EXPEDITION REPORT

Expedition dates: 26 October – 7 November 2008
Report published: December 2008

Studying jaguars, pumas and their prey in Brazil's Atlantic rainforest: the jaguar corridor.

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Expedition dates:
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Authors:
Marcelo Mazzolli
Projeto Puma

Matthias Hammer (editor)
Biosphere Expeditions

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Abstract

Expeditions to the southern Atlantic forest of Brazil were conducted with local students in August 2008 and Biosphere Expeditions in November 2008, to the APA (Area of Environmental Protection of Guaratuba) in the Serra do Mar Mountain range. This was the third Biosphere Expeditions survey conducted in the area, and the fifth overall survey if local expeditions are counted. The primary aim of the surveys is to locate core habitats for jaguar and puma at their southern range in the Atlantic Broadleaf Forest, and develop conservation strategies based on information gained locally, as a means to produce guidelines for conservation of these species and their habitat.

Sampling was conducted in the locality of Canasvieiras, in the municipality of Guaratuba and consisted of sign surveys and the deployment of 11 camera traps. Data collected included species richness, frequency, composition and observed occupancy. Frequency of puma (n=5) was higher than in the previous year, and jaguar was recorded once by tracks.

This study corroborates previous findings that the area may be considered of importance as habitat for jaguars due to the recurrent presence of species that have become rare elsewhere in southern Brazil, such as the tapir *Tapirus terrestris* and peccaries *Tayassu pecari* and *Pecari tajacu*, the surveillance of the area by private rangers, and also due to the good general aspect of the forest, including widespread presence of adult stands of palm hearts *Euterpes edulis*, which have also become rare elsewhere.

Resumo

Expedições para a Floresta Atlântica no sul do Brasil foram conduzidas com estudantes em Agosto de 2008 e Biosphere Expeditions em Novembro 2008, particularmente para a APA (Área de Proteção Ambiental de Guaratuba) localizada na cadeia de montanhas da Serra do Mar. Este foi o terceiro levantamento da Biosphere Expeditions na área de estudo, e o quinto ao todo, contando com a participação de expedições locais. O objetivo principal do projeto é encontrar núcleos de habitat para a onça-pintada e o puma em sua área de distribuição na porção sul da Floresta Atlântica, e desenvolver estratégias de conservação baseadas em informações obtidas localmente, a fim de produzir diretrizes para conservação destas espécies e de seu habitat.

A amostragem foi conduzida na localidade de Canasvieiras, município de Guaratuba, e consistiu em levantamento de vestígios e uso de 11 armadilhas-fotográficas. Dados coletados consistiram de riqueza de espécies, freqüência, composição, e ocupação observada. Freqüência de puma (n=5) foi maior do que nos anos anteriores, e a onça-pintada foi registrada uma vez por rastros.

Este estudo corrobora os resultados prévios de que a área de estudo pode ser considerada como habitat de importância para a onça-pintada em razão da recorrente presença de espécies que tem tornado-se raras em outras regiões do sul do Brasil, dentre elas anta *Tapirus terrestris* e porcos-do-mato *Tayassu pecari* e *Pecari tajacu*, a presença de patrulheiros, e também pelo bom aspecto geral da floresta, incluindo a presença generalizada de plantas adultas de palmito *Euterpes edulis*, o qual tem também tornado-se muito raro.

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1. Expedition Review

Matthias Hammer
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 an expedition to the Atlantic rainforest of Brazil, which aimed to initiate the first-ever concerted conservation project of Atlantic forest jaguar and puma populations and their prey in unstudied rainforest. The expedition's study site in the APA (Area of Environmental Protection) of Guaratuba, in the Serra do Mar Mountain range, is known for its outstanding beauty, with densely forested mountain ranges and mangrove lowlands reaching the Atlantic Ocean. It harbours one of the few jaguar populations surviving in broad-leaved Atlantic rainforest. Data collected by the expedition will form the basis for the management and protection of jaguars and pumas and their habitats within a highly threatened ecosystem.

