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EXPEDITION REPORT

Expedition dates: 20 – 2 August 2014
Report published: July 2015

Amazonian plethora: biodiversity monitoring of jaguars, pumas, primates and other flagship species of the Peruvian Amazon

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Authors

Alfredo Dosantos Santillán
Tahuayo River Amazon Research Center

Marcelo Mazzolli & Matthias Hammer (editors)
Biosphere Expeditions

Abstract

An expedition to the Tamshiyacu Tahuayo Community Regional Conservation Area (TTCRCA) (Loreto Region, Peru) was conducted with Biosphere Expeditions in 2014 with aim of determining patterns of distribution and frequency of wild felids, primates and other flagship species in the study area. This was the third annual Biosphere Expeditions survey in the area and sampling took place 22 - 25 July and 27 July - 2 August 2014 in two groups.

Sixteen layperson citizen scientists were trained, in two groups, to help collect data. The first group consisted of six persons and the second group of ten. The total area surveyed was 48 km^2, encompassing three major types of forest: terra firme, palm swamp forest and seasonally flooded forest. Species presence was recorded using a standard 2x2 km cell grid methodology developed for terrestrial expeditions using citizen scientist volunteers. Local assistants were also employed and shown to make a difference to animal detection rate, by roughly doubling it compared to surveys in 2012 and 2013. Sampling entailed recording mammals by sight, and tracks (only for the species composition study), as well as via nine camera traps distributed around the study site. The TTCRCA continues to show high animal biodiversity, with twenty-eight species being recorded, sixteen with arboreal habits (including ten primate species), one aquatic, and eleven with terrestrial habits. Human impact is low and large-bodies primates seem to be recovering in numbers since a hunting ban imposed in 2008.

Primates, in particular the saddleback tamarin and red titi monkeys, were recorded in a larger number of 2x2 km cells than other mammal groups. Detection rate for primates, both in species number and frequency of individuals, was found, unsurprisingly, to reflect the presence of ripe fruit trees in certain cells. Jaguar was detected twice by tracks. Other *Leopardus* sp., such as ocelot or margay, were recorded by tracks too. The presence of felids also points towards a healthy, relatively undisturbed habitat, which must be protected in the face of emerging threats. As such expeditions using the 2x2 km cell methodology will continue.

Resumen

Una expedición al Área de Conservación Regional Comunal Tamshiyacu-Tahuayo (ACRCTT) (Región Loreto, Perú) fue conducida en 2014 por Biosppher Expeditions con el objetivo de determinar patrones de distribución y frecuancia de felinos silvestres, primates y otras especies bandera en el área de estudio.. Este fue el tercer muestreo anual de Biosphere Expeditions en el área y el muestreo tomó lugar desde el 22 al 25 de Julio y del 27 de Julio al 2 de Agosto del 2014 en dos grupos.

Dieciseis científicos no especializados fueron entrenados, en dos grupos, para ayudar a colectar datos. El primer grupo consistió de seis personas y el segundo de diez. El área total muestreada fue de 48 Km^2 comprendiendo tres principales tipos de bosque: terra firme, bosque inundable de palmeras y bosque estacionalmente inundable. La presencia de especies fue registrada usando una cuadrícula de celdas standard de 2x2 km, est metodología fue desarrollada para expediciones terrestres usando ciudadanos científicos voluntarios. Tambien fueron empleados asistentes locales y demostraron hacer diferencia en cuanto a la tasa de detección de animales, por aproximadamente el doble comparado a los muestreos del 2012 y del 2013. El muetreo implicó el registro de animales por avistamiento y huellas (sólo para el estudio de composición de especies), así como tambien utilizando nueve trampas cámara distribuidas en el área de estudio. El ACCRTT continua mostrando una alta biodiversidad animal, con veintiocho especies registradas, dieciseis con hábitos arboreos (incluyendo diez especies de primates), una acuática y once con hábitos terrestres. El impacto humano es bajo y los primates grandes paracen estar recuperandose en número desde una prohibición impuesta el 2008.

Los primates, en particular el "tamarin común" y el "tocón colorado" fueron registrados en un gran número de celdas de 2x2 km que otros grupos de animales. La tasa de detección para primates, en ambas, número de especies y frecuencia de individuos, mostró reflejar la presencia de árboles con frutos maduros en ciertas celdas. El "jaguar" fue detectado dos veces a través de huellas. Otros *leopardus sp*., tales como el "ocelote" y el "margay" también fueron registradas a través de huellas. La presencia de felinos también apunta hacia un habitat saludable y relativamente imperturbado, el cual debe ser protegido de cara a amenazas emergentes. Tales expediciones usando la metodología de las celdas de 2x2 km continuarán siendo aplicados.

Contents

Please note: Each expedition report is written as a stand-alone document that can be read without having to refer back to previous reports. As such, much of this section, which remains valid and relevant, is a repetition from previous reports, copied here to provide the reader with an uninterrupted flow of argument and rationale.

1. Expedition review

M. Hammer (editor)
Biosphere Expeditions

1.1. Background

Biosphere Expeditions runs wildlife conservation research expeditions to all corners of the Earth. 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. Expeditions are open to all and there are no special skills (biological or otherwise) required to join. Expedition team members are people from all walks of life and 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 a survey of iconic wildlife species in one of the best conserved remaining regions of the Amazon basin with vast areas of unbroken canopy. The survey ran from 20 July to 2 August 2014. Since the Amazon was first explored scientifically, naturalists have been astounded by its diversity of plants and animals, with the western Amazon boasting the area's highest biodiversity. The Amazon harbours up to 300 species of trees in a single hectare, as well as hundreds of species of shrubs, vines, herbaceous plants and ferns. The Amazon supports over 2,000 species of birds, almost a quarter of the world´s total, and around 300 species of mammals.

