

Northern Colorado Plateau Herpetofauna Inventory 2001 Annual Report

Tim Graham and Renata Platenberg
USGS Canyonlands Field Station, 2290 S West Resource Blvd. Moab, UT 84532
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Introduction

Eight National Parks and Monuments in the Northern Colorado Plateau Network were surveyed for the presence of reptiles and amphibians from May to September 2001. Parks surveyed were: Bryce Canyon NP (BRCA), Capitol Reef NP (CARE), Cedar Breaks NM (CEBR), Fossil Butte NM (FOBU), Golden Spike NHS (GOSP), Pipe Spring NM (PISP), Timpanogos Cave NM (TICA), and Zion NP (ZION). The primary objective of the study was to provide a baseline inventory of herpetofauna in each park with the goal of documenting 90% of species present over two years of surveys. A secondary aim is to determine general abundance and distribution of species present, identifying park-specific species of special concern.

The level of existing information on reptiles and amphibians in these parks varies from little or none to moderate amounts. For the majority of parks surveyed this year, even baseline information on species presence/absence was lacking. Attempts were made to identify gaps in knowledge and to structure surveys accordingly.

The herpetofauna survey crew consisted of Tim Graham, Principal Investigator; Renata Platenberg, Crew Leader; and three Biological Science Technicians (Kim Galvin, Rebecca Harms and Jason Leon Jones). The crew generally worked as two independent units of two members each, enabling effort to be more widespread. Contact was maintained between the field crews and PI throughout the summer. Field summaries were provided to the PI in writing throughout the survey period.

Methods

Selection of sites for sampling was based on diversity and structure of habitat: more complex habitat will likely contain a more diverse herpetofaunal community. Wetlands, creeks, springs and ponds were searched wherever possible for the presence of amphibians, while ridges and rocky outcroppings were productive for locating reptiles. In each park unit, we attempted to survey each gross habitat present (e.g. riparian, upland grass, upland shrub, talus, etc.). Visual Encounter Surveys (VES) were carried out across the park: surveyors walked a route or traversed an area, searching for the presence of herpetofauna by looking under shrubs, within litter, on rocks, logs and branches, and under rocks, logs, etc. Basic habitat information was recorded for each VES, and all

herpetofauna encounters were recorded, along with time of observation and microhabitat. GPS coordinates were measured for the first individual of each species to be observed in an area. Areas for VES were selected based on habitat type, previously recorded herpetofauna encounters, and accessibility. Accessible habitat, for the purposes of this project, is defined as those areas to which the crew could negotiate themselves unassisted, e.g., without pack animals or helicopters, and without endangering themselves or others. For example, habitat that occurred on the tops of isolated buttes, halfway up a steep slope, or pockets between steep and rugged terrain (such as between the Waterpocket Fold in CARE) were deemed inaccessible. Parts of TICA were considered inaccessible because of the danger of dislodging rocks onto visitors. The crews frequently accessed remote areas by backpacking. Routes to and from random points selected for survey (see below) were also searched. Attempts were made to survey areas where less common species had been reported, as determined through records held by the park or Division of Wildlife, or from anecdotal species accounts.

In addition to VES, habitat-, time-, and area -constrained searches (TACs) were also carried out. Sites for sampling within each park unit were provided by the NCP Network for five of the eight parks (BRCA, CARE, CEBR, GOSP, and ZION). Using GIS, habitat within the park was stratified according to slope, elevation and aspect, and random points were generated within each habitat type. Points were selected for survey based on accessibility and survey-ability: those points which fell on a steep, inaccessible slope were moved whenever possible to nearby, contiguous terrain. One-hectare square plots were measured out around these points, and surveyed for two person-hours for the presence of reptiles and amphibians. Surveyors traversed the plot, searching for the presence of herpetofauna using the same search methods as for the VES. Habitat and vegetation data were collected for each plot on a standardized form and GPS coordinates were measured at three corners of the plot. We did not measure UTM coordinates for individual observations within plots. No attempt was made to select points for survey by habitat type or complexity, thus we frequently surveyed plots that would be expected to have low diversity or abundance of herpetofauna, such as dense gambel oak thickets and sandy flats with little or no vegetation.

Nighttime VES and night driving were also carried out, but as these methods proved to be largely unproductive, we did not devote much time to this activity.

Vouchers were collected in the form of photographic slides for every species we were able to capture at each park. Photographs were also taken of individuals that we were unable to capture; those that could be used to positively identify that individual will be submitted as vouchers. Where possible, morphometric measurements were taken for vouchered (photographed) specimens, which were then released unharmed. Amphibian larvae that could not be identified in the field were vouchered by being killed and preserved either in 10% formalin or ethyl alcohol. All road-kills and other specimens found dead were collected whenever feasible and frozen. Individual voucher specimens have been delivered to Northern Arizona University for processing. Appendices 1 and 2 contain voucher data.