Nobody knows how many jaguars and pumas there are in the APA of Guaratuba, an important refuge where these two cat species probably still survive in numbers. It is vital that this southernmost population of jaguars in the broad-leaved Atlantic rainforest is protected, as it contains the source population from which jaguar numbers could be re-established at an important area of its historical range. Biosphere Expeditions assisted local conservation efforts by initiating research in this unstudied area of forest, gathering key information vital for the protection of this highly endangered habitat and its resident species.

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1.2. Research Area

Brazil is located on the Atlantic coast of South America and is the largest country on the continent. Two-thirds of Brazilian territory is located within the Amazon basin. In addition to the Amazon, the Atlantic rainforest extends for about 3,500 kilometres along the coast with an area of over one million square kilometres. The Atlantic forest ecosystem is recognised as one of the most unique habitats on Earth, with numerous endemic species. It is one of the so-called world “hotspots” of biodiversity, with over 400 vascular plants per hectare, 50% of which are endemic. Animal diversity is also high: 215 species of mammals have been recorded, 73 of which are endemic; and out of a total of 183 species of amphibians, 91.8 % are endemic. Although biodiversity is very high, the status of many individual species is precarious. A recent estimate showed that 171 out of 202 species of vulnerable animals from Brazil are from the Atlantic forest.

Flag and location of Brazil and study site.

An overview of Biosphere Expeditions’ research sites, assembly points, base camp and office locations is at Google Maps.

The study area is situated in the APA of Guaratuba, although much of the Serra do Mar mountain Range in the State of Paraná, as well as its bays, are of interest to this project. The Serra do Mar mountain range harbours the largest continuous patches of Atlantic Broadleaf Rainforest of Brazil.

The Atlantic rainforest of Brazil is one of the most endangered ecosystems on Earth. It is hard to overstate the importance of this ecosystem in terms of conservation. Declared a UNESCO World Heritage Site in 1999, most scientists rank the Atlantic forest as one of the top three priorities for global conservation efforts. Very little of the Atlantic forest remains, and what does is highly fragmented. Despite this, it still maintains extremely high levels of diversity and endemism.

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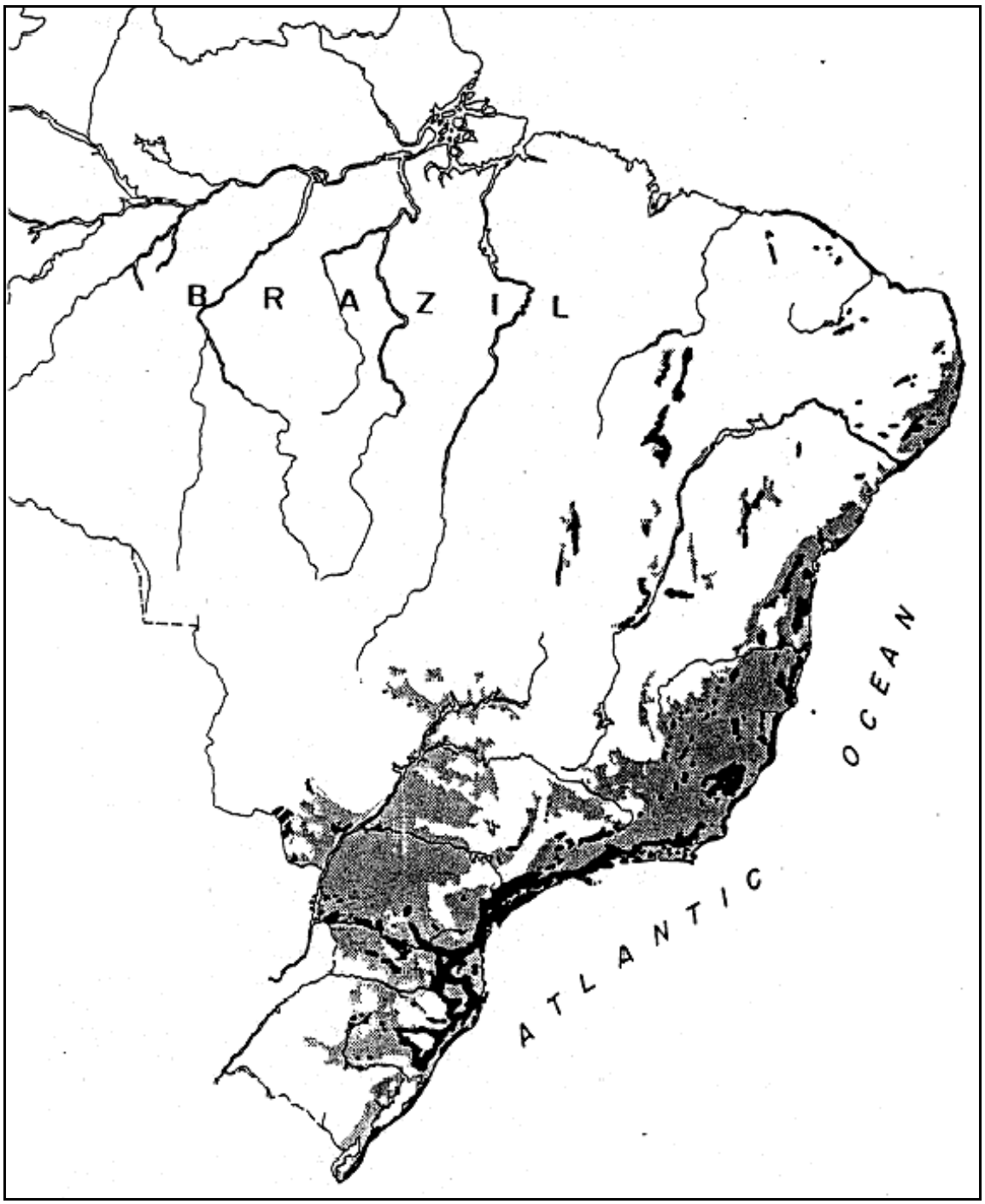