This project was based at the Tamshiyacu Tahuayo Community Regional Conservation Area (TTCRCA). Previous studies suggest that this area has the greatest mammal diversity and particularly the greatest primate diversity in the entire Amazon (Salovaara et al. 2003, Puertas et al. 1995)

The conservation activities performed by the communities of the upper Tahuayo River have had an important influence on the protection of the area. Logging, hunting and fishing activities were identified as serious threats and in the early 1980s a control system to prohibit the extraction of natural resources was introduced. Ten years later, in 1991, the Regional Government of Loreto declared the Tamshiyacu Tahuayo Community Reserve and the high primate diversity was a factor in its creation. In 2007 the Tamshiyacu Tahuayo Community Reserve changed its category to *Área de Conservación Regional Comunal Tamshiyacu Tahuayo* or Tamshiyacu Tahuayo Community Regional Conservation Area (TTCRCA).

Previous work on the trail grid at the Tahuayo River Amazon Research Center (TRARC) suggests that there may be two species of titi monkeys (one so far unknown), two species of saki monkeys (one so far unknown), two species of squirrel monkeys (one so far unknown) and two species of night monkeys (one or both so far unknown) (Dosantos, personal observation).

1.2. Research area

Figure 1.2a Flag and location of Peru and study site. An overview of Biosphere Expeditions' research sites, assembly points, base camp and office locations is at Google Maps.

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 was within the Loreto Department, which boasts the second largest protected area, the Pacaya Samiria National Reserve (over two million hectares) and also the first Community Regional Conservation Area of the country, TTCRCA of 421,000 hectares.

Biologists refer to the Tamshiyacu Tahuayo area as the "green paradise" of the Amazon forest. Located south of Iquitos, just off the main Amazon river, the reserve encompasses areas around the Tamshiyacu and Tahuayo rivers eastward towards the border with Brazil, The reserve is currently adding a million acres of undisturbed forest on to its boundary, which will then include land all the way to the border with Brazil.

In terms of biological diversity, the research area is amongst the richest in the world and the TTCRCA harbours many species that exist nowhere else. The reserve's mammal diversity has been shown to be the greatest of any region in the Amazon, and the number of primate species is the highest of any protected area or reserve in Peru (Puertas and Bodmer 1993). The area also harbours 240 species of fishes that inhabit rivers and lakes, and 550 species of birds (Gobierno Regional de Loreto), such as the harpy eagle and razor-billed curassow. Eighty-seven non-flying mammal species have been recorded (Gobierno Regional de Loreto) amongst them the Amazon manatee, pink river dolphin, giant river otter and jaguar. At least 14 species of primates are present (Puertas and Bodmer 1993), including an important population of the red uakari monkey (Swanson, N and J. Chism 2003). It is also an area of great plant diversity (Salovaara et al. 2003).

1.3. Dates

The expedition ran over a period of two weeks divided into two one-week slots, each composed of a team of international research assistants, scientists and an expedition leader. Slot dates were 20 – 26 July | 27 July – 2 August 2014. This period was chosen to coincide with the dry season when there is less likelihood of daily activities being interrupted by rain and when the trail grid is accessible.

1.4. Local conditions and support

Expedition base

The TRARC is a basic but very comfortable lodge right inside the remote Tamshiyacu Tahuayo Community Regional Conservation Area. Cabins all have twin or triple beds and a view to the Tahuayo River. All meals were prepared for the team and vegetarians and special diets were catered for. The TRARC was also equipped with a solar panel system that provides sufficient electricity to cover all the basic electricity needs.

Weather

The area lies within the confines of the Amazon basin with a sub-tropical climate and distinct wet and dry seasons. The wet season is between December and June when rainfalls are heavy and frequent and the humidity is high (around 90% inside the forest). During the dry season, when the expedition took place, the average temperature was 28.5ºC with a maximum of 32.0ºC.

Field communications

Mobile phones did not work in the research area, but the TRARC had satellite internet and telephone for emergency communication with Iquitos. In addition, the expedition leader sent an expedition diary to the Biosphere Expeditions HQ every few days and this was published via Facebook, Google+ and the Wordpress blog.

Transport & vehicles

Team members made their own way to the Iquitos assembly point on time. From there they travelled by boat to the TRARC (about four hours). Once at TRARC, studies were conducted on foot or by canoe. All transport, boats and vehicles were provided from the expedition team assembly point for the outward and return journeys.

Medical support & insurance

The expedition leader was a trained first aider, and the expedition carried a comprehensive medical kit. Further medical support was provided through a medical post in Esperanza village (Clinica Ana Stahl), about two hours by boat. The nearest hospital was in Iquitos, about four hours by boat. Safety and emergency procedures were in place, but did not have to be invoked, as there were no medical or other emergencies.

1.5. Expedition scientist

The expedition's local biologist was Alfredo Dosantos Santillán. Born in Iquitos, Peru, Alfredo graduated in Biological Sciences at the National University of the Peruvian Amazon at Iquitos. Alfredo has worked for several conservation projects and has played a role in the creation of three protected areas. He has also acted as a consultant for WWF at the Yurua River Project and for The Wildlife Conservation Society at the Pacaya Samiria National Reserve monitoring key (indicator) species, and at the Yavari River Project monitoring primate populations. He works actively for the preservation of the Amazon forest and the cultural patrimony of different ethnic groups in many different locations in the Peruvian Amazon.

