



EXPEDITION REPORT

Expedition dates: 6 – 19 September 2015
Report published: November 2015

**Amazonian plethora: biodiversity
monitoring of jaguars, pumas,
primates and other flagship species
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Authors

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**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 2015 with the aim of determining patterns of distribution and frequency of wild felids, primates and other flagship species in the study area. This was the fourth annual Biosphere Expeditions survey in the area and sampling took place between 6 and 19 September 2015.

Sixteen layperson citizen scientists were trained, in two groups, to help collect data. The first group consisted of ten persons and the second group of six. The total area surveyed was 48 square km, 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. Sampling entailed recording mammals by sight and tracks (only for the species composition study), as well as via ten camera traps distributed around the study site.

The TTCRCA continues to show high animal biodiversity, with 30 mammalian species recorded this year, seventeen with arboreal habits (including ten primate species), three aquatic, and ten with terrestrial habits. Human impact is low and large-bodied primates seem to be recovering in numbers since a hunting ban imposed in 2008.

Primates, in particular the brown capuchin (*Sapajus macrocephalus*) and the saddleback tamarin (*Saguinus fuscicollis*) were recorded in a larger number of 2x2 km cells than other mammal groups. Big troops of the red uakari monkey (*Cacajao calvus ucayalii*) were recorded at two separate occasions; this primate has not been recorded in previous years by Biosphere Expeditions.

The pink river dolphin, the Bolivian squirrel and the yagouaroundi were, on the other hand, recorded during previous surveys but not in this study. 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 (*Panthera onca*) was detected once by tracks and ocelot (*Leopardus pardalis*) by tracks and camera trap. The presence of felids also points towards a healthy, relatively undisturbed habitat, which must be protected in the face of emerging threats such as a cancerous cacao plantation right on the doorstep of the TTCRCA.

Resumen

Una expedición a la Área de Conservación Regional Comunal Tamshiyacu Tahuayo (Tamshiyacu Tahuayo Regional Conservation Area = TTRCA) (Región de Loreto, Perú) ha sido realizada con Biosphere Expeditions en 2015, con el objetivo de determinar los patrones de distribución y frecuencia de felinos salvajes, primates y otras especies emblemáticas en el área de estudio. Este fue el cuarto estudio anual de Biosphere Expeditions en la zona, y el muestreo se llevó a cabo entre el 6 y 19 de septiembre de 2015.

Dieciséis ciudadanos con vocación científica fueron entrenados, en dos grupos, para ayudar a recoger datos. El primer grupo estaba formado por diez personas y el segundo grupo por seis. El área total prospectada fue de 48 kilómetros cuadrados, abarcando los tres tipos principales de bosque: de tierra firme, bosque pantanoso de palma y bosques inundados estacionalmente. La presencia de especies se registró utilizando una metodología estándar de cuadrícula 2x2 km desarrollada para las expediciones terrestres utilizando voluntarios. El muestreo implicaba registrar la presencia de mamíferos visualmente y por rastros (sólo para el estudio de composición de las especies), así como a través de diez trampas fotográficas distribuidas en la zona de estudio.

El TTCRCA sigue mostrando una alta biodiversidad animal, con 30 especies de mamíferos registradas este año; diecisiete con hábitos arborícolas (incluyendo diez especies de primates), tres acuáticas, y diez con hábitos terrestres. El impacto humano es bajo y los grandes primates parecen estar recuperándose en número desde la prohibición de la caza impuesta en 2008.

Los primates, en particular el capuchino de cabeza grande (*Sapajus macrocephalus*) y el tamarindo de cabeza amarilla (*Saguinus fuscicollis*), se registraron en un mayor número de celdas km 2x2 que otros grupos de mamíferos. Grandes grupos de uacari calvo (*Cacajao calvus ucayalii*) se registraron en dos ocasiones; este primate no ha sido registrado en años anteriores por Biosphere Expeditions. El delfín rosado, la ardilla de Bolivia y el yaguarundí eran, por el contrario, registrados durante prospecciones anteriores, pero no en este estudio. El ratio de detección para los primates, tanto en número de especies como en frecuencia de individuos, como era de esperar, refleja la presencia de árboles frutales maduros en ciertas celdas.

El jaguar (*Panthera onca*) se detectó una vez por rastros, y el ocelote (*Leopardus pardalis*) por rastros y trampa fotográfica. La presencia de felinos también apunta hacia un hábitat saludable, relativamente tranquilo, que debe ser protegido frente a las amenazas emergentes, tales como la cancerígena plantación de cacao justo al lado del TTCRCA.

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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 6 to 19 September 2015. 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 6 – 12 September | 13 – 19 September 2015. 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 Tahuayo River Amazon Research Center is a basic but very comfortable lodge right inside the remote TTRCA. 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 28.5°C with a maximum of 32.0°C.

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 scientists

Alfredo Dosantos Santillán was born in Iquitos, Peru and graduated in Biological Sciences at the National University of the Peruvian Amazon in the same city. 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.

