



Geophis bellus Myers, 2003. Until recently, this small leaf litter snake was known only from the holotype, found in the new province of Panamá. Endemic to Panamá's cloud forests, this species is distinguished by its dark dorsal and ventral coloration and the presence of a white nuchal collar. *Geophis bellus* is considered one of the most threatened species in Panamá, because so few individuals have been found. Fortunately, most recently discovered populations are located within protected areas. Along with many other species of snakes, *G. bellus* is threatened by habitat destruction. Political borders are not boundaries to snakes, but may influence the protection of natural areas that are important habitat for snakes and other organisms. Pictured here is an individual from El Copé, province of Coclé, Panamá.

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Updated checklists of snakes for the provinces of Panamá and Panamá Oeste, Republic of Panama

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ABSTRACT: Political borders usually do not correspond with natural habitats, and thus organisms pass freely across them to utilize their appropriate environment. The redistribution or formation of new political borders, however, can impact the management of protected natural areas and the species that occur there. In 2014 a new province was formed in the Republic of Panama, Panamá Oeste, taken from the western portion of the old province of Panamá. Here we present checklists of snakes for Panama's two newly designated provinces, Panamá Oeste and Panamá.

Keywords: Conservation status, distribution, political borders, reserves

RESUMEN: Las fronteras políticas generalmente no se corresponden con los hábitats naturales, y por lo tanto organismos pasan libremente a través de ellas para utilizar su propio medio ambiente. La redistribución o la formación de nuevas fronteras políticas, sin embargo, pueden afectar a la gestión de las áreas naturales protegidas y las especies que allí se realizan. En el año 2014 una nueva provincia se formó en Panamá, Panamá Oeste, en la parte oeste de la antigua provincia de Panamá. Aquí les presentamos listas de serpientes para las nuevas provincias de Panamá Oeste y Panamá.

Palabras Claves: Distribución, estatus de conservación, fronteras políticas, reservas

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INTRODUCTION

Over the past 30 years, substantial reorganization has occurred in the intra-country political borders of the Republic of Panama. Such transitions began with the formation of the independent *comarcas*, administrative regions similar to reserves but with a higher governing power for areas with a substantial indigenous population, first with the split of Emberá from the province of Darién in 1983, and then with the formation of Ngäbe-Buglé from parts of the provinces of Chiriquí, Bocas del Toro, and Veraguas in 1997. Recently, a new province was formed; as of 1 January 2014, the province of Panamá (hereafter “former Panamá”) was divided into the provinces of Panamá (hereafter “current Panamá”) and Panamá Oeste (Fig. 1), as designated by law number 119, dated 30 December 2013. The division between the provinces was made along the Panama Canal.

With the formation of new political borders, biological data must be reevaluated to comply with the distribution of species, especially those that are rare, endemic, or in danger of extinction. With just two protected areas now located in the new province of Panamá Oeste (Fig. 2), it is essential to understand the geographic distribution of species so revised management programs can be developed and properly utilized. Here we present taxonomic checklists of snakes for the newly designated provinces, Panamá Oeste and Panamá.

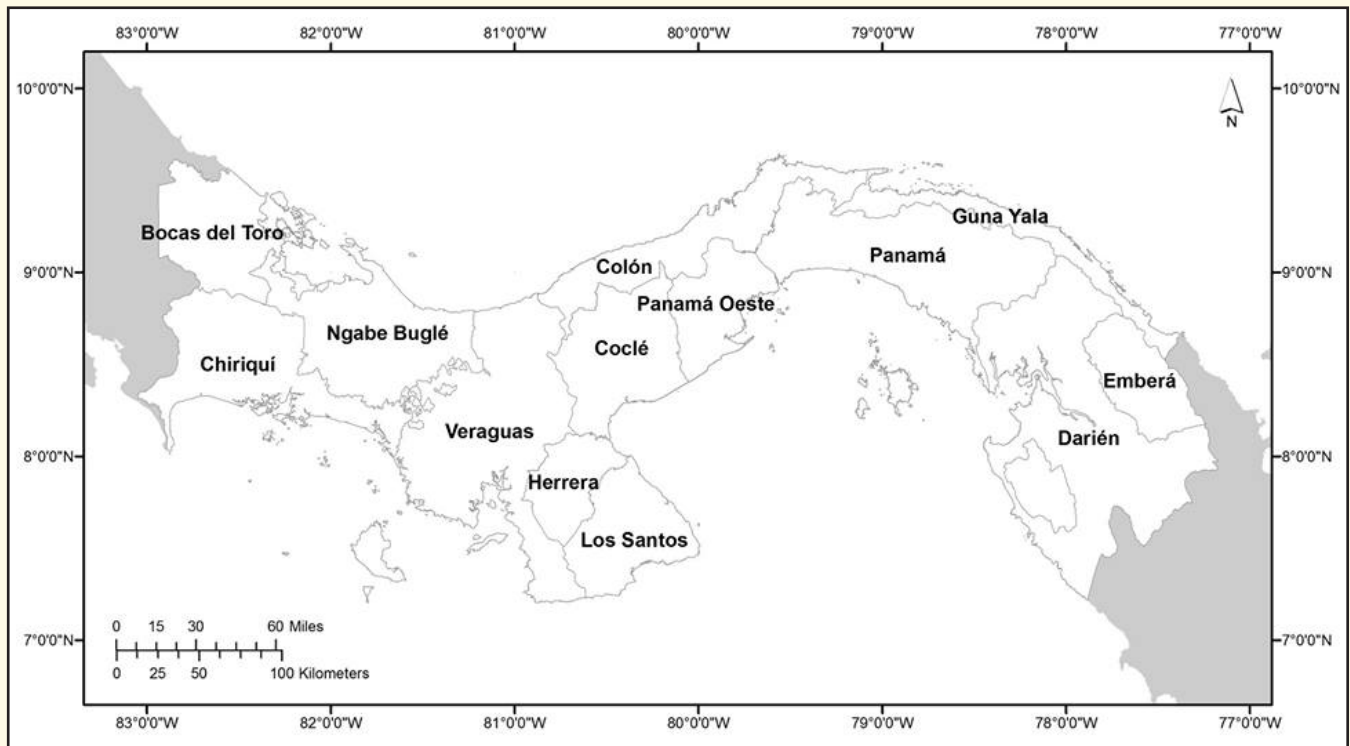


Fig. 1. Map of Panama with updated political borders for the provinces of Bocas del Toro, Chiriquí, Veraguas, Herrera, Los Santos, Coclé, Colón, Panamá Oeste, Panamá, and Darién, and the *comarcas* of Ngäbe Buglé, Guna Yala, and Emberá.

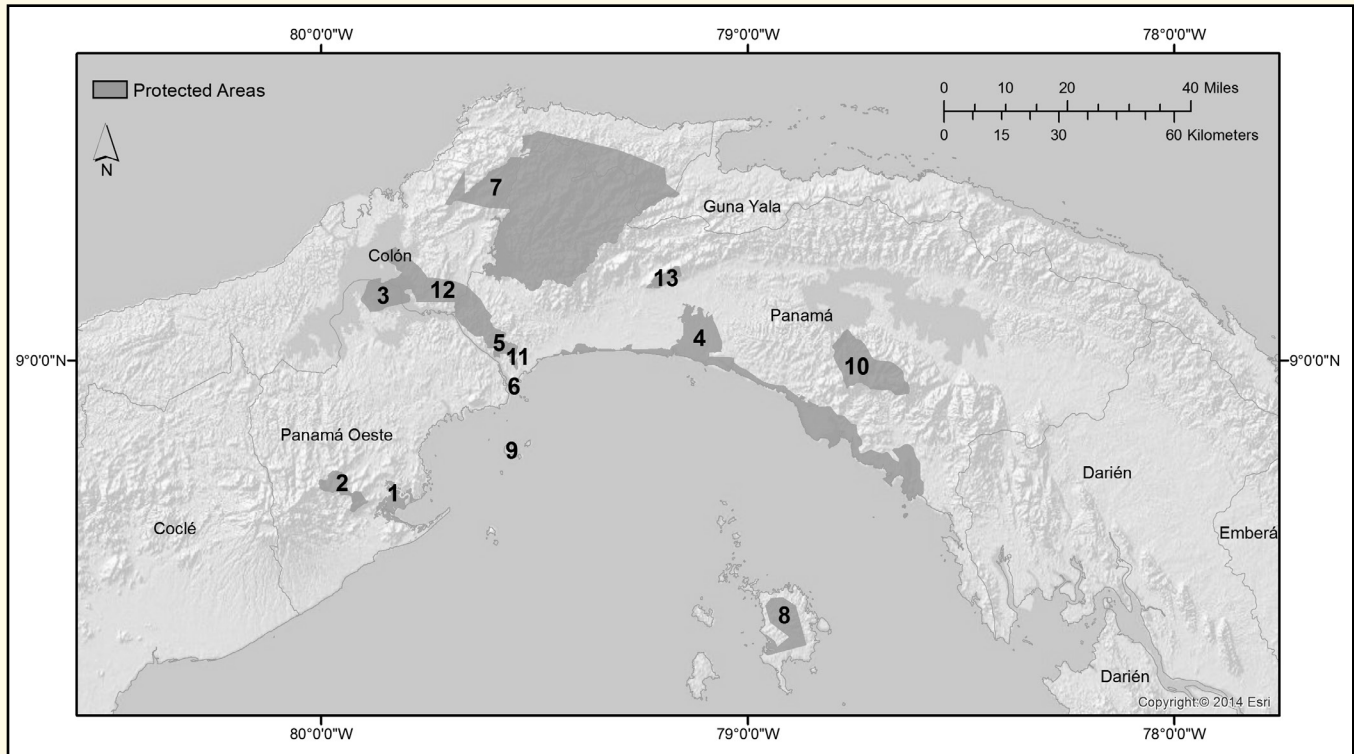


Fig. 2. Map showing the provinces of Panamá Oeste and Panamá, with protected areas shaded and numbered. Province of Panamá Oeste = (1) Área de Uso Múltiple Manglares de Sajalices, Bejuco, Líbano y Punta Chame, (2) Parque Nacional Altos de Campana, and (3) Monumento Natural Isla Barro Colorado. Province of Panamá = (4) Refugio de Vida Silvestre Bahía de Panamá, (5) Parque Nacional Camino de Cruces, (6) Reserva Natural Cerro Ancón, (7) Parque Nacional Chagres, (8) Reserva Hidrológica Isla del Rey, (9) Refugio de Vida Silvestre Islas Taboga y Urabá, (10) Reserva Hidrológica Maje, (11) Área Natural/Parque Natural Metropolitano, (12) Parque Nacional Soberanía, and (13) Zona de Protección Hidrológica Tapagra.

