

CONVENTION ON INTERNATIONAL TRADE IN ENDANGERED SPECIES
OF WILD FAUNA AND FLORA



Nineteenth meeting of the Conference of the Parties
Panama City (Panama), 14 – 25 November 2022

CONSIDERATION OF PROPOSALS FOR AMENDMENT OF APPENDICES I AND II

A. Proposal

The inclusion of all species of the family Centrolenidae in Appendix II.

A1. Inclusion of the following 12 species of glass frogs from the family *Centrolenidae* (Taylor, 1951) in Appendix II in accordance with Article II paragraph 2 (a) of the Convention and satisfying Criterion B in Annex 2a of Resolution Conf. 9.24 (Rev. CoP17).

Cochranella euknemos (Savage & Starrett, 1967)
Cochranella granulosa (Taylor, 1949)
Espadarana prosoblepon (Boettger, 1892)
Hyalinobatrachium aureoguttatum (Barrera-Rodriguez & Ruíz-Carranza, 1989)
Hyalinobatrachium fleischmanni (Boettger, 1893)
Hyalinobatrachium valerioi (Dunn, 1931)
Hyalinobatrachium iaspidiense (Ayarzagüena, 1992)
Hyalinobatrachium mondolfii (Señaris & Ayarzagüena, 2001)
Sachatamia albomaculata (Taylor, 1949)
Sachatamia ilex (Savage, 1967)
Teratohyla pulverata (Peters, 1873)
Teratohyla spinosa (Taylor, 1949)

A2. Inclusion of all other species in the family *Centrolenidae* (Taylor, 1951) in Appendix II in accordance with Article II paragraph 2 (b) of the Convention and satisfying Criterion A in Annex 2b of Resolution Conf. 9.24 (Rev. CoP17). At the time of writing (March 2022), this family contains a total of 158 (including 2 newly described species in 2022) described species in the following 12 genera:

Celsiella (2 spp.)
Centrolene (24 spp.) and *Centrolene incertae sedis* (6 spp.)
Chimerella (2 spp.)
Cochranella (8 spp.) and *Cochranella incertae sedis* (7 spp.)
Espadarana (5 sp.)
Hyalinobatrachium (33 spp.)
Ikakogi (2 spp.)
Nymphargus (41 spp.)
Rulyrana (6 spp.)
Sachatamia (5 spp.)
Teratohyla (5 spp.)
Vitreorana (10 spp.)

B. Proponent

Argentina, Brazil, Costa Rica, Côte d'Ivoire, Dominican Republic, Ecuador, El Salvador, Gabon, Guinea, Niger, Panamá, Perú, Togo, and the United States of America *

C. Supporting statement

1. Taxonomy

1.1 Class: Amphibia

1.2 Order: Anura

1.3 Family: *Centrolenidae* (Taylor, 1951)

1.4 All species in the family *Centrolenidae* as follows:

- Celsiella (2 spp.)
- Centrolene (24 spp.)
- Centrolene incertae sedis (6 spp.)
- Chimerella (2 spp.)
- Cochranella (8 spp.)
- Cochranella incertae sedis (7 spp.)
- Espadarana (5 spp.)
- Hyalinobatrachium (33 spp.)
- Ikakogi (2 spp.)
- Nymphargus (41 spp.)
- Rulyrana (6 spp.)
- Sachatamia (5 spp.)
- Teratohyla (5 spp.)
- Vitreorana (10 spp.)

See Annex 1 for the complete list of species, which reflects the best available checklist (<https://amphibiansoftheworld.amnh.org/Amphibia/Anura/Centrolenidae>, consulted on 31 December 2021) at the time of preparation of this proposal.

1.5 Scientific synonyms: None

1.6 Common names:

English:	Glass Frogs
French:	Grenouilles de verre
Spanish:	Ranas de Vidrio / Ranas de Cristal

1.7 Code numbers: None

Resolution Conf. 9.24 (Rev.CoP17), Annex 3, section on higher taxa, states that 'If all species of a higher taxon are included in Appendix I or II, they should be included under the name of the higher taxon.' In accordance with this, because all species are being proposed for listing, this proposal seeks to list the family *Centrolenidae* in CITES Appendix II. The taxonomy of glass frogs (family *Centrolenidae*) continues to change with the discovery and description of new species, and revisions of phylogenetic hypotheses creating new genus-species name combinations. The intent of this proposal is to explicitly include in Appendix II in the future any as-yet undiscovered species of the family *Centrolenidae* through the regular process of updating nomenclature of species in the CITES Appendices as directed by Resolution 12.11 on Standard Nomenclature.

2. Overview

Species of the family *Centrolenidae*, commonly known as glass frogs, are nocturnal arboreal frogs distributed throughout tropical Central and South America, ranging from southern Mexico and stretching all the way south into northern Argentina, and across the Andes from Venezuela (Bolivarian Republic of) to

* The geographical designations employed in this document do not imply the expression of any opinion whatsoever on the part of the CITES Secretariat (or the United Nations Environment Programme) concerning the legal status of any country, territory, or area, or concerning the delimitation of its frontiers or boundaries. The responsibility for the contents of the document rests exclusively with its author.

Bolivia (Plurinational State of). Despite this expansive range, many species have highly fragmented distributions. The greatest diversity of species is concentrated in the Andes of Venezuela, Colombia, Ecuador and Peru. Glass frogs rely exclusively on habitats with vegetation that contain permanent bodies of running water such as streams and waterfalls, and like all amphibians, they are highly vulnerable to pollution. They occur in both lowland and mountainous wet tropical forests; most species tolerate very low levels of habitat disturbance, although some do inhabit secondary forests.

There are presently 158 (with two newly described in 2022) recognized species of glass frogs grouped into 12 genera in the family *Centrolenidae*, and the number of scientifically described species is continuously increasing (see Annex I). In 2022, two new glass frog species were described in Ecuador, *Hyalinobatrachium mashpi* and *Hyalinobatrachium nouns*. Both species look the same, however, DNA establishes that they are new species. It is common with many species of glass frogs that by casual observance they are almost indistinguishable from others of the same genus and sometimes between different genera.

The wild populations of the majority of glass frog species have naturally restricted ranges and are additionally threatened by severe habitat loss and fragmentation, climate change, the introduction of invasive species, chain extinctions, and emerging infectious diseases such as the chytrid fungus *Batrachochytrium dendrobatidis*. More than 50% of all the species evaluated by the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species are threatened with extinction. Furthermore, many of these species have very fragmented distribution. Of those evaluated, 71% are declining in the wild. These declining species include representatives from 10 of the 12 genera (IUCN Amphibian Specialist Group, 2020).

Glass frogs are very charismatic species with large eyes and transparent skin that are traded internationally, mainly as exotic pets. This is possibly due to their unique transparent skin underneath the body through which their internal organs can be seen. Another factor may be that media outlets have regularly described species of the family *Centrolenidae* as resembling “Kermit the Frog,” thereby causing glass frogs to become increasingly popular as pets (Anderson, Natali, 2022). Most glass frogs are sold in Europe, the United States and Canada, although the lack of trade data currently hampers our understanding of the main species involved in the trade, as well as the main trade routes.

A few range states, such as Panama y Ecuador, have allowed small numbers of animals to be exported legally with permits. Costa Rica has only allowed export for scientific purposes. Glass frogs that are illegally traded are often discovered hidden in shipments of animals trafficked from Central America to Europe. In 2014, Costa Rican officers caught a German smuggler attempting to export specimens of reptiles and amphibians and among those confiscated were specimens of *Hyalinobatrachium valerioi* and *Sachatamia illex* (Altherr et al., 2016). Additionally, in 2017, a Russian individual traveling to the Netherlands was found to have hidden more than 100 glass frogs in his luggage. Traders in various countries such as Germany, the Netherlands, Spain, and the United States often advertise these frogs for sale on the Internet and at the large pet fairs in Europe.

Information from official records, such as those from Costa Rica, shows that glass frogs are being collected from the wild for scientific purposes. However, it is not clear what their final destination will be once the research is completed, and in similar cases with other species it was discovered that these types of specimens were later sold commercially. There have also been cases of illegal trade between wildlife management sites of specimens without legal origin. Costa Rican law does not allow collection of wildlife for commercial purposes. There is concern that wild individuals are being laundered as captive bred, as occurs with other species. In Costa Rica, various cases are currently under judicial investigation.

During the preparation of this proposal, records of trade in 12 species of glass frogs were obtained, either through online advertisements or in the U.S. Fish and Wildlife Service (USFWS) LEMIS trade data. An analysis of U.S. LEMIS wildlife trade data related to species of the *Centrolenidae* family revealed a number of key findings. The first was that while imports of live glass frogs were fairly consistent from 2010 to 2016, by 2020 they had increased dramatically, including a staggering increase of 6,800% from 2016-2017 and a 58% increase from 2020-2021. A second finding was that nearly all of the live imports of glass frogs documented were for commercial purposes. To be specific, 87% of live imports from the wild and 100% of live captive-bred imports were imported for commercial purposes. Lastly, it was determined that Costa Rica and Panama stood out among the diverse countries exporting specimens and extracts, with the former accounting for 52.15% of imports and the latter 39.15%. With respect to this information, it is worth noting that every specimen and extract, regardless of the country of origin, was taken from the wild. Additionally, many more species are likely to have entered trade, possibly in violation of national laws and without documentation. Based on available trade data (USFWS LEMIS), at least 30% of live glass frogs imported for commercial purposes have been either at the genus level or simply as a “non-CITES amphibian,” without

species information. In consultations with range states, no population management plans were reported for glass frog species.

An investigation into the availability of glass frogs for sale online in recent years found over 75 active listings, many offering more than one specimen for sale. These listings were found primarily on sites based in the United States, Europe and Japan. Within Europe, the majority of offers for sale came from Spain, Germany and the Netherlands. Country of origin was not indicated in the description of most of the specimens offered for sale, but some websites indicated that they were “captive bred.” While several species of glass frogs were found for sale, listings for *Hyalinobatrachium fleischmanni* were more common than any other species in the family Centrolenidae. In addition to listings that were selling specific species, there were also many that simply referred to specimens by their common names, such as glass frogs in North America, and “gummy frogs” in Japan. The price of the specimens found during this investigation ranged between \$25 USD and \$150 USD. However, reports from Interpol Germany indicate that glass frogs can sell for between EUR 900 and EUR 950, making them the most expensive species of this group in the market.

All species in the family *Centrolenidae* qualify for listing in CITES Appendix II, as the recorded trade in 12 species mean they meet the criteria in accordance with Article II, Paragraph 2(a) of the Convention and satisfy Criterion B of Annex 2(a) of Resolution Conf. 9.24 (Rev. CoP17). Furthermore, due to the close similarities in appearance that make it almost impossible to distinguish between species (Cisneros-Heredia & McDiarmid, 2007), the criteria are met for the inclusion of the entire genus under Annex 2(b) of the Convention.

Effective implementation of a CITES Appendix II listing for glass frogs will require all species to be listed, both to prevent identification hardships for law enforcement officers and to ensure the health and safety of these delicate amphibians by minimizing the amount of handling required to confirm compliance with CITES provisions during inspections. The identification of glass frog species is so complex that in several of the species it has been determined that differentiation between species is only possible by using DNA techniques (Posada, 2022).

Number of Species	IUCN Red List Category	Total species
10	Critically Endangered	92 species with some degree of serious threat to their survival
28	Threatened	
21	Vulnerable	
28	Data Deficient	
5	Not yet evaluated	
11	Near Threatened	11 threatened
55	Least concern	55 with no identified threats
Total 158 species		

The 158 species proposed in this document include 10 assessed as Critically Endangered, 28 as Endangered, 21 as Vulnerable, 11 as Near Threatened, 55 as Least Concern, and 28 as Data Deficient (IUCN Amphibian Specialist Group, 2020). Another 5 species have not yet been evaluated.

Due to the multitude of environmental and pathogenic pressures that are already causing the decline of many of these species, and the increase in illegal trafficking of these species already identified, any unregulated trade is likely to be detrimental to wild populations of the entire family. Several glass frog species have been found in international trade, however, the information from the IUCN Red List does not include information on their presence in international trade. It is also important to note that it is very difficult to do scientific field studies on the status of their populations. In Latin America, investment in field research on the species is very limited, so scientific data is scarce and very localized. For example, the *Hyalinobatrachium talamancae* frog, endemic to Costa Rica, is listed on the IUCN Red List website as having a stable population

and being a species of Least Concern (LC). This is based on personal communications with a researcher in 2015, without publication or population censuses that indicate what happened to the populations in this geographic area (576 km²) (estimated area of occurrence according to IUCN) over the last 7 years. It is essential to take into account these gaps in scientific information when considering whether or not a species is threatened (Annex 6).

3. Species characteristics

3.1 Distribution

Members of the family *Centrolenidae* are widely distributed throughout Central and South America and can be found in 19 range States. They inhabit streams and forests from Mexico all the way south to northern Argentina, as well as the island nation of Trinidad and Tobago. The only three countries on the continent south of Mexico where glass frogs have not yet been described are Chile, Paraguay, and Uruguay. The highest numbers of species are found in Colombia (74), Ecuador (51), Peru (32), and Venezuela (27) (see Annex 2 for full list). Likewise, these same countries also possess the highest numbers of endemic species.

3.2 Habitat

Glass frogs can be found in forested areas with the environmental characteristics these species require, from close to sea level to 3,500 meters high (IUCN Amphibian Specialist Group, 2020). They typically inhabit vegetation, shrubs and trees along rivers, streams, and waterfalls. They are found in lowland and montane tropical and subtropical forests, cloud forests, and moorlands. Most species are restricted to humid primary forests, but some are more generalists and can also be found in disturbed or secondary forests (Cisneros-Heredia & McDiarmid, 2007).

3.3 Biological characteristics

All glass frog species described so far are nocturnal and arboreal and lay their eggs on leaves, mosses or branches overhanging streams or nearby rocks. When the eggs hatch, the tadpoles fall into the water where they complete their development (Ruiz-Carranza & Lynch, 1991). The males of certain species of glass frogs, including some in the genera *Hyalinobatrachium* and *Centrolene*, are known to actively defend their eggs against predators (e.g. Vockenhuber et al., 2008), and significantly higher spawning mortality rates can occur if these guardian males are removed (Delia et al., 2017).

In other species, including members of the genus *Cochranella* and *Sachatamia*, females are the ones who frequently express parental care of the eggs and tadpoles. Males often make courtship or territorial calls from the underside of leaves in certain genera (e.g. *Hyalinobatrachium*) whereas those of other genera more typically call from the upper leaf surface (e.g. *Centrolene*). These positions also usually correspond with the locations where females deposit their eggs. Because many species live in close proximity to the roaring sounds of cascading water, these frogs typically have short high-pitched calls to help cut through the loud background noise.

3.4 Morphological characteristics

Glass frogs are small to medium-sized amphibians, typically ranging from green to brown, with transparent skin on the belly, creating a see-through window where parts of the internal organs and bones can be visible. Body size is highly variable across different glass frog species, mostly ranging from approximately 2 to 5 cm snout-vent-length (SVL). Sexual dimorphism is evident in most centrolenids, and females generally have a longer SVL than males. One notable exception is *Centrolene geckoideum*, where males are larger than females (Guayasamin et al., 2009). Most species have yellow or silvery eyes with fine black speckling or reticulation, and minimal patterning on the dorsal surface of the body, often involving highly variable amounts of spots and speckles. From the dorsal surface, many species of glass frogs appear highly similar, and are likely to prove challenging to differentiate by enforcement officers, especially when animals cannot be easily and safely handled due to the delicate nature of their skin and their skittish nature (Figure 1). Even species that do have distinctive patterns, such as the yellow spots on most *Hyalinobatrachium aureoguttatum*, can be highly variable from one animal to another (Figure 2), and thus color and pattern are not often independently confirmatory diagnosis for many species included in this family of frogs (Figure 3).