1.6. Expedition leader

This expedition was led by Malika Fettak. Malika Fettak is half Algerian, but was born and educated in Germany. She majored in Marketing & Communication at the University of Frankfurt, which led her to jobs in PR & Communications. She has travelled widely, especially in Africa and Northern Europe. Her love of nature and the outdoors, and taking part in a few Biosphere expeditions, persuaded her that a change of career was in order. Joining Biosphere Expeditions in 2008, she now runs the German office and German-speaking operations and leads expeditions whenever she can. Malika is also a keen sportswoman (triathlon, skiing, volleyball, etc.) and enjoys the outdoors.

1.7. Expedition team

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of all ages, nationalities and backgrounds. They were (with countries of residence in parentheses):

20 – 26 July 2014

David Glossop (UK), Neil Goodall (UK), Brigitte Heylen (Belgium), Frances Paterson (UK), Ngoc Anh Tan (France), Tom Van der Loy (Belgium)

27 July – 2 August 2014

Julian Carrillo (USA), David Glossop (UK), Neil Goodall (UK), David Hausman (USA), Andrew & Jayden & Keiran & Ashley Lane (UAE), Ngoc Anh Tan (France), Shelley Watson (UAE).

1.8. Expedition budget

Each team member paid towards expedition costs a contribution of £1,120 per person per one-week slot in 2014. The contribution covered accommodation and meals, supervision and induction, special non-personal equipment, and 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., or 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	18,410
Expenditure	
Base camp and transport includes all board, lodging and transport to and from base camp	6,643
Equipment & hardware includes all research materials purchased or hired	308
Staff includes salaries, travel and expenses	1,744
Administration includes registration fees, visas, sundries, etc.	53
Team recruitment Peru as estimated % of PR costs for Biosphere Expeditions	6,525
Income – Expenditure	**3,137**
Total percentage spent directly on project	**83%**

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) who 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. Biosphere Expeditions would also like to thank members of the Friends of Biosphere Expeditions and donors for their support in terms of finance and equipment.

1.10. Partners

For this expedition, Biosphere Expeditions was partnered with Amazonia Expeditions and the Tahuayo River Amazon Research Center. Through our expedition base at the Tahuayo River we were also involved with the local community, creating jobs for local people, providing health care, improving the educational services and building capacity through training and creating assets.

1.11. Further information and 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.

Copies of this and other expedition reports can be accessed via www.biosphere-expeditions.org/reports. Enquires should be addressed to Biosphere Expeditions via www.biosphere-expeditions.org/offices.

Please note: Each expedition report is written as a stand-alone document that can be read without having to refer back to previous reports. As such, much of this section, which remains valid and relevant, is a repetition from previous reports, copied here to provide the reader with an uninterrupted flow of argument and rationale.

2. Research on felids and primates

Alfredo Dosantos Santillán
Tahuayo River Amazon Research Center

2.1. Introduction

The study site has a great diversity of largely unresearched flora and fauna, save for some studies on the ecology and management of ungulates (Bodmer et al. 1994) and on primates (Salovaara et al. 2003, Puertas et al. 1995). A previous study by Puertas et al. (1995) in the Río Blanco area, reports densities for 14 species of primates, with the owl monkey being the most abundant (25 individuals per square km) followed by both species of tamarins, the saddleback tamarin and moustached tamarin (21.7 ind./km^2). Squirrel monkeys were recorded at a density of 18 ind./km^2, brown capuchins at 7.7 ind./km^2, and woolly monkey and white-fronted capuchin at 7.2 ind./km^2 and 5.6 ind./km^2, respectively. The Río Blanco area is also in the Loreto Region and about 10 km from the study site of this report, with Río Blanco the most important tributary of the Tahuayo River) (see Fig. 2.1a).

Within the Loreto Region (TTCRCA), the implementation of a wild feline and primate monitoring programme by Biosphere Expeditions is the first step towards the protection of their habitat. To ensure effective management and conservation, however, additional input from ecological and social studies throughout Loreto is needed for a rounded study. Since 2012 Biosphere Expeditions has concentrated its efforts in the area of the Tahuayo River in the Peruvian Amazon. This report covers the continuation of survey work in this area of the TTCRCA, conducted in July and August of 2014.

2.2. Methods

Study site

The TTCRCA is located in the Loreto Region of Peru, is 421,000 hectares in size, and is covered by diverse habitats. There is palm swamp forest dominated by a palm tree species locally called aguaje (*Mauritia flexuosa*), as well as seasonally flooded forest with its four sub-types of habitats: bajial, which stays flooded for around six months of the year, lower restinga (flooded for three to four months annually), higher restinga (zero to two months), and terra firme, which is never flooded.

The sampled area was divided into sections consisting of a grid of coded cells 2 x 2 km in size to help determine general location of sampled species (Figure 2.2a).