MATERIALS AND METHODS

Study Area

The former province of Panamá included all of the land that currently comprises the provinces of Panamá and Panamá Oeste; it consisted of an area of 9,633 km², and according to the 2010 census contained a human population of 1,385,052. Eight protected natural areas were located within the boundaries of the former province (Young et al., 1999).

The current province of Panamá maintains the former provincial and country capital, Panamá, a city of 880,691 people. The total area of the province is 9,166 km², and the estimated population is 1,249,032, based on the 2010 census. Most of the former province's natural areas are maintained within the new borders, including Parque Nacional Camino de Cruces (46.6 km²), Parque Nacional Chagres (shared with the province of Colón, 195.4 km²), Parque Nacional Soberanía (shared with the province of Colón, 195.4 km²), Área Natural/Parque Natural Metropolitano (2.5 km²), Refugio de Vida Silvestre Islas Taboga y Urabá (3.6 km²), Zona de Protección Hidrológica Tapagra (24.4 km²), Reserva Hidrológica Isla Maje (172.5 km²), and Reserva Natural Centro Ancón (0.4 km²) (Young et al., 1999; Jaramillo et al., 2010; Fig. 2).

Panamá Oeste is comprised of an area of 2,786 km², and contains an estimated population of 464,038, according to the 2010 census. The capital is La Chorrera, a town of 161,470 people. Panamá Oeste contains two terrestrial natural areas and one protected area of mangroves: Parque Nacional Altos de Campana (49.2 km²), Monumento Natural Isla Barro Colorado (81.9 km²), and Área de Uso Múltiple Manglares de Sajalices, Bejuco, Líbano y Punta Chame (28.3 km²) (Fig 2).

Compilation of Data

We compiled the data on the distribution of snakes from personal data collected by JMR, including new records (J. Ray, unpublished) for the western portion of the former province of Panamá, which now is Panamá Oeste, literature references, and museum records (VertNet, 2015). For taxonomic purposes, we followed the Taxonomic List available on the *Mesoamerican Herpetology* website (www.mesoamericanherpetology.com; accessed 15 May 2015). We followed Sabaj Pérez (2014) for the museum abbreviations and constructed the maps using ArcMap 10.1 (ESRI, 2012).

Conservation Status

We examined the conservation status of snakes in the current province of Panamá, and in Panamá Oeste, using two systems: the IUCN Red List (www.iucn.org) and the Environmental Vulnerability Score (EVS). The IUCN conservation status categories are as follows: Critically Endangered (CR), Endangered (EN), Vulnerable (VU), Near Threatened (NT), Least Concern (LC), and Data Deficient (DD). The EVS is a system developed by Wilson and McCranie (1992) to assess the conservation status of amphibians in Honduras, which later was applied to the remainder of the Honduran herpetofauna. The EVS, which does not consider marine or nonnative species, subsequently was used for different countries in several chapters in Wilson et al. (2010), and Wilson et al. (2013a, b) modified the system for its use in Mexico. More recently, Johnson et al. (*In Press*) used this measure for the Central American herpetofauna. The scores in this system range from 3 to 20, as follows: 3–9 = low vulnerability; 10–13 = medium vulnerability; and 14–20 = high vulnerability.

RESULTS

The former province of Panamá contained a rich snake fauna of 106 documented species, classified in 55 genera and nine families (Table 1). Of these, 11 species are endemic to the country, with some represented by one or a few specimens. An abundance of records was collected in the former Panama Canal Zone (Ibáñez et al., 1995; VertNet, 2015). Additionally, herpetological surveys of the former province of Panamá have been conducted in Parque Nacional Chagres (Ibáñez et al., “1994” 1995), and herpetofaunal checklists are available for Parque Nacional Altos de Campana (Ibáñez et al., 1996), Monumento Natural Isla Barro Colorado (Myers and Rand, 1969; Rand and Myers, 1990), some areas around the town of El Valle de Antón (Dunn, 1933), and Altos de María (Ray, 2009); all of these areas now are in Panamá Oeste.

The snake fauna of the current province of Panamá consists of eight families, 53 genera, and 84 species (Table 1). Eight of the species, all colubrids, are endemic to the country. The snake fauna of Panamá Oeste consists of seven families, 50 genera, and 73 species (Table 1).

Table 1. Snakes of the newly defined provinces of Panamá Oeste and Panamá, in the Republic of Panama. * = species endemic to the country. The IUCN status (A) is from www.iucnredlist.org, and (B) from Jaramillo et al. (2010). The EVS (A) is from Johnson et al. (*In Press*), with the vulnerability scores as follows: 3–9 = low, 10–13 = medium, and 14–20 = high; and the EVS (B) is from Jaramillo et al. (2010), with the vulnerability scores as follows: 3–8 = low, 9–11 = medium, and 12–17 = high.

Family	Species	IUCN		EVS		Distribution	
		A	B	A	B	Panamá Oeste	Panamá
Anomalepididae	<i>Anomalepis mexicanus</i>	DD	DD	11	7	X	
	<i>Helminthophis frontalis</i>	DD	DD	12	10		X
	<i>Liotyphlops albirostris</i>	NA	LC	9	5	X	X
Leptotyphlopidae	<i>Epictia goudotii</i>	NA	LC	5	7		X
	<i>Trilepida macrolepis</i>	NA	DD	12	6		X
Boidae	<i>Boa imperator</i>	NA	VU	8	8		
	<i>Corallus annulatus</i>	NA	DD	11	7		

	<i>Corallus ruschenbergerii</i>	NA	DD	13	7		
	<i>Epicrates maurus</i>	NA	LC	8	6		
Charinidae	<i>Ungaliophis panamensis</i>	NA	DD	12	8	X	
Colubridae	<i>Amastridium veliferum</i>	LC	LC	13	7	X	X
	<i>Atractus depressiocellus*</i>	DD	DD	15	13		X
	<i>Atractus imperfectus*</i>	DD	DD	16	13		X
	<i>Chironius exoletus</i>	NA	LC	12	9	X	X
	<i>Chironius flavopictus</i>	DD	DD	15	7	X	X
	<i>Chironius grandisquamis</i>	NA	LC	11	9	X	X
	<i>Clelia clelia</i>	NA	LC	10	8		X
	<i>Dendrophidion apharocybe</i>	NA	LC	16	9	X	X
	<i>Dendrophidion clarkii</i>	NA	NA	14	NA	X	X
	<i>Dendrophidion percarinatum</i>	NA	LC	11	9	X	X
	<i>Drymarchon melanurus</i>	LC	DD	6	7	X	X
	<i>Drymobius margaritiferus</i>	NA	LC	6	8	X	X
	<i>Erythrolamprus bizona</i>	LC	LC	12	9	X	X
	<i>Erythrolamprus mimus</i>	LC	LC	15	10		X
	<i>Lampropeltis micropholis</i>	NA	LC	10	8	X	X
	<i>Leptodeira rhombifera</i>	LC	LC	12	8	X	X
	<i>Leptodeira septentrionalis</i>	NA	LC	7	9	X	X
	<i>Leptophis ahaetulla</i>	NA	LC	10	8	X	X
	<i>Leptophis depressirostris</i>	NA	LC	14	9	X	X
	<i>Leptophis nebulosus</i>	LC	DD	14	12		X
	<i>Leptophis riveti</i>	NA	DD	14	9	X	
	<i>Liophis epinephelus</i>	NA	LC	10	9	X	X
	<i>Masticophis mentovarius</i>	NA	DD	6	10	X	
	<i>Mastigodryas alternatus</i>	LC	LC	12	7	X	X
	<i>Mastigodryas pleei</i>	NA	DD	14	9		X
	<i>Nothopsis rugosus</i>	LC	LC	10	7	X	X
	<i>Oxybelis aeneus</i>	NA	LC	5	8	X	X
	<i>Oxybelis brevirostris</i>	NA	LC	12	9	X	X
	<i>Oxybelis fulgidus</i>	NA	LC	7	8	X	X
	<i>Oxyrhopus petolaris</i>	NA	LC	12	9	X	X
	<i>Phrynonax poecilonotus</i>	LC	LC	7	8	X	X
	<i>Pseudoboa newwiedii</i>	NA	LC	14	10	X	X
	<i>Rhinobothryum bovallii</i>	LC	LC	16	9	X	X
	<i>Spilotes pullatus</i>	NA	LC	6	8	X	X
	<i>Stenorrhina degenhardtii</i>	NA	LC	9	8	X	X
	<i>Tantilla albiceps*</i>	DD	CR	16	13	X	
	<i>Tantilla armillata</i>	LC	NA	11	6	X	
	<i>Tantilla reticulata</i>	NA	DD	13	7		X
	<i>Tantilla ruficeps</i>	LC	DD	12	10	X	X
	<i>Tantilla schistosa</i>	LC	LC	7	8	X	X
	<i>Tantilla supracincta</i>	NA	DD	16	10	X	X
	<i>Tretanorhinus mocquardi</i>	NA	VU	15	7	X	
	<i>Tretanorhinus nigroluteus</i>	NA	DD	9	8		X
	<i>Xenodon rabdocephalus</i>	NA	LC	11	9	X	X