Identification of members of the family Centrolenidae is very complex. Some species can only be identified by DNA or dissection. The visible distinction between members of the family *Centrolenidae* often requires morphological examination of anatomical features, including but not limited to, the following: presence or absence of a humeral spine in the frog's armpit; the number of lobes present in the liver; the color of the bones; presence or absence of vomerine teeth in the roof of the mouth; whether the peritoneum (membrane lining the abdominal cavity) is transparent or white, whether the digestive tract appears translucent or white, etc. (Cisneros & McDiarmid, 2007; Guayasamin et al., 2009). The family has been reclassified several times. Some previously recognized groups proved to be polyphyletic, and additionally many species are cryptic, making it difficult to resolve the family classification. Identification of glass frogs is so complex that in several species it has been determined that differentiation between them is only possible using DNA techniques (Posada 2022).

Because many of these species are nearly indistinguishable (Figure 1), the whole family should be listed in CITES Appendix II, as all species due to their high similarity are susceptible to illegal trafficking as a result of problems in their identification by law enforcement officials in countries of their range of distribution, or where they enter proceeds from illegal trafficking. Twelve species have been identified and confirmed to be in international trade. At least 30% of the glass frogs imported into the USA for commercial purposes were only identified as a "non-CITES amphibian," without information on the species. Some specimens were recorded only as belonging to the "*Hyalinobatrachium* species" and others as "*Centrolene* spp." Since there are 33 described species of *Hyalinobatrachium* and 24 described species of *Centrolene*, it is possible that many additional species of glass frogs have entered the international market for commercial purposes, as their identification and taxonomic confirmation was not made.

3.5 Role of the species in its ecosystem

Glass frogs are key species in river food webs and play an important role in food chain dynamics as well as serving as indicators of ecosystem health. Although glass frog tadpoles are microbiotic feeders, adult specimens shift to a terrestrial diet based on insects (Verburg et al., 2007) and, accordingly, form part of the functional ecological groups that keep insect populations under control, including those that can transmit diseases to humans such as malaria, zika and dengue.

Glass frogs are known to have a wide variety of predators, including birds such as quetzals (Quiroga-Carmona & Naveda-Rodríguez, 2014), snakes, bats, and spiders (Delia et al., 2010). Glass frog eggs have also been observed to be eaten by crabs or predatory insects such as crickets and wasps (Delia et al., 2010; Vockenhuber et al., 2008). Thus, not only do these frogs help control insect populations, but they also themselves form a significant biomass of prey that supports the survival of many other forest species.

Like many of the amphibians due to their natural physiology they are extremely vulnerable to pollution and environmental changes so also many species of this family are indicators of the health and quality of the ecosystem. Glass frogs have been found with deformations that may be explained by agricultural contamination near habitat areas (Mateo Marín-Martínez et al., 2019).

4. Status and trends

4.1 Habitat trends

Over the past few decades, forest loss in Central and South America has reached over 9%, which is significantly higher than the world average of 5.2% (Manners & Varela-Ortega, 2017). The main cause of forest loss in these regions is the expansion of commercial agriculture, which accounts for 70% of the total (FAO, 2016). The main threats to Central American amphibians include habitat modification, habitat fragmentation, overexploitation, invasive species, and emerging threats that operate on a large spatial scale such as pollution, emerging infectious diseases, UV-B radiation and climate change, resulting in decrease in the quality of available habitat (Whitfield et al., 2016). This has a strong negative impact on the populations of glass frogs, considering that most species rely on undisturbed forests and very few are able to thrive in disturbed and secondary forests. As a result, the habitat of most species of the family *Centrolenidae* has declined significantly throughout the species' ranges (IUCN SSC Amphibian Specialist Group, 2020; Coloma et al., 2010; Solis et al., 2010a, b).

4.2 Population size

Data on the population size of glass frogs is very limited, but nearly 60% of all species evaluated by the IUCN Red List of Threatened Species (2020) are now endangered primarily due to declining habitat quality, fragmentation, and disease. Thirty-three of the 158 species have an unknown population status and lack data related to their state of vulnerability, either because they have not been evaluated or there is insufficient scientific information about the species, its population dynamics, and its threat status.

Amphibians in general, and glass frogs in particular, are species with strong difficulties when it comes to generating scientific field information on the status of their populations. In Latin America, investment in field research on species is very limited, so scientific data is scarce and very localized.

4.3 Population structure

There is very little available information describing the population structure of glass frogs. The trait most commonly described in studies on the species' ecology and life history traits is clutch size. The average clutch sizes recorded for *Hyalinobatrachium* species: *H. valerioi*, 29 eggs; *H. orientale*, 28.0 ± 5.3 eggs; and *H. fleischmanni*, 23 eggs (range 14-30) (Mangold et al., 2015; Nokhbatolfigohahai, 2015; Salazar-Nicholls & Del Pino, 2015).

Average clutch size of species of the genus *Centrolene*: *Centrolene daidaleum*, 21.8 ± 6.7 eggs (Cardozo-Urdaneta & Searis, 2012); *Centrolene prosoblepon*, 35.4 ± 4.79 eggs (Basto-Riascos et al., 2017); and *Centrolene salvage*, ranges from 15 to 27 eggs (Vargas-Salinas et al., 2014).

Average clutch size of species of the genus *Cochranella*: *C. granulosa* and *C. pulverata*, 81.48 ± 13.59 and 59.18 ± 7.5 eggs, respectively (Delia et al., 2017); *C. mache*, average clutch size of an observed female is reported as 30 eggs (Ortega-Andrade et al., 2013).

In the case of the genus *Sachatamia*, the only information available refers to a study on captive-bred *S. Albomaculata*, according to which average clutch size ranges from 28 to 60 eggs (Hill et al., 2012).

The limited information related to these aspects of the population and its structure is due to the great difficulty in generating scientific field information on the status of their populations. In Latin America, investment in field research on species is very limited, so scientific data is scarce and very localized. This shows how little information is available for all glass frog species, which is the reason for their vulnerable status.

4.4 Population trends

Of the 153 species in the family *Centrolenidae* that have been evaluated by the IUCN Red List of Threatened Species (2020), only 28 are known to have stable populations. Seventy-one percent (69) of species are in a state of decline in the wild. These include species from 10 of the 12 genera. Although 9 of the 12 species confirmed to be in the international pet trade are categorized as Least Concern, only four are considered to have stable populations. Five others have decreasing population trends and two are classified as "unknown" (IUCN SSC Amphibian Specialist Group, 2020). The population trends of the more than 250 specimens that entered into trade according to the LEMIS data from 2018 are unknown.

Species legally reported in international trade:

Species with decreasing populations:

Cochranella euknemos
Cochranella granulosa
Hyalinobatrachium valerioi
Sachatamia albomaculata
Sachatamia illex

Species with stable populations:

Hyalinobatrachium fleischmanni
Espadarana prosoblepon
Teratohyla spinosa

Hyalinobatrachium aureoguttatum
Hyalinobatrachium mondolfii

Species with unknown population status:

Teratohyla pulverata
Hyalinobatrachium iaspidiense

Glass frog species that appear to be common and have stable populations are still experiencing declines in the wild at the local level, sometimes even to the point of localized extinction. *Espadarana prosoblepon* has experienced population declines even inside protected areas (in Costa Rica and Panama) and also underwent local extinction at a site in Ecuador, likely caused by the emerging infectious disease chytridiomycosis (IUCN Amphibian Specialist Group, 2020b). Another commonly traded and widely distributed glass frog, *Hyalinobatrachium fleischmanni*, is also experiencing population declines in montane areas of Costa Rica and Mexico, which have likewise been linked to emerging diseases (IUCN Amphibian Specialist Group, 2020c) and other less studied causes.

4.5 Geographic trends

The main factor influencing the geographic trends of glass frog species is climate change, which is affecting the humid zones of mountaintops. Climate change reduces humidity in the range of altitudes at which the species occurs and could cause a shift in population distribution. The effects of climate change are usually more acute in high altitude forests. According to the IUCN Red List of Threatened Species, the following species are particularly sensitive to this process, and it is expected that their ranges will change: *Centrolene lynchi*, *C. peristictum*, *C. ballux*, *C. heloderma*, *C. balionota*, *C. scirtetes*, and *C. geckoideum*. In addition, in many range state countries, habitat loss affects all wild species, and more than 40% of all amphibian species are threatened (IPBES 2019).

5. Threats

The main threat to glass frog populations is habitat loss and fragmentation due to the expansion of the agricultural frontier to accommodate small farms, agro-industrial agriculture, cattle ranching, and illegal plantations. Habitat loss has also increased as a result of logging and timber extraction, mining, human settlements, and hydroelectric projects (Furlani et al., 2009; La Marca & Señaris, 2004a; Ortega-Andrade et al., 2013). Water pollution from herbicides, pesticides, oil spills, and illegal crop fumigation is also a significant threat to glass frogs (Castro et al., 2010; IUCN SSC Amphibian Specialist Group, 2017a). Climate change is a further threat to the population stability of glass frogs, as it affects the cloud layers especially near mountain peaks, and as a consequence reduces the necessary humidity in parts of the species' altitudinal range. These effects, both independently and collectively, lead to fragmentation of glass frog habitat (Ortega-Andrade et al., 2013).

Other threats are landslides, which can be considered a secondary consequence of habitat loss (e.g. logging), loss of soil structure, and increased rainfall as a result of climate change (La Marca y Señaris, 2004a; IUCN SSC Amphibian Specialist Group, 2017b). The introduction of alien predator fish species has also become a significant threat to certain species such as *Centrolene lynchi*, *C. peristictum* (Coloma et al., 2004 a, b), and *C. ballux* (Bolivar et al., 2004, IPBES 2019).

Certain species appear to have very small population sizes, such as *Hyalinobatrachium lemur* (now recognized as *Hyalinobatrachium pellucidum*). After 20 days of field survey effort in the species' known range and suitable habitat, only three individuals could be found (von May et al., 2008). Species that have limited ranges and small populations are especially vulnerable to decline and extinction driven by the aforementioned threats, in addition to emerging infectious diseases.

The emerging infectious disease chytridiomycosis, caused by infection with the amphibian chytrid fungus *Batrachochytrium dendrobatidis* now poses one of the greatest acute threats to the survival of amphibians globally (Voyles et al., 2018; Kolby & Daszak, 2016; Scheele et al., 2019). This aquatic fungal pathogen destroys the life support functions provided by the amphibians' skin, often leading to death by cardiac arrest (Voyles et al., 2009), and many species of glass frogs have been affected. This pathogen has been attributed to a notable decline of at least 21 species of glass frogs, and one of them is presumed extinct as a result. This species, *Nymphargus truebae*, was endemic to Peru where it was previously abundant and commonly encountered. Its entire range of distribution was found inside Parque Nacional Manu and its buffer zone in the Kosñipata Valley, Cusco Region. Despite existing inside a well-protected area, the entire population crashed around the time chytrid fungus arrived in the region. Despite years of continued surveillance, the

species has not been found since 2005 (IUCN Amphibian Specialist Group, 2017c) and is now presumed extinct.

Many sympatric, stream-breeding anuran species disappeared from this same area during the same period, illustrating the acute threat of chytrid to a diversity of species. Even species regarded as common, such as *Espadarana prosoblepon*, have suffered population declines inside protected areas (in Costa Rica and Panama), and also local extinctions (in Ecuador), likely associated with this ongoing disease event (IUCN Amphibian Specialist Group, 2020a). One of the most commonly traded and widely distributed glass frogs, *Hyalinobatrachium fleischmanni*, is also experiencing population declines in montane areas of Costa Rica and Mexico which have been linked to chytridiomycosis (IUCN Amphibian Specialist Group, 2020b). This resilient species is known to tolerate substantial water pollution and habitat alteration, and yet still it could not tolerate the cumulative pressures when also exposed to this pathogen. Once chytrid fungus invades a new region and becomes established, it can no longer be removed from the environment and remains a constant threat to the frog populations (IPBES 2019).

Glass frogs have been increasingly advertised by the media as resembling Kermit the Frog (from the Muppet Show), and demand for these animals by the international pet trade has multiplied, with an increase in the number of glass frogs for sale on websites, mainly in Europe. In 2018, the sale of nine species was reported and there are current reports of sales of 12 species. The number of specimens in the pet trade in the U.S. has increased exponentially, going from 13 live individuals in 2016 to 5,744 individuals in 2021.

Year	Number of live frogs imported
2010	6
2011	24
2012	33
2013	17
2014	25
2015	21
2016	13
2017	897
2018	2178
2019	2742
2020	3629
2021	5744
Source: LEMIS USA 2010-2021	

6. Utilization and trade

6.1 National utilization

Costa Rica does not allow the commercialization of any wild species as pets. There is illegal trade of species between local collectors and wildlife management sites such as zoos and breeders. Suspicious cases of trafficking related to scientific permits have been detected. In 2014, Costa Rican officials captured a German smuggler attempting to export reptile and amphibian species including specimens of *Hyalinobatrachium valerioi* and *Sachatamia ilex* (Altherr et al., 2016). Also in 2017, a Russian

individual bound for the Netherlands had more than 100 individual glass frogs hidden in his luggage. Dealers in various countries such as Germany, the Netherlands, Spain and the United States frequently advertise frogs for sale on the Internet or at Europe's largest pet fairs.

Information from official records, such as those from Costa Rica, show that glass frogs are being collected from the wild for scientific purposes. However, it is not clear what the final destination of the animals will be once the research is concluded. In the case of other species, situations have come to light where specimens have been sold commercially once the research is finished. It is suspected that some of these specimens may have been collected under scientific permits, but that the permit holders obtained those permits with commercial intent. Trade has also been discovered between wildlife management sites (farms, zoos, etc.) of specimens obtained illegally. Costa Rican regulations do not allow collection from the wild for commercial purposes. There is concern that wild animals are being laundered as captive bred, as occurs with other species. Costa Rica has several cases under judicial investigation.

Argentina: *Vitreorana uranoscopa* (Müller, 1924) is the only anuran species of the family Centrolenidae found in Argentina. It is classified by IUCN as Least Concern. At the national level it is considered an "insufficiently known species" by Resolution No. 1055/2013 due to the fact that there is very little information available about its populations and it only lives in the Paraná Pine Forest (*Araucaria angustifolia*) in the northeast of the country. This is currently a very fragmented habitat, which is decreasing in terms of its surface. In Argentina there are no registered sites for breeding or keeping frogs of the family Centrolenidae.

European Union: UNEP-WCMC conducted an online search between 21-25 June 2021 to document the availability of glass frogs (family Centrolenidae) for sale within the European Union. A total of 82 online retailers, marketplaces, discussion forums and Facebook groups were surveyed of which 11 (13%) were found to contain advertisements for glass frogs.

Overall, 28 advertisements featuring glass frogs were identified, listing six species (*Cochranella granulosa*, *Espadarana prosoblepon*, *Hyalinobatrachium aureoguttatum*, *H. fleischmanni*, *H. valerioi*, *Teratohyla pulverata*) for sale by EU-based traders. Fleischmann's glass frog (*Hyalinobatrachium fleischmanni*) was most frequently documented in advertisements (12) followed by the granular glass frog (*Cochranella granulosa*; 5) and the Nicaraguan giant glass frog (*Espadarana prosoblepon*; 5).

