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BAT CONSERVATION AND MANAGEMENT WORKSHOP FOR NICARAGUA

INITIAL ASSESSMENT



TECHNICAL REPORT

BAT CONSERVATION AND MANAGEMENT WORKSHOP FOR NICARAGUA

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Conservation and Sustainable Tourism in Critical Watersheds

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In collaboration with

Paso Pacífico

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Harp-traps are particularly effective in front of cave roosts, where many bats emerge at once. The bats hit the vertically-strung lines and then tumble down into the holding bag, where investigators remove them; this method is less stressful for bats than capture with mist nets.

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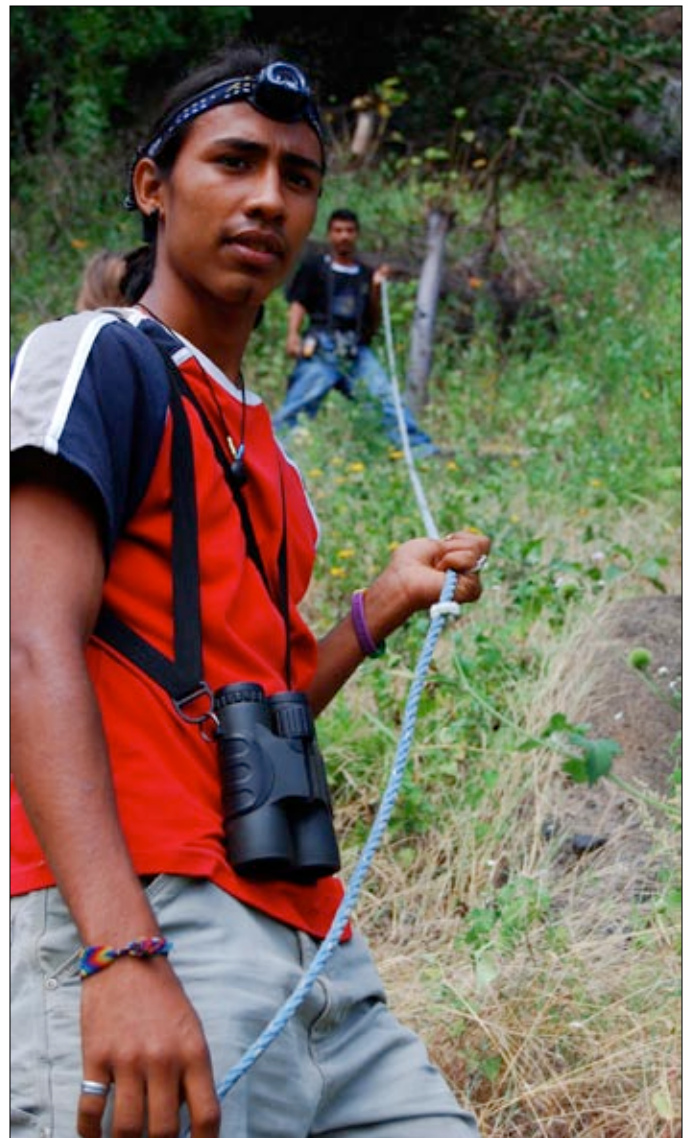
The only bats we saw in the cave at Masaya open to tourists were a few members of the genus *Carollia*; these small frugivores feed on the fruits of *Piper* (pepper) plants and other small shrubs.



INTRODUCTION

During the last several years, Bat Conservation International has developed its tremendously successful Bat Conservation and Management Workshops, providing training opportunities for wildlife biologists on techniques used in bat research. Hands-on experience gained by workshop participants includes netting and trapping, identification, radio tracking, night-vision observation, acoustic monitoring, and habitat assessment. However, the location of workshops in the United States and presentation in English has limited accessibility to international students, leaving many working and aspiring wildlife biologists in the developing world with few opportunities to master and integrate current methods in bat research into their study programs. In response to the need for on-the-ground training for biologists in habitat countries, we have begun the process of developing a Bat Conservation and Management Workshop program for international audiences.

