

**Bighorn Canyon National Recreation Area
Amphibian and Reptile Inventory/Survey
Study Plan, 2001**

Objectives:

The primary objective of this study is to document the occurrence of at least 90% of the species of amphibians and reptiles in Bighorn Canyon National Recreation Area. While pursuing this primary objective, we also will gather information on the distribution, relative abundance, and habitat associations of amphibians and reptiles. In addition to providing baseline information, these data will be of value in developing future plans for a monitoring program.

Potential Species:

Using a previous survey (Redder 1986) and field guides (Stebbins 1985, Baxter and Stone 1985, and Reichel and Flath 1995), we prepared a table of amphibian and reptile species that potentially occur in Bighorn Canyon National Recreation Area (Table 1). Although most of these species have been previously confirmed to occur in the study area, recent population declines of amphibians and reptiles in the western North America have made it necessary to redocument the occurrence of some species to obtain an accurate picture of species presence.

Sources of Information:

We will use several sources of information to ensure that we have maximized our chances of documenting the occurrence of all species.

1. *Previously Collected Data:* We will obtain information previously collected for amphibians and reptiles in the study area from the literature (e.g., Redder (1986), Baxter and Stone (1985), museum records, and state databases (Montana Natural Heritage Program and the Wyoming Natural Diversity Database).

2. *Contributed Observations:* We will interview park personnel, Wyoming Fish and Game employees, and other persons likely to have observed amphibians and reptiles in the study area. In 2002, we propose to conduct a one-day amphibian and reptile workshop to train park employees and other interested persons how to identify and report any amphibian and reptile observations that they make in the Bighorn Canyon area. As part of this training, we will provide identification materials and forms for reporting observations. This will enable park personnel and others to contribute valuable data from sightings made during the course of their

daily activities. We have found that such training sessions can significantly improve the quantity and quality of contributed observation data.

3. Field Surveys:

Sampling Locations

We will consider two broad categories of habitat to sample: (1) aquatic, wetland and riparian sites, and (2) terrestrial sites. Because all of the potential amphibian species breed in lentic habitats, we will focus our amphibian sampling efforts in those habitats. We will try to visit all potential breeding sites in the study area, using the best available information available from topographic maps, National Wetland Inventory maps, aerial photographs, and advice from park personnel to locate sites. If there are more sites than we will have time to survey, we will use a stratified random approach to selecting sites. The stratification will be based on type of wetlands, spatial distribution, and access.

If adequate GIS data are available, we will use a GIS and a stratified, random sampling design to select sites for terrestrial trapping and visual encounter surveys (see below). Our stratified random sampling design will utilize Digital Elevation Models (DEMs) and cover type maps. We will use ArcView 3.2, the Spatial Analyst and 3D Analyst modules (ESRI, Redmond, CA), and the Animal Movement extension (USGS) to develop a map of environmental types (or stratification units) based on topography and cover. The three topographic categories used will be based on slope and aspect: (1) flat (slope less than 5 degrees with no aspect); (2) northeast (slope greater than 5 degrees and an aspect between 315 and 135 degrees); and (3) southwest (slope greater than 5 degrees and an aspect between 135 and 315 degrees). We will use 3D Analyst with the DEMs to create a triangular irregular network (TIN) representing the surface of the study area with polygons (triangles) of varying slope and aspect. We will combine the categories from the cover type map to produce a map with three collapsed categories of cover. We will then combine the themes of the three topographic and three cover categories to produce themes for each of nine environmental types (stratification categories). We will be limited to only nine environmental types because the maximum number of trapping arrays that we can check within three days will be 18 and we want two replicates per environmental type. Traps need to be checked at least every 3 days to minimize animal mortality. We will use ArcView to randomly select ten point locations within each environmental type theme to ensure that there will be an adequate pool to draw from in the event that some of the predicted attributes of the

polygons are not present. We will select the closest polygon of the appropriate cover type for each point. We will only use polygons that are large enough to contain a 15 m X 15 m trapping array. We will use a GPS receiver (Trimble GeoExplorer II) to locate the randomly selected coordinates from the environmental type maps. Each site will be evaluated to determine if its attributes fall within the vegetation, slope, aspect, and size categories indicated by the GIS.

