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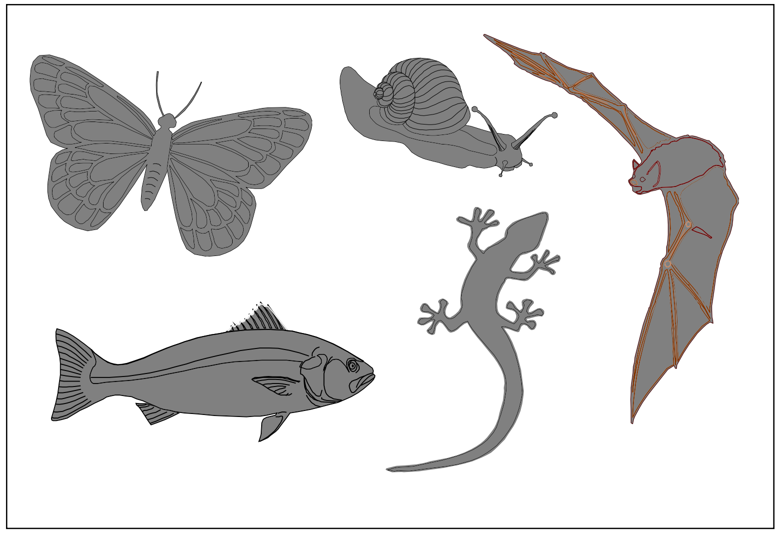

Small Mammals: Biodiversity Assessment at the Pagoreni Well Site

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Introduction

Small mammals constitute a primary component of the tropical rainforest (Voss and Emmons 1996). Through seed dispersal, pollination, microrhyzal dispersal, and control of insect populations and as part of the food chain for carnivorous animals, the small mammals—such as opossums, bats, and rodents—assist in the natural functions of ecosystems.

Amazonian rainforests in southeastern Perú support a number of small mammals in various habitats (Pacheco et al. 1993, Ascorra et al. 1996, Pacheco and Vivar 1996, Voss and Emmons 1996, Solari et al. 1997). At the Pagoreni well site, our goal was to continue gathering baseline information through an assessment of small mammals in the Lower Urubamba region. We compared the resulting data with the findings from previous work that used similar methodologies at the San Martin-3 and Cashiriari-2 well sites (Phase II of the overall study) and at the Cashiriari-3 well site (Phase III) (see Solari and Rodríguez 1997, Wilson et al. 1997, Solari et al. 1998).

Methods

Site Description

Field work took place in the area surrounding the Pagoreni well site (11^{0}42'22.5"S, 72^{0}54'10.7"W, 465 meters (m) in elevation). The terrain at Pagoreni is very steep. Vegetation is primary rainforest with some second-growth forest near the Camisea River. Bamboo is quite scarce when compared to some of the other study sites (see Alonso et al. this volume).

We sampled along four trails that ranged in elevation from 380 m to 430 m. The trails we used traversed several ravines and creeks. The forest was very heterogeneous along the trails.

We sampled at Pagoreni for two weeks, from April 8-21, 1998, at the end of the rainy season. It rained three times during our visit, always at night and all night long on April 14, 16, and 17. There was a new moon during the first week. By the second week, each morning began with a cloudy sky, and the temperature dropped considerably.

Non-flying Small Mammals

Trap lines were set along three trails: 1) the Overlook trail that runs along the top of a creek through primary forest with scarce understory and across a small creek as the trail descends to a lowland area, 2) the Chinook trail that passes through ravines vegetated by mature forest dominated by vines rather than large trees and characterized by a scarce understory, and 3) the Boddicker trail that runs through open forest and then crosses a temporary stream and ravines before continuing into dense forest.

We established 10 trap stations in each of three sections along each trail. The sections were measured as follows: 0 to 100 m from the well site, 300 to 400 m from the well, and 600 to 700 m from the site. Each station contained two traps, a Victor snap trap and a Sherman live trap. We added three National traps at stations 1, 5, and 10 in each section for a total of 23 traps per section and 69 per trail. The traps were baited daily, and we visited each trail twice a day with the objective of obtaining diurnal and nocturnal information.

This design is known as the "balanced blocks" sampling method. Because it incorporates similar traps and similar numbers of traps along each of the three trails, it allows for direct comparisons of results.

