

An Initial assessment of the mammalian fauna of Parque Nacional 'El Cusuco' and El Paraiso Valley

Introduction

Mammal species are relatively easy to identify and monitor, hence among the vertebrate groups the taxonomy, behaviour and biogeography of mammals is comparatively well known. Mammals are mobile and often select specific habitats and/or contribute to ecological processes such as seed dispersal, predation and pollination. Thus the population densities of mammal communities and their responses to ecosystem processes potentially provide much valuable environment information. The group also includes many charismatic flagship species of valuable to the promotion of conservation through increasing public interest and funding opportunities.

The rainforest regions of Honduras support a diverse mammalian assemblage, including both Central American endemics and taxa with predominantly South American or North American distributions. More than 180 terrestrial mammal species have been recorded from Honduras to date (Reid, 1997). However despite the biogeographical significance of the Central American land bridge, relatively few surveys have as yet been undertaken within Honduras. Voss and Emmons (1996) described the country as 'a crucial sampling gap' within the Neotropics and highlighted Honduras as priority area for the investigation of rainforest mammalian diversity.

Study areas

This study was part of a general baseline biodiversity survey conducted between 28/06/03 and 23/08/03 in Northwestern Honduras. The primary objective of this study was to provide a preliminary description of the mammal fauna that utilise two study sites: Parque Nacional El Cusuco and El Paraiso Valley, with a view to contributing information towards their longer term monitoring and management.

Information on detailed habitat classes within the region was not available, and time was not available for extensive systematic classification of habitats at each sampling site. No GPS was available; hence only approximate locations are provided.

Parque Nacional El Cusuco

Parque Nacional El Cusuco encompasses 23,440 ha of temperate forest within the Merendón mountain range, centred on a core zone at 1800-2242 metres above sea level (15° 29.8' – 15° 32.1' N, 88° 13.0' – 88° 16.3' W).

The vegetation within PNC is characterised by three predominant forest habitats:

- Cloud forest 1500-2242m
- Semi-arid pine forest, south-facing 800-1500m
- Wet deciduous forest, north-facing slopes 500-1500m (Brough, 1992).

Rainfall is abundant throughout most of the year, particularly during September through to December, and relative humidity averages 82%. The coolest months are December to February; the warmest are April to June. (Dirección Ejecutiva del Catastro Nacional, Tegucigalpa, Honduras, 1993).

Declared a protected area in 1987, the park is currently managed by the Héctor Rodrigo Pastor Fasquelle foundation. In 1996 the Nature Conservancy, in collaboration with the foundation published a rapid ecological assessment report for this area. This report recorded the presence of several CITES Appendix I species, including mantled howler monkey, ocelot, jaguar and Baird's tapir.

El Paraiso Valley

The second field site was a privately owned lowland forest reserve in El Paraiso valley. Some parts of the reserve were formerly cultivated, but for the last 25 years the forest has been allowed to reclaim these areas. Areas of primary forest are found in less accessible regions of the reserve. There have been no biodiversity surveys within this site prior to the present study.

Methods

Survey work conducted within Parque Nacional El Cusuco took place between 29/6/03 and 06/8/03. Here work focused predominantly on the established trail system in the vicinity of the visitors' centre, but also included some additional trapping carried out from 03/7/03 to 05/7/03 in Leonis valley and opportunistic walks from the visitors' centre to Cantiles valley and Bosque Enanu. Within the El Paraiso site, data were collected throughout the reserve between 08/7/03 and 10/7/03, and between 11/8/03 and 22/8/03.

A variety of methods were employed to sample the mammalian fauna present at each site. These were:

- Opportunistic surveys
- Baited live traps
- Pitfall traps
- Harp trap (bats)
- Interviews

Opportunistic surveys

Active opportunistic censuses were conducted when time and manpower allowed. These comprised of small groups of people walking quietly along forest trails, noting any mammal species observed. In Cusuco night searches were also undertaken to target nocturnal species.

Live traps

20 live traps were available for this study (Tomahawk Live Trap Co.). These were twelve small mammal traps (41 × 13 × 13 cm, code 102) and eight larger traps (66 × 23 × 23 cm code 106) for small and medium sized carnivores and other species. These traps were spaced at minimal intervals of 20m apart within different areas of each site. The small mammal traps were baited using either a mixture of oats and peanut butter or bread. A number of different baits were utilised in an effort to capture a variety species with the larger traps, these included canned fish, banana and dried meat. Traps were checked in the early morning and again when they were rebaited in the evening. In order to maximise the range of localities surveyed traps were set for periods of no more than four days before they were moved to a new location within the study site.

