned Lizard (*Phrynosoma douglassii brevirostre*)** Historical collection record in Firehole River basin, and one reported sighting at West Entrance in 1954. Otherwise, presence of this species has not been verified in YELL.

Rubber Boa (*Charina bottae*)

\*Gophersnake (Bullsnake) (*Pituophis catenifer sayi*)

\*Terrestrial (Intermountain Wandering) Gartersnake (*Thamnophis elegans vagrans*)

\*Common (Valley) Gartersnake (*Thamnophis sirtalis fitchi*)

Western (Prairie) Rattlesnake (*Crotalus viridis viridis*)

Eastern (Eastern Yellow-bellied) Racer (*Coluber constrictor flaviventris*). One reliable observation of this species along lower Yellowstone River in 1984. Otherwise, presence of this species has not been verified in YELL.

#### Lodge Creek Apex Site

### ◆ BACKGROUND

Under ARMI, a small number of selected areas in a region are designated as “apex” (formerly called “sentinel”) sites, where intensive population studies are conducted. Types of studies that are conducted at apex sites include investigation of demographic and life history characteristics of key species, the relation of environmental change to changes in demographic and life history characteristics over time, cause-effect of population changes, and protocol and technique development (USGS-ARM I 2001). Commonly, apex sites are areas where amphibian population data have been collected annually over the past several years.

The Lodge Creek area (Figure 6) serves as an apex site in the GYE-ARM I project. Work in 2000-2002 was funded by ARMI, supplemented by donated time. The Columbia Spotted Frog population of the Lodge Creek area was studied intensively during the years 1953-55 (Turner 1960), and again 1993-95, with continued monitoring since 1995 (Patla 1997; Patla & Peterson 1999). Research in the mid 1990s revealed that the population had declined sharply (about 70- 80%) since the 1950s. Continued monitoring of the site allows study of life history, demographic characteristics, and habitat use patterns over time, and observation of responses of the population to annually fluctuating weather and human activities (e.g., fuel hazard reduction and residential development in the area). In addition, it allows us to work with resource managers to apply mitigation measures, and to apply and test the technique of photo-identification as a means of population size estimation. Previous and current research contributes to an understanding of how human-caused habitat modifications may contribute to population decline. A scientific paper on research at Lodge Creek was written in 2002 and is currently in review (Patla & Peterson *in review*).

### ◆ METHODS

In 2002, we conducted breeding-site monitoring and capture/recapture work (using photo identification) within occupied habitat (breeding, foraging, and wintering sites). The area was visited on 12 occasions between May 20 and Sept. 13, with some occasions consisting of two or more days of field work. Capture/recapture-photography was conducted in the main study area (north of the highway) on Aug. 1-2, and again on Sept. 4-5. Capture/recapture-photography was conducted on lower Lodge Creek on Aug. 9 and Sept. 13-14.

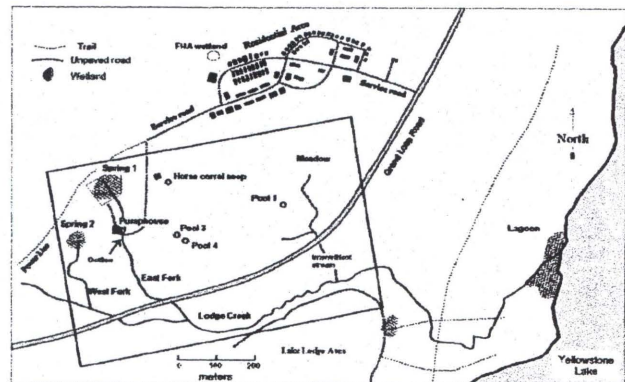


Figure 6. Lodge Creek apex site study area. Work is focused at the labeled sites within the rectangle and at FHA wetlands northwest of the residential area. Less intensive monitoring is conducted along Lodge Creek downstream of the rectangle and at the lagoon at the mouth of Lodge Creek.

