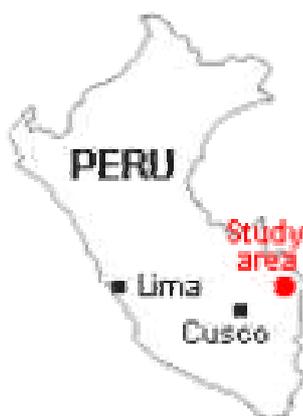


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Expedition report

Surveying monkeys, macaws and other wildlife of the Peru Amazon.



Expedition dates: 15 June – 25 July 2003

Report published: December 2003

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Abstract

In 2003 Biosphere Expeditions completed a second successful year of biodiversity investigations at the Piedras Biodiversity Station along the River Las Piedras in the Per Amazon. This year the expedition ran between 15 June and 25 July 2003 and concentrated on four projects.

The herpetology project was the first of its kind for the Piedras river system and in just four weeks the expedition collected and identified 71 species of frog, toad and reptile, a considerable number for such a short period of time.

Data collection continued on the mammal transects and at the macaw colpa. The mammal transect investigations collected data on animal populations and compared populations in a hunted versus a non-hunted area.

At the macaw colpa the team continued to investigate the impacts of boat traffic on parrot feeding behaviour and looked at species composition and numbers.

A further study was carried out at a mammal colpa. Using combined print traps and a remote sensor video camera 14 species of bird and animal were recorded feeding at the colpa.

En 2003 Biosphere Expeditions completo un segundo año exitoso de investigación en el Río Las Piedras. Este año la expedición se dió entre 15 de Junio y el 25 de Julio y se concentró en 4 proyectos.

El proyecto de Heptofauna fue el primero de este tipo en el Río Las Piedras. En solamente 4 semanas miembros de la expedición trabajando con Margarita Medina Muller, una bióloga Peruana, colectaron y identificaron 71 especies de rana, sapo y reptiles, un numero considerable por un periodo tan corto.

La colección de datos se continua con los transectos de mamíferos y en la colpa de Guacamayos. Los transectos de mamíferos reúne datos sobre poblaciones de animales y comparan las poblaciones en una zona donde se realiza cazaría contra una zona donde no se caza.

En la colpa de guacamayos se continua estudiando el impacto de trafico de botes sobre el comportamiento de alimentación de Guacamayos y observación de las especies y los números de individuos.

Otro estudio adicional se realizó en la colpa de mamíferos usando una combinación de trampas de huellas y una camera de video censor. 14 especies de aves y animales fueran registrado en la colpa.

Contents

Abstract	1
Contents	2
1. Expedition Review	3
1.1. Background	3
1.2. Research Area	3
1.3. Dates	4
1.4. Local Conditions & Support	5
1.5. Local Biologist	6
1.6. Expedition Leader	6
1.7. Expedition Team	6
1.8. Expedition Budget	8
1.9. Acknowledgements	9
1.10. Further Information & Enquiries	9
2. Mammal survey	10
2.1. Introduction	10
2.2. Location	10
2.3. Survey Methods	10
2.4. Results	12
2.5. Discussion	15
2.6. References	16
2.7. Appendices	17
3. A study of the diversity of mammals visiting a colpa in SE Peru	18
3.1. Introduction	18
3.2. Location	18
3.3. Methods	19
3.4. Results	19
3.5. Discussion	22
3.6. References	23
4. Human and other impacts on the behaviour of parrots & macaws at a clopa	24
4.1. Introduction	24
4.2. Location and Methods	24
4.3. Results	25
4.4. Discussion	29
4.5. References	30
5. Evaluation of the herpetofauna near the River Piedras in SE Peru	31
5.1. Introduction	31
5.2. Location	31
5.3. Materials and Methods	31
5.4. Results	32
5.5. Discussion	35
5.6. References	36
5.7. Acknowledgements	37
6. Mapping of the research area	38
7. Expedition leader's diary	40

1. Expedition Review

Matthias Hammer (editor)
Biosphere Expeditions

1.1. Background

Biosphere Expeditions runs wildlife conservation research expeditions to all corners of the Earth. Our projects are not tours, photographic safaris or excursions, but genuine research expeditions placing ordinary people with no research experience alongside scientists who are at the forefront of conservation work. Our expeditions are open to all and there are no special skills (biological or otherwise) required to join. Our expedition team members are people from all walks of life, of all ages, looking for an adventure with a conscience and a sense of purpose. More information about Biosphere Expeditions and its research expeditions can be found at www.biosphere-expeditions.org.

This expedition report deals with an expedition to Peru that ran from 15 June to 25 July 2003. Rapid Assessment Programs (RAPs) are snap-shot studies of an area, investigating the flora and fauna present in order to create species lists and determine relationships and impacts that may exist. The expedition's RAP included visual encounter surveys, mammal and bird censuses at so-called colpas (sites where animals congregate to eat soil), a reptile census and macaw behavioural studies.

Increasing economic development is putting a strain on the natural resources of the Peruvian Amazon. Unsustainable forms of farming and tourism are on the rise, especially along the Tambopata River, an area renowned for its biodiversity. The River Piedras represents an adjacent river system, connecting Tambopata and Manu, which has never been studied and has far less human presence than Tambopata. However, unlike Tambopata and Manu, Piedras is not protected and official protection is unlikely. For this reason vital research needs to be carried out and the results presented to conservation groups in an effort to conserve this unique tract of rain forest through activities such as ecotourism and sustainable forestry. Data collected by this expedition and the example set by the Piedras Biodiversity Station will be crucial in showing to locals and local decision-makers the level of Piedras biodiversity, how this can be protected through private schemes and preserved through sustainable management practices.

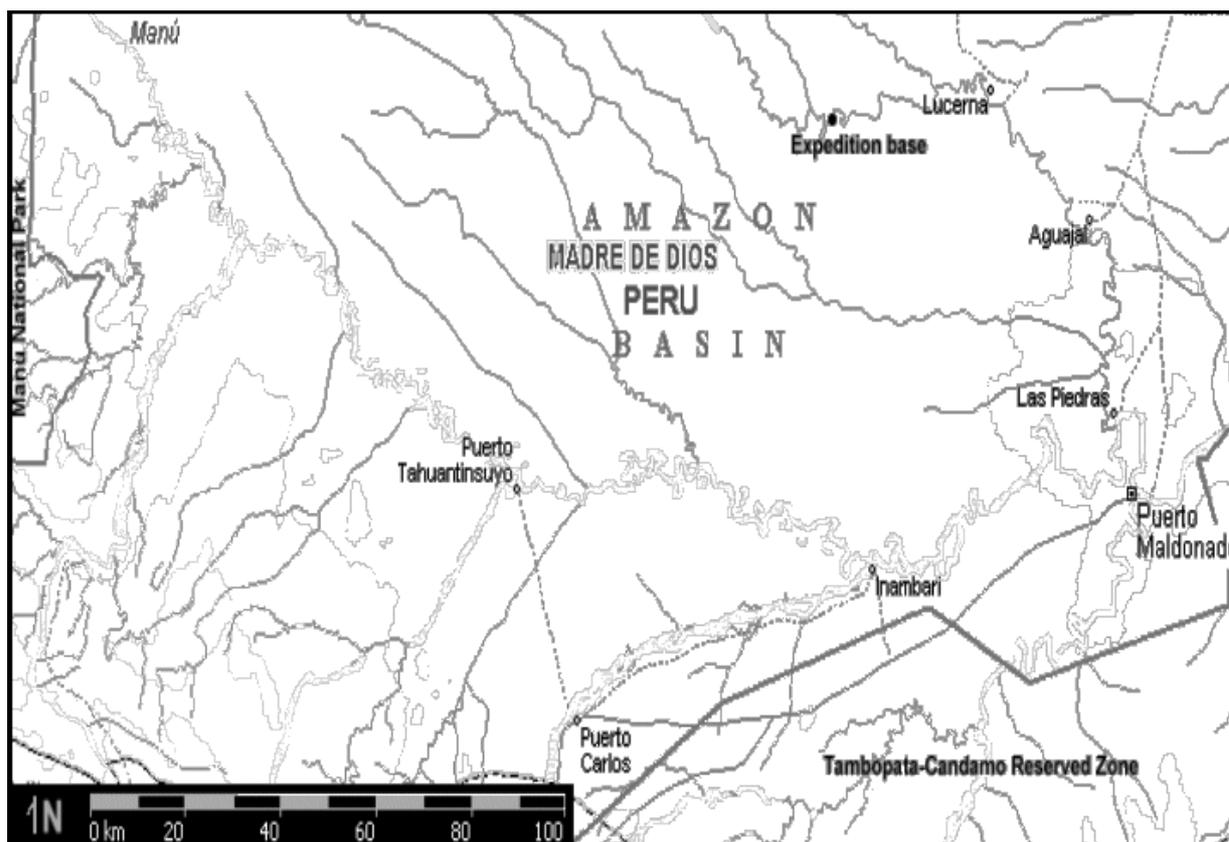
1.2. Research Area

Peru is located on the Pacific coast of South America and is the third largest country on the continent. Two thirds of Peruvian territory is located within the Amazon basin. The expedition base camp is within the department of Madre de Dios, internationally known as “the Biodiversity Capital of the World”. The department already contains two large national parks covering over half of its 78,000 km² area – Manu and the vast Bahuaja-Sonene (Tambopata) area. The Rio Piedras is located between the two.

In terms of biological diversity, the research area is amongst the richest in the world. Research conducted over the last 20 years in the Bahuaja-Sonene National Park has shown that it harbours more species of birds (587), butterflies (1,230) and many other

animal taxa than any other location of comparable size. Most recently it has also been identified as the largest uninhabited and untouched rain forest wilderness on Earth, covering about 1 million hectares (2.5 million acres) of undisturbed and un hunted habitat (the nearest rival, the island of New Guinea has about 100,000 hectares of uninhabited tropical forest habitat).

The area is also home to a number of landmark animals listed in the IUCN's Red Data Book. Amongst them the giant river otter, giant armadillo, giant anteater, ocelot, jaguarundi, jaguar, harpy eagle, crested eagle, spectacled caiman, and black caiman. Over 150 different species of tree can be found within 100 m² alone, and the WWF and IUCN have identified the area as a 'Centre of Plant Diversity'.



Map of the area showing Puerto Maldonado (assembly point), Manu (NW corner), Tambopata-Candamo (SE corner) and base camp location (N edge).

1.3. Dates

The expedition ran over a period of six weeks divided into three two-week slots, each composed of a team of international research assistants, guides, support personnel and an expedition leader. Expedition team dates were

15 June – 27 June 2003

29 June – 11 July 2003

13 July – 25 July 2003

Dates were chosen to coincide with the beginning of the dry season when data are most valuable, because the environment is relatively stable.

1.4. Local Conditions & Support

The area lies within the confines of the Amazon basin in SE Peru with a sub-tropical climate and distinct wet and dry seasons, the wet season being between October and April when it rains nearly every day and the humidity is high, around 90% inside the forest. During the dry season temperatures can rise to 35 °C but the humidity tends to be lower. Between May and July cold weather events known as *friajes* can occur when cold fronts move in from the South and temperatures drop to between 8-15 °C for up to 8 days. The area's ecosystems hold several world records in flora and fauna species numbers and are recognised as one of the planet's hotspots of biodiversity. Rainfall averages 2,000 mm per year and humidity averages about 75%.

The expedition was based in a remote region along the Las Piedras river. The expedition gained access to the site in approximately 7 hours from Puerto Maldonado. Once at base camp, all research sites apart from the macaw colpa were accessible by foot. The macaw colpa is 10 minutes upstream from the base camp by boat.

Base camp was a large, comfortable jungle lodge / research station made from local materials. The lodge has double rooms, showers and toilets. Team members paired up to share rooms. All meals were prepared for the team by the expedition cook and vegetarians could be catered for. There was no electricity at base camp.

Field communications

The research site is outside mobile phone coverage. Where possible Motorola GP320 two-way radios were used for communication between research teams and around base. However, because of the dense jungle foliage in practice this meant that radio-to-radio coverage, even on 5 Watt, was limited to fewer than 1000 m inside the forest and 2 – 5 km along the rivers. The lodge had a long-distance radio for emergency communication with Puerto Maldonado and the expedition carried a Motorola satellite phone for emergency calls and for daily internet connection. This was found to work well, especially since a special cone antenna was used to pick up satellite signals. Costs of this type of internet connection, however, are high (\$1 per minute flat rate), and speeds slow (9600 bits per second).

Transport & vehicles

Team members made their own way to the Puerto Maldonado assembly point. From there transport to the base camp involved a boat ride of approximately seven hours. Once at base most studies were conducted on foot. All transport, boats & vehicles were provided from the expedition team assembly point onwards and back.

Medical support & insurance

The expedition leader was a fully trained medical doctor, and the expedition carried a comprehensive medical kit. Further medical support was provided through a medical post in the Colpayo community, about 2 hours by boat, where there is an appointed expedition nurse. The nearest hospital is in Puerto Maldonado, about 6 hours by boat. All team members were required to carry adequate travel insurance covering emergency medical evacuation and repatriation.

A member of the Peruvian staff, who was a known epileptic, suffered two grand mal seizures during the expedition and was treated with parenteral diazepam. This was the only serious medical incidence. Apart from that there were a few insect bites and stings, and a few minor stomach upsets.

1.5. Local Biologist

The expedition's local biologist is Emma Hume. Born and raised in England, she first came to Peru in 1994 and hasn't been able to leave since. After spending a year working on conservation projects in Australia, she studied Natural Environmental Science at Sheffield University and shortly after went to Peru to work as a Resident Naturalist for Explorers Inn – one of the big lodges in Tambopata. She has also been an operations manager of another lodge and has worked as a naturalist guide in Tambopata and Manu. She set up the Piedras Biodiversity Station along with her partner Juan Julio, a local guide. She has travelled extensively including an expedition to the Tien Shan Mountains, Kyrgyzstan.

1.6. Expedition Leader

The expedition was led by Dr. Konrad Schmidt. Konrad was born and educated in Germany. He joined Biosphere Expeditions in 2003, just after having graduated from medical school. Interested in bushcraft and nature conservation from early on, he has travelled extensively around South America (where amongst other things he constructed a nature trail in the Chilean rain forest in cooperation with local students), Europe and China. His passion is for wildlife, climbing and mountaineering and Konrad is a former leader of a German scout association and a recognised guide of the German Alpine Club. When not leading expeditions into the field, Konrad works as a medical doctor in orthopedics.

1.7. Expedition Team

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of all ages, nationalities and backgrounds

15 June – 27 June 2003

Neil Crofts (UK), Lindy & Mark Edwards (UK), Janet & Alan Hoffberg (USA), Jörg Holdenried (Germany), Angela Moore (UK), Cara Morrison (UK), Diana Stephens (UK).

29 June – 11 July 2003

Sheila Boughton (UK), Emma Hawthorne (UK), David Hewitt (UK), Jörg Holdenried (Germany), Sandra McGraw (UK), Angela Moore (UK), Cara Morrison (UK), Carlo Risi (UK), Jay Ryles (UK).

13 July – 25 July 2003

Danielle Assemakis (UK), Amanda Atherton (UK), Claudia Gahlen (Germany), Syd Goldlust (USA), Joseph Inbar (USA), Maggie Neal (UK), Carlo Risi (UK), Gerhard Rölle (Germany), Winfried Straub (Germany)

Staff (throughout the above period)

Emma Hume (field biologist), Juan Julio Durand (guide), Pico Durand (supplies & logistics), Margarita Medina (herptologist), Jose Durand (boat driver), Orlando (tracker), Lucio (cook), Melissa (kitchen assistant),

1.8. Expedition Budget

Each team member paid towards expedition costs a contribution of £1100 per person per two week slot. The contribution covered accommodation and meals, supervision and induction, all maps and special non-personal equipment, all transport from and to the team assembly point. It did not cover excess luggage charges, travel insurance, personal expenses like telephone bills, souvenirs etc., as well as visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how this contribution was spent are given below.