Fifteen of the 28 identified ads (54%) described captive-bred frogs; two listed frogs (both *H. fleischmanni*) as wild-sourced and the remaining 11 did not specify the source. Vendors were predominately based in Germany (46%) and the Netherlands (39%) with the rest based in France and Spain. In addition, three advertisements for sellers based in the United Kingdom of Great Britain and Northern Ireland (hereinafter the UK) were identified; two of these ads were published when the UK was still an EU member state, while the date on which the third was published is unclear. The species offered were *H. fleischmanni*, *H. valerioi* and *Nymphargus grandisonae*. It was further determined that the species *Hyalinobatrachium iaspidiense* and *H. mondolfii* were also being offered for sale.

United States: In the U.S., LEMIS import statistics (see Annex #3) demonstrate that there has been an exponential increase in the use of and trade in the family Centrolenidae, particularly due to a growing demand for the species for the exotic pet trade. Although import data indicates that some of the imported specimens come from captive breeding facilities, this information is difficult to verify, as is the true origin of the species. What is clear is that the trend is towards increasing trade for use as pets.

6.2 Legal trade

An investigation of the availability of glass frogs for sale online in recent years found over 75 active listings, many offering more than one specimen for sale. The listings were primarily found on sites based in the United States, Europe and Japan. Within Europe, the majority of sale offers came from Spain, Germany and the Netherlands. Country of origin was not indicated in the description of most of the specimens listed for sale, but some websites indicated that their specimens were "captive bred." While several species of glass frogs were found for sale, listings for *Hyalinobatrachium fleischmanni* were more common than any other species in the family Centrolenidae. In addition to listings that were selling specific species, there were also many that simply referred to specimens by their common names, such as glass frogs in North America, and "gummy frogs" in Japan. The price of the specimens found during this investigation ranged between USD \$25 and \$150, but reports from Interpol Germany indicate that glass frogs can cost between EUR 900 and EUR 950, making them the most expensive species of this group in the market.

An analysis of U.S. wildlife trade data (LEMIS) related to the species of the family Centrolenidae revealed a number of key findings. The first was that while imports of live glass frogs were fairly constant between 2010 and 2016, by 2021 they had increased dramatically. Between 2016 and 2021, the number of glass frogs imported into the U.S. increased by more than 44,000%. A second finding was that nearly all documented live imports of glass frogs were for commercial purposes - 87% of live animals from the wild and 100% of live animals raised in captivity. Lastly, it was determined that Costa Rica and Panama stood out amongst the various exporting countries, the former representing 52.15% of imports and the latter 39.15%. With respect to this information, it is worth noting that every specimen, regardless of country of origin, was taken from the wild. Additionally, many more species are likely to have entered trade, possibly in violation of national laws and without documentation. According to available commercial data (USFWS LEMIS), at least 30% of live glass frogs imported for commercial purposes have been identified to the genus level or simply as a “non-CITES amphibian” with no information on the species. In consultations with range states, no management plans were reported for populations of glass frog species (Annex 4).

The high mortality rate of glass frogs transported for trade is another important factor to note. In 2007, 70 glass frogs were found with no identification of the species, only that they were from the *Centrolene* genus. The intention was to bring these frogs into the U.S., in transit from Panama. According to the records, they were collected from the wild for scientific purposes and transported in personal hand luggage. They all died during transport (USFWS LEMIS). Of the 24 recognized species in this genus, 16 are threatened with extinction and most are in decline (18 species) or have unknown population trends (14 species) (IUCN Amphibian Specialist Group, 2020a). In the largest seizure reported in Costa Rica (2019), more than 20% of the frogs were already dead by the time the trafficker was intercepted at the airport. Without more information available, it is difficult to assess this situation, but animals transported by scientists are normally expected to receive more care and attention than those transported as exotic pets for commercial purposes, and even more so when they have been granted special permission by the national wildlife authority for removal from wild populations. Although it cannot be confirmed, this unusual case could be an example of a shipment being traded for profit where the true commercial purpose was fraudulently documented as scientific to circumvent national laws that otherwise prohibit the collection of wild animals for commercial use.

This phenomenon warrants further investigation because other frogs have been taken from the wild and traded live to the U.S., and possibly other countries, with most being declared for scientific use and to a lesser extent to be taken to a zoo. This has happened with other species as well, which is why it is being analyzed as a new modus operandi in Costa Rica. Although wildlife authorities of range states have granted permits for these shipments, it is unclear whether they or their offspring (if any) are allowed to enter national and/or international trade after the scientific research or whether these animals and their progeny remain property of the range states governments. If no restrictions are put in place, potentially rare and endangered species that were originally exported for scientific purposes could wind up in trade and cause confusion with law enforcement, especially if range states have never issued export permits for trade for commercial purposes. Research permits from Costa Rica limit the use of live specimens, as no use is authorized that is not clearly specified. Since LEMIS data from USFWS shows that the aforementioned shipment did not violate U.S. law, this discussion is included here under “legal trade” rather than in the illegal trade section below, since it remains unconfirmed. If specimens imported into the U.S. have been fraudulently documented to circumvent foreign laws, this would be a violation of the U.S. Lacey Act.

A quick search for sites offering glass frogs found over 100 sites with specimens available for sale. *Hyalinobatrachium valerioi* sells for around USD 150 in the United States. In Europe, glass frogs are regularly sold on the Internet, and also at European reptile and amphibian fairs, particularly Terraristika, which is held in Hamm (Germany) four times a year. Traders involved are from Austria, Belgium, the Czech Republic, Germany, the Netherlands, Poland, Spain, and the United Kingdom. Prices of glass frogs vary, ranging from EUR 45 to 350, with *S. albomaculata* being the most expensive species. For example, *Hyalinobatrachium valerioi* and *Teratohyla pulverata* (referred to herein as *Cochranella pulverata*) were on sale in November and December 2017, and again in May and June 2018. In October 2017, the online platform www.terraristik.com was also offering glass frogs of the species *Hyalinobatrachium valerioi*. As in the case of Germany and the Netherlands, this website is also used to offer samples for future events. Specimens of *Hyalinobatrachium fleischmanni* were on offer at EUR 45 each, for sale at the Terraria Fair in Houten, the Netherlands (<http://vhm-events.nl/index.php/nl/terrararia-2018/terrararia-houten-september-2018>).

In Spain, *Hyalinobatrachium valerioi* is advertised on the Internet at EUR 89 per specimen (www.harkitoreptile.com/en/en), and *H. fleischmanni* at EUR 110 per male/female pair. Following the

In 2014, a German national was caught in Costa Rica trying to smuggle 438 specimens of frogs, lizards, and snakes to Germany, including 18 *Hyalinobatrachium valerioi* and 20 *Sachatamia ilex*. The authorities described the case as "the largest wildlife seizure in 20 years" (Fendt, 2014). Only a few days before the seizure was made, the smuggler's business partner had advertised several species of glass frogs on the website www.terrartistik.com for sale at the Terraristika Fair in Hamm, Germany. The following species were advertised on the Internet: *Sachatamia ilex*, *Hyalinobatrachium valerioi*, *Sachatamia albomaculata*, *Cochranella granulosa*, *Cochranella euknemos*, *Teratohyla spinosa* (referred to herein as *Cochranella spinosa*), and *Teratohyla pulveratum* (referred to herein as *Cochranella pulverata*) (Altherr, 2016).

In 2017, a Russian citizen bound for Europe was found carrying more than 100 glass frogs in his luggage; (see also Annex 6).

In 2017, a Dutch trader was advertising a large quantity of specimens of *Teratohyla spinosa* (referred to herein as *Cochranella spinosa*) on the website www.terrartistik.com, specifying that they were "captive-bred" specimens from Costa Rica. However, the Costa Rican authorities confirmed that there were no breeding establishments registered for that species, and that any export of specimens taken from the wild was illegal (personal comment, CITES Management Authority of Costa Rica, 2017). In 2019, the same Dutch trader also offered a blue-green variety of *Cochranella granulosa* from Costa Rica, as well as *Hyalinobatrachium fleischmanni* (Altherr & Lameter, 2020).

In 2019, at the Juan Santamaría Airport in Costa Rica, a Russian citizen was detained with more than 100 specimens of wild species that were captured in national territory. The animals were carried in personal hand luggage. This individual was carrying 43 specimens of *Sachatamia ilex* (montane glass frog) and 14 specimens of *Teratohyla spinosa* (dwarf glass frog).

6.5 Actual or potential trade impacts

While habitat degradation, climate change, and the chytrid fungus are the primary threats to species of glass frogs (von May et al., 2008; Mendoza & Arita, 2014), all other secondary threats further increase the negative pressures on wild populations. In recent years, a number of articles in the media comparing glass frogs to the popular "Kermit the Frog" (Martins, 2015) have aroused greater interest from society and traders in these species and may have contributed towards the exponential rise in trade demand observed in recent years. The IUCN Red List assessments of glass frogs do not mention trade as a threat because all assessments except for that of one species state that no records of trade exist. In contrast, the USFWS LEMIS wildlife trade records of importation to the United States, as well as online advertising in Europe, indicate that glass frogs have indeed become a target for the international exotic pet trade. Based on the dramatic shift in demand between 2017 and 2021, with a US-only increase of more than 44,000%, it is necessary to regulate the family *Centrolenidae* on an international level via listing on CITES Appendix II before the quantity of animals traded again increases unexpectedly and exponentially.

6.6 COVID-19

Due to the lack of employment in various sectors, it has been known that the pressure on wild species has increased. On the other hand, the economic funds invested by developing countries to control and monitor have been drastically reduced by the effects on the economy of governments. In Costa Rica, traffic control and protection operations were reduced, and the supervision of wildlife zoos were suspended due to the risks associated with COVID-19.

7. Legal instruments

7.1 National

There are national regulations governing the breeding, transportation, trade, and export of wildlife specimens in most of the countries in Central and South America in which glass frogs occur.

Argentina: The National Wildlife Conservation Law No. 22,421/1981 and its Regulatory Decree No. 666/1997 establish the general legal framework for the protection, conservation, propagation, repopulation and sustainable use of wildlife. In a complementary manner, Resolution No. 62/1986 prohibits the export, commercialization in federal jurisdiction and interprovincial trafficking of live specimens of all species of native fauna, except those bred in captivity. While Resolution No. 62/1986

establishes the requirements and regulates the collection and export of live, dead specimens or samples of wild species for scientific purposes.

Brazil: Under Art. 29 of Brazil's Environmental Crimes Act (Law 9,605 of 12th February 1998), "the killing, persecution, hunting, capture, or utilization of specimens of wild fauna is a crime."

Colombia: Article 56 of Decree 1608 pertaining to Law 23 of 1973 prohibits the hunting of wild fauna for commercial purposes without an appropriate permit. Article 60 provides the requirements for obtaining a permit to hunt and trade wild specimens.

Costa Rica: Wild species are protected by Wildlife Conservation Law No. 7317 of 1992 and implementing Regulation 40548, which prohibit the offtake of wild animals from their natural habitat. Article 75 prohibits the export of wild animals taken from their natural habitat. Article 112 of the Regulation establishes the only possible destinations for species reproduced in zoos for trading wild animals born in captivity. Trade can only occur after the third generation for endangered species and the first generation for other species from captivity.

Ecuador: Articles 80 and 82 of the Law on Conservation of Forests and Areas provide the requirements for authorization to trade wild fauna, including a penalty of five times the minimum wage for trading without the required permit.

El Salvador: Article 8 of Decree 844 pertaining to the Wildlife Conservation Law establishes the regulations to trade and export wild fauna, and also includes permit requirements.

Guatemala: Articles 26 and 27 of the Environment Law affords protection to endangered species; under Article 82, any form of trade in wild fauna is illegal. Only specimens obtained from authorized captive-breeding operations that meet the requirements established by law may be exported. Amphibians are protected under Articles 64 and 97 of the Constitution of the Republic of Guatemala and the Law on Protected Areas (Decree 4-89), according to which exporters must be registered and obtain permits.

Honduras: Wildlife Law, Decree 98/07, Article 98/07, prohibits the capture of endangered species. Hunting of specimens for commercial purposes is subject to authorization by local authorities and compliance with the permit requirements applied by the National Institute for Forest Conservation and Development, Protected Areas and Wildlife.

Mexico: Article 54 (General Law of Ecological Balance and Environmental Protection) provides the requirements for transportation of live specimens; Articles 53 and 54 establish trade permit requirements. Under Article 55, exports are permitted for scientific purposes.

Nicaragua: Decree 8-98 establishes the requirements to obtain a license for captive-breeding. Trade in species is only allowed for specimens of *Oophaga pumilio* acquired from one of the four operations that are licensed to export wild fauna.

Panama: Resolution 17.7 establishes the guidelines for trade in captive-bred specimens. Article 15 of the Wildlife Law prohibits the transportation of wildlife, unless authorized and in compliance with the requirements of the National Directorate for Protected Areas and Wildlife. Export permit requirements are provided under Article 37.

Peru: Law 29763 prohibits the acquisition, marketing, and export of wild fauna resources, unless duly authorized.

Further, Ecuador and Colombia have a Binational Strategy in place to pursue joint efforts with the supervisory body for the purpose of monitoring and controlling illegal trade, and to improve the management of seized specimens (Ministry for the Environment, Ecuador, 2015).

7.2 International

These species are not protected under any international law.

8. Species management

8.1 Management measures

There are no management measures in place for any of these species.

8.2 Population monitoring

No known monitoring systems.

8.3 Control measures

8.3.1 International

No information available.

8.3.2 Domestic

The removal of species classified on the IUCN Red List as Endangered is prohibited in all countries, and each country requires a permit for species that are not endangered. In Costa Rica, wild species cannot be captured from their habitat to be exported for commercial purposes. Only individuals of species born in captivity can be exported for commercial purposes, for threatened species they must be from the third filial generation, in the case of other species, from the first subsidiary generation. There are currently no authorized sites for breeding of glass frogs.

8.4 Captive breeding and artificial propagation

Approximately 87% of live glass frogs imported to the United States between 2004 and 2017 were declared as bred in captivity. The main exporters of captive-bred specimens to the United States were Nicaragua (300 specimens) and Canada (131 specimens). Germany (4), Costa Rica (3), Ecuador (46), and Panama (50) also exported specimens declared as captive-bred, but in smaller numbers (USFWS LEMIS 2018). According to press reports, a frog farm in Ecuador operated by a business called Wikiri is breeding *Hyalinobatrachium aureoguttatum* in captivity for export and claims to be doing this to combat poaching (AFP 2017). On their company website called "[Ecuafrog](#)," they state that, "Ecuafrog is a legal option, a pioneer in Ecuador, which counteracts the illegal trade of frogs," although aside from claiming that their high prices help discouraging illegal trade, there is little available information about whether or not their activity has in fact increased the threat of trade towards these frogs, or instead benefitted their conservation.

In Costa Rica, the Attorney General's Office ordered an analysis of all authorized wildlife management sites because anomalies have been detected in the management of species and their reproduction. Laundering was confirmed in an arthropod zoo for export purposes and investigations are open for other sites nationwide. There are concerns that having so many information gaps on species in the wild and very poor information on which species are successfully and legally bred in captivity could increase illegal laundering of glass frog species, such as *Cochranella spinosa*, as well as other rare or endemic species.

8.5 Habitat conservation

The habitat of most glass frog species is in decline and not protected by any type of conservation area. For example, only the habitat of 17 of the 36 species of *Hyalinobatrachium* is protected; the range of 25 of the 41 species of *Centrolene* is within or partially within the confines of a protected area; the habitat of 10 of the 24 species of *Cochranella* is protected; and 3 of the 4 species of *Sachatamia* are located within protected areas.

9. Information on similar species

The taxonomic classification of glass frogs is the result of a complex combination of 18 morphological characteristics and 7 ecological characteristics (Cisneros-Heredia & McDiarmid, 2007). Other genera, and in particular *Boana*, have species of frogs that share some but not all of the diagnostic characteristics of glass frogs. The genus *Boana* is found throughout South America and contains over 70 species. Certain

species, and in particular *Boana atlantica* and *Boana punctata*, are strikingly similar in color and pattern to a variety of species in the family *Centrolenidae*, but differ in the absence of transparent skin on their underside and in eye patterns and colors.