All statistical analyses were performed using SPSS (Statistical Package for the Social Sciences) for Windows 5.0.1 software (1992). In analyzing data from the sampling, we used ANOVA to compare differences in captures of species and individuals among the sections. We use the Tukey test when the ANOVA is significant to determine significant groups ($P<0.05$), and we randomly assessed the probability of abundance distribution among the sections using the Chi-square test (X^2). We also determined the success of sampling by type of trap, dividing the number of individuals captured by the total effort of each type of trap. The result was expressed as a percentage.

Flying Small Mammals

For bats, we set mist nets along the Chinook trail (April 9-13), Overlook trail (April 14-18), and North trail (April 19-22); the latter trail crosses two streams and runs along two steep hills. The nets were set across the trails, in creeks, and along the forest borders. We sampled just five nights at each trail to minimize decreases in the capture rate as the bats became familiar with the locations of the nets.

An average effort of six mist nets per night was expended along each trail. Mist nets were visited as frequently as was considered necessary, but especially early in the night (1930 to 2400 hours).

Bats are highly mobile, and this caused us to analyze data obtained from mist-net sampling differently from the analysis conducted for data obtained through trapping for non-flying small mammals. We divided the results of the netting effort according to habitat type as follows:

* dense forests—conspicuous understory, tall trees with wide trunks, and a wide canopy (mature forest);

* open understory forests—scarce, tall trees with narrow trunks, and a small canopy (successional forest);

* forest edges—border of the forest between the forest and open areas, generally created by human activities (regenerated forest);

* creeks—streams in the interior of the forest, generally small and close to areas of dense forest;

* ravine edge forests—natural division between the forest and an open area, caused by different levels of terrain; and

* ravines forests—similar to ravine edge forests but separating two forest zones at different levels of terrain (terrace forest).

The forest edge habitat might be characterized as a perturbed forest. The literature notes that this kind of habitat is frequently used by frugivorous species and sometimes by insectivores (Ascorra et al. 1996, Wilson et al. 1996, 1997).

To make comparisons among these habitats, we determined capture rates by net night (NN). We then segregated the data among the habitat types and calculated the average capture rate for species and individuals by habitat type. We took into account that the same number of mist nets was not used at each sampling location and that equal amounts of time were not spent at each location. We used ANOVA, Tukey test, and Chi-square tests, much as in analyzing the data for non-flying small mammals, but taking habitats into consideration instead of distances from the well.

In addition, we estimated the capture rate index per mist-net night for each species sampled as a measure of abundance (Wilson et al. 1996) independent of the habitat sampled.

Specimens were prepared as study skins, skeletons, or complete specimens in 10% formalin. Data registered included external measurements, reproductive condition, and habitat. Most bats were released after identification; in the case of opossums, we released only a few individuals. Specimens are deposited in the Departamento de Mastozoología of the Museo de Historia Natural, Universidad Nacional Mayor de San Marcos, Lima.

Results

We registered a total of 44 small mammal species, adding three new species, *Peropteryx kappleri, Didelphis albirentris,* and *Vampyrum spectrum,* to records from Phases II and III of the overall study (Solari et al. 1998). Thus far, we have recorded 94 small mammal species in the Lower Urubamba region (see Appendix), including the report of Guerrero and Zeballos (1997).

The Pagoreni sampling effort included 2898 trap nights (TN) and 80 net nights over 14 nights. Sampling resulted in 55 non-flying small mammals and 243 flying mammals, representing 30 bat, eight rodent, and six opossum species.

Compared to previous samplings, species richness was low for bats and rodents, but not for opossums. At the end of the sampling period, the cumulative species curve showed no asymptote (Fig. 1), probably because of the changes to standardize the sampling methods.

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At the well site, we noted the co-existence of several species of the same genera, a fairly unusual occurrence in nature.

