

Filling Spatial and Ecological Information Gaps in Threatened Forest-Sensitive Bat Species and Endangered Ecosystems in Nicaragua



Second night of bat sampling at Rio Escalante-Chacocente Wildlife Preserve. From left to right and up to bottom: José G. Martínez-Fonseca (instructor), James Hernández, Russell Barrantes, Adriana Urbina; Eduardo Medina, Julio Loza (co-instructor), Luis Gutiérrez (co-instructor), Maynor Fernández (co-instructor), Odalys Guardado, Chengpy Wu, Nikté Licon, and Kevin Manzanarez.

First Report

By José G. Martínez-Fonseca, Ph.D.

Training workshop: Bats of Nicaragua

One of the main goals of our project is to create local capacity to work with bats. To achieve this, we conducted a bat techniques training workshop available to students and young professionals. On October 1st of 2023, we posted on Facebook and other social media a call for applicants for this workshop (attachment #1). We emphasized that the goal of this workshop was to provide training for biology students, as well as students of other related disciplines. We also noted that the workshop would be focused on taxonomy, bat species identification, sampling methods (bat handling and netting), as well as data collection, and basics of acoustics.

The flyer was extremely successful, and it was shared 57 times from my personal profile alone. The flyer contained a link to an application form on google docs (attachment #2). In this form we asked about applicants' personal info, career, and expectations, as well as information on their previous experience working with bats and their current vaccination status for rabies.

A total of 22 people applied (attachment #3). The ages of applicants ranged from 17 to 40. Their backgrounds included biology students from the National University of Nicaragua (UNAN) and veterinary students from the Agriculture National University (UNA) as well as tourism guides. We also received requests from students in Mexico, El Salvador, and Costa Rica. About other 7 people reached out to me directly asking for opportunities to join the workshop, but most were from outside Nicaragua, and I informed them that the workshop was focused on creating capacity in Nicaragua. However, this is an important indicator of the need for training workshops like this one not only in Nicaragua, but across the Mesoamerican region.

We selected a total of 9 students, one of which had a last-minute issue and couldn't attend. I also ensured the availability of pre-exposure rabies vaccines for four of the participants that were not previously vaccinated but indicated that they would like to receive this series of vaccines. Everyone in the workshop was up to date with their vaccinations and could handle animals. Two collaborators from the Nicaraguan Ministry of Environment (MARENA) helped with workshop by volunteering on training people with bat handling. I prioritized selecting students that were in their last year of their bachelors' degree or had recently graduated and were seeking full-time biology work in the near future.

We conducted our workshop from December 8 to the 10 of 2023. We had planned to host the workshop on a biological station in the Rio Escalante-Chcacocente preserve. However, due to issues with access to a preserve (strong rains had damaged the road) we relocated the workshop to a school in the city of Santa Teresa, Carazo Department. We were still able to sample the sites we had initially proposed in the Rio Escalante-Chacocente Wildlife Preserve, one of the largest remaining patches of native Lowland Dry Forest and that has not been previously surveyed for bats.

For the workshop, I created two main presentations (attachments #4 and #5). One of the presentations served as an extended intro to bats, sampling techniques, and taxonomy of the main groups. We had other activities during this period, drawing bat morphology, and testing identification skills.

While I knew some of the participants had some English skills, prior to the workshop I translated materials from English to Spanish so that everyone could use them. As part of this, I created a simple but comprehensive identification guide for all the bat species of Nicaragua (attachment #6) that we used and tested during the workshop. As far as I know, this is the only Spanish-language key to identification of Nicaraguan bats. All other resources are available in English only. The identification guide was put to the test and all participants were extremely happy to have it available. They highlighted the usefulness and ease of use of this resource. I expect to keep refining the guide and testing it during the rest of the sampling process of this project.

During our two nights of sampling, we were able to capture 20 bat species, including White-winged Vampire Bats (*Diaemus youngi*) which had not been previously reported for the Carazo Department before. These 20 species represented a total of 150 individual bats. We used single and triple high net setups both nights. We will be presenting our dataset to the authorities of the reserve to update their species checklists. We also collected scat samples for future diet analysis using DNA metabarcoding. These samples will be transported to the United States at the end of the field season of this project.

