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Preventing the Disappearance of three Frog Species from Oaxaca, México

Report Layout

México

La Esperanza, Santiago Comaltepec, Oaxaca

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Project Partners & Collaborators

Joe Mendelson supported this project by reviewing and commenting on the original proposal and the description of *Charadrahyla esperancensis*.

CIIDIR Oaxaca, Instituto Politécnico Nacional provided us facilities for doing both office and fieldwork.

The municipality of Comaltepec and the people and authorities of La Esperanza supported our work by allowing access to their territory and guiding us both to different streams and remote areas of primary forest in their land. School teachers at this locality also contributed by helping organizing the environmental education workshops.

Section 1:

1.1 Summary

Amphibian populations are declining globally at higher rates than other vertebrates. We worked in remaining tracts of montane-cloud forest in Oaxaca, México, where several amphibian species occur under anthropogenic pressure. Our objectives were: to determine the existence of three endemic frog species, evaluate how habitat disturbance influences its persistence, explore the occurrence of *Batrachochytrium dendrobatidis* (*Bd*) in the area and increase social awareness of amphibian declines through environmental education and monitoring activities. We detected populations of *Sarcohyla celata* and gathered biological data that contributes to understand factors that allow its persistence. We got 112 frog skin swabs to test the presence of *Bd*, considered an important threat in the area. Unfortunately we were not able to detect *S. cyanomma* or *S. sabrina*, that have been considered presumably extinct since 1983 and 1970 respectively, neither in their type localities nor in the surrounding forest. We also discovered a new species of frog genus *Charadrahyla*. We held six environmental education and monitoring workshops with students. We were able to change amphibian perception in more than 50% We started a citizen

monitoring team and implemented a workshop to provide cameras and GPS to local guides for amphibian monitoring. Outreach education materials were elaborated.

1.2 Introduction

Mexico occupies the fifth place in amphibian richness and the second position for amphibians under threat of extinction. Oaxaca is the richest state in amphibian species (152) but 86% are included in IUCN, and many of them are distributed in unprotected cloud forests. Unfortunately, this habitat is among the most threatened ecosystems in northern Mesoamerica (Ornelas et al, 2013). Cloud forests have an important role both in the water supply as in the maintenance of the natural flow patterns of streams and rivers that are originated in them (Sánchez-Ramos y Dirzo, 2014). In addition, this ecosystem harbors a large number of threatened species. The northern slope highlands of the state of Oaxaca (known as Sierra de Juárez) (Fig. 1), harbors the most continuous and conserved montane cloud forest in Mexico (Jardel-Peláez et al, 2014). Even when land use change threatens Mexican cloud forest, the Community of La Esperanza, municipality of Santiago Comaltepec have made a voluntarily conservation effort to protect their forests since 2006 (Fig. 2). This area has an average annual rainfall between 5000 and 6000 mm, making it one of the most humid forests in the country and also the house of large number of water currents (Gual-Díaz y González-Medrano, 2014).

These mountains also contain the highest amphibian richness and endemism in Oaxaca. Unfortunately several of the endemic species are seriously threatened and have not been seen for several decades even when they were once abundant, such is the case of *Sarcohyala cyanomma* and *S. sabrina*, which have not been seen since 1983 and 1970, respectively.

Although, while some species are becoming scarce others are getting discovered showing that the area presents a greater biodiversity than the known one (Campbell and Duellman, 2000; Canseco-Márquez et al, 2017). In addition, most of the biology and ecology of these species is unknown which increases the threats that could put them at risk, as we won't be able to conserve them unless we understand their biology and their ecological

requirements for their survival. Even when this aspect and the declining status of amphibian species in the area has been previously pointed out, scientific research and social awareness in the area are scarce. Biological studies and social projects to halt this situation are important not only to preserve amphibians but the cloud forest where they live, which in long term is our project's goal.

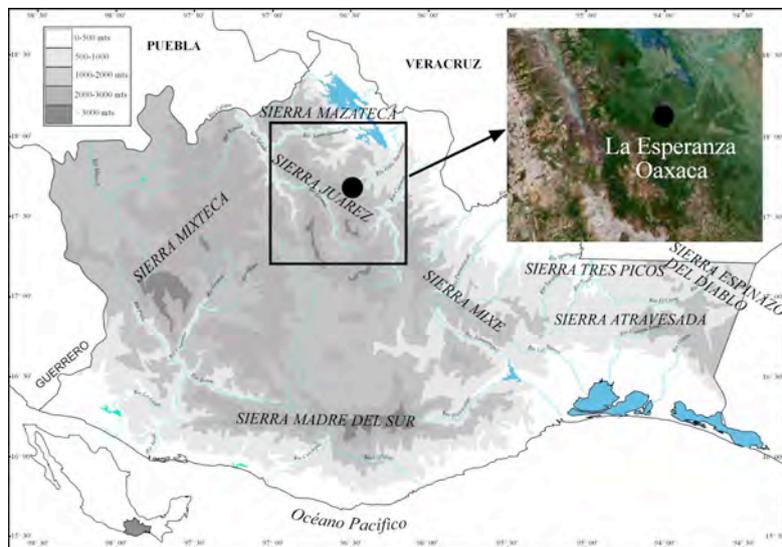


Fig. 1. Localization of La Esperanza in Sierra de Juárez, northern Oaxaca

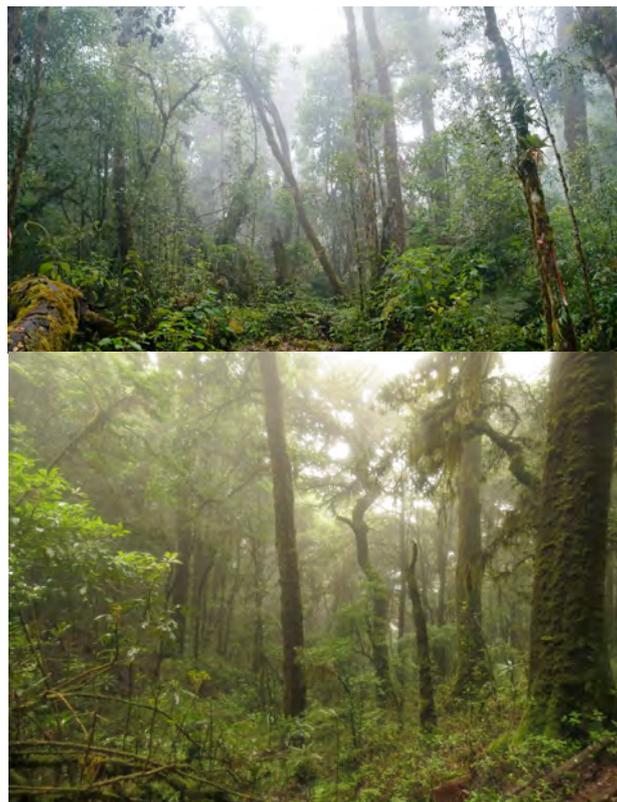


Fig.2. Cloud forest located in the community of La Esperanza

1.3 Project members

Edna González-Bernal

I have been hired since September 2014 by CONACYT (National Science Council) to develop scientific research in the *Centro Interdisciplinario de Investigación para el Desarrollo Regional unidad Oaxaca (CIIDIR-IPN)*. I obtained my PhD degree in 2013 at the University of Sydney. Area: Biological Sciences; my MSc degree in 2008 at Universidad Nacional Autónoma de México (UNAM). Environmental Biology and my Bachelors degree in 2002 at Universidad de las Américas (UDLA). Team role and activities: I worked as the team leader and supported our project by leading the field work design to gather biological information including amphibian ecology, habitat use and identification of pressure factors. I also participated in the data analysis, writing activities, including reports, outreach material and the description of the new *Charadrahyla* species.

Luis Canseco-Márquez

I'm in the final stage of the PhD at the Universidad Nacional Autónoma de México (UNAM) in Systematic area. My thesis topic is Molecular Phylogeny of the earth snakes genus *Geophis* (Dipsadidae). I obtained MSc degree in 2005. Granted by Universidad Nacional Autónoma de México (UNAM) with the thesis: Morphological phylogeny of lizards genus *Xenosaurus*. Bachelors degree obtained in 1996 granted by Benemérita Universidad Autónoma de Puebla (BUAP).

Team role and activities: I worked as the leader taxonomist of the team, I participated in the field work design and in the accurate species identification both during the field work and from pictures collected by the monitoring teams. I also contributed to understand species distribution patterns and participated in writing activities as well as the description of the new species of *Charadrahyla*. I worked as the leader in the implementation of citizen science activities. I also implemented the workshop to the local guides for citizen monitoring of amphibians.

Cynthia Ramírez-González

I am PhD student in the Instituto Politécnico Nacional with the thesis: Functional groups of an assembly of anurans of the Cloud Forest to the northern Oaxaca, Mexico. I obtained my Bachelors degree in 2014 at Tecnológico del Valle de Oaxaca and my MSC in 2016 by the Instituto Politécnico Nacional with the thesis topic: Amphibians from Oaxaca: richness and distribution. Team Role and activities: I worked as the leader in the environmental education activities of the project, also participated on the field work, data analysis, writing activities and in the description of the new species of *Charadrahyla* (Fig. 3)



Fig. 3. Project members. From left to right: MSc Luis Canseco-Márquez, MSc Cynthia Ramírez-González and PhD. Edna González-Bernal.

