Herpetofauna
of the
Hanford Nuclear Reservation,
Grant, Franklin and Benton Counties, Washington

Submitted by:

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To:

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Summary

An amphibian and reptile inventory was conducted at the Hanford Nuclear Reservation, Benton, Grant and Franklin counties, Washington from April to September 1998. This followed a similar inventory conducted in 1995. The main goals were to survey areas not covered in 1995, search for rare species, increase the species list for the site and collect life history information. Survey efforts were focused on detection of sensitive species and habitats. The information collected was used to make recommendations for management and to establish base-line information for future research and monitoring.

Several methods were chosen to optimize detection. These methods included visual encounter surveys, road surveys, call surveys, aquatic funnel traps, a seine, drift fences, cover boards and pitfall traps. Data collected from each encounter included location, life history, weather, habitat and microhabitat. All sightings were mapped onto USGS 7 ½ minute topographic maps. Point locations for each sighting were given in Universal Transverse Mercator (UTM) coordinates. Data were entered into Microsoft Excel spreadsheets.

Four amphibian and nine reptile species were found during the 1995 and 1998 inventories. Two species, the tiger salamander (*Ambystoma tigrinum*) and the Western terrestrial garter snake (*Thamnophis elegans),* were reported for the first time on the Hanford Site. The other species observed included the Great Basin spadefoot (*Scaphiopus intermontanus*), Woodhouse's toad *(Bufo woodhousei*), bullfrog (*Rana catesbeiana*), painted turtle (*Chrysemys picta*), short-horned lizard (*Phrynosoma douglassii*), sagebrush lizard (*Sceloporus graciosus*), side-blotched lizard *(Uta stansburiana*), racer (*Coluber constrictor*), gopher snake (*Pituophis catenifer*), Western rattlesnake (*Crotalus viridis*) and night snake (*Hypsiglena torquata*). Abundance, distribution and life history traits for each species are discussed within the report.

The Pacific treefrog (*Hyla regilla*), Western toad (*Bufo boreas*), Western skink (*Eumeces skiltonianus),* striped whipsnake (*Masticophis taeniatus*) and common garter snake (*Thamnophis sirtalis*), species reported or predicted to occur on the site or in the vicinity, were not found in 1995 or 1998. Speculation, on the occurrence of these species and other species that may occur at the site, is discussed in the report.

The land surrounding the Hanford Site has been converted to agriculture, grazing and development at the expense of native vegetation. The Hanford Site is one of the few large tracts of shrub-steppe habitat remaining in Washington. The site provides a refuge for amphibian and reptile populations. This is particularly important for species such as the Woodhouse's toad, sagebrush lizard, striped whipsnake and other species that are rare or have limited distributions in Washington. Management recommendations for this site include 1) maintain undisturbed habitat corridors around aquatic areas, 2) protect uncommon habitats including talus, White Bluffs and sand dunes, 3) monitor amphibian populations, and 4) maintain a database of amphibian and reptile sightings.

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INTRODUCTION

These surveys were part of a Hanford site-wide biodiversity inventory conducted by The Nature Conservancy of Washington. The Hanford Atomic Nuclear Reservation (Hanford Site) is a 560 sq. mile expanse of shrub-steppe that has not been converted to agricultural or large-scale development. The site presented an excellent opportunity to study Columbia Basin herpetofauna in a situation close to its native state. These surveys also presented an opportunity to document the presence and abundance of amphibian species, information that is particularly important with the growing concern over the apparent worldwide apparent decline of amphibian species (Wake and Morowitz 1991; Stebbins and Cohen 1995).

The herpetofauna inventory was started in 1995 as part of the Biodiversity Inventory of the Hanford Site. The 1995 surveys were designed as a preliminary inventory to create a species list for the site and to document the habitats being used. Special effort was focused on locating rare, threatened, sensitive and declining species.

A smaller herpetofauna inventory was conducted from April to September 1998. It focused on surveying specified habitats, searching for rare species and searching habitats that were not surveyed in 1995. Specifically, the surveys focused on locating amphibian breeding sites and searching high-quality habitats for rare species within upland plant communities. These surveys focused on Central Hanford, the North Slope and the Hanford Reach. Only one survey was conducted at the Arid Lands Ecology Reserve. Several revisits were made to sites that were surveyed in 1995 to compare results and consistency of habitat use over time. The information collected was used to make management recommendations and establish base-line information for future research and monitoring.

Nineteen amphibian and reptile species potentially occur within the boundaries of the Hanford Site (Table 1) (Nussbaum et al. 1983; McAllister 1995; Dvornich et al. 1997). Previous surveys (see Previous Work Overview) have documented fifteen species (Table 1).

Previous Work Overview

Prior to 1995, amphibian and reptile research had been conducted mainly through site-specific, small-scale projects (Rickard 1968; Rogers and Rickard 1977; Folliard and Larson 1991) and those in conjunction with waste clean up activities (i.e. the Basalt Waste Isolation Project) (Fitzner 1988; Marr et al. 1988). Other reports came from incidental sightings (Rogers and Rickards 1977; Rickard et al. 1988; Cadwell 1994). Summaries of species occurrences vary between reports, especially for amphibians. Gray and Rickard (1989) report the most amphibian species including the Pacific treefrog, Great Basin spadefoot, Woodhouse's toad, Western toad and bullfrog. Reports of reptile species are more consistent. Most of the reports list the short-horned lizard, sagebrush lizard, side-blotched lizard, racer, gopher snake, striped whipsnake, night snake and Western rattlesnake (Table 1). The painted turtle (Fitzner and Gray 1991; Downs et al. 1993) and the common garter snake (Richard et al. 1988) were also reported. The locations where these species have been encountered are vague or not recorded in many of the reports. No formal study had been conducted on the North Slope, although a brief summary of the amphibians and reptiles found in 1987 and 1989 were documented in "A Fisheries and Wildlife Service Annual Narrative Report" by Bill Radke. No amphibian and reptile species had been

documented for the Wahluke Wildlife Area (Fred Dobler, pers. comm. 1995).

Table 1. Amphibian and Reptile Species Predicted and Documented to Occur at the Hanford Site

Species	Predicted	Documented	Sources
Tiger Salamander (*Ambystoma tigrinum*)	Yes	No	-
Pacific Treefrog (*Hyla regilla)*	Yes	Yes	Rogers & Rickard 1977; Gray & Rickard 1989; Fitzner & Gray 1991
Great Basin Spadefoot *(Scaphiopus intermontanus)*	Yes	Yes	Rogers & Rickard 1977; Marr et al. 1988; Gray & Rickard 1989; Fitzner & Gray 1991
Woodhouse's Toad (*Bufo woodhousei*)	Yes	Yes	Gray & Rickard 1989; Fitzner & Gray 1991
Western Toad (*Bufo boreas*)	No	Yes	Gray & Rickard 1989; Rogers & Rickard 1977
Bullfrog (exotic) (*Rana catesbeiana*)	Yes	Yes	Gray & Rickard 1989
Painted Turtle (*Chrysemys picta*)	Yes	Yes	Fitzner & Gray 1991
Western Skink (*Eumeces skiltonianus*)	Yes	No	-
Short-horned Lizard (*Phrynosoma douglassii*)	Yes	Yes	Rickard 1972; Rogers & Rickard 1977; Rickard et al. 1988; Marr et al. 1988; Gray & Rickard 1989; Fitzner & Gray 1991; Folliard & Larsen 1991
Sagebrush Lizard (*Sceloporus graciosus*)	Yes	Yes	Rogers & Rickard 1977; Rickard et al. 1988; Marr et al. 1988; Gray & Rickard 1989; Fitzner & Gray 1991; Folliard & Larsen 1991
Side-blotched Lizard (*Uta stansburiana*)	Yes	Yes	Richard 1968, 1972; Rogers & Rickard 1977; Rickard et al. 1988; Marr et al. 1988; Fitzner 1988; Gray & Rickard 1989; Fitzner & Gray 1991; Folliard & Larsen 1991
Common Garter Snake (*Thamnophis sirtalis*)	Yes	Yes	Richard et al. 1988
W. Terrestrial Garter Snake (*Thamnophis elegans*)	Yes	No	-
Gopher Snake (*Pituophis catenifer*)	Yes	Yes	Rickard 1972; Rogers & Rickard 1977; Rickard et al. 1988; Marr et al. 1988; Fitzner 1988; Gray & Rickard 1989; Fitzner & Gray 1991; Folliard & Larsen 1991
Racer (*Coluber constrictor*)	Yes	Yes	Rickard 1972; Rogers & Rickard 1977; Rickard et al. 1988; Marr et al. 1988; Fitzner 1988; Gray & Rickard 1989; Fitzner & Gray 1991; Folliard & Larsen 1991
Nightsnake (*Hypsiglena torquata*)	Yes	Yes	Rogers & Rickard 1977; Rickard et al. 1988; Gray & Rickard 1989; Fitzner & Gray 1991; Folliard & Larsen 1991
Striped Whipsnake (*Masticophis taeniatus*)	Yes	Yes	Rogers & Rickard 1977; Rickard et al. 1988; Gray & Rickard 1989; Fitzner & Gray 1991
Ringneck Snake (*Diadophis punctatus*)	Yes	No	-
Rattlesnake (*Crotalus viridis*)	Yes	Yes	Rickard 1972; Rogers & Rickard 1977; Rickard et al. 1988; Gray & Rickard 1989; Fitzner & Gray 1991

Site Description

The Hanford Atomic Reservation occupies 560 square miles in portions of Benton, Franklin and Grant counties, Washington. The US government acquired the land in 1943 as a national security area for nuclear materials production. The majority of the land has been closed to the public since that time. With the exception of Hanford Works, the Columbia Basin irrigation project and a road system, no large-scale development has occurred. Hanford Works is confined to a few areas in the middle of the site and along the Columbia River. These areas, and the accompanying roads, railroads and transmission lines, occupy approximately six percent of the site (Gary and Rickard 1989). The Hanford Site is one of the largest expanses of intact shrub-steppe habitat remaining in the state (Dobler et al. 1996; Cassidy et al. 1997). The Hanford Site is located in the Central Arid Steppe Vegetation Zone of the Columbia Basin Ecoregion (Dvornich et al. 1997). The climate is arid. Summers are hot and dry and winters are cold. Most precipitation occurs between October and April, with about half the precipitation occurring as snow. Precipitation varies with elevation. Rattlesnake Mountain (3600 ft.) receives an annual average of 14 inches. The lower areas of the site along the Columbia River (360 ft.) receive less than five inches annual average rainfall (Rickard et al. 1988).

