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# AMPHIBIANS in The Middle of The World: ECUADOR

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Ecuador is a country defined by its small size and immense biodiversity. It is one of the smallest nations in South America — covering roughly 283,561 km<sup>2</sup> (about the size of the United Kingdom or the US state of Colorado) — yet it punches far above its weight in every

biological category. Straddling the Equator, the "Middle of the World" is where the sun's energy is most consistent, but the landscape is anything but uniform.

The country is famously divided into four distinct worlds: the Costa (Pacific lowlands), the Sierra (the Andean highlands), the

Oriente (the Amazonian basin), and the volcanic Galápagos Islands. This compressed geography creates a verticality that is almost unparalleled; one can travel from the humid tropical rainforests at sea level to the frozen glaciers of the high Andes in just a few hours. I previously discussed herping in the Galápagos Islands in a past issue (Barrio-Amorós 2024), and now I aim to introduce the amphibians of this amazing country.

With a population of approximately 18 million people, Ecuador is a vibrant blend of indigenous cultures (primarily in the Andes and Amazon), mestizo heritage, and Afro-Ecuadorian traditions on the coast. While the majority of the population is concentrated in bustling hubs and main cities like Guayaquil and the high-altitude capital, Quito, or other cities like Cuenca, much of the country remains a wild frontier. The relationship between the people and the land is complex; while urban centres grow, the rural and indigenous communities often remain the primary stewards of the forests that house the country's most vulnerable species.



One of the herping hotspots on the oriental slopes of the Ecuadorian Andes, overlooking the final foothills of the Andean chain as they descend toward the Amazonian lowlands.

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## Biodiversity

To call Ecuador "megadiverse" is an understatement. It is one of only 17 countries in the world to hold this title, containing nearly 10% of the world's plant species and more biodiversity

per 1 km<sup>2</sup> than almost anywhere else on Earth (with the exception of other small, super-biodiverse nations such as Costa Rica, Guatemala, or Panama), being in the top 5!

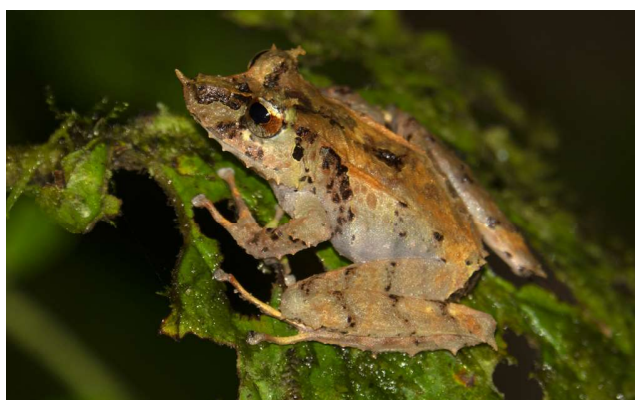
While birds and mammals are world-famous, it is the amphibians that truly represent the peak



*Osornophryne bufoniformis* – a small, stout toad endemic to the high Andean paramos, which can be quite common under rocks (left); some species of *Terraranae* are specialists in high Andean habitats: *Pristimantis riveti* is found mostly inside *frailejones* (*Espeletia* spp.) (right).



One of many species of marsupial frogs, *Gastrotheca riobambae*, an inhabitant of the cloud forests but also adaptable to human surroundings (left); *Epipedobates espinosai* - a terrestrial and diurnal dendrobatid that can be common in appropriate surroundings around Mindo (until recently known as *E. darwinwallacei*) (right).



*Pristimantis appendiculatus*, one of many tuberculate *Terraranae* in Ecuador and, in general, the northern Andes (left); reported by us as *Atelopus mindoensis*, back from extinction! (Finding this little toad alive was actually one of the happiest moments of my life!) (Photo by Eric Osterman) (right).

of Ecuadorian evolution. With over 650 recognized species of amphibians — and new ones being described at a staggering rate — Ecuador is a global epicentre for academic herpetology and, consequently, also for herping. This diversity is driven by the Andes, which act as a massive physical barrier and a generator of microclimates. Every valley, isolated peak, and river system has the potential to host a species found nowhere else on the planet.

