

The Subspecies of Amphibians and Reptiles of the State of Durango, Mexico

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To complement the recently published checklist of amphibians and reptiles of the state of Durango, Mexico (Valdez-Lares et al., 2013), we obtained more detailed information from the literature regarding the infraspecific taxonomic level of subspecies.

The validity, use and misuse of subspecies has been discussed in many fields for decades and the debate on whether or not they should be used continues (Starrett, 1958; Mallet, 2007) without consensus on their appropriateness. The use of subspecies has found greatest support in conservation biology (Mallet, 2007). In this field, subspecies can be seen as more specific targets to canalize efforts and resources for management and conservation purposes (Agapow et al., 2004; Gamauf et al., 2005; Haig et al., 2006).

With recent advances in molecular biology and biosystematics and the development of new methods for delimiting species (Fujita et al., 2012; Carstens et al., 2013), there is a trend to reevaluate the current classification of organisms, using in many cases a phylogenetic approach, to reassess their taxonomic situation. The evaluation can then result in the invalidity of certain subspecies or, in some cases, in their recognition as separate species (Mallet, 2006).

The subspecies role has been deeply discussed in mammal and avian taxonomy (e.g., Zink, 2004; Crifasi, 2007; Gippoliti and Amori, 2007, Hey, 2010; James, 2010; Patten, 2010). Less discussion has been given in herpetology (Frost and Hillis, 1990; Johnson et al., 2010; Hawlitschek et al., 2012), although the apparent trend is to discontinue the use of subspecies in recent publications. However, some major sources of taxonomic information on the Internet, like lists from the Society for the study of Amphibians and Reptiles (SSAR) (Crother, 2012) and the reptile-database list (Uetz and Hosek, 2014), consider and include subspecies. In Mexico, some of the more recent and detailed accounts of the herpetofauna in the country and in some particular regions, take into account subspecies (Lemos-Espinal and Smith, 2007a, 2007b; Liner, 2007).

Despite questions about the validity of subspecies, new subspecies are still being described (McCord et al., 2010; Hawlitschek et al., 2012), and many current subspecies lack

recent or proper studies that assess their taxonomic situation. Therefore, our aim in developing this list without taking part in the discussion on the validity of subspecies is to provide a brief general overview on the current taxonomic situation of subspecies in Durango, and to highlight potential areas for research that may lead to better knowledge of the diversity of amphibians and reptiles in this state. This work is relevant because herpetofauna populations in Durango have had little attention in recent systematic studies and thus there are many questions about the taxonomic situation of many of the subspecies present.

According to the two websites mentioned above, among the 33 amphibian species listed by Valdez-Lares et al. (2013), five (15.15%) have currently recognized subspecies (Table 1), whereas 63 (53.38%) of the 118 reptile species listed have recognized subspecies (Table 2).

Amphibians

Frost's website (Frost, 2014), the most complete account of amphibian species, treats all subspecies as synonyms of their covering species; however, comments and updates about subspecies are covered.

Two species of the genus *Anaxyrus* have subspecific associated taxa (Table 1). Frost (2014) suggests that the subspecies of *A. debilis* are unlikely to be anything other than arbitrarily defined sections of clines and that *A. woodhousii australis* may be a distinct species as evidenced by Masta et al. (2002).

Craugastor augusti cactorum and *C. a. latrans* have been suggested to be two different species (Goldberg et al., 2004), but a formal taxonomic change is pending on the evaluation of populations through central Mexico (Frost, 2014). Two records of this species in central Durango were considered similar to another subspecies, *C. a. augusti*, but not assigned with certainty to any subspecies, suggesting that the recognition of an additional taxon may even be necessary (Zweifel, 1967).

Ambystoma rosaceum may be composed of two allopatric populations (Shaffer, 1983) that Shaffer and McKnight (1996) suggested as distinct species, of which the southern population (Durango/Zacatecas) would be *A. nigrum* and the northern

Table 1. Amphibian species in Durango, Mexico, with valid subspecies.