Our previous experience in Latin America led us to focus on developing this first international workshop series in Central America, specifically in Nicaragua. In spite of being Central America's largest and most ecologically diverse country, there has been a dearth of scientific research there. There are also a number of local partners with a keen interest in developing bat research in the country. Local partners include the U.S. Forest Service's International Institute for Tropical Forestry, which is funding biodiversity monitoring in Nicaragua; and Paso Pacífico, an NGO dedicated to the conservation of tropical dry forest in Nicaragua. Given the confluence of interest, partners, and funding, we made a one-week trip to Nicaragua in January 2008 to assess potential sites for presenting at least two workshops on Bat Conservation and Management in Nicaragua.

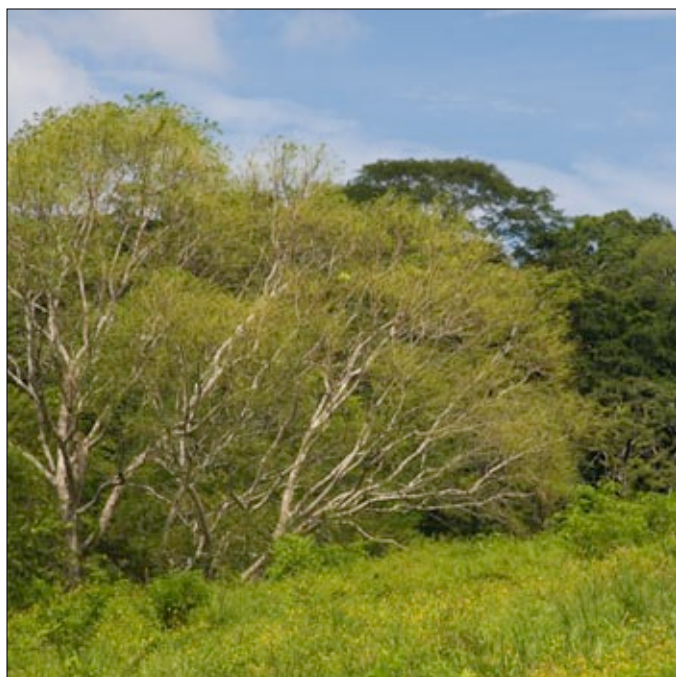


- ◀ This proboscis bat (*Rhynchonycteris naso*) is an agile flyer that feeds on small flying insects; they roost on tree trunks overhanging rivers and water.
- ▶ Osmond Picado (foreground), a guide at Montibelli private reserve, climbing to a small cave at Montibelli where small, sparrow-like bats (*Balantiopteryx plicata*) roost.
- ▶ *Dermanura phaeotis*, the pygmy fruit-eating bat, is common in forests and disturbed areas of Central America.
- ▼ One of the sites prioritized by Paso Pacifico, visited during reconnaissance trip.



TRIP GOALS

The primary goal of this initial trip was to assess the potential of several sites (primarily public and private reserves) as locations for hosting workshop participants and/or as satellite locations during a workshop where participants could practice capture techniques. These sites (see Table 1 for full details) were identified based on the previous knowledge of workshop organizers and partners, and were chosen due to their relative ease of access, potential for inclusion of various habitats harboring unique bat assemblages, and presence in areas prioritized for conservation activities by Paso Pacifico and USFS.