The site is divided into four management areas for administrative purposes (Map 1). A brief summary of each area follows. For more information, refer to the Biodiversity Inventory and Analysis of the Hanford Site 1994 Annual Report (Pabst 1994).

The Fitzner-Eberhardt Arid Lands Ecology Reserve (ALE) was established in 1967 for ecological research and educational purposes. The area occupies 75,000 acres in Benton County (Map 2). Rattlesnake Mountain borders the site to the west. The only aquatic habitats are springs. Talus is common in the canyons of Rattlesnake Mountain and Yakima Ridge. This area is managed by the United States Fish and Wildlife Service (USFWS) by revocable agreement with the DOE and is closed to the public.

Saddle Mountain National Wildlife Refuge (SMNWR) occupies 32,000 acres located in Grant County (Map 3). As with ALE, it is managed by the USFWS under revocable management agreement with Department of Energy (DOE). Aquatic habitats include the Columbia River and the ponds, wetlands and lakes associated with the Columbia Basin Irrigation Project. Saddle Mountain Lake is the largest (730 acres). The western portion of the White Bluffs is located at this site. The site has no basalt outcroppings or talus. Sand dunes are located in the eastern area of the site and south of Saddle Mountain Lake. This property is closed to the public.

Wahluke Wildlife Area (WWA), managed by the Washington Department of Fish and Wildlife (WDFW) under revocable agreement with the DOE, is located in portions of Grant and Franklin counties (Map 4). This area occupies 58,000 acres. Aquatic areas include ponds associated with the Columbia Basin Irrigation Project and the Columbia River. The White Bluffs border the site along the Columbia River. Saddle Mountain borders the site to the north. Saddle Mountain has the only basalt outcroppings and talus on the site. This site has many sand dunes. The area has been open for public recreation since 1978.

Central Hanford (CH) is located in Benton County. It occupies the areas south of the Columbia River excluding ALE and is managed by the DOE (Map 5). This area has sustained the majority

Map 1.

Map 2.

Map 3.

Map 4.

Map 5.

of nuclear-related activities and development since the 1940s. Aquatic habitats include those associated with the Columbia River and West Lake. Additional irrigation canals and ponds were present in the past, but did not contain water during this inventory. Some vernal ponds are also present. Basalt outcroppings and talus are present at Gable Mountain, Gable Butte and Umtanum Ridge. The site has an extensive dune habitat in the southeastern portion of the site and scattered dunes in other areas of the site. This area is closed to the public.

METHODS

Sample site selection and data collection

Potential sample sites were chosen based on USGS 7½-minute topographic maps, habitat type and by driving or walking around the site. Animals were identified as encountered. Where possible, species were identified without being handled. Animals were not marked. For each animal found, information was collected on life history, location, weather, habitat and microhabitat. Data were recorded on standardized data sheets (Appendix A). The locations were marked on USGS 7½-minute topographic maps. Point coordinates were generated using UTMs (Zone 11).

Sampling Methods

Many techniques have been described for the inventory and monitoring of amphibian and reptile populations (Gibbons & Semlitsch 1981; Heyer et al. 1994; Olson et al. 1997). Each method varies in its detection success for certain species, cost, effort and feasibility for individual habitats. This inventory used eight detection techniques with the goal of optimizing the number of amphibians and reptiles detected. The following is a brief summary of these methods. Survey methods and terminology are based primarily on Heyer et al. (1994).

Visual encounter surveys (VES) -- involve walking through an area systematically searching for animals on the surface, in vegetation and under objects. VES are usually conducted for a prescribed time or are timed. This method is used to determine species richness of an area and relative abundance. VES allows coverage of a variety of areas under diverse conditions. This method is especially useful in detecting the presence of a variety of species in a relatively short period, but may not detect more secretive or fossorial species. Attempts were made to perform VES during optimal times, season and weather conditions, to encounter desired species. Most survey areas were chosen because the habitat seemed favorable for a particular species. When necessary and possible, animals were captured, but most identification was made visually, usually with the aid of binoculars. VES were conducted on a daily basis during each visit to the site. VES were used for both terrestrial and aquatic habitat surveys.

Drift fences -- form artificial barriers that are used to direct animals into a trap (Fitch, 1987). Drift fences can be useful in sampling small areas, particularly in detecting secretive or rare species. The disadvantages to this method include the expense, limited sample area and the number of animals (primarily small mammals) that often die in the traps. Previous Hanford studies have also used drift fence arrays (Fitzner 1988; Marr et al. 1988; Folliard and Larsen 1991).

Drift fences were used for the 1995 inventory work. The drift fences were constructed of Visqueen (.006" plastic sheeting) stapled onto 24 inch wooden stakes. The funnel traps were constructed of 1/8" X 1/8" galvanized hardware cloth fashioned into a 17 cm diameter by 70 cm long cylinder with hardware cloth funnels on each end. Each trap had a latched opening on the side. The arrays were composed of three 7.5 meter drift fence segments arranged in a line or a "T" configuration. Four funnel traps were used in each array at the end of the fence segments. One drift fence also included four pitfall traps. Each trap was outfitted with an external wood cover and a layer of cardboard or sand inside the trap. The pitfall traps had elevated wood covers. Approximately 5 cm of sand was placed in each pitfall trap. Depending on weather and location, traps were checked every one to three days. Captured animals were moved away from the drift fence and released. When not in use, trap doors were left open and pitfall traps were filled with sand.

Drift fence arrays were installed in three places (Map 6). One was located in Bobcat Canyon (ALE) along the base of a talus slope. On SMNWR, an array was set at the western end of the White Bluffs and another was set on a sand dune near wasteway Pond 15. The Bobcat Canyon and White Bluffs sites were believed to be rattlesnake hibernation sites.

Pitfall traps -- are smooth walled containers deep enough to trap the animals being surveyed. The containers are placed in the ground flush with the surface. Rickard (1968) and Fitzner (1988) used pitfall traps to capture lizards on the Hanford Site.

In 1995, one 4 X 4 pitfall grid was installed on SMNWR (Map 6). The grid was located in the eastern end of the refuge. The pitfall traps were placed 15 meters apart. Plastic containers were used for the traps. The containers had openings averaging 10 cm in diameter and were about 15 cm deep. Each pit was covered with a piece of wood elevated off the ground by strips of wood. The traps were closed by flipping the wood covers over flush with the edge of the container. The grid was placed in a sagebrush (*Artemisia tridentata*) and rabbit-brush (*Chrysomthamnus* sp.) habitat where no lizards had been found during VES surveys.

Cover Boards -- are pieces of wood, metal or other materials placed in an area to attract amphibians and reptiles. Cover boards are especially attractive to lizards and snakes that use the boards for ecdysis, thermal buffering and cover from predators. Under certain conditions, cover boards have been shown to increase the number of reptiles captured (Reichenback 1982). Unlike traps, these artificial shelters are used voluntarily by animals, so there is little chance of mortality.

Thirty-nine plywood boards, 50 X 80 cm, were placed in five locations (Map 6). Four boards were placed on the bank above the Columbia River at the Central Hanford boat launch/field station. A fallen sign and discarded boards, in the same area, were also checked when the cover boards were checked. Twenty boards were placed on the southwest end of Gable Mountain (CH). Two cover boards were placed in the "central ponds" area of the WWA. A fallen sign in the same area was also used. Boards were placed in two areas at ALE. Ten boards were placed in the Yakima Barricade area, along with 18 pieces of four inch flexible drainpipe cut in 30 cm sections

and cut in half lengthwise. Three boards were placed at the crossroads south of Benson Ranch. Other boards, already in this area, were also checked.

Call Surveys—Vocalization is an important part of the breeding behavior of most species of anurans. Males emit vocalizations, or "calls", during the breeding season to advertise their location. The calls are species-specific and, in general, species breeding in the same area emit dissimilar calls (Porter 1972). The calls can be used to locate breeding habitat, determine species composition at breeding sites, record breeding phenology and estimate the relative abundance of adult males (Zimmerman 1994). Males of some species also produce sporadic territorial calls outside of the breeding season (e.g. Pacific treefrog, bullfrog).

Call surveys were used to identify anurans and to locate breeding habitats. Potential breeding sites were located using topographic maps. Sites were chosen based on suitability of habitat and accessibility. Most of the sites were accessible by road or by a short hike. Roads paralleling bodies of water were driven with periodic stops to listen for calls. Mileage was recorded and/or flags were left to mark the spot. Where possible, the call areas were revisited and surveyed to collect information on habitat and to search for eggs and larvae.

Call surveys were conducted in both 1995 and 1998. Call surveys were conducted at Lower Snively Springs area and at many locations along Dry Creek. At SMNWR, these surveys were conducted at many locations along the wasteway pond system and Saddle Mountain Lake. At WWA, call surveys were conducted at the ponds in the boat launch area ("boat launch ponds"), ponds located in the central portion of the site ("central ponds"), ponds located near Highway 24 ("northern ponds"), ponds in the Ringold area, at WB-10 Lake and along the irrigation wasteway canal draining WB-10 Lake and flowing to the boat launch area. On Central Hanford, call surveys were conducted at five Columbia River sloughs and at West Lake.

Road Surveys – Night road surveys are an effective survey method under correct conditions (Fitch 1987; Shaffer & Juterbock 1994) and can yield species not detected using other survey methods (Klauber 1939). The main advantage of this method is that many miles can be surveyed in a relatively short period and it facilitates finding nocturnal species. Because of the size of the site, a great deal of driving was done moving between survey areas. Roads were surveyed during the day while driving between sites. At night, roads were driven specifically to search for snakes and anurans. When encountered, snakes and anurans were identified and moved off the road.

Aquatic Funnel Trapping (AFT) -- is effective in measuring presence and relative abundance of aquatic amphibians (Richter 1995; Adams et al. 1997). "Pop bottle traps" were made using 2-liter plastic beverage bottles (Bill Leonard, pers. comm.) and used in June 1995. Locations included Dry Creek at Benson Ranch (ALE), wasteway ponds (SMNWR), a wetland (SMNWR), WB-10 Lake (WWA), and the "northern ponds" (WWA). Commercially available collapsible mesh minnow traps were used in 1998. Traps were set in June, July and August. Locations were at West Lake (CH), a Columbia River slough near the old school house (CH) and a pond in the Ringold fish hatchery area (Map 6).

