Lowland Riparian Herpetofaunas: The San Pedro River in Southeastern Arizona

Philip C. Rosen
School of Natural Resources, University of Arizona, Tucson, AZ

Abstract—*Previous work has shown that southeastern Arizona has a characteristic, high diversity lowland riparian herpetofauna with 62-68 or more species along major stream corridors, and 46-54 species in shorter reaches within single biomes, based on intensive fieldwork and museum record surveys. The San Pedro River supports this characteristic herpetofauna, at least some of which still occurs in the lower basin within the Sonoran Desert. It has about 64 species (55 vouchered to date), with 48-53 species within each of three somewhat ecologically homogeneous portions of the basin. This assemblage is more similar to other lowland herpetofaunas than to an example of a canyon riparian herpetofauna. Most of the characteristic riparian species are not known to be abundant along the San Pedro, and some expected species are apparently absent, suggesting that the herpetofauna may have not yet recovered from the history of grassland, cienega, and bottomland degradation.*

Introduction

Remarkably, the riparian herpetofauna of southeastern Arizona has not been accurately described between Ruthven's (1907) and Van Denburgh and Slevin's (1913) annotations and records for the Santa Cruz River riparian at Tucson and the present. Two reports with limited circulation provided data on riparian herpetofaunal assemblages in southeastern Arizona (Johnson and Lowe 1978, in the northern Santa Rita Mountains; and Corman 1988, for the upper San Pedro River). Jakle and Gatz (1985), Jones (1981, 1988a,b, and others), Szaro and Belfit (1986), Vitt and Ohmart (1978), and Warren and Schwalbe (1985) provided data on riparian herpetofaunal assemblages in western and central Arizona and the Colorado River, yet Szaro and Belfit (op. cit.) noted the absence of a clear description of this distinctive assemblage. Lowe (1989) initiated a synthetic analysis of the riparian herpetofauna of the warm deserts of North America, and Rosen et al. (this proceedings) summarized the herpetofaunas of 4 sites in southeastern Arizona. The San Pedro River is the largest, reasonably intact example of the original riparian richness of southern Arizona. Here I present an account of its herpetofauna and compare it to that of other riparian sites in Arizona.

Methods

I constructed a checklist and a preliminary estimate of species' relative abundances based on a survey of museum specimen records and Troy Corman's (1988) outstanding unpublished study of the upper basin. I included museum records for the river environs, including up to two miles from the riparian bottomlands, since it is impossible to be certain whether such records are or are not definitely from the bottomland, and since species occurring that close would likely be found in the bottomlands at least occasionally. Collecting effort has been most focused in the upper basin, and it is difficult to entirely separate riparian and non-riparian records, so I have summarized the latter for the upper basin; in the lower reaches, so little collecting has been done away from the river that this was not possible. Museum records were excluded if localities could not be located to an adequate precision, but I did not examine most of the specimens to verify identifications; questionable records are discussed below. To compare the San Pedro to other riparian systems in southeastern Arizona, I computed its coefficient of similarity (according to the formula $\%\ Similarity = 100\ X\ 2C/(N_1 + N_2)$, where C is the number of species in common between the sites, and N_i is the number of species at each site) for comparison to results presented by Rosen et al. (this proceedings).

Description of the River System

For this report, I treat the river in three sections: (1) the upper basin, from the international border (4,269 ft elevation) to the origin of the St. David Ditch south of Curtiss Flats (3,704 ft); (2) the Benson region, from Curtiss Flats to Pomerine and down to The Narrows (3,305 ft); and (3) the lower basin, from the Narrows to the Gila River confluence at Winkelman (1,907 ft). I treated the broad flats around Benson separately because they include the broadest floodplain, most intensive human utilization, and a limited history of herpetofaunal survey, and did not include the uppermost basin, in Mexico, because I lacked data for it.

The upper basin includes the Bureau of Land Management's San Pedro River National Conservation Area, with perennial flow in much of its length, large pools, and a mature cottonwood-dominated gallery forest fringed with mesquite bosque and sacaton. The surrounding uplands grade from semi-desert grassland down to Chihuahuan desertscrub dominated by creosotebush. Pump irrigation occurred in the upper reach of the

upper basin, near Hereford and Palominas, although some of this activity is being retired to conserve water for the river. Rocky hills are close to the river near Charleston and Fairbank.