TRIP PARTICIPANTS

- **Kimberly Williams-Guillén**, Postdoctoral Fellow in the School of Natural Resources and Environment of the University of Michigan, and **Kari Gaukler**, Education Coordinator of Bat Conservation International, led this brief field trip. Both have experience working in Nicaragua in ecological research and environmental education. Additional participants (below) provided assistance with logistical support and bat capture at the sites we assessed. These participants included:
- **Julie Martínez**, Paso Pacifico, Nicaragua. Martínez has worked with Paso Pacifico for 2 years in environmental education and community outreach. She has extensive relationships with local landowners, NGO's, and other conservation stakeholders in the research area, and facilitated logistical aspects of the trip.
- **Julie York**, U.S. Forestry Service, Bend, OR. York has experience capturing and surveying bats in the United States and Mexico (where she worked with Williams-Guillén for 2 months as a research volunteer).
- **Mark Williams**, who is Williams-Guillén's brother; he assisted with bat capture and transport between sites.
- **Osmond Picado** and **Juan González** work as nature guides at Montibelli resort, and have experience in bird capture. They learned how to set up the triple high and harp trap on the first night at Montibelli, and were so good at it that we decided to take them with us. They accompanied us to all sites except La Flor, helping with equipment transport and set-up at capture sites.

METHODS

Study Area

We focused on sites in southwestern Nicaragua, in the areas between Managua and the Costa Rican border (Fig. 1). This area comprises the “Paso del Istmo,” one of two priority areas where Paso Pacifico is working with landowners and community members in conservation of the country’s remaining tropical dry forests. This area of Nicaragua is probably the best area for launching workshops, given the relatively well-developed infrastructure and proximity to population centers. Additionally, this region is undergoing the most rapid and drastic forms of land-use change and conversion to agriculture, suggesting that bats and other native biodiversity are under the greatest threat of short-term population reduction and change in community structure.



Capture and Identification Methods

Given that our primary goal was simply to get a feel for bat abundance and diversity at each site, we took a flexible approach to our trapping set-up. At all sites, we used a triple-high mist-net system set across a road or similar linear feature that could serve as a travel corridor for bats. The triple-high system was usually augmented with 1-3 single-high mist-nets. The harp trap was deployed on all but the last two nights; capture rates with the trap were very high in front of the cave in Masaya, but low along forest trails at Montibelli and Domitila. We therefore chose not to use it at Apoyo or La Flor, although we do expect that it would yield some captures in these areas if placed along appropriate forest trails. Nets were opened at dusk (except at La Flor, where problems in obtaining cooperation from local landowners set our schedule back) and left open for 3-4 hours (usually until moonrise).



- ◀ A couple of Davy’s naked-backed bats (*Pteronotus davyi*) captured at Masaya hang out with Kim Williams-Guillén before flying off.
- ▶ Measuring the forearm length of a great fruit-bat (*Artibeus literatus*); these bats feed on fruits from canopy trees, including many species of wild figs.
- ▲ The Domitila Wildlife Private Reserve.
- ▼ The Montibelli Wildlife Private Reserve.

RESULTS

We captured bats representing a minimum of 26 species belonging to six families; a summary of the bats captured is presented in Table 2. We captured well over 143 bats; the totals in Table 2 reflect only those bats for which we collected data on age, sex, size, etc. and do not include bats which were released or escaped prior to processing. (At Masaya volcano, a large number of bats were released directly from the harp trap, since capture rates were very high in front of the cave entrance.) The bats captured included a number of bats rarely captured in mist nets (e.g., the highly-maneuverable emballonurids), limited to certain habitats undergoing rapid development (e.g., the greater and lesser fishing bats found in riparian and lakeshore areas), and species whose capture represents major range extensions (e.g., *Mormoops megalophylla*). Complete data on bats processed can be found in Appendix I.

Montibelli presented the bat assemblage most “typical” of a Neotropical forest, with herbivorous phyllostomids dominating in terms of both abundance and species richness. All phyllostomid species captured (10 species) were frugivorous or nectarivorous. The larger frugivores *Artibeus* (including the smaller species sometimes classified in their own genus, *Dermanura*) bats were the most abundant at the site. Many *Artibeus* are fig-feeders, and wild *Ficus* was common at Montibelli (and several other sites). The three insectivorous species captured (vesperilionids *R. tumida*, *Eptesicus fuscus*; mormoopid *Pteronotus parnelli*) are also common in many Neotropical forests. The following morning we visited a small cave on the edge of the Montibelli property which serves as a roost for emballonurids, probably *Balantiopteryx plicata* based on its size and coloration (we observed several roosting individuals up close).