Seines -- have been used successfully in eastern Washington to catch tiger salamanders and long-toed salamanders (Fred Dobler, pers. comm.) in ponds and irrigation wasteways. Attempts were

Map 6.

made to use a seine in 1995. The seining was haphazard due to difficulties encountered including thick vegetation, deep water and unstable shores (deep mud). The seine was used at WWA in a Columbia River slough near Ringold, part of WB-10 Lake and in the "northern ponds". Seining at SMNWR included ponds along the irrigation wasteway and two ponds near the Columbia River.

Literature and Database Information

Literature and database searches were conducted to gather information about the site. Information was requested from the University of Michigan, Michigan State University and WDFW. Biologists at Battelle Pacific Northwest Laboratory and other biologists familiar with Hanford were contacted for information.

RESULTS

Six hundred six (606) amphibian and reptile records were entered during the 1995 and 1998 surveys (Appendix D). Records represent observation location. Records may include more than one animal and sites may have been visited more than one time. Four amphibian and nine reptile species were found (Figure 1). The amphibians included three anuran species and one salamander species. The tiger salamander was recorded for the first time at the Hanford Site. The reptiles included one turtle species, three lizard species and five snake species. Spatial distribution maps for each species are presented in Appendix B. Life history, location and habitat information for each animal encountered is presented in Appendix D and available on Microsoft Excel spreadsheets. A four-letter species code was used for each species on these spreadsheets (Appendix C). Table 7 lists each species reported to occur on the Hanford site, the Washington State and Federal Status, the property where each species was found and the relative abundance of each species. This table includes species that were not found during this inventory, but were reported from other sources.

Results by Method

Surveys in 1995 took place between March 3 and October 15. Eighty-three days were spent in the field with an average of 11 days per month (Table 2). Surveys started as early as 0630 and went as late as 2300. In 1998, surveys started April 17 and ended Sept. 6 with 23 days spent in the field (Table 3). Survey times were similar to 1995.

Visual encounter surveys (VES) -- were conducted daily during survey periods in 1995 and 1998. All VES were conducted by at least two people in 1995 and 1998 except for VES during the summer of 1995 (only one searcher). VES for striped whipsnake in 1998 used three to four searchers to increase the area covered. VES were conducted in a variety of habitats including ponds, lakes, sloughs, talus slopes, hillsides, sagebrush flats, grassland, springs, the White Bluffs and sand dunes. Twelve species were detected using this method (Fig. 2).

Figure 1. Total records of amphibians and reptiles observed.

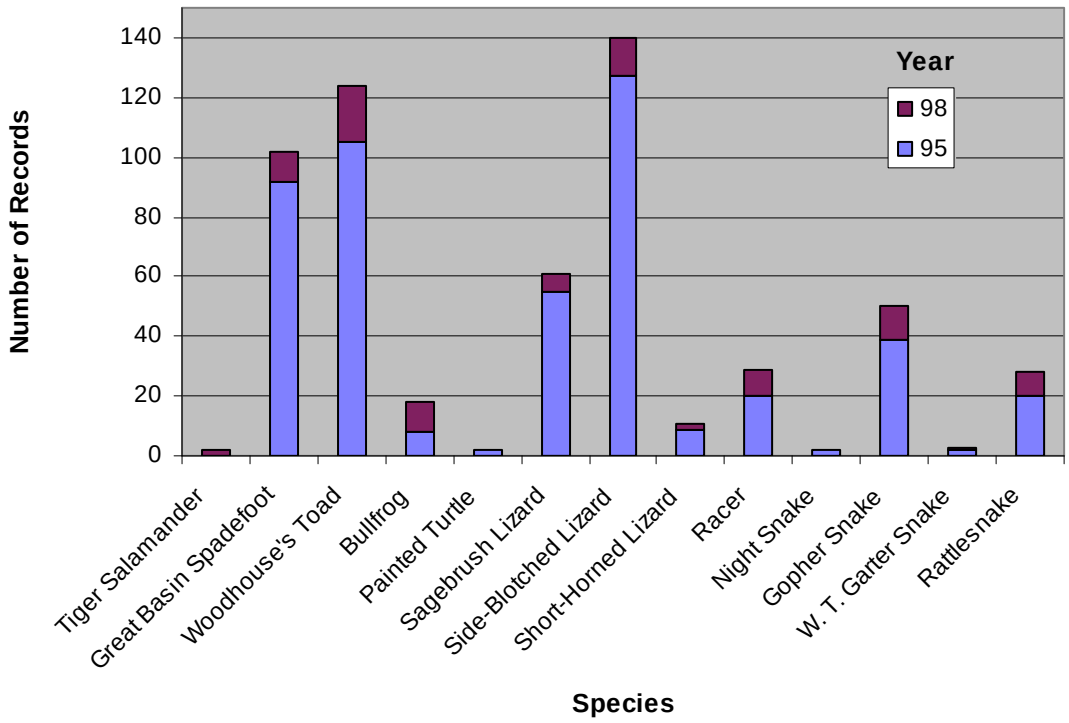


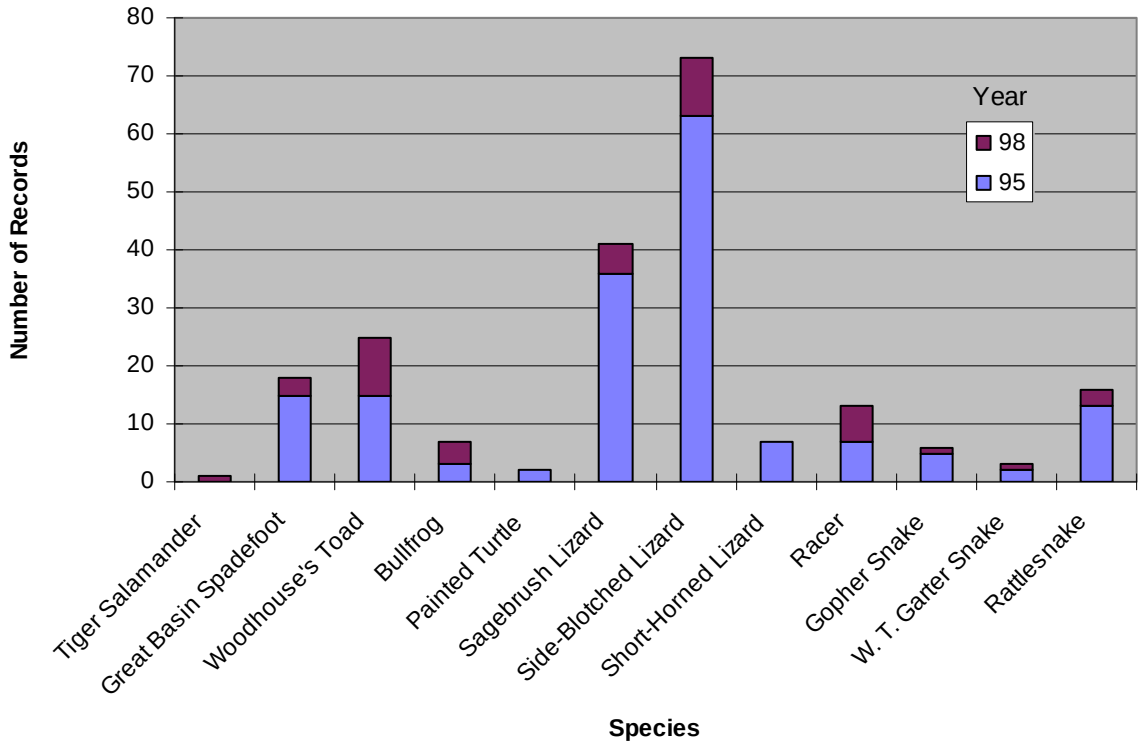
Table 2. Survey Dates in 1995

March 3 – 7	May 19 – May 25	Aug. 14 – 19
March 27- April 2	June 3 – 6	Sept. 4 – 11
April 16 – 20	June 21- 27	Sept. 28 – Oct. 3
April 24 – 27	July 10 – 17	Oct. 12 - 15
May 7 – May 11	July 25 – 31	

Table 3. Survey Dates in 1998

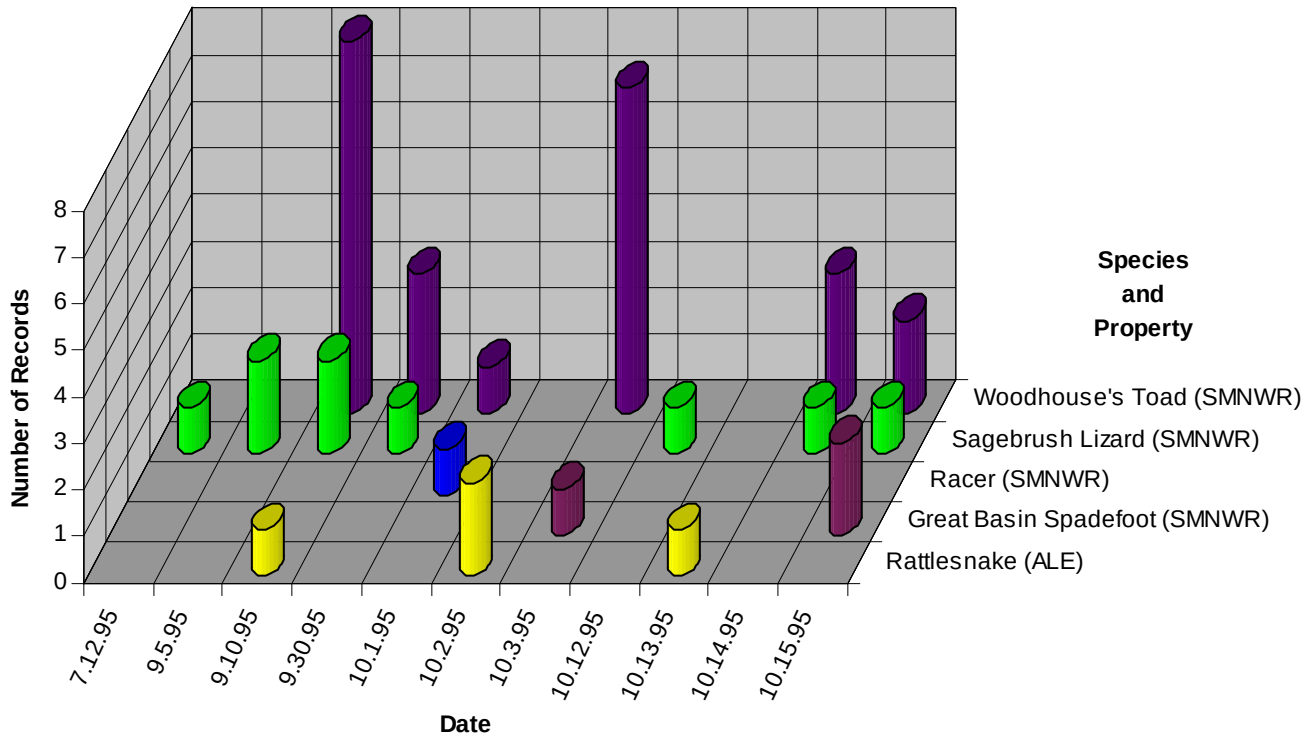
April 17 – 19	May 24 – 25	June 27 - 29	July 25 – 26	Aug. 29 – 30
April 25 – 26	June 6 - 7	July 11 – 12	Aug. 7 – 9	Sept. 5 - 6

Figure 2. Records of amphibians and reptiles observed by visual encounter surveys.



