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Newly-discovered populations of four threatened endemic salamanders (Caudata: Plethodontidae) from the highlands of central Honduras

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Neotropical plethodontid salamanders are being increasingly recognized as playing a significant role in the global amphibian crisis, with cases of declines and apparent extirpations of salamanders endemic to geographically small habitats being documented in Mexico and Guatemala (ROVITO et al. 2009). Like Mexico and Guatemala, Honduras has a diverse and relatively well-documented endemic salamander fauna, with 32 species in five genera reported from the country (MCCRANIE 2009). Of these species, at least 23 are considered Critically Endangered or Endangered based on IUCN Red List criteria (TOWNSEND & WILSON 2010, TOWNSEND et al. 2010), primarily due to loss of their already-restricted mountain-top habitats.

From 2006 to 2008, the authors conducted fieldwork at over 20 cloud forest localities in Honduras and completed a country-wide assessment of the conservation and management needs of endangered amphibians. Within the boundaries of two protected areas in central Honduras (Fig. 1), Parque Nacional Cerro Azul Meámbar and Parque Nacional Montaña de Yoro, we collected samples of salamanders that represent previously undocumented populations of the salamanders *Bolitoglossa oresbia*, *Nototriton lignicola*, *N. limnospectator*, and *Oedipina kasios*. Identification of all specimens herein referred to these four species was confirmed by analysis of mtDNA sequence data from the genes 16S and cytochrome *b*; molecular analyses related to these taxa are reported elsewhere (SUNYER et al. 2010, TOWNSEND et al. 2010). Forest formation definitions follow HOLDRIDGE (1967).

Bolitoglossa oresbia was recently described on the basis of three specimens collected from an irregular patch of remnant cloud forest (Lower Montane Wet Forest formation) less than one hectare in total extent on the peak of Cerro El Zarcadero (Figs. 1B) in central Honduras (Mc-

CRANIE et al. 2005). This patch is the only remaining forest near the peak of this mountain, and is adjacent to a set of communications towers and surrounded by agricultural clearings given over primarily to corn and other staple crops. In the original description, the authors indicated that *B. oresbia* was “the most critically endangered salamander in Honduras” (MCCRANIE et al. 2005:111), and, given its extremely limited and vulnerable distribution, this species is classified as Critically Endangered on the IUCN Red List (MCCRANIE et al. 2006) and could be considered one of the most threatened amphibians on earth. On 17–18 July 2007, we visited Cerro Zarcadero, finding a single subadult *B. oresbia* (UF 156333; Fig. 2A) active on vegetation at night.

From 6–13 July 2008, we surveyed a ridge above Quebrada Varsovia (14.79913° N, 87.89128° W), on the southwestern side of Parque Nacional Cerro Azul Meámbar (Fig. 2B) in Departamento Comayagua. Five specimens of *Bolitoglossa oresbia*, one adult male (UF 156529; Fig. 2C, D) and four small juveniles (UF 156526–27, 156530–31), were collected while active on vegetation at night along a trail that follows a steep hillside through undisturbed Lower Montane Wet Forest, 1640–1680 m above sea level. An adult female (UF 156528) was collected along the same trail during the daytime, when it was dislodged from a standing, rotten tree trunk approximately 1 m above the ground. A third adult (UF 156532) was collected while apparently asleep in moist leaf litter during the morning of 12 July 2008 along the trail leading to the aforementioned campsite (14.79618° N, 87.89527° W), 1560 m a.s.l. These new localities are only around 8 airline km north of Cerro Zarcadero, and the intervening area, while wholly converted to agriculture, is no lower than 1300 m a.s.l. at any given point.