Results

There were nine 7-day field sessions between 3 May and 4 September, resulting in 33 park visits (Appendix 3). Parks were visited on at least three occasions during the 2001 field season (Appendix 4). Due to the short spring and summer seasons of the higher altitude parks, such as CEBR, TICA and FOBU, visits to these parks did not start until mid-late June or July.

Approximately 340 surveys were carried out during the field season, 23% of which were TACs with the remaining being VES, nighttime VES and night driving. We made approximately 2566 individual observations of reptiles and amphibians. Species lists for each park were generated and compared with expected lists provided at the start of the survey (Appendix 5). Maps showing TACs and species observations, as well as park topography and locations of roads, are contained in Appendix 6.

Park-by-park results are documented below, along with recommendations for further survey in each unit.

Bryce Canyon National Park

Four visits were made to BRCA, for a total of 17 days in the field. Locations surveyed included Swamp Canyon, Sheep Creek, Pasture Wash, Yellow Creek, Aqua Canyon, Whiteman Bench, Little Henderson Canyon, Mossy Cave, Jolley Hollow, the Fairyland Trail, Yovimpa Pass, Riggs Spring, Corral Hollow, Mutton Hollow, Bullberry Spring and areas along the plateau. Twenty-three one-hectare plots were searched throughout the park, out of 59 total surveys. Four lizard species and two snake species were documented; no amphibians were observed. No specimen vouchers were collected from BRCA.

Further survey should focus on monsoon-breeding amphibians, usually not easily detectable except during periods of rain. Spring breeding amphibians, such as *Pseudacris triseriata* and *Rana pipiens*, may also be present, and should be searched for during the early spring months. Reptile survey at Bryce appears to be most productive during the late summer weeks in August and early September.

Capitol Reef National Park

Eight visits were made to CARE, for a total of 30 days in the field. Locations surveyed included Cathedral Valley, Jones Bench, Deep Creek, Temple of the Sun/Moon, Jailhouse Rock and the South Desert, Sulphur Creek, Chimney Rock, Cohab Canyon, Hickman Bridge, Pleasant Creek, Oak Creek, Grand Wash, Capitol Gorge, Old Wagon Trail, Sheets Gulch, Red Canyon, Surprise Canyon, Burr Trail, Onion Beds and Hall's Creek (from the Post to the southern boundary of the park, including the Narrows). Approximately 90 surveys were carried out, including 21 one-hectare plots. Four amphibian species, 10 lizard and 5 snake species were documented, with over 1200 individual observations recorded. Eight road-killed snakes from 3 species (*Masticophis*

taeniatus, *Pituophis melanoleucus* and *Lampropeltis getula*) were collected, along with eight anuran tadpole samples, half of which were found dead. There is an additional voucher of a desiccated neonatal garter snake (*Thamnophis elegans*) in our collection. In addition to these, 10 anuran metamorphs are being maintained in captivity until they reach a stage when they can be positively identified before being vouchered.

Much of the accessible terrain in CARE was surveyed this season, and more species from the expected list were documented than at any other park. Survey priorities for the next round of visits should concentrate on locating snake species, and to determine distribution and abundance of species already documented. Targeted survey methods, such as funnel and pitfall traps, could be utilized to maximize effort. Although it is possible that the Glen Canyon Chuckwalla (*Sauromalus obesus multiforaminatus*) occurs in the park, the potential distribution of this species is very limited, restricted only to the extreme southern tip of the park. Time and effort would be better spent gathering more information on other species, such as *Cnemidophorus velox* and *Phrynosoma hernandesi*, which, although common at other park units, are rare here. However, as survey requirements take us into that southern tip, additional time could be allotted for locating the chuckwalla.

Cedar Breaks National Monument

Three visits were made to CEBR, for a total of 7 days in the field. Twenty surveys were carried out, including 5 one-hectare plots and two nighttime pond surveys. Alpine Pond was dip-netted for larval amphibians. All ponds, springs and wetlands, the plateau, and Ashdown Creek and Rattle Creek below the Breaks were surveyed. No reptiles or amphibians were observed during any visit.

