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Species Occurrence and Distribution of Amphibians and Reptiles in Hells Canyon

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EXECUTIVE SUMMARY

This study about the occurrence and distribution of amphibians and reptiles in Hells Canyon was conducted by the Herpetology Laboratory at Idaho State University in Pocatello, Idaho, and Idaho Power Company (IPC) in Boise, Idaho. The general objectives were to 1) determine the general distributions, habitat associations, and relative abundances of amphibians and reptiles through the use of a variety of sampling techniques and 2) develop distribution maps for amphibians and reptiles in the area.

We used a variety of techniques to sample the diverse community of amphibian and reptile species in the Hells Canyon Study Area. Standard techniques for sampling amphibian and reptile populations included 1) drift fences with funnel traps; 2) timed visual searches of wetlands, streams, and upland habitat; 3) nighttime driving searches; and 4) incidental observations.

According to historic records and predicted distributions, 29 amphibian and reptile species potentially occur in the study area. However, we documented 22 species. These species included one special status reptile species—the sagebrush lizard (*Sceloporus graciosus*)—and four special status amphibian species—the western toad (*Bufo boreas*), Woodhouse's toad (*Bufo woodhousii*), tailed frog (*Ascaphus truei*), and Columbia spotted frog (*Rana luteiventris*).

Seventy-two drift fences with funnel traps (51 in 1996 and 21 in 1997) were constructed and monitored from May 5 to July 7, 1996, and from April 6 to July 9, 1997. We captured 1,403 individuals (10 reptile and 3 amphibian species). Of the reptiles, the five most abundant species captured were the racer (*Coluber constrictor*) (15.6 captures/100 trap nights), gopher snake (*Pituophis catenifer*) (5.3 captures/100 trap nights), western whiptail (*Cnemidophorus tigris*) (2.2 captures/100 trap nights), western rattlesnake (*Crotalus viridis*) (2.1 captures/100 trap nights), and night snake (*Hypsiglena torquata*) (0.8 captures/100 trap nights). There were no significant differences in overall capture rates among the three reservoir reaches ($P = 0.50$) nor among individual capture rates for the racer ($P = 0.10$), gopher snake ($P = 0.16$), and western rattlesnake ($P = 0.11$). However, the night snake had significantly higher capture rates ($P = 0.01$) along Oxbow Reservoir than along Hells Canyon or Brownlee reservoirs. The western whiptail was captured only along Brownlee Reservoir.

To evaluate relationships between vegetation associations and amphibian and reptile distributions, we categorized vegetation cover types identified in the study area (Holmstead 2001) into four habitat types: *Desertic* (including *Desertic Herbland* and *Desertic Shrubland*), *Grass* (*Grassland*), *Riparian* (*Scrub-Shrub Wetland*, and *Forested Wetland*), and *Shrub* (*Shrub Savanna* and *Shrubland*). The racer, gopher snake, and western rattlesnake did not discriminate among habitat types. Though western whiptails were captured in all four habitat types on Brownlee Reservoir, the species showed highest abundances at sites dominated by *Desertic* habitat ($P = 0.02$). The night snake was captured in all habitat types except *Riparian*. Night snake capture rates were higher in *Desertic* habitat than either *Grass* or *Riparian* habitat but similar in *Shrub* habitat.

Topography, soil substrate, and precipitation show marked changes from Weiser, Idaho, to the confluence with the Salmon River. This longitudinal gradient affects the distribution of vegetation. As expected, species common to the sagebrush plains of southern Idaho and southeast Oregon (such as the side-blotched lizard [*Uta stansburiana*], western whiptail, longnose leopard lizard [*Gambelia wislizenii*], and striped whipsnake [*Masticophis taeniatus*]) were observed in the southern portion of the study area where suitable habitat is found. The western fence lizard (*Sceloporus occidentalis*) was found from approximately Brownlee Dam north, corresponding to where rocky outcrops become more dominant and cliffs and talus slopes become more numerous. The common garter snake (*Thamnophis sirtalis*), racer, western terrestrial garter snake (*Thamnophis elegans*), western rattlesnake, western skink (*Eumeces skiltonianus*), gopher snake, rubber boa (*Charina bottae*), and night snake were either distributed projectwide or presumed to be distributed projectwide.

In 1996 and 1997, we sampled 50 wetland sites (ponds, springs, and/or seep areas) above Hells Canyon Dam and recorded the presence or absence of amphibians. We confirmed western toads at 24 sites, long-toed salamanders (*Ambystoma macrodactylum*) at 22 sites, Pacific treefrogs (*Pseudacris regilla*) at 21 sites, bullfrogs (*Rana catesbeiana*) at 6 sites, Great Basin spadefoot toads (*Spea intermontana*) at two sites (ponds < 100 m apart) and Columbia spotted frogs at 1 site. We were unable to confirm the presence of amphibians at three sites.

During the spring and summer seasons of 1996 through 1999, we surveyed 14 backwater ponds below Hells Canyon Dam for breeding western toads. Eight (57%) of the ponds contained western toads, and six (43%) of these ponds exhibited evidence of western toad breeding. Seven additional backwater ponds were identified from aerial photographs, but no surveys were conducted. Seven wetlands not associated with the Snake River were surveyed below Hells Canyon Dam, while another two wetlands were only surveyed informally. Western toads were present at three of these wetlands, and breeding was confirmed at two sites. Long-toed salamander larvae were observed at three sites below Hells Canyon Dam, but Pacific treefrogs were observed only incidentally.

In addition, during the spring and summer seasons of 1996 through 1998, we surveyed eight tributaries below Hells Canyon Dam, five tributaries to Brownlee Reservoir, and one tributary each to Oxbow and Hells Canyon reservoirs for the presence of tailed frogs. The species was reported in five tributaries (33% of streams surveyed): Brownlee Creek, Dukes Creek, Deep Creek, Granite Creek, and Sheep Creek. In May 1997, we encountered one adult female tailed frog on the rocky shore of the Snake River at the confluence of the Snake River and Granite Creek.

As with the reptiles, there appear to be distinct changes in species composition along a north/south gradient within the study area. The bullfrog and the Great Basin spadefoot toad were only captured or observed in the southern portion of Brownlee Reservoir. The long-toed salamander, western toad, and Pacific treefrog occurred projectwide. The Columbia spotted frog was only known from one location within the study area.

Overall, the study area contains large areas of high-quality reptile habitat. Except for the ringneck snake and desert horned lizard, we found all reptile species expected to occur in the study area. On the other hand, wetland habitat for breeding amphibians is more limited by the

steep topography associated with the study area. Wetlands in the area include springs, seeps, stock ponds, canals, and overflow and backwater ponds associated with streams or the Snake River. Much of the habitat is protected from development and heavy recreational use by the steep rocky terrain. However, other important habitat such as springs and seeps are vulnerable to disturbance. Therefore, to maintain and enhance the existence of viable populations of reptile and amphibians, we propose the following five management recommendations: 1) maintain high spring flows below Hells Canyon Dam to ensure that the backwater ponds, which provide breeding habitat for western toads, are filled; 2) continue to manage for native plant communities and discourage any land-use activities that degrade them; 3) map all snake dens encountered within the study area and discourage any land-use activities that would impact known den sites; 4) locate and protect natural springs and seeps; and 5) map the northward progression of bullfrogs within the study area.

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1. INTRODUCTION

1.1. Justification

Until recently, managing for viable populations of native reptiles and amphibians was not a priority of the regulatory agencies in the Pacific Northwest. Reptiles and amphibians were overlooked as important functional components of the ecosystem, often because of their relative size, secretive nature, and appearance, and because most programs focused on game species. However, the apparent widespread declines in amphibian (Blaustein and Wake 1990, Heyer et al. 1994) and reptile populations (Beck 1997a, Gibbons et al. 2000) have increased concern for reptile and amphibian populations and brought them into the arena of nongame species management.

Reptiles and amphibians are deemed important resources for study for a number of reasons: 1) they are integral components of the food chain, both as prey and as predators, 2) they are excellent indicators of the environmental quality for both aquatic and terrestrial habitat, and 3) twelve species of concern may occur within the study area (Tables 1 and 2). Proper management of the Hells Canyon Study Area requires an understanding of the common amphibian and reptile species, as well as of sensitive, threatened, and endangered species.

This descriptive study will help Idaho Power Company (IPC) meet requirements of the Federal Energy Regulatory Commission (FERC) to describe wildlife resources of the Hells Canyon Project and its vicinity. Because reptiles and amphibians are important components of the biological diversity in Hells Canyon, they are also considered important under FERC relicensing guidelines for their ecological and sensitive status qualities. This study was proposed in the *Formal Consultation Package for the Relicensing of the Hells Canyon Project* (IPC 1997). In addition, updated study plans were made available in July 1999 and February 2000 (IPC 2000).

1.2. State of Knowledge

Relatively little information is available on the distribution and abundance of reptiles and amphibians in the deserts of the Intermountain West (Munger et al. 1994) or, more specifically, in the vicinity of the study area. Historic records available for the area through the Northern Intermountain Herpetological Database are limited. However, amphibians and reptiles were studied at Craig Mountain Wildlife Mitigation Area near the northern border of the Hells Canyon Study Area (Llewellyn and Peterson 1995), along the lower Snake River in eastern Washington (Metter 1960), along the Snake River in southwestern Idaho at the Snake River Birds of Prey National Conservation Area (NCA) (USDI 1979; Diller and Johnson 1982; Diller and Wallace 1981, 1986), and around C.J. Strike Reservoir (Beck 1997a,b). Prior to efforts reported here, Asherin and Claar (1976) had conducted the only formal surveys for reptiles and amphibians within the Hells Canyon Study Area. They conducted timed searches in 1974 and reported five amphibian and eight reptile species occurring in the area (Asherin and Claar 1976).

The following paragraphs briefly describe the range and habitat requirements for each species that may occur in the study area.

Salamanders—The long-toed salamander (*Ambystoma macrodactylum*) is the most common and widespread salamander in the Pacific Northwest (Nussbaum et al. 1983). Long-toed salamanders are generally found in moist areas of diverse habitats ranging from semiarid sagebrush deserts to dry woodlands, humid forests, and alpine meadows (Nussbaum et al. 1983). During the breeding season, they can be found in or near ponds, vernal pools, or small lakes (Digital Atlas of Idaho 2000); they often breed in newly formed, temporary, or recently disturbed pools of water (Corkran and Thoms 1996). The long-toed salamander is the earliest amphibian species to breed each year, which may help the newts avoid predation by aquatic insects or garter snakes that are not active until later in the year (Nussbaum et al. 1983, Corkran and Thoms 1996).

The tiger salamander (*Ambystoma tigrinum*) is found throughout North America. This salamander lives in grasslands and shrub-steppe and breeds in warm ponds or shallow lake edges in mid to late spring. Most records in the region are from the Columbia Basin of eastern Washington and the Great Basin of southeastern Idaho (Corkran and Thoms 1996). Isolated populations occur at scattered locations in Oregon. Because of the general rarity and habitat limitations in Oregon, the tiger salamander is considered sensitive there (Marshall et al. 1996).

Toads—The western toad (*Bufo boreas*) ranges from southeast Alaska south to northern California and western Montana. It prefers forested and brushy areas from sea level to high mountains. The western toad breeds in vernal ponds, beaver ponds, oxbows, back channels, and occasionally streams. In some portions of their range, western toads are common to abundant and appear to be doing well. However, in other portions (such as southeastern Idaho and the Rocky Mountains), the number and size of toad populations have declined (Bartelt 1997). Many factors have been investigated to determine the cause of widespread toad declines. These factors include episodic acidification (Vertucci and Corn 1996), disease (Carey 1993), and ultraviolet radiation (Corn 1998), but the cause of decline is still unclear. Chytrid fungus, implicated as a likely cause of amphibian die-offs around the world, has been isolated in toad populations in Colorado (USGS 2000).

The Woodhouse's toad (*Bufo woodhousii*) ranges west from the eastern seaboard of the United States to as far as Montana and the southeastern corner of California. The species prefers riparian habitats, sagebrush flats, and fields. Reproduction occurs in relatively permanent waters such as irrigation ditches and canals, pools in streams, ponds, lake margins, and reservoirs (Nussbaum et al. 1983). Museum records indicate the species occurs in the vicinity of the study area.

The Great Basin spadefoot toad (*Spea intermontana*) occurs in semiarid areas of sagebrush, grassland, or open forest with sandy soil in the interior of the Northwest. It uses a variety of temporary and permanent waters, including roadside ditches, pond edges, stock tanks, and rain-filled depressions (Nussbaum et al. 1983, Corkran and Thoms 1996). Spadefoots have developed a couple of adaptations to the unpredictability of desert rainfall: they have an irregular facultative breeding season that tracks local conditions, and embryos and tadpoles develop rapidly to escape temporary pools that dry up (Nussbaum et al. 1983).

Frogs—The Pacific treefrog (*Pseudacris regilla*), also called the Pacific chorus frog, is common and widespread in the Pacific Northwest and occurs from sea level to high montane elevations. The species breeds in shallow ponds, seasonal pools, stock tanks, or slow streams in early spring to early summer (Nussbaum et al. 1983). They will lay their eggs in almost any small body of temporary water and, as a result, may lose a year's reproductive effort in ponds or puddles that dry up too quickly.

The tailed frog (*Ascaphus truei*) ranges in the Rocky Mountains from southeast British Columbia to northern Idaho and from southeastern Washington to northeastern Oregon. The tailed frog is found from sea level to near timberline, occurring in or near fast-flowing, small permanent streams within forested areas. The species remains hidden under rocks during the day and emerges at night to feed along stream edges (Nussbaum et al. 1983). Cool or cold water temperatures appear to be critical to this frog (Nussbaum et al. 1983), and they are generally found in streams with clear water, cobble or boulder substrates, and little silt (Corkran and Thoms 1996). The status of the species is unknown, but evidence indicates a decline (Marshall et al. 1996), possibly associated with timber harvest (Csuti et al. 1997).

The Columbia spotted frog (*Rana luteiventris*) ranges from extreme southeastern Alaska through western Alberta, western Montana, and northwestern Wyoming to northern Utah and central Nevada and west to northeastern Oregon and eastern Washington. Disjunct populations include the Great Basin population (in Nevada, southwestern Idaho, and southeastern Oregon), the West Desert and Wasatch Front populations (Utah), and a population in the Big Horn Mountains of Wyoming. The spotted frog is generally found in moist, upper-elevation environments, including coniferous or mixed forests, grasslands, and sage or sage-juniper brushlands. Breeding occurs in ponds, ephemeral pools, marshes, and stream oxbows, as well as along the margins of lakes and slow-flowing streams where emergent vegetation is present and water is only a few inches deep. Populations of spotted frogs have greatly decreased because of interspecific competition with northern leopard frogs (*Rana pipiens*) and introduced bullfrogs (*Rana catesbeiana*) and because of reduced riparian habitat (Spahr et al. 1991, Marshall et al. 1996). The predicted distribution of the spotted frog includes higher elevations adjacent to the Hells Canyon Study Area (Csuti et al. 1997, Groves et al. 1997).

The northern leopard frog (*Rana pipiens*) ranges in North America as far north as the Great Salt Lake and as far south as Arizona and New Mexico. The species occurs in north-central Oregon along the Columbia River and in the Snake River drainage of northern Malheur and southern Baker counties. Northern leopard frogs prefer marshes and meadows from which they can range into hay fields and grassy woodlands. This frog is known in Oregon from older records, but recent observations are lacking (Csuti et al. 1997). Anecdotal evidence exists for their decline in Idaho (Groves et al. 1997). The predicted distribution of the northern leopard frog includes the southern portion of the study area near Farewell Bend (Groves et al. 1997).

Since its introduction into the Pacific Northwest in the 1920s or 1930s, the bullfrog (*Rana catesbeiana*) has become well established in many permanent waters, especially at lower elevations (Nussbaum et al. 1983). Breeding sites include lakes, ponds, sloughs, and slow-moving rivers and streams. These highly aquatic frogs are seldom found far from the edge of their water source. The bullfrog is much larger than the native amphibians and has eaten and outcompeted many native amphibians at warm ponds in the region (Corkran and Thoms 1996).

Lizards—The Mojave black-collared lizard (*Crotaphytus bicinctores*) ranges through northeastern California; southeastern Oregon; and adjacent parts of Idaho, Nevada, and western Utah. The species is found in sparsely vegetated, dry hillsides in areas with talus slopes, rocks, or boulders (Groves et al. 1997). Little is known about the status and distribution of the Mojave black-collared lizard. The predicted distribution of this species is south of the study area (Csuti et al. 1997, Groves et al. 1997).

The desert horned lizard (*Phrynosoma platyrhinos*) is found from southeastern Oregon, southwestern Idaho, and northern Utah south through the southwestern U.S. desert to northern Mexico. This species prefers arid regions with sandy flats, alluvial fans, and dune edges. The desert horned lizard is found in sagebrush or salt-desert shrub, creosote bush, greasewood, and cactus deserts. The predicted distribution of this species includes the southern portion of the study area (Csuti et al. 1997, Groves et al. 1997). Because this uncommon species is easily collected, populations can be depleted by overcollecting (Csuti et al. 1997).

The sagebrush lizard (*Sceloporus graciosus*) ranges from southern Montana to northwestern New Mexico, and west to Washington, Oregon, California and northern Baja California. This species is found from sea level to at least 5,000 ft (1524 m; Brown et al. 1995); in areas with open ground and some low bushes; and in sagebrush habitats, chaparral, juniper woodlands, and open coniferous forests. The sagebrush lizard is the most common lizard of the sagebrush plains of southeastern Oregon and Idaho (Csuti et al. 1997, Groves et al. 1997).

The longnose leopard lizard (*Gambelia wislizenii*) ranges south from southeastern Oregon and southern Idaho into Baja California and northern Mexico. The species is found in relatively flat desert areas characterized by sandy to gravelly soil and scattered shrubs. Although longnose leopard lizards rely on rodent burrows for cover, they can dig their own burrows. The species is predicted to occur in the southern portion of the study area near Farewell Bend (Csuti et al. 1997, Groves et al. 1997).

The western fence lizard (*Sceloporus occidentalis*) ranges south from central Washington to northern Baja California. They are found in rocky canyons and talus slopes of both deserts and wooded areas, but they avoid low, flat desert valleys. They require elevated perches and use stumps, logs, rocks, old buildings, and other forms of shelter (Brown et al. 1995).

The side-blotched lizard (*Uta stansburiana*) occurs from south-central Washington, southwestern Idaho, and Utah to southern California, New Mexico, and western Texas. The species lives in a variety of habitats including flat deserts and rocky canyons in arid to semiarid regions (Csuti et al. 1997, Groves et al. 1997). The side-blotched lizard may be found on sand, rocky soil, desert pavement, and bouldery slopes. In areas where they occur, side-blotched lizards are often the most abundant species.

The western skink (*Eumeces skiltonianus*) is found from south-central British Columbia through Washington, Oregon, and Idaho to western Utah, Nevada, and southern California. The species is found in a variety of habitats, including desert canyons, open woodlands up to about 7,154 ft (2,150 m) in elevation. Rocky habitats with some moisture are preferred (Nussbaum et al. 1983).

The western whiptail (*Cnemidophorus tigris*) ranges from southeastern Oregon and southwestern Idaho through the southwestern United States into Baja California and northern Mexico. The lizard inhabits the brushy desert regions with firm sandy or silty soil dominated by greasewood, saltbush, or sagebrush. The species frequents both loose and packed soils and uses rodent burrows or digs its own (Nussbaum et al. 1983).

Snakes—The rubber boa (*Charina bottae*) occurs from southern British Columbia to the mountains of southern California and east to western Montana and Wyoming. The species occurs in a wide variety of habitats, ranging from deserts and grasslands to woodlands and mountain forests (Nussbaum et al. 1983). The rubber boa can be found in rotting stumps or logs, bark, flat rocks, crevices in cliffs, and forest litter. Because of their fossorial (or burrowing) and nocturnal habits, the rubber boa may appear uncommon, but in appropriate habitat, they can be common to abundant (Brown et al. 1995).

The racer (*Coluber constrictor*) ranges from southern Canada to Guatemala. This species is found in open habitats such as meadows, sagebrush flats, and talus slopes, but it is generally absent from dense forests and high mountains (Nussbaum et al. 1983, Brown et al. 1995). Racers are known to den with various other snake species and generally return to the same den site in subsequent years (Brown et al. 1995).

The ringneck snake (*Diadophis punctatus*) can be found from southern Washington and Idaho to northern Baja California and the southern part of the Mexican Plateau. In the arid parts of the West, the species is restricted to mountains and watercourses, although it may descend in desert areas to 2,400 ft (732 m). The species is predicted to occur on the Idaho side in the northernmost portion of the study area (Groves et al. 1997).

In the Northwest, the night snake (*Hypsiglena torquata*) is restricted to arid regions, usually in the vicinity of rocky outcrops up to about 1,700 ft (518 m) in elevation. It can also be found using rodent burrows in areas with low desert shrubs and sandy soils. As its name suggests, this species is primarily nocturnal and more active on relatively cool nights of early summer (Csuti et al. 1997).

The striped whipsnake (*Masticophis taeniatus*) ranges south from central Washington through the Great Basin and desert Southwest into central Mexico. It is found in low-elevation arid regions with scattered vegetation and open rocky areas. Such areas include grasslands, sagebrush flats, rocky stream courses, and canyon bottoms (Brown et al. 1995, Csuti et al. 1997). The striped whipsnake is generally most abundant in areas that support a diversity of lizards.

Longnose snakes (*Rhinocheilus lecontei*) have been reported from Canyon, Ada, Elmore, and Owyhee counties in Idaho (Diller and Wallace 1981). The species was collected adjacent to agricultural lands, as well as in rocky and sandy areas, open desert land, and riparian habitats (Diller and Wallace 1981). The snake appeared to be much more abundant on the south side of the Snake River than on the north side (Diller and Johnson 1982). However, obvious habitat preferences were not found for the western longnose snake in southwestern Idaho (Diller and Wallace 1981, Diller and Johnson 1982). The predicted distribution of this species does not include the Hells Canyon Study Area (Groves et al. 1997).

The western ground snake (*Sonora semiannulata*) is found in arid desert scrub vegetation with sandy soil suitable to its fossorial habits. The species preys on a variety of invertebrates (Vitt and Ohmart 1978). In the Snake River Birds of Prey Natural Conservation Area (NCA), western ground snakes appear to have restricted habitat requirements and were therefore collected only in or near talus or scree slopes (Diller and Wallace 1981). Western ground snakes appear to be rare but locally abundant in suitable habitat. The predicted distribution of this species does not include the Hells Canyon Study Area (Groves et al. 1997).

The gopher snake (*Pituophis catenifer*) ranges south from southwestern Canada to northern Mexico. It occurs in diverse habitats from lowlands to mountains, deserts, and grasslands to woodlands and open forests. The species is also found on agricultural land. It is generally absent from dense forests and high mountains in the Northwest (Nussbaum et al. 1985). The gopher snake seeks cover under rocks and debris or in rodent burrows (Brown et al. 1995). It winters in communal dens in rocks or burrows shared with other snakes such as the western rattlesnake (*Crotalus viridis*), racer, and striped whipsnake (Nussbaum et al. 1985).

The western terrestrial garter snake (*Thamnophis elegans*) ranges south from central British Columbia to southern California and east to the western Great Plains. It is found in a variety of habitats including grasslands, shrublands, and woodlands, as well as in wetlands near streams, ponds, and lakes (Groves et al. 1997). Dens are typically in rocky areas, and western terrestrial garter snakes may share den sites with rubber boas, racers, and common garter snakes (*Thamnophis sirtalis*).

The common garter snake (*Thamnophis sirtalis*) is the most wide-ranging reptile in North America and occurs from Canada to Mexico, but it is absent from the southwestern United States. It inhabits a wide variety of areas, including grasslands, shrublands, and forests. In drier regions, they are more closely associated with water (Brown et al. 1995). The common garter snake winters in rocky areas with other snake species.

The western rattlesnake (*Crotalus viridis*), found in the western half of the United States, occurs in diverse habitats from deserts and chaparral to open forests. It is usually observed in drier regions near rocks, cliffs, or downed logs (Csuti et al. 1997). They generally use rocky areas for basking and escape cover, but they may also use rodent burrows for refuge (Brown et al. 1995). Hibernacula are generally on south-facing slopes and not shaded by vegetation (Nussbaum et al. 1983).

1.3. Objectives

This study about amphibians and reptiles in Hells Canyon was conducted by the Herpetology Laboratory at Idaho State University in Pocatello, Idaho, under contract to Idaho Power Company (IPC) in Boise, Idaho. The general objectives were to 1) determine the general distributions, habitat associations, and relative abundances of amphibians and reptiles through the use of a variety of sampling techniques and 2) develop distribution maps for amphibians and reptiles in the area.

To address the main objectives, we developed the following specific objectives:

1) Identify species potentially present in the study area
2) Determine species occurrence and distribution within the study area through the use of drift-fence trapping, pond surveys, stream surveys, walking surveys, nighttime driving, and incidental observations
3) Conduct drift-fence trapping within distinct habitat types and on north- and south-facing slopes to determine the following information and then use that information to extrapolate results across the study area:

   a) relative abundance among reptile species
   b) relative abundance among habitat types
   c) relative abundance between north- and south-facing aspects
   d) relative abundance among reaches
   e) reptile diversity

4) Conduct pond surveys to

   a) classify amphibian abundance within the study area
   b) evaluate habitat associations
   c) evaluate amphibian distribution within the study area

5) Conduct stream surveys to identify the presence of tailed frogs
6) Conduct walking surveys in suitable habitat to identify the presence of the Mojave black-collared lizard and other special status species
7) Model the predicted distribution of special status species present in the study area

2. STUDY AREA

2.1. Location

The Hells Canyon Reach of the Snake River is situated in west-central Idaho and northeastern Oregon (Figure 1). The Snake River, a major tributary to the Columbia River, is the focal point of Hells Canyon. Its generally northward flow forms part of the boundary between Idaho and Oregon. The Hells Canyon Study Area is located between the city of Weiser and the confluence of the Salmon and Snake rivers (from approximately RM 351 to RM 188). The Hells Canyon Complex is located on the Snake River in the southern portion of Hells Canyon and includes three reservoirs—Brownlee, Oxbow, and Hells Canyon. The reach below Hells Canyon Dam is unimpounded, although the three-dam complex controls flows.

Federal agencies, including the Bureau of Land Management (BLM) and U.S. Forest Service (USFS), are responsible for managing the majority of public lands in Hells Canyon. These areas fall within the jurisdictional boundaries of the Wallowa-Whitman National Forest, Oregon; Payette National Forest, Idaho; Nez Perce National Forest, Idaho; Four Rivers Field Office (FO)

of the Lower Snake River District, BLM–Idaho; Cottonwood FO of the Upper Columbia-Salmon Clearwater District, BLM–Idaho; and Baker FO and Malheur FO of the Vale District, BLM─Oregon. Other agencies with natural resource jurisdiction in the greater project area include the U.S. Department of Interior (USDI) National Marine Fisheries Service (NMFS), USDI Bureau of Indian Affairs, USDI Fish and Wildlife Service (FWS), and state agencies from Idaho and Oregon.

In the upstream reach of the study area, the Snake River can be characterized as a low-gradient (0.2 to 0.4 m/km) river, with several island complexes. Agricultural impacts are apparent with high amounts of irrigation returns causing high turbidities and increased nutrient loading. Farmland and rural development on flat to gentle topography surround this reach. Brownlee Reservoir is a steep-sided reservoir with a maximum depth approaching 300 ft (91 m) near the dam. Large rock outcrops occur throughout the entire length. Oxbow Reservoir is a small re-regulating reservoir surrounded by moderate to steep topography (20 to 75% slopes). Shorelines are primarily basalt outcrops and talus, except for alluvial fans created by small tributaries. Hells Canyon Reservoir is also a re-regulating reservoir with maximum depths approaching 200 ft (61 m). Shorelines in the reservoir are generally very steep, and substrates are primarily composed of basalt outcrops and talus slopes. The Snake River in the downstream reach is a high-gradient river (1.8 m/km) with a wide diversity of aquatic habitat, including numerous large rapids, shallow riffles, and deep pools. Substrates are highly diverse, ranging from large basalt outcrops and boulders to cobble/sand bars. This unimpounded reach of the Hells Canyon is considered to be the deepest gorge in North America. The Hells Canyon Reach is surrounded at the upstream end by nearly vertical cliff faces.

2.2. Physiography

Hells Canyon is the deepest and one of the most rugged river gorges in the continental United States. It ranges between 2,000 and 3,000 ft (610 and 914 m) in depth from Weiser to Oxbow Dam. Below Oxbow Dam, the river enters a narrow, steep-sided chasm measuring up to 5,500 ft (1,676 m) deep. From the confluence with the Grande Ronde River, the Snake River then flows into a lava-filled basin and through a much shallower canyon to Lewiston, Idaho (DOE 1985). The elevation of the Snake River near Weiser is about 2,090 ft (637 m) mean sea level (msl), descending to about 910 ft (277 m) msl at the confluence of the Salmon River about 59 mi below Hells Canyon Dam.

Throughout the canyon, topography is generally steep and broken with slopes often dominated by rock outcrops and talus slopes. At the deepest points of the canyon, the walls rise almost vertically. Canyon walls are deeply dissected by numerous side canyons with tributaries to the Snake River. The Seven Devils Mountains to the east and the Wallowa Mountains to the west form the upper reaches of the canyon walls. These mountains form a series of jagged peaks reaching almost 10,000 ft (3,048 m), with subalpine and alpine conditions to the west (USDA 1990).

2.3. Land Features and Geology

Hells Canyon consists of a series of folded and faulted metamorphosed sediments and volcanics overlain unconformably by nearly horizontal flows of Columbia River basalt. This basalt group covers much of eastern Washington, northern Oregon, and adjacent parts of Idaho (Bush and Seward 1992). The older rocks in the series are Permian to Jurassic in age and represent at least two episodes of island arc volcanism and adjacent marine sedimentation similar to those found today in the Aleutian Islands west of Alaska. These rock units represent old island arc chains that were sequentially "welded" to the west coast of North America during the late Paleozoic and early to mid-Mesozoic eras by subduction of a tectonic plate beneath the North American continental tectonic plate (Asherin and Claar 1976, USDA 1994).

In more recent geologic time, Hells Canyon was formed as the Snake River eroded the Blue Mountains in Oregon and Seven Devils Mountains in Idaho (DOE 1985). The Snake River has existed since the Pliocene and probably cut to its present level during the Pleistocene. During the Pleistocene, glacial meltwater provided abundant runoff for downcutting, while regional uplifting created weak points in the 2,000- to 3,000-ft-thick (610- and 914-m-thick) basalt plateau that overlaid the Blue and Seven Devils mountains. Resulting erosion formed the currently observed drainage pattern that established the Snake River (DOE 1985). Northeast-trending, high-angle fault patterns characterize the extensive Snake River fault system running throughout the study area (Fitzgerald 1982).

Besides basalt, other rock types are also present within the study area. Extensive limestone outcrops are found in some tributary drainage areas, and local granitic outcrops also occur.

2.4. Soils

The soils throughout Hells Canyon are derived primarily from Columbia River basalt, covered in most areas with a thin mantle of residual soils from weathered native rock. Isolated areas contain deposits of windblown silt. Unconsolidated materials include ash-loess from the Mount Mazama eruption 6,900 years ago, river sands and gravel deposited during the Bonneville Flood 15,000 years ago, and colluvium and talus deposited more recently. The amount of soil cover declines northward through Hells Canyon. Near Hells Canyon Dam (RM 247), most rock faces are nearly vertical with little soil cover (USDA 1994).

Most soil complexes are well drained and vary from very shallow to moderately deep. Loams are the dominant textural class and vary from very stony to silty, often with a clay subsoil component (NRCS 1995).

2.5. Climate

From late fall to early spring, the climate of west-central Idaho and eastern Oregon is typically influenced by cool and moist Pacific maritime air. Periodically this westerly flow is interrupted by outbreaks of cold, dry continental air from the north, which is normally blocked by mountain ranges to the east. During the summer, a Pacific high-pressure system dominates weather

patterns, resulting in minimal precipitation and more continental climatic conditions overall (Ross and Savage 1967). Hells Canyon, located in the High Desert region, is significantly influenced by the rain shadow of the Cascade Mountains to the west.

Climatological information is summarized for Weiser, Richland, Brownlee Dam, and Lewiston (Figure 2). Average annual precipitation is lowest at the southern end of the study area (Weiser, 286 mm [11.3 inches]), increases northward (Richland, 298 mm [11.7 inches]), peaks around Brownlee Dam (445 mm [17.5 inches]), and declines toward Lewiston (326 mm [12.8 inches]). The average annual precipitation ranges from about 380 to 500 mm (15 to 20 inches), depending on elevation. Nearly 45% of the average annual precipitation at Brownlee Dam falls from November through January, which strongly contrasts with the 9% average recorded for July through September. Thus, most precipitation occurs in the spring and winter (Tisdale et al. 1969, Tisdale 1986, Johnson and Simon 1987), and little or no precipitation falls during the hottest months of summer. Average annual evapotranspiration is estimated to be about 1,300 mm (51 inches).

Mean annual temperatures are similar among the four weather stations. Generally, the climate tends to become drier and warmer downstream of Brownlee Dam. Climatological information from Brownlee Dam (RM 284.6) is probably characteristic of the central section of the study area. The canyon bottom area is dry with seasonal temperatures ranging from lows of about ─5 °C (23 °F) in January to highs of about 35 °C (95 °F) in July (Figure 2). Temperatures below freezing are normally experienced from mid-November through mid-April. As a rule, winters in the canyon are mild, while summers on the canyon floor may be hot. Mean temperatures above 2,000 m (6,562 ft msl) elevation range from –9 °C (16 °F) in January to 13 °C (55 °F) in July. By contrast, mean temperatures below 1,000 m (3,281 ft msl) elevation range from 0 °C (32 °F) in January to between 28 °C (82 °F) and 33 °C (91 °F) in July (Johnson and Simon 1987).

2.6. Vegetation

The types of vegetation growing along the canyon slopes of the middle Snake River are the result of three primary ecological factors: topography, soils, and climate. Climate exerts the strongest influence on the development of plant life. The relatively mild winters below the canyon rim have allowed the development of disjunct species such as hackberry (*Celtis reticulata*), which is most often found in the southwestern states, though it commonly occurs in the middle and lower Snake River area (Tisdale 1979, DeBolt 1992).

Within the context of regional climate, topography is a major influence on the development and distribution of vegetation (Tisdale et al. 1969; Tisdale 1979, 1986). The topographical complexity of Hells Canyon has produced a mosaic of vegetation types (Tisdale 1979, BPA 1984, USDI 1987). Grassland, shrubland, riparian, and coniferous forest communities exist in close proximity. Interfingering of grassland and forest, for example, occurs at a number of sites throughout the canyon due to variations in aspect (Tisdale 1979).

Twenty-six cover types were identified along the Snake River in the Hells Canyon Study Area (Holmstead 2001). The area that was classified covered up to approximately one-half mile on both sides of the Snake River or associated reservoirs. The dominant cover types were *Grassland*

(35.5%), *Shrub Savanna* (21.0%), *Lotic* (16.1%), *Shrubland* (6.6%), and *Cliff/Talus* (5.6%). All remaining cover types covered less than 5% of the area classified.

Wetland and Riparian Communities—A narrow band of diverse riparian communities follows the course of the Snake River and its many tributaries (Huschle 1975, Asherin and Claar 1976, Miller 1976, Miller and Johnson 1976, DeBolt 1992). The riparian zone is vital because of its biological diversity, although limited in geographic area (USDI 1987). Predominant tree species in riparian areas include white alder (*Alnus rhombifolia*), water birch (*Betula occidentalis*), and black cottonwood (*Populus trichocarpa*). Predominant shrub species in riparian areas include syringa (*Philadelphus lewisii*), netleaf hackberry, chokecherry (*Prunus virginiana*), black hawthorn (*Crataegus douglasii*), and poison ivy (*Toxicodendron radicans*). Emergent wetland communities are dominated by broad-leaved pepperweed (*Lepidium latifolium*), marsh grass (*Heleochloa alopecuroides*), purple loosestrife *(Lythrum salicaria*), cocklebur (*Xanthium strumarium*), hemp dogbane (*Apocynum cannabinum*), poison hemlock (*Conium maculatum)*, or alkali saltgrass (*Distichlis stricta*) (Holmstead 2001). Robust emergent vegetation such as common cattail (*Typha latifolia*), narrowleaf cattail (*Typha angustifolia*), American bulrush (*Scirpus americanus*), and common spikerush (*Eleocharis palustris*) are present but have a very limited distribution. Willows are sparsely represented, and various forbs grow on the shoreline side of these stands (Asherin and Claar 1976).

