May 19th, 2012

The Forman School Reptiles & Amphibians Team 2012: Post-Expedition Report

Authors: Lauren Morrow, Shannon Smith, Dylan Kirby

[ABSTRACT]

The purpose of the 2012 Forman Reptiles and Amphibians team was to catalog species found on the Rara Avis reserve, assess the condition of endangered species, and observe the effects of the Chytrid fungus on the local amphibian population. The team did this by spending a two-week period in the rainforest of Costa Rica and catching species manually, then recording details on their location and phenotype. The team found several species that may indicate a resistance to the Chytrid fungus, and also observed a wide variety of animals that demonstrated the biodiversity of the ecosystem. One species was never before observed on the reserve. The diversity and abundance of specimens show that the ecology of the reserve is in fair (and possibly improving) condition. The team concluded that the reptile and amphibian species are in good condition, but to prove that they are improving the next year's team will have to find similarly encouraging results.

[INTRO]

The tropical rainforest is well known as one of the most biodiverse ecosystems on the planet. Costa Rica is a leading country in conservation of this habitat. There are, however, some threats to species that do not come from habitat loss and disruption. The Chytrid fungus (*batrachochytrium dendrobatidis*) has been spreading rapidly and ruthlessly throughout the world, devastating amphibian

populations. It is estimated that the fungus reached the Rara Avis reserve in the late 1980's (Figure 1). A survey was done by previous rainforest teams to determine how widespread the fungus was in the streams of the reserve, and they found that over 50% of the streams were infected. This statistic refers to only the streams in which the team found infected individuals, but it is likely that other streams are infected, too. The widespread effect of the fungus indicates that it is found even in undisturbed areas. Part of the mission of this year's team was to assess any possible indications of a change in the ecosystem's response to the stress of the fungus.