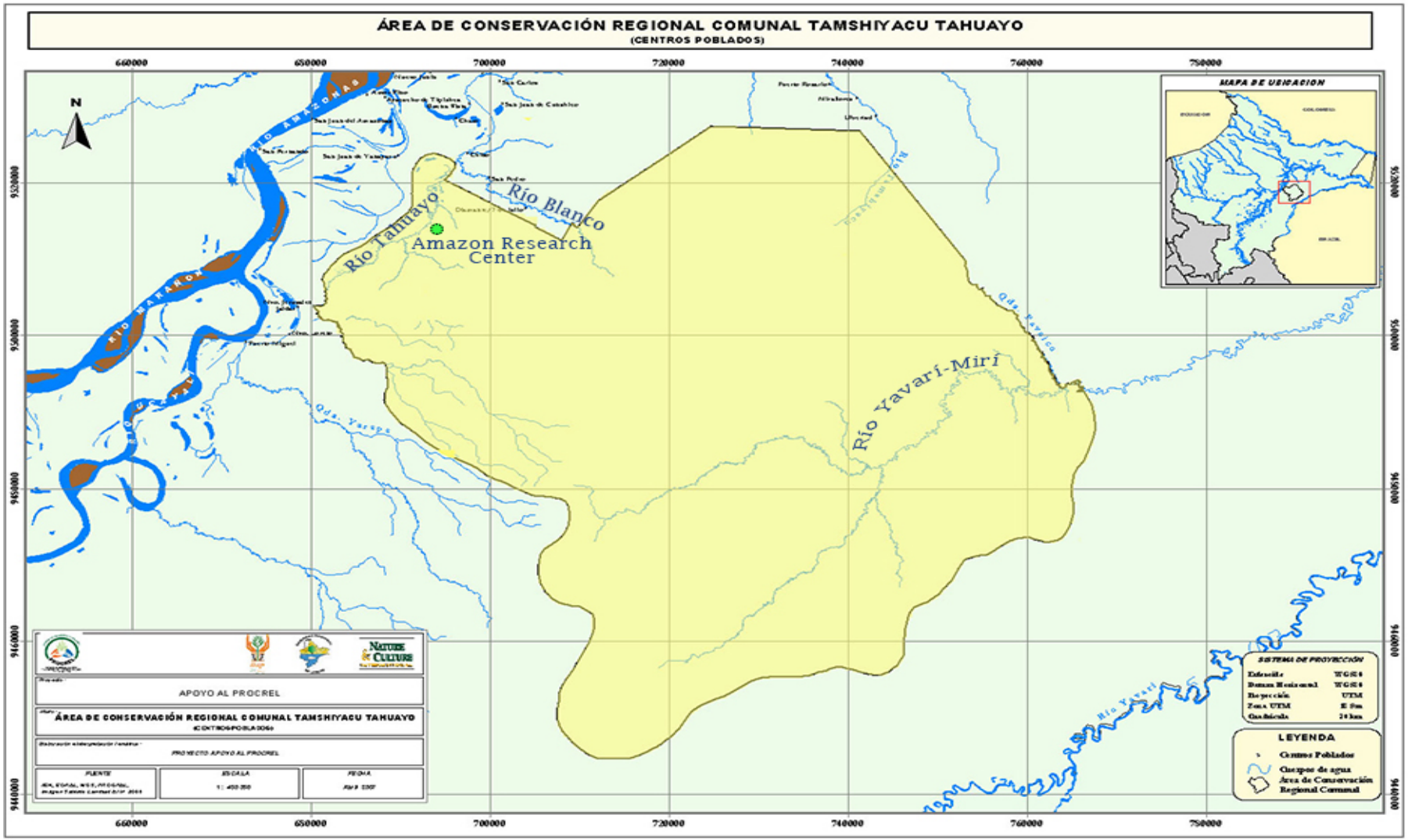

Figure 2.1a. Map showing the location of the Amazon Research Center in relation to the Tamshiyacu Tahuayo Comunity Regional Conservation Area, Río Blanco and Río Yavari-Miri.