Masaya presented the most unusual bat assemblage. There is a lava tube cave there, separated by a rock fall into two caves. One is open to the public for guided tours. We saw only a few *Carollia* and *Glossophaga* roosting in this cave, and it would present a good opportunity to explain how disturbance can result in bats leaving a cave, as well as an opportunity to use roost staining to assess past cave use. The second cave is not open to the public, and is the location of a large bat roost. Using a harp trap erected in front of the second cave’s entrance, we captured examples of all five mormoopid species found in Nicaragua, including three individuals of *Mormoops*, the ghost-faced bat. The latter is significant because its range in Central America is believed to end near the Nicaraguan-Honduran border. These captures extend the range ~200 km south. Given the forearm lengths of >50mm and known range of *Mormoops* species, the individuals captured are probably *M. megalophylla*. However, all had unusual bald heads (Fig. 3) unlike the *M. megalophylla megalophylla* populations known in Northern Central America, suggesting the possibility of geographically and morphologically unique subpopulation. Due to limited assistance, we did not maintain a count of all of the bats that were captured at the cave entrance, although the main cave at Masaya clearly houses hundreds (more likely thousands) of bats. Other species captured at the site in mist nets were phyllostomids, including the unusual hairy-legged vampire bat (*Diphylla ecaudata*, IUCN Red List status Near Threatened).

Netting at Domitila took place along a riparian corridor and yielded 13 species of bats from four families. The site was unusual in that captures of non-phyllostomids nearly equaled those of leaf-nosed bats (there were no harp-trap captures at





the site). We captured both species of fishing bats (both *Noctilio leporinus* captured were very pregnant females), two emballonurid species, one molossid, and one vespertilionid. Amongst the phyllostomids, several common vampire bats (*Desmodus rotundus*) were captured, suggesting that Domitila could serve for as a training area for workshop components focused on vampire control.

Netting at Laguna de Apoyo and La Flor was much less successful. While many bats were seen or heard (using bat detectors) foraging in the areas where we had nets, areas over water were foci for bat foraging at these two sites, but netting over water at these sites was unfeasible (would require waders at the very least to set up). The steep crater walls at Laguna de Apoyo would make netting in the forested areas a challenge. Forested areas in La Flor could be more promising, but since landowners were unwilling to even allow passage to our truck so it could reenter the reserve at an easier access point, the feasibility of working at the site may be limited. La Flor has at least one bat cave, but one entrance can be reached only using ropes, while the other lies at the border of a neighboring plot; according to the site's manager, written permission from the landowner (Fernando Sequeira) must be procured before working the site. At Apoyo, we caught nine bats (including one emballonurid), while netting on the border of a mangrove swamp in La Flor yielded only three irritated *Artibeus*.



- ◀ Kari Gaukler removes a hairy-legged vampire bat (*Diphylla ecaudata*) from a mist net, while park guards at Masaya look on. Unlike the common vampire bat, *Diphylla ecaudata* feeds on avian blood and is rarely a nuisance to humans. This species is listed on the IUCN red list as near-threatened.
- ▶ This ghost-faced bat (*Mormoops megalophylla*) was captured in front of the bat cave at Masaya Volcano; this species has not been documented before in Nicaragua.
- ▶ The greater fishing bat, *Noctilio leporinus*, at Domitila. Notice the long feet, which the bat uses to gaff fish swimming near the surface. This adult female is very pregnant!