Section 2:

2.1 Aim and objectives

The main aim of our project was to increase efforts to rediscover two endemic frog species, record biological data of a third frog species to understand how habitat transformation affects it, gather samples of skin swabs to determine Bd presence and to improve awareness of the amphibian crisis in the local community through environmental education and monitoring activities. To achieve this we established four specific objectives:

1. Determine the absence/presence of these species in the area including places of historical records.
2. Evaluate how habitat disturbance caused by human activities influences ecological aspects of these species.
3. Take samples (skin swabs) of the amphibians found in the area to determine, in a second stage, the absence/presence of *B. dendrobatidis*
4. Involve the local community in the amphibian populations declines problem through environmental education and by establishing long term monitoring teams through the creation of a citizen science project.

In general, we achieved all the objectives although, we were not able to detect populations of *Sarcohya cyanomma* and *S. sabrina*.

2.2 Changes to original project plan

The first challenge that we faced were political problems in the community that, delayed the project starting date. Due to these issues we were able to introduce ourselves, present our project to the local authorities and get permission until September 2016. Social issues also interfered with the environmental education calendar as teachers in the state went to strike and the school classes were suspended for several months. As many of the teenagers that attend school are from distant communities it was not possible to congregate them. Another challenge in regards to educational activities was that several kids abandoned classes for different issues; this changed the number of persons that we were able to work with. In relation to field work, the September field trip had to be changed as heavy rain caused landslides on the access road and consequently we were not able to reach the area.

The citizen science workshop dates also had to be adjusted several times as we were unable to congregate enough people; in addition the workshop was cancelled by the community authorities twice.

The total length of our activities exceeded the planned project duration but that was the necessary time to reach all our objectives.

2.3 Methodologies

Biological information.

a. Surveys to locate *Sarcohya cyanomma* and *S. sabrina*

From early May to late August a total of three different field trips were made specifically trying to locate individuals of *S. cyanomma* and *S. sabrina*. Along these trips we surveyed a total of 12 streams both in the type localities of the species and adjacent forest. We also explored different forest patches where we were able to locate potential streams (Fig. 4). The surveys were made during 8 different nights, by four persons from 19.00 hrs to 1 am searching for organisms in potential sites following the visual encounters technique (Heyer *et al.* 1994).

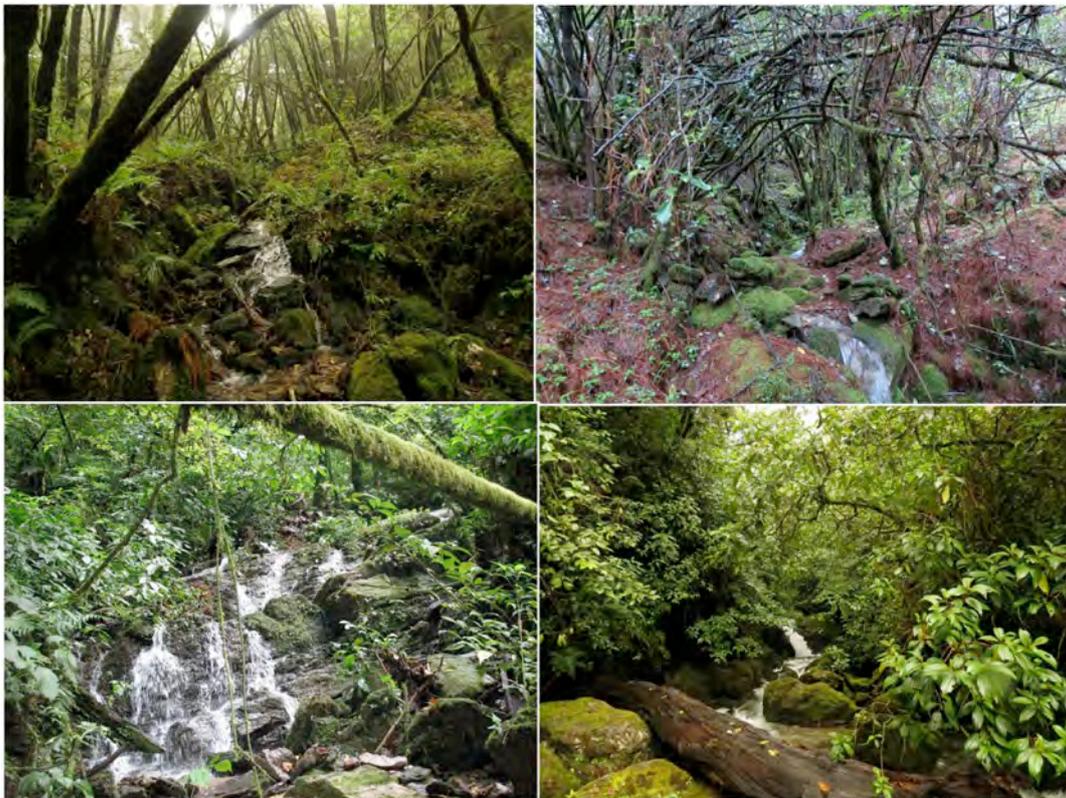


Fig. 4. Some of the streams sampled during the project.

b. Monitoring of *Sarcohyia celata*

We searched for this species in streams located in patches both of primary and secondary montane cloud forest during 5 different fieldtrips along 2017. Considering that habitat loss is one of the main causes for amphibian declines, we included a design that allowed us to evaluate sensitivity to human alteration by searching for frogs at streams located in forests with different degree of human influence. This was achieved by monitoring streams at different distances from human built structures such as roads, houses or fences (Table 1) In each stream, individuals were searched in potential sites following the visual encounters technique (Heyer *et al.* 1994) along a 50 m long transect. Each stream was visit twice on different nights by three persons per field trip. The order of the visits was randomized. From each individual we recorded sex, age, length, activity, and microhabitat characteristics.

Table1. Characteristics of the streams where we searched for individuals of *Sarcohyia celata*.

Conservation degree	Distance to anthropogenic structures	Vegetation condition
Optimal	More than 4 km	Primary cloud forest
Intermediate	From 400 to 800 m	Secondary cloud forest
Perturbed	From 0 to 400 m	Human managed sites

c. Chytrid sampling

We gathered skin swab samples of frogs along a perturbation gradient (Fig. 5). We surveyed frogs during both the dry and the wet season in the same streams where we did the monitoring activities (see table 1). Each encountered frog was

captured and skin swabs were taken following the technique described in the *chytrid swabbing protocol* (amphibiaweb adapted from Boyle *et al.* 2004). All safety and security measures were taken to avoid the possible spread of the disease or cross contamination of the samples. Once the procedure was finished each individual was released in the same place where it was encountered.



Fig. 5. Getting frog skin swabs at La Esperanza.

d. Environmental education and citizen science

On February, September and October 2017, we implemented three environmental education workshops. The goal of these workshops was to broaden the biological knowledge of amphibians that the kids and teenagers had. To achieve this, we explained biological and ecological aspects of amphibians and their main threats using different activities such as: talks, drawings, games, photographic exhibitions, sensory activities and short films (Figs.6, 7, 8). To evaluate both the original knowledge that the kids had and the effect of these workshops, we applied 34 surveys before and after the workshops. The same survey was applied twice per kid. We used the differences in the answers as an indicator of either improvement of the knowledge and perception or a lack of it. We also exchanged information about

local perception of these organisms and we presented the new frog species that we discovered, *Charadrahyla esperancensis*, using a poster that we designed (Appendix 1)



Fig. 6. Environmental education activities with kids: (A-C) drawing amphibians; (D-E) environmental awareness games-experimenting amphibian´s movement; (F) students showing their drawings.



Fig. 7. Environmental education activities with teenagers



Fig. 8. Participation of high school students during the second environmental education workshop and photographic exhibition.

e. Citizen Science workshop

On March 25, 2018 we implemented a Citizen Science workshop with people that showed interest in participating. We provided three cameras, batteries, battery chargers and GPS to: Ignacio López, Víctor Hernández and Juan López (Fig. 9). The workshop had two phases: , a theoretical and a practical one. During the theoretical phase, we taught the participants how to use the cameras and the GPS and also the taxonomic characters that are important to correctly

identify frog species. The practical phase was developed at the field, near places where we had registered frogs before. In this phase we trained the participants in biological aspects of frogs, showed them the most commonly used habitats and the potential places to find them. In this phase, the participants also practiced the use of the equipment (cameras and GPS) (Fig. 10).



Fig. 9. Delivery and use explanation of the monitoring equipment



Fig. 10. Amphibian monitoring training: team members practicing the equipment use in the field and exploring frog habitats

2.4 Outputs and Results

a. Surveys to locate *Sarcohya cyanomma* and *S. sabrina*

A total survey effort of 246 hours/person was employed trying to locate these species in streams at their type localities and adjacent forest patches.

