

FRUGIVOROUS BATS AND COLLPAS – ACTIVITY HOTSPOTS AS CONSERVATION PRIORITIES FOR THE RAINFORESTS OF SOUTH-EASTERN PERU

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In the Peruvian Amazon, several species of non-volant mammals and birds visit *collpas* to eat soil. *Collpas* are also called mineral licks or salt licks. Large herds of white-lipped peccaries, tapirs, deer, monkeys, parrots, parakeets, guans are among the most common *collpa* visitors. In addition, large numbers of frugivorous bats congregate at *collpas* to drink rainwater accumulated in the soil depressions made by larger geophagous mammals. Some explanations for geophagy suggest that the intentional consumption of soil is driven by high concentrations of key resources at *collpas*, such as minerals or clay. Because soils in the Amazon are relatively poor in nutrient elements due to leaching produced by high volumes of rain, plants may contain low amounts of some nutrients. Thus, frugivorous species, such as bats, may use *collpas* as secondary sources of nutrients limited in their diets.

In 2007 and 2008 I worked at Los Amigos Conservation Concession located at the confluence of the Madre de Dios and Los Amigos rivers in the Department of Madre de Dios in southeastern Peru (12°30' to 12°36' S and 70°02' to 70°09' W). This private concession protects over 140,000 hectares of Amazonian forest. The average annual temperature ranges from 23.93 to 24.13°C, and average annual rainfall ranged from 2152 to 2682 mm, unevenly distributed between the wet (~ October-April) and the dry seasons (~ May-September) (Atrium 2008).

I studied the extraordinary phenomenon of *collpa* visitation by bats. The main goal was to describe the patterns of use of *collpas* by bats and compared it to other non-*collpa* sites. In addition, I was trying to determine potential reasons to explain this outstanding behavior.

Although bats do not eat soil as geophagous animals do, they drink muddy water accumulated at *collpas*. Thus, the explanations for this behavior may be similar to the ones that have been suggested to explain geophagy. Furthermore, in a preliminary study I found higher bat activity at *collpas* than in an artificial reservoir of clear creek water at Los Amigos Biological Station. So, it is very unlikely that bats that visit *collpas* to obtain water.

The results of the first part of my study developed in 2005 - published in BIOTROPICA the Journal of Tropical Biology and Conservation (Bravo et al. 2008) - shows that *collpas* are activity hotspots for frugivorous bats in the Peruvian Amazon. The capture rates at *collpas* were 10 times higher than in the forest and the most bats were frugivorous (mostly of the subfamily Stenodermatinae). In addition, I found a strong female bias among bats at *collpas* compared to bats in the forest, and most of them were in reproductive condition. Thus, potential explanations for *collpa* visitation by bats may be related to the high nutritional demands of reproductive female frugivorous bats.

In this study I continued the work done in 2005. For that, from July to October (dry season) 2007 and from February to May (wet season) 2008, I with several extraordinary field assistants (students and local people) captured bats at *collpas* along the Los Amigos River. We also captured bats in forest and gap sites to compare bat activity among sites. Bat activity was defined as the number of bats per net per hour. Similar to the results found in 2005, I found a significantly higher bat activity at *collpas* compared to forest and gap sites (Figure 1). More than 10 bats per net per hour were captured at *collpas*, whereas in forests and gaps sites less than one individual per net per hour was captured.