Fredrik Tegnér is a biologist from Uppsala University in Sweden with a Master of Science degree in Ecology and Conservation. Fredrik has also worked as a photographer and film maker for Tierra Grande AB together with National Geographic photographer Mattias Klum.

1.6. Expedition leader

Malika Fettak is half Algerian, but was born and educated in Germany. She majored in Marketing & Communications and worked for more than a decade in both the creative department, but also in PR & Marketing of the publishing industry. Her love of nature, travelling and the outdoors (and taking part in a couple of Biosphere expeditions) persuaded her that a change of career was in order. Joining Biosphere Expeditions in 2008, she runs the German-speaking operations and the German office and leads expeditions all over the world whenever she can. She has travelled extensively, is multilingual, a qualified off-road driver, diver, outdoor first aider, and a keen sportswoman.

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):

6 – 12 September 2015

Imogen Cauthery (UK), Katie & Lansing Crane (USA), Edward Durell (USA), Mary Fitzpatrick (USA), Neil Goodall (UK), Ana Humbert Camps (Spain), Douglas O'Neill (USA), Ngoc anh Tran (France), Brenda Walkenhorst (USA).

13 – 19 September 2015

Stephen Bell (UAE), Edward Durell (USA), Neil Goodall (UK), Suzie Schnell (USA), Ngoc anh Tran (France), Christy Wise (USA).

1.8. Expedition budget

Each team member paid towards expedition costs a contribution of £1,240 per person per one-week slot in 2015. 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	17,110
 Expenditure	
Base camp and transport includes all board, lodging and transport to and from base camp	5,102
Equipment & hardware includes all research materials purchased or hired	2,124
Staff includes salaries, travel and expenses	1,330
Administration includes registration fees, visas, sundries, etc.	83
Team recruitment Peru as estimated % of PR costs for Biosphere Expeditions	4,186
 Income – Expenditure	 4,285
 Total percentage spent directly on project	 75%

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, as well as Oriol Sagristà for abstract translation.

1.10. Partners

For this expedition, Biosphere Expeditions was partnered with [Amazonia Expeditions](#) and its 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.

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2. Research on felids and primates

Alfredo Dosantos Santillán & Fredrik Tegnér
Tahuayo River Amazon Research Center

2.1. Introduction

This study was conducted in the Tamshiyacu Tahuayo Community Regional Conservation Area (TTCRCA). This area covers 421,000 hectares and hosts a great biodiversity. The study area is especially rich in terms of primates and scientists believe that there are still many new species left to describe (Salovaara et al. 2003, Puertas et al. 1995, Bodmer et al. 1994). A previous study by Puertas et al. (1995) in the Río Blanco area (located about 10 km from the current study area) reports densities of up to 14 species of primates, including the elusive red uakari monkey (*Cacajao calvus ucayalii*), which is considered Vulnerable by the IUCN (Veiga & Bowler 2008). Within the Loreto Region and the 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 September 2015.

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: bajjal, 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).

