

Notes on Mexican Herpetofauna 15: The Risk of Invasive Species in Northeastern Mexico

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Resumen

Las poblaciones de anfibios y reptiles en numerosos ecosistemas Mexicanos están actualmente en un estado alto de deterioro. Hay varias razones para explicar esta disminución dramática. Pero una que ha recibido poca atención por parte de los científicos nacionales y esta pobremente documentada es la introducción de especies exóticas (particularmente aquellas que toleran los cambios constantes). Muchas de ellas son explotadas con fines comerciales (comida, ornamentación, investigación ect). En años recientes se ha incrementado el comercio de mascotas en México, fuera de la capital, expandiéndose a todas las ciudades grandes del país. Cualquier especie vendida como mascota es una fuerte candidata en convertirse en una especie invasiva potencial en áreas que son ecológicamente similares. En la actualidad no existe un estudio extensivo sobre anfibios y reptiles invasivos en México, con excepción del estudio con *Lithobates catesbeianus* (American bullfrog) introducido para su explotación alimentaria. Este anfibio escapo de sus instalaciones de crianza y se establecían en forma silvestre, ahora compitiendo con otros anfibios por recursos. CONABIO (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad, 2009) menciona en una de sus publicaciones (Capital Natural de México) la escasa información existente sobre especies exóticas en México, donde se evidencia un gran vacío de información en este mercado que se ha venido expandiendo en años recientes y su posible efecto sobre las especies nativas. Es importante incrementar la documentación sobre la venta de mascotas y sus posibles consecuencias sobre las especies nativas, si estas fueran liberadas en el medio natural.

Currently, populations of amphibians and reptiles are greatly deteriorating in numerous Mexican ecosystems. There are several reasons for this. However, one reason that has received little attention by national scientists and is poorly documented is the introduction of exotic species (particularly those that tolerate changing conditions). Many such exotics are exploited for commercial purposes (food, ornament, research, etc.) and they are strong candidates to become invasive species. This potential has been recognized as one of the biggest threats to species diversity (Kenward and Holm, 1993; Mooney and Cleland, 2001; Stohlgren and Schnase, 2006; Wilcove et al., 1998).

A related problem is that species commensal with humans, such as dogs, cats, rats and mice, can be important predators of invertebrates, amphibians, reptiles, mammals, small birds and their eggs (Jaksic, 1998; Mellink, 1992). It is inevitable that suburban ecosystems or human-dominated environments experience a reduction or even disappearance of herpetofauna in the presence of domestic cats, both house pets and those that have gone feral. These felids are extremely effective predators, especially on lizards, so when they are present in a rural area, eventually there will be a loss of herpetological diversity.

Exotic vertebrates can have a major impact on natural or semi-natural ecosystems through competition for resources and through the introduction of diseases and parasites. In exceptional conditions exotic species can bear zoonoses transmissible

to humans (Domínguez-Torres and Mellink, 2003; Jaksic, 1998; Johnson and Klemens, 2005).

A very well documented example of the impact caused by an invasive reptile species is the case of the brown treesnake, *Boiga irregularis*, which was introduced into the Pacific Island of Guam, negatively affecting native species by reducing the density of bats and causing the extinction of many species of lizards and birds (Rodda and Fritts, 1992; Rodda and Savidge, 2007; Rodda and Tyrrell, 2008; Rodda et al., 1997; Rodda, McCoid et al., 1999; Rodda, Sawai et al., 1999) and its presence has damaged human infrastructure (Pimentel, 2002, 2005).

In recent years there has been an increase in the trade of reptiles as pets in Mexico. Almost any exotic species sold as a pet is a strong candidate to become an invasive species in areas that are the ecological equivalent of their homeland. Many of the animals imported into Mexico for the pet trade have their origin in Florida (Meshaka, 2004; Meshaka et al., 2004; Powell and Henderson, 2008), where some are already established as invasive species and appear to be actively expanding their ranges.