Income	£	
Expedition contributions	28,396	
Expenditure		% of which spent directly on project
Camp includes accommodation, food, gas, wood, phone and other comms	1,866	100
Transport includes fuel, parts for transport from Puerto to and around camp	1,365	100
Equipment and hardware includes research materials, research gear	1,674	84
Staff includes salaries, travel and expenses to camp, tips, gifts	8,944	100
Team recruitment Peru as estimated % of PR costs for Biosphere Expeditions	5,900	100
Income – Expenditure (unadjusted)	20,057	
Income – Expenditure (adjusted to % spent on project)	19,789	
Total percentage spent directly on project	70%	

1.9. Acknowledgements

This study was conducted by Biosphere Expeditions which runs wildlife conservation expeditions all over the globe. Without our expedition team members, who are listed above and provided an expedition contribution and gave up their spare time to work as research assistants, none of this research would have been possible. The support team and staff, also mentioned above, were central to making it all work on the ground. Thank you to all of you, and the ones we have not managed to mention by name (you know who you are) for making it all come true. A special thanks to Emma Tatum-Hume, our local biologist, and her partner Juan J. Durand Torres, our guide, for giving us inspiration and the world the wonderful Piedras Biodiversity Station to live and work in. Biosphere Expeditions would also like to thank WASAI lodge and its staff for providing logistical support, as well as Land Rover, Motorola, Silva, Field & Trek, Globetrotter Ausrüstung and Gerald Arnhold for their sponsorship.

1.10. Further Information & Enquiries

More background information on Biosphere Expeditions in general and on this expedition in particular including pictures, diary excerpts and a copy of this report can be found on the Biosphere Expeditions website www.biosphere-expeditions.org.

Enquires should be addressed to Biosphere Expeditions at the address given below.

2. Mammal survey

Emma Tatum-Hume
Piedras Biodiversity Station

2.1. Introduction

This study is part of a long term investigation looking at the impacts of subsistence hunting on mammal populations in the Las Piedras River, Southeast Peru. We used two treatments, one a hunted site (active site), the other a site where no hunting has occurred during the last four years (inactive site). At each treatment site, line transect census techniques were used to assess the biodiversity and relative abundance of large mammals and hunted bird species. A total of 179.1 km were walked during the census and 23 mammal species recorded, 20 species on the inactive transect and 16 on the active transect. For the majority of species, especially those which are more likely to be hunted, the abundance of mammals on the active transect was roughly half that of the inactive transect.

2.2. Location

The study was carried out as part of a research expedition conducted by Biosphere Expeditions and the Piedras Biodiversity Station. The expedition ran from 14 June to 25 July 2003 and studies were conducted between 17 June and 24 July 2003. The expedition base was the Piedras Biodiversity Station on the banks of the river Las Piedras, approximately 60 km Northwest (approximate bearing 325°) along the River Las Piedras (GPS position S 12° 05.663' W 69° 52.852'). This remote site can be reached by river taking approximately 7 hours in a boat with outboard motor.

The river Las Piedras lies between Tambopata and Manu, two areas in Southeast Peru renowned for high biodiversity and protected by the Peruvian government as a Reserve Zone and a National Park respectively. Lying adjacent to these areas, Piedras until recently has received little human impact and no research had previously been carried out in the area. The study site consists mainly of lowland tropical rainforest that receives an average annual rainfall of approx. 2,500 mm. The wet season is from October to April and the mean temperature 27°C. Mahogany wood was selectively extracted from the base camp area, the site of the inactive transect, four years ago, but since then the only human presence has been the once yearly visits of 'Los Castañeros', a family that stays in the area for up to one month to extract Brazil nuts. The active transect began on the opposite side of the river from camp. A family have been living downstream from this transect for the past 22 years and they and other woodcutters sporadically hunt and take out wood from the area.

2.3. Survey Methods

The expedition survey team consisted of several paying but untrained team members who gave up their holiday time to assist in the research project. Their work and expedition contribution made the research possible. Teams were at base camp for two weeks and then changed over with some people staying for more than one two week slot. Teams consisted of nine expedition members, plus one expedition leader, one field biologist, one guide, one mammal spotter and various support personnel (the

latter not participating in the survey). Expedition team members were trained by the field scientist and guide in visual animal and bird recognition and made familiar with the calls and behavior of the most common mammals that inhabit the area.

Data was collected from two line transects which were both prepared the previous year using standardized techniques (Peres 1999). They were measured and marked with plastic tape every 50 m to allow measurement of distance travelled. The inactive transect began 1.5 km from base camp and was 4.25 km long. The active transect began on the opposite side of the river from camp and was 3.44 km long.

Transect surveys have proven to be the most reliable method of producing relative abundance data in rainforest environments. Previous studies (Perez 1999, Emmons 1984) recorded primates, caviomorph rodents, sciurids, ungulates, cracids, trumpeters, tinamous, wood quails and a number of species of avian canopy frugivores. In this study the only bird species included were those that are commonly hunted such as spix's guan (*Penelope jacquacu*), blue-throated piping guan (*Aburria pipile*), razor-billed curassow (*Mitu tuberosa*) and pale-winged trumpeter (*Psophia crepitans*). All mammal species encountered on the transects were recorded. Of particular interest are those that are considered to be preferred bushmeat species. These include spider monkeys (*Ateles belzebug*), howler monkeys (*Alouatta seniculus*), white-lipped peccaries (*Tayassu peccari*), collared peccaries (*Tayassu tajacu*), red brocket deer (*Manzama americana*) and tapir (*Tapirus terrestris*) (Schulte-Herbruggen et al. 2003). The transects were walked daily between 06:00 – 10:30 to avoid the hottest part of the day when animals tend to be less active (Peres 1999). If it rained whilst on the transect for more than ten minutes, the transect was abandoned as rain decreases the observer's ability to detect species.

The transects were walked at an average speed of 1.2 km/h and took between three and four hours to complete. For each detection event the observers recorded the time, distance along the transect, species, number of individuals, the perpendicular distance from the trail, group width, cue (how first detected), demography, visibility and weather conditions (see Fig. 2.3a). The perpendicular distance on the inactive trail was measured with a Leica rangefinder.

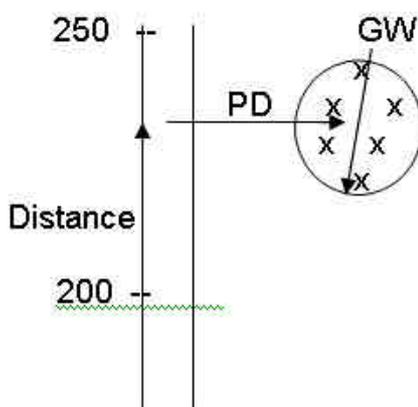


Figure 2.3a. Schematic diagram of data recorded, where GW is group width, PD is perpendicular distance.

Data from both transects was combined to produce Fig. 2.3b, which shows at what distance from the center of the transects the highest frequency of mammals were encountered. As can be seen, the majority of mammals were first sighted on the transect itself which demonstrates that mammals are not avoiding the transects due to hunting and that the data collected is reliable in so far as that mammals were encountered before they were alerted to the researchers' presence.

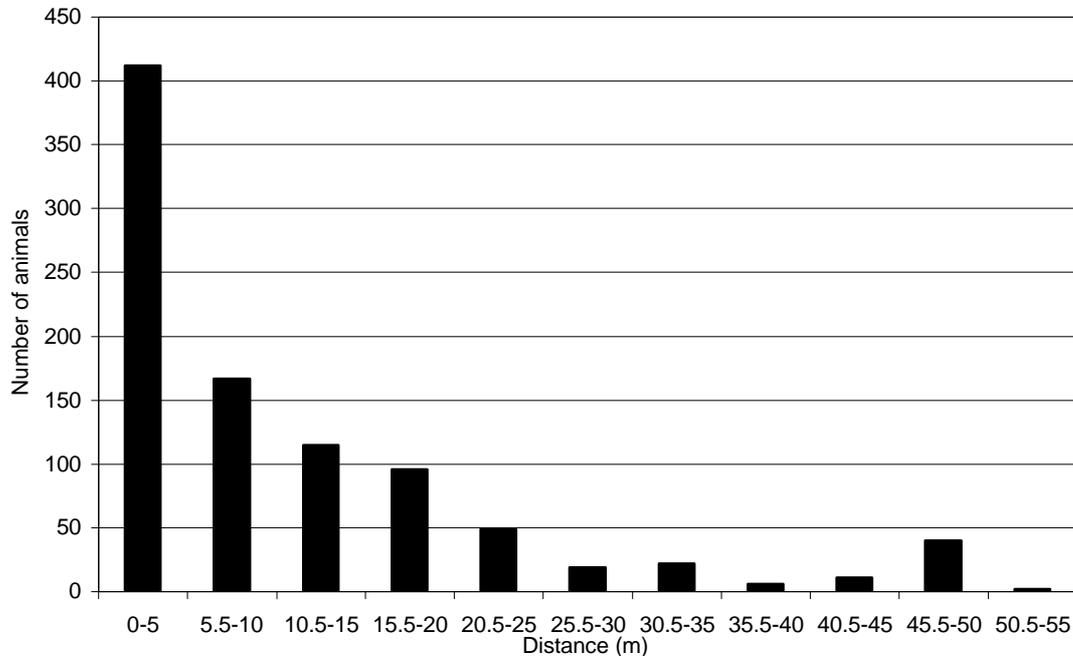


Figure 2.3b. Frequency distribution of perpendicular distance for both transects.

Mammal densities can be calculated from line transect methodology (Bodmer et al. 1997), but require a large number of observations for meaningful analysis. 20 observations per species is the minimum recommended for density analysis, the ideal is 40. During this study the minimum number of observations was only achieved for four species at the inactive site (brown capuchins, saddle-back tamarins, South American red squirrel and spix guan). Relative estimates of animal abundances were therefore used to compare the different populations between the active and inactive site (groups per 10 km, animals per 10 km).

2.4. Results

The total length of transect censored was 179.1 km, 127.5 km at the inactive site and 51.6 km at the active site. A total of 20 species were recorded from direct observation and from track identification on the inactive transect, 16 species were identified on the active transect.

On both transects the most commonly seen animal was the saddle-back tamarin and the most commonly seen bird the spix guan. The relative abundance of both species was almost 50% lower at the active site compared to the inactive.

Table 2.4a. Observations from the two transects. The first row shows the total number of group encounters, the second row the number of group encounters per 10 km walked and the third row the number of individuals per 10 km walked. The end column shows the percentage change from the active to the inactive site.

Species		Inactive transect	Active transect	% change from active to inactive
MAMMALS				
Saddle-backed tamarin <i>Saguinus fuscicollis</i>	Total group encounters	33	9	-73
	Group encounters per 10 km	2.59	1.74	-33
	Individuals per 10 km	13.25	6.78	-49
Dusky ti-ti <i>Callicebus moloch brunneus</i>	Total group encounters	5	0	-100
	Group encounters per 10 km	0.39	0	-100
	Individuals per 10 km	1.18	0	-100
Squirrel monkey <i>Samiri sciureus sciureus</i>	Total group encounters	3	1	-67
	Group encounters per 10 km	0.24	0.19	-21
	Individuals per 10 km	5.49	6.20	13
Brown capuchin <i>Cebus apella</i>	Total group encounters	21	5	-76
	Group encounters per 10 km	1.65	0.97	-41
	Individuals per 10 km	6.43	3.10	-52
White-fronted capuchin <i>Cebus albifrons</i>	Total group encounters	6	4	-34
	Group encounters per 10 km	0.47	0.78	65
	Individuals per 10 km	1.8	2.52	40
Monk saki <i>Pithecia monachus</i>	Total group encounters	9	0	-100
	Group encounters per 10 km	0.71	0	-100
	Individuals per 10 km	2.27	0	-100
Red howler <i>Alouatta seniculus</i>	Total group encounters	13	3	-77
	Group encounters per 10 km	1.02	0.58	-43
	Individuals per 10 km	3.22	1.55	-52
Spider monkey <i>Ateles belzebuth</i>	Total group encounters	6	1	-83
	Group encounters per 10 km	0.47	0.19	-60
	Individuals per 10 km	2.12	1.36	-36
Red brocket deer <i>Manzama americana</i>	Total group encounters	11	1	-90
	Group encounters per 10 km	0.86	0.19	-78
	Individuals per 10 km	0.94	0.19	-80
Grey brocket deer <i>Manzama gouazoubira</i>	Total group encounters	3	0	-100
	Group encounters per 10 km	0.24	0	-100
	Individuals per 10 km	0.24	0	-100
Collared peccary <i>Tayassu tajacu</i>	Total group encounters	4	3	-25
	Group encounters per 10 km	0.31	0.58	87
	Individuals per 10 km	1.02	1.94	90
White-lipped peccary <i>Tayassu pecari</i>	Total group encounters	8	0	-100
	Group encounters per 10 km	0.63	0	-100
	Individuals per 10 km	10.67	0	-100
South American red squirrel <i>Sciurus spadiceus</i>	Total group encounters	37	16	-57
	Group encounters per 10 km	2.9	3.10	7
	Individuals per 10 km	3.69	3.29	-11
Grey squirrel sp. <i>Sciurus spp.</i>	Total group encounters	7	3	-57
	Group encounters per 10 km	0.55	0.58	3
	Individuals per 10 km	0.55	0.58	3

Table 2.4a continued. Observations from the two transects.

Species		Inactive transect	Active transect	% change from active to inactive
Brown agouti	Total group encounters	12	3	-75
<i>Dasyprocta variegata</i>	Group encounters per 10 km	0.94	0.58	-38
	Individuals per 10 km	0.94	0.58	-38
Paca	Total group encounters	0	2	100
<i>Agouti paca</i>	Group encounters per 10 km	0	0.39	100
	Individuals per 10 km	0	0.39	100
South American coati	Total group encounters	2	0	-100
<i>Nasua nasua</i>	Group encounters per 10 km	0.24	0	-100
	Individuals per 10 km	0.24	0	-100
Southern tamandua	Total group encounters	0	3	100
<i>Tamandua tetradactyla</i>	Group encounters per 10 km	0	0.58	100
	Individuals per 10 km	0	0.58	100
Armadillo sp	Total group encounters	0	1	100
<i>Dasypus spp.</i>	Group encounters per 10 km	0	0.19	100
	Individuals per 10 km	0	0.19	100
Brazilian tapir		Tracks	Tracks	
<i>Tapirus terrestris</i>				
Jaguar		Heard, tracks, scat	Tracks	
<i>Panthera onca</i>				
Puma		Tracks & scat		
<i>Puma concolor</i>				
Ocelot		Tracks & scat		
<i>Leopardus pardalis</i>				
Total number of mammal species recorded		20	16	
BIRDS				
Spix guan	Total group encounters	35	8	-77
<i>Penelope jacquacu</i>	Group encounters per 10 km	2.75	1.55	-44
	Individuals per 10 km	4.47	2.33	-48
Blue throated piping guan	Total group encounters	10	2	-70
<i>Pipile cumanensis</i>	Group encounters per 10 km	0.78	0.58	-26
	Individuals per 10 km	1.10	0.78	-29
Razor-billed curassow	Total group encounters	2	2	0
<i>Mitu tuberosa</i>	Group encounters per 10 km	0.16	0.39	144
	Individuals per 10 km	0.16	0.39	144
Pale-winged trumpeter	Total group encounters	8	1	88
<i>Psophia leucoptera</i>	Group encounters per 10 km	0.63	0.19	-70
	Individuals per 10 km	2.27	0.58	-75
Total number of bird species recorded		4	4	
Total sample effort (km)		127.50	51.60	

2.5. Discussion

The survey has revealed some interesting facts. Species which locals prefer to hunt such as the spider monkey, red brocket deer and white lipped peccary were all found to have from between a 35% to 100% lower abundance on the active transect compared to the inactive one. This strongly suggests that hunting is affecting populations of these animal species. The collared peccary is also hunted, but as its abundance was found to be higher on the active transect, hunting may not yet have had an impact on this species. Interestingly, abundance levels of monkey species other than hunted species were found to be higher on the inactive transect. Only time and continued study will reveal if this is an effect of human presence, the time of year or other variables.

