State of the World's Amphibians:

The Second Global Amphibian Assessment

Table of Contents

Cover: The Galaxy Frog *Melanobatrachus indicus* is one of the rarest frogs in India and the only species of its genus, making it quite literally one-of-a-kind. This star-studded frog is classified as Vulnerable because of ongoing habitat loss within its restricted range in the Western Ghats.

Right: Jackson's Climbing Salamander *Bolitoglossa jacksoni*, see pg. 70

Acknowledgments

First and foremost, we thank the 1,000+ scientists who contributed their time, expertise, and data (including datasets they have yet to publish) to the IUCN Red List assessments of the second Global Amphibian Assessment (GAA2).

We express our deep gratitude to Simon Stuart for his dedication to amphibian conservation, and for his guidance and friendship; to Darrel Frost for his curation of Amphibian Species of the World, which served as the source of amphibian taxonomy for the first and second GAA initiatives, and remains integral to understanding the depth and breadth of amphibian biodiversity; and to Craig Hilton-Taylor for his tireless commitment to the IUCN Red List of Threatened Species, his patient training, and his meticulous processing of each assessment.

Finally, we thank all of our financial supporters for their investment in this critical initiative:

Recommended citation:
Re:wild, Synchronicity Earth, IUCN SSC Amphibian Specialist Group. 2023. *State of the World's Amphibians: The Second Global Amphibian Assessment.* Texas, USA: Re:wild.

Executive Summary

Amphibians are incredibly diverse, occur in nearly every habitat, and span almost the entire planet. Many species have narrow habitat preferences and small distributions, often making them especially sensitive to the rapid environmental changes taking place worldwide. Amphibian populations can provide valuable insights into the overall health and ecological balance of an ecosystem.

Through the second Global Amphibian Assessment (GAA2), more than a decade of research on amphibians by over 1,000 experts has been compiled to assess the extinction risk of 8,011 species worldwide. The GAA2 follows on from the first GAA, completed in 2004, which illuminated the unfolding amphibian extinction crisis and established a baseline for monitoring trends and measuring conservation impact. Now, the GAA2 reveals that the conservation status of the world's amphibians continues to deteriorate.

We now know that 41% of amphibians are globally threatened with extinction, making them the most threatened vertebrate group.
Salamanders are particularly at risk, with 3 out of every 5 species threatened with extinction. The number of amphibian extinctions could be as high as 222, when considering the 37 confirmed extinctions and an additional 185 species with no known surviving population.

Habitat loss remains the most common threat to amphibians, affecting 93% of threatened species.
Agricultural expansion continues to be the main cause of habitat loss and degradation, followed by timber and plant harvesting, and infrastructure development. Amphibians are also threatened by disease in many parts of the world. Over the past few decades, chytridiomycosis has had a devastating impact on amphibian populations, and the emergence of a new fungal pathogen in Europe that targets salamanders has raised fears of another epizootic. The effects of climate change are emerging as a concerning threat as amphibians are particularly sensitive to changes in their environment.

Amphibian species are not evenly distributed across the globe.
They are predominantly clustered in tropical montane humid forests as well as on tropical islands. Islands with high endemism and extensive habitat loss, such as those in the Caribbean, dominate the list of 15 countries or territories with an extraordinarily high percentage of threatened species. The Neotropics, home to almost half of the world's amphibians, is also the most highly threatened realm, with 48% of species at risk of extinction. Other large concentrations of threatened amphibians are found in western Cameroon and eastern Nigeria, the Eastern Arc Mountains of Tanzania, Madagascar, the Western Ghats of India, Sri Lanka, and central and southern China.

Conservation needs to be massively scaled-up.
Since 1980, the extinction risk of 63 species has been reduced due to conservation interventions, proving that conservation works. We must build on this momentum and significantly scale-up investment in amphibian conservation if we are to stop and reverse declines. Drawing on the results of the GAA2, this report provides guidance for conservation by identifying landscapes with disproportionately high numbers of threatened species, as well as the most highly threatened amphibian genera. It also highlights the need to protect globally important sites for amphibians, and the urgent necessity to better understand and find solutions to the problems that disease and climate change present. It is imperative that we now use this information to effectively conserve and restore the world's amphibians.

A Critically Endangered species endemic to the Western Ghats in India, the Resplendent Bush Frog *Raorchestes resplendens* lives up to its name. Each year during the southwest monsoon, hundreds of people travel from afar just to witness this brightly colored frog in the wild.

© Sandeep Das

Forewords

The headline finding of The State of the World's Amphibians report is that 41% of all amphibians are threatened with extinction – a sobering figure that should raise alarm bells and lead us to act. Mobilizing resources to find missing or lost species, protect their native habitat, and breed them under human care for future reintroduction, are just a few of the many interventions in the conservation toolbox to stop and revert species declines.

Amphibians, as well as cycads, sharks, and corals, are among the groups of animals, fungi and plants that have undergone the greatest population declines. They are part of the more than one million species facing higher risk of extinction in the near future. The Anthropocene era, created by the impact of humans on the planet, is characterized by the intertwined climate and biodiversity crises.

To address this, in 2022, the world's nations adopted a series of targets under the Global Biodiversity Framework of the Convention on Biological Diversity. Governments have committed to avoiding extinction and restoring species. Crucial to achieving these targets is knowing which species are closest to extinction, why, and where they occur.

The State of the World's Amphibians report is a landmark analysis of the second Global Amphibian Assessment conducted by the IUCN SSC Amphibian Specialist Group's Red List Authority. It compiles the expertise and knowledge needed to guide conservation policies for these threatened animals.

The vision of IUCN is a "just world that values and conserves nature." Under the umbrella of the Union, Members, Commissions and the Secretariat, have catalyzed conservation actions that have prevented an even worse extinction crisis. I invite you to study these pages carefully, be inspired by the opportunities to restore our planet, and join us in saving amphibians, and ourselves. We know how to do conservation, we just need to do more of it.

Jon Paul Rodríguez
Chair, IUCN Species Survival Commission

Only described to science in 2015, Davenport's Reed Frog *Hyperolius davenporti* lives in a very small area in the Southern Highlands of Tanzania. This restricted range paired with continuing forest loss due to the expansion of agriculture, wood extraction, and human settlements has led to its Critically Endangered status.

© Tim Davenport

A female Magdalena Giant Glass Frog *Ikakogi tayrona* is unwaveringly devoted to protecting her young. This Vulnerable species is endemic to the Sierra Nevada de Santa Marta, an isolated mountain range in northern Colombia, where it is threatened by habitat loss resulting from agriculture and water pollution from agrochemicals.

© Pedro Peloso

Amphibians are some of the world's most diverse animals with an astonishing array of life history strategies. Although most species live in warm, tropical forests, others live in deserts, grasslands, temperate forests, wetlands, and in cold streams of some of the highest mountains on earth. Amphibians are a precious part of evolutionary history, and a key part of many food webs and ecosystems. But they are also vulnerable to abrupt environmental changes, making them an excellent indicator for the state of our planet's biodiversity.

This report presents a summary of the current status of amphibians across the world, covering all biomes and continents. As such, it serves as a guide for where and how to best conserve the 8,000+ amphibian species that share this planet with us.

The results of the first Global Amphibian Assessment, published in 2004, identified amphibians as the most threatened vertebrates worldwide and implicated disease, habitat loss, and over-exploitation as the leading threats. After nearly two decades of research, the second Global Amphibian Assessment now reveals that a staggering 41% of amphibian species are threatened with extinction, and the effects of climate change have emerged as a leading threat.

Our response to this increasingly dire situation should focus on this report's findings, for example:

- Genera with the highest proportion of threatened species can serve as catalysts for collaborative efforts to recover the most threatened amphibians. The Atelopus Survival Initiative, launched in 2021, has done just this, forging partnerships to conserve the genus, raising the profile of Atelopus toads, and catalyzing conservation efforts across all range countries.
- Developing collaborative approaches to the effective conservation of globally important sites for amphibians — Key Biodiversity Areas — and landscapes with high numbers of threatened amphibians is another strategic approach proposed by this report. It leverages the collective resources, ingenuity, and voices of all stakeholders to save and recover the amphibians present within a given site or landscape, while also benefiting countless other species of animals, plants, and fungi.

The State of the World's Amphibians should coalesce efforts to conserve amphibians into cost efficient and effective collaborations and serve as a clear call for the resources needed to deliver these strategic actions. To save amphibians, we must work as a global community to make the step-change required.

Penny Langhammer
Executive Vice President, Re:wild

Catherine Bryan
Trustee, Synchronicity Earth

Introduction

A chocolate brown salamander with a yellow streak cascading down its back, Müller's Mushroom-tongue Salamander *Bolitoglossa mulleri* is endemic to the forests of southern Mexico and northern Guatemala. Logging, agriculture, expanding human settlements, and reduced precipitation due to climate change all contribute to its Vulnerable listing.

Introduction

Amphibians are our allies in understanding the health of our planet. By protecting and recovering amphibians, we have the opportunity to restore terrestrial and aquatic ecosystems, safeguard genetic diversity, and invest in human communities for a fairer world in which all life thrives.

This report presents the results of the second Global Amphibian Assessment (GAA2). In-depth analyses of these data show where in the world new species are being described by science, the current conservation status of amphibians and what factors are driving changes for the better and the worse, and the opportunities for collaborative efforts to scale up both research and conservation for priority sites and species.

The Global Amphibian Assessment

The Global Amphibian Assessment (GAA) is a recurring initiative that comprehensively assesses all known amphibian species for the IUCN Red List of Threatened Species (IUCN Red List). It relies on the invaluable contributions of hundreds of dedicated herpetologists from over 100 countries. The GAA stands as a shining example of international collaboration and a shared commitment to understanding the conservation status of species.

2001 - 2004

The Global Amphibian Assessment (GAA), coordinated by IUCN and Conservation International and with assistance from NatureServe, provides the first comprehensive assessment of the extinction risk of all known amphibians at the time – 5,743 species.

2005

The IUCN Species Survival Commission establishes the Amphibian Specialist Group (ASG) from the amalgamation of the Declining Amphibian Population Task Force and the Global Amphibian Specialist Group.

2008

Threatened Amphibians of the World is published, providing an in-depth analysis of the GAA data, and individual species accounts for all threatened and extinct species.

2009

The Amphibian Red List Authority (ARLA) is established as the branch of the ASG responsible for assessing the extinction risk of all the world's amphibian species. This involves maintaining all amphibian data on the IUCN Red List.

2012 - 2014

Amphibian reassessments begin and build momentum toward the launch of the second Global Amphibian Assessment (GAA2) in 2015.

2015 - 2022

The GAA2, a joint initiative of IUCN, Re:wild and Synchronicity Earth, reassesses all GAA species and produces first-time assessments for 2,200+ newly described species. The IUCN Red List now has updated assessments for 8,011 amphibian species, a 40% increase since GAA.

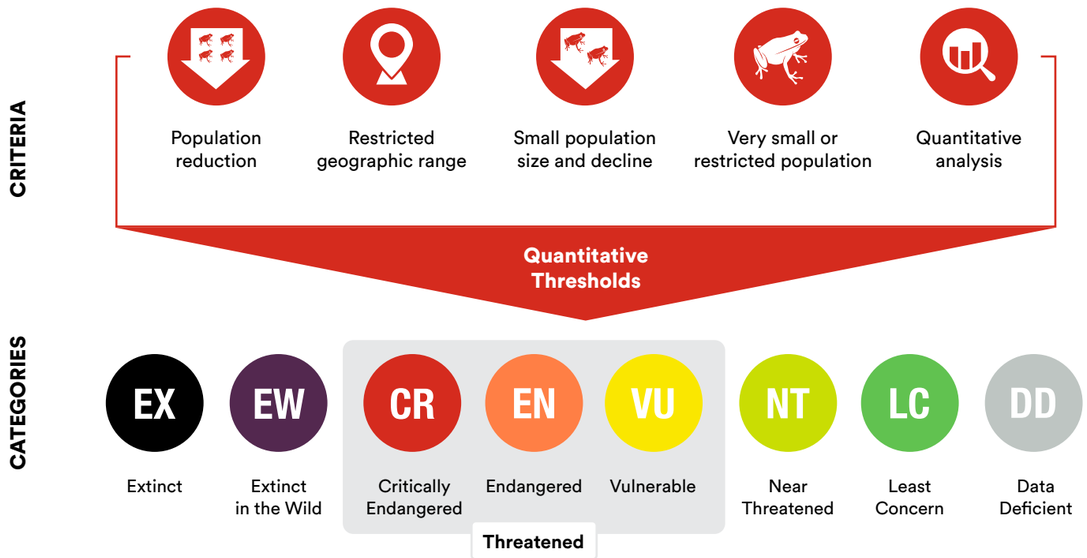
2023 - 2028

The third Global Amphibian Assessment (GAA3) has already begun with the anticipated completion date at the end of 2028.

2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028

The IUCN Red List is the world's most comprehensive information source on the global extinction risk status of species. It serves as one of the foundational tools for conservation planning, action, and investment at all scales. Far more than a list, it includes information on species' geographic range, population size and trends, ecology and habitat preferences, use and trade, threats, and conservation measures in place and needed. Each species is evaluated against the IUCN Red List Categories and Criteria and assigned to one of eight categories, with Vulnerable, Endangered and Critically Endangered species considered 'threatened'.

The IUCN Red List of Threatened Species

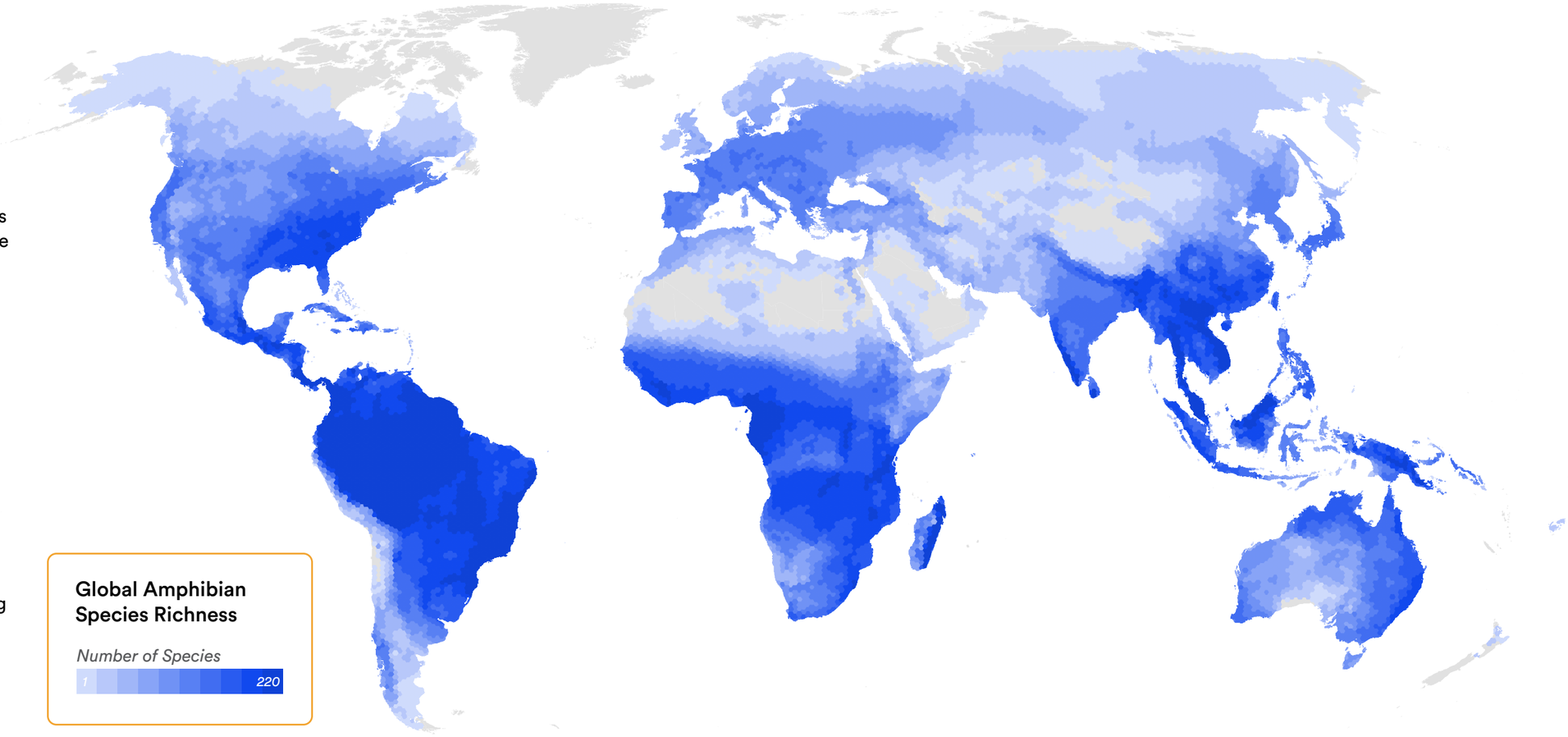


The Remarkable Diversity of Amphibians

Frogs, salamanders, and caecilians occur on every continent except Antarctica, yet the more than 8,600 described species are not equally distributed across the globe. Most amphibians live in humid tropical habitats, although some have evolved to survive in extreme environments such as dry deserts and the frozen tundras of the Arctic Circle.

Amphibians exhibit a wide variety of life history and reproductive strategies. Some species give birth to live young, while others raise their tadpoles in a skin pouch like a kangaroo. Frogs are well known as species that metamorphose from tadpoles, but some amphibians lay eggs that develop directly into miniature forms of adults, whereas others retain their juvenile characteristics – like gills – even into adulthood.

Amphibians have evolved into an incredible diversity of sizes, colors and behaviors. They can be as tiny as a common housefly and as long as a cow. Some resemble multi-colored jewels scattered on the forest floor, while others are masters of camouflage, mimicking tree bark or leaf-litter. There are amphibians that can glide through the air and others that spend nearly their entire lives underground.



Biogeographic Realms

Biogeographic realms are broad divisions of the Earth's land surface, defined by distinctive patterns of biodiversity.

See pg. 46 -59 for a detailed summary per realm

NEARCTIC

Salamanders represent 58% of amphibian species in the Nearctic, making it the only realm where salamanders outnumber frogs. The United States is the country with the most salamanders in the world, with 209 species. New species descriptions are infrequent in the Nearctic realm, as it has already received substantial research effort.

NEOTROPICS

Almost half of the planet's amphibians are found in the Neotropics. Brazil, Colombia, Ecuador, and Peru are home to the greatest number of species in the Neotropical realm and worldwide. The number of amphibian species in this region continues to rise unabated, with Brazil topping the list at 385 new species described since 2006.

PALEARCTIC

Despite being the largest realm by area, the Palearctic has only a moderate number of species that decreases northwards as the climate cools. Fewer new species have been described from well-studied countries in Europe, while China is still in the midst of a wave of new species discoveries.

AFROTROPICS

The Afrotropical realm has received considerably less research effort, but it is expected to be a treasure trove of amphibians. Most new species emerged from two amphibian hotspots: the forests of West and Central Africa and Madagascar, the latter of which has seen an astounding 175+ new species described since 2006.

INDOMALAYA

Increased taxonomic research in the Indomalayan region has generated a wave of new species descriptions, particularly from southern China and India. These two countries, along with Indonesia, hold the greatest number of amphibians in the region, with many more species awaiting discovery.

AUSTRALASIA & OCEANIA

Most Australasian amphibians are found in the forests of eastern Australia and New Guinea, and only three amphibian species are native to Oceania. While New Guinea has produced an extraordinary number of new species descriptions in recent years, the island remains one of the least explored areas for amphibians.

Three Major Groups

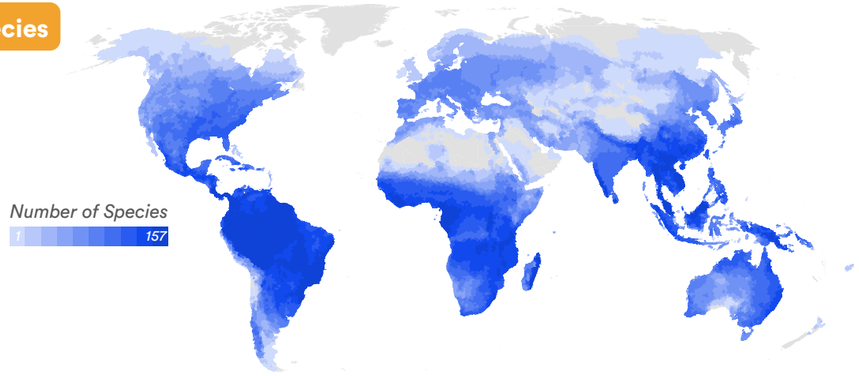
Frogs & Toads

88% Global Diversity

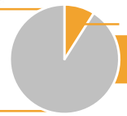
7047 Species

Anura

All toads are frogs, but not all frogs are toads. These tailless amphibians occur in nearly every corner of the globe, though they are particularly concentrated in tropical regions. Most of the world's amphibians are frogs.



Salamanders

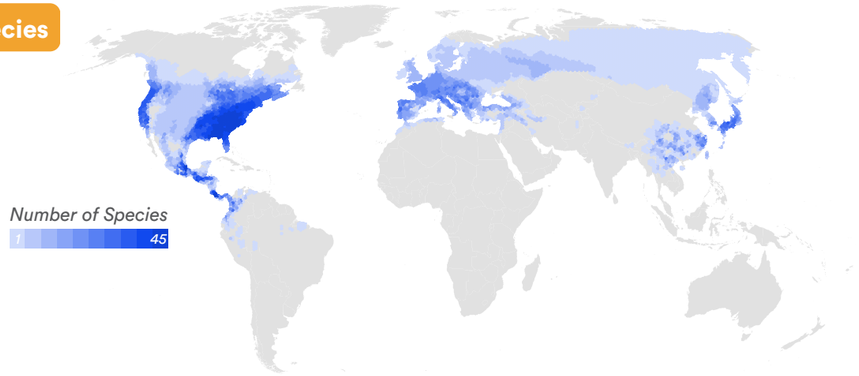


9% Global Diversity

758 Species

Caudata

Salamanders are tailed amphibians with long bodies and short limbs. They are almost entirely restricted to the northern hemisphere, with especially high concentrations in North America, Mesoamerica, Europe, Japan, and China.



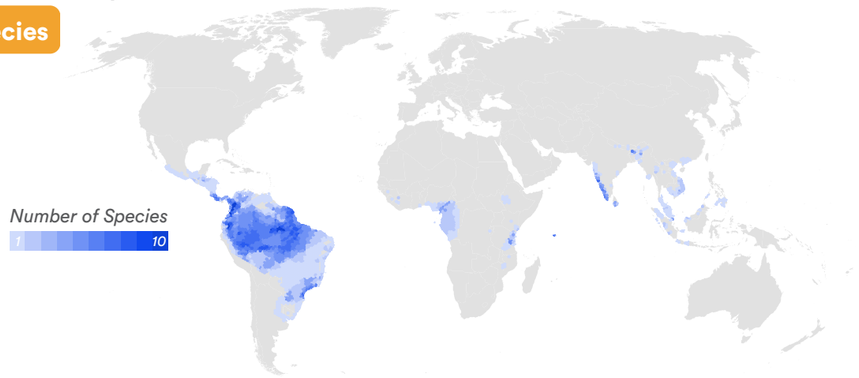
Caecilians

3% Global Diversity

206 Species

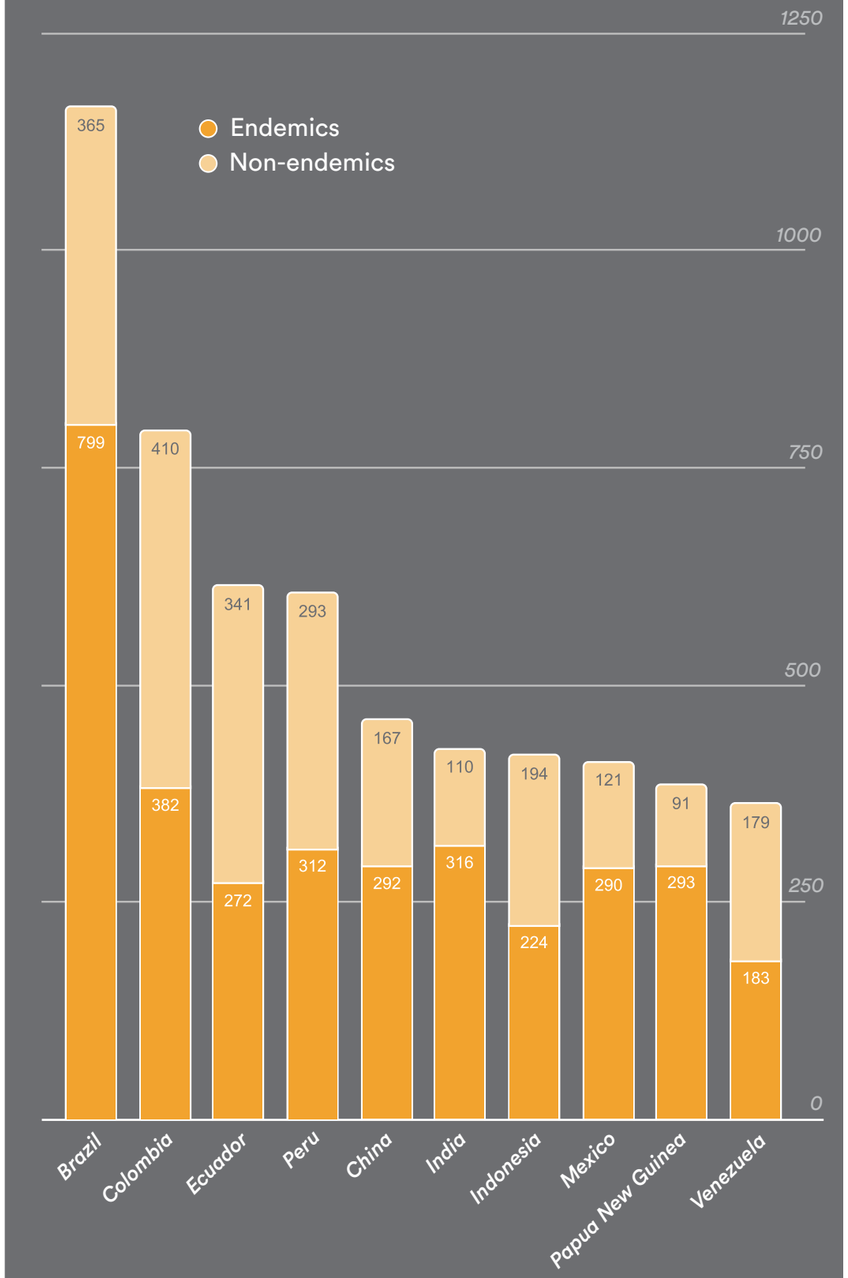
Gymnophiona

Caecilians are the least studied amphibians. These mysterious legless creatures often live underground and resemble large worms. Caecilians are found only in scattered regions in the tropics of Mesoamerica, South America, Africa and Asia.