Further survey should concentrate on the explosive spring breeding amphibians during the appropriate time period. It was reported that amphibians were heard calling during the days prior to our first visit in June, but we did not observe any adults, egg masses, or tadpoles. It may be required to access the park in spring, prior to the opening date, to survey the ponds on the plateau. Since CEBR is at 10,000 ft elevation, surveyors may be required to use alternate forms of transportation to reach these ponds, as the road is snow packed and closed all winter. CEBR would be a good place to try out the use of “wanted posters”: posters with illustrations of species the public is likely to encounter on one of the two well-used trails, with the request that sightings be reported to the visitors center. This type of information could provide direction for timing of survey visits. In addition, attempts should be made to locate reptiles in the Ashdown Creek/Rattle Creek areas, although no herpetofauna encounters have ever been reported from this region.

Fossil Butte National Monument

Three visits were made to FOBU, for a total of 9 days in the field. Twenty-five surveys were carried out at the Fossil Lake Trail and adjoining beaver ponds, Moosebone Canyon, Millet Canyon, Murder Hill, Ruby Point, West Dam Site, Chicken Creek, Small Pox Creek, Fossil Butte, and the Historic Quarry Trail. Two amphibian, one lizard and

one snake species were observed. No TACs were carried out at this park, as the NCP Network did not generate random points for survey for this unit. One *Ambystoma tigrinum* found dead in Millet Canyon was collected; however, this specimen is in very poor condition and may not be retained in the collection. Two anuran tadpoles and one *A. tigrinum* larva were vouchered.

Further survey should concentrate on explosive spring breeding amphibians. *Pseudacris triseriata* has been observed by park staff, and the timing of survey visits is crucial for locating breeding individuals. In addition, more effort should be spent on locating snake species that are likely to occur, such as *Pituophis melanoleucus*, and to understanding patterns of distribution of *Phrynosoma hernandesi* and dispersal of *A. tigrinum* within the park boundary.

Golden Spike National Historic Site

Three visits were made to GOSP, for a total of 5 days in the field. Twenty surveys were completed, including 5 one-hectare plots. Locations sampled included Blue Creek, the Big Fill Walk, the East and West Tours, the Ravine and the maintenance yard/residence/visitors center areas. Four amphibian, three lizard and four snake species were observed. One *Coluber constrictor* specimen, found dead and collected by R. Wilson, Head Ranger, has been vouchered.

Further survey priorities include documenting the presence of *Phrynosoma hernandesi*, and the distribution of *Spea intermontana*.

Pipe Spring National Monument

Three visits were made to PISP, for a total of 5 days in the field. The entire park unit was surveyed on each of the three visits. Most of the survey effort was focused on the rocky slope and escarpment, and the mixed-sage fields. Three amphibian, 8 lizard, and 3 snake species were observed. Two anuran tadpole specimens were taken as vouchers.

Although small, the reptile potential of this park is great. The staff members are eager to learn and assist in surveys, and they have been keeping records of observations. It may be possible to use targeted methods, such as funnel traps, to determine presence of the less common snake species, and it is likely the staff would be willing to assist in such an undertaking, so long as they are not trapping and handling rattlesnakes. Again, targeting breeding amphibians should be another priority for this park unit.

Timpanogos Cave National Monument

Three visits were made to TICA, for a total of 5 days in the field. Fifteen surveys were carried out, concentrated around accessible areas (Cave Trail, Historic Trail, picnic areas, maintenance areas, Nature Trail). Surveys were also carried out on the talus slope on the north side of the canyon, away from public view. In addition, areas to the north of the park boundary were searched, as these were wetland areas created by the water pipeline,

and may have constituted valuable amphibian breeding habitat. One voucher was collected, a road-killed *Charina bottae*.

We documented all the species that the TICA rangers are familiar with, and it is unlikely that there are many more undetected reptile or amphibian species present in this unit. However, it would be worth targeting amphibians using minnow/funnel traps in the creek, and the use of coverboards for reptiles might be beneficial here.

Zion National Park

Five visits were made to ZION, for a total of 25 days in the field. Ninety-one surveys, of which 25 were one-hectare plots, produced 930 observations. Locations surveyed include Coal Pits Wash, Chinle Trail, Gopher Tortoise area by Springdale (Edgemont Trail), Parunaweep, East Rim Trail, West Rim Trail, Court of the Patriarchs, Weeping Rock, Hidden Canyon, Emerald Pools, Temple of Sinewava, Paru'us Trail, Watchman Trail, Oak Creek, Residence and maintenance areas, Potato Hollow, Wildcat Canyon, Stevens Wash, Pocket Mesa, Smith Mesa, Lava Point, Timber Creek, LaVerkin Creek, Hop Valley, and locations along the Zion-Mt Carmel Highway. Twelve anuran tadpole specimens were collected (five found dead, one was a tail tip taken for genetic analysis), and one *Uta stansburiana* was found dead and collected in alcohol. We also brought back frozen road-killed reptiles, collected by park staff: two *Cnemidophorus tigris*, two *Masticophis taeniatus*, two *Pituophis melanoleucus*, one *Lampropeltis getula*, one *Sonora semiannulata*, and one *Sceloporus* sp.

