

and

Distribution of Amphibians and Reptiles Along the Truckee River System

Abstract

From 28 May to 22 August 1992, an intensive survey of the amphibians and reptiles along the entire length of the Truckee River system was conducted during drought conditions. The main objective was to determine the current distribution of amphibians and reptiles (especially obligate aquatic/riparian species) within this river system. Four amphibian and 8 reptilian species were observed. Of these 12 species, 5 (42%) are obligate aquatic/riparian species: the western toad (*Bufo boreas*), northern leopard frog (*Rana pipiens*), Pacific chorus frog (*Pseudacris regilla*), bullfrog (*R. catesbeiana*), and western aquatic garter snake (*Thamnophis couchii*). Only two species (Pacific chorus frog and western terrestrial garter snake (*T. elegans*)) were found along the entire Truckee River. The distribution of the northern leopard frog appears to be decreasing and is now restricted to only a small stretch of the river. The decreased distribution of the leopard frog in the Truckee is possibly due to success of the introduced bullfrog. No Great Basin spadefoot toads (*Spea intermontana*), mountain yellow-legged frogs (*R. muscosa*), or western pond turtles were observed. Based on the literature and our knowledge of the local herpetofauna, individuals of these species should occur within the Truckee River system. The results of this study that indicate declines in amphibian distribution and population size correlate with other investigations in the Northwest, other parts of the United States, and the world.

Introduction

The Truckee River originates in California at Lake Tahoe near Tahoe City and flows for about 161 km into the Great Basin where it empties into Pyramid Lake in northwestern Nevada. During normal conditions, the rate of flow is more than 14,004.5 l per second with most of the water coming from Lake Tahoe. The lake water flows over a natural rim at an elevation of 1,900 m. The Truckee River also gains water from its many tributaries as it flows toward Pyramid Lake, which is situated at an elevation of 1,198 m. Several tributaries have been dammed to counter water shortages. Thus, during drought conditions when the river carries about 2,839 l per second or less, much of the river's flow comes from these reservoirs.

Because the Truckee travels through such a range of elevations, the ecosystems associated with the river vary from forests (both evergreen and deciduous), mountain meadows, meadows, and marshes, to cold desert shrub. At the lower elevations, the Truckee River is often bordered by agricultural and urban developments.

The upper part (about 65 km) of the river from Lake Tahoe almost to Verdi flows primarily through evergreen forest that contains ponderosa pine (*Pinus ponderosa*), jeffrey pine (*P. jeffreyi*), and lodge-

pole pine (*P. contorta*) with a few marshy areas that have small ponds and a few mountain meadows. This upper stretch of the river has a fast to moderate rate of flow and would be classified as a mountain stream or river. The lower stretch of the Truckee from about Verdi to Pyramid (about 96 km) flows through a deciduous forest that contains primarily black cottonwood (*Populus trichocarpa*) and fremont cottonwood (*P. fremontii*), a few agricultural areas, a few marshy areas, some small municipalities, the cities of Reno and Sparks, and an extensive cold desert shrub area typical of the Great Basin. This lower stretch of the river has a moderate to slow rate of flow, typical of a large valley stream or river. Much of the lower stretch, especially that part of the river between Wadsworth and Pyramid Lake is slow and pondlike. Beaver and beaver dams are found along the entire river. The dams create pondlike areas and are more prevalent during drought conditions. During normal conditions, dams are broken due to the high rate of flow, especially in the upper parts of the river.

There is little information about amphibians and reptiles along the Truckee River. Linsdale (1940) and La Rivers (1942) reported on the amphibians and reptiles in Nevada, including specimens collected along the Truckee River. Banta

(1965) published a distributional checklist of amphibians and reptiles inhabiting the state of Nevada, which also contained some information on the herpetofauna found along the Truckee River. Finally, Stebbins (1966) and Behler, et al. (1979) wrote field guides that include some coverage of herpetofauna along the Truckee River.

The objective of this study was to determine the current distribution of amphibians and reptiles (especially obligate aquatic/riparian species) within the various ecosystems along the Truckee River system. Throughout the northwest, other regions of the United States, and the world, amphibian populations appear to be declining. Thus, another objective of this study was to examine for declines in amphibian populations in the Truckee system.