Drift fences – Drift fences were used in 1995 (Map 6). The ALE drift fence was installed at the base of a talus slope in Bobcat Canyon on May 19. This drift fence was open for seventeen days from May 19 –23, Sept. 8-10, Sept. 29 – Oct. 3, Oct. 12- 15. Only rattlesnakes were captured. Two drift fences were installed at SMNWR, one at the western end of the White Bluffs and the other on a sand dune near Pond 15. The "White Bluff" drift fence was installed on April 24. It was open for ten days from April 24-26, May 9-11, 22-25. No animals were captured. The "sand dune" drift fence was open for sixteen days from Sept. 5-10, Sept. 28 –Oct. 3, Oct. 12-15. Thirty-five amphibians and reptiles were captured. Two sagebrush lizards were found under the drift fence equipment in July before the traps were used in the array. Trap death included three juvenile Woodhouse's toads and one small mammal. Captures for each drift fence are listed in Fig. 3.

Figure 3. Records of drift fence captures.



Pitfall traps – One pitfall grid was set up in 1995. The traps were open for sixteen days from Aug. 14-19, Sept. 28-Oct. 3 and Oct. 12-15. The Great Basin spadefoot and side-blotched lizards were captured (Table 4). Two side-blotched lizards were captured because they burrowed under the wood covers while the traps were closed. No trap death occurred.

Table 4. Pitfall Trap Captures

	Date of Capture					
Species captured	Aug. 19	Sept. 28	Oct. 2	Oct. 3	Oct.12	Oct. 15
Great Basin Spadefoot				X		
Side-blotched Lizard	X	X	X		X	X

Cover boards—Cover boards were used in 1995. The boards were checked regularly during the field season. Only side-blotched lizards were found under the boards that were placed for this survey. Other species were found under discarded wood and signs that were found around the Hanford Site (Table 5). Five snake skins were found under boards, but were not identified to species.

Table 5. Reptiles Found Under Cover Boards in 1995

	Property		
Species captured	ALE	Central Hanford	WWA
Side-blotched Lizard	14	1	0
Sagebrush Lizard	0	3	0
Racer	0	0	1

Call Surveys – were conducted in 1995 and 1998 from mid-March to mid-July on all properties. The Great Basin spadefoot, Woodhouse's toad and bullfrog were detected. Amphibian breeding locations are indicated on the species distribution maps (Appendix B).

Road Surveys – Roads were sampled each day of the survey. Eight species were found (Fig. 4). The night snake, a nocturnal species, was dead, as were most of the gopher snakes found during the day. One of the Woodhouse's toads was dead and the other four were found at dusk.

Night road sampling took place for the specific purpose of searching for nocturnal snakes and anurans. Sampling took place on 35 nights (Table 6). Animals were found on the roads 17 of 21 nights (81%) in 1995. Animals were found 9 of 14 nights (64%) searched in 1998 (Fig. 5). The racers were dead.

Table 6. Night Road Sampling Dates

1995		**1998**	
Month	**Day**	**Month**	**Day**
May	7,8,9,24	April	18,26
June	3,21,23,24,25,	May	24,25
July	11,14,15,16,28,30	June	6,27,28,29
Aug.	14,18	July	11,25
Sept.	6,8,9	Aug.	7,8,29
Oct.	1	Sept.	5

Aquatic funnel traps (AFT) – Trapping locations are listed in the Methods section and on Map 6. Three species were captured (Fig. 6).

Seines – were used in 1995 at six sites. Only fish were captured.

Literature and database Information

Twelve reports and journal articles were found with Hanford herpetofauna references (see Literature Cited). University of Michigan Zoology Museum, Michigan State University Museum and the WDFW Herpetofauna databases had references to amphibians and reptiles collected or reported from the Hanford site. Batelle PNL biologists provided access to field notes compiled by the late Richard Fitzner. The notes pertaining to amphibians and reptiles are summarized in Appendix E. Batelle biologists also provided information about the site (see Discussion and Species Accounts).

Figure 4. Records of amphibians and reptiles observed by day road sampling.

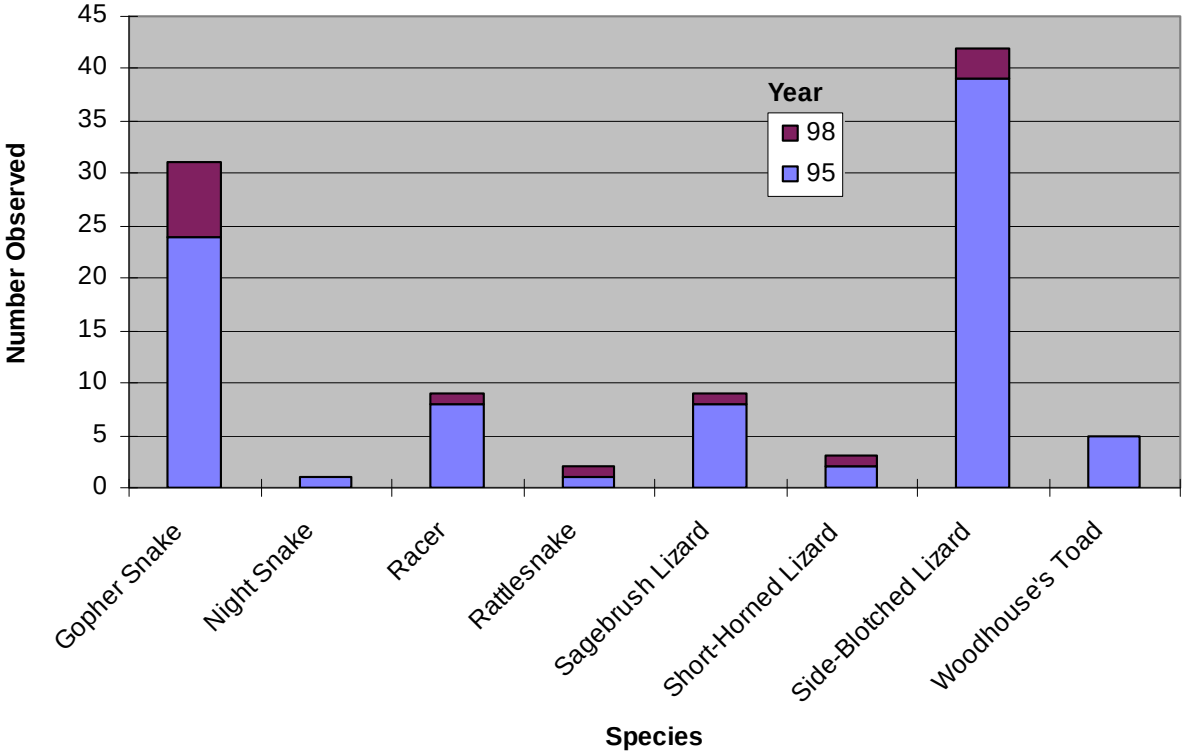


Figure 5. Records of amphibians and reptiles observed by night road sampling.

