Final Report on Herpetofauna Monitoring

In the Tijuana Estuary National Estuarine Research Reserve

By

Robert Fisher, Ph.D.
United States Geological Survey
Western Ecological Research Center
San Diego State University

And

Ted Case, Ph.D.
Professor
Department of Biology
University of California San Diego

2/2000

Table of Contents

Tables and Figures

Appendix I: Reptile and Amphibian Species Accounts

Appendix II: Letters of Collaboration

Introduction

Habitat fragmentation has been targeted as one of the most serious threats to global bio-diversity. This is a very real threat in southern California, as past and present impacts from urbanization have created a veritable patchwork of fragmented habitat. Intensive development over the last century in coastal southern California has led to the destruction of the majority of the coastal dune, wetlands, and coastal sage scrub habitats.

The Tijuana Estuary National Estuarine Research Reserve (TENERR) represents one of the only intact coastal dune habitats in San Diego County. It lies within the California floristic province, which is considered one of 18 global biodiversity hot spots (Wilson 1992, Mittermeier 1998). Only 20% or less of the coastal sage scrub, maritime succulent scrub, and coastal dune habitats of southern California habitat have not yet been converted to urban and agricultural uses (Westman 1981). In order to effectively manage these lands and maintain the natural species richness of this region, a sound understanding of the resident species and communities is of utmost necessity. This research set out to gain the necessary information and bi-national cooperation needed to maintain the respective species and communities within the general vicinity of the TENERR.

This report summarizes three years of herpetofauna sampling at the TENERR, San Diego County, California. Over the course of monitoring, baseline data was gathered to measure the presence, diversity, and relative abundance of species that comprise the herpetofaunal communities of the TENERR. Over time, this baseline data will be useful to determine and track changes in the numbers and types of these species in this area.

Materials and Methods

Three general areas were sampled including the coastal dune area, mesa tops and slopes (Border Field), and marsh upland habitat (Fig. 2). Each of the three sample areas was comprised of a series of pit-fall drift-fence arrays distributed as shown in figure 1. The arrays are distributed throughout the various microhabitats within each study area. Each array consists of seven 5-gallon buckets sunken with the bucket mouth flush with surrounding substrate, and connected by shade cloth drift-fences (three 15-meter arms) in the shape of a Y (Fig. 1). A hardware cloth funnel trap is placed at each of the three arms for capturing snakes and large lizards. Sampling is conducted at each study site for 10 consecutive days every 6 weeks, for a total of 50 to 60 days a year, and spread evenly across annual seasons. Traps are closed between the sampling periods.

The animals captured are individually marked (except for a few species that lack adequate marking techniques) either by toe clipping or scale-clipping (used only for snakes) and then released. Any incidental deaths are preserved as voucher specimens to be deposited in the California Academy of Sciences (CAS) herpetological collection. The protocols developed ensure that the majority of the animals captured remain alive when the traps are open. Open traps were checked once every 24 hours, each morning. The reptiles and amphibians are processed in the field and any other animals that may be present are also released. Processing includes marking, weighing, and measuring the body length; toe-clip and tail tip samples from lizards and snakes are taken and kept in 70% ethanol for future molecular systematic studies.

Characteristics of the habitat were included in our study to address the conservation issues and the effects of local and regional habitat parameters. Data was recorded for exposure, slope angle, substrate, and local plant species composition and structure.

Results

Herpetofaunal monitoring at the TENERR began in March of 1997 and continued through the end of 1999. Funding to continue this research has been provided by the City of San Diego and will allow monitoring to continue until the spring of 2001. To date, a total of 1,423 individual reptile and amphibians representing 19 total species were verified on the TENERR over this period (Table 3). Fourteen of the 1,423 total individuals represent incidental captures. Of the 1,423 reptiles and amphibians captured, there were 9 snake, 7 lizard, and 3 amphibian species (Tables 3-5). From the attached seasonal survey captures table, it is shown that trends in seasonal activity are evident. Spring had the highest number of individual captures, followed by winter, fall, and summer in descending order. The number of species captured was roughly correlated to this seasonal trend, with the greatest number of individuals being captured in spring and winter.

It should be emphasized that the specialized census techniques being employed in this study have been shown to be extremely effective in detecting cryptic species not detected by other sampling means (Case and Fisher, in press; Lichtwardt, pers. comm.; Scott, pers. comm.) in the coastal habitats of southern California. It has been used extensively outside of southern California, but no long-term survey of coastal sage scrub has used this technique. The traditional techniques of transect surveys, although extensively used for sensitive species (i.e. *Cnemidophorus hyperythrus*, *Phrynosoma coronatum*), have been shown to entirely misrepresent population levels (Case and Fisher, in press) and are not quantitative across observers. The pitfall trap array data will be directly compared quantitatively across these study sites and additional sites in southern California to determine regional patterns of diversity and abundance of sensitive species.

Incidental captures events were also extremely important in that two of the fourteen incidental captures were the coastal rosy boa (*Charina* (*Lichanura*) *trivirgata*), and the two-striped garter snake (*Thamnophis hammondii*). These were the only two individuals of these species that were found over the course of this research. A total of five other species were captured incidentally, including the silvery legless lizard

(*Anniella pulchra*), coast horned lizard (*Phrynosoma coronatum*), Baja racer (*Masticophis flagellum*), side-blotched lizard (*Uta stansburiana*), San Diego gopher snake (*Pituophis melanoleucus*), and the southern Pacific rattlesnake (*Crotalus viridis*).

Discussion

This study was the most comprehensive analysis of the diversity and abundance of herpetofauna ever conducted in the TENERR. Earlier herpetofauna surveys were conducted (Espinoza 1989), but were shorter in duration and did not sample as many areas across the TENERR. Espinoza (1989) used pitfall bucket sampling, but used a different pitfall trap design with fewer buckets and areas sampled. This survey recorded 13 species, two of which are restricted to riparian habitat with permanent water (*Rana catesbiana* and *Xenopus laevis*). These two species are exotics, this habitat was not accessed during this recent survey and these two species were not recorded elsewhere in the TENERR with this current survey. All other species detected by Espinoza (1989) have been accounted for by this current survey.

Several notable trends are evident based on the data. Historic records indicate that there has been a decline in the resident snake species of this region. Three snakes including the long nosed snake (*Rhinocheilus lecontei*), glossy snake (*Arizona elegans*), and the red diamond rattlesnake (*Crotalus exsul* (*ruber*)) are missing from this region, despite early records that indicate their presence at the very same location where the present surveys were conducted (L. Klauber unpubl. field notes from the 1920's-1940's). A similar extirpation has been shown in the pacific pocket mouse, which was historically found at the TENERR (Pavelka, pers.comm.).

The Baja racer (*Masticophis flagellum fuliginosus*) was found at all of the three sampling areas. Earlier studies to survey the herpetofauna of this region did not detect this species (Espinoza 1989, L. Klauber unpubl. field notes from the 1920's-1940's). This snake has not been recently recorded in southern California, and appears to be well represented in the TENERR. Full protection of this snake is warranted, due to the fact that it is a Baja California endemic whose range is limited in the United States to a zone of up to 10 km north of the international border, and inland as far east as Campo.

Continual habitat loss and degradation of habitat in this zone will likely result in the extirpation of this species throughout its U.S. range.

The rosy boa (*Charina* (*Lichanura*) *trivirgata*) was an incidental capture as a result of searching the roads while driving to the study site. This represents the first record of this species from the TENERR. It was found in Goat Canyon near the wastewater treatment facility construction site (Fig. 2). Additional attention should be focused on the slopes of Spooner's Mesa, which is located on the east side of Goat Canyon. This site was noted as potential rosy boa habitat by Espinoza (1989), this verification illustrates the importance of the slope and mesa habitat south of the Tijuana River. The manner in which this individual was located (searching the roads), suggests that the large amount of traffic in the border area me be a factor in the rarity of this species in the TENERR. A better determination of rosy boa population size and viability can potentially be made with such efforts. This species occurrence at the TENERR represents one of only two extant coastal populations of rosy boas in the U.S.

The two-striped garter snake (*Thamnophis hammondii*) was captured incidentally, and represents the only individual of this species found on the TENERR. This species was found in the marsh upland area near array 14, and was a juvenile indicating recruitment is taking place in the TENERR. The arrays are not proximate to the pools and available water in the area that garter snakes would forage in and near. Manual surveys in these areas may turn up more individuals.