OVERALL ASSESSMENT

A complete assessment of all sites netted and visited can be found in Appendix I. While not all netting sites were equally successful, it is clear that Nicaragua harbors a diverse and understudied bat fauna meriting a great deal more research than has been carried out to date. Considering all relevant factors, the best site for presenting a workshop is probably Montibelli, although the small reserve itself probably does not have enough different habitats to necessitate several days of capture, and we would have to incorporate visits to satellite sites. Fortunately, several areas that could serve as additional sites are within a 45 min drive of Montibelli. Immediately outside of Montibelli is a small cattle ranch, which could possibly serve as a site for a capture night focused on vampire bat control. Montibelli is also the base nearest to Masaya Volcano, a site that will undoubtedly serve an important role in education regarding cave assessment.

In spite of its lack of electricity, Domitila would probably provide the next-best site for a workshop, given the abundance of primary forest habitat in the area. Domitila and Mombacho may be too far from Montibelli to realistically serve as satellite netting sites (approximately 1 hour each way from Domitila); however, it could be feasible to have the first two-thirds of the workshop in Montibelli, and then transfer to Domitila in order to work there and in Mombacho for the following days; such a transfer would not take up more than a couple of hours and would allow for more incorporation of primary forest into sampling. It is possible that access to Mombacho from Domitila would be faster via the Pan-American Highway.

We can also make a number of more specific recommendations to implement in time for the May workshop. For example:

Given the capture success at Masaya cave and the presence of other (smaller) caves throughout the study area, it may well be worth the financial investment to purchase a harp trap for use with workshop participants, particularly if any sort of cave monitoring will be incorporated into the biodiversity surveys to be supported by the IITF.

Given the presence of a possibly undescribed population of *Mormoops megalophylla* at Masaya and the presence of other bats which may be present beyond previously-established range boundaries (e.g., we found two individuals whose uropatagium morphology was consistent with *Dermanura watsoni*, although in practice this species can only be unambiguously differentiated from *D. phaeotis* via inspection to the lower rear molars, which is exceedingly difficult with live specimens), we recommend expanding the permit application to allow for collection of voucher specimens. This will require developing a liaison at an in-country university where specimens could be housed following temporary export to the United States for detailed analyses.

The population of bats roosting at Masaya Volcano is both extremely important and largely uninvestigated. Many Nicaraguans harbor misconceptions about bats, and the May workshop will present a wonderful opportunity to engage the public. Inviting a reporter from *La Prensa* or *El Nuevo Diario* to join the workshop during capture at Masaya Volcano could lead to a widely-read article which would: (1) Publicize the training workshop and further research planned in Nicaragua; (2) Provide an opportunity to dispel widely-held beliefs about bats (e.g., that they are all *vampiros*); (3) Describe the importance

of the Masaya bats, both in terms of its unique species and the undoubted importance of this colony in controlling arthropod pests in the region's agricultural areas; and (4) Convey to the public the importance of not disturbing bat roosts. Press coverage of Merlin's visit to Nicaragua would be desirable given his international renown.

The sites visited present opportunities to incorporate additional components into the May and/or January 2009 workshops. For example, in May we could make and erect artificial bat roosts, and then in January revisit and monitor these. (Owners/managers of Montibelli, Domitila, and Mombacho would probably be amenable to having artificial roosts). Given our observations of several arboreal roosts in tree hollows, a demonstration of tree climbing methods and bucket traps at roosts may be possible (KWG is planning on taking a course in tree climbing and purchasing needed equipment for her work in Mexico and could volunteer to do this, presuming she doesn't fall out of a tree first.)



