Rapid Assessment Program (RAP) Survey of Small Mammals in the Grensgebergte and Kasikasima Region of Southeastern Suriname

Authors: Lim, Burton K., and Banda, Hermando

Source: A Rapid Biological Assessment of the Upper Palumeu River Watershed (Grensgebergte and Kasikasima) of Southeastern Suriname: 161

Published By: Conservation International

URL: https://doi.org/10.1896/054.067.0119

Chapter 11

Rapid Assessment Program (RAP) survey of small mammals in the Grensgebergte and Kasikasima region of Southeastern Suriname

Burton K. Lim and Hermando Banda

SUMMARY

A total of 39 species of small mammals (<1 kg) were documented during a biodiversity survey conducted from 9–24 March 2012 in a remote area of Southeastern Suriname. Taxonomic composition included 28 species of bats, 8 species of rats, and 3 species of opossums. The most common bat was the larger fruit-eating bat (*Artibeus planirostris*), which accounted for 38% of total captures. Although the capture rate for rats was substantially lower, as is typical of the Guiana Shield, spiny rats composed of 2 species (*Proechimys* spp.) were the commonest. For small opossums, there were 3 species documented by 1 individual each. Of the 3 sites sampled, the lowland sites were most similar with Upper Palumeu having the highest diversity of bats and Kasikasima having the highest abundance for bats. The highland site of Grensgebergte had the highest diversity and abundance for small non-volant mammals but the lowest for bats. This region of Southeastern Suriname has a mix of primary rainforest in a mosaic of lowland and highland habitats that supports diverse and different faunal communities of small mammals. The species composition was heterogeneous with no opossums shared among sites, whereas 25% of rats and just over 50% of bats were shared among sites. The most noteworthy records were the documentation of the poorly known water rat (*Nectomys rattus*) near the open granite outcrop of Grensgebergte.

INTRODUCTION

Small mammals (bats, rats, and opossums) that are less than 1 kg in body mass comprise approximately 75% of the mammalian species diversity in the Guianas (Lim et al., 2005). However, they are poorly known in comparison to the more charismatic and conspicuous larger species such as monkeys and cats. In Suriname, there are 194 species of mammals currently known from the country. Small mammals, in particular, are important for conservation because many are seed dispersers responsible for natural forest succession, pollinators of flowers, and controllers of insect populations through their foraging behavior and diet. High species diversity and relative abundance make small mammals an ideal group for rapid assessment program (RAP) surveys and long term monitoring. This is particularly important for regions such as the Grensgebergte area that have not been surveyed for biodiversity and conservation purposes (Husson, 1978).

METHODS

(1) The first study area (Site 1) was a camp on the Upper Palumeu River along a trail to Brazil used by the local Amerindians (N 2.47705°, W 55.62941°, 234 m elevation). It was situated in rainforest on rolling terrain and surveyed for 6 nights from 9–14 March 2012. (2) The second area (Site 2) was a granite outcrop in the Grensgebergte mountain range (N 2.52667°, W 55.77018°, 778 m) in montane forest. It was surveyed for 3 nights from 15-17 March 2012. (3) The third area (Site 4; the third site was surveyed primarily for aquatic organisms) was near Kasikasima across from an Amerindian village on the Palumeu River (N 2.97741°, W 55.38479°, 210 m). It was situated in rainforest on rolling terrain and surveyed for 7 nights from 20-26 March 2012. Mist nets were set at the base of Kasikasima mountain (N2.97741°, W55.40770°, 277 m) approximately 3 km west of Site 4 on the last evening of sampling.

Survey methods for small mammals followed standard protocols outlined in the report of an earlier RAP survey of the Kwamalasamutu region of Suriname (Lim and Joemratie, 2011). Sherman live traps of 2 sizes (23 × 8 × 9 cm and 35 × 12 × 14 cm) were used for sampling the terrestrial and arboreal rats, and small opossums. A maximum of 120 traps were set approximately 5 meters apart both on the ground and in trees along a transect within the forest. For bats, mist nets were usually set in pairs (12 × 2.6 and 6 × 2.6 m) approximately 100 meters apart within the forest understory across transect trails, over creeks, in swamps, near tree fall gaps, and by rocky outcrops. A maximum of 21 mist nets were set and opened from approximately 18:00 to 24:00 h.