Top 10

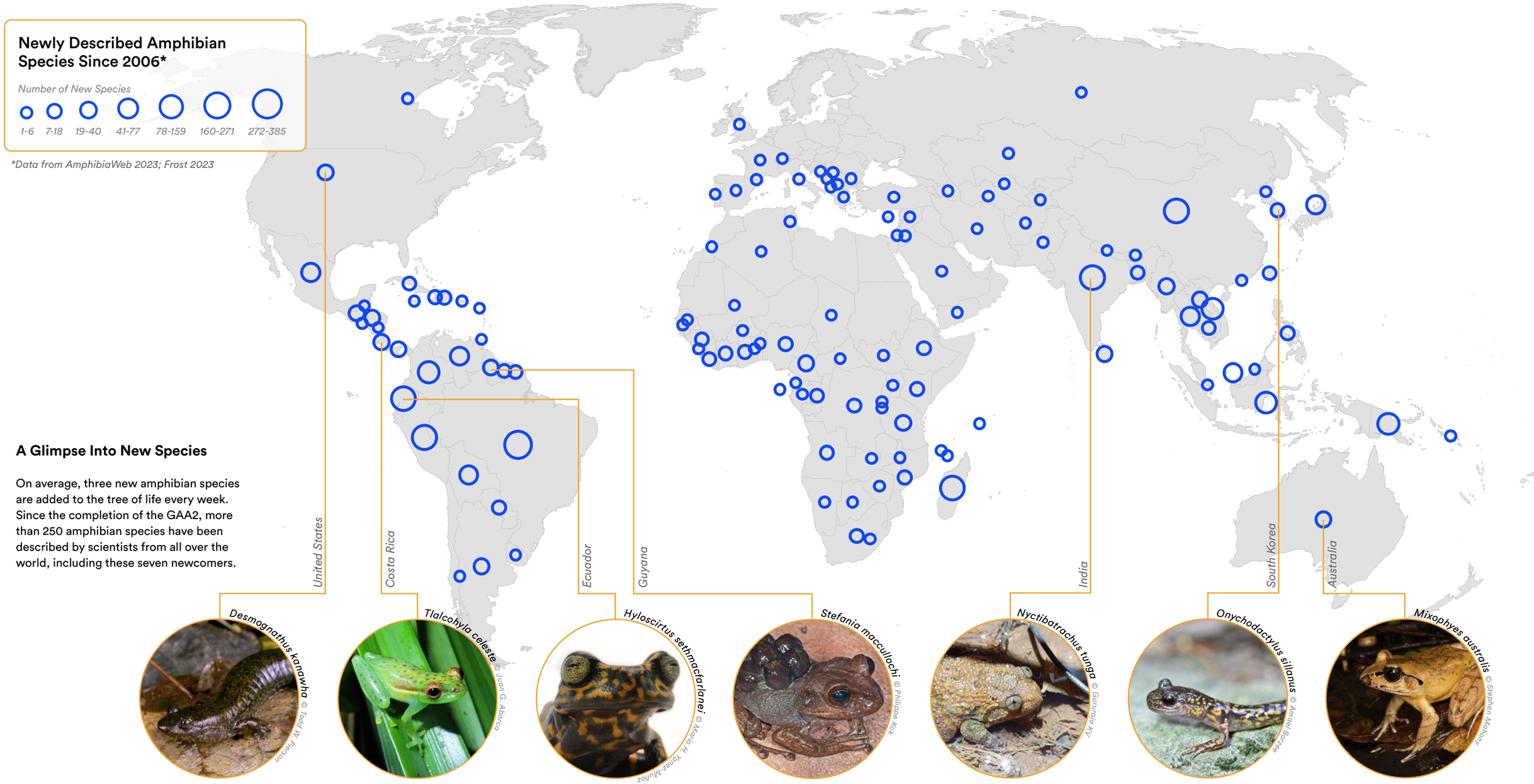
Countries with the most amphibians in the world



The Race to Describe the World's Amphibians

New species of amphibians are continually being described by scientists. Exploration of remote and difficult-to-reach parts of the world is uncovering previously unknown species, while advances in technology and DNA sequencing techniques are making it easier to identify new species than ever before. Each year, an average of 155 amphibian species are described, steadily increasing our knowledge of this group of animals.

At this rate, it is predicted that by the end of 2024, the world will have identified an astounding 9,000 amphibian species. The race to document the planet's amphibian species is vital, as the information gathered by scientists is used to inform conservation efforts, shape environmental policy, and better understand the interconnectedness of life on Earth.



A Glimpse Into New Species

On average, three new amphibian species are added to the tree of life every week. Since the completion of the GAA2, more than 250 amphibian species have been described by scientists from all over the world, including these seven newcomers.

Status of Amphibians

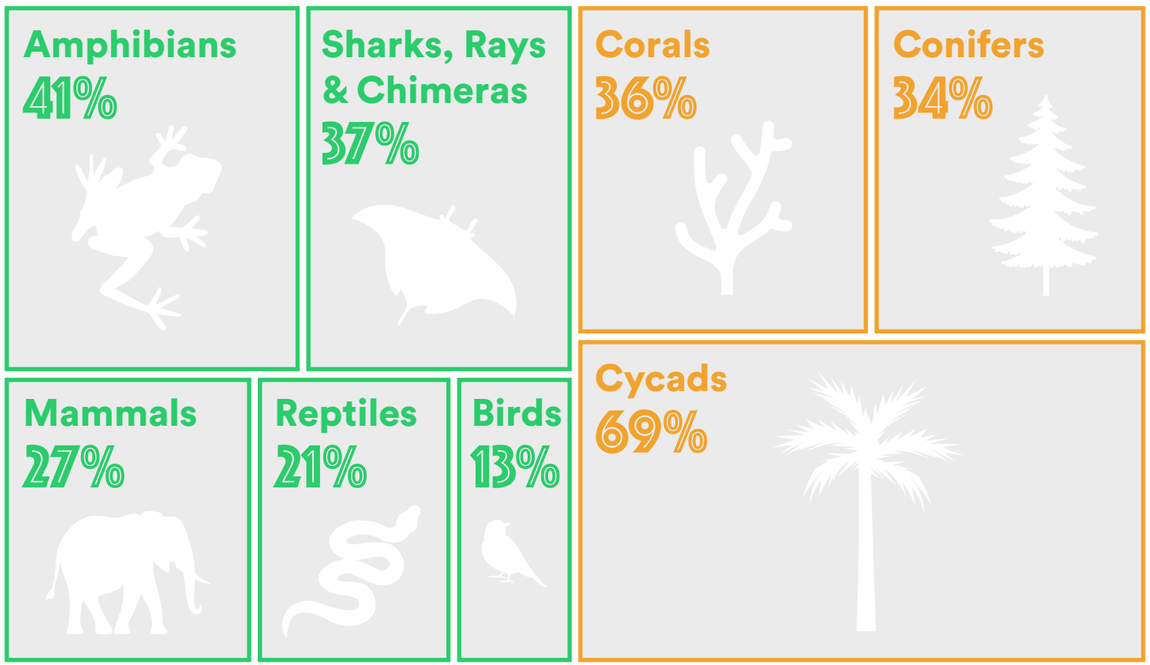
The Titicaca Water Frog *Telmatobius culeus* is a large, aquatic frog endemic to the Lake Titicaca basin in the Andean highlands of Peru and Bolivia. This Endangered frog is experiencing significant declines due to a perfect storm of threats: habitat degradation, introduced species, over-exploitation, disease, and climate change effects.

Conservation Status

Of the more than 150,000 animal, plant, and fungus species assessed for the IUCN Red List, 28% are globally threatened. Meanwhile, the GAA2 reveals that 41% of amphibians – or two out of every five species – are threatened. Among amphibians, salamanders are at particularly high risk of extinction, with 60% of species threatened.

The World's Most Threatened Vertebrates

There are a growing number of comprehensively assessed taxonomic groups published on the IUCN Red List. By using this global standard for measuring conservation status, it is possible to compare assessments across different groups. In comparison to other comprehensively assessed vertebrates, amphibians are the most threatened (41%), followed by sharks, rays and chimeras (37%), mammals (27%), reptiles (21%), and birds (13%). Other comprehensively assessed taxonomic groups are the reef-forming corals with 36% of species threatened, conifers with 34%, and cycads with 69%[2].

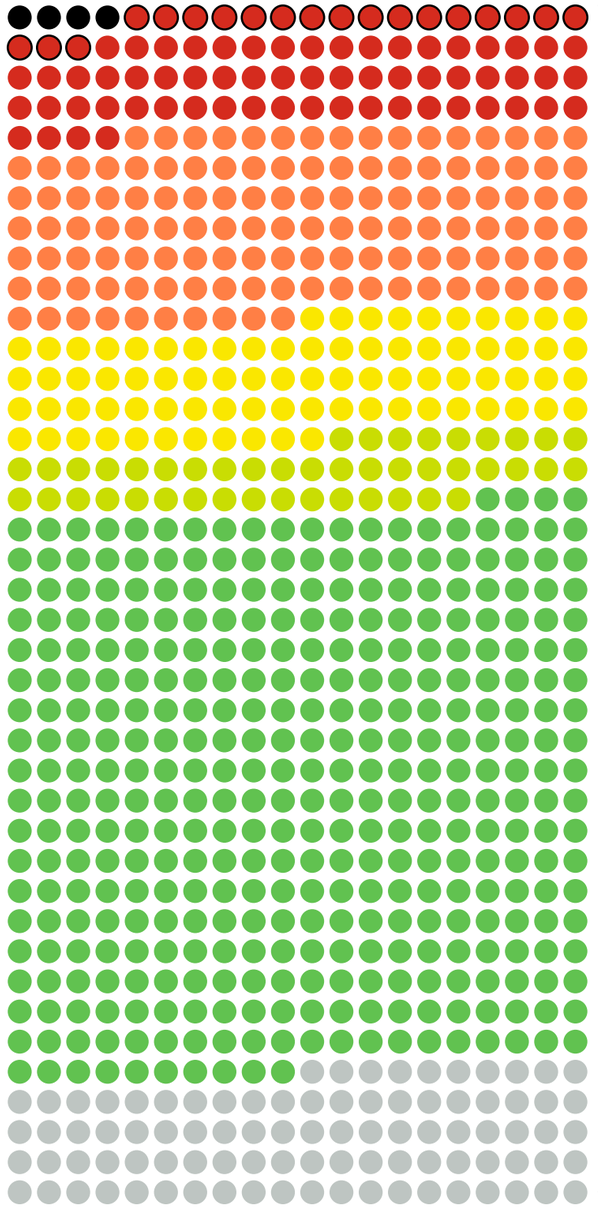


[1] *It is likely that DD species are threatened in similar or greater proportion as data sufficient species. Thus, a best estimate of the percentage of threatened species is calculated by excluding DD species from the total. EX species are also excluded. EW species are considered threatened species as there is still the chance for reintroduction in the wild.*
[2] *IUCN (2023)*

2 in 5 amphibians are threatened with extinction

- Extinct & Extinct in the Wild
- Critically Endangered (Possibly Extinct)
- Critically Endangered
- Endangered
- Vulnerable
- Near Threatened
- Least Concern
- Data Deficient

37
Confirmed extinctions (four since 2004)
Plus two Extinct in the Wild

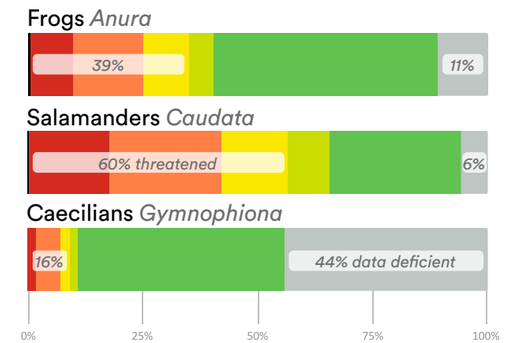


1 dot = 10 species

8,011
Total number of species assessed in the GAA2

2,873
Threatened species - listed as Critically Endangered, Endangered, or Vulnerable

41%
Of amphibian species assessed are threatened



Extinction risk varies across the three amphibian orders. Salamanders are considerably more threatened, on average, than frogs and caecilians. However, it is difficult to ascertain the true status of caecilians since many are Data Deficient.

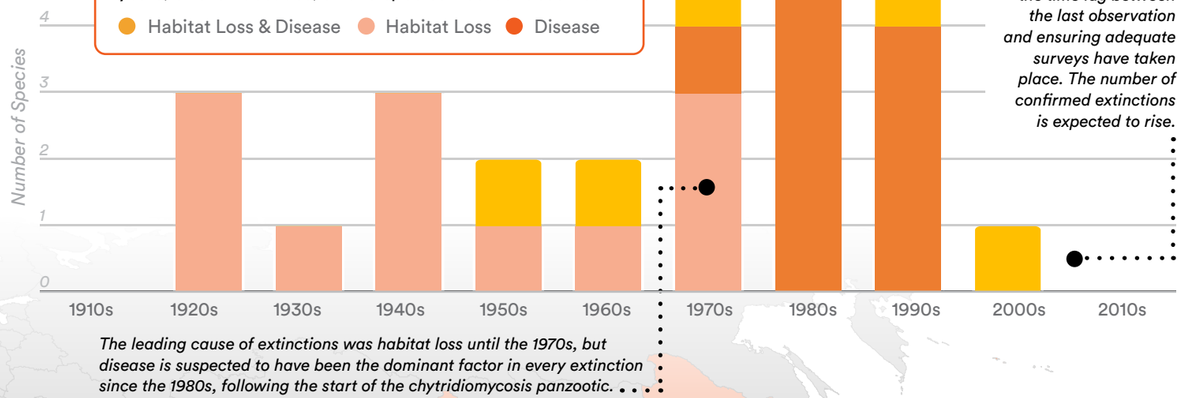
909 Species are Data Deficient
There is insufficient data to determine extinction risk
11% DD in GAA2, down from 23% in GAA

What We've Lost: Extinctions

Amphibians are disappearing faster than we can study them. With four more species listed as Extinct in the GAA2, there are now a total of 37 Extinct and two more Extinct in the Wild, surviving only in captivity. Extinctions are difficult to confirm, however. Due to the strict requirements for a species to be declared Extinct, these numbers are more a reflection of research effort rather than an accurate representation of global extinctions. Strong evidence suggests amphibian extinctions are significantly underestimated.

The Driving Forces of Amphibian Extinctions

For most species, we don't know the exact year of extinction, but rather the year it was last seen in the wild. In lesser surveyed areas an extinction may have taken place years, or even decades, after a species was last observed.



The low number of extinctions in the last two decades is due to the time lag between the last observation and ensuring adequate surveys have taken place. The number of confirmed extinctions is expected to rise.

The leading cause of extinctions was habitat loss until the 1970s, but disease is suspected to have been the dominant factor in every extinction since the 1980s, following the start of the chytridiomycosis panzootic.

USA
Anaxyrus baxteri (EW)
Lithobates fisheri
Plethodon ainsworthi

GUATEMALA
Craugastor myllomyllon
Pseudoeurycea exspectata

HONDURAS
Craugastor anciano
Craugastor omoaensis

VENEZUELA
Atelopus vogli

COSTA RICA
Atelopus chiriquiensis
Atelopus senex
Incilius periglenes

© Marcos Guerra / STRI

PANAMA
Atelopus chiriquiensis
Oophaga speciosa

Once abundant in the highlands of the Costa Rica-Panama border, the Chiriqui Harlequin Toad experienced a drastic disease-related decline over five years. Despite exhaustive searches, it has not been seen since 1996.

BRAZIL
Boana cymbalum
Phrynomedusa fimbriata

© Julia Lorsch Maher/WCS

TANZANIA
Nectophrynoides asperginis (EW)

The only species extinction documented in the 21st century is the Kihansi spray toad, because there has been no self-sustaining population in the wild since 2004.

CHINA
Cynops wolterstorffi

AUSTRALIA
Litoria nyakalensis
Rheobatrachus silus
Rheobatrachus vitellinus
Taudactylus acutirostris
Taudactylus diurnus

© Michael Mahony

Formerly a conspicuous inhabitant of upland rainforest streams in Queensland, the Sharp-snouted Day Frog experienced rapid declines due to disease between 1988 to 1993 and, despite extensive surveys, has not been seen since 1997.

© Wikipedia

SRI LANKA
Nannophrys guentheri
Pseudophilautus adspersus
Pseudophilautus dimbullae
Pseudophilautus eximius
Pseudophilautus extirpo
Pseudophilautus halyi
Pseudophilautus leucorhinus
Pseudophilautus maia
Pseudophilautus malcolmsmithi
Pseudophilautus nanus
Pseudophilautus nasutus
Pseudophilautus oxyrhynchus
Pseudophilautus pardus
Pseudophilautus rugatus
Pseudophilautus temporalis
Pseudophilautus variabilis
Pseudophilautus zal
Pseudophilautus zimmeri

A Spotlight On Sri Lanka

Sri Lanka holds the record for the most amphibians listed as Extinct. Of the 111 amphibians known from this tropical island country, 18 are listed as Extinct, 11 of which were last recorded in the late 1880s. Habitat loss is presumed to be the cause, with primary forest now covering only 3% of the island[3]. Recognition of these extinctions was only possible because of specimens that were collected between 1850 and 1940 and deposited in museums, followed by "intensive exploration" from 1993 to 2003[4]. Four species were not described until the early 2000s[5], even though they had gone extinct decades earlier. Unlike the unique case of Sri Lanka, most countries have been inadequately surveyed and lack extensive specimen collections dating back decades. Thus, the true number of amphibian extinctions may never be fully known.

[3] *Mongabay (2006)*
[4] *Meegaskumbura et al. (2007)*
[5] *Manamendra-Arachchi & Pethiyagoda (2005)*

Species on the Brink

Amphibians at greatest risk of extinction are listed as Critically Endangered (CR), with the optional tags of Possibly Extinct (CR(PE)), and Possibly Extinct in the Wild (CR (PEW)). Extensive habitat loss has resulted in concentrations of CR species in the Atlantic Forest of Brazil, Cameroonian Highlands, and Western Ghats of India, while species in China and Mainland Southeast Asia are under extreme pressure from both habitat loss and over-exploitation. Narrow range species endemic to islands, including Sri Lanka, Madagascar and the Caribbean, are also being pushed to near-extinction due to high deforestation rates. High concentrations of CR species are also found in the tropical rainforests of Mesoamerica, the Andes of South America, and northeast Australia, where disease and habitat loss have decimated populations.

Distribution of Species at High Risk of Extinction: CR, CR(PE), and CR(PEW)

Number of Species

1 — 23

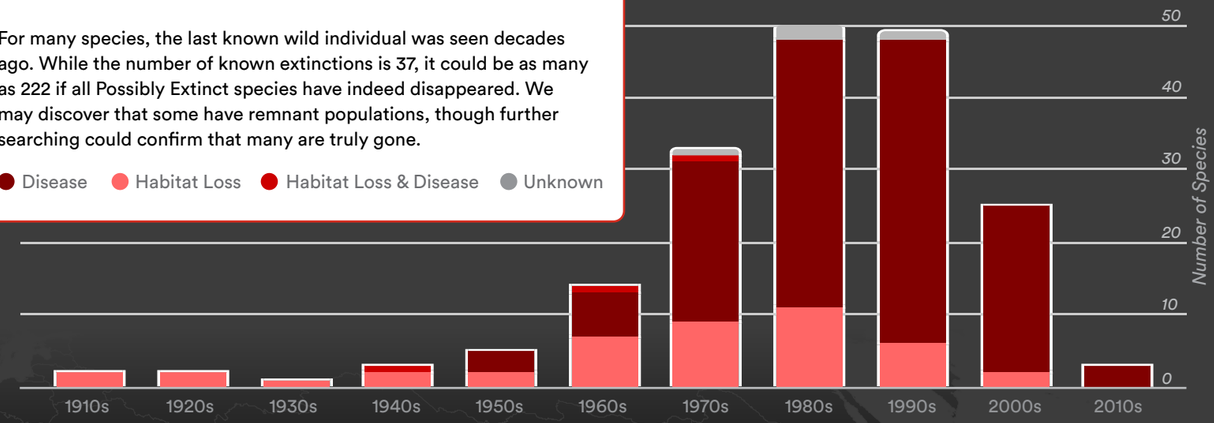
Possibly Extinct Species: Are They 'Lost' or Extinct?

It can be difficult to determine when a species has gone extinct, especially for cryptic amphibians occurring in under-surveyed areas. The GAA2 determined there are 185 Possibly Extinct species with no known surviving population and, given the evidence, are likely Extinct.

For many species, the last known wild individual was seen decades ago. While the number of known extinctions is 37, it could be as many as 222 if all Possibly Extinct species have indeed disappeared. We may discover that some have remnant populations, though further searching could confirm that many are truly gone.

Disease · Habitat Loss · Habitat Loss & Disease · Unknown

The number of amphibian extinctions could be as many as: 222

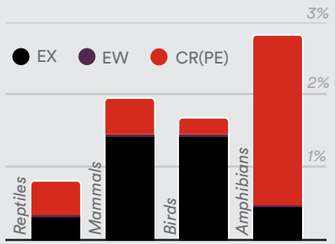


Harlequin Toads *Atelopus*

Many harlequin toads have experienced catastrophic declines linked to chytridiomycosis, often in combination with habitat loss and climate change effects. Three species are Extinct and 66 are Critically Endangered, of which more than half are Possibly Extinct. While the recent rediscovery of surviving populations suggests that some species are persisting, others may not be so fortunate.

Compared to Other Groups

Amphibians far exceed other groups of vertebrates when comparing the proportion of species on the brink of extinction. The large CR(PE) to EX ratio for amphibians illustrates the ongoing extinction crisis and unless there is immediate action, the number of Extinct amphibians will soon surpass mammals and birds.



Threatened Species Hotspots

Threatened amphibians are concentrated in certain parts of the world. They tend to be clustered in moist tropical forests in mountainous areas as well as on tropical islands. The most notable concentrations of threatened species are located in the Caribbean, Mesoamerica, the Tropical Andes, the mountains and forests of western Cameroon and eastern Nigeria, Madagascar, the Western Ghats of India, and Sri Lanka. Other major concentrations occur in the Atlantic Forests of southern Brazil, the Eastern Arc Mountains of Tanzania, central and southern China, and the Annamite Mountains of Vietnam.

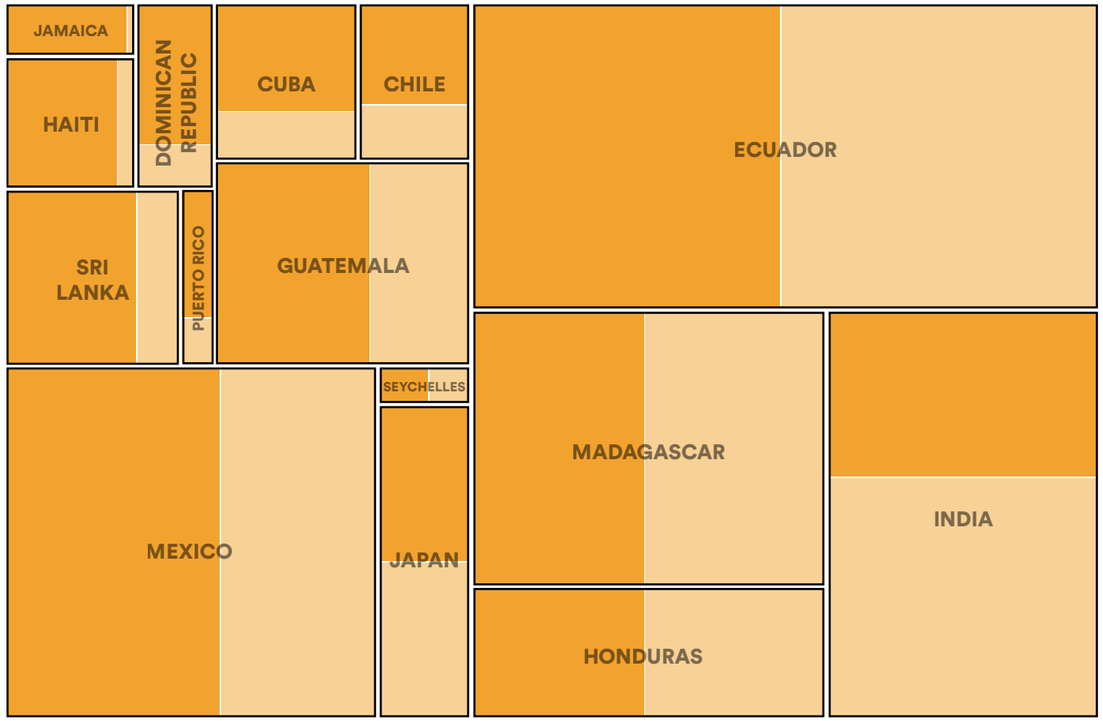
Nine countries have more than 100 threatened species (see below). Colombia ranks highest for number of threatened species (301) followed closely by neighboring Ecuador (291). As expected, this list is dominated by megadiverse countries, although there are notably two missing, Indonesia and Papua New Guinea, which have only 29 and 27 threatened species respectively. In contrast, Madagascar ranks 12th for total diversity but 6th for threatened species.