Pitfall traps

These were established at nine sites within each site, in a variety of habitats. Each trap-line comprised between three and five 60L buckets imbedded in the ground, spaced 5 m apart, with a 30 cm high plastic sheeting drift fence passing over the centre of each bucket. These traps were checked every morning for the duration of the live trapping surveys. When not in operation these traps were closed to prevent accidental captures.

Harp trap

A harp trap was set before dusk at forest path sites for six evenings within each study area. A riverine site and a location further into the forest were sampled within each study area in an attempt to sample both 'edge-gap' and forest interior species. In Cusuco these sites were surveyed for three evenings each, in El Paraiso the harp trap was set for four evenings at the riverine site, and for two evenings within the forest interior. The trap was checked for bats at hourly intervals following dusk, and was closed approximately four hours after nightfall. Each bat was left in a holding bag for between one and two hours to allow the collection of faecal samples before it was released at the site of capture.

Captured mammals were identified following Reid (1997) and Emmons and Feer (1997) and processed at the site of capture. Morphometric data was collected for the smaller species (rodents, mouse opossums, shrews and bats); these included sex, reproductive condition, weight, and length of head and body, hind foot, tail, tibia and ear where appropriate. Each small mammal was given a distinct fur clip to permit the recognition of recaptures. Larger species were weighed within the traps then released.

Interviews were conducted with two of the park personnel from Parque Nacional Cusuco to determine which mammal species they believed present within the park

Results and Discussion

Species lists compiled for Parque Nacional El Cusuco and El Paraiso Valley forest are provided in Table 1, together with details of the recording methodologies. Morphometric data for captured individuals are listed in Tables 2 and 3.

This study obtained direct evidence for the presence of 18 mammal species within Parque Nacional El Cusuco (interviews with El Cusuco park personnel added a further 18 species to this list), and 21 within El Paraiso. Only five species were recorded present within both sites (Table 1). Six species (*D. virginiana*, *M. mexicana*, *C. parva*, *S. variegatoides*, *O. Phyllotis* and *R. gracilis*) were recorded directly through capture or observation that were not previously detected by the Nature Conservancy Rapid Assessment Survey. The 1996 survey did however record 20 species present within El Cusuco that this study did not directly observe.

Opportunistic surveys

Opportunistic censusing identified only five mammal species (*D. novemcinctus*, *S. variegatoides*, *N. narica*, *C. mesoleucus* and *E. Barbara*), however none of these species were registered via the live trapping regime. Opportunistic searches were not an effective technique for detecting small mammal species other than diurnal squirrels. Five night walks undertaken within Parque Nacional El Cusuco detected no mammal species. During walks to harp trap sites in El Paraiso valley the only species to be sighted and identified was *D. novemcinctus*.

Live traps

Only three rodent species were captured using the live traps (*H. desmarestianus*, *O. phyllotis* and *P. mexicanus*; Table 1). Although there a good capture rate of rat-like animals was achieved (63 captures or 16% trap success), no squirrels or small mice were captured and the trapping technique needs to be modified to include these groups in future surveys. The larger live traps captured only two species: *D. marsupialis* and *D. virginiana*.

Pitfall traps

The pitfall traps were established primarily to sample the local herpetofauna, as part of a complementary biodiversity survey. This methodology however was successful also in capturing small mammal species that could not jump or climb out of the buckets. These traps caught two species of rodent (*S. teguina* and *R. gracilis*), two shrew species (*C. parva* and *C. merriami*) and the marsupial *M. mexicana*, all of which were not sampled using the live traps.

The relative capture rate of small terrestrial species varied markedly; *H. desmarestianus* and *P. mexicanus* were the most frequently recorded species. Other species, such as *M. mexicana* and *R. gracilis* were trapped only once and twice respectively.

Harp trap

No bats were captured within Parque Nacional El Cusuco. The Nature Conservancy Rapid Assessment team noted the presence of three species in the same area. In contrast to this survey, this earlier study utilised mist nets, which can be more easily set in a variety of habitats, and typically capture different species to harp traps, including high flying bats and those with relatively low frequency echolocation calls.

Six evenings trapping within El Paraiso forest resulted in 43 bat captures, representing 13 species. Nine species were captured at the riverine site, these were *L. aurita*, *G. soricina*, *M. megalophylla*, *P. parnellii*, *C. perspicillata*, *S. lilum*, *A. lituratus*, *A. jamaicensis* and *D. rotundas*. In contrast four species were recorded within the forest interior (*G. soricina*, *A. watsoni*, *P. helleri* and *T. tricolor*). Only *G. soricina* was recorded within both habitats. Although the survey periods were very short, this preliminary data suggests there might be distinct differences between the bat assemblages of the riverine and forest interior trap sites. An additional two species (*M. ater* and *M. sinaloae*) were captured using hand nets in the vicinity of the survey team's living quarters.