10. Consultations

The proposal to list glass frogs of the family *Centrolenidae* on Appendix II in accordance with Article II 2(a) of the Convention and satisfying Criterion B of Annex 2(a) of Resolution Conf. 9.24 (Rev. CoP17), was consulted with all range states including France for French Guyana, other countries in Latin America and the Caribbean, and the United States. European Union countries, the United Kingdom and other countries on a global level were also consulted.

Argentina, Peru, El Salvador, Panama, Ecuador, Suriname, Bolivia, the Dominican Republic, the United States, Trinidad and Tobago, St. Lucia, Cameroon, Guinea and Nepal have agreed to support this proposal (Annex 7).

The Nomenclature Specialist of the Animals Committee was also consulted during preparation of this proposal to ensure accurate nomenclature for the glass frog family. All of his observations and recommendations were included in this proposal.

Also, at an international level, a number of NGOs were consulted by the Costa Rican CITES Management Authority: Pro Wildlife, Defenders of Wildlife, the Wildlife Conservation Society, Humane Society International, Costa Rica por Siempre, International Fund for Animal Welfare, Conservation International and members of the Species Survival Network among others, including the Network for Observance and Application of Wildlife Regulations in Central America and the Dominican Republic (ROAVIS). Enforcement agents in Europe, the United States, and glass frog range states were consulted through Interpol Costa Rica.

At a national level, a consultation process was conducted that included Academia: National University, University of Costa Rica, State University Remote, Technological Institute of Costa Rica (ITCR), School of Agriculture of the Humid Tropical Region (EARTH), National Technical University (UTN), Tropical Agricultural Research and Teaching Center (CATIE), College of Biologists of Costa Rica, College of Veterinary Doctors of Costa Rica, College of Agricultural Engineers of Costa Rica, National Animal Health Service (SENASA), State Phytosanitary Service (SFE), National Museum of Costa Rica, National Institute for Innovation and Transfer of Agricultural Technology (INTA).

In addition, the National Commission of Environmental Security, the Ministry of Public Security, the Environmental Judicial Prosecutors, Interpol, the National Customs Service, the Ministry of Environment and Energy (MINAE), the National Commission for Biodiversity Management (CONAGEBIO) and the National System of Conservation Areas (SINAC) were consulted.

11. Additional remarks

The great difficulty in distinguishing between different species and genera of the family *Centrolenidae* provides an opportunity for exploitation by those who desire to trade in rare or endangered species if only some, but not all, species of glass frogs were to become adopted for CITES listing. Further, considering conservation of these species from a global perspective, CITES listing of this family of frogs will significantly reduce pressure on wild populations that are already threatened by habitat fragmentation, climate change, and the severe emerging disease (chytridiomycosis) caused by fungus.

Emerging infectious diseases are threatening amphibians around the world, and especially the chytrid fungus *Batrachochytrium dendrobatidis*. This aquatic pathogen infects the skin of amphibians, impeding their normal functions and eventually causing death by cardiac arrest in susceptible animals (Voyles et al., 2009). Because glass frogs are highly associated with bodies of water and often remain in riparian zones for long periods of time, they are at higher risk of exposure to fungal infection than land or tree frogs. Wild populations of at least 21 glass frog species are known to have already declined and may still be declining as a direct result of exposure to this pathogen (Scheele et al., 2019).

12. References

AFP. 2017. Selling US\$600 frogs – to save them from poachers. Article in New Straits Times, dated July 18 Available at <https://www.nst.com.my/world/2017/07/258493/selling-us600-frogs-%E2%80%93-save-them-poachers>

- Altherr, S., Schuller, A. & A. Fischer. 2016. Stolen Wildlife – why the EU stills needs to tackle smuggling of nationally protected species. Pro Wildlife (ed.), Munich, 40 pp.
- Altherr, S. & K. Lameter. 2020. Stolen Wildlife III – The EU is a main hub and destination for illegally caught exotic pets. Report by Pro Wildlife (ed.), Munich, Germany, 40 pp.
- Anderson, Natali. Mar 24, 2022. Two New Species of Glassfrogs Discovered in Ecuador. <http://www.sci-news.com/biology/two-new-hyalinobatrachium-species-10648.html>
- Basto-Riascos, M.C., López-Caro, J. & Vargas-Salinas, F. 2017. Reproductive ecology of the glass frog *Espadarana prosoblepon* (Anura: *Centrolenidae*) in an urban forest of the Central Andes of Colombia, *Journal of Natural History* 48: 27-28. DOI:10.1080/00222933.2017.13718
- Bolívar, W., Coloma, L. A., Ron, S., Cisneros-Heredia, D. & Wild, E. 2004. *Centrolene ballux*. The IUCN Red List of Threatened Species 2004: e.T54907A11220008.
- Castro, F. Lynch, J. & Grant, T. 2010. *Sachatamia orejuela*. The IUCN Red List of Threatened Species 2010: e.T54976A11221316.
- Cardozo-Urdaneta, A. & Señaris, J.C. 2012. Vocalización y biología reproductiva de las ranas de cristal *Hyalinobatrachium pallidum* y *Centrolene daidaleum* (Anura, *Centrolenidae*) en la Sierra de Perijá, Venezuela. Memoria de la Fundación La Salle de Ciencias Naturales, 70: 87-105.
- Cisneros-Heredia, D.F. & McDiarmid, R.W. 2007. Revision of the characters of *Centrolenidae* (Amphibia: Anura: Athesphatanura) with comments in its taxonomy and the description of new taxa of glassfrogs. *Zootaxa*, 1572: 1 - 82.
- Coloma, L. A., Ron, S., Wild, E. & Cisneros-Heredia, D. 2004a. *Centrolene lynchi*. The IUCN Red List of Threatened Species 2004: e.T54924A11225650.
- Coloma, L. A., Ron, S., Lynch, J., Cisneros-Heredia, D. & Wild, E. 2004b. *Centrolene peristictum*. The IUCN Red List of Threatened Species 2004: e.T54931A11228004.
- Coloma, L. A., Ron, S. R., Wild, E., Cisneros-Heredia, D., Solís, F., Ibáñez, R., Santos-Barrera, G. & Kubicki, B. 2010. *Hyalinobatrachium fleischmanni*. The IUCN Red List of Threatened Species 2010: e.T55014A11238651.
- Delia, J., Bravo-Valencia, L. & Warkentin, K.M. 2017. Patterns of parental care in Neotropical glass frogs: fieldwork alters hypotheses of sex-role evolution. *J. Evol. Biol.* 30(5): 898.
- Delia, J.; Cisneros-Heredia, D.; Whitney, J. and R. Murrieta-Galindo. 2010. Observations on the Reproductive Behavior of a Neotropical Glassfrog, *Hyalinobatrachium fleischmanni* (Anura: *Centrolenidae*). *South American Journal of Herpetology* 5(1):1-12
- FAO. 2016. State of the World's Forests 2016. Forests and agriculture: land-use challenges and opportunities. Rome.
- Fendt, L. 2014. Costa Rica deports a German caught smuggling over 400 frogs and reptiles in takeout containers. Article in PRI as of September 18. <https://www.pri.org/stories/2014-09-18/costa-rica-deports-german-caught-smuggling-over-400-frogs-and-reptiles-takeout>.
- Furlani, D., Ficetola, G.F., Colombo, G., Ugurlucan, M. & de Bernardi, F. 2009. Deforestation and the structure of frog communities in the Humedale Terraba-Sierpe, Costa Rica. *Zoological Science* 26(3):197 – 202.
- Guayasamin, J.M., Castroviejo-Fisher, S., Trueb, L., Ayarzagüena, J. Rada, M. & Vilá, C. 2009. Phylogenetic systematics of Glassfrogs (Amphibia: *Centrolenidae*) and their sister taxon *Allophryne ruthveni*. *Zootaxa*, 2100: 1 – 97.
- Guayasamin, J. M. 2010. *Centrolene buckleyi*. The IUCN Red List of Threatened Species 2010: e.T54908A11220443.
- Guayasamin J.M. *et al.* 2022. Two new glassfrogs (Centrolenidae: *Hyalinobatrachium*) from Ecuador, with comments on the endangered biodiversity of the Andes. *PeerJ* 10: e13109; doi: 10.7717/peerj.13109
- Hill, R.L., Kaylock, J.B., Cuthbert, E., Griffith, E.J. & Ross H.L. 2012. Observations on the captive maintenance and reproduction of the cascade glass frog, *Sachatamia albomaculata* (Taylor, 1949). *Herpetological Review*, 43: 601-604.
- 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. S. Díaz, J. Settele, E. S. Brondízio E.S., H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A.

- Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany. 56 pages.
- IUCN 2020. The IUCN Red List of Threatened Species. Version 2020-3. <https://www.iucnredlist.org> Downloaded on 14 December 2020.
- IUCN SSC Amphibian Specialist Group. 2020a. *Espadarana prosoblepon*. The IUCN Red List of Threatened Species 2020: e.T78163669A54342487. <https://dx.doi.org/10.2305/IUCN.UK.2020-1.RLTS.T78163669A54342487.en> Downloaded on 14 December 2020.
- IUCN SSC Amphibian Specialist Group. 2020b. *Hyalinobatrachium fleischmanni*. The IUCN Red List of Threatened Species 2020: e.T55014A3021859. <https://dx.doi.org/10.2305/IUCN.UK.2020-1.RLTS.T55014A3021859.en> . Downloaded on 14 December 2020.
- IUCN SSC Amphibian Specialist Group. 2017a. *Hyalinobatrachium esmeralda*. The IUCN Red List of Threatened Species 2017: e.T55012A85895006.
- IUCN SSC Amphibian Specialist Group. 2017b. *Centrolene sabinii*. The IUCN Red List of Threatened Species 2017: e.T78457419A89226082.
- IUCN SSC Amphibian Specialist Group. 2017c. *Nymphargus truebae*. The IUCN Red List of Threatened Species 2017: e.T54999A60338909. <https://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T54999A60338909.en> Downloaded on 16 December 2020.
- IUCN Red List (2018): see classifications for *Centrolene*, *Cochranella*, *Hyalinobatrachium*, and *Sachatamia*. The IUCN Red List of Threatened Species. Version 2018-1. <www.iucnredlist.org>.
- Kolby JE, Daszak P. 2016. The emerging amphibian fungal disease, chytridiomycosis: a key example of the global phenomenon of wildlife emerging infectious diseases. *Microbiol Spectrum* 4(3):E110-0004-2015.
- Kubicki, B., Bolaños, F., Chaves, G., Solís, F., Ibáñez, R., Coloma, L.A., Ron, S.R., Wild, E., Cisneros-Heredia, D.F. & Renjifo, J. 2010. *Espadarana prosoblepon*. The IUCN Red List of Threatened Species 2010: e.T54934A11228804.
- La Marca, E. & Señaris, C. 2004. *Hyalinobatrachium fragile*. The IUCN Red List of Threatened Species 2004: e.T55015A11239077.
- La Marca, E. & Señaris, C. 2004b. *Cochranella riveroi*. The IUCN Red List of Threatened Species 2004: e.T54987A11224731.
- Lehtinen, R. & P.A. Georgiadis. 2012. Observations on parental care in the glass frog *Hyalinobatrachium orientale* (Anura: *Centrolenidae*) from Tobago, with comments on its natural history. *Phyllomedusa*. 11. 59-61. 10.11606/issn.2316-9079.v11i1p75-77.
- Ministerio de Medio Ambiente. 2015. Estrategia binacional para la prevención y control del tráfico ilegal de flora y fauna silvestre de la zona de integración fronteriza. Ecuador, 2015.
- McCaffery, R. & Lips. K. 2013. Survival and abundance in males of the glass frog *Espadarana* (*Centrolene*) *prosoblepon* in Central Panamá. *Journal of Herpetology*: 47(1): 162-168.
- Mangold, A., Trenkwalder, K., Ringler, M., Hödl, W., & Ringler, E. 2015. Low reproductive skew despite high male-biased operational sex ratio in a glass frog with paternal care. *BMC Evolutionary Biology* 15: 181.
- Manners, R. & Varela-Ortega, C. 2017. Analysing Latin American and Caribbean forest vulnerability from socio-economic factors. *Journal of Integrative Environmental Sciences* 14(1): 109-130.
- Martins, R. 2015. New Species of See-Through Frog Found, Looks Like Kermit. National Geographic, Article as of April 21. <https://news.nationalgeographic.com/2015/04/150421-glass-frog-kermit-discovery-animals-science-costa-rica/>
- Mateo Marín-Martínez, Vanessa Serna-Botero. *An alarming case? Hindlimb malformation in the endemic Colombian glass frog, *Sachatamia punctulata* (Ruiz-Carranza and Lynch, 1995) (Anura, Centrolenidae)*. *Herpetology Notes*, volume 12: 919-921 (2019)
- Mendoza, A. M. & Arita, H. T. 2014. Priority setting by sites and by species using rarity, richness and phylogenetic diversity: The case of neotropical glassfrogs (Anura: *Centrolenidae*). *Biodiversity and Conservation*, 23 (2): 909 – 926.