Methods

This study was conducted during drought conditions from 28 May to 22 August 1992. The study was an intensive ecological survey of the amphibians and reptiles along the entire length of the Truckee River System. In addition, we examined sites on the Little Truckee River between Stampede and Boca Reservoir. We measured environmental factors such as water temperature and Ph at each study site.

We selected a total of 31 study sites: 27 along the Truckee River, two along the Little Truckee River, and two at ponds located close to the Truckee River (Figure 1 and Table 1). We located study sites at an average distance of 6.1 km apart to ensure coverage of the entire Truckee River. We also selected study sites that were accessible and that appeared to have favorable habitat for amphibians and reptiles.

We investigated the study sites three times during 1992 (Table 2). The three census periods ensured that data would be collected on breeding and tadpole development. We examined a minimum of 0.4 km of river at each study site. During an investigation, binoculars were used to assist in identification. We used dip nets to collect amphibians, aquatic snakes, and potential prey such as small fish. Sample amphibian larvae were preserved in vials for later identification in the laboratory.

We recorded habitat characteristics for each amphibian or reptile that was observed, and, if the animal was on land, we recorded the distance from

the river. We also noted potential prey and predators in the area.

At the study site we recorded ambient temperatures, water temperatures, water Ph, rate of flow, and water depth. During the first census period, the ambient temperature was recorded at various times of the day. During the second and third census periods, the ambient temperature was recorded at the first site visited, midday, and at the last site visited. Water temperature was recorded at a depth of about 2.5 dm. The pH was recorded with an electronic pH meter. Rate of flow was classified as slow, moderate, or rapid. The water depth was measured when it remained constant throughout the study site and was estimated when it varied at a site.

Results and Discussion

Environmental Factors—Mean ambient temperatures for the three census periods were 26 (range 18-35°C), 24 (range 15-31°C), and 23°C (range 14-35°C), respectively. Thus, ambient temperatures were highly favorable for both amphibian and reptilian activity throughout all three census periods. Ambient temperatures were somewhat low for a relatively short period of time on only two days—on July 6, at 0910, the temperature was 15°C and on August 17, at 0920, it was 14°C. Also, on two days, ambient temperatures were fairly high for a short period of time—on June 4, at 1455, the temperature was 35°C and on August 17, at 1605, it was 35°C.

Average river temperatures for the first, second, and third census periods were 18 (range 13-27°C), 20 (range 14-29°C), and 21°C (range 17-28°C), respectively. Even though these recorded river temperatures were on the average lower than ambient temperatures, they were favorable for both amphibian and reptilian activity.

A general increase in river temperature from Lake Tahoe to Pyramid Lake was observed, with relatively low river temperatures from Lake Tahoe to about Reno 13 to 20°C; (Study Site 1 to 21), and relatively high temperatures from Lovelock to Pyramid Lake 20 to 28°C; (Study Sites 22 to 31). These temperature differences explain the distribution of some species along the Truckee. For example, bullfrogs (*Rana catesbeiana*) prefer pondlike environments or slow-moving streams with much aquatic and emerging vegetation associated