The only rattlesnake found in the TENERR is the southern pacific rattlesnake (*Crotalus viridis helleri*). This species was only recorded from the north-west slope of Bunker Hill within the Border Field study area (Fig. 2). This location has a diverse and relatively intact native vegetative and floral community as well. Efforts should be made to preserve such intact regions, since further development and projects in and around the TENERR area will continue to further isolate the fragmented habitats. Further fragmentation limits the ability of adjacent populations to disperse or colonize intact habitats, and species declines may continue to result.

The blind snake captures (*Leptotyphlops humilis*) represent the first records from the TENERR. This is likely the result of the sampling techniques used in this study as this species is relatively small and fossorial, rendering itself difficult to find. The blind

snake captures were from the north-west slopes of Bunker Hill, at arrays associated with large patches of Bergerocactus.

Arrays 6-8 near Monument 258 are within an area that is relatively intact from both a floral and faunal perspective. Marked erosion from the impacts of past road use are evident though. Nine of 19 species found at the TENERR are found in these three arrays. The orange-throated whiptail, Coronado skink, and silvery legless lizard are all found here, and are state and federal species of special concern. Another uncommon species, the Baja racer, is found here. Coastal sage scrub and chaparral slopes found in this area are of substantial quality, and additional studies of the species found here (both plant and animals) are merited.

Dune habitats in the TENERR are relatively intact, given their widespread loss as a result of the urbanization of coastal California. These dune habitats are comprised of a unique faunal assemblage of sand adapted (arenicolous) species, such as the silvery legless lizard (*Anniella pulchra*), the side-blotched lizard (*Uta stansburiana*), and the coast horned lizard (*Phrynosoma coronatum blainvillei*). Other notable species found in the dunes are the Baja racer (*Masticophis flagellum fuliginosus*), and the western spadefoot toad (*Scaphiopus hammondii*). The coast horned lizard is particularly notable in that it has evidently undergone a dietary shift to feed on the resident *Formica sp.* ants. This "shift" is apparently the result of an absence of the preferred food source for the coast horned lizard, the native harvester ants.

The orange-throated whiptail lizard is a species of special concern at both the federal and state level. This lizard was the most abundant species represented in our captures, although it was only found in 6 arrays, all from the Border Field area. It was absent from both the upland marsh, and dune habitats. These findings suggest that this species is locally abundant but with specific and narrow habitat requirements which are met in the mesa top and steep slopes south of the Tijuana River. That this species is more abundant than was earlier thought (Espinoza, 1989), may be due in large part to the changes in survey techniques applied by Fisher and Case, as well as the expanded survey area to the southern mesa and slopes.

Seasonal activity patterns can be seen from both the total species and total individual captures data. More individuals were captured in the spring, winter, fall, and

summer in descending order. (Tables 4 and 5). More species were captured in the spring and winter (n=16), and summer and fall (n=14: Table 4). The data show general trends by season, but some species show a very strong correlation to seasonal movement patterns.

The orange-throated whiptail was well most abundant in the spring and fall as represented by total individuals captured.

Study Goals

Five distinct goals were set forth when this research began in 1997. Listed below are the five goals, and how they were accomplished.

First Goal: Results of this research will give a complete herpetofauna inventory of the Tijuana Slough National Wildlife Refuge (TSNWR) and Tijuana Estuarine National Research Reserve (TENERR).

A variety of habitats including dunes, marsh upland, and grassland areas were sampled continuously in the TSNWR and TENERR. Pitfall sampling and incidental observations are believed to have generated a thorough and comprehensive list of the herpetofaunal species present (Table 3). Evidence of thorough sampling is indicated by the cryptic species found such as the silvery legless lizard, the western blind snake, and the western skink. Additionally, rare species such as the Baja racer (*Masticophis flagellum fuliginosus*) and the coastal rosy boa (*Charina* (*Lichanura*) *trivirgata*) were recorded from this locality for the first time in many years.

The inability to verify presence of three snake species obviously indicates a problem. *Crotalus* (*ruber*) *exsul* is likely to have been extirpated as a result of habitat loss. The long nosed snake (*Rhinocheilus lecontei*) and glossy snake (*Arizona elegans*) are both nocturnal, and may have been extirpated as a result of continual ambient lighting and frequent road driving involved in monitoring the international border. Such lighting simulates daytime for nocturnal creatures and may have a negative impact on their behavior, or increased their susceptibility to predation.

Second Goal: Data from this study will be used to generate a greater ecosystem management approach to avoid single species management conflicts within the TNERR.

The data collected have shown that species are not distributed evenly across the TENERR. The different areas and microhabitats within the TENERR are comprised of distinct communities. Understanding the distribution of species in the TENERR will help to avoid conflicts when managing different areas and/or species within the TENERR.

The mesa tops and steep slopes of the Border Field area share a wealth of biodiversity. Two arrays, the north-west slope of Bunker Hill, combine for 13 of the 19 species recorded from the TENERR (Table 3). This survey has recorded 17 of the 19 TENERR species within this region (Table 3). It is critical when managing the TENERR to protect the existing habitat on the mesas and slopes south of the Tijuana River. Re-vegetation projects in this region will greatly enhance these truly unique populations by providing more suitable habitat and connecting small patches of existing habitat.

Habitat restoration efforts within the TENERR can be augmented by a knowledge of the respective species distribution both geographically and temporally.

Third Goal: This study will encourage scientific cooperation between the USA and México that can serve as a model for future binational studies focused on common ecosystems.

A variety of binational partnerships and partnering objectives resulted directly from this research.

- Partnering with Universidad Autonoma de Baja California (UABC) was initiated as result of this research.
- Cooperation between the Dean of both UABC and the University of California San Diego (UCSD) was facilitated in order to include members of the Biology departments from both respective schools (Appendix II).

- Tours of the TENERR study area, USGS lab, and the San Diego State University (SDSU) were given to both students and faculty of UABC.
- Robert Fisher served on the committee of Annaberta Gatica as she completed a Master's Degree (M.S.) at UABC.
- Joint grant proposals were submitted by the principal investigators, and members of UABC to the National Science Foundation (NSF), Conabio, and CONACyT in order to request additional funding. This proposed funding was to extend related research into México (It should be noted that no related work was conducted in México as no additional grant monies were awarded, although high ratings were consistently obtained).
- Seminars on the Natural History of Baja California have been given annually and for the past four years by Robert Fisher, to a class taught by Dr. Alejandro O. Rodriguez Pereda entitled "Introduction to the Regional ecology of Baja California." This seminar was given at the Instituto de Cultura de Baja California, Civic Center, Tijuana.
- Robert Fisher, Ph.D. also serves on the 'Border Security Road Focus Group', which is involved with 'Operation Gatekeeper' initiated by the Immigration and Naturalization Service (INS). Dr. Fisher's involvement in this group has helped to minimize impacts to the natural resources of the TENERR, while allowing for effective patrolling and security implementation along this international border region in conjunction with 'Operation Gatekeeper.'

Fourth Goal: Data from this study will be used to direct acquisition priorities by identifying the habitats of greatest herpetofaunal diversity.

Greatest diversity of species was seen in the Border Field and mesa tops area along the international border. Specifically, the slopes of Bunker Hill have a high herpetofaunal, as well as floral diversity. The remoteness and intact vegetative communities are believed to have contributed to the high diversity of this area. This area should have a high conservation priority.

Fifth Goal: Data from this study will be used to expand educational programs conducted within the reserve to further include transitional upland habitats in immediate proximity to estuarine and marine habitats.

The resulting species lists for respective sampling areas will allow resource biologists to accurately list the resident species. Refined species lists will also allow a more directed educational program specific to those species that are present. The researchers and field assistants work with volunteers and interns to expand skills and knowledge of herpetofauna sampling techniques. They are also available for educational talks and programs utilizing the data gathered from this survey. This not only valuable for expanding the knowledge of those who frequent the reserve, but provides greater awareness for a larger community. The materials provided in this report will be useful to inform researchers, contractors, cooperating agencies and the public what they me find throughout the reserve and the importance of this relatively intact habitat in the TENERR.