Dipsadidae	<i>Coniophanes fissidens</i>	NA	LC	7	9	X	X
	<i>Coniophanes joanae*</i>	DD	DD	15	14		X
	<i>Dipsas articulata</i>	LC	LC	15	10		X
	<i>Dipsas nicholsi*</i>	LC	DD	15	11		X
	<i>Dipsas temporalis</i>	NA	DD	13	8	X	X
	<i>Dipsas viguieri*</i>	LC	DD	13	12		X
	<i>Enuliophis sclateri</i>	NA	DD	13	7	X	X
	<i>Enulius flavitorques</i>	NA	LC	4	6	X	X
	<i>Geophis bellus*</i>	DD	VU	16	13		X
	<i>Geophis brachycephalus</i>	LC	LC	11	10	X	
	<i>Geophis hoffmanni</i>	NA	DD	12	7	X	X
	<i>Geophis tectus*</i>	LC	DD	13	10		X
	<i>Hydromorphus concolor</i>	LC	LC	12	7	X	X
	<i>Imantodes cenchoa</i>	NA	LC	6	6	X	X
	<i>Imantodes gemmistratus</i>	NA	LC	6	7	X	X
	<i>Imantodes inornatus</i>	LC	LC	12	7		X
	<i>Ninia maculata</i>	LC	LC	12	7	X	X
	<i>Phimophis guianensis</i>	NA	LC	13	8	X	X
	<i>Pliocercus euryzonus</i>	NA	LC	12	9	X	X
	<i>Rhadinaea decorata</i>	NA	LC	9	7	X	X
	<i>Rhadinaea sargenti*</i>	LC	DD	14	11		X
	<i>Sibon annulatus</i>	LC	LC	14	9	X	
	<i>Sibon argus</i>	LC	LC	16	12	X	
	<i>Sibon longifrenis</i>	LC	DD	14	10	X	
	<i>Sibon nebulatus</i>	NA	LC	5	8	X	X
	<i>Siphlophis cervinus</i>	NA	DD	16	10	X	X
	<i>Trimetopon barbouri*</i>	DD	VU	15	11	X	X
	<i>Urotheca fulviceps</i>	NA	DD	13	8	X	X
	<i>Urotheca guentheri</i>	LC	DD	12	7		X
Sibynophiidae	<i>Scaphiodontophis venustissimus</i>	NA	DD	13	9		X
Elapidae	<i>Hydrophis platurus</i>	NA	LC	NA	NA	X	X
	<i>Micrurus clarki</i>	LC	DD	17	9		X
	<i>Micrurus dissoleucus</i>	LC	DD	15	10		X
	<i>Micrurus mipartitus</i>	NA	LC	15	12	X	X
	<i>Micrurus multifasciatus</i>	LC	LC	15	10	X	X
	<i>Micrurus nigrocinctus</i>	LC	LC	10	8	X	X
	<i>Micrurus stewarti*</i>	LC	NT	17	14	X	
Viperidae	<i>Bothriechis lateralis</i>	LC	LC	16	12	X	
	<i>Bothriechis schlegelii</i>	NA	LC	11	10	X	X
	<i>Bothrops asper</i>	NA	LC	10	9	X	X
	<i>Lachesis stenophrys</i>	NA	NT	17	10	X	X
	<i>Porthidium lansbergii</i>	NA	NT	15	8	X	X
	<i>Porthidium nasutum</i>	LC	LC	12	8	X	X
Total Genera						50	53
Total Species						73	84

Family Anomalepididae.—Two species of blindsnakes occur in the current province of Panamá (Table 1). *Liotyphlops albirostris* is relatively abundant in the Canal Zone, as well as in Islas de Las Perlas, including on Isla del Rey and Isla San José (Fig. 3). Conversely, *Helminthophis frontalis* has been documented from a single locality in the former Panama Canal Zone (Fig. 3). Two species of blindsnakes occur in Panamá Oeste (Table 1), with *L. albirostris* documented mostly near the Canal Zone and *Anomalepis mexicanus* only from one locality (Fig. 3). *Anomalepis mexicanus* was reported from the former province of Panamá; with the reorganization of the borders, this species now is known from Panamá Oeste, but not from the current province of Panamá (Fig. 3).

Family Leptotyphlopidae.—Two species of leptotyphlopids are found in the current province of Panamá, although each with just one record (Table 1, Fig. 4). To date, no species have been reported from Panamá Oeste (Table 1, Fig. 4).

Family Boidae.—Four species of boas are known from the current province of Panamá (Table 1), including *Boa imperator*, which has been reported from several localities on the mainland and three islands on Islas de Las Perlas (Fig. 5). *Corallus ruschenbergerii* also is known from Islas de Las Perlas (FMNH 154316; Fig. 5). Three species of boas have been reported from Panamá Oeste (Table 1), including *B. imperator*, which has been reported from two localities (Fig. 5). *Corallus ruschenbergerii*, however, has not been reported for this area (Table 1, Fig. 5).

Family Charinidae.—A single record of *Ungaliophis panamensis* has been reported from Panamá Oeste (Table 1, Fig. 6), representing a new record for this region (Ray, 2015).

Family Colubridae.—This family is well represented in the current province of Panamá (Table 1), and includes 24 genera, and 39 species (Figs. 7–14). Of these, two species are endemic to the country, both in the genus *Atractus* (Jaramillo et al., 2010). These species are known from just one specimen (*A. depressiocellus*) or part of a specimen (*A. imperfectus*) (Myers, 2003). This family also is well represented in Panamá Oeste (Table 1), and includes 23 genera, and 36 species (Figs. 7–14). In addition to published or vouchered records, E. Griffith (pers. comm.) observed an individual of *Rhinobothryum bovallii* in July of 2006, near Altos de María in the far western part of the province (Fig. 13). Two specimens of *Masticophis mentovarius* were found dead and added to the faunal list in 2015 (J. Knight, J. Ray, and J. Wedow, unpublished; Fig. 11).

Several species in this family were reported from the western part of the former province of Panamá, which now constitute records for Panamá Oeste. *Leptophis riveti* is an uncommon snake in Panama, reported only from Altos de Campana (Ibáñez et al., 1996), a protected area now in Panamá Oeste (Fig. 10). *Tantilla albiceps* presents an interesting situation, as this species is known from a single specimen found on Monumento Nacional Isla Barro Colorado (Barbour, 1923). This island is located in the Panama Canal Zone, in the far eastern portion of Panamá Oeste (Fig. 14). Although Barro Colorado is one of the best-studied sites in the Neotropics, another specimen of *T. albiceps* never has been found, and thus this species might be extirpated on the island and possibly extinct. Pending a taxonomic review of the *Tantilla melanocephala* group, Knight et al. (2012) recognized *T. armillata* from the country of Panama; this species was reported for one locality in the former province of Panamá, which now is in the northeastern corner of Panamá Oeste (Fig. 14).

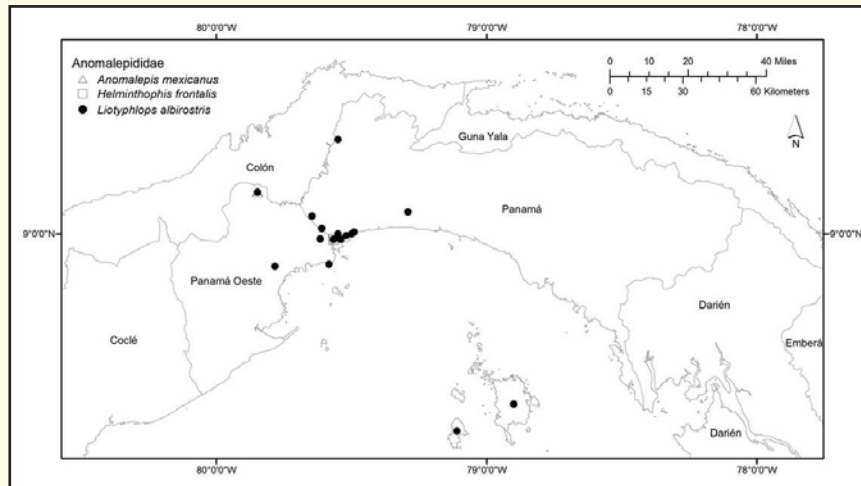


Fig. 3. Distribution map of members of the family Anomalepididae in the new province of Panamá and the province of Panamá Oeste.

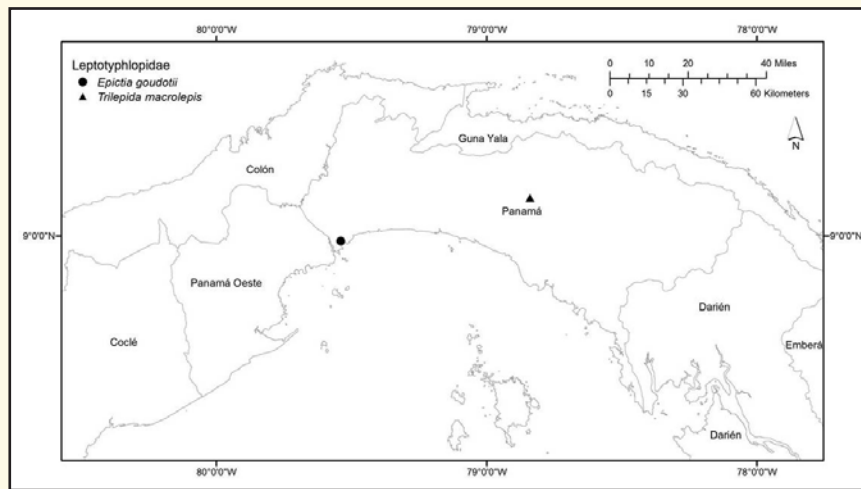


Fig. 4. Distribution map of members of the family Leptotyphlopidae in the new province of Panamá and the province of Panamá Oeste.