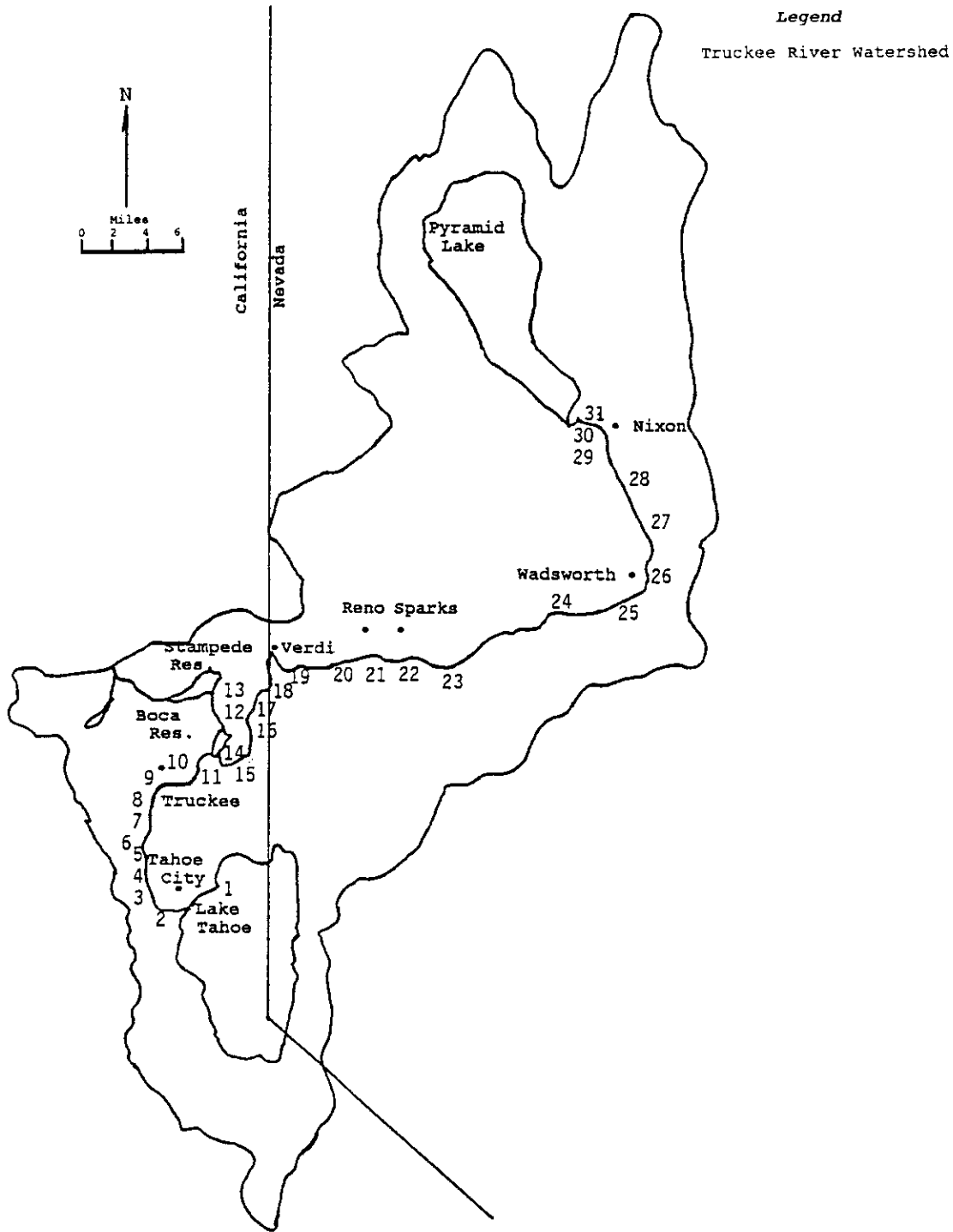


Figure 1. Map of the study area. The numbers indicate the approximate locations of the 31 study sites. The outer line depicts the Truckee River Watershed.

TABLE 1. Name and elevation of the 33 study sites.

Study Site	Elevation (m)	Study Site Name
1	1900	Lake Tahoe
2	1900	Fanny Bridge
3	1896	Twin Crags
4	1894	American Gas
5	1886	River Ranch Inn
6	1866	Squaw Creek
7	1826	Bullshhead
8	1805	Cabin Creek
9	1791	Granite Flat
10	1759	Truckee
11	1709	Prosser
12 ¹	1731	Boca Rest Campground
13 ¹	1731	Boyington Mills Campsite
14	1677	Hirschdale
15	1659	Hirschdale Bridge
16	1616	Floriston
17	1580	Farad
18	1515	Coldron Ditch
19 ¹	1497	Verdi Pond
20	1416	Mayberry Park
21	1391	Oxbow Park (Reno)
22	1338	Lockwood
23	1306	Tracy Clark Power Plant
24A ¹	1288	Derby Dam Oxbow
24B	1288	Derby Dam (River)
25	1270	Orchard
26	1241	Wadsworth Bridge
27	1220	S bar S
28	1213	Dead Ox Wash
29	1208	Little Nixon
30	1201	Nixon Bridge
31	1198	North Nixon

¹These sites are not on the Truckee River. They are on streams that flow into it or they are ponds located close to the river.

with fairly high water temperatures. The distribution of bullfrogs in the Truckee River System only includes the lower, often pondlike, stretch of the Truckee. Bullfrogs were first encountered at the Coldron Ditch study site (Study Site 18).

Average pH of the Truckee River increased from 8.0 in early summer, to 8.2 in mid-summer, and to 8.9 in late summer.

Amphibians tolerated a pH range of 6.0 to 10.4. It does not appear that the pH of the Truckee River influenced the distribution patterns of the various amphibians.