LITERATURE CITED

Espinoza, R. 1989. Herpetofauna of the TENERR Restoration Project. In, Draft EIR of the TENERR Tidal Restoration Program. Prepared by Entrix, Inc., Pacific Estuarine Research Laboratory and Philip Williams and Associates, Ltd.

Mittermeier, R., P. Robles Gil, and C.G. Mittermeier. 1997. Megadiversity. Cemex. Mexico City, Mexico.

Westman, W.E. 1981. Factors influencing the distribution of species of Californian coastal sage scrub. Ecology 62:439-455.

Wilson, E.O. 1992. The Diversity of Life.

Figure 1. Terrestrial survey protocol and designs for arrangement of pitfall and funnel traps with drift fences. Figures are not drawn to scale.

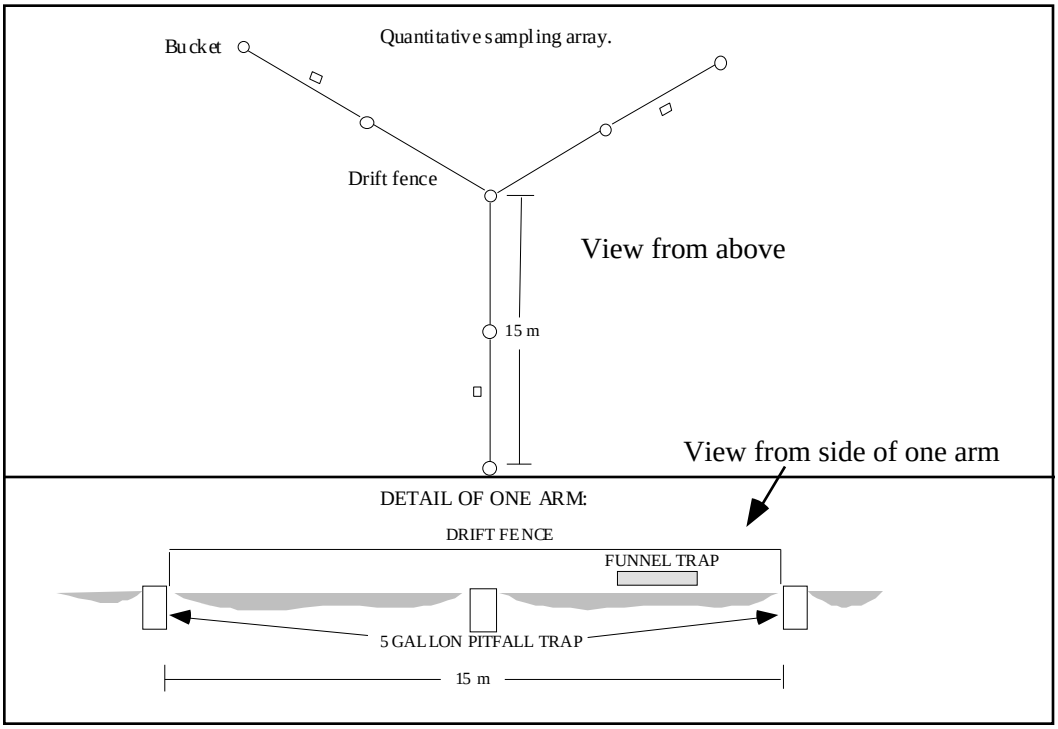


Figure 2. Map of herpetofaunal array locations at the Tijuana Estuary study site. Arrays 1-5 comprising the dune arrays, 7-11 comprising the Border Field arrays, 12-15 being the marsh upland arrays.

Table 1. GPS locations of the Herpetofaunal Arrays at the TENERR.

Site	Array	Latitude	Longitude
TENERR	1	32.5503478	117.1261375
TENERR	2	32.5479604	117.1249015
TENERR	3	32.5457875	117.1243691
TENERR	4	32.5422119	117.1234424
TENERR	5	32.5407665	117.1237969
TENERR	6	32.535075	117.1171042
TENERR	7	32.5351217	117.1191163
TENERR	8	32.5350532	117.1179519
TENERR	9	32.5391011	117.109126
TENERR	10	32.5384142	117.1076438
TENERR	11	32.5378235	117.1073918
TENERR	12	32.5602968	117.1263128
TENERR	13	32.559886	117.1244742
TENERR	14	32.5609874	117.1242619
TENERR	15	32.5616498	117.1257403

Table 2. Species common names index.

Batrachoseps pacificus	Pacific Slender Salamander
Hyla regilla	Pacific Treefrog
Scaphiopus hammondii	Western Spadefoot Toad
Anniella pulchra	California Legless Lizard
Elgaria multicarinatus	Southern Alligator Lizard
Eumeces skiltonianus	Western Skink
Cnemidophorus hyperythrus	Orange-Throated Whiptail
Sceloporus occidentalis	Western Fence Lizard
Uta stansburiana	Side-Blotched Lizard
Phrynosoma coronatum	Coastal Horned Lizard
Leptotyphlops humilis	Western Blind Snake
Charina trivirgata	Coastal Rosy Boa
Hypsiglena torquata	Night Snake
Lampropeltis getula	California King Snake
Masticophis flagellum	Baja California Coachwhip
Masticophis lateralis	California Whipsnake
Pituophis melanoleucus	San Diego Gopher Snake
Thamnophis hammondii	Two-Striped Garter Snake
Crotalus viridis	Southern Pacific Rattlesnake
Extirpated Species	
Crotalus exsul (*ruber*)	Red diamond rattlesnake
Rhinocheilus lecontei	Coastal long nosed snake
Arizona elegans	Coastal glossy snake

Table 3. Total species captures by location

Total for 1997 through 1999

Species	Dunes						Border Field (Mesa Tops)							Marsh	Upland				TOTAL
	1	2	3	4	5	D*	6	7	8	9	10	11	B*	12	13	14	15	U*	
Batrachoseps pacificus Pacific Slender Salamander							2			1									3
Hyla regilla Pacific Treefrog			2	3						2	2			4			5		18
Scaphiopus hammondii Western Spadefoot Toad		2											Tp						2
Anniella pulchra Silvery Legless Lizard					4	1	1		1			1			2		1		11
Elgaria multicarinatus Southern Alligator Lizard							3	9	8	7	4			7	2	5	5		50
Eumeces skiltonianus Western Skink					1		6	13	12	18	14	21		14	15	12	10		136
Cnemidophorus hyperythrus Orange throated Whiptail							46	36	45	128	76	105							436
Sceloporus occidentalis Western Fence Lizard		1		2			26	10	15	71	19	18		34	55	44	52		347
Uta stansburiana Side-Blotched Lizard	13	12	39	45	46		7	5	12	24	18	40	1						262
Phrynosoma coronatum Coast Horned Lizard	23	6	31	1	12	1								2					75
Leptotyphlops humilis Western Blind Snake										9	2								11
Charina (*Lichanura*) *trivirgata* Coastal Rosy Boa													1						1
Hypsiglena torquata Night Snake										1		1							2
Lampropeltis getula California King Snake							1	1		2	3			3	2	2	2		16
Masticophis flagellum Baja Racer/Whipsnake			1		6	1		1	1					4	4	2			20
Masticophis lateralis Striped Racer							2		4		1	1							8
Pituophis melanoleucus San Diego Gopher Snake		4		1					1	3			7	4			1		20
Thamnophis hammondii Two Striped Garter Snake																		1	1
Crotalus viridis Southern Pacific Rattlesnake										2	1		1						4
Total Individuals:	36	23	71	52	69	3	80	63	81	246	127	176	10	66	72	58	65	1	1423
Total Species:	2	5	4	5	5	3	9	7	9	12	10	7	5	8	6	5	7	1	19

D*, B* and U* columns represent animals captured in area but not at a specific array.
Tp indicates several Tadpoles of this species were observed.