The Benson region has floodplain widths of up to two miles or more, in contrast to 3/4 mile or less for most of the upper and lower basins. Flow is diverted and pumping is extensive as the river enters the Benson region at Curtiss Flats, and water moves through an often densely populated pastoral landscape where it supplies numerous fields and ponds. There are substantial groves of cottonwood and mesquite in this area, as well as well-watered pastures, and at least one relict cienega. The river, however, is not perennial in this reach, and the riparian environment is dominated in places by non-native saltcedar (*Tamarix ramosissima*). Chihuahuan desertscrub growing on highly eroded benches surrounds this reach.

The lower basin begins in The Narrows, where the steep bajadas of the Rincon and Galiuro Mountains encroach with rocky habitat near the river. Downstream of this non-perennial reach, the river alternates between several short perennial reaches with a small stream in a relatively large sandy bed. The stream is often surrounded by mixes of cottonwood, willow, saltcedar, and mesquite, whereas in the dry reaches the broad strand is margined by a more arid riparian vegetation with much mesquite and saltcedar. Where the floodplain allowed it, farms and irrigated pastures were established using pump irrigation, but these are being purchased and retired by The Nature Conservancy, which now has extensive holdings along in the lower basin.

The lower basin is fringed by steep bajadas that increasingly support Sonoran desertscrub with declining elevations, and these bajadas are dissected by major canyons that support important perennial streams, some of which approach or reach the river bottom. In contrast, in the upper basin and Benson region, the bottomlands are distant from the few surrounding, small perennial waters, which are almost completely confined to mountain canyons.

There are one or two cienegas on the bottomlands in the lower basin, which are thought to be relicts of a more mesic habitat type (cienega and sacaton grasslands interspersed with stands of bosque and gallery forest) that occupied much of the riparian lowlands of southeastern Arizona prior to their degradation about a century ago (see McLaughlin 2004; Hendrickson and Minckley 1985, and references therein). Prior to this, significant portions of the river were marshy and grassy, and the San Pedro Valley supported much more grassland and less desertscrub than it does today (Turner et al. 2003).

Results

Species Richness

The occurrence of 55 species of amphibians and reptiles is verified by vouchers along the 126-mile reach of San Pedro River in the United States, including 4 non-natives. The expected total list is about 64 species, including 5 non-natives (table 1). Expected totals for other lowland riparian systems in southeastern Arizona are 62 for Cienega Creek, and over 68 for the Santa Cruz River (unpublished data). By way of contrast, Organ Pipe Cactus National Monument supports about 48 species (Rosen and Lowe 1996), the Whetstone Mountains support about 40 (Turner et al. 1999), the Colorado River below Lake Mead supported about 46 (Vitt and Ohmart 1978; Stebbins 2003), and the lower Gila River below Phoenix supported about 45 (Rosen, in press). Riparian areas in southeastern Arizona support relatively high species richness reflecting the proximity of woodlands and grasslands (see Jones et al. 1985), as well as the apparently optimal conditions for many species that occur at elevations between 2,400 and around 4,500 feet.

Three relatively homogenous segments of the San Pedro River yielded 34-44 vouchered species, with expected totals of 48-53 species (table 1), compared to 37-42 vouchered species and expected totals of 46-54 species at comparable areas in southeastern Arizona (Rosen et al., this proceedings). Thus, there is remarkably consistent, relatively high species richness in these environments, with the San Pedro River approaching the regional maximum for a riverine system, which probably occurs along the Santa Cruz River.

Species Composition

The San Pedro species list was less similar to that of Leslie Canyon (63.8% similarity) than to those of San Bernardino NWR, Las Cienegas NCA, and Tucson-San Xavier (78.7%, 75.3%, and 78.8%, respectively), confirming the marked similarity among lowland riparian sites in southeastern Arizona (Rosen et al., this proceedings).

The San Pedro supported all the characteristic lowland riparian species identified in four other herpetofaunas in southeastern Arizona (Rosen et al., this proceedings), except that the Great Plains narrow-mouthed toad was present only on the Santa Cruz River. Species diversity is elevated by the appearance and increasing dominance of characteristic Sonoran Desert species in the lowermost basin, including the side-blotched lizard, zebra-tailed lizard, tiger whiptail, banded sand snake, saddled leaf-nosed snake, and many others. Elevational range of the system thus likely plays an important role in its species diversity (table 2).