Sampling Techniques

To ensure that we have maximized our chances of detecting the occurrence of all species, we will employ a variety of sampling techniques (Table 2).

A. Visual Encounter Surveys (Jones 1986, Crump and Scott 1994)

The primary technique for sampling amphibians will be visual encounter surveys of wetland, riparian, and aquatic sites. Visual encounter surveys consist of observers walking through the study sites and recording observations of any species encountered. In wetland areas, visual encounter surveys (during which periodic samples are taken with dip nets) are very effective at detecting the larvae of frogs, toads, and salamanders (Crisafulli 1997). We will use a fine-mesh dip net, and dip every 5-7 steps around the perimeter of the wetland, as well as portions of the wetland that can be waded through. We will also listen for any calling amphibians. Amphibian and environmental data will be recorded onto a standardized data form (Figure 1).

Visual encounter surveys of terrestrial sites will also involve observers walking through selected study sites (e.g., along cliff faces, in washes, or 100 transects in shrub lands and grasslands). In addition, we will turn cover objects, such as rocks and logs, to expose hiding animals.

B. Aquatic Funnel Trapping (Adams et al. 1997)

We will use standard minnow traps to conduct the aquatic funnel trapping survey. Aquatic funnel traps use a holding chamber with two tapered openings that direct organisms toward the trap interior. This has proven to be an effective method of capture, especially for larvae (Adams et al. 1997). Traps will be placed at designated areas with at least 10 cm of standing water. Trapping will be conducted for at least two nights for each designated area. A maximum of ten traps will be used at each site.

C. Terrestrial Funnel Trapping (Jones 1986, Beck 1997)

The main technique for gathering information on reptiles will be the use of metal drift fences with funnel traps. Trapping arrays consist of a cross (X) configuration of 15 m sections of metal

flashing with hardware cloth funnel traps on the ends of the flashing and a 4-way wooden trap in the center. This array design has been used successfully for projects on the Idaho National Engineering and Environmental Laboratory and in Hells Canyon. Approximately 18 trapping arrays will be used. Trapping sites will be selected with a GIS, using a stratified-random scheme based on cover types and topography. A variety of macro and microhabitat data will be gathered for each trapping site (elevation, slope, aspect, soils, vegetation, etc.). Traps will be installed in early April and run from about April 15th to July 15th. We will check the traps every 2-3 days. All reptiles captured will be sexed, measured, weighed, and then released. Data will be recorded on data sheets and then transcribed into a microcomputer spreadsheet.

D. Calling Surveys (Rand and Drewery 1994, Zimmerman 1994)

Calling surveys will be conducted in the spring to identify amphibian species that provide audible calls. Two different techniques will be used to perform calling surveys.

1. Automated Recording System - This method requires the use of an automated recording system (Frog Logger) that records sounds at specified intervals (Peterson and Dorcas 1994). The information that is recorded will be used as a reference to determine known sites where amphibians are present and calling. A Frog Logger will be placed at a known location where amphibians have called from in the past. This will provide us with information about when calling begins so we can perform calling surveys during the height of the breeding season. We may also place Frog Loggers in designated areas to determine if the nights we performed Road Calling Surveys (see below) were typical nights of calling, and that we did not sample on evenings when amphibians were not calling at reference areas. This will help ensure that we do not overlook the presence of rare species.

2. Road Calling Surveys- We will drive the roads just after dusk, stopping at designated points along the route and listening for calling frogs (Thoms et al. 1997).

We will also listen for calling anurans during the visual encounter surveys in the wetland sites.

E. Road Surveys (Jones 1986, Shaffer and Jutterbock 1994)

As some species are best found on roads following sunset, we will perform some road surveys via nighttime road driving (to the extent allowable by the limited roads within the park). If possible, we will try to conduct road surveys on rainy as well as clear nights. This technique will probably be most effective for toads and snakes such as gopher snakes and rattlesnakes.

F. Opportunistic Observations.

We will record all opportunistic observations (i.e., those observations not part of a planned survey), including UTM coordinates. As time allows, we will also investigate herpetologically promising sites not included in the formal surveys. All of these observations will be entered into the GIS and displayed along with the contributed observations.

G. Artificial Cover.

Although artificial cover has been used effectively elsewhere (e.g., Grant et al. 1992, Fellers and Drost 1994), we have had relatively little success with this technique in the northern intermountain west and thus do not plan to use it.