Family	Subspecies in Durango
Bufonidae	<i>Anaxyrus debilis insidiator</i> (Girard, 1854)
	<i>Anaxyrus woodhousii australis</i> (Shannon and Lowe, 1955)
Craugastoridae	<i>Craugastor augusti cactorum</i> (Taylor, 1939)
Eleutherodactylidae	<i>Eleutherodactylus nitidus petersi</i> (Duellman, 1954)
Ambystomatidae	<i>Ambystoma rosaceum nigrum</i> Shannon, 1951

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(Sonora/Chihuahua) *A. rosaceum* (Frost, 2014). Specimens of *A. rosaceum* unassigned to subspecies, were recorded by Webb and Baker (1984) in the municipality of Tamazula, close to the limit with the state of Chihuahua, where Lemos-Espinal and Smith (2007a) consider all the populations as *A. rosaceum rosaceum*. Therefore, populations from extreme northwest Durango may correspond to *A. r. rosaceum*, but at present there are no other records to corroborate the presence of this taxon.

Reptiles

The current taxonomic situation of the subspecies *Trachemys gaigeae hartwegi*, *Barisia imbricata ciliaris* and *Gerrhonotus liocephalus taylori* are briefly mentioned in Valdez-Lares et al. (2013) and therefore, not repeated here. The subspecies of the genus *Crotalus* present in Durango are summarized in Muñiz-Martínez and Valdez-Lares (2012). Despite the mention of *Crotalus lepidus lepidus* and *C. molossus molossus* in that account, they need confirmation and are thus not presented here.

Within the genus *Phrynosoma*, the species *P. hernandesi* is included instead of *P. douglasii*, following Zamudio et al. (1997). However samples of the taxon *brachycercum*, previously known as *P. douglasii brachycercum*, and whose known distribution falls within Durango's highlands, were not included in that study and its status is pending on new evidence. Crother (2012) points out three scenarios for the taxon *brachycercum*: 1) it constitutes a lineage that is related to, but fully separated from *P. hernandesi*, 2) a partially separated lineage within *P. hernandesi*, or 3) an unseparated (artificial) part of the *P. hernandesi* lineage. Within *P. orbiculare*, the subspecies *durangoensis* is not generally recognized as a valid taxon. However, Bryson (2011) confirmed that some mitochondrial lineages, among them *P. o. durangoensis*, are consistent with the subspecies division made by Horowitz (1955) based on morphological characters, as a separate lineage from *P. o. bradti* from Chihuahua.

One of the groups with taxonomic and systematic issues that need addressing is the *Sceloporus grammicus* complex (Crother, 2012). Populations in Durango are often referred to as *S. g. disparilis*, and therefore we include this one in the list. The identity of some populations in Durango of *S. poinsettii* also needs to be addressed. The two subspecies certain to occur in Durango are *S. p. amydrus* in the southeast, and *S. p. macrolepis* in the western portion (Webb, 2008). In the rest of the state, populations are considered as intermediate variants sharing morphological characteristics between these two subspecies, but also with *S. p. poinsettii* and *S. p. polylepis* (Webb, 2006). These last two subspecies are present in the neighboring states of Chihuahua and Coahuila (Lemos-Espinal and Smith, 2007a, 2007b).

Some other individuals with intermediate characteristics between subspecies have been reported from Durango. The only record of *Geophis dugesii* in the state was considered to be an intergrade between subspecies *G. d. dugesii* and *G. d. aquilonaris* (Webb, 1977). For the species *Diadophis punctatus*, scattered records exist referring to subspecies *D. p. dugesii* (Gadsden et al., 2006), *D. p. regalis* or intergrades between the two subspecies (Gehlbach, 1965). In both cases (*G. dugesii* and *D. punctatus*), considering the known distribution of their respective subspecies, it is probable that all subspecies mentioned

are present in Durango, but further information is required.

Some subspecies, like *Uta stansburiana stejnegeri* and *Boa constrictor imperator* have been suggested to merit species status (Hynková et al., 2009; Upton and Murphy, 1997). However, at the moment are still considered subspecies awaiting further studies to support the modifications. *Thamnophis rufipunctatus unilabialis*, recently studied by Wood et al. (2011), is not considered a valid subspecies and is placed in synonymy with *T. rufipunctatus* in Crother (2012) and Uetz and Hosek (2014).