FIGURE I: Progression of BD fungus through Costa Rica

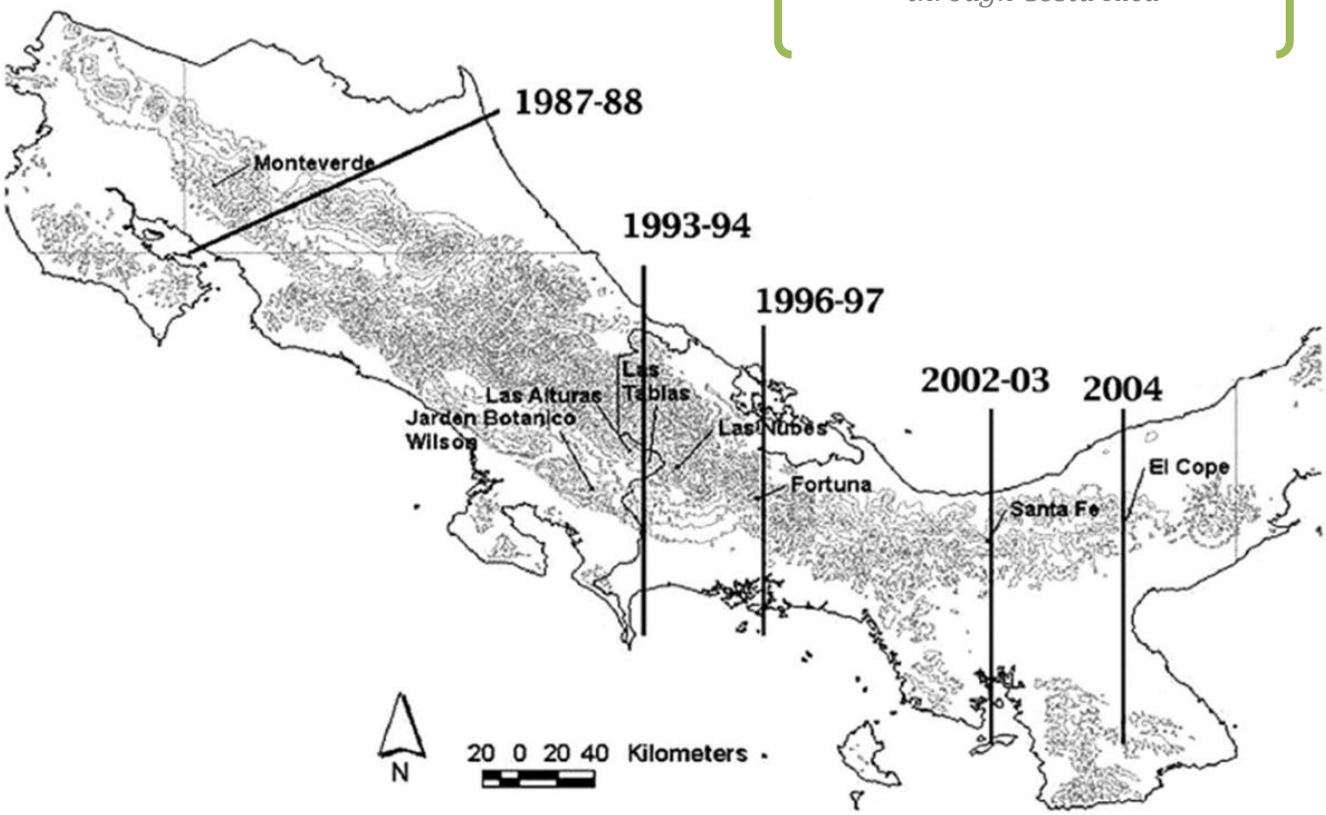
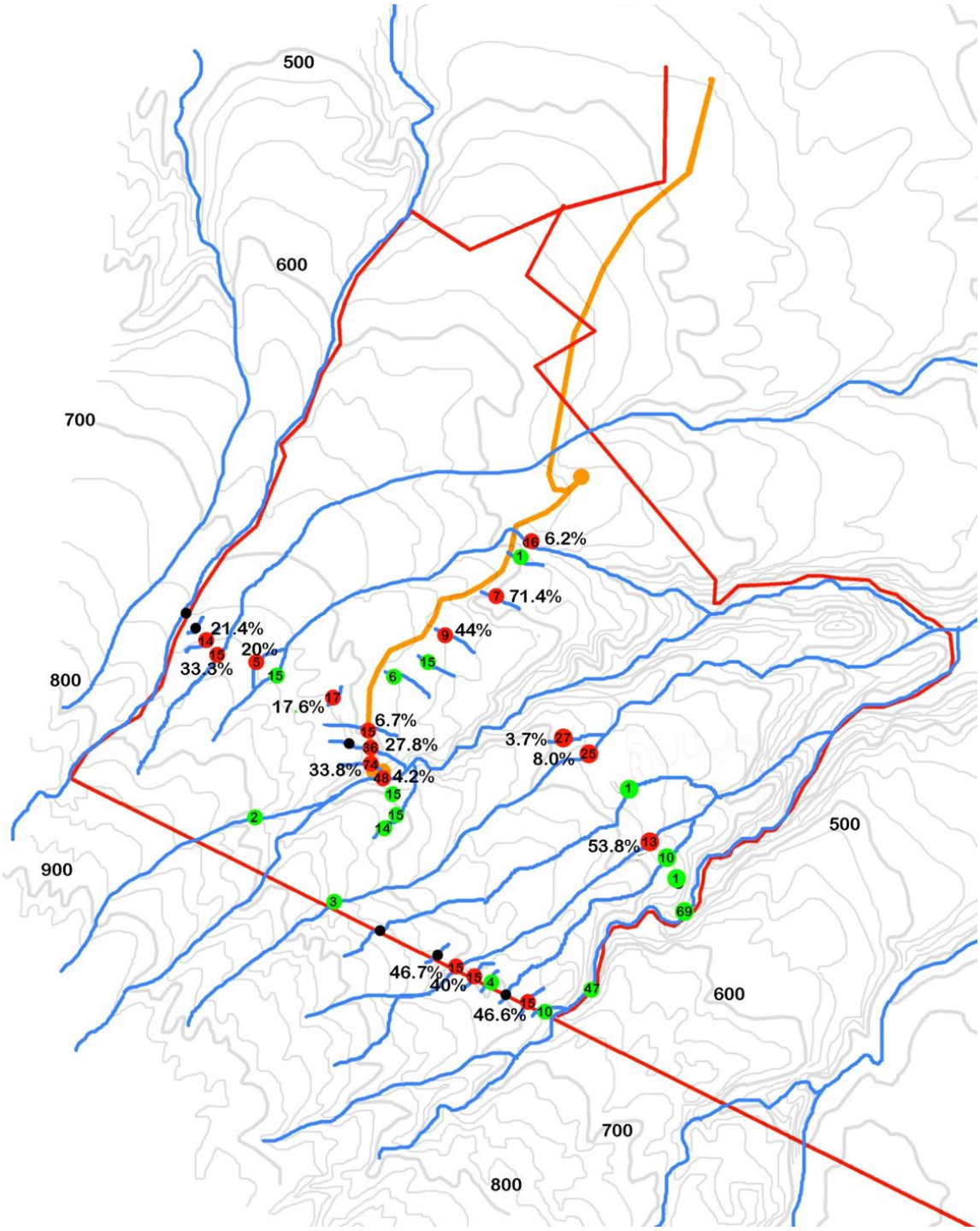