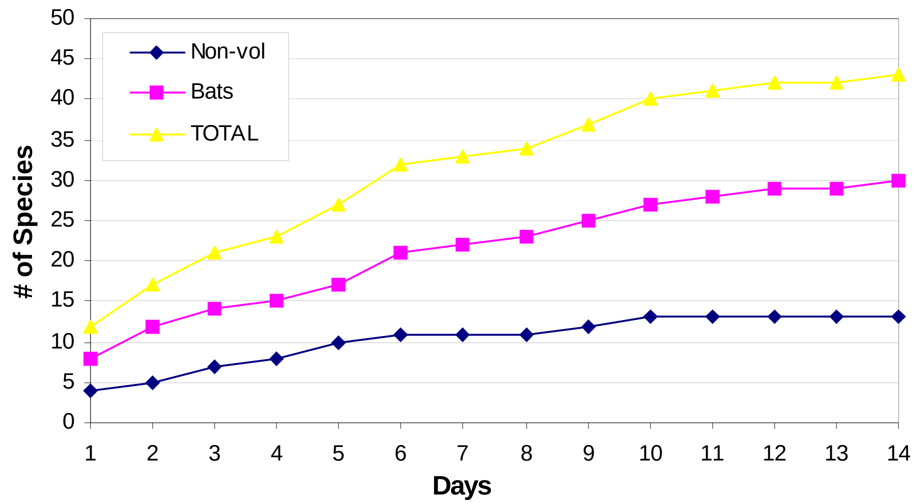

Figure 1. Small mammal species accumulation curve for Pagoreni.

The species identifications are being confirmed. For example, the skull and dental characteristics of rodents of the genera *Oecomys*, *Oryzomys*, and *Proechimys* have been closely examined (see Hershkovitz 1960, Patton 1987, Musser et al. 1998).

The most common opossums were of the genus *Micoureus*, the most common rodents of the genus *Oryzomys* (Fig. 2), and the most common bats of the genus *Artibeus* (Fig. 3). At first glance, it appears that habitat preferences followed those described in Phases II and III of the overall study, where bamboo was the favored habitat of non-flying small mammals, while bats preferred mature forests (Solari et al. 1998). Neither of these forest types occurred at Pagoreni; thus the mammal species composition is somewhat different from the other well sites (Table 1).

At the well site, we noted the co-existence of several species of the same genera, a fairly unusual occurrence in nature. We recorded four sympatric marsupials of the Marmosinae. We also recorded the co-existence of two Chiroptera predators, *Chrotopterus auritus* and *Vampyrum spectrum* (Phyllostominae), three species of *Dermanura* and three of *Chiroderma* (Sterodermatinae), and the first record of the emballonurid *Peropteryx kappleri*.

Diversity and Abundance

Some groups showed a high diversity. The co-existence of the Marmosinae genera (sensu Hershkovitz 1992), *Marmosa*, *Gracilinanus*, *Micoureus*, and *Marmosops*, indicated that the Pagoreni area contains a variety of optimal refuges similar to the bamboo area at the Cashiriari-3 well site (Solari et al. 1998). Different from the other well sites, at Pagoreni *Micoureus regina* was the most common species (seven individuals), somewhat more abundant than *Marmosops noctivagus*, the next most common species. A notable difference between these species is that *M. regina* is arboreal while *M. noctivagus* is terrestrial. The record *Gracilinanus* sp. was interesting because it allowed us a comparison with juveniles sampled at

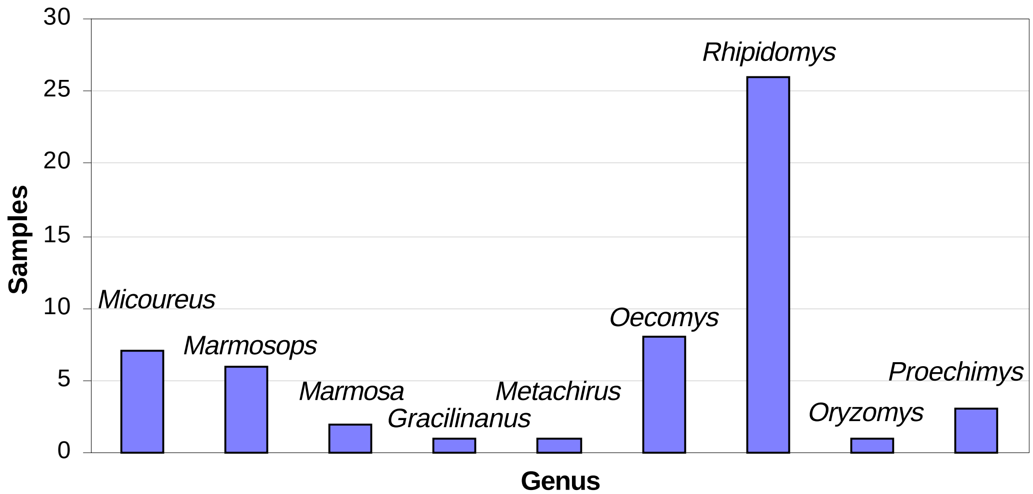

Figure 2. Abundance of non-volant small mammal genera at Pagoreni.