TABLE 2. Days afield, time afield, and distance censused for each census period.

Days Afield	Numbered Field Days	Time Afield (Hrs.)	Distance Censused (Km)
5/26-6/12	5	21.00	20.2
7/6-7/13	4	17.50	21.8
8/14-8/22	3	12.75	18.1
Totals	12	51.25	60.1

The drop in elevation between Lake Tahoe and Reno is about 549 m, and only 152 m between Reno and Pyramid Lake, resulting in a faster rate of flow in the upper Truckee River. The slower rate of flow of the lower Truckee contributes to the pondlike habitat associated with this stretch of the river. These flow rates are important in explaining distribution of herpetofauna along this river system.

Although this study was conducted during drought conditions, during all three censuses the depth and amount of flow was sufficient to sustain a variety of fish and amphibian species. The biggest difference in flow occurred between the second and third censuses. At some of the sites during the third census (August 14 to August 22), there was a noticeable decrease in flow due to closure of Boca Reservoir. Only sites 19 (Verdi Pond) and 24A (Derby Dam Oxbow) were completely dry. At site 21 (Oxbow Park, Reno) a pond next to the river was completely dry during the second census (July 6 to July 13).

Throughout the study the level of Lake Tahoe was below the natural rim, and water was pumped from the lake over the rim. Water pumped from the lake generated some fairly large pondlike areas in the Truckee River immediately downstream from Lake Tahoe. The Truckee River accumulated additional flow from small tributaries.

Species of Amphibians and Reptiles Observed—During this study, we observed four amphibian species in three different families (Table 3). Of the four species observed, two are strictly aquatic forms—the bullfrog (*R. catesbeiana*) and the northern leopard frog (*R. pipiens*). In the adult stage, the Pacific chorus frog is semi-terrestrial. Also, the western toad (*B. boreas*) is essentially terrestrial in the adult stage.

Five lizard species in two families were observed along the Truckee River (Table 3). All five

TABLE 3. List of amphibian and reptilian species observed during this study.

Family	Scientific Name	Common Name
ORDER: Salientia or Anura (Frogs and Toads)		
Bufo	<i>Bufo boreas</i>	Western Toad
Hyla	<i>Pseudacris regilla</i>	Pacific Chorus Frog
Rana	<i>Rana pipiens</i>	Northern Leopard Frog
	<i>Rana catesbeiana</i>	Bullfrog
ORDER: Squamata (Lizards and Snakes)		
Iguanidae	<i>Gambelia wislizenii</i>	Longnose Leopard Lizard
	<i>Sceloporus magister</i>	Desert Spiny Lizard
	<i>Sceloporus occidentalis</i>	Western Fence Lizard
	<i>Uta stansburiana</i>	Side-blotched Lizard
Teiidae	<i>Cnemidophorus tigris</i>	Western Whiptail
Colubridae	<i>Pituophis catenifer</i>	Gopher Snake
	<i>Thamnophis couchi</i> ¹	Western Aquatic Garter Snake
	<i>Thamnophis elegans</i> ²	Western Terrestrial Garter Snake

¹Subspecies: *T. c. couchi*; Sierra Garter Snake

²Subspecies: *T. e. elegans*; Mountain Garter Snake

species are well adapted to dry habitats and can be found away from free water. However, many individuals were often noted close to the river in riparian habitats. All of these lizards include insects in their diet, which are abundant in riparian habitats.

All three snake species observed during the study are in the family Colubridae (Table 3). Of these three species, the western aquatic garter snake (subspecies: Sierra Garter Snake (*Thamnophis couchi couchi*)) is primarily aquatic. The gopher snake (subspecies: Great Basin Gopher Snake (*Pituophis catenifer deserticola*)) and the western terrestrial garter snake (subspecies: Mountain Garter Snake (*Thamnophis elegans elegans*)) occur in both terrestrial and aquatic habitats.

Of the 12 amphibian and reptilian species observed during the study, only five species (42%) are obligate aquatic/riparian species: the western toad, Pacific chorus frog, northern leopard frog, bullfrog, and western aquatic garter snake.

Based on literature and our knowledge of the local herpetofauna, 20 species of amphibians and reptiles may occur on the Truckee River system. Of these 20 species, only three are obligate aquatic/riparian species: the Great Basin spadefoot toad (*Spea intermontana*), mountain yellow-legged frog (*R. muscosa*), and the western pond turtle (*Clemmys marmorata*).