There is no riparian vegetation along many shoreline sections (Holmstead 2001). Rather, upland vegetation on steep canyon slopes simply meets the rocky shoreline. Grassland communities are also common along the Snake River and its tributaries. Where these grassland communities occur, such as on the canyon slopes, the dominant species are bluebunch wheatgrass (*Pseudoroegneria spicata*), cheatgrass (*Bromus tectorum*), and Idaho fescue (*Festuca idahoensis*) (Asherin and Claar 1976, Holmstead 2001).

Herbaceous-Dominated Vegetation Types—The dry climate and typically stony, shallow soils of the canyon have favored the development of grassland steppe communities at the lower and middle elevations (Tisdale 1979, 1986). Commonly occurring grass species in the study area include bunchgrasses such as bluebunch wheatgrass, Sandberg bluegrass (*Poa secunda*), and Idaho fescue (Garrison et al. 1977, BPA 1984, Tisdale 1986, Franklin and Dyrness 1988). Sand dropseed (*Sporobolus cryptandrus*) and red threeawn (*Aristida longiseta*) are also common and, at times, dominant (BPA 1984, Tisdale 1986).

Habitat types in which bluebunch wheatgrass is dominant occur throughout the study area and occupy over half of its grassland area (Tisdale 1986). Bluebunch wheatgrass flourishes on deep, loamy soils but adapts to coarser and shallower soils as well. Generally, it is associated with Idaho fescue on deeper soils and with Sandberg bluegrass on shallower soils.

In upland habitats, the most common upland weed is cheatgrass (Holmstead 2001). This species can significantly alter native rangeland vegetation composition through competitive exclusion of native species reproduction and the facilitation of wildfires. Other widespread introduced upland species include medusahead (*Taeniatherum caput-medusae*) (listed as a noxious weed in Oregon) and bulbous bluegrass (*Poa bulbosa*) (Holmstead 2001). These annual graminoids have probably been introduced and spread in the canyon by a number of vectors (e.g., livestock grazing, mining, homesteading, recreation). Medusahead is a serious threat to upland

assemblages in the canyon. Not only can it take over sites previously dominated by weeds such as cheatgrass, but it is also capable of establishing and maintaining itself in diverse communities of native perennial plants (Miller 1976).

Shrub-Dominated Vegetation Types—Shrub species comprise a large segment of the canyon's overall vegetation composition. Shrub-steppe vegetation types occur at mid-elevations in the Hells Canyon study area, especially in the southern region of the study area. For example, big sagebrush (*Artemisia tridentata*) is a dominant species in the southern sector of the study area, particularly in the area around Brownlee Reservoir (BPA 1984, Holmstead 2001). Commonly occurring shrubs include big sagebrush (*Artemisia tridentata*), antelope bitterbrush (*Purshia tridentata*), hackberry, serviceberry (*Amelanchier alnifolia*) and bitter cherry (*Prunus emarginata*) (BPA 1984, Tisdale 1986). Other species of sagebrush are also present, including low sagebrush (*Artemisia arbuscula*), stiff sagebrush (*Artemisia rigida*), and silver sagebrush (*Artemisia cana*) (Tisdale and Hironaka 1981, Franklin and Dyrness 1988). For the most part, sagebrush stands are limited to the area around Brownlee Reservoir. In these stands, the herbaceous layer is dominated by Sandberg bluegrass and cheatgrass, with a variety of forbs also occurring.

Stands of hackberry are found essentially downstream of Brownlee Dam either on lower slopes with rocky residual/colluvial soil or on alluvial terraces with sandy soil (Tisdale 1986, Holmstead 2001). Hackberry is known to have occurred historically throughout the Brownlee Reservoir reach along the Snake River, becoming increasingly rare upriver of the Farewell Bend area where broad floodplains favored establishment of more mesic species (Blair et al. 2001). Most hackberry-dominated sites along the Brownlee Reservoir reach were inundated with reservoir construction. In existing stands below Brownlee Dam, hackberry is often mixed with a number of other shrub and tree species, including antelope bitterbrush, blue elderberry (*Sambucus cerulea*), and ponderosa pine (BPA 1984). The herbaceous layer is most often dominated by bluebunch wheatgrass, with cheatgrass and sand dropseed dominant in those areas that have been heavily disturbed by the grazing and trampling of cattle.

Tree-Dominated Vegetation Types—Although coniferous forest communities are generally restricted to the higher elevations of steep canyon slopes, they do reach down to the Snake River in certain locations of the study area. The predominant forest community is a ponderosa pine (*Pinus ponderosa*)/bluebunch wheatgrass plant association, which extends to the river on north-facing slopes at sites along Oxbow and Hells Canyon reservoirs (Asherin and Claar 1976, Bonneville Power Administration 1984). This association typically occurs as a savanna of ponderosa pine trees distributed over a grassland steppe dominated by bluebunch wheatgrass. Shrubs are almost completely absent, except for sparsely distributed, drought-resistant species such as antelope bitterbrush and serviceberry (Garrison et al. 1977, Johnson and Simon 1987). A ponderosa pine/hackberry type may also extend down to the river in this area. Hackberry dominates the shrub layer in moderate density, and poison ivy is also abundant (Asherin and Claar 1976).

2.7. Land Use

The study area and vicinity are still dominated by the land-use patterns established at the turn of the century: irrigated and nonirrigated agriculture, livestock grazing, mining, large areas of open space, scattered rural development, and rapidly growing recreational activities. The bottomlands adjacent to the reservoirs are generally used for grazing, some farming, and recreation. Since construction of the Hells Canyon Complex, most human-caused, or anthropogenic, influences have occurred above Hells Canyon Dam. This portion of the study area is more easily accessible for livestock operations, recreation, and other human activities (such as farming and residential pursuits), compared with the reach below Hells Canyon Dam (Blair et al. 2001). Significant disturbances occurred upstream of the Hells Canyon Dam area well before the 1950s (Blair et al. 2001). Mining, logging, and especially livestock grazing were pronounced in the upstream watershed. The relatively moderate hill slopes, from the headwaters of Brownlee Reservoir downstream to about Brownlee Dam, are more accessible to livestock grazing today than the steeper, rocky slopes more characteristic of Oxbow and Hells Canyon reservoirs.

2.8. Plant Operations

Hells Canyon, on the Oregon–Idaho border, is the deepest canyon in North America and home to IPC's largest hydroelectric generating complex, the HCC. The HCC includes the Brownlee, Oxbow, and Hells Canyon dams, reservoirs, and power plants. Operations of the three projects of the complex are closely coordinated to generate electricity and to serve many other public purposes.

IPC operates the complex to comply with the FERC license, as well as to accommodate other concerns, such as recreational use, environmental conditions and voluntary arrangements. Among these arrangements are the 1980 Hells Canyon Settlement Agreement, the *Fall Chinook Recovery Plan* adopted in 1991, and, between 1995 and 2001, the cooperative arrangement that IPC had with federal interests in implementing portions of the Federal Columbia River Power System (FCRPS) biological opinion flow augmentation, which is intended to avoid jeopardy of the FCRPS operations below the HCC.

Brownlee Reservoir is the only one of the three HCC facilities—and IPC's only project—with significant storage. It has 101 vertical feet of active storage capacity, which equals approximately 1 million acre-feet of water. On the other hand, Oxbow and Hells Canyon reservoirs have significantly smaller active storage capacities—approximately 0.5 and 1.0% of Brownlee Reservoir's volume, respectively.

Brownlee Dam's hydraulic capacity is also the largest of the three projects. Its powerhouse capacity is approximately 35,000 cubic feet per second (cfs), while the Oxbow and Hells Canyon powerhouses have hydraulic capacities of 28,000 and 30,500 cfs, respectively.

Target elevations for Brownlee Reservoir define the flow through the HCC. However, when flows exceed powerhouse capacity for any of the projects, water is released over the spillways at those projects. When flows through the HCC are below hydraulic capacity, all three projects operate closely together to re-regulate flows through the Oxbow and Hells Canyon projects so

that they remain within the 1-foot per hour ramp rate requirement (measured at Johnson Bar below Hells Canyon Dam) and meet daily peak load demands.

In addition to maintaining the ramp rate, IPC maintains minimum flow rates in the Snake River downstream of Hells Canyon Dam. These minimum flow rates are for navigation purposes and IPC's compliance with article 43 of the existing license. Neither the Brownlee Project nor the Oxbow Project has a minimum flow requirement below its powerhouse. However, because of the Oxbow Project's unique configuration, a flow of 100 cfs is maintained through the bypassed reach of the Snake River below the dam (a segment called the Oxbow Bypass).

3. METHODS

3.1. Historic Distribution of Reptiles and Amphibians

A list of reptile and amphibian museum records was compiled for the Hells Canyon Study Area from the Northern Intermountain Herpetological Database (NIHD), Idaho Conservation Data Center (IDCDC), and Idaho Museum of Natural History (IMNH) (Appendices 1-A and 1-B). This researched list helped in determining species occurrence and distribution within the study area and in identifying possible and probable species present in the study area (Table 1).

3.2. Survey Techniques

We used a variety of survey techniques to effectively sample a cross-section of the amphibian and reptile community present in the Hells Canyon Study Area. These standard techniques for sampling such populations included 1) drift fences with funnel traps, 2) timed visual searches (including pond, stream, and walking surveys), and 3) nighttime driving (considered as incidental observations).

Drift fences with pitfall and funnel traps have been effectively used to sample amphibian and reptile communities in a variety of habitats (Corn 1994, Greenberg et al. 1994). They intercept amphibians and reptiles moving on the surface of the ground and redirect them into a pitfall or funnel trap. Pitfall traps are most effective for surface-active lizards, frogs, and toads, whereas large snake species are more effectively captured in funnel traps (Greenberg et al. 1994). Because snake species, particularly secretive or nocturnal species, were the target organisms for drift fences in our study, we selected funnel traps. Drift-fence trapping was used to determine presence, distribution, and relative abundance of reptiles.

Timed visual searches can be effective for sampling small ponds, ephemeral pools, and streams, as well as for sampling terrestrial habitat (Corn and Bury 1989, Olson et al. 1997). The basic approach for conducting timed visual searches in aquatic habitat includes several tasks: 1) using binoculars to scan for basking frogs, 2) slowly walking in the water or on the adjacent bank and visually searching for eggs, larvae, and adults, and 3) using a dip net to find and capture larvae and adults. Walking surveys for reptiles in appropriate habitat can be conducted according to the

same approach but with slight modifications. For example, dip netting is usually replaced by lifting rocks and vegetative debris in areas likely to hide reptiles. Time visual searches were the primary sampling technique for amphibians in the study area. We also used this technique to survey for the Mojave black-collared lizard, a sensitive species.

Nighttime driving is effective for documenting nocturnal species that migrate across roads (Jones 1986). To conduct nighttime driving surveys, surveyors generally cruise secondary roads at low to moderate speeds (22–34 mph), using low headlight beams. These searches usually start at dusk and last for 2 to 3 hours.

In addition to trapping and amphibian surveys (Appendices 2 and 3), all incidental observations were recorded to supplement data about species distribution (Appendix 4).

3.2.1. Drift-Fence Trapping

To obtain the most useful data regarding reptile presence, distribution, and relative abundance, we designed drift-fence trapping efforts focusing on suitable habitat types and yearly activity patterns of reptiles.

3.2.1.1. Trap Site Selection

We took a cluster-sampling approach for reptiles in the Hells Canyon Study Area. A cluster sample is a simple random sample in which each sampling unit is a collection or cluster of elements (in this study *habitat types*). Clusters were defined as those sample areas that were accessible by vehicle and foot and contained the maximum number of habitat types. Generally, we selected sites near a tributary to enhance our chances of sampling different habitat types that exist near each other. Because travel time between sites is the greatest limiting factor when checking drift fences with funnel traps, clumping allowed us to increase the number of arrays without substantially increasing travel time between sites.

We used a stratified random sample design with trapping (cluster) sites spaced as evenly as possible throughout the study area on both the Oregon and Idaho sides. Limited accessibility below Hells Canyon Dam precluded trapping. In 1996, four trap sites were located on both the Idaho side (Hells Canyon Reservoir) and Oregon side (Brownlee Reservoir). In 1997, two trap sites were located on the Oregon side of Hells Canyon Reservoir, and three on the Idaho side of Brownlee Reservoir. Three trap sites, two on the Oregon side of Oxbow Reservoir and one on the Idaho side of Brownlee Reservoir, were established as control sites in 1996 to be sampled each year. However only one site, Black Canyon Creek on the Oregon side of Oxbow Reservoir, was sampled in 1997.

Several trapping arrays were placed at each trap site. The number of arrays depended on the presence of distinct cover types. Reptiles are more closely tied to habitat structure (i.e., the presence of shrubs, forbs, riparian areas, or grasses) than they are to the plant species composition (Jones 1986). Therefore, rather then using vegetation cover types as defined by Holmstead (2001), we used habitat types to select the placement of arrays. The four habitat types we used were based on combining structurally similar vegetation cover types. So the *Desertic* habitat type included the *Desertic Herbland* and *Desertic Shrubland* cover types, the *Grass*

habitat type included *Grassland*, the *Riparian* habitat type included *Scrub-Shrub Wetland* and *Forested Wetland*, and the *Shrub* habitat type included *Shrub Savanna* and *Shrubland*. Furthermore, we stratified trap-site locations between north- and south-facing aspects of each drainage. To minimize vandalism, sites that could not be seen from the roads were generally selected. The same trapping protocols were followed at each trapping site and array.

3.2.1.2. Trapping Protocol

In the spring seasons of 1996 and 1997, 72 drift-fence arrays were constructed and placed in the field (51 and 21 in 1996 and 1997, respectively) (Appendix 2). Each array consisted of four 7.5-m sections of 50.8-cm metal flashing, placed perpendicular to each other in a plus-sign configuration (Figure 3) with the center trap placed at the intersection. This construction was a modification of the trapping array described by Campbell and Christman (1982), Jones (1986), and Karns (1986). We placed open-ended funnel traps at the end of each 7.5-m section. These end traps were constructed of 1/8-inch hardware cloth (Beck 1997a). The center trap was a plywood box with single-ended funnels attached to the four center pieces of the array. We partially buried each trap and used soil substrate and a cardboard cover to reduce reptile and amphibian mortality. Signs identifying each array as an IPC research project were intended to deter vandalism or harm to the trapped animals.

Drift-fence trapping is most effective when target reptiles are most active. Studies conducted in southwestern Idaho showed that lizard activity begins in late March or early April, peaks in May and June, and declines rapidly in July and August (Diller and Johnson 1982, Beck and Peterson 1996). Likewise, most snake species are most active during May and June (Diller and Johnson 1982, Beck and Peterson 1996). Therefore, we scheduled trapping between May 5, 1996, and July 7, 1996, and between April 6, 1997, and July 9, 1997. We checked arrays every third day, although on rare occasions trapping intervals were longer because of logistical constraints.

3.2.2. Wetland Surveys

To obtain the most useful information about pond-breeding amphibians, we designed wetland surveys to occur where and when these amphibians were most likely to be observed (Appendix 3).

3.2.2.1. Site Selection

All wetlands within one-half mile of the high-water mark on each reservoir were identified from topographic maps and surveyed for amphibians. In addition, wetlands further than one-half mile from the reservoirs were also surveyed where accessible. However, because many wetlands in the study area are small and not delineated on topographic maps or visible from aerial photographs, wetland surveys were also conducted opportunistically at small ponds, seeps, and even road ruts filled with water.

Below Hells Canyon Dam, backwater ponds along the Snake River may provide important breeding sites for amphibians (Palmer 1991). To identify these ponds, we examined aerial photographs (taken August 9, 1997) and digital orthophoto quads (from June 23, 1994, and August 7, 1994, at 1:80,000-scale, and from May 22, 1992, at 1:40,000-scale) showing areas

along the Snake River where backwater ponds form along sandbars and gravel bars as water recedes after spring runoff. All identified ponds were digitized using ArcView©, a Geographical Information System (GIS) developed by Environmental Systems Research Institute (ESRI). Other wetlands within the half-mile corridor were also identified from topographic maps. Because accessibility below Hells Canyon Dam is limited, we generally accessed the area by raft or jet boat. Amphibian and reptile searches below the dam were conducted with other field surveys. Therefore, they were limited by logistical constraints, and not all wetlands could be visited (Table 3).

3.2.2.2. Wetland Survey Protocol

To determine the presence and distribution of pond-breeding amphibians, we followed the U.S. Fish and Wildlife Service protocol developed by Stephen Corn to collect data (Heyer et al. 1994). Timing ourselves, we walked the edge of a pond looking for adult amphibians and egg masses. Because larvae are sometimes difficult to observe, we periodically used dip nets to sample for larvae. We also turned over any cover objects that were adjacent to the pond. If possible, we waded through the pond to determine its depth. At each pond we measured pH (Oakton, pH Testr 2, accurate ± 0.2, Forestry Suppliers, Inc., Jackson, MS), water conductivity (Oakton, TDS Testr, accurate ± 2%, Forestry Suppliers, Inc., Jackson, MS), and water temperature (Quick Reading Miller-Weber Cloacal Thermometer, Queens, NY).

3.2.3. Stream Surveys

We conducted stream surveys to determine the presence, distribution, and relative abundance of the tailed frog. Therefore, sampling sites and protocol were designed for this species only.

3.2.3.1. Site Selection

The tailed frog is found from sea level to near timberline, occurring in or near fast-flowing, small permanent streams within forested areas (Groves et al. 1997). They generally prefer streams with clear cold water, cobble or boulder substrates, and little silt (Corkran and Thoms 1996). Based on this information, we sampled for tailed frogs in perennial streams with high gradients, complete canopy cover, and low silt loads. Intermittent streams tended to be low gradient, warm, and silty with little canopy cover. On rafting trips below Hells Canyon Dam, we sampled both perennial and intermittent streams whenever there was a stream at a scheduled stop.

3.2.3.2. Stream Survey Protocol

In 1996, five streams—Connor Creek, Dennett Creek, Sturgill Creek, Brownlee Creek, and Dukes Creek—were surveyed on Brownlee Reservoir, and one stream—Kinney Creek—was surveyed on Hells Canyon Reservoir. Fifty-meter transects were surveyed at the mouth of each creek, one-half mile upstream, and one mile upstream. Because Brownlee Creek had road access along its entire length, it was surveyed at half-mile increments up to 8.5 mi from the mouth.

In 1997, seven streams—Battle Creek, Granite Creek, Sheep Creek, Temperance Creek, Kirkwood Creek, Cache Creek, and Birch Creek—were surveyed below Hells Canyon Dam. In addition, in 1998, one tributary on Oxbow Reservoir (Wildhorse River) and one tributary below

Hells Canyon Dam (Deep Creek) were surveyed. We surveyed approximately 100 m of the river bed along each stream. Below Hells Canyon Dam, we started sampling streams at the closest access point from the Snake River and progressed upstream. For the first 5 m, we turned every stone and probed the vegetation, the bank, and any existing holes. In the remaining 95 m, we turned those stones that we considered potential tailed frog habitat, such as large rocks in the center of the stream (Charles R. Peterson, ISU, unpubl. data). As we turned a rock, we held a dip net downstream of the rock. If a tailed frog was under the rock, it tended to be washed into the net. In addition to recording the entire sampling time, we measured pH, water conductivity, and water temperature at each stream.

3.2.4. Timed Reptile Surveys

Timed walking surveys for reptiles were designed to provide the most useful presence and distribution data on lizard species such as the Mojave black-collared lizard, desert horned lizard, side-blotched lizard, and longnose leopard lizard.

3.2.4.1. Site Selection

We established 10 sites in the southern portion of the study area for walking surveys (Figure 1). Sites were subjectively chosen in grassland or shrubland habitats that contained large rock outcroppings because we considered the chances of observing species such as Mojave black-collared lizard, desert horned lizard, side-blotched lizard, and longnose leopard lizard to be high.

In the area below Hells Canyon Dam, we conducted surveys opportunistically at scheduled stops and at evening camps. We also recorded incidental sightings.

3.2.4.2. Survey Protocol

We conducted 10.25 hours of timed searches for the Mojave black-collared lizard at the 10 sites on Brownlee Reservoir from May through June 1998. Surveyors walked through suitable habitat in the southern portion of the study area and searched specifically for Mojave black-collared lizard, but they recorded any opportunistic observations of other reptile species. These surveyors lifted rocks and vegetative debris in areas likely to hide reptiles.

3.2.5. Nighttime Driving

In 1996, the local roads were driven to survey for nocturnal species migrating across roads (Table 4). These surveys were usually conducted late at night (from 11:00 P.M. to 2:00 A.M.) on nights following unusually hot days. Data from nighttime driving surveys were recorded as incidental observations.

3.2.6. Incidental Observations

We reported any incidental observations to supplement survey data (Appendices 4 and 5). Incidental reptile sightings were usually either opportunistic observations made during other fieldwork or observed as “road-kill.” Field crews were trained in reptile and amphibian

identification by Dr. Charles R. Peterson, Idaho State University, Pocatello, Idaho. If we observed an uncommon species for the area or a species well outside of its reported range, we either captured the individual for identification or returned to the site to try confirming the observation.

3.3. Data Analysis

We conducted appropriate analyses to calculate relative abundance and species diversity, habitat relationships, and species distribution for the reptile and amphibian species.

3.3.1. Relative Abundance and Species Diversity

Trapping Arrays—Amphibian captures were excluded from the analyses since the funnel traps did not specifically target these species. Also, because captures were generally concentrated at arrays close to a breeding site, amphibian trapping data were considered biased and could not be used to make inferences about the distribution of amphibian species across the landscape.

Capture rates (that is, the number of captures/100 trap nights) were calculated for each reservoir reach and habitat type for all species combined, as well as for individual species, if sufficient data were available. We used Analysis-of-Variance (ANOVA) procedures (PROC GLM, SAS Institute Inc. 1988) to investigate differences in capture rates among reservoirs and habitat types. Differences among reservoirs and habitat types were tested using a factorial model with interaction term. The overall residual mean square error served as the error term. Capture rates did not differ among north- and south-facing aspects ($P = 0.54$). Therefore, sites on north- and south-facing aspects were considered replicates within each trapping site.

We used trapping data for each reservoir of the study area to calculate Shannon diversity indices for reptiles. These indices (H') were calculated from the equation $H' = -\sum p_i \ln p_i$. The quantity p_i is the proportion of individuals found in the i^{th} species. We did not calculate a species diversity index for amphibian captures because we captured only three species, one of which was recorded at a single site (that is, the Great Basin spadefoot at Virgin Gulch).

Wetland/Stream Surveys—Wetland and stream survey results were tabulated according to species above and below Hells Canyon Dam. The information was then used to classify species as *abundant* (> 100 individuals), *common* (25–100 individuals), *uncommon* (10–25 individuals), or *rare* (< 10 individuals) and to determine the frequency of occurrence (or constancy) for each species (*low* for < 20 sites, *medium* for 20–50 sites, and *high* for > 50 sites).

3.3.2. Habitat Relationships

Trapping Arrays—In the analysis of reptile–habitat relationships, we evaluated both macrohabitat (or habitat type) and microhabitat (or aspect) relationships. We asked the following questions:

1) Do individual or overall species abundances differ among habitat types?

2) Do individual or overall species abundances differ between north- and south-facing slopes?

3) Are reptile communities similar among arrays?

The first two questions were addressed through the use of ANOVA procedures as described above. To answer the third question, we used Two-Way-Species-Indicator-Analysis (TWINSPAN) to ordinate reptile communities at all trapping arrays for the purposes of investigating relationships among these reptile communities and determine whether any indicator species could be identified. TWINSPAN is a hierarchical classification program that uses reciprocal averaging repeatedly to divide the data set into progressively smaller groups (Hill 1979). This program first constructs an ordination of the arrays. Then, the ordination is used to classify reptile species according to their ecological preferences, after which the two classifications are used to obtain a two-way table that expresses the reptile species synecological relationships. The table is constructed in such a way that species are arranged in a sequence that brings together species similar in their distribution as well as sites similar in species composition. Therefore, matrix entries are calculated into blocks in the matrix, especially along the diagonal. The end result of this analysis closely resembles the "hand" method of classification outlined by Muller-Dombois and Ellenberg (1974). Capture rates were transformed using default species cut levels, which de-emphasize abundant species, allowing less abundant species to have more influence in the classification.

Wetland/Stream Surveys—We compiled data by species for each pond type, pH, and conductivity. Aerial photographs taken before the Hells Canyon Dam was constructed (1955 and 1964 photographs) were visually compared with aerial photographs taken August 9, 1997, to determine qualitative changes in backwater ponds.

3.3.3. Species Distribution

Non-modeled Distributions—Dot-distribution maps were generated for each reptile and amphibian species recorded in the Hells Canyon Study Area. Data from all survey methods were included.

Modeled Distributions—We proposed modeling the predicted distribution for all sensitive species found in the study area. However, limited observations of the sagebrush lizard, Woodhouse's toad, and Columbia spotted frog suggest that their range is very restricted. In addition, because insufficient data were available, we did not attempt to model the predicted distributions for these three species.

Although metamorphosed toads are largely terrestrial and use diverse habitats, western toads use a broad range of wetland sites for breeding. During the breeding season, sexually mature toads move to the water. We surveyed a variety of wetland habitats that we considered potential breeding habitats for western toads. However, many of these wetland types (such as seeps, overflow ponds, and backwater ponds) are not delineated on the Hells Canyon cover-type map. Therefore, any modeling of breeding habitat could only be done by using broad cover types such as *Scrub-Shrub Wetland* or *Forested Wetland* or by using a hydrology layer rather than the specific habitats used by the western toad. The resulting general distributional information would

be too coarse for any practical application; therefore, modeling was not considered useful for the western toad.

Tailed frogs, on the other hand, have very narrow habitat associations, and predictive modeling can be useful in elucidating the potential distribution of this species. Based on habitat preferences reported in the literature, we used the following criteria to model the predicted distribution: 1) perennial streams; 2) first-, second-, third-, or fourth-order streams; 3) streams with headwaters over 5,000 ft in elevation; and 4) streams with headwaters located within forested habitat. Tailed frog habitat is described as fast, small, permanent forest streams with clear cold water, cobble or boulder substrates, and little silt (Corkran and Thoms 1996). Therefore, we selected perennial streams and excluded the many intermittent streams because they are often more sparsely vegetated or have generally warmer water temperatures and limited or no connectivity to extensive forested habitat. Stream order was included in the model to exclude streams that are too large for the tailed frog. Diller and Wallace (1999) sampled first- and second-order streams in California, and Bull and Carter (1996) sampled streams narrower than 5 m in northeastern Oregon. Streams with headwaters in forested habitat over 5,000 ft (1,524 m) in elevation were selected because of their connectivity to extensive forested habitat and the lower water temperatures associated with these streams.

Base layers required to model potential tailed frog habitat included 1:24,000-scale hydrography, digital elevation data, and 1:250,000-scale land-use/land-cover data. The hydrography layer was created by combining Large-Scale Digital Line Graph (DLG) data, USFS Cartographic Feature Files (CFF), and manual digitization of stream networks to fill in data gaps where electronic data did not exist. All sources of data used in this project were organized by 7.5-minute U.S. Geological Survey (USGS) topographic quadrangle boundaries. The study area for the tailed frog covered fifty 7.5-minute quadrangles.

The Large-Scale DLG data produced by the USGS are digital representations of cartographic information. These DLG data files are vector files containing line data digitized from USGS topographic maps and published as 7.5-minute quadrangles at 1:24,000-scale. They offer a full range of attribute codes, are highly accurate, and are topologically structured. These characteristics make them ideal for use in GIS. Of the 50 quadrangles needed to cover the study area, 26 were derived from DLGs.

CFF data are electronic versions of the USFS primary base series (PBS) maps, which are also developed from USGS 7.5-minute topographic map series and then enhanced and revised to satisfy Forest Service needs. They are also constructed to meet National Map Accuracy Standards (NMAS). Only three CFFs were available for use in this project.

The remaining twenty-one 7.5-minute quadrangles required to complete the study area were manually digitized using a digital raster graphic (DRG) as a backdrop on which to trace the stream channels. A DRG is a scanned image of a USGS standard series topographic map, including all map collar information. The image inside the map neatline is georeferenced to the surface of the earth and fit to the Universal Transverse Mercator (UTM) projection. The horizontal positional accuracy and datum of the DRG match the accuracy and datum of the source map. The map is scanned at a minimum resolution of 250 dots per inch.

Attributes describing the perennial nature or intermittence of stream reaches were available in both the DLG and CFF layers. A new variable was calculated in each layer so that when the data were joined, information regarding stream type was not lost. The manually digitized stream segments were classified according to the information available on the source DRG. All three GIS layers were then joined, and a single layer describing stream networks was created.

The final piece of information needed for the hydrography layer was Strahler stream order. To obtain this information, we identified arc segments that were not attached to another arc segment at one end. We created an attribute that would describe stream-order magnitude. Then starting with the lowest orders, we progressively attributed and deleted each order.

To describe elevation within the study area, we used the USGS Digital Elevation Model (DEM). This data type is a digital representation of cartographic information in a raster form. DEMs consist of a sampled array of elevations for a number of ground positions at regularly spaced intervals. The DEM data for 7.5-minute units correspond to the USGS 1:24,000-scale topographic quadrangle map series for all of the United States and its territories. Each 7.5-minute DEM is based on 30- by 30-m data spacing with the Universal Transverse Mercator (UTM) projection, and each 7.5- by 7.5-minute block provides the same coverage as the standard USGS 7.5-minute map series. We merged 130 DEM quadrangles into one seamless DEM. The DEM was then reclassified into two groups: areas above 5,000 ft (1,524 m) and areas below 5,000 ft in elevation.

Land-use and land-cover (LULC) data were derived from thematic overlays registered to 1:250,000-scale base maps. These data provided information on urban or developed land, agricultural land, rangeland, forest land, water, wetlands, barren land, tundra, and perennial snow or ice. From the LULC, we queried all forested habitats and used this layer as another input to the model.

To analyze the data using the stream hydrography layer, we first eliminated all intermittent streams from our analysis area. Next, we removed all streams greater than fifth order. All stream channels that did not originate above 5,000 ft were also removed. And finally streams that did not abut forested habitat were eliminated. Using these intersected data sets, we produced a map modeling the predicted distribution of the tailed frog and overlaid this map with survey locations where tailed frogs were found to be present or absent (Figure 4).

4. RESULTS

4.1. Historic Distribution of Reptiles and Amphibians

Museum records exist for 23 reptile and amphibian species from Idaho (Washington and Adams counties) and Oregon (Baker County) (Appendices 1-A and 1-B). Based on historic records and predicted distributions (Csuti et al. 1997, Groves et al. 1997), 29 amphibian and reptile species potentially occur in the study area (Table 1).

We documented 22 species with drift-fence trapping, timed surveys (pond, stream, or walking), and incidental observations. In addition, we documented three new county records (for the side-blotched lizard, night snake, and striped whipsnake). Of the seven species that were not documented, three species—Mojave black-collared lizard, longnose snake, and western ground snake—had no historic records in the vicinity of the study area. The remaining four species—ringneck snake, leopard frog, tiger salamander, and desert horned lizard—had historic records in at least one county, but they were not documented during our study. The ringneck snake has a historic record along the Salmon River, and the leopard frog was historically observed near Weiser, Idaho, and Huntington, Oregon. In 1996, one tiger salamander larvae was recorded in Baker County but not in the vicinity of the study area. The desert horned lizard has historic records from Huntington, Oregon, and Payette, Idaho.

4.2. Reptiles

4.2.1. Relative Abundance and Species Diversity

Drift-fence Trapping—Using drift fences with funnel traps, we captured 1,357 reptiles of 10 species and 46 amphibians of 3 species (for a total of 1,403 individuals) during the two year trapping study (Table 5).

The five most abundant reptile species captured were the racer (766 captures, 15.6 captures/100 trap nights), gopher snake (270 captures, 5.3 captures/100 trap nights), western whiptail (139 captures, 2.2 captures/100 trap nights), western rattlesnake (105 captures, 2.1 captures/100 trap nights), and night snake (40 captures, 0.8 captures/100 trap nights) (Table 5). These species accounted for 94% (1,320 out of 1,403 individuals) of all captures. The remaining five reptiles species comprised only a fraction of the total number of species captured. The mean abundance for each of the other species captured was less than or equal to 0.4 captures/100 trap nights (Table 5). Insufficient numbers of these species were captured to evaluate differences in capture rates.

There were no significant differences in overall capture rates among the three reservoir reaches ($P = 0.50$) nor among individual capture rates for the racer ($P = 0.10$), gopher snake ($P = 0.16$), or western rattlesnake ($P = 0.11$). However, the night snake had significantly higher capture rates ($P = 0.01$) along Oxbow Reservoir than along the Hells Canyon and Brownlee reservoirs. The western whiptail was captured only along Brownlee Reservoir.

Based on total captures and other observations within the study area, we ranked each species's relative abundance based into four abundance categories: *rare* (< 10 individuals), *uncommon* (10–25 individuals), *common* (25–100 individuals), or *abundant* (> 100 individuals). Three species were classified as rare, four as uncommon, three as common, and four as abundant (Table 6).

Also, from data collected during trapping and incidental observations, we ranked each species' frequency of occurrence (or constancy) into three categories: *low* (< 20 sites), *medium* (20–50 sites), or *high* (> 50 sites). Six species were classified as low, and four species as both medium and high (Table 6).

Reptile species diversity (*H'*) was similar among Brownlee, Oxbow, and Hells Canyon reservoirs (1.26, 1.01, and 1.13, respectively).

Timed Searches—The Mojave black-collared lizard, the targeted organism, was not found during timed walking surveys in potential habitat along upper Brownlee Reservoir. However, we recorded four reptile and one amphibian species. Species observed included longnose leopard lizard, western whiptail, racer, side-blotched lizard, and Woodhouse's toad (Table 7).

Below Hells Canyon Dam, five reptile species were recorded during timed searches. These species were the western fence lizard, western rattlesnake, racer, gopher snake, and western skink. The western terrestrial garter snake and common garter snake were observed incidentally.

4.2.2. Habitat Associations

We calculated the mean number of captures/100 trap nights within each habitat type for all species combined and for the five most abundant reptile species within the study area (Table 8). We did not capture sufficient numbers of the other five reptile species (Table 5) to effectively determine habitat associations.

When capture rates for individual species were combined, differences in capture rates were not found among habitat types ($P = 0.53$). Likewise, capture rates did not differ among either habitat types or among habitats for each of the three reservoir (P values > 0.05). The most common species—the racer, gopher snake, and western rattlesnake—did not appear to discriminate among habitat types. The racer was captured in all habitat types sampled on all reservoirs. The gopher snake was captured in all habitat types sampled on all reservoirs except in the *Grass* habitat type on Oxbow Reservoir (Table 8). The western rattlesnake was also observed in all habitats but not in all habitats on each reservoir. No significant differences in capture rates were found among habitat associations for the racer, gopher snake, or western rattlesnake (P values > 0.05).

The western whiptail was only captured on Brownlee Reservoir. Western whiptails were captured in *Desertic*, *Grass*, *Riparian*, and *Shrub* habitats (Table 8), but they had highest abundances at *Desertic* sites ($P = 0.02$). Whiptail captures were approximately four times higher in *Desertic* habitat (23 captures/100 trap nights) than in *Shrub* habitat (6 captures/100 trap nights). The night snake was captured in all habitat types except *Riparian* (Table 8). Night snake capture rates were higher in *Desertic* habitat than in either *Grass* or *Riparian* habitat types but was not significantly different from the capture rate in *Shrub* habitat (Table 8).

Capture rates were similar between arrays located on north- and south-facing slopes for overall capture rates ($P = 0.98$). Likewise, the racer ($P = 0.72$), gopher snake ($P = 0.20$), western whiptail ($P = 0.63$), western rattlesnake ($P = 0.25$), and night snake ($P = 0.34$) showed no differences between arrays located on either north- or south-facing aspects.

4.2.3. Distribution

TWINSPAN analysis did not separate the sites based on cover type. Instead, it appeared to suggest a distributional gradient along the length of the study area. The first division of

TWINSPAN reflected a separation between nine arrays located on upper Brownlee and all other sites (Appendix 6). The western whiptail and striped whipsnake were indicator species for these southern sites (RM 309–333), while the western rattlesnake, night snake, and high capture rates of gopher snake and racer were indicators of the other arrays in the study area. The second division pulled out arrays on Oxbow and Hells Canyon reservoirs based on the presence of the night snake and western fence lizard rather than of the western rattlesnake.

A north/south gradient is suggested by the separation of the southern arrays in the TWINSPAN analysis. This gradient is further supported by incidental observations recorded in the study area. Through these incidental observations, the western whiptail was reported as far north as the Powder River (Figure 5d). The side-blotched lizard was recorded only in the southern portion of the study area as far north as the Burnt River (Figure 5c), and the longnose leopard lizard was reported in the area near Farewell Bend (Figure 5b). Both the sagebrush lizard and striped whipsnake were observed as far north as Oxbow Dam (Figures 5a and 6d, respectively). The western fence lizard was recorded throughout the study area from Dukes Creek (RM 285) north (Figure 6a). The racer, western terrestrial garter snake, western rattlesnake, western skink, gopher snake, rubber boa, common garter snake, and night snake were either distributed projectwide or presumed to be distributed projectwide (Figures 6–8).