Priorities for further survey are to attempt to locate the rarer species suspected to occur in ZION, such as *Heloderma suspectum* and *Coleonyx variegatus*. As with the other parks, the early spring breeding amphibians may be present. There are a number of snake species listed in the expected species list that are likely to occur in this park unit, but are difficult to locate without spending inordinate amounts of time searching. These are species that are frequently opportunistically documented, that is, someone is in the right place at the right time. The park rangers could be encouraged to collect records and to photograph what they observe wherever possible, and indeed many of the rangers that we had contact with at Zion this summer did just that. We were able to verify the presence of the elusive *Diadophis punctatus* based on a photograph and UTM coordinates provided by a ranger.

General survey recommendations for all parks

The overall success of the TACs as a method for inventory was poor. Few, if any, new species were found in the one-hectare plots, and a disproportional amount of time was spent engaged in this low-productive activity. In canyon country, it is difficult to find one hectare of contiguous habitat, and measuring out the plot is frequently problematic and sometimes even dangerous, due to steep slopes, drop-offs, and dense vegetation. Although random points for selection of survey locations are a valuable and effective tool, how the survey should be carried out at these points needs revision.

The nature of this project means that a small number of field personnel is stretched across huge expanses: in 2001 four people attempted to cover some 440,000 acres in eight units ranging from Arizona to Wyoming. Under these circumstances, it is difficult to plan to be in the right locations at the appropriate time and under the appropriate climatic conditions to target certain species, e.g. the explosive breeding amphibians that are only active for a few days each year. Setting up a “hotline” facility for park rangers at all fifteen park units across the NCP could maximize survey success for such species. As and when they encounter these species, they can report sightings or calling activity to us, and we can arrange for a crewmember to arrive within a few days. The hotline could also be used for any fire activity, which brings reptiles out into the open, thereby increasing visibility.

Timing of survey is also important for reptiles, in that many species undergo aestivation during the hot summer months. Searching for anything other than heat-tolerant lizards during these times is unlikely to produce useful results, and can be considered a waste of effort and limited resources. Time should be spent pre-season to research weather patterns and to consult with park staff and local experts to identify those periods of time when survey is unlikely to be productive.

Observation cards held at certain park units have been very helpful in highlighting appropriate survey locations, but these frequently date back pre-1980’s. The staff at TICA and PISP have been recording herpetofauna observations all summer, and this has proved to be a valuable resource. Observation record sheets were distributed to the rangers at Zion, although these have not yet been returned. It is recommended that all NCP parks units be supplied with observation cards, and training in species identification could be included if requested.

Revision of Expected Species list

Appendix 5 contains the expected species list, against which we have measured survey success rate (Table one). The expected species lists were generated for each park based on expert opinion, park records and other historical documentation, and species range maps. They also include dubious anecdotal observations that may be the result of misidentification. These lists do not reflect the habitat types within the park units, nor do they take into account limiting factors such as elevation. Depending on the availability of park records or other documentation, the number of expected species may be greatly overestimated. For a large and diverse park such as ZION, it may be difficult to rule out the presence of a particular species, but in other less diverse parks, such as FOBU, GOSP and TICA, certain species can probably be removed from the expected list based on the limited kinds of habitats actually within the park boundaries. For example, the staff at FOBU are very familiar with the terrain and species occurring within the park and, based on their expert opinion, we located all but two species likely to be present (missing are *Pseudacris triseriata* and *Pituophis melanoleucus*). Adjusting the species list to reflect this situation increases the overall survey success from 31% to 67% (50% for amphibians, 100% for lizards, and 50% for snakes). AT GOSP, we only failed to find one species that has been reported there (*Phrynosoma hernandesi*), bringing the survey

success rate from 48% to 92% (100% for amphibians, 75% for lizards, 100% for snakes). At TICA, we documented all the species known to be resident within the park (except for *Crotaphytus collaris*, which is not likely to be present in this locality). This brings TICAs success rate up from 14% to 100%. In CARE, much of the documentation has been carried out by biologists, and is therefore reliable. The species list more accurately represents what is actually present in the park, as is evident from the high success rate for the detection of lizards. However, not much is known about the snakes at CARE, and the list contains a number of species that are unlikely to occur in the habitats available in CARE. We propose that the expected species lists for all 15 parks be revised, in consultation with experts and through bibliographic research, to a list that more accurately reflects habitat, geological and climatic factors and species distributions.