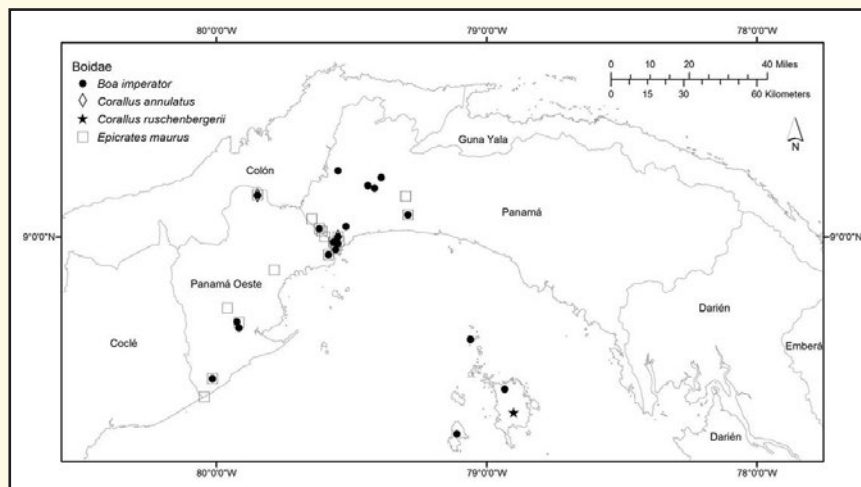


Fig. 5. Distribution map of members of the family Boidae in the new province of Panamá and the province of Panamá Oeste.

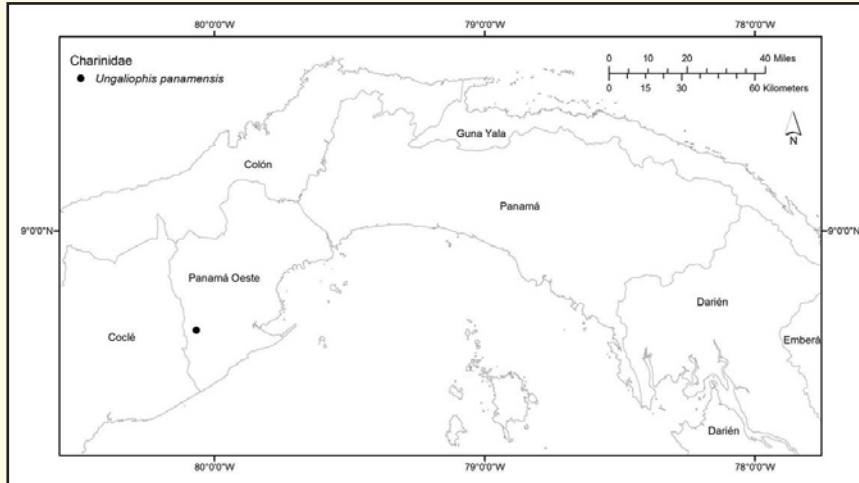


Fig. 6. Distribution map of the single member of the family Charinidae in the province of Panamá Oeste.

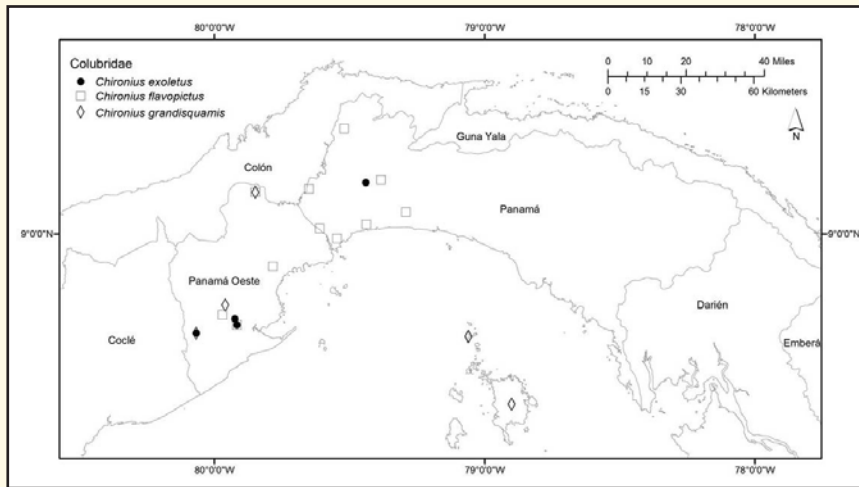


Fig. 7. Distribution map of members of the genus *Chironius* of the family Colubridae in the new province of Panamá and the province of Panamá Oeste.

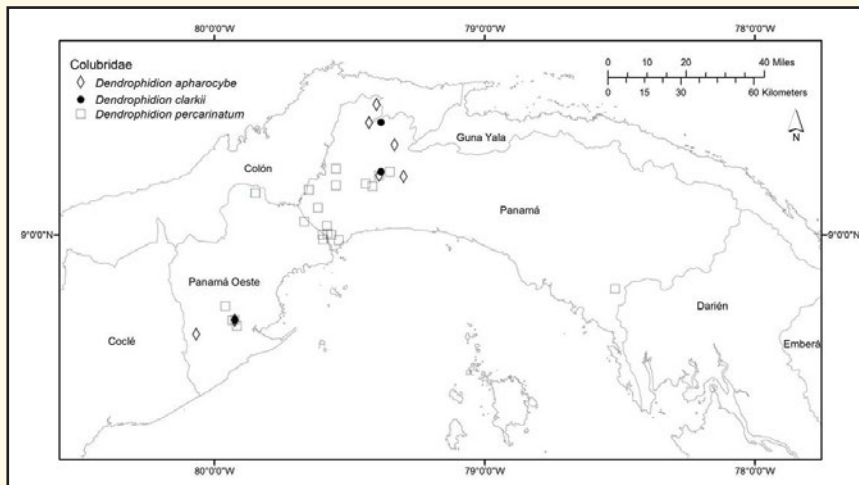


Fig. 8. Distribution map of members of the genus *Dendrophidion* of the family Colubridae in the new province of Panamá and the province of Panamá Oeste.

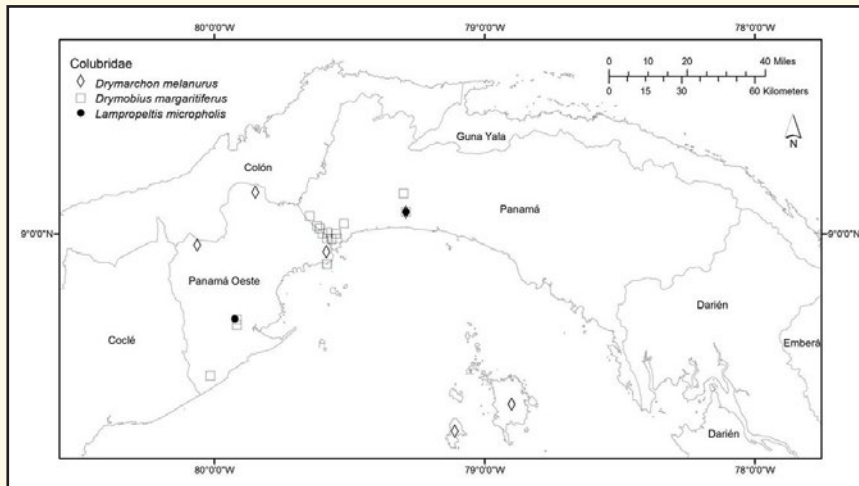


Fig. 9. Distribution map of members of the genera *Drymarchon*, *Drymobius*, and *Lampropeltis* of the family Colubridae in the new province of Panamá and the province of Panamá Oeste.

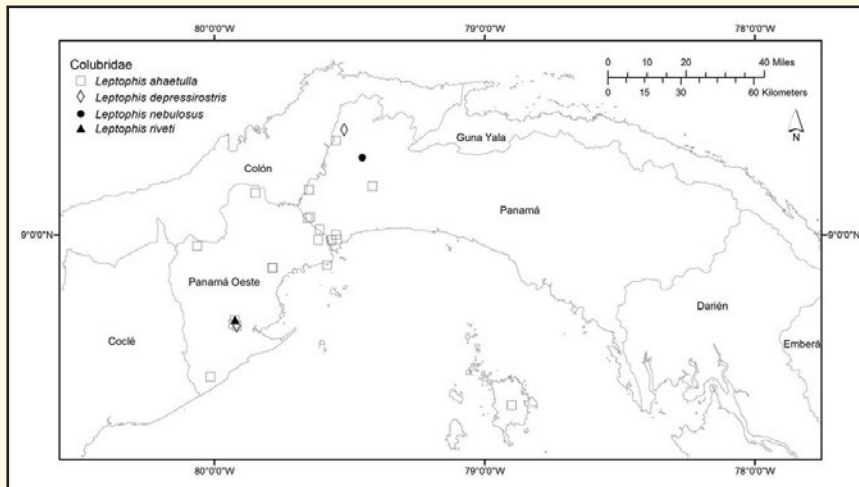


Fig. 10. Distribution map of members of the genus *Leptophis* of the family Colubridae in the new province of Panamá and the province of Panamá Oeste.