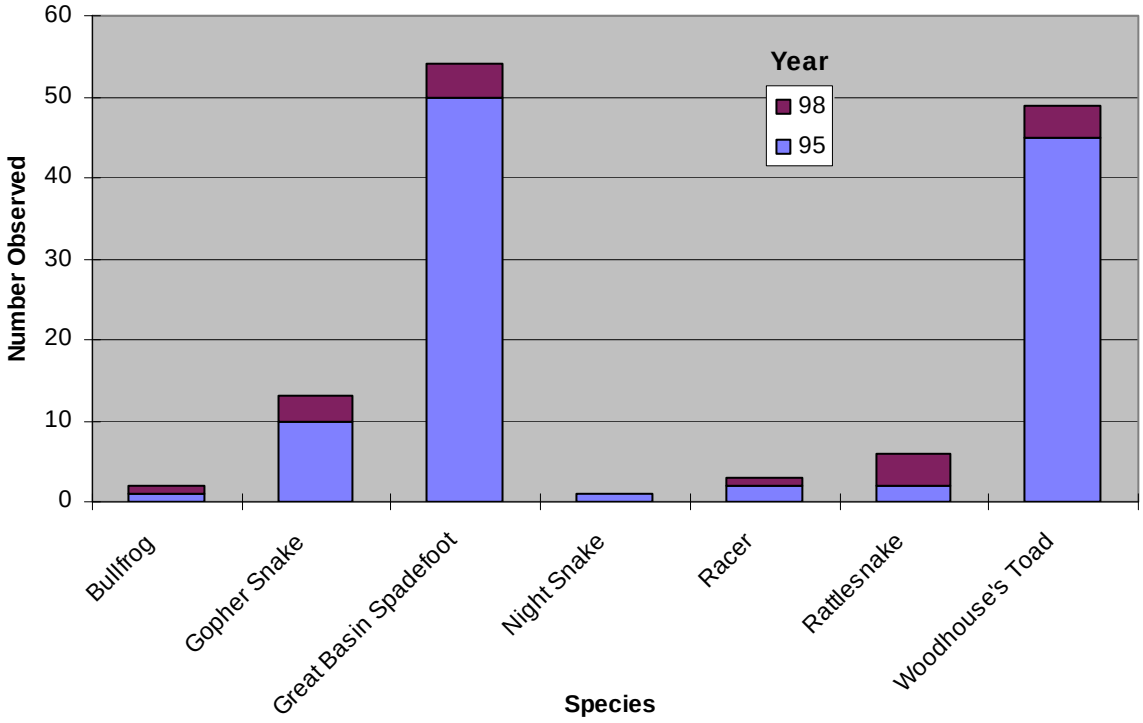
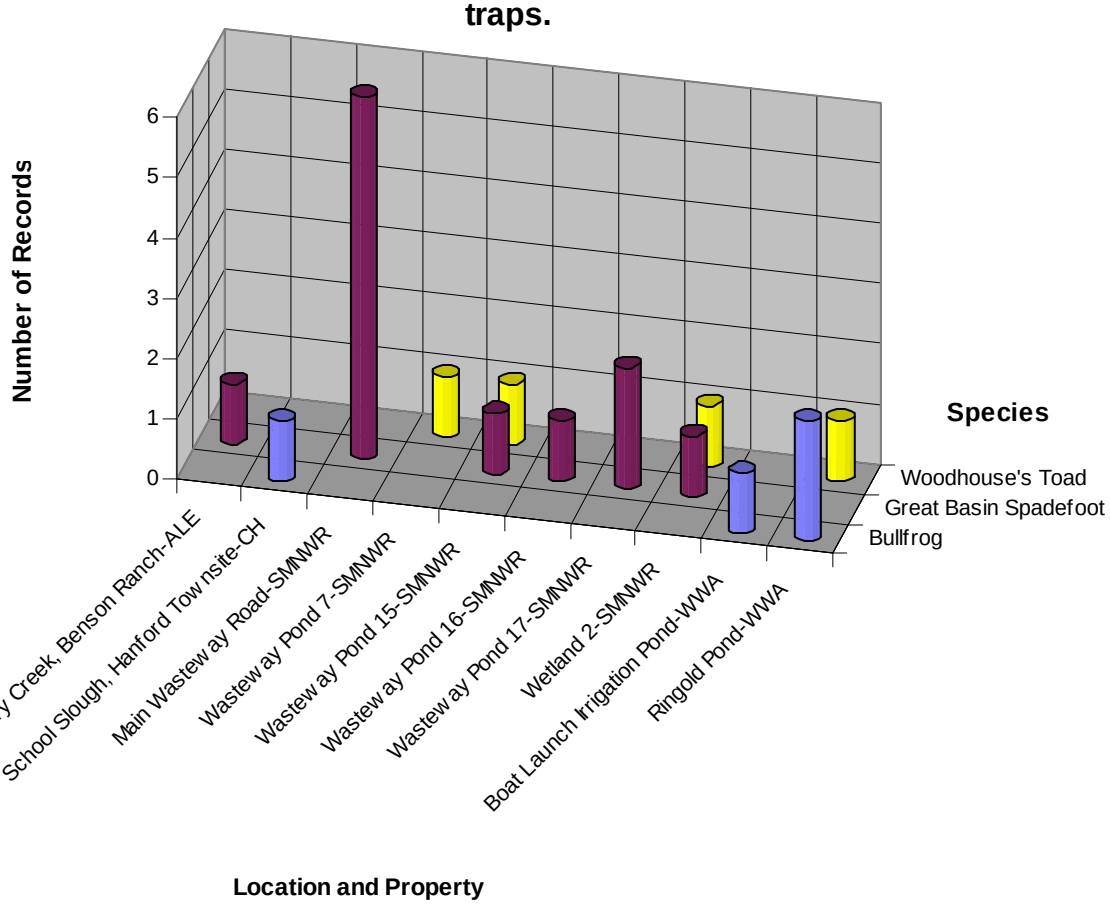


Figure 6. Records of amphibians captured with aquatic funnel traps.



Discussion

This is the first herpetofauna inventory to cover the entire Hanford Site. Results from this inventory, and other studies, have found 16 species (Table 7). The Western terrestrial garter snake and tiger salamander were found for the first time in 1995 and 1998 respectively. The possibility still remains that other species may be found (see Speculation on Species Distribution).

Relative abundance, status and site location for each species is listed in Table 7. Relative abundance is speculative. It is based on the ease of detection under appropriate conditions and habitat for each species, the numbers found and the distribution throughout the site.

Table 7. Species List for the Hanford Site

Common Name	Status	Relative Abundance	ALE	CH	SMNWR	WWA
Tiger Salamander	State Monitor	unknown				X
Great Basin Spadefoot	None	locally common	X	X	X	X
Woodhouse's Toad	State Monitor	locally common		X	X	X
Pacific Treefrog*	None	unknown				
Bullfrog	Introduced	common		X		X
Painted Turtle	None	unknown				X
Short-horned Lizard	None	uncommon	X	X	X	X
Sagebrush Lizard	Federal Sp. of Concern	common in sandy areas		X	X	X
Side-blotched Lizard	None	abundant	X	X	X	X
Racer	None	common	X	X	X	X
Night Snake	State Monitor	rare	X*	X	X	
Striped Whipsnake*	State Candidate	rare	X*	X*		
Gopher Snake	None	common	X	X	X	X
W. Terrestrial Garter Snake	None	unknown				X
Common Garter Snake*	None	unknown				
Rattlesnake	None	common	X	X	X	X

* Species observed or reported before 1995.

Field work started in the first week of March 1995. With the exception of side-blotched lizards, no amphibians or reptiles were detected until the last week of March. Temperatures at ALE were below freezing at night and shallow springs still had ice. Most species were still being found in mid-October 1995. Late March through early November is probably the typical activity period for most of the amphibians and reptiles.

Unusual weather conditions in 1995 may have influenced the survey results, particularly for anurans. It was the wettest year on record at the Hanford Site. Data in late December of 1995 indicated that 11.77 inches of precipitation had been recorded, doubling the annual average of 6.25 inches (Dana Hoitink, Hanford meteorologist, pers. comm.). In addition, the average temperature, especially in the months of January, February, May and September, were above average. The months of June and August were below average temperature. The anurans may have been more surface-active than normal due to the additional moisture. Dry Creek (ALE) extended past the Benson Ranch area killing the sagebrush and creating wetland areas. Great Basin spadefoots started calling as an area became flooded and tadpoles were found throughout the newly flooded areas.

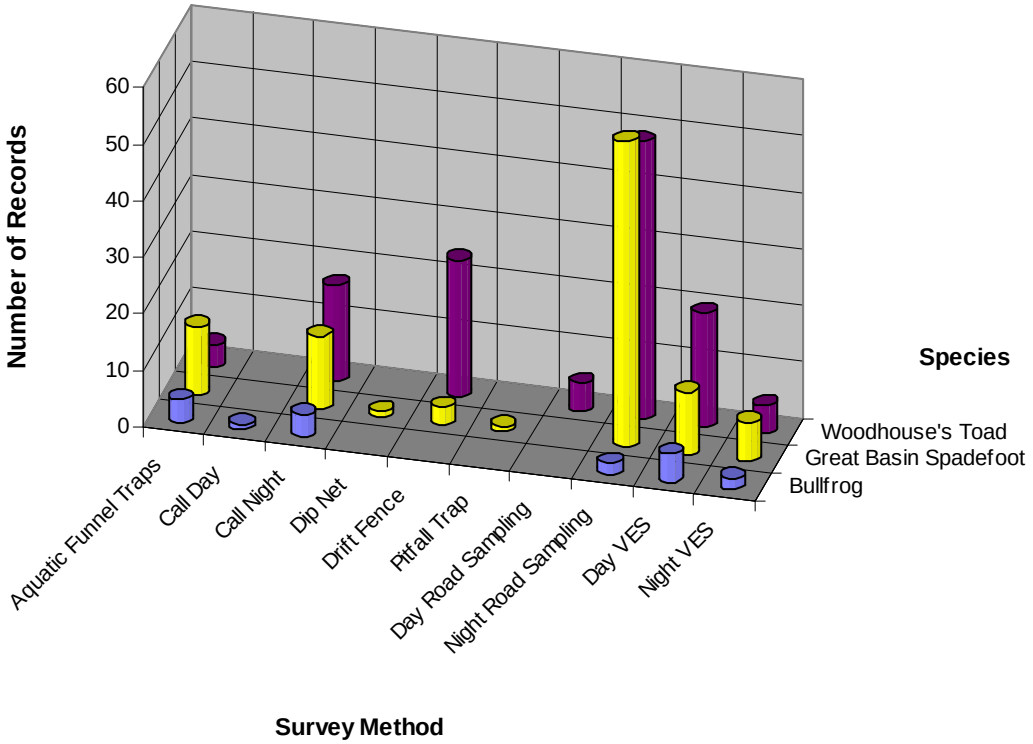
Two differences were noted between surveys in 1995 and 1998. There appeared to be a decrease in side-blotched lizards in 1998 relative to 1995. In 1995, this species was abundant. They were easy to detect because they tended to occur in high densities. In 1998 they were much more difficult to find and were found in smaller numbers. The difference in rainfall between 1995 and 1998 may be the reason for the change. The other difference was a drop in the number of observations on roads at night. Snakes and anurans were found 81% of the time in 1995, but only 64% of the time in 1998. This probably had more to do with the roads that were driven than an actual change in the number of animals on the roads. In 1995, more time was spent on roads next to water bodies (SMNWR and ALE in particular) resulting in many toad and spadefoot observations.

The following is a general summary for trends seen in the amphibian and reptile groups. Specific descriptions for each species are given in the Species Accounts.

Amphibians

Four species of amphibians were found during these surveys (Table 7). Amphibian surveys started in early March 1995 and in early April 1998. Most of the aquatic habitats, known to be at the site, were surveyed using at least one of the survey methods. All eastern Washington amphibian species need aquatic habitats for breeding. This was the main factor influencing amphibian distribution. The further a survey area was from water, the lower the chance of encountering amphibians, even after the breeding season. The majority of Great Basin spadefoot and Woodhouse's toad records were from night driving surveys. The majority of anuran breeding sites were found using call surveys and day VES (Fig. 7).

Figure 7. Records of anurans observed by survey method.



The tiger salamander was found for the first time during the 1998 surveys. These are the first salamanders found at the Hanford Site. Both eggs and a large larval salamander were found in ponds southeast of the WWA boat launch. Beaver created a series of ponds from the irrigation water that seeps through the White Bluffs. Similar ponds are also found in the northern areas of the White Bluffs. The tiger salamander was found in two of the ponds. They probably occur in all of them. They may be associated with the Columbia River (the only natural source of water in that area) or they may have migrated into the area along the irrigation canal system.

The long-toed salamander is not predicted to occur in the Hanford area of the Central Arid Steppe (Dvornich et al. 1997). In 1998, it was found within the Central Arid Steppe (Lower Crab Creek area) approximately 14 miles northwest of Saddle Mountain Lake (pers. observation). The possibility remains that it may be found on the Hanford Site.