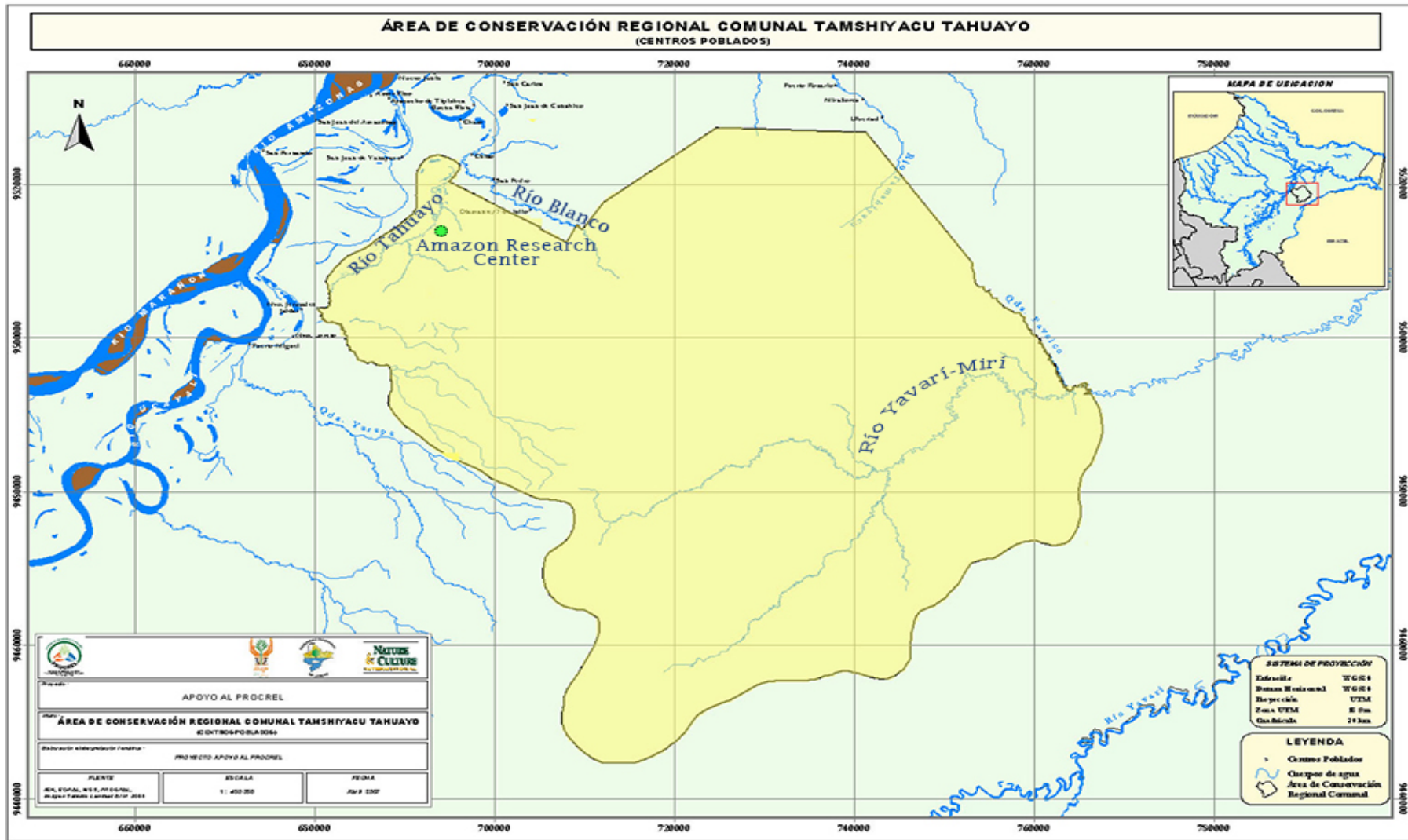


Figure 2.1a. Map showing the location of the Amazon Research Center in relation to the Tamshiyacu Tahuayo Regional Conservation Area, Río Blanco and Río Yavari-Miri.