- Nokhbatolfighahai, M., Pollock, C.J. & Downie, J.R. 2015. Oviposition and development in the glass frog *Hyalinobatrachium orientale* (Anura: *Centrolenidae*). *Phyllomedusa* 14: 3-17
- Ortega-Andrade, H. M., Rojas-Soto, O., & Paucar, C. 2013. Novel Data on the Ecology of *Cochranella mache* (Anura: *Centrolenidae*) and the Importance of Protected Areas for This Critically Endangered glass frog in the Neotropics. *PLoS ONE*, 8(12), e81837.
- Owen, J. 2014. See-Through Frogs With Green Bones Discovered in Peru. National Geographic, Article as of August 25. <https://blog.nationalgeographic.org/2014/08/25/see-through-frogs-with-green-bones-discovered-in-peru/>
- Posada-Swofford, Ángela. 2022. National Geographic, Two new species of see-through frog named in Ecuador. <https://www.nationalgeographic.com/animals/article/two-new-species-of-glassfrog-discovered>
- Quiroga-Carmona, M. & Naveda-Rodríguez, A. 2014. Crested Quetzal (*Pharomachrus antisianus*) preying on a Glassfrog (Anura, *Centrolenidae*) in Sierra de Perijá, northwestern Venezuela. *Revista Brasileira de Ornitologia*, 22(4): 419-421.
- Rueda, J. V. & Ramírez-Pinilla, M. P. 2004. *Centrolene notostictum*. The IUCN Red List of Threatened Species 2004: e.T54928A11227049.
- Ruiz-Carranza, P. M., & J. D. Lynch. 1991. Ranas *Centrolenidae* de Colombia I. Propuesta de una nueva clasificación genérica. *Lozania*, 57: 1–30.
- Scheele BC, Pasmans F, Skerratt LF, Berger L, Martel A, Beukema W, et al. (2019) Amphibian fungal panzootic causes catastrophic and ongoing loss of biodiversity. *Science*. 363(6434): 1459-1463.
- Salazar-Nicholls, M.J. & del Pino, E.M. 2015. Early development of the glass frogs *Hyalinobatrachium fleischmanni* and *Espadarana callistomma* (Anura: *Centrolenidae*) from cleavage to tadpole hatching. *Amphibian & Reptile Conservation* 8(1) [Special Section]: 89–106 (e88).
- Solís, F., Ibáñez, R., Jaramillo, C., Chaves, G., Savage, J., Cruz, G., Wilson, L.D., Köhler, G., Kubicki, B. & Sunyer, J. 2010a. *Cochranella granulosa*. The IUCN Red List of Threatened Species 2010: e.T54964A11232691.
- Solís, F., Ibáñez, R., Chaves, G., Savage, J., Jaramillo, C., Fuenmayor, Q., Castro, F., Grant, T., Wild, E., Kubicki, B. & Köhler, G. 2010b. *Sachatamia ilex*. The IUCN Red List of Threatened Species 2010: e.T54920A11224601.
- Tahir, T. 2018. Glass hopper: Tiny frog is so SEE-THROUGH you can see eggs growing inside her. Article in Daily Mail, April 19. <http://www.dailymail.co.uk/news/article-5633773/Glass-hopper-Tiny-frog-eggs-growing-inside-her.html>
- Thomson, Robyn, Hoskisson Paul A., Brozio, Downie Sarah; Downie Roger. 2018. Apparent lack of chytrid infection in northeast Tobago's frogs. *Living World*, J. Trinidad and Tobago Field Naturalists' Club.
- US LEMIS Database (2017): Import data for *Centrolene* spp., *Cochranella* spp., *Hyalinobatrachium* spp., and *Sachatamia* spp. for the period 2004-2016. Provided from FOIA request by the United States Law Enforcement Management Information System 2017.
- US LEMIS Database (2022): Import data for *Centrolene* spp., *Cochranella* spp., *Hyalinobatrachium* spp., and *Sachatamia* spp. for the period 2004-2021. Provided from FOIA request by the United States Law Enforcement Management Information System 2022.
- Vallejos, J. G., & Ramirez-Soto, K. (2020). Causes of embryonic mortality in *Espadarana prosoblepon* (Anura: *Centrolenidae*) from Costa Rica. *Phyllomedusa: Journal of Herpetology*, 19(1), 83-92. <https://doi.org/10.11606/issn.2316-9079.v19i1p83-92>
- Vargas-Salinas, F., Quintero-Ángel, A., Osorio-Domínguez, D., Rojas-Morales, J. A., Escobar-Lasso, S., Gutiérrez-Cárdenas, P. D. A., Rivera-Correa, M. and Amézquita, A. 2014. Breeding and parental behaviour in the glass frog *Centrolene savagei* (Anura: *Centrolenidae*). *Journal of Natural History* 48 (27-28): 1689-1705.
- Verburg, P.; Kilhamt, S.; Pringle, C.M.; Lipst, K. and D.L. Drak. 2007. A stable isotope study of a neotropical stream food web prior to the extirpation of its large amphibian community. *Journal of Tropical Ecology* 23: 643-651.
- Vockenhuber, E., Hödl, W. and Karpfen, U. 2008. Reproductive behaviour of the glass frog *Hyalinobatrachium valerioi* (Anura: *Centrolenidae*) at the tropical stream Quebrada Negra (La

- Gamba, Costa Rica). *Stapfia* 88, Kataloge der oberösterreichischen Landesmuseen Neue Serie, 80 (2008): 335-348.
- Von May, R., Catenazzi, A., Angulo, A., Brown, J.L., Carrillo, J., Chávez, G., Córdova, J.H., Curo, A., Delgado, A., Enciso, M., Gutiérrez, R., Lehr, E., Martínez, J., Medina-Müller, M., Miranda, A., Neira, D., Ochoa, J., Quiroz, A., Rodríguez, D., Rodríguez, L., Salas, A., Seimon, T., Seimon, A., Siu-Ting, K., Suárez, J., Torres, C. & Twomey, E. 2008. Current state of conservation knowledge on threatened amphibian species in Peru. *Tropical Conservation Science*, 1: 376–396.
- Voyles, J., D. C. Woodhams, V. Saenz, A. Q. Byrne, R. Perez, G. Rios-Sotelo, M. J. Ryan, M. C. Bletz, F. A. Sobell, S. McLetchie, L. Reinert, E. B. Rosenblum, L. A. Rollins-Smith, R. Ibáñez, J. M. Ray, E. J. Griffith, H. Ross and Richards-Zawacki, C.L. 2018. Shifts in disease dynamics in a tropical amphibian assemblage are not due to pathogen attenuation. *Science* **359** (6383): 1517-1519.
- Voyles, J., Young, S., Berger, L., Campbell, C., Voyles, W. F., Dinudom, A., Cook, D., Webb, R., Alford, R. A., Skerratt, L. F., and Speare, R. 2009. Pathogenesis of chytridiomycosis, a cause of catastrophic amphibian declines. *Science* 326: 582-585
- Whitfield S, Lips K, Donnelly. 2016. Amphibian Decline and Conservation in Central America, *Copeia* 104(2), 351-379, (18 May 2016). <https://doi.org/10.1643/CH-15-300>

ANNEXES

Annex 1. Inventory of glass frog species divided by criteria for inclusion in CITES Appendix II

Inclusion of the following 12 glass frog species from the family Centrolenidae (Taylor, 1951) in Appendix II in accordance with paragraph 2 (a) of Article II of the Convention and complying with Criterion B of Annex 2a of Resolution Conf. 9.24 (Rev. CoP17).

Cochranella euknemos (Savage and Starrett, 1967)
Cochranella granulosa (Taylor, 1949)
Espadarana prosoblepon (Boettger, 1892)
Hyalinobatrachium aureoguttatum (Barrera-Rodriguez and Ruíz-Carranza, 1989)
Hyalinobatrachium fleischmanni (Boettger, 1893)
Hyalinobatrachium valerioi (Dunn, 1931)
Hyalinobatrachium iaspidiense (Ayarzagüena, 1992)
Hyalinobatrachium mondolfii (Señaris and Ayarzagüena, 2001)
Sachatamia albomaculata (Taylor, 1949)
Sachatamia ilex (Savage, 1967)
Teratohyla pulverata (Peters, 1873)
Teratohyla spinosa (Taylor, 1949)

The inclusion of all the rest of the species in family Centrolenidae (Taylor, 1951) in Appendix II in accordance with paragraph 2(b) of Article II of the Convention and satisfying Criterion A of Annex 2(b) of Resolution Conf. 9.24 (Rev. CoP17). At the time of drafting (June 2022), this family consisted of 146 with additional species described in 10 genera (according to Frost 2021, at:

<https://amphibiansoftheworld.amnh.org/Amphibia/Anura/Centrolenidae>)

"Centrolene" acanthidiocephalum (Ruiz-Carranza and Lynch, 1989)
"Centrolene" azulae (Flores and McDiarmid, 1989)
"Centrolene" medemi (Cochran and Goin, 1970)
"Centrolene" petrophilum Ruiz-Carranza and Lynch, 1991
"Centrolene" quindianum Ruiz-Carranza and Lynch, 1995
"Centrolene" robledo Ruiz-Carranza and Lynch, 1995
"Cochranella" duidaeana (Ayarzagüena, 1992)
"Cochranella" euhystrix (Cadle and McDiarmid, 1990)
"Cochranella" geijskesi (Goin, 1966)
"Cochranella" megista (Rivero, 1985)
"Cochranella" ramirezi Ruiz-Carranza and Lynch, 1991
"Cochranella" riveroi (Ayarzagüena, 1992)
"Cochranella" xanthocheridia Ruiz-Carranza and Lynch, 1995
Centrolene altitudinalis (Rivero, 1968)
Centrolene antioquiensis (Noble, 1920)
Centrolene ballux (Duellman and Burrowes, 1989)
Centrolene buckleyi (Boulenger, 1882)
Centrolene charapita Twomey, Delia, and Castroviejo-Fisher, 2014
Centrolene condor Cisneros-Heredia and Morales-Mite, 2008
Centrolene daidalea (Ruiz-Carranza and Lynch, 1991)
Centrolene geckoidea Jiménez de la Espada, 1872
Centrolene heloderma (Duellman, 1981)
Centrolene hesperia (Cadle and McDiarmid, 1990)
Centrolene huilensis Ruiz-Carranza and Lynch, 1995
Centrolene hybrida Ruiz-Carranza and Lynch, 1991
Centrolene lemniscata Duellman and Schulte, 1993
Centrolene lynchi (Duellman, 1980)

Centrolene muelleri Duellman and Schulte, 1993
Centrolene notosticta Ruiz-Carranza and Lynch, 1991
Centrolene paezorum Ruiz-Carranza, Hernández-Camacho, and Ardila-Robayo, 1986
Centrolene peristicta (Lynch and Duellman, 1973)
Centrolene pipilata (Lynch and Duellman, 1973)
Centrolene sabini Catenazzi, Von May, Lehr, Gagliardi-Urrutia, and Guayasamin, 2012
Centrolene sanchezi Ruiz-Carranza and Lynch, 1991
Centrolene savagei (Ruiz-Carranza and Lynch, 1991)
Centrolene solitaria (Ruiz-Carranza and Lynch, 1991)
Centrolene venezuelense (Rivero, 1968)
Chimerella corleone Twomey, Delia, and Castroviejo-Fisher, 2014
Chimerella mariaelenae (Cisneros-Heredia and McDiarmid, 2006)
Cochranella erminea Torres-Gastello, Suárez-Segovia, and Cisneros-Heredia, 2007
Cochranella guayasamini Twomey, Delia, and Castroviejo-Fisher, 2014
Cochranella litoralis (Ruiz-Carranza and Lynch, 1996)
Cochranella mache Guayasamin and Bonaccorso, 2004
Cochranella nola Harvey, 1996
Cochranella resplendens (Lynch and Duellman, 1973)
Espadarana andina (Rivero, 1968)
Espadarana audax (Lynch and Duellman, 1973)
Espadarana callistomma (Guayasamin and Trueb, 2007)
Espadarana durrellorum (Cisneros-Heredia, 2007)
Nymphargus anomalus (Lynch and Duellman, 1973)
Nymphargus armatus (Lynch and Ruiz-Carranza, 1996)
Nymphargus balionotus (Duellman, 1981)
Nymphargus bejaranoi (Cannatella, 1980)
Nymphargus buenaventura (Cisneros-Heredia and Yáñez-Muñoz, 2007)
Nymphargus cariticommatus (Wild, 1994)
Nymphargus caucanus Rada, Ospina-Sarria, and Guayasamin, 2017
Nymphargus chami (Ruiz-Carranza and Lynch, 1995)
Nymphargus chancas (Duellman and Schulte, 1993)
Nymphargus cochranae (Goin, 1961)
Nymphargus colomai Guayasamin and Hutter, 2020
Nymphargus cristinae (Ruiz-Carranza and Lynch, 1995)
Nymphargus garciae (Ruiz-Carranza and Lynch, 1995)
Nymphargus grandisonae (Cochran and Goin, 1970)
Nymphargus griffithsi (Goin, 1961)
Nymphargus humboldti Guayasamin, Cisneros-Heredia, McDiarmid, and Hutter, 2020
Nymphargus ignotus (Lynch, 1990)
Nymphargus lasgralarias Hutter and Guayasamin, 2012
Nymphargus laurae Cisneros-Heredia and McDiarmid, 2007
Nymphargus lindae Guayasamin, 2020
Nymphargus luminosus (Ruiz-Carranza and Lynch, 1995)
Nymphargus luteopunctatus (Ruiz-Carranza and Lynch, 1996)
Nymphargus manduriacu Guayasamin, Cisneros-Heredia, Vieira, Kohn, Gavilanes, Lynch, Hamilton, and Maynard, 2019
Nymphargus mariae (Duellman and Toft, 1979)
Nymphargus megacheirus (Lynch and Duellman, 1973)
Nymphargus mixomaculatus (Guayasamin, Lehr, Rodríguez, and Aguilar, 2006)
Nymphargus nephelophila (Ruiz-Carranza and Lynch, 1991)
Nymphargus ocellatus (Boulenger, 1918)
Nymphargus oreonympha (Ruiz-Carranza and Lynch, 1991)
Nymphargus phenax (Cannatella and Duellman, 1982)
Nymphargus pluvialis (Cannatella and Duellman, 1982)
Nymphargus posadae (Ruiz-Carranza and Lynch, 1995)
Nymphargus prasinus (Duellman, 1981)
Nymphargus rosada (Ruiz-Carranza and Lynch, 1997)
Nymphargus ruizi (Lynch, 1993)

Nymphargus siren (Lynch and Duellman, 1973)
Nymphargus spilotus (Ruiz-Carranza and Lynch, 1997)
Nymphargus sucre Guayasamin, 2013
Nymphargus truebae (Duellman, 1976)
Nymphargus vicenteruedai (Velásquez-Álvarez, Rada, Sánchez-Pacheco, and Acosta-Galvis, 2007)
Nymphargus wileyi (Guayasamin, Bustamante, Almeida-Reinoso, and Funk, 2006)
Rulyrana adiazeta (Ruiz-Carranza and Lynch, 1991)
Rulyrana flavopunctata (Lynch and Duellman, 1973)
Rulyrana mcdiarmidi (Cisneros-Heredia, Venegas, Rada, and Schulte, 2008)
Rulyrana saxiscandens (Duellman and Schulte, 1993)
Rulyrana spiculata (Duellman, 1976)
Rulyrana susatamai (Ruiz-Carranza and Lynch, 1995)
Sachatamia electrops Rada, Jeckel, Caorsi, Barrientos, Rivera-Correa, and Grant, 2017
Sachatamia orejuela (Duellman and Burrowes, 1989)
Sachatamia punctulata (Ruiz-Carranza and Lynch, 1995)
Teratohyla adenocheira (Harvey and Noonan, 2005)
Teratohyla ameliae (Cisneros-Heredia and Meza-Ramos, 2007)
Teratohyla midas (Lynch and Duellman, 1973)
Vitreorana antisthenesi (Goin, 1963)
Vitreorana baliomma Pontes, Caramaschi, and Pombal, 2014
Vitreorana castroviejo (Ayarzagüena and Señaris, 1997)
Vitreorana eurygnatha (Lutz, 1925)
Vitreorana franciscana Santana, Barros, Pontes, and Feio, 2015
Vitreorana gorzulae (Ayarzagüena, 1992)
Vitreorana helenae (Ayarzagüena, 1992)
Vitreorana parvula (Boulenger, 1895)
Vitreorana ritae (Lutz, 1952)
Vitreorana uranoscopa (Müller, 1924)
Celsiella revocata (Rivero, 1985)
Celsiella vozmediano (Ayarzagüena and Señaris, 1997)
Hyalinobatrachium adespinosai Guayasamin, Vieira, Glor, and Hutter, 2019
Hyalinobatrachium anachoretus Twomey, Delia, and Castroviejo-Fisher, 2014
Hyalinobatrachium aureoguttatum (Barrera-Rodriguez and Ruiz-Carranza, 1989)
Hyalinobatrachium bergeri (Cannatella, 1980)
Hyalinobatrachium cappellei (Van Lidth de Jeude, 1904)
Hyalinobatrachium carlesvilai Castroviejo-Fisher, Padial, Chaparro, Aguayo-Vedia, and De la Riva, 2009
Hyalinobatrachium chirripoi (Taylor, 1958)
Hyalinobatrachium colymbiphyllum (Taylor, 1949)
Hyalinobatrachium diana Kubicki, Salazar, and Puschendorf, 2015
Hyalinobatrachium durante (Rivero, 1985)
Hyalinobatrachium esmeralda Ruiz-Carranza and Lynch, 1998
Hyalinobatrachium fragile (Rivero, 1985)
Hyalinobatrachium guairarepanense Señaris, 2001
Hyalinobatrachium ibama Ruiz-Carranza and Lynch, 1998
Hyalinobatrachium kawense Castroviejo-Fisher, Vilà, Ayarzagüena, Blanc, and Ernst, 2011
Hyalinobatrachium mashpi Guayasamin, Brunner, Valencia-Aguilar, Franco-Mena, Ringler, Medina Armijos, Morochz, Bustamante, Maynard, and Culebras, 2022
Hyalinobatrachium mesai Barrio-Amorós and Brewer-Carias, 2008
Hyalinobatrachium muiiraquitan Oliveira and Hernández-Ruz, 2017
Hyalinobatrachium munozorum (Lynch and Duellman, 1973)
Hyalinobatrachium nouns Guayasamin, Brunner, Valencia-Aguilar, Franco-Mena, Ringler, Medina Armijos, Morochz, Bustamante, Maynard, and Culebras, 2022
Hyalinobatrachium orientale (Rivero, 1968)
Hyalinobatrachium orocostale (Rivero, 1968)
Hyalinobatrachium pallidum (Rivero, 1985)
Hyalinobatrachium pellucidum (Lynch and Duellman, 1973)
Hyalinobatrachium talamancae (Taylor, 1952)
Hyalinobatrachium tatayoi Castroviejo-Fisher, Ayarzagüena, and Vilà, 2007

Hyalinobatrachium taylori (Goin, 1968)
Hyalinobatrachium tricolor Castroviejo-Fisher, Vilà, Ayarzagüena, Blanc, and Ernst, 2011
Hyalinobatrachium vireovittatum (Starrett and Savage, 1973)
Hyalinobatrachium viridissimum (Taylor, 1942)
Hyalinobatrachium yaku Guayasamin, Cisneros-Heredia, Maynard, Lynch, Culebras, and Hamilton, 2017
Ikakogi ispacue Rada, Dias, Pérez-González, Anganoy-Criollo, Rueda-Solano, Pinto-E., Mejía Quintero, Vargas-Salinas, and Grant, 2019
Ikakogi tayrona (Ruiz-Carranza and Lynch, 1991)

Annex 2. Range state distribution of frogs in the family Centrolenidae.

