

Notes on the Herpetofauna of Nayarit, Mexico 2: Amphibians and Reptiles of the Municipality of Compostela

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(all photographs depict specimens and habitat found in the municipality of Compostela)

Abstract

With the objective of increasing our knowledge on the herpetological composition of the municipality of Compostela, we performed surveys in different types of vegetation during the period from 2013 to 2016. This is our second survey for a particular municipality of the state. Based on the information obtained, we here report our findings of 71 species (21 amphibians and 50 reptiles) in four orders, 29 families and 54 genera. The most diverse family is the Colubridae, with 13 species.

Resumen

Con el objetivo de dar a conocer la composición de anfibios y reptiles del municipio de Compostela, del 2013 al 2016 fueron realizados muestreos en diferentes tipos de vegetación. Este es el segundo inventario sobre el estado que se demuestra la presencia actual de las especies, base a los muestreos realizados se encontraron 71 especies de herpetofauna; de estos 21 fueron anfibios y 50 reptiles, en cuatro órdenes, 29 familias y 54 géneros. El género Colubridae es el más diverso, con 13 especies.

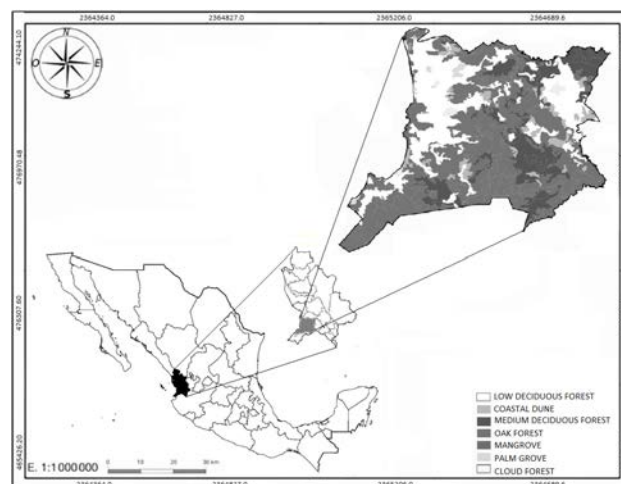
Introduction and Background

Previous studies of herpetofauna in the Mexican state of Nayarit have documented the herpetological composition of species found in the state (Luja et al., 2014; Loc-Barragán et al., 2015; Woolrich-Piña et al., in press). These documents form the basis of future work, such as the recent study on composition, distribution and conservation of the herpetofauna of this state (Woolrich-Piña et al., 2016). Research on amphibians and reptiles in the state has received great impulse; however, existing studies have not dealt with vegetation types or municipalities. The objective of our research was to provide regional accounts of herpetofauna for the state and the second summary list of amphibians and reptiles for a municipality of Nayarit, in this case, Compostela. The principal intention of this field work was to obtain a reliable list of herpetofauna. This information would improve management strategies of flora and fauna in this municipality that has been affected by quick growth in development for tourism and other anthropogenic activity (cattle raising and paved road construction).

Study site (Biogeography)

Nayarit is located at the junction of three prominent physiographic segments of Mexico: (1) the Coastal Plain—17% of its surface area, (2) the Sierra Madre Occidental—53.2%; (3) the Trans-Mexican Volcanic Belt 28.7% (Woolrich-Piña et al., 2016). The municipality of Compostela is located in the southern region of Nayarit, it has an area of 1848 km², is located between 20°51' and 21°23' N latitude, and between 104°47' and 105°23' W longitude; with an altitude gradient between 0 and

1700 m. It is bordered to the north by the municipalities of San Blas and Xalisco; to the south by the municipality of Bahía de Banderas and the state of Jalisco; to the east by the municipalities of Santa María de el Oro and San Pedro Lagunillas, and by the state of Jalisco; and to the west by the Pacific Ocean. It occupies 6.82% of the surface area of the state. One of the seven natural protected areas of Nayarit is in this municipality: “Sierra de Vallejo” (SEMARNAT and CONANP, 2005). Compostela presents a diversity of landscapes and vegetation: Cloud Forest and Oak Forest, representing around 17.66% of the municipality’s surface; Medium Deciduous Forest and Low Deciduous Forest with 50.58%; Mangrove 0.51%; Coastal Dune 0.7%; Palm Grove 0.30% and Agricultural 30.25% (INEGI, 2009).



The location of the municipality of Compostela, Nayarit, Mexico.

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Incilius mazatlanensis observed in Medium Deciduous Forest, on the road to Alta Vista, Compostela. Photograph by Guillermo A. Woolrich-Piña.