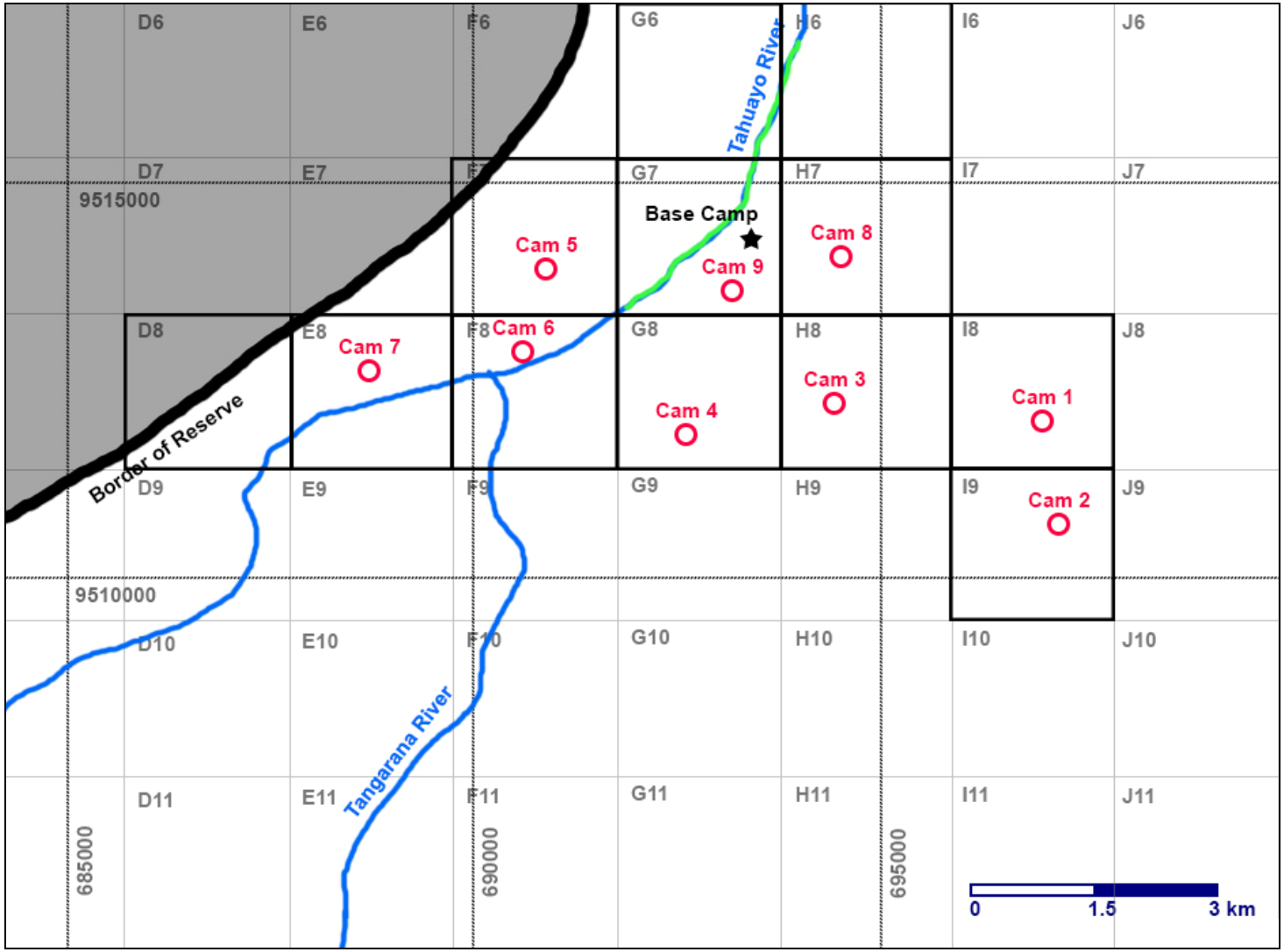

Figure 2.2a. Map showing cells (2 x 2 km in size) sampled, location of base and camera trap locations.
The green line over the river shows the maximum extent of canoe surveys. Coordinates are in UTM, datum is WGS 84.

Training of participants

A total of 16 volunteer in two groups, the first consisting of six volunteers and the second group of ten volunteers, were given talks and practical lessons in learning the use of GPS, research techniques, safety, skills and procedures during the first two days of their stay. The first excursions into the forest were conducted under the supervision of Biosphere Expeditions staff. After a few days, team members were confident enough to navigate in the forest, install camera traps and collect data from wildlife sightings.

Ecological sampling

Data on mammalian presence were collected from field surveys in a continuous cell grid of 2 x 2 km, each coded by a combination of letters and numbers. Resampling of cells was carried out where possible, taking into account that wildlife species will be present in some instances and absent in others, thus the presence or absence of a species from a certain area can only be confirmed with repeated sampling (Table 2.2a).

Data collection procedures included camera trapping and recording any mammal signs, vocalisations or sightings in the cell sampled. Data sheets were used by volunteers to record information, including the exact GPS position and cell number along with details such as species observed, number of individuals (in the case of a sighting). Some complementary information such as characteristics of tracks left by species, as well as the type of habitat where they were found, were also recorded. This was done to ensure that species that might not be recorded by tracks and not by any of the other sampling methods, were logged too in order to create a full assessment of the area's mammal species composition.

Volunteers also took a mammal species identification card to identify species sighted and had local assistants primarily to help with species identification. Once the volunteers were back at the expedition base, all data collected were transferred to the relevant spreadsheet in a laptop.

Foot surveys

A land transect census on foot was carried out covering six cells (Table 2.3a). Upon an encounter with a target species, the volunteers collected data about that species, time, distance of the subject from the observer, bearing and number of individuals (if possible), as well as general observations about behaviour, weather conditions, cell code, and sampling date. Volunteers performed repeated samplings in six cells as follows: D8 with 2 resamplings, F7 with 13, F8 with 14, G7 with 14, H7 with 12 and H8 with 14 resamplings during the survey.

Volunteers were instructed only to record individuals or troops of animals of the same species consecutively if there was none or very little probability that they were the same individuals to avoid biased results. The main consideration was that these sightings had to be at least 30 minutes apart from each other.

Canoe surveys

River censuses using canoes were carried out along the Tahuayo River, radiating out from the expedition base to collect data about species presence and frequency. The river census covered an area of three cells: G6, G7 and H6 (see Figure 2.2a).

Upon a sighting, the species was recorded, alongside the location of the sighting using a GPS, as well as group size and other variables. Data were recorded on data sheets and then transferred to a laptop at the expedition base. The volunteers also used GPS data to determine the distance travelled in the canoe.

Camera trapping

Nine digital, motion-activated cameras (seven Reconyx HyperfirePro and two Bushnell were placed in the study area. The location for each camera is detailed in Table 2.2a (below) and shown in Figure 2.2a (above). Team members carried a GPS to obtain geographical coordinates of locations for each camera trap through the cell grid and surrounding forest. One of the cameras (number 9) stayed in situ for three nights only, because it belonged to one of the volunteers who retrieved it when she went back from the first slot of the expedition. Four of the cameras (numbers 4 - 7) worked only for one night and then failed unbeknown to the survey team, so they were retrieved after ten nights without repair, but only yielded photos for one night. Four cameras (numbers 1 - 3 and 8) did not fail and worked for the full ten nights.

Table 2.2a. Sampling history of individual cameras.

ID	GPS Coordinates	Cell	Date installed/ Date removed	Total trap nights
Camera 1	18M 0696488 UTM 9511622	I8	22/07/2014 01/08/2014	10
Camera 2	18M 0696015 UTM 9511328	I9	22/07/2014 01/08/2014	10
Camera 3	18M 0694664 UTM 9513075	H8	22/07/2014 01/08/2014	10
Camera 4	18M 0691927 UTM 9513891	G8	22/07/2014 23/07/2014	1
Camera 5	18M 0690317 UTM 9515031	F7	22/07/2014 23/07/2014	1
Camera 6	18M 0689735 UTM 9514160	F8	22/07/2014 23/07/2014	1
Camera 7	18M 0687955 UTM 9512870	E8	22/07/2014 23/07/2014	1
Camera 8	18M 0691256 UTM 9516114	G7	22/07/2014 01/08/2014	10
Camera 9	18M 06946901 UTM 9514359	H7	22/07/2014 25/08/2014	3
			Total trap nights	**47**

2.3. Results

Species occurrence

Over eleven days of surveying, volunteers covered a combined distance of 130 km, on foot, covered a combined distance of 35 km by canoe and camera-trapped a total of 47 nights using nine camera traps. During the sampling period, and with all the different methodologies, 12 cells were covered (see Table 2.3b for details on sampling methods and cells sampled). A total of 28 species of mammals were recorded, ten of which were primates. Table 2.3b summarises which animals were detected in which cells by what method.