Nototriton limnospectator is an Endangered moss salamander previously known only from forest above 1600 m

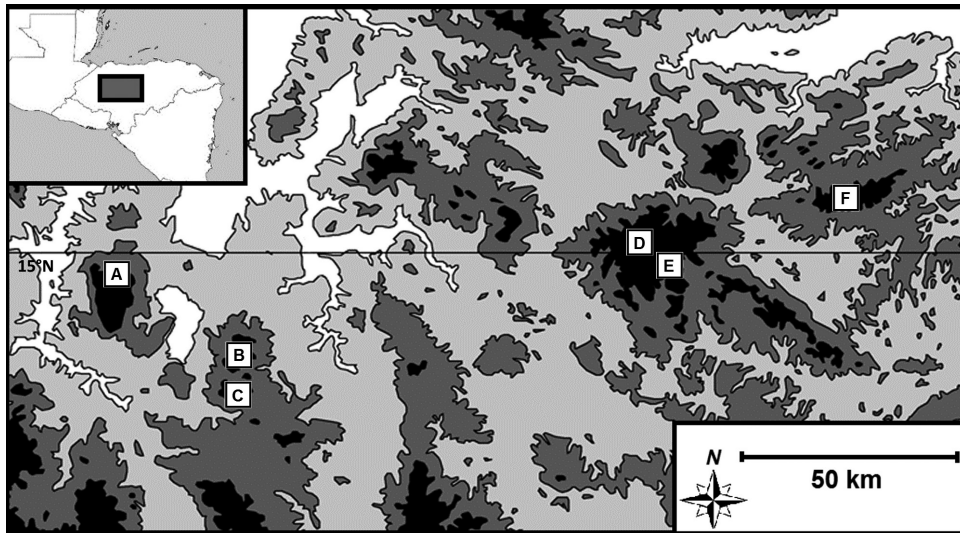


Figure 1. Map of the central highlands of Honduras illustrating localities mentioned in the text; light gray = 500–1000 m elevation, dark gray = 1000–1500 m elevation, black = 1500 – 3000 m elevation. Localities include Parque Nacional Montaña de Santa Bárbara (A); Parque Nacional Cerro Azul Meámbar (B); Cerro Zarciahero (C); Cataguana, Parque Nacional Montaña de Yoro (D); Montaña de la Sierra, Parque Nacional Montaña de Yoro (E); Parque Nacional La Muralla (F).



Figure 2. Subadult *Bolitoglossa oresbia* from the type locality (UF 156333, Cerro Zarciahero) (A); Parque Nacional Cerro Azul Meámbar, viewed from the vicinity of Santa Elena on the northern side (B); Adult male *Bolitoglossa oresbia* (UF 156529, above Quebrada Varsovia, Parque Nacional Cerro Azul Meámbar); (C); In situ photo of adult male *Bolitoglossa oresbia* (UF 156529) (D).



Figure 3. *Nototriton limnospectator* (UF 156539, above Quesbrada Varsovia, Parque Nacional Cerro Azul Meámbar) (A); Juvenile *Nototriton limnospectator* (UF collection, above Los Pinos, Parque Nacional Cerro Azul Meámbar) (B); *Nototriton lignicola* (UF 156543, Cerro El Filón, Parque Nacional Montaña de Yoro) (C); Quebrada Cataguana, Parque Nacional Montaña de Yoro, 1820 m elevation (D).

elevation in Parque Nacional Montaña de Santa Bárbara (Fig. 1A), an isolated karstic mountain to the west of Lago de Yojoa (CRUZ et al. 2008a). The limited distribution of *N. limnospectator* led to its inclusion on the species list of the Alliance for Zero Extinction (Alliance for Zero Extinction 2010). During 2008, we collected four specimens of *N. limnospectator* from three sites in Parque Nacional Cerro Azul Meámbar (Fig. 2B), including two individuals (UF 156539–40; Fig. 3A) found on 7 and 9 July 2008 alongside juvenile *Bolitoglossa oresbia* (UF 156526–27, 156530–31) while active on low vegetation at night. Another individual (UF 156541) was collected on 27 August 2008 from near a campsite farther along the Quebrada Varsovia (14.80448° N, 87.89073° W), 1710 m a.s.l., while active at night on a root buttress. All three of these localities are in the Lower Montane Wet Forest formation. We collected a juvenile *N. limnospectator* (UF collection; Fig. 3B) from underneath a moss mat at night on 7 June 2008 along Sendero Bosque Nublado, 1105 m elevation, above Centro de Visitantes de Parque Nacional Cerro Azul Meámbar “Los Pinos” (14.87235° N, 87.90565° W), Departamento Cortés. This locality lies in the Premontane Wet Forest formation. These new localities are approximately 20–25 km east of the nearest locality in Parque Nacional Montaña de Santa Bárbara (McCRANIE

& WILSON 2002), from which they are isolated by the largest freshwater lake in Honduras, Lago de Yojoa.

