

Finding snakes in the Colombian Amazon forest: A collaborative endeavor

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Poison frogs secrete some of the most toxic molecules in animals. However, the origin of these chemical defenses in these amphibians is still unknown. A possible explanation is that the prey chemical defenses and predator resistance coevolve in an escalating manner. Snakes are an understudied but important predator of poison frogs; both groups co-occur across South America, including most of Colombia. This model possesses particular characteristics never studied, one being that each individual poison frog secretes more than one toxin with different target sites, so multiple resistant mechanisms are expected in this snake. Overall, my research aims to reveal the basis of toxin resistance in snakes (*Erythrolamprus reginae*) and the potential role of coevolution with poison frogs (*Ameerega trivittata*) in generating rainforest biodiversity. I study this model in the Colombian Amazon alongside community members and perform genetic, physiological, and behavioral analyses. My project contributes to understanding how these species' assembly maintains their biodiversity in the recently threatened and highly biodiverse Amazon rainforest.

To evaluate different toxin resistance mechanisms in snakes it is necessary to find them in their habitat. This summer was a very challenging fieldwork experience. Usually, I try to spend more time in January conducting field research because it overlaps with the rainy season in the Amazon basin. However, this year, I had to adjust the field season to June and July. The landscape in the dry season is different. According to the local people, amphibians and reptiles are less active (reproductive time happens during the rainy season) or migrating to the primary forest in these months. Therefore, it was more difficult to find an abundant number of frogs and snakes. Seeing how the landscape changes in the dry season was very unexpected but amazing. After the river recedes, all the activities change. The local port has to move to a place that one month ago was an island. All the local food changes (I tried new and delicious fruits, fish, and chili). Local people spend their weekends on “beaches” that appear when the river is absent. I loved to see how everything changed.

Happily, I met a lot of people who are willing to help me with this project. Especially, empirical scientists from indigenous communities and local institutions that conduct research on the Amazonian biodiversity (Institute of Amazonian Studies SINCHI). I learned a lot of natural history from them, not only about the species that I am working with but also about the highly complex interactions inside the forest. I understood better how the local communities interact with the rainforest and how they interpret Western knowledge. Thanks to them, I and my local collaborator achieved a couple of research goals. We collected toxin profile samples from several three-stripe poison dart frogs (*Ameerega trivittata*) to analyze temporal changes in alkaloid content. Also, we performed predation experiments on the royal ground snake (*Erythrolamprus reginae*). This snake regularly feeds on *A. trivittata* and our aim is to understand the genes that are expressed after consuming neurotoxins.

Every day in the forest is unexpected, you never know what you are going to find: animals that you have never seen or heard, extraordinary shapes, horrendous or relaxing smells, new deforested sites, or vegetation taking over an abandoned construction. The rainforest is a quickly changing environment. “La manigua” (the rainforest) gives and takes, as local people say. As a field researcher, I experience it similar to the light adaptation. At the first look, everything looks so steady but, once you spend more and more time, you realize how full of movement and extraordinarily alive and complex it is. In addition, for me, it was very surprising to learn the names of different herps in local languages (there are more than 10 different languages coexisting only in Leticia). These languages contain a tremendous amount of knowledge about the forest. For example, in most languages, there are no general terms for “frogs” or “snakes”. Instead, they have different names to classify the use of this biodiversity. They have a single term for “eatable small frogs”, “poisonous frogs”, “eatable big frogs”, “false corals”, among others.

PS: I would like to remember, besides all the beautiful things I learned, that fieldwork is hard and is a collaborative endeavor. There are thousands of variables at play, from territorial conflicts to different conceptions about how to interact with nature, not to mention the weather, mosquitos, hunger, fatigue, accessibility, budget constraints, permits, and even luck. By saying this, I would like to highlight and recognize the work of field biologists and the absolute necessity to keep

interacting closely with nature. In addition, I would like to remember how fundamental and underestimated guides (often not professional biologists) and local collaborators are. Without them, I would have been lost in the forest since day one, and I would not have seen or learned even half of the amazing things I saw and learned thanks to their knowledge. On this occasion I would like to thank Darío Alarcón Naforo, José (Alias Pelacho), Pablo (Acapú reserve guide), Ana Milena Castro, Rances, Gabriel and Alfonso Fierro.



Erythrolamprus reginae snake. (Photo by Valeria Ramírez Castañeda.)



Valeria Ramírez Castañeda in Lake Tarapoto, 2 hours from Leticia in boat looking for a poison frog, (Photo by Alfonso Fierro.)