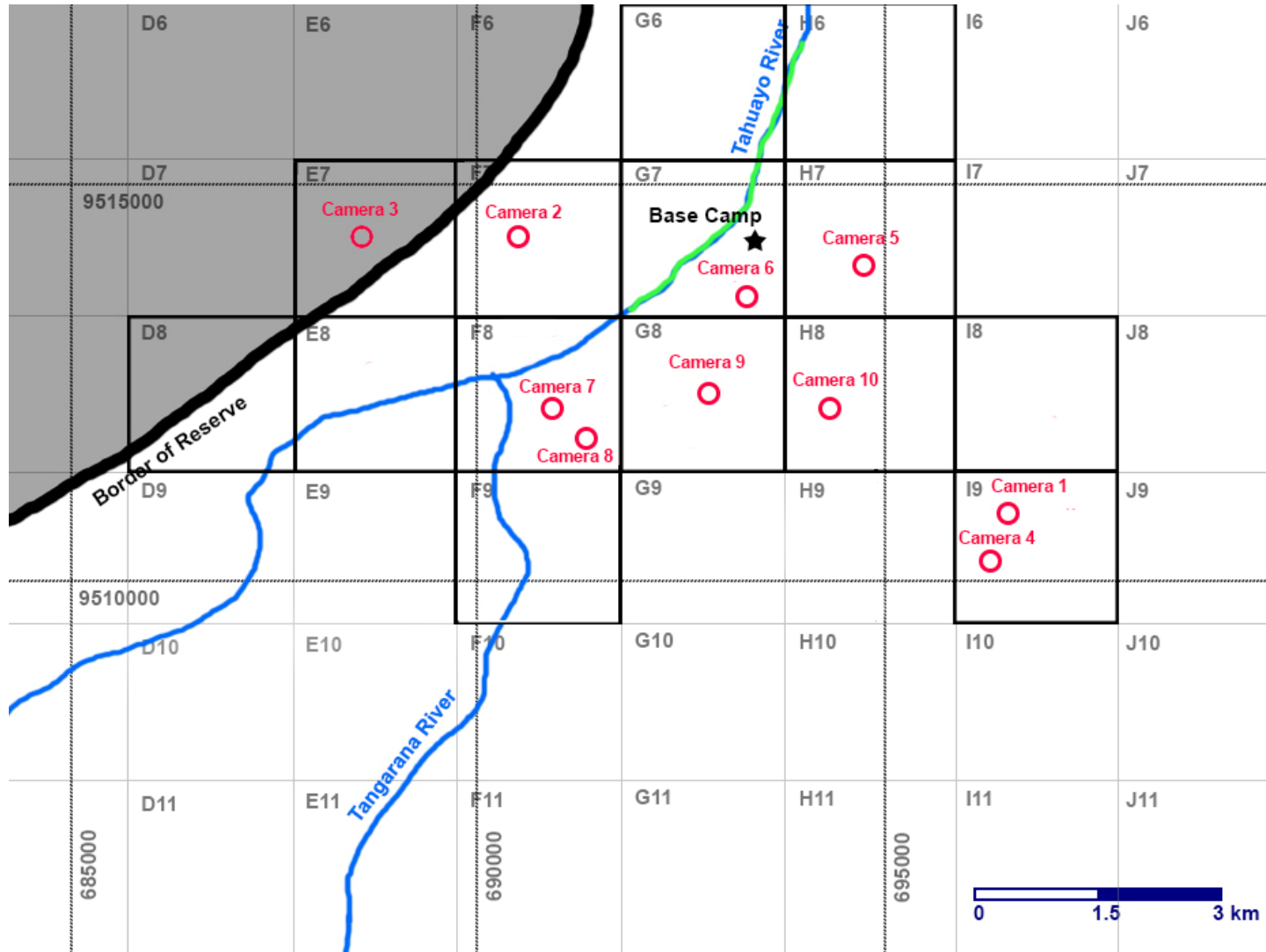


Figure 2.2a. Map showing cells (2 x 2 km in size) sampled, location of base and camera trap locations. The green line over the river shows the maximum extent of canoe surveys. Coordinates are in UTM, datum is WGS 84.

Training of participants

A total of 16 volunteers in two groups, the first consisting of ten volunteers and the second group of six 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 during 9 days of field surveying in a continuous cell grid of 2 x 2 km, each coded by a combination of letters and numbers as detailed in Mazzolli & Hammer (2013). 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, was 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, GPS location and distance to 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 transect and repeated samplings in ten cells as follows: I8 and I9 with 2 resamplings, D8 and E8 with 4, F7, F8, F9, G7, H7 and H8 with 9 respectively throughout 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 two cells: G6 and G7 which were surveyed upstream and downstream 9 times respectively (see Figure 2.2a).

Upon a sighting, the species was recorded, alongside the location of the sighting using a GPS, as well as the distance, bearing, 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

Ten digital, motion-activated cameras (Bushnell Hyperfire) 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 throughout the cell grid and surrounding forest. The cameras stayed in situ, collecting data for 10 consecutive nights.

Table 2.2a. Sampling history of individual cameras.

ID	GPS coordinates	Cell	Date installed Date removed	Total trap nights
Camera 1	18M 0696015 UTM 9511278	I9	08/09/2015 18/09/2015	10
Camera 2	18M 06960484 UTM 9515299	F7	08/09/2015 18/09/2015	10
Camera 3	18M 06969739 UTM 9514155	E7	08/09/2015 18/09/2015	10
Camera 4	18M 06966024 UTM 9511613	I9	08/09/2015 18/09/2015	10
Camera 5	18M 06963893 UTM 9484637	H7	08/09/2015 18/09/2015	10
Camera 6	18M 06960720 UTM 9515875	G7	08/09/2015 18/09/2015	10
Camera 7	18M 06961383 UTM 9512125	F8	08/09/2015 18/09/2015	10
Camera 8	18M 06917291 UTM 9512502	F8	08/09/2015 18/09/2015	10
Camera 9	18M 06963707 UTM 9512768	G8	08/09/2015 18/09/2015	10
Camera 10	18M 06964766 UTM 9512839	H8	08/09/2015 18/09/2015	10

Data analysis and species' nomenclature

Species were described in terms of number of cells in which they were found, overall frequency and by which method they were recorded. Data recorded for cells were number of times resampled and species frequency and composition.

The IUCN Red List (2015) nomenclature and distribution is considered here as the most up-to-date classification for mammals and was thus adopted in the current report, as opposed to previous expedition reports¹. Besides nomenclature, all species also had their distribution maps verified in the IUCN database, except the saki monkey and the white-fronted capuchin. In the case of the saki monkey, its distribution did not feature in the IUCN database at the time this report was written, but was mentioned as having been recently split into a number of species described in Marsh (2014), which is therefore adopted here, with *Pithecia monachus* inhabiting the study site. Chances of confusion with other neighbouring species are nearly zero, as both *P. isabela* (new species) and *P. aequatorialis* inhabit the western banks of the Ucayali river, whereas the distribution of *P. monachus* is restricted to the eastern side of the same river, where the study site for this report is situated. As for the white-fronted capuchin, it is found in the IUNC Red List as *Cebus albifrons* with no distribution map either, but with details of its division into several species by Boubli et al. (2012), including *Cebus yuracus*, the species whose distribution extends to the study site.