It is remarkable, however, that despite relatively limited collecting effort in the lower basin, there is already a vouchered set of core riparian-obligate species, including the desert grassland box turtle, Clark's spiny lizard, eastern fence lizard, and southwestern black-headed snake along the riparian corridor deep in Sonoran Desert of the lower basin, with at least some reaching the area of the Gila River confluence.

Species richness is also elevated to some extent by the presence of rocky habitat near the river at Charleston, Fairbank, and The Narrows. These areas are sources of records for the eastern collared lizard, and Sonoran whipsnake, and are sites where the red-spotted toad, canyon treefrog, black-necked gartersnake, and other rock-dwelling species could be found along the river.

Discussion

While some of the characteristic riparian species, such as the desert grassland (western) box turtle, were apparently fairly abundant in recent decades (Corman 1988), many of

Table 1—Herpetofauna of the San Pedro River and its riparian environs in the United States. Numbers in the table are museum voucher specimens found in a nationwide search. Records interpreted as within ≤2 miles of the riparian bottomland are included. The Benson reach is defined as from Curtiss Flats to Pomerine, while the upper reach is from the international border to there and the lower reach from there to the Gila River confluence. TEC and PCR refer to additional records by Troy Corman (1988 and personal communication) and P. C. Rosen (unpublished notes); E indicates a species that is expected to occur, with (r) indicating rock-dwelling species that have been or are likely to be found very locally along the river where appropriate habitat abuts the riparian zone. Species less likely, but possible, are indicated with a question mark (?). Non-native species are denoted by (NN), and dangerously venomous ones by (*). The specimen of *Gyalopion canum* from the lower basin was lost (Mayne 1985 and personal communication). The table also provides a listing for the upper San Pedro Valley outside the river environs, as explained in text.

		River Reach				
English name	**Scientific name**	**Lower**	**Benson**	**Upper**	**Entire U.S. reach**	**Upper valley**
Amphibians (12 species)						
Tiger Salamander - NN	*Ambystoma tigrinum*		E		**E**	E
Sonoran Desert Toad	*Bufo alvarius*	4	1	TEC	**5**	3
Great Plains Toad	*Bufo cognatus*	E	1	1	**2**	2
Green Toad	*Bufo debilis*		14	?	**14**	1
Red-spotted Toad	*Bufo punctatus*	TEC	?	C?	**TEC**	3
Woodhouse's Toad	*Bufo woodhousii*	1	2	67	**70**	7
Canyon Treefrog	*Hyla arenicolor*	2(r)	?(r)	?(r)	**2(r)**	
American Bullfrog - NN	*Rana catesbeiana*	6	PCR	1	**7**	E
Chiricahua Leopard Frog [1]	*Rana chiricahuensis*			1(ex)	**1(ex)**	E
Lowland Leopard Frog	*Rana yavapaiensis*	7	1	13	**21**	E
Couch's Spadefoot	*Scaphiopus couchii*	TEC	E	10	**10**	8
Mexican Spadefoot	*Spea multiplicata*	?	E	PCR	**PCR**	32
Turtles (5 species)						
Spiny Softshell - NN	*Apalone spinifera*	1	?	TEC	**1**	
Desert Tortoise	*Gopherus agassizii*	?(r)			**?(r)**	
Sonoran Mud Turtle	*Kinosternon sonoriense*	1	2	14	**17**	
Western Box Turtle	*Terrapene ornata*	1	PCR	15	**16**	PCR
Slider - NN	*Trachemys scripta*	1	E	TEC	**1**	
Lizards (21 species)						
Giant Spotted Whiptail	*Aspidoscelis burti stictogramma*	?	?	TEC	**TEC**	
Little Striped Whiptail [2]	*Aspidoscelis inornata*			1(?)		
Sonoran Spotted Whiptail	*Aspidoscelis sonorae*	4	E	TEC	**4**	E
Tiger Whiptail	*Aspidoscelis tigris*	8	3	6	**17**	2
Desert Grassland Whiptail	*Aspidoscelis uniparens*	PCR	2	32	**34**	17
Zebra-tailed Lizard	*Callisaurus draconoides*	3	4	2	**9**	1
Western Banded Gecko	*Coleonyx variegatus*	1	E	1	**2**	E
Greater Earless Lizard	*Cophosaurus texanus*	7	E	2	**9**	E
Eastern Collared Lizard	*Crotaphytus collaris*	1(r)	?(r)	1(r)	**2(r)**	E
Madrean Alligator Lizard	*Elgaria kingii*	1	E	2	**3**	1
Long-nosed Leopard Lizard	*Gambelia wislizenii*	1	E	1	**2**	E
Mediterranean Gecko - NN	*Hemidactylus turcicus*	E	E		**E**	E
Lesser Earless Lizard	*Holbrookia maculata*	1	E	5	**6**	49
Texas Horned Lizard	*Phrynosoma cornutum*		2	4	**6**	9
Short-horned Lizard	*Phrynosoma hernandesi*			1	**1**	1
Regal Horned Lizard	*Phrynosoma solare*	PCR	4	3	**7**	PCR
Clark's Spiny Lizard	*Sceloporus clarkii*	5	4	10	**19**	4
Desert Spiny Lizard	*Sceloporus magister*	8	1	3	**12**	2
Eastern Fence Lizard	*Sceloporus undulatus*	21	2	8	**31**	4
Tree Lizard	*Urosaurus ornatus*	29	1	21	**51**	12
Side-blotched Lizard [2]	*Uta stansburiana*	12	?	1(?)	**12**	
Gila Monster *	*Heloderma suspectum*	1	1	1	**3**	5
Snakes (25 species)						
Glossy Snake	*Arizona elegans*	3	1	1	**5**	E
Banded Sand Snake	*Chilomeniscus cinctus*	2			**2**	
Ring-necked Snake	*Diadophis punctatus*	E	1	1	**2**	E
Chihuahuan Hook-nosed Snake	*Gyalopion canum*	(1)	1	2	**3**	E