Map of the Atlantic forest showing estimated extent around 1500 (grey) and extent in 1990 (black).

The forest, which once spread along the Atlantic coast and much of southern Brazil, is now reduced to fewer than 8% of its original extent because of intensive human occupation, beginning with sugar cane plantation in the 1500s and later coffee plantations.

To address this lack of information, the expedition's research work also assessed which human occupation strategies are most compatible with the concurrent survival of large mammals, with special emphasis on the habitat quality for the jaguar and puma. Few areas are left, which have remained untouched and these are of high importance for their intrinsic value as a source of species, and as a model for recovering disturbed areas.

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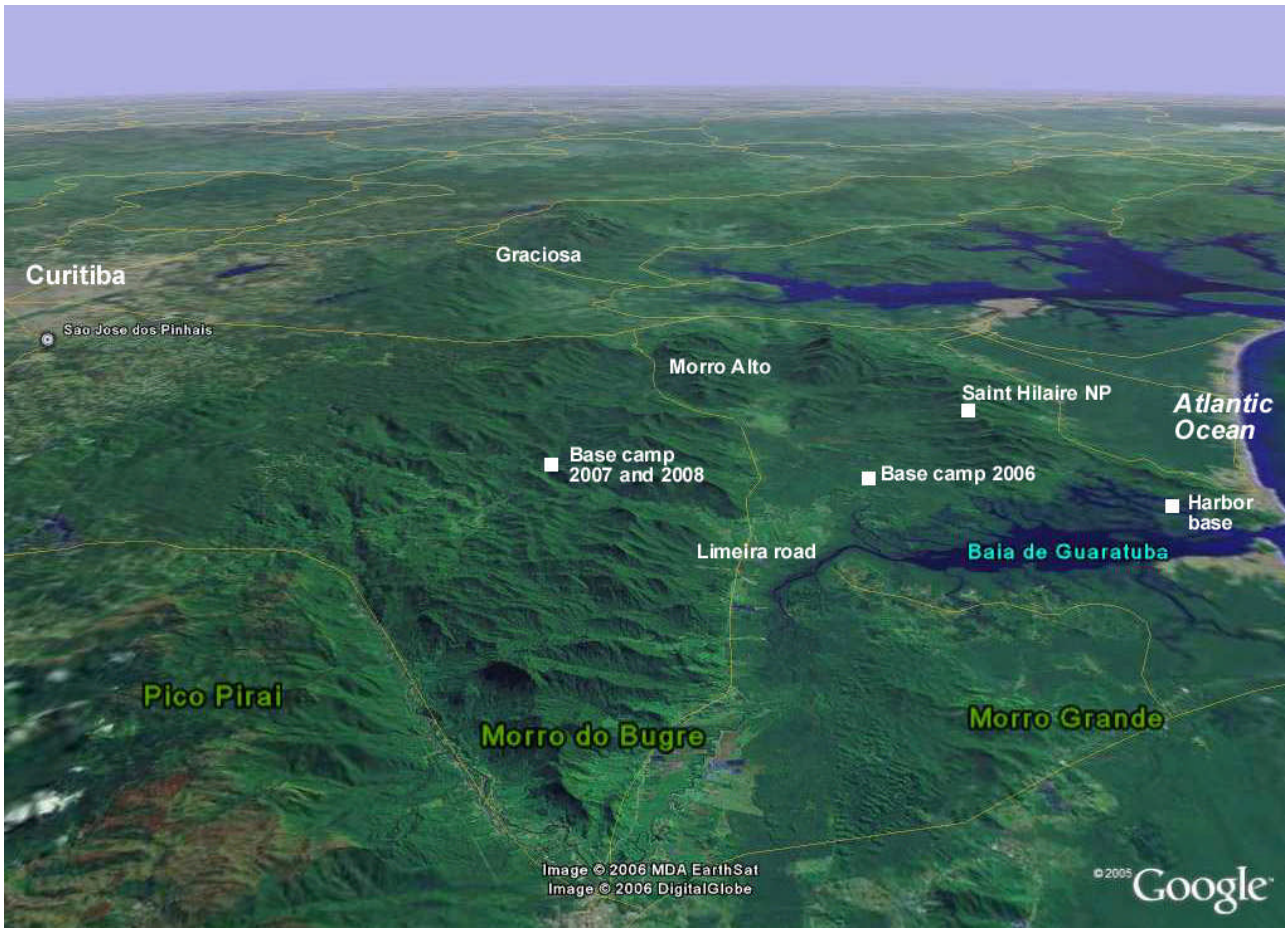
1.3. Dates

The expedition ran over a period of two weeks from 26 October to 7 November 2008 and was composed of a team of international research assistants, guides, support personnel and an expedition leader (see below for team details).

1.4. Local Conditions & Support

Expedition base & transport

The expedition assembly point was Curitiba, where expedition team members were met by the expedition leader and by the local scientist to be taken directly to base camp (see map below) using two Land Rover Defenders kindly provided by Land Rover Brazil.



Map showing study area including study bases, main road network, and major landmarks. © Google Earth.