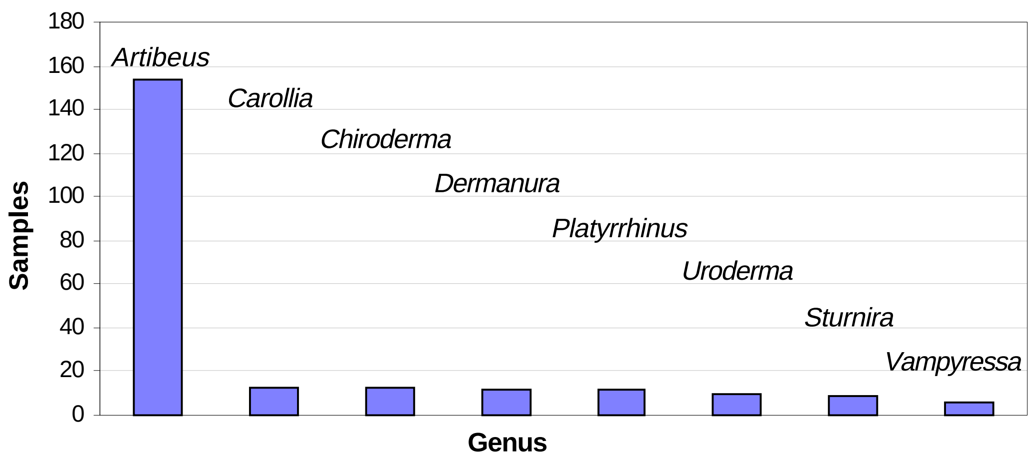

Figure 3. Abundance of major bat genera at Pagoreni.

Cashiriari-3 and tentatively assigned to *G. agilis*.

As noted above, bat diversity (30 species over two weeks) was low—in fact, the lowest recorded thus far in the overall study. The bats all belonged to two families: Emballonurid, represented by a single individual, and Phyllostomidae, the best represented group with 29 species in 16 genera (Appendix). The subfamily Stenodermatinae is normally the most diverse and abundant subfamily in the rainforest; its value in forest regeneration has been well documented (Wilson et al. 1996). The subfamily Glossophaginae was not represented at all in this sampling. This group, along with *Carollia*—the most abundant genus in rainforests (Wilson et al. 1996)—and *Sturnira*, shows a preference for feeding in dense understories. The records of two individuals of the common vampire *Desmodus rotundus* indicated that the Pagoreni well site supports this bat's feeding habits (the blood of medium and large mammals).

Table 1. Capture rates for small non-flying mammals at four well sites in the Lower Urubamba (SM-3=San Martin-3, CASH-2=Cashiriari-2, CASH-3=Cashiriari-3, PAG=Pagoreni; numbers in parentheses indicate the capture rate)

Species	SM-3	CASH-2	CASH-3	PAG
Marmosops noctivagus	1 (0.5)	1 (1.0)	3 (1.4)	6 (2.1)
Oecomys bicolor	0 (0.0)	1 (1.0)	7 (3.3)	6 (2.1)
Oryzomys macconnelli	3 (1.6)	5 (4.8)	0 (0.0)	6 (2.1)
O. megacephalus	3 (1.6)	4 (3.8)	9 (4.2)	12 (4.1)
O. nitidus	30 (15.9)	0 (0.0)	43 (20.3)	8 (2.8)
Oryzomys (as a group)	36 (19.1)	9 (8.6)	52 (24.5)	26 (9.0)
Proechimys	6 (3.2)	4 (3.8)	6 (2.8)	3 (1.0)
Total individuals	60 (3.2)	20 (19.1)	80 (37.7)	55 (19.0)
Sampling effort (TN)	1890	1045	2120	2898

The co-existence of three *Dermanura* species was also recorded at Cashiriari-2 and -3, but the co-existence of three *Chiroderma* species was observed only at Pagoreni. Such high levels of congeneric simpatry would indicate a rich variety of resources in the area. The two predator bats *Chrotopterus auritus* and *Vampyrum spectrum* were recorded as co-existing in the dense canopy forests along the North trail. Generally bat predators are poorly represented as to species numbers and abundance. Their presence indicates favorable habitat in relation to forest structure.