Craugastor occidentalis observed in Medium Deciduous Forest in Alta Vista, Compostela. Photograph by Jesús Loc-Barragán.



Craugastor pygmaeus observed in Oak Forest. Locality: Mazatán, Compostela. Photograph by Jesús A. Loc-Barragán.



Eleutherodactylus nitidus observed in Medium Deciduous Forest. Locality: Cumbres de Huicicila, Compostela. Photograph by Jesús Loc-Barragán.



Eleutherodactylus pallidus observed in Cloud Forest. Locality: Rancho Pajaritos, Sierra Vallejo, Compostela. Photograph by Jesús A. Loc-Barragán.



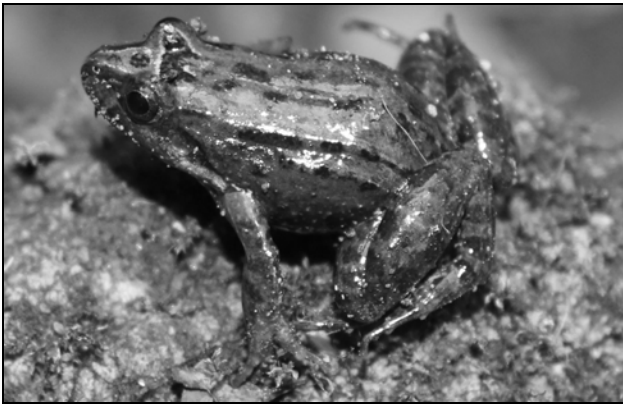
Diaglena spatulata observed in Medium Deciduous Forest on the road to Alta Vista, Compostela. Photograph by Guillermo A. Woolrich-Piña.



Tlalocohyla smithii observed in Low Deciduous Forest. Locality: Rancho Agua Sarca, on the Compostela-Mazatán road, Compostela. Photograph by Jesús A. Loc-Barragán.



Agalychnis dacnicolor observed in Medium Deciduous Forest on the road to Alta Vista, Compostela. Photograph by Guillermo A. Woolrich-Piña.



Leptodactylus melanonotus observed in Low Deciduous Forest. Locality: Calexico, Compostela. Photograph by Jesús Loc-Barragán.



Lithobates forreri observed in Low Deciduous Forest on the Compostela-Mazatán road, Compostela. Photograph by Jesús A. Loc-Barragán.



Lithobates magnaocularis observed in Low Deciduous Forest on the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.



Gerrhonotus liocephalus observed in Low Deciduous Forest. Locality: Rancho Agua Sarca, on the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.



Heloderma horridum observed in Low Deciduous Forest. Locality: Carrillo Puerto, Compostela. Photograph by Jesús A. Loc-Barragán.



Ctenosaura pectinata observed in Low Deciduous Forest. Locality: Rancho Agua Sarca, on the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.



Holcosus sinister observed in Medium Deciduous Forest. Locality: Alta Vista, Compostela. Photograph by Guillermo A. Woolrich-Piña.



Drymobius margaritiferus observed in Low Deciduous Forest. Locality: Rancho Agua Sarca on the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.



Lampropeltis polyzona observed in Low Deciduous Forest. Locality: Mazatán, Compostela. Photograph by Jesús A. Loc-Barragán.



Leptodeira maculata observed in Low Deciduous Forest along the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.



Crotalus basiliscus observed in Oak Forest. Locality: Mazatán, Compostela. Photograph by Jesús A. Loc-Barragán.



Kinosternon integrum observed in Low Deciduous Forest. Locality: Rancho Agua Sarca, on the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.

Material and Methods

Field trips were conducted from September 2013 to December 2016, with approximately 40 sampling visits lasting five to 10 days each for different study sites within the municipality. Sampling effort was flexible, depending on conditions and vegetation types. We conducted daytime (0900–1200 h) and nocturnal (2100–2300 h) surveys; our main searching activity was focused on direct observation and rock lifting, trying our best not to disturb the habitat (Goode et al., 2004, 2005), using equipment such as hooks, bags and lanterns. Specimens were bagged, transported to the lab for photography and released the next day at the locality where they were collected.