Three species of anurans were common. The Great Basin spadefoot was found on all four properties. The spadefoots were always found within a mile of some source of water. Woodhouse's toads were found on all properties except ALE. This species enters Washington State only along the Snake and Columbia Rivers. This species has not been documented north of the Vernita Bridge area (pers. obs., Dvornich et al. 1997). This species was also always found within a mile of water with one exception. One Woodhouse's toad was found almost three miles west of the Columbia River on Central Hanford. A depression in that area may have held water earlier in the year (as suggested by the vegetation) but water was not present in July.

The bullfrog is an eastern North American species that was introduced to the Northwest (Nussbaum 1983, Stebbins 1985). Records of the bullfrogs in Franklin and Benton Counties exist from the late 1950s (WDFW herpetological database). Bullfrogs were found at WWA and Central Hanford. They are common in water bodies associated with Wahluke Branch 10 Irrigation Wasteway from WB-10 Lake to the boat launch area. They also are common in ponds at the base of the White Bluffs and near the Ringold fish hatchery. On Central Hanford they occur in the Columbia River sloughs. Bullfrogs are reported to be detrimental to some amphibian species (Leonard et al. 1993, Stebbins and Cohen 1995).

An anomaly of this inventory is that the Pacific treefrog was not found. The Pacific treefrog was reported to occur in riparian areas (Gray and Rickard 1989; Fitzner and Gray 1991) and in the 200 Area Plateau waste ponds (Rogers and Rickard 1977). Rogers and Rickard (1977) state that the only amphibian they had seen was the Great Basin spadefoot, but list the Pacific treefrog as a species that commonly occurs in the 200 Area plateau associated with waste ponds. The waste ponds on Central Hanford were drained before the 1995 inventory. Fitzner and Gray (1991) list the Pacific treefrog in a table of reptiles and amphibians known to inhabit the Hanford Site. No specific location is given. Battelle PNL biologist contacted in 1995 had not seen the Pacific treefrog at the Hanford Site. They also did not know the riparian locations where they were reported to have occurred, although John Hall (pers. comm.) thought they might have been found at Rattlesnake Springs.

The Pacific treefrog is the most common and widely distributed frog in Washington (Nussbaum et al. 1983, McAllister 1995, Dvornich et al.1997). This species is easy to detect because it has an extended breeding season, the males are vociferous and the tadpoles tend to be common. This

species should have been detected during call surveys or VES. If they are present, they are rare or occur at sites that were not surveyed.

Rogers and Rickard (1977) also report Western toads (*Bufo boreas*) at the 200 Area plateau waste ponds. This species was not found during the 1995 or 1998 surveys. All captured toads were checked for body shape, color, cranial crests and parotoid shape to confirm the species as *Bufo woodhousei.* The facts that no Western toads were found and that this species is not known to inhabit the more arid portions of the state (Nussbaum et al 1983, McAllister 1995, Dvornich et al. 1997 and Leonard et al. 1993.) suggest that the reference to this toad may be a misprint or incorrect identification (i.e. of Woodhouse's toad).

The northern leopard frog (*Rana pipiens*) once occurred along the Columbia River in Benton County (T09N R29E S29 – WDFW database) and was once common at the Columbia National Refuge (Leonard et al. 1993). This species has experienced dramatic decline throughout its range. It has reportedly disappeared from the Columbia National Wildlife Refuge, perhaps due to predation by the bullfrog (Leonard et al. 1993). If bullfrogs are responsible for the decline of leopard frogs, then it is doubtful that this species will be found at the Hanford Site since bullfrogs were found in all leopard frog habitat surveyed.

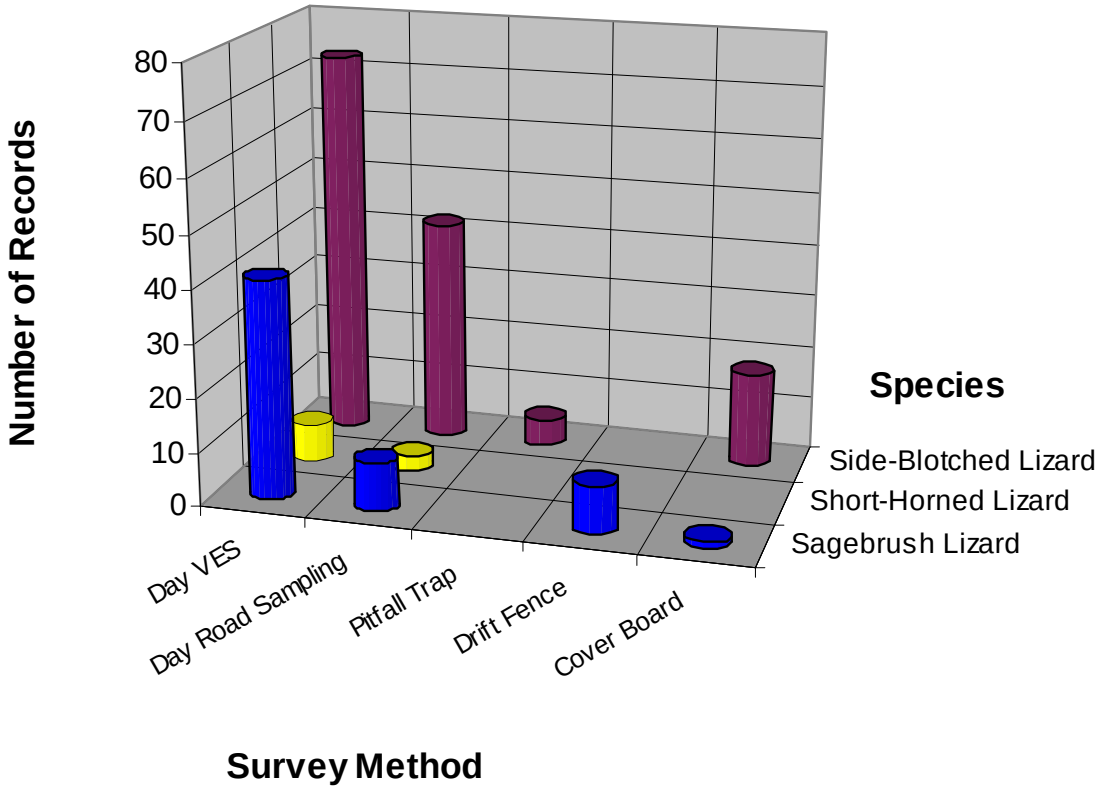
Reptiles

Turtles - Remains of two painted turtles were found in the wetland area near the boat launch (WWA) in 1995. The first shell was found on a pond bank. It was complete with some flesh, primarily the tail. Based on size, it was probably a female. The other shell was found under vegetation in a stream that flows into the wetland. It was incomplete and deteriorating. This area was searched for nests and turtles, but none were found. Raccoon footprints were found on the shore. Raccoons will prey on nesting turtles and on turtle nests. Fitzner and Gray (1991) report painted turtles from Hanford Site ponds.

Lizards – The majority of lizards were found using visual encounter surveys (Fig. 8). The side-blotched lizard was the most common reptile. They were found on every property. They inhabit a variety of habitats including disturbed areas. Lizards were not found in annual dominated grassland or sagebrush with a dense cheatgrass (*Bromis* sp.) understory except near roads. Sagebrush lizards were found on all properties except ALE. They were usually in sandy areas, primarily dunes. Previous Hanford studies found them in bitterbrush (*Purshia tridentata*) habitat (Rogers and Rickard 1977; Marr et al. 1988). Any shruby vegetation, including Russian thistle, in sandy substrates seemed to provide the structure this species needed. In some areas, they were found in habitats that only had bunch grasses (Indian rice grass) and herbaceaous vegetation. Nussbaum et al. (1983) states that side-blotched lizards and sagebrush lizards rarely occur together because of elevation preferences. At the Hanford Site they are found together. In sandy habitats, the sagebrush lizard was more common. Side-blotched lizards were most common at sites with fine soils. Only eleven short-horned lizards were found. Horned lizards are seldom abundant (Pianka and Parker 1975). They were found at eight locations. On ALE they are found on Rattlesnake Mountain. On the North Slope and on Central Hanford they were found in sandy areas, primarily dunes.

Skinks (*Eumeces skiltonianaus*) were not found. Bill Radke (based on a conversation with Richard Fitzner) thought that skinks had been found on the southwest end of Gable Mountain. Shelter boards and VES were used in this area, but only rattlesnakes were found. Hanford is within the predicted habitat zone of the skink but this species has not been documented from Benton, Franklin or southern Grant counties (Dvornich et al. 1997).

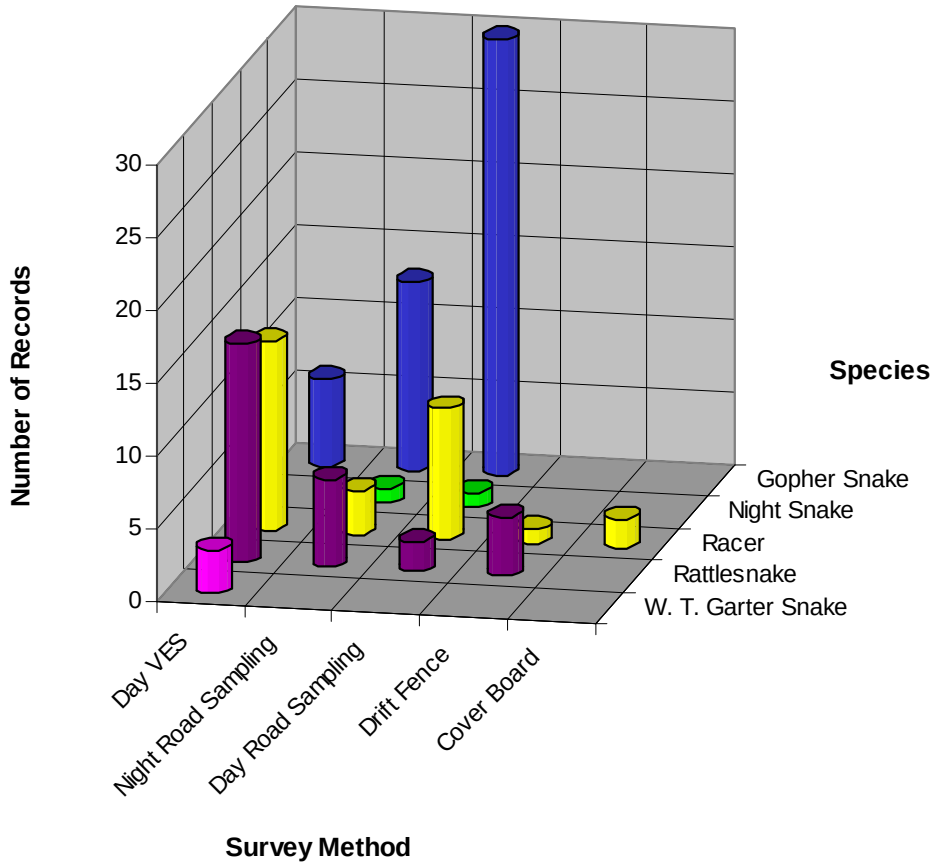
Figure 8. Records of lizards observed by survey method.