Table 4. Total number of species captures by season

Captures by Seasons	**Winter**	**Spring**	**Summer**	**Fall**	**Total**
Effort (days sampled)	**39**	**41**	**28**	**22**	**130**
Batrachoseps pacificus	3				3
Hyla regilla	11		5	2	18
Scaphiopus hammondii	1	1			2
Anniella pulchra	1	7	3		11
Elgaria multicarinatus	20	20	6	4	54
Eumeces skiltonianus	44	43	31	18	136
Cnemidophorus hyperythrus	37	178	55	166	456
Sceloporus occidentalis	110	93	74	70	347
Uta stansburiana	84	49	54	75	262
Phrynosoma coronatum	42	20	8	6	76
Leptotyphlops humilis		4	5	2	11
Charina trivirgata			1		1
Hypsiglena torquata				2	2
Lampropeltis getula	2	8	5	1	16
Masticophis flagellum	3	11	2	4	20
Masticophis lateralis	4	4			8
Pituophis melanoleucus	3	11	1	4	19
Thamnophis hammondii		1			1
Crotalus viridis	2	1		1	4
Total Individuals:	367	451	250	355	1423
Total Species:	16	16	14	14	19

Table 5. Total species capture rates by season

Capture Rate by Seasons	Winter	Spring	Summer	Fall	Total
Effort (days sampled)	**39**	**41**	**28**	**22**	**130**
Batrachoseps pacificus	0.08				0.02
Hyla regilla	0.28		0.18	0.09	0.14
Scaphiopus hammondii	0.03	0.02			0.02
Anniella pulchra	0.03	0.17	0.11		0.08
Elgaria multicarinatus	0.51	0.49	0.21	0.18	0.42
Eumeces skiltonianus	1.13	1.05	1.11	0.82	1.05
Cnemidophorus hyperythrus	0.95	4.34	1.96	7.55	3.51
Sceloporus occidentalis	2.82	2.27	2.64	3.18	2.67
Uta stansburiana	2.15	1.20	1.93	3.41	2.02
Phrynosoma coronatum	1.08	0.49	0.29	0.27	0.58
Leptotyphlops humilis		0.10	0.18	0.09	0.08
Charina trivirgata			0.04		0.01
Hypsiglena torquata				0.09	0.02
Lampropeltis getula	0.05	0.20	0.18	0.05	0.12
Masticophis flagellum	0.08	0.27	0.07	0.18	0.15
Masticophis lateralis	0.10	0.10			0.06
Pituophis melanoleucus	0.08	0.27	0.04	0.18	0.15
Thamnophis hammondii		0.02			0.01
Crotalus viridis	0.05	0.02		0.05	0.03
Total Individuals:	9.41	11.00	8.93	16.14	10.95
Total Species:	16	16	14	14	19

Table 6. 1997 species captures by location

	1997																		
	Dunes						Border	Field						Marsh	Upland				
Species	1	2	3	4	5	D	6	7	8	9	10	11	B	12	13	14	15	U	TOTAL
Batrachoseps pacificus																			
Hyla regilla			2	3										2					7
Scaphiopus hammondii																			
Anniella pulchra					1		1		1										3
Elgaria multicarinatus							2	4	1	2				2		1	5		17
Eumeces skiltonianus					1		1	3	1	6	4	14		1	1	4	1		37
Cnemidophorus hyperythrus							9	5	13	50	14	28							119
Sceloporus occidentalis		1		1			9	5	4	19	7	5		10	14	14	14		103
Uta stansburiana	6	6	16	15	20		4	2	3	17	11	26	1						127
Phrynosoma coronatum	15	2	15	1	2									2					37
Leptotyphlops humilis										4									4
Charina trivirgata													1						1
Hypsiglena torquata										1		1							2
Lampropeltis getula							1							2		2	1		6
Masticophis flagellum					4	1		1	1					2	3	1			13
Masticophis lateralis							2		4		1	1							8
Pituophis melanoleucus		1		1						1			2	1					6
Thamnophis hammondii																		1	1
Crotalus viridis										1			1						2
Total:	21	10	33	21	28	1	29	20	28	101	37	75	5	22	18	22	21	1	493

Table 7. 1998 species captures by location

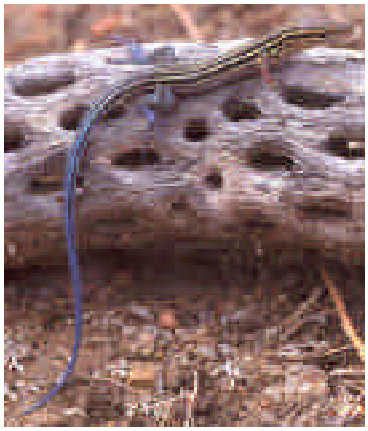
	1998																		
	Dunes						Border	Field						Marsh	Upland				
Species	1	2	3	4	5	D	6	7	8	9	10	11	B	12	13	14	15	U	TOTAL
Batrachoseps pacificus							2			1									3
Hyla regilla																			
Scaphiopus hammondii		1																	1
Anniella pulchra					3	1						1			2		1		8
Elgaria multicarinatus								2	4	2	4			3	2	2			19
Eumeces skiltonianus							3	5	7	10	8	4		10	9	3	3		62
Cnemidophorus hyperythrus							28	23	19	55	49	68							242
Sceloporus occidentalis				1			5	4	4	34	7	5		16	22	24	28		150
Uta stansburiana	3	4	18	25	16			1	5	3	4	6							85
Phrynosoma coronatum	4	3	7		7														21
Leptotyphlops humilis										5	2								7
Charina trivirgata																			
Hypsiglena torquata																			
Lampropeltis getula										1	1			1	2				5
Masticophis flagellum			1		1									1		1			4
Masticophis lateralis																			
Pituophis melanoleucus		1							1	2			4	3			1		12
Thamnophis hammondii																			
Crotalus viridis											1								1
Total:	7	9	26	26	27	1	38	35	40	113	76	84	4	34	37	30	33		620

Table 8. 1999 species captures by location

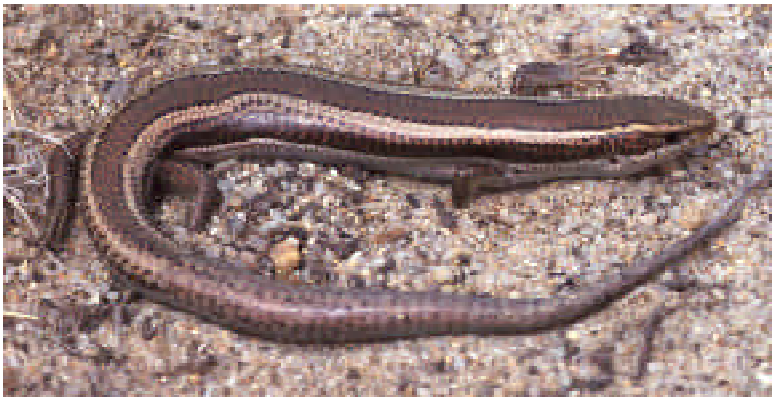
	1999																	
	Dunes						Border	Field						Marsh	Upland			
Species	1	2	3	4	5	D	6	7	8	9	10	11	B	12	13	14	15	U	TOTAL
Batrachoseps pacificus																			
Hyla regilla										2	2			2			5		11
Scaphiopus hammondii		1																	1
Anniella pulchra																			
Elgaria multicarinatus							1	3	3	3				2		2			14
Eumeces skiltonianus							2	5	4	2	2	3		3	5	5	6		37
Cnemidophorus hyperythrus							9	8	13	23	13	9							75
Sceloporus occidentalis							12	1	7	18	5	8		8	19	6	10		94
Uta stansburiana	4	2	5	5	10		3	2	4	4	3	8							50
Phrynosoma coronatum	4	1	9		3	1													17
Leptotyphlops humilis																			
Charina trivirgata																			
Hypsiglena torquata																			
Lampropeltis getula								1		1	2						1		5
Masticophis flagellum					1									1	1				3
Masticophis lateralis																			
Pituophis melanoleucus		2											1						2
Thamnophis hammondii																			
Crotalus viridis										1									1
Total:	8	4	12	5	14	1	13	8	13	32	14	17	1	10	17	6	11		310

Scientific name: *Anniella pulchra* **Common name:** California Legless Lizard
Distribution within study area: Entire study area.
size: 3.15-5.5 in (8.0-14.0 cm)
Distinguishing characters: Legless; silver or beige on dorsal side; greenish yellow venter; smooth shiny scales; black mid-dorsal line running length of body; additional lines where ventral and dorsal colors meet; distinct glossy black tip on tail, if not regenerated.
Juveniles: Cream or silver on dorsal half; grey or pale yellow on ventral half, but very similar to adults.
Dimorphism: None
Similar species: ***Leptotyphlops humilis*****:** lacks dorsal stripes and eyelids.
Additional notes: Only legless lizard in California. A burrowing species seldom seen unless uncovered. Prefers loose soils associated with drainages and valley bottoms, but also occurs on hillsides. It is found throughout the reserve but appears to be most common on the back dunes. Can be nocturnal during summer, but rarely on roads at night.