FIGURE II: Infected streams of Rara Avis
KEY: Red = infected
Green = not infected



In the Rara Avis expedition of 2012, the reptiles and amphibians team was concerned with the recording and cataloging of any reptile or amphibian it encounters. This is a digression from the goals of previous teams, which centered their attention on the specific behavior of a few species. One key focus was on the *bufo marinus*, also known as the Cane Toad. This enormous toad releases toxins from glands which are behind its eyes. Another topic of interest was the study of anole lizards, which have exotic defense behavior. When agitated, anole lizards change color, bob their heads and extend a throat fan to ward off their predators. It is believed that this head bobbing could be a form of communication between the lizards. Previous teams have worked extensively to devise plausible methods to capture and study the animals of focus. Some methods used to execute these experiments are pitfall traps, glue traps, and harnesses. A pitfall trap is simply a bucket submerged under the soil surface to catch reptiles and amphibians that are difficult to catch by hand. A makeshift harness would be fastened to a *bufo marinus*. The materials for this method include fishing rods, dental floss, dental floss containers, duct tape, and rubber gloves. Glue traps are raised into the canopy that will obtain reptiles and amphibians that are beyond the reach of the team. In recent years, the team has put more of a focus on cataloging the specimens rather than studying their habits. The project found that planned experiments such as the harnessing of *bufo marinus* are not very productive due to the presence and distribution of species relies too heavily on the weather. Thus, planning for a study of a specific species is subject to failure because the species may not even appear during the two-week period. Relevant and enlightening data on the state of the reserve ecosystem can be derived from a broader study, and therefore is of greater use.

[METHODS]

Throughout the two-week period the 2012 team went on daily hikes, filling out data sheets of information on the animals that were caught. The data sheets require specific information on the animals and the conditions of their capture. Some conditions that need to be recorded upon capture are country, province, locality, elevation, location description, date, weather, percent cloud cover, time, and air temperature. The information on the actual animal includes species, common name, sex, age, weight, coloration, snout-vent length, total length, and activity. Other noteworthy details are method of collection/observation, and any photographic images.

Some methods of collection include capturing by hand, by using a rubber band, by noose, or by pitfall trap. Methods of observation could be but are not limited to open observation, observation through binoculars, or observation of vocalizations. These approaches are effective in several different ways. The procedures executed during the expedition, however primitive, were very effective. The team would do at least two hikes every day… one before noon and one after dark. The difference in temperatures and light intensity allowed the team to observe a wider variety of species. Most species were collected by hand and put in Ziploc bags to be carried back to camp and catalogued. The more venomous species were collected using a snake hook and were put in a snake bag. Between collection and cataloguing, the specimens were kept in their Ziploc bags and hung on a clothesline (this method does not harm the animals when executed properly). This allowed for organization and easy access to the species needed. They would wait on the line until they were catalogued and photographed, then they would be released. For the safety of the animals, the team tried to record and photograph each specimen within

twenty-four hours of their capture. The more venomous species would be released by the team leader (Twan Leenders) at an undisclosed location. The sensitive species such as the Crowned Tree Frog would be released close to the location where they were found so that they would not be disturbed. To record the data on the species, the team would first identify it through noting key features and looking in the field guides for a match. When the species was known, the team would take notes on the conditions and characteristics listed above (data sheets). The data compiled from these individual observations is relevant to the observation of trends. This data can then be compared to the observations of past teams in order to detect long-term trends in species population, distribution, and behavior.