The total number of confirmed species in each range state and the number of those that are endemic to a single range state. Distribution data has been taken from the IUCN Red List of Threatened Species (2020). Of the 153 species assessed, 96 are restricted to a single range state.

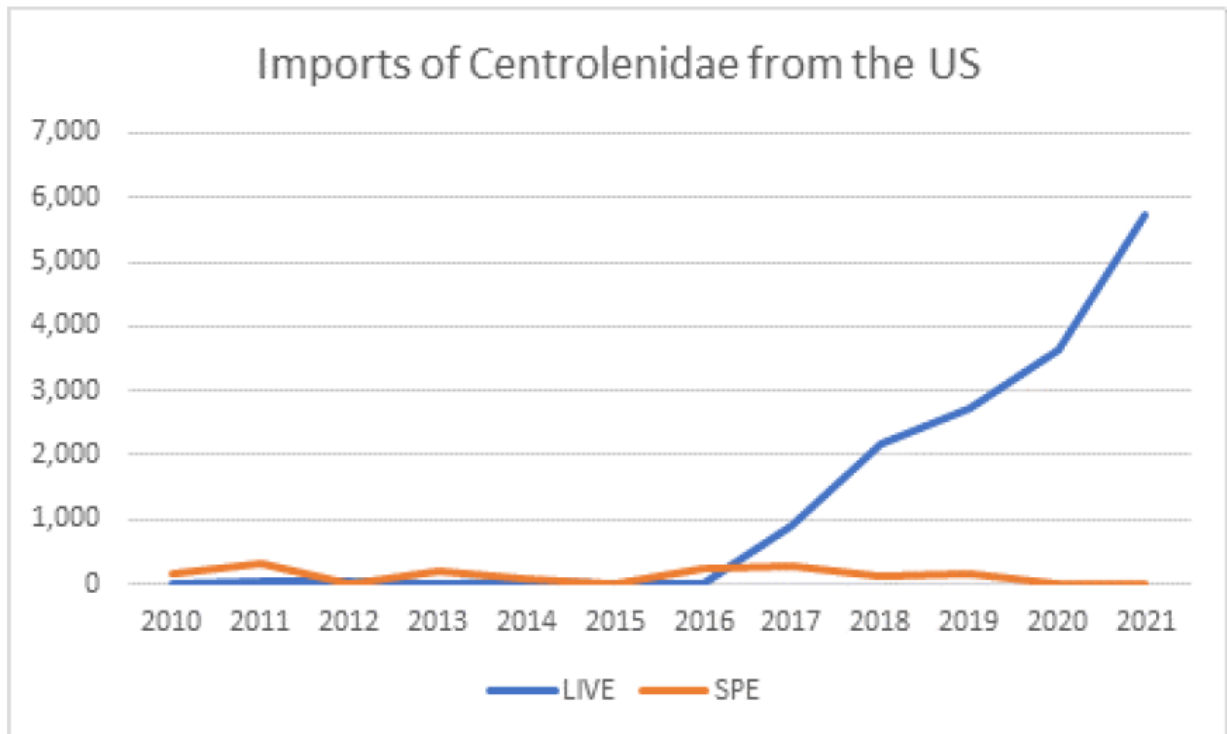
	País / Country	No. Especies / species*	Endémicas / endemic
1.	México	1	
2.	Guatemala	1	
3.	Belize	1	
4.	Honduras	7	
5.	El Salvador	1	
6.	Nicaragua	7	
7.	Costa Rica	14	2
8.	Panamá	13	
9.	Colombia	74	35
10.	Venezuela	27	20
11.	Guyana	6	1
12.	French Guyana	4	1
13.	Suriname	4	1
14.	Brazil	7	2
15.	Trinidad and Tobago	1	
16.	Ecuador	51	16**
17.	Perú	32	17
18.	Bolivia	6	3
19.	Argentina	1	
			TOTAL ENDEMIC
			98**

* Some species are present in various countries.

** This includes the two new species in Ecuador. *J.M. Guayasamin et al. 2022. Two new glassfrogs (Centrolenidae: Hyalinobatrachium) from Ecuador, with comments on the endangered biodiversity of the Andes. PeerJ 10: e13109; doi: 10.7717/peerj.13109*




Annex 4. Number of live glass frogs imported to the United States according to the trade records from USFWS LEMIS from 2010 to 2021.


This data only includes species of *Hyalinobatrachium* spp., *Centrolene* spp., *Cochranella* spp. and *Sachatamia* spp., so additional trade in Centrolenidae may have occurred.





Annex 5. Examples of glass frogs available for sale.

Annex 6 - Examples of Glass Frog Availability in the Market


Country of sale	Website	Social Media	Species	Link of the sale	Price (if available)	Country of origin	Picture of species	Notes
USA	underground reptiles		Fleischmann's Glass Tree Frog	https://undergroundreptiles.com/product/fleischmanns-glass-tree-frog/	\$34.99	n/a		at least three were for sale
USA	Backwater Reptiles	Available on Pinterest: https://www.pinterest.ru/pin/241927811209653678/?lp=tr	"Glass Tree Frog Hyla punctata/fleischmanni"	https://www.backwaterreptiles.com/frogs/glass-tree-frog-for-sale.html	\$39.99 (medium)	n/a		
USA	LLL Reptile		"Northern Glass Frogs" "Species: Hyalinobatrachium fleischmanni"	https://www.llreptile.com/products/35590-northern-glass-frogs	n/a	n/a		"Subscribe to be notified when this product is restocked"
USA	Josh's Frogs	Facebook: https://www.facebook.com/Josh'sFrogs/	"Fleischmann's Glass Frog - Hyalinobatrachium fleischmanni (Captive Bred)" "Hyalinobatrachium Fleischmanni, Fleischmann's Glass Frog, Northern Glassfrog, and the San Jose glass frog. The genus name hyalinobatrachium"	https://www.joshsfrogs.com/fleischmann-s-glass-frog-hyalinobatrachium-fleischmanni-captive-bred.html	\$99.99	n/a	n/a	"Sign up to get notified when this product is back in stock"





USA	Josh's Frogs		Hyalinobatrachium valerioi	https://www.joshsfrogs.com/reticulated-glass-frog-hyalinobatrachium-valerioi-cbp.html	149.99 (buy 4 for 124.99 each and save 17%)	"captive bred CBP"		Out of stock
USA	Reptile Rapture		"GLASS FROG - BLACK EYED - JUVENILES, Hyalinobatrachium fleischmanni"	https://reptilerapture.net/glass-frogs.html	n/a	n/a		It states that shipping costs \$55 and that "Live animals will be shipped by fed Ex overnight shipping"
USA	Morph market		"Fleischmann's Glass Tree Frog Glass Frog Adult Centrolenidae"	https://www.morphmarket.com/us/c/amphibians/frogs/glass-frogs/715355	Price: US\$35.00 Shipping: At Least 45.00 (Domestic)	n/a		"wild caught" "field collected" First Posted: 10/21/21 Last Renewed: 01/03/22 Last Updated: 01/11/22 ID#: GFTF102121
USA	morph market		"Fleischmann's Glass Frog - Hyalinobatrachium Fleischmanni (Captive Bred CBP) Other Frog Baby/Juvenile"	https://www.morphmarket.com/us/c/amphibians/other-frogs/472909	Price: US\$99.99 Shipping: 39.99 (Domestic) Price reduced	"Origin: Domestically Produced"		
USA	Chief Reptile		"NORTHERN GLASS FROG" "Hyalinobatrachium fleischmanni"	https://www.chiefreptile.com/products/northern-glass-frog	\$69.99	n/a		"sold out"







USA	dark knight exotics	Instagram: thedarkknightexotics "Next generation of #Hyalinobatrachium #valerioi Check out our website for currently availability!"	"glass frogs"	https://darkknightexotics.com/shop/oiis/categories/glass-frogs	n/a	n/a	n/a	"new products are coming soon"
USA	Dr. Logan's Amphibian Husbandry Consulting	From another instagram user: "thedarkknightexotics These #Hyalinobatrachium #valerioi are so curious 🐸🐸 if you're looking for any, we highly recommend @logans_anurans . Tell him we sent you."	"amphibian husbandry"	https://logansanurans.com/	n/a	n/a		It appears that glass frogs can be purchased from this person/website/Instagram account but it doesn't explicitly state that frogs are for sale.
USA	Snakes at Sunset		"Suriname Glass Frogs for sale (Hyla sp.)"	https://snakesatsunset.com/suriname-glass-frogs-for-sale-hyla-sp/	\$39.99	Suriname		"out of stock" "Awesome Glass Frogs for sale now available! These are limited, and super hard to get lately."







USA	UGR Wholesale		"Fleischmann's Glass Tree Frog" & "Hyalinobatrachium fleischmanni"	https://ugrwholesale.com/shop/amphibians/fleischmanns-glass-frog/	\$25.00	"Field Collected"		"Approximately .75 – 1 inch In Length Fascinating Amphibians Coming In Lime Green Color And Almost Completely Transparent "
USA	Black Jungle Exotics		"Hyalinobatrachium valerioi"	https://www.blackjungleterrariumsupply.com/Hyalinobatrachium-valerioi-Captive-Bred-Glass-Frog_p_3351.html	Your Price: \$125.00 Retail Price: \$149.99 Your Savings: \$24.99 (17%)	"(Captive Bred Glass Frog)"		"Hyalinobatrachium valerioi (Glass Frog) Captive bred young but well started froglets approximately <1" available. "
USA	The Frog Depot		"Fleischmani glass frog"	https://www.thefrogdepot.com/products/fleischmani-glass-frog?_pos=1&_sid=66e428619&_ss=r	\$30.00			
USA	NJ Exotic Pets	Facebook Group - "Glass frog breeding COOP"	"Glass frogs"		n/a	n/a		Facebook interaction that shows someone saying they bought 2 glass frogs from NJ Exotic Pets and suggesting someone else wanting glass frogs should try the store. (December 30, 2020)





USA		Facebook Group - "Glass Frogs"	"Glass Frogs"	https://www.facebook.com/groups/153881434814576/user/100011464772542	n/a	n/a		Individual on facebook advertising the availability of glass frogs. Location is unclear, english and french are used. (December 5, 2021)
USA	Reptiles n Critters		"Suriname Glass Frog" Hyalinobatrachium sp	https://www.reptilesncritters.com/suriname-glass-grog.html	\$49.99	The name indicates it is probably from Suriname		Out of stock
USA	Understory enterprises		"hyalinobatrachium-aureoguttatum"	https://www.understoryenterprises.com/frogs-from-wikiri/hyalinobatrachium-aureoguttatum	n/a	n/a		
USA	Understory enterprises		"Hyalinobatrachium valerioi"	https://www.understoryenterprises.com/other-frogs/hyalinobatrachium-valerioi				
USA		Facebook	Hyalinobatrachium fleischmanni (that is not the correct species though)	https://www.facebook.com/groups/450102428426177/?ref=br_rs	\$375 for 6 frogs shipped (paypal accepted)	"These are some of the first CB frogs in the US originating from field collected adults"		"All shipments are through SYR to your local fedex hub for am pickup and will be shipped with the appropriate phase/heat packs as needed.
USA		Facebook	Hyalinobatrachium fleischmanni	https://www.facebook.com/groups/450102428426177/?ref=br_rs	Hourglass tree frogs- adult \$35 or 6 @160 and H. Fleischmanni glass	n/a		








USA	Underground Reptiles		Hyalinobatrachium fleischmanni	https://undergroundreptiles.com/shop/glass-tree-frog/	USD 29.99		https://ibb.co/4JkLv8j	
USA	Josh's Frogs		Hyalinobatrachium fleischmanni	https://www.joshsfrogs.com/fleischmann-s-glass-frog-hyalinobatrachium-fleischmanni-captive-bred-cbp.html		USD 149.99	https://imgbb.com/rc1trNly	23 specimens available. Certified Breeder Program.
USA	Josh's Frogs		Hyalinobatrachium valerioi (reticulated glass frog)				https://imgbb.com/MGDgplZ	10 specimens available.
USA	Big Apple Herp		Teratohyla pulverata (Powdered Glass)	https://www.bigappleherp.com/products/powdered-glass-frogs			https://ibb.co/HDvFNDZ	
Canada	All Reptiles		"Northern Glass Frog"	https://allreptiles.ca/glass-frog-5985.html	\$119.99	n/a		"Availability: Out of stock - Contact us and we will see what we can do"
Canada	Tails & Scales		"Northern Glass Frog"	https://tailsandscales.ca/products/northern-glass-frog-1	\$90.00			"Bright translucent treefrogs from central america."
Canada	Roonami		"Northern Glass Frog"	https://www.roonami.com/preorder-northern-glass-frog.html	C\$85.00	n/a		These Glass Frogs are marked as available for Preorder and it states that there are 4 in stock. "In stock (4)"

Denmark	Terraristik		"Glass frogs and leaf frogs (Glasfrösche und Laubfrösche) for sale (100% offspring; minimum is 3 months of age): Cochranella granulosa Hyalinobatrachium valerioi Hyalinobatrachium aureoguttatum Espadarana	https://www.terraristik.com/tb/buy-and-sell/glass-frogs-and-leaf-frogs-glasfroesche-und-laubfroesche/a940345/	n/a	n/a		seller is Tobias Eisenberg. There is an option to message him.
UK	Exotic Pets		"Glass Tree Frog Hyalinobatrachium fleischmanni"	https://www.exotic-pets.co.uk/glass-tree-frog.html	n/a	n/a	n/a	"This item is currently unavailable."
UK	Fantastic Frogs		"Hyalinobatrachium fleischmanni"	https://fantasticfrogs.co.uk/product/hyalinobatrachium-fleischmanni/	£59.50 inc Vat	n/a		"out of stock"
Spain	Mascotas Algama		"Ranita de Cristal - Hyalinobatrachium fleischmanni"	https://www.mascotasalgama.com/Ranita-de-Cristal-Hyalinobatrachium-fleischmanni	53,00€ (marked down from 63 euros)	n/a		"sold out"
Spain	DNAT ecosistemas		"Ranita de Cristal - Hyalinobatrachium fleischmanni"	https://www.dnatecosistemas.es/tienda-reptiles-y-anfibios/anfibios/ranas-y-sapos/ranita-cristal-hyalinobatrachium-fleischmanni-venta-de-reptiles-anfibios-online-venta-de-camaleones-online-tienda-online-de-reptiles-.html	n/a	n/a		"producto agotado" (sold out)

Spain	DNAT ecosistemas		"Ranita de Cristal granulosa - cochranella granulosa"	https://www.dnatecosistemas.es/temas.es/tienda-reptiles-y-anfibios/anfibios/ranas-y-sapos/ranita-cristal-granulosa-cochranella-granulosa-venta-de-reptiles-anfibios-online-venta-de-camaleones-online-tienda-online-de-reptiles-.html	n/a	n/a		"producto agotado" (sold out)"
Spain	Mil anuncios		Hyalinobatrachium fleischmanni	https://www.milanuncios.com/reptiles/myalinobatrachium-fleischmanni-reptil-248293452.htm	75 euros	n/a		
Spain	Mil anuncios		Hyalinobatrachium fleishmanni	https://www.milanuncios.com/otros-animales/pareja-ranashyalinobatrachium-f-en-venta259927433.htm	2 frogs for 110 euros	n/a		
Spain	Harkito Reptile		Hyalinobatrachium valerioi - rana de cristal	http://www.harkitoreptile.com/es/anfibios/1223-hyalinobatrachium-valerioi-rana-de-cristal.html	89 euros			
Spain		Facebook	Listed by family: Centrolenidae	https://www.facebook.com/search/top/?q=venta%20de%20ranas%20de%20cristal&epa=SEARCH_BOX	75 Euros	n/a		
Spain		Facebook	"Ranas cristal"	https://www.facebook.com/search/top/?q=venta%20de%20ranas%20de%20cristal&epa=SEARCH_BOX	1300 M. N c/u			More photos by Whatsapp 3324934651. Eight specimens available.