Small mammals caught were preliminarily identified in the field and up to 2 individuals per species per night were kept as a representative collection of species diversity. All other individuals were released. Voucher specimens were prepared as dried skins with carcasses temporarily preserved in ethanol for later cleaning of the skulls and skeletons in a dermestid beetle colony at the Royal Ontario Museum (ROM), or as whole animals fixed in 10% formalin with later long-term storage in 70% ethanol. This will enable examination of both osteology and soft anatomy for morphological study and confirmation of field identifications. Tissue samples of liver, heart, kidney, and spleen were preserved in 95% ethanol for later storage in a –80°C ultra-cold freezer for molecular study of genetic variation and verification using DNA barcoding (Borisenko et al. 2008).

A reference collection of voucher specimens will be deposited at the University of Suriname's National Zoological Collection of Suriname, and the Royal Ontario Museum as documentation of the biodiversity of mammals in Southeastern Suriname and available for study by the scientific community. They will also contribute to ongoing research projects on the evolution of mammals in the Neotropics and comparison of community ecology in the Guianas.

Species diversity and relative abundance data was analyzed using EstimateS version 8.2 (Colwell 2009). Biodiversity measures included the calculation of 7 species richness estimators, 4 diversity indices, 8 shared species similarity indices, and species accumulation curves with asymptote functions.

RESULTS

Preliminary field identifications documented 39 species of small mammals represented by 366 individual captures, of which 189 were kept as voucher specimens and 177 individuals were released. More specifically, 28 species of bats were represented by 345 individuals, 8 species of rats and mice were represented by 18 individuals, and 3 species of opossums were represented by 3 individuals (Appendix 11.1). One bat (*Molossus rufus*) and one opossum (*Gracilianus emiliae*; Figure 11.1) were caught by hand and included in our report but not used in the analysis of biodiversity measures. The richness estimators ranged from 31 to 41 species of bats and 14 to 22 species of rats and opossums expected with the methods used (Table 11.1). In addition, a gray four-eyed opossum (*Philander opossum*) was seen climbing up a tree in a swampy area on the trail to Kasikasima Mountain but not collected.

The commonest species of bat (larger fruit-eating bat, *Artibeus planirostris*; Figure 11.2) represented over ⅓ of the total captures in mist nets. It was more than twice as frequently caught as the next most abundant species (moustached bat, *Pteronotus parnellii*; Figure 11.3) and was documented at all 3 sites as were 2 other species (Seba's short-tailed fruit bat, *Carollia perspicillata* [Figure 11.4], and round-eared bat, *Lophostoma silvicolum* [Figure 11.5]). By contrast, the 3 species of opossums were caught only once, each at one of the 3 different sites. For rats and mice, the Guianan terrestrial spiny rat (*Proechimys guyannensis*) was the most common with 5 captures but it was caught at only Site 2 in

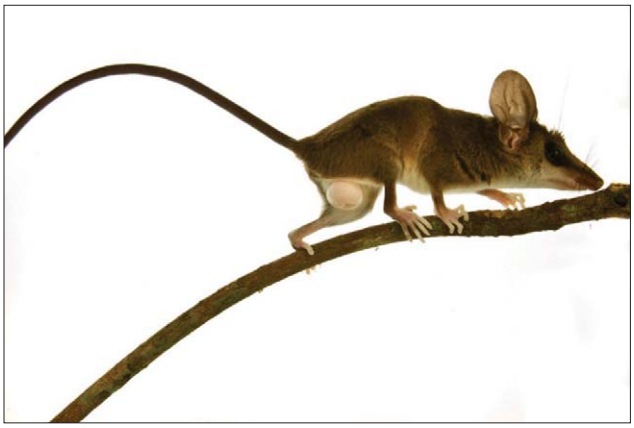

Figure 11.1. Delicate slender opossum (*Marmosops parvidens*) caught at the Upper Palameu site by Piotr Naskrecki. Photo by Piotr Naskrecki.

Figure 11.2. Larger fruit-eating bat (*Artibeus planirostris*). Photo by Burton Lim.

Figure 11.3. Common moustached bat (*Pteronotus parnellii*). Photo by Burton Lim.

Table 11.1. Summary of the small mammal RAP survey data in Southeastern Suriname. The data is separated into the 3 sampling sites: Upper Palumeu (UP), Grensgebergte (GR), and Kasikasima (KA). The observed data are summarized from Appendix 11.1. Richness estimators, asymptote function, and diversity indices were computed using EstimateS (Colwell 2009).