Unfortunately we could not locate any individual of either *S. cyanomma* or *S. sabrina*. This is probably due to habitat transformation as several human activities had been implemented in the area. In the case of *S. cyanomma*, several cabins were developed exactly in the place where the holotype and

paratypes of this species were collected in 1974. In addition, the monitored streams, located in forests crossed by a paved road (175 hwy Oaxaca-Tuxtpec), are continuously exposed to human interference. Overcollection, even since they were discovered, might have also contributed to their decline.

b. Monitoring of *Sarcohyala celata*

This species is considered as Critically Endangered (CR) by the IUCN and was thought to be extinct in the wild from 1984 to 2011 when 11 organisms were discovered in the Sierra de Juarez Oaxaca (Caviedes-Solis et al. 2015). The IUCN hypothesizes that this species has disappeared in suitable habitat, probably due to chytridiomycosis, habitat fragmentation and disturbance due to human activities (IUCN 2018).

The selected working area and fieldwork design allowed us to explore the perturbation hypothesis, as we were able to work in streams located both in pristine and perturbed forests. Of the 8 monitored streams included in this design, we were able to find individuals of *S. celata* only in two. These two streams were those located at bigger distance from human interfered sites such as roads, buildings, agriculture fields or cattle raising sites. Both of these streams are located in primary montane cloud forests around 4 km away from any anthropogenic activity and with more than 45 years without human management. The access to these streams is through the forest without walking paths. This result suggests that this species needs pristine forests, or that it presents a degree of sensitivity to human presence, as we couldn't find any individual at the streams nearer to anthropogenic structures (See table 1).

Along the five fieldtrips we found a total of 60 individuals (Fig. 11). Considering the encounter rate, it seems that this species is more active during March and May, which precludes the rainy season in the area (Fig. 12). We consider this is a pattern that relates to the intensity of the rains in the area during the months of August and September when the streams increase their flow considerably. Of these 60 individuals, 75% were males, 20% were females, 3.3 % were metamorphs and 1.6% juveniles (Fig. 13). Even when several aspects of the life

cycle of the species are unknown, the fact that we found metamorphs and juveniles during March and May shows that the species uses these streams to reproduce. It is probable that the reproductive time occurs during March and April.

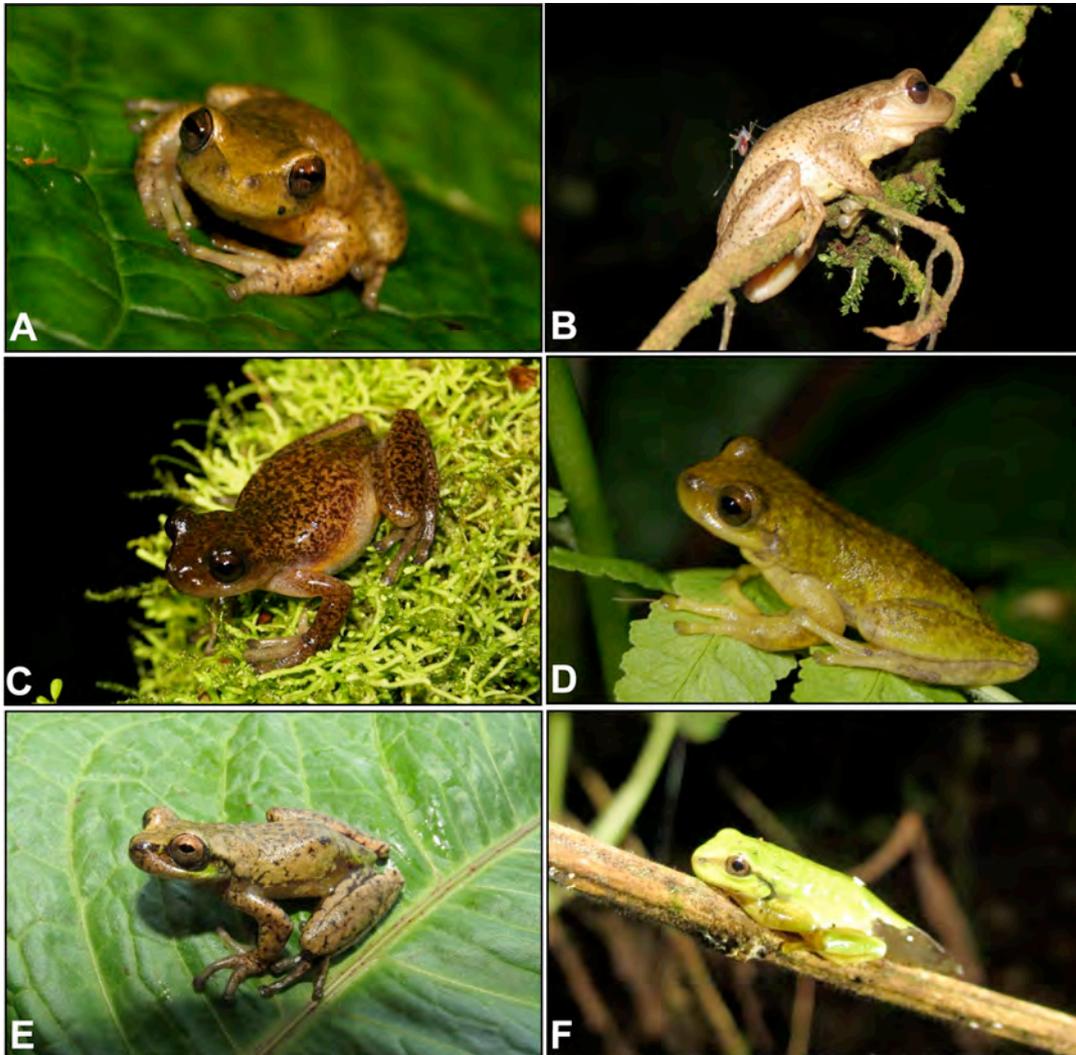


Fig. 11. (A-D) Adult individuals of *Sarcohyla celata* found at streams located in primary montane cloud forest and (E-F) an adult male and a metamorph found in a stream located at a second location.

In addition, we found another population of this species in an area located around 8 km away of the village, through primary cloud forest. Due to safety reasons we didn't monitor this stream. We consider that as far as the population of "La Esperanza" doesn't change its conservation priorities, these streams act as a good refuge for this critically endangered species.

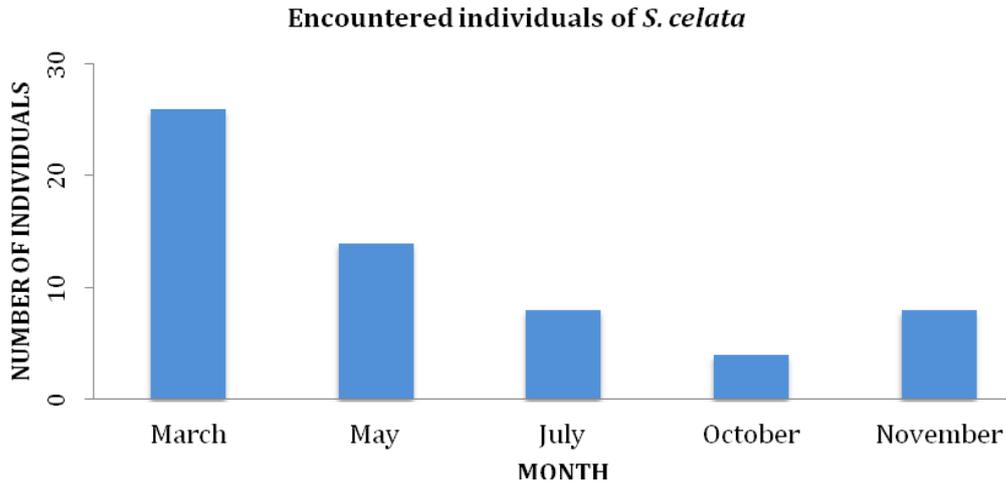


Fig. 12. Number of individuals of the species *Sarcohyala celata* found during 2017, at two different streams located in pristine montane cloud forest. The frogs were more abundant during the transition months between the dry and the wet season.