Interviews

Species lists compiled during interviews with Parque Nacional El Cusuco personnel were largely consistent with the combined lists from this study and the 1996 Rapid Assessment. Of the 49 mammal species recorded present within the park (all survey methodologies including interviews) 11 were recorded solely on the strength of their identification during interviews. Only park staff that had worked within the park for a number of years were questioned, as the casual guides had limited knowledge of the fauna and rarely differentiated between species within the same family. Despite this, even the more experienced staff rarely made any distinction between different families of smaller mammals, particularly rodents, and recognised none of the bat species.

Threats

17 of the mammal species recorded present in Parque Nacional El Cusuco and El Paraiso, are included in the CITES Appendices I, II or III (Table 1), i.e. these species are considered threatened or in danger of extinction. The Cusuco Rapid Assessment team noted that the area ‘was exposed to relatively intense activities of hunting before being declared a national park’ (my translation). Although no evidence was found of a continued hunting presence during this short survey it is likely that hunting for the meat and exotic pet trades has reduced the populations of many of the larger mammal species in the past.

Recommendations for future surveys

Each inventory technique is biased to some extent because each can collect or otherwise record only a fraction of the species diversity present. A combination of many methods must therefore be utilised if a census of an entire community is to be attempted. Many nocturnal species (for example *C. didactylus*, *C. centralis* and *B. sumichrasti*) were not detected by this study but were reported present by interviewees. A greater emphasis on nocturnal surveys is required to determine whether these species are present within each study site. Similarly, it is recommended that a combination of harp traps, mist nets and hand nets be utilised to survey the bat fauna of this region in future. Although the harp trap was successful, suitable locations for its placement were limited. Mist nets offer more flexibility and are particularly effective in capturing high-flying species that could not be sampled using the harp trap.

Many mammal species occur at low densities, hence are encountered unpredictably. Camera traps set in along animal trails are often the best approach by which to record these more secretive species. In view of recent thefts within El Cusuco there are obvious security issues that would have to be addressed, however the strategic placement of camera traps in relatively undisturbed areas is highly recommended in future years.

There was a constant problem of bait removal by ants, particularly within El Paraiso Valley. Where possible, trap rebaiting was left as late as possible in the day to minimise bait clearance by diurnal ant species, but as there are also many nocturnal species this was only partially successful. Ants removed bread more slowly but this was ineffective bait for small mammals. It is suggested that plantain or hard biscuits may prove suitable alternatives.

Numerous people assisted with various aspects of this survey. Particular thanks go to everyone from Operation Wallacea who assisted with this survey, Rene and Hector from Parque Nacional El Cusuco who provided information regarding species presence, and finally Antolin and Hazael who always cheerfully gave 110%.

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Table 1. Mammal species positively identified within Parque Nacional ‘El Cusuco’ and El Paraiso Valley forest.

Order	Family / Subfamily	Species	Common name		Type of contact			CITES Appendix	
			English	Spanish	Cusuco Assessment	Rapid (Cusuco)	This study (El Paraiso)		
Didelphimorphia	Didelphidae	<i>Didelphis marsupialis</i>	Common opossum	Guazalo, tacuazín	O	In	C		
		<i>Dudelphis virginiana</i>	Virginia opossum	Guazalo, tacuazín		C, In	C		
		<i>Metachirus nidicaudatus</i>	Brown four-eyed opossum	Guazalo, tacuazín	O				
Insectivora	Soricidae	<i>Marmosa mexicana</i>	Mexican mouse opossum				C		
		<i>Cryptotis parva</i>	Least shrew				C, In		
		<i>Cryptotis merriami</i>	Merriam’s small-eared shrew		R		C, In		
Chiroptera	Mormoopidae	<i>Mormoops megalophylla</i>	Ghost-faced bat	Murciélago				C	
	Phyllostominae	<i>Pteronotus parnellii</i>	Common moustached bat	Murciélago				C	
		<i>Lonchorhina aurita</i>	Common sword-nosed bat	Murciélago				C	
	Glossophaginae	<i>Glossophaga soricina</i>	Common long-tongued bat	Murciélago				C	
	Caroliinae	<i>Carollia perspicillata</i>	Seba’s short-tailed bat	Murciélago	O			C	
	Stenodermatinae	<i>Sturnira lilum</i>	Little yellow-shouldered bat	Murciélago		C			C
		<i>Artibeus lituratus</i>	Great fruit-eating bat	Murciélago					C
		<i>Artibeus jamaicensis</i>	Jamaican fruit-eating bat	Murciélago					C
		<i>Artibeus watsoni</i>	Thomas’ fruit-eating bat	Murciélago					C
		<i>Uroderma bilobatum</i>	Common tent-making bat	Murciélago		C			
		<i>Platyrrhinus helleri</i>	Heller’s broad-nosed bat	Murciélago					C
	Desmodontinae	<i>Desmodus rotundas</i>	Common vampire bat	Murciélago				C	
	Thyropteridae	<i>Thyroptera tricolor</i>	Spix’s disk-winged bat	Murciélago				C	
Molossidae	<i>Molossus ater</i>	Black mastiff bat	Murciélago					C	
	<i>Molossus sinaloae</i>	Sinaloan mastiff bat	Murciélago					C	

