AmphibiaWeb tracks the paradox:
New species discovery in an era of declines

New Species Gallery

2012 Urspelerpes brucei

© Todd Pierson

2012 Astylosternus laticephalus

© Daniel Portik

2011 Gracixalus quangi

© Jodi Rowley

2010 Bolitoglossa nympha

© Sean Michael Rovito

2011 Staurois guttatus

© Alexander Haas

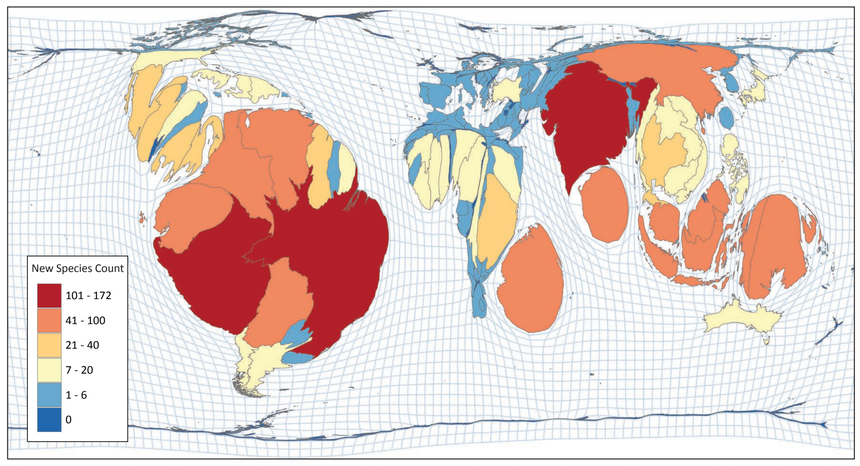
The Paradox

Approximately 30% of amphibian species are threatened and the status of about 20% remains unknown, leaving only half of amphibians which scientists feel are not threatened. Indeed, some amphibian systematists have described their work as "forensic taxonomy" since, in some cases, we are now describing species already believed to have gone extinct. Therefore, it is paradoxical that as we face an age of amphibians being the most imperiled vertebrate group, we are also in an age of exciting species discovery. It might seem counter-intuitive that with increasing documentation of amphibian extinctions and population collapse, the number of new species being discovered continues to rise. In 1985, Frost's *Amphibian Species of the World* reported 4,013 species but today the number of recognized species has risen to over 7,000, an increase of almost 60%, with no sign that numbers of species described per year is slowing. There are now more species of living frogs than mammals!

Amphibian Orders

The cartograms below show the distributional richness of the three orders of amphibians: the legless Gymnophiona (caecilians) are less well known and distributed mainly in the tropics of South America and India; in contrast, the Caudata (salamanders and newts) are concentrated in North America; most numerous are the anurans (frogs and toads), which are found on all continents except Antarctica and exhibit the most affected of amphibians with dramatic declines and extinctions globally.

New Species Discovery



The cartogram above illustrates where new amphibian species have been discovered since AmphibiaWeb regularly tracked new species (2005-2012). The top four countries for new species discovery are Brazil (172 new species), Peru (120), India (114), and China (84). Diagramming biodiversity data by country demonstrates as much about the state of knowledge as the effort being conducted. The New Species Discovery cartogram reflects where in the world field and taxonomic work is being done.

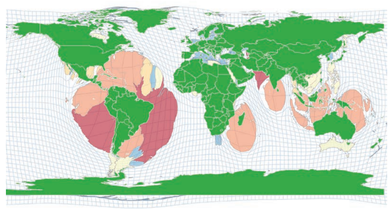
Why Use Cartograms?

Cartograms present geographically relevant, numerical data in an efficient diagram. Usually applied to social and economic data, we present area cartograms of biodiversity data to highlight the state of amphibian diversity and discovery for use in conservation planning and assessment. While amphibians do not recognize political boundaries, biologists, and conservation planners necessarily do. Cartograms reflect these political realities.

Cartograms are a novel way for biologists and planners to gauge the effectiveness and balance of field work, data on amphibian biodiversity, and conservation policy on a global scale.

How did you do that?

We use a cartographic technique called a continuous or density-equalizing cartogram to visualize the most up-to-date data compiled on amphibian species and their geographic distribution. Specifically we implement the diffusion-based cartogram method of Gastner and Newman (2004) in which area is purposely distorted in proportion to an attribute while maintaining recognizable topology. Areas of high value diffuse away from areas of low value until the density is equalized uniformly thus distorting national boundaries while maintaining zero flow between boundaries. This allows us to still recognize countries even though their shape is distorted.