Table 1—*Continued.*

English name	Scientific name	River Reach: Lower	Benson	Upper	Entire U.S. reach	Upper valley
Snakes—*continued*						
Western Hog-nosed Snake	*Heterodon nasicus*		?	1	**1**	4
Night Snake	*Hypsiglena torquata*	1	2	1	**4**	3
Common Kingsnake	*Lampropeltis getula*	1	2	3	**6**	8
Plains Blindsnake	*Leptotyphlops dulcis*		2	TEC	**2**	1
Western Blindsnake	*Leptotyphlops humilis*	E	1		**1**	?
Sonoran Whipsnake	*Masticophis bilineatus*	?	?	1	**1**	2
Coachwhip	*Masticophis flagellum*	5	4	1	**10**	10
Saddled Leaf-nosed Snake	*Phyllorhynchus browni*	3			**3**	
Gopher Snake	*Pituophis catenifer*	3	2	4	**9**	11
Long-nosevd Snake	*Rhinocheilus lecontei*	3	7	2	**12**	13
Mountain Patch-nosed Snake [3]	*Salvadora grahamiae*			?	**?**	E
Western Patch-nosed Snake	*Salvadora hexalepis*	2	3	4	**9**	5
Ground Snake [3]	*Sonora semiannulata*			?	**?**	2
Southwestern Black-headed Snake	*Tantilla hobartsmithi*	8	4	1	**13**	E
Plains Black-headed Snake	*Tantilla nigriceps*	?	2	1	**3**	E
Yaqui Black-headed Snake [3]	*Tantilla yaquia*			?	**?**	?
Black-necked Gartersnake	*Thamnophis cyrtopsis*	?(r)	?(r)	?(r)	**E(r)**	1
Mexican Gartersnake	*Thamnophis eques*	?	(ex?)	6	**6**	E
Checkered Gartersnake	*Thamnophis marcianus*	6	5	22	**33**	5
Lyre Snake	*Trimorphodon biscutatus*	1	1	2	**4**	E
Sonoran Coralsnake *	*Micruroides euryxanthus*	5	2	2	**9**	2
Massasauga * [1]	*Sistrurus catenatus*			(ex)	**(ex)**	1
Western Diamondback *	*Crotalus atrox*	2	1	9	**12**	6
Mohave Rattlesnake *	*Crotalus scutulatus*	2	3	1	**6**	14
Tiger Rattlesnake *	*Crotalus tigris*	TEC			**TEC**	
Total Museum Records Found		174	89	292	**555**	251
Vouchered Total		40	34	44	**55**	35
Expected Species Total		50	48	53	**64**	57
Non-native species		4	4	3	**5**	3