The capture index for bats, estimated as captures/NN, point to differences in species abundance for the bat community (Wilson et al. 1996). The most abundant species was *Artibeus lituratus*, with an index close to one capture per NN (0.96), followed by *A. planirostris* (0.81), which was trailed by *A. obscurus* (0.15). These values indicate a forest with a high production of fruits as these species are important in seed dispersal (Ascorra et al. 1996). Other species with low values (>0.1) were also frugivores: *Uroderma bilobatum*, *Platyrrhinus helleri*, and *Chiroderma salvini*.

For rodents, we recorded the co-existence of two species of the arboreal genus *Oecomys*. Unlike at Cashiriari-3, the species at Pagoreni were found in the forest interior. Three species of the genus *Oryzomys* were also sampled, including *O. megacephalus* (formerly *O. capito*; see Musser et al. 1998), which was the most abundant species (more than 12 individuals). Only one juvenile specimen of *Rhipidomys* sp. was sampled, from a trap in the ground. At San Martin-3, this species was captured in mature forest with an abundance of vines (Solari et al. 1998).

Capture rates for non-flying mammals at Pagoreni (expressed as individuals/100 TN) showed similar values for most of the species. Only *Oryzomys megacephalus* reached a value greater than 0.4 (0.41), while *O. nitidus, O. macconnelli*, and *Oecomys bicolor* were less than 0.3 (0.27, 0.21, and 0.21, respectively). The rate for the

Proechimys species was 0.1. The opossums *Micoureus regina* and *Marmosops noctivagus* had similar values (0.24 and 0.21, respectively).

Compared to other locations sampled previously in the Lower Urubamba, the capture rates were high for *Marmosops noctivagus*, close to the maximum for *Oryzomys megacephalus*, and very low for *Oryzomys nitidus* and *Proechimys* (Table 1).

Community Distribution Patterns

At the same time that we assessed diversity, we obtained information about species and individual distributions in the communities. The sampling design allowed us to segregate samples taken in each of the three distance sections. The primary purpose of such an analysis is to assess the impacts of gas extraction activities on natural communities.

Rodents and opossums

Considering only the number of animals sampled (55 individuals, including released animals), we observed that there was a trend toward greater abundance in the section nearest the well site (25 captures, X [mean]=8.33), with smaller values in the medium-distance (17 captures, X=5.67), and far-distance (13 captures, X=4.33) sections. Analysis of variation among sections shows that the difference was not significant (F=3.4; g.l.=2, 6; $P > 0.1$). Chi-square tests also indicated no significant differences (X^2=4.07; g.l.= 2; $P > 0.1$).

Additionally, we analyzed captures according to the type of traps (Victor, Sherman, and National). We estimated the success of each type of trap according to the section where the traps were placed, for a total of nine categories (three types of traps at each of the three sections). The highest rate of success (2.6%) occurred in the sections closest to the well site. Lower values were measured for the medium-distance (1.8%) and far-distance (1.3%) sections.

In the sections nearest the well site, National traps were the most successful (six captures in 126 TN, 4.8%), followed by the Victor traps (2.4%) and Sherman traps (2.1%). Overall, however, the Victor traps were most successful at 2.1% (26 captures in 1260 TN), followed by Nationals at 1.9% (seven captures in 378 TN), and Sherman traps at 1.8% (22 captures in 1260 TN). Overlook trail had the highest capture rate at 2.1% (20 captures), followed by Boddicker trail at 1.9% (18 captures) and Chinook trail at 1.8% (17 captures).

Our qualitative assessment for each section showed similar values for rodents and opossums. The sections nearest the well included nine species (including three opossums), while the medium-distance sections yielded eight species (two opossums), and the far-distance sections resulted in nine species (three opossums). Some species were recorded exclusive to one section grouping, including *Gracilinanus* sp. and *Proechimys* sp. only in the near-distance sections and *Metachirus nudicaudatus* and *Marmosa murina* only in the far-distance sections. While additional records are needed for a more exact analysis, it is interesting to note that only *Oryzomys megacephalus* showed a preference for the sections closest to the well (Fig. 4).

At the same time that we assessed diversity, we obtained information about species and individual distributions to help in assessing the impacts of gas extraction activities on natural communities.