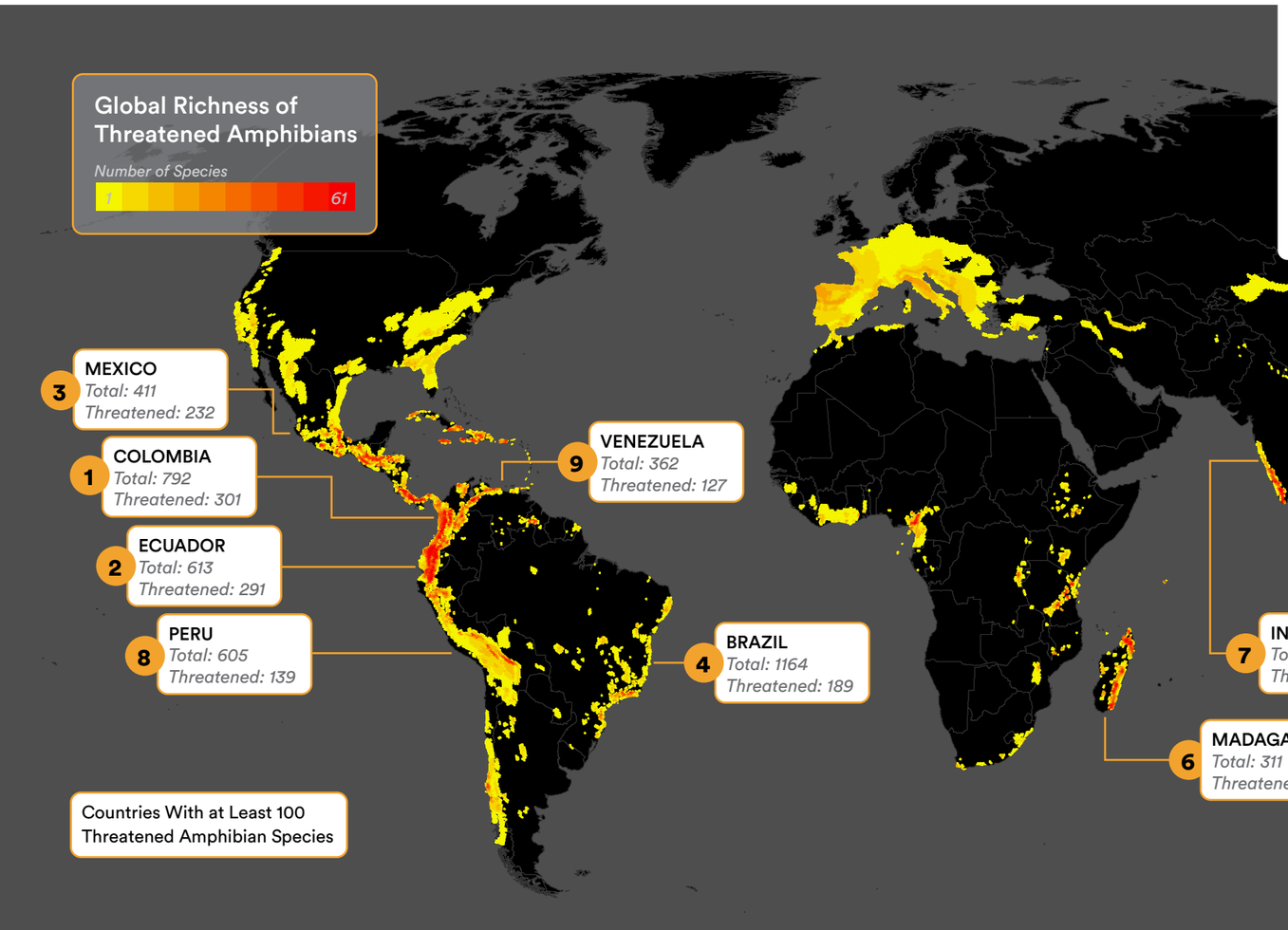
In this treemap, countries are sized relative to the total number of amphibians within them, then scaled by threatened status. For example, Jamaica has relatively fewer species, however nearly all (95%) are threatened.

- Threatened
- Non-threatened

Jamaica (95%), Haiti (87%), Dominican Republic (78%), Sri Lanka (76%), Puerto Rico (74%), Cuba (70%), Chile (65%), Guatemala (60%), Mexico (58%), Seychelles (55%), Japan (50%), Ecuador (49%), Madagascar (49%), Honduras (49%), India (41%).

Countries and territories where amphibians are disproportionately threatened
Greater than or equal to the global average of 41%





Amphibians are disproportionately threatened (i.e., greater than or equal to the global average of 41%) in 15 countries or territories, nine of which are islands with a large percentage of endemic species and extensive habitat loss.

Three Caribbean countries – the island of Jamaica, and Haiti and the Dominican Republic, which form the island of Hispaniola – lead the world in terms of percentage of threatened amphibians, with more than 75% of their species being at risk of extinction, and Puerto Rico and Cuba are trailing closely behind. Several countries in Mesoamerica (Guatemala, Mexico, and Honduras) and the Andes of South America (Chile and Ecuador) also make the top 15 list for highest proportion of globally threatened amphibians.

Poorly Known Species

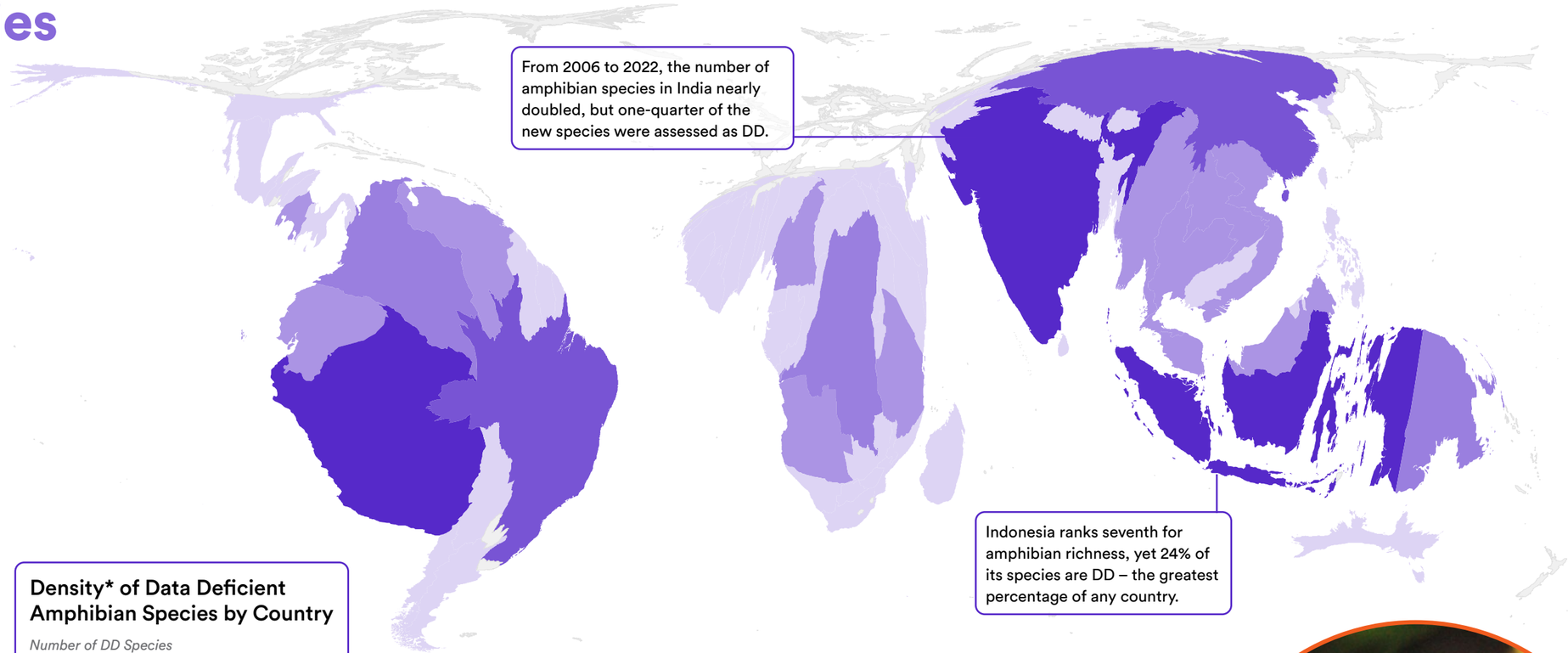
The true number of threatened amphibians remains unknown. There are 909 species (11%) categorized as Data Deficient (DD), meaning there is insufficient data available to assess their extinction risk.

If DD species are threatened in the same proportion as data sufficient species[6], there could be at least 370 more threatened amphibians that remain unidentified. **A recent study suggested that as many as 85% of DD amphibians could be threatened[7].** Further research is urgently needed to identify the species at a high risk of extinction before it is too late.

Amphibian data can be scarce for a range of reasons, such as a shortage of herpetologists or challenges in accessing certain areas. In the highly biodiverse country of Indonesia, there has been relatively limited survey effort in part because of a lack of trained herpetologists. The Democratic Republic of the Congo, Myanmar, Angola, and Papua New Guinea are facing similar challenges of data scarcity. In contrast, countries such as India, Peru and China have seen a recent growth in amphibian research resulting in a wealth of new species descriptions. Yet many of these new species are known only from one or a few individuals and are often categorized as DD.

From 2006 to 2022, the number of amphibian species in India nearly doubled, but one-quarter of the new species were assessed as DD.

Indonesia ranks seventh for amphibian richness, yet 24% of its species are DD – the greatest percentage of any country.



Density* of Data Deficient Amphibian Species by Country

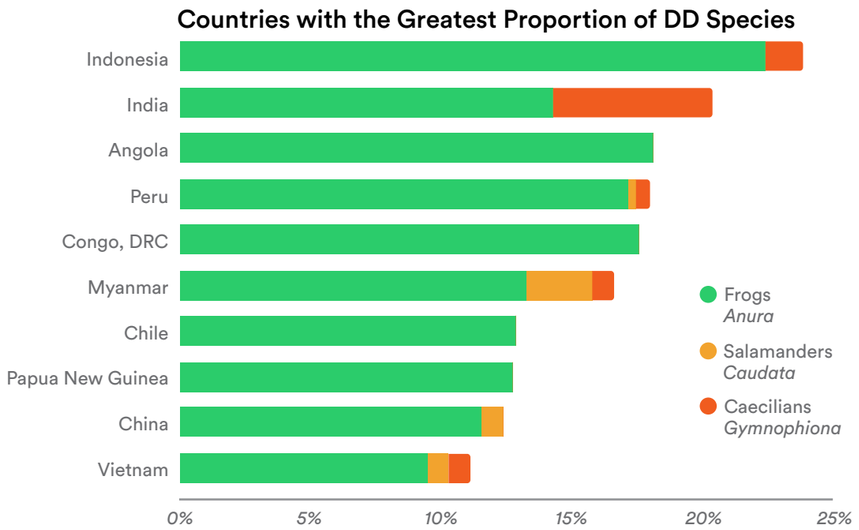
Number of DD Species

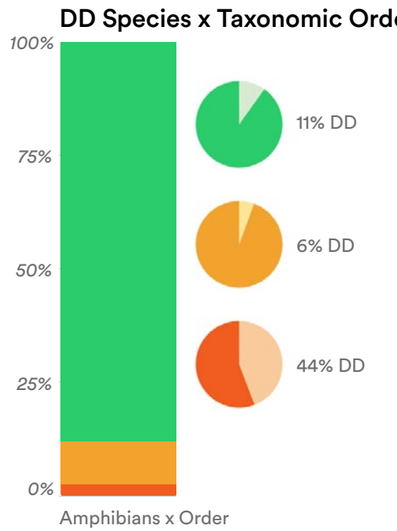
1 — 115

** Visualized using density equalizing cartograms. The size and shape of countries are purposely distorted in direct proportion to the number of DD species they hold.*

Possible Reasons for Data Deficiency

- Type specimens only
- Few observations
- Old records (>20 years)
- Taxonomic uncertainty
- Unknown provenance
- Unknown population status
- Unknown threats





An undescribed caecilian of Ichthyophis sp. from Thailand © Ben Tapley

Mysterious Caecilians

Most caecilians live underground, making it challenging to determine their range, population size, and threats. With such little information available, 44% of caecilians are classified as DD. Countries with the most DD caecilians are India (26), Brazil (11), and Malaysia (7). This poorly-known group is in critical need of further research to better understand their extinction risk.

[6] Hoffmann et al. (2010)
[7] Borgelt et al. (2022)

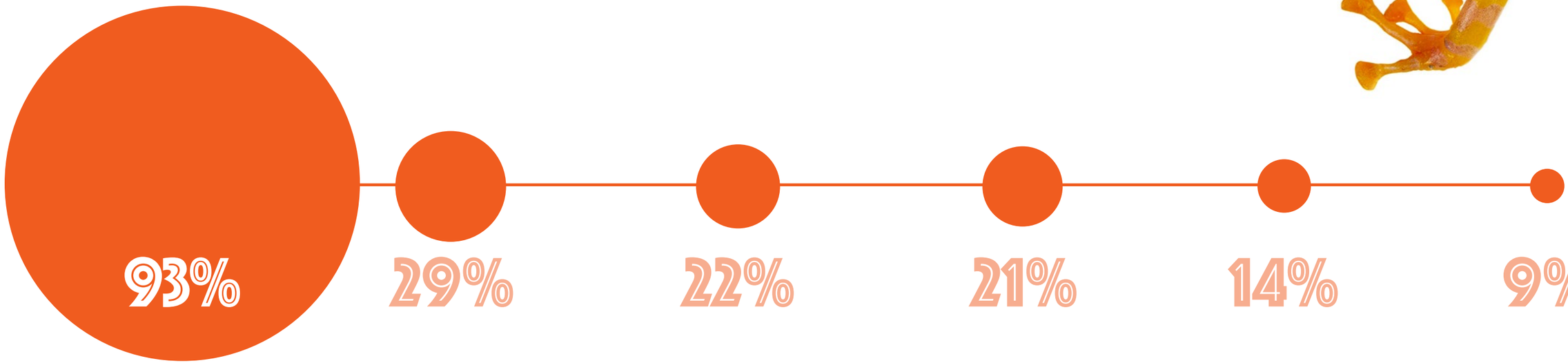
Threats to Amphibians

The Green Redbelly Toad *Melanophryniscus macrogranulosus*, is endemic to the Atlantic Forest, one of the most threatened biomes of Brazil. Listed as Endangered, this species is threatened due to habitat conversion, fragmentation and degradation caused by urban growth, agriculture, and pollution.

Threats Driving Amphibian Declines

The IUCN Red List provides a clear and compelling picture of the many ways in which human activities are driving amphibians towards extinction. Every major threat, from the conversion of habitats to climate change to disease, affects amphibians. In many cases species are impacted by multiple and potentially compounding threats, thereby exacerbating their vulnerability.

2873 TOTAL THREATENED SPECIES



HABITAT LOSS

A rapidly growing human population and unsustainable consumerism continues to drive deforestation, agricultural expansion, infrastructure development, energy production, and pollution, leaving amphibians with fewer places to live, breed, and feed.

CLIMATE CHANGE

Climate change presents an emerging, serious challenge for amphibian survival. With further predicted changes in temperature and humidity, the extent and severity of this threat are expected to magnify in the future.

DISEASE

Chytridiomycosis, a disease caused by the chytrid fungus *Batrachochytrium dendrobatidis* (*Bd*), has been implicated in amphibian declines worldwide. This disease is the suspected cause of 9 of the 11 documented extinctions since the 1980s. The emergence of *Batrachochytrium salamandrivorans* (*Bsal*) in Europe is particularly concerning for salamanders.

FIRE

Fires, both natural or human-caused, can result in habitat loss and degradation, as well as direct mortality. The combination of climate change and deforestation has led to hotter and drier weather patterns, thus more frequent and intense fires, making it difficult for populations to recover.

INVASIVE SPECIES

Many invasive species can outcompete native amphibians for resources or prey on them directly. For example, non-native fish can prey on amphibian eggs and tadpoles, while invasive plants can modify the habitat available to amphibians, leading to population declines.

OVER-EXPLOITATION

Over-exploitation and unsustainable trade practices have put significant pressure on many species of amphibians. Some are harvested for food or traditional medicine, while others are collected for the pet trade because of their uniqueness or beautiful coloration.

The Ornate Rainfrog *Pristimantis ornatissimus* is Endangered because of a population decline, suspected to be at a rate of more than 50%, due to habitat loss driven by industrial agriculture and commercial logging on the Pacific slopes of the Ecuadorian Andes.

© Jaime Culebras

Habitat Loss and Degradation

Habitat loss and degradation is the top threat to amphibians, impacting 2,686 (93%) threatened species. With the global human population exceeding 8 billion by the end of 2022, the demand for resources is increasing. Land is rapidly being cleared for timber production while agricultural and urban expansion are replacing key amphibian habitats. Many amphibians that once tolerated a degree of habitat disturbance are disappearing with the intensification of agricultural practices and increased use of pesticides. Any remaining fragments of native habitat are often too small or degraded to support a viable population, or the distance between fragments is too large for an amphibian to traverse.

Leading Drivers of Habitat Loss and Degradation for Threatened Amphibians

2686 THREATENED SPECIES

Agriculture is the **main driver** of habitat loss and impacts **77%** of threatened species

53%
Timber & Plant Harvesting
1533 species

47%
Infrastructure Development
1348 species

29%
Pollution
827 species

16%
Mining & Energy Production
469 species

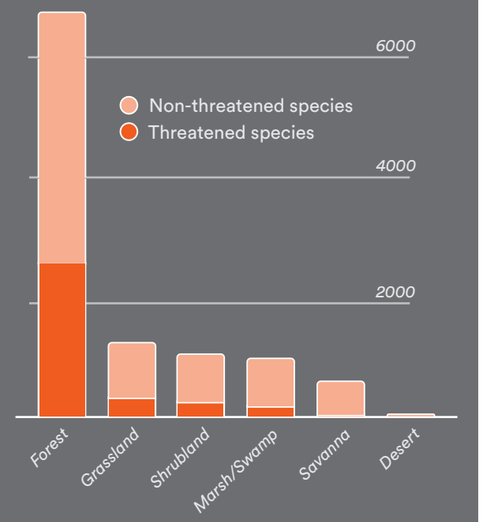
11%
Water Management
325 species

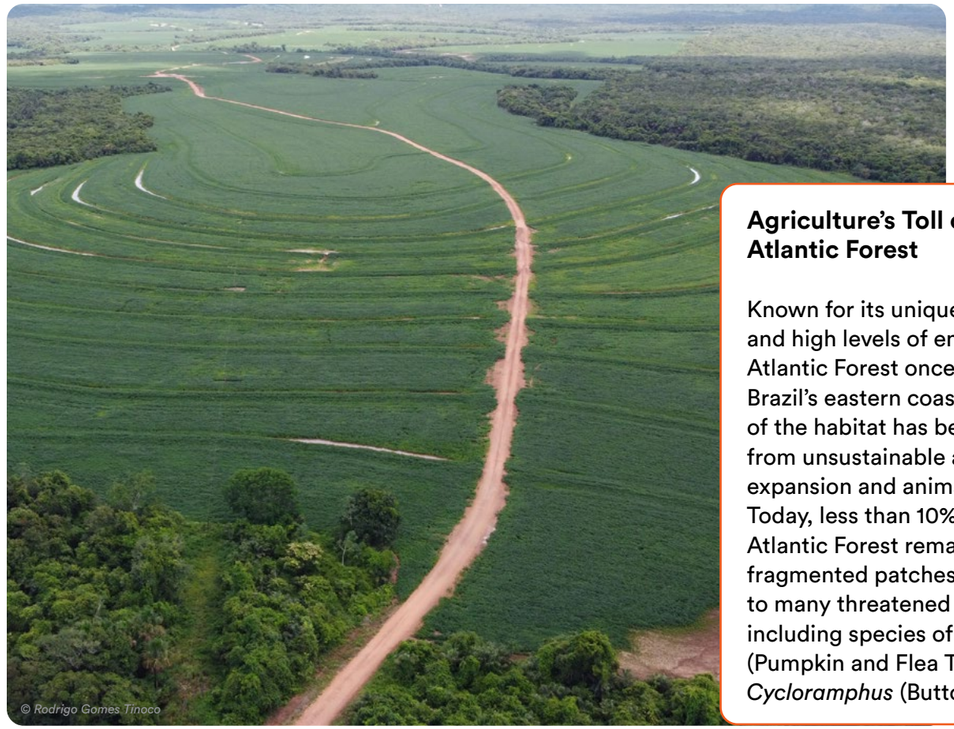
Forest Loss and Degradation Threatens the Most Amphibians

With 84% of amphibian species living in forests, it comes as no surprise that deforestation is having a devastating effect on their populations.

Agricultural expansion, primarily cattle ranching and the cultivation of crops, continues to be the main driver of deforestation and forest degradation.

Clear-cutting of trees can result in severe habitat loss, whereas selective logging can lead to habitat degradation and may exacerbate the impact of other threats, such as fires.



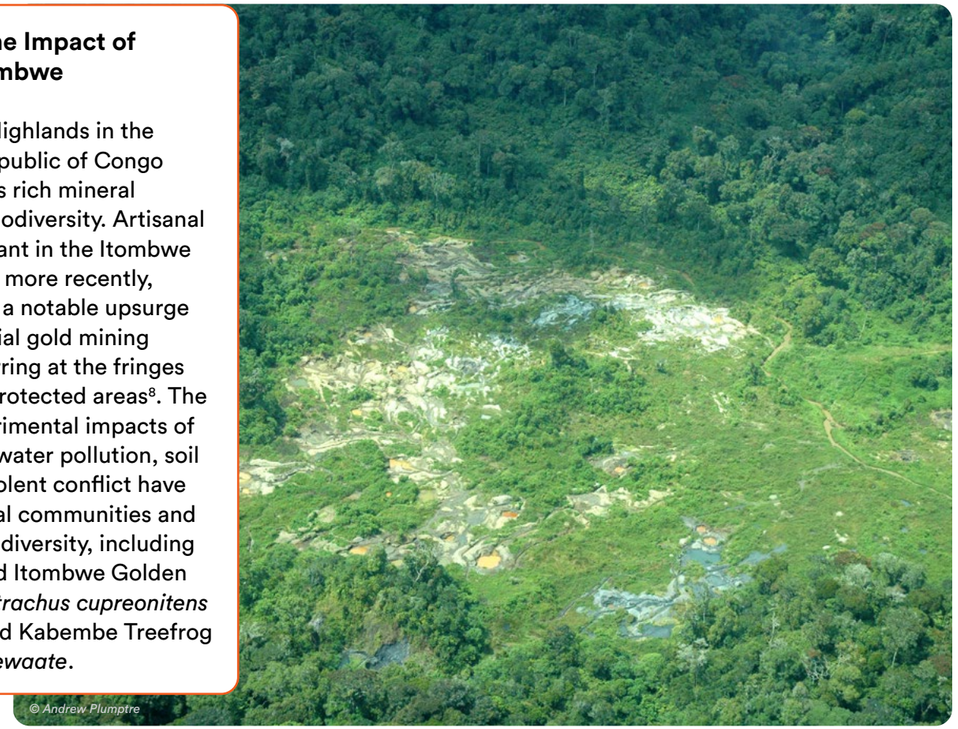

© Rodrigo Gomes Tinoco

Agriculture's Toll on the Atlantic Forest

Known for its unique species and high levels of endemism, the Atlantic Forest once spanned Brazil's eastern coastline. Much of the habitat has been degraded from unsustainable agricultural expansion and animal agriculture. Today, less than 10% of the Atlantic Forest remains. The highly fragmented patches provide refuge to many threatened amphibians, including species of *Brachycephalus* (Pumpkin and Flea Toads) and *Cycloramphus* (Button Frogs).

Unearthing the Impact of Mining in Itombwe

The Itombwe Highlands in the Democratic Republic of Congo is famous for its rich mineral deposits and biodiversity. Artisanal mining is rampant in the Itombwe Highlands, and more recently, there has been a notable upsurge in semi-industrial gold mining activities occurring at the fringes of and within protected areas[8]. The associated detrimental impacts of deforestation, water pollution, soil erosion, and violent conflict have threatened local communities and the region's biodiversity, including the Endangered Itombwe Golden Frog *Chrysobatrachus cupreonitens* and Endangered Kabembe Treefrog *Leptopelis mtoewaate*.


© Andrew Plumptre

[8] *Verweijen et al. (2022)*

Climate Change

Amphibians are ectotherms with moist, highly permeable skin, and rely on the availability of water for survival. These attributes render amphibians, more so than other vertebrates, particularly sensitive to changes in humidity and temperature, as well as other environmental shifts related to global climate change.

Climate change effects are an ongoing or future threat to 846 threatened amphibians (30%), although this number is expected to rise as better data and projections on species' responses to climate change become available. Habitat shifting and alteration, and increasing frequency, duration, and severity of extreme weather events are among the major factors contributing to amphibians' increasing extinction risk. Climate change can also exacerbate other threats, such as fires, disease, or invasive species, thereby compounding impacts.

Effects of Climate Change on Threatened Amphibians

846 THREATENED SPECIES

Climate change is **impacting 30%** of threatened species

67%
Drought
570 species

49%
Habitat Shifting & Alteration
417 species

18%
Storms & Flooding
150 species

16%
Temperature Extremes
135 species

© Tomas Castelazo

© Todd W. Pierson

Longer dry seasons and decreased precipitation threatens the Finca Chiblac Salamander *Bradytriton silus* of Mexico and Guatemala, while increased hurricane frequency and intensity in the Caribbean is contributing to the Mountain Coqui's *Eleutherodactylus portoricensis* Endangered status.

© NOAA

© Alejandro Ríos Franceschi

Drought

Climate change is exacerbating natural droughts, causing them to be longer, more frequent, and more severe. Considering the critical role that water plays in amphibian reproduction, development, and survival, it is no wonder that changes to water availability represent the strongest climate-linked driver of amphibian declines.

Salamanders are particularly sensitive to shrinking water availability. Lungless terrestrial salamanders require cool, moist microhabitats to prevent desiccation, while subterranean species depend on rainfall to replenish groundwater. Overall drier conditions associated with reduced water levels and hydroperiod (timing of water availability) may threaten semi-aquatic and aquatic salamanders.

Habitat Shifting & Alteration

Due to their limited dispersal ability, many amphibians may struggle to adjust their distribution in response to shifts in the availability of suitable habitats. Some species may be able to migrate towards cooler or more humid areas, so long as suitable habitats exist, but others atop mountains, on small islands, or in remaining patches of forest may have nowhere to go.

Long-term warming and drying of the Andean páramo ecosystem is expected to result in major changes in habitat composition, but many mountain-top amphibians endemic to these high-elevation humid grasslands will have no option of migrating upwards.

Storms & Flooding

Extreme weather events, such as severe storms and flooding, can cause short-term population crashes, and recovery can be hampered by the degradation and loss of suitable habitat and breeding sites.