Additionally, thanks to the coordination with the Nicaraguan Bat Conservation Program, our sampling nights were considered part of the Christmas Bat Count (see attachment #7; Pacifico-Carazo RVS Chacocente), an activity coordinated through almost all countries in Latin America. This effort is coordinated through the Latin American and Caribbean Network for Bat Conservation (RELCOM).

During the workshop we also raffled three field guides to the participants (Reid 2009; Mammals of Southeast Mexico and Central America). We provided printed copies of the Updated Checklist of Bats of Nicaragua, the Nicaraguan Identification Guide, as well dichotomous keys to the bats of Costa Rica and Honduras. We provided all food, transportation, headlamps, gloves, and lodging free of charge to all participants. We also provided “Rite in the rain” notebooks and pencils to record data as part of our emphasis on the importance of proper data collection.

Next activities: Sampling

We are currently working on the logistics of sampling our proposed areas. We will start our sampling in the SE of Nicaragua in the Rio San Juan Department. We will be visiting the area from the 18 to the 24 of February 2024. Then from the Feb 25 to March 02, we will be sampling in the NE of Nicaragua. A total of four of the recently trained participants of the workshop will be traveling with a collaborator and myself to these sites.

We will also dedicate most of March to sample the other proposed areas in Northern Nicaragua. But we are still working on the schedule. Two of the students in the workshop that will be

joining us for the sampling in NE Nicaragua might also use part of our sampling data to complement their thesis work.

XI CONTEO NAVIDEÑO DE MURCIÉLAGOS
Los murciélagos necesitan amigos

Programa conservación murciélagos de Nicaragua - PCMN
Conservacionmurcielagos.pcmn@gmail.com

Fechas: 2023

- RACCS- Blufields-RSP
Hermanos Hodgson Sobalvarro
8 al 9 de Diciembre
- Pacifico- Carazo RVS,
Chacocente
8 al 9 de Diciembre
- Pacifico-Masaya - AICOM- PNVM
8 al 9 de Diciembre
- RACCN-Siuna- MLR Forestal
12 al 14 de Diciembre
- Pacifico- Rivas Reserva Mono Bayo
19 al 21 de Diciembre

Logos: PCMN, INIA, BICU, RACCS, PASO PACÍFICO, ESTADOS UNIDOS DE AMÉRICA CENTRAL, MLR FORESTAL

Christmas bat count Nicaragua.

Attendees for Workshop (roughly translated into English).

Name and surname, age, city	Attended Workshop	Why are you interested in this workshop?	What experience do you have working with bats or any other biology topic?	Do you have experience handling mammals or other fauna species? Explain	Are you available to conduct scientific sampling in Feb & Apr 24	English level	Comments
Yanerling Artola, 24 years, Managua	No	I am a biologist, and I would like to acquire knowledge about this technique to apply to future projects.	Molecular biology	I have been to some Christmas counts a couple of years ago.	Yes	Intermediate	
Kevin Steven Torrez Manzanarez, 23 years, Managua	Yes	Acquire greater knowledge, learn in more detail about bat monitoring, and learn about bat bioacoustics.	Participation in bat monitoring, where my first meeting was through an invitation from Eduardo Medina and Arnulfo Medina; Where in this I was acquiring knowledge in the monitoring system through fog nets, capture, manipulation and basic identification of individuals, instructed and guided by Arnulfo, after this first experience, I participated in other monitoring occasions in the company of Arnulfo and Eduardo. I have participated in other taxa such as Herpetology, Ornithology, Botany, I have monitored wildlife through camera traps and participated in research projects.	Yes, during participation in different monitoring activities I have acquired experience in the manipulation of various species including Chiropterans, herpetofauna and avifauna.	Yes	None	By participating in the workshop, I will be able to reinforce knowledge and learn new knowledge, where bioacoustics is a topic of great importance and learning from it would be a great opportunity, where in this way I will be able to put into practice the new knowledge acquired through the workshop.
Russell Alexander Barrantes Martinez, 21 years, Managua	Yes	I study biology and I like wildlife.	I have had the opportunity to participate in the 2022 Christmas bat count, in addition to monitoring bats in caves and monitoring the winter survival of migratory birds.	Yes, I have manipulated mist nets and banded birds in the Volcan Mombacho natural reserve, I have participated in bat monitoring in the	Yes	Basic	