Not only does hunting appear to have caused a decrease in abundance of preferred bushmeat species, but also there was a decrease in the number of species seen overall on the active transect. For example, the timid Saki monkey was only recorded on the inactive transect, but this species was not seen on the active transect. As this species is particularly sensitive to human presence, it is highly likely that localised hunting has caused this species to move further away.

Large bird species such as guans, curassows and trumpeters are usually the first bird species to disappear from an area that is hunted (Peres 1999). Trumpeters in particular tend to inhabit areas well away from human disturbance (Hilty & Brown 1986). Spix guan, common piping guan, razor-billed curassow and pale-winged trumpeter were all recorded on both transects, although abundance was lower for all species except the razor-billed curassow on the active transect, suggesting that hunting may be decreasing local populations.

Results show that hunting is affecting both numbers of species and numbers of individuals of preferred bushmeat species. The fact that these species are still encountered means that hunting is still at a sustainable level and has not made these species locally extinct. The collection of more data and over a longer period of time will enable more definite conclusions to be drawn and help proposals to be made on how to maintain mammal populations in an area with human presence.

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2.7. Appendices

Appendix 2.7a. List of medium to large size mammal species seen around the station to date.

White-lipped Peccary <i>Tayassu pecari</i>	Giant Anteater <i>Myrmecophaga tridactyla</i>
Collared Peccary <i>Tayassu tajacu</i>	Giant Armadillo (T) <i>Priodontes maximus</i>
South American Coati <i>Nasua nasua</i>	Neotropical otter <i>Lontra longicaudis</i>
Spider Monkey <i>Ateles paniscus</i>	Brazilian Rabbit <i>Sylvilagus brasiliensis</i>
Red Howler Monkey <i>Alouatta seniculus</i>	Capybara <i>Hydrochaeris hydrochaeris</i>
Monk Saki Monkey <i>Pithecia monachus</i>	Amazon Bamboo Rat (H) <i>Dactylomys dactylinus</i>
Brown Capuchin <i>Cebus apella</i>	Red Acouchy <i>Myoprocta acouchy</i>
White-fronted Capuchin <i>Cebus albifrons</i>	Tapir <i>Tapirus terrestris</i>
Dusky Ti-Ti Monkey <i>Callicebus brunneus</i>	Jaguar <i>Panthera onca</i>
Night Monkey <i>Aotus trivirgatus</i>	Puma <i>Puma concolor</i>
Squirrel Monkey <i>Saimiri sciureus sciureus</i>	Ocelot <i>Leopardus pardalis</i>
Saddle-backed Tamarin <i>Saguinus fuscicollis</i>	Jaguarundi (T) <i>Herpailurus yaguarundi</i>
South American Red Squirrel <i>Sciurus spadiceus</i>	Tayra <i>Eira barbara</i>
Bolivian Squirrel <i>Sciurus ignitus</i>	Nine-banded Armadillo <i>Dasybus novemcintus</i>
Grey Brocket Deer <i>Mazama gouazoubira</i>	Brown Agouti <i>Dasyprocta variegata</i>
Red Brocket Deer <i>Mazama americana</i>	Paca <i>Agouti paca</i>

T – tracks only, H – heard only.

3. A study of the diversity of mammals visiting a colpa in Southeastern Peru

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3.1. Introduction

There are currently few studies reporting on the use of clay licks (or so called colpas) by Amazonian wildlife. This study monitored how wildlife utilised a colpa near the river Las Piedras, Department of Madre de Dios, Southeast Peru. Colpas are sites which herbivores and omnivores visit to ingest soil, a phenomenon known as geophagy. Geophagy is common throughout the world in wild animals as well as in livestock (Kreulen 1985) and has been reported in a wide range of species from primates to antelopes and giraffes. Previous studies have been concerned with the question of why certain mammals perform this behaviour. Many theories have been put forward, the main ones relate to geophagy alleviating gastrointestinal upsets or in supplementing minerals in the diet (Krishamani et al.). In the Neotropics, studies have concentrated on parrot colpas (Munn 1992, Hammer 2001), geophagy in primates (Heymann & Hartmann 1991, Izawa 1993, Müller et al. 1997) and on soil analysis (Emmons & Stark 1979). Few studies have monitored the terrestrial species using colpas or considered the best methodology to use. It is therefore hoped that this study will add significantly to those on mammalian geophagy.

In the current study track plates and a remote sensor video camera trap were used to record mammal activity. Nine species of mammal and five species of birds were recorded. The most common mammal visitor was the South American red squirrel (*Sciurus spadiceus*) and the most common bird visitor the spix guan (*Penelope jacquacu*). Visitation rates were however low for all species. Limitations were encountered with the use of both methodologies. The camera was unable to record the whole of the colpa as it did not have a wide angle lens and at night infrared light illumination was inadequate so although recordings were made, it was not possible to identify species. The limitations encountered using plates included finding a suitable substrate to use as infill and being able to cover all potential entrances to the colpa. All mammals recorded entering the colpa were herbivores, supporting existing theories for clay consumption.

3.2. Location

The colpa studied was located approximately 60 km Northwest (approximate bearing 325°) along the River Las Piedras (GPS position S 12° 07.013' W 69° 54.166'). The area is accessible by boat, taking about seven hours from the nearest town of Puerto Maldonado. The area contains at least two other mammal colpas. The forest around the colpa is 'terra firma' or 'high forest'. The colpa is a large depression in the forest floor extending back from a dried streambed. The wall at the back of the colpa was crescent in shape extending over 10 m and was approximately 1 m high. Various tree roots were exposed in the wall and it was slightly cavernous in places where animals had scraped out the soil. The floor of the colpa was very muddy with pools of stagnant water and there were a number of obvious trails leading to the colpa from which animals entered and exited. A number of branches and small trees also overhung the colpa allowing access by tree dwelling animals.

3.3. Methods

Two methods of data collection were used to try and maximise species recorded, one method making up for the other's potential shortfalls. A video camera was used as it would record movements 24 hours a day and was thought to be less intrusive than using human observers, as it had virtually no smell and made little noise. The second method used plates to record tracks of mammals entering or leaving the colpa. The main disadvantage of this method was that it would not record arboreal mammals such as monkeys and squirrels or bird species that may fly into the colpa.

A Sony DCR-TRV19E "Handycam" digital video camera and a Trailmaster TM 700v "Passive Infrared Video Trail Monitor" were used to record mammal movements. The position of the camera and sensor was changed on various occasions to try and maximise the area being recorded. The camera was checked approximately every three days to make sure that it was working and had not run out of tape. Data were taken from the tapes at the end of the survey.

To record tracks, four plates of varying sizes were laid, wide enough to cover an entrance (between 60 cm and 1.5 m) and long enough to ensure that a mammal could not step over it (on average 80 cm). Plates were checked every 24 hours at about 15:00. Each plate was checked and any mammal tracks were identified and recorded along with the plate number they were found in. The plate was then cleaned using a rake and a machete. As the survey was carried out during the dry season, the substrate frequently became too dry and so water also needed to be added so that the plates were soft enough to leave imprints of the smaller mammals.

In order to compare visitation rates for different species, rates were calculated from track records. A track identified in one of the plates was recorded as a single "hit". Even if there was more than one track present of a species on one or several plates, it was still just counted as one hit, as it was not possible to identify tracks made by different individuals. Had tracks on separate plates been recorded as separate visits, visitation rates would have been overestimated. The same theory was applied to the camera recordings. Each time a species was seen in a given 24 hour period it was counted as a "hit". As mammals passed on and off the screen it was difficult to say if it was the same individual or a different one. Had all individuals been counted as separate visits, visitation rates would have been overestimated. As data were combined in this way the visitation rates are likely to be lower than actual rates. Visitation rates were expressed as hits per seven days, ie how many times in a week a particular species visited the colpa.

3.4. Results

Data were collected over a period of 28 days between 18 June and 24 July 2003. Using only data collected by the camera, only four species of mammal were recorded and four species of bird. Plates recorded a total of eight mammal species and two bird species. When the two methods are combined a total of nine mammal species and five bird species were recorded. Red howler monkeys were also observed directly above the colpa, although not recorded feeding (Table 3.4a).

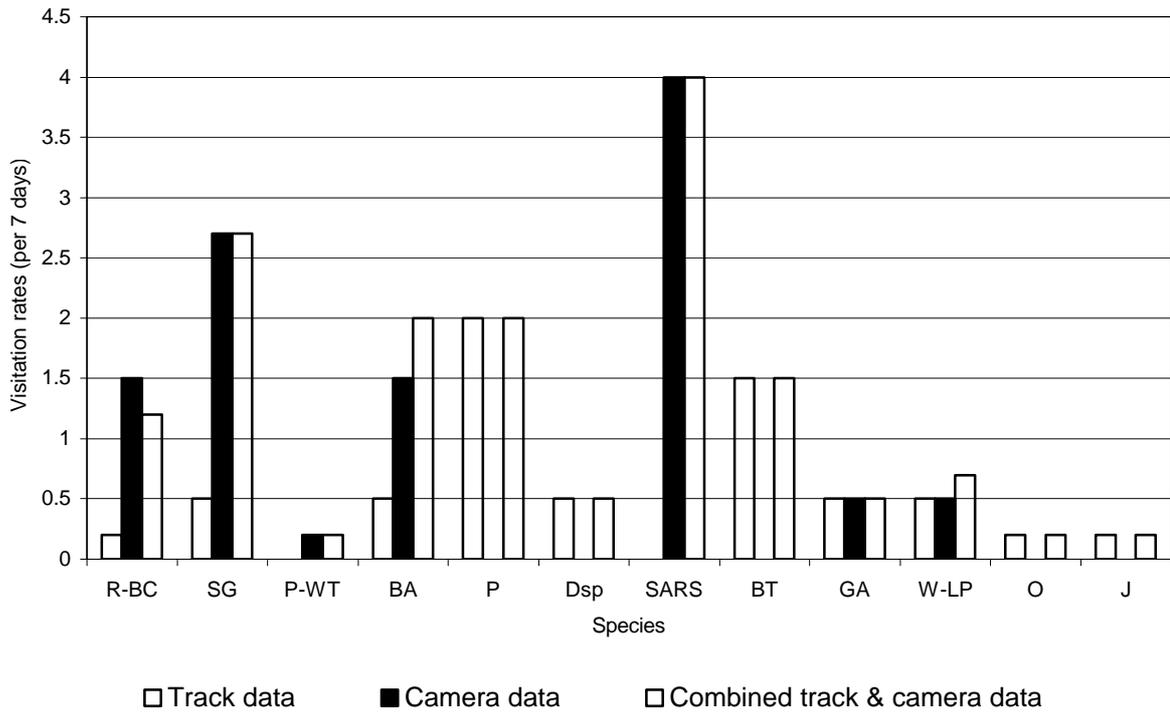
The mammal species recorded visiting the colpa most frequently was the South American red squirrel (4 visits per 7 days). The bird species recorded visiting the colpa most frequently was the spix guan (2.7 visits per 7 days) (Fig. 3.4a).

The majority of diurnal feeding activity of both birds and mammals occurred in the morning between 05:30 and 10:30. Some activity was also recorded late afternoon between 16:30 and 17:30 (Fig. 3.4b). All nocturnal activity was recorded between dusk and 00:50. After this time no mammals were seen until dawn at 05:00.

All mammals recorded entering the colpa to feed have an exclusively herbivorous diet, feeding on a combination of leaves, fruits and nuts or flowers. The two species of cat that were recorded are likely to have been there to hunt, rather than feed at the colpa. Pale-wing trumpeters were also recorded at the colpa, but were likely to have just been passing through.

Table 3.4a. Species observed visiting the colpa.

Recorded from tracks	Recorded by video camera	Observations 2003	Results from 2002	All results 2002 & 2003 combined
MAMMALS				
Y	Y	Y	Y	Brown agouti
Y				Paca
Deer sp.			Y	Red brocket deer
			Y	Grey brocket deer
Y				Brazilian tapir
Y	Y	Y	Y	Green agouchy
Y	Y		Y	White-lipped peccary
			Y	Collared peccary
	Y	Y	Y	South American red squirrel
			Y	Red howler monkey
Y				Ocelot
Y				Jaguar
			Total	
8	4	3	8	12
BIRDS				
Y	Y	Y	Y	Razor-billed currawong
Y	Y	Y	Y	Spix guan
	Y			Pale-winged trumpeter
		Y	Y	Violaceous quail dove
		Y		Plumbeous dove
			Y	White-tipped dove
			Y	Ruddy ground dove
			Y	Grey necked wood rail
			Total	
2	3	4	6	8



Key: R-BC razor-billed curassow, SG spix guan, PWT pale winged trumpeter, BA brown agouti, P paca, Dsp deer species, SARS South American red squirrel, BT Brazilian tapir, GA green agouchy, W-LP white-lipped peccary, O ocelot, j Jaguar

Fig. 3.4a. Visitation rates for birds and mammals showing track data, camera data and combined track & camera data

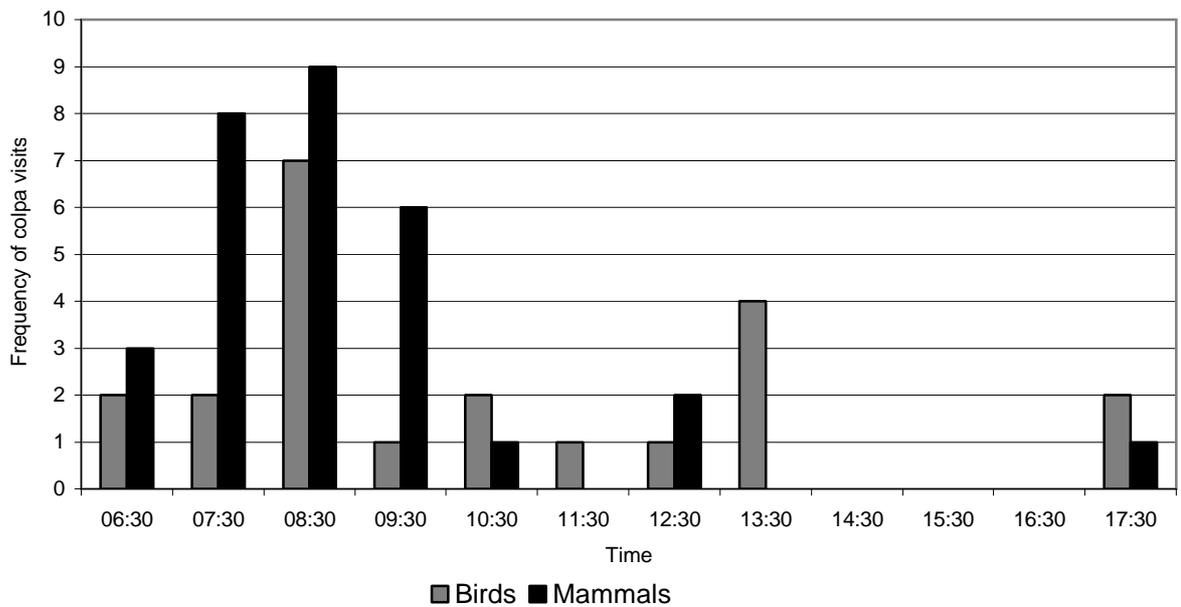


Fig. 3.4b. Timing of colpa visits

3.5. Discussion

The results suggest that the use of colpas is related to mammals and birds that have a vegetarian diet and that it is a herbivorous subset of species, rather than the wildlife population as a whole that use mammal colpas. Izawa (1993), whilst studying soil ingestion by red howler monkeys (*Alouatta seniculus*) in Colombia, noted that white-lipped peccaries (*Tayassu pecari*), collared peccaries (*Tayassu tajacu*), deer (*Manzama* sp.) and guans were also utilising colpas. The results presented here support existing hypotheses (Hammer 2001) for the function geophagy in that it helps alleviate gastrointestinal upsets and allows consumers to ingest a wider range of foods.