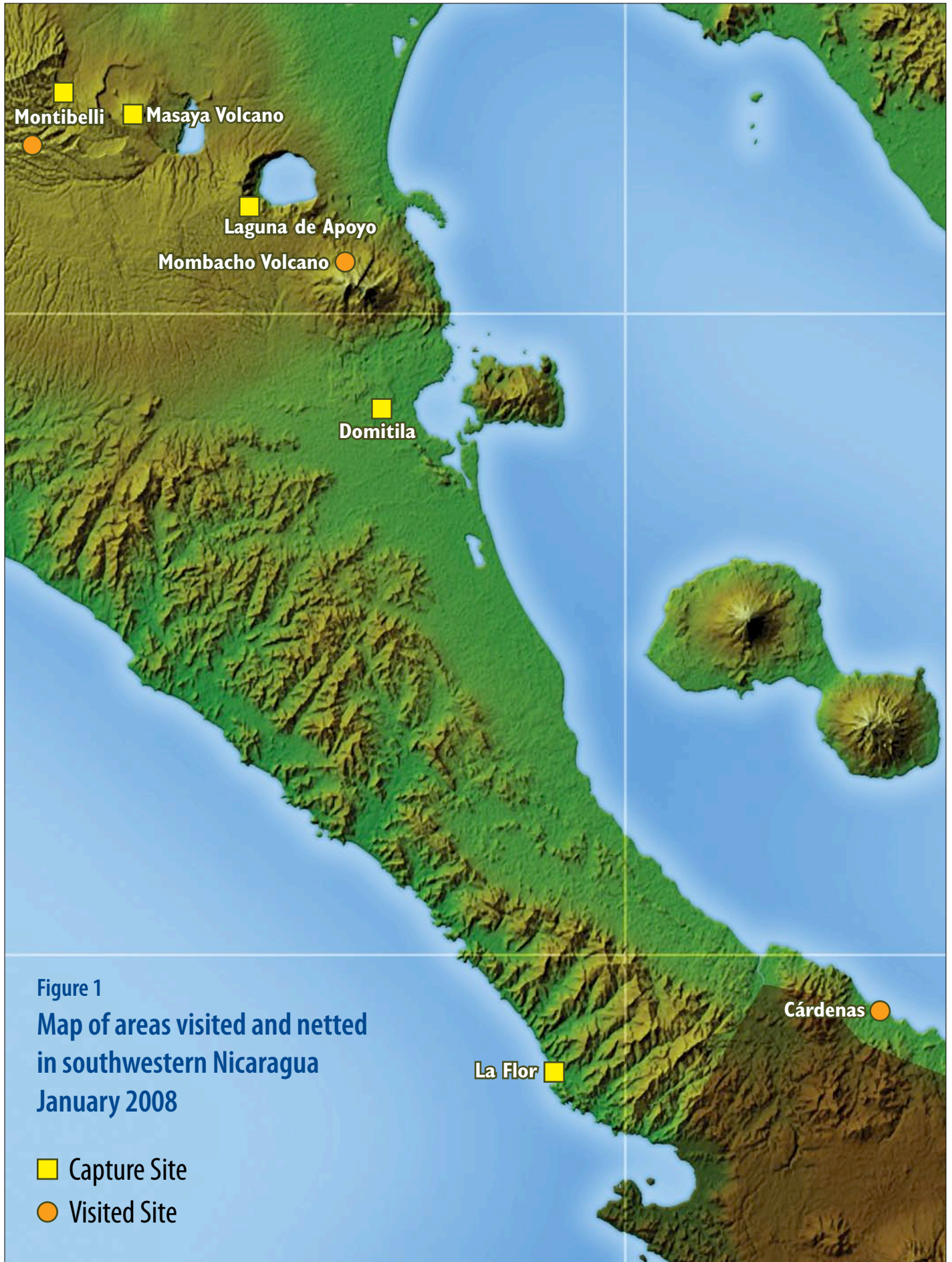
The Mombacho Volcano Nature Reserve