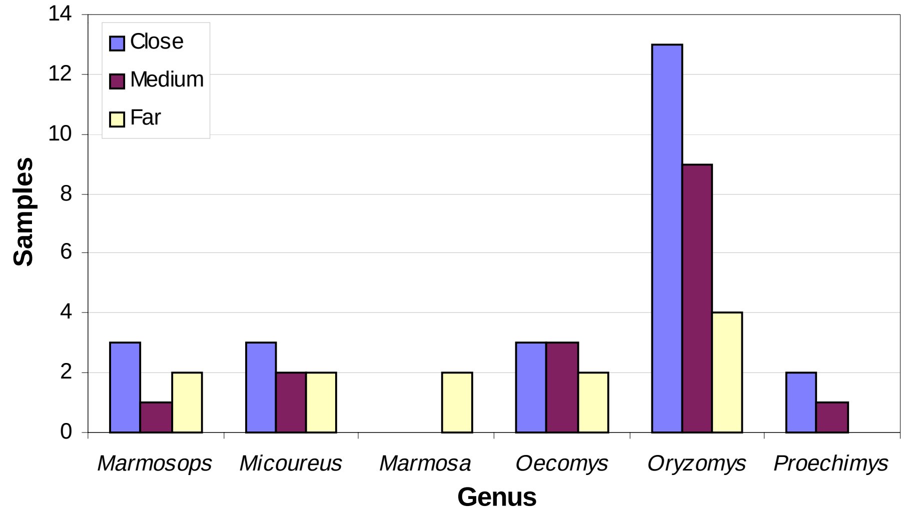

Figure 4. Frequency of captures of non-volant small mammal genera at Pagoreni.

Greater bat diversity was found in the interior scarce understory forest habitat, where we recorded 16 species, than in the other habitats.

We did not evaluate possible differences among rates for traps set on the ground and in vegetation because the height (less than two meters) at which the arboreal traps were set is not considered representative of the arboreal strata (see Malcolm 1991). We did note, however, that more arboreal species were captured (including *Gracilinanus* sp., *Marmosa murina*, and *Oecomys bicolor*) than terrestrial species in these traps. In fact, *Gracilinanus* sp. and *Marmosa murina* were captured exclusively in arboreal traps. On the other hand, some species such as *Oryzomys* spp. and *Proechimys* spp. were captured only in the ground traps, similar to other studies (Pacheco and Vivar 1996, Voss and Emmons 1996, Emmons and Feer 1997, Solari et al. 1997).

Bats

We separated the total number of bats sampled (243) through netting efforts at each of the six habitat types. Note that the values for individuals or species by habitat are not completely comparable because of differences in the number of mist nets employed and the number of nights sampled in the habitats. The average capture rates by NN showed significant differences among habitats using the ANOVA test (for species, F=4.3; g.l.=5, 74; P<0.002); for individuals, (F=7.2; g.l.=5, 71; P<0.001). The Chi-square test for abundance among habitats was also significant (X^2=55.6; g.l.=5; *P*<0.0001). The average capture rate of species was more significant between the ravine in forest border (X=3.7, SD=1.88) and the forest border (3.5, 1.92). At the individual level, expressed as average captures, the habitats showing the highest values were the ravine in forest border (X=7.3, SD=2.83) and the forest border (X=5.2, SD=3.45). The lowest values for both species and individuals occurred in the creek and interior scarce understory forest habitats.

Qualitatively, greater diversity was found in the interior scarce understory forest habitat, where we recorded 16 species. The ravine in

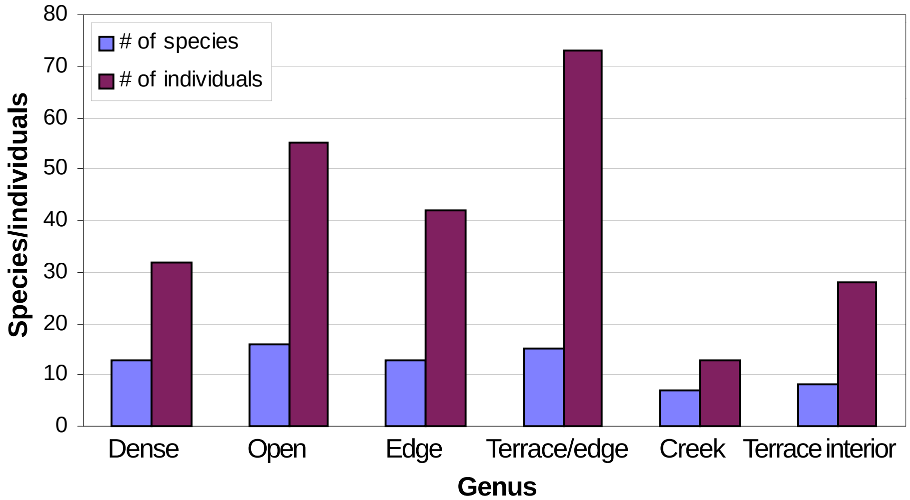

Figure 5. Distribution of bat species at Pagoreni, by habitat.