Table 1 continued

Edentata	Mymecophagidae	<i>Tamandua mexicana</i>	Northern tamandua	Perico ligero	In			
		<i>Cyclops didactylus</i>	Silky Anteater			In		
	Dasypodidae	<i>Dasypus novencinctus</i>	Nine-banded armadillo	Cusuco	S	In	O	
		<i>Cabassous centralis</i>	Northern naked-tailed armadillo	Cusuco		In		
Primates	Cebidae	<i>Alouatta palliata</i>	Mantled howler monkey	Olingo	R	V, In		I
		<i>Ateles geoffroyi</i>	Central American spider monkey			In		II
Lagomorpha	Leporidae	<i>Sylvilagus brasiliensis</i>	Forest rabbit	Conejo, ñeco	In	In		
		<i>Sylvilagus floridanus</i>	Eastern cottontail			In		
Rodentia	Sciuridae	<i>Sciurus deppei</i>	Deppe's squirrel	Ardita	O			
		<i>Sciurus variegatoides</i>	Variegated squirrel			O, In		
	Geomydae	<i>Orthogeomys grandis</i>	Large pocket-gopher	Timba, taltuza	S			
	Heteromydae	<i>Heteromys desmarestianus</i>	Forest spiny pocket mouse	Ratón	C		C, In	C
		Muridae	<i>Tylomys nudicaudus</i>	Northern climbing rat	Ratón	R		
	<i>Ototylomys phyllotis</i>		Big-eared climbing rat				C	C
	<i>Peromyscus mexicanus</i>		Mexican deer mouse	Ratón	C		C, In	C
	<i>Scotinomys teguina</i>		Alston's singing mouse	Ratón	C		C, In	
	Erethizontidae	<i>Reithrodontomys gracilis</i>	Slender harvest mouse	Ratón			C	
		<i>Coendou mexicanus</i>	Mexican porcupine	Zorro espín	O		In	III
	Aboutidae	<i>Agouti paca</i>	Paca	Tepescuintle	R		In	III
		<i>Dasyprocta punctata</i>	Central American agouti	Guatuza	R			III
Carnivora	Procyonidae	<i>Bassariscus sumichrasti</i>	Cacomistle	Mico rayado		In		
		<i>Potos flavus</i>	Kinkajou	Kinkaju, micho de noche	O	In		III
		<i>Procyon lotor</i>	Northern raccoon	Mapache	In, S		In	
		<i>Nasua narica</i>	White-nosed coati	Pizote	R	O, In	III	

Table 1 continued

	Canidae	<i>Urocyon cinereoargenteus</i>	Gray fox	Zorra	O	In			
	Mustelidae	<i>Conepatus mesoleucus</i>	Common hog-nosed skunk	Zorrillo	R	O, In			
		<i>Mephitis macroura</i>	Hooded skunk	Zorrillo	R				
	Felidae	<i>Galictis vittata</i>	Greater grison	Zabin		In			
		<i>Eira barbara</i>	Tayra	Motete, cadejo	R	O, In		III	
		<i>Lutra longicaudis</i>	Neotropical river otter				In		I
		<i>Felis concolor</i>	Puma	Puma, león	R				II
		<i>Leopardus pardalis</i>	Ocelot	Tigrillo	R	S, In		V, S	I
		<i>Leopardus wiedii</i>	Margay				In		I
		<i>Herpailurus yaguaroundi</i>	Jaguarundi	Gato de monte	R		In		I
	Perissodactyla Artiodactyla	<i>Panthera onca</i>	Jaguar	Tigre	R	S, In		I	
		Tapiridae	<i>Tapirus bairdii</i>	Baird's tapir	Danto, tapir	R	S, In		I
	Cervidae	<i>Tayassu tajacu</i>	Collared peccary	Quequeo	In, S			II	
		<i>Dicotyles pecari</i>	White-lipped peccary				In		II
		<i>Odocoileus virginianus</i>	White-tailed deer	Venado	S				
		<i>Mazama americana</i>	Red brocket deer	Guizisil, tilopo	In	S, In			