In some of the recent records for the state, subspecies have been omitted as a format requisite. This is the case of *Drymarchon melanurus rubidus* (Muñiz-Martínez and Valdez-Lares, 2011), *Leptodeira splendida eppiphata* and *Leptophis diplotropis diplotropis* (Valdez-Lares and Muñiz-Martínez, 2011a, 2011b), identified to subspecific level by the authors. Also the record of *Heloderma horridum* in northwest Durango (Ahumada-Carrillo et al., 2011) was determined as the subspecies *exasperatum* (Ivan Ahumada-Carrillo, pers. comm.).

Other subspecies previously known to occur in Durango such as *Nerodia erythogaster bogerti* and *Rhinocheilus lecontei tessellatus*, have been reevaluated and found as invalid taxa and synonymized within the species (Makowsky et al., 2010; Manier, 2004). Also, the subspecies *Lampropeltis getula splendida* has been revalidated to species status as *L. splendida* (Pyron and Burbrink, 2009), as should be listed in Valdez-Lares et al. (2013). For the rest of the subspecies of reptiles in the state, there is no recent information on the matter. The following corrections to our species checklist (Valdez-Lares et al., 2013) are made to match the valid species names in the reptile database (Uetz and Hosek, 2014): *Holbrookia maculata* instead of *H. approximans*, *Thamnophis valida* instead of *T. validus*, *Thamnophis elegans* instead of *T. errans*, *Sceloporus undulatus* instead of *S. edbelli*, *Rena humilis* instead of *Leptotyphlops humilis*, and *Anolis nebulosus* instead of *Norops nebulosus*.

The taxonomic rank of subspecies remains highly contentious, largely because traditional subspecies boundaries have sometimes been contradicted by molecular phylogenetic data. However, the broader picture is that subspecies of amphibians and reptiles often provide an effective shortcut for estimating patterns of intraspecific genetic diversity, thereby providing a useful tool for the study of evolutionary divergence and conservation. Subspecies may be of considerable conservation utility, as proxies for the substructure found within species, especially where molecular data are absent or the species lack recent evaluation.

As we stated above, our purpose is to provide a broad overview of the subspecies reported to be present in the state. Durango, by its physiographic and climatic characteristics, is an area where many subspecies converge and can be a key zone for future research on the systematics of some species of herpetofauna.

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Table 2. Reptile species in Durango, Mexico, with valid subspecies.

Family	Subspecies in Durango
Emydidae	<i>Trachemys gaigeae hartwegi</i> (Legler, 1990)
Kinosternidae	<i>Kinosternon hirtipes murrayi</i> Glass and Hartweg, 1951
Anguidae	<i>Barisia imbricata ciliaris</i> (Smith, 1942) <i>Elgaria kingii ferruginea</i> Webb, 1962 <i>Gerrhonotus liocephalus taylori</i> Tihen, 1954
Crotaphytidae	<i>Crotaphytus collaris melanomaculatus</i> Axtell and Webb, 1995 <i>Gambelia wislizenii wislizenii</i> Baird and Girard, 1852
Gekkonidae	<i>Phyllodactylus tuberculatus saxatilis</i> Dixon, 1964
Helodermatidae	<i>Heloderma horridum exasperatum</i> Bogert and Martín del Campo, 1956 <i>Heloderma horridum horridum</i> (Wiegmann, 1829)
Phrynosomatidae	<i>Cophosaurus texanus scitulus</i> (Peters, 1951) <i>Holbrookia maculata approximans</i> Baird, 1858 <i>Phrynosoma hernandesi brachycercum</i> Smith, 1942 <i>Phrynosoma orbiculare bradti</i> Horowitz, 1955 <i>Sceloporus clarkii boulengeri</i> Stejneger, 1893 <i>Sceloporus grammicus disparilis</i> Stejneger, 1916 <i>Sceloporus horridus oligoporus</i> Cope, 1864 <i>Sceloporus merriami ballingeri</i> Lemos-Espinal, Smith, Auth and Chiszar, 2001 <i>Sceloporus nelsoni nelsoni</i> Cochran, 1923 <i>Sceloporus poinsettii amydrus</i> Webb, 2006 <i>Sceloporus poinsettii macrolepis</i> Smith and Chrapliwy, 1958 <i>Sceloporus scalaris brownorum</i> Smith, Watkins-Colwell, Lemos-Espinal and Chiszar, 1997 <i>Sceloporus scalaris unicanthalis</i> Smith, 1937 <i>Sceloporus spinosus spinosus</i> Wiegmann, 1828 <i>Sceloporus torquatus melanogaster</i> Cope, 1885 <i>Sceloporus undulatus edbelli</i> Smith, Chiszar and Lemos-Espinal, 1995 <i>Urosaurus bicarinatus tuberculatus</i> (Schmidt, 1921) <i>Urosaurus ornatus caeruleus</i> (Smith, 1935) <i>Uta stansburiana stejnegeri</i> Schmidt, 1921
Scincidae	<i>Plestiodon lynxe bellii</i> (Gray, 1845)
Teiidae	<i>Aspidoscelis costata huico</i> (Zweifel, 1959) <i>Aspidoscelis gularis semiannulatus</i> (Walker, 1967) <i>Aspidoscelis inornata chihuahuae</i> (Wright and Lowe, 1993) <i>Aspidoscelis inornata heptagramma</i> (Axtell, 1961) <i>Aspidoscelis inornata paulula</i> (Williams, 1968) <i>Aspidoscelis marmorata marmorata</i> (Baird and Girard, 1852) <i>Aspidoscelis marmorata pulcher</i> (Williams, Smith and Chrapliwy, 1960)
Boidae	<i>Boa constrictor imperator</i> Daudin, 1803
Colubridae	<i>Arizona elegans expolita</i> Klauber, 1946 <i>Bogertophis subocularis amplinotus</i> Webb, 1990