Some species now commonly sold as pets in Mexico include: tokay geckos, *Gekko gecko*; leopard geckos *Eublepharis macularius*; Afro-American house geckos, *Hemidactylus mabouia*; common house geckos, *H. frenatus*; monitor lizards like savannah monitors, *Varanus exanthematicus*, and Nile monitors, *V.*

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niloticus; pythons like Children's python, *Antaresia childreni*, Indian pythons, *Python molurus*, and reticulated pythons, *P. reticulatus*; land tortoises like Indian star tortoises, *Geochelone elegans* and Mediterranean spur-thighed tortoises, *Testudo graeca*; and red-eared sliders, *Trachemys scripta*. Many of the above have proven to be aggressive invasive species in other countries and are now also commercialized in Mexico's larger cities (a list of the most popular amphibian and reptile pets sold in the Monterrey metropolitan area is included).

Due to the great diversity of habitats in Mexico, there is an extremely high risk for many of these species to become invasive and establish themselves in particularly sensitive areas. Unfortunately there has been little documentation on any taxa that might have escaped into the wild, except for a few examples mentioned below.

The only extensive study to date on amphibians or reptiles as invasive species in Mexico has been on the American bullfrog, *Lithobates catesbeianus*, introduced for food exploitation. This amphibian escaped from cultivation installations and spread to establish in the wild, where it now competes with other amphibians for available resources. It even preys on gartersnakes and watersnakes, which are natural predators of amphibians and other vertebrates (Casas-Andreu and Aguilar-Miguel 1997a, b; Casas-Andreu et al., 2001). The bullfrog's impact on wild populations has previously been documented by others (e.g., Rosen and Schwalbe, 1995).

The common house gecko, *Hemidactylus frenatus*, was introduced accidentally and has colonized urban areas (Schmidt et al., 1996). The Afro-American house gecko, *H. mabouia*, was presumably introduced by the same route. These lizards compete with the Mediterranean gecko, *H. turcicus*, which was introduced into Mexico long ago, and has shown a great capacity for dispersion in tropical and subtropical areas, including the cities. It is now common, for instance, to hear the nighttime vocalizations of this species in the Monterrey metropolitan area. Local residents are aware of them and seem to tolerate them, but as yet their impact on the local biota is undocumented.

Some introduced reptile species have been expanding their range in Mexico without attracting much attention. Such is the case for the Asian parthenogenic blind snake, *Ramphotyphlops braminus*. This exotic species has an extensive distribution because of its accidental dispersion along with ornamental plants coming from Asia to the United States and then to Mexico. Mostly this snake remains unnoticed; we don't know the impact it has had on the country's biota. Its presence in Mexico was formally reported by Guzmán and Muñoz-Martínez (1999).

Another specific example of an invasive species in Mexico was documented by Martínez-Morales and Cuarón (1999) where they mention the decline of several endemic bird and mammal populations endemic to the island of Cozumel, due to the introduction of the common boa, *Boa constrictor*. This species is an inhabitant of Mexican mainland, which is only 50 km away.

The common cornsnake, *Pantherophis guttata*, which does not inhabit Mexico, is widely sold in pet shops. Released specimens could hybridize with the native ratsnake, *P. emoryi*, impacting genetic stability.

On the other hand, the expansion of commercialization has been slowing down due to prices of pets in Mexico (legal or illegal). In many cases the prices are double or triple the prices for the same pets sold in the United States.

In summary, given the limited information about introduced species in Mexico, their ecological, economic and social consequences are unknown. The current role of biologists in this regard is limited to inventories, identification of new species, analysis of ecosystems and in a very small measure the biology of native species. It is necessary to continue working intensively in these areas, but also to implement early detection, preventive measures, and methods for elimination of potential invasive species.