The Great Basin spadefoot toad has been reported to be associated with the Truckee River

system (Linsdale, 1940; La Rivers 1942; and Banta, 1965). Preferred habitats for this species include rivers, ponds, springs, reservoirs/lake, irrigation overflows, sagebrush flats, and piñon-juniper woodlands (Fichter, et al., 1964; Stebbins, 1966). In the Truckee River system, most of the suitable habitat for this species is found in the lower elevations especially that part of the river close to Pyramid Lake, and individuals of this species have been collected at the southern end of the lake (Linsdale, 1940).

The mountain yellow-legged frog has been reported in the Lake Tahoe region (Linsdale, 1940 and Banta, 1965). Suitable habitat for this species is streams with moderate flow and rocky bottoms. This habitat is found in much of the upper Truckee River. However, it is unlikely that the mountain yellow-legged frog occurs in the main part of the river system because of the presence of trout. Bradford (1989) discovered that viable populations of mountain yellow-legged frogs cannot coexist with trout (*Salmo*) and brook trout (*Salvelinus*) which prey on tadpoles. It is possible that this frog is found in some tributaries to the Truckee River that have suitable habitat for this frog species and do not contain predatory fish species.

Toulouse (pers. comm.) reported three pond turtles (*C. marmorata*) at Oxbow Park in a 1.1 m deep pond, which contained many cattails. He also reported that one of the three turtles entered the Truckee River, which is connected to the pond

by a small stream. If the western pond turtle is still extant in the Truckee River, the population size is very small, and this species may be extremely vulnerable to eradication. This species was recently petitioned for listing under the Endangered Species Act (Jennings, et al., 1992; unpublished manuscript). Burroughs (pers. comm.) stated that in about June, 1993, members of the U.S. Fish and Wildlife Service decided that they would not list the western pond turtle as an endangered species. Their reason for not listing it was insufficient data, especially data that indicates a lack of substantial recruitment.

Distribution and Habitat of Amphibians Observed—

Three species of amphibians (the Pacific chorus frog, bullfrog, and western toad) were observed at more than one site, whereas the northern leopard frog was found at only one site along the Truckee River (Table 4). The Pacific chorus frog is the only amphibian species that appears to be located along the entire Truckee River. The bullfrog is distributed throughout the lower Truckee from the Coldron Ditch downstream to Pyramid Lake. The distribution of the western toad along the Truckee appears to be limited to a few areas along the lower Truckee River. However, numbers of tadpoles (thousands at site 30) and later toadlets at these sites were very high, suggesting a fairly large population of adult toads.

It appears that the distribution of the northern leopard frog along the Truckee has been restricted to only a small stretch of the river at study site 28. Linsdale (1940) reported northern leopard frogs

on the Truckee River at Verdi and at 15.3 km east of Reno. At study site 28, northern leopard frogs were found in both the river and in a spring-fed pond about 80 m to the east of the river. The pond was about 100 m long, 14 cm deep, with a muddy bottom. Much of the pond was surrounded by bulrush (*Scirpus acutus*). A stretch of about 10 m of the northeastern edge of the pond consisted of salt grass and sedges (0.3 m high) growing in a wet substrate. We observed several northern leopard frogs in this area. The edges of the river at this site have grasses, clover (*Trifolium*), sedges, and rushes. During the first census, four of the five adults were found around the northeastern edge of the pond, and one was noted along the river. During the second and third censuses, more frogs were observed along the river (31 frogs) than along the edges of the pond (2 frogs). It appears that the frogs moved from the pond to the river sometime between the first and second census. It's possible that in late spring or early summer, the frogs moved to the pond to breed, and then moved back to the river. The presence of either eggs or larvae in the pond would have confirmed this pattern; however, no eggs or larvae were noted in the pond throughout the study.

The lower Truckee from about Lockwood downstream has ample breeding and adult habitat for a variety of amphibian species. This section of the river is generally pondlike with a slow rate of flow; shallow, warm water; and large quantities of aquatic vegetation including *Elodea*, *Spirogyra*, and duckweed (*Lemna*) that offer excellent cover for tadpoles, froglets, and toadlets. Also, emerging vegetation (especially bulrushes, sedges, and a variety of grasses) along the edges of the lower Truckee River offer excellent cover. In contrast, the upper Truckee River, from Lake Tahoe downstream to about Verdi is lacking in breeding habitat, i.e., breeding ponds for egg and larval development. During drought conditions, major side channels of the river become excellent breeding ponds that contain adequate aquatic and emerging vegetation. During this study we observed Pacific chorus frog larvae in such habitats. It is possible that during normal conditions, this observed reproduction does not occur.