Caribbean Islands, such as Puerto Rico, are experiencing more frequent and severe tropical storms due to climate change. While amphibians in this region are accustomed to severe weather events, powerful hurricanes are striking with more frequency than ever before, impeding amphibian populations from recovering in between events.

Temperature Extremes

Amphibians are ectothermic, meaning that their body temperature is dependent on their surrounding environment. As a result, they are highly sensitive to changes in temperature and are particularly vulnerable to extreme temperature events. More and increasingly severe heat waves can lead to reduced metabolic rates, disrupt breeding patterns, and impact ecological interactions with predators, prey, or pathogens.

Disease

Chytridiomycosis, a deadly infectious disease caused by the fungal pathogen *Batrachochytrium dendrobatidis* (*Bd*), represents one of the major drivers of biodiversity loss in amphibians. During the 1980s through mid-2000s, *Bd* spread globally, with amphibian communities in Australia, Mexico and Mesoamerica, the Andes of South America, and the western US among the hardest hit, and many species now nearing the brink of extinction - or worse. Unfortunately, the damage is nowhere near done – *Bd* is still making its way across Africa and has not yet been detected in Melanesia, where its introduction would be a severe threat to the region's amphibians. As yet, no treatment has been developed that effectively treats the disease in wild populations.

© Michael McFadden

What the GAA2 tells us about *Bd*:

Bd is a significant ongoing threat for 600 threatened species, and a future threat for 75 species. Chytridiomycosis has been implicated in 9 of the 11 extinctions since the 1980s.

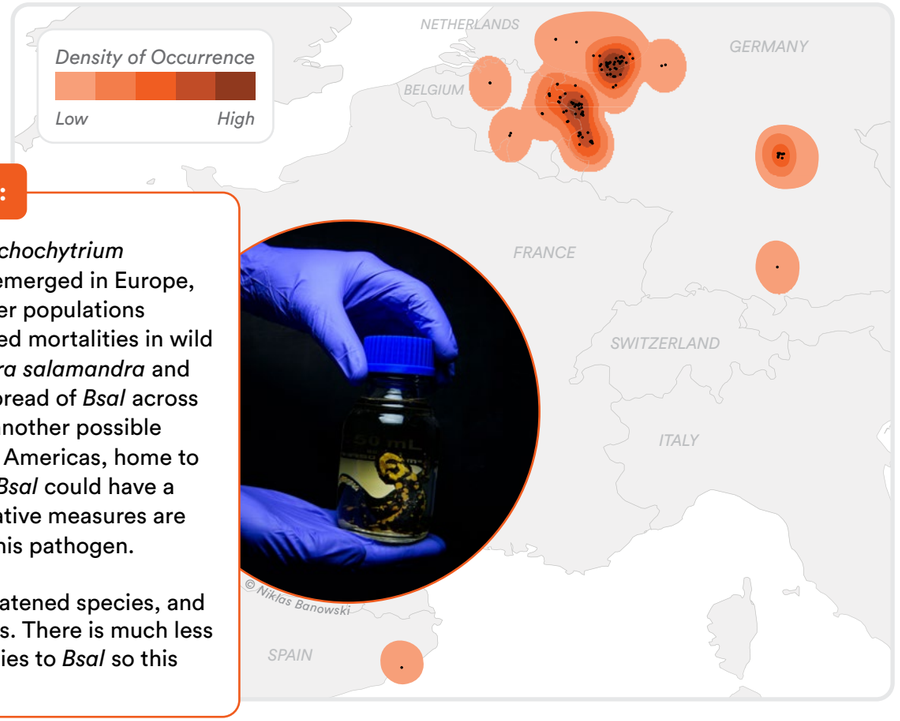
600
Threatened Species
Bd Current Threat

75
Threatened Species
Bd Future Threat

9 OF 11
Extinctions
Since 1980s

***Bsal* Hotspots**

Kernel density map of hotspots of Bsal occurrence in European salamanders.



© Nikias Banowski

What the GAA2 tells us about *Bsal*:

A closely related chytrid fungus, *Batrachochytrium salamandrivorans* (*Bsal*), has recently emerged in Europe, and poses a severe threat to salamander populations around the world. Observed *Bsal*-related mortalities in wild European salamanders (e.g, *Salamandra salamandra* and *Triturus cristatus*) and the continued spread of *Bsal* across Europe are sounding the alarm about another possible disease panzootic. If introduced to the Americas, home to the greatest diversity of salamanders, *Bsal* could have a devastating impact. Stringent preventative measures are needed to avoid the global spread of this pathogen.

Bsal is an ongoing threat for three threatened species, and a potential future threat for 238 species. There is much less known about the susceptibility of species to *Bsal* so this number is just a rough estimate.

Signs of Resilience

While disease has had a devastating impact on many amphibian populations, there are indications that some species are persevering. At least 60 species that once suffered precipitous declines, presumably due to chytridiomycosis, have since moved to a lower extinction risk category. Some may have survived the disease outbreak and developed natural immunity to chytrid infection, serving as a source for the recovery of subpopulations, while others have reduced extinction risk because declines have stopped, even though their populations have not necessarily recovered.

It is important to note that while some amphibian populations have shown signs of resilience, many species remain at risk. Restoring and protecting suitable amphibian habitats will help to ensure that amphibian populations have a better chance of recovering and maintaining healthy numbers.

Chytrid in Australia

Stream-breeding frogs in the rainforests of eastern Australia have been particularly affected by chytridiomycosis. It is the suspected cause of five confirmed, and two possible, extinctions in the country. Ten Critically Endangered species are at a high risk of extinction, in part due to *Bd*.

While chytrid continues to threaten many Australian amphibians, others are surviving against all odds. Eight species moved to a lower extinction risk category as their populations are no longer declining. Some frogs are surviving in environmental refugia that, with a warming climate, are becoming unfavorable for *Bd*; other frogs may have evolved resistance. These species are beacons of hope and can provide valuable insights for other disease-affected species around the world.

© Conrad Hoskin

Litoria nannotis This species was Least Concern in 1980, then Endangered in 2004 due to population declines as a result of disease. In 2022, the species was downlisted to Least Concern.

LC (1980) → EN (2004) → LC (2022)

© Conrad Hoskin

Litoria dayi This species was Least Concern in 1980, then Endangered in 2004 due to population declines as a result of disease. In 2022, the species was downlisted to Vulnerable.

LC (1980) → EN (2004) → VU (2022)

Fire

Changes in fire frequency and intensity are a threat to 22% of threatened amphibians. Fires can have short-term (e.g., direct mortality) and long-term effects (e.g., reduction of prey species, loss and degradation of habitat and breeding sites) on amphibian populations. With increasing fire frequency, populations may be unable to recover in between fire events and thereby experience long-term declines.

© 2020 Toa55/Shutterstock

Impacts of climate change

Drier and hotter conditions as a result of climate change are altering fire regimes. The unprecedented bushfires in eastern Australia in 2019–20 were preceded by years of record-breaking drought. The extraordinarily dry conditions, combined with record-breaking temperatures resulted in catastrophic damages, including an estimated 51 million frogs killed or affected[9]. Such events are predicted to become more frequent globally as climate change effects intensify[10].

The Jemez Mountains Salamander *Plethodon neomexicanus* is threatened by large-scale, high-intensity wildfires taking place within its restricted range in New Mexico, USA.

© Todd W. Pierson

According to current climate and land-use change projections, the occurrence and severity of wildfires is expected to escalate, with a global increase of intense fires by up to 14% by 2030, 30% by 2050, and 50% by the end of the century[10].

[9] *Van Eeden et al. (2020)*
[10] *United Nations Environment Programme (2022)*

Invasive Species

Invasive species pose a threat to 415 threatened amphibians (14%) through direct predation, competition, habitat degradation, and disease transmission. For example, the introduction of non-native predatory fish, especially into formerly fishless water bodies, can deplete amphibian populations and even cause local extinctions. Species endemic to islands are especially susceptible to invasive species because they have evolved in isolation and may lack the evolutionary adaptations to compete for resources or defend themselves. On several islands, such as those in the Caribbean and the Ryukyu Archipelago of Japan, the introduction of mongoose to control rat or snake populations has had an unforeseen outcome: the predation of native amphibians.

Amphibians Gone Rogue

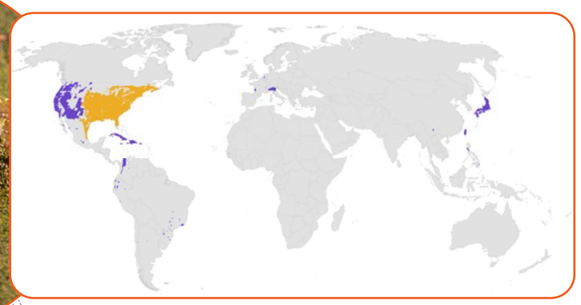
Two amphibians included on the "One Hundred of the World's Worst Invasive Alien Species" list[11] are known to negatively impact native amphibian populations.

American Bullfrog
Lithobates catesbeianus

Native to eastern North America, this species has been introduced to over 40 countries, mainly for human consumption. Escapees from farms have established thriving populations that outcompete native amphibians, and can act as carriers for disease.

© Alejandro Rios Franceschi

Current distribution of the American Bullfrog (*Lithobates catesbianus*)



Cane Toad
Rhinella marina

Native to South America and known for their voracious appetite, this species was introduced for agricultural pest control in many countries, despite little evidence of their effectiveness. Instead, cane toads compete with native amphibians for resources and prey on their tadpoles.

© Michael McFadden

Current distribution of the Cane Toad (*Rhinella marina*)

[11] *Global Invasive Species Database (2023)*

Over-exploitation

Amphibians, primarily frogs and salamanders, are collected from the wild for a variety of reasons, including human consumption, medicine, and the international pet trade. Such activities represent a threat to 256 globally threatened species (9%). Amphibians may be especially vulnerable to over-exploitation because of their small geographic ranges, high demand of novel and/or rare species, and gaps in trade regulations.

Frogs

671
Species are collected for human use

10%
of all frog species

Frogs are the most common amphibians in the international pet trade. The main centers of export are the rainforests of Africa, Mesoamerica, South America and Southeast Asia, where demand is particularly high for vibrant (*Dendrobatidae, Bombinatoridae, Mantella*), horned (*Ceratophrys*), and aquatic (*Hymenochirus* and *Xenopus*) species. Collection of frogs as a food source occurs predominantly in Asia, but globally, Europe is the largest importer of frog legs sourced from the wild. The main countries exporting to Europe are India, Bangladesh, Indonesia, Turkey and Albania[12], where the trade is unregulated and causing significant population declines in some species.

The brightly colored Dyeing Poison Frog *Dendrobates tinctorius* from the Guianas region in South America is highly prized in the pet trade. It is listed on CITES Appendix II along with all other *Dendrobates* species.

© *Jaime Culebras*

PET TRADE

671 species

49% pet trade

27% of which are threatened

CONSUMPTION

671 species

48% consumption

24% of which are threatened

[12] *Auliya et al. (2023)*
[13] *USFWS (2016)*
[14] *Thomas et al. (2019)*
[15] *Grear et al. (2021)*

The Fire Salamander *Salamandra salamandra* is popular in the global pet trade.. Wild populations have declined because of *Bsal*, which was introduced to Europe through the pet trade.

© *Jaime Culebras*

Salamanders

182
Species are collected for human use

24%
of all salamander species

Population declines can result from direct collection of individuals or indirectly from the global wildlife trade, as this is the primary mechanism for the spread of amphibian chytrid fungi. Most popular are the colorful Asian fire-bellied newts (*Cynops*), European Fire Salamander (*Salamandra salamandra*), and several newts of the Asian genus Tylototriton. While strict trade policies[13, 14], have effectively restricted the trade of certain known *Bsal* carrier species in Europe and the United States, other potential *Bsal* carriers continue to be traded in large numbers, representing an ongoing threat to salamander biodiversity worldwide[15].

PET TRADE

182 species

74% pet trade

52% of which are threatened

MEDICINE

182 species

24% medicinal purposes

70% of which are threatened

The Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) is a multilateral agreement that regulates international trade in wild animals and plants. Species are listed in three Appendices according to the degree of protection they need[16].

Appendix I

Prohibits any international trade of 24 globally threatened amphibian species.

Appendix II

Includes at least 351 amphibians that are at risk of becoming threatened if international trade is not closely controlled. This Appendix can include individual species, an entire genus, or family.

Appendix III

Includes five amphibians that have their trade regulated at the request of other CITES parties to prevent unsustainable or illegal exploitation.

[16] *CITES (2023)*

Biogeographic Realms

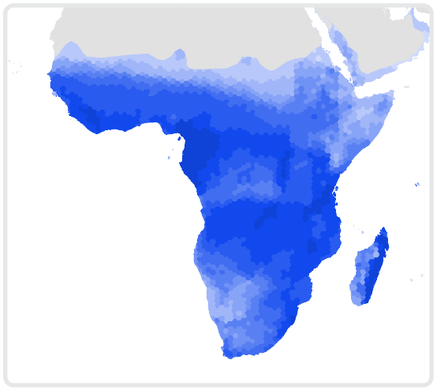
Biogeographic realms[17] play a crucial role in shaping the distribution and diversity of species. Each realm and the species within them face their own unique set of challenges and threats. Examining the status of amphibians across biogeographic realms can provide valuable insight into amphibian diversity patterns, threat patterns, as well as inform the development of large-scale conservation strategies.

Atelopus coynei, a Critically Endangered toad from the *Bufonidae* family, is endemic to the foothills of the Andes in Ecuador. The drastic declines and near-disappearance of this once abundant species have been linked to chytrid infections, while the surviving population is heavily threatened by habitat loss.

© Jaime Culebras

[17] *Biogeographic realms are defined following Olson et al. (2001)*

Afrotropics



1170 Species

15% Global Total

99% Endemism

Species Richness

1 — 141

Number of Species

TAXONOMY OVERVIEW

Frogs (1141) Salamanders (0) Caecilians (29)

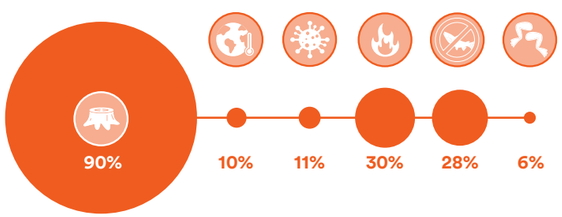
0% 100%

THREATENED STATUS

Extinct & Extinct in the Wild
Critically Endangered
Endangered
Vulnerable
Near Threatened
Least Concern
Data Deficient

0% 100%

MAJOR THREATS



Habitat loss is the most prominent threat, with the top drivers being agriculture, logging, and infrastructure development. Disease is an increasing threat, particularly in central and eastern Africa. The impacts of climate change on amphibians are poorly studied in this realm and likely underestimated.

TOP 10 MOST THREATENED GENERA*

Order	Genus	Number of Species in Realm (% threatened)
ANURA	*Probreviceps*	6 (100%)
ANURA	*Werneria*	6 (100%)
ANURA	*Nothophryne*	5 (100%)
ANURA	*Anodonthyla*	11 (91%)
ANURA	*Callulina*	9 (89%)
ANURA	*Stumpffia*	15 (83%)
ANURA	*Nectophrynoides*	13 (82%)
ANURA	*Leptodactylodon*	15 (80%)
ANURA	*Rhombophryne*	15 (80%)
GYMNOPHIONA	*Boulengerula*	8 (75%)

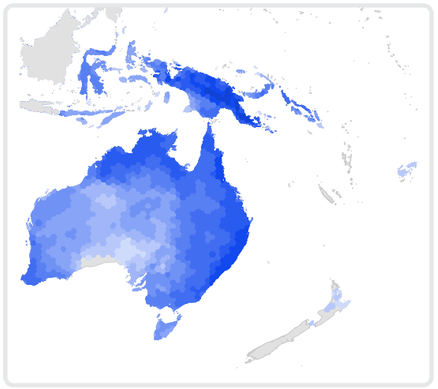
** Only genera with at least 5 species are included.*

Endemic to the montane forests of Tanzania and Zimbabwe in East Africa, all six species of *Probreviceps* are Endangered due to restricted range and ongoing habitat loss caused by agriculture and logging.

© Michele Menegon

Threatened species are most concentrated in Madagascar, Cameroon and adjacent montane Nigeria, and the Eastern Arc Mountains of Tanzania. Notably, 40% of Afrotropical threatened species are endemic to Madagascar. Due to a lack of surveys in the rainforest of the Congo Basin, the largest rainforest in Africa and second largest in the world after the Amazon, the richness of amphibians is believed to be greatly underestimated. As deforestation continues, it is likely that the Congo Basin will become a future hotspot for threatened amphibians.

Australasia & Oceania



760 Species

9% Global Total

99% Endemism

Species Richness

1 — 72

Number of Species

TAXONOMY OVERVIEW

Frogs (760) Salamanders (0) Caecilians (0)

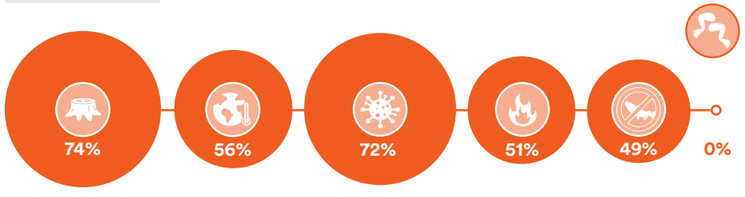
0% *100%*

THREATENED STATUS

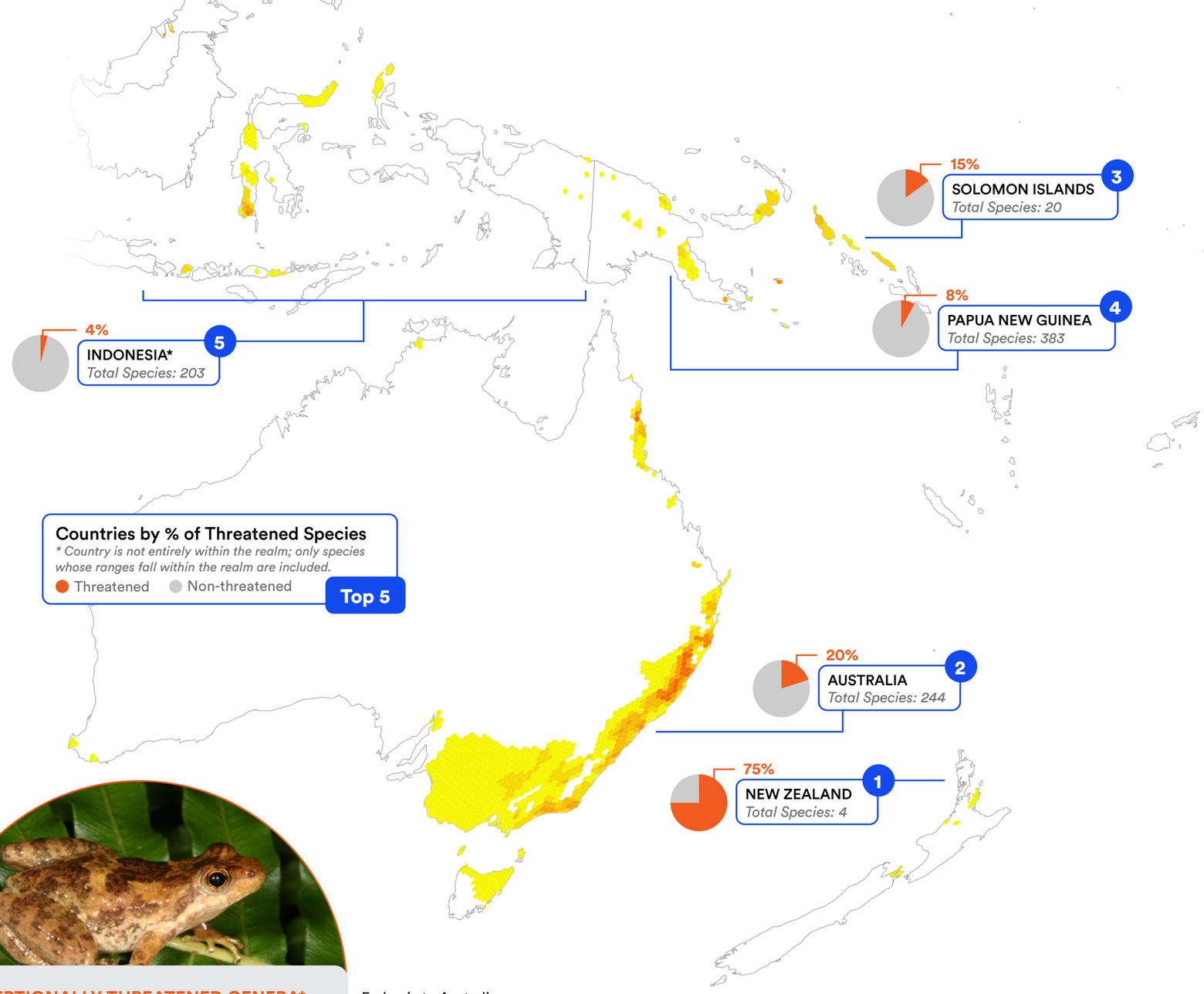
Extinct & Extinct in the Wild
Critically Endangered
Endangered
Vulnerable
Near Threatened
Least Concern
Data Deficient

0% *100%*

MAJOR THREATS



Habitat loss threatens the most species in this realm, however Australasian amphibians are disproportionately affected by disease (72%) compared to other realms. Climate change effects, fire, and invasive species impact over half of threatened species, highlighting the multiple and compounding threats confronting amphibians in this realm.



EXCEPTIONALLY THREATENED GENERA*

Order	Genus	Number of Species in Realm (% threatened)
ANURA	*Philoria*	6 (100%)
ANURA	*Taudactylus*	6 (75%)
ANURA	*Liopelma*	4 (75%)
ANURA	*Mixophyes*	8 (43%)

** Only genera with at least 3 species and % threatened greater than the global average of 41% are included.*

Endemic to Australia, high elevation, stream-dwelling *Taudactylus* frogs have suffered serious population declines due to disease. Two of the six species are Extinct while another has not been seen since 2000 and is possibly extinct.

© Michael McFadden

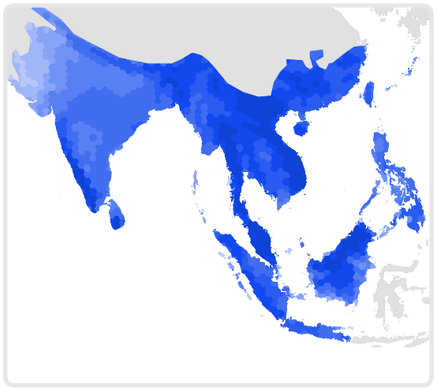
Threatened Amphibian Richness

1 — 6

Number of Species

The majority of threatened species (56%) in this realm are endemic to Australia, where they are concentrated in the forests of the east coast and southern corner of the west coast. Papua New Guinea, ranked ninth in the world for total number of species, has the second highest number of threatened species in the realm (27), but this represents only 8% of the total diversity of the country. The islands of the Pacific Ocean have very few amphibians. New Zealand has four species, three of which are threatened, Fiji has two (not shown) and Palau only one (not shown), none of which are threatened.

Indomalaya



1526 Species

19% Global Total

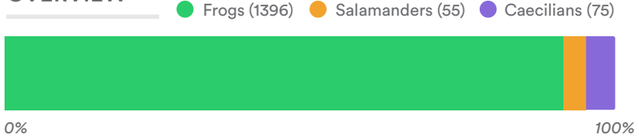
95% Endemism

Species Richness

1 — 114

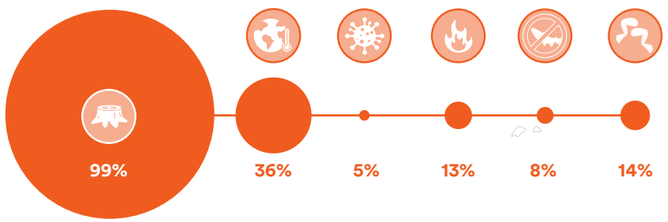
Number of Species

TAXONOMY OVERVIEW

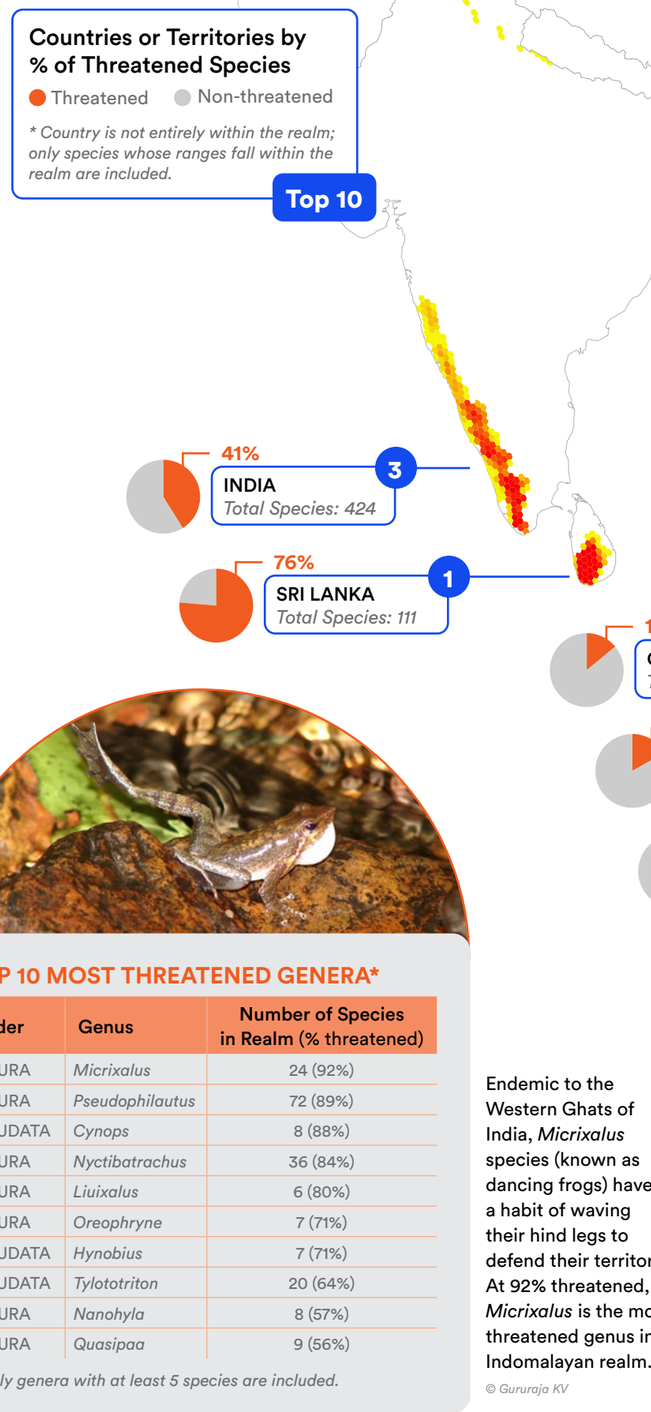


THREATENED STATUS

MAJOR THREATS



Habitat loss and degradation is by far the most significant threat in Indomalaya, impacting 99% of threatened species. Over one-third of amphibians are threatened by the effects of climate change, particularly those endemic to the Western Ghats. Over-exploitation is a threat for 14% of threatened species, predominantly for those occurring in China.