A problem sometimes faced by researchers who identify an exotic or invasive species, lies in the application of federal law Norma Oficial Mexicana NOM-059-ECOL-2001, that established certain status categories for Mexican species, such as threatened or endangered (Anonymous, 2001). Some species categorized as endangered or protected in one region of Mexico may well be exotic and potentially invasive in another part of the country. Due to this law researchers may be unable to perform effective control or elimination of any such invasive species, which can cause irreversible damage to local communities. On the other hand, there are some particular examples, as in the case of the common boa in Cozumel Island, where the interpretation of the law is still problematic.

CONABIO (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad) mentions the scarcity of information on exotic species in Mexico in one of its publications (CONABIO, 2009). This only emphasizes the great void of information on the expansion of the animal trade in recent years and its possible effect on native species. It is essential to document all introduced species, adding to CONABIO data bases (<http://www.conabio.gob.mx/invasoras>) to address the problem and thus ensure that our native endemic species are not affected.

Finally, it is important to clarify that we are not against responsible dealers of exotic amphibians and reptiles (Rodda and Tyrrell, 2008) in Mexico, but for those dealers and buyers that perform illegal practices that could harm Mexican herpetofauna. There has to be stronger law enforcement.

We are aware that enthusiastic amateur herpetologists around the world have contributed to our understanding of the biology of hundreds of species, we understand that it is human nature, being close to nature, even though it's a tiny piece in your home, many of us begin our interest in amphibians and reptiles this way, but we should also be aware that there will come a day when importation of wildlife from developing countries will come to a halt and we will only be able to satisfy our desire to have these extraordinary creatures in our homes or research facilities through the efforts of talented breeders.

There are perhaps tons of documented articles and books on extreme exploitation of our natural resources all over the world, but if we are to enjoy nature as such; we need to implement strong policies of protection of our last wild ecosystems in every corner of the planet, for future generations stop habitat alteration that will continue fragmenting healthy ecosystems, look a

climate change its here to stay without forgetting the impact that invasive species (plants and animals) have caused around the world.

Mega extinction is galloping faster than we thought, and further loss of biological diversity in the world seems inevitable.

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Exotic amphibian and reptile species commonly sold in local pet shops in the metropolitan area of Monterrey, Mexico.