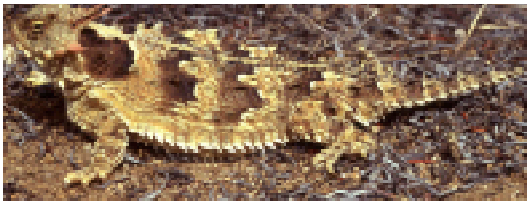
Scientific name: *Elgaria multicarinatus* **Common name:** Southern Alligator Lizard
Distribution within study area: Border Field and Marsh Upland.
Size: 3.1-7.25 in (7.8-18.4 cm)
Distinguishing characters: A long-bodied species with black and white crossbars on back and tail; brown, yellow, grey or reddish ground color; prominent fold along sides of body; dorsal scales strongly keeled; black or dusky bars on sides; yellow eyes; tail over twice the body length (if not regenerated); large head with pointed snout; small legs; broad, forked tongue; animals from mid-elevations in Orange County may be uniform grey with either red or black spots down back.
Juveniles: Broad dorsal stripe of yellow, tan, or reddish-gold; indistinct crossbands.
Dimorphism: Head broader and more triangular in adult males.
Similar species: ***Eumeces skiltonianus*****:** Have smooth dorsal scales; lack lateral folds.
Additional notes: A distinctive species that can appear snake-like at first glance. Individuals will attempt to bite and defecate when handled; large adults can inflict painful bites, though not dangerous. This species is common throughout the densely vegetated upland habitat North and South of the Tijuana River.



Scientific name: *Cnemidophorus hyperythrus* **Common name:** Orange-Throated Whiptail
Distribution within study area: Border Field Arrays.
Size: 2-2.83 in (5.0-7.2 cm)
Distinguishing characters: A distinctive species with five or six light colored stripes down a black, brown, or grey dorsal side; middle stripe may be forked at both ends; whitish-yellow or cream on venter; orange throat (females and juveniles may lack this character); head is yellow-brown to olive colored; tongue is forked and flicked continually.
Juveniles: Legs and tail are cobalt blue.
Dimorphism: Entire ventral surface of males including tail may be orange, although gravid females may also have some orange especially lining the lower jaw; colors are most distinct in breeding season; males have larger femoral pores than females.
Similar species: ***Eumeces skiltonianus*:** Has very shiny scales; thicker tail; smaller legs.
Additional notes: A species with a distinctive, jerking gait. This species is commonly found south of the Tijuana River on the mesa tops and steep slopes in the maritime succulant scrub.



Scientific name: *Eumeces skiltonianus* **Common name:** Western Skink
Distribution within study area: Entire study area.
Size: 1.73-2.95 in (4.4-7.5 cm)
Distinguishing characters: Broad, brown stripe down middle of the back edged with black; pale whitish or golden stripes down sides, separated by a beige stripe beginning behind eyes; ventral side is whitish or grey; smooth scales; small legs; stripes appear faded in older adults.
Juveniles: Stripes are more contrasting; a bright cobalt blue tail.
Dimorphism: Male has orange to pinkish margin of lower jaw and ventral side of tail during breeding season. Sex of non-breeding adults and juveniles is difficult to distinguish.
Similar species: ***Cnemidophorus hyperythrus*:** Has large, square ventral scales, forked tongue, larger legs, granular dorsal scales.
***Elgaria multicarinatus*:** Has keeled dorsal scales; prominent lateral fold.
Additional notes: A common species, although seldom seen in the open. Small, delicate species with smooth scales making individuals difficult to handle. Will lose tail easily, and body scales may come off of young individuals if handled too roughly. Lives in most terrestrial habitat types. This species is found throughout the reserve bu appears to be most common in the upland habitat and mesa tops, being rare on the back dunes.



Scientific name: *Phrynosoma coronatum* **Common name:** Coast Horned Lizard
Distribution within study area: Dunes and Marsh Upland.
Size: 2.3-4.2 in (5.9-10.6 cm)
Distinguishing characters: A distinctive flat-bodied species; two horns at back of head longer than surrounding spines; two rows of fringed scales down sides; two rows of enlarged pointed scales on margin of lower jaw; yellowish, brown or grey dorsum with contrasting wavy blotches of darker color; pointed scales on dorsum of body; beige or yellow venter with black spotting.
Juveniles: Similar to adults; cranial spines shorter and less pronounced.
Dimorphism: Male has broader tail at base, enlarged postanal scales, and femoral pores; adult females are larger than adult males.
Additional notes: Individuals may eject blood from eyes when handled. A gentle species that is easily handled, although may try to push cranial spines into hands while held. Though once common to the entire San Diego area, this species is in decline, the back dunes appearing to have one of the densest populations of horned lizards remaining in Coastal San Diego.

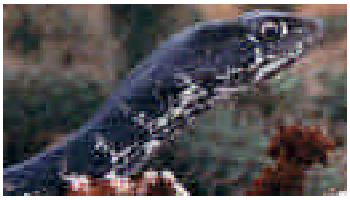
Scientific name: *Sceloporus occidentalis* **Common name:** Western Fence Lizard
Distribution within study area: Entire study area.
Size: 1.97-3.31 in (5.0-8.4 cm)
Distinguishing characters: A robust species; dorsal scales keeled and pointed; dark brown or black blotched pattern; small blue spots on back and large one on throat; blue ventral patches, with a black mid-ventral stripe separating the patches; yellow or orange on rear under surfaces of limbs.
Juveniles: Lacks blue on throat; blue ventral patches faint or absent.
Dimorphism: Swollen tail base in males with paired enlarged scales just posterior of vent, and femoral pores; female has less vivid markings and lacks, or has smaller, pale blue ventral patches.
Similar species: ***Uta stansburiana*:** Has black to blue blotch behind forelimbs.
Additional notes: A common species occurring throughout study area but is more rare on the dunes. This lizard is often referred to as the "Blue Belly" owing to the large blue patches on the ventral surface of the mature males.

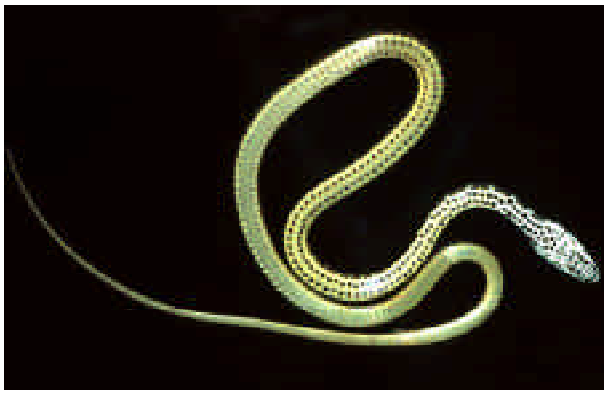
Scientific name: *Uta stansburiana* **Common name:** Side-Blotched Lizard
Distribution within study area: Dunes and Border Field.
Size: 1.57-2.36 in (4.0-6.0 cm)
Distinguishing characters: A small species; a conspicuous bluish-black blotch on each side behind the forelimbs; dorsum blotched or spotted with blue, orange, yellow, brown and/or black; whitish to grey on venter; orange or light blue patch on throat, and no blue belly patches.
Juveniles: Similar to adult female in pattern; lacks blue-black spots on sides.
Dimorphism: Male has swollen tail base, blue and yellow flecks on mid-dorsal side, and enlarged postanal scales; female lacks blue and yellow mid-dorsal flecks and is blotched dorsally in brown and black.
Similar species: ***Sceloporus occidentalis*:** Have keeled, pointed dorsal scales; lack bluish-black spots on side behind forelimb.
Additional notes: A common species throughout the study area, but prefers open habitats with rock or sand.. This lizard is very common on the back dunes and south of the river along the mesa tops and steep slopes.