### ◆ RESULTS AND DISCUSSION

Figure 6 depicts the study area. A summary of monitoring results in terms of reproductive effort is provided in Table 5 for 2000-2002. Three breeding areas were active in 2002. The total number of egg masses has declined each year since 2000, from 49-54 in 2000 to 43 in 2001 to 41 in 2002. The number of egg masses in the lagoon in 2002 was the smallest number observed in the 3 years. The FHA wetland (wet meadow next to Federal Highway Administration housing in the residential area) produced the highest number of egg masses on record (11 masses). However, this site appears to be a sink for reproduction, with the wetland shrinking to one or two small pools by late July. Only 1 metamorph was found at this site in 2002; other tadpoles and near-



metamorphs may have been eaten by a mallard hen (persistently present at the one remaining pool on July 27; few tadpoles present.) At Pool 3, few tadpoles appeared to survive from the 9 egg masses, with less than 20 tadpoles observed in early July (usual visual estimates are 100 or more in July). Pool 3 was close to total dessication in early July but was replenished by rainstorms. Larval growth rates were more rapid than those previously observed. Metamorphs from Pool 3 were seen as early as July 27, and their size was larger than previous years (e.g., mean body length of 19.3 mm in 2002; 14.3 mm in 2001). Warm temperatures in 2002 and/or low density of tadpoles may explain the unusual growth rates.

	2000	2001	2002
<b>Number of egg masses</b>			
Pool 3 (main study area)	14	7	9
FHA meadow	(unknown)	6	11
Lagoon	35-40	30	21
<b>Date of egg deposition</b>			
Pool 3	5/15-5/27	5/15-5/21	5/18-5/25
FHA meadow	(unknown)	mid May	5/19 & later
Lagoon	5/15-5/19	about 5/21	about 5/20
<b>Pools dry?</b>			
Pool 1	About 7/12 (est)	By 7/6/01	Last visit 7/4, still had water
Pool 4	By about 8/20	By 8/3/01	By 9/4
Pool 3	About 8/10	By about 8/20/02, then slightly replenished & dry again by 8/31	Persists, but very small by early July, then replenished by rain
<b>FHA meadow</b>	(unknown)	By 8/3/01	By 7/27 only 1 pool (2.5 x 2 m)
<b>Lagoon</b>	Persists	Persists	Persists
<b>Metamorphosis?</b>			
Pool 3	Probably none	Scant. Max number seen: 14.3 mm (n=009)	More than expected given small numbers of tadpoles seen. first one seen 7/27, 32 meta on 8/1, 20 meta on 8/13. Mean SVL: 19.3 (n=26, se=0.287)
<b>FHA meadow</b>	7	None	1 on 8/2
<b>Lagoon</b>	Some <30 found on 8/28	Good. Max number seen: 33, and seen consistently on 4 visits, 8/9 to 9/14/01. Mean SVL = 27.8 (n=009)	Max number seen: 46 on 9/12. Mean SVL: 30.2 (n=27, se=0.302)

In the main study area, 85 frogs were captured and photographed in the initial capture period; 40 frogs in the recapture period. Data are summarized in Table 6. Population estimates are pending, and will be based on analysis of the digital photos of individual frogs to ascertain recapture rates. In 2002, we found that <8% of the population of the main study area was in the juvenile life stage, compared to 52% in 2000 and 25% in 2001. This steady reduction of juveniles probably reflects recruitment failures in the drought years of 2000-2001. Among adults, females were more numerous than males in 2002, reversing the situation of the previous 2 years. Females predominated in the population in Turner's studies of the 1950s and in our study of the 1990s, so the 2002 sex-ratio data are more normal. Mean weight-length ratios of adult males and females were greater in 2002 than 2001, suggesting that frogs were in better condition, but statistical tests have not yet been performed to determine if the difference is significant.

Habitat use patterns, based on distribution of frogs, were mostly similar in 2002 to previous years, with frogs again absent from Lodge Creek within the horse pasture and clustered around other stream sections and wetlands in the main study area. However, the number of adult frogs (and egg masses) seen in the FHA wetlands is unprecedented (14 adults on June 7). By mid June, most adults apparently left the area. Some (5) adult females were found at the horse corral seep in mid-June; these possibly were frogs that bred at FHA and overwinter in the Lodge Creek springs. Wood debris that I re-placed in the horse corral seep area following fuel hazard removal operations provided cover that these frogs were using.

Table 6. Lodge Creek capture results, 2000-2002.