Results

We documented the presence of 71 species, of which 21 are amphibians and 50 are reptiles (Table 1). The 21 amphibian species are grouped into one order, eight families and 12 genera. SEMARNAT (2010) lists 12 of these species as endemic to Mexico and five as protected (*Eleutherodactylus pallidus*, *E. teretistes*, *Hypopachus ustus*, *Lithobates forreri* and *L. pustulosus*). IUCN (2018) lists one species as Vulnerable (*Craugastor pygmaeus*) and three as Data Deficient (*C. occidentalis*, *E. pallidus* and *E. teretistes*). Based on the environmental vulnerability score (EVS), nine species are at low vulnerability, nine at medium vulnerability and two (*E. pallidus* and *E. teretistes*) at high vulnerability.

The 50 reptile species occur in three orders, 21 families and 42 genera. SEMARNAT (2010) categorizes 27 of these species as endemic to Mexico, one species as introduced (*Hemidactylus frenatus*), 16 as protected, five as threatened (*Heloderma horridum*, *Ctenosaura pectinata*, *Leptophis diplotrophis*, *Masticophis mentovarius* and *Rhinoclemmys pulcherrima*) and four as being in danger of extinction (*Chelonia mydas*, *Eretmochelys imbricata*, *Lepidochelys olivacea* and *Dermodochelys coriacea*). IUCN (2018) lists one species as Critically Endangered (*E. imbricata*), one as Endangered (*C. mydas*), four as Vulnerable (*Crocodylus acutus*, *L. olivacea*, *D. coriacea* and *Trachemys ornata*), one as Near Threatened (*Agkistrodon bilineatus*), and two as Data Deficient (*Plestiodon parvulus* and *Coniophanes lateritius*); 10 species are not evaluated. Based on the environmental vulnerability score (EVS), 15 species are at low vulnera-

bility, 14 at medium vulnerability and 15 at high vulnerability. The amphibian family with the most species was Hylidae with five. The reptile family with the most species was Colubridae with 13. Differences were observed in species richness among the seven plant communities. Nine species of amphibians and reptiles were observed in Cloud Forest, 13 in the Oak Forest, 37 in Medium Deciduous Forest, 46 in Low Deciduous Forest, six in Mangrove, eight in Palm Grove, and nine in Coastal Dunes vegetation (Tables 1 and 2). Some of our records represent extensions of distribution, and new records for the municipality of Compostela.

Discussion and Conclusions

The herpetofauna of Nayarit comprises 154 species: 36 amphibians of which 21 are endemic to Mexico and 118 reptiles of which 67 are endemic for the country (Woolrich-Piña et al., 2016). Our survey numbers for the municipality of Compostela represent 55.5% and 73.1% respectively of the amphibian and reptile richness of the state. The number of species found in this study is an important factor when considering conservation alternatives for the different vegetation types, for the municipality and the state. This is the second study of this type we have performed for a particular municipality of Nayarit; our first was Tecuala (Loc-Barragán and Lazcano, 2018). López-Solis and Luja (2014) reported on their fieldwork on the herpetofauna of the municipality of Tepic, Nayarit, showing a preliminary result of 33 species (14 amphibians and 19 reptiles). Table 2 compares



Oak Forest at Sierra Vallejo, Compostela. Photograph by Jesús A. Loc-Barragán.



Micrurus proximans observed in Low Deciduous Forest. Locality: Rancho Agua Sarca on the Compostela-Mazatán road. Photograph by Jesús A. Loc-Barragán.



Salvadora mexicana observed in Medium Deciduous Forest. Locality: road to Alta Vista, Compostela. Photograph by Guillermo A. Woolrich-Piña.

results for the three municipalities.

Acknowledgments

We thank PROMEP (“Los vertebrados de la Sierra de Vallejo” Project) for financial support to for scholarship (UAN-CA-261) obtained to JALB, and CONACyT (Grant no. 290805)

for the Postdoctoral fellowship to GAWP in 2013–2014. We thank Fausto R. Mendez de la Cruz for obtaining our collecting permit from SEMARNAT OFICIO NÚM (SGPA/DGVS/01629/16), and Dr. Larry David Wilson for reviewing the manuscript. We thank all the people of the *ejidos* of Alta Vista, El Moteón, La Peñita de Jaltemba, Zacualpan, El Capomo, Carrillo Puerto, Calexico and Mazatán for their hospitality and support for these field trips.