Variable	Bats					Small non-volant mammals			
	UP	GR	KA	Total		UP	GR	KA	Total
Observed data:									
Individuals	112	14	218	334		2	14	4	20
Species	21	5	19	27		2	7	4	10
Trap-nights	86	30	117	223		518	272	837	1727
Richness estimators:									
ACE	24	8	24	34		3	13	10	22
ICE	28	11	26	34		3	12	9	20
Chao 1	25	6	23	41		3	10	10	21
Chao 2	23	6	22	31		3	8	9	16
Jack 1	27	7	25	34		4	10	7	18
Jack 2	28	8	27	37		5	11	10	21
Bootstrap	24	6	22	31		8	8	5	14
Average richness	26	7	24	35		4	10	9	19
Asymptote function:									
MMMeans	29	12	27	33		2	16	6	32
Diversity indices:									
Alpha	8	3	5	7		12974	6	29192	10
Shannon	8	1	2	2		1	2	1	2
Shannon Exponential	11	4	6	9		2	6	4	9
Simpson	8	4	4	5		1	7	1	11

Table 11.2. Shared species and similarity indices between sampling sites (Upper Palumeu – UP; Grensgebergte – GR; and Kasikasima – KA) for small mammals surveyed in Southeastern Suriname as computed using EstimateS (Colwell, 2009).

Group	First Sample	Second Sample	Shared Species	Jaccard Classic	Sorensen Classic	Chao-Jaccard-Raw Abundance-based	Chao-Jaccard-Est Abundance-based	Chao-Sorensen-Raw Abundance-based	Chao-Sorensen-Est Abundance-based	Morisita-Horn	Bray-Curtis
Bats	UP	GR	4	0.182	0.308	0.253	0.282	0.404	0.44	0.37	0.127
	UP	KA	14	0.538	0.7	0.868	0.883	0.929	0.938	0.835	0.509
	GR	KA	3	0.143	0.25	0.353	0.357	0.522	0.526	0.504	0.06
Small non-volant mammals	UP	GR	0	0	0	0	0	0	0	0	0
	UP	KA	1	0.2	0.333	0.2	0.274	0.333	0.43	0.333	0.333
	GR	KA	1	0.1	0.182	0.1	0.124	0.182	0.22	0.154	0.111

the Grensgebergte Mountains. The closely related Cuvier's terrestrial spiny rat (*P. cuvieri*) was one of the next commonest species with 3 individuals caught. These large rats (ca. 500 g) are prey for many top-level predators such as cats and snakes. The only rat that was caught at all 3 sites was the arboreal rice rat *Oecomys auyantepui*. The water rat *Nectomys rattus* (Figure 11.6) was also captured 3 times, but all were from the Grensgebergte Mountains site.

Figure 11.4. Seba's short-tailed fruit bat (*Carollia perspicillata*). Photo by Burton Lim.

Figure 11.5. Round-eared bat (*Lophostoma silvicolum*). Photo by Burton Lim.

Figure 11.6. Water rat (*Nectomys rattus*) caught at the Grensgebergte site. Photo by Trond Larsen.

In terms of study sites, the first site on the Upper Palumeu documented 25 species of small mammals that were represented by 116 individuals including 22 species of bats (113 individuals), 2 species of rats (2 individuals), and 1 species of opossum (1 individual). The second site on Grensgebergte documented 12 species of small mammals represented by 28 individuals including 5 species of bats (14 individuals), 6 species of rats (13 individuals), and 1 species of opossum (1 individual). The third camp at Kasikasima documented 23 species of small mammals represented by 222 individuals including 19 species of bats (218 individuals), 3 species of rats (3 individuals), and 1 species of opossum (1 individual).

The diversity indices indicated that Upper Palumeu was the most diverse site for bats and Grensgebergte was the least diverse for bats (Table 11.1). In contrast, Grensgebergte was the most diverse site for small non-volant mammals. Upper Palumeu and Kasikasima had the most shared species of bats and the highest similarity indices (Table 11.2). The numbers were low but Upper Palumeu and Kasikasima also had slightly higher similarity indices than the other 2 site comparisons for small non-volant mammals.