TOP 10 MOST THREATENED GENERA*

Order	Genus	Number of Species in Realm (% threatened)
ANURA	*Micrixalus*	24 (92%)
ANURA	*Pseudophilautus*	72 (89%)
CAUDATA	*Cynops*	8 (88%)
ANURA	*Nyctibatrachus*	36 (84%)
ANURA	*Liuixalus*	6 (80%)
ANURA	*Oreophryne*	7 (71%)
CAUDATA	*Hynobius*	7 (71%)
CAUDATA	*Tylototriton*	20 (64%)
ANURA	*Nanohyla*	8 (57%)
ANURA	*Quasipaa*	9 (56%)

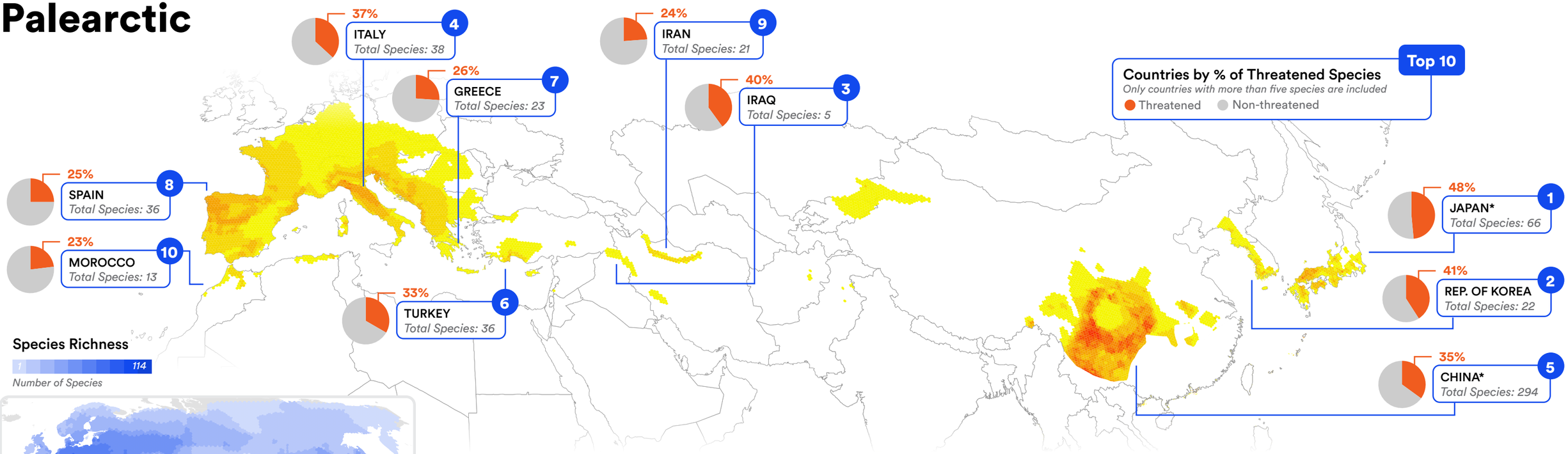
** Only genera with at least 5 species are included.*

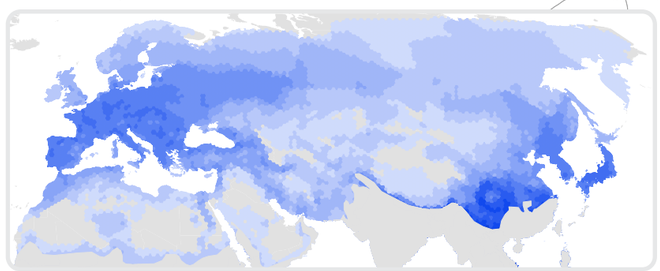
Endemic to the Western Ghats of India, *Micrixalus* species (known as dancing frogs) have a habit of waving their hind legs to defend their territory. At 92% threatened, *Micrixalus* is the most threatened genus in the Indomalayan realm.

© Gururaja KV

Over 40% of threatened species in Indomalaya are distributed in southern Sri Lanka (71 species) and the Western Ghats of India (139). Vietnam is home to 73 threatened species, mostly endemic to the central and southern Annamite Mountains. In the Ryukyu Archipelago of Japan, 43% of species are threatened. Particularly high concentrations of threatened amphibians occur on the islands of Hainan and Taiwan, as well as in southern Yunnan in Indomalayan China.

Palearctic



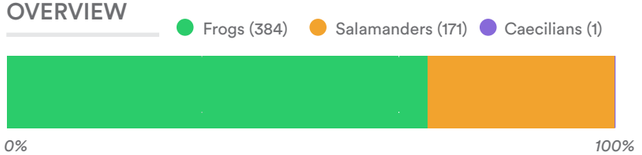


556 Species

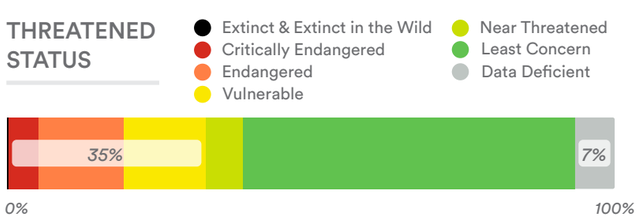
7% Global Total

69% Endemism

TAXONOMY OVERVIEW



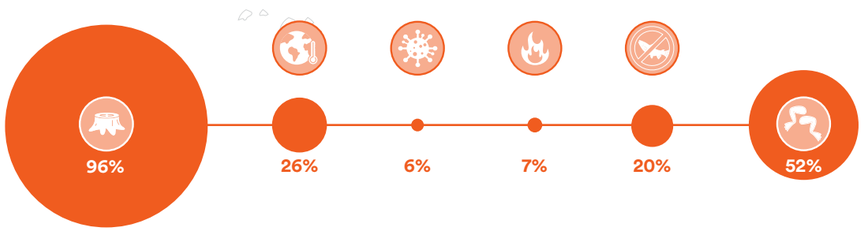
THREATENED STATUS



Threatened Amphibian Richness

Salamanders constitute less than one-third of the Palearctic's amphibian diversity (31%), but are three times as threatened (64%) than frogs (21%). Just over half of the 180 threatened species from this realm are found in Palearctic China, where salamanders are particularly at risk of extinction (74%). Mainland Japan has the greatest percentage of threatened species (48%) in the realm, and all but one are salamanders. Similarly in Italy, salamanders dominate the list of threatened species.

MAJOR THREATS



Palearctic amphibians are largely threatened by habitat loss and degradation, including the realm's many salamanders that are particularly susceptible due to their small range sizes. Just over half of its threatened species are impacted by over-exploitation for the pet trade and human consumption. Disease is currently a threat to only 6% of threatened species in this realm, though this is expected to increase as *Bsal* spreads.

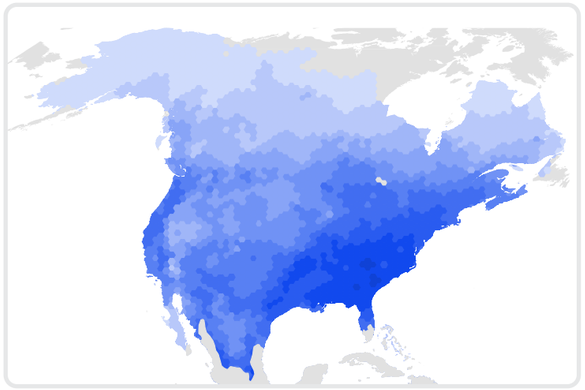
Giant salamanders in the genus *Andrias* are the largest living amphibians in the world. These fully-aquatic species have experienced large population declines due to over-exploitation and extensive habitat loss and degradation.

TOP 10 MOST THREATENED GENERA*

Order	Genus	Number of Species in Realm (% threatened)
CAUDATA	*Andrias*	3 (100%)
CAUDATA	*Batrachuperus*	5 (100%)
CAUDATA	*Pseudohynobius*	5 (100%)
CAUDATA	*Lyciasalamandra*	7 (100%)
CAUDATA	*Tylototriton*	11 (100%)
CAUDATA	*Speleomantes*	8 (88%)
ANURA	*Quasipaa*	6 (80%)
CAUDATA	*Neurergus*	5 (80%)
CAUDATA	*Hynobius*	49 (74%)
ANURA	*Oreolalax*	16 (60%)

** Only genera with at least 3 species are included.*

Nearctic



412 Species

5% Global Total

78% Endemism

Species Richness

Number of Species

1 — 71

EXCEPTIONALLY THREATENED GENERA*

Order	Genus	Number of Species in Realm (% threatened)
CAUDATA	*Thorius*	3 (100%)
CAUDATA	*Chiropterotriton*	10 (80%)
CAUDATA	*Isthmura*	4 (75%)
CAUDATA	*Aquiloeurycea*	3 (67%)
CAUDATA	*Gyrinophilus*	4 (50%)
CAUDATA	*Eurycea*	33 (44%)

** Only genera with at least 3 species and % threatened greater than the global average of 41% are included.*

Endemic to the highlands of Mexico, salamanders belonging to the *Isthmura* genus have black bodies adorned with striking hues of red, orange, or pink. However, deforestation, mining, agriculture, and rapid human development pose significant threats to their survival.

© Sean Michael Rovito

Threatened Amphibian Richness

1 — 12

Number of Species

Salamanders constitute a remarkable 58% of all amphibians in the Nearctic realm, of which 30% are threatened (compared to 20% of frogs). While Mexico has the highest percent of threatened species in the Nearctic (31%), it is dwarfed by that of southern Mexico in the Neotropical realm (59%). In the United States, threatened species are concentrated in the Sierra Nevada Mountains in the West and the Appalachian Mountains in the East, as well as Texas and the Southeast Coastal Plains. Canada is home to only one threatened amphibian.

TAXONOMY OVERVIEW

Frogs (171) Salamanders (241) Caecilians (0)

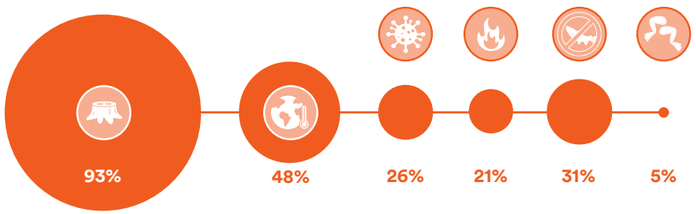
0% 100%

THREATENED STATUS

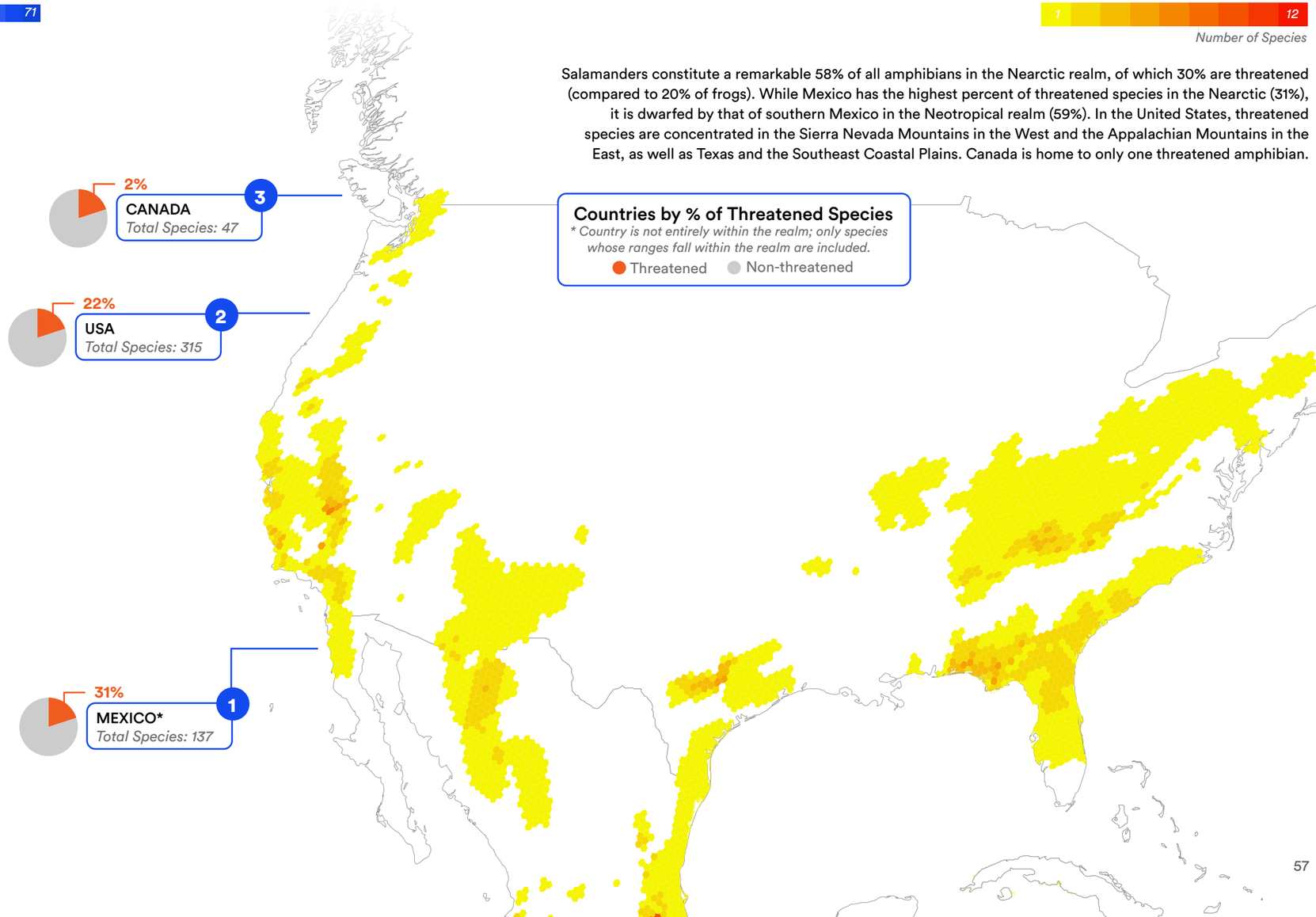
- Extinct & Extinct in the Wild
- Critically Endangered
- Endangered
- Vulnerable
- Near Threatened
- Least Concern
- Data Deficient

0% 100%

MAJOR THREATS



Threatened amphibians of the Nearctic are most affected by habitat loss and degradation (93%). Climate change effects are affecting nearly half of threatened species in this realm, mostly due to increasing severity and duration of droughts (74%). Disease is a threat to about one-quarter of threatened amphibians, not including the potential devastating impacts of disease if *Bsal* were to be inadvertently introduced to North America.



Neotropics

3852 Species

48% Global Total

98% Endemism

Species Richness

1 — 220

Number of Species

TAXONOMY OVERVIEW

Frogs (3434) Salamanders (316) Caecilians (102)

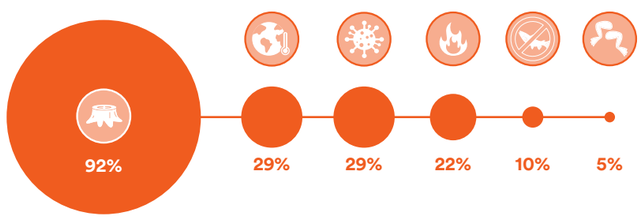
0% 100%

THREATENED STATUS

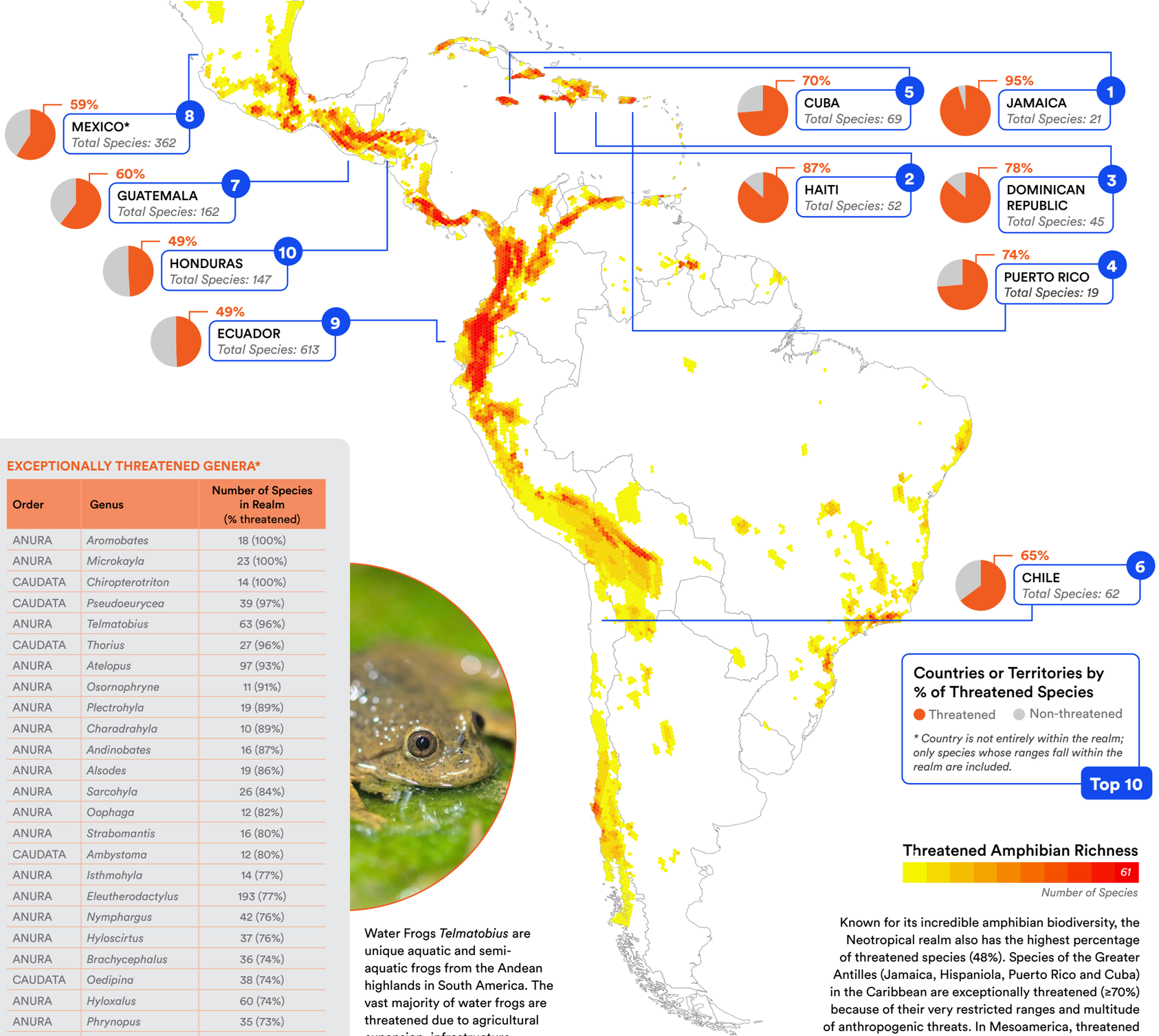
- Extinct & Extinct in the Wild
- Critically Endangered
- Endangered
- Vulnerable
- Near Threatened
- Least Concern
- Data Deficient

0% 100%

MAJOR THREATS



Nearly 60% of the world's threatened amphibians occur in the Neotropics, where the majority (92%) are facing high levels of habitat loss and degradation. Many Neotropical species are believed to have fallen victim to chytridiomycosis, including most of the 170 Possibly Extinct species. The effects of climate change, particularly because of reduced rainfall and humidity, are affecting roughly one-third of threatened amphibians. However, this is likely an underestimate.



EXCEPTIONALLY THREATENED GENERA*

Order	Genus	Number of Species in Realm (% threatened)
ANURA	*Aromobates*	18 (100%)
ANURA	*Microkayla*	23 (100%)
CAUDATA	*Chiropterotriton*	14 (100%)
CAUDATA	*Pseudoeurycea*	39 (97%)
ANURA	*Telmatobius*	63 (96%)
CAUDATA	*Thorius*	27 (96%)
ANURA	*Atelopus*	97 (93%)
ANURA	*Osornophryne*	11 (91%)
ANURA	*Plectrohyla*	19 (89%)
ANURA	*Charadrahyla*	10 (89%)
ANURA	*Andinobates*	16 (87%)
ANURA	*Alsodes*	19 (86%)
ANURA	*Sarcohyla*	26 (84%)
ANURA	*Oophaga*	12 (82%)
ANURA	*Strabomantis*	16 (80%)
CAUDATA	*Ambystoma*	12 (80%)
ANURA	*Isthmohyla*	14 (77%)
ANURA	*Eleutherodactylus*	193 (77%)
ANURA	*Nymphargus*	42 (76%)
ANURA	*Hyloscirtus*	37 (76%)
ANURA	*Brachycephalus*	36 (74%)
CAUDATA	*Oedipina*	38 (74%)
ANURA	*Hyloxalus*	60 (74%)
ANURA	*Phrynopus*	35 (73%)
ANURA	*Ecnomiohyla*	12 (70%)

** Only genera with at least 10 species are included.*

Water Frogs *Telmatobius* are unique aquatic and semi-aquatic frogs from the Andean highlands in South America. The vast majority of water frogs are threatened due to agricultural expansion, infrastructure development, pollution, disease, and climate change.

© Arturo Muñoz Saravia

Known for its incredible amphibian biodiversity, the Neotropical realm also has the highest percentage of threatened species (48%). Species of the Greater Antilles (Jamaica, Hispaniola, Puerto Rico and Cuba) in the Caribbean are exceptionally threatened (≥70%) because of their very restricted ranges and multitude of anthropogenic threats. In Mesoamerica, threatened species predominantly occur in highland forests, and in South America they are concentrated in the Atlantic Forest of Brazil and the Andes Mountains.

Guiding Conservation

Amphibians need urgent, dedicated conservation action. They are often not adequately protected under existing conservation initiatives due to having tiny geographic ranges that can easily fall outside protected areas, as well as being uniquely impacted by disease and climate change - for which practical remedies in the wild are still lacking. Concerted species-specific actions are needed to avoid further extinctions.

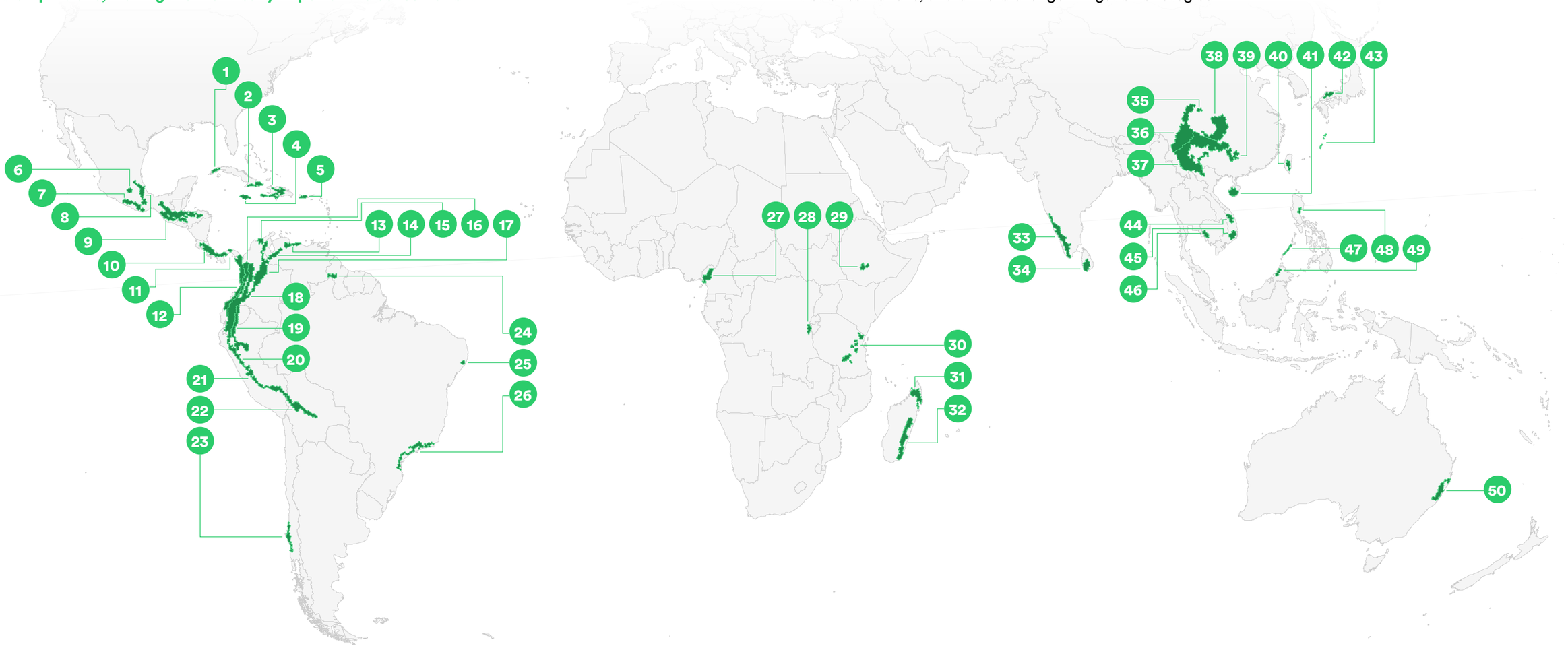
The GAA2 is a snapshot of the current conservation status of amphibians, providing essential data to guide conservation planning and action. This section highlights conservation solutions for threatened amphibians geographically, taxonomically, and thematically. The coordinated efforts of stakeholders around a holistic plan of action for these places and species groups has enormous potential to address threats, recover species, and prevent extinctions.