				caves of Voldan Masaya			
Eduardo Medina. 26 years. Ticuantepe	Yes	By learning in acoustics	Wildlife monitoring	5 years	Yes	None	
Chengpy Wu Sánchez, 22 years Managua	Yes	The ecological importance that bats have is very broad, so for me it would mean a lot to be able to participate in scientific dissemination, learn more how to manage and process them, and in the future work with them and study the entire relationship they have with their environment.	I belong to the PCMN and have given ed talks. environmental about bats, I am a V-year Biology student and I have had multiple experiences with the flora, fauna and fungi of the nation.	I have handled (very cautiously) bats on 3 occasions and birds.	Yes	Advanced	Thank you for this opportunity, what you do is great:))) greetings!!
Odalys, 24 years, Managua	Yes	Why it gives me the opportunity to learn and grow on a personal and professional level.	Experience in bat sampling methods with mist nets. Taking morphometric measurements. Identification of bats in the field.	Experience in handling bats, saurians and snakes.	Yes	None	

<p>Nikté Liconá, 26 years, Managua</p>	<p>Yes</p>	<p>My motivation to participate in this workshop is twofold. Firstly, I consider that bats play a vital role in the ecological balance of ecosystems but that they are also a very vulnerable species, which is why their study and the effective communication of the results of scientific research are of utmost importance, contributing to raising awareness and raising awareness among the population about the importance of conserving these species. Secondly, I want to direct my professional future towards areas of research and scientific dissemination in wildlife. I believe that this opportunity will allow me to acquire new knowledge to carry out scientific research in situ and develop skills and experience to be able to carry out studies in this field. to future.</p>	<p>I have had the opportunity to participate in the annual counts carried out by the PCMN since 2018, contributing to the captures and identification of bats. I recently had the opportunity to participate in an in-situ research stay with African fauna in which we developed various biodiversity studies in the field.</p>	<p>Yes, since 2018 I have participated in various projects and institutions in which I have had the opportunity to handle, capture and contain various species of wildlife.</p>	<p>Yes</p>	<p>Advanced</p>	<p>My desire to participate in this project is not only limited to wanting to acquire learning in bat research techniques, but also, I hope to be of help and support to you in everything that my abilities allow me, so that the projects and scientific research expeditions are carried out satisfactorily.</p>
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<p>James Arach Hernández Espinal, 20 years, El Rosario</p>	<p>Yes</p>	<p>I am interested because I am a 4th year biology student and I need to train in different areas of research. When I have the opportunity to go to the field to train with fauna, I realize that there is a lot to know and that only the field gives you experience and scientific knowledge.</p>	<p>I am currently a volunteer in the MOSI project (winter survival monitoring) at the Mombacho station since last year. and a small volunteering with Professor Octavio Saldaña learning with mist nets to learn how to catch bats and a little small mammal in the Masaya Volcano reserve, but I am a beginner.</p>	<p>During a workshop, mice and gophers were captured and bats were captured in the nets. With birds, it is being monitored from November to March three days each month. 2022/2023.</p>	<p>Yes</p>	<p>Basic</p>	<p>I am very interested in learning how to collect scientific data through sampling in the field, I want to learn how to perform analysis of the collected data and understand the results of what one is investigating. I hope you can give me the opportunity.</p>
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<p>Adriana Urbina delgado, 24 years, Managua</p>	<p>Yes</p>	<p>This workshop is of great interest to me because I want to expand my knowledge about the research techniques used in bats since, in addition to being aware of their importance on the planet, I am currently working on pathogens present in Central American bats, by hand. from the University of Michigan, so the workshop will allow me to have a better understanding of topics related to these species at hand with professionals, in addition to allowing me to strengthen the skills necessary to work with them. Likewise, I would love to be able to share experiences and, if possible, offer my disposition and tools (stains, microscope, etc.) for microbiological and hematological monitoring of bats, with the purpose of working as a team and achieving the main objective of different sciences. biological, this being the</p>	<p>Currently I was accepted in a research project led by Dr Kelly Speer and Dr Nicté Ordoñez from the University of Michigan, to carry out epidemiological censuses of small mammals, focusing mainly on bats and wild rodents, whose purpose is to investigate viral and bacterial pathogens (mainly Leptospira sp) present in them, to