Primates, in particular the saddleback tamarin and red titi monkey, were recorded in a larger number of cells than other mammal groups. Cells were resampled with a similar frequency (between 12 and 14 times) with the exception of D8, which was sampled only twice on foot (see Table 2.3a).

For the camera trap sampling, the cell with the most species recorded was I8, which recorded paca, collared peccary, and tayra (see Figure 2.3b). In addition H8 recorded collared peccary. Cameras located in cells E8, F7, F8, G7, G8, H7 and I9 did not record any species.

Table 2.3a. Cells, their number and method of sampling. Resampling for camera trapping = sampling nights.

Cell	Sampling method / Number of resamplings		
	Canoe survey	Foot survey	Camera trap nights
D8		2	
E8			1
F7		13	1
F8		14	1
G6	7		
G7	7	14	10
G8			1
H6	7		
H7		12	3
H8		14	10
I8			10
I9			10

Figure 2.3a. Species recorded by camera traps: Paca (left), tayra (centre) and collared peccary (right).

Table 2.3b. Cells and the different methods applied in the study. Columns show methods employed and resampling, except for camera traps.

Common name	Scientific name	Sampling method				Cell species was recorded in								
		Canoe	Foot	Camera	D8	E8	F7	F8	G6	G7	G8	H7	H8	H9	I8
Pygmy marmoset	*Cebuella pygmaea*	x	x				x			x					
Saddleback tamarin	*Saguinus fuscicollis*		x				x	x		x		x	x		
Moustached tamarin	*Saguinus mystax*		x					x		x		x	x		x
Squirrel monkey	*Saimiri macrodon*		x				x	x					x		
Owl Monkey	*Aotus nancymaae*		x				x								
White-fronted capuchin	*Cebus yaracus*		x				x	x							
Brown capuchin	*Cebus macrocephalus*		x			x	x			x		x			
Red titi monkey	*Callicebus discolor*	x	x				x	x		x		x	x	x	
Saki monkey	*Pithecia* sp.	x	x					x	x	x		x			
Red howler monkey	*Alouatta seniculus*		x		x										
Three-toed sloth	*Bradypus variegatus*	x						x		x					
Collared anteater	*Tamandua tetradactyla*		x							x		x			
Coati	*Nasua nasua*		x							x		x			
Amazon red squirrel	*Sciurus* sp.		x									x			
Amazon dwarf squirrel	*Microsciurus flaviventer*		x			x	x	x							
Yellow-crowned brush tailed rat	*Isothrix bistriata*		x				x	x		x	x	x			
Agouti*	*Dasyprocta fuliginosa*		x	x	x					x		x	x		
Paca*	*Agouti paca*		x									x	x		x
Bicolor porcupine*	*Coendou bicolor*		x									x			
Nine banded armadillo*	*Dasypus novemcinctus*		x									x			
Brocket deer*	*Mazama* sp.		x							x	x	x	x		
Tapir*	*Tapitus terrestris*		x					x		x	x	x	x		
White-lipped peccary*	*Tayassu pecari*		x					x				x	x		
Collared peccary*	*Tayassu tajacu*		x	x				x				x	x		x
Giant river otter*	*Pteronura brasiliensis*	x								x					
Tayra*	*Eira barbara*		x	x									x		x
Margay / Ocelot*	*Leopardus* sp.		x							x					
Jaguar*	*Panthera onca*		x				x			x					

* Species that were recorded only by their footprints.

Frequency

For the estimation of frequency (relative abundance), only data collected from foot surveys were used, because it was the method that had the most sightings.Results are shown in Table 2.3c.

Table 2.3c. Frequency of mammal species along a total distance of 87.7 km walked during foot surveys.

Common name	Scientific name	Groups* / individuals sighted	Frequency per cell					
			D8	F7	F8	G7	H7	H8
Pygmy marmoset	*Cebuella pygmaea*	1	0	1	0	0	0	0
Saddleback tamarin	*Saguinus fuscicollis*	26	0	2	11	0	10	3
Moustached tamarin	*Saguinus mystax*	12	0	0	5	0	5	2
Squirrel monkey	*Saimiri macrodon*	9	0	7	1	0	0	1
Owl monkey	*Aotus nancymaae*	1	0	1	0	0	0	0
White-fronted capuchin	*Cebus yaracus*	1	0	1	0	0	0	0
Brown capuchin	*Cebus macrocephalus*	18	0	14	3	1	0	0
Red titi monkey	*Callicebus discolor*	13	0	1	7	3	0	2
Saki monkey	*Pithecia* sp.	8	0	0	4	3	1	0
Red howler monkey	*Alouatta seniculus*	1	1	0	0	0	0	0
Three-toed sloth	*Bradypus variegatus*	1	0	0	1	0	0	0
Coati	*Nasua nasua*	2	1	0	0	0	1	0
Amazon red squirrel	*Sciurus* sp.	2	0	1	1	0	0	0
Amazon dwarf squirrel	*Microsciurus flaviventer*	2	1	0	0	0	1	0
Yellow-crowned brush tailed rat	*Isothrix bistriata*	4	0	2	0	0	1	1
Bicolour porcupine	*Coendou bicolor*	1	0	0	0	0	1	0

* Number of groups sighted applies to primate species and coati; number of individuals recorded applies to the remaining species.