Photos I, II, III, IV: Reptile and amphibian team working in the field

[RESULTS]

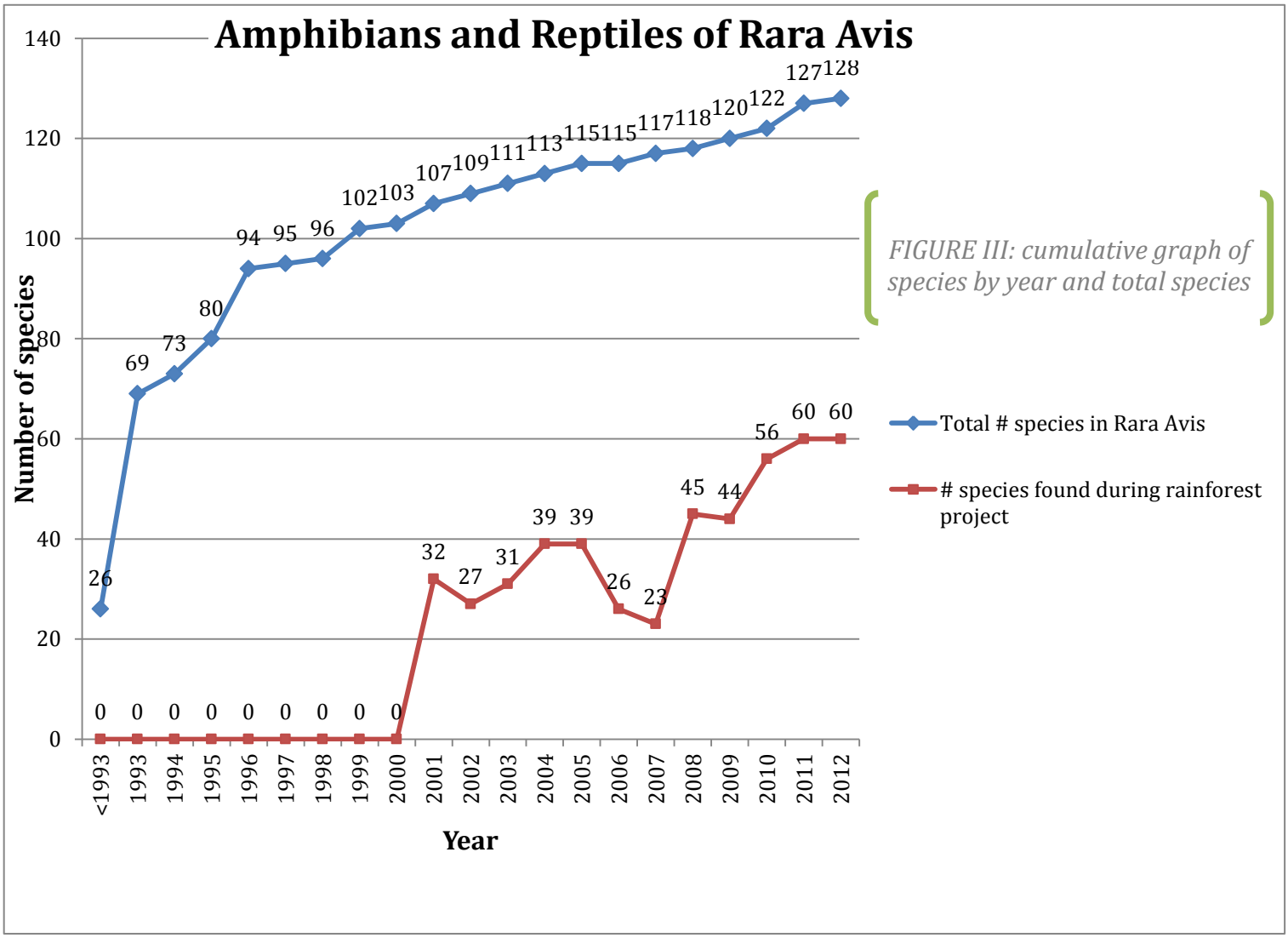


FIGURE III: cumulative graph of species by year and total species

Amphibians and Reptiles of Rara Avis - Cumulative List 2001-2011

SPECIES	FAMILY	ORDER	location		
Dermophis parviceps	Caeciliidae	Amphibia	C		
Gymnopis multiplicata	Caeciliidae	Amphibia	P&C		
Bolitoglossa alvaradoi	Plethodontidae	Amphibia	C		
Bolitoglossa colonnea	Plethodontidae	Amphibia	C	2	**X**
Oedipina pseudouniformis	Plethodontidae	Amphibia	C	1	**X**
Oedipina sp. nov.	Plethodontidae	Amphibia	P		
Atelopus varius	Bufonidae	Amphibia	C		
Bufo coniferus	Bufonidae	Amphibia	C		
Bufo haematiticus	Bufonidae	Amphibia	P&C	3	**X**
Bufo marinus	Bufonidae	Amphibia	P	4	**X**
Bufo melanochlorus	Bufonidae	Amphibia	P&C		
Centrolene ilex	Centrolenidae	Amphibia	P&C	20+	**X**
Centrolenella prosoblepon	Centrolenidae	Amphibia	P		
Cochranella spinosa	Centrolenidae	Amphibia	P&C	20+	**X**
Oophaga pumilio	Dendrobatidae	Amphibia	P&C	20+	**X**
Phyllobates lugubris	Dendrobatidae	Amphibia	P	1	**X**
Agalychnis callidryas	Hylidae	Amphibia	P&C	5	**X**
Agalychnis saltator	Hylidae	Amphibia	P		
Anotheca spinosa	Hylidae	Amphibia	P&C	4	**X**
Cruziohyla calcarifer	Hylidae	Amphibia	P&C		