For the herper, Ecuador is a treasure map replete with iconic species. From the mossy *páramos*, where the air is thin and cold, to the steaming leaf litter of the Amazonian floor, the country offers a glimpse into the raw, unbridled power of speciation. In this article, I shall focus on just a few of the hundreds of species inhabiting the country that I have encountered during my numerous expeditions.

## The Andes

The Ecuadorian Andes, characterized by the dramatic convergence of the Cordillera Occidental and the Cordillera Oriental and separated by a high-altitude inter-Andean valley, extend approximately 600–650 km from north to south and span a total width of 150–200 km.

This mountainous backbone is punctuated by approximately 84 volcanic structures, including roughly 27 that are considered potentially active, with the extinct stratovolcano Chimborazo reaching a maximum altitude of 6,263 m above sea level. Within this complex topography, the cloud forest (or evergreen montane forest) occupies a vital belt between 1,000 and 2,800 m, covering roughly 1.3 million hectares of the Sierra. The higher elevations above the timberline (starting near 3,000–3,500 m) are dominated by the páramo, which exists as isolated islands encompassing approximately 1.2–1.3 million hectares of moisture-regulating grasslands and frailejones. These habitats are essential for the region's extreme levels of micro-endemism.

Some of the iconic species found in the northern páramos include the small and grotesque toad *Osornophryne bufoniformis* (Peracca, 1904), normally found under rocks, and the beautiful land frog (*Terrarana*) *Pristimantis riveti* (Despax, 1911). Many other species inhabit these areas, with one or more typically endemic to each páramo and its surrounding forests between 2,800 and 3,400 m above sea level.

In the surrounding cloud forests at around 2,500 m, and expanding into anthropogenic habitats (crops, cattle grasslands, etc.), one can find the resilient *Gastrotheca riobambae* (Fowler, 1913), a marsupial frog that carries its young in a dorsal pouch. In the lower cloud forests, such as Mindo (around 1,000–1,800 m), some species are terrestrial and diurnal, like the striking *Epipedobates espinosai* (Funkhouser, 1956), which was known until very recently as *Epipedobates darwinwallacei* Cisneros-Heredia & Yáñez-Muñoz, 2011. Others are terrestrial but nocturnal, such as certain particularly appealing *Pristimantis* species, like *Pristimantis appendiculatus* (Werner, 1894).

One night in August 2019, while searching for that particular species with my friends Melissa Costales and Eric Osterman, we encountered something we were not prepared to recognize at first glance. Near an adult female *P. appendiculatus*, I spotted a small green toad with a black lateral line and reddish spots on the dorsum. We looked at each other, initially skeptical; seconds later, when the realization hit us, we were jumping and shouting with excitement!

We had rediscovered one of the rarest species in all of Ecuador, which had not been seen for 30 years, despite rigorous efforts and a significant herpetological focus on the region (Arteaga et al. 2013). This was *Atelopus mindoensis* Peters, 1973, which had been considered extinct for a long time (Barrio-Amorós et al. 2020). Neotropical forests continually yield new data and surprises to the trained eye!



Some of the most bizarre yet abundant toads in the Amazon are those of the *Rhinella margaritifera* complex (left); the genus *Rhinella* harbours many typically shaped toads, but this species, *R. festae*, does not fall into that category! (right).

## The Upper Amazon

The Amazon, or Oriente, encompasses roughly 130,000 km<sup>2</sup> in the country, extending approximately 600 km in length and up to 300 km in width from the Peruvian and Colombian borders to the eastern Andean foothills. This bioregion includes two prominent and isolated volcanic systems: Sumaco, reaching 3,732 m, and the highly active Reventador, which rise sharply above the surrounding lowlands that typically sit below 600 m. The landscape is dominated by the most extensive block of primary habitat in the country, consisting of approximately eight to nine million hectares of tropical evergreen



With around 100 species in the genus *Atelopus*, there are still species to be described, like this one in southern Ecuadorian Amazon



Bufoanids can have many more shapes and ways of life than one could imagine: this highly arboreal species is *Osornophryne guacamayo* (female – left, male – right), which lives always on branches and trees.