Scientific name: *Pituophis melanoleucus annectens* **Common name:** San Diego Gopher Snake
Distribution within study area: Entire study area.
Size: 31.5-55.5 in (80-141 cm)
Distinguishing characters: A large species; yellow or cream dorsum becoming orange-tinted toward tail; black or brown dorsal blotches on body; widely spaced on tail; smaller blotches on sides; venter yellow or yellow-orange, pinkish toward tail; faint mottling on venter especially tail; dark line across head between orbit of eyes; orange or brick colored eyes with round pupils; dorsal scales keeled.
Juveniles: Similar to adults.
Dimorphism: None
Similar species: ***Arizona elegans*****:** Has smooth scales; countersunk lower jaw; single anal plate. ***Hypsiglena torquata*****:** Has flat head; white labial scales; vertical pupils.
Additional notes: A large species that may hiss loudly, flatten head, vibrate tail, and strike when annoyed, appearing as a viper. Usually becomes calm when handled. Widespread in most habitat types. This species is an oppurtunist and generalist, it can be active any month of the year and any time day or night.

Scientific name: *Charina (Lichanura) trivirgata roseofusca* **Common name:** Coastal Rosy Boa
Distribution within study area: Border Field..
Size: 22.4-35.4 in (57-90 cm)
Distinguishing characters: Heavy-bodied species with smooth, shiny scales; small eyes with vertically oval pupils; chin shields enlarged; lacks plate-like scales on top of head; bluish-grey ground color with three broad brown, orange, or reddish brown longitudinal stripes; same color mottling on interspaces; cream venter, spotted with grey; some individuals lack contrast between stripe and ground color, appearing unicolored, either reddish or silvery grey; subcaudal scales undivided.
Juveniles: Lighter ground color; contrasting dorsal pattern more distinct.
Dimorphism: Anal spurs well developed in the male; weak or absent in the female.
Additional notes: A gentle species that is easily handled; often rolls body into ball concealing head when handled or injured. Appears to be declining on coast, where it was once common. Difficult to detect, this species is often observed along roads in the late evening or early morning. Genus name for this species has recently been changed to *Charina*, although most people still use the name *Lichanura*.

Scientific name: *Thamnophis hammondii* **Common name:** Two-Striped Garter Snake
Distribution within study area: Marsh Upland
Size: 15.4-28.4 in (39-72 cm)
Distinguishing characters: A species that lacks a mid-dorsal stripe; olive, brown or brownish-grey dorsum; dull yellow, orange, or salmon venter; lengthwise rows of small, dark spots; yellow stripes on sides; throat pale; eyes brick color with round pupils; red tongue; dorsal scales keeled; usually black patches on neck behind head; occasional melanic individuals lacking side stripes.
Juveniles: Similar to adults.
Dimorphism: Female has extremely constricted tail immediately posterior of the base.
Similar species: ***Masticophis lateralis*:** Has smooth scales; black tongue.
Additional notes: This species excretes foul smelling musk when handled. This species appears to be relatively rare within the reserve, being captured only once by hand near the marsh upland arrays.



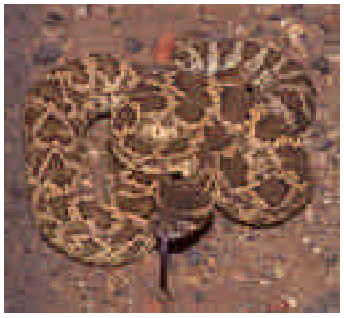


Scientific name: *Masticophis flagellum fulginosus* **Common name:** Baja California Coachwhip
Distribution within study area: Entire Study Area.
Size: 24-52 in (62-132 cm)
Distinguishing characters: A slender species; dark grey-brown or olive above with white spotting on sides, becoming more prominent on neck and upper body; dark blotches on neck and head; venter cream, and spotted with paired black spots toward head; slender body and tail; large eyes with round pupils; occasional inland individuals may be completely black on dorsum.
Juveniles: Black, brown, or tan transverse bands on lighter (grey) background; neck markings absent in hatchlings and faint in juveniles less than 24in (61 cm) in length.
Dimorphism: None
Similar species: ***Masticophis lateralis*:** Has distinct yellow lateral stripes. ***Masticophis flagellum piceus*:** Generally red body with black head and neck; pink venter.
Additional notes: A fast moving, alert diurnal snake that is difficult to capture. This species has a rather small range in the extreme southern edge of San Diego County but is common throughout the reserve. When captured it tends to flatten its head, lower its jaw drooling slightly, and remain limp or coil into a ball.

Scientific name: *Masticophis lateralis* **Common name:** California Whipsnake or Striped Racer
Distribution within study area: Border Field.
Size: 22.4-49.2 in (57-125 cm)
Distinguishing characters: A slender species; black, or brownish on dorsum; lighter color toward tail; yellow or white dark-edged stripe down sides from back of head to vent; white, cream or pale yellow venter becoming salmon/pink at tail; large eyes with round pupils; smooth scales.
Juveniles: Similar to adults.
Dimorphism: None
Similar species: ***Masticophis flagellum*****:** Lacks lateral striping. ***Thamnophis hammondii*****:** Has keeled scales and red tongue.
Additional notes: An alert, fast moving, diurnal snake that is difficult to capture. May bite and excrete musk when handled. This species has been captured only on the mesa tops and steep slopes south of the Tijuana River, but may be found more widespread with continued monitoring.

Scientific name: *Lampropeltis getula californiae* **Common name:** California Kingsnake
Distribution within study area: MArsh Upland and Border Field
Size: 19.7-43.8 in (50-111 cm)
Distinguishing characters: A polymorphic species with various color and pattern phases consisting primarily of alternating bands of black or brown, and white or yellow (banded phase) or longitudinal stripes of these same colors (striped phase); some individuals exhibit partial patterns of both and can appear marbled, spotted, or blotched; scales smooth and glossy; snout light colored; single anal scale.
Juveniles: Similar to adults.
Dimorphism: None
Additional notes: Individuals may excrete musk, vibrate tail, and bite when handled. Widespread in many habitats. Though this snake is found often in the upland habitat, it has yet to be captured on the dunes, though it may turn up with continued monitoring.

Scientific name: *Hypsiglena torquata* **Common name:** Night Snake
Distribution within study area: Border Field
Size: 9.8-13.8 in (25-35 cm)
Distinguishing characters: A pale grey, beige or light brown species; brown paired blotches on dorsum; usually three large black blotches on the neck, sometimes merging; venter whitish or yellow; flat head; vertical pupils; brown bar behind eyes; white labial scales; scales smooth, often with irridescence.
Juveniles: Similar to adults.
Dimorphism: None
Similar species: ***Arizona elegans*****:** Have round pupils. ***Pituophis melanoleucas*****:** Has round pupils; keeled scales. ***Crotalus viridis*****:** Has rattle on tail.
Additional notes: May flatten head, coil tightly, and vibrate tail when disturbed appearing as a viper. A gentle species that is easily handled. Often found under rocks. This is an extremely coastal population for this species, being found so far only on the steep slopes south of the river.

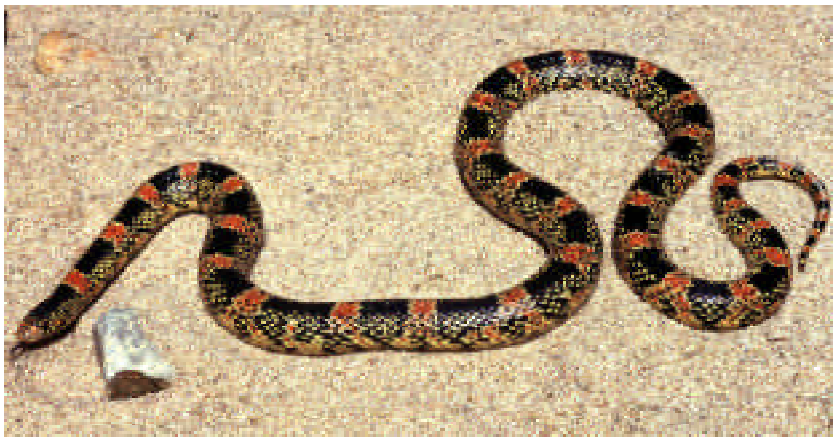


Scientific name: *Crotalus viridis helleri* **Common name:** Southern Pacific Rattlesnake
Distribution within study area: Border Field.
Size: 22-40 in (55-102 cm)
Distinguishing characters: A rattlesnake with grey, olive, or brown ground color and light-edged, darker diamonds on dorsum; blotches on sides dark, angular and also light-edged; light stripe from corner of mouth to eye; low-contrast dark tail rings, with terminal ring poorly defined and twice as wide; venter light yellow or cream with faint blotching; high elevation populations can be very dark or black dorsally, with little or no pattern definition.
Juveniles: Similar to adults, but with bright yellow-green tail.
Dimorphism: Male has a more stout tail than the female.
Similar species: ***Crotalus ruber*****:** Has conspicuous black and white banded tail; usually tannish or reddish dorsal coloration
Additional notes: A nervous species that will aggressively defend itself when annoyed. **VENOMOUS**; don't handle or use extreme caution. Occurs in all habitat types in the focal area. Unusually, this species has been found only on the slopes and mesas south of the river, and not yet in the upland habitat.