Distribution and Habitat of Reptiles Observed— We observed most of the lizards along the lower Truckee River from site 23 (Tracy Clark Power Plant) downstream to Pyramid Lake (Table 9),

TABLE 4. Specific localities along the Truckee River where amphibian and reptilian species were found.

Species	Study Sites
<i>Bufo boreas</i>	22, 30, 31
<i>Pseudacris regilla</i>	4, 6, 15, 19, 21, 26, 29
<i>Rana pipiens</i>	28
<i>Rana catesbeiana</i>	18, 19, 21-27, 29-31
<i>Gambelia wislizenii</i>	27, 28
<i>Sceloporus magister</i>	23-25, 27, 29, 31
<i>Sceloporus occidentalis</i>	16, 18, 21, 24, 25
<i>Uta stansburiana</i>	24A
<i>Cnemidophorus tigris</i>	24A, 28, 29, 31
<i>Pituophis catenifer</i>	26
<i>Thamnophis couchi</i> ¹	3, 7, 10, 11, 13, 15
<i>Thamnophis elegans</i> ²	1-5, 7, 9-15, 19-21, 26, 28

¹Subspecies: *T. c. couchi*

²Subspecies: *T. e. elegans*

although western fence lizards (*Sceloporus occidentalis*) were found upstream from Tracy Clark to site 16 (Floriston) at an elevation of 1,580 m. Because most lizards are primarily desert-dwelling animals, this distribution pattern would be expected.

Most of the 15 desert spiny (*S. magister*) and 20 western fence lizards were observed on big rocks (about one to two m in diameter) along the river. Western whiptail (*Cnemidophorus tigris*), longnose leopard (*Gambelia wislizenii*), and side-blotched (*Uta stansburiana*) lizards showed a preference for sandy or gravelly areas with scattered shrubs and/or small rocks (about 0.3 to 0.5 m in diameter).

The most widely distributed and abundant reptile observed (53 were counted) during this study was the semiaquatic western terrestrial garter snake (Table 10). It appears to be the only reptilian species that lives along the entire stretch of the river. The western terrestrial garter snake was often observed in the river (10 of 53 observations; 19%), and would often swim under rocks when pursued. It was also frequently observed near the edge of the river, especially in grassy areas with overhanging mountain alders (*Alnus tenuifolia*) or Pacific willows (*Salix lasiandra*). Of 32 observations, the average distance from the edge of the river was 3.6 m.

All 10 western aquatic garter snakes were counted in or along the upper part of the river from site 3 (near Lake Tahoe; 1,896 m in elevation) downstream to site 15 (Hirschdale Bridge; 1,659 m in elevation). This highly aquatic species (8 of 10 were observed in water; 80%) appeared to have a preference for mountain streams with a moderate rate of flow and those parts of the river with overhanging vegetation such as willows and alders. Two western aquatic garter snakes were observed in swampy, grassy areas with scattered willows.

Only one Great Basin Gopher Snake (*P. c. deserticola*) was observed during the study. This large snake (1.4 m in length) was in the river at site 26 (Wadsworth Bridge). The river at this site had a very slow rate of flow, an abundant growth of aquatic weeds, and many bullfrog tadpoles and young adults.

Current Status and Impact of Drought on Observed Amphibians and Reptiles on the Truckee River System—As long as the Truckee River maintains even a minimal flow, it does not appear that