In a study carried out in 2002 by Biosphere Expeditions and the Piedras Biodiversity Station at the same colpa, observations alone were used to gather data. It was concluded that by using plates to record mammals entering at night a fuller picture of colpa activity would be obtained. By using plates the additional nocturnal animals recorded were paca, Brazilian tapir, jaguar and ocelot, although only two of the additional species would have been there to feed on the clay. This puts the total number of mammals and birds recorded at the colpa from the two years of study at twenty species – eight species of bird and twelve species of mammal. A further species, the black spider monkey, has been recorded at the colpa outside of the expedition dates.

Although the use of plates increased the number of species recorded, one species was noticeably absent, namely the collared peccary. In 2002 collared peccaries were the second most frequent visitor to the colpa with a visitation rate of 2.9 per 7 days. This year they were not recorded at all. Visitation rates also declined for other large mammal species - white-lipped peccary, red brocket deer and red howler monkey. It is probable that increased human scent left around the colpa from the cleaning of plates, (even though care was taken not to touch the ground or vegetation), reduced the numbers of animals visiting the colpa. Apart from increased human scent another drawback of using plates was that although the plates covered all major entrances to the colpa, it is also possible that mammals entered in parts where there were no plates and animals entering from above such as squirrels were not recorded at all. Also, the substrate used in the plate to record the tracks had to be watered daily to prevent drying out, which again added to colpa disturbance.

Using a remote sensor camera in theory is an ideal method of monitoring a mammal colpa as it is so unobtrusive. Problems, however, were experienced as the lens was not wide enough to include the entire colpa wall so that parts were left out where animals may have fed. Another drawback was the sensor had a delay of a few seconds before the camera began to record, by which time the mammal on a number of occasions had moved out of the field of view. A final problem was encountered with night surveillance as the infrared light was not strong enough to identify any of the mammals that set off the sensor and so even though recordings were made, it was impossible to tell which animal had triggered them. By using the combined plate and camera methodologies, however, further insights into colpa use have undoubtedly been obtained, but the drawbacks of using each methodology need to be considered and techniques adapted in order to obtain more accurate results in future. The results of this study will be used as a basis for further studies into visitation rates and colpa use.

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4. Human and other impacts on the behaviour of parrots and macaws at a colpa in Southeast Peru

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4.1. Introduction

Avian geophagy or soil eating has been studied in a large number species from Grey Louries in Botswana to parrots and macaws in Peru (Munn 1994, Hammer 2001, Brightsmith 2003). Avian colpas in Amazonia are commonly located along river banks on exposed cliff faces, which contain a particular combination of clay minerals. Many theories have been put forward to explain the phenomenon of geophagy, including adsorption of dietary toxins and mineral supplementation, especially exchangeable sodium (Brightsmith and Aramburu 2003).

Previous studies of parrot and macaw clay licks, locally known as colpas, have tended to concentrate on colpas located in protected areas, which are characterised by low levels of or no boat traffic, where birds tend to feed without human interference. However, many colpas exist outside of these protected areas. In order for sustainable populations of parrots and macaws to survive in the wild outside such conservation areas, it is necessary to study the impacts that humans have on colpa-specific bird behaviour.

The study documented here was designed to monitor the behaviour of parrots and macaws visiting a colpa beyond the confines of a protected area and investigated the effect of boat traffic on colpa activity, a factor which has not been previously studied. The results of this study will be presented to local conservation groups in Peru in an attempt to increase awareness of the effects of boat traffic on parrot and macaw behaviour and will be used as a basis for further studies on macaw activity at colpas in the future.

4.2. Location and Methods

The study was undertaken at a small colpa located on the banks of the River Las Piedras, approximately 60 km Northwest (approximate bearing 325°) of the town of Puerto Maldonado. The colpa is approximately 15 m high and 25 m wide, its GPS position is S 12° 03.905' W 69° 53.308'. The colpa was observed by up to three people on the opposite side of the river, a distance of about 100 m, from a temporary hide so that impact of observers' activities on the birds was minimised. Silva Eterna 10 x 42 and 10 x 25 binoculars were used to aid the identification of the smaller parrots, the larger macaws being easily identifiable by the naked eye.

The colpa census was carried out over 27 days between 17 June and 14 June 2003, a total of 233 hours and 27 minutes. Each daily census was divided into three shifts: 05:45 to 08:30, 08:30 to 12:30 and 12:30 to 15:00, or until there were no birds in the trees above the colpa. Observers recorded a number of variables including time of arrival of first species, first species feeding and thereafter the number of birds feeding at five minute intervals. Weather conditions were also noted, as was the presence of fog. Boat traffic passing the colpa was recorded and the effect that the boat had on the activity of the birds.

4.3. Results

Species diversity and colpa use

Although the results reported are exclusively for the family Psittacidae (parrots and macaws), a total of 14 species of birds and one mammal were recorded in the immediate area around the colpa. Eleven species were from the family Psittacidae, two were from the family Columbidae (pigeons) and one from the family Caracidae (chachalaca). The mammal species recorded was a South American red squirrel. Of the eleven parrots species seen around the colpa, ten were recorded feeding (Table 4.1a).

Table 4.1a. Species using the Las Piedras colpa.

English name	Latin name
Blue-headed Parrot	<i>Pionus menstruus</i>
Dusky-headed Parakeet	<i>Aratinga weddellii</i>
Orange-cheeked Parrot	<i>Pionopsitta barrabandi</i>
White-bellied Parrot*	<i>Pionites leucogaster*</i>
Mealy Parrot	<i>Amazona farinosa</i>
Colbalt winged Parakeet	<i>Brotogeris cyanopectera</i>
Yellow-crowned Parrot	<i>Amazona ochrocephala</i>
Red Bellied Macaw	<i>Orthopsittaca manilata</i>
Chestnut-fronted Macaw	<i>Ara severa</i>
Scarlet Macaw	<i>Ara macao</i>
Red and Green Macaw	<i>Ara chloroptera</i>

*Only recorded in trees around colpa, not feeding. Has been seen feeding outside expedition dates.

A measure of how frequently a species of bird visits the clopa is seen by clopa use which is measured in parrot minutes as the number of minutes a species feeds on the colpa (for example 2 birds on the colpa for 10 minutes = 20 minutes).

The species with the greatest colpa use was the red and green macaw (17725 parrot minutes), the largest of the macaw species seen in the area (Fig 4.3a). The average colpa use for red and green macaws was therefore 76 parrot minutes per hour, as compared with last year when their colpa use was 24 minutes per hour.

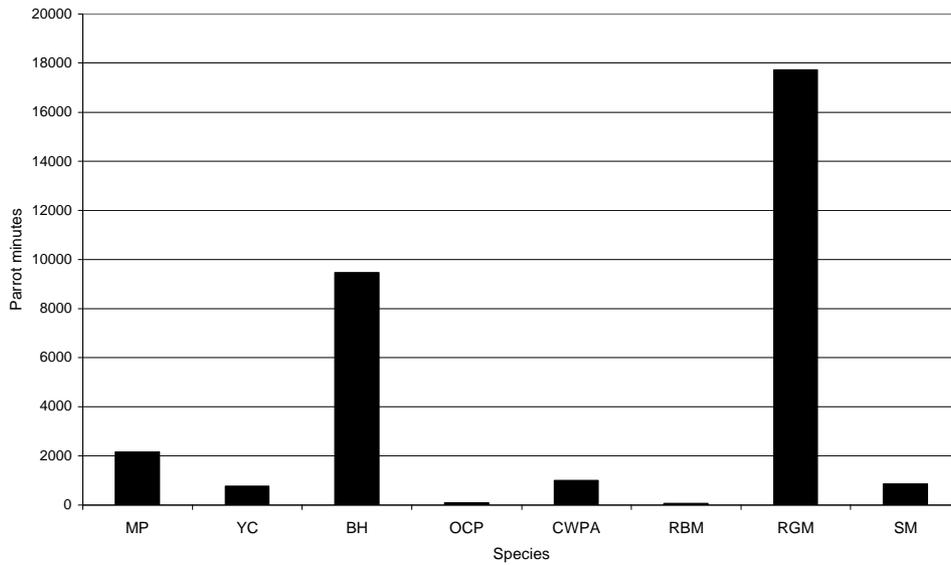


Fig. 4.3a. Colpa use (parrot minutes) for each species for June & July 2003.
 Key: MP mealy parrot, YC yellow crowned parrot, BH blue headed Parrot, OCP orange cheeked parrot, CWPA cobalt winged parakeet, RBM red bellied macaw, RGM red and green macaw, SM scarlet macaw

Distinct daily feeding patterns were noted between the different species. For seven of the ten species using the colpa, 100% of their feeding activity occurred early morning before 08:10 (Fig 4.3b). Of these species the blue-headed parrot and yellow crowned parrot were recorded as being the first species on the colpa on 80% of all census days. In contrast the mealy parrot tended to feed towards the end of the initial burst of early morning activity. Two species, the red and green macaw and scarlet macaw were seen to use the colpa at any time of day with two peaks of activity between 08:30 to 10:30 and 11:30 to 13:00 (Fig. 4.3c)

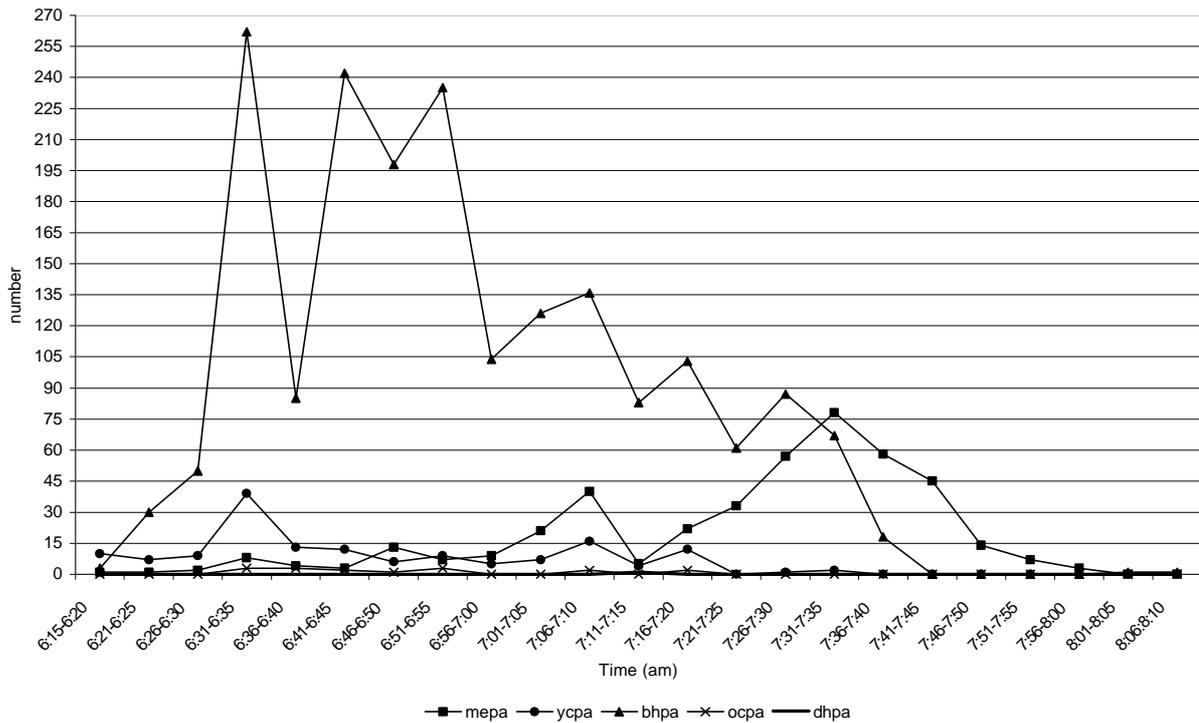


Fig. 4.3b. Parrot feeding times.
 Key: mepa mealy parrot, ycpa yellow crowned parrot, bhpa blue headed parrot, ocpa orange cheeked parrot, dhpa dusky headed parrot.

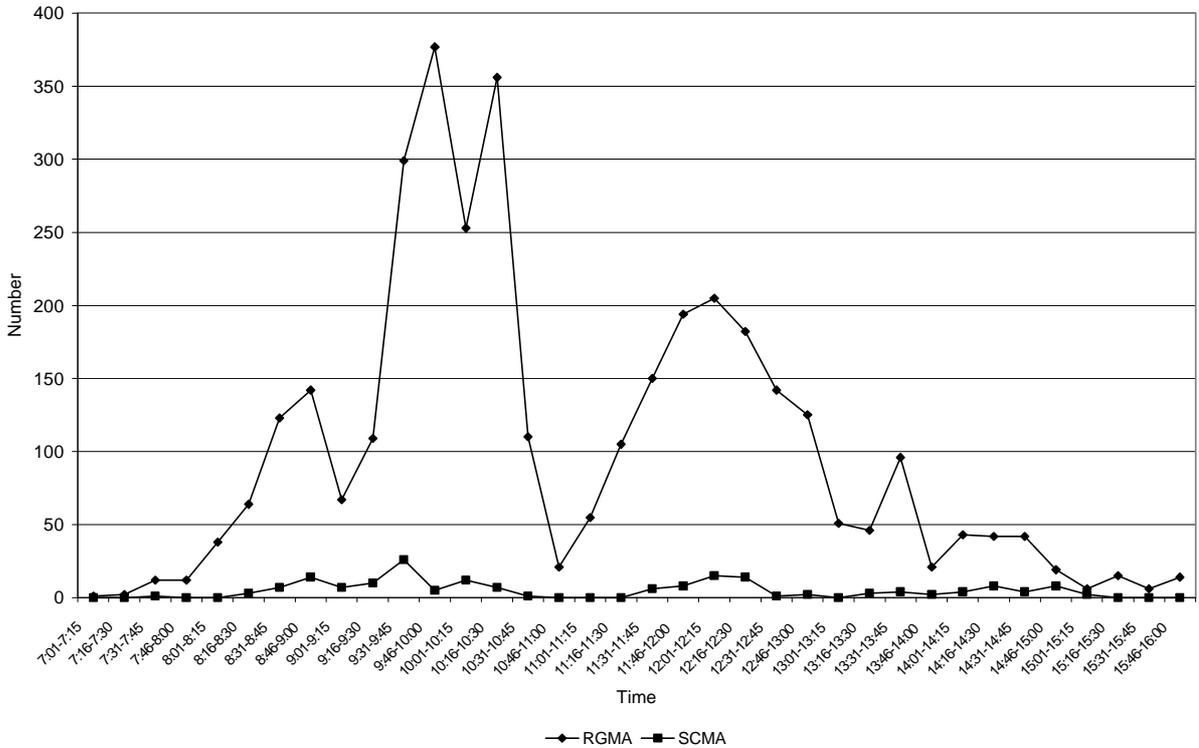


Fig. 4.3c. Macaw feeding times.
 Key: RGMA red and green macaw, SCMA scarlet macaw.

Effects of boat traffic

A total of 102 boats were seen passing the colpa, making a mean of one boat every 2 hours and 17 minutes. This is a notable reduction in traffic since last year, when a boat passed on average every 40 minutes. Of the 102 boats, 42% passed when there were no birds near the colpa and so had no effect on the feeding patterns of the birds. Of the remaining 58% of boats, 46% caused a ¹tree flush, 13% caused a ²colpa flush and the remaining 41% had little notable effect – usually either because there were few birds present or a different boat had passed shortly before.

A passing boat generally caused two flushes, the first occurred before the boat had come into view and the second as it neared the colpa wall. On one occasion blue-headed parrots continued feeding as a boat passed, but were partially hidden behind vines. On one occasion men were observed to wave their hands and shout at the birds as their boat passed the colpa. On a separate occasion a boat was seen to pass the colpa and stop downstream, a few minutes later a gunshot was heard and a man seen returning to the boat with a dead red and green macaw.