Voucher Specimens

We propose to collect: (1) one adult for each species of amphibian and reptile in the Wyoming and Montana portions of the study area; (2) tissue samples (blood, or scale, toe, or tail clips) from five individuals (preferably larvae, metamorphs, or juveniles); (3) voucher photographs of all species found in the study area; and (4) recordings of each species of amphibian call. The photographs will be taken with a digital camera and archived onto a compact disk. The photographs and specimens will be stored at the Idaho Museum of Natural History in accordance with National Park Service procedures.

Data Management and Analysis

Data will be collected on standardized, paper forms and then entered into Excel spreadsheets. The spreadsheet data will then be imported into an Access database developed in consultation with the National Park service.

For the VES and trapping study, we plan to use ANOVA and contingency tables with exact tests for the univariate analysis and logistic regression for the multivariate analysis of the occurrence data. If adequate sample sizes are obtained, results from the occurrence analyses will be used with a GIS to generate predicted distribution maps for each species. For the species trapped, capture rates (number of individuals trapped/100 trap days) will be calculated and analyzed with ANCOVA for habitat, year, day number, and weather effects on capture rates.

Data from all sources will be combined to produce an atlas of amphibian and reptile occurrences for the study area

Project Schedule:

Overall, we expect to spend approximately 4 field weeks in 2001, 12 field weeks in 2002, and a total of 5 weeks for preparation, data compilation, and report preparation.

Spring 2001:

- compile available environmental and herpetological data for study area.
- enter or import existing data into an Access database and ArcView.
- begin developing a stratified sampling scheme for placing trapping arrays and upland VES.
- when weather is suitable, begin field surveys (calling, road driving, VES).
- become familiar with site.
- enter data into spreadsheets as they are being collected.

Summer 2001:

- Develop stratified sampling scheme for placing trapping arrays and upland VES.
- Verify suitability of selected trapping sites.

Fall/Winter 2001:

- Summarize 2001 field data.
- Prepare annual report.
- Finalize trapping design.

Spring/Summer 2002:

Conduct trapping study; supplement with VES as necessary.

Winter 2002

We expect to complete the final report for this project during the winter of 2002/2003.

Personnel.

- Dr. Charles Peterson (Professor of Zoology, Idaho State University) will provide supervision for the project, help design the study, conduct the training session, visit the site for approximately one week during 2001 and 2002, and assist with analysis and report writing.
- Mr. Ryan Baum (Biological Sciences graduate student, Idaho State University) will help design the project, conduct the field surveys, analyze the data, and prepare the final report.
- We have included funding for an undergraduate student to help with installing the traps in the spring of 2002.

References:

Adams, M.J. and K.O. Richter and W.P. Leonard. 1997. Surveying and Monitoring Amphibians Using Aquatic Funnel Traps. In, Olsen, D.H. and W.P. Leonard and R.B. Bury. (ed.) *Sampling Amphibians In Lentic Habitats*. Society For Northwestern Vertebrate Biology. 47-54.

Baxter, G.T. and M.D. Stone 1985. Amphibians and Reptiles of Wyoming. 2nd ed. Cheyenne: Wyoming Game and Fish Dept.

Beck, J.A. 1997. Distribution, relative abundance, habitat characteristics, and movements of three snake species at the C.J. Strike Reservoir in southwestern Idaho. MS. Thesis. Idaho State University, Pocatello, ID. 101 pp.

Crisafulli, C. M. 1997. A Habitat-Based Method For Monitoring Pond-Breeding Amphibians. In, Olsen, D.H. and W.P. Leonard and R.B. Bury. (ed.) *Sampling Amphibians In Lentic Habitats*. Society For Northwestern Vertebrate Biology. 94-96.

Crump, M.L. and N.C. Scott. 1994. Visual encounter surveys. Pp. 84-92. Pp. 146-150 *In: Measuring and monitoring biological diversity standard methods for amphibians*. W.R. Heyer et al., (eds). Smithsonian Institution Press, Washington, D.C.

Fellers, G.M. and C.A. Drost. 1994. Sampling with artificial cover. Pp. 146-150 *In: Measuring and monitoring biological diversity standard methods for amphibians*. W.R. Heyer et al., (eds). Smithsonian Institution Press, Washington, D.C.