forest border habitat had the next highest diversity at 15 species, as well as the largest number of captures (73), followed by interior scarce understory forest with 55 captures. The creek habitats had 13 individuals of seven species (Fig. 5). Some species were recorded exclusively in one habitat, including *Chrotopterus auritus*, *Tonatia saurophila*, and *Peropteryx kappleri* (interior dense forest); *Phyllostomus elongatus* and *Vampyressa macconnelli* (interior scarce understory forest); *Vampyrum spectrum* (forest border); and *Chiroderma villosum*, *Enchistenes hartii*, and *Vampyrodes caraccioli* (ravine in forest border). The most effective capture effort occurred in ravine forest border (7.3 inidividuals/MN); the least effective effort was in creek habitats (one individual/MN).

Discussion

The small mammal community recorded at Pagoreni, like those at San Martín-3, Cashiriari-2, and Cashiriari-3, exhibited interesting particulars in its specific composition. The most important determinants in the make-up of the community are likely the steep terrain and varied forest structure (primary forest and open understory areas). Apparently, these characteristics cause relatively low diversity of species and abundance of individuals at Pagoreni for non-flying and flying small mammals.

The non-flying species respond to the effects of gaps and the forest border in a similar way as do their counterparts in other locations; that is, they experience a slight increase in the abundance of some species, both terrestrial and arboreal. The arboreals seem to prefer open forest (see Hutterer et al. 1995), while it is difficult to be precise about the preferences of the terrestrial, primarily granivorous, small mammals. We can speculate that some, particularly rodents, are colonizing the forest border areas, causing an increase in their numbers in those habitats. There, they find the resources for their generalized diet and will reproduce at higher rates, suggested as the means for maintaining high densities (Emmons 1984). Note the high capture rate

For non-flying small mammals, we recommend that future researchers increase the number of replications in the sampling sections close to the well sites and far away, eliminating the medium-distance section.

for the "commensal" arboreal rodent *Oecomys bicolor* in the area of the San Martín-3 well site (Solari and Rodríguez 1997). We made similar observations for *Oligoryzomys microtis* at temporary camps in other forest areas (Solari pers. observation).

Bats, because or their high mobility, are less prone to the effects of local variations in habitat than are the non-flying small mammals. However, a high abundance of Stenodermatinos indicates a forest in the process of developing (Ascorra et al. 1996, Wilson et al. 1996), while the relative scarcity of other groups such as the Carollinae indicates (at least in the sampled areas) that forest regeneration occurred relatively quickly. As at other sites such as Pakitza (Ascorra et al. 1996), forest borders show a high diversity, apparently because they offer a greater variety of food resources.

This effort contributed data to the baseline for the Lower Urubamba region and gave us the opportunity to test standardized protocols for sampling small mammals. We recommend that in the future, researchers increase the number of replications in the sampling sections close to the well sites and far away, eliminating the medium-distance section. For bats, we recommend a more precise characterization of the habitats chosen for study. We also recommend that traps be set in all possible microhabitats (terrestrial and arboreal) in a wider range of environments (including flood forest, terrace forest, etc.). This should elicit more data that can be used in analyzing population dynamics (see Emmons 1984). Sampling across a wider range of habitats and areas will also help determine more accurately how they might be affected by natural gas exploration and extraction.

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Appendix. Small mammal species recorded in the Lower Urubamba (SM-3= San Martin-3, CASH-2=Cashiriari-2, CASH-3=Cashiriari-3, RIV=sites studied along the Urubamba and Camisea rivers; PAG=Pagoreni)