Spain			Hyalinobatrachium valerioi					For Expoterraria fair in Madrid, Spain
Germany	Rana terrarienbau		"Hyalinobatrachium fleischmanni"	https://rana-terrarienbau.de/produkt/hyalinobatrachium-fleischmanni/	€60,00 Including VAT plus shipping	"glass frog from Central America"		"sold out"
Germany	Interaquaristik		"Fleischmann's Glasfrosch, Hyalinobatrachium fleischmanni"	https://www.interaquaristik.de/fleischmann-s-glasfrosch-hyalinobatrachium-fleischmanni/a-103009	49,95 EUR	n/a		"This item is currently unavailable."
Germany	Enimalia ADS		"Hyalinobatrachium fleischmanni "	https://www.enimalia.com/it/rane-vendita				"Available for next Hamm show"
Germany	Enimalia ADS		Hyalinobatrachium valerioi	http://www.enimalia.com/it/rane-vendita				
Germany	Ebay (germany)		"Hyalinobatrachium valerio"	https://www.ebay-kleinanzeigen.de/s-anzeige/hyalinobatrachium-valerioi-glasfrosche/1035049116-244-3756	150 euros			
Germany	Bens Jungle		"Hyalinobatrachium valerio"	https://bens-jungle.com/hyalinobatrachium-valerio	n/a			"price upon request" "product out of stock"
Germany		Facebook	"Hyalinobatrachium fleischmanni"	https://www.facebook.com/TropicalFrogs/?eid=ARCTIN5mDp_z3gFyzL7IiaEwKstvoo04FRnOqw8gclp6gnF_ws1S2yp1mfc4-GCzoknaNr3gB8oA	n/a	n/a		For the Terranistikbörse in Berlin on Sunday, October 14, or preferably for pickup in Froshroom Dresden I offer the following animals... 0.0.5 Glass Frog, H. valerio (04/2018)"

								"offspring" but not declared as REAL captive-bred (could be offspring of wc animals) Date item was found for sale: 9/28/2020
Germany	terrarium.com		Cochranella granulosa					Date item was found for sale: 9/28/2020
Germany	terrarium.com		Hyalinobatrachium valerioi					Date item was found for sale: 9/28/2020
Germany	terrarium.com		Hyalinobatrachium fleischmanni					Date item was found for sale: 9/28/2020
Germany	terrarium.com		Hyalinobatrachium aureoguttatum					Date item was found for sale: 9/28/2020
Germany	terrarium.com		Espadarana prosoblepon (= Centrolene prosoblepon)					Date item was found for sale: 9/28/2020
Germany	https://terrarium.de/content/index.php	Facebook: terraristika Hamm - "MARKTPLATZ" (group)	Hyalinobatrachium aureoguttatum					For Reptiles and Amphibians fair in Hamm, Germany
Germany	https://terrarium.de/content/index.php	Facebook: terraristika Hamm - "MARKTPLATZ" (group)	Hyalinobatrachium valerioi		123 euros			For Reptiles and Amphibians fair in Hamm, Germany
Germany	https://terrarium.de/content/index.php		Hyalinobatrachium valerioi (Glasfrosch - Glass Frog - Rana Crystal)					For Reptiles and Amphibians fair in Hamm, Germany
Germany			Cochranella pulverata (dusty glass frog)					For Reptiles and Amphibians fair in Hamm, Germany (12/2017)

Germany			Hyalinobatrachium valeroi					For Reptiles and Amphibians fair in Hamm, Germany
Germany			Hyalinobatrachium valeroi					For Reptiles and Amphibians fair in Hamm, Germany
Germany			Hyalinobatrachium valeroi					For Reptiles and Amphibians fair in Hamm, Germany (3/7/14)
Germany			Hyalinobatrachium valeroi					
Germany			Cochranella pulverata					
Austria			Hyalinobatrachium valeroi		100 euros			
France	Hobby Reptiles		"Hyalinobatrachium fleischmanni, grenouille de verre de fleischmann, grenouille de	https://www.hobbyreptiles.com/fr/autres-especes/1073-Hyalinobatrachium-fleischmanni.html	85, 00 euros	"born in captivity in the EU"	n/a	"announced stock at supplier (to be confirmed)"
France	Amphibase (Nimo.fr)		"Glass frogs [Hyalinobatrachium sp]"	https://nimo.fr/forums/1510363-glass-frogs-hyalinobatrachium-sp/	n/a	n/a		Message board with discussion of availability of glass frogs in France.

Netherlands	Dutch Rana		"Hyalinobatrachium fleischmanni"	https://www.dutchrana.nl/shop/kikkers/boomkikkers/hyalinobatrachium-fleischmanni/	49,59 Euros	n/a	<p>"Unfortunately, sending live animals (frogs) is not possible. The risk is too great and sending by parcel post is prohibited. The animals (frogs) you have ordered must be collected from our store in Heerlen.</p> <p>To order animals you can email to: rjschouten@dutchrana.nl</p> <p>Optionally, ordered animals (frogs) can also be taken free of charge to a trade fair where we are present. View our agenda here ."</p>
Netherlands	terrariumistik.com		Cochranella granulosa			Captive-bred	<p>"Costa Rica" as reference. 3 specimens for sale.</p> <p>Date item was found for sale: 8/12/2020.</p>
Netherlands	terrariumistik.com		Cochranella granulosa				<p>"for Hamm." Date item was found for sale: 12/10/2019</p>

Netherlands	terrariumistik.com		Hyalinobatrachium valerioi			Captive-bred		"for Hamm." Date item was found for sale: 12/10/2019
Netherlands	terrariumistik.com		Hyalinobatrachium fleischmanni			Captive-bred		"Nicaragua" as reference. Date item was found for sale 8/12/2020
Netherlands	terrariumistik.com		Espadarana prosoblepon (= Centrolene prosoblepon)			Captive-bred		"Ecuador" as reference. 3 specimens for sale. Date items was found for sale 8/12/2020
Netherlands		Facebook	Cochranella spinosa	https://www.facebook.com/TheFrogPoint/				
Netherlands			Hyalinobatrachium valerioi	www.peruvian-frogimport.com	175 Euros			
Poland	terrariumistik.com		Cochranella pulverata / Teratohyla					"for Hamm." Date item was found for sale: 12/4/2019
Japan	Reptiles ishihara	contact: @fishpet_1	Parverata tree frog	https://reptiles-ishiara.com/2859	"Please come to the store to	n/a		"in stock"
Japan	Repbuddy	repbuddy@ceo_tsuru コメントをどうぞ	"FREISCHMAN TREE FROG (GRIM FROG)" "modoki" "gumi frog"	http://repbuddy.net/?p=1421				"This too cute tree frog, but all species of glass frogs have been proposed to enter CITES (International Convention on the Protection of Rare Animals). ... It may be now that you can enjoy this cuteness."

Japan	Fever!!		"Freishman tree frog modoki"	http://kaeru-hanbai-fever.co.jp/scb/shop/shop.cgi?No=123&	Price: ¥14,000 (tax included, shipping not	n/a		"sold out"
Japan		Instagram Username: kitanatures_102	we have been inquiring about! Gummy frog, also known as Flychman Frog Modoki in stock!"	n/a	n/a	n/a	n/a	n/a
Japan		Instagram Username: kitanatures_102	"Popular species with many inquiries! !! Gummy frog, Freishman tree frog, is in stock now! !! It was #Frogsman tree frog #Frogsman tree frog breeding #Gummy frog #Hyalinobatrachium fleischmanni #Frogs I want to connect with people #I like	n/a	n/a	n/a	n/a	"DECEMBER 18, 2021"
Japan		Instagram Username: kitanatures_102	Freishman Tree Frog is in stock now! !! It is a popular gummy frog! The sheer belly is a little	n/a	n/a	n/a	n/a	"MARCH 20, 2021"
Japan		Instagram Username: aquaanimal_freedom	"Gummy frog has entered the Zama store"	n/a	n/a	n/a	n/a	n/a

Japan		Instagram username: Okahako	today as well! Parverata Frog Modoki is in stock! Last day's Flyman was fast, so if you're looking for one this time, you better hurry!"	n/a	n/a	n/a	n/a	n/a
Japan		Instagram username: satomi_souma	stock Flyman frog modoki now in stock."	n/a	9800 Yen	n/a	n/a	"It's always a funny frog."
Japan		Instagram username: satomi_souma	Post 2: Also Frog Modoki.	n/a	n/a	n/a	n/a	post 2: "New arrival. Only 5 of these are available in stock"
Japan	Rakuten		Hyalinobatrachium fleischmanni	https://item.rakuten.co.jp/chameleonheart/10000017/	JPY 15,900		https://ibb.co/smwqWY1	1 specimen available.
Japan	Kaeru Hanbai Fever!!		Hyalinobatrachium aureoguttatum	http://www.kaeru-hanbai-fever.co.jp/scb/shop/shop.cgi?No=196&	JPY 35,000		https://ibb.co/cv6MY8p	
Japan	Rakuten		Teratohyla pulverata	https://item.rakuten.co.jp/chameleonheart/10000020/	JPY 15,900		https://ibb.co/DznD7T1	1 specimen available.
Japan	The Reptiles Club		Hyalinobatrachium fleischmanni	https://hachikura.cart.fc2.com/ca191/12861/p-r191-s/	JPY 14,080		https://ibb.co/YZtXBb4	
Japan	The Reptiles Club		Cochranella granulosa	https://hachikura.cart.fc2.com/ca191/12860/p-r191-s/	JPY 18,480		https://ibb.co/pb69hKH	
Japan	The Reptiles Club		Teratohyla pulverata	https://hachikura.cart.fc2.com/ca191/12859/p-r191-s/	JPY 19,800		https://ibb.co/52ySB4N	
Japan	Reptile Shop		Teratohyla pulverata	http://www.enzou.net/Amphi.html	JPY 15,000		https://ibb.co/W6WGLXw	

Japan	Ikimono Shoten		Teratohyla pulverata	https://www.qsqs.jp/products/frog1	JPY 12,000		https://ibb.co/tbxTcdXQ	
-------	----------------	--	----------------------	---	------------	--	---	--

Annex 6 : Endemic glass frog species per country.

	<i>Hyalinobatrachium spp.</i>	<i>Centrolene spp.</i>	<i>Cochranella spp.</i>
Ecuador	<i>Hyalinobatrachium yaku</i> <i>Hyalinobatrachium mashpi</i> <i>Hyalinobatrachium nouns</i>	<i>Centrolene condor</i> <i>Centrolene gemmatum</i> <i>Centrolene pipilatum</i> <i>Centrolene ocellifera</i> <i>Centrolene puyoense</i>	<i>Cochranella mache</i>
Costa Rica	<i>Hyalinobatrachium vireovittatum</i> <i>Hyalinobatrachium diana</i>		
Guyana	<i>Hyalinobatrachium ignioculus</i>	<i>Centrolene papillahallicum</i>	
French Guyana	<i>Hyalinobatrachium kawense</i> <i>Hyalinobatrachium tricolor</i>		
Bolivia			<i>Cochranella nola</i> <i>Cochranella phryxa</i>
Brazil	<i>Hyalinobatrachium muiraquitana</i>		
Surinam			<i>Cochranella geijskesi</i>
	<i>Hyalinobatrachium orocostale</i>		
Perú	<i>Hyalinobatrachium anachoretus</i>	<i>Centrolene charapita</i> <i>Centrolene hesperium</i> <i>Centrolene lemniscatum</i> <i>Centrolene muelleri</i> <i>Centrolene sabini</i> <i>Centrolene azulae</i>	<i>Cochranella erminea</i> <i>Cochranella guayasamini</i> <i>Cochranella euhystrix</i> <i>Cochranella saxiscandens</i>

Annex 7: Ranges state consultations and consultations with other CITES Parties.

Request	Range state	Other Party	Confirmed co-proponent	Confirmed support at Plenary
Co-proponent	Argentina		Yes	
Co-proponent	Mexico		No	
Co-proponent	Guatemala		No	
Co-proponent	Belize		No	
Co-proponent	Honduras			Yes
Co-proponent	El Salvador		Yes	
Co-proponent	Nicaragua		No	
Co-proponent	Colombia		No	
Co-proponent	Venezuela		No	
Co-proponent	Guyana		No	
Co-proponent	French Guyana		No	

Co-proponent	Surinam		Yes	
Co-proponent	Trinidad & Tobago		Yes	
Co-proponent	Ecuador		No	
Co-proponent	Brazil		No	
Co-proponent	Perú		Yes	
Co-proponent	Bolivia		Yes	
Co-proponent	Panamá		Yes	
Co-proponent		Portugal	No	
Co-proponent		Romania	No	
Co-proponent		Slovakia	No	
Co-proponent		Slovenia	No	
Co-proponent		Spain	No	
Co-proponent		Sweden	No	
Co-proponent		United Kingdom	No	

Co-proponent		Niger	No	
Co-proponent		Nigeria	No	
Co-proponent		United States of America	Yes	
Co-proponent		Bahamas	No	
Co-proponent		Barbados	No	
Co-proponent		Dominica	No	
Co-proponent		Jamaica	No	
Co-proponent		Paraguay	No	
Co-proponent		Dominican Republic	Yes	
Co-proponent		Saint Kitts and Nevis	No	
Co-proponent		Saint Lucia	Yes	
Co-proponent		Saint Vincent and the Grenadines	No	
Co-proponent		Uruguay	No	
Co-proponent		Bangladesh	No	

Co-proponent		Benin	No	
Co-proponent		Bhutan	No	
Co-proponent		Burkina Faso	No	
Co-proponent		Burundi	No	
Co-proponent		Cameroon	Yes	
Co-proponent		Central African Republic	No	
Co-proponent		Chad	No	
Co-proponent		Comoros	No	
Co-proponent		DRC	No	
Co-proponent		Ethiopia		Yes
Co-proponent		Gabon	No	
Co-proponent		Guinea	Yes	
Co-proponent		Guinea-Bissau	No	
Co-proponent		India	No	
Co-proponent		Israel	No	

Co-proponent		Kenya	No	
Co-proponent		Liberia	No	
Co-proponent		Malaysia	No	
Co-proponent		Maldives	No	
Co-proponent		Mali	No	
Co-proponent		Mauritania	No	
Co-proponent		Nepal	Yes	
Co-proponent		Korea	No	
Co-proponent		Senegal	No	
Co-proponent		Sierra Leone	No	
Co-proponent		Somalia	No	
Co-proponent		Sri Lanka	No	
Co-proponent		Côte d'Ivoire		Yes
Co-proponent		France	No	

Figure 1. Similarity of appearance between different species and genera of glass frogs in the family Centrolenidae. It is known that the species on the left are traded and are classified as Least Concern by the IUCN Red List. The species on the right are Threatened and could easily be mistaken for the Least Concern species. Note how species in different genera look similar in appearance as determined by colors, shapes and patterns which are easily observable and which are the characteristics that are most frequently examined for identification by law enforcement officials. Some species can only be identified with certainty by genetic analysis.