[1] Apparently extirpated in the U.S. reach, but might still occur upstream in Mexico.
[2] The following species are excluded from the known and expected herpetofauna based on probable locality errors (Sidewinder [*Crotalus cerastes*]; Side-blotched Lizard from the upper basin; taxonomic confusion (Chihuahuan Spotted Whiptail [*Aspidoscelis exsanguis*]; and use of base camp or transshipment point as the given locality (Rock Rattlesnake [*Crotalus lepidus*], Twin-spotted Rattlesnake [*Crotalus pricei*], Mountain Skink [*Eumeces callicephalus*], Sonoran Mountain Kingsnake [*Lampropeltis pyromelana*], and Mountain Spiny Lizard [*Sceloporus jarrovi*]; similarly, the Little Striped Whiptail is provisionally excluded, as specified in the Discussion and in Rosen et al. 1998).
[3] Not confirmed in the river herpetofauna, but may occur in upper basin in Mexico, which has not been extensively surveyed.

Table 2—Elevational ranges, reach lengths, and maximum expected herpetofaunal diversity (species richness) for a series of major lowland corridors in southern Arizona. Similar accounting methods were used to include or exclude species for each case, as described in the text and in Rosen et al. (this proceedings).

	Elevation (ft) Min	Max	Range	Reach length (mi)	Number of species
San Pedro River (U.S. only)	1907	4269	2362	126	64
Santa Cruz River (Bog Hole to Tucson Mountains)	2060	5040	2980	132	68
Cienega Creek (Santa Cruz Co. line to Vail Diversion)	3192	4554	1362	32	62
Gila River (Salt R. to Colorado confluence)	115	931	816	300	45
Colorado River (Hoover Dam to Int'l border)	91	665	574	183	46

them were uncommon or rare; this may reflect the historic degradation of mesic riparian communities such as cienegas and grassy meadows. The cessation of grazing during the 1980s is having profound effects on vegetation and avifaunal recovery (Krueper et al. 2003), but this has not been investigated for the herpetofauna. To the extent that mesic grassland and cienega re-develop, marked changes in the herpetofauna may be expected, and these could be documented by comparison with Corman's (1988) solid baseline data.

Corman (1988, and personal communication, 2004) made the only recorded observations to date of the giant spotted whiptail on the San Pedro, and its presence, if verified, suggests it should be more widespread elsewhere than it is currently known to be (Rosen et al. 2002). The San Pedro River in the region where Corman found this lizard (on stony slopes adjoining the river near Charleston and the Babocomari at its confluence with the river [T. Corman, personal communication]) was originally dominated by grass rather than thornscrub and woodland (Turner et al. 2003), and therefore the species' absence from much of the Santa Cruz River is more likely due to its disappearance following habitat degradation rather than natural absence associated with grassland environments.

Grassland species of long tenure may have disappeared from the San Pedro in the immediate aftermath of the grazing-induced catastrophe of the late 1800's. Wright and Lowe (1965) suggested this for the little striped whiptail. Although I have argued that the original locality label may have been in error (Rosen et al. 1998), this species may still be declining in parts of New Mexico that suffered similar grazing impacts (C. W. Painter, personal communication, 2002), and the issue remains unresolved.

The mapped occurrence of the Massasauga on the upper San Pedro (Lowe et al. 1986), though based on un-vouchered observations, suggests that this grassland species also was present, but has dwindled and probably been extirpated from the valley. This rattlesnake has certainly become progressively less widespread in southeastern Arizona based on its recorded occurrences on the orders of 100, 50, and 10 years ago (A. T. Holycross, unpublished). Suitable habitat probably existed near the river in the upper basin, and may have continued to exist into the mid-late 20th century near Palominas and Hereford, where the species could conceivably be relocated.

Other species may have disappeared without a trace when the grassland was razed. A likely example is the bunchgrass lizard (*Sceloporus slevini*). Smith et al. (1998) demonstrated that this often-montane species is sensitive to drought and grazing at low elevations. Its occurrence in the Sonoita Grasslands suggests it should also be at the San Pedro River. At Empire Cienega, lowland populations have continued to thrive in sacaton, which is only lightly impacted by grazing, but the population is centered on an intact cienega and cienega stream where sacaton and mesquite contact it closely. This habitat situation may have been too rare to sustain this lizard in the larger, more heavily scoured San Pedro River through the period of maximal grassland destruction and bottomland erosion, although it seems likely that suitable habitat is currently present.

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