The species accumulation curves for bats are quite distinct from each other with Grensgebergte being the most different with no overlap in number of species or individuals when compared to the other 2 sites (Figure 11.7). The asymptote function of the curve also levels off at half the values for Upper Palumeu and Kasikasima (Table 11.1). For small non-volant mammals, the accumulation curve for Grensgebergte is again distinct from the other 2 sites but with more numbers of species and individuals (Figure 11.8), which is reflected in its higher asymptote function (Table 11.1). The asympotote function calculated for the total survey of bats indicated 81% completeness of survey (observed/estimated; 27/33) based on the methods used. The completeness of survey for small non-volant mammals was much lower at 34%.

DISCUSSION

Each of the 3 sites surveyed for small mammals during the Southeastern Suriname RAP had a different faunal composition in terms of species diversity and relative abundance. The highland site of Grensgebregte was the most distinctive, whereas the lowland sites of Upper Palumeu and Kasikasima were the most similar. Although not numerous in terms of diversity or abundance, half of the 8 species of rats documented during the survey were found only at Grensgebergte. This indicates that the montane habitats support a unique community ecology of non-volant small mammals that is different from the surrounding lowland regions. Although the number of species was similar to an earlier RAP to the

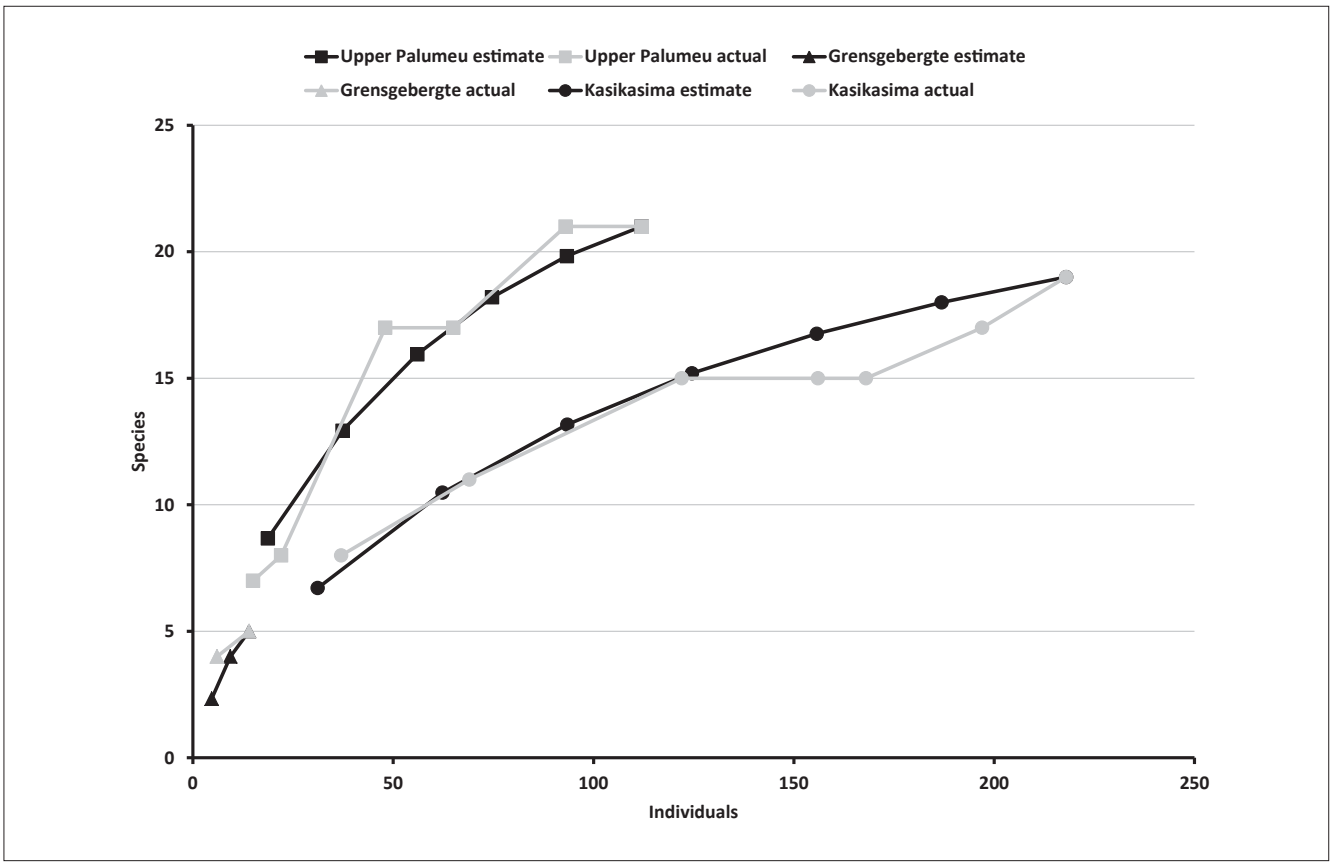

Figure 11.7. Species accumulation curves for bats at the 3 sites surveyed during the Southeastern Suriname RAP.

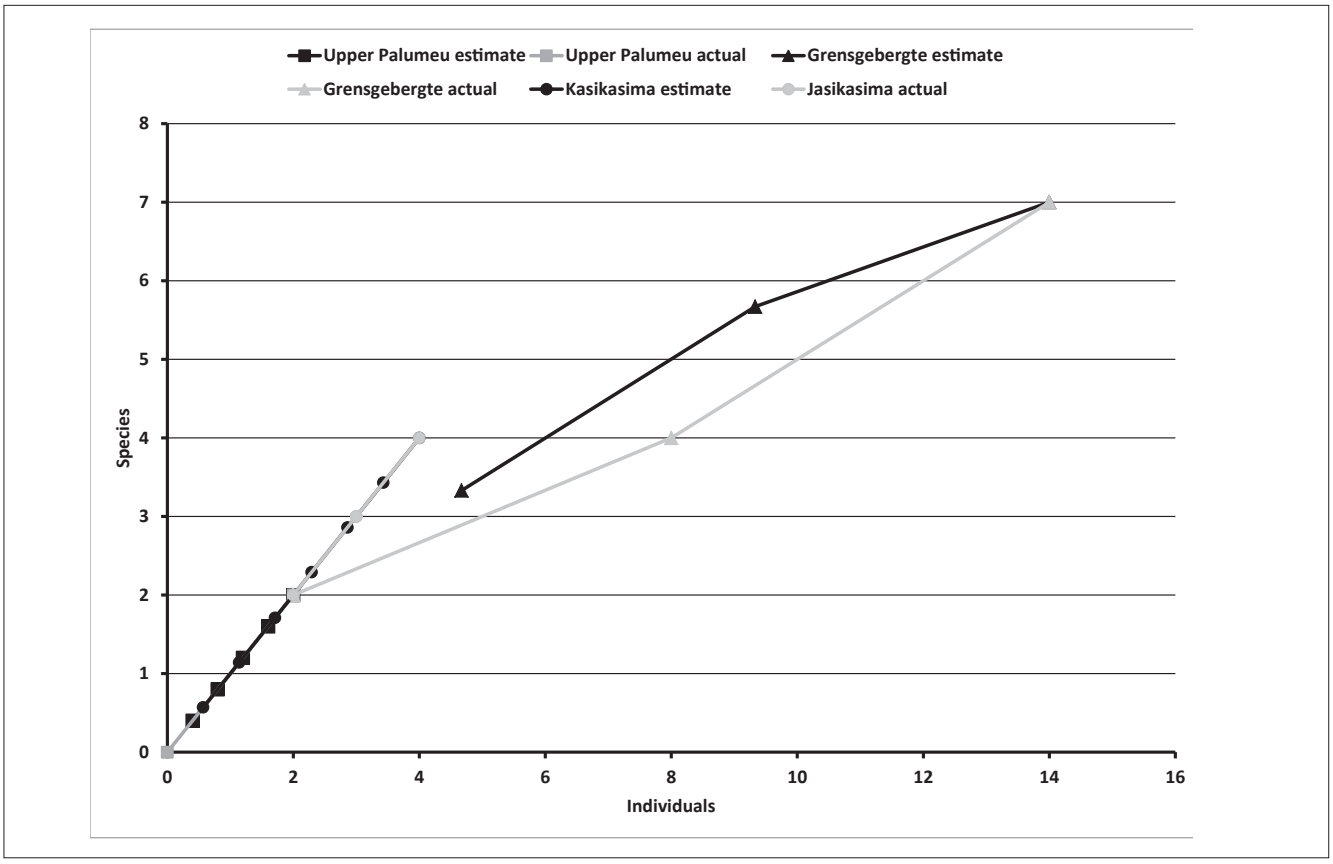

Figure 11.8. Species accumulation curves for small non-volant mammals at the 3 sites surveyed during the Southeastern Suriname RAP.