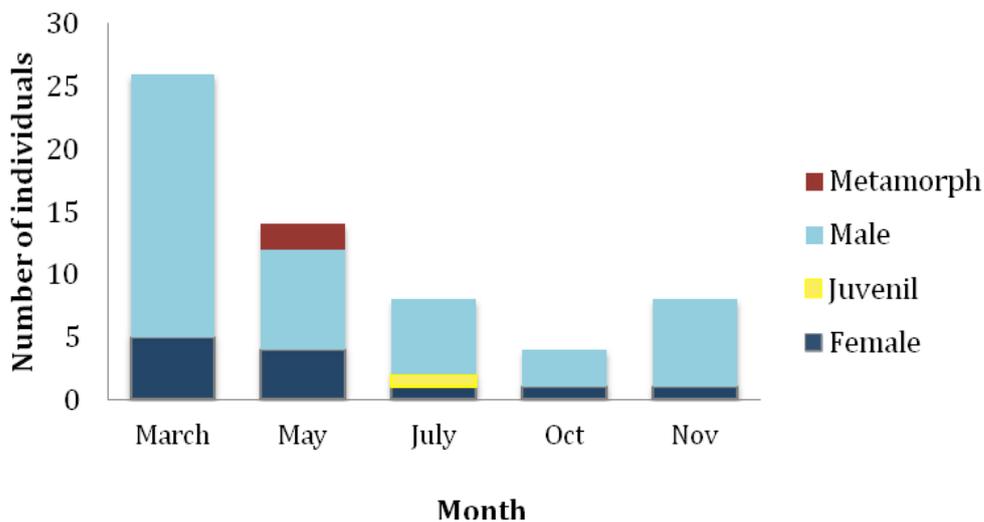


Fig. 13. Number of individuals, by sex and age, found at streams located in primary cloud forest during 2017.

c. Chytrid sampling

A total of 122 skin swabs of seven different species were gathered (Fig. 14). Of these, 71 were taken during the wet season while 51 during the dry season. As we followed the perturbation gradient design, we consider we will be

able to test the effect of perturbation on chytrid infection if the existence of this fungus is real in the area, as it has been hypothesized (IUCN 2018). Of these 122 samples, 41 were taken from frogs located at the "optimal streams", 38 at the "intermediate streams" and 43 at the "perturbed streams". A total of 19 skin swabs of the species *S. celata* were taken

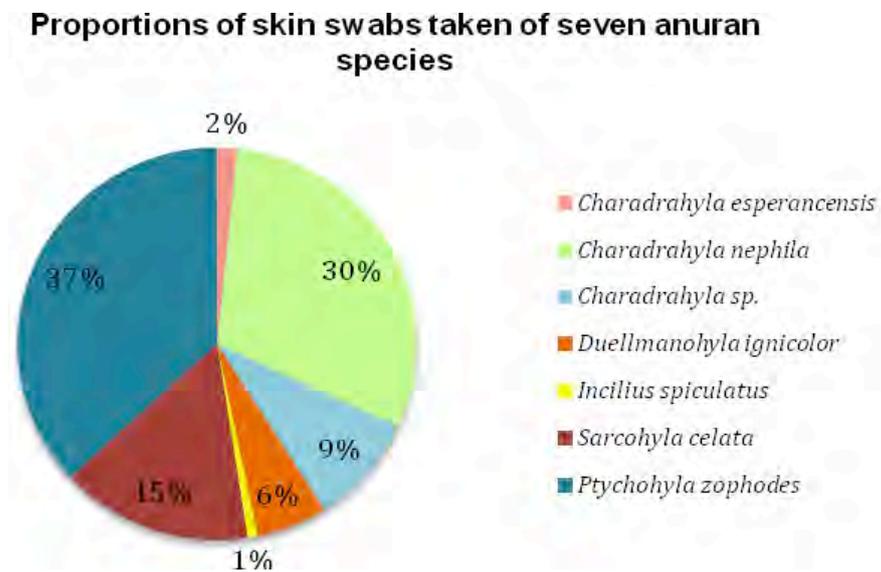


Fig. 14. Proportions of 122 skin swabs taken by species.

If we found financial support to analyse these samples we might be able to: 1) confirm or reject the presence of this disease in the area, 2) test the effect of perturbation on it (if it is present) and 3) evaluate a seasonal effect.

d. Environmental education

We found that the environmental education activities had a positive effect on the perception that kids and teenagers had about amphibians. For example, before attending the workshops, kids and teenagers didn't know the meaning of the word "amphibian", they had a negative perception of these organisms, they didn't know about their biology, function or what makes amphibians important, or understand any of the factors that threat them. After the workshops, more

than 50% of the students (total 34) had a positive change, increased their knowledge and understanding about these organisms and 100% proposed ideas for their conservation (Figs. 15,16,17)



Fig. 15. Negative and positive perception towards amphibians before and after the workshops.

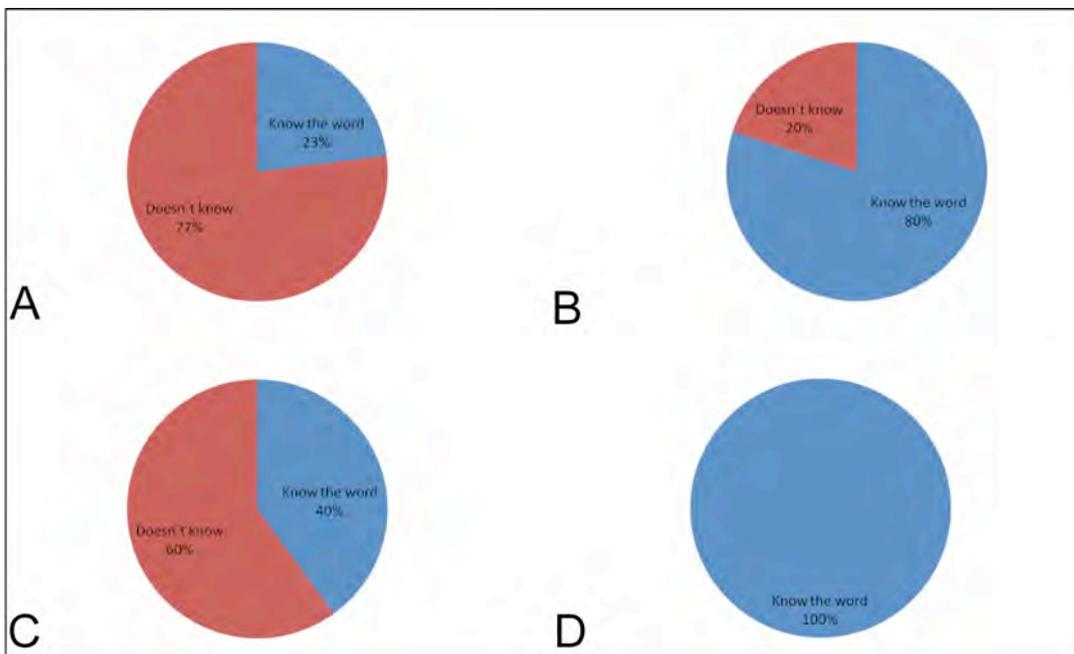


Fig. 16. Change in the understanding of the term "amphibian". A, B : kid's knowledge before and after workshops; C,D : teenager's knowledge before and after the workshops

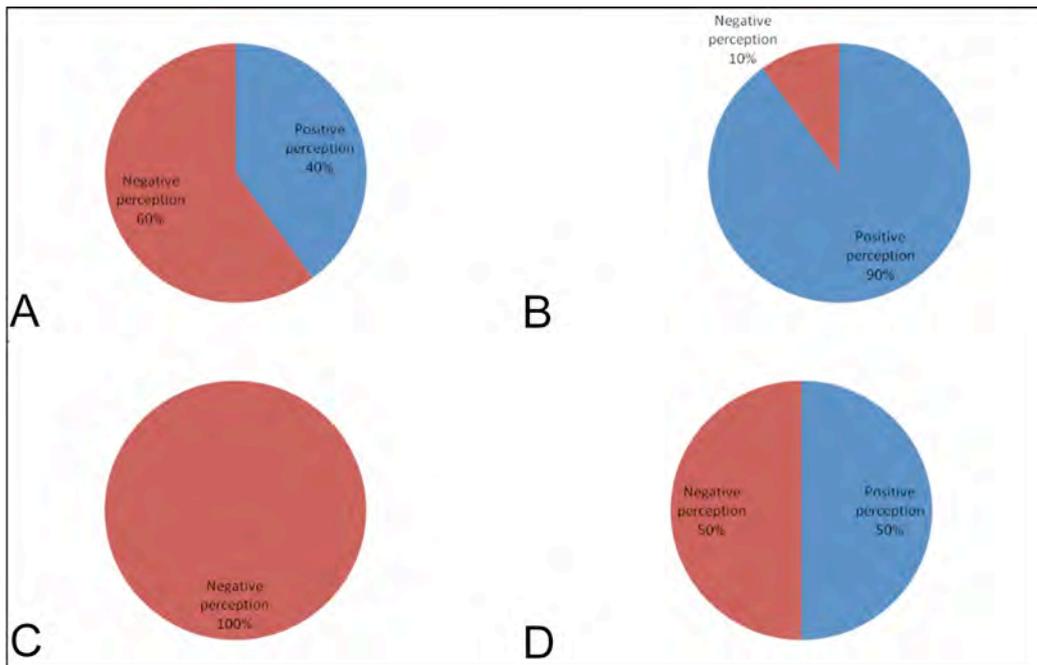


Fig. 17. Change in the understanding of the term "amphibian". A, B : kid's knowledge before and after workshops; C,D : teenager's knowledge before and after the workshops

e. Citizen science

Until now, through the monitoring of amphibians carried out by the community members of Esperanza, five species have been recorded, which correspond to *Craugastor berkenbuschii*, *C. mexicanus*, *C. loki*, *Incilius spiculatus* and *Smilisca baudinii*. These species have been observed in the areas where people usually go in a common working day such as: agriculture fields near La Esperanza, the riverbank and the urban area.

One of the difficulties that this initiative has presented in La Esperanza is the use of GPS for the registration of species since, despite having implemented workshops on its use, the community members are not confident enough yet with this equipment. In the same way, due to the intense rains that occur in these forests, the "observers" comment that they have not been able to take the equipment, because they are worried of it getting wet. Likewise, the lack of time of one of the teams, due to their activities as part of the communal authority, has caused that the camera and GPS provided, have not being used. However,

because the change of communal authority is about to occur, the head of the monitoring team has committed to use this material in his free time and during his daily journeys to working sites in the forest.