The Upper Amazon is one of the richest areas in the Neotropics for centrolenids or glass frogs: here depicted is *Hyalinobatrachium munozorum*, an inhabitant of the canopy (left); another glass frog in the area is *Rulyrana mcdiarmidi*, a saxicolous species (right).

forest. This includes the high-biodiversity piedmont transition zones and the vast *terra firme* and seasonally flooded forests of the lowland basin.

It would be impossible to mention all the amphibian species in the area; therefore, I shall highlight only some of the most iconic, or those I have had the opportunity to photograph.

This region is home to several remarkable bufoanids, such as the crested toad *Rhinella margaritifera* (Laurenti, 1768) and the distinctive-

faced *Rhinella festae* (Peracca, 1904). Naturally, it is also home to various *Atelopus* species, including *Atelopus nepiozomus* Peters, 1973, *Atelopus palmatus* Andersson, 1945, and even several species that remain undescribed.

The transparency of centrolenids never ceases to amaze. One might encounter the delicate *Hyalinobatrachium munozorum* (Lynch & Duellman, 1973), the ornate *Rulyrana mcdiarmidi* (Cisneros-Heredia et al., 2008), or



A common dweller of the Amazonian rainforests is this beautiful species with golden spots, the Midas glass frog *Teratohyla midas* (left); less common, and closely associated with foothill forests, is this glass frog with very long fingers, *Nymphargus posadae* (right).



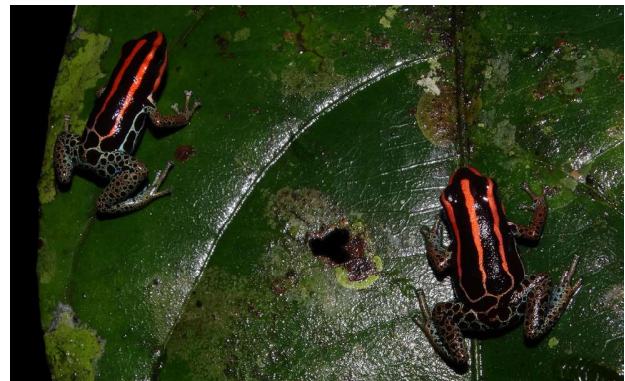
Probably the most beautiful and one of the rarest of all glass frogs in Ecuador, the recently described and already critically endangered *Centrolene charapita*.

*Allobates zaparo* (left), a Batesian mimic, is nearly identical to *Ameerega bilinguis* (right), the poisonous model; both species are microsympatric.

the golden-spotted *Teratohyla midas* (Lynch & Duellman, 1973). In more specialized niches, one might find the rare *Nymphargus posadae* (Ruiz-Carranza & Lynch, 1995) near the base of the Sumaco volcano, or the breathtakingly beautiful *Centrolene charapita* Twomey et al., 2014, at the southern edge of the country.

The Amazon offers a masterclass in evolution. The poison-dart frog *Ameerega bilinguis* (Jungfer, 1989) is often found alongside its Batesian mimic, the innocuous *Allobates zaparo* (Silverstone, 1876) — a harmless frog that has evolved to look nearly identical to its toxic neighbour for protection. It is also possible to observe *Ranitomeya variabilis* (Zimmermann & Zimmermann, 1988) or *Ranitomeya ventrimaculata* (Shreve, 1935) in different areas; the former typically inhabiting bromeliads, while the latter is widespread on vertical mossy trunks. Another jewel is the Ecuadorian morph of *Excidobates captivus* (Myers, 1982), a small representative of the genus.

Among tree frogs, the genus *Osteocephalus* is incredibly speciose here (with 14 species in Ecuador alone). Perhaps the most unusual is *Osteocephalus verruciger* (Werner, 1901), with its coarsely verrucose dorsum. Meanwhile, the genus *Hyloscirtus* — such as the spectacular *Hyloscirtus lindae* (Duellman &



As *Ranitomeya ventrimaculata* is a diurnal species, at night, it can be seen (often in pairs) sleeping exposed on green leaves.