Duellmanohyla rufioculis	Hylidae	Amphibia	C	4	**X**
Duellmanohyla uranochroa	Hylidae	Amphibia	C		
Ecnomiohyla sp.	Hylidae	Amphibia	C		
Hypsiboas rufitelus	Hylidae	Amphibia	P		
Scinax boulengeri	Hylidae	Amphibia			
Scinax elaeochrous	Hylidae	Amphibia	P&C		
Smilisca phaeota	Hylidae	Amphibia	P&C	6	**X**
Smilisca sordida	Hylidae	Amphibia	P&C	2	**X**
Craugastor bransfordii	Craugastoridae	Amphibia	P&C	10+	**X**
Craugastor fitzingeri	Craugastoridae	Amphibia	P&C	10+	**X**
Craugastor gollmeri	Craugastoridae	Amphibia			
Craugastor megacephalus	Craugastoridae	Amphibia	P&C	4	**X**
Craugastor mimus	Craugastoridae	Amphibia	P	2	**X**
Craugastor noblei	Craugastoridae	Amphibia			
Pristimantis cerasinus	Strabomantidae	Amphibia	C	2	**X**
Pristimantis cruentus	Strabomantidae	Amphibia	P&C	4	**X**
Pristimantis ridens	Strabomantidae	Amphibia	P&C	20+	**X**
Diasporus diastema	Eleutherodactylidae	Amphibia	P&C	20+	**X**
Leptodactylus melanonotus	Leptodactylidae	Amphibia	P&C	3	**X**
Leptodactylus savagei	Leptodactylidae	Amphibia	P&C	2	**X**
Nelsonohryne aterrima	Microhylidae	Amphibia	C		
Rana taylori	Ranidae	Amphibia	P		
Rana vaillanti	Ranidae	Amphibia	P	1	**X**
Rana warszewitschii	Ranidae	Amphibia	P&C	6	**X**

new for the preserve!