In spite of this, it is known that through this activity, the relatives and neighbors of those who have photographed frogs, had increased their curiosity towards these organisms. By direct conversations with the residents we noticed that they now pay more attention to frog behaviour when they find these animals in their homes during the rainy season. This has been promoted because they have realized, by looking to the monitoring teams, that taking pictures is a way of making new registers of amphibians and they feel encourage to do the same. Proof of this are the photographs in Fig. 18, which were recorded by the neighbour of a team member with a cell phone camera



Fig. 18. Cell phone photos of *Craugastor berkenbuschi* and *Smilisca baudinii* obtained by the neighbour of a team member

2.5 Communication & Application of results

To divulge and share our findings, we offered a talk at La Esperanza focused on the factors that affect amphibians and the benefits of maintaining big extensions of primary forest conserved for them. We also delivered two posters: one about "*The frog from La Esperanza*", the other one about chytridiomycosis and the ways to reduce the spread of the fungus (Appendix 1, 2) Both posters had a positive impact and generated interest in native frogs. The messages that had the biggest impact were that the new species is endemic to La Esperanza and that it gets its name in recognition to the conservation efforts that the

community does. At a regional level we offered a talk in a local amphibian festival. At a national level we were able to: get a publication in a newsletter about our project and *Charadrahyla esperancensis* (Appendix 3), a TV interview in which we exposed some of our results (<https://www.youtube.com/watch?v=Bava0kg5dLc>), a report at Conacyt press (<http://www.conacytprensa.mx/index.php/sociedad/personajes/20624-edna-gonzalez-descubrio-rana-la-esperanza>), and a presentation at a Simposia (2018). We also published the description of *C. esperancensis* in a scientific journal (Canseco-Márquez *et al.* 2017) and we are working on other two scientific papers.

2. 6 Monitoring and Evaluation

1. Evaluation of the gathered data: Our fieldwork results show the effect of habitat perturbation on the distribution and presence of *S. celata*. The data shows the sensitivity of this species to human perturbation and contributes to understand the factors that affect it.

Two different populations of *S. celata* were discovered.

2. Comparison of surveys applied before and after environmental education activities: there was a positive effect, perception change was 50% or higher.

3. Number/importance of species recorded by monitoring teams: a rare and critically endangered frog species, *Incilius spiculatus* was recorded.

4. Behavioural change through any of the activities of the project: Monitoring teams had a positive influence on other persons that now are also recording frogs with their cell phones and show awareness of frog habitats when managing their land. There was a positive effect of the outreach material in particular the poster about the new species and the frog field guide, on the habitants.

As a research group (Ecology for amphibian conservation ECA), we created a blog to offer amphibian information, including this project. So far we have had 264 visits along 2018 and more than 500 visits until February 2019.

2. 7 Achievements and Impacts

1. Discovery and monitoring of *Sarcohyla celata* populations.

S. celata was considered a possible extinct species until 2011 and 2012 when 20 individuals were rediscovered. (Caviedes-Solis *et al.* 2015). This project allowed the discovery of viable populations of this species. The monitoring activities and the field work design provided additional biological knowledge of the species. We gathered data that suggests the requirements of the species to survive.

2. More than 100 skin swab samples gathered. One of the suspected responsible factors of amphibian declines in our study area is the fungus *Batrachochytrium dendrobatidis* (*Bd*). We gathered skin swabs from seven anuran species in the area to determine the presence of the fungus in the area. This will allow us to know if this disease is a real threat for native amphibians in the zone.

3. Positive impact of environmental education Through the educational activities we changed the negative perception in 90% of kids and 50% of the teenagers that we reached. We achieved to transmit to them knowledge related to the amphibian importance, biology, ecology and threats.

4. Elaboration of outreach material. We created two posters: one about the new frog species, the other about chytridiomycosis. We elaborated a frog identification field guide that shows the frog diversity of the place (Appendix 5). This guide includes species that we recorded and basic information about them like: habitat, distribution, risk category and pictures. We are encouraging some of the guides to offer frog watching guided walks. This guide will be very helpful for this activity.

In addition to our main objectives, we were able to generate extra achievements:

- **Discovery and description of a new frog species.** During our fieldwork we discovered a new species of frog (Fig 19). In honour to the people of the locality we called it *Charadrahyla esperancensis*, "the frog from La Esperanza". The given name and the understanding of the "endemicity" concept created pride and sensibility among the locals in relation to amphibians. The new species was introduced to the people of La Esperanza through talks and a informational poster (Appendix 1)



Fig. 19. Individuals of the new species *Charadrahyla esperancensis*

- **Recompilation of biological data of a frog species with data deficient status.** During our monitoring activities we found several individuals of *Ptychohyla zophodes*, we gathered data about it such as preferred habitat, individual information and abundance. This species is recorded as data deficient by the IUCN.
- **Rediscovery of *Craugastor polymniae*.** Paradoxically, while being unable to locate *Sarcohyala cyanomma* and *S. sabrina*; we were able to

locate individuals of *Craugastor polymniae*, a species of direct development that was presumably extinct. This species is known only from two specimens obtained in 1983, since then it wasn't recorded. We located in several of the monitored streams.

- **Data gathered to reassess the conservation status of *Charadrahyla nephila*.** Due to our monitoring design, we explored the effects of anthropogenic perturbation on *C. nephila*. Based on experience, we speculate that this species might be more sensitive than previously considered by IUCN.

2.8 Capacity Development and Leadership capabilities

Through the development of this project we were able to improve leadership and scientific skills. As a team, we faced several challenges that placed us on limit situations. We were able to find a way to get consensus, make decisions in unforeseen situations and achieve our goals. Maybe the biggest challenge initially was the interaction with a community that faced political division and that is ruled in an autonomous way. Getting permission to work in their land was difficult as we were unknown people to them. Through constant interaction in different contexts during the development of the project we were able to gain their trust and in some cases even their friendship. This allowed us to develop skills to break the language and cultural barriers to be able to interact, transmit and receive information from the local people.

The gained support also allowed us to access remote areas of forest and to be able to develop the social goals of the project. In a parallel way, we increased our scientific knowledge basically by two ways: by working together, as the three of us have different work focus, and through the interaction with the people of the community, specially the elderly that posses knowledge on amphibians and the forest. By describing the new species we gained biogeography and taxonomy knowledge.

Section 3:

3.1 Conclusion

Habitat loss is considered the main threat for amphibians that are distributed in montane cloud forests. Gathering information that allows the understanding of the ways perturbation affects them is basic to make good conservation decisions. The results of this project show that the critically endangered species, *Sarcohyala celata*, shows high sensitivity to human presence as it was only found in primary forests with at least 90% vegetation coverage. This highlights the importance of conserving streams located in this type of forests. Unfortunately we were not able to detect *S. cyanomma* or *S. sabrina*, which are still considered "possibly extinct". Nevertheless, the fact that the local community has an interest in conserving extended areas of forest, increases the chances that suitable habitat exists for these species to survive.

Another considered frog threat in the area is the presence of *Batrachochytrium dendrobatidis*. Most of the records in the area are from tadpoles with missing mouth parts. This is the first time that a scientific protocol has been applied to test the presence of this disease. We gathered 112 frog skin swabs to test it.

The environmental education activities that we held had a positive effect on the perception that kids and teenagers had about amphibians. This shows that access to scientific information can have in long term an impact on the conservation of the native frogs as most students developed appreciation for this vertebrates. The establishment of a citizen science program will allow to keep recording frog information in the area.

3.2 Problems encountered and lessons learnt

The first challenge that we faced were political problems in the community that created division among habitants. As this community is ruled in an autonomous way all the permissions are granted through the consensus of the assembly.

The social division interfered with this but at the end we learnt that through one-to-one interaction, in addition to a clear and concrete presentation of the objectives of our project the assembly participants perceived the importance of

the project. After getting permission, in general we consider that our activities went well and most of the issues were solved in a positive way through the establishment of good communication.

Another challenge with the authorities was that they are changed every year and we had to establish links again to show the importance of the project. This due to that each authority had their own idea of the community priorities, in addition to the perception that it is important to receive a direct and quick benefit from their work instead of a long term one.

During the workshops we faced apathy towards information of the natural environment, mainly in young people. We think this behaviour is promoted by an interest in emigrate from the community in search of better economic opportunities. As a consequence they are not interested in topics like biodiversity, contamination, deforestation, climatic change or other environmental aspects that might be happening at their locality. We also perceived a lack of connection between school activities-members and families, which contributes to an absence of knowledge transmission between the elderly and the youth. To break this once again we promoted direct interaction through sports (basketball) and home activities with their families, such as asking to their parents or grandparents about nature in the past. In contrast, when working on environmental education with children, they showed a more avid attitude towards both information and activities. But both age groups (kids and teenagers) were very open to try new experiences of educational activities, like drawing with new materials, playing sensorial games or watching documentaries, these activities helped us to increase their receptiveness

The fieldwork activities went well because there were local guides open to work with us. Even when these guides had previously work with other researchers that had arrived in the past to the community, this was the first time for them working with amphibians. Through explorative walks and conversations we finally found the streams with the characteristics that we were seeking and after some nights of work together they improved their frog detection ability. This

made the work easier and encouraging as a team-working atmosphere was developed.