Altig, 1978), with its "painted nails" — clings to the torrential streams of the Andean slopes. Other notable species include members of the *Dendropsophus leucophyllatus* group, such as *Dendropsophus sarayacuensis* (Shreve, 1935) or *Dendropsophus bifurcus* (Andersson, 1945).

Another significant and strangely odorous frog is the chocolate-coloured *Nyctimantis rugiceps* Boulenger, 1882, which can aggressively defend tree holes used for reproduction against other



*Excidobates captivus* is a small and rare species inhabiting big bromeliads in terrestrial habitats in the southern Ecuadorian Amazonia (left); the treefrogs of the genus *Osteocephalus* are omnipresent in the Ecuadorian Amazon, where 14 species are known and *O. verruciger* is probably one of the most prominent of them due to its highly granular dorsum (right).

males. Other striking tree frogs in the family Phyllomedusidae include *Phyllomedusa vaillanti* Boulenger, 1882, *Phyllomedusa tarsi* (Cope, 1868), and *Agalychnis hulli* (Duellman & Mendelson, 1995).

It was in the Amazonian foothills of Ecuador where the Spanish herpetologist Jiménez de la Espada described the first known *Pristimantis*, *Pristimantis galdi* Jiménez de la Espada, 1870, in 1870 — one of the most distinctive in the genus. Another highly specialized species due to its cryptic nature is *Pristimantis katoptroides* (Flores, 1988),

reminding us that the most fascinating species are often the hardest to spot.

During an expedition to the Sumaco volcano, I observed the abundance and peculiar habits of the arboreal bufonid *Osornophryne guacamayo* Hoogmoed, 1987. This slow tree-climber adopts unexpected poses, from vertical surfaces to positions reminiscent of "frog yoga". It differs significantly from the short-limbed, nearly sympatric *Osornophryne sumacoensis* Gluesenkamp, 1995, and bears little resemblance to the stout, high-Andean *O. bufoniformis*.



Another species of *Osteocephalus* is smaller and has more vivid colours, *O. cabreræ* (left); a striking species of *Dendropsophus* from the *leucophyllatus* group is *D. bifurcus* (right).



This is a frog I had always wanted to find in nature, not because it is especially spectacular, but because the published references talk about its chocolate smell... *Nyctimantis rugiceps*; and yes, it does smell of it, but it is also more beautiful than I expected, with complex behaviour (left); some of the most spectacular monkey frogs occur here in the Upper Amazon, the most common being *Phyllomedusa vaillanti* (right).

## The Humid Chocó

The Pacific slopes of the Ecuadorian Andes represent a sharp altitudinal transition spanning approximately 70,000–80,000 km<sup>2</sup>, running the 600 km length of the country and reaching widths of 100–150 km from the coastline to the high peaks of the Western Cordillera.

This region generally lacks internal volcanic structures, as the primary volcanic activity is centered on the Andean crest to the east; yet, the terrain reaches maximum altitudes of 4,500–5,000 m at the mountain transitions. The habitat is defined by a north-south moisture gradient, where the northern Chocó wet forests and the southern Tumbesian dry forests historically occupied over six million ha. The critical cloud forest belt, situated between 1,000 and 3,000 m, serves as a high-biodiversity bridge between the coastal lowlands and the alpine zones, harbouring a significant portion of the region's endemic and threatened species.