Chelydra serpentina	Chelydridae	Reptilia	P		
Rhinoclemmys annulata	Emydidae	Reptilia	P&C		
Kinosternon leucostomum	Kinosternidae	Reptilia	P&C	3	**X**
Hemidactylus frenatus	Gekkonidae	Reptilia	P	1	**X**
Lepidoblepharis xanthostigma	Gekkonidae	Reptilia	P&C	1	**X**
Sphaerodactylus homolepis	Gekkonidae	Reptilia	P&C		
Thecadactylus rapicauda	Gekkonidae	Reptilia	P&C	2	**X**
Basiliscus plumifrons	Iguanidae	Reptilia	P	1	**X**
Corytophanes cristatus	Iguanidae	Reptilia	P&C	1	**X**
Dactyloa frenata	Iguanidae	Reptilia	C		
Dactyloa insignis	Iguanidae	Reptilia	C		
Dactyloa microtus	Iguanidae	Reptilia	C		
Norops biporcatus	Iguanidae	Reptilia	P&C	2	**X**
Norops capito	Iguanidae	Reptilia	P&C	1	**X**
Norops carpenteri	Iguanidae	Reptilia	P&C	1	**X**
Norops humilis	Iguanidae	Reptilia	P&C	10+	**X**
Norops lemurinus	Iguanidae	Reptilia	P&C	2	**X**
Norops limifrons	Iguanidae	Reptilia	P&C	10+	**X**
Norops oxylophus	Iguanidae	Reptilia	P&C	8	**X**
Norops pentaprion	Iguanidae	Reptilia	P&C		
Polychrus gutturosus	Iguanidae	Reptilia	C		
Sphenomorphus cherriei	Scincidae	Reptilia	P&C	2	**X**
Ameiva festiva	Teiidae	Reptilia	P&C	5	**X**
Anadia ocellata	Gymnophthalmidae	Reptilia	C		
Ptychoglossus plicatus	Gymnophthalmidae	Reptilia	C		
Lepidophyma flavimaculatum	Xantusiidae	Reptilia	P&C		
Celestus hylaius	Anguidae	Reptilia	P&C		
Diploglossus bilobatus	Anguidae	Reptilia	C		
Diploglossus monotropis	Anguidae	Reptilia	P		
Boa constrictor	Boidae	Reptilia	P&C		
Amastridium veliferum	Colubridae	Reptilia	C		
Chironius exoletus	Colubridae	Reptilia	C	1	**X**
Chironius grandisquamis	Colubridae	Reptilia	P&C		
Clelia clelia	Colubridae	Reptilia	P&C		
Coniophanes fissidens	Colubridae	Reptilia	P&C	1	**X**
Dendrophidion paucicarinatum	Colubridae	Reptilia	C		
Dendrophidion vinitor	Colubridae	Reptilia	P&C		
Dryadophis melanolomus	Colubridae	Reptilia	P&C	1	**X**
Drymarchon corais	Colubridae	Reptilia	C		
Drymobius margaritiferus	Colubridae	Reptilia	P		
Drymobius melanotropis	Colubridae	Reptilia	C		
Drymobius rhombifer	Colubridae	Reptilia	P		
Enuliophis sclateri	Colubridae	Reptilia	P		
Erythrolamprus mimus	Colubridae	Reptilia	P&C		
Geophis brachycephalus	Colubridae	Reptilia	C	1	**X**
Geophis hoffmanni	Colubridae	Reptilia	P&C		
Hydromorphus concolor	Colubridae	Reptilia	P&C	1	**X**
Imantodes cenchoa	Colubridae	Reptilia	P&C	5	**X**
Lampropeltis triangulum	Colubridae	Reptilia	C		

Leptodeira annulata	Colubridae	Reptilia	C		
Leptodeira septentrionalis	Colubridae	Reptilia	P&C		
Leptophis depressirostris	Colubridae	Reptilia	P&C	1	**X**
Leptophis nebulosus	Colubridae	Reptilia	C	2	**X**
Liophis epinephelus	Colubridae	Reptilia	C		
Ninia maculata	Colubridae	Reptilia	P&C		
Ninia sebae	Colubridae	Reptilia	P	1	**X**
Oxybelis aeneus	Colubridae	Reptilia	P&C	1	**X**
Oxybelis brevirostris	Colubridae	Reptilia	P&C	4	**X**
Oxyrhopus petola	Colubridae	Reptilia	C		
Pseustes poecilonotus	Colubridae	Reptilia	P&C	1	**X**
Rhadinaea decorata	Colubridae	Reptilia	P&C	2	**X**
Rhinobothryum bovallii	Colubridae	Reptilia	C		
Scapiodontophis annulatus	Colubridae	Reptilia	P&C	1	**X**
Sibon annulatus	Colubridae	Reptilia	P&C	1	**X**
Sibon longifrenis	Colubridae	Reptilia	P&C	1	**X**
Sibon nebulatus	Colubridae	Reptilia	P&C		
Spilotes pullatus	Colubridae	Reptilia	P&C		
Stenorrhina degenhardtii	Colubridae	Reptilia	P&C		
Tantilla alticola	Colubridae	Reptilia	C		
Tantilla reticulata	Colubridae	Reptilia	P&C		
Tantilla ruficeps	Colubridae	Reptilia	P		
Tantilla supracincta	Colubridae	Reptilia	P		
Urotheca decipiens	Colubridae	Reptilia	P&C		
Urotheca euryzona	Colubridae	Reptilia	P&C		
Urotheca guentheri	Colubridae	Reptilia	C		
Urotheca pachyura	Colubridae	Reptilia	C		
Xenodon rabdocephalus	Colubridae	Reptilia	P&C		
Micrurus alleni	Elapidae	Reptilia	P		
Micrurus multifasciatus	Elapidae	Reptilia	C		
Micrurus nigrocinctus	Elapidae	Reptilia	P&C	1	**X**
Bothrops asper	Viperidae	Reptilia	P&C	2	**X**
Bothriechis schlegelii	Viperidae	Reptilia	P&C	6	**X**
Lachesis stenophrys	Viperidae	Reptilia	P&C		
Porthidium nasutum	Viperidae	Reptilia	P&C	1	**X**