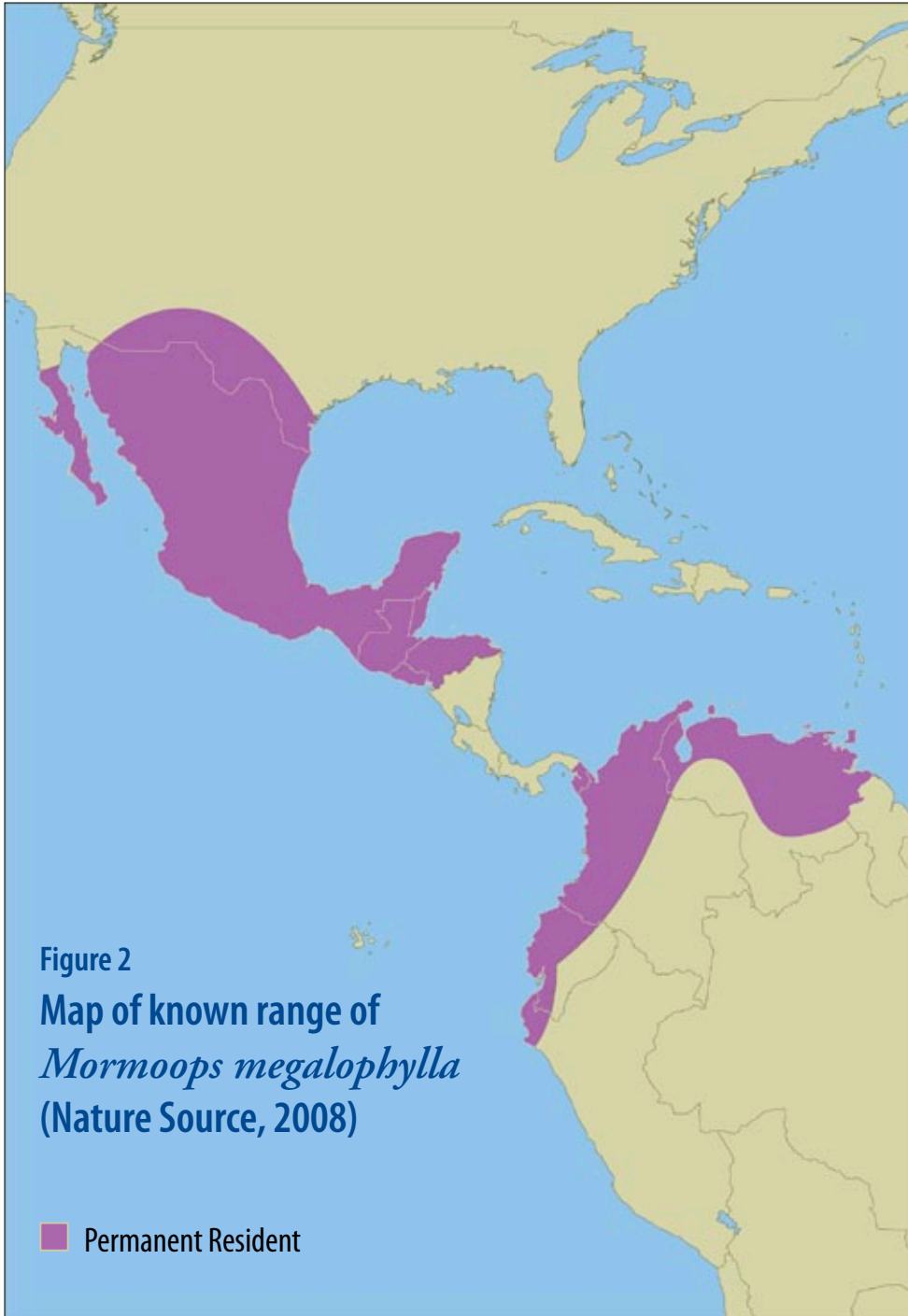
TABLE I. SITES VISITED DURING RECONNAISSANCE TRIP