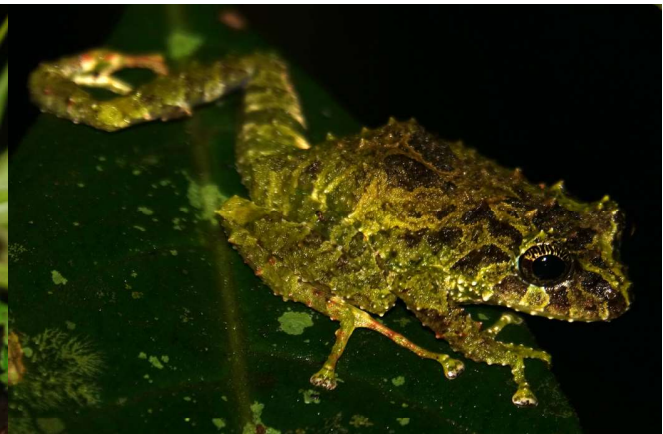
Of course, there are several Chocó specialities, such as the Little Devil Frog (*Oophaga sylvatica* (Funkhouser, 1956)), which



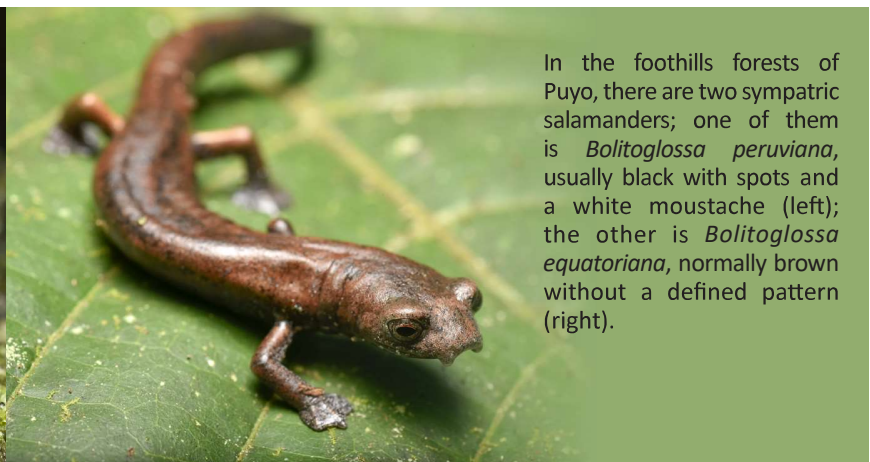
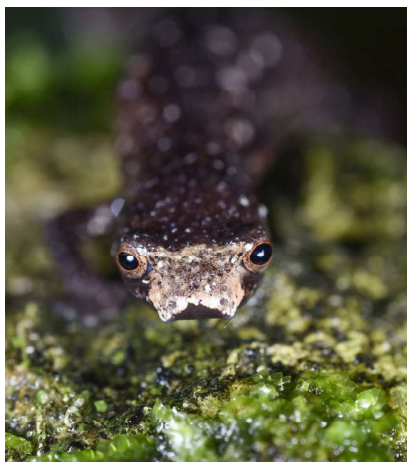
A second species of phyllomedusid is the largest in the country, *Phyllomedusa tarsius*.



*Pristimantis galdi* is the type species of its genus, the largest among vertebrates; it was described by the Spanish explorer Marcos Jiménez de la Espada.



Some species of *Pristimantis* are so cryptic that if they remain still on tree bark covered with moss, they are totally invisible, like this *P. katoptroides*.



In the foothills forests of Puyo, there are two sympatric salamanders; one of them is *Bolitoglossa peruviana*, usually black with spots and a white moustache (left); the other is *Bolitoglossa equatoriana*, normally brown without a defined pattern (right).



Here is the author (with hat) with some of his fellow explorer-friends. (From left to right: Eric Osterman, Amanda Quezada, César Barrio-Amorós and Darwin Núñez; photo by José Vieira).



*Oophaga sylvatica* is probably the most phenotypically variable poison frog in Ecuador, along with *Epipedobates tricolor* and *E. anthonyi*. Here we see different colour patterns, all from northwestern Ecuador.

displays a stunning array of colour morphs across its range. Unfortunately, the species is endangered by unscrupulous collectors and poachers. Recently, we reported the third country record of a rare centrolenid, *Cochranella granulosa* (Taylor, 1949) (Barrio-Amorós et al. 2024).