Type of contact

C	Collected
O	Observed
In	Interview
S	Spoor
V	Vocalisations
R	Recorded present but type of contact not documented

Table 2. Morphometric measurements of mammals captured during this study (excluding bats) (* refers to pit trap captures)

Date	Site	Trail/trap location	Weather	Species	Body weight (g)	Sex	Age / reproductive status	Head/body length (cm)	Tail length (cm)	Foot (cm)	Arm (cm)	Ear (cm)	Hair clip
01/7/03	Cusuco	Quetzal trail	Dry	<i>C. parva</i> *	6.5	M	A	6.7	2.5	1.11	1.50	-	G
01/7/03		Quetzal trail	Dry	<i>H. desmarestianus</i>	109	M	A	11.5	17.5	3.41	3.46	1.88	
02/7/03		Quetzal trail	Dry	<i>H. desmarestianus</i>	68	F	A, NP	12.5	15.6	3.42		1.82	D
13/7/03		Quetzal trail	Rain	<i>C. merriami</i> *	10	M	A	6.5	2.1	1.25	1.58	-	A
14/7/03		Dante trail	Rain	<i>H. desmarestianus</i>	69	F	A, NP	11.7	16.8	3.22	3.33	1.65	E
14/7/03		Quetzal trail	Rain	<i>H. desmarestianus</i> *	40	M	J	10.5	11.8	3.22	3.00	1.40	E
14/7/03		Minas trail	Rain	<i>R. gracilis</i> *	9	F	A, SP	5.4	10.7	1.62	1.98	1.16	C
15/7/03		Dante trail	Rain	<i>P. mexicanus</i>	61	F	A, NP	13	13.7	2.69	3.45	1.64	A
15/7/03		Quetzal trail	Rain	<i>M. mexicana</i> *	12	M	J	7.8	11.7	1.40	2.27	1.31	B
15/7/03		Dante trail	Rain	<i>S. teguina</i> *	16	M	A	7.5	5.9	1.69	1.93	1.19	D
16/7/03		Dante trail	Rain	<i>H. desmarestianus</i>	46	F	J	9.5	12.9	3.06	2.95		AC
16/7/03		Dante trail	Rain	<i>H. desmarestianus</i>	70	F	A						
16/7/03		Dante trail	Rain	<i>H. desmarestianus</i>	88	F	A, NH	11.8	17.8	3.36	3.62	1.70	CG
16/7/03		Dante trail	Rain	<i>P. mexicanus</i>	64	F	A, NP	12.0	14.2	2.49	3.33	1.67	D
17/7/03		Dante trail	Dry	<i>H. desmarestianus</i>	67	M	A	12.5	15.1	3.35	1.21	3.50	F
17/7/03		Dante trail	Dry	<i>H. desmarestianus</i>	74	F	A, NP	12.5	14.2	3.29		3.47	
17/7/03		Dante trail	Dry	<i>H. desmarestianus</i>	Recap	F							E
17/7/03		Dante trail	Dry	<i>H. desmarestianus</i>	Recap	F	A, NH						CG
19/7/03		Dante trail	Rain	<i>H. desmarestianus</i>	Recap	F							CG
19/7/03		Dante trail	Rain	<i>H. desmarestianus</i>		F	A						
19/7/03		Dante trail	Rain	<i>H. desmarestianus</i> *									
20/7/03		Dante loop	Rain	<i>R. gracilis</i> *	12	M	A	6.3	9.3	1.65	2.20	1.26	A
20/7/03		Dante loop	Rain	<i>H. desmarestianus</i>	100	M	A	13.6	18.0	3.50	3.85	1.75	H
20/7/03		Dante loop	Rain	<i>R. gracilis</i> *	11	F	A, SP	6.5	10.3	1.75	1.60	1.34	B
21/7/03		Dante loop	Rain	<i>H. desmarestianus</i>		F	A, NP						
21/7/03		Dante loop	Rain	<i>H. desmarestianus</i>	58	F	A, NP	11.0	16.6	3.38	3.14	1.75	I
21/7/03		Dante loop	Rain	<i>H. desmarestianus</i>	73	F	A, NH	12.2	16.8	3.42	3.68	1.96	AF
22/7/03		Dante loop	Dry	<i>H. desmarestianus</i>	85	F	A, NH	12.4	17.3	3.12	3.40		