Snakes – One hundred fourteen (114) snakes were recorded. Most were found during road surveys (Fig. 9). Gopher snakes were the most commonly observed snake with 50 records. The use of road surveys may have biased the results in favor gopher snakes. Gopher snakes seem to be particularly drawn to roads and are prone to being killed by vehicles. Marr et al. (1988) captured more racers (48) than gopher snakes (35) at trapping stations located at twelve sites on ALE and Central Hanford.

Racers and western rattlesnakes were also common. Twenty-nine racers were found. They were found on all four properties in a variety of habitats such as sagebrush, grassland (including cheatgrass dominated) and sand dunes.

Figure 9. Records of snakes observed by survey method.



Twenty-eight rattlesnake records were entered. Most were found in rocky areas of Rattlesnake Mountain, Yakima Ridge, Umtanum Ridge, Gable Mountain and Saddle Mountain. They were also observed in the sagebrush flats, grasslands and dunes. Three rattlesnake hibernation sites were found in late March-early April 1995. On ALE, they were found in talus at Bobcat Canyon and Yakima Ridge. They were also trapped in the Bobcat Canyon drift fence array as they returned in the fall. On SMNWR, they were seen and heard in crevices of the White Bluffs (west end). This was the only place where rattlesnakes were found on SMNWR. Bill Radke (pers. comm. 1995) reported that this was the only place he had ever seen them at SMNWR also.

Four garter snakes were seen at WWA. One was seen near the "central ponds" and the rest were found in the ponds near the boat launch. Two were identified as western terrestrial garter snakes. No common garter snakes were found, but Richard et al. (1988) reports them from riverine habitats. In 1995, road crew personnel reported finding "striped snakes" under boards in the Central Hanford boat launch area. Cover boards and VES were conducted in this area in 1995 and 1998 but only a shed skin (probably garter snake) was found.

Two night snakes were found during the 1995 field season. One was found dead on the Midway Power Station Road and the other was a live snake found on Highway 24 (SMNWR). Folliard and Larson (1991) report a night snake found on 7 Oct.1989 at the Yakima Barricade Site (ALE). Rogers and Rickard (1977) report night snakes on Gable Butte and two captured at the 200 W badge house in 1973. R. Fitzner captured a female night snake in 1989 at the southwest end of

Gable Mountain (Bill Radke, pers. comm.). In the Northwest, night snakes are reported to occur in rocky areas (Nussbaum et al. 1983). The snakes found in 1995 were not in rocky areas.

The striped whipsnake, a Washington State Candidate Species, was not found. They are documented on the Hanford Site. Published sightings include the BC Crib Area in June 1977 (Rogers and Rickard 1977) and a dead snake found on Highway 24 in October 1988 in the Yakima Barricade Area (Folliard and Larson 1991). Fitzner (Appendix E - field notes) reports seeing a striped whipsnake on 27 June 1972 in the B.C. Crib 200E Area. He described it as a "terrific climber" and "very fast both on the ground and in the bushes." He also recorded a striped whipsnake (as prey) in a nest (most likely a Swainson's hawk) in the Gate 119 Area on 11 July 1974.

In 1998, VES surveys, with two to four people, were conducted for the striped whipsnake in the Yakima Barricade Area (CH and ALE). Surveyors walked parallel transects through sagebrush-bitterbrush habitat. Only one deteriorating snake skin and a few side-blotched lizards were found on Central Hanford and many side-blotched lizards were seen on ALE.

Little is known about the striped whipsnake in the Pacific Northwest. Less than twenty sightings have been reported to the Washington Department of Fish and Wildlife Herpetological database. The most recent record is from 1991. Studies in Utah (Parker and Brown 1973) found that the striped whipsnake showed high den-site fidelity. No den site information has been published for this species in Washington (see Recommendations).

Rubber boas (*Charina bottae*) have not been reported from the Hanford Site and are rare in the Columbia Basin (Dvornich et al. 1997). Florence Caplow and Kathryn Beck (pers. comm.) reported seeing a rubber boa while surveying for rare plants. They saw it on 16 April 1994 at the end of the paved road on top of Saddle Mountain (WWA). This sighting needs confirmation.

Management and Research Recommendations

The land surrounding the Hanford Site has been converted to agriculture, grazing and development at the expense of native vegetation. The Hanford Site is one of the few large tracts of shrub-steppe habitat remaining in Washington. The site provides a refuge for amphibian and reptile populations. This is particularly important for species such as the Woodhouse's toad, sagebrush lizard, striped whipsnake and other species that are rare or have limited distributions in Washington.

Three Washington State Monitor species (Woodhouse's toad, tiger salamander and night snake) and a Federal Species of Concern (sagebrush lizard) were found at the site. The striped whipsnake, a State Candidate Species, was not found, but is documented from the site. The majority of sites reported for the Woodhouse's toad in Washington are from the Hanford Site. Tiger salamanders were found in ponds at the base of the White Bluffs (WWA) and may be found elsewhere at the site. Night snakes are present and widespread, but are rarely detected. Sagebrush lizards are common on sand dunes on all properties except ALE. Amphibians and reptiles are vulnerable to habitat alteration, especially those that affect reproduction and

hibernation sites. The following are recommendations to ensure the diversity of the Hanford herpetofauna.

1) Maintain undisturbed habitat corridors around springs, wetlands, ponds and sloughs. These are important habitats for amphibians, garter snakes and turtles.

2) Discourage night driving on the gravel roads that parallel the SMNWR irrigation wasteway ponds and Dry Creek (ALE) during the Woodhouse's toad and Great Basin Spadefoot breeding season and fall dispersal period. This is especially important for the SMNWR wasteway road. In April 1995, this road had an average of one adult toad every tenth (1/10) mile. The toads are on these roads at other times of the year also, but not in the densities seen in the early spring and fall.

3) Protect talus slopes and the western end of the White Bluffs. These areas are rattlesnake hibernation sites and may be used by other species. In Utah, rattlesnakes, racers, gopher snakes and striped whipsnakes hibernated together in communal talus den sites and showed a high fidelity to specific den sites (Parker and Brown 1973).

4) Protect sand dune habitats. Sagebrush lizards were found almost exclusively in association with vegetated sand dunes. In addition, Woodhouse's toad, Great Basin spadefoot, short-horned lizard, side-blotched lizard, racer, gopher snake and rattlesnake occur in dune habitats

5) Striped whipsnake hibernation den sites need to be located and protected. This species is rare and difficult to find. In the past, field crews have worked around the site searching for various species, particularly birds. These crews should be encouraged to report striped whipsnakes if they encounter them. A radio-telemetry study of this species should be conducted to determine habitat use and den site location.

6) Maintain a database (or submit data to the Washington Department of Fish and Wildlife Herpetological database) of amphibian and reptile sightings, particularly of amphibians, rare species and new species to the site. Reports should include detailed location information.

7) Amphibian populations should be monitored regularly. The following are potential threats to these populations at the Hanford Site. Water levels fluctuate in the Columbia River sloughs. The sloughs can fill and empty daily. Most of the water bodies are a result of irrigation water that moves through the site. The amount of water fluctuates resulting in rapid flooding and drying of ponds. In one case, dozens of anuran egg masses desiccated when a pond dried out in a few days. The irrigation water may contain pesticides and herbicides. Both have been suggested as a cause of amphibian declines (Stebbins and Cohen 1995; Berrill et al.1997). Bullfrogs are common on WWA and in Central Hanford sloughs. Bullfrogs have been implicated as one of the causes of decline of some western frog species (Leonard et al. 1993; Stebbins and Cohen 1995). Both Woodhouse's toads and Great Basin spadefoot can breed in areas where bullfrogs do not occur and both species are predominately terrestrial. These life history traits may lessen the effect of bullfrogs. Lastly, the irrigation wasteway system provides travel corridors for a variety of aquatic species. Many of these species, including bullfrogs, may be detrimental to the native herpetofauna.

Species Accounts

The following are summaries of the life history, habitat and distribution information collected for each species found at the Hanford Site. Life history information is based on two field seasons of observation. The 1995 field season started in the first week of March and ended 15 October. The 1998 field season started 17 April and ended 6 Sept. The property where the record was documented is in parentheses.

Tiger Salamander (*Ambystoma tigrinum*).
State Monitor Species

Life history, habitat and distribution: This is the first record of the tiger salamander at the Hanford Site (WWA). Three eggs were found 17 April 1998. The eggs were attached to woody debris (Russian thistle) on the edge of the pond 1.0 mile southeast of the WWA boat launch. The entire edge of the pond was searched, but these were the only eggs found. A larval salamander was captured in a dip net 9 Aug. 1998 in a pond 1.5 miles southeast of the WWA boat launch. The ponds are located at the base of the White Bluffs southeast of the boat launch. Beaver have created a series of ponds from the water that seeps through the White Bluffs. Tiger salamanders probably breed in all of the ponds. The tiger salamander may be dispersing using the irrigation canals and the water seeping through the White Bluffs (Wahluke Branch Canal). If so, they may be in any water body connected to this system.

Woodhouse's Toad (*Bufo woodhousei*).
State Monitor Species.

Life history: The earliest sighting of this species was 17 April 1998 at the edge of a WWA pond. It had probably been disturbed by survey activities. No other toads were seen or heard until May. The earliest sighting of active toads was 7 May 1995 (SMNWR). The earliest calling was heard 8 May 1995 (SMNWR). The latest calling date was 25 July 1998 in a Columbia River slough (CH). Newly hatched tadpoles were also found on this date, indicating that breeding continues well into July in some areas. Trapped tadpoles were in the process of metamorphosis when captured 29 June 1998 (WWA). The earliest newly metamorphosed toads were seen 11 July 1995 (SMNWR). Toads were still active on 15 October 1995 when surveys ended. Adults were crepuscular and nocturnal. Most adults were found near water bodies or on roads. Toadlets were found on the edges of ponds during the day. Toads were surface active throughout the season with or without rain.