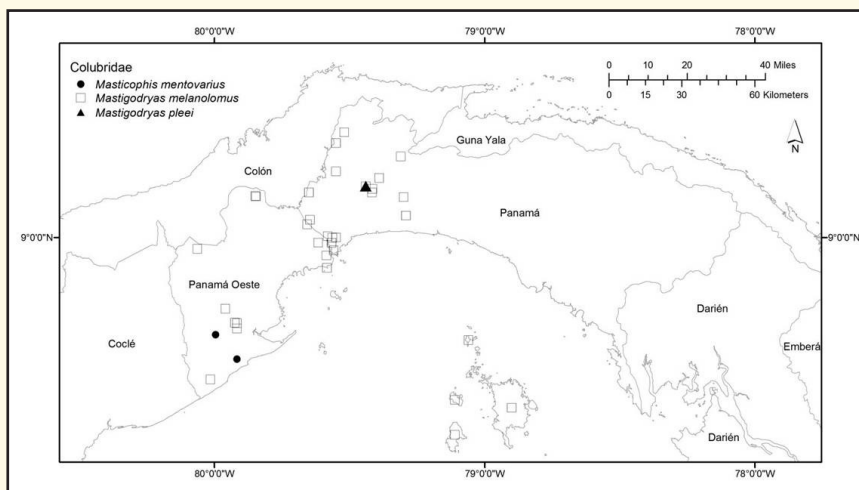


Fig. 11. Distribution map of members of the genera *Masticophis* and *Mastigodryas* of the family Colubridae in the new province of Panamá and the province of Panamá Oeste.

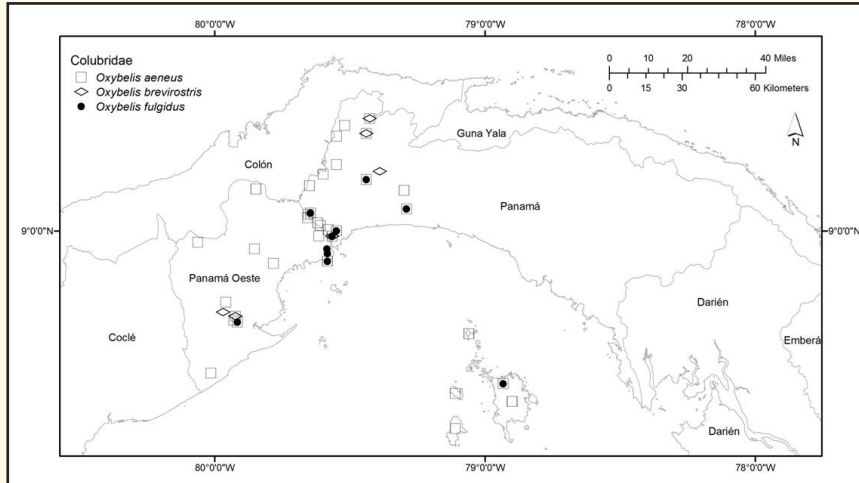


Fig. 12. Distribution map of members of the genus *Oxybelis* of the family Colubridae in the new province of Panamá and the province of Panamá Oeste.

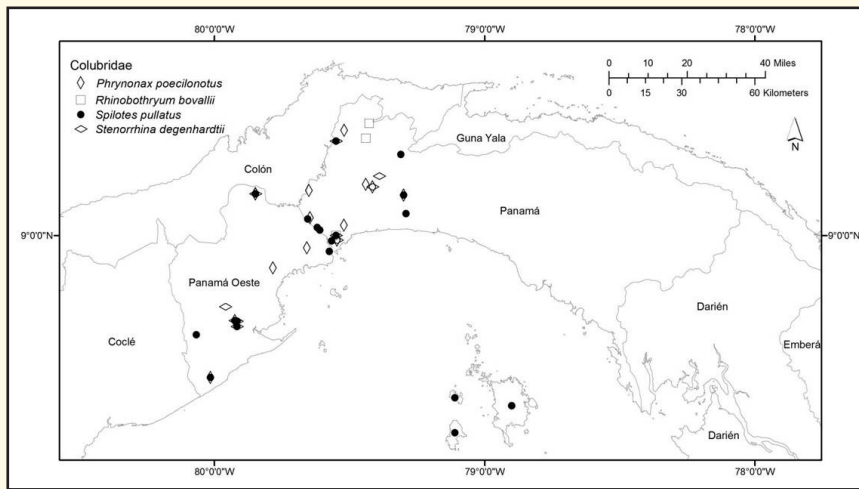


Fig. 13. Distribution map of members of the genera *Phrynonax*, *Rhinobothryum*, *Spilotes*, and *Stenorrhina* of the family Colubridae in the new province of Panamá and the province of Panamá Oeste.

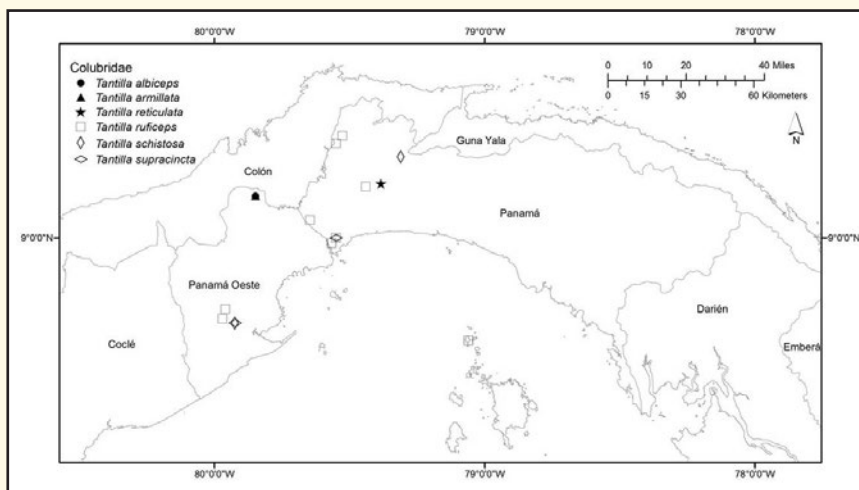


Fig. 14. Distribution map of members of the genus *Tantilla* of the family Colubridae in the new province of Panamá and the province of Panamá Oeste.

Family Dipsadidae.—This family is well represented in the current province of Panamá (Table 1), and includes 15 genera and 25 species (Figs. 15–26). Of these, seven species are endemic to the country. In Panama, *Urotheca fulviceps* was known only from the Canal area, but recently Ray and Santana (2014) expanded the range of this species to include the province of Coclé, a location between the known Panamanian localities and those reported near or on the Península de Osa in Costa Rica (Solórzano, 2004). The distribution of *Trimetopon barbouri* was limited to the former Panama Canal Zone (Köhler, 2008), until Ray and Knight (2013) reported an individual from the province of Coclé, and Derry et al. (2015) recently extended the range into the province of Chiriquí.

The Dipsadidae also is well represented in Panamá Oeste (Table 1), and includes 15 genera and 20 species (Figs. 15–26). Of these, *T. barbouri* is endemic to the country. *Ninia celata*, which was documented by Ray (2009) from Altos de María, is not included in the current faunal list because photographs of the individual were lost and a positive identification cannot be made from the field notes. Given the range extension this would have represented, we removed it from this checklist; hopefully, a specimen from this area with a positive identification can be found. *Geophis bellus* previously was known only from only the type locality in the former province of Panamá (Myers, 2003; Fig. 19), but its distribution has been extended to include the provinces of Colón, Coclé, and Veraguas (Elizondo Lara et al., 2015). In time, this species likely will be found in suitable habitat in Panamá Oeste, perhaps in Parque Nacional Altos de Campana.

Three species in this family were reported from the western part of the former province of Panamá, which now constitute records for Panamá Oeste. In an unpublished dissertation, Ray (2009) indicated the presence of *Geophis brachycephalus* in Altos del María, now in Panamá Oeste (Fig. 19); this species has not been reported from the current province of Panamá. Montgomery et al. (2007) reported *Sibon longifrenis* from Altos del María in a dietary note, and this information was included in Ray (2009); this species has not been reported from the current province of Panamá (Fig. 24). Suitable habitat exists in this area, and if this species were found there it would represent the southern and eastern extent of its range. *Sibon annulatus* and *S. argus* also were reported by Ray (2009) from Altos del María, now in Panamá Oeste (Fig. 24); Ibáñez et al. (“1994” 1995) reported *S. argus* from Parque Nacional Altos de Campana (Ibáñez et al., “1994” 1995), now in Panamá Oeste, so the only species of *Sibon* reported for the current province of Panamá is *S. nebulatus* (Fig. 24). *Tretanorhinus mocquardi* is another uncommon snake that was reported from the province of Colón and two localities in the former province of Panamá, now in eastern Panamá Oeste (MCZ Catalogue; VertNet, 2015; Fig. 25).

Family Sibynophiidae.—A single record of *Scaphiodontophis venustissimus* is available, from the current province of Panamá (Table 1, Fig. 27)

Family Elapidae.—Six species of elapids, in two genera, occur in the current province of Panamá (Table 1). Both *Micrurus clarki* and *M. dissoleucus* are known from a single locality, but the other species are more widely distributed (Figs. 28–29). Five species of elapids, in two genera, have been reported in Panamá Oeste (Table 1; Figs. 28–29). Of these, *M. stewarti* is endemic to Panama; this species was reported from the former province of Panamá, but after the borders were reorganized is not known from the current province of Panamá and only from two localities Panamá Oeste (Fig. 29). *Micrurus dissoleucus* is known from the current province of Panamá and the province of Coclé, so eventually we expect it will be found in Panamá Oeste.

Family Viperidae.—Five species of vipers, representing four genera, are known from the current province of Panamá, and six species of vipers, in four genera, have been reported from Panamá Oeste (Table 1; Fig. 30). Griffith et al. (2008) reported *Bothriechis lateralis* from the former province of Panamá; after the borders were reorganized this species has been recorded from Panamá Oeste, but not from the current province of Panamá (Fig. 30).