Table 2 continued

22/7/03	Dante loop	Dry	<i>H. desmarestianus</i>	55	F	A, NP	11.4	16.8	3.20	3.52	1.77	AB
22/7/03	Dante loop	Dry	<i>H. desmarestianus</i>	95	M		14.5	17.2	3.60	3.69	1.38	DG
23/7/03	Dante loop	Dry	<i>H. desmarestianus</i>	Recap	M							
23/7/03	Dante loop	Dry	<i>H. desmarestianus</i>	58	F	A, NP	12.0	14.8	3.18	3.26	1.52	DE
23/7/03	Dante loop	Dry	<i>H. desmarestianus</i>		M							
23/7/03	Dante loop	Dry	<i>H. desmarestianus</i>	69	F	N, NH	12.0	15.8	3.20	3.22	1.67	GH
23/7/03	Dante loop	Dry	<i>H. desmarestianus</i>	64	F	A, NH	12.4	17.3	3.05	3.31	1.78	GI
31/7/03	Pisote trail	Dry	<i>H. desmarestianus</i>	65	F	A						
31/7/03	Minas trail	Dry	<i>P. mexicanus</i>	58	M	A	11.0	14.3	2.62	3.35	1.61	D
01/8/03	Minas trail	Rain	<i>P. mexicanus</i>	Recap	M	A						D
01/8/03	Minas trail	Rain	<i>P. mexicanus</i>	43	M	J	11.5	13.0	2.67	2.72	1.55	B
01/8/03	Pisote trail	Rain	<i>H. desmarestianus</i>	74	F	A, NP	12.0	16.4	3.30	3.31	1.66	B
01/8/03	Pisote trail	Rain	<i>H. desmarestianus</i>		M	A	13.5	16.8	3.50	3.60		C
01/8/03	Pisote trail	Rain	<i>H. desmarestianus</i>	93	M	A	13.2	16.4	3.10	3.36	1.91	D
02/8/03	Minas trail	Dry	<i>P. mexicanus</i>	Recap								D
02/8/03	Pisote trail	Dry	<i>H. desmarestianus</i>	65	F	A, NP	11.0	15.8	3.22	3.41	1.78	
02/8/03	Pisote trail	Dry	<i>H. desmarestianus</i>	75	F	A, NP	13.4	16.4	3.22	3.32	1.70	
03/8/03	Pisote trail	Dry	<i>H. desmarestianus</i>			J						
03/8/03	Pisote trail	Dry	<i>H. desmarestianus</i>	67	F							
03/8/03	Pisote trail	Dry	<i>H. desmarestianus</i>	71	F	A, NH	11.8	17.2	3.22	3.50	1.52	
03/8/03	Pisote trail	Dry	<i>H. desmarestianus</i>	83	F	A, NH	13.0	17.0	3.20	3.16	1.84	
03/8/03	Pisote trail	Dry	<i>D. virginiana</i>	700		J						H
04/8/03	Minas trail	Dry	<i>P. mexicanus</i>									
05/8/03	Pisote trail	Dry	<i>H. desmarestianus</i>	55	FF	A, NH	12.0	18.0	3.40	3.61	1.46	A
05/8/03	Pisote trail	Dry	<i>H. desmarestianus</i>	Recap	F							H
05/8/03	Pisote trail	Dry	<i>H. desmarestianus</i>	66	F	A	11.0	17.0				
06/8/03	Pisote trail	Dry	<i>H. desmarestianus</i>	85	M	A	14.8	16.5	3.42	3.70	1.39	
06/8/03	Pisote trail	Dry	<i>H. desmarestianus</i>	Recap	F	A	12.2	18.0				A
06/8/03	Minas trail	Dry	<i>P. mexicanus</i>									
03/7/03	Leonis River site	Dry	<i>H. desmarestianus</i>		M	A	10.6	12.3	3.02	3.08	1.71	D
03/7/03	River site	Dry	<i>H. desmarestianus</i>	75	F	A, P	12.0	18.1	3.42	3.51	1.98	F
04/7/03	River site	Rain	<i>H. desmarestianus</i>	43	F	J	8.2	11.4	2.93	2.94	1.62	G
04/7/03	River site	Rain	<i>H. desmarestianus</i>	93	F	A, NP						