Colpa erosion

There was a noticeable change in the wall of the colpa that occurred between 19 and 20 June. After this erosion event birds were not monitored feeding until 23 June. A smaller change was noticed on the right hand side of the colpa wall on 8 July, and birds were monitored feeding the following day.

After these two erosion events, early morning activity was sporadic and on several mornings the parrots were observed gathering in the trees above the colpa, but later seen to fly upstream and gather at a site with no obvious exposed area of clay. Birds were seen feeding at this site on a very small section - 1.5 m high by 1 m wide - the only area free of vegetation. In order to feed at this section the birds had to wait their turn in the surrounding vegetation, as there was only space for about ten birds to feed at a time. The larger macaws were never seen to feed on this section, a finding consistent with a 2001 expedition study (Hammer 2001) on a smaller colpa, which also recorded very little macaw activity.

Effects of weather

Rain only occurred on one day of the census and thick mist occurred on five early mornings. No birds were seen feeding on any of these days.

Flushes

A total of 254 tree and colpa flushes were recorded. Observers could not see any reason for 74% of the flushes. 19% were caused by boats and 7% by birds of prey or large birds flying in the area.

¹Tree flush – birds fly from the trees around the colpa in a large group. Often triggered by a specific event, in this case boat traffic.
²Colpa flush – birds feeding on the colpa fly off in a large group. Often triggered by a specific event, in this case boat traffic.

4.4. Discussion

Colpa use appears to have dramatically increased since last year. The number of parrot minutes recorded for red and green macaws have increased by over three times. Considering that natural factors are unlikely to have caused such an increase in bird activity, the only variable that has dramatically changed is boat traffic. This year three and a half times less boat traffic was recorded, causing fewer disturbances to macaw feeding patterns and resulting in greater colpa use. Although there was less boat traffic this year and as a result feeding activity has increased, boat traffic is still affecting macaw behaviour at the colpa and usage is unlikely to be at its natural level.

Even when human disturbance is not affecting macaw behaviour, there are many natural factors that influence colpa use. Had the study been carried out during the wet season, rain would undoubtedly have affected colpa use and fog was seen to affect parrot colpa use on five mornings during this survey.

Erosion has also been noted to affect colpa use. The parrots' feeding behaviour was upset for two days following the land slip on 19 June. The disruption is likely to be due to the birds' naturally cautious behaviour when visiting the colpa. From personal observations and earlier studies (Hammer 2001) it is clear that birds very rarely fly straight on to the colpa, but instead gather in trees around and may spend many hours there before venturing down to feed. The only occasions when birds were observed to fly in from another area of the forest and straight onto the colpa is when other birds were already feeding. An erosion event may therefore make them even more wary about landing on the colpa.

After the initial disruption caused by erosion, macaws were observed to feed again, but parrots fed only on a couple of occasions and then tried a new site upstream, which, although smaller, may contain different mineral assemblages or concentrations needed for their diet.

It is possible that the erosion event removed the minerals they require and exposed a section with a different mineral makeup. Mineral analyses are needed to test this theory further to see if the sites have different minerals or concentrations of minerals that may explain the birds' feeding preference. However, these purely anecdotal ethological observations suggest that the need for certain minerals may be the driving force behind the preference for the parrots for clay at certain colpa sites, since they appeared to be prepared to wait their turn to feed at a small (preferred) site covered with vegetation, rather than feed together at the larger census colpa.

The study showed that parrot and macaw behaviour when using a colpa is very complex. Various factors have been seen to influence avian behaviour, from natural events such as the weather, erosion of the colpa face, or the presence of a larger bird of prey, to human influenced actions, most noticeably, boat traffic. In order to study the affects of boat traffic, results need to be gathered over a longer period of time. But just by looking at the very significant increase in colpa use that occurred when boat traffic decreased, as seen between 2002 and 2003 with red and green macaws, it is clear that human presence is influencing colpa use. The question that remains is just how detrimental on bird health is the lack of soil consumption and will it affect the population of birds in the area? Colpas appear to be a scarce resource, especially those inside protected areas. A better understanding of parrot and macaw behavior in response to human presence is needed to ensure the long-term survival of wild populations.

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5. Evaluation of the herpetofauna near the River Piedras in Southeast Peru

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5.1. Introduction

I present the results of the first phase of evaluation of the herpetofauna along the River Piedras Biodiversity Station, Madre de Dios, Peru. I found a total of 71 species, of which 45 were amphibians and 26 reptiles. I also evaluated the types of habitat in which the specimens of each species were found.

5.2. Location

The Piedras Biodiversity Station is found in Loreto in the province of Tambopata, Department of Madre de Dios, Peru; the geographic location is S 12° 07.013' W 69° 54.166'. The elevation of the area is approximately 300 m above sea level. There are two seasons in the year: the rainy season, between November and May and the dry season between May and October. Apart from the different aquatic habitats, there are also different vegetation forms that contribute to the diversity of habitats (Beltran 2001).

5.3. Materials and Methods

The study was carried out between 13 June and 20 July 2003, in the dry season, following VES (Visual Encounter Survey) methodology in order to compile a species list (Scott 1994). Field work consisted of diurnal and nocturnal forages into the different habitat types. The types of habitats or forest types that were included in the survey were flood plain forest, high forest and swamp forest (aguajal). The study also included temporary ponds (which were almost dry during the collection period), streams with moving water and areas of secondary forest (forest with riverside succession). In order to survey these areas, an existing trail system was used that passed through most of the habitat types. The project would not have been possible without the help of Biosphere Expeditions who provided invaluable support of funds and personnel.

Three kinds of register were used: (1) visual, for the majority of species encountered; (2) photographic, which will also be used to make up a photographic guide and (3) audio, for male frogs only (a compact disc "Frogs of Tambopata" was used from the laboratory of natural sounds, Cornell University). Each species found was taken to the research station in a fabric or plastic bag. Photographs, descriptions and measurements were taken the following day. The majority of the specimens captured were preserved. Audio transect methodology was not used to identify species, but "play back" was used occasionally when frogs were heard calling. It was mostly used around bodies of water (streams, swamps and the river).

The cumulative record of species was evaluated by plotting an accumulation curve of species collected against number of days of collection (Fig. 5.5a).

5.4. Results

The study was carried out over 27 days with a total of 76.27 person hours and an average of 3.47 person hours per night. Expedition team members from Biosphere Expeditions were present on all collections. The remaining time was spent taking measurements and photographs of the specimens collected.

A total of 71 species were encountered, of which 45 were amphibians and 26 reptiles. Of the 26 species of reptile, there were 12 lizards, 9 snakes, 2 turtles and 3 caimans (Table 5.4a).

Table 5.4a. Amphibians and reptiles of Piedras Biodiversity Station (** species visually identified but not collected).

	HABITAT TF = terra firma TA = alluvial terrace A = aguajal (p = pasto, r = ramas) R = River margin QD = stream (ar = arboreal, bq = stream margin, s = soil, t = ground/ leaf litter, aq = aquatic)	ABUNDANCE C = common (more than 3 sightings) R = rare	ACTIVITY N = nocturnal D = diurnal	REGISTER V = visual A = audio F = photo
CLASS AMPHIBIA				
FROGS				
Bufonidae				
<i>Bufo marinus</i>	TF, TA, R; t	C	N	V/A/F
<i>Bufo typhonius</i>	TF, TA; t	C	D	V/F
Dendrobatidae				
<i>Colostethus conspicuus</i>	TF; t	C	D	V/A/F
<i>Epipedobates femoralis</i>	TF; t	R	D	V/F
<i>Epipedobates hahneli</i>	TF, TA; bq	C	D	V/A/F
<i>Epipedobates trivittatus</i>	TF; t	C	D	A
Hylidae				
<i>Hyla boans</i>	TA, R; ar	C	N	A
<i>Hyla brevifrons</i>	TA; ar	R	N	V/F
<i>Hyla fasciata</i>	TF, TA; ar	C	N	V/F
<i>Hyla geographica</i>	A; ar	R	N	A
<i>Hyla lanciformis</i>	TF, TA, R; bq	C	N	V/A/F
<i>Hyla leucophyllata</i>	A; ar, p	C	N	V/A/F
<i>Hyla parviceps</i>	TF, TA; ar	C	N	V/F
<i>Hyla parviceps</i> group	TF, A; ar, p	C	N	V/F
<i>Hyla rhodopepla</i>	TF, A; ar, p, r	C	N	V/A/F
<i>Osteocephalus taurinus</i>	TA; ar	R	N	V/F
<i>Phyllomedusa atelopoides</i>	TA; t	R	N	V/F
<i>Phyllomedusa bicolor</i>	TA; ar	R	N	A
<i>Phyllomedusa camba</i>	TF, A; ar	C	N	V/A/F
<i>Phyllomedusa palliata</i>	TF; ar	C	N	V/F
<i>Phyllomedusa tomopterna</i>	TF; ar	R	N	V/F
<i>Scinax garbei</i>	TF, A; ar, r	C	N	V/A/F
<i>Scinax cf. icterica</i>	TF, TA; ar	C	N	V/F
<i>Scinax rubra</i>	TF; ar	C	N	V/F
<i>Scinax pedromedinae</i>	TF, TA; bq	C	N	V/F
<i>Sphaenorhynchus lacteus</i>	A; ar, p	C	N	V/A/F

Table 5.4a continued. Amphibians and reptiles of Piedras Biodiversity Station (** species visually identified but not collected).

	HABITAT TF = terra firma TA = alluvial terrace A = aguajal (p = pasto, r = ramas) R = River margin QD = stream (ar = arboreal, bq = stream margin, s = soil, t = ground/ leaf litter, aq = aquatic)	ABUNDANCE C = common (more than 3 sightings) R = rare	ACTIVITY N = nocturnal D = diurnal	REGISTER V = visual A = audio F = photo
Leptodactylidae				
<i>Adenomera hylaedactyla</i>	TF, TA; t	C	D/N	V/A/F
<i>Adenomera</i> sp.1	TF, TA; t	C	D/N	V/F
<i>Edalorhina perezii</i>	TA; t, bq	R	N	V/F
<i>Eleutherodactylus altamazonicus</i>	TF; t	R	N	V/F
<i>Eleutherodactylus buccinator</i>	TA; t, bq	R	N	V/F
<i>Eleutherodactylus cf. cruralis</i>	TF, TA; t	C	D/N	V/F
<i>Eleutherodactylus fenestratus</i>	TA; t, bq	C	N	V/A/F
<i>Eleutherodactylus peruvianus</i>	TF; t	C	N	V/A/F
<i>Eleutherodactylus skydmainos</i>	TF, t	R	N	V/F
<i>Eleutherodactylus toftae</i>	TF, TA; t	C	N	V/A/F
<i>Eleutherodactylus ventrimarmoratus</i>	TF; t	R	N	V/F
<i>Leptodactylus pentadactylus</i>	TA; t, bq	R	D/N	V/A/F
<i>Leptodactylus petersii</i>	TF, TA, A; t, bq	C	N	V/A/F
<i>Leptodactylus leptodactyloides</i>	TA; t, bq	R	N	V/F
<i>Physalaemus petersi</i>	TA; t, bq	C	N	V/F
Microhylidae				
<i>Chiasmocleis ventrimaculata</i>	TA; t, bq	C	N	V/F
<i>Chiasmocleis bassleri</i>	TA; t, bq	R	N	V/F
<i>Elachistocleis bicolor</i>	TA; t	R	N	V/F
<i>Hamptophryne boliviana</i>	TF, TA; t	C	D/N	V/F
CLASS REPTILIA				
SAURIA				
Gekkonidae				
<i>Gonatodes humeralis</i>	TF, TA; ar	C	D	V/F
<i>Thecadactylus rapicauda</i> **	TF; ar	R	N	V/F
Polychrotidae				
<i>Anolis fuscuaratus</i>	TF, TA; ar	C	D	V/F
<i>Anolis nitens</i>	TA; ar	R	D	V/F
<i>Anolis ortonii</i>	TA; ar	R	D	V/F
Teiidae				
<i>Ameiva ameiva</i>	TF; t	C	D	V/F
<i>Kentropyx altamazonica</i>	TA, R; t	R	D	V/F
<i>Pantodactylus schreibersii</i>	TA; t	R	D	V/F
<i>Prionodactylus eigenmani</i>	TF; t, bq	R	D	V/F
<i>Tupinambis teguixin</i> **	TA, R; t	R	D	V/F
Tropiduridae				
<i>Tropidurus plica</i>	TF; ar	R	D	V/F
<i>Stenocercus fimbriatus</i>	TF; t	R	D	V/F

Table 5.4a continued. Amphibians and reptiles of Piedras Biodiversity Station (** species visually identified but not collected).

	HABITAT TF = terra firma TA = alluvial terrace A = aguajal (p = pasto, r = ramas) R = River margin QD = stream (ar = arboreal, bq = stream margin, s = soil, t = ground/ leaf litter, aq = aquatic)	ABUNDANCE C = common (more than 3 sightings) R = rare	ACTIVITY N = nocturnal D = diurnal	REGISTER V = visual A = audio F = photo
SNAKES				
Boidae				
<i>Corallus hortulanus</i>	TA; ar	R	N	V/F
Colubridae				
<i>Tripanurgos compressus</i>	TA; t, ar	R	D	V/F
<i>Liophis reginae</i>	TA; t	R	D	V/F
<i>Clelia clelia</i> **	TF; t	R	N	V
<i>Dipsas catesbyi</i>	TF; TA; t, ar	C	D/N	V/F
<i>Imantodes cenchoa</i>	TA ; ar	R	N	V/F
<i>Leptodeira annulata</i>	TF; ar	R	N	V/F
<i>Xenopholis scalaris</i>	TF; t	R	D	V/F
Viperidae				
<i>Lachesis muta</i> **	TA; t	R	N	V/F
TESTUDINES				
Pelomedusidae				
<i>Podocnemis unifilis</i>	R; aq	C	D	V
Testudinidae				
<i>Geochelone denticulada</i>	TF, TA; t	R	D	V/F
CROCODYLIA				
Crocodylidae				
<i>Caiman crocodilus</i>	R; aq	C	D/N	V/F
<i>Melanosuchus niger</i>	R; aq	R	N	V/F
<i>Paleosuchus trigonatus</i>	A, QD; aq	C	N	V/F

A total of four relatively small swamp areas (aguajales) were found and two species, *Hyla rhodopepla* and *Leptodactylus petersii* were present in all four areas. The rest of the species were only found in one or two of the pond areas. The small and medium sized species belonging to the family Hylidae were all found in the swamp areas with the exception of the genus *Scinax*.

5.5. Discussion

A total of 71 species of herpetofauna were recorded at the Piedras Biodiversity Station, 45 species of amphibian and 26 species of reptile. All species are new registers for the area.

The number of species registered so far at the Piedras Biodiversity Station represents approximately 60% for amphibians and 38% for reptiles of the expected number of species that may inhabit the area when compared with the species richness of other nearby river systems (Table 5.5a).

Table 5.5a. Species richness in other areas of Madre de Dios.

Taxa	Chocha Cashu ¹	Pakitza ²	Cuzco Amazónico ³	Reserva Tambopata ⁴	Río Los Amigos ⁵	Río Las Piedras ⁶
Amphibians	82	68	64	81	82	45
Reptiles	64	60	81	81	57	26

Sources: (1) Rodríguez & Cadle 1990; (2) Morales & McDiarmid 1996; (3) Duellman & Salas 1991; (4) McDiarmid & Cocroft 1995, no publ.; (5) von May 2003, no publ.; (6) this study

The difference between the number of amphibians encountered and the number of reptiles is due to the extra time spent searching for amphibians and the bias of the methodology, since collections were made primarily at night. In order to record more reptile species, data collection would have to occur over a longer period of time, usually over a period of years in the case of snakes (Scott 1994). In this first phase of the study, during the dry season, the collections were surprisingly productive despite the unfavourable climatic conditions for collecting amphibians as demonstrated by the species accumulation curve (Fig. 5.5a).