total species seen in Rara Avis:

Caiman crocodylus	El Gavilan				
Gonatodes albogularis	Horquetas				
Basiliscus vittatus	Horquetas				
Sceloporus malachiticus	Poas Volcano				
Iguana iguana	El Gavilan				

Several species found this year were excellent indicators toward the diversity of the reserve. The Ghost Glass Frog (*centroline ilex*) was first recorded on the reserve in 1999, and is greatly increasing in abundance. It was heard every night, and caught several times. This may indicate a resurgence of a genetic line that is immune to the *batrachochytrium dendrobatidis* fungus that has been sweeping through Central America.

Another species observed in greater numbers was the Crowned Tree Frog (*anotheca spinosa*), which was not observed until 2008. As seen in the Cumulative List, it was recorded four times in a two-week period. This situation was also observed with the Rufous-eyed stream frog (*duellmanohyla rufioculis*), which was also seen four times this year.

Photo V: anotheca spinosa

The *oedipina pseudouniformis* salamander highlighted in the table was never before observed on the Rara Avis reserve. Since the number of species is still increasing (see graph), it is likely that not all species that reside on the reserve have been found and documented. This is further supported by the findings of the 2011 team, which observed a new species of a salamander in a bromeliad.


Photos VI, VII: dissection of bromeliad; oedipina pseudouniformis

[DISCUSSION]

The mission of the Reptiles and Amphibians Team 2012 was to catalog local reptiles and amphibians and to gain an understanding of the condition of endangered species in the Rara Avis reserve. Several key findings support the conclusion that the biodiversity of the reserve is not only rich, but possibly improving. The Ghost Glass Frog was seen in unexpectedly high numbers. Its abundance was not likely the result of luck in finding the animals, because it was heard not only every night but sometimes with the voices of several individuals sounding at once. This species was suspected to be greatly affected by the Chytrid fungus, and the sudden upturn in its population in the past thirteen years suggests (but does not affirm) a genetic line that is immune to the fungus. The team suspects that the Crowned Tree Frog could be following the same pattern of progress. If so, these two species may be the beginning of a "genetic revolution" in which the affected amphibian species of the world would go through accelerated natural selection and repopulate with resistance to the Chytrid fungus. If next year's team is able to

observe these two species in similar numbers, it would support this hypothesis. If other rare species are found in greater numbers on the 2013 expedition, the theory of "genetic revolution" would be further supported, as well.

[OTHER NOTES]

It is recommended that next years' Reptile and Amphibian team be very familiar with the local amphibians of Rara Avis, especially the various types of small brown frogs. These frogs are particularly difficult to identify. Looking through the Cumulative List of species found this year and identifying the most common animals before the expedition would make cataloging much faster in the field.

Useful equipment and gear include: varying sizes of Ziploc bags, knee-height rubber boots, Rite-in-Rain notebooks (normal ones will get saturated with the humidity and will therefore tear easily when written on), waterproof day pack, clothespins, and lots of batteries. Also, next year's team should be prepared to hike long distances as the Reptile and Amphibian team ventured out on the trails whenever possible. Another suggestion for all future teams would be that if team members have some free time, they should try to join one of the other teams, because the wealth of knowledge cached in the Costa Rican Rainforest is learned best through experience.

[BIBLIOGRAPHY]

Leenders, T. (2001) A guide to Amphibians and Reptiles of Costa Rica. Zona Tropical,

Miami

Twan Leenders
Conservation Biologist
Connecticut Audubon Society