Jones, K. B. 1986. Amphibians and reptiles. Pp. 267-290 *In: Cooperrider, A. Y., R. J. Boyd, and H. R. Stuart (eds.), Inventory of monitoring of wildlife habitat*. U.S. Dept. Inter. Bur. Land. Manage. Service Center, Denver, Co. 858 pp.

Grant, B. W., A. D. Tucker, J. E. Lovich, A. M. Mills, P. M. Dixon, and J. W. Gibbons. 1992. The use of coverboards in estimating patterns of reptile and amphibian biodiversity. In: McCullough, D. R., and Barrett, R. H., eds. *Wildlife 2001: Populations*. Essex, England: Elsevier Science Publishers, pp. 379-403.

Peterson, C.R. and M.E. Dorcas. 1994. Automated data acquisition. Pp. 47-55. *In*: Measuring and monitoring biological diversity standard methods for amphibians. W.R. Heyer et al., (eds). Smithsonian Institution Press, Washington, D.C.

Rand, A.S. and G.E. Drewery. 1994. Acoustic monitoring at fixed sites. Pp. 150-152. *In*: Measuring and monitoring biological diversity standard methods for amphibians. W.R. Heyer et al., (eds). Smithsonian Institution Press, Washington, D.C.

Redder, A. 1986. Fish, Amphibian, and Reptile Inventory. For Bighorn Canyon National recreation Area. Unpublished report. Wyoming Cooperative Fishery and Wildlife Unit.

Reichel, J. and D. Flath. 1995. Identification of Montana's Amphibians and Reptiles. Montana Outdoors. May/June.

Shaffer, H.B. and J.E. Juterbock. 1994. Night driving. *In*, Heyer, W.R., M.A. Donnelly, R.W. McDiarmid, L.C. Hayek, and M.S. Foster. (ed.) Measuring and Monitoring Biological Diversity Standard Methods for Amphibians. 163-166.

Stebbins, R.C. 1985. A Field Guide to Western Reptiles and Amphibians. Boston, Ma. Houghton Mifflin Co.

Thoms, C., C.C. Corkran and D. H. Olsen. 1997. Basic Amphibian Survey for Inventory and Monitoring in Lentic Habitats. *In*, Olsen, D.H. and W.P. Leonard and R.B. Bury. (ed.) *Sampling Amphibians In Lentic Habitats*. Society For Northwestern Vertebrate Biology. 44.

Zimmerman, B.L. 1994. Audio strip transects. Pp. 92-97. *In*: Measuring and monitoring biological diversity standard methods for amphibians. W.R. Heyer et al., (eds). Smithsonian Institution Press, Washington, D.C.

Table 1. Potential species of amphibians and reptiles of the Bighorn Canyon National Recreation Area. Prepared from Stebbins 1985, Baxter and Stone 1985, Redder 1986, and Reichel and Flath 1995.

Common Name	Scientific Name	Occurrence
<i>Amphibians</i>		
Tiger Salamander	<i>Ambystoma tigrinum</i>	confirmed
Western Toad	<i>Bufo boreas</i>	possible
Great Plains Toad	<i>Bufo cognatus</i>	possible
Woodhouse's Toad	<i>Bufo woodhousei</i>	confirmed
Plains Spadefoot	<i>Spea bombifrons</i>	confirmed
Boreal Chorus Frog	<i>Pseudacris maculata</i>	confirmed
Northern Leopard Frog	<i>Rana pipiens</i>	confirmed
Columbia Spotted Frog	<i>Rana luteiventris</i>	possible
<i>Reptiles</i>		
Snapping Turtle	<i>Chelydra serpentina</i>	confirmed
Painted Turtle	<i>Chrysemys picta</i>	confirmed
Spiny softshell	<i>Apolone spinifera</i>	confirmed
Pigmy Short-horned Lizard	<i>Phrynosoma douglassii</i>	confirmed
Sagebrush Lizard	<i>Sceloporus graciosus</i>	confirmed
Rubber Boa	<i>Charina bottae</i>	confirmed
Racer	<i>Coluber constrictor</i>	confirmed
Milk Snake	<i>Lampropeltis triangulum</i>	confirmed
Gopher Snake	<i>Pituophis catenifer</i>	confirmed
Western Terrestrial Garter Snake	<i>Thamnophis elegans</i>	confirmed
Plains Garter Snake	<i>Thamnophis radix</i>	possible
Common Garter Snake	<i>Thamnophis sirtalis</i>	possible
Western Rattlesnake	<i>Crotalus viridis</i>	confirmed

Table 2. Proposed sampling techniques for amphibians and reptiles of the Bighorn Canyon National Recreation Area.