Amid encroaching agriculture, expanding human settlements, and echoing logging machinery, the Critically Endangered Honduras Spikethumb Frog *Plectrohyla dasypus* fights for survival within its dwindling range. Chytridiomycosis, a silent but devastating fungal disease, adds urgency to its plight.

Threatened Amphibian Landscapes

Using the richness map of globally threatened species and applying standardized criteria (see Annex I), **50 Threatened Amphibian Landscapes** (TALs) are identified here for the first time. Although these landscapes combined cover only a very small proportion of the globe, **together they contain 71% of all threatened amphibians, making them critically important to conservation.**

Each individual TAL has a high concentration of threatened species and is facing multiple threats. In addition to habitat protection, solutions may also need to include habitat management, restoration, and rewilding, as well as, disease management, captive breeding and species reintroductions, invasive species control, wildlife trade restrictions, and climate change mitigation strategies.



1. Mountains of Western Cuba
2. Mountains of Eastern Cuba
3. Mountain Ranges of Hispaniola
4. Jamaica
5. Puerto Rico
6. Trans-Mexican Volcanic Belt
7. Sierra Madre del Sur of Mexico
8. Sierra Madre Oriental of Mexico
9. Highlands of Northern Mesoamerica
10. Highlands of Southern Mesoamerica
11. Central Panama
12. Chocó-Darién of Panama and Colombia
13. Venezuelan Coastal Range
14. Venezuelan Andes
15. Sierra Nevada de Santa Marta in Colombia
16. Western Cordillera of the Colombian Andes
17. Eastern Cordillera of the Colombian Andes
18. Northern Central Cordillera of the Andes in Colombia, Ecuador, and Peru
19. Eastern Side of the Central Andes in Ecuador and Peru
20. Western Cordillera of the Peruvian Andes
21. Central Cordillera of Peru
22. Bolivian Yungas
23. Valdivian Temperate Forests of Chile
24. Central Pakaraima Mountains in the Guiana Shield
25. Northern Atlantic Forest of Brazil
26. Southern Atlantic Forest of Brazil
27. Cameroonian Highlands
28. Albertine Rift in the Democratic Republic of the Congo
29. Ethiopian Highlands
30. Eastern Arc Mountains in Tanzania
31. Northern Madagascar
32. Eastern Madagascar
33. Western Ghats of India
34. Southern Highlands of Sri Lanka
35. Qinling-Dabashan Mountains of China
36. Hengduan Mountains of China
37. Yunnan-Guizhou Plateau of China
38. Wuling Mountains of China
39. Nanling Mountains of China
40. Island of Taiwan
41. Island of Hainan
42. Southwestern Japan
43. Central Ryukyu Islands of Japan
44. Central Annamite Highlands of Vietnam and Lao People's Democratic Republic
45. Lang Biang Region of Vietnam
46. Cardamom Mountains of Cambodia
47. Palawan Island in the Philippines
48. Sierra Madre on Luzon Island in the Philippines
49. Sabah in Northern Borneo
50. Central Coast of Eastern Australia

See Annex I for TAL selection criteria and a complete list of TALs with summary data.

Irreplaceable Sites

Amphibians often have very small distributions, hence focused conservation on discrete sites of global importance for amphibians can secure the future of entire species. These Key Biodiversity Areas (KBAs) hold globally threatened or geographically restricted species and occur within and outside of threatened amphibian landscapes, and many of these sites are completely irreplaceable.


© Andrew Snyder

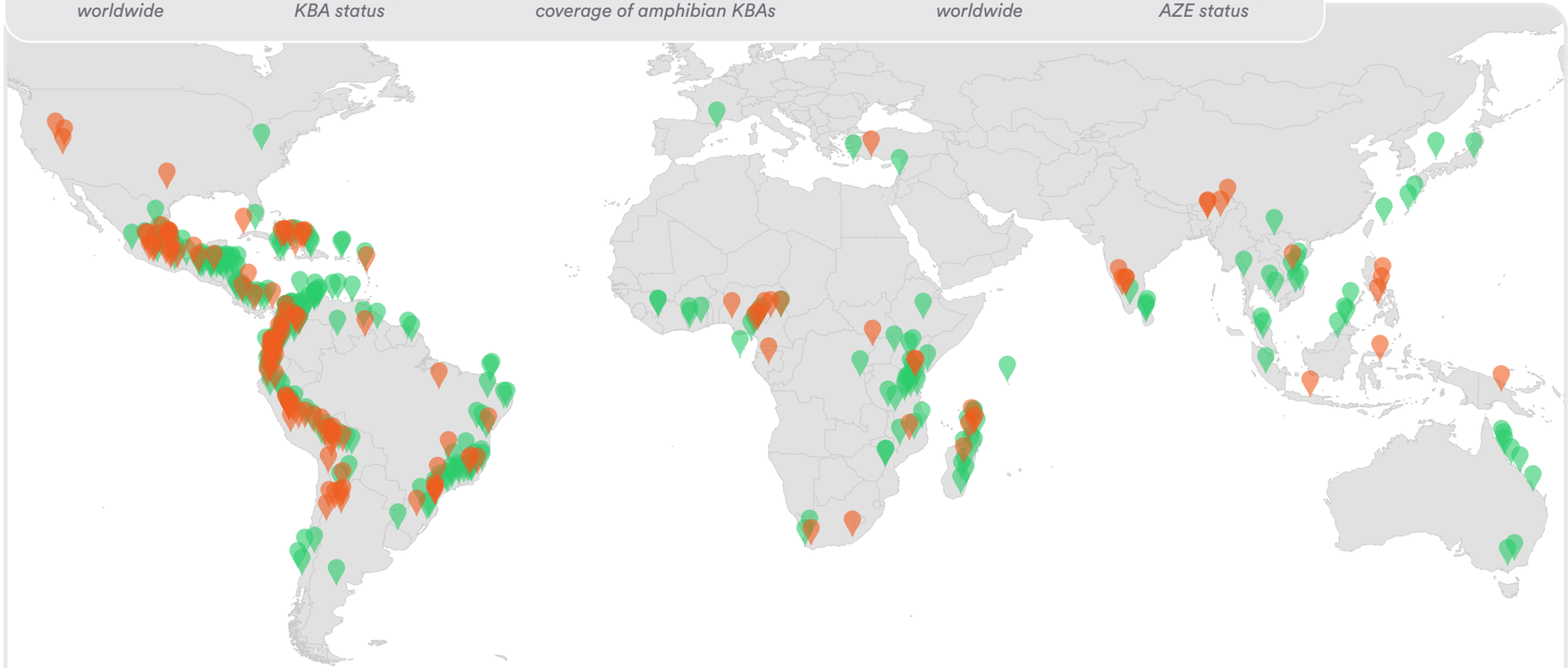
1,198
# of KBAs identified for amphibians worldwide

1,350
# of amphibian species that trigger KBA status

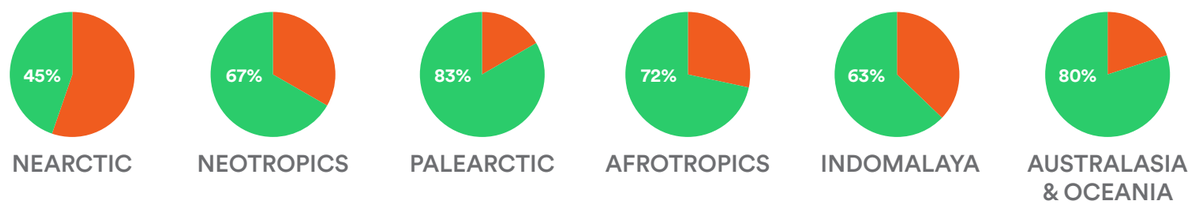
38%
Average protected area and Other Effective Area-Based Conservation Measure (OECM) coverage of amphibian KBAs

375+
# of AZEs identified for amphibians worldwide

700+
# of amphibian species that trigger AZE status



Only AZE sites are shown here for ease of viewing at the global scale, the full list of KBAs are available to view online in the KBA Database.



Spatial Tools

Two global initiatives, the Key Biodiversity Areas (KBAs) Partnership and the Alliance for Zero Extinction (AZE), are using the results of the GAA2 to identify critical sites for amphibian conservation. Safeguarding these sites is essential to reversing the current trend of catastrophic loss of amphibians around the world.

KBA
KEY BIODIVERSITY AREA

Key Biodiversity Areas (KBAs) are sites of global importance for the persistence of biodiversity. They are identified by national constituencies using globally standardized criteria that consider globally threatened biodiversity, geographically restricted biodiversity, ecological integrity, biological processes and irreplaceability[18].

Both the number of KBAs identified for amphibians and the number of amphibian species triggering sites as important are expected to increase considerably as additional National Coordination Groups are established and as more amphibian taxa are targeted as high priority for conservation actions.

ALLIANCE FOR Zero Extinction

Alliance for Zero Extinction (AZE) sites are the subset of KBAs that hold the last remaining population of one or more Endangered or Critically Endangered species[19]. If habitats within these sites are destroyed, the highly threatened species within them are likely to become globally extinct. The AZE update for amphibians was completed by Re:wild in 2022 using the results of the GAA2, with at least 375 AZE sites identified for over 700 amphibian species worldwide.

[18] https://www.keybiodiversityareas.org/
[19] https://zeroextinction.org/

Highly Threatened Genera

Species within the same genus share common ancestry and have similar characteristics, and this often means they are vulnerable to the same threats. The top 10 most threatened frog genera contain 12% of all threatened frogs, while almost two-thirds (64%) of threatened salamanders are among the top 10 most threatened salamander genera. Highly threatened frog genera are predominantly found in Mesoamerica and the Andes of South America, but also Madagascar and the Western Ghats of India. Exceptionally threatened salamander genera occur in Mesoamerica, the Andes of South America, China, and Japan.

By using the GAA2 results to identify genera with a particularly high proportion of threatened species, conservation can be tailored to benefit multiple species and mitigate known threats.

Top 10 Most Threatened Frog Genera

- Contain 12% of threatened frog species
- Mainly in Mesoamerica and the Andes in South America

Top 10 Most Threatened Salamander Genera

- Contain almost two-thirds (64%) of all threatened salamander species
- Mainly in Mesoamerica, the Andes in South America, China and Japan

TOP 10 MOST THREATENED FROG GENERA

Genus	Number of Species *(% threatened)*	Realm	Threatened Amphibian Landscapes
Aromobates	18 (100%)	Neotropics	14 - Venezuelan Andes 17 - Eastern Cordillera of the Colombian Andes
Microkayla	23 (100%)	Neotropics	21 - Central Cordillera of Peru 22 - Bolivian Yungas
Telmatobius	63 (96%)	Neotropics	18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru 20 - Western Cordillera of the Peruvian Andes 21 - Central Cordillera of Peru 22 - Bolivian Yungas
Atelopus	97 (93%)	Neotropics	10 - Highlands of Southern Mesoamerica 11 - Central Panama 12 - Chocó-Darién of Panama and Colombia 13 - Venezuelan Coastal Range 14 - Venezuelan Andes 15 - Sierra Nevada de Santa Marta in Colombia 16 - Western Cordillera of the Colombian Andes 17 - Eastern Cordillera of the Colombian Andes 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru 20 - Western Cordillera of the Peruvian Andes 21 - Central Cordillera of Peru 22 - Bolivian Yungas
Micrixalus	24 (92%)	Indomalaya	33 - Western Ghats of India
Osornophryne	11 (91%)	Neotropics	18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru
Anodonthyla	11 (91%)	Afrotropics	31 - Northern Madagascar 32 - Eastern Madagascar
Plectrohyla	19 (89%)	Neotropics	9 - Highlands of Northern Mesoamerica
Pseudophilautus	72 (89%)	Indomalaya	34 - Southern Highlands of Sri Lanka
Charadrahyla	10 (89%)	Neotropics	7 - Sierra Madre del Sur of Mexico 8 - Sierra Madre Oriental of Mexico 9 - Highlands of Northern Mesoamerica

TOP 10 MOST THREATENED SALAMANDER GENERA

Genus	Number of Species *(% threatened)*	Realm	Threatened Amphibian Landscapes
Pseudoeurycea	39 (97%)	Neotropics	6 - Trans-Mexican Volcanic Belt 7 - Sierra Madre del Sur of Mexico 8 - Sierra Madre Oriental of Mexico 9 - Highlands of Northern Mesoamerica
Thorius	29 (96%)	Neotropics	7 - Sierra Madre del Sur of Mexico 8 - Sierra Madre Oriental of Mexico
Chiropterotriton	23 (91%)	Neotropics	6 - Trans-Mexican Volcanic Belt 8 - Sierra Madre Oriental of Mexico
Tylototriton	29 (78%)	Palearctic/ Indomalaya	35 - Qinling-Dabashan Mountains of China 36 - Hengduan Mountains of China 37 - Yunnan-Guizhou Plateau of China 38 - Wuling Mountains of China 41 - Island of Hainan
Cynops	10 (78%)	Palearctic/ Indomalaya	36 - Hengduan Mountains of China 37 - Yunnan-Guizhou Plateau of China 43 - Central Ryukyu Islands of Japan
Hynobius	55 (75%)	Palearctic/ Indomalaya	39 - Nanling Mountains of China 40 - Island of Taiwan 42 - Southwestern Japan
Oedipina	38 (74%)	Neotropics	9 - Highlands of Northern Mesoamerica 10 - Highlands of Southern Mesoamerica
Bolitoglossa	134 (66%)	Neotropics	7 - Sierra Madre del Sur of Mexico 9 - Highlands of Northern Mesoamerica 10 - Highlands of Southern Mesoamerica 12 - Chocó-Darién of Panama and Colombia 13 - Venezuelan Coastal Range 14 - Venezuelan Andes 16 - Western Cordillera of the Colombian Andes 17 - Eastern Cordillera of the Colombian Andes 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru
Nototriton	20 (63%)	Neotropics	9 - Highlands of Northern Mesoamerica 10 - Highlands of Southern Mesoamerica
Paramesotriton	14 (62%)	Palearctic/ Indomalaya	37 - Yunnan-Guizhou Plateau of China 38 - Wuling Mountains of China 39 - Nanling Mountains of China

For both tables: only genera with at least 10 species are included.
Additional genera with 50% or more threatened species are included in Annex II.

Targeting Zero Extinctions

Emergency measures are needed to prevent further amphibian extinctions.

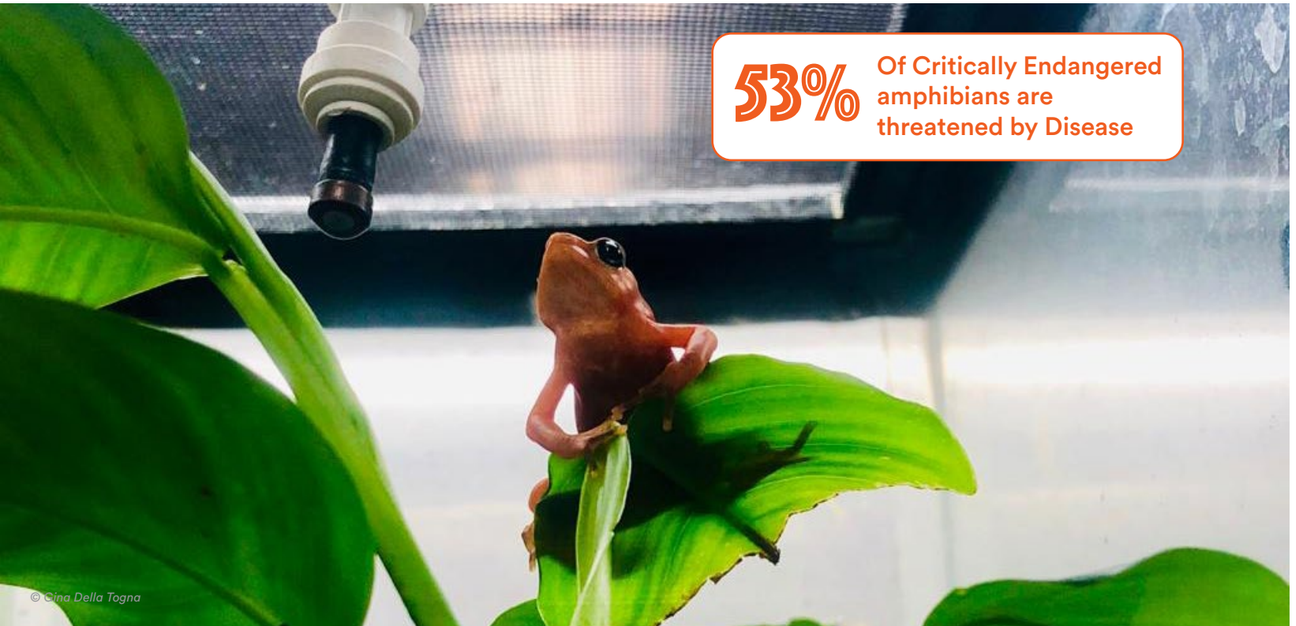
The governments of the world have committed to the ambitious goal of halting all human-induced species extinctions by 2050[20]. While habitat loss and degradation remain the most common threat to amphibians, there is a growing proportion of species being pushed to the brink of extinction by disease and climate change effects. Habitat protection alone will not be sufficient in reducing the extinction risk and promoting the recovery of these species. If further amphibian extinctions are to be prevented, the threats of disease and climate change must also be adequately addressed.

Combating Disease

Infectious diseases can cause amphibian declines and extinctions even in intact, protected habitats. While the peak of the current chytridiomycosis epizootic has passed, the disease continues to be a threat to many amphibians worldwide as an effective treatment for wild populations has yet to be developed. With the ominous emergence of Bsal, chytridiomycosis remains capable of pushing species to extinction in a very short period of time.

Urgent Actions Needed

- Establish or expand conservation breeding programs, incorporating biobanking and assisted reproductive technologies, to safeguard against extinction and enable future reintroductions and translocations.
- Develop practical solutions to managing and curing disease in the wild.
- Active site management to prevent introduction and outbreaks of disease (e.g. disease free enclosures).
- Implement preventative measures to stop the spread of disease (e.g. strict trade regulations).
- Monitor amphibian communities for novel disease prevalence.



Preparing for a Changing Climate

Among all the threats to amphibians, climate change is the most complex as it can impact species in a myriad of ways. Global temperatures are continuing to rise, weather patterns are changing, and the frequency, intensity and duration of extreme weather events, such as droughts, storms and wildfires, are increasing, all the while compounding the many threats already challenging amphibians.

Urgent Actions Needed

- Further research to understand the direct impacts and compounding consequences of climate change on amphibians, and determine the necessary conservation measures required. Especially important is establishing a global monitoring system spanning different geographies, elevations, and habitats.
- Expand habitat protection, particularly at high elevations, to provide buffers and corridors allowing species to naturally migrate into newly suitable areas.
- Assisted migration for species with limited dispersal ability, as well as conservation breeding programs to ensure species' survival and enable future conservation translocations.
- Active management of habitats and ecosystems to permit species' persistence. For example, supplementary watering during extended drought to ensure breeding success.

Collaboration is needed to find and implement solutions

To effectively tackle these two threats, it is imperative to develop large-scale, multi-institutional collaborations that bring together the best science and monitoring methods. These collaborations should harness the invaluable insights and expertise of local conservation organizations, which possess a unique understanding of the species, culture, and environments found in their respective regions. For each of these critical challenges, global partnerships are essential not only to better understand the problems, but to identify practical, on-the-ground solutions that can save hundreds of species.

[20] *COP15: Final text of Kunming-Montreal Global Biodiversity Framework https://www.cbd.int/article/cop15-final-text-kunming-montreal-gbf-221222*

Lost Species

A growing number of amphibians are believed to be lost to science. A lost species is one not confirmed alive by photographic, audio or genetic information for over 10 years in the wild and has no ex-situ population under human care[21]. Some lost amphibians have been unseen for decades and are only known from museum specimens, while others are naturally rare and difficult to document. Lost species are often feared extinct, but extinction is not their sole fate. They may still be out there awaiting rediscovery.

Ambitious search initiatives, such as Re:wild's Search for Lost Species[22], are necessary to ramp up efforts to find and save lost species before they quietly slide into extinction. The list of lost amphibians has been updated based on GAA2 data and additional input from the IUCN SSC Amphibian Specialist Group, and contains more than 400 lost amphibians. We encourage the amphibian conservation community to focus searches for these lost species and initiate conservation action for them if rediscovered.

[21] *Long & Rodríguez (2022)*
[22] *www.rewild.org/lost-species*

How does a species become lost?

- It occurs in an inaccessible area (e.g. due to rugged terrain or conflict)
- It could be extinct
- It is extremely rare and survives in small numbers in a small geographical area
- It is highly cryptic, either due to its behavior or life history

Lost and Found: Jackson's Climbing Salamander
Bolitoglossa jacksoni

Nestled in the heart of Guatemala's Cuchumatanes Mountains, the Jackson's climbing salamander made its debut to scientists in 1975, only to suddenly disappear without a trace. Despite more than 30 expeditions of dedicated searching, the elusive gold and black amphibian remained missing and landed a spot on Re:wild's Top 25 "Most Wanted" Lost Species list.

More than 40 years after the initial sighting, Jackson's climbing salamander was rediscovered in 2017 by a guard at the edge of the Yal Unin Yul Witz Reserve. The reserve was established only two years prior by a consortium of international organizations, including Re:wild, to protect some of the last remaining habitat for the species and other endemic amphibians.

Collaborating for Conservation

Three groups dedicated to amphibian conservation were founded over the last two decades. Inspired by the results of the first GAA and guided by the Amphibian Conservation Action Plan, their shared vision of ***Amphibians Thriving in Nature*** drives action worldwide to halt the extinction crisis.

A global alliance of partners, the ASA promotes and coordinates the implementation of conservation actions for amphibians, guided by its thematic priorities. It raises the profile of amphibians within the conservation community and the public, issues small grants, and hosts the Future Leaders of Amphibian Conservation Award.

Amphibians thriving in nature.

The ASG is a network of over 300 individuals from 43 regions advancing amphibian conservation through science. Regional and thematic working groups, and bespoke task forces, coordinate member activities. The ASG's Red List Authority (ARLA) maintains the amphibian assessments on the IUCN Red List through the Global Amphibian Assessment initiative.

AArk's mission is ensuring the survival and diversity of amphibian species, focusing on those that cannot currently be safe-guarded in their natural environments. It coordinates programs implemented by partners around the world, with an emphasis on range country programs, and with a constant attention to the obligation to couple captive conservation measures with necessary efforts to protect or restore species in their natural habitats.

The Amphibian Conservation Action Plan (ACAP) examines the mechanisms of and strategies for reducing the following major threats to amphibians:

- Climate change
- Ecotoxicology
- Habitat loss
- Infectious diseases
- Trade and sustainable use

© Andrew Snyder

previous issues

A collaboration of the conservation community, the plan is regularly updated providing current evaluations of our understanding of threat mechanisms. It outlines the following key conservation tools for advancing amphibian conservation at the global and local levels:

- Communication and education
- Conservation planning
- Surveys and monitoring
- Habitat protection
- Assisted reproductive technologies and biobanking
- Conservation breeding
- Genomics
- Translocations

A Sustainable Future for the GAA

The results of the GAA2 present a snapshot in time. They reflect current knowledge and understanding of the conservation status of amphibians. However, a great deal is still unknown. Research is continually providing new insights and the threats to amphibians will continue to evolve. Maintaining and improving the GAA data are key if conservation programs are to adaptively manage their strategies. Across time, GAA data also monitor the effectiveness of conservation actions by detecting improvements to the conservation status of amphibians. Long-term investment across several areas of research is needed to achieve this.

© Jaime Culebras

Maintaining IUCN Red List Assessments

To monitor the conservation status of individual species as well as global trends, the GAA has ambitious new plans to implement a regular five-year reassessment cycle.

Key components of the plan include:

- Reassessment of all threatened species every five years and non-threatened species every ten years.
- Completion of first time assessments for newly described species on an annual basis.
- Development of partnerships with regional institutions to build local capacity and enhance collaboration between national, regional, and global assessment processes.

The ARLA is seeking institutions and individuals interested in being involved in delivering the next GAA installment both globally and regionally. This evolution of the GAA will allow for greater local ownership of the assessment process and stimulate more conservation planning and action for amphibians at the local level.

Taxonomic Research

Taxonomy forms the backbone of the GAA, and assessments of species' extinction risk will be more robust if the underlying taxonomy is reliable.

Key areas for further taxonomic research include:

- Continuing to describe new species; an average of 150 new amphibian species are described by taxonomists annually[23], and this rate seems unlikely to decrease in the near future.
- Clarification of species complexes which comprise multiple undescribed species, some of which may be threatened.
- Resolving ongoing taxonomic confusion for poorly known species so that they can be removed from Data Deficient and have their extinction risk assessed.

Of the 909 Data Deficient amphibians in GAA2, 32% are listed primarily because of taxonomic issues.

Population Monitoring

Population monitoring is critical for determining trends, identifying conservation needs and assessing the effectiveness of conservation measures.

At present there are very few amphibians that are regularly monitored and as a result it can be difficult to quantify population declines and opportunities to prevent further declines or extinction may be lost.

Regular population monitoring, in particular of threatened species, is urgently needed to improve our understanding of a species' conservation status.

© Jaime Culebras

Measuring Species Recovery and the Impact of Conservation

The newly developed IUCN Green Status of Species (GSS) complements the IUCN Red List and provides a more comprehensive picture of the conservation status of a species. It measures how close a species is to being fully ecologically functional across its range, and estimates the impact of past, present and future conservation actions.

Initially, a small subset of GSS assessments will be completed as part of the GAA3, with the number increasing until they become an integral part of the GAA process. These will be powerful tools for informing conservation plans, adaptive management, and providing clear guidance towards achieving national and international biodiversity targets.

[23] *Womack et al. (2022)*

The Impact of Conservation

Despite the sobering results of the GAA2, there is growing evidence that conservation efforts are having a positive impact on amphibians. The extinction risk of at least 63 amphibian species has decreased since 1980, mostly due to improved protection and management of their habitats. Conservation efforts have also played a crucial role in preventing further increases in extinction risk for many species. The following success stories provide inspiration and hope amid the numerous tales of loss.

Puerto Rican Crested Toad
Peltophryne lemur

CR → EN

Downlisted from Critically Endangered in 2004 to Endangered in 2020 thanks to a captive breeding and reintroduction program.