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Table 1. Distributional and conservation status of the herpetofauna of Compostela, Nayarit, Mexico. **END** = endemism: E = endemic to Mexico; N = not endemic to Mexico; I = Introduced. **NOM** = protection status under NOM-ECOL-059-2010 (SEMARNAT, 2010): P = En Peligro de Extinción (Endangered); Pr = Protección Especial (Special Protection); A = Amenazada (threatened). IUCN Categorization: CR = Critically Endangered; EN = Endangered; VU = Vulnerable; NT = Near Threatened; LC = Least Concern; DD = Data Deficient; and NE = Not Evaluated. Environmental Vulnerability Score, low (L) vulnerability species (EVS of 3–9); medium (M) vulnerability species (EVS of 10–13); and high (H) vulnerability species (EVS of 14–20) (Wilson et al. 2013; Woolrich-Piña et al., 2016). Vegetation: CF = Cloud Forest; OF = Oak Forest; MDF; Medium Deciduous Forest; LDF = Low Deciduous Forest; M = Mangrove; PG = Palm Grove CD = Coastal Dune. Nomenclature from Wilson et al., 2013a and 2013b.

Family	Species	END	NOM	IUCN	EVS	Vegetation
Bufonidae	<i>Incilius marmoratus</i>	E	—	LC	M(11)	MDF, LDF
	<i>Incilius mazatlanensis</i>	E	—	LC	M(12)	CF, MDF, LDF, CD
	<i>Rhinella horribilis</i>	N	—	LC	L (3)	CF, MDF, LDF, CD
Craugastoridae	<i>Craugastor augusti</i>	N	—	LC	L (8)	CF, OF
	<i>Craugastor occidentalis</i>	E	—	DD	M(13)	OF, CF, MDF
	<i>Craugastor pygmaeus</i>	E	—	VU	L(9)	OF, CF, MDF
	<i>Craugastor vocalis</i>	E	—	LC	M(13)	MDF
Eleutherodactylidae	<i>Eleutherodactylus nitidus</i>	E	—	LC	M(12)	OF, CF
	<i>Eleutherodactylus pallidus</i>	E	Pr	DD	H (17)	CF, MDF, LDF
	<i>Eleutherodactylus teretistes</i>	E	Pr	DD	H (16)	CF, OF
Hylidae	<i>Diaglena spatulata</i>	E	—	LC	M(13)	MDF, LDF
	<i>Dryophytes eximius</i>	E	—	LC	M(10)	MDF, LDF
	<i>Smilisca baudinii</i>	N	—	LC	L (3)	MDF, LDF, PG
	<i>Smilisca fodiens</i>	N	—	LC	L(8)	LDF
	<i>Tlalocohyla smithii</i>	N	—	LC	L (8)	OF, MDF, LDF
Phyllomedusidae	<i>Agalychnis dacnicolor</i>	E	—	LC	M(13)	CF, MDF, LDF, PG, CD
Leptodactylidae	<i>Leptodactylus melanonotus</i>	N	—	LC	L (6)	MDF, LDF, PG
Microhylidae	<i>Hypopachus ustus</i>	N	Pr	LC	L (7)	LDF, PG
Ranidae	<i>Lithobates forreri</i>	N	Pr	LC	L (3)	LDF
	<i>Lithobates magnaocularis</i>	E	—	LC	M(12)	OF, MDF
	<i>Lithobates pustulosus</i>	E	Pr	LC	L (9)	CF, MDF
Crocodylidae	<i>Crocodylus acutus</i>	N	Pr	VU	H (14)	MS, CD
Anguidae	<i>Gerrhonotus liocephalus</i>	N	Pr	LC	L (6)	MDF, LDF
Dactyloidae	<i>Norops nebulosus</i>	E	—	LC	M(13)	OF, MDF, LDF, PG, CD
Gekkonidae	<i>Hemidactylus frenatus</i>	I	—	—	—	MDF
Helodermatidae	<i>Heloderma horridum</i>	E	A	LC	H (14)	MDF
Iguanidae	<i>Ctenosaura pectinata</i>	E	A	NE	H (15)	MDF, LDF, M, CD
	<i>Iguana iguana</i>	N	Pr	LC	M(12)	MS
Phrynosomatidae	<i>Sceloporus albiventris</i>	E	—	NE	H(16)	LDF
	<i>Sceloporus clarkii</i>	N	—	LC	M(10)	LDF
	<i>Sceloporus melanorhinus</i>	N	—	LC	L (9)	LDF
	<i>Sceloporus utiformis</i>	E	—	LC	H (15)	OF, MDF, LDF
	<i>Urosaurus bicarinatus</i>	E	—	LC	M(12)	LDF, M
Phyllodactylidae	<i>Phyllodactylus lanei</i>	E	—	LC	H (15)	MDF
	<i>Phyllodactylus tuberculatus</i>	N	—	LC	L (8)	CF, MDF
Scincidae	<i>Plestiodon parvulus</i>	E	—	DD	H (15)	OF, MDF, LDF, PG
Teiidae	<i>Aspidoscelis costata</i>	E	Pr	NE	M(11)	OF, MDF, LDF
	<i>Aspidoscelis lineattissima</i>	E	Pr	LC	H (14)	MDF, LDF, M
	<i>Holcosus sinister</i>	E	—	NE	M(13)	MDF, LDF