Common Name	Visual Encounter Surveys	Aquatic Funnel Trapping	Terrestrial Funnel Trapping	Calling Surveys	Road Driving
Amphibians					X
Tiger Salamander	X	X	X		X
Western Toad	X	X	X		X
Great Plains Toad	X	X	X	X	X
Woodhouse's Toad	X	X	X	X	X
Plains Spadefoot	X	X	X	X	X
Boreal Chorus Frog	X	X	X	X	
Northern Leopard Frog	X	X	X	X	
Columbia Spotted Frog	X	X	X		
Reptiles					
Snapping Turtle	X				
Painted Turtle	X				X
Spiny softshell	X				
Pigmy Short-horned Lizard	X		X		
Sagebrush Lizard	X		X		
Rubber Boa	X		X		X
Racer	X		X		
Milk Snake	X		X		?
Gopher Snake	X		X		X
Western Terrestrial Garter Snake	X		X		X
Plains Garter Snake	X		X		X
Common Garter Snake	X		X		X
Western Rattlesnake	X		X		X

Figure 1. Amphibian survey data sheet.

AMPHIBIAN SURVEY DATA SHEET - modified after S.P. Corn, NBS, Fort Collins, CO

(ver. 1 May 1996)

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DATE		BEGIN TIME		END TIME		OBSERVERS		
LOCALITY								
STATE		COUNTY		MAP NAME		OWNER		ELEVATION
T	R	S		UTM ZONE/DATUM		NORTHING		EASTING
AMPHIBIAN AND REPTILE SPECIES PRESENT (INDICATE NUMBERS IN CATEGORIES IF POSSIBLE)								
SPECIES	ADULT	JUVENILE	METAM.	LARVAE	EGGS	CALLING	TECHNIQUE(S)	VOUCHER
FISH PRESENT		YES ??? NO		FISH SPECIES:				
ENTIRE SITE SEARCHED?		YES NO		IF NO, INDICATE AREA: meters of shoreline habitat				
WEATHER:		RADIATION: CLEAR PARTIAL OVERCAST		WIND: CALM LIGHT MEDIUM HEAVY				
AIR TEMPERATURE (1 M SHADED)		°C OR F		% CLOUD COVER:		PRECIPITATION: SNOW RAIN		
WATER		TEMPERATURE (1CM)		pH:		CONDUCTIVITY		SAMPLE?
COLOR		CLEAR STAINED		TURBIDITY		CLEAR CLOUDY		
SITE DESCRIPTION		PUT SKETCH AND ADDITIONAL COMMENTS ON BACK OF SHEET						
ORIGIN		NATURAL MAN-MADE MAN-MODIFIED		DRAINAGE		PERMANENT OCCASIONAL NONE		
SITE TYPE TEMPORARY or PERMANENT LAKE/POND MARSH BOG STREAM SPRING/SEEP ACTIVE or INACTIVE BEAVER POND								
NATIONAL WETLAND INVENTORY CLASIFICATION					GAP ANALYSIS COVER TYPE (IF KNOWN)			
STREAM ORDER 1 2 3 4 5 6								
SITE LENGTH m		SITE WIDTH m		MAXIMUM DEPTH		< 1M 1 - 2 M > 2 M		
PRIMARY SUBSTRATE SILT/MUD SAND/GRAVEL COBBLE BOULDER/BEDROCK OTHER:								
% OF LAKE MARGIN WITH EMERGENT VEGETATION 0 1 - 25 25 - 50 >50								
EMERGENT VEGETATION SPECIES (IN ORDER OF ABUNDANCE)								
NORTH SHORELINE CHARACTERISTICS				SHALLOWS PRESENT	SHALLOWS ABSENT	EMERGENT VEG PRESENT		EMERGENT VEG ABSENT
DISTANCE TO FOREST EDGE m				FOREST TREE SPECIES				