On 7 June 1998, fourteen adult toads were found dead around the edge of a shallow pond near Vernita Bridge. All that remained of most of the toads were the heads and skin, both of which contain poison glands (Porter 1972). They appeared to be males that had been killed from their calling positions. Great Basin spadefoot and Woodhouse's toad tadpoles were present in the pond. There was no evidence that indicated what the predator was.

Habitat and Distribution: Toads were found on all properties except ALE. Aquatic habitats appeared to be the most important habitat feature. All but one toad was found within a mile of an aquatic habitat. Terrestrial habitats included shrubland, grassland, sand dune, White Bluffs, Columbia River sloughs, wetlands and ponds. At SMNWR, most of the toads were found in association with the irrigation wasteway pond system. Adult toads were common on the main

wasteway road at night, especially during the breeding season. Many juvenile toads were captured in the SMNWR sand dune drift fence array in 1995. At WWA, toads were also associated with the irrigation areas, especially WB-10 Lake, and were found on roads. At Central Hanford, toads were found in Columbia River sloughs and on Route 2. In 1998, one toad was found on Route 1, approximately three miles west of the Columbia River.

Great Basin Spadefoot (*Scaphiopus intermontanus*)

Life history: The earliest calling was on 31 March 1995 at Dry Creek (ALE). The latest calling was heard 24 June 1995 (ALE). The latest eggs were found was 7 June 1997. The first newly metamrophosed spadefoots were seen 15 July 1995 (ALE). Spadefoots were still active 15 October 1995 when the field season ended. Spadefoots are nocturnal. Nussbaum et al. (1983) reports that they are surface active after rainfall. During these surveys, spadefoots were found on roads throughout the season with or without rain. Over 29 juvenile (2.3 to 3.2 cm SVL) spadefoots were found on Gate 117 road, Gate 118 road and the road between (ALE) from Sept. 8-10, 1995. These were cool, rainy nights. The juvenile toads were probably dispersing from the creek.

Habitat and Distribution: They were found on all properties. The presence of water appeared to be the most important habitat feature. All spadefoots were found within a mile of an aquatic habitat. Terrestrial habitats included sagebrush, cheat grass-tumble mustard, sand dune, White Bluffs, Columbia River sloughs, wetlands and ponds. They were the only anuran found at ALE where they occur near and breed in Dry Creek. At SMNWR, most of the spadefoots were found near the irrigation wasteway ponds. Some adults were also found on the main wasteway road and on the paved road in the northwestern portion of the property. One was captured in pitfall traps and three were captured in the sand dune drift fence array. At WWA, spadefoots were found near ponds and on roads in the areas south of Highway 24. At Central Hanford, they were found near Columbia River Sloughs.

Bullfrog (*Rana catesbeiana*)

Introduced species

Life history: Bullfrogs are the last anuran to become active in the spring. During pond surveys at the base of the White Bluffs 17 April 1998, no bullfrogs were seen. They were abundant at the same site later in the year. The earliest calls were heard 24 May 1995 (WWA. Tadpoles were captured at three sites (WWA, CH) in aquatic funnel traps and one site with a dip net (WWA) in 1998. This species has a one to three year larval period (Olson and Leonard 1997). The latest observation was 1 October 1995, but this species is probably active until mid to late October.

Habitat and Distribution: Bullfrogs are obligate aquatic species that prefer pond-like environments with lots of vegetation (Leonard et al. 1993). They are common in the Wahluke Branch irrigation canal system including WB-10 Pond and the other ponds along this canal (WWA). They are also in ponds near the Ringold Fish Hatchery and ponds in the White Bluffs. On Central Hanford, they occupy at least two of the sloughs along the Columbia River. This species is dispersing along the Columbia River and the irrigation canal system.

Painted Turtle (*Chrysemys picta*)

Life history, habitat and distribution: Two painted turtle shells were found in a pond located near the WWA boat launch. One shell, found 18 August1995, was complete with carapace, plastron and some flesh, primarily the tail. Based on the size of the shell, it was most likely a female. The second shell was found 6 September 1995 in shallow water hidden by vegetation. This shell was incomplete and deteriorating.

Side-blotched Lizard (*Uta stansburiana*)

Life History: Nussbaum et al. (1983) describes this species as being sporadically active as early as late March. The earliest sighting of the side-blotched lizard during this project was 6 March 1995 at WWA. Five lizards were active on a south-facing hill (White Bluff) on the road to the boat launch. The first young-of-the-year were seen 15 July 1995 (ALE). These lizards were still active in October (1995) when the surveys ended. This species has specific activity periods. Most of the year (late spring to early fall) they are easiest to see in the morning and early evening. During this time, they bask at the edge of plant cover. These lizards were always found on the ground. They were quick to start using cover boards.

Habitat and distribution: They were found in a variety of habitats on all four properties. The main requirement was the presence of open or sparsely vegetated areas intermixed with shrubs or other vegetation that provided shelter. They were found in shrub-dominated habitats, rocky areas, the While Bluffs and sand dunes. They were found in cheatgrass dominated areas where clearings, such as roads, were present. Fine soils were typical of many of the habitats were they were found, but they also were found in sandy soils. They were common on road banks on ALE and SMNWR.

Sagebrush Lizard (*Sceloporus graciosus*)

Federal Species of Concern

Life History: The earliest sighting of the sagebrush lizard was 26 April 1998 (WWA). The first young-of-the-year were seen 18 August 1995 (WWA). These lizards were still active in October (1995) when the surveys ended. They are easiest to see in the morning and evening. During this time, they bask at the edge of plant cover. This species is a ground dwelling lizard (Nussbaum et al, 1983), but at Hanford, they were frequently found on shrub branches 15 to 30 cm off the ground.

Habitat and distribution: This species was found on all properties except ALE. Typically, this species was found on sand dunes. They were found basking on the perimeter or within sagebrush, rabbit-brush, bitterbrush, Russian tumbleweed and in some places under clumps of herbaceous vegetation. Two populations were not on dunes or in sandy habitats. One population was found near the old military site (WWA) and two sagebrush lizards were found on the "western paved road" (SMNWR). Bill Radke (pers. comm.) reported them on the largest island in Saddle Mountain Lake.

Short-horned Lizards (Phrynosoma douglassii)

Life history, habitat and distribution: Eleven short-horned lizards were found. The earliest was found 21 May 1995 and the latest was recorded in 1 October 1995. They were found on all four

properties. Most were found on dunes (SMNWR, WWA and CH) but on ALE, they are found at the top of Rattlesnake Mountain.

Racer (Coluber constrictor)

Life history, habitat and distribution: The earliest sighting of a racer was 2 April 1995. It was found under deteriorating truck parts in a southern area of SMNWR. The earliest active snake was found 25 April 1995 (SMNWR). The earliest sighting of a neonate was 16 August 1995 (SMNWR). These snakes were still active in October 1995 when the surveys ended. They were found on all properties in both grassland and shrub-dominated habitats. When shrubs were present, they were usually found basking at the perimeter. In cheatgrass dominated habitats, they were found on roads or under debris. This species seems particularly drawn to debris such as old car bodies (SMNWR), downed signs (WWA), and other objects including piles of old antifreeze cans (CH). Racers were also found on the edge of wetlands in two places (CH, SMNWR)

Night Snake (Hypsiglena torquata)

State Monitor Species

Life history, habitat and distribution: A road-kill snake was found 16 July 1995 on the Midway Power Station Road (CH) and a live adult was found 28 July 1995 on Highway 24 (SMNWR). This species is reported to occur in rocky areas (Nussbaum et al. 1983) but the snakes found in 1995 were not found near rocky areas. Both snakes were found in sagebrush habitat. This species has been reported from all properties except WWA.

Gopher Snake (Pituophis catenifer)

Life history, habitat and distribution: The earliest sighting of a gopher snake was 29 March 1995 (ALE). The earliest sighting of a neonate gopher snake was 29 September 1995 (ALE). These snakes were still active in October 1995 when the surveys ended. Gopher snakes were the first active snakes in the spring and probably hibernate individually at scattered locations. They are diurnal in the spring and fall, and nocturnal during the summer. Gopher snakes were found on all four properties. They occur in most habitats including shrubland, grassland, rocky areas, sand dunes and the White Bluffs. They appear to be drawn to roads at dusk and at night. They tend to extend the body in a straight line and will often stay that way even when approached. This behavior makes them prone to being killed by vehicles.

Western Terrestrial Garter Snake (Thamnophis elegans)

Habitat and Distribution: Two were found in 1995 and one was found in 1998. All of the garter snakes identified to species were found in the ponds near the WWA boat launch.

Western Rattlesnake (Crotalus viridis)

Life history, habitat and distribution: Rattlesnakes were found starting 30 March 1995. They were heard in talus at Bobcat Canyon and on Yakima Ridge (ALE). In the fall, they were captured in the Bobcat Canyon drift fence returning to the talus. They were also found in the western end of the White Bluffs (SMNWR) in April of 1995 and 1998. No neonates were found. These snakes were still active in October 1995 when the surveys ended. Rattlesnakes were found on all four properties. They were most common in rocky areas, but were also found in shrubland, grassland, dunes and in the White Bluffs.

photo page 1

photo page 2

photo page 3

photo page 4

photo page 5

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Appendix A. Standardized data sheets

Appendix B. Amphibian and Reptile Distribution Maps

Appendix C. Four-letter species code

AMTI	Tiger Salamander (*Ambystoma tigrinum*)
SCIN	Great Basin Spadefoot (*Scaphiopus intermontanus*)
BUWO	Woodhouse's Toad *(Bufo woodhousei*)
RACAT	Bullfrog (*Rana catesbeiana*)
CRPI	Painted Turtle (*Chrysemys picta*)
PHDO	Short-horned Lizard (*Phrynosoma douglassii*)
SCGR	Sagebrush Lizard (*Sceloporus graciosus*)
UTST	Side-blotched Lizard *(Uta stansburiana*)
THEL	Western Terrestrial Garter Snake (*Thamnophis elegans*
COCO	Racer (*Coluber constrictor*)
PICA	Gopher Snake (*Pituophis catenifer*)
CRVI	Western Rattlesnake (*Crotalus viridis*)
HYTO	Night Snake (*Hypsiglena torquata*).

Appendix D. Data Spreadsheets

Appendix E. Summary of Amphibian and Reptile observations from Richard Fitzner's Field Journals

Note: The first entry or date recorded was used as the name of the journal. Animals are abbreviated as follows: Coluber constrictor (Cc), Pituophis melanoleucus (=catenifer) (Pm), Crotalus viridis (Cv), Uta stansburiana (Us), Sceloporus graciosus (Sg) and Phrynosoma douglassii.