Table 2 continued

04/7/03		River site	Rain	<i>H. desmarestianus</i>	34	F	J							
08/7/03	El Paraiso	Storehouse	Rain	<i>O. phyllotis</i>		M	A	13.4	12.0	2.53	3.32	1.74	E	
08/7/03		Helicop. trail	Rain	<i>D. virginiana</i>	2200		A							
08/7/03		Helicop. trail	Rain	<i>D. virginiana</i>	500		J							
08/7/03		Helicop. trail	Rain	<i>D. marsupialis</i>	350		J							
09/7/03		Helicop. trail	Dry	<i>H. desmarestianus</i>										
10/7/03		Helicop. trail	Dry	<i>D. marsupialis</i>	1700		A							
10/7/03		Helicop. trail	Dry	<i>D. virginiana</i>	2700		A							
10/7/03		Helicop. trail	Dry	<i>D. virginiana</i>	400		J							
11/8/03		Below waterfall	Rain	<i>P. mexicanus</i>	79	F	A	11.0	12.3	2.62	3.37	1.41	G	
12/8/03		Above WF	Dry	<i>D. virginiana</i>	1050									
12/8/03		Below WF	Dry	<i>P. mexicanus</i>	Recap									
13/8/03		Above WF	Dry	<i>D. virginiana</i>	1800									
13/8/03		Below WF	Dry	<i>D. virginiana</i>	1000									
15/8/03		Above WF	Dry	<i>D. virginiana</i>	550									
15/8/03		Above WF	Dry	<i>D. virginiana</i>	1600									
19/8/03		Storehouse	Dry	<i>P. mexicanus</i>	67	F	A, NP	11.4	12.9	2.79	2.18	1.59	G	
19/8/03		Storehouse	Dry	<i>P. mexicanus</i>										
19/8/03		Above WF	Dry	<i>D. virginiana</i>	1800		With young							
20/8/03		Storehouse	Dry	<i>H. desmarestianus</i>	42	F	J	10.2	14.4	3.10	3.00	1.55	D	
20/8/03		Above WF	Dry	<i>D. virginiana</i>	1800		With young							
21/8/03		Storehouse	Dry	<i>P. mexicanus</i>	62	M	A	12.0	12.9	2.60	3.20	1.52	D	
21/8/03		Storehouse	Dry	<i>P. mexicanus</i>	63	M	A	12.0	11.5	2.89	3.46	1.88	B	
21/8/03		Storehouse	Dry	<i>O. phyllotis</i>	63	F	A, NH	12.5	14.0	2.37	3.39	1.48	D	
22/8/03		Storehouse	Dry	<i>P. mexicanus</i>	Recap								B	
22/8/03		Above WF	Dry	<i>D. virginiana</i>	700									
22/8/03		Above WF	Dry	<i>D. virginiana</i>	1500									

Table 3. Morphometric measurements of bats captured within El Paraiso valley

Date	Trap location	Time processed	Weather	Species	Body weight (g)	Sex	Age / reproductive status	Tibia (cm)	Fore-arm (cm)	Ear (cm)	Tragus/*anti-tragus (cm)	Tail (cm)	Faecal sample number	Other notes
11/08/03	River trail	20:20	Some rain earlier	<i>P. parnellii</i>	16	M	A	2.28	5.82	1.77	-	1.20	1	
11/08/03	River trail	20:35		<i>P. parnellii</i>	23	M	A	2.33	6.42	1.65	-	1.21	2	
11/08/03	River trail	20:40		<i>C. perspicillata</i>	24	F	A	2.20	4.41	1.71	0.42	-	-	
11/08/03	River trail	21:00		<i>A. jamaicensis</i>	60	F	A, P	2.73	6.04	1.24	0.32	-	-	
11/08/03	River trail	21:15		<i>C. perspicillata</i>	24	F	A	1.93	4.39	1.52	0.43	-	-	
11/08/03	River trail	21:38		<i>A. jamaicensis</i>	64	F	A	2.60	6.17	1.45	0.43	-	-	
11/08/03	River trail	21:46		<i>C. perspicillata</i>	16	M	A	1.85	3.94	1.40	0.45	-	-	
11/08/03	River trail	21:51		<i>C. perspicillata</i>	20	M	A	2.15	4.30	1.50	0.45	-	-	
11/08/03	River trail	22:02		<i>C. perspicillata</i>	16	F	A	1.80	4.16	1.30	0.31	-	-	3
11/08/03	River trail	22:13		<i>P. parnellii</i>	22	F	A	2.31	5.96	1.64	-	1.14	4	
11/08/03	River trail	22:42	<i>S. lilum</i>	14	M	A	1.85	3.66	1.35	0.35	-	-		
11/08/03	Also captured and released straight from trap: One <i>P. parnellii</i> , two <i>C. perspicillata</i> and two <i>A. jamaicensis</i>													
12/08/03	River trail	20:19	Heavy rain earlier	<i>P. parnellii</i>	21	M	J	2.43	6.09	1.65	0.30	0.87	6	
12/08/03	River trail	20:23		<i>M. megalophylla</i>	18	M	A	2.43	5.57	1.31	0.31	1.64	7	
12/08/03	River trail	20:30		<i>P. parnellii</i>	20	F	A	2.42	5.82	1.45	-	1.25	5	
12/08/03	River trail	20:35		<i>P. parnellii</i>	19	F	A	2.28	6.04	1.65	-	1.22	8	
12/08/03	River trail	20:40		<i>P. parnellii</i>	23	F	A	2.33	5.86	1.65	-	1.20	9	
12/08/03	River trail	20:45		<i>L. aurita</i>	16	M	A	2.20	4.91	2.70	1.65	-	10	nose leaf 2.43cm
12/08/03	River trail	21:00		<i>C. perspicillata</i>	19	M	J	2.19	4.41	1.61	0.52	-	-	
12/08/03	River trail	21:50		<i>C. perspicillata</i>	17	M	A	2.22	4.59	1.52	0.39	-	11	
12/08/03	River trail	21:55		<i>P. parnellii</i>	18	F	A	2.30	5.90	1.28	-	1.10	12	
12/08/03	River trail	22:01		<i>P. parnellii</i>	20	F	A	2.44	5.70	1.77	-	1.27	13	
12/08/03	River trail	22:07	<i>C. perspicillata</i>	25	M	A	1.99	4.50	1.33	0.45	-	-		
12/08/03	River trail	22:10	<i>P. parnellii</i>	20	M	A	2.29	5.95	1.66	-	1.07	14		
13/08/03	River trail	19:40	Mostly dry	<i>M. megalophylla</i>	16	F	A	2.47	5.60	1.22	0.43	1.22	15	
13/08/03	River trail	19:45		<i>C. perspicillata</i>	19	F	A, P	2.05	4.52	1.33	0.40	-	-	