prepare a doctoral thesis by Dr. Ordoñez, whose objective is to provide guidelines to prevent future epidemic outbreaks that get out of control, in addition to determining the role that these pathogens play in the organism of micromammals, helping in a way direct in its conservation. The field phase will be carried out in January 2024, which would not affect the workshop dates. On the other hand, I have participated in bat counting in La Dalia Matagalpa, within the Sombra Ecolodge reserve, in 2019. Regarding biology topics, I was in a journal club for 6 months taught online at the Ricardo Palma University in Peru, whose topic was the control of epidemics in wildlife, where we analyzed scientific papers, we were given important guidelines for scientific writing and virtual presentations were made in different universities in Peru. On the other hand, I have participated in bird counts and</p>	<p>I have had the opportunity to work with domestic and wild birds, in restraint and sampling techniques. Likewise, within reptiles, I have worked mainly with turtles and snakes in the areas mentioned above. Likewise, during my internship at SENASA-Honduras I worked on epidemiological control and taking blood samples with buffaloes, deer and other wild ruminants. In the case of felines, I have participated in immobilization, nutrition and handling of pumas and lions.</p>	<p>Yes</p>	<p>Advanced</p>	<p>I consider that having a multidisciplinary team will be of great help for this workshop, so, in addition to being extremely grateful if I am accepted, I am committed to making my laboratory and public health knowledge available for anything that is needed and not needed. only to be part of the workshop, but to go further and volunteer in research work with bats in our country.</p>
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		<p>conservation of species and consequently the balance of ecosystems and promotion of public health.</p>	<p>monitoring in Reserva la Makina, Isletas de Granada and Reserva Tepesmoto. In addition to supporting the monitoring and release of newborn turtles on Juan Venado Island in León, where I am also in the process of requesting permits to take samples for research into pathogens on the skin of the species of turtles that are born on the island. .</p> <p>Likewise, I have been a volunteer at the Thomas Belt Zoo and the National Zoo of Nicaragua, where I rotated through different areas, all involved in the understanding and comprehensive management of the fauna present or rescued. I have contributed to environmental education issues, giving talks on public health, pathogens and epidemiology of wildlife and production animals, in the community of Cedro Galán and sectors of La Libertad, San Pedro de Lóvago and Juigalpa in Chontales; In this last department, an awareness module was also provided to ranchers about the importance of snakes in the ecosystem.</p>				
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Steven José Flores Blanco, 22 years, León	No	Since I started my career, I have been interested in bats, I have had the opportunity to do work on them and I would like to learn much more.	Evaluation of the diversity of mammals at the UNAN Environmental Botanical Garden - León	Yes, bat manipulation	Maybe	Basic	
Silvia Fonseca, 20 years, Managua.	No	Due to the degree, I am studying (biology) I know the importance of bats at an ecological level, because of this I am very interested in becoming more familiar with them and learning more about them and their importance.	I have not had the opportunity to work with bats but with other species, like with iguanas, I was helping in a zoo to capture them, weigh them, measure them and create a database of them.	With iguanas and snakes, I have attended fairs where I have had the opportunity to handle some species of snakes, and with equals at a fair and contributing to the zoo.	Yes	Basic	I am currently a biology major, in my third year, I would like to apply because it is an experience and knowledge that always seemed of great importance to me to add to my growth as a student of a very broad career, I feel that this opportunity would be of great help to start training.
Diana 25 years, Managua	No	I am studying veterinary medicine, currently almost starting my fourth year, I want to specialize in wildlife and among my plans is to be a scientific researcher.	I have been a spectator in professional counts of natural memories	I have had the opportunity to do internships at the Chontales Zoo and also take special courses in wildlife and zoo.	Yes	Basic	
Brandon Rios Alemán 29 años de edad Rivas	No	It is extremely important to know the species of bats that exist in the country and their importance in the ecosystems.	Learn more about the biodiversity of the area	Handling of migratory birds	Yes	Basic	It is of utmost importance to appropriate knowledge that helps the conservation of species for the conservation of our ecological diversity.
Mirna Alejandra Jimenez Velazquez,	No	I want to learn about NC species and data processing	In environmental education about its importance with the PCMN program	Yes, I have handled bats, not many but yes.	Maybe	None	Bats need friends!