4.3. Amphibians

4.3.1. Relative Abundance

Wetland Surveys—In 1996 and 1997, we sampled 50 wetland sites (ponds, springs, and/or seep areas) above Hells Canyon Dam and recorded the presence or absence of amphibians (Table 9 and Appendix 3). We confirmed western toads at 24 sites, long-toed salamanders at 22 sites, Pacific treefrogs at 21 sites, bullfrogs at 6 sites, Great Basin spadefoot at 2 sites (ponds < 100 m apart), and Columbia spotted frogs at 1 site. We were unable to confirm the presence of amphibians at 3 sites (Table 9).

During the spring and summer seasons of 1996 through 1999, we surveyed 14 backwater ponds below Hells Canyon Dam for breeding western toads (Table 3). Eight (57%) of the ponds contained western toads, and six (43%) of the ponds exhibited evidence of western toad breeding. Seven additional backwater ponds were identified from aerial photographs, but surveys were not conducted because of logistical constraints. Seven wetlands not associated with the Snake River were surveyed below Hells Canyon Dam (Table 3), while two wetlands were only surveyed informally. Western toads were present at three of these wetlands, and breeding was confirmed at two sites. Long-toed salamander larvae were reported at three sites below Hells Canyon Dam, but Pacific treefrogs were found only incidentally.

A visual comparison of aerial photographs taken before the Hells Canyon Dam was constructed (photographs taken in 1955 and 1964 were evaluated) and photographs taken in 1997 indicated that the size and shape of the backwater ponds were fairly similar (Figures 9–12), but in some cases vegetation had encroached (Figure 10), while other sites had eroded (Figure 11).

Stream Surveys—We surveyed eight tributaries below Hells Canyon Dam, five tributaries to Brownlee Reservoir, one tributary to Oxbow Reservoir, and one tributary to Hells Canyon Reservoir for the presence or absence of tailed frogs during the spring and summer seasons of 1996 through 1998 (Table 10). Tailed frogs were confirmed in five tributaries (33% of the streams surveyed): Brownlee Creek, Dukes Creek, Deep Creek, Granite Creek, and Sheep Creek. Tailed frog tadpoles were also found incidentally in Lake Fork Creek (a tributary to the north fork of Pine Creek) and Lightning Creek (both found at higher elevations outside the project area). On May 5, 1997, we encountered one adult female tailed frog on the rocky shore of the Snake River at the confluence with Granite Creek.

Relative Abundance and Frequency of Occurrence—Three amphibian species—the western toad, Pacific treefrog, and long-toed salamander—were common and found throughout the study area. The five other species recorded in the study area had more limited distributions. Amphibian abundance was based on the total number of individuals observed at wetlands and incidental observations. Species were classified as *abundant* (> 100 individuals), *common* (25–100 individuals), *uncommon* (10–25 individuals), or *rare* (< 10 individuals) within the study area. The three most common species—western toad, Pacific treefrog, and long-toed salamander—were considered abundant within the study area. Only the Great Basin spadefoot was considered common, while the tailed frog was considered uncommon. The remaining three species—bullfrog, Columbia spotted frog, and Woodhouse's toad—were classified as rare.

We also determined constancy for each species within the study area. Five species (Woodhouse's toad, tailed frog, Great Basin spadefoot, bullfrog, and Columbia spotted frog) were classified as low, the long-toed salamander and Pacific treefrog as medium, and the western toad as high (Table 6).

4.3.2. Habitat Associations

The Pacific treefrog was found in wetlands with the widest range in both pH (7.6 to 10.5) and conductivity (80 to 1310 μOhms). The western toad had a similar range in pH (7.6 to 10.4), but a narrower range in conductivity (140 to 430 μOhms). The long-toed salamander had a slightly lower range of pH (7.8 to 9.1), but a large range in conductivity (90 to 1160 μOhms).

In addition, we found long-toed salamanders in seeps, constructed stock ponds, mine drainages, and road ruts. The Pacific treefrog used road ruts, springs, stock ponds, and overflow areas below Oxbow Dam. Western toads were found breeding in springs, seeps, stock ponds, Grouse Creek (in the Brownlee Reservoir reach), overflow ponds on the Wildhorse River, and backwater ponds below Hells Canyon Dam.

4.3.3. Distribution

Amphibian species had different distributions within the study area (Table 6, Figures 13 and 14). As with the reptiles, there appears to be distinct changes in species composition along a north/south gradient within the study area. The bullfrog and Great Basin spadefoot were only captured or observed in the southern portion of Brownlee Reservoir (Figure 13a and 13c). The

long-toed salamander, western toad, and Pacific treefrog occur projectwide (Figure 14). The Columbia spotted frog was only known from one location within the study area (Figure 13b).

Based on modeling results, we predicted that 28 tributaries to the Snake River, or segments of tributaries (19 in Idaho and 9 in Oregon), provide potential habitat for the tailed frog (Figure 4). We found tailed frogs in 5 tributaries, all of which were predicted to have tailed frogs, and observed no tailed frogs in 5 other tributaries for which the species was predicted to be absent. However, no tailed frogs were found at 5 additional tributaries that were predicted to have tailed frogs.

4.4. Sensitive Species

Although 12 of the 29 species that do or may occur within the study area have special state or federal status (Table 2), none are federally or state listed as threatened or endangered. However, the Columbia spotted frog is a candidate for federal listing in Oregon, two species are designated as federal species of concern, and nine species have either Idaho or Oregon special status (see Table 2 for a complete listing of special status species and definitions). One special status reptile species—the sagebrush lizard—and four amphibian species—the western toad, Woodhouse's toad, tailed frog, and Columbia spotted frog—were observed in the study area.

5. DISCUSSION

5.1. Reptile Community

The reptile community in the Hells Canyon Study Area includes species common to the sagebrush plains in the southern portion of the study area (such as the longnose leopard lizard, sagebrush lizard, side-blotched lizard, western whiptail, and striped whipsnake), habitat generalists (such as the racer, gopher snake, and western rattlesnake), and riparian species (such as the western terrestrial garter snake and common garter snake). We recorded 14 reptile species in the study area, the most common of which was the racer. It was found in all habitats and distributed projectwide. The gopher snake and western rattlesnake were also widespread and found in a variety of habitats. Other studies conducted in the vicinity showed similar results. Llewellyn and Peterson (1995) reported that racers, followed by western rattlesnakes, were the most common snake species found at the low elevations of Craig Mountain Wildlife Mitigation Area along the Snake and Salmon rivers. In the Hells Canyon Study Area, we observed all species found at this mitigation area except the ringneck snake. Asherin and Claar (1976) conducted timed searches in the Hells Canyon Study Area in 1974. They too reported that the racer was the most common snake species in the study area, followed by the gopher snake; both species occurred in a wide variety of habitats. Eight reptile species were reported to occur and an additional four reptile species were suspected to occur in Hells Canyon in 1974 (Table 1) (Asherin and Claar 1976). All species reported or suspected to occur by Asherin and Claar (1976) were observed during our study.

Drift-fence trapping was the most effective means of capturing large numbers of reptile species in the study area. Although trapping efforts did not document the presence of all potentially occurring species within the study area, drift fences were effective in determining relative abundance, general habitat associations, distribution, and species diversity.

5.1.1. Relative Abundance

Because drift-fence trapping was not conducted by Asherin and Claar (1976) or Llewellyn and Peterson (1995), reptile relative abundance was only compared to a similar drift-fence trapping effort conducted along the Snake River at C.J. Strike Reservoir in southwestern Idaho (Beck 1997b).

The Hells Canyon Study Area showed a species composition similar to that for the reptile community found along C.J. Strike Reservoir (Beck 1997b). However, the relative abundance of individual species of snakes differed between the two sites. In the C.J. Strike Study Area, the gopher snake made up 52% of all snake captures, followed by striped whipsnake (14%), racer (12%), night snake (7%), western rattlesnake (7%), ground snake (5%), longnose snake (3%), and western terrestrial garter snake (< 1%) (Beck 1998). In contrast, the most commonly captured snake species in the Hells Canyon Study Area was the racer (64% of all snake captures), followed by the gopher snake (23%), western rattlesnake (9%), night snake (3%), western terrestrial garter snake (< 1%), striped whipsnake (< 1%), and rubber boa (< 1%). The gopher snake is most common in semiarid, brushy areas adjacent to farms (Nussbaum et al. 1983), which is habitat typical of the C.J. Strike area. The racer is present in a wide variety of open habitats such as meadows, sagebrush flats, and talus slopes (Brown et al. 1995), which is habitat typical of the Hells Canyon Study Area. The dominant cover types in Hells Canyon are *Grassland* (35.5%), *Shrub Savanna* (21.0%), *Lotic* (16.1%), *Shrubland* (6.6%), and *Cliff/Talus* (5.6%) (Holmstead 2001). Thus, abundant habitat exists for reptiles preferring these habitats.

Among the lizards, the western whiptail was the most common species found in both the C.J. Strike (50% of all lizard captures) and Hells Canyon study areas (86% of all lizard captures). However, the side-blotched lizard was the second most common species in the C.J. Strike Study Area (49%), whereas the western fence lizard was the second most common lizard in the Hells Canyon Study Area (10%). The high number of incidental observations of western fence lizard (49 separate observations) indicates that, although the species may not be captured in drift-fence arrays as easily as other species, it is common in the study area (Table 11).

5.1.2. Habitat Associations

Reptile species used a variety of habitat types in Hells Canyon. Capture rates among habitat types did not differ (Table 8). Likewise, no differences in capture rates among habitat types were found for the racer, gopher snake, and western rattlesnake. The Hells Canyon Study Area consists of a mosaic of habitats, often in close proximity. For example, because of aspect, slope, soil characteristics, and past disturbance, a hillside may contain pockets of upland shrub, mountain shrub, forested upland, riparian habitat, or rock outcroppings within a larger expanse of grassland. This mosaic favors habitat generalists over habitat specialists that favor a large

expanse of similar habitat. The racer, rattlesnake, and gopher snake used all habitat types and appear to be least discriminating in their habitat associations.

On the other hand, the western whiptail appears to be the most discriminating in habitat associations. This species prefers firm sandy or silty soil with sagebrush or greasewood shrubs (Brown et al. 1995). Such habitat is found only on Brownlee Reservoir, the only reservoir on which the western whiptail was captured. Although it was captured in all habitat types on Brownlee, a significantly higher capture rate was found for *Desertic* sites. This finding is consistent with its known preference for desert areas with dense bushy vegetation (Nussbaum et al. 1983). The western whiptail was observed on several occasions in the drawdown zone of Brownlee Reservoir.

The night snake was never captured in riparian habitat. In the Northwest, the night snake is restricted to arid regions in the vicinity of rock outcroppings (Nussbaum et al. 1983, Beck and Peterson 1996).

5.1.3. Distribution

Topography, soil substrate, and precipitation show a marked gradient from Weiser, Idaho, to the confluence with the Salmon River. This longitudinal gradient affects the distribution of vegetation (Holmstead 2001). The southern portion of the study area consists of more moderate soil-covered slopes vegetated by sagebrush, as well as native and exotic grasslands. Northward, bitterbrush replaces sagebrush, slopes become steeper, and cliffs and rocky outcrops become more dominant. As expected, species common to the sagebrush plains of southern Idaho and southeast Oregon were observed in the southern portion of the study area (Figure 5). Since the western fence lizard requires elevated perches, such as rocks, logs, or stumps (Brown et al. 1995), and is found in rocky canyons and on talus slopes (Nussbaum et al. 1983), it was found from approximately Brownlee Dam north, corresponding to where rocky outcrops become more dominant and cliffs and talus slopes become more numerous (Figure 6).

The common garter snake, racer, western terrestrial garter snake, western rattlesnake, western skink, gopher snake, rubber boa, and night snake are distributed projectwide or presumed to be distributed projectwide (Figures 6–8). The racer, western rattlesnake, western skink, and gopher snake are habitat generalists that use the desertic habitat in the southern portion of the study area as well as the steep, rocky canyons of the northern portion. The rubber boa is found throughout the study area, but unlike the other common species, is most often observed at higher elevations. The lowest observation was on Hells Canyon Reservoir at 1,953 ft (595 m) in elevation, but most observations were much higher. Although we captured night snakes at trap sites from Farewell Bend to the Hells Canyon Reservoir, none were found below Hells Canyon Dam. Night snakes are most easily detected through the use of drift-fence trapping, which we were unable to do below Hells Canyon Dam. Night snakes have been reported on the Salmon River north of the study area (Llewellyn and Peterson 1995). Therefore, we presume that night snakes are present throughout the study area.

5.2. Amphibian Community

Eight amphibian species were recorded in the Hells Canyon Study Area, while two potential species, the tiger salamander and the northern leopard frog, were not observed. Other studies conducted in the study area or vicinity had similar species composition. Asherin and Claar (1976) recorded five species in the Hells Canyon Study Area and suspected that the Great Basin spadefoot was present (Table 1). Likewise, all species found in the Hells Canyon Study Area, except Woodhouse's toad, were recorded at the Craig Mountain Wildlife Mitigation Area (Llewellyn and Peterson 1995).

The western toad, long-toed salamander, and Pacific treefrog were the most common and widespread amphibians in the Hells Canyon Study Area (Table 6 and Figure 14). They were found breeding in a variety of wetland habitats, with numbers of larvae ranging from a few to thousands. In contrast, Llewellyn and Peterson (1995) found that the Columbia spotted frog was the most common amphibian species at the Craig Mountain Wildlife Mitigation Area. However, they found the Columbia spotted frog only at high-elevation ponds and not at lower elevations along the Snake and Salmon rivers. The western toad was found at both high- and low-elevation ponds, but it was more common at the low-elevation riverine ponds (Llewellyn and Peterson 1995).

5.2.1. Relative Abundance

The western toad, Pacific treefrog, and long-toed salamander were the only amphibian species that were observed frequently enough during pond surveys or incidentally to be classified as abundant (Table 6). The Great Basin spadefoot was classified as locally common, and the tailed frog as uncommon. All remaining species—the bullfrog, Columbia spotted frog, and Woodhouse's toad—were classified as rare.

Breeding habitat in ponds probably limits amphibian populations in the study area. Because naturally occurring ponds are rare within the study area due to topography, species that can use other breeding habitat are more effective at propagating. Western toads, Pacific treefrogs, and long-toed salamanders can successfully breed in a variety of habitats within the study area; therefore, they are the most common, or abundant, species.

5.2.2. Habitat Associations

The three most common amphibians in the study area—the western toad, long-toed salamander and Pacific treefrog—are species found throughout the Pacific Northwest. They are found in a variety of pond types and ranges of pH and conductivity.

Long-toed salamanders tend to use newly formed, temporary, or recently disturbed pools of water (Corkran and Thoms 1996). In the study area, they were found in seeps, man-made stock ponds, mine drainages, and road ruts. The Pacific treefrog uses shallow, quiet waters for breeding, especially pools with emergent vegetation, but they will lay eggs in almost any small body of water (Nussbaum et al. 1983). We found treefrogs in road ruts, springs, stock ponds, and overflow areas below Oxbow Dam. In montane areas, the western toad breeds in spring pools,

vernal ponds, beaver ponds, and slow-moving portions of streams; in desert regions they may use stock ponds and reservoirs (Nussbaum et al. 1983). Western toads were found from Brownlee Reservoir to the Salmon River. We found them breeding in springs, seeps, stock ponds, shallow and slow-moving portions of Grouse Creek (a tributary to Brownlee Reservoir), overflow ponds on the Wildhorse River, and backwater ponds below Hells Canyon Dam. Llewellyn and Peterson (1995) reported that western toads were the most diverse amphibian breeders in the Craig Mountain Wildlife Mitigation Area, breeding in backwater ponds along the Salmon and Snake rivers, man-made ponds, oxbows, and shallow areas of streams. Likewise, the western toad used the most diverse habitats for breeding of all amphibians in the Hells Canyon Study Area.

5.2.2.1. Western Toad

Backwater ponds are typically created when flood events deposit large amounts of sand and gravel along the river shoreline (Figure 9b). As floodwaters recede and water levels drop throughout the summer, backwater ponds develop in oxbows, behind gravel bars, and in depressions scoured in sand deposits. There are three major backwater pond types within Hells Canyon: gravel bar, oxbows, and scoured sand. All are relatively permanent and appear to provide consistent breeding habitat for toads from year to year. However, these ponds are temporally dynamic. In high-water years, backwater ponds may not be exposed until late in the season as water levels decrease, but in low-water years, ponds at slightly higher elevations may dry up early in the season although additional ponds forming at slightly lower water levels are exposed.

The presence of western toad tadpoles in backwater ponds surveyed below Hells Canyon Dam indicates that western toads breed effectively in relatively permanent backwater ponds. Similarly, western toads also breed in backwater ponds associated with the Salmon River, on the Snake River below the confluence with the Salmon River (Llewellyn and Peterson 1995), and in overflow ponds on tributaries to Oxbow Reservoir (such as the Wildhorse River). Metter (1960) also found breeding western toads along the lower Snake River in Washington; he noted that one adaptation is that the species delays breeding along the Snake River until the high runoff water recedes. Concern has been raised about the impact of flow fluctuations on breeding habitat for the western toad below Hells Canyon Dam (Palmer 1991). A visual comparison of aerial photographs taken before Hells Canyon Dam was constructed, in 1955 and 1964, and photographs taken in 1997 indicated that the size and shape of the backwater ponds were fairly similar (Figures 10–12), but vegetation had encroached at some sites (Figure 10) while other sites had eroded (Figure 11). We found evidence of western toad breeding at 43% (6 of 14) of the ponds surveyed. Toads were present in an additional 14% of ponds (2 of 14). If possible, we checked backwater ponds multiple times to confirm breeding. However, because some ponds were surveyed on only one occasion, the survey may have missed the time for breeding frogs or tadpoles. When they were present at these backwater ponds, breeding toads and tadpoles often numbered in the thousands (Table 3), indicating that the western toad continues to breed successfully below Hells Canyon Dam.

5.2.2.2. Tailed Frog

Stream Surveys—Bull and Carter (1996) surveyed for tailed frogs in the Wallowa–Whitman and Umatilla National Forests in Oregon. They selected permanent streams narrower than 5 m wide, higher than 1,200 m, and characterized by cold water (less than 20 °C). They found tailed frogs in 26 of 37 streams in Wallowa County and 5 of 10 streams in Baker County. Asherin and Claar (1976) did not encounter the tailed frog during surveys along the Snake River and considered the species to have only a slight possibility of occurring in the Hells Canyon Study Area. In 1996, tailed frog tadpoles were found in Dukes Creek, at 1 mile (48 tadpoles) from the mouth, 0.5 mile (18 tadpoles) downstream, and then at the mouth (1 tadpole). Tailed frogs were also found 8.5 miles upstream of the mouth of Brownlee Creek (20 tadpoles). Their presence in Brownlee and Dukes creeks suggest that tailed frogs could occur in suitable streams throughout the study area. However, subsequent searches of streams on Brownlee and Hells Canyon reservoirs in 1996 did not locate tailed frog tadpoles. In 1997 and 1998, streams below Hells Canyon Dam were surveyed and tailed frogs were found in three streams: Deep Creek, Granite Creek, and Sheep Creek.

Except for Brownlee Creek, which has road access, most of the streams were surveyed within a mile of the Snake River. Therefore, even those streams for which tailed frogs were absent at low elevations may have tailed frogs at higher elevations. Because of the road access, Brownlee Creek was surveyed at half-mile intervals until tailed frogs were found approximately 8.5 miles from Brownlee Reservoir. The proximity of tailed frogs to the Snake River may be related to closeness to forest, canopy coverage along the stream, and food availability. In creeks where tailed frogs were found at low elevations, forested habitat generally extended much deeper into the canyon. Except for its presumed positive influence on water temperature, the effects of continuous canopy coverage on tailed frogs is unknown. Regarding food availability, tailed frog larvae feed on diatoms that they scrape from rocks in swift, cold, and relatively high-gradient streams. Extensive algal growth was observed on the rocks in many of the larger streams below Hells Canyon Dam (Beck, pers. obs.). These algae cover the rocks, killing the diatoms and effectively reducing food availability for tailed frog tadpoles. If algae depend on high summer temperatures, they may grow only in lower reaches of the tributaries and thereby exclude tailed frog tadpoles there. Although tailed frog tadpoles were found at the mouth of Dukes Creek and an adult was found on the shoreline of the Snake River at the mouth of Granite Creek, their presence in the lower reaches of these tributaries appears to be the exception rather than the rule.

Predicted Distribution—Tailed frogs require cold, clear mountain streams for breeding (Nussbaum et al. 1983). These streams are characterized by cold temperatures (< 20 °C), high-gradient riffles, small cobble and large boulders, and little fine sediment (Corn and Bury 1989, Diller and Wallace 1999). Streams in the study area generally have high gradients with varying degrees of fine sediment, cobble, and boulders. Using landscape-level GIS analysis, we modeled a predicted distribution for tailed frogs. In our model, we selected perennial streams to exclude the unsuitable intermittent streams in the study area. These many unsuitable streams are often more sparsely vegetated, generally have warmer water temperatures, and have limited to no connectivity to extensive forested habitat. Streams with headwaters in forested habitat higher than 5,000 ft (1,524 m) in elevation were selected because of their connectivity to extensive forested habitat and their lower water temperatures.

The model predicted that tailed frogs would occur in about twice as many tributaries or portions of tributaries in Idaho than in Oregon (19 and 9, respectively). This finding primarily reflects differences in the topography associated with the study area. On the Idaho side, there is a more continuous rise up to the higher elevations in the Seven Devils Mountains, Cuddy Mountain, and Hitt Mountain, resulting in streams with headwaters above 5,000 ft. On the Oregon side, the rim of the study area is much lower, extending up to Big Lookout Mountain and the ridge between the Imnaha River drainage.

Because of several factors not accounted for in the model, the predicted distribution of the tailed frog could be overestimated. Fourth-order streams were included in the model since tailed frog larvae were observed in portions of two streams designated as fourth order. However, we do not know whether these tadpoles were washed downstream by a flooding event or whether they normally inhabit the lower portions of the streams. Diller and Wallace (1999) sampled first- and second-order streams in California, and Bull and Carter (1996) sampled streams narrower than 5 m in northeastern Oregon. Thus, the inclusion of fourth-order streams may lead to an overestimated tailed frog distribution.

Topography was another factor that was not accounted for by the model. A few streams with very steep topography were predicted to contain tailed frogs. Waterfalls are not uncommon in these streams and would preclude the presence of tailed frogs in the lower reaches. Four streams with headwaters located on Big Lookout Mountain in Oregon were predicted to contain tailed frogs. However, no historic records of tailed frogs are available for that area, probably because this mountain is fairly isolated. The nearest records of tailed frogs in Oregon are for the Wallowa Mountains. Therefore, the absence of tailed frogs at one predicted stream, Connor Creek, is probably because the tailed frog is absent from that region. One tailed frog record is available for the Hitt Mountains in Idaho, but the population levels were unknown for this mountain range.

5.2.3. Distribution

Amphibian distribution varies by species within the study area (Figures 13 and 14). As with the reptiles, there appear to be distinct changes in community composition along a north/south gradient. Although the long-toed salamander, Pacific treefrog and western toad occurred projectwide (Figure 14), other species had more limited distribution.

The bullfrog and Great Basin spadefoot toad were only captured or observed in the southern portion of Brownlee Reservoir. Bullfrogs are an adaptable but introduced species. We observed them as far north as RM 323 on Brownlee Reservoir. If they have not done so already, they may colonize the northern portion of the study area. Llewellyn and Peterson (1995) reported a juvenile bullfrog along the Salmon River in the Craig Mountain Wildlife Mitigation Area. Bullfrogs have been reported to prey on leopard frogs (Leonard et al. 1993) and may seriously threaten Idaho's native amphibian species. Great Basin spadefoot toads require sandy areas for hibernation between breeding episodes (Nussbaum et al. 1983). This habitat is limited except in the southern portion of the study area near Farewell Bend.

The Columbia spotted frog was also known from only one location, a site at 2,080 ft (634 m) near Richland, Oregon. The predicted distribution of the Columbia spotted frog includes higher

elevations within a broader study area for relicensing known as the "rim-to-rim" study area (Groves et al. 1997). Our survey effort concentrated on the lower elevations outside optimal spotted frog habitat. Spotted frogs may also be abundant at higher elevations on Oxbow and Hells Canyon reservoirs. Llewellyn and Peterson (1995) found the spotted frog to be the most abundant species at higher elevation ponds but absent from the lower elevation riverine habitat in the Craig Mountain Wildlife Mitigation Area.

The Woodhouse's toad was recorded at two locations on Brownlee Reservoir. Woodhouse's toads are historically known from the southern portion of the study area (Nussbaum et al. 1983, Leonard et al. 1993). However, despite extensive surveys (trapping, incidental observations, and pond surveys), our limited observations suggest that they are not abundant within the study area.

5.3. Comparison of Survey Techniques

A single survey technique cannot adequately be used to sample all amphibian and reptile species in a topographically varied area (Table 11). Each of the survey techniques contributed unique species to the total spectrum of species. Twenty-one species were recorded through incidental observations. Drift fences had the second highest number of species, with 10 reptile and 3 amphibian species captured. Pond surveys provided the principal information on amphibian species, and 7 amphibian and 3 reptile species were observed during these surveys. During walking surveys, 8 reptile and 1 amphibian species were observed. During stream surveys, which were conducted specifically for the tailed frog, only this species was observed.

Incidental observations played an important role in determining species occurrence and distribution within the study area. For example, most observations for the common garter snake, rubber boa, longnose leopard lizard, sagebrush lizard, side-blotched lizard, western fence lizard, Columbia spotted frog, and Woodhouse's toad (Table 11) were incidental. Therefore, most of what we know about their distribution in the study area comes from our incidental observations. In addition, the longnose leopard lizard was thought to have been extirpated from the Farewell Bend area on the Idaho side (Charles R. Peterson, ISU, pers. comm.) until incidental observations in 1997 and walking surveys in 1998 indicated that they were extant. Although no longnose leopard lizards were trapped, their presence was determined through incidental observations.

These findings emphasize the importance of recording all observations and using a variety of techniques to effectively determine species occurrence and distribution within a given area.

5.4. Special Status Species

Twelve species within the study area have special status classification (Table 2). Because this study is the most extensive reptile and amphibian study ever undertaken within the Brownlee, Oxbow, and Hells Canyon reservoir reaches, resulting data greatly enhanced our knowledge of these special status species in the study area. In addition, these data can be used to refine species status designations in Idaho and Oregon.

In 1996, a single larval tiger salamander was found at one location in Baker County. Asherin and Claar (1976) considered this species likely to occur in the Hells Canyon Study Area. However, we did not observe tiger salamanders in the study area. Because the larvae of this species are extensively used for fishing bait, their release at the end of an unsuccessful day of fishing may explain several small isolated populations in Oregon (Corkran and Thoms 1996).

The Woodhouse's toad has been known to occur from historic records in the vicinity of the study area near Weiser, Idaho. The species has also been recorded on the lower Snake River (Nussbaum et al. 1983). During our study, we observed the Woodhouse's toad twice (Figure 13); both observations were on the Oregon side, one near Cobb Rapids and one near Quicksand Creek on Brownlee Reservoir. The Woodhouse's toad may have invaded the Northwest from the East, using the Snake and Columbia rivers as avenues of dispersal (Nussbaum et al. 1983). Despite the extensive surveys, the two observations, which were confined to the southern portion of the study area, indicate that this species is rare in the study area. Because the species prefers riparian habitats, sagebrush flats, and fields, it may find the steep, rocky habitat from Brownlee Dam north unsuitable.

The once common leopard frog has disappeared from areas in Washington (Leonard et al. 1993) and Idaho (Charles R. Peterson, ISU, pers. comm.). This frog is known in Oregon mostly from older records, and recent records have failed to find it in the state (Csuti et al. 1997). Leonard et al. (1993) hypothesizes that leopard frogs in the Columbian National Wildlife Refuge in Washington may have disappeared because of predation by bullfrogs. Bullfrogs are locally abundant in the southern portion of the study area (Brownlee Reservoir around Weiser) where leopard frogs were historically present. Therefore, bullfrogs may have caused a decline in leopard frog populations within the study area. In addition, low population levels may have decreased our ability to detect this species.

The Columbian spotted frog is generally found in moist, upper-elevation environments, including coniferous or mixed forests, grasslands, and sage or sage-juniper brushlands. Breeding occurs in ponds, ephemeral pools, marshes, and stream oxbows, as well as along the margins of lakes and slow-flowing streams with emergent vegetation and very shallow water. The Columbia spotted frog was found at one location within the half-mile corridor study area. Spotted frogs were observed near the confluence of Eagle Creek and the Powder River during several consecutive years. In the spring, snowmelt floods much of the area, and the creek consists of many channels through meadows and forested areas. Llewellyn and Peterson (1995) reported that the Columbia spotted frog is abundant at upper-elevation ponds in the Craig Mountain Wildlife Mitigation Area. And although the spotted frog was predicted to occur at higher elevations adjacent to the Hells Canyon Study Area (Csuti et al. 1997, Groves et al. 1997), we did not survey these higher sites during our study. Populations of spotted frogs have significantly decreased because of loss of riparian habitat and interspecific competition with northern leopard frogs and introduced bullfrogs (Spahr et al. 1991, Marshall et al. 1996).

The western toad was observed breeding throughout the study area and appears to be doing well. Declines noted in other portions of the species range (in Colorado, Wyoming, and southeastern Idaho) do not appear to be happening in the study area. The causes of these declines are not well understood. Possible causes include the chytrid fungus, which has been isolated in populations in Rocky Mountain National Park (USGS 2000), drought, habitat destruction and modification,

pollution and increased levels of ultraviolet radiation (Vertucci and Corn 1996, Corn 1998). However, in the study area, we observed large numbers of larvae and toadlets. Thousands of toadlets were crossing roads near Cuprum, Idaho, and numerous toadlets were observed in uplands near Temperance Creek in September 1996.

The tailed frog, observed at several locations throughout the study area, is likely more common at higher elevations. This species has been classified as sensitive because of a decline in population numbers, primarily caused by timber harvest (Marshall et al. 1996).

The secretive nature of the ringneck snake, often occurring within talus and under rocks and rotten logs (Brown et al. 1995), makes them difficult to capture or find during casual observations. The predicted distribution of the ringneck snake includes the northern portion of the study area below Hells Canyon Dam (Groves et al. 1997). The ringneck snake probably occurs within the study area and could be documented through intense searching in appropriate habitat.

On the other hand, the longnose snake and western ground snake were not expected in the study area because both species have a limited range in the region. Their known and predicted distribution is along the Snake River south of the study area (Nussbaum et al. 1983, Groves et al. 1997). However, these species are difficult to detect, and little is known about their ecology or life history. Therefore, both species were included as possible species in the study area, although neither species was reported.

The desert horned lizard was reported in the Hells Canyon Study Area near Huntington, Oregon, in 1982 and in Payette County near Payette, Idaho, in 1910. The record at Huntington lies at the northern extent of the species range. This species is found in arid regions with sandy flats, alluvial fans, and edges of dunes in sagebrush, salt-desert shrub, or greasewood. Because this uncommon species is easily collected, populations can be depleted by overcollecting (Csuti et al. 1997). During extensive fieldwork, we observed no desert horned lizards in the Hells Canyon Study Area. However, the species has recently been found in the Farewell Bend region (Allan St. John, pers. comm.).

Malheur County, Oregon, has historic records of the Mojave black-collared lizard in the area south of the study area. Therefore, we conducted timed searches in potential habitat in the southern portion of the study area. Sites selected were characterized as dry hillsides with sparse vegetation and rock piles (Groves et al. 1997). However, we found no Mojave black-collared lizards during this search effort or incidental to other surveys.

The sagebrush lizard was historically reported in the vicinity of the study area, and we observed the species at two locations on the Idaho side of Brownlee Reservoir and near Oxbow Dam (Figure 5). The sagebrush lizard is found from sea level to about 5,000 ft (1524 m), in sagebrush habitats, chaparral, juniper woodlands, open coniferous forests, and areas of open ground with some low bushes. This species is the most common lizard of the sagebrush plains of southeastern Oregon and Idaho (Csuti et al. 1997, Groves et al. 1997). And although the predicted distribution of this lizard includes most of the study area from Hells Canyon Dam south (Csuti et al. 1997, Groves et al. 1997), the actual distribution of the sagebrush lizard is unknown. In fact, we rarely observed sagebrush lizards in the study area. The sagebrush lizard and western fence lizard

rarely occur together (Brown et al. 1995). We generally found western fence lizards in areas with a rocky component (Brown et al. 1995) such as the study area from Brownlee Dam north. The sagebrush lizard may occur at slightly higher elevations not surveyed during our study.

6. CONCLUSIONS AND MANAGEMENT RECOMMENDATIONS

6.1. Conclusions

A diverse group of reptiles was present in the Hells Canyon Study Area. This group of 14 recorded reptile species included species found in the sagebrush plains in the southern portion of the study area (such as the longnose leopard lizard, sagebrush lizard, side-blotched lizard, western whiptail, and striped whipsnake), habitat generalists (such as the racer, gopher snake, and western rattlesnake), and riparian species (such as the western terrestrial garter snake and common garter snake). As expected, species common to the sagebrush plains of southern Idaho and southeast Oregon were observed in the southern portion of the study area where suitable habitat is found. The racer, western rattlesnake, western skink, night snake, and gopher snake are habitat generalists that use the desertic habitat in the southern portion of the study area as well as the steep, rocky canyons of the northern portion. The rubber boa is found projectwide, but unlike the other common species, it is associated with higher elevations.

In addition, eight amphibian species were recorded in the Hells Canyon Study Area. The western toad, long-toed salamander, and Pacific treefrog were the most common and widespread amphibians in the study area; they were also found breeding in a variety of wetland habitats (numbers of larvae ranged from a few individuals to thousands). In contrast, the bullfrog and Great Basin spadefoot were only captured or observed in the southern portion of Brownlee Reservoir. If they have not already done so, bullfrogs may colonize the northern portion of the study area. Llewellyn and Peterson (1995) reported a juvenile bullfrog along the Salmon River in the Craig Mountain Wildlife Mitigation Area. Bullfrogs have been reported to prey on leopard frogs (Leonard et al. 1993) and may seriously threaten Idaho's native amphibian species. Tailed frogs were found in five tributaries to the Snake River. We had predicted, based on modeling results, that 28 tributaries to the Snake River, or segments of tributaries (19 in Idaho and 9 in Oregon), could harbor tailed frogs.

6.2. Management Recommendations

The study area consists of large areas of high-quality reptile habitat. All reptile species expected to occur in the study area—except for the ringneck snake and desert horned lizard—were found there. On the other hand, wetland habitat for breeding amphibians is more limited because of the steep topography associated with the study area. These wetlands include springs, seeps, stock ponds, canals, and overflow and backwater ponds associated with streams or the Snake River. Much of the habitat is protected from development and heavy recreational use by the steep, rocky terrain. However, other important habitat such as springs and seeps are vulnerable to disturbance.

Therefore, to maintain and enhance the existence of viable populations of reptile and amphibians, we propose the following five management recommendations:

1) Maintain high spring flows below Hells Canyon Dam to ensure that the backwater ponds, which provide breeding habitat for western toads, are filled. Ponds are formed in oxbows, behind gravel bars, and in depressions scoured in sand as flows drop throughout the summer.
2) Continue to manage for native plant communities and discourage any land-use activities that degrade them.
3) Map all snake dens encountered within the study area. Discourage any land-use activities (such as recreational activities or activities associated with project operations and maintenance) that would impact known den sites.
4) Locate and protect natural springs and seeps.
5) Map the northward progression of bullfrogs within the study area. Alert the public through public information efforts of the impacts to native amphibian species of relocating bullfrogs within and outside the study area.

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8. LITERATURE CITED

Asherin, D. A., and J. J. Claar. 1976. Inventory of riparian habitats and associated wildlife along the Columbia and Snake rivers. Volume IIIA. College of Forestry, Wildlife and Range Sciences, University of Idaho, Moscow, ID. 556 p.

Bartelt, P. E. 1997. Idaho species account: western toad. Idaho Herpetological News 9:8-10.

Beck, J. M. 1997a. Distribution, relative abundance, and movement patterns of three snake species at the C.J. Strike Reservoir in southwestern Idaho. Masters Thesis. Idaho State University, Pocatello, ID.

Beck. J. M. 1997b. Presence and relative abundance of amphibians and reptiles in the C.J. Strike Study Area. In: Technical appendices to the new license application: C.J. Strike Hydroelectric Project. Volume 2. Idaho Power, Boise, ID. Technical Report E.3.2-K. 40 p.