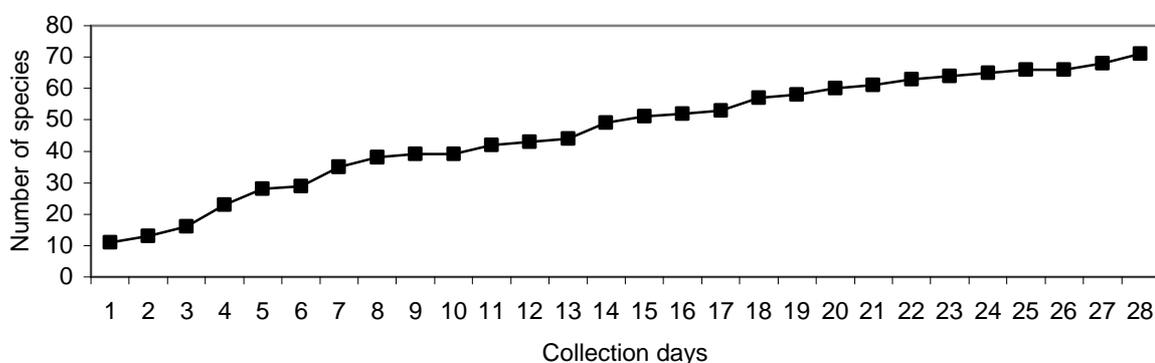


Figure 5.5a. Accumulation curve of species in respect to collection days at the Piedras Biodiversity Station (June-July 2003).

It is important to emphasize that taking samples of species was necessary for later identification, as photographs and descriptions alone cannot always provide enough information to make a correct identification of a species.

From the results of this survey and those of the next phase of the study, during the rainy season, we will have a better indication of the species of amphibians and reptiles that occur in the area and be able to determine the species richness which will serve as a basis for further investigations and aid in the conservation of the species in this area.

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5.7. Acknowledgements

I thank Emma Hume and Juan Julio Durand for making this study possible and for their help with the field work. Konrad for the use of the photographic equipment. To the group of Biosphere Expeditions, including Diana Stephens, Janet and Alan Hoffberg, Mark and Lindy Edwards, Neil Crofts, Cara Morrison, Dave Hewitt, Sheila Boughton, Sandra McGraw, Danielle Assemakis, Angela Moore, Claudia Gahlen, Gerhard Rölle, Joseph Inbar, Amanda Atherton, Maggi Neal, Carlo Risi and Emma Hawthorne for their help with the field work. A special thank you to Jörg Holdenried, Winfried Straub and Jay Ryles for their consistent help with the collections and the taking of photos. Also to Lucio Olvea, Jose Durand and Orlando for their help in the field and for finding new species for the register. I thank Rudolf von May for teaching me and giving me some of the references for this study and Mrs Lily Rodriguez for her help with the species descriptions and Juana Suarez for her help with the identification of the specimens.

6. Mapping of the research area

Konrad S. Schmidt
Biosphere Expeditions

The research area covered approximately 8 by 4 km on both sides of the Rio Piedras. Previously there existed only a general, very large scale map of the Rio Piedras (similar to the one on page 4). This and the rain forest environment, which looks largely similar and generally lacks defining geographic features, often made orientation difficult.

To create a more detailed map, we used GPS devices (Silva Multi-Navigators) to take GPS readings (waypoints) at regular intervals of approximately 100 m along the river and all trails emanating from base camp. Signal reception was sometimes poor because of the dense foliage, but in general reception was good enough for accurate readings. Distinct features like swamps, kapok trees or camps were also recorded. Distances below 100 m, like for example the width of a river, were measured using a laser-controlled Leica Rangemaster.

Our mapping activity provided some new insights and discoveries, for example a second, hitherto unknown mammal colpa, only 300 m away from base camp! Over 400 waypoints were recorded and transferred to paper to a scale of 1: 5,000. Base camp was used as the first known reference point and readings related in distance and bearing to it. In this way a “master map” of over 1.5 m width was generated. We estimate that the total error of bearing, pacing and drawing remained below 5% and it was often very surprising how much the course of the river and trails on the map differed from our perception.

For scaling down to a more manageable size a digital picture of the master map was taken and graphically finished. Finally a survey map of 1:30,000 scale was printed and copied. This format of roughly A4 size allows a clear overview of the research area (see Fig. 6a below).

As a first result of the mapping project the way back from the transect could be shortened by 1.5 km. This could be done because we realised from the map that two existing trails converged by only 60 m, one of which could be used as a shortcut back to base camp. When we cut a connecting trail from a bearing and GPS position taken from our new map, we were able to connect the two trails just as predicted by the map, which was also a satisfying way of proving the accuracy of our new map!

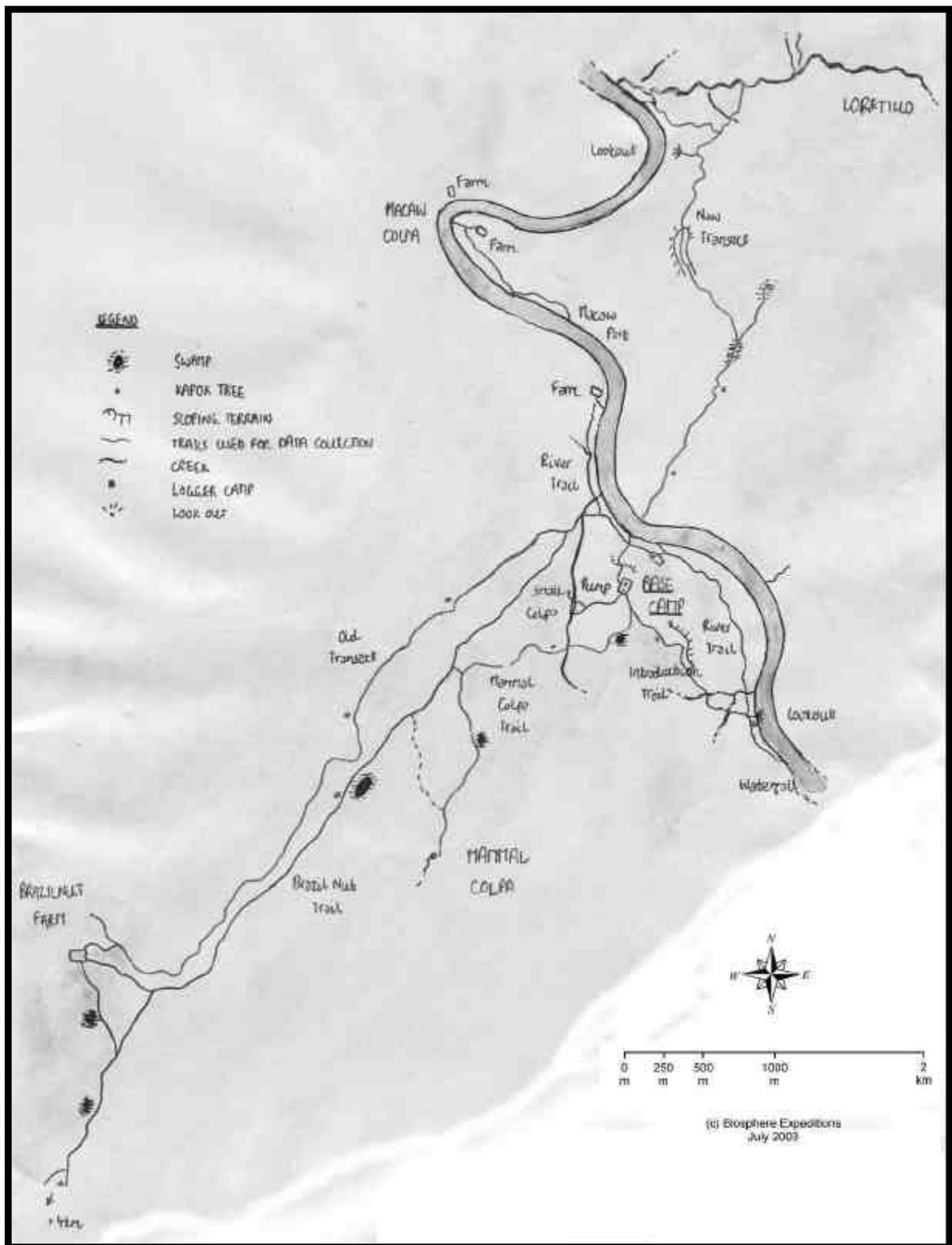


Fig. 6a. Map of the study area.

7. Expedition leader's diary: Peru 2003 (by Konrad S. Schmidt)

15 June

All team members appeared right on time at the meeting point. Except Neil, his flight yesterday from Lima had been cancelled. Fortunately we could pick him up later at the Rio Piedras. Juan Julio (JJ), our local partner, organized a taxi directly to a point at the bank, where our boat could stop.

After eight hours on the boat with passing of diverse caimans, turtles and even some spider monkeys, arrival at the research station. Four bungalows in a traditional style. Emma, our local scientist and JJ improved it a lot since last year, a great place to stay.

Before we fall into our beds, a last excitement: A huge bushmaster snake crossed the path to the river, at least four meters in length and thick like a human arm and quite toxic! Even JJ has only ever seen one living specimen in his entire life!

16 June

Introduction day. Emma and JJ took us on a first walk through the rainforest. Emma's group was the luckier one, they saw a harpy eagle, even for Emma the first time! In the afternoon we got a theory lesson in recognizing mammals and birds including typical sounds from a special CD.

In the evening Joerg and Diana started with the new frog project, run by Margarita, a biologist from Lima. It will be the first presence/absence study of frog species in this area. We will collect them for identification, and unfortunately one specimen of each species we have to be preserved (the euphemism for killed) and kept in formalin as a museum specimen.

17 June

First working day, already very productive. Really hard to get "hardcore Angela" away from the well frequented macaw colpa. But all were topped by Mark and Lindy on the transect, a standardized observing path. They encountered peccaries, an agouty, the tail of a red brocket deer and no fewer than five monkey species, including the very rare monk saki monkey. What a first day!

Matthias and I tried to install a video trap at the mammal colpa. Also at night (due to infrared light) all animals in angle of the sensor's view should be recorded. Finally it worked out and as a reward a cuvier's toucan crossed our way back. We will hopefully get a surprise from the recorded pictures tomorrow. The day ended with a tasty cake made by our five star cook Lucio for birthday girl Cara.

18 June

Raining all day, so most of the time we spent reading in the hammocks. Star of the day was Willy, a dwarf caiman, who the frog group caught yesterday. Janet and Alan could use their alligator knowledge from Florida. Alan showed us how to grasp the animal whilst keeping all arms and fingers attached. After an extended photo shoot we released him to the forest, Free Willy style!

Unfortunately the pictures on the video tape were quite blurred - we are trying it again after some adjustment. On our way back a laughing falcon allowed us some observation and with this came the real Sielmann/Attenborough feeling.

19 June

Still raining. The temperature drops to a comfortable 20C, but the third macaw shift had to be cancelled. The second macaw shift was very lucky to see a harpy eagle. And the transect group? They were chased by a gang of approximately 80 peccaries, bravely defended by the machete swinging Orlando.

Two recordings on the video tape! The first shows very clearly a couple of razor-billed curassows, the second was hard to identify, maybe an agouty. Alan and I fiddled for over an hour with improving the position of the camera and the sensor, with the result that everything stays like before.

Everybody felt fit in the evening, so we went off for boat trip on the nocturnal Rio Piedras. Caiman eyes glowed in the light of a torch, sleeping white wing swallows flushed up scared. We silently slipped downstream with the current on our way back, listening only to the music of the river and the forest.

20 June

First catastrophe of this expedition: A specimen of the very rare terrestrial frog *Leptodactylus* escaped during the photoshoot. Probably he foresaw an end in formalin...

On the transect there were some Ocelot, and to top it jaguar tracks! Orlando and Melissa even reported about jaguar calls last night. It's getting exiting...

While Margarita started education in herpetology, Neill, Cara, Angela and I went another time to the mammal colpa. On our way we first smelled the typical acrid odour, then we heard their typical jaw-clattering, finally we saw them, a small group of white-lipped peccaries hastily running away, it always happens this way.

On the video tape was a couple of spix's guan, we will try now night recordings with an external infrared.

Angela and I stayed a little bit behind the others on the way back, we didn't want believe that we could hear a yellow-headed parrot so close, but not see him. Finally we got him.

21 June

Nothing to report from the macaw colpa. Probably the yellow-headed vulture in a big tree above it discouraged the parrots and macaws from using the lick. The people who stayed at the station, were luckier: They were visited by a tarya, a kind of weasel, who wanted to try some papaya.

Two weekend-trips started in the afternoon: Angela, Janet and Alan went out with Emma to stay overnight at the mammal colpa, JJ took the rest to a abandoned Brazilnut farm. Although there were nine of us and we were not very quiet, we observed on our way to the farm a group of squirrel and capuchin monkeys, directly on the way a blue-throated piping guan and a unidentifiable green snake. The night walk round the farm was less successful. "Only" a rat and a woolly mouse opossum with big black shining eyes appeared in the beam of JJ's Maglite.

While frogging Diana had to fight with ants on her head and Margarita, the girl who handles snakes every day got very frightened by the cockroaches entering her mosquito net.

The ground round the farm is covered with nuts, apparently because the price on the world market dropped and it is now no longer worth transporting the nuts for sale in Puerto Maldonado. Our dinner, carefully packed in banana leaves by Lucio, was enriched by a soursop, a kind of big custard apple, which we picked.

22 June

Sunday, the majority voted for recreation. After Margarita showed us some basic Salsa steps, we went by boat to a small tributary of the Rio Piedras to go fishing. In the first ten minutes that Cara had ever fished in her life, she caught no fewer than three angle fish! The dinner was saved by boat driver Jose, who caught three more medium catfish. While the men stayed behind with awakened hunting instincts, the women were taken back to the station by JJ in a tiny wooden canoe. They took more than twice the time than we did in the motor boat, but they saw a capybara and a nightjar.

A blue and yellow macaw that Emma brought with her from a Tambobata lodge came over from the boat driver's house and became the favourite of the station.

23 June

Carrying on working again. The highlights of the transect were a rufous motmot with his fantastic long tail, a track of mother tapir with her baby, a street of leaf cutter ants and a loudly screaming group of dusky titi Monkeys; it's the first time we've encountered these on the transect. On our way back three saddle-backed tamarins seemed not to be disturbed by us and carried on browsing, feeding and resting. We could nearly touch them!

Emma explained the origin of a small clearing beside the path: Tangarana, a plain little tree, which only grows there, is living in symbiosis with these nasty fire ants: The ants live on the sap that the tree produces and because of this they kill all other plants around with a kind of herbicide.

In the afternoon Alan and I went out to the mammal colpa, fiddling once again with the video trap. The infrared light can't really be used, because it brightens only a small spot within the white angled visual display we need for observation. We measured angles with laser pointers, prevented the sensor from being eaten by an army of angry fire ants and left the camera hopefully in its final position.

When frogging in the evening, Cara, Joerg and Margarita got maybe the best sighting of this expedition so far: Four orange shining eyes in the dark belonging to two ocelots, who circled our froggers curiously from fewer than 10 m away! Cara: *"At first I thought my glimpse of the two red/orange eyes was a figment of my imagination - being out in the dark was playing tricks with my eyes. However, after turning the torch off and then back on, the eyes were still there in the dense undergrowth not more than 10 metres away from us. I called Margarita over and with her more powerful torch we were clearly able to see a cat. It was not at all timid, but very curious of us, moving slowly around us in a large circle until we realised there were in fact two pairs of eyes; two cats together! We stayed watching them for about 30 minutes with both parties as curious as the other. We were able to get some good views in the darkness with the strong torches. When we eventually carried on hunting for frogs in the swamp, every so often I would look up and the eyes were still there, not too far away, just watching us. It was really exciting!"*

24 June

Not every day can be a highlight. The activity which yields the most and is therefore the most popular is always the transect with a lot of monkeys and today a pale-winged trumpeter and an agouti.

At the macaw colpa a chestnut-fronted macaw was encountered, but only the parrots showed feeding activity. They seemed not to like macaw company at their meal.

At the mammal colpa red deer left some tracks, hopefully they left pictures as well on the video.