drought conditions will severely impact existing amphibian and reptilian populations on this river system. Most of the current populations observed appear to be doing fairly well, and most of these are adapted to low-water conditions. Because the northern leopard frog was only found at one site and its distribution in this system appears to be decreasing, a concern exists for its continued survival in this river system. The distribution of the northern leopard frog also appears to be decreasing in other systems. In an unpublished manuscript, Hovingh (1990) reported that northern leopard frogs were found in only two locations in north Great Salt Lake and was not found in either Ruby Valley or Steptoe Basin where it had been reported previously in the literature. The decreased distribution of the leopard frog in the Truckee system is possibly due to success of the introduced bullfrog, which may not be compatible with the northern leopard frog. This hypothesis is supported by Moyle (1973) who reported that the bullfrog doesn't appear to be compatible with two other ranids, the red-legged frog (*R. aurora*) and the foothill yellow-legged frog (*R. boylei*). He attributed the disappearance of *R. aurora* from the San Joaquin Valley, California, and the continuing reduction in the range of *R. boylei* in this region, to habitat alteration coupled with predation and competition from *R. catesbeiana*. Additional support for this hypothesis is found in a report by the Committee on Rare and Endangered Wildlife Species, 1966. According to this report, the bullfrog was held partially responsible for the elimination of the Vegas Valley frog, *R. pipiens fisheri*. Other possible hypotheses explaining the decline of western ranids have been reported by Hayes, et al., (1986). They suggested that in addition to the introduction of bullfrogs, over harvesting (commercial exploitation), habitation alteration, and fish predation are tenable, but not necessarily exclusive, alternative hypotheses accounting for the decline of western ranids.

To determine the actual cause of the decreased distribution of the northern leopard frog in the Truckee system, more studies are necessary. A study of reintroductions of this species in portions of the river with suitable habitat that are free of bullfrogs and predatory fish appears to be a good one. Reintroduction studies should also be conducted with other ranids throughout the western United States.

There is also concern and interest about the status of the western pond turtle in this river system. Apparently, a few western pond turtles are still living in the Truckee River. In an unpublished manuscript, Holland (1991) reported a single reliable sight record for the Truckee River drainage. He checked the site and interviewed the reporting parties in 1987. Also, he reported that the turtle was a large male and probably represents one of the last of this species in this area. In 1991, Holland (unpub. manus.) also conducted extensive sur-

veys along the Truckee, but found no turtles. During this study, no turtles were observed. Thus, it appears that the remaining population of western pond turtles along the Truckee River System is extremely small.

Acknowledgements

Thanks are due to Pat Coffin for his assistance and to Lucy Kinder for typing the manuscript. The Fish and Wildlife Service provided funding for this study.

Literature Cited

- Banta, B. H. 1965. A distributional checklist of the recent reptiles inhabiting the state of Nevada. Biological Society of Nevada. Occasional Papers. No. 5: 1-8.
- . 1965. A distributional check list of the recent amphibians inhabiting the state of Nevada. Biological Society of Nevada. Occasional Papers. No. 7: 1-4.
- Behler, J. L. and F. W. King. 1979. The Audubon Society Field Guide to North American Reptiles and Amphibians. Alfred A. Knopf, New York.
- Bradford, D. F. 1989. Allotropic distribution of native frogs and introduced fishes in high Sierra Nevada lakes of California: Implication of the negative effect of fish introductions. *Copeia* (3): 775-778.
- Committee on Rare and Endangered Wildlife Species. 1966. Rare and Endangered Wildlife of the United States. Bureau of Sport Fish, Wildl. Res. Pub. 34:RA-9.
- Fichter, F. and A. D. Linder. 1964. The Amphibians of Idaho. The Idaho State University Museum.
- Gregory, R. T., McCartney, J. M. and D. H. Rivard. 1980. Small Mammal Predation and Prey Handling by the Garter Snake *Thamnophis elegans*. *Herpetologica* 36(1): 87-93.
- Hayes, M. P. and Jennings, M. R. 1986. Decline of Ranid Frog Species in Western North America are Bullfrogs *Rana catesbeiana* Responsible. *Journal of Herpetology* 20(4): 490-509.
- LaRivers, I. 1942. Some New Amphibian and Reptile Records for Nevada. *Journal of Entomology and Zoology* 34(3): 53-68.
- Linsdale, J. M. 1940. Amphibians and Reptiles in Nevada. *Proceedings of American Academy of Arts and Sciences*. Vol. 73, No. 8, p. 197-257.
- Moyle, P. B. 1973. Effects of Introduced Bullfrogs, *Rana catesbeiana*, on the Native Frogs of the San Joaquin Valley, California. *Copeia* (1): 18-22.
- Smith, A. K. 1977. Attraction of Bullfrogs (Amphibia: Ranidae) to Distress Calls of Immature Frogs. *J. Herpetol.* 11: 234-235.
- Stebbins, R. C. 1966. A Field Guide to Western Reptiles and Amphibians. Houghton Mifflin Company, Boston.

Received 17 September 1993

Accepted for publication 18 January 1994