Beck, J. M., and C. R. Peterson. 1996. Night, ground, and longnose snake distribution, abundance, and macrohabitat use in the C.J. Strike area as determined by drift-fence trapping. Idaho Power, Boise, ID. 70 p.

Blair, C., J. Braatne, R. Simons, S. Rood, and B. Wilson. 2001. Effects of constructing and operating the Hells Canyon Complex on wildlife habitat. In: Technical appendices to the new license application for the Hells Canyon Complex. In progress. Idaho Power, Boise, ID. Technical Report E.3.2-44.

Blaustein, A. R., and D. B. Wake. 1990. Declining amphibian populations: a global phenomenon? Trends in Ecology and Evolution 5:203-204.

Bonneville Power Administration (BPA). 1984. Hells Canyon environmental investigation. Prepared by CH2M-Hill, Boise, ID. 300 p.

Brown, H. A., R. B. Bury, D. M. Darda, L. V. Diller, C. R. Peterson, and R. M. Storm. 1995. Reptiles of Washington and Oregon. Seattle Audubon Society, Seattle, WA. 176 p.

Bull, E. L., and B. E. Carter. 1996. Tailed frogs: distribution, ecology, and association with timber harvest in northeastern Oregon. U.S. Department of Agriculture, Forest Service Pacific Northwestern Research Station, Research Paper PNW-RP-497. 11 p.

Bury, R. B., H. W. Campbell, and N. J. Scott. 1980. Role and importance of nongame wildlife. In: N. Scott and W. W. Campbell, editors. Transactions of the North American Wildlife and Natural Resources Conference. p. 197-200.

Bush, J. H., and W. P. Seward. 1992. Geologic field guide to the Columbia River Basalt, northern Idaho and southeastern Washington. Idaho Geographical Survey, University of Idaho, Moscow, ID. Information Circular 49. 35 p.

Campbell, H. W., and S. P. Christman. 1982. Field techniques for herpetofaunal community analysis. In: N. J. Scott, editor. Herpetological communities. U.S. Fish and Wildlife Service Wildlife Research Report 13. Washington D.C. p. 193-200.

Carey, C. 1993. Hypothesis concerning the causes of disappearance of boreal toads from the mountains of Colorado. Conservation Biology 7:355-362.

Corkran, C. C., and C. R. Thoms. 1996. Amphibians of Oregon, Washington and British Columbia. Lone Pine Publishing, Edmonton, Alberta. 176 p.

Corn, P. S. 1994. Straight line drift fences and pitfall traps. In: W. R. Heyer, M. A. Donnelly, R. W. McDiarmid, L. C. Hayek, and M. S. Foster, editors. Measuring and monitoring biological diversity: standard methods for amphibians. Smithsonian Institute Press, Washington, D.C. p. 109-117.

Corn, P. S. 1998. Effects of ultraviolet radiation on boreal toads in Colorado. Ecological Applications 8:18-26.

Corn, P. S., and R. B. Bury. 1989. Logging in western Oregon: responses of headwater habitats and stream amphibians. Forest Ecology and Management 29:39-57.

Csuti, B., A. J. Kimerling, T. A. O'Neil, M. M. Shaughnessy, E. P. Gaines, and M. M. P. Huso. 1997. Atlas of Oregon wildlife: distribution, habitat, and natural history. Oregon State University Press, Corvallis, OR. 492 p.

DeBolt, A. 1992. The ecology of *Celtis reticulata* Torr. (Netleaf hackberry) in Idaho. Masters Thesis. Oregon State University, Corvallis, OR.

Department of Energy (DOE). 1985. Hells Canyon environmental investigation. Final report. DOE, Bonneville Power Administration, Office of Power and Resource Management. DOE/BP-11548-1.

Digital Atlas of Idaho. 2000. <http://imnh.isu.edu/digitalatlas/ida_ecology/ida_splash.htm> Accessed on December 5, 2000.

Diller, L. V., and D. R. Johnson. 1982. Ecology of reptiles in the Snake River Birds of Prey Area. U.S. Department of Interior, Bureau of Land Management, Boise District, Boise, ID. 107 p.

Diller, L. V., and R. L. Wallace. 1981. Additional distribution records and abundance of three species of snakes in southwestern Idaho. Great Basin Naturalist 41:154-157.

Diller, L. V., and R. L. Wallace. 1986. Aspects of the life history and ecology of the desert night snake, *Hypsiglena torquata deserticola*: Colubridae in southwestern Idaho. Southwestern Naturalist 31:55-64.

Diller L. V., and R. L. Wallace. 1999. Distribution and habitat of *Ascaphus truei* in streams on managed, young growth forests in north coastal California. Journal of Herpetology 33:71-79.

Fitzgerald, J. F. 1982. Geology and basalt stratigraphy of the Weiser embayment, west-central Idaho. In: B. Bonnichsen, R. M. Breckinridge, editors. Cenozoic geology of Idaho. Idaho Bureau of Mines and Geology, Moscow, ID. Bulletin 26. p. 103-128.

Franklin, J. F., and C. T. Dyrness. 1988. Natural vegetation of Oregon and Washington. Oregon State University Press, Corvallis, OR. 452 p.

Garrison, G. A., A. J. Bjugstad, D. A. Duncan, M. E. Lewis, and D. R. Smith. 1977. Vegetation and environmental features of forest and range ecosystems. U.S. Department of Agriculture, Forest Service, Washington D.C. Agriculture Handbook No. 475. 68 p.

Gibbons, J. W., D. E. Scott, T. J. Ryan, K. A. Buhlmann, T. D. Tuberville, B. S. Metts, J. L. Greene, T. Mills, Y. Leiden, S. Poppy, and C. T. Winne. 2000. The global decline of reptiles, déjà vu amphibians. BioScience 50:653-666.

Greenburg, C. H., D. G. Neary, and L. D. Harris. 1994. A comparison of herpetofaunal sampling effectiveness of pitfall, single-ended, and double-ended funnel traps used with drift fences. Journal of Herpetology 28:319-324.

Groves, C. R., B. Butterfield, A. Lippincott, B. Csuti, and J. M. Scott. 1997. Atlas of Idaho's wildlife: integrating gap analysis and Natural Heritage information. Idaho Department of Fish and Game, Nongame and Endangered Wildlife Program, Boise, ID. 372 p.

Heyer, W. R., M. A. Donnelly, R. W. McDiarmid, L. C. Hayek, and M. S. Foster. 1994. Measuring and monitoring biological diversity: standard methods for amphibians. Smithsonian Institute Press, Washington, D.C. 364 p.

Hill, M. O. 1979. TWINSPAN: a FORTRAN program for arranging multivariate data in an ordered two-way table by classification of the individuals and attributes. Ecology and Systematics, Cornell University, Ithaca, NY. 90 p.

Holmstead, G. 2001. Vegetation of the Snake River corridor in Hells Canyon—Weiser, Idaho to the Salmon River. In: Technical appendices to the new license application for the Hells Canyon Complex. Idaho Power, Boise, ID. Technical Report E.3.3-1.

Huschle, G. 1975. Analysis of the vegetation along the middle and lower Snake River. Masters Thesis. University of Idaho, Moscow, ID. 268 p.

Idaho Power Company (IPC). 1997. Formal consultation package for relicensing Hells Canyon Hydroelectric Project, FERC. No. 1971. Idaho Power, Boise, ID. 819 p.

Idaho Power Company (IPC). 2000. Detailed final study plans: Terrestrial Section for relicensing the Hells Canyon Complex (FERC No. 1971). Idaho Power, Boise, ID.

Johnson, C. G., and S. A. Simon. 1987. Plant associations of the Wallowa–Snake province, Wallowa–Whitman National Forest. U.S. Department of Agriculture, Forest Service Pacific Northwest Region. R-6 ECOL-TP-225A-86. 272 p.

Jones, K. B. 1986. Amphibians and reptiles. In: A. Y. Cooperrider, R. J. Boyd, and H. R. Stuart, editors. Inventory and monitoring of wildlife habitat. U.S. Department of the Interior, Bureau of Land Management, Service Center, Denver, CO. p. 267-290.

Karns, D. K. 1986. Field herpetology: methods for the study of amphibians and reptiles in Minnesota. James Ford Bell Museum of Natural History, University of Minnesota, MN. Occasional Paper 18:25-88.

Leonard, W. P., H. A. Brown, L. L. C. Jones, K. R. McAllister, and R. M. Storm. 1993. Amphibians of Washington and Oregon. Seattle Audubon Society, Seattle, WA. 168 p.

Llewellyn, R. L., and C. R. Peterson. 1995. Distribution, relative abundance, and habitat associations of amphibians and reptiles on the Craig Mountain Wildlife Mitigation Area. Idaho State University, Pocatello, ID. 59 p.

Marshall, D. B., M. W. Chilcote, and H. Weeks. 1996. Species at risk: sensitive, threatened, and endangered vertebrates of Oregon. Second edition. Oregon Department of Fish and Wildlife, Portland, OR.

Metter, D. E. 1960. The distribution of amphibians in eastern Washington. Masters Thesis. Washington State University, Pullman, WA. 89 p.

Miller, T. B. 1976. Ecology of riparian communities dominated by white alder in western Idaho. Masters Thesis. University of Idaho, Moscow, ID. 154 p.

Miller, T. B., and F. D. Johnson. 1976. Ecology of riparian communities dominated by white alder in western Idaho. In: Proceedings on terrestrial and aquatic vegetation. Eastern Washington State College, Cheney, WA. p. 11-123.

Muller-Dombois, D., and H. Ellenberg. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, New York, NY. 547 p.

Munger, J. C., L. Heberger, D. Logan, W. Peterson, L. Mealy, and M. Cauglin. 1994. A survey of the herpetofauna of Bruneau Resource Area, Boise District, with focus on the spotted frog, *Rana pretiosa*. U.S. Department of the Interior, Bureau of Land Management, Idaho State Office, Boise, ID. Technical Bulletin 94-7. 63 p.

Natural Resources Conservation Service (NRCS). 1995. Draft soil survey for Adams and Washington counties, Idaho. Weiser, ID.

Nussbaum, R. A., E. D. Brodie, and R. S. Strom. 1983. Amphibians of the Pacific Northwest. University of Idaho Press, Moscow, ID. 332 p.

Olson, D. H., W. P. Leonard, and R. B. Bury. 1997. Sampling amphibians in lentic habitats. Society for Northwestern Vertebrate Biology, Olympia, WA. Northwest Fauna No. 4. 134 p.

Palmer, T. 1991. The Snake River window to the West. Island Press, Washington, DC. 322 p.

Peterson, C. H. 1999. Northern Intermountain Herpetological Database. C. H. Peterson, Idaho State University, Pocatello, ID. Accessed on: May, 2001.

Ross, S. H., and C. N. Savage. 1967. Idaho earth science. Idaho Bureau of Mines and Geology, Moscow, ID.

SAS Institute, Inc. 1988. SAS/STAT user's guide. Release 6.03 edition. SAS Institute, Cary, NC. 1,028 p.

Spahr, R., L. Armstrong, D. Atwood, and M. Rath. 1991. Threatened, endangered, and sensitive species of the Intermountain Region. U.S. Department of Agriculture, Forest Service, Fish and Wildlife Management, Intermountain Region, Ogden, UT. 2 p.

Tisdale, E. W. 1979. A preliminary classification of Snake River canyon grasslands in Idaho. Forest, Wildlife, and Range Experiment Station, University of Idaho, Moscow, ID. 8 p.

Tisdale, E. W. 1986. Canyon grasslands and associated shrublands of west central Idaho and adjacent areas. Forest, Wildlife, and Range Experiment Station, University of Idaho, Moscow, ID. Bulletin No. 40. 42 p.

Tisdale, E. W., and M. Hironaka. 1981. The sagebrush-grass region: a review of the ecological literature. Forest, Wildlife, and Range Experiment Station, University of Idaho, Moscow, ID. 31 p.

Tisdale, E. W., M. Hironaka, and M.A. Fosberg. 1969. The sagebrush region in Idaho: a problem in range resource management. Agriculture Experiment Station, University of Idaho, Moscow, ID. Bulletin 512. 12 p.

U.S. Department of Agriculture (USDA). 1990. Final environmental impact statement, land and resource management plan. USDA, Forest Service, Pacific Northwest Region, Wallowa–Whitman National Forest, Baker, OR. 562 p.

U.S. Department of Agriculture (USDA). 1994. Final environmental impact statement: Wild and Scenic Snake River recreation management plan. USDA, Forest Service, Hells Canyon National Recreation Area, Pacific Northwest Region, Wallowa–Whitman National Forest, Baker, OR.

U.S. Department of Interior (USDI). 1979. Snake River Birds of Prey special research report. USDI, Bureau of Land Management, Boise District, Boise, ID. 122 p.

U.S. Department of the Interior (USDI). 1987. Proposed resource management plan and final environmental impact statement: Cascade Resource Area. USDI, Bureau of Land Management, Boise District, Boise, ID.

U.S. Geological Survey (USGS). August 8, 2000. USGS diagnoses causes of many U.S. amphibian die-offs. www.usgs.gov/public/press/public_affairs/press_releases/pr1272m.html. Accessed on: January 30, 2001.

Vertucci, F. A., and P. S. Corn. 1996. Evaluation of episodic acidification and amphibian declines in the Rocky Mountains. Ecological Applications 6: 449-457.

Vitt, L. J., and R. D. Ohmart. 1978. Herpetofauna of the lower Colorado River: Davis Dam to the Mexican border. Proceedings of the Western Foundation of Vertebrate Zoology 2:35-72.

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Table 1. Historic[a] and IPC records of amphibian and reptile species recorded in Idaho, Oregon, and the Hells Canyon Study Area.

Species	Adams, Idaho and Washington Co., Idaho	Baker Co., Oregon	Asherin and Claar (1976)	IPC	
				Idaho	Oregon
Amphibians					
Long-toed salamander *Ambystoma macrodactylum*	+	+	+	+	+
Tiger salamander *Ambystoma tigrinum*	—	+	—	—	—
Western toad *Bufo boreas*	+	+	+	+	+
Woodhouse's toad *Bufo woodhousii*	+	+	+	—	+
Tailed frog *Ascaphus truei*	+	+	—	+	+
Great Basin spadefoot *Spea intermontana*	+	+	S	+	—
Pacific treefrog *Pseudacris regilla*	+	+	+	+	+
Columbia spotted frog *Rana luteiventris*	+	+	—	—	+
Leopard frog *Rana pipiens*	+	+	—	—	—
Bullfrog *Rana catesbeiana*	—	+	+	+	—
Reptiles					
Mojave black-collard lizard *Crotaphytus bicinctores*	—	—	—	—	—
Longnose leopard lizard *Gambelia wislizenii*	+	+	+	+	—
Desert horned lizard *Phrynosoma platyrhinos*	—	+	—	—	—
Sagebrush lizard *Sceloporus graciosus*	+	+	S	+	—
Western fence lizard *Sceloporus occidentalis*	+	+	+	+	+
Side-blotched lizard *Uta stansburiana*	—	—	S	—	+
Western skink *Eumeces siltonianus*	+	+	+	+	+
Western whiptail *Cnemidophorus tigris*	+	+	+	+	+

Table 1. (Cont.)

Species	Adams, Idaho and Washington Co., Idaho	Baker Co., Oregon	Asherin and Claar (1976)	IPC	
				Idaho	Oregon
Reptiles					
Rubber boa *Charina bottae*	+	+	—	+	+
Racer *Coluber constrictor*	+	+	+	+	+
Ringneck snake *Diadophis punctatus*	+	—	—	—	—
Night snake *Hypsiglena torquata*	—	—	S	+	+
Striped whipsnake *Masticophis taeniatus*	—	—	—	+	+
Gopher snake *Pituophis catenifer*	+	+	+	+	+
Longnose snake *Rhinocheilus lecontei*	—	—	—	—	—
Western ground snake *Sonora semiannulata*	—	—	—	—	—
W. terrestrial garter snake *Thamnophis elegans*	+	+	+	+	+
Common garter snake *Thamnophis sirtalis*	+	+	S	+	+
Western rattlesnake *Crotalus viridis*	+	+	+	+	+

[a] Appendices 1-A and 1-B, Northern Intermountain Herpetological Database and Baker County Historic Herptile Data
+ Confirmed species occurrence
— No record
S Suspected to occur

Table 2. Special status reptile and amphibian species that may occur or have been documented to occur (1995–1999, shown in bold) in the Hells Canyon Study Area.

Species	State	State Status[a]	FWS Status[b]	BLM Status[c]
Tiger salamander	Idaho	—	—	—
	Oregon	Undetermined	—	—
Western toad	Idaho	Special Concern	Watch/Species of Concern	Sensitive
	Oregon	Vulnerable	—	—
Woodhouse's toad	Idaho	—	Watch	—
	Oregon	Peripheral	—	—
Leopard frog	Idaho	Special Concern	Species of Concern	Sensitive
	Oregon	Critical	—	—
Columbia spotted frog	Idaho	Special Concern	Candidate	Sensitive
	Oregon	Vulnerable	Watch	—
Tailed frog	Idaho	–	Species of Concern	–
	Oregon	Vulnerable	Species of Consern	–
Mojave black-collared lizard	Idaho	Special Concern	Watch	Sensitive
	Oregon	Vulnerable	—	—
Desert horned lizard	Idaho	—	—	—
	Oregon	Vulnerable	—	—
Sagebrush lizard	Idaho	—	—	—
	Oregon	Vulnerable	Watch	—
Ringneck snake	Idaho	Special Concern	Watch	Sensitive
	Oregon	—	—	—
Western ground snake	Idaho	Special Concern	Watch	Sensitive
	Oregon	Peripheral	—	—
Longnose snake	Idaho	Special Concern	Watch	Sensitive
	Oregon	—	—	—

[a] STATE STATUS

Undetermined status: Species in this category are species for which status is unclear. They may be susceptible to population decline of sufficient magnitude that they could qualify for endangered, threatened, critical, or vulnerable status, but scientific study will be required before judgment can be made.

Vulnerable: Species for which listing as threatened or endangered is not believed to be imminent and can be avoided through continued or expanded use of adequate protective measures and monitoring. In some cases the population is sustainable, and protective measures are being implemented; in others, the population may be declining and improved protective measures are needed to maintain sustainable populations.

Table 2. (Cont.)

Special concern: Species which are either low in numbers, limited in distribution, or have suffered significant habitat loss.

Peripheral or naturally rare: Peripheral species refer to those whose Oregon populations are on the edge of their range. Naturally rare species are those which had low population numbers historically in Oregon because of naturally limiting factors. Maintaining the status quo for the habitats and populations of these species is a minimum requirement. Disjunct populations of several species that occur in Oregon should not be confused with peripheral.

Critical: Species for which listing as threatened or endangered is pending, or those for which listing as threatened or endangered may be appropriate if immediate conservation actions are not taken. Also considered critical are some peripheral species that are at risk throughout their range and some disjunct populations.

[b] FWS STATUS

Species of concern: (Oregon) Former C2 candidates about which additional information is needed to propose them as threatened or endangered under the ESA. These are species that the USFWS is reviewing for consideration as candidates for listing under the ESA.

Candidate: (Oregon) Candidate taxa for which the USFWS have sufficient information to support a proposal to list under the ESA or that are candidates for listing by the ODA or under the OESA.

Species of concern and **Watch**: (Idaho) The USFWS Snake River Basin Field Office, Boise, has designated the species of concern and watch categories based on the following criteria:

> **Species of concern**: Available information supports tracking the status and threats to species because of one or more of the following reasons: negative populations trends have been documented, habitat is declining or threats to the habitat are known, subpopulations or closely related taxa have been documented to be declining, habitat for life phases outside of Idaho are known to be threatened, competition or genetic implications have resulted from introduction/stocking of exotic species, species has been identified as a species of concern by agencies or professional societies, or information is needed on status of threats to the species.
>
> **Watch species**: Species that are stable but with Idaho populations that are on the periphery of the range, Idaho population is disjunct but appears stable, unique habitat or the species is an indicator of a specific habitat type, or the status of the specie is poorly understood.

[c] BLM STATUS

Sensitive: Taxa that are under status review by the USFWS or NMFS, whose numbers are declining so rapidly that federal listing might become necessary, with typically small and widely dispersed populations, or inhabiting ecological refugia or other specialized unique habitats.

Table 3. Wetlands surveyed for amphibians below Hells Canyon Dam during the spring and summer of 1996–1998.

Site Name	UTME	UTMN	Date	State	Species	Breeding Evidence	Wetland Type	Remarks
Backwater Ponds Surveyed[a]								
Battle Creek	525496	5017969	07/97	OR	Western toad	No	Backwater pond isolated from Snake River.	Five male toads observed in pond
Sand Dunes (downriver of Battle Creek)	525555	5018180	07/97	OR	None	No	Backwater pond	No toads seen
Saddle Creek	529490	5026640		OR	None	No	Gravel bar	No formal survey; forms in low water
Sheep Creek	534897	5033470	07/97	ID	None	No	Backwater pond	No toads seen
Across from Pine Bar	534160	5039630	07/97	OR	Western toad	No	Backwater pond	Three adult BUBO seen; no evidence of breeding
Across from Pine Bar			07/98	OR	Western toad	Yes	Backwater pond	Dessicated adult collected; two age classes of tads visible
Upper Dry Gulch	536140	5041060	08/98	OR	None			No formal survey
Temperance Creek	536130	5043900	96-98	OR	Western toad	Yes	Oxbow pond	Adult toads in 1996; eggs and tads 1998
Hominy Creek	537049	5043725	06/98	OR	Western toad	Yes	Backwater pond	One adult and eggs recently deposited
			05/97	OR	None	No		No amphibians seen
Coral Creek	542000	5050100	1998	ID	None	No		No formal survey
Fish Trap Bar	541870	5051120	1998	OR	None	No		
Across from Pittsburg Landing	540350	5053170	07/98	OR	Western toad	Yes	Backwater pond	1000s of tads; adult BUBO collected
Five Pine Rapids toad pond (river mile 202)	531120	5069300	07/98	OR	Western toad	Yes	Backwater pond behind large bar. 100-m long with shallows	1000s of tads and metamorphs
			07/99		Western toad	Yes		
Mouth of Imnaha	518440	5073480	07/98	OR	None	No		
			08/00		Western toad	Yes		1000s of metamorphs
Wetlands Surveyed[b]								
Lamont Springs	524870	5012630	1996		None	No		No formal survey
Warm Springs Seep	525470	5016840						No formal Surveys
Bob Creek Seep	534040	5067050	1997	OR	None	No		
			1998		None	No		

Table 3. (Cont.)

Site Name	UTME	UTMN	Date	State	Species	Breeding Evidence	Wetland Type	Remarks
Wetlands Surveyed[b]								
Sheep Creek	534920	5034860	07/97	ID	Western toad	No	Cabin pond	Adults
Temperance Creek	536400	5042580	09/96	OR	Western toad	Yes	Canal	Toadlets in uplands
East of Pittsburg Landing	543160	5045560	06/96		Long-toed salamander	Yes		Larvae
Between Kirkwood and Pittsburg #1	543250	5045710	06/96		Long-toed salamander	Yes		Larvae
Between Kirkwood and Pittsburg #2	543349	5045723	06/96		Long-toed salamander	Yes		Larvae
Pittsburg Landing	541700	5053490	05/98	ID	Western toad	Yes	Farm Pond	40 adults
Backwater Ponds Not Surveyed[a]								
Pine Bar	535040	5038235		ID				
Across from Pittsburg, Forest Service	540660	5052930		OR				
Deep Creek	526840	5069390		OR				
China Bar	519530	5073780		OR				
Warm Springs	523730	5074000		ID				
Knight Creek	516680	5074800		OR				
Across from Salmon Mouth	515840	5078120		OR				

[a] Backwater ponds identified from 1990 aerial photographs.

[b] Wetlands not directly influenced by the Snake River.

Table 4. Roads driven to survey for reptiles and amphibians, including data on survey dates, and presence or absence of reptiles and amphibian.

Date	Road	Herptiles observed?
4 May 1996	Seid Creek Road	Yes
	Keinschmidt Grade	No
5 May 1996	Seid Creek Road	Yes
7 May 1996	North Fork Pine Creek Road	Yes
	Mill Creek Road	Yes
11 May 1996	Brownlee Creek Road (Hwy 71)	Yes
13 May 1996	Kleinschmidt Grade	No
27 May 1996	North Fork Pine Creek Road	Yes
	Mill Creek Road	
	Brownlee Creek Road	
28 May 1996	Connor Creek Road	Yes
1 June 1996	Eagle Creek Road	No
6 June 1996	North Fork Pine Creek Road	Yes
6 June 1996	Mill Creek Road	Yes
	Hitt Mountain Road	Yes
8 June 1996	Brownlee Creek Road	Yes
15 June 1996	North Fork Pine Creek Road	Yes
27 June 1996	Mill Creek Road	Yes
	North Fork Pine Creek Road	Yes
1 July 1996	Mill Creek Road	Yes
	North Fork Pine Creek Road	Yes
2 July 1996	Mill Creek Road	Yes
	North Fork Pine Creek Road	Yes
3 July 1996	Mill Creek Road	Yes
	North Fork Pine Creek Road	Yes
4 July 1996	Mill Creek Road	Yes
	Forest Service Road 77	Yes
	North Fork Pine Creek Road	Yes
	Mill Creek Road	Yes
	Brownlee Campground Road	Yes
	Middle Fork Brownlee Creek Road	Yes
18 July 1996	Eagle Creek Road	No
21 July 1996	Brownlee Campground Road	Yes

Table 5. Total number of each species (amphibians and reptiles) captured using drift-fences, the percentage of all species captured, and the mean abundance for each species, spring and summer of 1996 and 1997.

Species	Total Captures	Percent of Total	Mean Abundance[a] Brownlee (*N* = 33)[b]	Oxbow (*N* = 16)	HC (*N* = 23)	Combined (*N* = 72)
Amphibians						
Great Basin spadefoot[c]	29	2.1	1.0	0.0	0.0	0.4
Long-toed salamander	14	1.0	0.2	0.1	0.4	0.2
Western toad	3	0.2	0.1	0.1	0.0	< 0.1
Total Amphibian Captures	**46**					
Reptiles						
Gopher snake	270	19.2	5.9A [d]	3.3A	5.8A	5.3
Night snake	40	2.9	0.01C	1.8A	0.1B	0.8
Racer	766	54.6	12.3A	17.3A	19.9A	15.6
Rubber boa	1	0.1	0	0	0.1	< 0.1
W. terrestrial garter snake	7	0.5	0	0	0.4	0.1
Western fence lizard	16	1.1	0	0.7	0.3	0.3
Western rattlesnake	105	7.5	1.7A	0.8A	3.8A	2.1
Western skink	7	0.5	0	0.4	0.1	0.1
Striped whipsnake	6	0.4	0.1	0.1	< 0.1	0.1
Western whiptail	139	9.9	4.8A	0B	0B	2.2
Total Reptile Captures	**1357**		**25.0A**	**24.0A**	**31.4A**	

[a] Mean/100 trap nights
[b] Number of arrays
[c] All captures from one site
[d] Rows followed by the same letter are not different at $P = 0.05$

Table 6. Amphibian and reptile frequency of occurrence (constancy), relative abundance, and distribution within the Hells Canyon Study Area. Frequency of occurrence and distribution were based on total number of sightings, and relative abundance was based on trapping and wetland survey results.

Species	Constancy	Relative Abundance	Distribution
Amphibians			
Bullfrog	Low	Rare	Brownlee
Great Basin spadefoot	Low	Common	Brownlee
Pacific treefrog	Medium	Abundant	projectwide
Long-toed salamander	Medium	Abundant	projectwide
Columbia spotted frog	Low	Rare	unknown
Tailed frog	Low	Uncommon	Oxbow north
Western toad	High	Abundant	projectwide
Woodhouse's toad	Low	Rare	unknown
Reptiles			
Common garter snake	Low	Uncommon	projectwide
Gopher snake	High	Abundant	projectwide
Longnose leopard lizard	Low	Rare	Brownlee
Night snake	Medium	Common	presumed projectwide
Racer	High	Abundant	projectwide
Rubber boa	Medium	Common	projectwide (high elevations)
Northern sagebrush lizard	Low	Rare	unknown
Side-blotched lizard	Low	Rare	unknown
Striped whipsnake	Low	Uncommon	Brownlee to Oxbow
Western terrestrial garter snake	Medium	Uncommon	projectwide
Western fence lizard	High	Common	Oxbow north
Western rattlesnake	High	Abundant	projectwide
Western skink	Low	Uncommon	projectwide
Western whiptail	Medium	Abundant	Brownlee

[a] Frequency of Occurrence: Low: observed at < 20 sites, Medium: observed at 20–50 sites, High: observed at >50 sites.

[b] Relative abundance: Abundant: > 100 individuals, Common: 25–100 individuals, Uncommon: 10–24 individuals, and Rare: < 10 individuals.

Table 7. Results from timed searches conducted by IPC personnel during spring and summer of 1998.

Date	Project	Species	No.	Hours	UTM N	UTM E	Search Type	Temp.	CC
980603	BA	Woodhouse's toad	1	1.0	4900700	489700	Walk	70	1
980603	BR	Western whiptail Side-blotched lizard	1	2.0	4906650	483500	Walk	70	1
980604	BR	Western whiptail Racer	1	1.5	4912100	481500	Walk	70	0
980602	BR	Western whiptail	1	1.5	4900900	488700	Walk	80	1
980506	BR	Longnose leopard lizard	1	1.0	4904700	483300	Walk	70	0
980507	BR	None	0	0.5	4919100	482600	Walk	70	0
980506	BR	None	0	0.5	4900600	487700	Walk	75	0
980506	BR	None	0	0.5	4901900	486100	Walk	72	0
980602	BR	None	0	1.0	4906300	483950	Walk	80	1
980507	BR	Side-blotched lizard	1	0.75	4912100	480900	Walk	70	0

Table 8. Capture rates (number of captures/100 trap nights) in the four habitat associations for the five most common reptile species captured during the spring and summer of 1996 and 1997.

Species	Habitat Type			
	Desertic	Grass	Riparian	Shrub
Gopher snake	3.5A[1]	5.4A[2]	5.0A	5.7A
Night snake	2.0A	0.5B	0B	1.1AB
Racer	14.2A	16.4A	17.1A	15.1A
Western rattlesnake	1.4A	2.8A	2.2A	1.7A
Western whiptail[3]	23.1A	1.2B	0.5B	6.0B
Total	**33.3**	**26.3**	**24.7**	**27.0**

[1] Rows with the same letter are not significantly different at the $P = 0.05$ level.
[2] Captured in *Grass* habitat on all reservoirs except Oxbow Reservoir
[3] Species was only captured along Brownlee Reservoir; capture rates reflect only trapping arrays operated along Brownlee Reservoir.

Table 9. Wetland and pond surveys conducted above Hells Canyon Dam, species observed and chemical characteristics of the ponds (pH and conductivity), 1996–1997.

Site Name	Date	Species	Life Stage	Number	Eggs	pH	Conductivity (µOhm)
084 large pond	18-Jun-97	None				8.5	120
085 Lower Pond	26-Jun-97	Pacific treefrog	Adult	several		8.7	90
Forest Service seep	18-Jun-97	Pacific treefrog	Tadpoles	> 50		9.6	150
Gravel Pit Pond	29-Apr-97	Long-toed salamander	Larvae	hundreds		8.8	740
Grouse Creek site 1	09-May-97	Western toad	Adult		eggs	9.2	320
Grouse Creek site 2	09-May-97	Western toad	Adult		eggs	9.2	320
Grouse Creek site 3	09-May-97	Western toad	Adult		eggs	9.2	330
Laurance Cabin Pond	07-May-97	Western toad	Adult	3		7.6	320
	07-May-97	Pacific treefrog	Adult	5		7.6	320
	07-May-97	Western toad	Tadpoles	hundreds		7.6	320
Laurance Pasture	07-May-97	Common garter snake					
Laurance Pond	07-May-97	Western toad	Tadpoles	hundreds		8.1	430
	07-May-97	Pacific treefrog	Adult	1		8.1	430
Powder River Conservation Easement	14-May-97	Columbia spotted frog	Juvenile	2		8.5	90
Spring Creek Pond	07-May-97	Western toad	Eggs	hundreds	eggs	9.1	170
	07-May-97	Long-toed salamander	Larvae	1	eggs	9.1	170
Stock pond	26-Jun-97	Pacific treefrog	Tadpoles and metamorphs	thousands		8.1	210
	26-Jun-97	W. terrestrial garter snake	Tadpoles and metamorphs	thousands		8.1	210
Ten Mile Seep	29-Apr-97	Western toad	Tadpoles	200	eggs	10.4	320
	27-Jun-97	Bullfrog	Adult	1		10.4	320
Ten Mile Spring	26-May-97	Western toad	Adult	1			
West Weiser Flat Ponds (house pond)	10-Jun-97	Great Basin spadefoot	Tadpoles	hundreds		9.2	650
West Weiser Flat Ponds (pond 1)	10-Jun-97	Bullfrog	Adult			8.4	680
	10-Jun-97	Great Basin spadefoot	Tadpoles	hundreds		8.4	680
West Weiser Flat Ponds (pond 2)	10-Jun-97	Bullfrog	Tadpoles	3		8.6	240

Table 9. (Cont.)

Site Name	Date	Species	Life Stage	Number	Eggs	pH	Conductivity (µOhm)
West Weiser Flat Ponds (pond 3)	10-Jun-97	Bullfrog	Adult	4		8.1	280
Wildhorse Toad Ponds	07-Jul-97	Western toad	Tadpoles	hundreds		9	140
Ballard Creek Pond	08-May-97	Pacific treefrog	Adult	1	eggs	8.2	90
	08-May-97	Long-toed salamander	Larvae		eggs	8.2	90
Ballard Creek Seep	08-May-97	Pacific treefrog	Tadpoles	hundreds		7.6	80
Black Canyon Pond	16-Apr-97	None				8.3	240
Bob Creek Mine	10-Apr-97	Long-toed salamander	Larvae	hundreds	eggs	8.4	310
Confluence of Powder River and Flooded Meadow	14-May-97	None					
Farewell Bend Reservoir	25-Jun-97	Pacific treefrog	Adult	1		10.5	1310
Hunter Creek	15-May-97	Long-toed salamander	Larvae			8.2	160
	15-May-97	Pacific treefrog	Tadpoles			8.2	160
	15-May-97	Racer	Adult	1		8.2	160
Oxbow Powerplant	05-May-97	Pacific treefrog	Adult	1			
Parker Pond	05-May-97	Western toad	Eggs		eggs	8.3	150
	05-May-97	Long-toed salamander	Eggs		eggs	8.3	150
	05-May-97	Pacific treefrog	Eggs		eggs	8.3	150
Road Gulch Pond	25-Jun-97	Pacific treefrog	Adult	several		8.8	1160
	25-Jun-97	Long-toed salamander	Larvae	several		8.8	1160
Seep south of Binford Ranch	05-May-97	Long-toed salamander	Larvae	hundreds		7.8	170
Tunnel Seep	10-May-96	Long-toed salamander	Larvae	3		—	—
2.5 mi. N. Tunnel	15-Apr-96	Long-toed salamander	Larvae	10	Eggs	—	—
Tartar's pond	1-Jul-96	Bullfrog	Adult	1		—	—
	1-Jul-96	Western toad	Adult	200+		—	—
Across from Fox Creek	9-May-96	Pacific treefrog	Adult	1		—	—
Art's Seep	10-May-96	Western toad	Adult	1		—	—
Inlet of Art's Seep	17-May-96	Western toad	Larvae	250+	Eggs	—	—
Fox Creek Pond #4	10-May-96	Western toad	Adult	1		—	—
	15-Apr-96	Western toad	Adult	1		—	—
	10-May-96	Pacific treefrog	Adult	1		—	—

Table 9. (Cont.)