Frogging is becoming difficult these days, after five days without rain and 31 species caught already. It's hard to find more than one per hour now if you don't have Margarita's expert eye. The spooky tree frogs with their pale big eyes and their long suction-cup topped fingers maybe gave J.R.R. Tolkien the inspiration for the figure of Gollum in the Lord of the Rings. It's nearly impossible, to invent something what has not already been invented by Mother Nature...

25 June

Jaguar growling on the way to the macaw colpa! But the jaguar wore a red shirt, even JJ was fooled by the sneaky Orlando.

Still little activity at the colpa. Plenty of blue-headed parrots assembled in the trees above the colpa, but never came down to feed. Only five spectacled chachalacas jumped around a bit in the clay. A couple of the rare, but maybe most beautiful of the macaws - blue-and-yellow - flew over.

But today was peccary day. We saw the first white-lipped ones at the macaw colpa, with loud clattering and impolite choking noises. Later a smaller and less acrid smelling group of collared peccaries crossed the transect. They really seem to have bad vision; another white-lipped crowd with some babies even came within two or three meters of Diana, JJ and me, until they recognized us and started their scary sounding flight. Another marvellous sighting from the transect was directly into the face of a brown capuchin monkey, feeding on some seeds with its tiny, skilful hands. They look really human. In the distance white capuchins jumped directly in front of the day's last golden sun like flying shadows.

At the mammal colpa tapir and ocelot tracks could be found. Everybody is looking forward to playing the video tape on Friday.

26 June

Last day for six of us. The Hoffberg couple became victim of a new peccary attack, so Janet finally was really happy to have seen some: *"We looked for refuge in the tree and waited on some high logs for about 15-20 min. One turned and looked directly at Emma. She made loud grunts to scare them away and Alan blew his whistle loudly which scared the peccaries."*

Mark and Lindy can't get enough of transecting, so they started their fourth time this afternoon, unfortunately without seeing very much.

Cara and Joerg removed the camera; on the tape were some more birds, squirrels, a green agouchi, but also Emma and me.

The tarya came back for Papaya-feeding, running upside-down on the trunks.

If you ever feel cold in a European sauna, try barefoot soccer at an Amazonian beach. Margarita, Neill, Jose, JJ and I did, but finally we really enjoyed the physical exercise.

Final discussion about the expedition in the evening. There were really problems missing to speak about! I wouldn't be overstating if I said that everybody felt very content.

27 June

Back by boat to Puerto Maldonado. We were leaving richly filled with experience. Angela stayed at the camp, Cara and Joerg, our other two multislotter couldn't resist the lure of civilisation. The five hours on the river passed with a competition in estimating how many brazilnuts might fit into a kilogram. There are over 300, Diana won.

For the last hour we took an injured logger to Puerto Maldonado, three days ago he suffered a complete clavicular fracture. By peke-peke it would have taken him another day to get into hospital.

Although tired, we got a boost upon our arrival: The Wasai hotel pet, a three-toed sloth was this time very close and could be observed, dangling with his long arms in the branches.

After our last supper the younger generation completed the expedition visiting the local disco. Let me close this report by saying with Neill: "Vamousch!"

29 June

Once again starting the boat trip from Puerto Maldonado. With six new faces: Sandra, Sheila, James, David, Carlo and another Emma, who arrived just in time at the meeting point from giant otter watching in Tambopata. During the trip they got their baptism of fire in the form of a rainshower of really biblical dimensions. It was impossible to identify the borderline between water and sky and I can't remember having experienced a stronger one. Now we know why it is called the RAINforest here. But everybody weathered the storm stoically and was rewarded by an abundance of wildlife. Joerg and I were just talking about the species we'd most like to see during the next slot: howler monkeys and a capybara (world's biggest rodent), and as if our prayers had been answered by a fairy godmother, these two were seen on the side of the river. In addition, we saw a jabiru stork with his black bald head, and a large black caiman (unfortunately dead) with all his limbs stretched upwards, most likely having been killed by some loggers who believe that the killing of a black caiman ensures continued rainfall, thus aiding the shipping of their wood.

This session we started the team talk in more comfort on the sofas. This involved a little formal but very informative presentation by each person. Biosphere Expeditions seems to endlessly attract quite interesting people from all walks of life, but all with a common goal: a love of nature.

The day was ended with a demonstration of night vision equipment and flares.

30 June

Introduction walks after the risk assessment. We saw squirrel monkeys and some collared peccaries. I was glad to hear something more about the plants: the pona palm for example, which can store water in the middle enlarged portion of its trunk or the green sanipanga leaves, which turn purple when rubbed and can be used by painters. Inside the very hard sherbone nuts you often find some tasty beetle larvae; Margarita, Joerg and I passed the test of courage to bite on them.

In the afternoon Emma gave classes in identifying mammals, interrupted by a very close peccary-concert.

The night sky was very clear tonight. Beside the Southern Cross Scorpion, Centaur, Corvus and Virgo were identified.

1 July

Azulito, our blue-and-yellow macaw started his first flying trials under Angela's very kind care. One of these trials ended directly in my bed.

A medium Amazon tree Boa (1.5 m), caught by Joerg yesterday became the star of the show in the photo-shooting session this morning.

The first walks on the trails after four days are usually very successful. On the Transect this time six monkey species were encountered, including a glimpse of the very shy equatorial saki monkey!

Even the walk to the mammal colpa gave the opportunity for observation. After seeing some nice saddle-back tamarins, James and David had their first peccary experience. David bravely clutching his tiny safety-tree. Something weird happened on our way back. First, I briefly caught an acrid, but not peccary-like smell, resembling the predator cage in a zoo. Maybe an illusion, I thought. But then we heard a spix's guan flying away with loud cackling, interrupted by a kind of deep growling and some noises, as if there was something big moving inside the forest. Who knows what it was...

A beautiful display of Nature waited for us only a few meters away from the station. Within only a few hours a bride's veil had grown beside the trail, a perfect hexagonal white net, hanging down from a morel. By tomorrow it will have disappeared. All beauty on Earth seems only to last for the shortest time.

2 July

A new project was started today; another transect on the other side of the river. There is still hunting activity going on there, so hopefully, in time, we will be able to compare the two different data sets.

There was a season's record at the macaw colpa, with over a 100 birds counted! Also some jaguar tracks were found there.

A tiny blunt-headed treesnake was used by Margarita to demonstrate some snake anatomy. Why I didn't ask myself ever before such questions as: where do they release digested food or where is their heart beating? What an incredible construction they have!

Joerg and I installed the video camera at the mammal colpa once again. Typically, the colpa had been covered with peccary tracks, during the period when the camera had been removed!

Due to a short rain shower the monkeys climbed down, so we got a quite close view of some brown capuchins and their mates, the squirrel monkeys.

JJ found a small mouse opossum in his room and brought it out for inspection. It escaped and ran rings round four big men who scrambled about helplessly behind the tiny animal. Finally Joerg sacrificed himself in the name of science by getting a proper bite mark on his thumb from the little escapee.

3 July

The new transect across the river lies within a beautiful part of the jungle. It seems to be home to some different species, as today Orlando and Cara encountered a sting ray in a creek.

The second new project is the topographic coverage of the research area. Today, Angela and I started a first trial on the path to the port by using pacing and bearing by compass. In comparison with a standard GPS measurement, the total error of bearing, pacing and drawing errors remained below 5%. Thanks to Jose and a peke-peke we were able to go downstream to the waterfall and upstream to the macaw colpa to measure the majority of the turns and meanders of the Las Piedras River that we needed.

To end another productive day, David told us one of his Canadian grizzly adventures with absolutely comedian talent.

4 July

We have all now experienced the peccaries; however today a herd of up to 300 passing extremely close to the station, was a really new aspect. Even hours later their smell hung heavily in the air.

Never think the jungle can't show you new things all the time. Even the good old mammal colpa trail surprised Sandra, Cara and me with one of the most amazing sights of this expedition: A troop of black spider monkeys, the biggest species in this area, crossed the trail directly ahead of us swinging from vine to branch with breathtaking ease. A tiny baby clutched onto the back of its mother and occasional pink, bald faces glanced curiously from black furry rotating masses of gangly black arms, legs and tails. Cara thought even her ocelot experience had been topped today.

The mapping with the GPS to the colpa was carried out quite well in spite of the dense foliage. Finally something other than the usual birds and squirrels was captured on the video tape: a huge Agouti with gold/brown shining coat. On our way back a group of pale-winged trumpeters with white wobbling tails passed the trail .

Also the transect group observed something new, a grey brocket deer!

The leisure activities of the day included: juggling with Brazilnuts and Salsa for the advanced wherein Emma2 seems to have a real capacity.

5 July

There seem to be fewer, but more diverse types of animal to spot on the new transect. Today JJ encountered an armadillo! On the old transect Carlo broke the record for coming back from the Brazilnut farm in only 1:15 h!

Mapping goes on, today with Emma2 at the Waterfall, where the clear water of a meandering jungle stream falls into the muddy river. Because one of Emma's flip flops flushed down, we had a good reason to climb down and have a refreshing bath in this natural whirlpool and to take some kitschy pictures behind the waterfall.

Orlando found a large terrestrial turtle, which, after having been photographed, crept immediately under the main platform and stayed there, until darkness allowed a safe retreat.

Two groups departed in the evening for an overnight stay: Margarita, despite her fear of cockroaches went with Jay and David to the Brazilnut farm for "extreme frogging" and a girl gang (the two Emmas, Angela, Cara and Sheila) to the mammal colpa.

Sandra, Joerg, Jose, JJ and Orlando stayed for guitar playing and unsuccessful fishing (only a ray, which we had to release) at the station. A little scorpion crossed our way to the port while the big one shone down directly above us.

6 July

The excursionists came back with limited success, only one new frog species found but night monkeys seen at the Brazilnut farm; the mammal girls were surprised to find the tracks of a tapir, which they had heard during the night directly under the hide they had slept in!

The Sunday leisure activities this time were fishing, showering at the waterfall, football and volleyball at the beach. The loudest laughs were caused by the poor souls who had to get the ball out of the river and sank deep into the mud with some funny contortions.

In the evening we had a first singsong. "Killing me softly" was sung with gusto, but only "Let it be" and "La Bamba" could be recognized.

7 July

Today the macaws had been definitely disturbed by human impact; as some madereros stopped at the colpa and scared them by yelling for no apparent reason.

On the new transect Emma2 hardly saw a thing, except such "boring" animals as squirrels or spix's guans. As compensation she and Orlando stumbled over a troop of two howler monkeys with six young on their way back!

Joerg observed a possible attack by a harpy eagle on black spider monkeys: *"Suddenly I heard an alarm call and a second later the noise of an attacking eagle in the air. But he missed. A few minutes later the spider monkeys were gone and I continued my way to the lookout at the river. Maybe 300 m ahead I again heard the flapping of a big bird. The shape of the wings and its colour looked like those of a harpy eagle"*.

Cara and I tested mapping of undiscovered territory on the little stream, where our water-supply is taken from. Though no more than 400 m away from the station we paced and cut with a machete as possibly the first humans along the meanders feeling like Stanley and Livingstone and encountered some interesting details: tapir-tracks, a bat cave, some nice small waterfalls and a second mammal colpa, approximately half the size of the other one and covered with peccary tracks! Maybe a new research area?

By now Cara was looking at me a bit critically: will we end at the mammal transect as planned, or have we got to go back through the green hell? Luckily found the transect as predicted. In the afternoon we took some more GPS waypoints along the river. Two sunbitterns skimmed peacefully over the water surface and a similar but bigger bird dried its beautiful rusty coloured wings in the sun. I was too lazy to take a picture. Later at the camp Jose told me what bird it was: the rare hoatzin!

8 July

Again a bird attack on monkeys was observed: This time a hawk chased squirrel monkeys on the new transect!

Cara and Emma2 on the "old" transect today were so successful that it would make more sense to list the animals they haven't seen!

Jay, David and I left the station in the morning for an 11 hour mega mapping session and came back with over 70 new GPS positions of the mammal transect and the brazilnut trail. This one had been cut with a tractor some years ago perpendicular to the river to reach the up to 300 Brazilnut trees of the concession. We couldn't figure out where its end was, as my crew went on strike. To differentiate all the points we had to invent some curious abbreviations: Who would for example assume, what SFLTS19INT

means? (Strangler-Fig-Ladder-Point 19-Intersection) David was quite disappointed, that "Aguajal 5" was not named "Killer-Swamp".

The evening team talk was interrupted by Melissa's cry: A red snake directly beside a step to the team quarters! Joerg and I crept under the platform and a pole was used by courageous Joerg to finally catch the 1 m "beast".

9 July

The apparently most severe peccary attack of this expedition. Cara reported around 200 animals all showing off their punk hairstyles on the new transect, chasing her up a tree.

On the old transect Emma and Joerg were fooled by a jacamar, a small bird, which cries exactly like a lost cat, waiting in a tree for the fire brigade!

Star of the day was a small anteater, a so called tamandua, which is able to climb trees, unlike his giant cousin. After spotting JJ and Emma2 he fled up a tree near the port where he became a model for our photo shoot!

David and I spent most of the day drawing the mapping points we took yesterday. The distance we covered measured nearly 1 m on our map! A really surprising and useful result was that the mammal colpa trail passes the Brazilnut trail within less than 100 m!

Until now the "shortcut" we were using was more than 1 km in length. If the map is right, it might be possible to save approx. 2.5 km on the walk back from the old transect by cutting a new trail through.

Angela, Sandra, Jay and David left the station in the evening to seize the last opportunity to spend a night at the mammal colpa. The rest of us went to take a dip at the waterfall. As we pulled up in the boat, a 1.5m dwarf caiman was cooling off on the rocks by the waterfall. Before we got into the water, Jose and JJ wrestled the beast in Crocodile Dundee style and cameras were again in action. When we finally released him, he nearly flew into the water!

For the men amongst the group, the test of courage involved diving through the strong cascading torrents of water. Tomorrow's menu was assured when Jose caught a monster catfish of about 1.5 m in length!

10 July

When we got up this morning we all felt a dramatic drop in the temperature, the long anticipated friaje, a stream of cold air falling down from the Andes, had arrived. Walking in temperatures of 15-20C and overcast skies became quite pleasant this morning, but the animals didn't seem too impressed and stayed in bed!

Emma2 and I mapped the new transect where the landscape is very fascinating with steep hills and lookouts over the river. We met JJ and Cara, who just caught a little tortoise. Unfortunately, they lost it shortly afterwards after leaving it on the ground with their cameras, apparently thinking it will stay put.

In the afternoon, David became desperate to test out our mapping results. He and several others went out armed with machetes to cut a new trail to link up the mammal colpa trail to the Brazilnut trail. This was the moment of truth for the mapping project. Would they hit the other trail? After only 80 metres and half an hour of slashing they were through! Now a good 30 minute can be saved on our walk back!

But what about the intrepid explorers overnighing at the mammal colpa? When Jay, David, Angela and Sandra arrived, they were met by the pleasurable sight of three or four big jaguar paw prints in the colpa trays. After food, surveillance was set up over the colpa. David decided to call it a night and crawled under his mosquito net at 6:30 pm while the others kept watch. At 8:00 pm, Jay came down from the hide and wandered up the transect to use the local facilities. A little moonlit walk was in order and he wandered for a couple of hundred metres up the transect. And then... he hit the jackpot: "*I was standing still when I noticed two orange eyes appear in the distance and beginning slowly to come closer. I stayed motionless as the two dots continued to grow steadily larger. I was waiting for them to vanish into the pitch black night, but they kept on coming. Suddenly coming into my head torch light, I saw what the two eyes belonged to a big jaguar. It approached within about 4 metres and stayed crouched staring at me. I was frozen to the spot not knowing what to do, thousands of thoughts and emotions flying through my head. After a few seconds, it began to move towards me again with hungry unblinking eyes. This spurred me into action and I shouted and began hitting my machete against the nearest tree. Luckily, for me at least, the jaguar turned and fled, stopping only briefly to stare back. I made the 300 metres back to the colpa hide in about 40 seconds, leaping over roots and tree stumps, hitting trees as I went. I safely got up into the hide to eventually blurt out the story to my comrades. This was without a doubt the most exciting, scary, exhilarating evening of my life, and I'm still here to tell the story. Wow! Unfortunately, nothing more was seen of the jaguar that night and all the other animals kept away too.*"

After Jay's tale, Sandra didn't leave the hide again all night, the topics of conversation will be clear for the next days and a lucky Jay will go home with a real lifetime experience. I have to use Carlo's favourite word: Unbelievable!