Another challenge was the language barrier as the native language in the community is *Chinanteco*. This made the translation complex, as many Spanish words don't have an equivalent word in Chinanteco and vice versa. In addition, as the people perceived us as researchers from an institution, we worked on our own image by being friendly, open to interaction and by getting involve in local festivities and tournament games.

3.3 In the future

We have gathered money from the Mexican government to keep working on frog research; this has allowed us to continue the frog monitoring. It is necessary to give continuity to the environmental education activities (at a bigger scale and including different age groups), to reinforce the sensibility and positive effects gained. It is important to get financial support to process the frog swabs, getting information on the presence of chytridiomycosis is basic to understand the frog threats in the area.

We will evaluate different communication via to gather the information generated by the citizen monitoring teams, so far we have done this through the visits we have had when monitoring frogs.

We will keep divulging the information generated through presentations at scientific conferences, social forums and through the publication of our results in at least two more papers. The data gathered particularly for *Charadrahyla nephila*, *Ptychohyla zophodes* and *Sarcohyla celata* will be important to reassess their conservation status. The availability of the information, in addition to a reconsideration of the degree of sensitivity of these species, will help to have an accurate perception of their risk status and the actions that might be taken to reduce negative impacts on them.

3. 4 Financial Report

Itemized expenses	Total CLP Requested (USD)*	Total CLP Spent (USD)	% Difference	Details & Justification (Justification must be provided if figure in column D is +/- 25%)
PHASE I - PROJECT PREPARATION				
Communications (telephone/internet/postage)				
Field guide books, maps, journal articles and other printed materials				
Insurance				
Visas and permits				
Team training				
Reconnaissance				
Other (Phase 1)				
EQUIPMENT				
Scientific/field equipment and supplies	3814.07	3002.23	-21%	
Photographic equipment	494.48	550.77	11%	Part was used for printing the field guide
Camping equipment	1,197	1053.28	-12%	Part was used for printing the field guide
Boat/engine/truck (including car hire)				
Other (Equipment)	762.15	766.01	1%	Part was used for printing the field guide
PHASE II - IMPLEMENTATION				
Accommodation for team members and local guides	840	753.85	-10%	Part was used for designing the frog field guide
Food for team members and local guides	1,666.60	1502.91	-10%	
Travel and local transportation (including fuel)	959.99	961.59	0%	

Customs and/or port duties				
Workshops	512.65	462.35	-10%	Part was used for designing the frog field guide
Outreach/Education activities and materials (brochures, posters, video, t-shirts, etc.)	662.41	724.21	9%	
Other (Phase 2)		829.72		Even when originally we didn't considered these expenses, once in the field site we needed to hire local guides to open routes and to guide us to remote areas. We used the surplus of other items to cover this
PHASE III - POST-PROJECT EXPENSES				
Administration				
Report production and results dissemination				
Other (Phase 3)				
Total	10,909.35	10,606.92		

Section 4:

4.1 Appendices

Output	Number	Additional Information
Number of CLP Partner Staffs involved in mentoring the Project	3	
Number of species assessments contributed to (E.g. IUCN assessments)	2	Assesed: <i>Ptychohyla zophodes</i> and <i>Charadrahyla nephila</i> . We increase information from <i>Sarcohyla celata</i> .
Number of site assessments contributed to (E.g. IBA assessments)		
Number of NGOs established	0	
Amount of extra funding leveraged (\$)	14953	We included La Esperanza in a Scientific research proposal. CONACYT- Basic Science- Responsible Edna González Bernal
Number of species discovered/rediscovered	3	One new species: <i>Charadrahyla esperancensis</i> . Rediscovery of <i>Craugastor polymniae</i> , Research still going to determine either the possible rediscovery of <i>Megastomatohyla mixe</i> or the discovery of another new species
Number of sites designated as important for biodiversity (e.g. IBA/Ramsar designation)	1	Our research supports the importance of the northern mountain range in Oaxaca as important for biodiversity conservation.
Number of species/sites legally protected for biodiversity	0	
Number of stakeholders actively engaged in species/site conservation management	15	We developed continuous interaction and communication with the local authorities. A common conversation topic was the importance of the voluntary conservation program that the community has
Number of species/site management plans/strategies developed	0	
Number of stakeholders reached	15	Through the interaction with the local authorities along the whole period
Examples of stakeholder behaviour change brought about by the project.	6	When we presented new species using the designed poster and when we explained to them that this is an endemic species to their forest the authorities asked which actions they could take to preserve it and they even

		suggested to build ponds to ensure its survival. We need to increase the biological knowledge of <i>C. esperancensis</i> to be able to suggest proper conservation actions
Examples of policy change brought about by the project	1	
Number of jobs created	1	We are promoting, through guide's training and the frog field guide, the establishment of a frog watching tour in the area
Number of academic papers published	1	So far we have published the description of <i>C. esperancensis</i> and we are preparing 2 more papers with the information gathered and possibly a new species description
Number of conferences where project results have been presented	1	So far we have exposed the environmental education work at a National meeting: the Montane ecosystem symposia 2018.

Appendix 1. *Charadrahyla esperancensis*' poster

La rana de La Esperanza
(*Charadrahyla esperancensis*)

Los bosques mesófilos de montaña de La Esperanza en el municipio de Santiago Comaltepec son casa de una gran cantidad de ranas únicas en el mundo. Muchas de las ranas que se encuentran aquí, son endémicas, es decir solo existen aquí.

La gran diversidad de anfibios y otros organismos hace de los bosques de La Esperanza un lugar único y de gran importancia en el mundo.

La comunidad de La Esperanza conserva de forma voluntaria grandes extensiones de estos bosques. Gracias a estas acciones, Oaxaca, México y el mundo aún cuentan con especies de ranas que de otra manera probablemente ya estarían extintas.

Durante 2017 el grupo "Ecología para la Conservación de Anfibios" (ECA) ha realizado estudios en estos bosques con el fin de aumentar el conocimiento biológico sobre las ranas de esta zona. Gracias a este trabajo, recientemente se ha descubierto una nueva especie de rana, y como un reconocimiento al esfuerzo que hace la gente de la Esperanza en favor de la conservación se le ha nombrado "La rana de la Esperanza".

La rana de la Esperanza habita arroyos en áreas de bosque conservado y al parecer, le gusta moverse largas distancias. Debido a esto, es una rana sensible a la deforestación y susceptible a ser atropellada mientras se mueve a través de la carretera.

Esta rana nos recuerda que siempre habrá esperanza por conservar y descubrir nuevas especies de plantas y animales.

Nuestro proyecto ha sido un trabajo entre científicos y personas de La Esperanza financiado por "Conservation Leadership Programme" (CLP)

CONSERVATION LEADERSHIP PROGRAMME

Appendix 2. Chytridiomycosis' poster

ECOLOGÍA PARA LA CONSERVACIÓN DE ANFIBIOS E. C. A.

TU TAMBIÉN PUEDES AYUDARLOS

Los anfibios actúan como bioindicadores, su presencia puede ayudar a comprender el grado de salud de los ecosistemas, también son controladores de plagas.

Conservation Leadership Programme

DETÉN LA PROPAGACIÓN DE LA QUITRIDIOMICOSIS

Enfermedad causada por el hongo patógeno **Batrachochytrium dendrobatidis** (Bd), el cual afecta la piel de los anfibios y les puede provocar la muerte.

Es muy sencillo que lo trasportemos nosotros mismos siendo "vectores" de esta grave enfermedad.

El hongo habita en el agua y zonas de gran humedad, afectando principalmente a los anfibios debido a su delicada piel.

EL PROBLEMA RADICA EN QUE ES MUY FÁCIL DISPERSARLO

Transportando organismos infectados sin saberlo.
Dispersando esporas del hongo en las botas al pisar en zonas húmedas o arroyos contaminados y en las ruedas de vehículos.

Desinfectar el material utilizado entre las estaciones de muestreo o trabajo realizado en campo.

Aplicar una mezcla de cloro y agua al 10% con un atomizador sobre todo el contorno y las suelas de las botas antes de pasar al siguiente punto de trabajo.

Para esterilizar las manos basta con utilizar gel desinfectante o lavarse con un poco de alcohol.

¿COMO PUEDO AYUDAR? ...

Appendix 3. Divulagation of the discovery of *C. esperancensis* on the media. "La crónica de hoy" is a newspaper at a National level

crónica	<h1>17 academia</h1>	EL DATO EROSIÓN DE SUELOS	
<h1>17</h1>		El 33% del suelo del mundo sufre erosión, agotamiento de nutrientes o contaminación por el uso excesivo de agroquímicos FAD	academia@cronica.com.mx

Descubren otra especie de rana en la Sierra Norte de Oaxaca; se le llamó *La Esperanza*

► Esta familia de anfibios parece que se mueve mucho, por lo que es difícil de ver y, por tanto, desconocemos sus patrones de actividad, dice la investigadora del IPN, Edna González Bernal

[Arturo Ocas]

A pesar de la acelerada extinción de los anfibios que se experimenta en el planeta, en México fue descubierta una especie de rana que habita en los bosques de niebla o bosques mesófilos de la Sierra Norte de Oaxaca. Los biólogos mexicanos Edna González Bernal, Luis Camacho Márquez y Cynthia Ramírez González publicaron el hallazgo en la revista científica internacional *Zootaxa*, que es la publicación más importante del mundo en taxonomía animal, en la que se han reportado más de 23 mil organismos.