22 years, Managua							
Meyling Ramírez Alegría, 22 years, Managua.	No	I am interested in this workshop, because I would like to acquire new knowledge regarding taxonomy, capture techniques, and above all, about the topic of bioacoustics: methodology, data processing and analysis	I am part of the Nicaraguan Bat Conservation Program, so I have had the opportunity to participate in bat cave monitoring in the Masaya Volcano National Park. Likewise, I have collected and identified plant species in the cloud forest of the Mombacho Volcano Natural Reserve; and subsequently, to the processing of pollen from said species.	Yes, I have handled mammals such as bats and rodents; Likewise, I have had the opportunity to manipulate land birds, to proceed with their basic data processing.	Yes	Intermediate	
Elmer Farid Gutiérrez Flores, 17 years, Masatepe	No	I want to learn to identify the species of bats in Nicaragua so that I can develop scientific research regarding their conservation in the future. I also want to enrich my knowledge of biodiversity to later specialize in this natural resource.	I currently have one year of experience in monitoring resident and migratory birds participating with the team birding Nicaragua team. I participated in the first herpetofauna monitoring in the country, assigning myself the Private Natura Wild Reserve as a monitoring point. During the month of May of this year, I had the opportunity to capture and identify bats in the La Makina Private Wildlife Reserve.	As I previously mentioned, I have been able to manipulate different species of reptiles, amphibians, birds and some individuals of bats. This is for the purpose of identification and milling control of birds.	Yes	Intermediate	By applying this great learning resource, it will allow me to increase my knowledge that will later be implemented to develop scientific research.
Oscar Bermúdez Collado, 39 years, Managua	No	Like the bird taxon, I want to specialize with the study and monitoring of bats. I want to provide information about my country and educate communities to respect	Much experience in bird monitoring. With medium level bats.	High capacity for handling birds. Medium/High capacity for handling reptiles and amphibians.; Medium/Low ability	Yes	Basic	I am very interested in research, in scientific knowledge. Highly interested in learning to learn about monitoring methodologies, preparing scientific

		biodiversity, the forest and water.		to manipulate mammals.			articles and documenting Spp.
Esteban Andres Esquivias Flores, 25 years, Zapopan, Mexico	No	My dream is to dedicate myself to the study and conservation of bats since I was not able to have that experience during my time studying for my degree.	Acoustic monitoring and bat biology	Yes, on different occasions I have been a field technician assistant, monitoring, sampling and trapping wildlife in general where I had the opportunity to manipulate different fauna: arthropods, small mammals, herpetofauna, birds and fish.	Maybe	Advanced	I may not be from Nicaragua, but I am willing to pay my own expenses to have this great experience
San Sebastián Salitrillo, 28 years, Santa Ana, El Salvador	No	Since in my country these types of workshops are very rare, I would like to learn about the topic in your country.	Management of birds and protected areas	None	Yes	Intermediate	Thank you for the opportunity to apply, and even though I am not in Nicaragua I have the opportunity to pay for myself and go on the days that the workshop will take place. I really want to learn with you. Hopefully, I will be given the opportunity to share that great experience.