Table 3 continued.

13/08/03	River trail	19:51		<i>C. perspicillata</i>	30	F	A, P	2.20	4.68	1.34	0.44	-	16	
13/08/03	River trail	19:55		<i>C. perspicillata</i>	14	M	J	1.68	3.98	1.31	0.33	-	-	
13/08/03	River trail	20:36		<i>C. perspicillata</i>	25	F	A, P	2.16	4.54	1.56	0.37	-	-	
13/08/03	River trail	20:50	Rain	<i>D. rotundas</i>	29	F	A	2.62	6.06	1.38	0.49	-	17	
13/08/03	River trail	21:34		<i>A. lituratus</i>	69	F	A	2.06	7.26	1.72	0.43	-	-	
13/08/03	River trail	22:34		<i>P. parnellii</i>	21	M	A	2.30	6.08	1.45	-	1.20	18	<u>Humerus</u>
14/08/03	River trail	20:14	Dry	<i>G. soricina</i>	14	F	A	1.44	3.60	0.82	0.25	0.23	19	2.00
14/08/03	River trail	20:30		<i>S. lilum</i>	22	F	A P?	1.62	3.98	1.12	0.40	-	20	2.26
14/08/03	River trail	21:05		<i>C. perspicillata</i>	27	M	A	2.08	4.21	1.36	0.53	-	21	2.43
17/08/03	By vols' house	20:46		<i>M. sinaloae</i>	17	F	A	1.68	4.59	1.14	0.29	4.43	-	2.74
19/08/03	By vol's house	20:34		<i>M. ater</i>	29	M	A	2.00	5.08	1.34	0.44*	4.47	22	3.05
20/08/03	Trail above helicopter pad	19:57		<i>A. watsoni</i>	23	M	A	1.70	3.98	1.14	0.28	-	-	2.38
20/08/03	Helicopter	20:18		<i>Artibeus spp.</i>	13	F	A, P	1.49	3.81	1.23	0.30	-	-	2.27
20/08/03	Helicopter	21:10		<i>T. tricolor</i>	3	F	A	1.53	3.71	1.29	-	2.65	-	1.61
21/08/03	Helicopter	19:48		<i>A. watsoni</i>	12	M	A	1.55	3.71	1.05	0.33	-	-	1.92
21/08/03	Helicopter	19:54		<i>P. helleri</i>	21	F	A, P	1.69	4.00	1.36	0.37	-	-	2.43
21/08/03	Helicopter	20:03		<i>A. watsoni</i>	12	M	A	1.44	3.66	1.22	0.37	-	-	2.38
21/08/03	Helicopter	21:18		<i>G. soricina</i>	10	F	A	1.34	3.34	0.95	0.37	0.60	-	2.21