Other species that had their Latin names modified from previous reports are the red titi monkey, the brown capuchin and the squirrel monkey. The red titi monkey *Callicebus discolor* of previous reports are considered forthwith as *C. cupreus*, because *C. discolor* inhabits the western margin of river Ucayali (IUCN 2015). The brown capuchin *Cebus macrocephalus* is treated here as *Sapajus macrocephalus*, given that different genera (*Sapajus* versus *Cebus*) for the tufted (robust) and untufted (gracile) capuchins are now widely accepted by leading authors such as Alfaro et al. 2012. The squirrel monkey, treated in former reports as *Saimiri macrodon* is now referred to as *S. boliviensis peruviensis*, based on the IUCN Red List distribution maps and nomenclature.

The IUCN Red List did not mention the distribution or Latin nomenclature of the red howler monkey for the study site, encompassing the Ucayali and Marañón region, by the time this report was written. It was formerly considered *Alouatta seniculus*, which is now regarded as a synonym of *A. macconnelli*, with distribution spreading through the Guianas, eastern Venezuela and northern Brazil, but not Peru (IUCN 2015). A message was sent to the IUCN to have this checked. This report thus follows the latest revision of the howler monkey nomenclature, which maintains *A. seniculus* (Kowalewski et al. 2015), following a previous classification by the IUCN.

Finally, the squirrel monkey *Sciurus granatensis*, mentioned as recorded in an earlier draft of this report, in which it figured exclusively in the frequency table, was disregarded in this report for inhabiting Ecuador, Colombia and Venezuela, but not Peru (IUCN 2015).

¹ available via www.biosphere-expeditions.org/reports

2.3. Results

Species occurrence

Over nine days of surveying, volunteers covered a combined distance of 107 km by foot and a combined distance of 36 km by canoe. During the sampling period, using various sampling techniques, 12 cells were covered (see Table 2.3a, b & c for details on sampling methods and cells sampled). A total of 30 mammal species were recorded, ten of which were primates. Table 2.3b summarises which animals were detected in which cells and by which method. Cells were resampled with a similar frequency (nine times) with the exception of D8 and E8, which were sampled four times and I8 and I9 with two resamplings respectively. Cell number H7 hosted the largest number of mammalian sightings with 24 sightings in total. Cell number F8 together with G7 and H7 hosted the highest number of primates (see table 2.3c). All sightings for the canoe surveys occurred in cell G7. The Brazilian tapir (prints) were recorded in a total eight out of twelve cells, which is more than any other mammal species recorded during this study. Fresh tracks were sighted and recorded in seven out of ten days of surveying. The white-collared peccary was recorded in cell H7 and H8 and a group of 27 (counted) individuals were sighted in cell H8. Out of the primate species, the saddleback tamarin was observed at the highest rate with 16 groups sighted followed by 13 observations of the brown capuchin monkey and 12 recordings of the titi monkey and the common squirrel monkey (see table 2.3c). For the camera trap sampling, the cell with the most species recorded was H7, which recorded ocelot, tayra and a group of brown capuchin monkeys. In addition the camera in cell I9 (located in terra firme) recorded a tapir and one armadillo and the camera located in cell F9 recorded one tapir.

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		4	
E8		4	
F7		9	10
F8		9	20
F9	9	9	
G7	9	9	10
G8			10
E7	9		10
H7		9	10
H8		9	10
I8		2	
I9		2	20



Figure 2.3a. Species recorded by camera traps: Tapir (upper left corner), ocelot (upper right corner), brown capuchin monkeys (lower left corner) and armadillo (lower right corner).

Table 2.3b. Cells and the different methods by which species were recorded. Columns show methods employed and resampling, except for camera traps. Note that the specific names of the brocket deer and the Amazon red squirrel remain undefined. *denotes species that were recorded by footprints only.

Common name	Scientific name	Sampling method							Cell species was recorded in						
		Canoe	Foot	Camera	D8	E8	F7	F8	F9	G7	G8	H7	H8	H9	I9
Pygmy marmoset	<i>Cebuella pygmaea niveiventris</i>		x				x	x	x						
Saddleback tamarin	<i>Saguinus fuscicollis</i>		x				x	x	x	x	x	x	x		
Moustached tamarin	<i>Saguinus mystax</i>		x					x		x	x	x	x		x
Squirrel monkey	<i>Saimiri boliviensis peruviansis</i>		x				x	x	x	x	x	x	x		
Owl monkey	<i>Aotus nancymae</i>		x					x				x			
White-fronted capuchin	<i>Cebus yuracus</i>		x				x	x							
Brown capuchin	<i>Cebus macrocephalus</i>		x		x		x		x	x	x	x			
Red titi monkey	<i>Callicebus cupreus</i>	x	x					x		x			x		
Saki monkey	<i>Pithecia monachus</i>	x	x					x		x		x			
Red uakari monkey	<i>Cacajao calvus ucayalii</i>		x												
Three-toed sloth	<i>Bradypus variegatus</i>	x								x					
Collared anteater	<i>Tamandua tetradactyla</i>		x				x	x							
Coati	<i>Nasua nasua</i>		x				x			x					
Amazon red squirrel	<i>Sciurus spadiceus</i> or <i>igniventris</i>		x									x			
Amazon dwarf squirrel	<i>Microsciurus flaviventer</i>		x										x		
Yellow-crowned brush tailed rat	<i>Isothrix bistrata</i>		x				x	x		x	x				
Agouti	<i>Dasyprocta fuliginosa</i>		x					x	x					x	
Bicolor porcupine	<i>Coendou bicolor</i>		x							x					
Nine-banded armadillo	<i>Dasypus novemcinctus</i>		x												x
Tapir	<i>Tapirus terrestris</i>		x		x		x	x	x	x	x	x	x	x	
White-lipped peccary*	<i>Tayassu pecari</i>											x	x		
Collared peccary*	<i>Pecari tajacu</i>		x			x		x				x	x		
Giant river otter*	<i>Pteronura brasiliensis</i>	x								x					
Tayra	<i>Eira barbara</i>		x		x			x		x					
Ocelot	<i>Leopardus pardalis</i>		x				x								
Jaguar*	<i>Panthera onca</i>		x						x						
Neotropical river otter	<i>Lontra longicaudis</i>	x						x							
Brocket deer*	<i>Mazama</i> sp.		x					x		x	x	x			
Paca*	<i>Agouti paca</i>		x									x			