Juan Rodríguez, 39 years, Managua	No	To learn new capture and monitoring techniques.	I participated in research with Mr. Arnulfo Medina in different parts of Nicaragua	Yes, I have already handled mammals, mainly bats.	Yes	Basic	I have participated in several bat monitoring with Mr. Arnulfo Medina (q,e,p,d) I am currently monitoring mammals on my farm located in the mountains of Managua
Georgina Pérez Sotelo, 26 years, Managua.	No	Because I want to learn about taxonomy, capture, identification, disclosure and research regarding bats and their importance in the ecosystem.	I have no experience handling them, but I have had close contact, and I am currently enthusiastic about learning about the animals, their scientific names, taxonomy, importance, species, etc. I am currently a beginner bird watcher.	Yes, although I have not yet handled bats, I am aware of the subject and the pcmn program for which I wanted to volunteer.	Yes	Intermediate	I sent my resume although it does not reflect the experience, I have volunteering for various programs and organizations, as well as my knowledge of basic first aid, camping techniques, and teaching methodology.
Ariel Alexander Salinas Sequeira, 31 years, Managua	No	To learn, improve data quality and know the protocols for working with bats.	I have been able to collaborate with bat sampling since 2019 accompanied by researcher Arnulfo Medina in the north-central region and Sierras de Managua. I have also participated in teams within Bosawas and Indio Maíz by UNA and URACCAN.	Since 2012 I have been part of the migratory bird ringing team at the Los Guatuzos Ecological Center and over the years, I have been able to share with field researchers who have allowed me to learn about the ways of manipulating insects, reptiles and bats.	Yes	Intermediate	

Taller: Murciélagos de Nicaragua

Este formato es para aplicar a **un cupo gratuito** para entrenamiento en técnicas de investigación de murciélagos. En este curso se abordará identificación taxonómica de especies de murciélagos de Nicaragua, técnicas de captura y bioacústica, así como levantamiento y procesamiento básico de datos.

Las ocho (8) personas seleccionadas asistirán a dos seminarios teóricos y a un taller práctico de tres días (dos noches) en el Refugio de Vida Silvestre Rio Escalante-Chacocente. Además, tendrán la oportunidad de asistir a expediciones científicas en distintos puntos del país en 2024.

Si tiene alguna duda por favor contactar José G. Martínez-Fonseca al correo:
jm3934@nau.edu

Nota: Llene el formulario lo mejor que pueda. Se priorizan personas con carreras afines a biología y con conocimiento básico del inglés. Sin embargo, esto no es requerido. Además, tomar en cuenta que este curso esta dirigido a estudiantes y jóvenes profesionales.

* Indicates required question

Perimyotis subflavus en Nueva Segovia, Nicaragua



1. Nombre y apellidos, edad, ciudad y departamento de residencia en Nicaragua *
(ejemplo: José G. Martínez, 34 años, Jinotepe, Carazo)

2. Contacto (email, número de teléfono) *

3. Por qué esta interesado en este taller? *

4. Qué experiencia tiene trabajando con murciélagos o cualquier otro tema de biología? *

5. Cuenta con experiencia manipulando mamíferos u otras especies de fauna? Explíque *

6. Tiene disponibilidad de viajar en Nicaragua para conducir muestreos científicos *
entre los meses de febrero y abril de 2024.

Mark only one oval.

- Sí
- No
- Tal vez

7. Cuenta con vacunas contra la rabia? *

Mark only one oval.

- Sí
- No, pero estoy dispuesto a inmunizarme
- No, y no quiero

8. Nivel de Inglés *

Mark only one oval.

- Avanzado
- Intermedio
- Básico
- Ninguno

9. Por favor adjuntar Curriculum Vitae (CV) con experiencia relevante a las ciencias biológicas

Files submitted:

10. Por favor agregue cualquier comentario que estime conveniente para evaluar su aplicación:

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