Scientific name: *Leptotyphlops humilis* **Common name:** Western Blind Snake
Distribution within study area: Border Field.
Size: 7.2-13.0 in (18-33 cm)
Distinguishing characters: A thin cylindrical species with no neck constriction; blunt head and tail; purplish, brown or pink dorsum with silvery sheen; light venter; no enlarged ventral scutes; eyes vestigial, appearing as dark spot beneath head scales; spinelike terminal scale on tail tip.
Juveniles: Similar to adults, except lighter in color.
Dimorphism: None
Similar species: ***Anniella pulchra*:** Has eyelids; black dorsal striping and black tail tip.
Additional notes: Difficult to hold since they will squeeze out of hands. Excretes watery fluid that has a musky odor. This is relatively dense and unique population of Blind Snake, being found only within Bergerocactus patches on the north-west facing slope of Bunker Hill.

Scientific name: *Crotalus ruber (exsul)* **Common name:** Red Diamond Rattlesnake
Distribution within study area: Historic records for the area, has not been verified recently.
Size: 29-63 in (73-160 cm)
Distinguishing characters: A rattlesnake with tan, pink, or reddish dorsal color and prominent light-edged diamonds of darker hue; faint pepper marks over dorsal pattern; tail with conspicuous black and white rings; broad vertical eye stripe edged in lighter color.
Juveniles: Dark and light grey hues in pattern, changing to reddish with age.
Dimorphism: Male tail is more stout.
Similar species: ***Crotalus viridis*:** Lacks conspicuous black and white tail bands; juveniles have yellow-green tail.
Additional notes: A large species often associated with coastal sage scrub, rocky hillsides, and outcrops. Relatively docile, although some individuals may hiss loudly and/or rattle when annoyed. **VENOMOUS**; don't handle or use extreme caution. The name for this species may be changed to *exsul* in the future. This is a species in decline, with increasing interest in its behaviors and ranges, sightings should be verified and recorded.

Scientific name: *Arizona elegans occidentalis* **Common name:** California Glossy Snake
Distribution within study area: Historic records in area, has not been verified recently.
Size: 25.2-38.9 in (64-99 cm) Counties.
Distinguishing characters: Smooth, glossy scales; chocolate colored body blotches on a tan or light brown ground color; prominent eye stripe; eyes with slightly vertical pupils; countersunk lower jaw; single anal scale.
Juveniles: Similar to adults, but blotches darker.
Dimorphism: None
Similar species: ***Pituophis melanoleucas*****:** Has keeled scales; eyes with round pupils; divided anal scale. ***Hypsiglena torquata*****:** Has a triangular flattened head; vertical pupils; white labial scales.
Additional notes: An uncommon species in focal area, although historically this subspecies was widespread. Primarily nocturnal, it is associated with loose soils in valleys and washes suitable for burrowing. Gentle, calm, and easily handled. This appears to be a species currently in great decline. Surveys for suitable habitat should be conducted and sightings of this species should be verified and recorded.



Scientific name: *Rhinocheilus lecontei* **Common name:** Western Long-Nosed Snake
Distribution within study area: Historic records in area, has not been verified recently.
Size: 18.9-29.5 in (48-75 cm)
Distinguishing sharacters: A slender species; cream ground color; black dorsal saddles with red interspaces; cream or yellow venter; black spotting on a white head; black saddles speckled with white on the sides; very pointed snout; countersunk lower jaw; anterior portion of subcaudal scales undivided in most individuals.
Juveniles: Banding more pronounced; speckling on sides faint or absent.
Dimorphism: None
Similar species: ***Lampropeltis getula*****:** Have banding completely around body; all subcaudals divided; rounded snouts; lack countersunk lower jaw.
Additional notes: A gentle species that vibrates tail when annoyed. Some individuals may hemorrhage from the cloaca and excrete musk when handled. Surveys for this species should be continued and sightings should be verified an recorded.

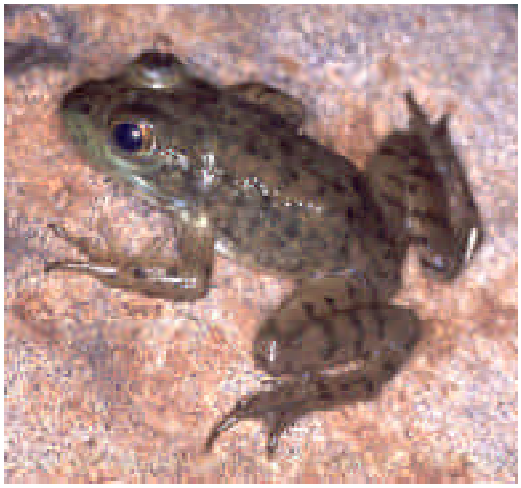
Scientific name: *Batrachoseps pacificus major* **Common name:** Pacific Slender Salamander
Distribution within study area: Border Field
Size: 1.30-2.64 in (3.3-6.7 cm)
Distinguishing characters: A worm-like species with a long, slender body and tail; small head and limbs; highly variable coloration of brownish, light tan, pinkish or greyish dorsum with faint speckling on venter.
Juveniles: Similar to adults.
Dimorphism: None
Additional notes: A common species throughout San Diego with a complex evolutionary history; often coils body and tail tightly when handled; fragile and easily injured. Within the reserve, this species has been observed recently only on the mesa and steep slopes south of the river. They should be further surveyd for by searching under decomposing wood in heavily vegetated areas.


Scientific name: *Hyla regilla* **Common name:** Pacific Treefrog
Distribution within study area: Entire study area.
Size: 1.0-2.0 in (2.5-5.0 cm)
Distinguishing characters: A small species with a prominent dark brown or black eyestripe; variable dorsal coloration of shades of green, tan, reddish, grey, brown or black; dark triangular blotch on head; variable dark blotches or spotting depending on color phase, which can change dramatically from dark to light in a short time; venter whitish or cream with yellow on undersides of legs and lower abdomen; toe webbing reduced; small toe pads; smooth skin.
Juveniles: Similar to adults, although usually uniform in dorsal coloration.
Dimorphism: Male has yellow throat.
Additional notes: Most common treefrog species in study area. Can occur distant from surface water in a variety of habitats. This treefrog has been captured in amazingly all habitat types in the study area.