2.4. Discussion and conclusions

The addition of a cell grid pattern to the sampling methods in 2013 allowed for coverage of a bigger sampled area than the year 2012 (13 species recorded), including terra firme (non-flooded) forest, which doubled the number of species recorded (26 species recorded). The same cell grid pattern was used in 2014 and the number of cells was expanded, yielding a record 28 species encounters for this year.

During the three years of wildlife data collection the greatest variation in the mammal species composition was observed in 2012 when only 13 species were recorded, unlike in 2013 and 2014 with 27 and 28 species recorded respectively (Table 2.4a). The most noticeable fluctuation of the results over the years was in 2012. The results between 2013 and 2014 were very similar in terms of number of species and the species composition, especially for primates. This difference, besides the addition of a grid as stated above, is very likely to be as a result of the addition of local field assistants starting in 2013, assisting the volunteers in spotting animals and driving canoes during river censuses. Once local field assistants were introduced, results improved, doubling the species recorded. This situation did not change for 2014 where only one more species was recorded in relation to the 2013.

Table 2.4a. Species recorded during 2012, 2013 and 2014

Common name	Scientific name	Years recorded		
		2012	2013	2014
Pygmy marmoset	*Cebuella pygmaea*		x	x
Saddleback tamarin	*Saguinus fuscicollis*	x	x	x
Moustached tamarin	*Saguinus mystax*	x	x	x
Squirrel monkey	*Saimiri macrodon*	x	x	x
Owl monkey	*Aotus nancymaae*		x	x
White-fronted capuchin	*Cebus yaracus*	x	x	x
Brown capuchin	*Cebus macrocephalus*	x	x	x
Red titi monkey	*Callicebus discolor*	x	x	x
Saki monkey	*Pithecia* sp.	x	x	x
Red howler monkey	*Alouatta seniculus*			x
Three-toed sloth	*Bradypus variegatus*		x	x
Two toed sloth	*Choloepus didactylus*		x	
Collared anteater	*Tamandua tetradactyla*	x	x	x
Coati	*Nasua nasua*		x	x
Amazon red squirrel	*Sciurus* sp.		x	x
Amazon dwarf squirrel	*Microsciurus flaviventer*		x	x
Bolivian squirrel	*Sciurus ignitus*		x	
Yellow-crowned brush tailed rat	*Isothrix bistriata*		x	x
Agouti	*Dasyprocta fuliginosa*	x	x	x
Paca	*Cuniculus paca*	x	x	x
Bicolour porcupine	*Coendou bicolor*			x
Nine banded armadillo	*Dasypus novemcinctus*			x
Brocket deer	*Mazama* sp.	x	x	x
Tapir	*Tapirus terrestris*	x	x	x
White-lipped peccary	*Tayassu pecari*			x
Collared peccary	*Tayassu tajacu*			x
Neotropical River otter	*Lontra longicaudis*		x	
Giant river otter	*Pteronura brasiliensis*		x	x
Pink river dolphin	*Inia geoffrensis*		x	
Tayra	*Eira barbara*		x	x
Margay / Ocelot	*Leopardus* sp.	x		x
Yagouarondi	*Puma yagouaroundi*		x	
Jaguar	*Panthera onca*		x	x

From all 28 species recorded in 2014 only the giant river otter is considered Endangered by the IUCN (IUCN 2014). Others, such as the jaguar and margay are considered Near Threatened and only the tapir is in the category Vulnerable. All species on the IUCN Red List face a high risk of extinction in the near future, but are still present on the study area. According to the IUCN, the main threats these species face are habitat loss and over-hunting of their prey. However, in the study area there is very little human activity, so their presence is recorded during the surveys. There is, however, a worrying emerging threat of forest clearance for cacao plantations in the immediate vicinity of the study site. The deleterious effects of this large plantation in terms of increased human activity and disturbance must be kept an eye on.

All the other species are place in the IUCN category of Least Concern. This does not mean that they are not in risk, however, because according to IUCN their populations are still decreasing, which is actually the overall situation for the populations of all species listed in this report.

The results show that cells F7 and F8 had the greatest number of primate species on the foot survey (seven and six species respectively), although for the canoe surveys the cell with the greatest number of primate species was G7 (n=3). Cell G7, along with cell H7, by contrast, had the lowest number of primate species on the foot surveys (n=3 for both cells), not including D8, since this cell was resampled only twice and only one primate species was recorded within. It is interesting to note that the resampling effort was similar among most cells and yet the difference between results was significant. For instance, there were twice as many detections for F7 (n=7), than G7 and H7 (each n=3). Since resampling effort was by and large unrelated to detection frequency, the reason for the differences is likely to be related to ecological features. For example, cell F7is indeed in a different habitat (mostly palm swamp) than G7 and H7 (both mostly lower restinga). Moreover, other species of palm trees that are not related to the palm swamps (locally called ‘shapaja’ (*Attalea moorei*) were full of ripe fruits during the sampling period in F7. This is likely to be the reason why several different species of primates were recorded in this cell and in a larger frequency per species, especially the relatively large brown capuchin monkey (n=14).

For the canoe survey, results show the same tendency. All three cells were sampled with the same sampling effort (seven resamplings in all cases), but the results differed. Cell G7 yielded three primate species, G6 one, and no species were recorded in H6. Since there was not much habitat difference per se between the cells, it is very likely that the availability of food here too is responsible for the difference in results.