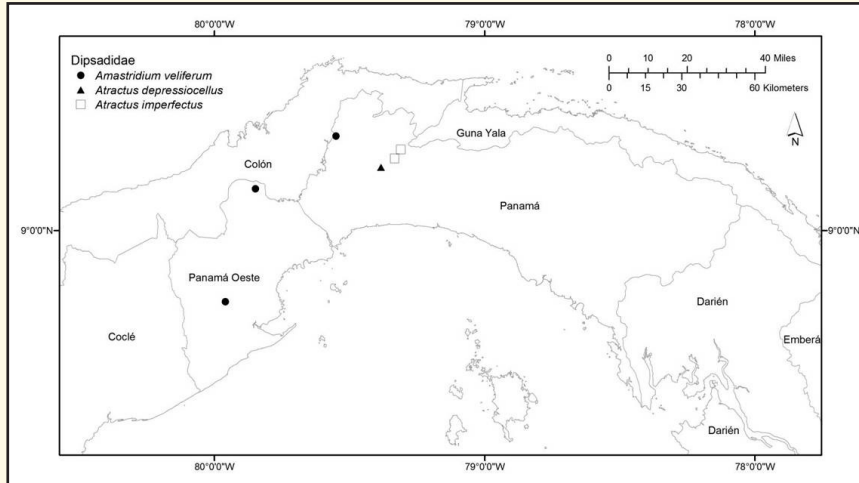


Fig. 15. Distribution map of members of the genera *Amastridium* and *Atractus* of the family Dipsadidae in the new province of Panamá and the province of Panamá Oeste.

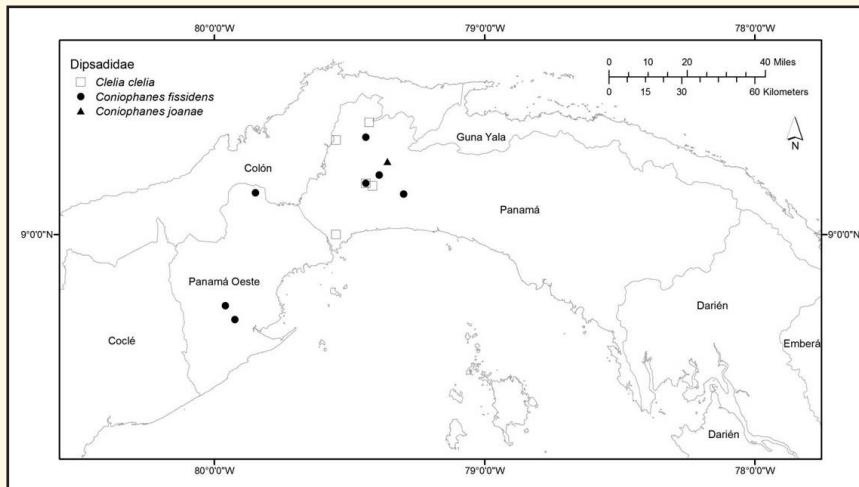


Fig. 16. Distribution map of members of the genera *Clelia* and *Coniophanes* of the family Dipsadidae in the new province of Panamá and the province of Panamá Oeste.

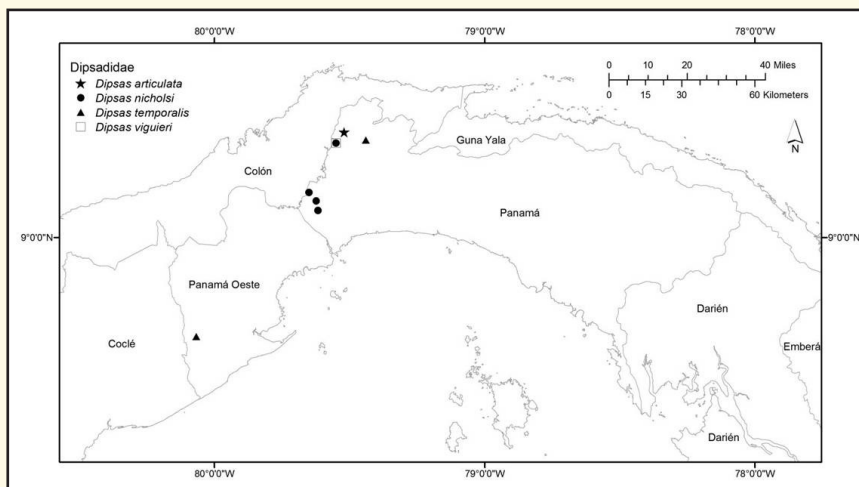


Fig. 17. Distribution map of members of the genus *Dipsas* of the family Dipsadidae in the new province of Panamá and the province of Panamá Oeste.

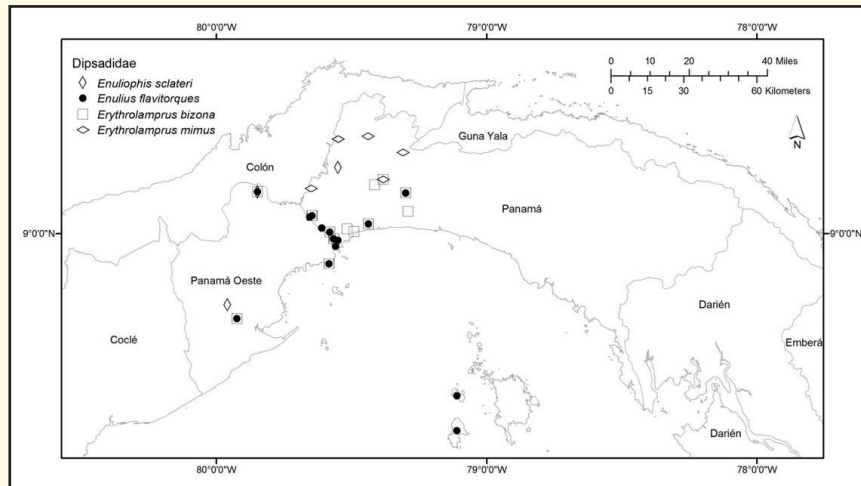


Fig. 18. Distribution map of members of the genera *Enuliophis*, *Enulius*, and *Erythrolamprus* of the family Dipsadidae in the new province of Panamá and the province of Panamá Oeste.

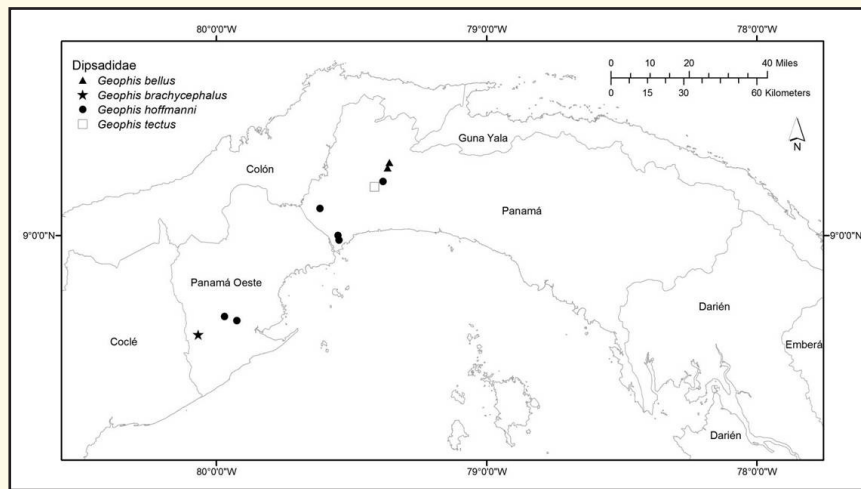


Fig. 19. Distribution map of members of the genus *Geophis* of the family Dipsadidae in the new province of Panamá and the province of Panamá Oeste.

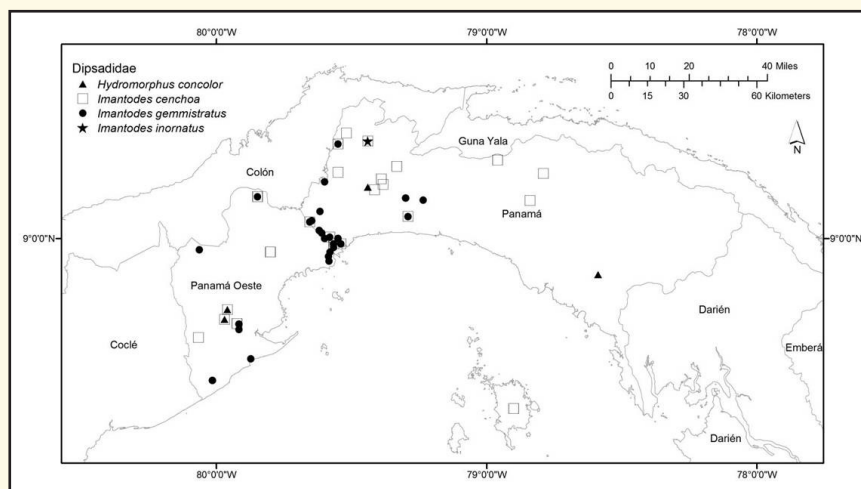


Fig. 20. Distribution maps of members of the genera *Hydromorphus* and *Imantodes* of the family Dipsadidae in the new province of Panamá and the province of Panamá Oeste.