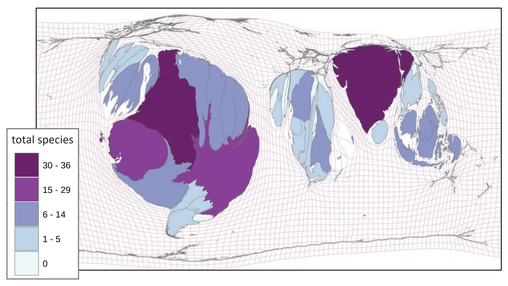


To create the cartograms, we compiled species tallies by country from the AmphibiaWeb database, and used ArcInfo and ArcGIS 10 (ESRI) to prepare a vector GIS layer with these attributes. With this shapefile, we used the appropriately named JAVA program Scape-Toad (Andrieu et al 2008) to implement Gastner and Newman's density-equalizing cartogram algorithm.

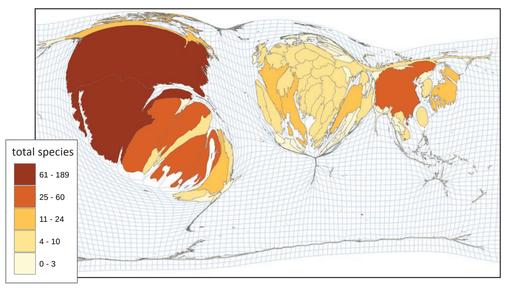
Andrieu, D., Kaiser, C., Ourednik, A. & Lévy, J. 2008. ScapeToad [software]. Chôros Laboratory, EPFL-ENAC-INTER. http://scapetoad.choros.ch.

Gastner, M.T. & Newman, M.E.J. 2004. Diffusion-based method for producing density-equalizing maps. *Proceedings of the National Academy of Sciences of the USA*. 101 (20): 7499 - 7504.

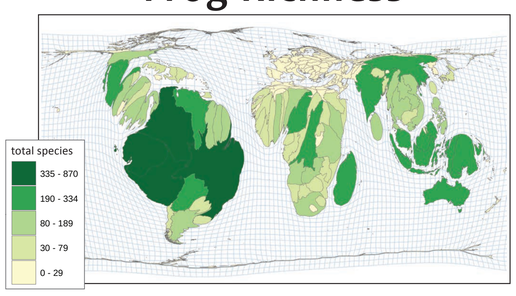
Caecilian Richness



Salamander Richness



Frog Richness



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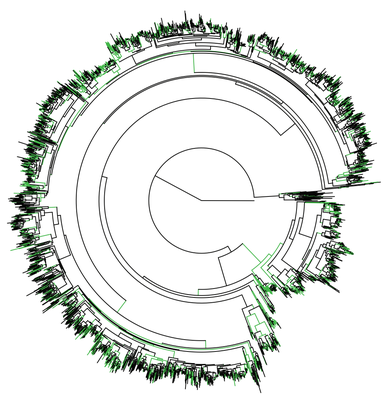
7,000th Amphibian!

2012 Centrolene sabini

© Alessandro Catenazzi

Catenazzi, A., von May, R., Lehr, E., Gagliardi-Urrutia, G., Guayasamin, J.M. 2012. A new, high-elevation glassfrog (Anura: Centrolenidae) from Manu National Park, southern Peru. *Zootaxa*, 3388: 56-68.



We used the latest published phylogeny based on DNA sequence data of nearly a third of amphibian species (Pyron & Wiens 2011) to illustrate the way in which taxonomy over the past three decades has contributed to our knowledge of relationships and phylogenetic diversity. In the tree above, we highlighted in green all species that do not appear in the summary provided by Frost in 1985. More than 900 of the nearly 2,900 species included in this phylogeny (approximately one-third of the tips) represent contributions from post-1985 taxonomy to understanding the Amphibian Tree of Life. Taxonomic effort appears distributed across amphibian diversity, including new discoveries from diverse lineages representing more than 250 million years of evolution.

At right, we illustrate the family tree available on AmphibiaWeb.