Scientific name	Common name in English	Common name in Spanish
<i>Agalychnis callidryas</i>	Red-eyed treefrog	Rana de ojos rojos
<i>Alligator mississippiensis</i>	American alligator	Caimán
<i>Antaresia childreni</i>	Children's python	Pitón niño
<i>Antaresia maculosa</i>	Spotted python	Pitón manchado Australiano
<i>Apalone ferox</i>	Florida softshell	Tortuga de concha blanda de Florida
<i>Basiliscus vittatus</i>	Striped basilisk	Lagartija Cristo
<i>Boa constrictor</i>	Boa constrictor	Boa constrictora
<i>Ceratophrys ornata</i>	Ornate horned frog	Rana Pacman
<i>Chamaeleo calyptratus</i>	Veiled chameleon	Camaleón de velo
<i>Chamaeleo jacksonii</i>	Jackson's chameleon	Camaleón Jackson
<i>Chamaeleo senegalensis</i>	Senegal chameleon	Camaleón de Senegal
<i>Chelydra serpentina</i>	Snapping turtle	Tortuga mordedora
<i>Chlamydosaurus kingii</i>	Frilled dragon, frilled lizard	Clamidosauro
<i>Corallus caninus</i>	Emerald tree boa	Boa esmeralda
<i>Crocodylus moreletii</i>	Morelet's crocodile	Cocodrilo de pantano
<i>Epicrates cenchria</i>	Rainbow boa	Boa arcoiris
<i>Eryx colubrinus</i>	Kenyan sand boa	Boa de arena Keniana
<i>Eublepharis macularius</i>	Leopard gecko	Gecko leopardo
<i>Eunectes murinus</i>	Green anaconda	Anaconda verde
<i>Eunectes notaeus</i>	Yellow anaconda	Anaconda amarilla
<i>Furcifer pardalis</i>	Panther chameleon	Camaleón pantera
<i>Gekko gekko</i>	Tokay gecko	Gecko tokay
<i>Geochelone carbonaria</i>	Red-footed tortoise	Tortuga de patas
<i>Geochelone denticulata</i>	Yellow-footed tortoise	Tortuga de patas
<i>Geochelone elegans</i>	Indian star tortoise	Tortuga estrella de la India
<i>Geochelone sulcata</i>	African spurred tortoise	Tortuga leopardo
<i>Hemidactylus frenatus</i>	Common house gecko	Gecko casero común
<i>Hemidactylus mabouia</i>	Afro-American house gecko	Gecko casero tropical
<i>Hemitheconyx caudicinctus</i>	Fat-tailed gecko	Gecko de cola gorda
<i>Iguana iguana</i>	Green iguana	Iguana verde
<i>Lampropeltis getula</i>	Common kingsnake	Serpiente rey
<i>Lampropeltis pyromelana</i>	Sonoran mountain kingsnake	Falsa coralillo
<i>Lampropeltis triangulum</i>	Milksnake	Falsa coralillo
<i>Lamprophis fuliginosus</i>	Olive house snake	Serpiente de casa Africana
<i>Lichanura trivirgata</i>	Rosy boa	Boa de arena Mexicana
<i>Morelia spilota</i>	Carpet and diamond pythons	Pitón carpeta
<i>Morelia viridis</i>	Green tree python	Pitón verde arbóreo
<i>Paleosuchus palpebrosus</i>	Cuvier's dwarf caiman, Cuvier's smooth-fronted caiman	Caimán enano
<i>Pantherophis emoryi</i>	Great Plains rat snake	Serpiente ratonera o maicera
<i>Pantherophis guttata</i>	Corn snake	Serpiente ratonera Texana o maicera
<i>Physignathus cocincinus</i>	Chinese water dragon	Dragón de agua
<i>Pogona vitticeps</i>	Central bearded dragon, inland bearded dragon	Dragón barbado
<i>Ptychozoon kuhli</i>	Flying gecko	Gecko volador
<i>Python curtus</i>	Blood python, short-tailed python	Pitón Sangre
<i>Python molurus bivittatus</i>	Burmese python	Pitón Burmese
<i>Python regius</i>	Ball python, royal python	Pitón bola

Scientific name	Common name in English	Common name in Spanish
<i>Python reticulatus</i>	Reticulated python	Pitón reticulado
<i>Python sebae</i>	African rock python	Pitón de las rocas
<i>Rhacodactylus ciliatus</i>	Crested gecko.	Gecko crestado
<i>Testudo graeca</i>	Mediterranean spur-thighed tortoise	Tortuga Griega
<i>Tiliqua scincoides</i>	Eastern blue-tongued skink	Skink de lengua azul
<i>Trachemys scripta elegans</i>	Red-eared slider	Tortuga de orejas rojas
<i>Tupinambis merianae</i>	Argentine black and white tegu	Tegu gigante Argentino
<i>Uroplatus fimbriatus</i>	Madagascan leaf-tailed gecko	Gecko cola de hoja
<i>Varanus acanthurus</i>	Ridge-tailed monitor, spiny-tailed monitor	Varano de cola espinosa
<i>Varanus albigularis</i>	White-throated monitor	Varano de garganta negra
<i>Varanus exanthematicus</i>	Savannah monitor	Varano de la sabana
<i>Varanus mertensi</i>	Mertens's water monitor	Varano arbóreo
<i>Varanus niloticus</i>	Nile monitor	Varano Africano
<i>Varanus ornatus</i>	Ornate monitor	Varano ornamentado
<i>Varanus panoptes</i>	Yellow-spotted monitor	Varano de argus
<i>Varanus salvator</i>	Water monitor	Varano de agua
<i>Varanus timorensis</i>	Timor monitor	Varano de Timor

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