Nototriton lignicola is a Critically Endangered species previously known only from 13 specimens collected inside two rotten logs at Cerro de Enmedio, Parque Nacional La Muralla (Fig. 1F), 1760–1780 m a.s.l. (McCRANIE & WILSON 1997; CRUZ et al. 2008b). Like *N. limnospectator*, *N. lignicola* is listed as a priority species by the Alliance for Zero Extinction (ALLIANCE FOR ZERO EXTINCTION 2010). On 10 June 2006, we collected a juvenile *N. lignicola* (UF 156544) from inside a fractured rock alongside Quebrada Cataguana (15.00601° N, 87.097261° W; Fig. 1.4, 3D), 1820 m a.s.l., Parque Nacional Montaña de Yoro, in northern Depto. Francisco Morazán. On 14 March 2007, we collected two adult *N. lignicola* (UF 156542–43; Fig. 3C) from inside rotten logs on Cerro El Filón above Quebrada Cataguana (15.00601° N, 87.097261° W), 2020 m a.s.l. These localities are in the Lower Montane Wet Forest formation and are approximately 45 km west of the only other known locality in Parque Nacional La Muralla, with the intervening territory bisected by a river valley (500–600 m a.s.l.) in the headwaters of the Río Aguán (TOWNSEND et al. 2009).

Oedipina kasios was recently described from Parque Nacional La Muralla, and is one of three described species



Figure 4. *Oedipina kasios* (UF 156500, Montaña de la Sierra, Parque Nacional Montaña de Yoro) (A); Mesic ravine surrounded by recently burned pine-oak forest, Montaña de la Sierra, Parque Nacional Montaña de Yoro, 1920 m elevation (B).

in a recently identified divergent clade (subgenus *Oeditriton*) within *Oedipina* (McCRANIE et al. 2008, SUNYER et al. 2010). This species occurs from 950–1780 m a.s.l. and has been found in the same logs as *Nototriton lignicola* (McCRANIE et al. 2008). On 25 September 2008, we collected a single specimen of *O. kasios* (UF 156500; Fig. 4A) in a small mesic ravine on Montaña de la Sierra (14.94896° N, 87.05611° W; Figs. 1.5, 4B), 1920 m a.s.l., in Lower Montane Moist Forest on the southeastern side of Parque Nacional Montaña de Yoro in northern Depto. Francisco Morazán. This area of Parque Nacional Montaña de Yoro is typified by regularly burned pine-oak forest with an open grassy understory interrupted by deep, narrow seepage ravines that support dense mesic vegetation (Fig. 4B), and apparently provide refuge for species like *O. kasios* during fire events. The Critically Endangered amphibians *Bolitoglossa cataguana* and *Plectrohyla guatemalensis* were also collected within and along the outer margins of this and similar ravines.

Both *Bolitoglossa oresbia* and *Nototriton limnospectator* have the relatively good fortune of now being found within the boundaries of Parque Nacional Cerro Azul Meámbar, which is among the best managed cloud forest protected areas in Honduras, thanks largely to the activities of the non-governmental organization Aldea Global and the Honduran National Institute of Conservation, Protected Areas, and Wildlife (ICF). Along with strong management, the rugged and, in some cases, nearly impenetrable topography of this collection of mountains (Fig. 2B) provides a relatively secure refuge for montane forest inhabitants like salamanders. In sharp contrast to Parque Nacional Cerro

Azul Meámbar, the nearby cloud forest of Parque Nacional Montaña de Yoro is among the most endangered patches of montane forest in Honduras. Despite the efforts of park management and the community leaders in the municipality of Marale, deforestation on nearly all sides of this large mountain has reached and, in many places, passed the 1800 m elevation lower boundary of the nuclear zone of the park. Parque Nacional Montaña de Yoro is one of the geographically largest yet biologically least-known areas of mesic forest above 2000 m a.s.l. in Honduras. Both, *N. lignicola* and *Oedipina kasios* were found in proximity to human disturbance at localities on opposite sides of the nuclear zone. Despite the continued upward expansion of rural agriculture, a relatively large expanse of intact montane forest remains, as does the opportunity to explore and catalog the biodiversity of this isolated refuge.

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