Table 2 (cont'd).

Family	Subspecies in Durango
Colubridae	<p><i>Coluber flagellum lineatulus</i> (Smith, 1941)</p> <p><i>Coluber mentovarius striolatus</i> (Mertens, 1934)</p> <p><i>Coluber taeniatus girardi</i> Stejneger and Barbour, 1917</p> <p><i>Conopsis nasus nasus</i> Günther, 1858</p> <p><i>Diadophis punctatus dugesii</i> Villada, 1875</p> <p><i>Drymarchon melanurus rubidus</i> Smith, 1941</p> <p><i>Geophis dugesii dugesii</i> Bocourt, 1883</p> <p><i>Hypsiglena jani texana</i> Stejneger, 1893</p> <p><i>Hypsiglena torquata torquata</i> (Günther, 1860)</p> <p><i>Lampropeltis mexicana greeri</i> Webb, 1961</p> <p><i>Leptodeira splendida ephippiata</i> Smith and Tanner, 1944</p> <p><i>Leptophis diplotropis diplotropis</i> (Günther, 1872)</p> <p><i>Pituophis catenifer affinis</i> (Hallowell, 1852)</p> <p><i>Pituophis deppei deppei</i> (Duméril, 1853)</p> <p><i>Salvadora grahamiae lineata</i> Schmidt, 1940</p> <p><i>Senticolis triaspis intermedia</i> (Boettger, 1883)</p> <p><i>Sonora semiannulata semiannulata</i> Baird and Girard, 1853</p> <p><i>Thamnophis cyrtopsis collaris</i> (Jan, 1863)</p> <p><i>Thamnophis cyrtopsis cyrtopsis</i> (Kennicott, 1860)</p> <p><i>Thamnophis eques megalops</i> (Kennicott, 1860)</p> <p><i>Thamnophis eques virgatenuis</i> Conant, 1963</p> <p><i>Thamnophis elegans errans</i> Smith, 1942</p> <p><i>Thamnophis marcianus marcianus</i> (Baird and Girard, 1853)</p> <p><i>Thamnophis melanogaster canescens</i> Smith, 1942</p> <p><i>Thamnophis melanogaster chihuahuensis</i> Tanner, 1959</p> <p><i>Trimorphodon tau tau</i> Cope, 1870</p>
Leptotyphlopidae	<p><i>Rena humilis segregus</i> Klauber, 1939</p>
Viperidae	<p><i>Crotalus lepidus klauberi</i> Gloyd, 1936</p> <p><i>Crotalus lepidus maculosus</i> Tanner, Dixon and Harris, 1972</p> <p><i>Crotalus molossus nigrescens</i> Gloyd, 1936</p> <p><i>Crotalus pricei pricei</i> Van Denburgh, 1895</p> <p><i>Crotalus scutulatus scutulatus</i> (Kennicott, 1861)</p> <p><i>Crotalus willardi meridionalis</i> Klauber, 1949</p>

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