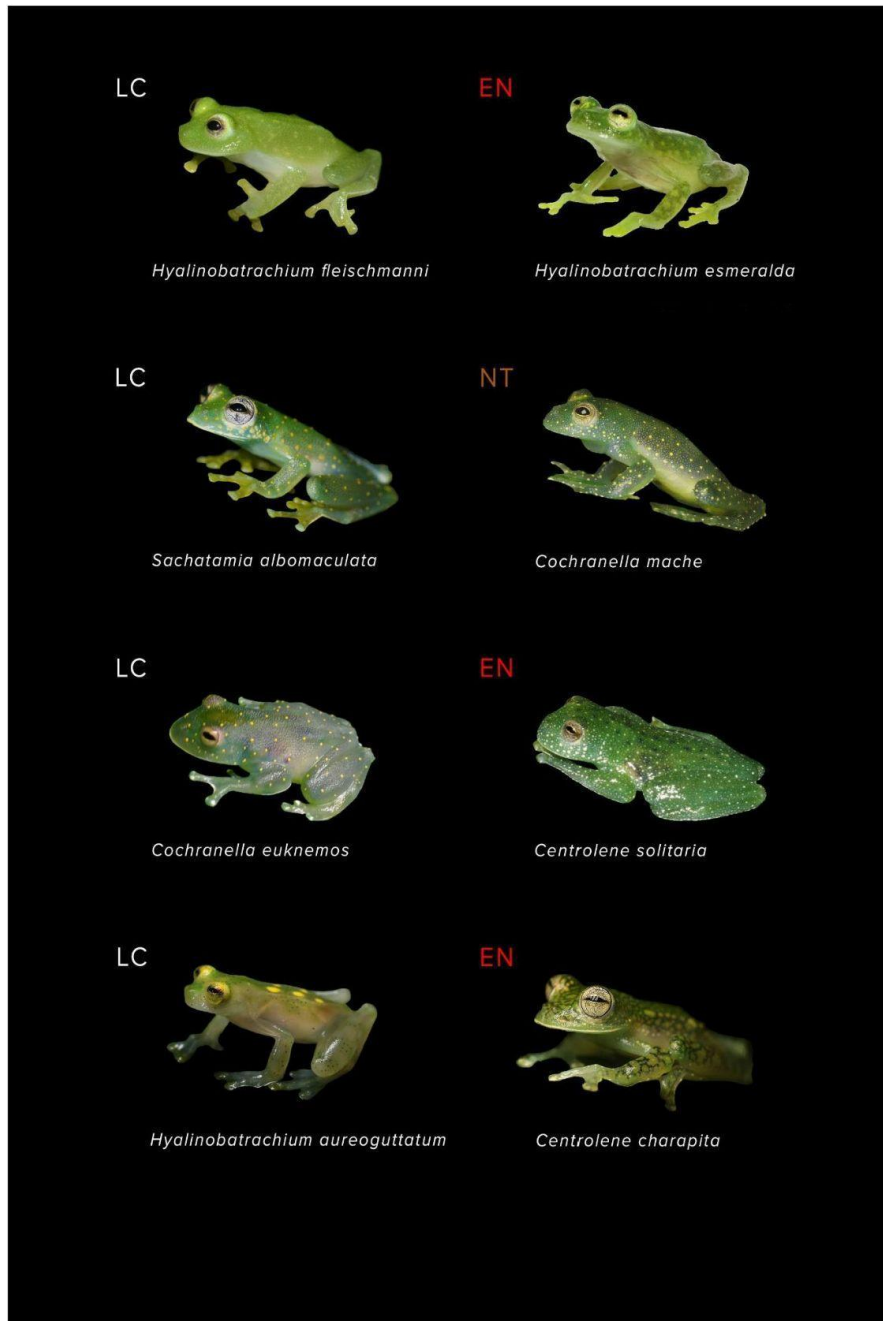


Image credits:

Page 1:

a) *Cochranella granulosa*

© Melquiades Castillo

CC-BY-NC

[inaturalist.org/observations/65463952](https://www.inaturalist.org/observations/65463952)

b) *Hyalinobatrachium orientale*

© Mike G. Rutherford

CC-BY-NC

<https://www.inaturalist.org/observations/3895121>

c) *Teratohyla pulverata*

© Gert Jan Verspui

CC-BY-NC

<https://www.inaturalist.org/observations/26678717>

d) *Centrolene huilensis*

© Ana María Ospina Larrea

e) *Teratohyla spinosa*

© dhfischer

CC-BY-NC

<https://www.inaturalist.org/observations/59865811>

f) *Nymphargus truebae*

© Alessandro Catenazzi

CC-BY-NC

<https://www.inaturalist.org/observations/2082707>

g) *Espadarana prosoblepon*

© David Monroy R

CC-BY-NC

<https://www.inaturalist.org/observations/59545507>

h) *Centrolene lynchi*

© Eric Osterman

Page 2:

a) *Hyalinobatrachium fleischmanni*

© Jonathan E. Kolby

b) *Hyalinobatrachium esmeralda*

© Ana María Ospina Larrea

c) *Sachatamia albomaculata*

© penterd

CC-BY-NC

<https://www.inaturalist.org/observations/45685823>

d) *Cochranella mache*

© Eric Osterman

e) *Cochranella euknemos*

© gecko_eb

CC-BY-NC

<https://www.inaturalist.org/observations/35921096>

f) *Centrolene solitaria*

© Ana María Ospina Larrea

g) *Hyalinobatrachium aureoguttatum*

© Cristian Gonzalez Acosta

CC-BY-NC

<https://www.inaturalist.org/observations/57942597>

h) *Centrolene charapita*

© Eric Osterman

Figure 2. Variation in appearance of one single species of glass frog in trade (*Hyalinobatrachium aureoguttatum*). The amount of variation in colors and patterns that can be found in certain glass frog species is similar to that found within different species. Therefore, identification based only on colors and patterns can be insufficient for differentiating between species in the family Centrolenidae that may be found in trade.

Image credit:

Wikiri

Selva

Viva.

At:

http://english.wikiri.com.ec/productos/ecuafrog/hyalinobatrachium_aureoguttatum.html

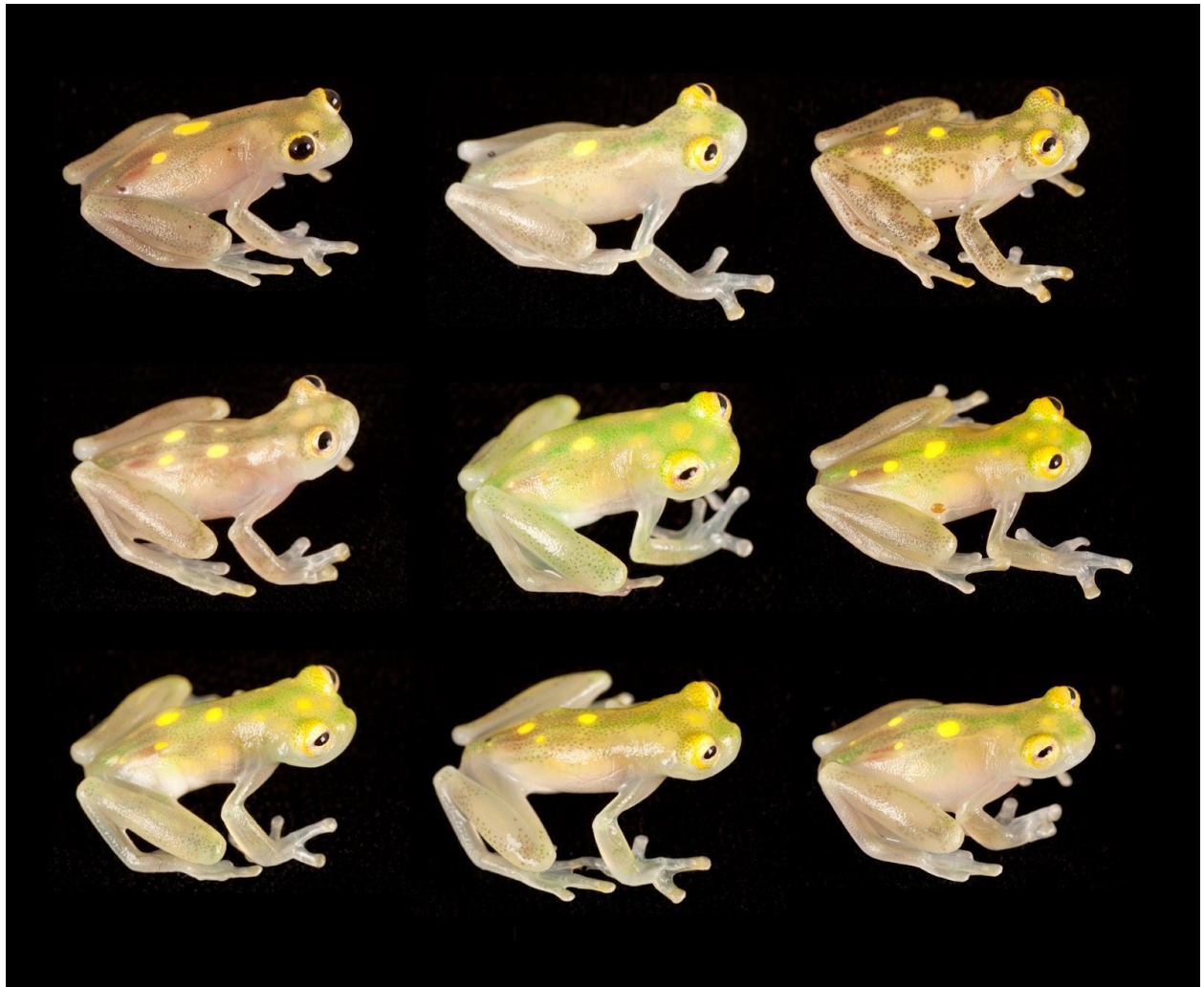


Figure 3. Similarity in appearance between glass frog species of low and high conservation interest.

The colors and patterns on the bodies of the glass frogs, the colors and patterns of the eyes, and the shape and appearance of the internal organs show only slight differences between many species in the family Centrolenidae. This is just one example to demonstrate how easily the observable characteristics of *Hyalinobatrachium fleischmanni*, a species of least concern, and *H. orientale*, a vulnerable species, will present identification challenges for those who are not experts in the morphology and taxonomy of frogs, especially in trade situations where close examination of small differences may not be feasible. Due to the challenges illustrated here, it is plausible that glass frog species that are endangered can be accidentally or intentionally traded alongside those that are more commonly found in commercial records.

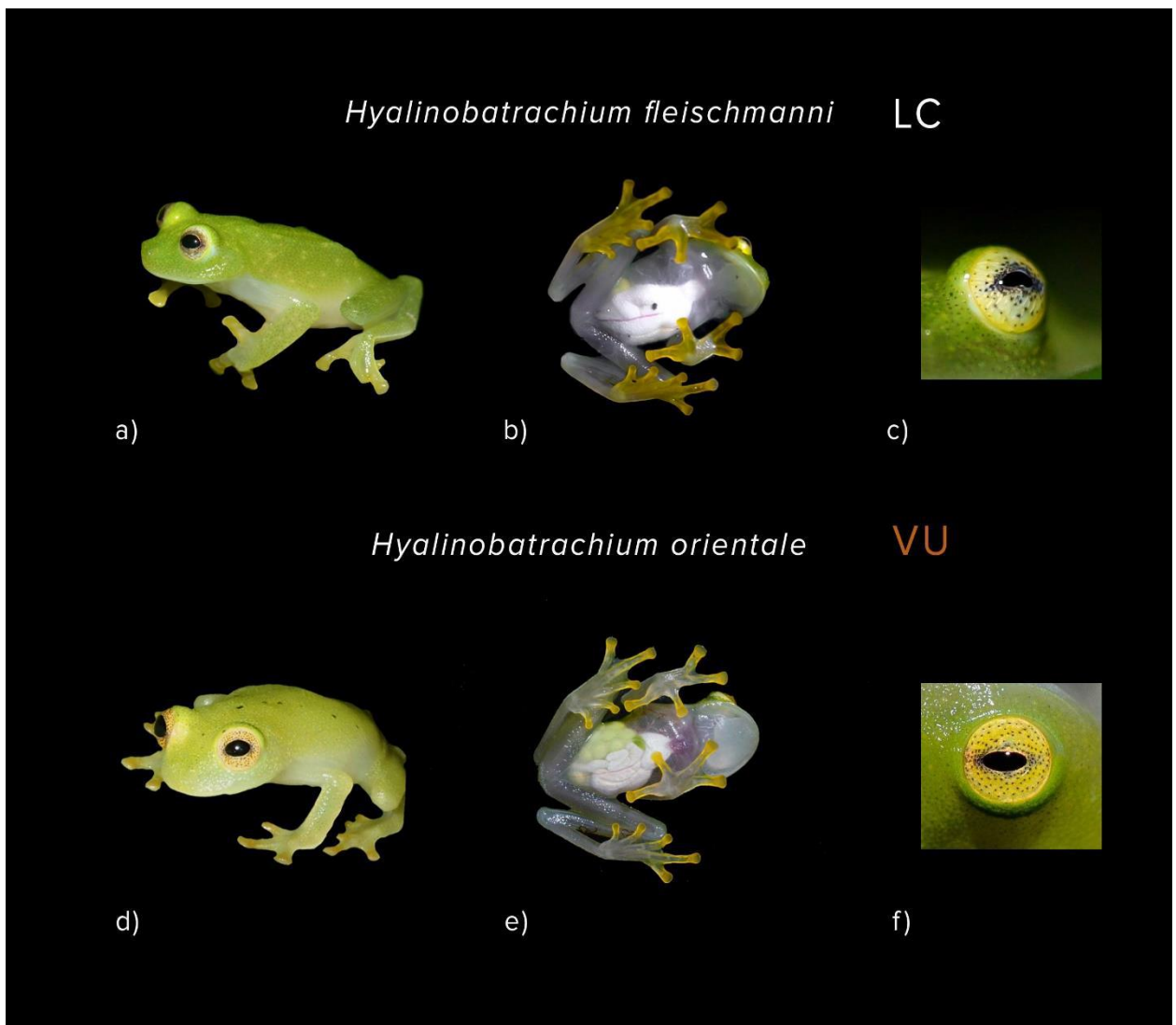


Image credits:

a) © Jonathan Kolby

b) © Katie Garrett

c) © Katie Garrett

d) © Mike G. Rutherford

CC-BY-NC

<https://www.inaturalist.org/observations/3895121>

e) © Christopher Pollock

f) © Christopher Pollock