Herping also provides clarity to science. Recent field observations have corrected previous records: what was once thought to be *C. granulosa* in Ecuador should now be considered *Cochranella cf. ramirezi* Ruíz-Carranza & Lynch, 1991, pending further molecular studies. Numerous other glassfrogs can be found in the region, including the spectacularly transparent *Hyalinobatrachium aureoguttatum* (Barrera-Rodriguez & Ruiz-Carranza, 1989) and *Hyalinobatrachium chirripoi* (Taylor, 1958).

Other frogs in the area include members of the Craugastoridae and Hylidae families. Both are favourites during my herping expeditions. The spectacular *Pristimantis ornatissimus* (Despax, 1911) is arguably the most beautiful frog in the genus. Another classic and still abundant species is the Chachi tree frog *Boana picturata* (Boulenger, 1899), a species with huge eyes that looks as though it were hand-painted.

One of the strangest-looking species is *Trachycephalus jordani* (Stejneger & Test, 1891), with its highly specialized casqued cranium, adapted to live in and seal small holes in trees and branches with its head. For those looking beyond frogs, the Chocó also hides several salamanders, the most abundant and one of the prettiest being *Bolitoglossa biseriata* Tanner, 1962, as well as the elusive, worm-like caecilian *Epicrionops bicolor* Boulenger, 1883.



In our reporting of *Cochranella granulosa* from Ecuador (Barrio-Amorós et al. 2024), we overlooked that the population we studied might instead represent *C. ramirezi*, whose description more closely matches the specimen examined. In the absence of more detailed studies, I would like to correct that identification and, for the time being, list it as *C. cf. ramirezi*.



*Pristimantis ornatissimus* is probably one of the most colourful and striking species in the genus.



Since I was very young, I had dreamed of visiting the Chocoan rainforests to find this amazing frog, *Boana picturata*, which has perhaps the largest eyes relative to body size among all anurans.



In the Pacific dry forests south of the Chocó, other species appear, including one very distinct in shape and size, *Trachycephalus jordani*, which inhabits holes in trunks and has a heavily reinforced casque head.



Caecilians are not easy to find anywhere. Here is a rare one, *Epicrionops bicolor*, found at a lodge on the Ecuadorian Pacific slopes.

## Dangers to Biodiversity

The Pacific slopes and Chocó lowlands are currently facing a critical tipping point due to the rapid expansion of large-scale African oil palm (*Elaeis guineensis* Jacq.) plantations. This agricultural intensification has resulted in the massive conversion of primary evergreen forests into fragmented monocultures, particularly in the provinces of Esmeraldas, Santo Domingo, and Los Ríos. This leaves only 3% to 8% (depending on the source) of the original forest habitat intact.

For the region's highly specialized amphibians, this transformation represents not only the direct loss of complex microhabitats but also a drastic reduction in environmental humidity and the introduction of agrochemical runoff into vital breeding streams. The resulting habitat isolation creates "islands" of remaining forest that are often too small to sustain viable populations of Chocoan endemics, leaving them increasingly vulnerable to local extinction. This is particularly true for *O. sylvatica*, whose phenotypic variation could be destroyed before it is even fully documented.

In the Ecuadorian Amazon, the primary drivers of environmental degradation are the legal and illegal extraction of mineral resources, particularly alluvial gold mining and large-scale copper and gold projects in the southern Andean foothills (Cordillera del Cóndor). These activities lead to the total removal of topsoil and the destruction of riparian vegetation, which are essential for the life cycles of numerous Amazonian frog species and all other beings. Beyond physical habitat loss, the use of mercury in artisanal mining and acid drainage from industrial sites contaminate the hydrological network, causing long-term toxicological impacts on both aquatic larvae and terrestrial adults.

When combined with expanding infrastructure for oil exploration, these mining pressures are rapidly encroaching upon previously pristine wilderness areas, threatening the stability of the world's most biodiverse amphibian assemblages.

## Planning Your Expedition

Ecuador is a paradise, but its terrain is rugged and its species are often hidden in micro-habitats. To truly experience the herpetological wealth of this country, it is essential to contact professionals like CRWild or other local partners. They provide the logistical expertise, local knowledge of restrictions, and connections to the right experts to ensure your expedition is both successful and ethically conducted.

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