Table 1. (cont'd)

Family	Species	EN	NOM	UICN	EVS	Vegetation
Boidae	<i>Boa sigma</i>	E	—	NE	H (15)	CF, MDF, LDF, M
Colubridae	<i>Drymarchon melanurus</i>	N	—	LC	L (6)	LDF
	<i>Drymobius margaritiferus</i>	N	—	NE	L (6)	MDF, LDF
	<i>Lampropeltis polyzona</i>	E	—	NE	M(11)	LDF
	<i>Leptophis diplotropis</i>	E	A	LC	H (14)	LDF, PG
	<i>Masticophis mentovarius</i>	E	A	LC	L (6)	LDF
	<i>Mastigodryas melanolomus</i>	N	—	LC	L (6)	OF
	<i>Oxybelis aeneus</i>	N	—	NE	L (5)	LDF
	<i>Salvadora mexicana</i>	E	Pr	LC	H (15)	MDF
	<i>Senticolis triaspis</i>	N	—	LC	L (6)	LDF
	<i>Trimorphodon paucimaculatus</i>	E	—	NE	H (15)	LDF
	<i>Coniophanes lateritius</i>	E	—	DD	M(13)	MDF
	<i>Hypsiglena torquata</i>	E	Pr	LC	L (8)	MDF
	<i>Imantodes gemmistratus</i>	N	Pr	LC	L (6)	LDF
Dipsadidae	<i>Leptodeira maculata</i>	N	Pr	LC	L (7)	MDF, LDF
	<i>Leptodeira septentrionalis</i>	N	—	LC	L (8)	LDF
	<i>Leptodeira splendida</i>	E	—	LC	H (14)	LDF
	<i>Manolepis putnami</i>	E	—	LC	M(13)	OF
	<i>Rhadinaea hesperia</i>	E	Pr	LC	M(10)	LDF
	<i>Tropidodipsas annulifera</i>	E	Pr	LC	M(13)	LDF
	<i>Tropidodipsas philippil</i>	E	Pr	LC	M(14)	LDF
Elapidae	<i>Micrurus proximans</i>	N	—	LC	—	LDF
Leptotyphlopidae	<i>Rena humilis</i>	N	—	LC	L (8)	OF
Viperidae	<i>Agkistrodon bilineatus</i>	N	Pr	NT	M(11)	LDF, PG
	<i>Crotalus basiliscus</i>	E	Pr	LC	H (16)	OF, MDF, LDF, PG
Cheloniidae	<i>Chelonia mydas</i>	N	P	EN	—	CD
	<i>Eretmochelys imbricata</i>	N	P	CR	—	CD
	<i>Lepidochelys olivacea</i>	N	P	VU	—	CD
Dermochelyidae	<i>Dermochelys coriacea</i>	N	P	VU	—	CD
Emydidae	<i>Trachemys ornata</i>	E	Pr	VU	H (19)	MDF, LDF, M
Geoemydidae	<i>Rhinoclemmys pulcherrima</i>	N	A	NE	L (8)	OF, MDF, LDF
Kinosternidae	<i>Kinosternon integrum</i>	E	Pr	LC	M(11)	MDF, LDF

Table 2. Composition of the herpetofauna reported for each of three Nayarit municipalities. Vegetation communities: LTS = Low Thorny Scrub, LDF = Low Deciduous Forest, MDF = Medium Deciduous Forest, OF = Oak Forest, CF = Cloud Forest, RV = Riparian Vegetation, CD = Coastal Dunes, M = Mangrove, HV = Halophyte Vegetation, PG = Palm Grove.

Municipality	Number of herpetofauna species for each vegetation community										Numbers of species of herpetofauna reported		Source
	LTS	LDF	MDF	OF	CF	RV	CD	M	HV	PG	Amphibians	Reptiles	
Tepic	—	—	—	—	—	—	—	—	—	—	14	19	Lopez-Solis and Luja (2014)
Tecuala	30	25	—	—	—	16	12	9	7	—	17	34	Loc-Barragán and Lazcano (2018)
Compostela	—	46	37	13	9	—	9	6	—	8	21	50	This study