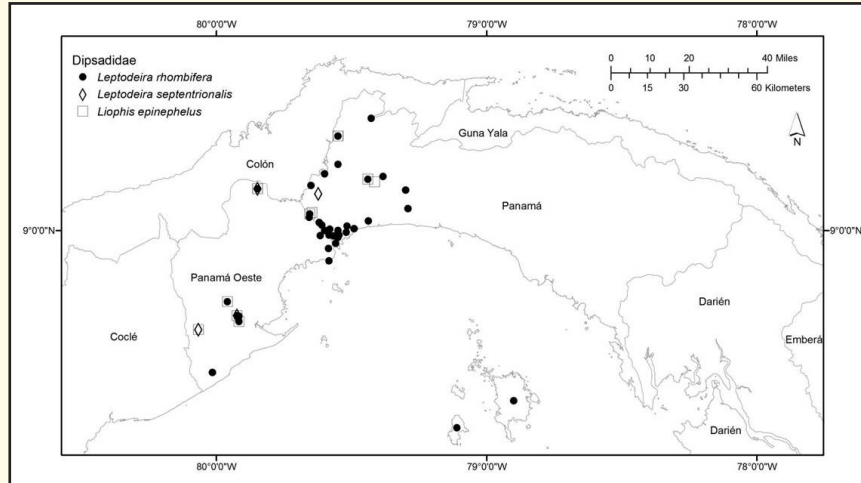


Fig. 21. Distribution map of members of the genera *Leptodeira* and *Liophis* of the family Dipsadidae in the new province of Panamá and the province of Panamá Oeste.

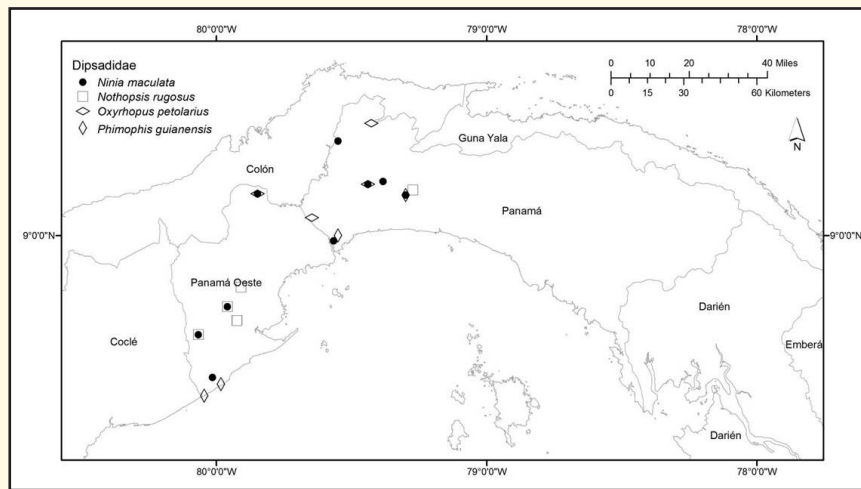


Fig. 22. Distribution map of members of the genera *Ninia*, *Nothopsis*, *Oxyrhopus*, and *Phimophis* of the family Dipsadidae in the new province of Panamá and the province of Panamá Oeste.

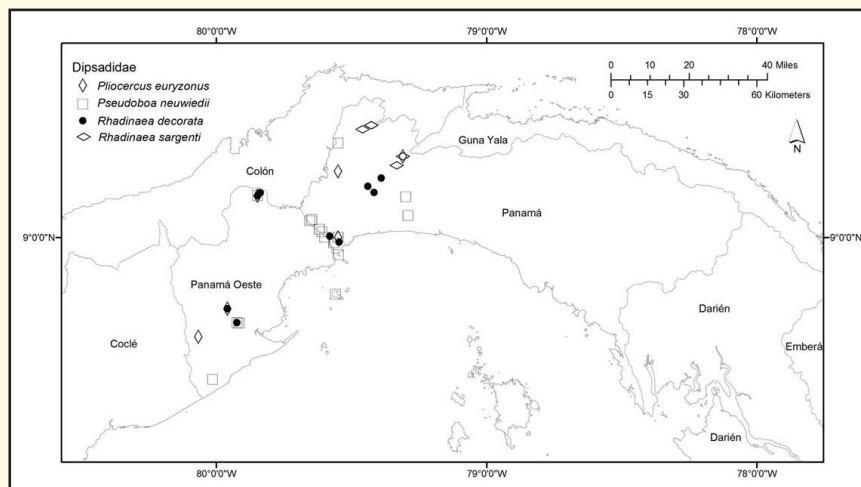


Fig. 23. Distribution map of members of the genera *Pliocercus*, *Pseudoboa*, and *Rhadinaea* of the family Dipsadidae in the new province of Panamá and the province of Panamá Oeste.

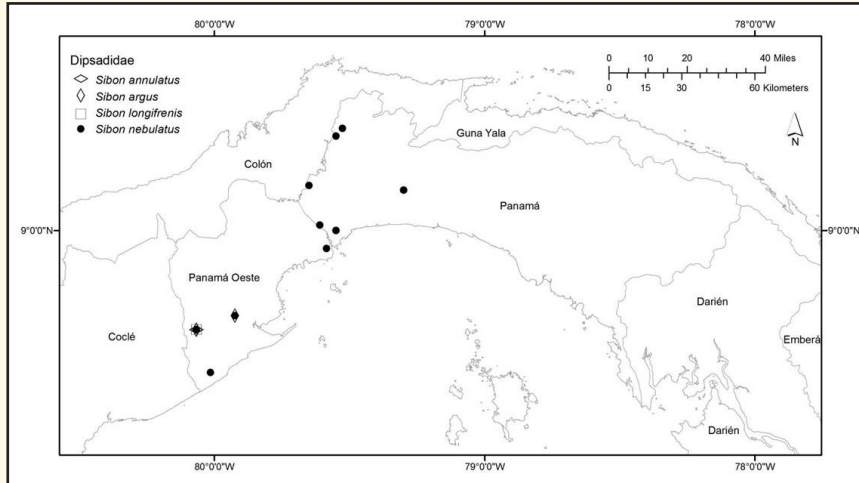


Fig. 24. Distribution map of members of the genus *Sibon* of the family Dipsadidae in the new province of Panamá and the province of Panamá Oeste.

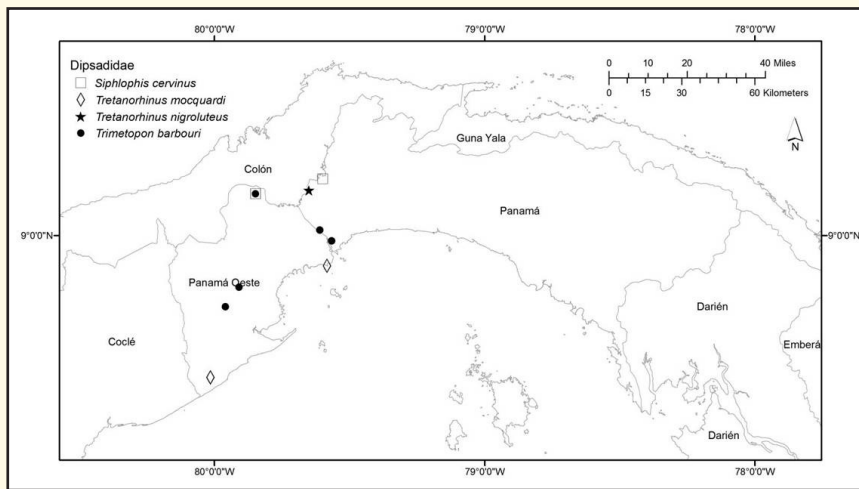


Fig. 25. Distribution map of members of the genera *Siphlophis*, *Tretanorhinus*, and *Trimetopon* of the family Dipsadidae in the new province of Panamá and the province of Panamá Oeste.

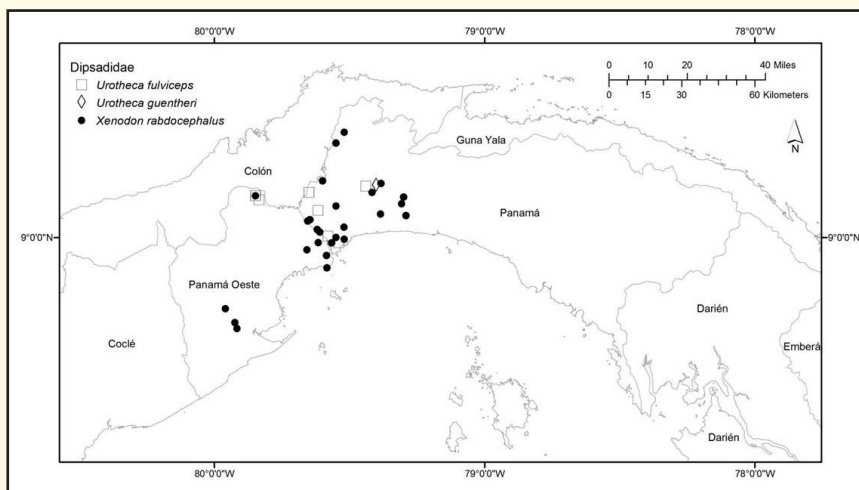


Fig. 26. Distribution map of members of the genera *Urotheca* and *Xenodon* of the family Dipsadidae in the new province of Panamá and the province of Panamá Oeste.