Capture Results						
<b>2000</b>						
	First Capture (7/18-7/19/00)			Second Capture (8/23-8/25/00)		
	146 total	146		129 total	129	
	Juvenile	Females	Males	Juv	Females	Males
Number Caught	73	32	41	67	26	36
Percent juv/female/male	50%	22%	28%	52%	20%	28%
Mean SUL (mm)	37.9	56.5	51.3	39.2	59.2	53.9
SUL, SE	0.45	1.46	0.44	0.40	1.65	0.59
Min. SUL	29.6	46.1	42.2	32.6	49.1	46.2
Max SUL	46.4	78.2	56.0	46.1	74.9	61.8
<b>2001</b>						
	First Capture (7/15-7/16/01)			Second Capture (8/21-8/23/01)		
	96 total	96		92 total	92	
	Juvenile	Females	Males	Juv	Females	Males
Number Caught	35	29	32	23	27	42
Percent juv/female/male	36.5%	30.2%	33.3%	25%	29%	46%
Mean SUL (mm)	42.0	56.6	52.2	42.3	57.1	53.0
SUL, SE	0.56	1.22	0.66	0.78	1.73	0.59
Min. SUL	31.1	46.6	46.5	33.1	46.3	45.7
Max SUL	46.0	72.4	58.6	45.7	73	62.6
Mean WT (g)	8.6	22.0	16.5	9.8	23.8	19.0
Weight, SE	0.31	1.48	0.55	0.45	2.16	0.68
Min WT	3.5	9.7	11.0	5.0	8.5	8.5
Max WT	11.5	45.5	22.0	13.5	44.5	31
Ratio Weight/L. length, me.	0.20	0.38	0.31	0.23	0.40	0.36
Ratio Weight/L. length, SE	0.005	0.018	0.008	0.008	0.025	0.009
<b>2002</b>						
	First Capture (8/1-8/2/02)			Second Capture (9/4-9/5/02)		
	85 total	85		40 total	40	
	Juvenile	Females	Males	Juv	Females	Males
Number Caught	5	42	38	3	21	16
Percent juv/female/male	5.9%	49.4%	44.7%	7.5%	52.5%	40.0%
Mean SUL (mm)	39.8	58.1	54.1	39.8	62.3	53.8
SUL, SE	0.78	0.71	0.51	2.80	1.45	0.79
Min. SUL	37.5	45.9	44.8	34.6	46.2	46.5
Max SUL	42.0	67.4	58.9	44.2	76.5	59.2
Mean WT (g)	7.7	24.7	20.3	8.2	31.8	21.2
Weight, SE	0.37	0.98	0.67	1.59	2.34	0.88
Min WT	7	12	10	5.5	14	14
Max WT	9	41.5	31	11	58	27
Ratio Weight/L. length, me.	0.19	0.42	0.37	0.20	0.50	0.39
Ratio Weight/L. length, SE	0.007	0.012	0.010	0.026	0.026	0.012

### Fuels management

The Lodge Creek study area is within the zone targeted for wildland-urban interface fuels management. The EA released by YELL in Sept. 2002 (YELL 2002) stated that it would incorporate our suggestions for mitigation measures within the sensitive habitat zones of the Lodge Creek spotted frog area: avoid or limit tree removal, no skidding or piling of logs, leave existing woody debris, conduct activities in October, and avoid moist swales and areas where water pools up after snowmelt or rain



showers. We hope that we will be able to assist in the implementation of these measures, if the project is approved.

#### *Amphibian Disease and Mortality*

Dead and diseased amphibians are of interest because of the role disease may be playing in amphibian population declines (Daszak et al. 1999). In 2002, as in 2001, we collected dead amphibians encountered during surveys (at 9 locations in 2002) and preserved them in ethanol. Specimens collected and their locations are listed in Appendix 2. Specimens have not yet been submitted for analysis because results from 2001 have not been received from the USGS National Wildlife Health Center NWHC, Madison.

A die-off of adult Columbia Spotted Frogs was reported by a MSU fish parasite researcher (Kendra Kinnan) along an unnamed drainage north of the Fishing Bridge sewage treatment plant in July 2002. We surveyed the drainage on two occasions in early August and reported our findings to YELL. At least 20 frogs were found dead or moribund along the stream. Specimens were collected and provided to YELL Aquatic Resources for submission to USGS NWHC. As of this writing, results have not been received. Dr. David E. Green provided a presentation (in absentia) to the USGS-ARMI meeting in San Diego in early December 2002 in which he reported that the cause of the Yellowstone spotted frog die-off was yet unknown.