La Esperanza tiene una estructura corporal que continúa en la parte lateral de la rana en un hazo.

Esta especie tiene forma y características que llaman mucho la atención, por ejemplo un hocico con una distintiva bajada posterior a la fosa nasal, que desde un lado podría ser comparada con la quilla o parte lateral de la proa de un barco. Además tiene los flancos y las superficies anteriores y posteriores de las extremidades con manchas amarillas.

Los estudios que hicieron posible este descubrimiento fueron posibles gracias al financiamiento conjunto de la organización *Conservation Leadership Programme (CLP)* y del Consejo Nacional de Ciencia y Tecnología (Conacyt).

González Bernal, quien es investigadora del Instituto Politécnico Nacional, explicó en entrevista con *Crónica* que la rana recién descubierta se encuentra en zonas montañosas que han sido dedicadas a la conservación por comunidades indígenas del municipio *La Esperanza*, en la región de la Chi-



Edna Leticia González Bernal, del CEDIAS, Unidad Oaxaca del IPN.

manilla. Es esta la razón por la que la rana recién descubierta recibió como nombre científico *Charadrius hyla esperancensis*, y como nombre coloquial *La Esperanza*.

"Esta es una especie que aparentemente se mueve mucho. Algunos de los ejemplares que se identificaron fueron hallados cruzando una carretera. Es una especie difícil de ver y no conocemos sus patrones de actividad por lo que es posible que no esté activa todo el año", indicó la doctora Edna González en entrevista telefónica con este diario desde el estado de Oaxaca.

La científica mexicana que obtuvo su doctorado en herpetología en la Universidad de Sidney, Australia, y este año fue una de las ganadoras de las Becas para Mujeres en la Ciencia L'Oréal-Unesco-Conacyt-AMC 2017 contó que la zona donde hallaron por primera vez a la rana *La Esperanza* no son los bosques más conservados de la Sierra Norte de Oaxaca. Incluso manifestó que entre sus colegas biólogos hubo sorpresa al enterarse del hallazgo porque esa región había sido explorada por científicos de Estados Unidos en los años 70s y 90s sin que hubieran identificado a este grupo.

BOSQUES Y LLUVIAS. Es importante subrayar que los anfibios han sido un grupo animal tradicionalmente poco estudiado, aunque actualmente se considera el grupo de animales vertebrados que está desapareciendo a mayor velocidad, como argumenta la líder del grupo que realizó el hallazgo y quien trabaja adscrita al Centro Interdisciplinario de Investigación para el Desarrollo Integral Regional (CIDIIR), Unidad Oaxaca del IPN.

"Encontrar una nueva especie de rana en estos bosques refleja el alto grado de diversidad biológica. Hay dos ideas importantes detrás de este descubrimiento: por un lado el que hay muchas cosas que todavía faltan por descubrir y, por otra parte, que estamos perdiendo un gran número de especies que todavía desconocemos", agregó.

El ecosistema en el que habita la rana *Charadrius hyla esperancensis* es uno de los más húmedos que hay en el país. En él abundan los arroyos y a lo largo del año la precipitación pluvial o lluvia acumulada es de 6 mil milímetros (mm).

En el reporte enviado a la revista *Zootaxa* se puntualizan algunos de los factores de riesgo que afronta la especie, principalmente los riesgos antropogénicos, por ejemplo la tala de algunas zonas del bosque y las carreteras que entran a la tierra.

"Encontramos algunas ranas muertas en la carretera. Sospechamos que es una especie que se mueve bastante, posiblemente buscando sitios de apareamiento en lugares lejanos a donde se refugia y esto las hace estar expuestas a mayores factores antropogénicos como la fragmentación de los terrenos boscosos. Algunos de estas variables nos hacen pensar que esta rana puede ser un modelo para medir las perturbaciones en pequeñas talas".

La investigadora dijo que otro factor de presión para que sobrevivan las especies es la extracción de animales silvestres de los ecosistemas para ser vendidos en las ciudades de México y en otros países.

"Las personas deben entender que los anfibios no son mascotas. Muchos son extraídos de la naturaleza con un grave costo para los ecosistemas. Si hay algunas especies que se reproducen en cautiverio, pero la mayoría de los que se venden son producto del tráfico ilegal. Hay países donde hay fucianación por los anfibios, como en Estados Unidos y en Japón y esto es un problema grave porque mucha gente quiere tener ranas sin entender sus requerimientos básicos para sobrevivir", concluyó Edna Leticia González Bernal.

Appendix 4. Description of the new species *Charadrahyla esperancensis*

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Discovery of another new species of *Charadrahyla* (Anura, Hylidae) from the cloud forest of northern Oaxaca, México

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Abstract

Charadrahyla esperancensis, a new species of tree frog, is described from the cloud forest of Sierra de Juárez on the northern slopes of Oaxaca. This species is sympatric with *C. nephila* and is distinguished by the presence of a protruding snout with a distinctive downward slope posterior to the nostril in lateral view, with an evident rostral keel, and the flanks and anterior and posterior surfaces of limbs with yellow spots. With the discovery of this new species, the species number of the genus increases to seven and adds another species of *Charadrahyla* for the assemblage of anurans from northern Oaxaca. This is the first instance of sympatry of species in the genus *Charadrahyla*. Additionally, we provide a key to the species of the genus.

Key words: new species, frog, *Charadrahyla*, montane cloud forest, sympatry, conservation, Sierra Juárez, Oaxaca

Resumen

Se describe a *Charadrahyla esperancensis*, una nueva especie de rana arborícola del bosque mesófilo de la vertiente norte de Oaxaca en la Sierra de Juárez. Esta especie es simpátrida con *C. nephila* y se distingue por la presencia de un hocico protuberante que descende hacia la parte posterior de la nariz en vista lateral, quilla rostral evidente, superficie anterior y posterior de las piernas con manchas amarillas. Con el descubrimiento de esta nueva especie, el número de especies del género aumenta a siete y se agrega otra especie de *Charadrahyla* para el ensamble de anuros del norte de Oaxaca. Este es el primer caso de simpatría de especies del género *Charadrahyla*. Adicionalmente, se proporciona una clave para las especies del género.

Palabras clave: nueva especie, rana, *Charadrahyla*, bosque mesófilo de montaña, simpatría, conservación, Sierra Juárez, Oaxaca

Introduction

The humid slopes of northern Oaxaca are home of a large assemblage of amphibians, several of them endemic to the state and restricted to the cloud forest. The diversity of treefrogs in this area is high and the community of the stream-breeding hylid frogs is exceptional (Delia *et al.* 2013). Many species have been described from the area (e.g., Campbell & Duellman 2001) but unfortunately, several are considered at risk by the IUCN Red List.

The genus *Charadrahyla* comprises six species, three of which are distributed in Oaxaca: *C. altipotens* in the Sierra Madre del Sur, *C. chaneque* at the eastern margin of the Isthmus of Tehuantepec, and *C. nephila*, known

Appendix 5. Species Catalogue. "The frogs from La Esperanza field guide"

This guide includes a brief description of native frog species that can be found in the locality. This includes the taxonomy, morphological description, biological and threats information and photos of the species.



La comunidad de La Esperanza conserva de forma voluntaria grandes extensiones de Bosque Mesófilo. Gracias a estas acciones aún se cuenta con especies de anfibios que de otra manera, habrían desaparecido hace mucho tiempo.

Los anfibios son organismos sensibles a cambios drásticos en el ambiente ocasionados por la tala, contaminación y/o modificación de los sitios que habitan, por lo que son buenos indicadores de la salud de los ecosistemas. Además nos proveen valiosos servicios ambientales como el consumo de insectos transmisores de enfermedades o plagas para cultivos y contribuyen en mantener limpia el agua de arroyos y manantiales.