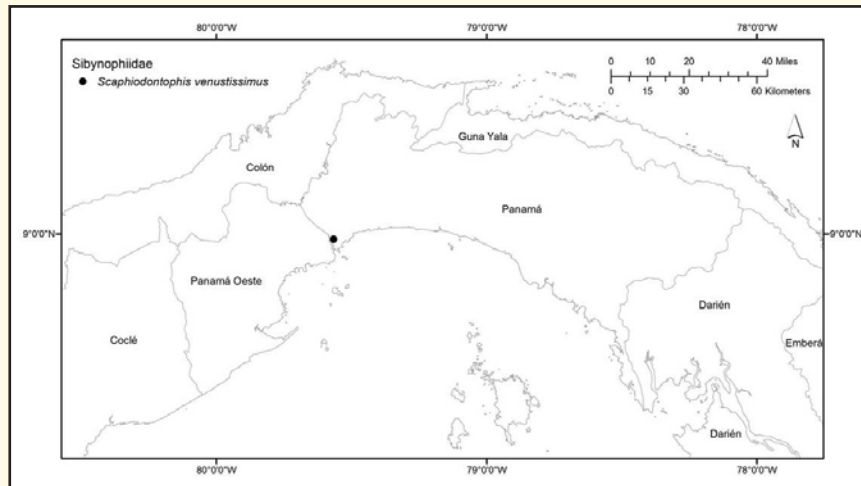


Fig. 27. Distribution map of the single member of the family Sibynophiidae in the new province of Panamá.

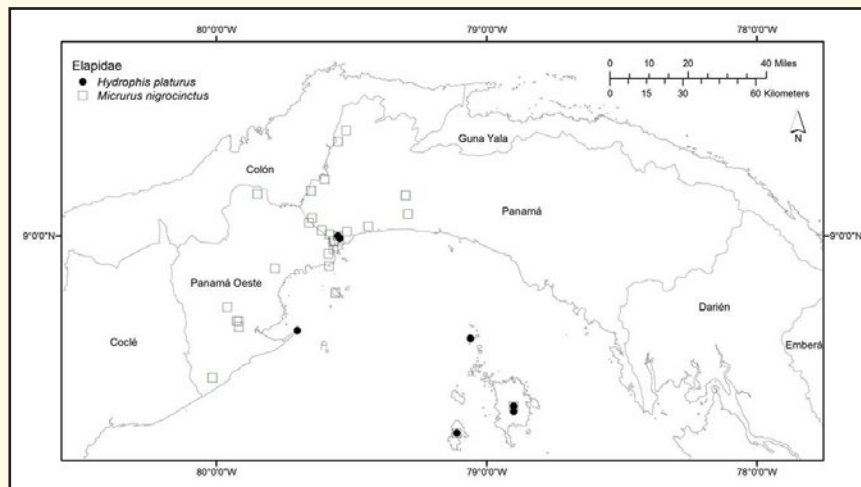


Fig. 28. Distribution map of *Hydrophis platurus* and *Micrurus nigrocinctus* of the family Elapidae in the new province of Panamá and the province of Panamá Oeste. Records for *H. platurus* shown in land areas are from nearby waters or beaches on the respective islands.

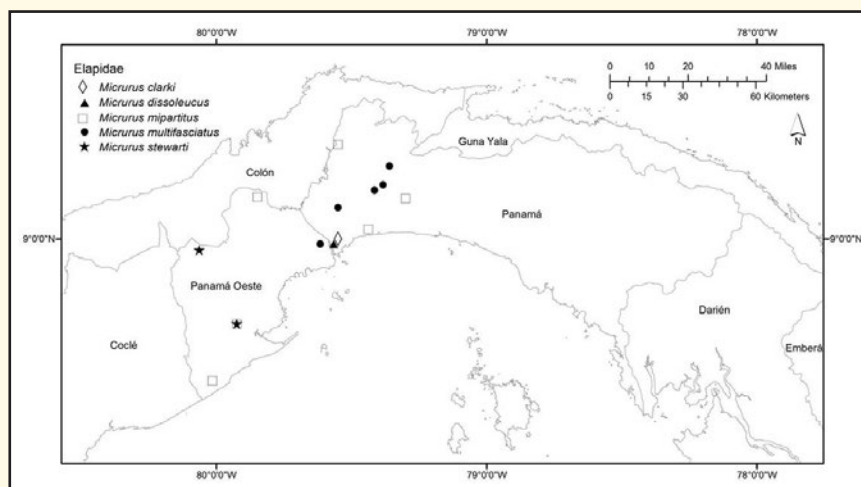


Fig. 29. Distribution map of all other members of the family Elapidae in the new province of Panamá and the province of Panamá Oeste.

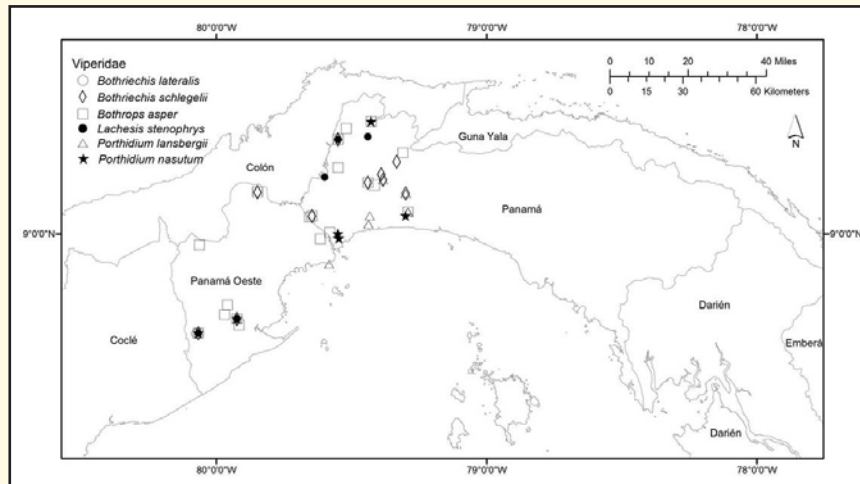


Fig. 30. Distribution map of members of the family Viperidae in the new province of Panamá and the province of Panamá Oeste.

CONSERVATION STATUS

Based on the criteria used by the IUCN for assessing conservation status, Jaramillo et al. (2010) placed the herpetofaunal species occurring in Panama into the various IUCN categories and indicated the following number of species: CR = 1, VU = 4, NT = 3, LC = 54, and DD = 33; two species were not assessed. To compare these data with current information, we examined the IUCN categories for the species occurring in our study area (www.iucn.org; accessed 30 May 2015), and the results were as follows: LC = 33, and DD = 9; 55 species were not assessed. The most current EVS information is found in Johnson et al. (*In Press*), who provide the following values for snake species occurring in Panama: 21 = low vulnerability, 42 = medium vulnerability, and 33 = high vulnerability; one species was not assessed. Jaramillo et al. (2010), previously had calculated the following EVS values for Panamanian snakes found in our study area: 46 = low vulnerability, 37 = medium vulnerability, and 11 = high vulnerability; one species was not assessed.

Wilson et al (2013 a, b), Mata-Silva et al. (2014), Johnson et al. (*In Press*), among other recent publications that have used the EVS measure, have compared the IUCN and EVS systems. In these studies, the IUCN system has been criticized for the sizeable number of species that remain unevaluated on account of the costs involved, and because the authors of these papers considered that many of these species and others in the DD and LC categories deserved to be placed into one of the three threat categories (CR, EN, and VU) or the NT category; in contrast, the EVS system can be applied quickly and efficiently to nearly all species, at little or no cost (Mata Silva et al., 2014; Johnson et al., *In Press*).

With regard to the EVS values, species included in this paper with high vulnerability scores are in the Colubridae, Dipsadidae, Elapidae, and Viperidae; other families include species of low or medium vulnerability. For the current province of Panamá, 12 colubrids (including two endemics), seven dipsadids (including five endemics), four elapids, and two viperids, a total of 25 (30.1%) of the species assessed, show high vulnerability (Johnson et al., *In Press*). Given the high number of protected areas within the province, many records for these species are of specimens collected in those areas. For the province of Panamá Oeste, 10 colubrids (including one endemic), five dipsadids (including one endemic), three elapids (including one endemic), and three viperids, a total of 21 (29.2%) of the species assessed, show high vulnerability (Johnson et al., *In Press*). Only three protected areas have been designated in Panamá Oeste, so many of these records are from specimens collected outside of these areas.

Surveys and research in both protected and unprotected areas, however, may yield more populations of some of the most vulnerable species. For example, a species with one of the highest scores (16), *Geophis bellus*, previously was known from only the type locality in the former province of Panamá, but its distribution has been

expanded and this species eventually might be found in Panamá Oeste (Fig. 19); *Trimetopon barbouri*, a species with an EVS of 15, was recorded only from the former Panama Canal Zone but now has been recorded from other provinces; and *Urotheca fulviceps*, with an EVS at the high end of the medium category (13), formerly was known in Panama only from the Canal area, but a recent report has expanded the range to include an area between the known Panamanian localities and those in adjacent Costa Rica (see Results).

DISCUSSION

The division of the former province of Panamá into two provinces, Panamá and Panamá Oeste, has resulted in the need to reorganize the distributional records for snakes in the area. The current province of Panamá has retained much of the original land and all but two of the protected areas, but several species of snakes once recorded from the province of Panamá now are in the province of Panamá Oeste, perhaps causing confusion when older records are considered. Among these are the rare *Tretanorhinus mocquardi* and the endemic *Tantilla albiceps* and *Micrurus stewarti*. Fortunately, records and observations of these species, and of many others, are from protected areas; however, this might be an artifact of collecting, as better field studies and assessments have been conducted on the herpetofauna at these sites. Regardless, efforts must be continued to manage the protected areas to ensure the survival of all species of snakes and to expand the protected areas, especially in the province of Panamá Oeste.

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Patty Ruback is a full-time mom and part-time GIS conservation specialist. She has collaborated on a number of research projects, and most recently has focused her attention on Panamanian snakes with La Mica Biological Research Station in Coclé Province. To date, she has co-authored six peer-reviewed scientific publications, in addition to the 2013 book, *The Venomous Snakes and their Mimics of Panama and Costa Rica*. Aside from her work on maps, she recently founded a grassroots organization in her community to help connect people with good local and sustainable food. Patty continues to travel extensively, as she educates her young daughter about conservation and social issues.