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#### ★ ACKNOWLEDGMENTS

Steve Corn (USGS Northern Rocky Mountain Science Center, Missoula, MT) is co-Principal Investigator for the USGS-ARMI project. The scale and continuity of amphibian survey work in YELL and GRTE since 2000 are due to Steve's efforts to include the GYE as a monitoring area in the national ARMI program. Collaboration with ARMI has been extremely productive in terms of the amount of work accomplished, method design, contacts with other researchers, and on-going data analysis. Blake Hossack, Erin Muths, and Sarah Street provided assistance with using PDAs, compiling the database, and other aspects of survey design and data collection. USGS-EROS Data Center (Alisa Gallant) provided the GIS watershed data.

We are grateful for the assistance and cooperation of many people in NPS. Lane Cameron served as the GRYE Biological Inventory Program coordinator until July 2002 and helped us with many aspects of the project since its implementation. Yellowstone National Park staff who assisted and guided us in 2002 include Ann Rodman, Christie Hendrix, and Liz Cleveland. We are particularly thankful to the backcountry office and Anita Varley for procuring campsites in the study areas, and to all those who made it possible for us to work in the Fawn Creek bear management area and make use of the patrol cabin (Kerry Gunther, Brian Helms and others). Lake Ranger district personnel helping us with logistics, boat transport on Yellowstone Lake, and housing include Pat Perotti, Rick Fey, Judie Lanning, and Susan Ross. Thanks to Aquatic Resources (Pat Bigelow) for interest and involvement with the spotted frog die-off, and especially to Kendra Kinnan for discovering the event and promptly notifying us. At Grand Teton NP, we were assisted by Andrew Langford, Virginia and Jim McCall, Mike Nicklas, Terry Roper, and Niki Tippits. We are grateful for boat transport, use of the lower Berry Creek cabin, and the assistance of all those who helped when a field crew member became ill. Sue Wolff and Vicki Trabold conducted amphibian surveys and participated in monitoring and leopard frog searches.

To the dedicated and hard-working field crew of 2002, we extend our sincere thanks: Matt Chatfield (field crew leader), Gunnar Carnwath, Haley Cooper, and Cody Lockhart. Char and Dave Corkran again traveled from Portland to volunteer their expert services in backcountry amphibian survey, and together with Ann Harvey made it possible to complete one of the most challenging units. The Corkrans also helped with survey of the more remote toad breeding sites in 2002.

At Idaho State University, Shirley Buchli, Pam Christensen, Sandy Mitchell, and Connie Peck helped us with supplies, equipment, and personnel. Merlin Hare created the maps (Figures 1 and 2), assisted with report preparation, and provided technical and computer support throughout the 2002 project.



### Appendix 1. Notes on the 2002 database

The 2002 relational database contains the results of the systematic surveys as well as incidental observations and records from surveys of targeted sites. It has four linked tables: Locations, Survey, Animal Observations, and Capture. Explanatory notes about fields are provided in the Description field that is accessed in design view of the tables. Data fields are similar to the database prepared last year but database design follows the USGS-ARMI prescribed format. The most significant difference is that each life stage of each species per site survey is recorded with a separate record in the 2002 database, whereas one record serves to describe all life stages per species per site survey in the 2000-2001 database. The 2002 database has been subjected to quality control but still may contain some errors. There is some redundancy among tables and some design or structural work is unfinished (e.g. some fields are unused and should be deleted or filled). Data from 2000-2001 and 2002 are housed separately at this time but eventually should be integrated into a single database. The 2002 database will be submitted to USGS-ARMI for inclusion in the national amphibian database.

### Appendix 3 Specimen Collection List, YELL and GRTE, 2002

UTMs are in NAD 27, zone 12

Id Number: GYE-1

Species: *Rana luteiventris*

Life stage: Large adult female, extruding eggs.

Location: Slide Lake, northwest YELL, UTM: 523701E, 4983222N

Date: 5/20/02

Collection: Found dead on bottom of a small spring-stream on west side.