Site Name	Date	Species	Life Stage	Number	Eggs	pH	Conductivity (µOhm)
Fox Creek Pond #3	10-May-96	Western toad	Adult	9		—	—
	15-Apr-96	Pacific treefrog	Adult	1		—	—
Fox Creek Pond #2	10-May-96	Western toad	Adult	3	Eggs	—	—
	15-Apr-96	Western toad	Adult	10		—	—
Fox Creek Pond #1	17-May-96	Western toad	Adult	1		—	—
	13-Apr-96	Western toad	Adult	5		—	—
	15-Apr-96	Pacific treefrog	Adult	1		—	—
Old Hwy Rd	17-Apr-96	Bullfrog	Adult	2		—	—
Quicksand Pond	13-Apr-96	Pacific treefrog	Eggs	20+		—	—
	29-Apr-96	Western toad	Adult	3	Eggs	—	—
	26-Mar-96	Pacific treefrog	Adult	1		—	—
	10-May-96	Western toad	Larvae	500+		—	—
	10-May-96	Pacific treefrog	Adult	2	Eggs	—	—
	21-May-96	Western toad	Larvae	500+		—	—
	21-May-96	Pacific treefrog	Larvae	2		—	—
Oxbow rest area	13-May-96	Long-toed salamander	Larvae	40+		—	—
Brownie Parkers Pond	18-Jul-96	Western toad	Adults	4	Eggs	—	—
Cottonwood Seep	13-May-96	Long-toed salamander	Larvae	40+	Eggs	—	—
Limepoint Seep	28-Mar-96	Long-toed salamander	Larvae	20+		—	—
	4-May-96	Long-toed salamander	Larvae	15		—	—
	4-May-96	Pacific treefrog	Eggs			—	—
	10-May-96	Pacific treefrog	Adult	5		—	—
Hells Canyon Dam Seep	28-Mar-96	Pacific treefrog	Adult	2		—	—
	10-May-96	Pacific treefrog	Adult	4		—	—
	22-May-96	Long-toed salamander	Larvae			—	—
Mamaloose Airstrip	19-Jun-96	Long-toed salamander	Adult	30+	Eggs	—	—
	19-Jun-96	Long-toed salamander	Larvae	150+		—	—
Lightning Creek Reservoir	19-Jun-96	Pacific treefrog	Adult	2		—	—
	19-Jun-96	Tailed frog	Adult	1		—	—

Table 10. Tailed frog stream surveys, presence/absence, and elevation, 1996–1998.

Tributary	Present	Number	Elevation (ft)	Temperature(°C)
Brownlee Reservoir				
Connor Creek	No	—		
Dennett Creek	No	—		
Sturgill Creek	No	—		12–16
Brownlee Creek	Yes	20	4435	12–14
Dukes Creek	Yes	1	2093	14
Dukes Creek	Yes	18	2375	13.6
Dukes Creek	Yes	43	2614	10
Oxbow Reservoir				
Wildhorse River	No	—		
Hells Canyon				
Kinney Creek	No	—		
Below Hells Canyon Dam				
Deep Creek	Yes	2	2640	
Battle Creek	No	—		
Granite Creek	Yes		1800	
Sheep Creek	Yes		1840	
Temperance Creek	No	—		
Kirkwood Creek	No	—		
Cache Creek	No	—		
Birch Creek	No	—		

Table 11. Number of sites with either amphibians or reptiles present, by survey technique.

Species	Drift Fences (1996–1997)	Pond Surveys (1996–1998)	Stream Surveys (1996–1998)	Walking Surveys (1998)	Incidental (1995–1999)	Total
Amphibians						
Long-toed salamander	7	19	0	0	9	35
Western toad	3	34	0	0	35	72
Woodhouse's toad	0	0	0	1	1	2
Tailed frog	0	1[a]	5	0	1	6
Great Basin spadefoot	1	2	0	0	0	3
Pacific treefrog	0	21	0	0	13	34
Bullfrog	0	6	0	0	1	7
Columbia spotted frog	0	1	0	0	1	2
Reptiles						
Longnose leopard lizard	0	0	0	1	3	4
Sagebrush lizard	0	0	0	0	2	2
Western fence lizard	9	0	0	1	49	58
Side-blotched lizard	0	0	0	1	3	4
Western skink	4	0	0	1	9	14
Western whiptail	10	0	0	3	15	28
Rubber boa	1	0	0	0	36	37
Racer	72	1	0	2	94	169
Night snake	19	0	0	0	3	22
Striped whipsnake	5	0	0	0	4	9
Gopher snake	64	0	0	1	103	167
W. terrestrial garter snake	6	1	0	0	20	27
Common garter snake	0	1	0	0	11	12
Western rattlesnake	34	0	0	1	81	116
Total number of species	**13**	**10**	**1**	**5**	**21**	**22**

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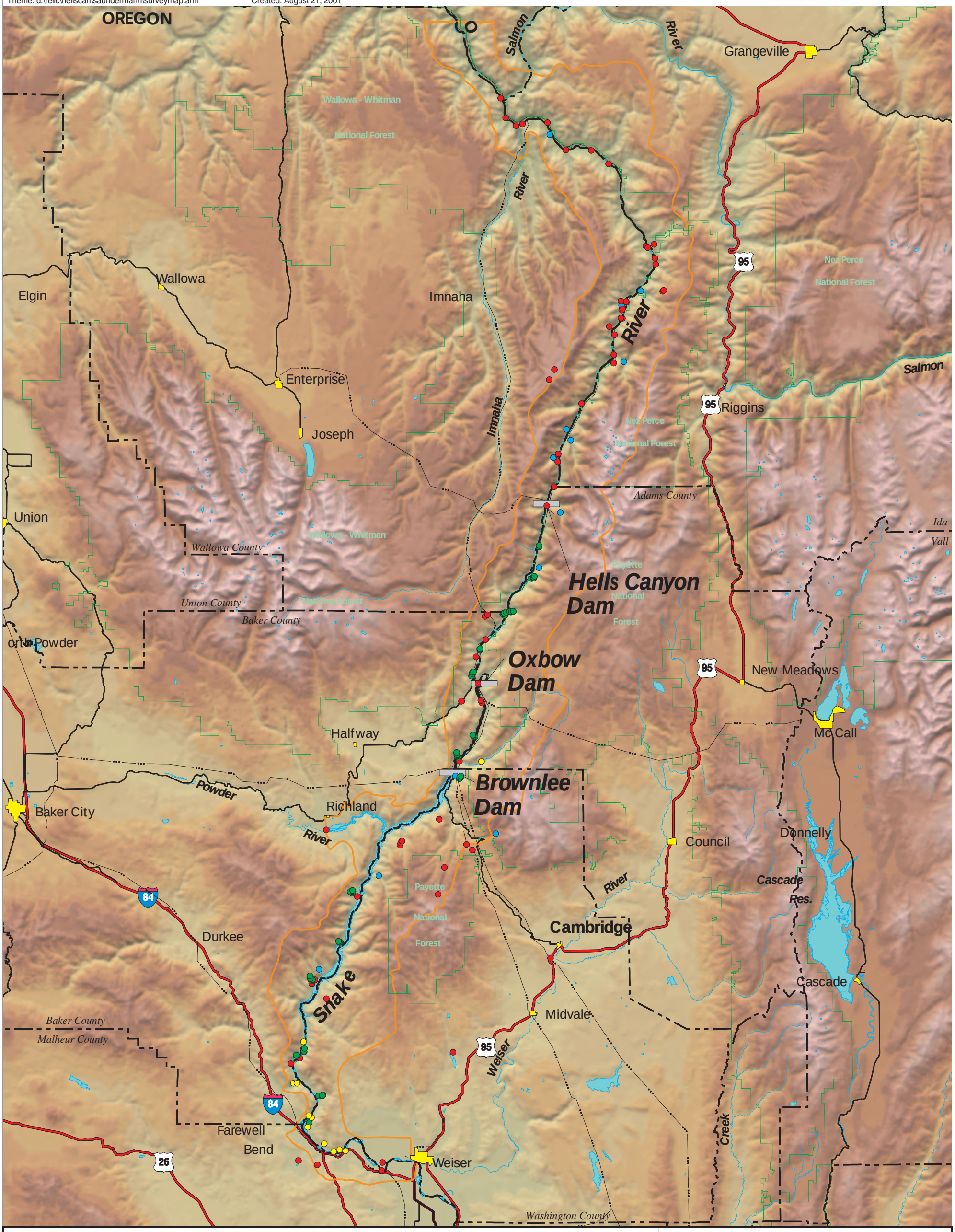

Vicinity Map

IDAHO POWER
An IDACORP Company

Features Legend

- Primary Route
- Secondary Route
- Transmission Lines
- County Boundary
- U.S. National Forest Service
- Rim –to –Rim Study Area
- Stream Survey
- Wetland Survey
- Trapping Array
- Walking Survey

N

Tech. Report E3.2–36 FIGURE 1
HELLS CANYON HYDROELECTRIC COMPLEX

Location of the Hells Canyon Study Area and Amphibian and Reptile Survey Points

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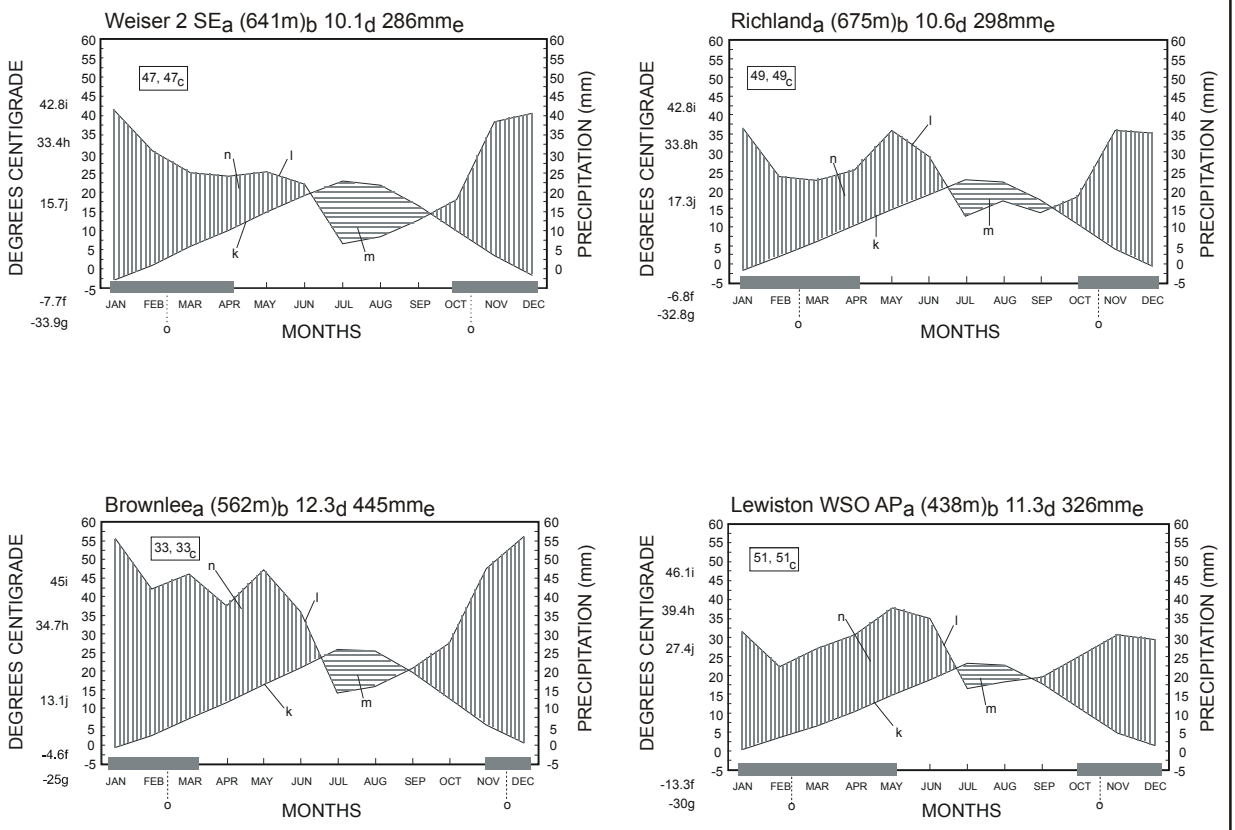

a: Station
b: Elevation
c: Number of years of observation (temperature, precipitation)
d: Mean annual temperature in °C
e: Mean annual precipitation in millimeters
f: Mean daily minimum of the coldest month
g: Lowest recorded temperature
h: Mean daily maximum of the hottest month
i: Highest recorded temperature
j: Mean daily temperature range
k: Monthly means of temperature in °C
l: Monthly means of precipitation in millimeters
m: Arid period (horizontal hatched)
n: Humid period (vertical hatched)
o: Months with an absolute minimum below 0 °C

Figure 2. Köppen climate diagrams for the Weiser, Richland, Brownlee, and Lewiston weather stations, Hells Canyon Study Area, Idaho–Oregon border.

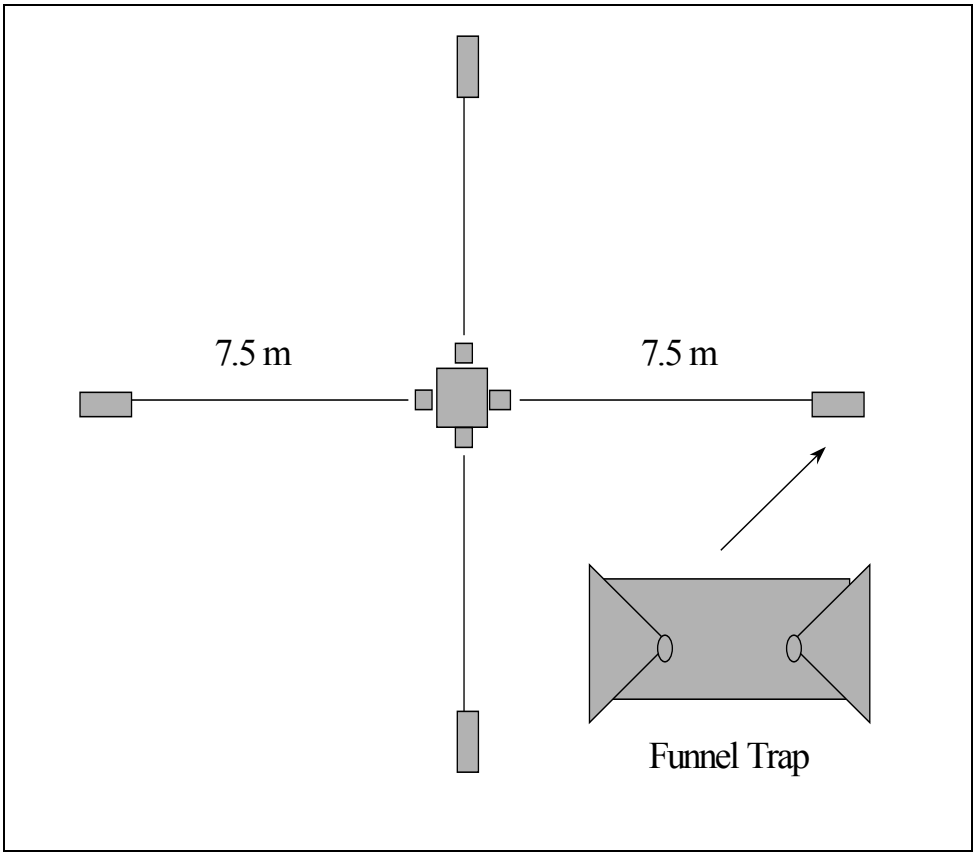

Figure 3. Drift-fence trapping array layout, Hells Canyon Study Area.

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Created: January 15, 2003

Wallowa
Enterprise
Joseph
Imnaha
Birch Creek
Kirkwood Creek
Temperance Creek
River
Sheep Creek
95
Riggins
Cache Creek
Granite Creek
Battle Creek
Adams County
Deep Creek
Wallowa County
Kinney Creek
Union County
Baker County
Hells Canyon Dam
Oxbow Dam
New Meadows
McCall
Halfway
Wildhorse River
Brownlee Dam
Dukes Creek
Richland
Brownlee Creek
Council
84
Sturgill Creek
Cambridge
Durkee
Connor Creek
Dennett Creek
Snake

Vicinity Map

Features Legend

- Primary Route
- Secondary Route
- Perennial Stream
- Intermittent Stream
- Transmission Lines
- County Boundary
- Predicted Tailed Frog Habitat
- Rim-to-Rim Study Area
- Forest Lands
- Cities
- Tailed Frog Presence
- Tailed Frog Absence

N

Tech. Report E.3.2-36 Figure 4
HELLS CANYON STUDY AREA

Predicted distribution of the tailed frog within the Hells Canyon Study Area

IDAHO POWER COMPANY
BOISE, IDAHO

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IDAHO POWER
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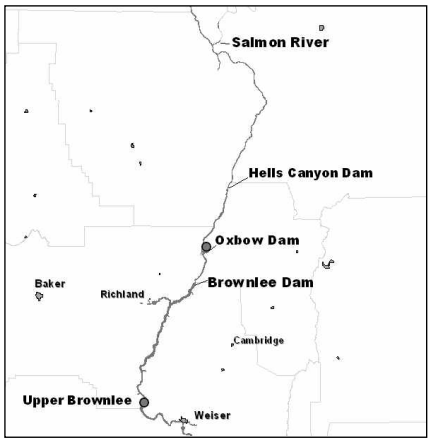
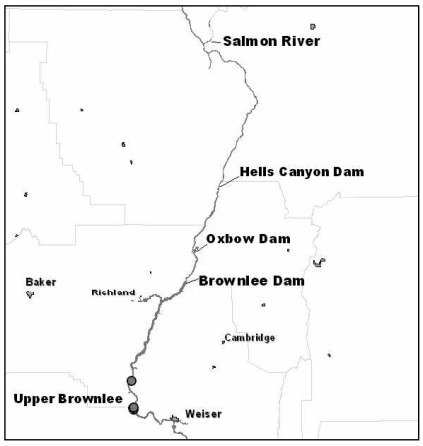
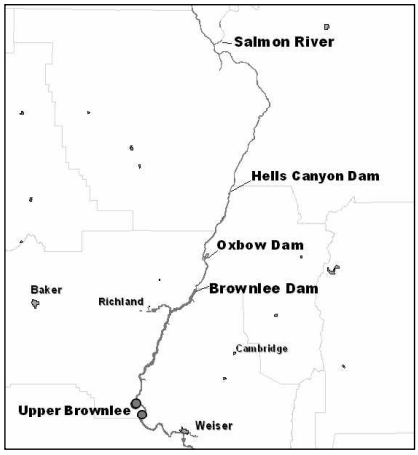


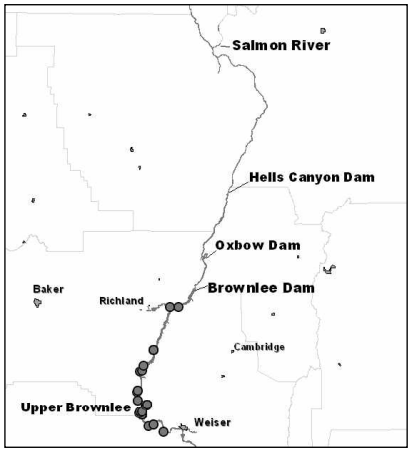
a) Sagebrush lizard



b) Longnose leopard lizard

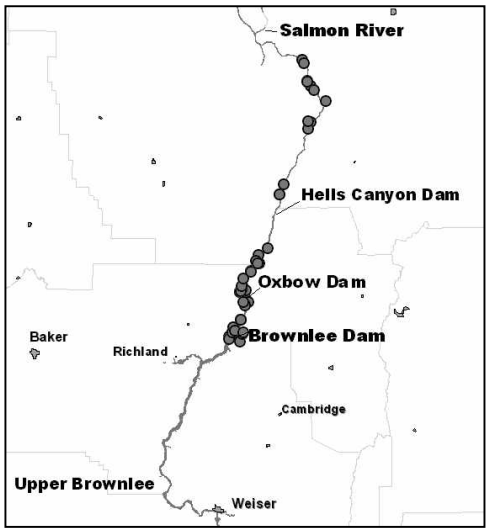


c) Side-blotched lizard

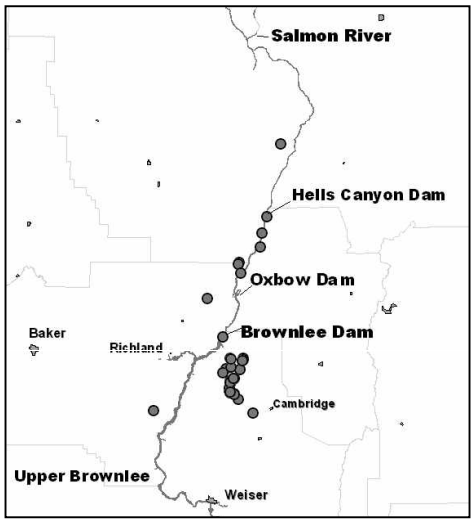


d) Western whiptail

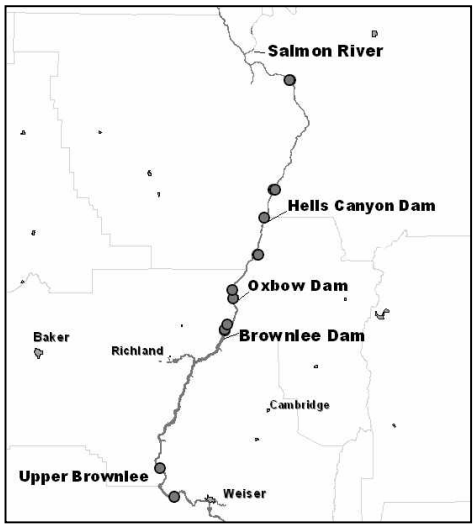
Figure 5. Reptile distribution in the Hells Canyon Study Area, 1995–1999, for a) sagebrush lizard, b) longnose leopard lizard, c) side-blotched lizard, and d) western whiptail.



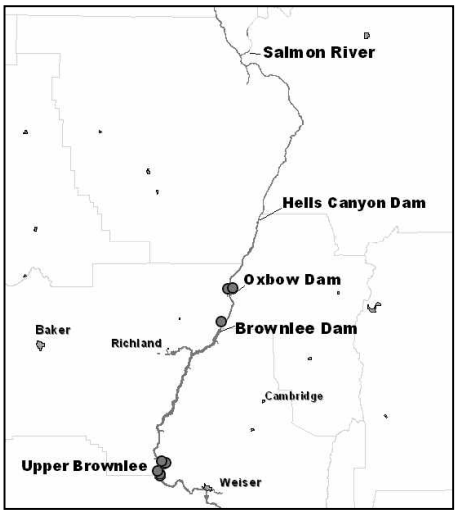
a) Western fence lizard



b) Rubber boa



c) Western skink



d) Striped whipsnake

Figure 6. Reptile distribution in the Hells Canyon Study Area, 1995–1999, for a) western fence lizard, b) rubber boa, c) western skink, and d) striped whipsnake.

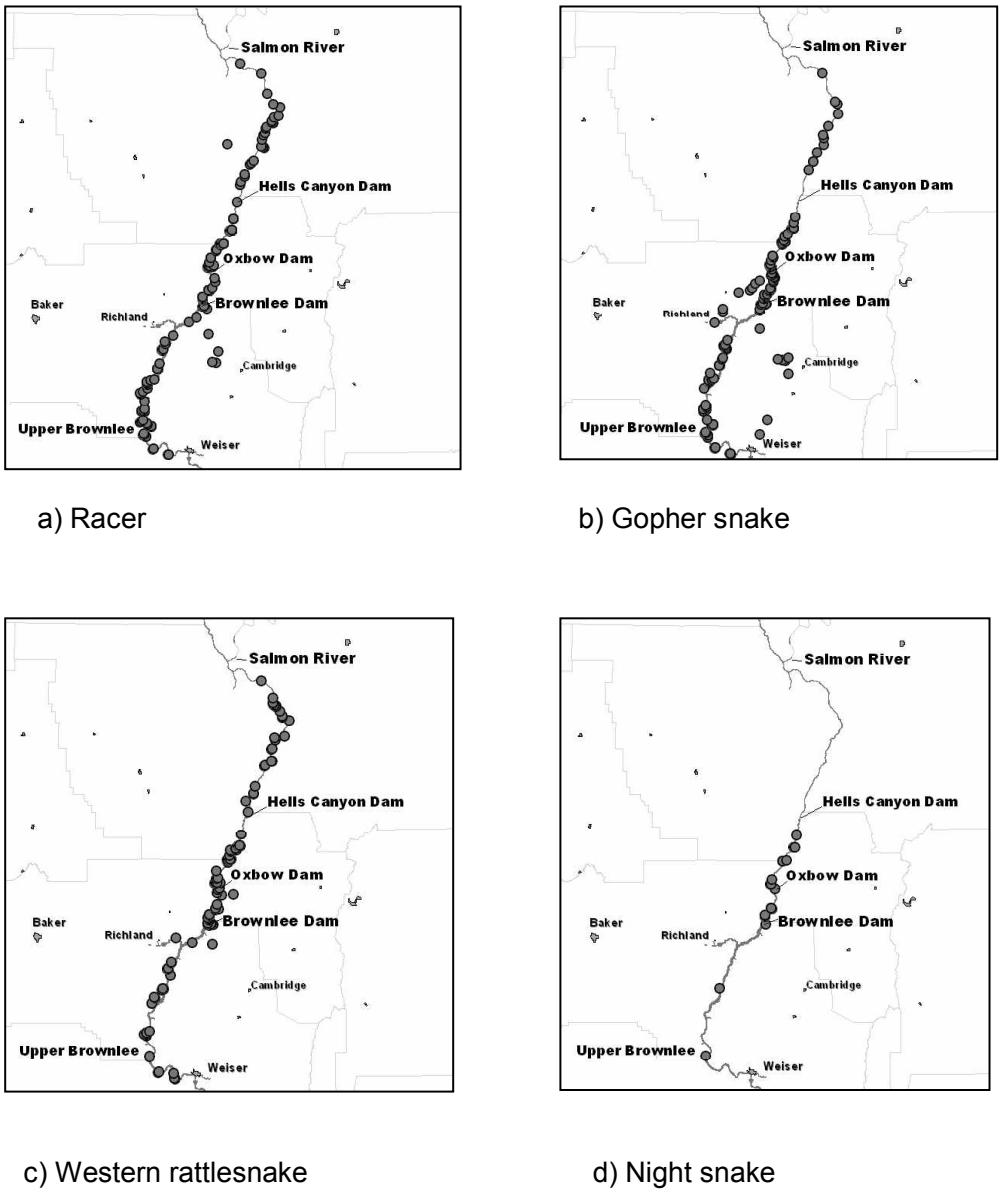


Figure 7. Reptile distribution a) racer, b) gopher snake, c) western rattlesnake, and d) night snake, in the Hells Canyon Study Area, 1995–1999.

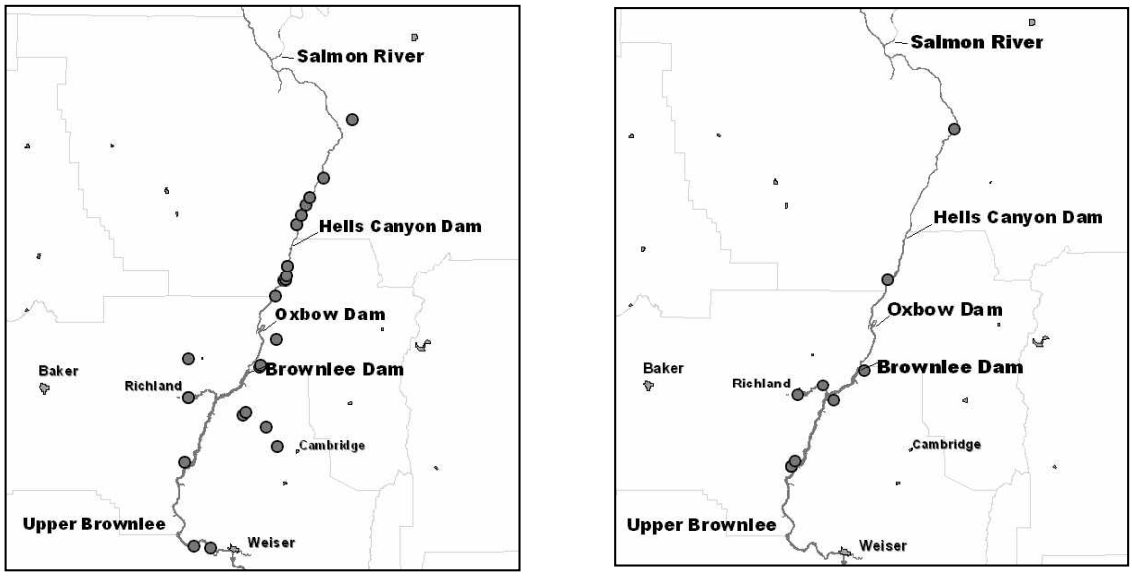


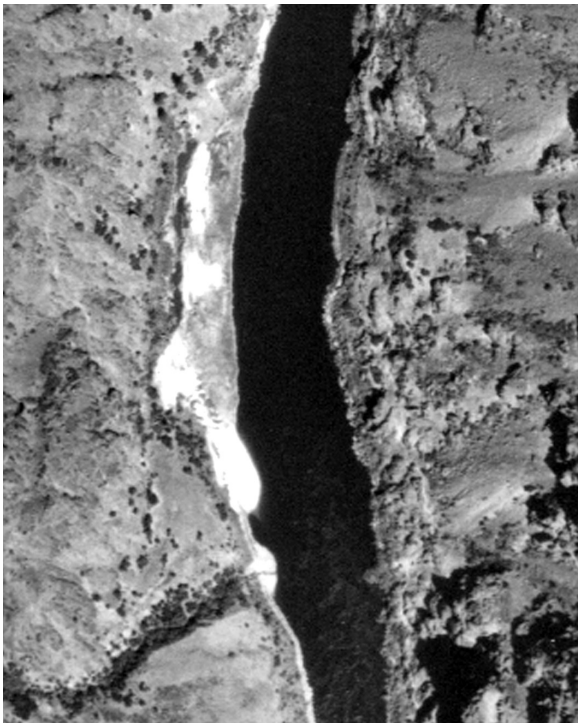
Figure 8. Reptile distribution a) western terrestrial garter snake, and b) common garter snake, in the Hells Canyon Study Area, 1995–1999.

a)

b)

Figure 9. Backwater pond located at Five Pine Rapids: a) 1997 aerial photograph and b) 1998 photograph of backwater pond.

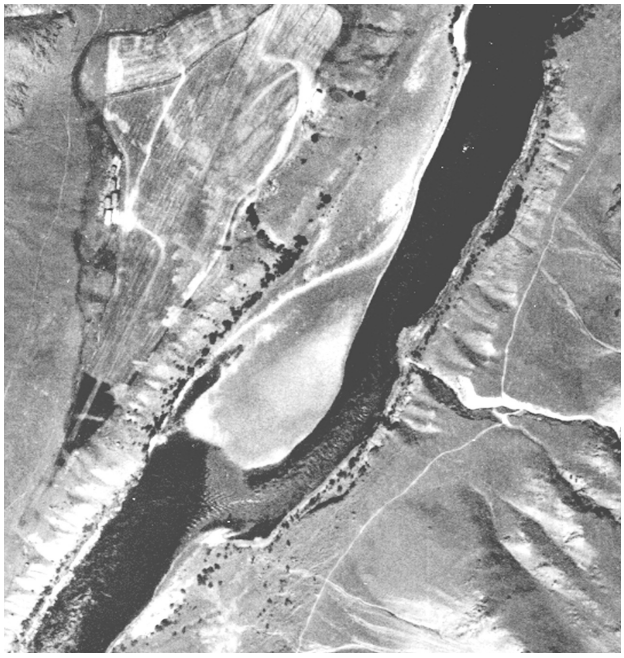
a)



b)

Figure 10. Aerial photographs taken at Battle Creek: a) 1964 and b) 1997.

a)



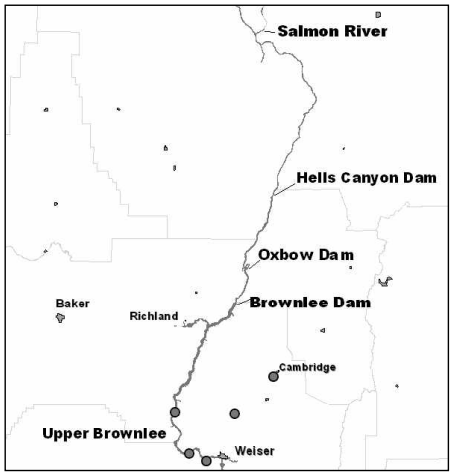
b)

Figure 11. Aerial photographs taken upstream of Temperance Creek: a) 1964 and b) 1997.

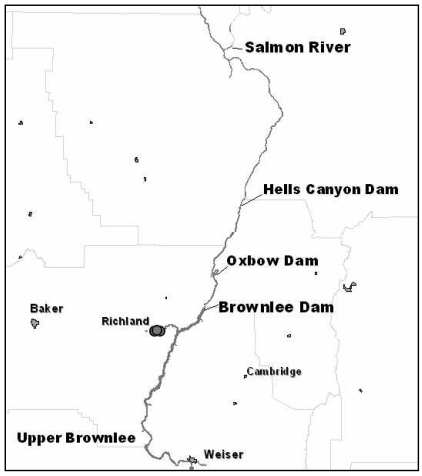
a)

b)

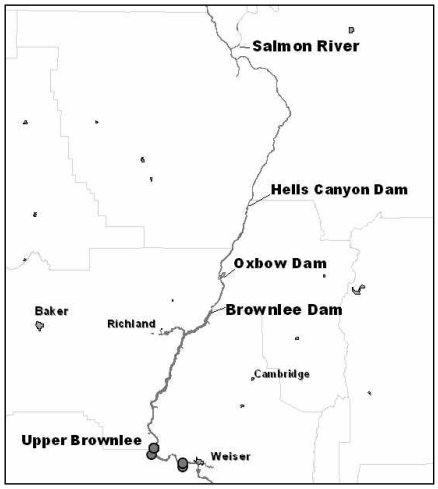
Figure 12. Aerial photographs taken at Temperance Creek: a) 1964 and b) 1997.



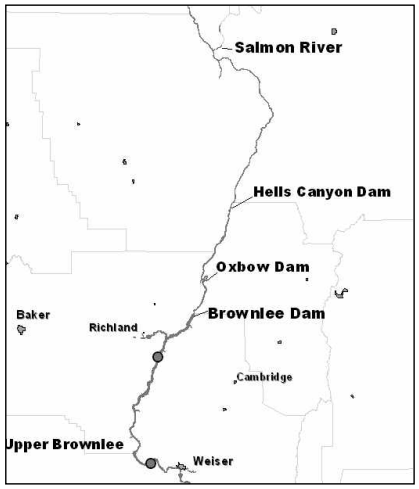
a) Bullfrog



b) Columbia spotted frog

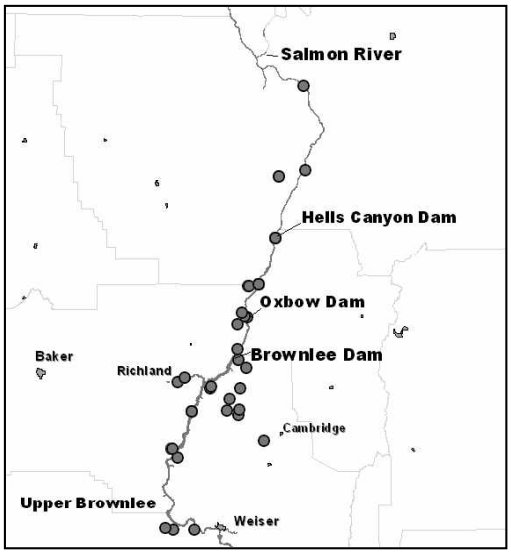


c) Great Basin spadefoot

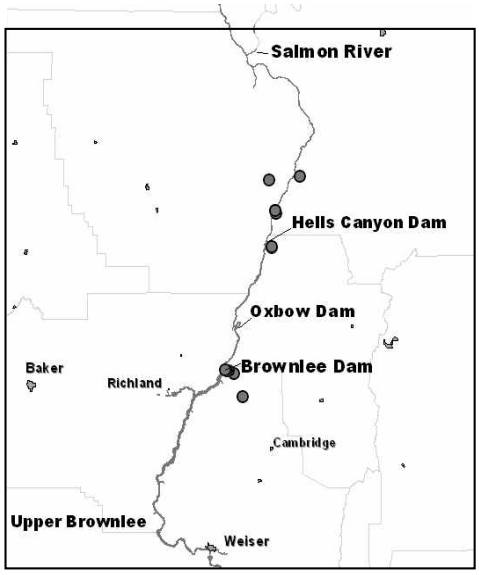


d) Woodhouse's toad

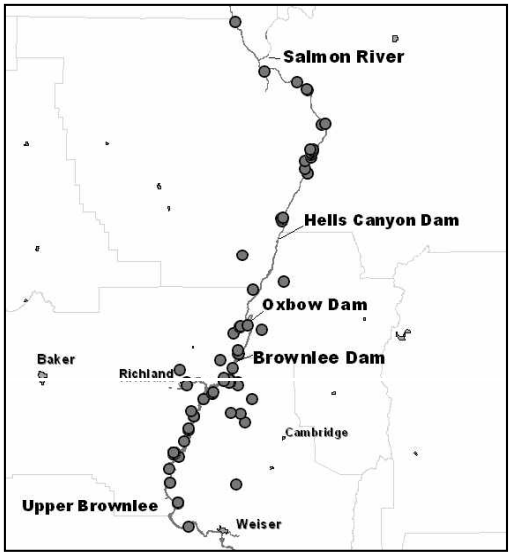
Figure 13. Amphibian distribution in the Hells Canyon Study Area, 1995–1999, for a) bullfrog, b) Columbia spotted frog, c) Great Basin spadefoot, and d) Woodhouse's toad.