Alcatraz Snouted Treefrog
Scinax alcatraz

CR → VU

Downlisted from Critically Endangered in 2004 to Vulnerable in 2020 as a result of effective habitat protection and management on Alcatraz Island, Brazil.

Yunnan Asian Frog
Nanorana unculuanus

EN → VU

Downlisted from Endangered in 2004 to Vulnerable in 2020 because of protection of its habitat and a hunting ban.

Stephen Island Frog
Leiopelma hamiltoni

EN → VU

Downlisted from Endangered in 2004 to Vulnerable in 2015 following management interventions, reforestation, and translocations in New Zealand.

Call to Action

The state of the world's amphibians is more dire today than at the time of the first Global Amphibian Assessment in 2004. Habitat loss and degradation remains a threat to almost all threatened amphibians, while disease continues to spread across the globe, with a new variant targeting salamanders of increasing concern. The emerging and intricate threat of climate change highlights the urgent need for research and piloting interventions to gain a better understanding of the problems and solutions before it is too late.

The second Global Amphibian Assessment identifies which amphibians are currently threatened, where they occur, and what threats they are facing. Based on these results, this report provides a guide for conservation action by identifying Threatened Amphibian Landscapes, the most threatened amphibian genera, lost amphibians, Key Biodiversity Areas for amphibians, and two threats that require solutions; disease and climate change.
For the governments of the world that in December 2022 committed to halting all human-induced species extinctions by 2050[24], this report provides a snapshot of the measures that are urgently needed to meet this goal, and prevent any further losses of amphibians.

On a brighter note, we know that conservation does work. Since 1980 the extinction risk of 63 species has decreased thanks to effective conservation actions, and hundreds of other species have benefited from conservation measures. These success stories demonstrate how, with adequate resources and political will, we can recover species.

What is needed now is a global movement to catalyze the recovery of the world's amphibians. We call for concerted and cohesive action by government agencies, donors, academia, and non-governmental organizations to improve the status of threatened amphibians, drawing upon the recommendations of this report and the knowledge detailed in the Amphibian Conservation Action Plan.

We also call for continued investment in the Global Amphibian Assessment so it can continue to provide the foundational information for guiding amphibian conservation and measuring the impact of conservation action.

The Amphibian Survival Alliance, Amphibian Specialist Group, and Amphibian Ark are coordinating a global network of thousands of scientists, conservation organizations, and funders focused on improving the conservation status of amphibians. Together they are coordinating action worldwide to halt the amphibian extinction crisis, but much more remains to be done. We invite everyone to join these efforts to scale up and focus conservation action for a future in which Amphibians are thriving in nature.

[24] *CBD (2023)*

The captivating 'foot-flagging' dance performance by the male Nelliyampathi Dancing Frog *Micrixalus nelliyampathi* has brought this pair into a loving embrace. Found only in high-elevation riparian streams of the Western Ghats in India, these tiny frogs are Vulnerable because of water pollution and the alteration of natural watercourses.

Annex I: Threatened Amphibian Landscapes

Criteria for TAL selection

- A cluster of at least five adjacent grid cells that each contain ≥4 threatened amphibian species. For island archipelagos, at least three or more neighboring islands that contain ≥ 4 threatened amphibian species.
- When adjacent grid cell(s) with 3 species create a corridor between clusters, these cells are included.
- If a cluster clearly includes more than one biogeographical area, it is split into smaller TALs accordingly.
- Adjacent grid cells in under-surveyed areas likely to contain high numbers of threatened species may also be included.

Note: *Species listed under Criteria A3 and E with disease identified as a future threat were omitted from the TAL identification process.*
Spatial resolution and projection: *The ISEA10 grid is a geodesic discrete global grid system, defined on an icosahedron and projected using the inverse Icosahedral Snyder Equal Area Projection. The hexagonal grid composed of individual cells retain their shape and area (864 km2) throughout the globe.*

					Major Threats (% Threatened Species Impacted)					
TAL #	**TAL**	**Countries**	**# Species (% Endemic)**	**# Threatened Species (% Threatened)**	**Habitat Loss**	**Disease**	**Climate Change**	**Over-exploitation**	**Fire**	**Invasive Species**
1	Mountains of Western Cuba	Cuba	21(29)	8(38)	100	13	13	0	25	13
2	Mountains of Eastern Cuba	Cuba	44(70)	31(70)	97	10	26	0	6	3
3	Mountain Ranges of Hispaniola	Haiti, Dominican Republic	67(69)	59(88)	97	14	73	2	59	0
4	Jamaica	Jamaica	21(100)	20(95)	100	45	100	0	0	80
5	Puerto Rico	USA	18(61)	13(72)	46	92	100	0	0	38
6	Trans-Mexican Volcanic Belt	Mexico	35(11)	12(34)	100	8	0	8	8	50
7	Sierra Madre del Sur of Mexico	Mexico	91(30)	47(52)	100	36	0	2	9	4
8	Sierra Madre Oriental of Mexico	Mexico	154(45)	89(58)	99	24	3	2	18	3
9	Highlands of Northern Mesoamerica	Mexico, Guatemala, Honduras	261(44)	165(63)	98	45	77	3	36	0
10	Highlands of Southern Mesoamerica	Costa Rica, Panama	250(34)	76(33)	88	59	17	9	7	7
11	Central Panama	Panama, Colombia	92(4)	11(12)	91	100	9	0	9	9
12	Chocó-Darién of Panama and Colombia	Panama, Colombia	245(18)	81(35)	96	28	12	11	5	10
13	Venezuelan Coastal Range	Venezuela	61(39)	17(31)	82	65	6	0	47	6
14	Venezuelan Andes	Venezuela	112(46)	54(50)	89	63	56	0	20	30
15	Sierra Nevada de Santa Marta in Colombia	Colombia	46(24)	12(27)	100	17	17	0	25	0
16	Western Cordillera of the Colombian Andes	Colombia	267(34)	111(44)	95	23	10	8	1	5
17	Eastern Cordillera of the Colombian Andes	Colombia	218(42)	71(35)	97	23	3	1	18	14
18	Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru	Colombia, Ecuador, Peru	733(44)	353(50)	97	17	11	3	10	12
19	Eastern Side of the Central Andes in Ecuador and Peru	Ecuador, Peru	387(20)	125(35)	97	15	9	8	10	5
20	Western Cordillera of the Peruvian Andes	Peru	45(49)	22(61)	95	36	9	9	23	0
21	Central Cordillera of Peru	Peru	236(45)	63(32)	89	29	6	6	19	5
22	Bolivian Yungas	Bolivia	150(32)	48(33)	88	58	69	4	13	10
23	Valdivian Temperate Forests of Chile	Chile	28(43)	17(61)	94	18	12	6	53	12
24	Central Pakaraima Mountains in the Guiana Shield	Brazil, Guyana, Venezuela	30(100)	22(88)	73	0	73	0	50	9
25	Northern Atlantic Forest of Brazil	Brazil	74(4)	6(8)	100	17	0	17	50	0
26	Southern Atlantic Forest of Brazil	Brazil	366(19)	77(22)	74	29	45	1	40	1
27	Cameroonian Highlands	Cameroon	310(10)	80(30)	100	26	20	9	15	4
28	Albertine Rift in the Democratic Republic of the Congo	Democratic Republic of Congo	54(11)	10(21)	100	10	0	20	0	0
29	Ethiopian Highlands	Ethiopia	28(18)	9(35)	100	0	0	0	0	0
30	Eastern Arc Mountains in Tanzania	Tanzania	139(29)	46(36)	100	0	2	0	15	0
31	Northern Madagascar	Madagascar	154(32)	52(34)	98	13	2	6	29	65
32	Eastern Madagascar	Madagascar	192(40)	65(35)	98	3	3	12	52	68
33	Western Ghats of India	India	232(69)	105(52)	99	21	71	4	8	3
34	Southern Highlands of Sri Lanka	Sri Lanka	93(76)	71(76)	100	0	89	1	68	21
35	Qinling-Dabashan Mountains of China	China	29(0)	8(28)	100	0	0	50	0	0
36	Hengduan Mountains of China	China	110(25)	39(36)	95	0	5	56	3	21
37	Yunnan-Guizhou Plateau of China	China	201(18)	53(28)	98	0	17	60	2	13
38	Wuling Mountains of China	China	82(16)	25(32)	96	0	0	56	0	8
39	Nanling Mountains of China	China	74(11)	10(14)	70	0	30	60	0	0
40	Island of Taiwan	China	32(6)	9(29)	100	0	11	0	0	0
41	Island of Hainan	China	44(27)	13(30)	92	0	23	31	0	0
42	Southwestern Japan	Japan	25(4)	8(32)	100	13	13	63	0	25
43	Central Ryukyu Islands of Japan	Japan	17(82)	10(59)	100	0	0	30	0	50
44	Central Annamite Highlands of Vietnam and Lao People's Democratic Republic	Vietnam, Laos PDR	96(15)	12(13)	100	0	0	8	0	0
45	Lang Biang Region of Vietnam	Vietnam	77(23)	21(27)	100	0	5	10	0	0
46	Cardamom Mountains of Cambodia	Cambodia	41(7)	4(10)	100	0	0	0	0	25
47	Palawan Island in the Philippines	Philippines	23(17)	6(26)	100	0	0	0	0	0
48	Sierra Madre on Luzon Island in the Philippines	Philippines	23(0)	4(17)	100	0	0	25	0	0
49	Sabah in Northern Borneo	Malaysia	101(21)	8(8)	100	0	0	0	0	0
50	Central Coast of Eastern Australia	Australia	60(12)	14(23)	86	57	100	0	100	79

Annex II: Highly Threatened Genera

Order	Family	*Genus*	Number of Species *(% threatened)*	Threatened Amphibian Landscape
ANURA	Aromobatidae	*Aromobates*	18 (100%)	14 - Venezuelan Andes 17 - Eastern Cordillera of the Colombian Andes
ANURA	Craugastoridae	*Microkayla*	23 (100%)	21 - Central Cordillera of Peru 22 - Bolivian Yungas
CAUDATA	Plethodontidae	*Pseudoeurycea*	39 (97%)	6 - Trans-Mexican Volcanic Belt 7 - Sierra Madre del Sur of Mexico 8 - Sierra Madre Oriental of Mexico 9 - Highlands of Northern Mesoamerica
ANURA	Telmatobiidae	*Telmatobius*	63 (96%)	18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru 20 - Western Cordillera of the Peruvian Andes 21 - Central Cordillera of Peru 22 - Bolivian Yungas
CAUDATA	Plethodontidae	*Thorius*	29 (96%)	7 - Sierra Madre del Sur of Mexico 8 - Sierra Madre Oriental of Mexico
ANURA	Bufonidae	*Atelopus*	97 (93%)	10 - Highlands of Southern Mesoamerica 11 - Central Panama 12 - Chocó-Darién of Panama and Colombia 13 - Venezuelan Coastal Range 14 - Venezuelan Andes 15 - Sierra Nevada de Santa Marta in Colombia 16 - Western Cordillera of the Colombian Andes 17 - Eastern Cordillera of the Colombian Andes 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru 20 - Western Cordillera of the Peruvian Andes 21 - Central Cordillera of Peru 22 - Bolivian Yungas
ANURA	Micrixalidae	*Micrixalus*	24 (92%)	33 - Western Ghats of India
CAUDATA	Plethodontidae	*Chiropterotriton*	23 (91%)	6 - Trans-Mexican Volcanic Belt 8 - Sierra Madre Oriental of Mexico
ANURA	Bufonidae	*Osornophryne*	11 (91%)	18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru
ANURA	Microhylidae	*Anodonthyla*	11 (91%)	31 - Northern Madagascar 32 - Eastern Madagascar
ANURA	Hylidae	*Plectrohyla*	19 (89%)	9 - Highlands of Northern Mesoamerica
ANURA	Rhacophoridae	*Pseudophilautus*	72 (89%)	34 - Southern Highlands of Sri Lanka
ANURA	Hylidae	*Charadrahyla*	10 (89%)	7 - Sierra Madre del Sur of Mexico 8 - Sierra Madre Oriental of Mexico 9 - Highlands of Northern Mesoamerica
ANURA	Dendrobatidae	*Andinobates*	16 (87%)	10 - Highlands of Southern Mesoamerica 12 - Chocó-Darién of Panama and Colombia 16 - Western Cordillera of the Colombian Andes 17 - Eastern Cordillera of the Colombian Andes 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru
ANURA	Alsodidae	*Alsodes*	19 (86%)	23 - Valdivian Forests of Chile
ANURA	Hylidae	*Sarcohyla*	26 (84%)	7 - Sierra Madre del Sur of Mexico 8 - Sierra Madre Oriental of Mexico
ANURA	Nyctibatrachidae	*Nyctibatrachus*	36 (84%)	33 - Western Ghats of India
ANURA	Microhylidae	*Stumpffia*	15 (83%)	31 - Northern Madagascar 32 - Eastern Madagascar
ANURA	Bufonidae	*Nectophrynoides*	13 (82%)	30 - Eastern Arc Mountains in Tanzania
ANURA	Dendrobatidae	*Oophaga*	12 (82%)	10 - Highlands of Southern Mesoamerica 12 - Chocó-Darién of Panama and Colombia 16 - Western Cordillera of the Colombian Andes
ANURA	Arthroleptidae	*Leptodactylodon*	15 (80%)	27 - Cameroonian Highlands
ANURA	Craugastoridae	*Strabomantis*	16 (80%)	10 - Highlands of Southern Mesoamerica 11 - Central Panama 12 - Chocó-Darién of Panama and Colombia 16 - Western Cordillera of the Colombian Andes 17 - Eastern Cordillera of the Colombian Andes 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru
ANURA	Microhylidae	*Rhombophryne*	15 (80%)	31 - Northern Madagascar
CAUDATA	Salamandridae	*Tylototriton*	29 (78%)	35 - Qinling-Dabashan Mountains of China 36 - Hengduan Mountains of China 37 - Yunnan-Guizhou Plateau of China 38 - Wuling Mountains of China 41 - Island of Hainan
CAUDATA	Salamandridae	*Cynops*	10 (78%)	36 - Hengduan Mountains of China 37 - Yunnan-Guizhou Plateau of China 43 - Central Ryukyu Islands of Japan
ANURA	Hylidae	*Isthmohyla*	14 (77%)	9 - Highlands of Northern Mesoamerica 10 - Highlands of Southern Mesoamerica
ANURA	Centrolenidae	*Nymphargus*	42 (76%)	12 - Chocó-Darién of Panama and Colombia 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru 20 - Western Cordillera of the Peruvian Andes 21 - Central Cordillera of Peru 22 - Bolivian Yungas
ANURA	Hylidae	*Hyloscirtus*	37 (76%)	10 - Highlands of Southern Mesoamerica 11 - Central Panama 12 - Chocó-Darién of Panama and Colombia 14 - Venezuelan Andes 16 - Western Cordillera of the Colombian Andes 17 - Eastern Cordillera of the Colombian Andes 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru 20 - Western Cordillera of the Peruvian Andes 22 - Bolivian Yungas
CAUDATA	Hynobiidae	*Hynobius*	55 (75%)	39 - Nanling Mountains of China 40 - Island of Taiwan 42 - Southwestern Japan
ANURA	Eleutherodactylidae	*Eleutherodactylus*	200 (75%)	1 - Mountains of Western Cuba 2 - Mountains of Eastern Cuba 3 - Mountain Ranges of Hispaniola 4 - Jamaica 5 - Puerto Rico 6 - Trans-Mexican Volcanic Belt
ANURA	Brachycephalidae	*Brachycephalus*	36 (74%)	26 - Southern Atlantic Forest of Brazil
CAUDATA	Plethodontidae	*Oedipina*	38 (74%)	9 - Highlands of Northern Mesoamerica 10 - Highlands of Southern Mesoamerica

Only genera with a minimum of 10 species are included.

Order	Family	*Genus*	Number of Species *(% threatened)*	Threatened Amphibian Landscape
ANURA	Dendrobatidae	*Hyloxalus*	60 (74%)	12 - Chocó-Darién of Panama and Colombia 16 - Western Cordillera of the Colombian Andes 17 - Eastern Cordillera of the Colombian Andes 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru 20 - Western Cordillera of the Peruvian Andes 21 - Central Cordillera of Peru
ANURA	Craugastoridae	*Phrynopus*	35 (73%)	21 - Central Cordillera of Peru
ANURA	Microhylidae	*Cophyla*	19 (72%)	31 - Northern Madagascar
ANURA	Hylidae	*Ecnomiohyla*	12 (70%)	8 - Sierra Madre Oriental of Mexico 9 - Highlands of Northern Mesoamerica 10 - Highlands of Southern Mesoamerica
ANURA	Centrolenidae	*Centrolene*	30 (68%)	12 - Chocó-Darién of Panama and Colombia 14 - Venezuelan Andes 16 - Western Cordillera of the Colombian Andes 17 - Eastern Cordillera of the Colombian Andes 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru 20 - Western Cordillera of the Peruvian Andes 21 - Central Cordillera of Peru
ANURA	Craugastoridae	*Niceforonia*	14 (67%)	17 - Eastern Cordillera of the Colombian Andes 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru 21 - Central Cordillera of Peru
CAUDATA	Plethodontidae	*Bolitoglossa*	134 (66%)	7 - Sierra Madre del Sur of Mexico 9 - Highlands of Northern Mesoamerica 10 - Highlands of Southern Mesoamerica 12 - Chocó-Darién of Panama and Colombia 13 - Venezuelan Coastal Range 14 - Venezuelan Andes 16 - Western Cordillera of the Colombian Andes 17 - Eastern Cordillera of the Colombian Andes 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru
ANURA	Dendrobatidae	*Colostethus*	14 (64%)	12 - Chocó-Darién of Panama and Colombia 16 - Western Cordillera of the Colombian Andes 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru
ANURA	Aromobatidae	*Mannophryne*	20 (63%)	13 - Venezuelan Coastal Range 14 - Venezuelan Andes 17 - Eastern Cordillera of the Colombian Andes
CAUDATA	Plethodontidae	*Nototriton*	20 (63%)	9 - Highlands of Northern Mesoamerica 10 - Highlands of Southern Mesoamerica
ANURA	Mantellidae	*Mantella*	16 (63%)	31 - Northern Madagascar 32 - Eastern Madagascar
ANURA	Hylodidae	*Crossodactylus*	13 (62%)	25 - Northern Atlantic Forest of Brazil 26 - Southern Atlantic Forest
CAUDATA	Salamandridae	*Paramesotriton*	14 (62%)	37 - Yunnan-Guizhou Plateau of China 38 - Wuling Mountains of China 39 - Nanling Mountains of China
ANURA	Craugastoridae	*Craugastor*	120 (59%)	7 - Sierra Madre del Sur of Mexico 8 - Sierra Madre Oriental of Mexico 9 - Highlands of Northern Mesoamerica 10 - Highlands of Southern Mesoamerica 11- Central Panama
ANURA	Alsodidae	*Eupsophus*	10 (60%)	23 - Valdivian Temperate Forests of Chile
ANURA	Dicroglossidae	*Quasipaa*	11 (60%)	35 - Qinling-Dabashan Mountains of China 36 - Hengduan Mountains of China 37 - Yunnan-Guizhou Plateau of China 38 - Wuling Mountains of China 39 - Nanling Mountains of China
ANURA	Hylidae	*Duellmanohyla*	10 (60%)	9 - Highlands of Northern Mesoamerica 10 - Highlands of Southern Mesoamerica
CAUDATA	Salamandridae	*Pachytriton*	10 (60%)	39 - Nanling Mountains of China
ANURA	Megophryidae	*Oreolalax*	18 (59%)	35 - Qinling-Dabashan Mountains of China 36 - Hengduan Mountains of China 37 - Yunnan-Guizhou Plateau of China 38 - Wuling Mountains of China
ANURA	Hemiphractidae	*Gastrotheca*	73 (59%)	10 - Highlands of Southern Mesoamerica 11 - Central Panama 12 - Chocó-Darién of Panama and Colombia 13 - Venezuelan Coastal Range 16 - Western Cordillera of the Colombian Andes 17 - Eastern Cordillera of the Colombian Andes 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru 20 - Western Cordillera of the Peruvian Andes 21 - Central Cordillera of Peru
ANURA	Mantellidae	*Gephyromantis*	41 (59%)	31 - Northern Madagascar 32 - Eastern Madagascar
ANURA	Craugastoridae	*Pristimantis*	541 (58%)	10 - Highlands of Southern Mesoamerica 11 - Central Panama 12 - Chocó-Darién of Panama and Colombia 13 - Venezuelan Coastal Range 14 - Venezuelan Andes 15 - Sierra Nevada de Santa Marta in Colombia 16 - Western Cordillera of the Colombian Andes 17 - Eastern Cordillera of the Colombian Andes 18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru 20 - Western Cordillera of the Peruvian Andes 21 - Central Cordillera of Peru 24 - Central Pakaraima Mountains in the Guiana Shield
ANURA	Bufonidae	*Peltophryne*	14 (57%)	1 - Mountains of Western Cuba 2- Mountains of Eastern Cuba 3 - Mountain Ranges of Hispaniola 5 - Puerto Rico
ANURA	Craugastoridae	*Noblella*	13 (55%)	18 - Northern Central Cordillera of the Andes in Colombia, Ecuador and Peru 19 - Eastern Side of the Central Andes in Ecuador and Peru 21 - Central Cordillera of Peru
ANURA	Ranidae	*Indosylvirana*	13 (54%)	33 - Western Ghats of India 34 - Southern Highlands of Sri Lanka
ANURA	Rhacophoridae	*Raorchestes*	69 (52%)	33 - Western Ghats of India 45 - Lang Biang Region of Vietnam
ANURA	Arthroleptidae	*Astylosternus*	12 (50%)	27 - Cameroonian Highlands
ANURA	Arthroleptidae	*Cardioglossa*	19 (50%)	27 - Cameroonian Highlands
ANURA	Cycloramphidae	*Cycloramphus*	30 (50%)	26 - Southern Atlantic Forest of Brazil
ANURA	Hemiphractidae	*Stefania*	19 (50%)	24 - Central Pakaraima Mountains in the Guiana Shield
ANURA	Mantellidae	*Spinomantis*	12 (50%)	31 - Northern Madagascar 32 - Eastern Madagascar
ANURA	Megophryidae	*Scutiger*	23 (50%)	36 - Hengduan Mountains of China
CAUDATA	Ambystomatidae	*Ambystoma*	33 (50%)	6 - Trans-Mexican Volcanic Belt

Extended Acknowledgments

Authors*
Janice Chanson
Kelsey Neam
**Authors contributed equally*

Design
Carrie Stengel
Kelsey Neam

Contributors
Jennifer (Luedtke) Swandby
Louise Hobin
Barney Long

Additional Design Support
Amber Lamb

For invaluable input and review we thank:
Ariadne Angulo
Amaël Borzée
Gina Della Togna
Pria Ghosh
Penny Langhammer
Andrew Snyder
Simon Stuart
Sally Wren

A special thank you to all the photographers
for permission to reproduce their photographs.