Conditions: Overcast and windy, TA 24°C.

Other amphibians: *R. luteiventris* egg masses and hatchlings, no live adults or juveniles seen.

Collected by: D. Patla

Id Number: GYE-2

Species: *Ambystoma trigrinum*

Life stage: Adult male

Location: Slough Cr area, YELL, Site name: Y-271-2, UTM 553947, 4975257

County and state: Park County, WY

Date: 6/11/02

Collection: Found dead

Conditions: Pond with sedges and bulrushes. Overcast, TA 10°C.

Other amphibians: None

Collected by: Matt Chatfield

Id Number: GYE-3

Species: *Rana luteiventris*

Life stage: Juvenile

Location: Hayden Valley, YELL, Site name: Y-245-9, UTM 558069, 4943607

County and state: Park County, WY

Date: 6/12/02

Collection: Found dead

Conditions: Pond with sedges. Partly cloudy, TA 12°C.

Other amphibians: *R. luteiventris* larvae, juv, and adults; *P. maculata* eggs, juv, and adults; 1 *B. boreas* juv.

Collected by: Matt Chatfield

Id Number: GYE-4

Species: *Rana luteiventris* and *Pseudacris maculata*

Life stage: Larvae

Location: Hayden Valley, YELL, Site name: Y-245-52 UTM 540516, 4942981

County and state: Park County, WY

Date: 6/30/02

Collection: From about 15 dead Ralu and 30 dead Psma tadpoles

Conditions: Pond with sedges. Windy, TA 14°C.

Other amphibians: *R. luteiventris* larvae and juv; *P. maculata* larvae; *A. tigrinum* larvae

Collected by: Gunnar Carnwath

Id Number: GYE-5

Species: *Pseudacris maculata*

Life stage: Larvae

Location: Hayden Valley, YELL, Site name: Y-245-70 UTM 538217, 4943320



County and state: Park County, WY

Date: 7/2/02

Collection: From 10 dead late-stage tadpoles

Conditions: Pond with sedges. Clear, TA 13.5°C.

Other amphibians: *R. luteiventris* and *B. boreas* adults

Collected by: Gunnar Carnwath

Id Number: GYE-6

Species: *Pseudacris maculata*

Life stage: Larva (1)

Location: Hayden Valley, YELL, Site name: Y-245-9 UTM 538065, 4943617

County and state: Park County, WY

Date: 7/3/02

Collection: Found dead

Conditions: Pond with sedges. Overcast, TA 15°C.

Other amphibians: *R. luteiventris* larvae and juv, *P. maculata* larvae and pre-metamorphs

Collected by: Gunnar Carnwath

Id Number: GYE-7

Species: *Pseudacris maculata*

Life stage: Larvae (2)

Location: Falls River Basin, YELL, Site name: Y-1436-3 UTM 503542, 4890275

County and state: Park County, WY

Date: 7/10/02

Collection: 2 dead seen and collected

Conditions: Pond with sedges and bullrushes. Clear, TA 26°C.

Other amphibians: *R. luteiventris* larvae and adults, *P. maculata* larvae and metamorphs

Collected by: Matt Chatfield

Id Number: GYE-8

Species: *Pseudacris maculata*

Life stage: Larva (1)

Location: Falls River Basin, YELL, Site name: Y-1436-1 UTM 503621, 4889677

County and state: Park County, WY

Date: 7/10/02

Collection: 1 dead seen and collected

Conditions: Pond with sedges and rushes. Clear, TA 26°C.

Other amphibians: *P. maculata* larvae, metamorphs, juv.

Collected by: Matt Chatfield

Id Number: GYE-9

Species: *Rana luteiventris*

Life stage: Larvae (2)

Location: Bechler Meadows, YELL, Site name: Bech-8, UTM 501243, 4892841

County and state: Park County, WY

Date: 7/16/02

Collection: 5 dead indiv, 1 dying and 1 died after captured. 2 indiv collected, others badly decomposed.

Conditions: Marshy area next to slow 5 dead indiv, 1 dying and 1 died after captured. 2 indiv collected, others badly decomposed. stream. Partly cloudy, TA 20°C.

Other amphibians: *R. luteiventris* larvae and metamorphs; *P. maculata* larvae and metamorphs.

Collected by: Matt Chatfield