Site	Dates Visited	Site Type & Facilities	Habitats	Proposed Use
Montibelli	Jan 23-24	Private reserve with on-site housing and meeting facilities	Secondary (?) tropical dry forest, small cave(s), shade coffee, pineapple agriculture, cattle ranching	Meeting site Capture site
Masaya Volcano	Jan 24	Public reserve with on-site ecological center	Craters, lava-tube caves with bats, tropical dry forest	Capture site
El Chocoyero-El Brujo	Jan 25	Public reserve with on-site educational center	Tropical dry forest, waterfalls	Capture site
Domitila	Jan 25	Private reserve with on-site housing	Primary and secondary tropical dry forest; riparian forest; lake shore ecosystems	Meeting site Capture site
Mombacho Volcano	Jan 26	Public reserve with on-site meeting facilities; established relationships with owners of surrounding private lands	Primary montane cloud forest; disturbed semi-deciduous forest; secondary tropical dry forest; shade coffee plantations; cattle ranching	Capture site Meeting site (possibly)
Laguna de Apoyo	Jan 26	Mostly private lands near lakeshore, situated near public reserve on lakeshore	Secondary tropical dry forest; lake shore	Capture site Meeting site (possibly)
La Flor and surround private lands	Jan 27	Ocean-side reserve surrounded by private lands with hotels and other facilities	Marine estuary; mangrove forest; tropical dry coastal forest; small bat cave(s)	Capture site Meeting site (possibly)
Areas between La Virgen and Cárdenas	Jan 28	Mostly private lands near shore of Lake Nicaragua	Secondary (?) semi-moist tropical forest, riparian forest, lake shore habitat, agricultural production, cattle pasture	Capture site

TABLE 2. SUMMARY OF SPECIES CAPTURED AT SITES VISITED

Species	Apoyo	Domitila	La Flor	Masaya	Montibelli	Total
Emballonuridae						
<i>Rhinonycteris naso</i>	–	3	–	–	–	3
<i>Saccopteryx bilineata</i>	1	–	–	–	–	1
<i>Saccopteryx leptura</i>	–	2	–	–	–	2
Molossidae						
<i>Molossus pretiosus</i>	–	1	–	–	–	1
Mormoopidae						
<i>Mormoops megalophylla</i>	–	–	–	2	–	2
<i>Pteronotus davyi</i>	–	–	–	10	–	10
<i>Pteronotus gymnonotus</i>	–	–	–	6	–	6
<i>Pteronotus parnelli</i>	–	–	–	14	1	15
<i>Pteronotus personatus</i>	–	–	–	13	–	13
Noctilionidae						
<i>Noctilio albiventris</i>	–	6	–	–	–	6
<i>Noctilio leporinus</i>	–	3	–	–	–	3
Phyllostomidae						
<i>Artibeus intermedius</i>	2	1	2	–	10	15
<i>Artibeus jamaicensis</i>	3	4	1	1	15	24
<i>Artibeus literatus</i>	1	–	–	–	3	4
<i>Carollia subrufa</i>	–	1	–	–	–	1
<i>Carollia perspicillata</i>	–	4	–	5	7	16
<i>Carollia sowelli</i>	–	–	–	–	1	1
<i>Dermanura phaeotis</i>	1	6	–	7	8	22
<i>Dermanura watsoni</i> (?)	–	–	–	–	2	2
<i>Desmodus rotundus</i>	–	5	–	–	–	5
<i>Diphylla ecaudata</i>	–	–	–	2	–	2
<i>Glossophaga commissarisi</i>	–	–	–	–	2	2
<i>Glossophaga soricina</i>	–	1	–	–	–	1
<i>Platyrrhinus helleri</i>	–	–	–	–	5	5
<i>Sturnira lilium</i>	–	1	–	–	–	1
Vespertilionidae						
<i>Eptesicus furinalis</i>	–	–	–	–	2	2
<i>Rhogeessa tumida</i>	–	1	–	–	1	2
Total	9	38	3	60	67	177





Map created September 2007

Note: Data presented in Infonaut at <http://www.natureserve.org/infonatura> were updated to be current with NatureServe's central databases as of April 2007.

This report was printed on February 5, 2008.



Figure 3

Left: head *Mormoops megalophylla* from U.S.A.; **Right:** head of *Mormoops megalophylla* from Masaya Volcano, Nicaragua, showing characteristic "bald patch" (indicated by arrow). Top photo by Merlin D. Tuttle, bottom photo by Julie York.