Paisaje de La Esperanza

SIMBOLOGÍA	
Terrestre	Momento de actividad
Arborescencia	Momento de actividad
Diurna	Localización
Crepuscular	Localización
Nocturna	Localización
Indirecto	Localización
Directo	Localización
México	Localización
Oaxaca	Localización
Sierra Norte	Localización
Categoría de riesgo	Tamaño

<p>Charadrahyla esperancensis FAMILIA HYLIDAE (Carrasco-Márquez, Ramírez-González y González-Bernal, 2017)</p> <p>Rana de tamaño mediano, hocico prominente, cuerpo delgado y de color café pálido o verde olivo. Los costados y parte de las patas muestran un fondo de color oscuro con manchas amarillas. El vientre es claro y con apariencia de granitos. Se le ha observado en la vegetación a la orilla de los arroyos y dentro de las bromelias en temporada de secas.</p> <p>4.80 cm</p>	<p>Sarcophyla celata FAMILIA HYLIDAE (Torre-Mendoza, 1962)</p> <p>Rana de tamaño mediano. Presenta una coloración verde oscuro con manchas en el dorso. Habita en zonas conservadas, sobre el cauce de los arroyos, es sensible a la perturbación.</p> <p>4 cm</p>	<p>Tripidonotus spinosus FAMILIA HYLIDAE (Steindachner, 1864)</p> <p>Rana moderadamente grande. El cuerpo es robusto. Los adultos poseen una serie de espinas en forma de corona en la parte de la nuca. Su espalda es de color café claro con machas de forma irregular de un color café más oscuro bordeadas con blanco. Su vientre es oscuro.</p> <p>6.8 a 8 cm</p>
<p>Ptychohyla zophodes FAMILIA HYLIDAE (González y Durán, 2010)</p> <p>Rana de tamaño mediano. Presenta una coloración café claro con manchas oscuras de forma irregular. Habita en la vegetación cercana al cauce de los arroyos y dentro del bosque. Hasta ahora se conoce muy poco de esta especie y sus hábitos.</p> <p>3.5 cm</p>	<p>Duellmanohyla ignicolor FAMILIA HYLIDAE (Duellman, 1961)</p> <p>Rana de tamaño pequeño. El dorso es de color verde brillante y el vientre color crema. Vive en la vegetación cercana a los arroyos. Se le considera como una especie frágil y sensible a la deforestación. La IUCN la considera como una especie amenazada.</p> <p>2.6 a 3.0 cm</p>	<p>Crangastor mexicanus FAMILIA CRAUGASTORIDAE (Smith, 1877)</p> <p>Rana de tamaño pequeño. Cabeza de forma triangular. Su color va desde rojizo a café oscuro y su piel es lisa. Presenta una línea oscura que va desde la punta de la nariz hasta el tímpano.</p> <p>3 a 4 cm</p>
<p>Eserodonta abdovita FAMILIA HYLIDAE (González y Durán, 2010)</p> <p>Rana de tamaño pequeño. Es de color café amarillento con manchas oscuras. Habita en partes altas de los árboles y arbustos sobre el cauce de los arroyos y dentro del bosque. Se conoce muy poco de sus hábitos.</p> <p>2.5 cm</p>	<p>Charadrahyla nephila FAMILIA HYLIDAE (Weitzman y González, 1926)</p> <p>Rana de tamaño grande. Es de color verde con manchas oscuras en el dorso y franjas café oscuro en las patas traseras. Vive en la vegetación cercana al cauce de los arroyos (sobre todo arbustos y árboles) y es muy sensible a la perturbación. Se considera como vulnerable por la IUCN.</p> <p>5 a 7.5 cm</p>	<p>Crangastor loki FAMILIA CRAUGASTORIDAE (Shreve y Wake, 1955)</p> <p>Rana de tamaño pequeño y cabeza triangular. Su coloración va desde tonos amarillos hasta café oscuro. Tiene una línea oscura que va desde la punta de la nariz hasta el tímpano. Su piel es ligeramente rugosa y se observa una marca en forma de "reloj de arena" en la espalda. Es una ranita común que vive y se reproduce en la hojarasca del bosque.</p> <p>2.5 a 3.5 cm</p>

Craugastor pygmaeus
FAMILIA CRAUGASTORIDAE

(Taylor, 1937)

Es una rana de tamaño pequeño. Su piel es generalmente de apariencia verrugosa, pero en algunos casos la piel puede ser lisa. El color es muy variable, en la mayoría de los casos se observa una mancha en forma de "V" invertida de color más oscura, también pueden presentar manchas color café y crema, con puntos oscuros entre los ojos. Sus patas poseen barras oscuras y su vientre puede ser de color café claro o amarillento. Puede vivir en lugares semi-perturbados.



Craugastor polymniae
FAMILIA CRAUGASTORIDAE

(Campbell, Lauer y Wells, 2000)

Rana de tamaño pequeño. El tímpano es pequeño. El color de su espalda es café verdoso con algunas marcas oscuras, las cuales también se observan debajo de los ojos y en la comisura de la boca. Su vientre es blanco o crema con algunos puntos oscuros en la garganta. Los brazos y piernas tienen barras que contrastan con colores café oscuro y crema claro.



Craugastor spatulatus
FAMILIA CRAUGASTORIDAE

(Varela, 1938)

Es una rana pequeña. Las patas tienen manchas en forma de bandas oscuras y las puntas de los dedos están expandidas en forma de pequeños triángulos o espátulas. Los labios presentan barras oscuras y claras. Su cabeza es un poco aplanada. La piel de la espalda es rugosa. El color de fondo de la espalda es gris olivo con grandes manchas color café oscuro. La garganta es de color oscuro y el vientre es moteado. Vive en sitios conservados y es una especie poco abundante.



****Incilius spiculatus***
FAMILIA BUFONIDAE

(Dressler, 1907)

Sapo de tamaño mediano a grande y cuerpo musculoso. Posee crestas en la cabeza muy grandes y un tímpano pequeño. Tiene unas glándulas de gran tamaño detrás de los tímpanos. A los lados del cuerpo tiene hileras de tubérculos parecidos a espigas. Su espalda es de color café rojizo y gris con una línea oscura que puede ser o no completa y en ocasiones posee manchas redondas y negras. Las manos y piernas presentan manchas café, alternadas por otras de color gris y la punta de los dedos es café rojiza. Vive en lugares conservados y tolera sitios medianamente perturbados.



*Actualmente se realizan estudios no solo de ranas sino también de otros anfibios, como lo es el sapo de espículas.

Craugastor lineatus
FAMILIA CRAUGASTORIDAE

(Rebeca, 1972)

Rana de tamaño mediano. Su coloración es café-rojizo y la apariencia de su espalda es ligeramente arenosa. Presenta una línea negra que va desde la punta de la nariz hasta detrás de los ojos, los cuales son de color rojo. Es una especie rara y vive en sitios conservados. La IUCN la considera en peligro crítico.



Localización

La Esperanza, se localiza en la Sierra Norte. Pertenece al municipio de Santiago Comaltepec y al Distrito de Ixtlán. Se ubica en las coordenadas 17° 35' de latitud Norte y 96° 35' de longitud Oeste a una altitud de 1,200 m s.n.m.

La orografía es montañosa. El clima es templado húmedo con temperaturas entre los 24°C y 30°C. La lluvia es constante con precipitaciones de hasta 5,000 mm.



Nuestro proyecto ha sido un trabajo conjunto entre científicos y pobladores de La Esperanza, financiado por "Conservation Leadership Programme" (C1P02294616) y CONACYT (256071).

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DISEÑO

MAYRA MIGUEL

AGRADECIMIENTOS

Al municipio de Santiago Comaltepec y a la comunidad de La Esperanza.

¿Quiénes somos?...



Ecología para la Conservación de Anfibios [E.C.A.] es un grupo de investigación formado en el 2016 en el Centro de Investigación Interdisciplinario para el Desarrollo Integral Regional (CIDIIR) Unidad Oaxaca, el cual pertenece al Instituto Politécnico Nacional.

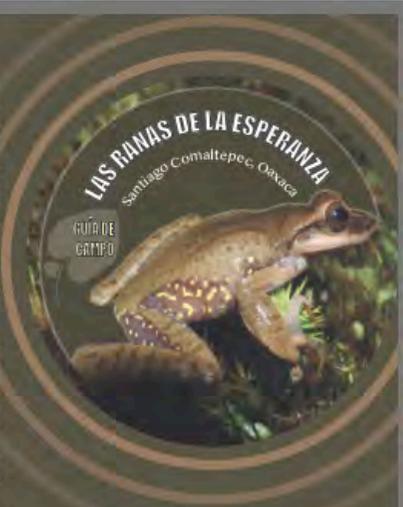
El equipo está conformado por la Dra. Edna González Bernal, alumnos de Maestría y Doctorado en Ciencias en Conservación y Aprovechamiento de Recursos Naturales.

El objetivo de este grupo es investigar y conocer sobre la situación de los anfibios, especialmente anuros en Oaxaca, estado con mayor diversidad de este grupo de organismos en México. Actualmente llevamos a cabo trabajos de monitoreo de especies en categoría de riesgo en bosques mesófilos de montaña, educación ambiental, ciencia ciudadana y divulgación en la Sierra Norte de Oaxaca y la Chinantla.



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En La Esperanza, existen anfibios (ranas, sapos y salamandras) que son endémicos, es decir, que solo existen ahí y no se encuentran en ninguna otra parte. Esta variedad de organismos junto con otros animales y plantas hacen que sus bosques sean un lugar único y de gran importancia en el mundo.



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4.3 Address list and web links useful

<https://ecaoaxaca.wordpress.com/>

<https://es-la.facebook.com/pages/category/Science-Website/Ecolog%C3%ADa-para-la-Conservaci%C3%B3n-de-Anfibios-2192168101057153/>

<https://amphibiaweb.org/>

http://www.conabio.gob.mx/conocimiento/regionalizacion/doctos/rtp_130.pdf

4.4 Distribution list

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