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* / individ. sighted	Frequency per cell					
			D8	F7	F8	G7	H7	H8
Pygmy marmoset	<i>Cebuella pygmaea niveiventris</i>	3	0	2	1	0	0	0
Saddleback tamarin	<i>Saguinus fuscicollis</i>	15	0	3	5	0	4	3
Moustached tamarin	<i>Saguinus mystax</i>	11	0	0	5	0	4	2
Squirrel monkey	<i>Saimiri boliviensis peruviansis</i>	11	0	3	1	0	0	1
Owl monkey	<i>Aotus nancymae</i>	1	0	1	0	0	0	0
White-fronted capuchin	<i>Cebus yaracus</i>	2	0	0	1	0	1	0
Brown capuchin	<i>Cebus macrocephalus</i>	20	4	5	3	1	3	4
Red titi monkey	<i>Callicebus cupreus</i>	11	0	0	4	5	0	2
Saki monkey	<i>Pithecia monachus</i>	11	0	0	4	3	2	2
Red uakari monkey	<i>Cacajao calvus ucayalii</i>	1	0	0	0	0	1	1
Three-toed sloth	<i>Bradypus variegatus</i>	2	0	0	0	2	0	0
Coati	<i>Nasua nasua</i>	2	0	0	0	0	2	0
Amazon red squirrel	<i>Sciurus spadiceus</i> or <i>igniventris</i>	5	0	3	0	2	0	0
Amazon dwarf squirrel	<i>Microsciurus flaviventer</i>	1	0	0	0	0	0	1
Yellow-crowned brush tailed rat	<i>Isothrix bistrata</i>	4	0	2	0	0	1	1
Bicolour porcupine	<i>Coendou bicolor</i>	1	0	0	0	0	1	0
Tayra	<i>Eira barbara</i>	2	0	0	1	1	0	0
Neotropical river otter	<i>Lontra longicaudis</i>	2	0	0	0	2	0	0
Tamandua	<i>Tamandua tetradactyla</i>	2	0	1	1	0	0	0
Dwarf squirrel	<i>Microsciurus flaviventer</i>	1	0	0	0	0	0	1
Agouti	<i>Dasyprocta fuliginosa</i>	4	0	1	2	0	0	1
White-lipped peccary	<i>Tayassu pecari</i>	1	0	0	0	0	0	1

* Number of groups sighted applies to primate species and White-lipped peccary; number of individuals recorded applies to the remaining species.

Table 2.3d. Frequency of mammal species along a total distance of 37 km by canoe surveys.

Common name	Scientific name	Groups*/individuals sighted	Cell
Neotropical river otter	<i>Lontra longicaudis</i>	2	G7
Three-toed sloth	<i>Bradypus variegatus</i>	2	G7
Saki monkey	<i>Pithecia monachus</i>	4	G7
Titi monkey	<i>Callicebus cupreus</i>	3	G7

* Number of groups sighted applies to primate species.

2.4. Discussion and conclusion

This study resulted in the highest number of recorded mammalian species ($n=30$) since Biosphere Expeditions started monitoring four years ago in the TTCRCA (see Table 2.4a). The addition of a cell grid pattern and local field assistants in 2013 allowed for coverage of a bigger sampled area (from 4 square kilometres in 2012, when 13 species were recorded, to 48 square kilometres in 2013) The inclusion of terra firme (non-flooded) forest doubled the number of species recorded (26). The same cell grid pattern has been used since its introduction in 2013 and the number of species recorded remains high, although the number of species was higher this year than previous years, with the red uakari monkey the only additional species not previously recorded.