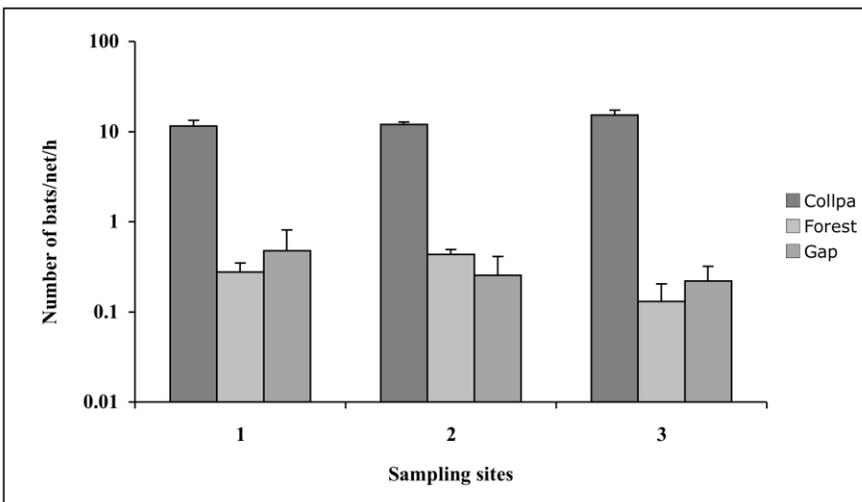


Figure 1. Bat activity at *collpa*, forest and gap sites in Los Amigos Conservation Concession (F=104.3; p < 0.001).

Furthermore, we found a strong female bias (~70%) among captured bats at *collpas* and most of them were in reproductive condition (~70%) (Figure 2). These results confirmed that bats are activity hotspots for frugivorous bats in the Peruvian Amazon.

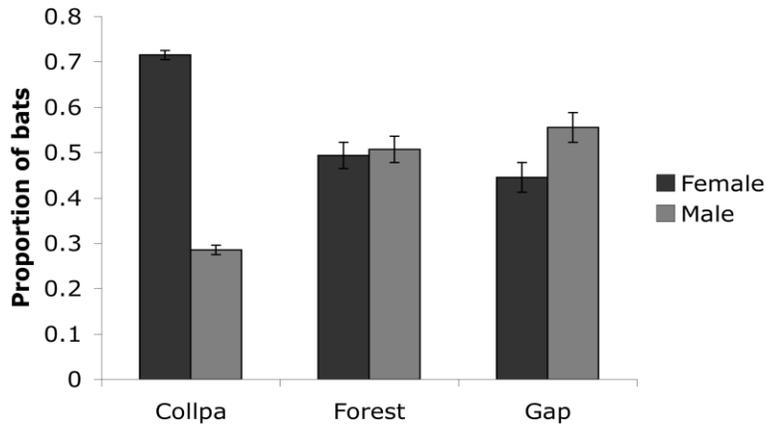


Figure 2. Proportion of male and female bats at *collpas*, forests and gaps.

The species richness observed at *collpas* was higher than at forests and gaps. At *collpas*, we identified 32 species, 21 of those were frugivores of the subfamily Stenodermatinae, only two species of the subfamily Carollinae. Contrary to Stenodermatinae species, Carollinae were very rare at *collpas*. However, at forest and gaps, species of the subfamily Carollinae were among the most common. In conclusion, the results suggest that *collpa* visitation by bats may be associated to frugivory and reproduction.

To determine whether mineral supplementation may be a potential explanation for *collpa* visitation by bats, I determined the mineral concentration of *collpa* water. We collected water between February- May and July – September 2008. The results showed that in fact *collpas* are mineral-rich water sources. Higher concentrations of some minerals were found in *collpa* water compared to other sources. The concentration of sodium was higher in *collpa* water compared to creeks and lakes. Because soils in the tropics are relatively poor in some nutrients, plants usually contain low amounts of sodium. As a consequence, frugivorous species may have sodium limitations, which may increase during reproduction. Thus, a potential explanation for *collpa* visitation by frugivorous bats in the Peruvian Amazon is the searching for dietary limited nutrients.

In conclusion, *collpas* are activity hotspots for reproductive stenodermatine frugivorous bats in the Peruvian Amazon. Larger numbers of bats were captured at *collpas* compared to forests and gaps respectively, with significantly less capture effort at *collpas*. In addition, *collpas* contain higher concentrations of some minerals. Thus, *collpas* may function as mineral sources for frugivorous bats in the Peruvian Amazon. I strongly recommend more research on bat *collpa* visitation, but based on the information generated in my study, I strongly suggest *collpas* to be considered important conservation targets in the Peruvian Amazon.