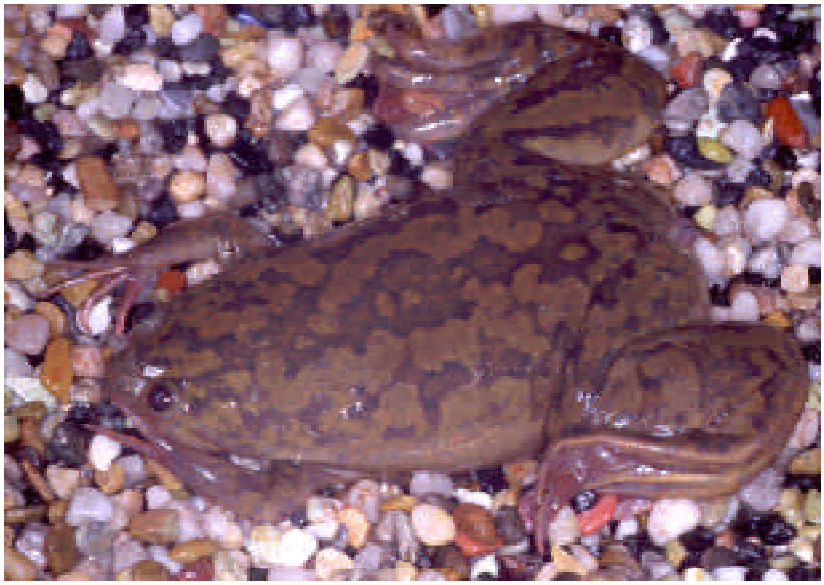

Scientific name: *Spea hammondii* **Common name:** Western Spadefoot
Distribution within study area: Dunes and Spooners Mesa..
Size: 1.5-2.95 in (3.8-7.5 cm)
Distinguishing characters: A relatively smooth-skinned species; eye is pale gold with vertical pupil; green or grey dorsum often with skin tubercles tipped in orange; whitish color on venter; wedge-shaped black spade on each hind foot.
Juveniles: Similar to adults, but spotting more distinct.
Dimorphism: None
Similar species: ***Bufo boreas*****:** Has white dorsal stripe and pronounced parotoid glands. ***Bufo microscaphus californicus*****:** Has very blunt snout and rough, warty skin. These species lack large spades on hind feet.
Additional notes: Populations are localized, but widespread. Prefers grassland, scrub and chaparral locally but could occur in oak woodlands. Nocturnal. Activity limited to wet season, summer storms, or during evenings with elevated substrate moisture levels. Easily handled, with less skin secretions than other toad species in study area. Their secretions smell like peanut butter and may cause sneezing. This population is unique as Tijuana Estuary supports one of the last remaining sand-dune population in coastal California.

Scientific name: *Bufo boreas* **Common name:** Western Toad
Distribution within study area: Historic records in area, has not been verified recently.
Size: 2.2-5.12 in (5.6-13.0 cm)
Distinguishing characters: A large toad species; white or cream dorsal stripe; dusky gray or greenish dorsally with skin glands concentrated within the dark blotches; parotoid glands are oval, widely separated, and larger than upper eyelids; mottled venter; horizontal pupils; lacks cranial crests.
Juveniles: Dorsal stripe weak or absent; large young have prominent dorsal and ventral spotting and yellow feet.
Dimorphism: Male has smoother skin; reduced dorsal blotching; nuptial pads (thickened skin) on forefeet during breeding season; throat pale as in female.
Similar species: ***Bufo microscaphus californicus*:** Has light colored stripe on head; very blunt snout; light-centered green, grey, brown or salmon color on dorsal side; lacks dorsal stripe; smaller total size.
Additional notes: A common species occupying a wide variety of habitats; frequently encountered during wet season on roads or near water at other times. When handled adults often vocalize (sounds like a peeping chick) while struggling. This still common toad in San Diego is known to have occured in the area but has not recently been observed within the reserve, further surveys should be made to verify the presence of this toad as well as the arroyo toad.

Scientific name: *Bufo microscaphus californicus* **Common name:** Arroyo Southwestern Toad
Distribution within study area: Possibly in Tijuana River washes.
Size: 2-2.95 in (5.0-7.5 cm)
Distinguishing characters: A stocky, blunt-nosed, warty-skinned species; horizontal pupils; greenish, grey or salmon on dorsum with a light-colored stripe across head and eyelids; light sacral and mid-dorsal patches; large, oval, and widely-separated parotoid glands; weak or absent cranial crests.
Juveniles: Ashy-white, olive or salmon on dorsal side; with or without black spotting; red-tipped tubercles on back.
Dimorphism: None, unless in breeding season when males develop nuptial pads on forefeet.
Similar species: ***Bufo boreas*:** White or cream dorsal stripe on length of body; dark dorsal blotches containing skin glands; lacks blunt nose.
Additional notes: Endangered and protected by federal law, any observations should be reported to U.S. Fish and Wildlife Service. Southern populations fragmented; uncommon within study area, although widespread. Prefers sandy or cobbly washes and associated upland habitats. Habitat conversion and sedimentation may have eliminated much of this toads specialized breeding habitat within the reserve, this should be verified with further surveys.



Scientific name: *Rana catesbeiana* **Common name:** Bullfrog
Distribution within study area: Possibly in riparian habitat in the reserve.
Size: 5.12-8.27 in (13.0-21.0 cm) **INTRODUCED: Occurs widespread in the Eastern U.S.**
Distinguishing characters: Largest frog in California; prominent sacral humps; olive, green or brownish dorsum with vague spots o blotches; lighter green head; whitish, grey-mottled venter; legs blotched or banded; conspicuous eardrums; lacks dorsolateral folds.
Juveniles: Similar to adults, but more spotting and more grey on the dorsum.
Dimorphism: Male has yellow throat; eardrum larger than eye; swollen thumb base.
Similar species: ***none***
Additional notes: An introduced species; wary and difficult to capture. Male produces distinctive, deep-pitched vocalizations. Individuals will squawk when jumping into the water to excape. Usually found in association with permanent water, but can disperse over land at least several kilometers. These species require permanent water as their tadpoles over-winter. They have been recorded previously from the river drainage.



Scientific name: *Xenopus laevis* **Common name:** African Clawed Frog
Distribution within study area: Recorded from Tijuana River drainage.
Size: 2-5.75 in (5-12.5 cm) **INTRODUCED: Native to southern Africa.**
Distinguishing characters: A highly aquatic species; smooth skin; forefeet unwebbed, hindfeet fully webbed with sharp black claws on inner toes; small head with blunt snout; eyes small, lidless and turned upward; olive to brown on dorsum with darker spots, blotches or mottling; whitish on venter; head and body flattened.
Juveniles: Similar to adults.
Dimorphism: Female is larger and has cloacal claspers.
Similar Species: Should not be confused with other frog species. The only totally aquatic frog in California.
Additional notes: Introduced to the U.S. in the 1960's and feeds on native amphibian tadpoles. Will move overland at night during rains, and may show up in very unlikely places including golf course ponds, streams, ditches and lakes. Very slippery, but harmless, when handled. These species thrive in disturbed and polluted habitats and are most closely associated with the Tijuana River.

Scientific name: *Clemmys marmorata* **Common name:** Western Pond Turtle
Distribution within study area: Historic records in Tijuana River, not recently verified.
Size: 4.7-7.2 in (12-18 cm)
Distinguishing characters: Low carapace with shields that have a network of lines or dashes of brown or black on a olive or dark background coming from its growth centers. Limbs and head olive, yellow, orange or brown often with darker lines, flecks or spots.
Juveniles: Tail as long as shell; head, limbs and tail marked with yellow; shields of the carapace have striking pattern of radiating lines.
Dimorphism: Male has a lighter throat; tail is much longer than that of female with cloaca extending past end of shell, whereas cloaca of female does not extend past end of shell; shell usually flatter and less marked than a female's, with underside concave.
Similar species: Although this is the only native turtle, ***Trachemys scripta*** is found introduced in many places but differs in having a greener shell, and large red markings on the side of the head.
Additional notes: An aquatic turtle that utilizes upland habitat seasonally. They occur in ponds, streams, lakes, ditches, and marshes. Surveys including trapping in upland ponds should be undertaken to verify presence or absence of this species.

Scientific name: *Trachemys scripta* **Common name:** Slider/Red-eared Slider
Distribution within study area: Possibly in Tijuana River Drainage
Size: 5.9-11.8 in (15-30 cm) **INTRODUCED: Native to eastern U.S.**
Distinguishing characters: Carapace has yellow streaking on olive or black shields; bright red, orange or yellow spot behind eyes; head and limbs are dark and striped with yellow; jagged rear edge of carapace.
Juveniles: Green coloration of carapace much brighter as juvenile. See upper right-hand picture.
Dimorphism: Male is usually darker and has longer nails on front feet than female.
Similar species: ***Clemmys marmorata*****:** Has spotted head and limbs, and lacks red spot behind ear.
Additional notes: An aquatic turtle, although found sometimes moving overland to lay eggs or leaving a drying pond. Becoming increasingly more common in urban areas of southern California.