Species	Family	SM-3	CASH-2	CASH-3	RIV	PAG
Didelphimorphia						
Caluromysiops irrupta	cal			X		
Didelphis marsupialis	did	X			X	X
Philander opossum	did	X				
Chironectes minimus	did	X		X	X	
Metachirus nudicaudatus	mar				X	X
Gracilinanus cf. *agilis*	mar			X		X
Marmosa murina	mar			X		X
Marmosops noctivagus	mar	X	X	X	X	X
Marmosops parvidens	mar		X		X	
Micoureus regina	mar			X	X	X
Monodelphis emiliae	mar	X				
Chiroptera						
Centronycteris maximiliani	emb			X		
Peropteryx macrotis	emb		X			
Peropteryx kappleri	emb					X
Rhynchonycteris naso	emb				X	
Saccopteryx bilineata	emb	X	X			
Saccopteryx leptura	emb	X	X	X	X	
Noctilio cf. *leporinus*	noc				X	
Chrotopterus auritus	phy		X			X
Micronycteris megalotis	phy			X	X	
Micronycteris minuta	phy		X			
Mimon crenulatum	phy	X			X	
Phylloderma stenops	phy	X				
Phyllostomus elongatus	phy				X	X
Phyllostomus hastatus	phy		X	X	X	
Tonatia brasiliense	phy		X			
Tonatia saurophila	phy	X				X
Tonatia sylvicola	phy	X	X			
Vampyrum spectrum	phy					X
Anoura caudifer	phy	X	X	X	X	
Anoura geoffroyi	phy		X			
Choeroniscus intermedius	phy	X	X		X	
Choeroniscus minor	phy			X		
Glossophaga soricina	phy		X			
Lonchophylla thomasi	phy	X	X	X	X	
Carollia brevicauda	phy	X	X	X	X	X
Carollia castanea	phy	X	X	X	X	X
Carollia perspicillata	phy	X	X	X	X	X
Rhinophylla fischerae	phy		X	X		
Rhinophylla pumilio	phy	X	X		X	X
Artibeus lituratus	phy	X	X	X	X	X

Appendix. Small mammal species recorded in the Lower Urubamba (Cont.)

Species	Family	SM-3	CASH-2	CASH-3	RIV	PAG
Artibeus obscurus	phy	X	X	X	X	X
Artibeus planirostris	phy	X	X	X	X	X
Dermanura anderseni	phy		X		X	X
Dermanura cinerea	phy	X	X	X	X	
Dermanura glauca	phy		X	X		X
Dermanura gnoma	phy				X	X
Enchistenes hartii	phy	X		X		X
Chiroderma salvini	phy			X	X	X
Chiroderma trinitatum	phy		X			X
Chiroderma villosum	phy	X	X	X	X	X
Platyrrhinus brachycephalus	phy	X	X	X	X	X
Platyrrhinus helleri	phy	X	X	X	X	X
Platyrrhinus infuscus	phy		X	X	X	X
Platyrrhinus cf. *lineatus*	phy			X		
Sphaeronycteris toxophyllum	phy			X	X	
Sturnira lilium	phy	X	X	X	X	X
Sturnira magna	phy		X			
Sturnira tildae	phy		X	X	X	X
Uroderma bilobatum	phy	X	X	X	X	X
Uroderma magnirostrum	phy			X	X	
Vampyressa bidens	phy		X		X	X
Vampyressa macconnelli	phy	X	X	X	X	X
Vampyressa pusilla	phy		X		X	X
Vampyrodes caraccioli	phy		X		X	X
Desmodus rotundus	phy		X		X	X
Diphylla ecaudata	phy	X				
Thyroptera lavali	thy			X		
Thyroptera tricolor	thy	X		X		
Eptesicus brasiliensis	ves		X			
Myotis albescens	ves			X		
Myotis nigricans	ves	X	X	X	X	
Myotis riparius	ves	X	X	X	X	
Myotis simus	ves		X			
Molossus ater	mol	X	X			
Molossus molossus	mol	X				
Promops centralis	mol	X	X			
Rodentia						
Neacomys spinosus	mur	X	X	X		
Nectomys squamipes	mur	X		X	X	
Oecomys bicolor	mur	X	X	X		X
Oecomys roberti	mur			X		X
Oecomys cf. *superans*	mur				X	
Oligoryzomys microtis	mur	X				
Oryzomys megacephalus	mur	X	X	X	X	X
Oryzomys macconnelli	mur	X	X			X

Appendix. Small mammal species recorded in the Lower Urubamba (Cont.)

Species	Family	SM-3	CASH-2	CASH-3	RIV	PAG
Oryzomys nitidus	mur	X		X	X	X
Rhipidomys cf. *couesi*	mur	X		X		X
Oxymycterus cf. *inca*	mur	X		X		
Dactylomys dactylinus	ech	X		X	X	
Mesomys hispidus	ech				X	
Proechimys longicaudatus	ech				X	
Proechimys cuvieri	ech	X			X	X
Proechimys aff. *cuvieri*	ech	X				
Proechimys simonsi	ech	X	X	X	X	X
Total species	96	48	50	49	53	44