Several of the species recorded appear on the IUCN Red List (IUCN 2015). The giant river otter is considered Endangered, the jaguar is considered Near Threatened and the Brazilian tapir and the red uakari monkey fall into the Vulnerable category. For the first time during the expedition two big troops ($n = \sim 80$ and $n = \sim 50$) of the red uakari monkey were observed, on two separate occasions. During both sightings the animals were recorded foraging for food in aguajal (palm swamp) areas. On both occasions, troops of the common squirrel monkey and the brown capuchin were recorded travelling together with the red uakari. The red uakari occupies a vast home range, but is Vulnerable and very elusive and therefore poorly studied. Because of this, the presence of this flagship species reinforces the conservation significance of the area. Findings such as these are of great weight and importance when it comes to conservation and wildlife management purposes in the TTCRCA. Another flagship species of great conservation significance is the Brazilian tapir. Fresh tapir tracks were found throughout the study and were recorded in eight out of twelve cells. The tapir was also recorded by camera traps on two separate occasions.

The results show that cells H7 and F8 had the greatest number of primate species encounters for foot surveys ($n=8$ and $n=7$ sightings respectively), although for the canoe surveys the cell with the greatest number of primate species was G7 ($n=2$). 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 and E8, since these cells were only resampled twice and only one primate species was recorded within each cell.

Notable differences from last year's sampling (see Dosantos et al. 2014) occurred in cells F7, G7 and H7. Last year's sampling resulted in a low number of primate species in G7 and H7 ($n=3$) and almost twice as many species encounters in F7 ($n=7$). This year turned out to be the complete opposite with H7 yielding the highest encounters ($n=8$) and G7 ($n=6$), whereas only three species of primates were found in cell F7. The reason for these big variations is most likely due to ecological variation. These different cells cover different habitats. Cell F7 is mostly covered by aguaje (palm swamp) and G7 and H7 are mostly covered by lower restinga, hosting different trees, which fruit at different times. The 2014 survey was conducted in July and August when the water was higher. This year's survey was conducted in September, with almost no rain during the two weeks of research, which is likely to have had an impact on the results.

Table 2.4a. Species recorded during 2012, 2013 and 2014. The number of species (at the bottom) include the two undefined taxa, the brocket deer and the Amazon red squirrel. x = recorded, - = not recorded.

Classification (order and family) and common name	Latin name	2012	2013	2014	2015
CARNIVORA					
<i>FELIDAE</i>					
Jaguar	<i>Panthera onca</i>	—	x	x	x
Ocelot	<i>Leopardus pardalis</i>	x	—	—	x
Yagouaroundi	<i>Puma yagouaroundi</i>	—	x	—	—
<i>MUSTELIDAE</i>					
Giant river otter	<i>Pteronura brasiliensis</i>	—	x	x	x
Neotropical river otter	<i>Lontra longicaudis</i>	—	x	—	x
Tayra	<i>Eira barbara</i>	—	x	x	x
<i>PROCIONIDAE</i>					
Coati	<i>Nasua nasua</i>	x	x	x	x
CETARTIODACTYLA					
<i>CERVIDAE</i>					
Brocket deer	<i>Mazama</i> sp.	x	x	x	x
<i>TAYASSUIDAE</i>					
Collared peccary	<i>Pecari tajacu</i>	—	—	x	x
White-lipped peccary	<i>Tayassu pecari</i>	—	—	x	x
<i>INIIDAE</i>					
Pink river dolphin	<i>Inia geoffrensis</i>	—	x	—	—
CINGULATA					
<i>DASYPODIDAE</i>					
Nine banded armadillo	<i>Dasypus novemcinctus</i>	—	—	x	x
PERYSSODACTYLA					
<i>TAPIRIDAE</i>					
Tapir	<i>Tapirus terrestris</i>	x	x	x	x
PILOSA					
<i>MYMECOPHAGIDAE</i>					
Collared anteater	<i>Tamandua tetradactyla</i>	x	x	x	x
<i>BRADYPODIDAE</i>					
Three-toed sloth	<i>Bradypus variegatus</i>	—	x	x	x
Two toed sloth	<i>Choloepus didactylus</i>	—	x	—	—
PRIMATES					
<i>AOTIDAE</i>					
Owl monkey	<i>Aotus nancymae</i>	—	x	x	x
<i>ATELIDAE</i>					
Red howler monkey	<i>Alouatta seniculus</i>	—	—	x	x
<i>CEBIDAE</i>					
Brown capuchin	<i>Sapajus macrocephalus</i>	x	x	x	x
White-fronted capuchin	<i>Cebus yuracus</i>	x	x	x	x
<i>CALLITRICHIDAE</i>					
Moustached tamarin	<i>Saguinus mystax</i>	x	x	x	x
Pygmy marmoset	<i>Cebuella pygmaea niveiventris</i>	—	x	x	x
Saddleback tamarin	<i>Saguinus fuscicollis</i>	x	x	x	x
Squirrel monkey	<i>Saimiri boliviensis peruviansis</i>	x	x	x	x
<i>PITHECIIDAE</i>					
Red titi monkey	<i>Callicebus cupreus</i>	x	x	x	x
Red uakari monkey	<i>Cacajao calvus ucayalii</i>	—	—	—	x
Saki monkey	<i>Pithecia monachus</i>	x	x	x	x
RODENTIA					
<i>CUNICULIDAE</i>					
Paca	<i>Cuniculus paca</i>	x	x	x	x
<i>DASYPROCTIDAE</i>					
Agouti	<i>Dasyprocta fuliginosa</i>	—	x	x	x
<i>ECHIMYIDAE</i>					
Yellow-crowned brush tailed rat	<i>Isothrix bistrata</i>	—	x	x	x
<i>ERETHIZONTIDAE</i>					
Bicolour porcupine	<i>Coendou bicolor</i>	—	—	x	x
<i>SCIURIDAE</i>					
Amazon red squirrel	<i>Sciurus spadiceus</i> or <i>igniventris</i>	—	x	x	x
Bolivian squirrel	<i>Sciurus ignitus</i>	—	x	—	—
Amazon dwarf squirrel	<i>Microsciurus flaviventer</i>	—	x	x	x
Number of species		13	27	27	29