11 July

It looks like the friaje is here to stay, registering only about 16C in the morning! We departed by boat to Puerto, looking more like a polar expedition, laden with sleeping bags and woolly hats.

A stopover at an oxbow lake beside the river provided us with some scary views of piranha Jose had caught. To test its reputation, we stuck a leaf into its mouth. In the blink of an eye, its razor sharp teeth had cut a perfect semicircular hole from the leaf. Onward the weary travellers toiled until they came to a grinding halt on a sand bar. Everybody out and push came the cry as we all took our shoes and socks off and clambered overboard into the muddy water to push the sturdy vessel free. Surprisingly the water was warm, perhaps we should swim back?

Despite the temperature some animals could be seen and finally Angela Angela got to see a Capybara.

This second slot of the expedition ended in Puerto's "El Hornito" with a lot of "familiar" sized pizzas and some application of the learned Salsa-steps in the local disco.

13 July

This time a more cosmopolitan team gathered, a good mixture of British, Americans and Germans. Without a bag belonging to Syd, that had been lost somewhere between Miami and Santiago, we started another boat trip to the station. Although still quite chilly some animals turned up on the river banks like two capybaras (in German: "Water-Pigs"), some horned screamers with their "antennas" coming out of their heads and we saw a preview of the colpa by seeing some red and green macaws feeding on a clay lick.

14 July

Frozen faces at breakfast, only 14C, but the friaje seems to be disappearing step by step.

Except Joe, all of the new group are jungle virgins, so it was nice to see them in wonderment at the rainforest. How did Claudia say? At home I am cultivating hard what here grows as weeds! Jose showed us some hallucinogenic plants and his new dugout canoe in progress.

For the first time an introduction walk in German was also offered. I can be proud of my paisenos, all of them ate the beetle-larvae's of the Sherbone nuts without hesitating. As a reward they got to see what I had to wait three weeks for: an amazing black spider monkey troop in a kapok tree and even something which I hadn't seen so far: a big howler monkey with a dark mane and a huge wide highway of leafcutter ants ending in their castle near the mammal colpa trail. Winfried grabbed a rotten branch and fell out of the tree at the river lookout point, with the expression of real surprise on his face. Luckily he landed on the soft, muddy beach, leaving an impressive print in the sand.

Another class in Amazonian zoology in the afternoon. We learned from Margarita that all male snakes have two penises, in case one is not working, wow!

Emma mentioned that the new Peruvian Government might be more engaged in conservation than the previous one, the President was educated at Harvard and is married to a conservation orientated American. So in future the chances to support sustainable forestry in this region will hopefully increase, based on our, and others' documentation of local biodiversity.

15 July

We start working on the projects. The spider monkeys seem to get more and more active; on the old transect no fewer than 13 of them were encountered. Just below the macaw colpa, Gerhard, Amanda and Winfried observed some Health Ministry officials cooking and eating a caiman. Apparently they were going upstream for a vaccination campaign. One of them was about to head into the jungle with a gun for a desert. JJ called: "Where are you going, this is private land?" and the man returned. Well, how ever can Peru set up a working control of hunting and logging in their country, if even the officials set such a bad example?

During our absence a big pacu fish of at least 8 kilos bit on one of Jose's lines.

We are already getting a team with its own character. In the afternoon a magician session came up, Carlo and Maggie conjured with cards, Winfried and his pupil Lucio with a rope and Joe showed us some mind teasing puzzles with matches.

Before the moon rose we saw a beautiful night sky, Alpha Centauri, our nearest neighbour star could be spotted just left of the Southern Cross.

16 July

There was another tamandua seen on the new transect, with a different colour pattern on his coat; apparently they are quite polymorphic. This one was a red/blond with a black saddle. Really pleasing to see two different ones in such a short space of time.

Setting up the video camera at the mammal colpa again. Syd seems to be a good new partner in crime, he even made his camera available to try another night shot. In the meantime Gerhard took care of the "gardening" of the traps, looking in his camouflage shirt a bit like Gene Hackman in Vietnam. On our way a female red brocket deer crossed the trail within a distance of 10 metres and an Amazon squirrel allowed us to observe it from fewer than 5 metres. It is amazing that some creations of Mother Nature are so universal, that they look absolutely the same all over the world.

One more human attack at the macaw colpa: some loggers even attempted to shoot at our splendid birds had JJ not interfered. Allegedly there exists a disgusting Peruvian delicacy of macaw head soup! Especially for the macaw population hunting is a real problem, as they only reach sexual maturity after five years and pair for life, only rearing perhaps one or two chicks. In the evening a discussion about hunting and fishing came up. Some team members didn't understand why we avoid hunting but go fishing. Ethically there is no difference, which species you kill, but Emma explained that experiences at more inhabited regions have shown that fish have more biological power to recover their population than terrestrial wildlife.

17 July

Today was apparently the worst day in the history of the old transect. Amanda, Emma and Margaret saw nearly nothing, but almost everything on their way back.

At the macaw colpa I waited nearly four hours for some feeding action with the drawn 500 mm, but as you'd expect there was little action. Ironically, an hour after I left, they came down in near record numbers - about 65 on the colpa. Have a break, have a Kitkat...

In the afternoon a machetero troop marched out to cut a connecting trail to the little mammal colpa at the pump creek, which Cara and I found last week. It is "unbelievable", how fast you can produce a trail that looks like it has existed for years. Facts are created by actions.

Our daily team talk was interrupted by a porcupine alarm from Jose. Everybody turned out with torches, screening the trees (I didn't know that they can climb), but nothing was found. The porcupine heard us coming. But Winfried successfully scared us by jumping out from a bush covered in a bed sheet.

18 July

First time Margerita and her helpers went out frogging in the morning and at the river bank, finding even a new species, black and tiny.

There is still a lot to map. Claudia and I explored an old farm upstream, and our supply farm downstream of the macaw colpa, both part of Emma's and JJ's concession. As a professional canoer, Claudia showed me how to use the paddle only on one side of the boat without drifting sideways. On our way we observed a big troop of white capuchins and discovered a really wide "Bacardi" beach, which looked inviting for future volleyball and football games. In the evening we only managed it on our home beach, enjoying some challenging matches.

19 July

A small group of macaws assembled today directly above the observation hide. For Amanda and Claudia that meant that any leg-stretching or going to the toilet would cause that fatal alarm call, which flushes all the macaws off the colpa resulting in at least a half hour wait until they start feeding again.

The previous night was the last time for frogging with Margerita and produced three new species, one of them a beautiful dark tree frog with golden, star-shaped lines in his eyes. With these her collection comprises 48 species, quite a satisfying result. During the rainy period she will come back to collect hopefully approximately 30 species more. At the Tambopata river 60 species were collected, also during the dry season, but by using other methodologies such as pitfall traps.

Two overnight weekend excursions set off today: Amanda, Claudia, Maggie, Danni and Carlo went out to the mammal colpa, Winfried and I wanted to map the remotest point of our research area, the end of the Brazilnut trail. On our way we found an overgrown connection to the Brazilnut farm, which could save another 500 metres of the way back from the old transect. At the farm an agouti unwillingly separated itself from feeding on the nut paradise when it saw us.

The further we got into the jungle, the less animal activity there seemed to be. In a region where there haven't been any humans for six years we expected the opposite, supported with hopes from some jaguar droppings on the trail. But wildlife seems to be more concentrated along the river and has already become quite used to our research station.

In the dark we started a little night walk. After only 50 metres Winfried asked me: "Our tent is over there, isn't it?". "No, more in that direction, I think!" Everything looked the same, you couldn't make out the hand in front of your eyes and after a few turns you got really confused. By using a compass and a big Brazilnut tree as a fixed point we fortunately regained our orientation quickly again, having had quite an instructive experience.

20 July

Back from the end of the Brazilnut trail, where it branches out to the several Brazilnut trees, we spotted the first animals in already explored terrain, two acrobatic black spider monkeys and a yellow-rumped cacique with its light yellow wings and black tipped tail, one of the few birds you can encounter if you hear their call.

There were dejected faces of the mammal colpa crew when we reached the camp. Although they observed the colpa the whole night, they saw really a lot of animals: ants, mosquitoes and spiders... Maybe this was because they had a light on and giggled throughout the night. Obviously the mammals will not venture near the colpa unless everything is absolutely quiet.

Everybody chilled out that Sunday morning. In the afternoon people started to take some walks to the waterfall and some sports at the Bacardi beach, which unfortunately was quite infested by sandfly armies - the price you pay for a bit of paradise in the rainforest.

21 July

A huge snake appr. 2.5 metres in length had been seen briefly on the old transect, with colouring similar to the dangerous bushmaster.

Syd and I changed the camera at the mammal colpa with trembling hands: Will we perhaps reap something else this time other than our regular guests, the squirrel and that razor-billed curassow couple? Yes, we did, although again very dark, one of the night shots showed an exciting record: Two pairs of glowing eyes were peering around, a smaller and a bigger one. Hard to say who they belonged to, possibly paca and tapir? Anyway, the record was taken on the night before some tapir tracks had been encountered in the colpa. In addition, we finally caught a peccary group, unfortunately just before the tape ran out. This made Emma really happy

The day ended with another sing-song in English, German and Spanish.

22 July

Data production efforts were changing on all fronts. While Margaret and Emma were lulled to sleep in the macaw colpa because of the absence of activity, the transect people had much reason to rejoice: Carlo observed a male red brocket deer with small horns and saw five species of monkeys, including the dusky titi monkey. Amanda spotted four howler monkeys all by herself, which JJ missed. This made her quite proud. In addition, on the new transect Danielle and Gerhard encountered another tamandua, feeding on a termite nest in a tree.

Claudia and Joe volunteered for another hardcore mini-expedition to map the Rio Loretillo, the stream where the new transect ends. We started approx. 1.6 km upriver of the macaw colpa at its extremely muddy mouth, sinking in deeply with both legs, or, in the case of Joe, with all extremities. After a few hundred metres the riverbed became more stable and allowed us to walk more comfortably. It was also completely free of rocks and stones, which is quite remarkable for this area: Underneath a few centimetres of pulsating humus, there is only sand, and the rain forest will easily turn into desert, if we don't take care to conserve the vegetation and associated top soil.

The first daylight broke through the canopy, glittering delightfully on the rapids in the stream. The early morning here has a kind of untouched atmosphere. Although along the first kilometres there was evidence of many human footprints indicating hunting activity, the riverbank was covered everywhere with many tracks, including a whole host of tapir and jaguar prints!

We reached the end of the new transect unexpectedly early, so there was the opportunity to continue forward, with a little more feeling of pioneering. The water became clearer and we spotted some freshly hatched baby fish and caught a small river turtle. The presence of more logs in the stream complicated progress, and the lost Inca City unfortunately was, as always, just behind the next turn.

We used the dugout to return on the Rio Piedras and observed a red capped cardinal, a small, pretty river bird.

As I was writing this diary, a huge bug flew into the station to take a seat on one of the columns. Over 10 cm in length, with a bizarre, peanut shaped head, the lantern fly is a rare bug that has produced much material for myths. Some people believe that it is bioluminescent and this is what has given it its name, although this is completely wrong. In the book "Neotropical Companion" we read that a girl stung by a lantern fly is required to have sex with her boyfriend within 24 hours, or else she will die. Nervously, our girls hid behind the busy photographers.

Excuse me, but this isn't the end of this full day. On a whim, JJ, Winfried and I started a little night walk to the nearby new colpa, armed with a bright halogen torch. After a few minutes, two yellow eyes reflected the light perhaps 15 metres in front of us. Curiously, they moved around, and then we saw for a few seconds a little yellow body, spotted with black rings, jumping noiselessly across the trail. For a while longer the eyes remained fixed on us from the undergrowth and then this kind of unreal moment was gone. Nobody said a word. Oh my god, we had seen an ocelot!

23 July

Today a crime wave hit new heights at the macaw colpa. Carlo and Syd observed a logger entering the forest near the colpa with a shotgun. A few minutes later a shot was heard from the station. After that the logger came back with a stolen bunch of bananas and a poor, dead red and green Macaw, possibly the only animal he could reach. Unfortunately the boat had no name so the most Carlo could do was to note any distinctive features - perhaps we can catch with them on the river before Puerto.

Prior to today, Maggie's wildlife viewing had been somewhat limited, but she was more than compensated by encountering all kinds of monkeys on today's transect: No fewer than eight sightings, including 32 squirrel monkeys and, in addition, 9 coaties, a kind of racoon, which noone else had seen!

Joe and Winfried were a bit desperate for a workout and cleaned the shortcut to the Brazilnut farm that Winfried and I had explored on Saturday.

After our evening talk JJ, Jose, Winfried and I left the station to sleep near the mouth of Loretillo. We went upstream by boat under a beautiful, clear night sky. The Southern Cross accompanied us, visible as a ghost through the black canopy.

We had to leave our first campsite, invaded by a leafcutter army, which had already started to cut our tent bags to pieces – our tents would surely have been the next target!

24 July

Up at 4 am for some observation along the Loretillo. Wading upstream was too noisy, so we decided to walk using a shortcut to the end of the new transect. Starting there, Winfried and I could wade downstream, leaving a slightly cold JJ behind. I think that's it, except that I now have an answer if asked how to see a jaguar in as short a time as possible: wading downstream in the same speed as the current is nearly noiseless, and the winding stream always provides new sights. If you do this every morning from 4 to 6 am with a strong halogen spotlight you could be lucky relatively soon.

Winfried and I had only three quarters of an hour before we had to start the new transect, although we saw a dwarf caiman, which allowed us to approach approximately half a metre away.

On the transect there were only few mammals, but we got some really nice bird views: a couple of black-tailed trogons posed side by side on a branch, a green male, a brown female, both with red throats, and a Cuvier's toucan was spotted posing in guidebook picture fashion, black and white with a huge yellow bill; what an incredible bird!

At the same time there was nearly no activity at the macaw colpa, probably because the birds had been totally frightened by yesterday's events. But what is hard to believe is that Amanda and Joe, on taking a walk to relieve the boredom during one of the many quiet periods, spotted a dusky titi monkey and managed to get within 2 m!

In the afternoon Danielle and I needed to perform some acrobatics on a papaya tree to procure dinner's desert.

25 July

We have come to the last day of this expedition, which has gone very fast, too fast.

On the way down by boat a red brocket deer swam through the river, causing a concert of camera clicking. Along the riverbanks some beautiful yellow and pink flowered trees had bloomed.

Unfortunately, there were no 6-metre black caimans to be seen during our stop at the oxbow lake, just as last time. But 10 hoatzins were seen on a tree by the lake shore. Jose and I caught two small fish, one of them a piranha. And finally, Gerhard's biggest unfulfilled wish came true, a tropical rain shower. Unfortunately, it came at a really inappropriate time (no-one had their waterproofs out, all were packed neatly away!).

About two-thirds of the way to Puerto, we passed and recognized the logger float transporting those guilty of the macaw murder. Taken to task by JJ, they naturally denied everything. Hopefully, the slow progress in awareness of conservation will go on in the future as we continue to confront the local populace.

Arrival in Puerto, last supper at "El Hornito", late disco night with Meringue and Salsa.

The last moments of a long period often seems like a revival of nostalgia. I don't like leaving, so I will make it short: six weeks of living in the jungle, and six weeks of working with all kinds of ages, professions and nationalities are gone now. We all got a bit more of an idea of what a rainforest means. It is one of the most impressive habitats of our planet. Our thinking and acting will change after having seen this. And the memories will last forever.