Table One. Percentage of the expected species documented during 2001, based on the existing, unrevised expected list.

Park	Amphibians	Lizards	Snakes	Overall
BRCA	0%	49%	20%	23%
CEBR	0%	0%	0%	0%
CARE	50%	91%	45%	63%
FOBU	33%	25%	33%	31%
GOSP	57%	43%	49%	48%
PISP	33%	57%	27%	41%
TICA	0%	14%	23%	14%
ZION	42%	61%	35%	46%

Preparation for 2002 field season

Preparation for the 2001 field season was limited in scope, due to the hiring freeze and resultant late start of the season, among other reasons. Field data forms and spreadsheets for data entry were not available at the initiation of data collection, and therefore some of the data collected during this season is somewhat inconsistent. The crew was not sufficiently equipped, e.g. with cameras, to function as two independent units until several weeks into the season. Due to the seasonal differences between the Northern and Southern Plateau units, training for the field crews occurred later than initially planned. This being the first year of this project, these types of hindrances are to be expected. The data collection infrastructure is now in place: data sheets have been tested in the field and revised accordingly, spreadsheet requirements have been identified, and a data collection protocol has been devised. Many of the logistical problems encountered during 2001 have been identified and solved. There remain, however, other preparation considerations that should be addressed pre-season to maximize the success of this project.

There are a number of ways that survey success can be enhanced through pre-season preparation. Time should be spent at the park units prior to the onset of the survey season to a) establish communication between the survey crew leader, park management and rangers; b) collate information resources, such as observation cards and expert knowledge amongst the staff; c) identify the survey priorities of the park; and d) gain a familiarity of the terrain and identify any logistical difficulties. This could also be an appropriate time to offer training in species identification to park staff, if requested. Consultation with other herpetologists and with the Southern Plateau group should be carried out to adjust survey methodology. The expected species list needs to be revised (as discussed above), again in consultation with other herpetologists. Part of the pre-season time should be devoted to data mining, not just from the parks but more importantly, from other sources such as museum collections and universities. A full bibliography of herpetofauna-related topics related to the areas to be surveyed needs to be compiled and made accessible through a searchable database and on-site storage of references. These activities can prove instrumental in increasing the efficiency of the survey work, but they must be carried out pre-season, rather than during time devoted to fieldwork. These preparatory activities will require additional time and funding, as they have not been figured into the survey budget and indeed should not be considered to be field survey activities.

The late start of the 2001 season meant that the early-breeding amphibians were more difficult to document, therefore the 2002 season should start earlier in the spring, as early as late February in some cases. Using knowledge gained from the bibliography and expert opinion as outlined above, the survey season should be scheduled around unproductive survey times, such as the hot, pre-monsoon period. Recruitment of field crew should start earlier as well, and should target those with more experience in herpetology by advertising through internet news groups (e.g. Herp-L), herpetological and biological conservation societies and web pages, and universities.

Long-term monitoring recommendations

The project has not been running long enough to determine long-term monitoring priorities for the Northern Colorado Plateau or for any of the parks surveyed this year.

First-year product summary

The contents of the first-year product delivered from the USGS to the NPS in October 2001 are as follow:

- 1) Summary report outlining methods used and areas sampled in each park, plus an assessment of current problems and corrective actions needed, and recommendations for work to be performed in upcoming field seasons, including recommendations for long-term monitoring.

- 2) Electronic copies of the species and survey data in a format designed by the Herpetofauna Crew.
- 3) Hard copies of all completed field data forms.
- 4) Electronic GPS data.
- 5) Copies of all field notes recorded during the study.
- 6) Original slides for all voucher photographs: these have not yet been catalogued or labeled.
- 7) Electronic data on all voucher specimens taken during the course of the study (voucher specimens themselves have been delivered to Northern Arizona University for processing).
- 8) Additional information on herpetological references and information for individual parks (Appendix 7).
- 9) Abstract submitted as contributions to upcoming research conference (Appendix 8).
- 10) Executive Summary outlining project results for 2001.

Electronic copies can be found on J:\higher life\NPS herp inventory\NPS herp inventory 2001 annual report (will be moved to a different drive after consultation with computer staff)

List of Appendices

- Appendix 1: Voucher specimens preserved in alcohol
- Appendix 2: Frozen voucher specimens
- Appendix 3: 2001 field schedule
- Appendix 4: Park visits
- Appendix 5: Species documented at each park and expected species list
- Appendix 6: Park maps
- Appendix 7: Additional data resources
- Appendix 8: Flagstaff abstracts
- Appendix 9: Executive summary