The GAA2 was an extensive collaboration of over 1,000 individuals. The data underlying the analyses included in this report were provided by an incredible expert network to whom we are grateful:

Abdulaziz Al-Qahtani, Abel Batista, Abhijit Das, Adam Clause, Adolfo Amézquita, Adrián García Rodríguez, Adrian Antônio Garda, Adriano Oliveira Maciel, Aimee McIntyre, Akshay Gawade, Alan Channing, Albertina Pimentel Lima, Alberto Estrada, Alberto Gosá, Alberto Puente-Rolón, Alberto Sánchez-Vialas, Aldemar Acevedo Rincón, Aldrin Mallari, Alejandro Ramírez, Alejandro Arteaga-Navarro, Alejandro Calzada, Alejandro Ríos-Franceschi, Alessandro Catenazzi, Alessandro Ribeiro Morais, Alex Figueroa, Alexander Kupfer, Alex Rebelo, Alex Ttito, Alex Villegas, Alexander González, Alexander Shepack, Alexandre Pinheiro de Almeida, Alfonso Miranda Leiva, Alfredo Pedroso, Alfredo Salvador, Ali Qashqaei, Allen Allison, Álvaro Román, Amaël Borzée, Amanda Belén Quezada Riera, Amanda Haigh, Amatha Wickramasinghe, Amir Hamidy, Amit Hegde, An Martel, Ana Almendariz, Ana Longo, Anand Padhye, Anchalee Aowphol, Anderson Jean, Andolalao Rakotoarison, André Pansonato, Andrea Terán, Andreas Hertz, Andreas Kay, Andreas Schmitz, Andrés Aguayo, Andres Maletzky, Andrés Charrier, Andrés García Aguayo, Andrés Merino-Viteri, Andrés Camilo Montes-Correa, Andrés Posso-Terranova, Andrés Rymel Acosta-Galvis, Andrés Valenzuela, Andrew J. Crawford, Andrew Cunningham, Andrew Glusenkamp, Andrew Gray, Andrew Plumptre, Andrew Snyder, Andrew Turner, Andrew Watson, Andrew Whitworth, Angel Romero, Ángel Sosa-Bartuano, Angel Soto, Angelica Crottini, Annemarie Ohler, Annika Hillers, Ansel Fong G., Anslem de Silva, Antoine Fouquet, Antonín Krása, Antonio Cadiz, Antonio Muñoz-Alonso, Antonio Ramírez Velázquez, Antonio Romano, Anuar Shahrul, Argelina Blanco-Torres, Ariadne Angulo, Ariadne Fares Sabbag, Ariel Rodríguez, Arístides García Vinalay, Arlene Cardozo-Urdaneta, Arlo Hinckley, Artem A. Kidov, Arturo Muñoz Saravia, Arturo Salmeron, Arvin C. Diesmos, Atherton de Villiers, Atsushi Tominaga, Attapol Rujirawan, Audrey Owens, Austin Fitzgerald, Awadh Al Johany, Awal Riyanto, Axel Kwet, Aziz Avci, Balint Halpern, Barbod Safaei Mahroo, Barkha Subba, Barnagleison Silva Lisboa, Basundhara Chettri, Belisario Cepeda-Quilindo, Ben Evans, Ben Wielstra, Ben D. Bell, Benedikt Schmidt, Benjamin Tapley, Bhaskar Saikia, Bianca Berneck, Billie Harrison, Bin Wang, Biraj Shrestha, Blake Klocke, Bo Cai, Bo Wen, Boris Blotto, Boris Tuniyev, Branko Hilje, Breda Zimkus, Brian Crawford, Brian Gratwicke, Brian Halstead, Brian Hudgens, Brian Kubicki, Bruce Christman, Bruce Means, Bruno Timbe-Borja, Bryan Stuart, Burhan Tjaturadi, Byron Wilson, Caio Marinho Mello, Caleb Ofori-Boateng, Camila Castro Carrasco, Carl Hutter, Carlos Camp, Carlos Marin, Carlos C. Martínez Rivera, Carlos Pacheco, Carlos Valle-Piñuela, Carlos R. Vásquez-Almazán, Carlos Frederico Duarte da Rocha, Carmen Úbeda, Carol Hughes, Carola A. Haas, Carolina Reyes-Puig, Caroline Zank, Caroline Batistim Oswald, Cathy Brown, Ceal Klingler, Célio Fernando Baptista Haddad, Celsa Señaris, César Aguilar Puntriano, César Barrio-Amorós, César Cuevas, César Jaramillo, César Malambo, Chandramouli S.R., Charif Tala, Chatoan Tesia, Chelmala Srinivasulu, Chou Wenhao, Chris Beirne, Chris Dahl, Chris Phipps, Chris Portway, Christian Supsup, Christine Strüssmann, Christophe Dufresnes, Christopher Austin, Christopher Evelyn, Christoph Grünwald, Christopher Norment, Christopher Raxworthy, Cinthia Aguirre Brasileiro, Claude Miaud, Claudia Fabiola Cortez Fernández, Claudia Corti, Claudia Koch, Claudia Molina, Claudia María Vélez, Claudio Correa, Claudio Azat, Conrad J. Hoskin, Corinne Richards-Zawacki, Cristian Marte, Cristiano Liuzzi, Cristiano Nogueira, Cristopher Antúnez, Cuong The Pham, Cybele Sabino Lisboa, Daiana Paola Ferraro, Daicus Belabut, Dale Roberts, Damany Calder, Damion L. Whyte, Dan Cogălniceanu, Daniel Jablonski, Daniel Ariano-Sánchez, Daniel Cassiano Lima, Daniel Chávez Jácome, Daniel Davila, Daniel Escoriza, Daniel Medina, Daniel Mejía-Vargas, Daniel Oliveira Mesquita, Daniel Padilla Jiménez, Daniel Portik, Daniel Rodríguez, Daniele Canestrelli, Daniele Salvi, Daniele Seglie, Danilo Balete, Danny Boiano, Dario Cardozo, Darrell Frost, David Beamer, David Blackburn, David Donaire-Barroso, David J. Gower, David Hillis, David Hunter, David McLeod, David Newell, David Steen, David Tarkhnishvili, David Wake, Dawne Emery, Deanna H. Olson, Déborah Praciano de Castro, Delia Basanta, Delio Baeta, Denis Vallan, Deon Gilbert, Devin Edmonds, Diana Székely, Diego Armijos-Ojeda, Diego Baldo, Diego Barrasso, Diego Ferrer, Diego Gómez, Diego Janisch Alvares, Diego Ortiz, Diego A. Flores Padron, Diego F. Cisneros-Heredia, Diego José Santana, Dinal Samarasinghe, Dinesh Gabadage, Ding-Qi Rao, Djoko Iskandar, Doade Yang, Donan Satria, Dushantha Kandambi, Eddie Rakotondrasoa, Edgar Bernal Castro, Edgar Jose, Edgar Lehr, Edgardo Flores, Edgardo Griffith, Edmund Leo Rico, Edmundo Perez Ramos, Edson Cortez, Eduardo Boza, Eduardo Pineda Arredondo, Eduardo Sanabria, Eduardo Schaefer, Eduardo J. Rodríguez-Rodríguez, Eduardo José dos Reis Dias, Edvárd Mizsei, Edward Aruna, Edward Camargo, Edwin Gómez-Méndez, Edwin Tambara, Edwin E. Infante-Rivero, El Hassan El Mouden, Elaine Maria Lucas Gonsales, Eli Geffen, Eli Greenbaum, Elizabeth Bell, Elizabeth Jockusch, Elizah Nagombi, Elnaz Najafi-Majd, Elodie Courtois, Elson Meneses-Pelayo, Emanuel Morán, Emanuel Teixeira da Silva, Emerson Sy, Enerit Sacbanaku, Enrico Lunghi, Enrique La Marca, Enrique Ramos, Enzo Isaak Carias Perdomo, Eric Van Den Berghe, Erick Arias, Erika Ximena Cruz-Rodríguez, Esteban Lavilla, Estefany Cano, Estefany Illueca, Evan S.H. Quah, Evan Twomey, Evy Arida, Eyup Başkale, Fabio Pupin, Fábio Hepp, Fábio Maffei, Fabio Leonardo Meza-Joya, Fang Yan, Fargang Torki, Fausto Nomura, Fausto Siavichay Pesántez, Federico Bolaños, Federico Kacoliris, Felipe Camurugi Almeida Guimarães, Felipe Rabanal, Felipe Sá Fortes Leite, Fernanda de Pinho Werneck, Fernando Bird Pico, Fernando Castro, Fernando Rojas-Runjaic, Fernando Vargas-Salinas, Fikirte Gebresenbet, Firoz Ahmed, Flavia Netto, Florina Stănescu, Francesca Protti, Francesco Ficetola, Francesco Lillo, Francisco Brusquetti, Francisco S. Álvarez, Franco Andreone, Francois Becker, Frank Glaw, Frank Pasmans, Franklin Enrique Castañeda, Fred Kraus, Gabriel Calapa, Gabriel Lobos, Gabriel Seneg, Gabriela Agostini, Gabriela Parra-Olea, Gail Ross, Gang Wei, Gary Bucciarelli, Gayathri Sreedharan, Geng Baorong, Geoffrey Hammerson, Geoffrey Heard, George Lonsdale, Georgi Popgeorgiev, Georgina Santos-Barrera, Geraldo Jorge Barbosa de Moura, Gerardo Chaves, Germán Chavez, Gilbert Adum, Gilbert Alvarado Barboza, Gilles Pottier, Gilson Rivas, Gina DellaTogna, Giovanna Chipana, Giovanni Chaves Portilla, Giulia Tessa, Giussepe Gagliardi, Glib Mazepa, Gonçalo Rosa, Gopalakrishna Bhatta, Göran Nilson, Govindappa Venu, Graeme Gillespie, Graham Reynolds, Grant Webster, Greg Hollis, Gregor Aljančič, Guido F. Medina-Rangel, Guillermo Velo-Antón, Guinevere Wogan, Gustavo Casas, Gustavo Fermín, Gustavo Pisso, Gustavo Ruano-Fajardo, Gustavo González-Durán, H.T. Lalremsanga, Hana Putra Wicesa, Harald Hinkel, Harith Farooq, Harry Hines, Héctor Zumbado Ulate, Heidi Ross, Helen Díaz Páez, Helen Meredith, Hellen Kurniati, Hernán Pastore, Hidetoshi Ota, Hiva Faizi, Holly Siow, Ian Vogel, Ibere F. Machado, Idriss Bouam, Ignacio De la Riva, Igor Luis Kaefer, Ikuo Miura, Ilias Strachinis, Indraneil Das, Iñigo Martínez-Solano, Irina Maslova, Iris Holmes, Itamar Alves Martins, Iuri Ribeiro Dias, Iván Ahumada Carrillo, Ivan Nunes, Izabela Menezes Barata, J. Amanda Delgado C., Jaime Bosch, Jaime Culebras, Jaime Pefaur, Jaime Smith, Jaime Villacampa, James Aparicio, James Harvey, James Rorabaugh, James Randall McCranie, Jamie Voyles, Jan Pauel, Jana C. Riemann, Janak Khatiwada, Jason Brown, Javier García-Gutiérrez, Javier Sunyer, Javiera Cisternas, Jayaditya Purkayastha, Jayanta Kumar Roy, Jean-Marc Thirion, Jeanne Tarrant, Jeet Sukumaran, Jef Jaeger, Jeff Dawson, Jeff Humphries, Jeffrey Hall, Jelka Crnobrnja-Isailović, Jennifer Dever, Jennifer Jones, Jenny Loda, Jeremy Feinberg, Jeremy Klank, Jeremy Lindsell, Jeroen Speybroeck, Jesse Delia, Jessica Galvez, Jesús Manzanilla, Jiang Jianping, Jian-Huan Yang, Jichao Wang, Jigme Tshelthrim Wangyal, Jihène Ben Hassine, Jill Newman, Jim Lee, Jimmy Alexander Guerrero-Vargas, Jin-Long Ren, Jing Chai, Jing Che, João Filipe Riva Tonini, João Victor Andrade Lacerda, Jodi J.L. Rowley, Joe Robb, Johannes Els, Johannes Penner, John Cleghorn, John Lamoreux, John MacGregor, John Maerz, John Measey, John Murphy, John Palis, John Phillips, John Poynton, John Tupy, John Wilkinson, John O. Cossel, John

Roger Downie, Joie de Leon, Jonah van Beijnen, Jonathan Campbell, Jonathan Kolby, Jong Sik Choe, Jonh Mueses-Cisneros, Jorge Brito, Jorge García, Jorge Guerrel, Jos Kielgast, José Langone, José Perez, José Vicente Rueda, José Francisco Cáceres Andrade, José Luis Aguilar-López, José Luis Vieira, José Manuel Padial, José Rances Caicedo Portilla, Jose Vincente Rueda-Almonacid, Joseph Mendelson, Joseph Pechmann, Joseph J. Apodaca, Josiah Townsend, Josimar Estrella, Josue Ramos Galdámez, Juan Abarca Alvarado, Juan Guayasamin, Juan Carlos Chaparro, Juan Carlos Cusi, Juan Carlos Ortiz, Juan Carlos Sánchez, Juan David Loaiza, Juan Emiro Carvajal Cogollo, Juan Fernando Webster Bernal, Juan Pablo González de la Vega, Juan Pablo Ramírez, Juan Pablo Reyes, Juan Ramón Fernández Cardenete, Judit Vörös, Julian Faivovich, Julián N. Lescano, Juliane Petry de Carli Monteiro, Julie Razafimanahaka, Justin Gerlach, K. P. Dinesh, K.P. Rajkumar, Kotambylu Vasudeva Gururaja, Kadaba Shamanna Seshadri, Kalamanji Govindaiah Girish, Kanishka Ukuwela, Kanto Nishikawa, Karina Núñez, Karoline Ceron, Karthikeyan Vasudevan, Katherine Krynak, Kathleen Webster, Katja Poboljsaj, Kaushik Deuti, Keerthi Hemkant, Keerthi Krutha, Kelly Irwin, Kelum Manamendra-Arachchi, Ken Wray, Kevin Carter, Kevin Hamed, Kevin Messenger, Khaled Merabet, Kim Howell, Kimberly Castro, Kimberly Stephenson, Kin Onn Chan, Konstantinos Sotiropoulos, Koshiro Eto, Krishna Komanduri, Kristiina Ovaska, Krushnamegh Kunte, Krystal Tolley, Laura Bravo, Laura Sandberger-Loua, Laura Cecilia Pereyra, Leandro Alves da Silva, Leandro João Carneiro de Lima Moraes, Lee Grismer, Lee Kats, Leomerth Lacruz, Leonardo Vignoli, Leonardo Moreira, Leslie Minter, Leticia Afuang, Li Cheng, Li Jia-tang, Liam Bolitho, Lindsey Thurman, Lingyun Xiao, Lior Blank, Lisa Paguntalan, Lisandro Morán, Lorena Quiroga, Louis du Preez, Luan Thanh Nguyen, Luca Coppari, Lucas Barrientos, Lucas Ferrante, Lucas Batista Crivellari, Luciana Barreto Nascimento, Luciana Signorelli, Lucindo Gonzales, Luis Amador, Luis Canseco-Márquez, Luis Castillo Roque, Luis Coloma, Luis M. Díaz, Luis Elizondo, Luis Herrera, Luis Mamani Ccasa, Luis Zambrano, Luis Alberto Rueda-Solano, Luís Felipe Toledo, Luis Fernando Marin da Fonte, Luis Fernando Ribeiro, Luis Orlando Armesto Sanguino, Luiz Fernando Rocha Ugioni, Luke Easton, Madhava Botejue, Madhava Meegaskumbura, Madhushri Mudke, Mae Diesmos, Mael Dewynter, Maggie Haines, Manfredo Turcios Casco, Manuel Guayara, Manuel E. Acevedo, Manuel Morales, Manuel H. Bernal, Marc Hayes, Marcela Vidal, Marcelo Duarte Freire, Marcelo Felgueiras Napoli, Marcelo José Sturaro, Márcio Borges-Martins, Marco Méndez, Marco Rada, Marcos A. Ponce, Marcos Ramírez Zárate, Marcos Rodríguez, Marcos Vaira, Marcus Thadeu Teixeira Santos, Mareike Petersen, Maresa Scofield, Margarita Lampo, Maria Beatriz Pérez Lara, Maria Elena Cuello, Marina Rodes Blanco, Marinus Steven Hoogmoed, José Mario Solís Ramos, Mario H. Yánez-Muñoz, Marisol Pedregosa, Marius Burger, Mark Bailey, Mark D. Scherz, Mark Wilkinson, Mark-Oliver Rödel, Marta Bernardes, Marta Duré, Marvin Anganoy, Mary-Ruth Lowe, Masafumi Matsui, Matheus de Toledo Moroti, Mathieu Denoel, Matt Greenlees, Matthew Forrest, Matthew Niemiller, Matthew O'Donnell, Matthew Schlesinger, Matthieu Berroneau, Matthias Stoeck, Maura Santora, Mauricio Akmentins, Mauricio Ocampo, H. Mauricio Ortega-Andrade, Mauricio Pacheco, Mauricio Pareja, Mauricio Rivera-Correa, Max Dehling, Maxon Fildor, Mayke De Freitas, Md. Kamrul Hasan, M. Monirul H. Khan, Mendis Wickramasinghe, Mian Hou, Michael Barej, Michael Britton, Michael Cunningham, Michael Harvey, Michael Jowers, Michael Lannoo, Michael Lau, Michael Mahony, Michael McFadden, Michael Sisson, Michele Menegon, Michelle Abadie, Michelle Christman, Michelle C. Castellanos-Montero, Miguel Gómez Laporta, Miguel Landestoy, Miguel Urgilés, Miguel Vences, Mike Hudson, Mileidy Betancourth-Cundar, Min Mi-Sook, Mirco Solé, Mirna Garcia-Castillo, Mirza D. Kusrini, Misbahul Munir, Mistar Kamsi, Mizuki Takahashi, Moacir S. Tinôco, Mohammad Firoz Ahmed, Mohd. Abdul Muin, Mohini Mohan Borah, Moisés Escalona, Moises Kaplan, Mozafar Sharifi, Muhammad Rais, Murilo Sousa Andrade, N.A. Aravind, N'Goran G. Kouamé, Naalin Perera, Naitik Patel, Nancy Fairchild, Nate Engbrecht, Nathan Bendik, Natsuhiko Yoshikawa, Nayana Pradeep Kumara, Nayana Wijethilaka, Nazan Üzüm, Neelesh Dahanukar, Neftalí Ríos-López, Nereida Guerra Arevalo, Néstor Basso, Nethu Wickramasinghe, Nicholas Van Gilder, J. Nicolas Urbina-Cardona, Nikhil Dandekar, Nikhil Modak, Nikki Dyanne Realubit, Nikolay Poyarkov, Nina Bulakhova, Ninad Gosavi, Ninda Baptista, Nirhy Rabibisoa, Nono LeGrand Gonwouo, Norhayati Ahmad, Nurhayat Özdemir, Nzano Humtsoe, Octavio R. Rojas Soto, Oliver Hawlitschek, Oliver Quinteros, Olivier Guillaume, Olivier Pauwels, Omar Hernandez, Omar Rojas Padilla, Onil Ballestas, Orlando Ariel Garcés, Oscar Lasso-Alcalá, Oscar Jesús Damián-Baldeón, Oswaldo Cortés, Pablo Venegas, Parham Beyhaghi, Patricia Bejarano-Muñoz, Patricia A. Burrowes, Patricia Mendoza, Patrick Colombo, Patrick Malonza, Patrick McLaughlin, Patrick Ribeiro Sanches, Paul Granado, Paul Gutiérrez, Paul Hamilton, Paul Moler, Paul Oliver, Paul Székely, Paul Walker, Paul Y. Imbun, Paula Hanna Valdujo, Paulo Christiano de Anchietta Garcia, Pedro Galvis, Pedro Lopez del Castillo, Pedro Ivo Simões, Pedro Luiz Vieira Peloso, Perry Ong, Peter Heimes, Peter Trontelj, Petros Lymberakis, Phil Bishop, Philip Clerke, Philip de Pous, Philipp Wagner, Philippe Geniez, Philippe J.R. Kok, Pierre Razafindraibe, Pierre-André Crochet, Pierson Hill, Pipeng Li, Pradeep Samarawickrama, Pratyush Mohapatra, Priti Hebbar, Pritpal Soorae, Prudhvi Raj Gunturu, Rachel Montesinos Martins Pereira, Rachunliu Kamei, Rafael L. Joglar, Rafael Lajmanovich, Rafael Márquez, Rafael Félix de Magalhães, Rafael Filgueira Jorge, Rainer Günther, Rainer Schulte, Rakshya Thapa, Ramachandran Kotharambath, Ramón Rivero, Randall Babb, Randall Jiménez Quirós, Raoul Manenti, Raphali Rodlis Andriantsimanarilafy, Raquel Betancourt, Raquel Hernández, Raul Maneyro, Rayna Bell, Rebecca Tarvin, Regina Medina, Reinaldo Aviles, Rémi Duguet, Renata Platenberg, Renato Morales, Renato Christensen Nali, Renato Neves Feio, Renee Catullo, Renoir J. Auguste, Reuber Albuquerque Brandão, Rhys Burns, Ricardo Cossio, Ricardo Miller, Ricardo Reques, Richard Highton, Richard Jenkins, Richard Kuyper, Richard Tinsley, Rick Lehtinen, Rita Cáceres Charneco, Rob Hopkins, Robert Fisher, Robert Hansen, Robert Murphy, Robert Powell, Roberto Alonso, Roberto Elías Piperis, Roberto Gutiérrez, Roberto Ibáñez, Roberto Luna Reyes, Robin Moore, Robin Suyesh, Robson Waldemar Ávila, Roby Nuñez, Rod Hitchmough, Rodrigo Aguayo, Rodrigo Cajade, Rodrigo Lingnau, Rodrigo Barbosa Ferreira, Rogério Pereira Bastos, Rohan Pethiyagoda, Roland Knapp, Ronald Crombie, Ronald Nussbaum, Ronald Zollinger, Ronaldo Lagat, Rosa Elena Zegarra, Ross MacCulloch, Ross Maynard, Roy Santa Cruz, Rubie Causaren, Rudolf von May, Rupert Mathwin, Rury Eprilurahman, Ruth Percino Daniel, S Harikrishnan, S. Blair Hedges, S.A.M Amer, S.P Vijayakumar, S.R. Ganesh, Sabitry Choudhury Bordoloi, Salim Busais, Sally Wren, Salomón Ramírez-Jaramillo, Salvador Carranza, Sam Cuenca, Samanta Iop, Sampath de Alwis Goonatilake, Sampath Udugampola, Samuel Turvey, Samuel Campos Gomides, Sandeep Das, Sandra Buckner, Sandra Diaz, Sandra Galeano, Sandra V. Flechas, Sandy Arroyo, Sanjay Molur, Sanoj Wijayasekara, Santiago Carreira, Santiago Castroviejo-Fisher, Santosh Bhattarai, Sara L. Ashpole, Sarah Mângia, Sarig Gafny, S.D. Biju, Scott Trageser, Scott Travers, Sean Graham, Sean Reilly, Sean Rovito, Sebastián Barrionuevo, Sebastián Lotzkat, Sebastian Kohn, Sergé Bogaerts, Sergio Rosset, Sergio Terán Juárez, Serkan Gül, Seyyed Saeed Hosseinian Yousefkhani, Shahrul Anuar, Shannon Behmke, Sharyn Marks, Sheila Pereira de Andrade, Sherif Baha El Din, Shingo Tanabe, Shu Chen, Silvia J. Robleto-Hernández, Simon Clulow, Simon P. Loader, Simon N. Stuart, Sixto J. Incháustegui, Skye Wassens, Sloane Jackson, Sofía Carvajal-Endara, Soumphthone Phimmachak, Sonali Garg, Sonam Phunstho, Sondra Vega, Soumia Fahd, Spartak Litvinchuk, Stanley Salazar, Stefan Lötters, Steffen Reichle, Stéphane Augros, Stephen Busack, Stephen Mahony, Stephen J. Richards, Steve Morey, Steven Anderson, Steven Gutiérrez, Steven Whitfield, Subarna Ghimire, Suélen da Silva Alves Saccol, Sumio Okada, Suranjan Karunarathna, Sushil Dutta, Sylvain Dubey, Tahar Slimani, Tainá Figueras Dorado Rodrigues, Tamara Osborne-Naikatini, Tanya Chan-Ard, Tao Thien Nguyen, Taran Grant, Tatianne P.F. Abreu-Jardim, Tatjana Dujsebayeva, Tatsuhiro Tokuda, Teddy Angarita Sierra, Tej Kumar Shrestha, Teresa Camacho Badani, Thaís Barreto Guedes da Costa, Thais Helena Condez, Thiago Silva-Soares, Thiago R. De Carvalho, Thomas Doherty-Bone, Thomas Ziegler, Thy Neang, Tiago Gomes do Santos, Tian Zhao, Tiffany Kosch, Timothy P. Cutajar, Tito Barros, Todd W. Pierson, Tom Brown, Tom Devitt, Tom Kirschey, Tom Martin, Tomohiko Shimada, Travis Taggart, Truong Q. Nguyen, Trupti D. Jadhav, Tutul Bortamuli, Twan Leenders, Ufuk Bülbül, Uğur Kaya, Ulmar Grafe, Ulrich Schulte, Umilaela Arifin, Uthpala Jayawardena, Vaclav Gvozdik, Valentina Caorsi, Valentina Posse, Valeria Corbalán, Valeria Franco, Valerija Zakšek, Vanda Lúcia Ferreira, Varad Bhagwan Giri, Victor Acosta Chaves, Victor Jiménez, Víctor Vargas, Victor Wasonga, Victor Zaracho, Victor G. Dill Orrico, Vincent Farallo, Vinicius Guerra Batista, Vishan Pushpamal, Vishnupriya Sankaraman, Vitor Carvalho-Rocha, Vladlen Henríquez, Walter Smith, Wan-Sheng Jiang, Wang Bin, Wang Jichao, Wang Jie, Waqas Ali, Wendy Bolaños, Wenhao Chou, Werner Conradie, Werther Pereira Ramalho, William Branch, William Flint, Wilmar Bolivar, Wouter Beukema, Xiaohong Chen, Xiaomao Zeng, Feng Xie, Yang Daode, Yankho Chapeta, Yasuchika Misawa, Ying-Yong Wang, Yong Min Pui, Youszef Oliveira da Cunha Bitar, Yuan Zhigang, Yuechan Zhang, Yurii Kornilev, Yusnaviel García Padrón, Zaida Ortega Diago, Zeng Xiaomao, Zhao Wenge, Zhi-Tong Lyu, Zhiyong Yuan, Zhong Zhao, Mediyansyah, Mumpuni.

References

AmphibiaWeb (2023) Available at: https://amphibiaweb.org

Auliya *et al.* (2023) *Nature Conservation* 51: 71-135

BirdLife International (2022) *State of the World's Birds 2022: Insights and solutions for the biodiversity crisis.* BirdLife International

Butchart *et al.* (2007) *PLoS One* 2(1): e140

CBD (2023) *COP15: Final text of Kunming-Montreal Global Biodiversity Framework* Available at: https://www.cbd.int/article/cop15-final-text-kunming-montreal-gbf-221222

Frost (2023) *Amphibian Species of the World: an Online Reference.* Available at: https://amphibiansoftheworld.amnh.org

Global Invasive Species Database (2023) *100 of the World's Worst Invasive Alien Species.* Available at: http://www.iucngisd.org/gisd/100_worst.php

Grear *et al.* (2021) *Biological Conservation* 260: 109222

Hughes *et al.* (2021) *ELife* 10: e70086.

IPBES (2019) *Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.* IPBES

IUCN (2012) *IUCN Red List Categories and Criteria: Version 3.1.* Second edition. IUCN

© Andrew Snyder

© Andrew Snyder

Long & Rodríguez (2022) *Oryx* 56(4): 481-482

Luedtke *et al.* (2023) *Nature (in press)*

Mongabay (2006) *Forest data: Sri Lanka Deforestation Rates and Related Forestry Figures* Available at: https://rainforests.mongabay.com/deforestation/forest-information-archive/Sri_Lanka.htm

Meegaskumbura et al. (2007) *Zootaxa* 1397(1): 1-15

Manamendra-Arachchi & Pethiyagoda (2005) *The Raffles Bulletin of Zoology* Supplement No. 12: 163-303.

Olson *et al.* (2001) *BioScience* 51: 933-938

Thomas *et al.* (2019) *Amphibia-Reptilia* 40(3): 265-290

Titley *et al.* (2017) *PloS One* 12(12): e0189577

Womack *et al.* (2022) *Ichthyology & Herpetology* 110(4): 638-661

UNEP (2022) *Spreading like Wildfire: The Rising Threat of Extraordinary Landscape Fires.* UNEP

USFWS (2016) *Injurious Wildlife Species; Listing Salamanders Due to Risk of Salamander Chytrid Fungus.* USFWS

van Eeden *et al.* (2020) *Impacts of the unprecedented 2019-20 bushfires on Australian animals.* WWF-Australia

Verweijen *et al.* (2022) Conservation, conflict and semi-industrial mining: the case of eastern DRC. *IOB Analyses & Policy Briefs:* 49. Universiteit Antwerpen, Institute of Development Policy

The vibrant Rio Pescado Stubfoot Toad *Atelopus balios* experienced drastic declines during the 1980s with chytridiomycosis reported as the likely cause. This Critically Endangered toad is now rare and survives at only a single site, where it is facing high rates of habitat loss.

asa amphibian survival alliance

ASG IUCN SSC Amphibian Specialist Group

IUCN SSC Species Survival Commission

re:wild

SYNCHRONICITY EARTH