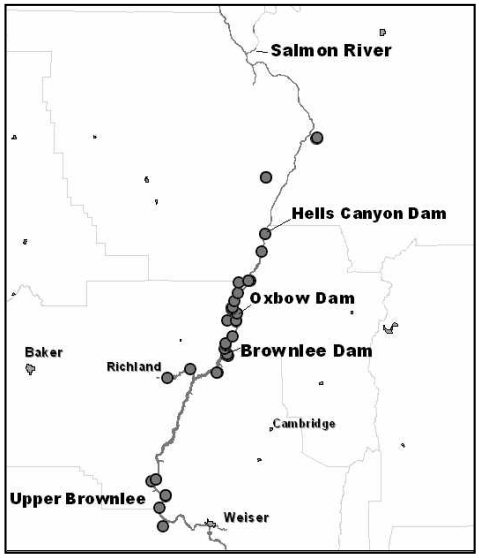
a) Pacific treefrog



b) Tailed frog



c) Western toad



d) Long-toed salamander

Figure 14. Amphibian distribution in the Hells Canyon Study Area, 1995–1999, for a) Pacific treefrog, b) tailed frog, c) western toad, and d) long-toed salamander.

Appendix 1-A. Reptile and amphibian localities for the Idaho portion of Hells Canyon from the Northern Intermountain Herpetological Database, accessed 1998.

MUSEUM	CAT	GENUS	SPECIES	COUNTY	LOCALITY	EASTING_M	NORTHING_M	ELEV	YEAR	COLLECTOR
MVZ	12358	*Thamnophis*	*elegans*	Washington	1 mi. NE Heath; SW slope Cuddy Mtn.	517080	4957222	2300	1930	A.E. Borell
MVZ	12364	*Crotalus*	*viridis*	Washington	1 mi. NE Heath; SW slope Cuddy Mtn.	517080	4957222	2300	1930	R.M. Gilmore
MVZ	12350	*Coluber*	*constrictor*	Washington	1 mi. NE Heath; SW slope Cuddy Mtn.	517080	4957222	2300	1930	R.M. Gilmore
MVZ	12351	*Coluber*	*constrictor*	Washington	1 mi. NE Heath; SW slope Cuddy Mtn.	517080	4957222	2300	1930	R.M. Gilmore
MVZ	12357	*Thamnophis*	*elegans*	Washington	1 mi. NE Heath; SW slope Cuddy Mtn.	517080	4957222	2300	1930	A.E. Borell
MVZ	15231	*Ascaphus*	*truei*	Washington	SW slope Cuddy Mtn.	517098	4956912	2250	1932	R.T. Orr
MVZ	12336	*Ascaphus*	*truei*	Washington	1 mi. NE Heath; SW slope Cuddy Mtn.	517098	4956912	2250	1930	R.M. Gilmore
MVZ	12344	*Ascaphus*	*truei*	Washington	1 mi. NE Heath; SW slope Cuddy Mtn.	517098	4956912	2250	1930	A.E. Borell
UIM	408	*Bufo*	*woodhousei*	Washington	11 mi. ENE of Weiser	517136	4903794	580	1986	P. Dumas
UIM	267	*Rana*	*pipiens*	Washington	8 mi. W of Weiser, Weiser River	517165	4898027	710	1958	P. Dumas
UIM	27	*Eumeces*	*skiltonianus*	Washington	3 mi. SW of Midvale	518505	4921845	790	1954	P. Dumas
UIM	200	*Rana*	*pipiens*	Washington	14 mi. E of Weiser, mouth of Bear Creek	518687	4901471	670	1964	P. Dumas
UIM	409	*Rana*	*pipiens*	Washington	11 mi. E of Weiser	522004	4899199	720	1958	P. Dumas
CAS	11350	*Ascaphus*	*truei*	Adams	Yountly Gulch Creek, 2.5 mi SSW of Cuprum	522625	4990035	1300	1984	W.C. Brown
UIM	60	*Sceloporus*	*occidentalis*	Washington	12 mi. E of Weiser, Cove Creek	523775	4899195	780	1955	P. Dumas
LACM	21007	*Pituophis*	*catenifer*	Washington	3.9 mi. S of Cambridge, Hwy 95	524696	4929972	850	1954	B. Brattstrom
UIM	208	*Pituophis*	*catenifer*	Washington	13 mi. E of Weiser	525208	4899065	1130	1955	P. Dumas
AC	110	*Pseudacris*	*regilla*	Washington	Cambridge. Weiser River.	525703	4934545	850	1965	Bridwell
UIM	324	*Sceloporus*	*occidentalis*	Washington	6 mi. N of Cambridge	525832	4944824	1050	1981	C. Atteberry
AC	133	*Thamnophis*	*elegans*	Idaho	Near Cambridge, Weiser River	525837	4935292	850	1965	Birdwell
AC	85	*Bufo*	*boreas*	Washington	Cambridge	525837	4935292	850	1964	Bridwell
UIM	308	*Crotalus*	*viridis*	none	Barnard Creek, Hells Canyon	530790	5027113	500	1980	J. Bender
MVZ	12331	*Bufo*	*boreas*	Adams	1 mi. N Bear R.S.; SW slope Smith Mtn.	532769	4997561	2000	1930	R.M. Gilmore
MVZ	12330	*Bufo*	*boreas*	Adams	1 mi. N Bear R.S.; SW slope Smith Mtn.	532769	4997561	2000	1930	R.M. Gilmore
MVZ	12329	*Bufo*	*boreas*	Adams	1 mi. N Bear R.S.; SW slope Smith Mtn.	532769	4997561	2000	1930	R.M. Gilmore
MVZ	12332	*Bufo*	*boreas*	Adams	1 mi. N Bear R.S.; SW slope Smith Mtn.	532769	4997561	2000	1930	R.M. Gilmore

Appendix 1-A. (Cont.)

MUSEUM	CAT	GENUS	SPECIES	COUNTY	LOCALITY	EASTING_M	NORTHING_M	ELEV	YEAR	COLLECTOR
MVZ	12326	*Bufo*	*boreas*	Adams	1 mi. N Bear R.S.; SW slope Smith Mtn.	532769	4997561	2000	1930	A.E. Borell
MVZ	12328	*Bufo*	*boreas*	Adams	1 mi. N Bear R.S.; SW slope Smith Mtn.	532769	4997561	2000	1930	A.E. Borell
MVZ	12327	*Bufo*	*boreas*	Adams	1 mi. N Bear R.S.; SW slope Smith Mtn.	532769	4997561	2000	1930	A.E. Borell
MVZ	12361	*Thamnophis*	*elegans*	Adams	10 mi. N Bear R.S.; SW slope Smith Mtn.	532769	4997561	2000	1930	R.M. Gilmore
MVZ	12277	*Charina*	*bottae*	Adams	1 mi. N Bear Ranger Sta.; S.W. slope Smith Mtn.	532769	4997561	2000	1930	R.M. Gilmore
MVZ	12333	*Bufo*	*boreas*	Adams	Summit Smith Mtn.	533179	4997760	2440	1930	R.M. Gilmore
MVZ	12337	*Ascaphus*	*truei*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	R.M. Gilmore
MVZ	12338	*Ascaphus*	*truei*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	R.M. Gilmore
MVZ	12339	*Ascaphus*	*truei*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	R.M. Gilmore
MVZ	12335	*Bufo*	*boreas*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	R.M. Gilmore
MVZ	12334	*Bufo*	*boreas*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	R.M. Gilmore
MVZ	12343	*Ascaphus*	*truei*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	R.M. Gilmore
MVZ	12345	*Ascaphus*	*truei*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	A.E. Borell
MVZ	12340	*Ascaphus*	*truei*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	R.M. Gilmore
MVZ	12341	*Ascaphus*	*truei*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	R.M. Gilmore
MVZ	12342	*Ascaphus*	*truei*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	R.M. Gilmore
MVZ	12362	*Thamnophis*	*elegans*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	R.M. Gilmore
MVZ	12359	*Thamnophis*	*elegans*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	A.E. Borell
MVZ	12363	*Thamnophis*	*elegans*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	R.M. Gilmore
MVZ	12278	*Charina*	*bottae*	Adams	0.5 mi. E of Black Lake	535413	5003732	2500	1930	A.E. Borell
UIM	222	*Coluber*	*constrictor*	Washington	22 mi. E of Weiser, Crane Creek	536581	4899230	1060	1955	P. Dumas
CM	39830	*Ambystoma*	*macrodactylum*	Idaho	Seven Devils Lake	537869	5021120	2050	1955	J.R.
CM	39831	*Ambystoma*	*macrodactylum*	Idaho	Seven Devils Lake	537869	5021120	2050	1955	J.R.
UIM	207	*Pituophis*	*catenifer*	Washington	7 mi. N of Olds Ferry	482875	4916127	1100	1955	P. Dumas
UIM	115	*Gambelia*	*wislizenii*	Washington	Olds Ferry	483207	4903964	1100	1955	P. Dumas
CAS	916	*Rana*	*pipiens*	Washington	mouth of Weiser River, Weiser	502348	4898189	610	1894	Gilbert et al.
CAS	917	*Rana*	*pipiens*	Washington	mouth of Weiser River, Weiser	502348	4898189	610	1894	Gilbert et al.

Appendix 1-A. (Cont.)

MUSEUM	CAT	GENUS	SPECIES	COUNTY	LOCALITY	EASTING_M	NORTHING_M	ELEV	YEAR	COLLECTOR
CAS	918	*Rana*	*pipiens*	Washington	mouth of Weiser River, Weiser	502348	4898189	610	1894	Gilbert et al.
CAS	919	*Rana*	*pipiens*	Washington	mouth of Weiser River, Weiser	502348	4898189	610	1894	Gilbert et al.
CAS	920	*Rana*	*pipiens*	Washington	mouth of Weiser River, Weiser	502348	4898189	610	1894	Gilbert et al.
CAS	921	*Rana*	*pipiens*	Washington	mouth of Weiser River, Weiser	502348	4898189	610	1894	Gilbert et al.
CAS	926	*Rana*	*pipiens*	Washington	mouth of Weiser River, Weiser	502348	4898189	610	1894	Gilbert et al.
CAS	927	*Rana*	*pipiens*	Washington	mouth of Weiser River, Weiser	502348	4898189	610	1894	Gilbert et al.
CAS	928	*Rana*	*pipiens*	Washington	mouth of Weiser River, Weiser	502348	4898189	610	1894	Gilbert et al.
CAS	1686	*Thamnophis*	*sirtalis*	Washington	Weiser	502821	4899261	620	1894	M. Gelliert party
CAS	1687	*Thamnophis*	*sirtalis*	Washington	Weiser	502821	4899261	620	1894	M. Gelliert party
CAS	1688	*Thamnophis*	*sirtalis*	Washington	Weiser	502821	4899261	620	1894	M. Gelliert party
CAS	2108	*Gambelia*	*wislizenii*	Washington	Weiser	502821	4899261	620	1894	G.H. Gilbert
CAS	2109	*Gambelia*	*wislizenii*	Washington	Weiser	502821	4899261	620	1894	G.H. Gilbert
CAS	2110	*Sceloporus*	*graciosus*	Washington	Weiser	502821	4899261	620	1894	C.H. Gilbert
USNM	45231	*Phrynosoma*	*platyrhinos*	Payette	Payette	506206	4880008	720	1910	L.G. Jewett
USNM	45232	*Phrynosoma*	*platyrhinos*	Payette	Payette	506206	4880008	720	1910	L.G. Jewett
USNM	45233	*Cnemidophorus*	*tigris*	Payette	Payette	506206	4880008	720	1910	S.G. Jewett
USNM	44538	*Thamnophis*	*sirtalis*	Payette	Payette	506206	4880008	720	1910	Not Verified
UIM	545	*Bufo*	*boreas*	Washington	Brownlee Reservoir, dock near dam	508028	4964417	600	1954	Atteberry
UIM	413	*Pseudacris*	*regilla*	Washington	3 mi. E of Weiser	508656	4899442	820	1956	P. Dumas
UIM	594	*Pseudacris*	*regilla*	Washington	T13N, R4W, Sec. 31, Mann Creek Quad	510895	4918335	1000	1955	J. Marks
UIM	117	*Gambelia*	*wislizenii*	Washington	5 mi. E of Weiser	511844	4899140	800	1954	P. Dumas
USNM	161047	*Ascaphus*	*truei*	Washington	Brownlee Creek	512279	4952903	1250	1965	Not Verified
USNM	161049	*Ascaphus*	*truei*	Washington	Brownlee Creek	512279	4952903	1250	1965	Not Verified
USNM	161052	*Ascaphus*	*truei*	Washington	Brownlee Creek	512279	4952903	1250	1965	Not Verified
USNM	161053	*Ascaphus*	*truei*	Washington	Brownlee Creek	512279	4952903	1250	1965	Not Verified
MVZ	21242	*Pituophis*	*catenifer*	Washington	Weiser D.O.R. on U.S. Hwy 95 about 12 mi. N of town	512399	4917973	1000	1936	F.H. Test
UTEP	8451	*Crotalus*	*viridis*	Washington	8.3 mi. W of Cambridge	513416	4937998	1230	1959	G.F. Toland & K. Armstrong

Appendix 1-A. (Cont.)

MUSEUM	CAT	GENUS	SPECIES	COUNTY	LOCALITY	EASTING_M	NORTHING_M	ELEV	YEAR	COLLECTOR
AC	139	*Ascaphus*	*truei*	Washington	Keithly Creek, T14N, R4W, NW ¼, NW ¼, S9	513680	4929157	1100	1984	P. Olmstead
FMNH	166492	*Ascaphus*	*truei*	Washington	Brownlee Creek	513772	4953526	1230		
FMNH	166493	*Ascaphus*	*truei*	Washington	Brownlee Creek	513772	4953526	1230		
FMNH	166494	*Ascaphus*	*truei*	Washington	Brownlee Creek	513772	4953526	1230		
FMNH	166495	*Ascaphus*	*truei*	Washington	Brownlee Creek	513772	4953526	1230		
FMNH	166496	*Ascaphus*	*truei*	Washington	Brownlee Creek	513772	4953526	1230		
LACM	51390	*Ascaphus*	*truei*	Washington	Brownlee Cr. Camp	513772	4953526	1230	1964	Metter
LACM	51413	*Ascaphus*	*truei*	Washington	Brown Creek	513772	4953526	1230	1965	Metter
UIM	65	*Crotalus*	*viridis*	Washington	6 mi. SW of Midvale	514574	4919322	1000	1955	P. Dumas
UIM	74	*Spea*	*intermontana*	Washington	6.5 mi. E of Weiser	514668	4899181	760	1958	P. Dumas
UIM	196	*Spea*	*intermontana*	Washington	6.5 mi. E of Weiser	514668	4899181	760	1958	P. Dumas
UIM	270	*Spea*	*intermontana*	Washington	6.5 mi. E of Weiser	514668	4899181	760	1958	P. Dumas
UIM	206	*Pituophis*	*catenifer*	Washington	4 mi. S of Midvale, U.S. 95	516576	4921097	980	1955	P. Dumas
UIM	210	*Pituophis*	*catenifer*	Washington	4 mi. S of Midvale, U.S. 95	516576	4921097	980	1955	P. Dumas
UIM	223	*Coluber*	*constrictor*	Washington	4 mi. S of Midvale, U.S. 95	516576	4921097	980	1955	P. Dumas
UIM	260	*Rana*	*pipiens*	Washington	8 mi. E of Weiser, Cove Creek	516701	4896481	760	1955	P. Dumas
MVZ	12346	*Pseudacris*	*regilla*	Washington	1 mi. NE of Heath; Cuddy Mtn.	517080	4957222	2300	1930	A.E. Borell
MVZ	12360	*Thamnophis*	*elegans*	Washington	1 mi. NW of Heath; SW slope Cuddy Mtn.	517080	4957222	2300	1930	R.M. Gilmore
CM	39832	*Ambystoma*	*macrodactylum*	Idaho	Seven Devils Lake	537869	5021120	2050	1955	J.R.
MVZ	64640	*Ambystoma*	*macrodactylum*	Idaho	Seven Devils Lake	537944	5021074	2250	1955	D.S. Farner
MVZ	64639	*Ambystoma*	*macrodactylum*	Idaho	Seven Devils Lake	537944	5021074	2250	1955	D.S. Farner
AC	116	*Ambystoma*	*macrodactylum*	Adams	1 km E of Paradise Flat, T19N, R3W, Sec. 34. 4500. Artemisia rigid	541547	5007216	1750	1989	E. Yensen
MVZ	12324	*Ambystoma*	*macrodactylum*	Washington	15 mi. E of Midvale; Crane Cr.	542617	4923035	1000	1930	A.E. Borell
MVZ	12349	*Coluber*	*constrictor*	Washington	Crane Cr.; 15 mi. E of Midvale	542617	4923035	1000	1930	R.M. Gilmore
MVZ	12347	*Sceloporus*	*occidentalis*	Washington	Crane Cr.; 15 mi. E of Midvale	542617	4923035	1000	1930	A.E. Borell
MVZ	12348	*Coluber*	*constrictor*	Washington	Crane Cr.; 15 mi. E of Midvale	542617	4923035	1000	1930	A.E. Borell
MVZ	12352	*Pituophis*	*catenifer*	Washington	Crane Cr.; 15 mi. E of Midvale	542617	4923035	1000	1930	A.E. Borell

Appendix 1-A. (Cont.)

MUSEUM	CAT	GENUS	SPECIES	COUNTY	LOCALITY	EASTING_M	NORTHING_M	ELEV	YEAR	COLLECTOR
MVZ	12356	*Thamnophis*	*elegans*	Washington	Crane Cr.; 15 mi. E of Midvale	542617	4923035	1000	1930	A.E. Borell
MVZ	12355	*Thamnophis*	*elegans*	Washington	Crane Cr.; 15 mi. E of Midvale	542617	4923035	1000	1930	A.E. Borell
MVZ	12353	*Pituophis*	*catenifer*	Washington	Crane Cr.; 15 mi. E of Midvale	542617	4923035	1000	1930	A.E. Borell
MVZ	12354	*Thamnophis*	*elegans*	Washington	Crane Cr.; 15 mi. E of Midvale	542617	4923035	1000	1930	A.E. Borell
IMNH	937	*Thamnophis*	*sirtalis*	Adams	Meadows (10 mi. W)	543864	4978503	1500	1967	
BSU	42	*Pituophis*	*catenifer*	Adams	1 mi. NW of Council (roadkill)	543888	4954198	925	1979	E. Yensen
USNM	39794	*Rana*	*pretiosa*	Adams	Indian Valley	545094	4933667	980	1895	Not Verified
USNM	40070	*Pituophis*	*catenifer*	Adams	Indian Valley	545094	4933667	980	1895	Not Verified
UCM	7539	*Rana*	*pretiosa*	Idaho	3 mi. S of Atkins, marsh by Little Salmon River	550098	5022524	600	1954	
UIM	26	*Rana*	*pretiosa*	Idaho	3 mi. S of Atkins	550098	5022524	600	1953	P. Dumas
UIM	287	*Thamnophis*	*sirtalis*	Idaho	3 mi. S of Atkins, Little Salmon River	550098	5022524	600	1954	P. Dumas
UIM	307	*Rana*	*pretiosa*	Idaho	3 mi. S of Atkins, Little Salmon River	550098	5022524	600	1964	P. Dumas
UMMZ	129584	*Thamnophis*	*elegans*		Little Salmon R at Sheep Creek circa 7 mi. S of Riggins	551057	5020879	600	1969	R. Miller
UIM	213	*Bufo*	*boreas*	Idaho	5 mi. up Salmon River from Riggins	553296	5037165	550	1954	P. Dumas
CRCM	62	*Diadophis*	*punctatus*	Idaho	Whitebird	554136	5067384	750	1962	J. T. Brumley + N. Brumley
UMMZ	124568	*Thamnophis*	*elegans*		Little Salmon River just E of New Meadows	555511	4979962	1190	1963	R.M. Bailey
IMNH	675	*Ascaphus*	*truei*	Idaho	Elk Creek near Riggins (11 mi. from town)	556460	5010403	1500	1986	
UIM	260	*Thamnophis*	*elegans*	Adams	3 mi. N of New Meadows, Little Salmon River	556486	4984388	1125	1955	P. Dumas
UIM	284	*Thamnophis*	*sirtalis*	Adams	3 mi. N of New Meadows	556486	4984388	1125	1955	P. Dumas
IMNH	430	*Ascaphus*	*truei*	Idaho	Little Elk Creek near old diversion near Riggins	557257	5009177	1500	1986	
CPS	2833	*Ambystoma*	*macrodactylum*	Idaho	6 mi. N of Whitebird on U.S. Hwy 95	557680	5074751	1000	1939	M.J., W.C.B., J.W.S.
CPS	2837	*Pseudacris*	*regilla*	Idaho	6 mi. N of Whitebird on U.S. Hwy 95	557680	5074751	1000	1939	M.J., W.C.B., J.W.S.
CPS	2841	*Bufo*	*boreas*	Idaho	6 mi. N of Whitebird on U.S. Hwy 95	557680	5074751	1000	1939	M.J.
UIM	32	*Thamnophis*	*elegans*	Adams	Six Mile Creek, 4 mi. N of New Meadows	560000	4989600	1250	1954	P. Dumas
MVZ	15217	*Bufo*	*boreas*	Adams	3 mi. W of Payette Lake	565319	4978247	1560	1932	R.T. Orr
MVZ	15220	*Bufo*	*boreas*	Adams	3 mi. W of Payette Lake	565319	4978247	1560	1932	R.T. Orr

Appendix 1-A. (Cont.)

MUSEUM	CAT	GENUS	SPECIES	COUNTY	LOCALITY	EASTING_M	NORTHING_M	ELEV	YEAR	COLLECTOR
MVZ	15221	*Bufo*	*boreas*	Adams	3 mi. W of Payette Lake	565319	4978247	1560	1932	R.T. Orr
MVZ	15218	*Bufo*	*boreas*	Adams	3 mi. W of Payette Lake	565319	4978247	1560	1932	R.T. Orr
MVZ	15219	*Bufo*	*boreas*	Adams	3 mi. W of Payette Lake	565319	4978247	1560	1932	R.T. Orr
MVZ	15213	*Bufo*	*boreas*	Adams	Thorn Cr. Ranger Station; 3 mi. W of Payette Lake	566000	4982687	1750	1932	A.H. Miller
MVZ	15212	*Bufo*	*boreas*	Adams	Thorn Cr. Ranger Station; 3 mi. W of Payette Lake	566000	4982687	1750	1932	A.H. Miller
CPS	3990	*Thamnophis*	*elegans*	Idaho	Grangeville	567124	5085839	1000	1939	W.C.B.

Appendix 1-B. Historical Herp Sightings for Baker County, Oregon.

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
Juvenile	4/21/1972	Western Skink	7s	38e	22	S1/4	Muddy Creek	3600	West of Haines, very blue tail
Juvenile	5/5/1972	Western Skink	7s	38s	22	S1/4	Muddy Creek	3600	West of Haines, very blue tail
NO DATA	Spring '72	Western Skink	9s	40e	29	N1/4	Baker City	3540	ODFW Horse Barn South in Baker
Adult	91-96 Summer	Tailed Frog	6s	46e	9,14,15,24		Lake Fork Creek	4800-6400	Several Adults
Adult	91-96 Summer	Tailed Frog	6s	47e	19		Lake Fork Creek	6800	
Male Adult	8/10/1994	Tailed Frog	6s	45e	25		Trail Creek	5600	
Male Adult	9/15/1995	Tailed Frog	7s	45e	16	SWNS	Summit Creek	5600	
Male Adult	8/6/1993	Tailed Frog	7s	45e	18	SESE	S. Fork Spring Creek	4800	
Larval Stage	8/5/1993	Tailed Frog	7s	45e	18	SWNW	Spring Creek	4400	
Larval Stage	8/5/1993	Tailed Frog	7s	44e	13	SENE	Conundrum Creek	4400	
Adult & Larval Stage	8/26/1992	Tailed Frog	6s	43e	13	NENE	Two Color Creek	6400	
Adult	10/27/1995	Spotted Frog	7s	43e	14	SESE	Goose Creek	4000	
Adult & Eggs	5/10/1993	Western Toad	7s	43e	35	SESE	Goose Lake	4000	Copulating Adults and Egg Strings
Adult	3/10/1996	Western Toad	8s	45e	14	NWSE	Summit Ridge	4000	Small Adult-3" STL
Adults Larvae Eggs	5/18/1991	Western Toad	8s	45e	9	SENE	Barnhard Pond	4200	Egg Strings
Adults Larvae	5/11/1994	Pacific Tree Frog	7s	47e	8	NESW	Little Elk Pond	4000	
Adults Larvae	5/10/1993	Pacific Tree Frog	7s	43e	35	SESE	Goose Lake	4000	
Male Female Juvenile	7/21/1992	Tailed Frog	6s	46e	32	SENE	E. Pine Creek	5200	3 Males, 2 Females, 15 Juveniles
Juvenile	7/28/1992	Tailed Frog	6s	46e	34	NWNE	W. Trinity Creek	5200	4 Juveniles
Juvenile	7/30/1992	Tailed Frog	6s	46e	29	NENE	E. Pine Creek	6000	1 Juvenile
Male Female Juvenile	8/19/1992	Tailed Frog	6s	46e	28	SENW	E. Pine Tributary	6000	1 Male, 1 Female, 11 Juveniles
Male	8/19/1992	Tailed Frog	6s	46e	29	NENE	E. Pine Creek	6000	1 Male

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
Male	8/19/1992	Tailed Frog	6s	46e	28	SWNW	E. Pine Tributary	6000	1 Male
Eggs Larvae	5/13/1994	Pacific Tree Frog	7s	43e	24	SENW	Ledge Creek	4400	
Female Juvenile	8/26/1992	Tailed Frog	6s	43e	13	NENW	Two Color Creek	6400	I Female, 5 Juveniles
NO DATA	8/27/1992	Tailed Frog	6s	46e	34	NENW	W. Trinity Creek	5200	
NO DATA	8/27/1992	Tailed Frog	6s	46e	28	SENE	W. Trinity Creek	5200	
Male	9/4/1992	Tailed Frog	6s	46e	20	SESE	E. Pine Tributary	6000	1 Male
Juvenile	9/9/1992	Tailed Frog	6s	46e	20	NESE	E. Pine Tributary	6000	3 Juveniles
Male	9/9/1992	Tailed Frog	6s	46e	20	NENW	E. Pine Creek	6000-6800	2 Males
Male Female	9/10/1992	Tailed Frog	6s	46e	20	NWSE	E. Pine Creek	6000-6800	6 Males, 4 Females
Male Female	9/11/1992	Tailed Frog	6s	46e	17	SESW	E. Pine Creek	6000-6800	8 Males, 10 Females
Male	9/1/1992	Tailed Frog	6s	46e	1	NENE	Cabin Creek	6000-6800	1 Male
NO DATA	6/23/1992	Western Skink	7s	44e	18		Torch-Light Creek	4400	
NO DATA	6/22/1992	Western Skink	8s	44e	8		Sparta Butte	4400	
NO DATA	6/20/1994	Racer	8s	45e	5	SWNW	Skull Creek	4000	
NO DATA	6/15/1990	Western Rattlesnake	6s	47e	33	NWNE	Fall Creek	5200	
NO DATA	6/28/1990	Rubber Boa	7s	43e	23	SWNE	Goose Creek	4000	
NO DATA	5/18/1993	Gopher Snake	8s	45e	7	SW	Eagle Creek	4000	
NO DATA	6/27/1991	Western Fence Lizzard	8s	43e	22		Larkspur Creek	4600	
NO DATA	6/23/1992	Western Fence Lizzard	7s	35e	12		Dark Canyon	4700	
Larvae	Summer '96	Great Basin Spotted Frog	10s	35e	10		Olive Creek Tributary	6000	Several Larvae, FS 1042-900 road, miner's pond located in Placer mined draw, water source is spring
Adult	10/1/1996	Great Basin Spotted Frog	10s	36e	9		Gimlet Creek	4480	1 Adult, access FS7386 Road-Two mining ponds west of road
Adult	Summer '96	Great Basin Spotted Frog	10s	35.5e	36		Simpson Creek	5280	2 Adults, access FS7380 Road to Road 270, miners settling pond in drainage

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
Adult Larvae	9/1/1996	Great Basin Spotted Frog	10s	35.5e	14		Geiser Creek	4760	Numerous Adults and Larvae, Diamond Jack mine ponds, FS1044-120 Road
Adult	Summer '96	Great Basin Spotted Frog	9s	38e	31		Deer Creek	4250	Several Adults, FS7240/400 Road, Old Beaver Pond, Deer Creek
Adult Larvae	Summer '96	Great Basin Spotted Frog	9s	37e	20		Cracker Drainage	4500	Adults & Larvae, Mine Tailing Ponds
Adult Larvae	Summer '96	Great Basin Spotted Frog	10s	38e	20		Philip Lake	4300	Adults & Larvae, West side of Lake, Mine tailings with ponds, water level varies
Adult Larvae	6/20/1996	Great Basin Spotted Frog	12s	39e	36960		Pine Creek	4400-4800	Adults and many Larvae, Five irrigation & Mining Ponds
Adult	Summer '96	Great Basin Spotted Frog	8s	36e	2		Onion Drainage	5400	Adults, FS73/492 road, old mining ponds off Onion Creek
Adult Larvae	6/20/1996	Great Basin Spotted Frog	8s	35e	34		Boulder Drainage	4750	5+ Adults & Larvae, off FS73 Road to 73/011 Rd, Turbid mining pond and adjacent wet meadow ponds
Adult	Summer '96	Great Basin Spotted Frog	8s	36e	21		Baldy Creek	6400	3+ Adults, wet meadow pond in N. Fork John Day Wilderness near Baldy Creek
Adult	Summer '96	Great Basin Spotted Frog	9s	37e	30		Deer Creek	4600	1 Adult, FS6540 Road, small off-channel pond on old mining site
Adult	Summer '96	Great Basin Spotted Frog	10s	63e	9		Gimlet Creek	4720	1 Adult, access FS1060 Road, small pond created by partial dam in creek
Adult	Summer '96	Great Basin Spotted Frog	10s	35.5e	21		Unnamed Tributary	4820	1 Adult, access FS1046-045 Road, pond with riparian veg. Created by partial dam in tributary
NO DATA	Summer '96	Great Basin Spotted Frog	10s	35.5e	25		N. Fork Burnt River	5000	Access miners spur road to flood plain along river
Adult	Summer '96	Great Basin Spotted Frog	10s	35.5e	14		Winterville Creek	5000	2 Adults, access FS1044-040 road, off channel pond with riparian veg. Cattails, etc., historic mining site
Adult Juvenile	9/19/1996	Great Basin Spotted Frog	8s	35.5e	2	SWNW	Onion Creek	4800	1 Adult & 3 Juveniles, ponds upstream of county road 24 to surface drainage crossing road NF771

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
Larvae	9/19/1996	Long-toed salamander	8s	44e	2	SWNE	Onion Creek	4800	12 Larvae, near metamorphosis, deeper pond upstream of county road 24, first temporary pool above road
NO DATA	8/24/1993	Western Rattlesnake	7s		31	SESW	Forshey Meadow	4200	
General Statement	General Statement	Pacific Tree Frog						4000-7000	Adults & Larvae generally observed across the district
General Statement	General Statement	Long-toed salamander						4000-7000	Adults & Larvae generally observed across the district
General Statement	General Statement	Western Fence Lizard						<4000	Generally observed between Little Eagle Creek and Balm Creek (west side of district)
General Statement	General Statement	Gopher Snake						No Specific Data	Generally across the lower elevation throughout the district
General Statement	General Statement	Western Aquatic Garter Snake						No Specific Data	Fairly commonly observed across the district
Juvenile	9/19/1996	Great Basin Spotted Frog	8s	35.5e	2	SWNW	Onion Creek	4800	Juvenile, ponds upstream of county road 24 to surface drainage crossing road NF771. 2nd pool up with dense aquatic vegetation:eleopcharis sp., cares sp., juncus sp.
Adult Juvenile	9/20/1996	Great Basin Spotted Frog	8s	36e	21	NWNW	Baldy Creek	6550	1 Adult, 4 recently metamorphosed Juveniles, N. Fork John Day Wilderness, Wetland-Meadow complex with streamside pools, frogs captured among sedge, water depth 30-40 centimeters
Larvae	9/20/1996	Long-toed salamander	8s	36e	21	NWNW	Baldy Creek	6550	10 Larvae, N. Fork John Day Wilderness, wetland-meadow complex with streamside pools. Water depth 0.75-1.0 cooler than surrounding waters
Adult	9/20/1996	Great Basin Spotted Frog	10s	35.5e	14		Jay Gould Mine Ponds		1 Adult, N. Fork John Day Wilderness, Baldy Cr. Area, Larger pond, abundant emergent vegetation, new pond created summer, 1996 --note--this legal is not verified

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
Larvae	9/20/1996	Long-toed salamander	10s	35.5e	14		Jay Gould Mine Ponds		6 Larvae, 4.5-7.0 cm. STL, N. Fork John Day Wilderness, Baldy Creek area larger pond, abundant emergent vegetation, new pond created summer, 1996--note--this legal is not verified
Larvae	9/20/1996	Long-toed salamander	10s	36e	9		Gimlet Creek Mine Ponds	4600	1 Larvae, N. Fork John Day Wilderness, upper pond, some emergent aquatic vegetation
Adult	9/20/1996	Great Basin Spotted Frog	10s	36e	9		Gimlet Creek Mine Ponds	4600	1 Large Adult, N. Fork John Day Wilderness, Lower pond, some emergent aquatic vegetation
Adult Juvenile	9/20/1996	Great Basin Spotted Frog	12s	39e	3/10		Pine Creek Mine Ponds	4200	2 Adults, 1 Juvenile, pond upstream of county road 731. Sparse littoral vegetation, >1,5 meter depth
Larvae Juvenile	9/21/1996	Long-toed salamander	12s	39e	3/10		Pine Creek Mine Ponds	4800	75-80 Larvae, 58 newly metamorphosed juveniles found under woody debris along pond edge, upstream of county road 731, largest and highest pond in drainage
Adult	9/21/1996	Long-toed salamander	12s	39e	3/10		Pine Creek Mine Ponds	4800	1 Adult, upstream of county road 731 small pond near creek, NE of largest and highest pond in drainage
Adult Juvenile	9/21/1996	Great Basin Spotted Frog	10s	35.5e	14		Geiser Bowl Mine Ponds		6 Adults 50-77 mm length, 2 recently metamorphosed Juveniles, largest, highest pond, about 2 meters depth, abundant algae colonies and aquatic vascular plants.
Juvenile	9/21/1996	Long-toed salamander	10s	35.5e	14		Geiser Bowl Mine Ponds		2 Juveniles, gills nearly resorbed, largest highest pond, about 2 meters depth, abundant algae colonies and aquatic vascular plants.
Adult	6/20/1996	Great Basin Spotted Frog	12s	39e	3/10		Pine Creek Mine Ponds	4800	9 Adults, highest pond, 1-2 meter depth, >2acres.
NO DATA	6/20/1996	Common Garter Snake	12s	39e	3/10		Pine Creek Mine Ponds	4800	3 THIS, highest pond, 1-2 meter depth, >2 acres, permanent.

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
Adult	6/20/1996	Great Basin Spotted Frog	12s	39e	3/10		Pine Creek Mine Ponds	4600	5 Adults, pond directly below highest, impoundment, dry by late summer, emergent vegetation in June, <1 meter depth.
Larvae	6/20/1996	Western Toad	12s	39e	3/10		Pine Creek Mine Ponds	4600	Many Larvae, pond directly below highest, impoundment, dry by late summer, emergent vegetation in June, <1 meter depth.
Larvae	6/20/1996	Long-toed salamander	12s	39e	3/10		Pine Creek Mine Ponds	4600	Many Larvae, pond directly below highest, impoundment, dry by late summer, emergent vegetation in June, <1 meter depth.
Larvae	6/20/1996	Pacific Tree Frog	12s	39e	3/10		Pine Creek Mine Ponds	4600	Many Larvae, pond directly below highest, impoundment, dry by late summer, emergent vegetation in June, <1 meter depth.
Adult	6/20/1996	Great Basin Spotted Frog	12s	39e			Pine Creek Mine Ponds	4200	2 Adults, pond upstream of county road 731. Sparse littoral vegetation, >1.5 meter depth, permanent.
Larvae	6/20/1996	Pacific Tree Frog	12s	39e			Pine Creek Mine Ponds	4200	5+ Larvae, pond upstream of county road 731. Sparse littoral vegetation, >1.5 meter depth, permanent.
Larvae Adult	6/20/1996	Great Basin Spotted Frog	12s	39e			Pine Creek Mine Ponds	4200	10 Adults, 59 Larvae, lower cluster of ponds at the mine, larvae in permanent mine dredge pond. Abundant algae, submerged vegetation, 102+ meter depth.
Eggmass Adult	6/20/1996	Western Toad	12s	39e			Pine Creek Mine Ponds	4200	1 Adult, 1 Eggmass, lower cluster of ponds at the mine, Larvae in permanent mine dredge pond, abundant algae, submerged vegetation, 1-2+ meter depth.
Larvae	6/20/1996	Long-toed salamander	12s	39e			Pine Creek Mine Ponds	4200	3 Larvae, lower cluster of ponds at the mine, Larvae in permanent mine dredge pond, abundant algae, submerged vegetation, 1-2+ meter depth.