Kwamalasamutu region of Suriname, the number of individuals caught in the Palumeu region was almost 10-fold less (18:149). However, the Kwamalasamutu RAP was anomalous in that the rat abundance was unusally high for the Guiana Shield (Lim and Joemratie 2011).

The species diversity of bats was highest at Upper Palumeu, which suggests that this forested area is in pristine condition and is representative of primary lowland rainforest in the Guiana Shield of South America. In contrast, Kasikasima had nearly as high species diversity but had exceptionally high abundance (over twice as many as the other sites) for 2 species of bats. The first species (Parnell's moustached bat; *Pteronotus parnellii*) was very common in the rocky outcrops at the base of Kasikasima Mountain, approximately 3 km inland from our basecamp situated on the right bank of the Palumeu River. The crevices and overhangs of the granite boulders were used as day roosts because our nets caught primarily this species in the early evening. The second species (larger fruit-eating bat; *Artibeus planirostris*) was very abundant in the forest surrounding our campsite, which was across the river from an Amerindian settlement. The supply of fruits necessary to maintain high populations of these large fruit-eating bats may be the ephemeral result of coincidental masting of fruiting trees in the area or perhaps a more commensal association with human cultivation activities. A similarly high abundance of *Artibeus planirostris* was found at Werehpai on a previous RAP survey to the Kwamalasamutu region of Suirname (Lim and Joemratie 2011). However, this result was attributed in part to the established trail system to the petroglyph caves that were acting as flyways and facilitated the netting of bats. Although the area was previously used for farming, there was not the persistant human presence as found at Kasikasima. Nonetheless, in some habitats *Artibeus planirostris* can be the dominant species of bat with a major influence on seed dispersal and forest succession.

In comparison to other small mammal studies in Suriname, the results of our survey in the Grensgebergte area was similar to Kwamalasamutu (Lim and Joemratie 2011) with *Artibeus planirostris* being the most common species of bat. Among sites between these RAP surveys, species diversity and relative abundance were similar for the lowland sites of Upper Palumeu and Werehpai. By contrast, the short-tailed fruit bat *Carollia perspicillata* was the commonest at Bakhuis (Lim 2009) and Brownsberg (Lim et al. 2005) in more disturbed areas in the north.

In terms of small non-volant mammals, Grensgebergte was similar to Bakhuis with species of terrestrial spiny rats (*Proechimys* spp.) being most common, whereas Kwamalasamutu and Brownsberg had other species as the commonest. For species diversity and relative abundance, Kwamalasamutu was unusually high for the Guiana Shield (Lim and Joemrate 2011) with this Grensgebergte survey more typical of the region.

One of the more interesting discoveries was the capture of 3 individuals of the water rat *Nectomys rattus* (Figure 11.6) from the Grensgebergte Mountains site. This is a water-adapted species with webbing on its hindfeet. All were caught in habitat with ephemeral water sources near the tops of the mountain range.

CONSERVATION RECOMMENDATIONS

Grensgebergte was the most remote and unexplored of the three sites surveyed for small mammals. Although it was sampled only for three days, there was relatively high species diversity for rats in comparison to lowland sites. The surrounding mountain ranges in southeast Suriname warrant more biological study to ascertain and uncover the unique faunal and floral community that resides in this pristine tropical environment. These low-elevation mountains can function as important corridors of biodiversity between protected areas in neighboring countries of the Guiana Shield region.

The Upper Palumeu had the highest species diversity for bats indicating its relatively undisturbed habitat. Although there is a camp and trail connecting Suriname and Brazil, it is only used infrequently by the Amerindians for travel between villages in the area. This rolling terrain acts as an ecological buffer for the mountain ranges that are interspersed within the lowland rainforest.

Kasikasima had the highest relative abundance of bats and in particular a large proportion of the fruit-eating bat species *Artibeus planirostris*. This indicates a healthy supply of fruiting trees that can sustain a large population of this frugivorous animal. There is a nearby village and ecotourist facilities but the impact on the surrounding forest seems minimal and the trail to Kasikasima Mountain is not regularly maintained. Incorporating all three sites or areas into a multi-use nature reserve will benefit the connectivity of surrounding protected areas, and the conservation and promotion of biodiversity.