Puertas et al. (1995) studied the primate population in the Tahuayo–Río Blanco area and the Yavarí Mirí River (see Fig. 2.1a for a location of the Yavarí Mirí River) near the study site (about 10 km distance as the crow flies) and found similar species richness, recording eleven primate species. The current study recorded nine primate species in 2013 (Dosantos et al. 2014) and ten species during this 2014 survey. There was also a similarity in terms of the most frequent species, i.e. the medium- and small-sized species such as owl monkey, saddleback tamarin and squirrel monkey (see Table 2.4a). However, results in terms of large-bodied species were considerably different, for instance, woolly monkey, brown capuchin and saki monkey (see Table 2.4a).

Methods differed in the number of species each was able to detect. Camera traps recorded 3 species, canoe surveys (by sight) detected 5 species and foot surveys (also by sight) recorded 16 species. These are unweighted results, meaning that more effort was employed on foot on the trails, which is likely to have biased results by inflating the numbers of species detected by sight during foot surveys.

Each method also differed by which species it detected exclusively, i.e. some methods detected some species not recorded by other methods (see Table 2.3a). Canoe surveys recorded 5 species (2 of them exclusively), foot surveys 16 (12 of them exclusively) and camera traps 3 (all three of them exclusively).

The differences in the species recorded by each sampling method support the need for their application in order to assess the mammal species composition of the study site. The three methods recorded species that have different habitat preferences and different habits. For instance, the survey by land transects recorded diurnal arboreal species such as primate species that roam around the flooded forest searching for fruit as well as terrestrial mammals such as coati, white-lipped peccary, collared peccary, etc. Nocturnal, terrestrial and elusive species less likely to be seen can be and were recorded by camera traps, such as jaguar, collared peccary and paca, but this methods has limitations, for instance, it cannot record arboreal species; and, the river census recorded mostly water or river bank dwellers such as the giant river otter, three toed sloth (sometimes it is possible to find them within the forest but more commonly at the river bank).

Table 2.4b. Comparison of primate populations studied by Puertas et al. (1995) at Río Blanco and Yavarí Mirí, and Dosantos et al. (2013 and this report) at TRARC.

Common name	Scientific name	Río Blanco ind./km^2	Yavarí Mirí ind./km^2	TRARC 2013 groups sighted	TRARC 2014 groups sighted
Medium- and small-sized primates					
Owl monkey	*Aotus nancymaae*	25	24	1	1
Saddleback tamarin	*Saguinus fuscicollis*	22	38	19	26
Squirrell monkey	*Saimiri macrodon*	18	57	8	9
Large-bodied primates					
Wooly monkey	*Lagothrix poeppigii*	7	25	0	0
Brown capuchin	*Cebus macrocephalus*	8	11	15	18
Saki monkey	*Pithecia* sp.	4	5	9	8

The relative abundance of the saddleback tamarin in all three sites of Río Blanco, Yavarí Mirí and TRARC (this is the second year in a row that this species is the most frequent in the TRARC study site) coincides with results from other studies carried out in different locations of the Peruvian Amazon (Aquino et al. 2005; Aquino et al. 2009). This is most likely due to the almost non-existent hunting pressure for this species as a result of its small body size (0.3 kg) and also due to its higher reproductive rate. However, the relative abundances of large-bodied primates are different between the three sites. For example, the woolly monkey displays the highest abundance (among large-bodied monkeys) in the

Yavarí Mirí area (25 ind/km^2), followed by the Río Blanco area (7 ind/km^2), but it was not recorded in this study. These differences are likely to be due to the fact that both the Río Blanco and the Yavarí Mirí areas are placed in a vast terra firme forest area, where the woolly monkeys are known to be more abundant than in the flooded forest. Also, hunting of primates has only recently been strictly prohibited, around six years ago in the Tamshiyacu Tahuayo Community Regional Conservation Area so the large-bodied primate population is still recovering from previous hunting pressure.

For wild felids, only jaguar was recorded by tracks in cells G7 and F7. Tracks from small felids were also recorded, but they could not be identified with any certainty. They could have been either ocelot or margay, both belonging to the genus *Leopardus*, therefore those findings were recorded under their generic name: *Leopardus* sp. In spite of the small number of records for felids, the results are important. Predators regulate prey populations, so the presence of a large predator such as the jaguar indicates the presence of a sufficient population of prey species. Also, the unfortunate event of camera failure could have contributed to the small number of records.

Recommendations for further work

This study is the beginning of a set of standardised wildlife censuses and constitutes the first baseline survey for further wildlife monitoring activities. Future surveys will follow the same standardised survey methodology so that results can be used to detect changes in parameters such as species presence, abundance and distribution, habitat use, biodiversity, etc. In collaboration with the Tahuayo River Basin Management Committee, fact-based decisions can then be taken regarding management and resource use in the reserve.

The addition of the cell grid to the sampling method has been a great improvement and will be continued. By using the cell grid, we were able to record a greater diversity of species compared to 2013, for the same sampling effort and despite the problems with camera trapping.

For this year's study the Biosphere Expeditions citizen scientists again had help from the local Tahuayo River people, continuing the successful collaboration from 2013. The local helpers are excellent wildlife trackers and can recognise species from calls, etc., thereby constituting a great asset for the project. Also, their participation in the project will help to broadcast the benefits for the local people of the flora and fauna of the region.

The project had a smaller camera trap sampling effort this year (47 trap nights) in comparison with 2013 (70 trap nights). Cameras that have failed during the survey causing data loss must be repaired or replaced for further surveys.

2.5. Literature cited

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Appendix I: Expedition diary and reports

A multimedia expedition diary is available at https://biosphereexpeditions.wordpress.com/category/expedition-blogs/amazonia-2014/.

All expedition reports, including this and previous expedition reports, are available at www.biosphere-expeditions.org/reports.