Methods differed in the number of species each was able to detect. Camera traps recorded four species, canoe surveys (by sight) detected four species and foot surveys (also by sight) recorded 20 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. The time of day of surveying is also likely to have played a role in biasing results as, due to expedition logistics constraints, all foot surveys were conducted in the morning and canoe surveys in the early afternoon.

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 five species; three of them (the neotropical river otter, the giant river otter (tracks) and the three-toed sloth) were exclusively seen on the river. During the foot surveys, 20 species were recorded with 14 species only recorded using this methodology. Out of the five mammal species recorded by the camera traps, two of them were only recorded this way.

The differences in species composition recorded by each of the sampling methods support the need for their combined application in order to assess the complete mammalian diversity 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 white-lipped peccary, collared peccary, etc. The reason for the low repeated samplings in cell D8 and E8 was due to the fact that the river was too low for the boat to access these cells during the second week of field work. Cells I8 and I9 were only sampled twice due to the remote location of these cells.

Nocturnal, terrestrial and elusive species less likely to be seen can be and were recorded by camera traps, such as ocelot and the Brazilian tapir. But using camera traps also has its limitations. For instance, it cannot record arboreal species. The river census recorded mostly water-living or river bank dwellers such as the neotropical river otter or the three-toed sloth (sometimes it is possible to find these species within the forest but more commonly at the river bank).

In the two previous years of surveying, the saddleback tamarin was recorded as the most abundant primate species with 19 and 26 encounters respectively (see Table 2.4b). This year's study, however, recorded only 15 groups of the saddleback tamarin. Instead the brown capuchin monkey was recorded as the most abundant, with 20 groups recorded. The higher rating of brown capuchin monkeys could be a result of the law in 2008 prohibiting the hunt for primates in the TTCRCA area, with brown capuchin now recovering rapidly.

In the case of felids, jaguar was recorded by tracks in cell F9 and ocelot was recorded in cell F7, also by tracks, as well as by camera trap in cell H7. Despite the low 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.

Table 2.4b. Comparison of primate populations studied by Dosantos et al. (2012, 2013, 2014 & 2015²) at TTRCA.

Common name	Scientific name	2012 (n groups)	2013 (n groups)	2014 (n groups)	2015 (n groups)
Medium- and small-sized primates					
Saddleback tamarin	<i>Saguinus fuscicollis</i>	17	19	26	15
Squirrel monkey	<i>Saimiri boliviensis peruviansis</i>	8	8	9	11
Large-bodied primates					
Red uakari monkey	<i>Cacajao calvus ucayalii</i>	0	0	0	2
Brown capuchin	<i>Sapajus macrocephalus</i>	17	15	18	20
Saki monkey	<i>Pithecia monachus</i>	6	9	8	7

Recommendations for further work

This study established a set of standardised wildlife censuses and baseline surveys for further wildlife monitoring activities. Future surveys by others should 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.

For this year's study the Biosphere Expeditions citizen scientists again had help from the local Tahuayo River people, continuing the successful collaboration started in 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 bigger camera trap sampling effort this year with ten functioning cameras in comparison with 2014 with only four fully functioning cameras due to several failures. Future survey should continue in the month of September to keep data consistent and aim to use 20 or more camera traps to maximise species capture.

Finally, the editors strongly recommend that the very clear and present danger of [illegal cacao plantations on the borders of the TTRCA](#) should be addressed immediately by local partner Amazonia Expeditions and other local NGOs and civil society groups. Since Amazonia Expeditions' business model and many local communities depend on intact nature as a source of livelihoods, these cancerous plantations by a corporation well known for its highly destructive activities pose a serious threat to wildlife and human communities in the area. The editors hope this report will serve to steer Amazonia Expeditions away from its current ostrich approach in this matter.

² available via www.biosphere-expeditions.org/reports

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-2015/>.



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