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
NO DATA	6/20/1996	Common Garter Snake	12s	39e			Pine Creek Mine Ponds	4200	4 Snakes, age class not specified. Lower cluster of ponds at the mine, larvae in permanent mine dredge pond, abundant algae, submerged vegetation, 1-2+ meter depth.
NO DATA	7/5/1974	Western Skink	5s	48e	31	SWNW	North Pine Creek	4400	North Pone Creek just below DOE Creek.
NO DATA	6/14/1984	Western Skink	6s	18e	1	NE	Copperfield Bridge Crossing	1600	Copperfield bridge crossing Snake River, Oregon side.
General Information	1980	Bullfrog					Baker County		Few in number, occasionally seen or known to be present, observed near Huntington.
General Information	1980	Northern Leopard Frog					Baker County		Few in number, occasionally seen or known to be present, observed near Huntington.
General Information	1980	Tailed Frog					Baker County		Medium levels, considered commonly seen.
General Information	1980	Pacific Tree Frog					Baker County		Abundant, always seen.
General Information	1980	Western Terrestrial Garter Snake					Baker County		Abundant, always seen.
General Information	1980	Gopher Snake					Baker County		Abundant, always seen.
General Information	1980	Night Snake					Baker County		Not recorded, but may occur in Snake Canyon.
General Information	1980	Western Rattlesnake					Baker County		Abundant, always seen.
General Information	1980	Common Garter Snake					Baker County		AKA: Red spotted garter snake, abundant, always seen.
General Information	1980	Rubber Boa					Baker County		Medium levels, considered commonly seen.
General Information	1980	Racer					Baker County		Abundant, always seen.

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
General Information	1980	Desert Horned Lizard					Baker County		Few in number, occasionally seen or known to be present, observed near Huntington.
General Information	1980	Sagebrush Lizard					Baker County		Few, occasionally seen or known to be present.
General Information	1980	Western Fence Lizard					Baker County		Medium levels, considered commonly seen.
General Information	1980	Western Skink					Baker County		Medium levels, considered commonly seen.
General Information	1980	Western Whiptail Lizard					Baker County		Few, occasionally seen or known to be present, reported near Keating.
General Information	1980	Long-toed salamander					Baker County		Medium levels, considered commonly seen.
General Information	1980	Great Basin Spade-foot Toad					Baker County		Few, occasionally seen or known to be present.
General Information	1980	Western Toad					Baker County		Abundant, always seen.
General Information	1980	Painted Turtle					Baker County		Occasional reports, may be introduced.
118 cm in Length	5/19/1982	Gopher Snake					Burnt River Canyon Road		Roadkill confluence of French Gulch and Burnt River, 3.7 miles west of Deer Creek, plant association: juniperous occidentals, artemesia tridentata, Agropyron spileatum, also cicocarpus ledifolius, Purshia tridentata, Chrysothamnus sp., Pinus ponderosa, Pseudotsuga meziesii.
Adult Female	5/20/1982						Burnt River Canyon Road		Pond, north side of road, 0.4 miles upstream from confluence of French Gulch and Burnt River observed larvae/tadpoles, species not specified.
Approx. 24 inches	5/21/1982	Wandering Garter Snake					Burnt River Canyon Road		On road, 0.4 mile upstream from confluence of French Gulch and Burnt River.

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
62.7 cm svl	5/19/1982	Wandering Garter Snake	12s	41e	4	NESESE	Burnt River Canyon Road	2750	On road, 1.3 miles west of Burnt River confluence with French Gulch.
2nd year Adult	5/19/1982	Wandering Garter Snake	12s	42e	29	SENE	Durkee Valley	2620	On road, 1.6 miles west of Jct. Of Burnt River Road and Old US 30.
64 cn svl	5/20/1982	Yellow Belly Racer	14s	45e	8	SE	Snake River Canyon	3000	1100 hours at cattle guard where road from Huntington to Snake River turns North along the river plant community: artemelia sp., rhus glabra, bromus tectorum, Poa sanbergil, erigeron sp., verbascum blattaria, penstemon desertus sp.
22 inch svl	5/20/1983	Yellow Belly Racer	14s	45e	8	SE	Snake River Canyon	3000	Dead on road, 0.25 mile north of cattle guard where road from Huntington to Snake River turns North along the river. Plant community: artemlia sp., rhus glabra, bromus tectorum, Poa snadbergii, erigeron sp., verbascum blattaria, penstemon desrtus sp.
Males Females	5/20/1982	Western Toad	12s	45e	27	NE	Snake River Canyon	2100	3 Males, 2 Females, small pond on a south tributary to Hibbard Creek, 50 yards upstream from the confluence with Snake River, which is 100 yards above the culvert under the main Snake River road the plant community: artemeliasp, rhus glabra, bromus tectorum, Poa sandergii, erigeron sp., verbascum blattaria, penstemon desertus sp.
Male Adult	5/21/1982	Western Toad	12s	45e	27	NE	Snake River Canyon	2100	1 Male adult, second pondup on a south tributary to Hibbard Creek, 50 yards upstream from the confluence with Snake River, which is 100 yds above the culvert under the remain Snake River road. The plant community: artemelia sp., rhus glabra, bromus tectorum, Poa sandbergii, erigeron sp., verbascum blattaria, penstemon desertus sp.

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
Approx. 18 inch length	5/22/1982	Gopher Snake	12s	45e	27	NE	Snake River Canyon Road	2100	On road, did not catch, 11.3 miles south of Hibbard Creek. Plant community: artemelia sp., rhus glabra, bromus tectorum, Poa sandbergii, erigeron sp, verbascum blattaria, penstemon desertus sp.
NO DATA	5/23/1982	Yellow Belly Racer	14s	45e	8	SE	Snake River Canyon Road	3000	Dead on Road, 0.25 mile west of corner where Snake River road turns west and follows Burnt River to Huntington. Plant Community: artemelia sp., rhus glabra, bromus tectorum, Poa sandbergii, erigeron sp., verbascum blattaria, penstemon desertus sp.
Adult	5/24/1982	Pacific Tree Frog	12s	44e	35	SWNW	Walnut Springs Exclosure	3400	2020 hours P.D.T., captured on frog and heard 4 others calling in the springs
NO DATA	5/25/1982	Gopher Snake	13s	44e	4	SWNE	Dixie	2230	2 snakes dead on road.
Male 87 mm svl	5/21/1982	Long-toed salamander	14s	45e	19	NESW	Birch Creek Road	2620	1330 Hours, 1 mile south of Huntington at top of ridge habitat description: narrow flat ridge crest~ 100 yards wide & 0.25 mile on. Predominantly big sage (artemilia tridentata) with occasional to numerous patches of bare ground from 2 feet x 10 feet to 5 feet x25 feet. Remaining cover of grasses, predominantly cheat grass (bromus tectorum and forbs: fescue, box-tail, balsamrhjiza, rabbit brush (Chrysothamnus sp.), sunflower (helianthus sp.)
36 inch svl 42.45 inch stl	5/24/1982	Gopher Snake	13s	44e	8	SW	Dixie Creek Canyon	2360	0850 hours on Dixie creek road, 2.5 miles west of rye valley exit from-84.
~3 feet length	5/24/1982	Gopher Snake	13s	44e	8	SW	Dixie Creek Canyon	2360	On Dixie creek road, 2.9 miles west of Rye Valley exit from-84.
36 inch stl	5/24/1982	Yellow Belly Racer	13s	44e	7	SE	Dixie Creek Canyon	2490	D.O. Ro. On Dixie Creek Road 3.3 miles west of Rye Valley exit from 1-84.

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
adult	5/24/1982	Long-toed salamander	13s	43e	17	SESW	Dixie Creek Canyon	3540	4 Adults (one with 4.2cm svl), -0.25 mile south of McKenny's Ranch House in and near highly euthrophic stock pond fed by spring-fed stream.
NO DATA	5/24/1982	Pacific Tree Frog	13s	43e	17	SESW	Dixie Creek Canyon	3540	0.25 mile south of McKenny's Ranch House, highly euthrophic stock pond fed by spring-fed stream.
Adult	5/25/1982	Pacific Tree Frog	13s	43e	27	NWNE	Dixie Creek Canyon	3940	0915 Hours, 1 Adult, heard many, beaver creek crossing on Bowman flat, plant community: sagebrush, bitterbrush, erioginum sp., juniper, fleabane (ericeron sp.), Poa bulbosa brodea douglasii, several phlox sps., Indian paint brush, bitterroot, mariposa lily.
NO DATA	5/25/1982	Gopher Snake	13s	43e	22	SESE	Dixie Creek Canyon	3940	0.7 mile NE up Jeep Trail from Beaver creek crossing on Bowman flat, plant community: sagebrush, erioginum sp., juniper, fleabane (erigeron sp.) Poa bulbosa, bordea douglasii, several phlox sps., Indian paintbrush, bitterroot, calochortus sp. (mariposa lily)
NO DATA	5/25/1982	Western Rattlesnake	13s	43e	27	NWNW	Dixie Creek Canyon	3940	Beaver Creek crossing on Bowman flat, plant community: sagebrush, bitterbrush, erioginum sp., juniper, fleabane (erigeron sp.) Poa bulbosa, brodea douglasii, several phlox sps., Indian paintbrush, bitterroot, mariposa lily.
NO DATA	5/25/1982	Western Rattlesnake	13s	43e	22	SESE	Dixie Creek Canyon	3940	0.6 mile NE up Jeep Trail from Beaver creek crossing on Bowman flat, plant community: sagebrush, erioginum sp., juniper, fleabane (erigeron sp.) Poa bulbosa, bordea douglasii, several phlox sps., Indian paintbrush, bitterroot, calochortus sp. (mariposa lily)
Adult	5/25/1982	Western Rattlesnake	13s	43e	NO DATA	(Township Center)	Dixie Creek Canyon	2230-3150	1 Adult, dead on Dixie Creek Road, between Bowman Flat and I-84.
First Year	5/25/1982	Western Rattlesnake	13s	43e	NO DATA		Dixie Creek Canyon	2230-3150	Dead on Dixie Creek Road, Between Bowman Flat and I-84.

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
NO DATA	5/26/1982	Western Toad	12s	44e	35	SWNW	Walnut Springs Exclosure	3400	Plant Community: Walnut trees, willow, sagebrush, cheat grass, Poa bulbosa, mustard, cardoria sp.
NO DATA	5/26/1982	Pacific Tree Frog	12s	44e	35	SWNW	Walnut Springs Exclosure	3100	Many frogs, plant community: walnut trees, willow, sagebrush, cheat grass, Poa bulbosa, mustards, cardoria sp.
NO DATA	5/26/1982	Gopher Snake	12s	44e	35	SWNW	Walnut Springs Exclosure	3100	Plant Community: Walnut trees, willow, sagebrush, cheat grass, Poa bulbosa, mustard, cardoria sp.
NO DATA	May 1983	Painted Turtle	9s	40e	10		NO DATA		Turtle crossing road within 0.25 mile of ponds-location not available on printed table but is available on Oregon Natural Heritage Program data base (GIS).
118 mm stl 73 mm svl	5/28/1955	Desert Horned Lizard	14s	45e	18		Huntington	2230	Specimen at Corvallis, OR- O.S.U.. #3099
NO DATA	7/16/1982	Sagebrush Lizard	9s	41e	5	SESE	Virtue Flats	3580	On Virtue Flat Road, erosion gully 1.3 miles from jct of virtue flat main road and virtue flat farms road.
Larvae	7/16/1982	Spade-Foot Toad	9s	41e	8	NENW	Virtue Flats	3580	Many larvae, 1.2 miles down virtue flats farms road, small cattle pond-50 yards east of road.
NO DATA	7/17/1982	Sagebrush Lizard	8s	42e	31	Center	Virtue Flats	3280	10 Lizards, east on HWY 86, 11.2 miles from jct I-84, north on gravel road to rock quarry. Plant Community: sagebrush, rabbitbrush, horsebrush, Indian rice grass, cheat grass, ag.spic.
NO DATA	7/17/1982	Pacific Tree Frog	8s	42e	31	SE	Virtue Flats	3280	1 Frog, east on HWY 84 11.2 miles from jct I-84, north on gravel road to rock a quarry, plant community: sagebrush, rabbitbrush, horsebrush, Indian rice grass, cheat grass, ag.spic.

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
Adult Male Juvenile	7/19/1982	Long-nosed Leopard Lizard	14s	45e	19	NESW	Birch Creek Road	2620	1 Male adult, 1 male juvenile, 1 mile south of Huntington on Birch Creek Road, top of Ridge, habitat description: Narrow, flat ridge crest~100 yards wide and 0.25 miles long. Predominantly big sage with occasional to numerous patches of bare ground from 2 ft. x10ft. to 5 ft. x25 ft. remaining cover of grasses predominantly cheat grass and forbs: 70% sage cover, 10% bare, 20% grasses cover: (cheat, fescue, fox-tail, balsamrhiza sagittata, rabbit brush, sunflower)
Adult Male Juvenile	7/20/1982	Long-nosed Leopard Lizard	14s	45e	19	NESW	Birch Creek Road	2620	3 Adults, 2 post-copulatory males, 1 juvenile, 1 mile south of Huntington on Birch Creek Road, top of ridge, habitat description: Narrow, flat ridge crest~1--guards wide and 0.25 miles long. Predominantly big sage with occasional to numerous patches of bare ground from 2 ft x 10 ft to 5 ft-25ft. remaining cover of grasses predominantly cheat grass and forbs. 70% sage cover, 10% bare, 20% grasses cover: (cheat, fescue, fox-tail, balsamrhiza sagittata, rabbit brush, sunflower)
NO DATA	7/19/1982	Western Whiptail Lizard	14s	44e	12	NE	Huntington	2620	2 Lizards, found 0.25 miles apart, 1 mile NW of Huntington on old US 30 near bench marker, up in NE direction to flats on old pasture separates the habitat in which the lizards were found. Habitata descriptions: area 1: 0.25 acre island hilltop, rock scab 20% (rocks 2 ft diameter covered with white mineral deposits), big sage 30% (not dense) cheat grass 45% grass and forbs 3% , bare ground 2%, ~10% NE facing slope. Area two: ~15% SW facing toeslope near small intermittent stream, big sage 60% (dense), bare ground 15%, grasses (cheat) 15%, rocky patches 10% (<30cm angular rocks), few forbs.

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
3 feet length	7/22/1982	Yellow Belly Racer	14s	44e	12	NE	Huntington	2620	1 Mile NW of Huntington on old US 30, near bench marker, up in E direction to flats, in the old pasture that separates two rocky areas. Sparse short grass and few forbs. Bovine grazing apparent.
Adult Gravid Female	7/20/1982	Northern Desert Horned Lizard	14s	45e	18	SWNE	Huntington	2360	Lizard in burrow with just head sticking out, cold and inactive palpated 4 eggs, 0.4 mile east of Huntington, (jct of river road and US 30) flat area on top of hill, habitat description: slope variable 5-30% west facing lizard on 5% west facing portion, bare ground 20% (scattered 4-10 sq. ft. areas), loose brown soil, occasional to 40cm diameter rock, big sage 20%, (scattered), buck wheat 10% (scattered), grasses and forbs 50% (cheat, some balsamroot) occasional but not numerous anthills.
Adult	7/22/1982	Northern Desert Horned Lizard	14s	45e	18	SWNE	Huntington	2360	Dead, 0.1 mile south of Huntington on US 30 and -300 yards east of the highway, scattered sage with much bare ground hillside.
NO DATA	7/20/1982	Western Whiptail Lizard	14s	45e	18	SWNE	Huntington	2360	Caught a glimpse of large, fast lizard, assume to have been a …." 0.4 mile east of Huntington, (jct of river road and US 30) flat area on top of hill, habitat description: slope variable 5-30% west facing-lizard on 5% west facing portion-bare ground 20% (scattered 4-10 sq ft. areas), loose brown soil, occasional to 40 cm diameter rock, big sage 20% (scattered), grasses and forbs 50% (cheat, some balsamroot) occasional but not numerous anthills.
NO DATA	7/21/1982	Sagebrush Lizard	11s	42e	1	SW	Durkey	3150	Surveyed sandunes SE of Oxman siding north of Durkey
2 cm length	7/22/1982	Pacific Tree Frog	12s	41e	3	SESE	Burnt River Canyon Road	2620	On burnt river shore, 200 yards up stream from mouth of French Gulch Creek.

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
NO DATA	7/22/1982	Wandering Garter Snake	12s	42e	29	SENE	Durkey Valley	2620	1.6 miles west of jct. Of Burnt river road and old US 30, near ranch house.
NO DATA	7/22/1982	Gopher Snake	12s	42e	29	SENE	Durkey Valley	2620	1.6 miles west of jct. Of Burnt river road and old US 30, near ranch house.
NO DATA	7/22/1982	Western Rattlesnake	13s	45e	9	Center	Snake River Road	2230	Dead on road, 7.2 miles north on Snake river road from confluence of Burnt River.
NO DATA	7/22/1982	Gopher Snake	11s	45e	25	SESE	Snake River Road	2100	Dead on road, 19.0 miles north on Snake river road from confluence of Burnt River.
NO DATA	7/22/1982	Wandering Garter Snake	12s	41e	3	SW	Durkey Valley	3000	1.6 miles West of jct. Of Burnt River Road and Old US 30 near ranch house "perhaps there is a denning area up the draw to the north"
Larvae	6/20/1994	Pacific Tree Frog	7s	43e	25	SENW	Holcomb Valley	4400	
NO DATA	5/12/1993	Western Fence Lizard	8s	44e	8		Sparta Butte	4400	
NO DATA	5/18/1993	Western Fence Lizard	8s	44e	12	NE	Trouble Creek	3600	
Larvae	6/20/1996	Pacific Tree Frog	12s	40e	6	SW	Cornet Creek	4300	Larvae density 100 per sq. meter, stock pond upstream from enclosure, adjacent to road 1125.
Larvae Adult	6/20/1996	Long-toed salamander	12s	40e	6	SW	Cornet Creek	4300	Larvae density 3-10 per sq. meter, stock pond upstream form enclosure, adjacent to road 1125.
Adult Larvae	6/20/1996	Great Basin Spotted Frog	9s	35e	34	NESW	Boulder Creek	4750	3 Adults, 13 Larvae (in pond), area around Boulder reek south of road 7355, off the 011/012 road, dredge pond, wet meadow and streams above pond, pond water was extremely turbid with emergent vegetation.
Larvae	6/20/1996	Pacific Tree Frog	9s	35e	34	NESW	Boulder Creek	4750	32 Larvae, area around Boulder creek south of road 7355, off the 011/012 road, dredge pond, water extremely turbid with emergent vegetation.

Appendix 1-B (Cont.)

Sex/Age	Date	Common Name	Township	Range	Section	Quarter Section	Location	Elevation (ft)	HABITAT TYPE/COMMENT
Larvae	6/20/1996	Long-toed salamander	9s	35e	34	NESW	Boulder Creek	4750	16 Larvae, area around Boulder creek south of road 7355, off the 011/012 road, dredge pond, water extremely turbid with emergent vegetation.
Larvae, possibly neo-tonic	6/20/1996	Tiger Salamander	10s	35.5e	14		Jay Gould Mine Ponds		1 Larvae (8.8cm total length) 1 Larvae (90. Total length)-not- the length is not verified- pond 10 sq. meters surface area and generally <0.3 meters depth, Pacific Spiketail Dragonfly nymphs present
NO DATA	5/1/1982	Painted Turtle	9s	40e	10		NO DATA		Turtle crossing road within 0.25 mile of ponds-location not available on printed table but is available on Oregon Natural Heritage Program data base (GIS).

Appendix 2. Trapping array characteristics including cover type, years sampled, UTM coordinates, elevation, and aspect.

Array No.	Array	Cover type	Year	UTM N	UTM E	County	State	Elev. (ft)	Aspect (°)
1	Binfrd60	G	1997	4991193	516202	Baker	OR	2135	137.4
2	Binfrd61	S	1997	4991225	516265	Baker	OR	2094	107.9
3	Binfrd62	S	1997	4991497	516741	Wallowa	OR	1785	108.0
4	Binfrd63	G	1997	4991361	516424	Baker	OR	2108	163.3
5	Binfrd64	R	1997	4990900	516531	Baker	OR	1759	150.4
6	Grouse70	G	1997	4910007	485841	Washington	ID	2377	308.8
7	Grouse71	D	1997	4909960	485147	Washington	ID	2316	249.7
8	Grouse72	S	1997	4909936	485459	Washington	ID	2259	193.8
9	Grouse73	S	1997	4909981	485700	Washington	ID	2296	214.5
10	Grouse74	D	1997	4910041	485775	Washington	ID	2319	170.5
11	Hunter75	S	1997	4981095	511018	Baker	OR	1895	110.3
12	Hunter76	S	1997	4981413	511256	Baker	OR	1891	143.7
13	Hunter77	G	1997	4981344	511074	Baker	OR	1952	95.5
14	Hunter78	R	1997	4980710	510930	Baker	OR	1908	82.1
15	Limept08	R	1996	4991517	517596	Adams	ID	1863	248.1
16	Limept09	G	1996	4991584	517882	Adams	ID	1995	312.6
17	Limept10	D	1996	4991644	517971	Adams	ID	2104	217.4
18	Limept11	S	1996	4991617	517653	Adams	ID	1941	198.4
19	Limept12	S	1996	4991598	517360	Adams	ID	1754	259.9
20	Schmam01	S	1996	5002731	522327	Adams	ID	1954	332.3
21	Schmam02	G	1996	5002524	522320	Adams	ID	2186	310.2
22	Tenmil79	S	1996	4917972	482776	Washington	ID	2229	327.3
23	Tenmil80	G	1996	4917495	482688	Washington	ID	2402	270.9
24	Tenmil81	G	1996	4917399	482718	Washington	ID	2421	290.6
25	allisn04	G	1996	4997159	521065	Adams	ID	1927	314.2
26	allisn05	D	1996	4997268	521362	Adams	ID	2139	174.2
27	allisn06	G	1996	4997295	521479	Adams	ID	2108	207.7
28	allisn07	R	1996	4997540	521534	Adams	ID	2229	147.7
29	bdeacn37	G	1996	4935830	488700	Baker	OR	2310	69.5
30	bdeacn38	G	1996	4935870	488820	Baker	OR	2190	221.6
31	bdeacn39	R	1996	4935901	488704	Baker	OR	2260	72.0
32	bdeacn40	S	1996	4936000	488590	Baker	OR	2320	120.0
33	bdeacn41	G	1996	4936030	488510	Baker	OR	2388	165.9
34	blkcan21	R	1996	4967346	508471	Baker	OR	2008	136
35	blkcan22	S	1996	4967466	508459	Baker	OR	2067	112.2
36	blkcan23	S	1996	4967259	508567	Baker	OR	2053	250.2
37	blkcan25	R	1996	4967781	508439	Baker	OR	2177	145.9

Appendix 2. (Cont.)

Array No.	Array	Cover type	Year	UTM N	UTM E	County	State	Elev. (ft)	Aspect (°)
38	blkcan26	S	1996	4967842	508414	Baker	OR	2248	113.4
39	blkcan65	S	1997	4967461	508465	Baker	OR	2067	112.2
40	blkcan66	S	1997	4967790	508484	Baker	OR	2248	113.4
41	blkcan67	R	1997	4967281	508519	Baker	OR	2017	235.2
42	blkcan68	S	1997	4967048	508707	Baker	OR	1988	217.1
43	blkcan69	G	1997	4967282	508502	Baker	OR	1989	235.2
44	cliffc16	S	1996	4970505	511525	Baker	OR	1963	137.7
45	cliffc17	D	1996	4970597	511377	Baker	OR	2069	193.2
46	cliffc18	R	1996	4970568	511296	Baker	OR	2024	150.8
47	cliffc19	S	1996	4970704	511226	Baker	OR	2122	208.6
48	cliffc20	S	1996	4970765	511127	Baker	OR	2138	77.9
49	dukesc27	D	1996	4963660	508930	Washington	ID	2480	192.6
50	dukesc28	G	1996	4963871	509114	Washington	ID	2575	121.6
51	dukesc29	S	1996	4963410	508870	Washington	ID	2529	3.4
52	dukesc30	G	1996	4963490	508990	Washington	ID	2427	338.2
53	dukesc31	R	1996	4963656	509182	Washington	ID	2500	308.4
54	foxcrk42	S	1996	4929566	484111	Baker	OR	2229	192.9
55	foxcrk43	R	1996	4929730	483750	Baker	OR	2303	71.7
56	foxcrk44	G	1996	4930190	483690	Baker	OR	2386	106.2
57	foxcrk46	G	1996	4929470	483823	Baker	OR	2327	122.7
58	foxcrk47	S	1996	4929440	483874	Baker	OR	2294	350.2
59	qksand33	G	1996	4944440	490946	Baker	OR	2651	210.2
60	qksand34	G	1996	4944595	490885	Baker	OR	2730	196.5
61	qksand35	S	1996	4944137	490800	Baker	OR	2838	51.4
62	qksand36	S	1996	4944390	490462	Baker	OR	2973	82.7
63	tunnel48	S	1996	4916788	481528	Baker	OR	2255	202.8
64	tunnel49	R	1996	4916759	481505	Baker	OR	2219	152.8
65	tunnel50	S	1996	4916742	481459	Baker	OR	2239	79.0
66	tunnel51	G	1996	4916844	481374	Baker	OR	2369	156.8
67	tunnel52	G	1996	4916786	481362	Baker	OR	2347	97.0
68	vgulch82	S	1997	4905441	483572	Washington	OR	2211	242.3
69	xhomes13	R	1996	4985227	512335	Adams	ID	1917	263.1
70	xhomes14	G	1996	4985341	512359	Adams	ID	1929	298.4
71	xhomes15	G	1996	4985113	512345	Adams	ID	1948	259.5
72	blkcan83	R	1997	4967729	508435	Baker	ID	2160	80.6

Appendix 3. Wetland/pond survey locations above Hells Canyon Dam, 1996–1997.

Site Name	Location	ST	Site Type	UTM E	UTM N
084 large pond	First pond off of forest service road 084	ID	man-made stock pond	511077	4951411
085 Lower Pond	Lower pond off of the 085 road	ID	man-made stock pond	510081	4952340
Forest Service seep		ID	Seep Pond	505290	4943939
Gravel Pit Pond	Gravel Pit-Farewell Bend, Idaho	ID	man-made pond		
Grouse Creek site 1	Grouse Creek	ID	Stream	485672	4910009
Grouse Creek site 2	Grouse Creek	ID	Stream	485846	4910148
Grouse Creek site 3	Grouse Creek	ID	Stream	485846	4910148
Laurance Cabin Pond	Laurance Cabin	ID	man-made stock pond	498875	4952235
Laurance Pasture	Between Laurance Pond and Laurance Cabin	ID	Wetland	498987	4952599
Laurance Pond	Below Laurance Pasture	ID	man-made stock pond	499196	4952916
Powder River Conservation Easement	Mouth of Powder River	ID	Canal	486435	4954798
Spring Creek Pond	Spring Creek above corral	ID	man-made stock pond	505485	4956581
Stock pond	Off of Forest Service road to Cottonwood	ID	man-made stock pond	506368	4948499
Ten Mile Seep	Road rut at Ten Mile Creek, ID	ID	spring-filled road rut	482634	4917946
Ten Mile Spring	Ten Mile	ID	spring	482634	4917946
West Weiser Flat Ponds (house pond)	Ponds off of Madison Road adjacent to the Snake River	ID	man-made irrigation pond	495933	4898742
West Weiser Flat Ponds (pond 1)	Ponds off of Madison Road adjacent to the Snake River	ID	man-made irrigation pond	495790	4897397
West Weiser Flat Ponds (pond 2)	Ponds off of Madison Road adjacent to the Snake River	ID	man-made irrigation pond	495792	4897290
West Weiser Flat Ponds (pond 3)	Ponds off of Madison Road adjacent to the Snake River	ID	man-made irrigation pond	495792	4897290
Wildhorse Toad Ponds	Backwater area adjacent to Wildhorse Creek. 500m upstream of Oxbow Reservoir	ID	Backwater pond created when floods receded	508899	4966388
Ballard Creek Pond	Top of Ballard Creek	OR	man-made stock pond	513643	4991041
Ballard Creek Seep	Top of Ballard Creek	OR	seep-pond, made by road	513221	4990774
Black Canyon Pond	Along Brownlee Oxbow road just past Black Canyon	OR	pond		
Bob Creek Mine	Mine above old homestead near Bob Creek, OR	OR	abandoned mine with water flowing from it	511689	4983965
Confluence of Powder River and Flooded Meadow	Confluence of Powder River and Flooded Meadow	OR	Flooded meadow		
Farewell Bend Reservoir	Two Miles south of Farewell Bend State Park	OR	reservoir	481755	4899075
Hunter Creek	Hunter Creek Horse Pasture	OR	man-made stock pond	511042	4980851

Appendix 3. (Cont.)

Site Name	Location	ST	Site Type	UTM E	UTM N
Oxbow Power Plant	Below Oxbow Power Plant	OR	man-made overflow pond	512024	4979504
Parker Pond	Parker Lane, Pine, OR	OR	man-made irrigation pond	509240	4976477
Road Gulch Pond	Off Map-between road gulch and reservoir	OR	man-made stock pond	484918	4898348
Seep south of Binford Ranch	Oregon side Hells Canyon Reservoir. South of Binford Ranch	OR	seep-pond, made by road	513315	4986872
Tunnel Seep	Oregon side of Brownlee	OR	Seep	480490	4915410
2.5 mi. N. Tunnel	2.5 mi. N pavement BR N Tunnel	OR		481990	4916330
Tartar's Pond	Alan Tartar's pond	ID	Pond	507814	4917326
Across from Fox Creek	Pond east of Brownlee, across from Fox Creek	ID	Pond	486460	4926350
Art's Seep	Fox Creek Seep	OR	Seep	484068	4928892
Inlet of Art's Seep	Fox Creek Seep	OR	Seep	483982	4928894
Fox Creek Pond #4	Fox Creek	OR	Pond	484205	4929438
Fox Creek Pond #3	Fox Creek	OR	Pond	484122	4929484
Fox Creek Pond #2	Fox Creek	OR	Pond	484146	4929500
Fox Creek Pond #1	Fox Creek	OR	Pond	484122	4929528
Old Hwy Rd	300 m E Old Hwy Rd. 10m E Rd.	ID	Pond	524243	4933189
Quicksand Pond	Beside Rd. N. of Quicksand	OR	Pond	491679	4943578
Oxbow rest area	Seep at Oxbow rest area	OR	Seep	512724	4976201
Brownie Parkers Pond		OR	Pond	509267	4976496
Cottonwood Seep	Cottonwood Creek	OR	Seep	512501	4976573
Limepoint Seep	Limepoint Creek	ID	Seep	517292	4991640
Hells Canyon Dam Seep	S. of Dam on East side of Road	ID	Seep	523621	5009436
Mamaloose Airstrip	Outside Rim-to-Rim Study Area	OR		524030	5030680
Lightning Creek Reservoir	Outside Rim-to-Rim Study Area	OR		524910	5032380

Appendix 4. Incidental observations recorded by IPC personnel, Hells Canyon Study Area, 1995–1998.

Date	Project	Species	No.	Time	UTM N	UTM E	CT	Comments
950315	OX	Long-toed salamander	1		4965910	508080	R	
950328	HC	Long-toed salamander	100+	1300	4991750	517200	SSW	tadpoles/eggs
950329	HC	Pacific treefrog	2	1000	4991750	517200	SSW	mating adults
950330	HC	Long-toed salamander	24+	1200	5009400	523550	EHW	tadpoles/eggs
950330	HC	Pacific treefrog	1	1200	5009400	523550	EHW	adult female
950404	BR	Long-toed salamander	4	1500	4957950	495300	EHW	tadpoles
950405	BR	Pacific treefrog	1	1200	4929500	484100	EHW	adult male
950405	BR	Western toad	12	1200	4929500	484100	EHW	12 adults
950406	BR	Pacific treefrog	6	1100	4962950	509600	G	6 adults
950406	BR	Long-toed salamander	100+	1100	4962950	509600	G	eggs
950831	BR	Columbia spotted frog	2		4955200	487300	RES	2 adults
951007		Tailed frog	1	1440	4985170	504680	RIV	Lake Fork Creek, out of project area
950406	BR	Western toad	5		4943600	491650	EHW	up to 5 adult, egg masses
951010	BR	Western toad	1	2000	4927930	486231	SS	1 adult
950404	BR	Common garter snake	1	1500	4957950	495300	EHW	
950405	BR	Western rattlesnake	1	1700	4931800	485100	CTS	
950412	HC	Rubber boa	1	1330	5009075	524100	G	
950418	BR	W. terrestrial garter snake	1	1000	4931100	485250	SSW	
950423	HC	Western fence lizard	1	1630	4983200	511800	S	
950423	HC	Western rattlesnake	1	1645	4983500	512200	S	
950425	HC	Western skink	1	1400	4997310	521880	G	
950426	HC	Western fence lizard	1	1630	4983120	511800	SS	
950427	OX	Gopher snake	1	1730	4975950	512900	S	dead on road
950427	HC	Gopher snake	1	1730	4980200	511100	S	dead on road
950427	BR	Racer	1	1600	4958830	506000	G	
950427	HC	Rubber boa	1	1400	4999050	522050	SS	
950427	BR	Western rattlesnake	1	1400	4955800	501180	DH	
950510	OX	Gopher snake	1	1430	4969350	510980	CTS	

Appendix 4. (Cont.)

Date	Project	Species	No.	Time	UTM N	UTM E	CT	Comments
950515		Rubber boa	1	1500	4977450	501050	FU	N. Fk. Pine Ck., out of project area
950516	BR	Gopher snake	1	1130	4963410	506730	G	
950516	BR	Gopher snake	1	1230	4963495	507150	RES	swimming in BR, across from Board Ck.
950516	HC	Western skink	1	1630	4980000	512025	CTS	
950517	BR	Western rattlesnake	1	1615	4963740	509340	G	
950518	BR	Racer	3	1500	4956710	502610	S	3 in area, one in shrub eating mouse
950530	BR	Racer	1	1030	4947100	492100	SS	
950531	HC	Racer	1	1115	4981630	511990	G	
950531	BR	Western rattlesnake	1	1020	4963110	508460	G	
950531	BR	Western rattlesnake	1	810	4965530	508660	FW	
950531	HC	Western rattlesnake	1	1100	4981650	511940	G	
950601	OX	Racer	1	1300	4974600	514100	SSW	
950602	HC	Common garter snake	1	800	4995210	517700	SSW	
950602	HC	Common garter snake	1	1000	4995320	517725	SSW	
950604	HC	Gopher snake	1	930	4994800	519100	G	
950607	BR	Western rattlesnake	1	1700	4964080	508020	CTS	
950608	BR	Gopher snake	1	1615	4926000	481850	SS	
950608	BR	Racer	1	1400	4924730	480910	G	
950608	BR	Racer	1	1430	4925280	480800	G	
950608	HC	Western rattlesnake	1	1040	4983180	511660	SS	
950623	BR	Western rattlesnake	1		4941600	491930	SS	
950716	BR	Rubber boa	1		4934500	480350	FU	Big Lookout Mt.
950912	BR	Western skink	1	1030	4912320	482820	SS	
950925	BR	Western rattlesnake	1	1730	4963610	508770	SS	
950925	BR	Western rattlesnake	1	1830	4963340	510130	SS	
950926	HC	Western rattlesnake	1	1130	4995500	517575	DS	
951005	HC	Rubber boa	1	1630	4991570	513410	S	upper Ballard Ck. Road
951005	HC	Rubber boa	1	1630	4990790	513100	S	dead, possible predation
951005		Rubber boa	1	1630			S	dead on N. Pine Ck. Road, out of project area

Appendix 4. (Cont.)