LITERATURE CITED

Borisenko, A.V., B.K. Lim, N.V. Ivanova, R.H. Hanner, and P.D.N. Hebert. 2008. DNA barcoding in surveys of small mammal communities: a field study in Suriname. Molecular Ecology Resources, 8:471–479.

Colwell, R.K. 2009. EstimateS: statistical estimation of species richness and shared species from samples. Version 8.2. User's guide and application published at: http://purl.oclc.org/estimates.

Husson, A.M. 1978. The mammals of Suriname. Zoological Monographs. Rijksmuseum Natural History. 2: 1–569.

Lim, B.K. 2009. Environmental assessment at the Bakhuis bauxite concession: small-sized mammal diversity and abundance in the lowland humid forests of Suriname. The Open Biology Journal. 2:42–53.

Lim, B.K., M.D. Engstrom, H.H. Genoways, F.M. Catzeflis, K.A. Fitzgerald, S.L. Peters, M. Djosetro, S. Brandon,

and S. Mitro. 2005. Results of the Alcoa Foundation-Suriname expeditions. XIV. Mammals of Brownsberg Nature Park, Suriname. Annals of Carnegie Museum. 74: 225–274.

Lim, B.K., M.D. Engstrom, and J. Ochoa G. 2005. Mammals. *In:* T. Hollowell and R. P. Reynolds (eds.). Checklist of the terrestrial vertebrates of the Guiana Shield. (Bulletin of the Biological Society of Washington, 13: 77–92.

Lim, B.K., and S. Joemratie. 2011. Rapid Assessment Program (RAP) survey of small mammals in the Kwamalasamutu region of Suriname. *In:* B.J. O'Shea, L.E. Alonso, and T.H. Larsen (eds.). A rapid biological assessment of the Kwamalasamutu Region, Suriname (Conservation Internationa., RAP Bulletin of Biological Assessment 63. Pp. 144–149.

Appendix 11.1. Preliminary checklist of 39 species of small mammals documented from 3 sites during the RAP of the Grensgebergte area and number of individuals captured.

Asterisk (*) indicates 2 species that were caught by hand and not by traps or nets.

Species	Upper Palumeu	Grensgebergte	Kasikasima	Total
Opossums (3 species)				
*Marmosops parvidens**	1			1
Marmosa murina		1		1
Monodelphis brevicaudatus			1	1
Subtotal	**1**	**1**	**1**	**3**
Rats (8 species)				
Neacomys dubosti	1			1
Oecomys auyentepui	1	1	1	3
Oecomys rutilus		1		1
Nectomys rattus		3		3
Hylaeamys megacephalus			1	1
Proechimys cuvieri		2	1	3
Proechimys guyannensis		5		5
Rhipidomys nitela		1		1
Subtotal	**2**	**13**	**3**	**18**
Bats (28 species)				
Ametrida centurio	3			3
Anoura caudifer			1	1
Artibeus bogotensis		6		6
Artibeus lituratus	1		2	3
Artibeus obscurus	18		12	30
Artibeus planirostris	29	4	99	132
Carollia brevicauda	2		1	3
Carollia perspicillata	2	2	16	20
Chiroderma villosum	1			1
Chrotopterus auritus	3		2	5
Desmodus rotundus	1			1
Glossophaga soricina			1	1
Lionycteris spurrelli	3		1	4
Lonchophylla thomasi	4		5	9
Lophostoma silvicolum	3	1	4	8
Mesophylla macconnelli	1			1
Micronycteris megalotis			1	1
Mimon crenulatum			1	1
*Molossus rufus**	1			1

table continued on next page

Appendix 11.1. continued

Species	Upper Palumeu	Grensgebergte	Kasikasima	Total
Phyllostomus elongatus	4		5	9
Phyllostomus hastatus	3			3
Platyrrhinus helleri	1	1		2
Pteronotus parnellii	17		47	64
Rhinophylla pumilio	4		8	12
Sturnira lilium			5	5
Sturnira tildae	2		5	7
Trachops cirrhosus	9		2	11
Uroderma bilobatum	1			1
Subtotal	**113**	**14**	**218**	**345**
Total	**116**	**28**	**222**	**366**