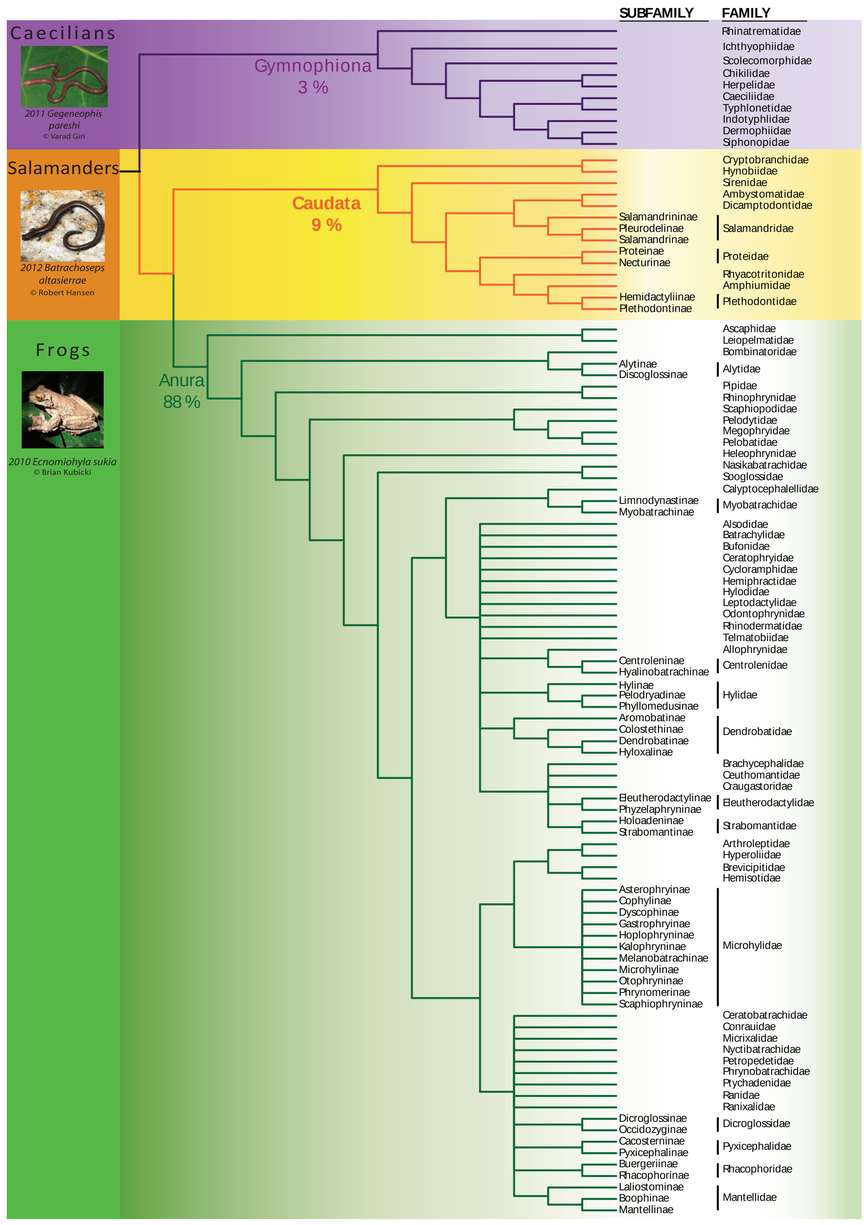
Why track?

AmphibiaWeb aims to provide a stable reference system for amphibian species for the purposes of our species accounts as well as a service to the broader community. To that end, we try to document taxonomic changes, track new additions, and solicit feedback from experts. A taxonomic subcommittee of the AmphibiaWeb Steering Committee uses a set of criteria focused on stability, scientific support and usefulness to provide a working taxonomy for a broad audience. A full statement, our current taxonomy, and downloadable figures for the Amphibian Family Tree are available at AmphibiaWeb.org/taxonomy.

In 2012, we celebrate the description of the 7,000th amphibian species!

Frost, D.R., ed. 1985. *Amphibian Species of the World: A Taxonomic and Geographical Reference*, 551, Allen Press, Inc. and the Association of Systematics Collections, Lawrence, KS.

Pyron, R. A. & J.J. Wiens. 2011. A large-scale phylogeny of Amphibia with over 2,800 species, and a revised classification of extant frogs, salamanders, and caecilians. *Molecular Phylogenetics and Evolution* 61: 543-583.



Where else can you find AmphibiaWeb accounts?

EOL Encyclopedia of Life · iNaturalist.org

Via webservice, original and dynamically updated AmphibiaWeb species accounts appear on both **EOL** and **iNaturalist** species pages. Content is shared with partners with full credits to the original author and AmphibiaWeb.

How to Contribute:

Help Record Species!

Record and share your observations with science and fellow citizen scientists on the Global Amphibian Bioblitz. Log onto iNaturalist.org to start contributing.

Global Amphibian BioBlitz Find every one...

Become an AmphibiaWeb contributor!

- Write species accounts, or have your herpetology students contribute
- Share amphibian photos, sound recordings, and videos, which are linked to species accounts
- Contact AmphibiaWeb with your ideas

Thanks

CalPhotos contributors
UC Berkeley Undergraduate Apprentices
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Mel Roderick
Conor Loughridge and The Wiggly Tendrils
Tim Halliday
Darrel R. Frost

Thanks to the HerpNET institutions

August 2012, MSK

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