Date	Project	Species	No.	Time	UTM N	UTM E	CT	Comments
950730	BR	Rubber boa	1		4953900	514600		1 adult
950601	BR	Western rattlesnake	1	935	4932200	484610	DH	
950601	BR	Western rattlesnake	1	948	4932230	484590	DH	
950426	OX	Western skink	1	1645	4969550	509690	G	4" long w/ tan & brown stripes, tail grey/brown
950515	BR	Longnose leopard lizard	1	1500	4917650	482820		AMAH, KDW, VP, FE
950404	OX	Western fence lizard	1	1400	4978560	513030	DS	grey/brwon w/ spiny back/tail
960320	HC	Western skink	1	1030	5012230	524300	SS	
960320	OX	Western fence lizard	1	1146	4977320	514070	DS	caught and photographed by VP
960326	BR	Common garter snake	1	1500	4929550	484000	EHW	
960326	BR	Common garter snake	1	1500	4929500	484200	EHW	
960404	BR	Long-toed salamander	1	1500	4963810	509100	G	on Brte slope 25 m from moist draw
960406	HB	Gopher snake	1	1700	5048520	541240	G	
960407	HB	Racer	1	1530	5045440	539400	FW	
960407	HB	Racer	1	1600	5045170	540070	G	consuming a vole
960409	HC	Western rattlesnake	1	900	4986460	511670	SS	no reaction (flight or defense)
960409	HC	Western rattlesnake	1	1330	4995590	520380	G	digesting prey (distended)
960413	BR	Common garter snake	2	1600	4954610	486500	FW	snakes w/in 50 m of each other
960416	OX	Racer	1	1400	4967400	508600	SS	
960417	BR	Gopher snake	1	1430	4929500	484200	EHW	
960429	BR	Western rattlesnake	1	1200	4935275	488110	G	rattled and fled
960502	BR	Western rattlesnake	1	1400	4915500	481500	G	rattled and fled
960507	HC	Gopher snake	1	1015	4976550	511700	SS	
960507	HC	Western rattlesnake	1	1100	4977220	512030	SSW	juvenile, slow retreat
960507	BR	Western fence lizard	1	1130	4964400	506700	TS	~800 ft above reservoir
960507	BR	Bullfrog	15	1200	4900550	488500	EHW	Cobb rapids pond. No other amphs seen.
960507	BR	Western skink	3	1200	4900550	488500	SSW	
960507	BR	Rubber boa	2	1600	4951580	510375	FU	copulating, female large (20")

Appendix 4. (Cont.)

Date	Project	Species	No.	Time	UTM N	UTM E	CT	Comments
960508	OX	Western fence lizard	1	1245	4981300	512800	G	dark blotches on sides
960508	BR	Long-toed salamander	2+	1530	4954700	486400	FW	juveniles (tadpoles)
960508	BR	Columbia spotted frog	2	1530	4954700	486400	FW	
960509	HC	Racer	1	1200	4988820	514910	SS	GOSN and UK lizard also seen in area
960510	HC	Western fence lizard	1		4994900	517950	SBW	
960510	HC	Western rattlesnake	1	1000	4994900	517950	SBW	retreated into burrow
960512	BR	Western fence lizard	1	1800	4962400	510950	G	
960513	HC	Western rattlesnake	1	1030	4997300	521900	SS	trampled by horse? but still alive
960515	BR	Western toad	1	1015	4950450	495600	G	on steep slope 80 m above lone pine down cr
960515	BR	Western rattlesnake	1	1130	4957800	494275	FW	no reaction
960516	OX	Pacific treefrog	1	1930	4967200	509300	SSW	AURAL OBS
960520	HB	Racer	2	1000	5042800	536750	G	
960521	HB	Western rattlesnake	1	900	5045150	541000	FW	retreat off of road
960521	HB	Racer	3	1400	5047750	540500	SS	
960522	HB	Racer	3	1200	5048600	542300	SS	
960523	HB	Western rattlesnake	1	1400	5059800	536000	SSW	
960523	HB	Western rattlesnake	1	1800	5058900	536500	SS	
960524	HB	Western fence lizard	1	1200	5067800	534200	SS	
960529	BR	Racer	4	1400	4927100	484850	G	
960529	BR	Rubber boa	1	2000	4954575	510400	R	ran over
960530	BR	Western rattlesnake	1	940	4935750	488850	SS	curled beneath Artr
960604	HB	Racer	1	1030	5027300	530500	G	
960604	HB	Racer	1	1100	5028450	531200	SS	
960604	HB	Racer	1	1700	5034950	534750	FW	in tree
960604	HB	Gopher snake	1	1800	5034800	534900	SS	
960605	HB	Gopher snake	1	1500	5037995	535185	FU	
960605	HB	Racer	1	1630	5037900	535100	SS	
960606	HB	Western rattlesnake	1	1100	5039790	535700	SS	

Appendix 4. (Cont.)

Date	Project	Species	No.	Time	UTM N	UTM E	CT	Comments
960606	HB	Western fence lizard	1	1800	5044500	537050	SS	
960606	HB	Western fence lizard	1	1900	5044650	537175	SSW	
960607	HB	Gopher snake	1	1200	5053115	540950	SSW	
960612	BR	Tailed frog	50	1600	4962550	510650	FW	tadpoles in various stages
960613	BR	Racer	1	1000	4950580	495620	SS	hunting with raised head
960617	HC	Racer	1	1000	4988800	514750	G	
960617	HC	Western fence lizard	1	1020	4988900	514850	S	
960617	HC	Western rattlesnake	1	1100	4994800	517850	SS	dark
960619	OX	Racer	1	930	4971700	512900	G	
960709	OX	Western rattlesnake	2		4978610	512320	FW	1 GOSN also seen at this location
960710	OX	Gopher snake	1	2030	4966100	508100	R	
960710	OX	Western rattlesnake	1	2045	4966150	508060	R	
960711	HC	Western rattlesnake	1	900	4990120	516710	SS	
960718	HB	Racer	1		5021330	527200	FW	UTMS are approx.
960720	HB	Western rattlesnake	1		5032400	532300	SS	
960720	HB	Western rattlesnake	1		5032900	532760	G	
960722	HB	Western rattlesnake	1	830	5043600	536950	SSW	
960722	HB	Western toad	8	1000	5043140	536900	SBW	
960509	OX	Western rattlesnake	1	945	4970150	512400	S	2+ ft long w/6-10 rattles. faint pattern.
960807	OX	Western fence lizard	2	1200	4966350	509710	G	Wildhorse River
960807	BR	Western whiptail	1	1300	4956210	500390	RES	at high water mark.
960807	BR	Western fence lizard	2		4963450	506740	RES	at concrete net holder.
960812	HB	Western rattlesnake	1	1600	5023600	528440	SSW	combined form with #136
960813	HB	Gopher snake	1	1500	5023600	528440	S	combined form with #135
960813	HB	Western skink	1	1400	5023520	528510	SSW	~12 cm long w/blue tail (juvenile).
960814	OX	Western fence lizard	1	1030	4976330	512630	SSW	2 1/2 in. long
960814	OX	Western fence lizard	1	1730	4965970	508060	R	on side of field house.
960828	BR	Pacific treefrog	1	1200	4956500	489100	RES	1 1/2 in., green phase.

Appendix 4. (Cont.)

Date	Project	Species	No.	Time	UTM N	UTM E	CT	Comments
960829	OX	Western fence lizard	1	1630	4988590	514860	FW	Ballard Creek.
960831	OX	Western rattlesnake	1	2200	4979150	512840	SS	~50-60 cm. Whitetail Creek.
960901	BR	Racer	2	1300	4962420	510610	G	1adult and 1 juvenile. Dukes Creek.
960902		Pacific treefrog	3	1500	4960055	512700	EHW	tan/brown phase juveniles. Dukes Cr. @5000ft
960905	HB	Western fence lizard	1		5058200	537400	SS	15 cm. Big Canyon Creek.
960905	HB	Western fence lizard	1		5056500	538500	SS	McCarty Creek.
960905	OX	Western fence lizard	3	1300	4967300	508550	SSW	3 juveniles in different locations.
960908	OX	Western fence lizard	1	2000	4965970	508060	R	juvenile.
960909	BR	Racer	1	1245	4963600	508700	FW	Dukes Creek.
960910	BR	Racer	1	900	4944630	491250	SS	60 cm. north of Quicksand Creek.
960911	OX	Western toad	1	1400	4966300	508550	FW	5 in. Wildhorse River.
960916	BR	Western rattlesnake	1	1300	4963750	508390	SSW	Dukes Creek.
960921	HC	Striped whipsnake	1	1400	4981500	513190	SS	~4 ft. dark brown w/cont. longitudinal stripes.
960921	HC	Racer	1	1400	4981610	513150	SS	
960921	HC	Western fence lizard	1	1400	4981610	513150	SS	
960927	HC	Western fence lizard	4	1115	4982010	511660	SS	dark phase. Homestead Road.
961002	HC	Western rattlesnake	1	1815	4981570	513290	SS	aggressive. bit shotgun.
961002	HC	Racer	1	1800	4981980	513420	SS	small but adult-colored.
961002	HC	Sagebrush lizard	1	1800	4981980	513420	SS	scales not keeled.
961015	HC	Racer	1	1300	4997030	520680	SS	late in season (cold). one live, one dead on road.
961015	HC	Racer	1	1530	4981520	513330	DS	late in season (cold).
961015	HC	Racer	1	1700	4981180	512620	SSW	ditto.
961009	BR	Gopher snake	1	1000	4945000	491120	SS	length 1 meter.
961010	BR	Common garter snake	1	1430	4963380	509750	S	small. contrasting yellow, black, red.
961023	OX	Western rattlesnake	1	1300	4978510	512580	SS	20 cm. brightly contrasting. on dark soil.
960523	HB	Western rattlesnake	1	1800	5059020	536600	SSW	scout GPS gave wrong UTM's and elev.
970322	OX	Western fence lizard	4	1530	4965300	511700	TS	early observation.

Appendix 4. (Cont.)

Date	Project	Species	No.	Time	UTM N	UTM E	CT	Comments
970331	BR	Racer	4	1400	4963660	508920	SS	early observation.
970422	BR	W. terrestrial garter snake	1	1200	4954810	486430	FW	western terrestrial garter snake.
970422	HB	Western skink	1	1600	5067240	534475	SS	
970501	BR	Side-blotched lizard	1	1600	4907900	484180	SS	side-blotched lizard.
970505	BR	Columbia spotted frog	1	1130	4954810	486430	FW	
970521	HB	Gopher snake	1	1200	5031550	532090	SS	
970528	HB	Racer	1	1120	5027400	530400	G	
970528	HB	Western fence lizard	1	1200	5017600	525540	SSW	
970528	HB	Racer	1	1200	5017600	525540	SSW	
970530	BR	Longnose leopard lizard	1	1600	4903940	483550	SS	longnose leopard lizard on an old dune.
970601	BR	W. terrestrial garter snake	1	1700	4949390	507200	SSW	assumed defensive posture. @4600 FT
970604	HC	Western fence lizard	1	1500	4992550	516960	S	
970605	HC	Western fence lizard	1	1300	4981480	510790	SS	
970615	OX	Western rattlesnake	1	1700	4976600	518830	S	elevation 4300 feet.
970721	HC	Western toad	2000	1800	4993700	526000	FW	covered road for 0.5 mile @ 4600 FT. T-storm coming.
970818	HB	Gopher snake	3		5027400	530400	SS	
970818	HB	W. terrestrial garter snake	1		5027400	530400	SS	
970820	HB	Western fence lizard	2		5060100	536100	SS	
970911	BR	Western toad	1	1100	4955600	489200	EHW	
970916	HB	W. terrestrial garter snake	1	1200	5024900	529000	SSW	
970919	HB	Western fence lizard	1	1400	5041920	536490	SS	
970923	HB	Western toad	1	915	5017600	525100	SS	huge— 5"-6" long.
970923	HB	Racer	1	1130	5017600	525160	SSW	
970923	HB	Western rattlesnake	1	1245	5020340	527715	SSW	very active.
971001	HC	Western fence lizard	1	1100	4976040	512640	TS	
971016	OX	Racer	1	1400	4976050	513800	SS	
971016	OX	Western rattlesnake	1	1400	4976050	513800	SS	

Appendix 4. (Cont.)

Date	Project	Species	No.	Time	UTM N	UTM E	CT	Comments
971022	HB	Racer	1	1600	5009990	523900	SSW	
971113	HC	Racer	1	1530	4988400	514650	SS	late-season observation.
980428	HB	Western toad	25	1800	5053500	541650	EHW	mostly males
980428	BR	Columbia spotted frog	10	1100	4954650	488750	FW	
980506	BR	Western toad	1	800	4950490	495520	SSW	
980507	OX	Pacific treefrog	50		4979060	512780	SS	tadpoles
980507	OX	Long-toed salamander	20		4979060	512780	SS	tadpoles
980512	BR	Western toad	351	730	4956760	505340	SS	one adult, ~350 hatchlings
980512	BR	Long-toed salamander	50	730	4956760	505340	SS	recently hatched
980527	BR	Pacific treefrog	2	1130	4954750	486490	EHW	
980602	BF	Western toad	1	1500	4975620	517700	G	
980603	BA	Woodhouse's toad	1	1030	4900620	489770	CTS	skull near PRFA nest
980603	BA	Pacific treefrog	5+	1000	4898440	492730	SS	all stages of development
980609	BR	Western toad	1	905	4957390	503110	EHW	
980618	BR	Pacific treefrog	250	900	4962970	509580	G	large tadpoles metamorphosing
980618	HC	Western toad	2	1300	4974260	506830	SSW	
980623	OX	Western toad	1	930	4977230	512080	EHW	
980803	HB	Western toad	30	1800	5041950	536480	RIV	toadlets in dried pond area
980803	HB	Western toad	200	1200	5017735	525540	RIV	newly hatched, bluegill in same pond
980826	HB	Tailed frog	2	1300	5008020	525950	RIV	juveniles
980402	HC	Western fence lizard	1	1300	4991700	517500	DS	
980427	HB	Western fence lizard		1000	5052300	542940	SSW	
980427	HB	Western rattlesnake	3	1600	5052240	543100	S	seen over several days
980428	HB	W. terrestrial garter snake	1	900	5055770	545800	SSW	
980504	OX	Western fence lizard	1	1300	4965980	508070	U	at House 564
980504	HC	Rubber boa	1	1024	4987350	513900	SSW	
980506	BR	Longnose leopard lizard	3	1300	4904500	483100	DS	
980507	OX	Western fence lizard	1	1045	4966450	509000	G	
980507	OX	Night snake	1	1100	4979060	512780	SS	

Appendix 4. (Cont.)

Date	Project	Species	No.	Time	UTM N	UTM E	CT	Comments
980508	BR	Side-blotched lizard	5	1330	4911700	480420	CTS	during collared liz survey
980528	HC	Western fence lizard	1	1620	4985950	512050	SBW	
980602	BA	Western whiptail	1	1300	4900710	488680	CTS	
980603	BR	Side-blotched lizard	1	1245	4906810	483460	SS	
980603	BR	Western whiptail	1	1350	4906820	483390	SS	
980604	BR	Racer	1	930	4911820	480710	F	
980604	BR	Western whiptail	1	1153	4912240	481510	CTS	
980623	OX	Western fence lizard	1	920	4977230	512080	EHW	near slash pile in mouth of Cottonwood Cr.
980624	HB	W. terrestrial garter snake	1	1200	5034400	535500	SSW	Northern OBS
980701	BF	W. terrestrial garter snake	1	1000	4975820	518210	G	Barber Flats
980715	BR	Western whiptail	1	1300	4926350	483400	SSW	
980725	HB	W. terrestrial garter snake	1	1315	5021100	527350	FW	
980726	BA	W. terrestrial garter snake	1	1200	4899750	494355	AG	
980728	BA	Western rattlesnake	1	1000	4899390	493290	FW	
980804	HB	Western rattlesnake	1	1700	5069340	531040	SSW	
980818	HB	Western rattlesnake	1	1730	5034620	535370	F	
980818	HB	Racer	1	1700	5034220	535930	FW	
980818	HB	Racer	1	1630	5034415	535535	FW	
980819	HB	Western rattlesnake	1	1950	5044600	536650	SS	small
980819	HB	Racer	1	1330	5039700	535550	SBW	
980819	HB	Western rattlesnake	1	1145	5039520	535390	SBW	3 ft.
980820	HB	Western fence lizard	1	1930	5044800	536450	G	
980820	HB	Western fence lizard	4	1945	5066680	534720	RIV	
980825	OX	Western fence lizard	20	1200	4966000	512000	SS	seen throughout the day
980825	OX	W. terrestrial garter snake	1	1300	4965880	512300	RIV	hunting minnows along Wildhorse
980831	HB	Western rattlesnake	1	1430	5012840	525140	FW	

Appendix 4. (Cont.)

Date	Project	Species	No.	Time	UTM N	UTM E	CT	Comments
980901	HB	Western skink	1	1500	5023340	528145	SBW	
980903	HB	Western rattlesnake	1	1830	5056130	538910	SBW	
980904	HB	Western rattlesnake	1	1100	5061860	535960	SSW	
980916	HB	Gopher snake	1	1215	5039070	534590	SBW	
980921	BR	Western whiptail	1	1330	4956230	496350	RES	In draw-down zone
980929	HB	Gopher snake	1	1130	5027321	530242	FW	
980930	HB	Western fence lizard	1	1100	5059550	536150	SSW	
980930	HB	Western rattlesnake	1	1100	5059560	536150	SSW	
981001	HB		1	1300	5008900	525780	FW	
980818	HB	Racer	1	1740	5034890	535180	SSW	
981002	BR	Racer	1	1000	4931000	485450	SS	dead on road
981002	BR	Common garter snake	1	1100	4931300	485290	SSW	
981002	BR	Gopher snake	1	1200	4931400	485190	SSW	
960507	HC	Racer	1	1015	4976550	511700	SS	
960524	HB	Racer	1	1200	5067800	534200	SS	
960604	HB	Racer	2	1800	5034800	534900	SS	
960606	HB	Racer	2	1100	5039790	535700	SS	
960606	HB	Racer	2	1800	5044500	537050	SS	
960709	OX	Gopher snake	1		4978610	512320	FW	
960720	HB	Racer	2		5032400	532300	FW	
960720	HB	Racer	2		5032900	532760	SSW	
960722	HB	Gopher snake	1	1000	5043140	536900	FW	

Appendix 5. Incidental observations recorded by ISU personnel during the spring and summer of 1996.

Species	UTM Easting (m)	UTM Northing (m)	County	State	Date	Elevation (m)
Common garter snake	484122	4929528	Baker	OR	03/26/1996	667
Common garter snake	484122	4929484	Baker	OR	03/26/1996	665
Racer	515459	4943722	Washington	ID	04/08/1996	1023
Gopher snake	481540	4915990	Washington	ID	04/08/1996	792
Racer	483976	4929570	Baker	OR	04/13/1996	675
Gopher snake	491655	4942994	Baker	OR	04/13/1996	639
Gopher snake	485642	4930119	Baker	OR	05/10/1996	659
Gopher snake	485178	4929797	Baker	OR	05/10/1996	620
Gopher snake	484235	4928631	Baker	OR	05/10/1996	646
Racer	517789	4991626	Adams	ID	05/11/1996	609
Gopher snake	512437	4984496	Adams	ID	05/11/1996	536
Western toad	511125	4941217	Washington	ID	06/07/1996	1280
Western toad	482354	4923193	Baker	OR	07/07/1996	646
Racer	489597	4938329	Baker	OR	07/08/1996	679
Gopher snake	491026	4945090	Baker	OR	07/08/1996	862
Western rattlesnake	512016	4972119	Baker	OR	07/09/1996	562
Racer	521045	4997178	Adams	ID	07/10/1996	590
Gopher snake	517285	4938281	Washington	ID	07/10/1996	959
Gopher snake	521041	4997163	Adams	ID	07/10/1996	585
Western whiptail	482273	4925857	Baker	OR	07/12/1996	705
Western rattlesnake	507967	4966433	Baker	OR	07/12/1996	466
Gopher snake	513167	4975195	Baker	OR	07/12/1996	558
Gopher snake	490032	4961448	Baker	OR	07/12/1996	1054
Gopher snake	490088	4960985	Baker	OR	07/12/1996	1020
Gopher snake	490139	4939402	Baker	OR	07/12/1996	657
Gopher snake	497201	4968956	Washington	ID	07/12/1996	764
Common garter snake	484154	4929464	Baker	OR	3/26/96	663
Gopher snake	481528	4916788	Baker	OR	4/15/96	682
W. terrestrial garter snake	488500	4900550	Washington	ID	4/20/96	847
Rubber boa	513850	4950490	Washington	ID	5/02/96	1284
Western rattlesnake	481434	4916824	Baker	OR	5/03/96	705
Western toad	513850	4950490	Washington	ID	5/05/96	1284
Western rattlesnake	517596	4991617	Adams	ID	5/05/96	600
Gopher snake	519184	4939378	Washington	ID	5/05/96	904
Gopher snake	512441	4976691	Baker	OR	5/07/96	559

Appendix 5. (Cont.)

Species	UTM Easting (m)	UTM Northing (m)	County	State	Date	Elevation (m)
Gopher snake	517187	4992271	Adams	ID	5/07/96	521
Racer	484154	4929464	Baker	OR	5/10/96	663
Gopher snake	484293	4928781	Baker	OR	5/10/96	646
Gopher snake	484236	4928657	Baker	OR	5/10/96	646
Gopher snake	484236	4928657	Baker	OR	5/10/96	646
Gopher snake	520749	4997143	Adams	ID	5/10/96	545
Gopher snake	517250	4991380	Adams	ID	5/10/96	508
Common garter snake	484122	4929484	Baker	OR	5/10/96	665
Western toad	509627	4976773	Baker	OR	5/11/96	583
Racer	508595	4966946	Baker	OR	5/11/96	561
Racer	508595	4966946	Baker	OR	5/11/96	561
Racer	517690	4991610	Adams	ID	5/11/96	597
Gopher snake	513120	4975501	Baker	OR	5/11/96	485
Gopher snake	508988	4966925	Baker	OR	5/11/96	557
Gopher snake	506590	4961580	Washington	ID	5/11/96	661
Gopher snake	506400	4951980	Washington	ID	5/11/96	651
Gopher snake	512398	3983720	Adams	ID	5/11/96	520
Racer	509114	4963871	Washington	ID	5/13/96	779
Western rattlesnake	511201	4969674	Baker	OR	5/13/96	552
Western rattlesnake	508045	4964081	Washington	ID	5/13/96	640
Western rattlesnake	509250	4963730	Washington	ID	5/13/96	752
Western rattlesnake	517186	4993120	Adams	ID	5/13/96	515
Gopher snake	512174	4977058	Baker	OR	5/13/96	568
Racer	482850	4916630	Washington	ID	5/14/96	820
Gopher snake	511201	4969674	Baker	OR	5/14/96	552
Gopher snake	482850	4916630	Washington	ID	5/14/96	820
Western toad	489930	4938920	Baker	OR	5/17/96	683
Western toad	508386	4955758	Washington	ID	5/17/96	797
Racer	483982	4928894	Baker	OR	5/17/96	704
Racer	483982	4928894	Baker	OR	5/17/96	704
Racer	483982	4928894	Baker	OR	5/17/96	704
Racer	482890	4921690	Baker	OR	5/17/96	671
Gopher snake	484067	4928892	Baker	OR	5/17/96	684
Gopher snake	484067	4928892	Baker	OR	5/17/96	684
Gopher snake	484067	4928892	Baker	OR	5/17/96	684
Western whiptail	480906	4916100	Baker	OR	5/21/96	639

Appendix 5. (Cont.)

Species	UTM Easting (m)	UTM Northing (m)	County	State	Date	Elevation (m)
Gopher snake	490460	4944820	Baker	OR	5/21/96	841
Gopher snake	489870	4938770	Baker	OR	5/21/96	671
Gopher snake	485940	4930360	Baker	OR	5/21/96	671
Western toad	489850	4938460	Baker	OR	5/22/96	689
Western toad	489850	4938460	Baker	OR	5/22/96	689
Racer	481553	4916646	Baker	OR	5/23/96	644
Rubber boa	521464	4997302	Adams	ID	5/25/96	637
Gopher snake	511852	4977669	Baker	OR	5/25/96	563
Gopher snake	511483	4980160	Adams	ID	5/25/96	534
Western toad	506430	4961080	Washington	ID	5/27/96	651
Rubber boa	507260	4962730	Washington	ID	5/27/96	630
Rubber boa	509710	4942430	Washington	ID	5/27/96	1480
Racer	514495	4938502	Washington	ID	5/27/96	1048
Racer	482410	4916890	Washington	ID	5/27/96	719
Racer	481930	4912960	Washington	ID	5/27/96	658
Racer	483700	4911330	Washington	ID	5/27/96	658
Racer	484010	4910910	Washington	ID	5/27/96	658
Racer	482820	4916540	Washington	ID	5/27/96	820
Racer	482820	4916540	Washington	ID	5/27/96	820
Striped whipsnake	484040	4910920	Washington	ID	5/27/96	658
Striped whipsnake	483460	4904560	Washington	ID	5/27/96	667
Gopher snake	509820	4967987	Baker	OR	5/27/96	558
Gopher snake	506590	4960190	Washington	ID	5/27/96	685
Gopher snake	514656	4938543	Washington	ID	5/27/96	1048
Gopher snake	516609	4938389	Washington	ID	5/27/96	976
Gopher snake	509863	4912288	Washington	ID	5/27/96	798
Gopher snake	482950	4912120	Washington	ID	5/27/96	652
Gopher snake	506381	4905811	Washington	ID	5/27/96	710
Gopher snake	483460	4904560	Washington	ID	5/27/96	667
Gopher snake	483460	4904560	Washington	ID	5/27/96	667
W. terrestrial garter snake	514694	4944129	Washington	ID	5/27/96	1040
Western toad	484293	4928781	Baker	OR	5/28/96	646
Racer	482020	4925930	Baker	OR	5/28/96	597
Gopher snake	490230	4959545	Baker	OR	5/28/96	913
Gopher snake	484423	4932448	Baker	OR	5/28/96	771
Gopher snake	485111	4929707	Baker	OR	5/28/96	642

Appendix 5. (Cont.)

Species	UTM Easting (m)	UTM Northing (m)	County	State	Date	Elevation (m)
Western toad	490860	4945510	Baker	OR	5/29/96	914
Western rattlesnake	509978	4955008	Washington	ID	5/29/96	925
Gopher snake	504691	4972965	Baker	OR	5/29/96	691
Gopher snake	491665	4943315	Baker	OR	5/29/96	659
Gopher snake	488510	4936030	Baker	OR	5/29/96	734
Gopher snake	488510	4936030	Baker	OR	5/29/96	734
Western rattlesnake	521362	4997268	Adams	ID	5/31/96	634
Western rattlesnake	517690	4991610	Adams	ID	5/31/96	569
Rubber boa	513850	4950490	Washington	ID	5/4/96	1284
Rubber boa	509870	4944960	Washington	ID	5/7/96	1395
Rubber boa	518690	4933470	Washington	ID	5/7/96	905
Racer	511434	4970429	Baker	OR	6/01/96	576
Gopher snake	491594	4942834	Baker	OR	6/01/96	639
Gopher snake	491592	4943956	Baker	OR	6/01/96	699
Common garter snake	541110	5048330	Idaho	ID	6/03/96	383
Racer	543150	5052340	Idaho	ID	6/04/96	538
Racer	539320	5046160	Idaho	ID	6/04/96	382
Gopher snake	506657	4973998	Baker	OR	6/07/96	653
Gopher snake	503034	4970688	Baker	OR	6/07/96	726
Gopher snake	502018	4969844	Baker	OR	6/07/96	718
Gopher snake	486400	4954580	Baker	OR	6/07/96	646
Gopher snake	492054	4947175	Baker	OR	6/07/96	916
Gopher snake	482544	4918638	Baker	OR	6/07/96	657
Gopher snake	507890	4964160	Washington	ID	6/08/96	630
Gopher snake	521687	5000010	Adams	ID	6/08/96	569
Gopher snake	517619	4993865	Adams	ID	6/08/96	522
Western rattlesnake	520008	4996195	Adams	ID	6/09/96	527
Gopher snake	512000	4979111	Baker	OR	6/09/96	581
Gopher snake	512421	4973384	Baker	OR	6/09/96	570
Racer	487220	4931310	Baker	OR	6/10/96	658
Racer	491720	4948110	Baker	OR	6/10/96	1009
Gopher snake	484500	4929370	Baker	OR	6/10/96	642
Western rattlesnake	492090	4947040	Baker	OR	6/12/96	1009
Gopher snake	512714	4974032	Baker	OR	6/12/96	561
W. terrestrial garter snake	486400	4954580	Baker	OR	6/12/96	646
Western rattlesnake	516632	4990258	Adams	ID	6/13/96	528

Appendix 5. (Cont.)

Species	UTM Easting (m)	UTM Northing (m)	County	State	Date	Elevation (m)
Western fence lizard	508459	4967466	Baker	OR	6/13/96	626
Western fence lizard	508595	4966946	Baker	OR	6/13/96	561
Western fence lizard	508595	4966946	Baker	OR	6/13/96	561
Western toad	509720	4944790	Washington	ID	6/15/96	1456
Rubber boa	511410	4947010	Washington	ID	6/15/96	1205
Rubber boa	511410	4941070	Washington	ID	6/15/96	1248
Rubber boa	513210	4938920	Washington	ID	6/15/96	1113
Western toad	510150	5003590	Wallowa	OR	6/19/96	1180
Racer	519590	5035780	Wallowa	OR	6/19/96	1792
Night snake	511127	4970765	Baker	OR	6/19/96	634
Rubber boa	529350	5037160	Wallowa	OR	6/23/96	1713
Gopher snake	516609	4938389	Washington	ID	6/27/96	976
Racer	520749	4997143	Adams	ID	6/28/96	545
Rubber boa	509710	4942430	Washington	ID	6/6/96	1480
Rubber boa	909940	4941540	Washington	ID	6/6/96	1353
Rubber boa	511520	4940870	Washington	ID	6/6/96	1242
Gopher snake	517811	4937846	Washington	ID	7/1/96	948
W. terrestrial garter snake	518659	4937130	Washington	ID	7/1/96	915
Rubber boa	511410	4947010	Washington	ID	7/2/96	1205
Rubber boa	511130	4946850	Washington	ID	7/2/96	1211
Rubber boa	510340	4946230	Washington	ID	7/2/96	1211
Rubber boa	509770	4943280	Washington	ID	7/2/96	1486
Pacific treefrog	509690	4942170	Washington	ID	7/2/96	1486
Pacific treefrog	519370	4932480	Washington	ID	7/2/96	844
Rubber boa	515050	4954950	Washington	ID	7/21/96	443
Rubber boa	514550	4953870	Washington	ID	7/21/96	399
Rubber boa	510010	4946030	Washington	ID	7/3/96	1211
Rubber boa	509890	4945550	Washington	ID	7/3/96	1211
Rubber boa	509890	4941590	Washington	ID	7/3/96	1395
Western whiptail	484236	4928657	Baker	OR	7/3/96	646
Racer	512901	4939073	Washington	ID	7/3/96	1134
Western rattlesnake	481270	4916230	Baker	OR	7/3/96	673
Gopher snake	516462	4938408	Washington	ID	7/3/96	981
Gopher snake	519390	4932180	Washington	ID	7/3/96	862
Pacific treefrog	509750	4944180	Washington	ID	7/3/96	1468
W. terrestrial garter snake	486330	4968770	Baker	OR	7/3/96	1317

Appendix 5. (Cont.)

Species	UTM Easting (m)	UTM Northing (m)	County	State	Date	Elevation (m)
Common garter snake	484122	4929528	Baker	OR	7/3/96	667
Western toad	505730	4944890	Washington	ID	7/4/96	1573
Rubber boa	515030	4954160	Washington	ID	7/4/96	417
Rubber boa	508470	4950830	Washington	ID	7/4/96	391
Rubber boa	507140	4949250	Washington	ID	7/4/96	1256
Rubber boa	511320	4946930	Washington	ID	7/4/96	1205
Western rattlesnake	507720	4963380	Washington	ID	7/4/96	630
Gopher snake	516632	4990258	Adams	ID	7/5/96	528
Western toad	488063	4934104	Baker	OR	7/7/96	645
Western rattlesnake	492032	4947214	Baker	OR	7/8/96	1069
Rubber boa	509978	4955008	Washington	ID	8/3/96	925

Appendix 6. Two-Way-Indicator-Species-Analysis (TWINSPAN) with reptile community composition and abundance data from drift-fence arrays, Hells Canyon Study Area, 1996–1997. Values denote capture rates (captures/100 trap nights). Cut levels were the default values 0, 2, 5, 10, and 20.

River	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Mile	8	8	8	8	8	8	8	6	6	8	8	8	6	6	5
	3	3	3	0	5	3	0	0	1	3	0	0	0	9	6
Habitat[a]	G	S	S	D	D	S	S	G	D	S	S	S	S	S	D
Array[b]	4	3	4	4	4	3	4		1	3	4	4		1	2
	3	5	2	5	9	6	8	4	7	8	7	4	2	1	6
WESK[c]	-	1	1	-	-	2	-	-	-	-	-	-	-	-	-
NISN	-	3	-	2	1	2	2	1	1	1	1	2	2	2	2
WFLI	1	-	-	-	-	1	2	-	1	-	1	-	-	2	1
RUBO	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WERA	-	-	-	-	-	-	-	-	-	-	-	-	1	2	3
WTGS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RACE	2	5	3	5	3	4	3	3	4	4	3	4	4	4	4
GOSN	-	-	-	1	1	2	2	2	2	2	2	3	2	3	2
WEWH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STWH	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1

River	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	2	2	2	3	3	3	2	2	2	2	2	3	3	3	3	3	3	3	2	2	2	2	2	3	3	3	2	3	2	3	3	3
Mile	6	5	5	5	6	5	5	6	6	8	8	6	6	2	2	6	6	8	2	0	0	8	8	8	8	8	1	1	0	0	0	2	0	8	6	6	6	6	1	1	2	6	2	8	1	0	2
	1	2	2	6	0	6	6	1	1	3	5	0	1	3	3	9	9	3	4	9	9	3	3	0	5	5	5	5	4	4	4	4	9	5	6	6	0	9	5	5	4	6	3	3	5	4	4
Habitat[a]	G	S	G	R	S	S	S	R	S	R	G	S	S	S	G	G	S	R	R	G	G	S	S	R	S	R	R	S	G	G	S	S	S	G	R	G	R	R	S	G	G	G	G	R	G	S	S
Array[b]	1	2	2	2		2	2	1	1	3	5		1	2	2	1	1	3	6	2	3	3	4	4	5	5	5	5	5	6	6	6	3	5	6	7		1	5	5	6	7	2	4	5	6	6
	6	0	1	8	1	5	7	5	9	4	2	3	8	2	4	3	2	7	4	9	3	9	0	6	1	3	5	8	9	0	2	3	2	0	9	0	5	4	4	7	7	1	3	1	6	1	5
WESK[c]	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NISN	-	-	1	-	2	1	1	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WFLI	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RUBO	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WERA	2	3	4	3	2	2	2	1	1	2	2	2	1	-	1	2	2	2	2	-	1	1	1	1	-	2	2	1	2	2	3	2	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
WTGS	1	1	1	2	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RACE	4	4	4	4	4	5	5	5	5	5	5	4	4	5	4	3	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	5	4	3	3	3	3	3	3	2	1	2	2	2
GOSN	3	2	2	3	3	3	2	3	3	3	3	4	4	5	4	2	3	2	2	3	1	-	3	2	3	3	2	2	2	2	2	3	2	2	2	-	1	1	1	2	2	2	2	2	-	2	2
WEWH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
STWH	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

River	3	3	3	3	3	3	3	3	3
Mile	3	3	0	2	0	3	3	3	3
	0	0	9	4	9	0	0	0	3
Habitat[a]	G	S	R	G	G	D	S	D	S
Array[b]			3	6	3			1	6
	6	9	1	6	0	7	8	0	8
WESK[c]	-	-	-	-	-	-	-	-	-
NISN	-	-	-	-	1	-	-	-	-
WFLI	-	-	-	-	-	-	-	-	-
RUBO	-	-	-	-	-	-	-	-	-
WERA	-	-	-	-	-	-	-	-	-
WTGS	-	-	-	-	-	-	-	-	-
RACE	3	2	3	2	4	2	3	1	2
GOSN	2	2	2	2	3	2	-	2	2
WEWH	3	1	1	1	3	5	4	5	5
STWH	1	-	-	-	-	1	-	-	2
	1	1	1	1	1	1	1	1	1
	0	0	0	0	0	1	1	1	1
	0	0	0	0	1				

[a] Habitat: G—Grass, S—Shrubland, R—Riparian, D—Desertic
[b] Array names and locations reported in Appendix 2
[c] Species Codes: WESK—Western skink, NISN—Night snake, WFLI—Western fence lizard, RUBO—Rubber boa, WERA—Western rattlesnake; WTGS—Western terrestrial garter snake, RACE—Racer, GOSN—Gopher snake, WEWH—Western whiptail, STWH—Striped whipsnake

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