Prior to the team members' arrival, staff prepared base camp from 20 November 2008. The facility is owned by a Mr. Simões that kindly provided access to it.

Base camp consisted of ten tents installed on wooden platforms, where the team slept, and a house where meals where served, equipment was stored and other common activities were conducted.

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Base camp with tents installed on wooden platforms above the forest floor.

There were two dedicated cooks to prepare all meals. Lunch often consisted of a snack lunch pack taken to the field. There was a 110V electricity supply at base.

Field communications

There was no telephone, and mobile phones did not work at base. The nearest landline telephone was about one hour from base camp. Regular expedition diary updates were uploaded to www.biosphere-expeditions.org/diaries for friends & family to access.

Medical support & insurance

The expedition leader was a trained first aider, and the expedition carried a comprehensive medical kit. Further medical support was provided by hospitals in the towns of Matinhos, Guaratuba, Paranagua and Curitiba. All team members were required to be in possession of adequate travel insurance covering emergency medical evacuation and repatriation. Safety and emergency procedures were in place.

There were no serious medical incidents. There was a sprained wrist from a fall, which was dealt with at camp.

1.5. Expedition Scientist

The expedition's local biologist was Marcelo Mazzolli. Born in Brazil, he graduated in Biology in 1992, with a master's degree from the University of Durham, UK. His Ph.D. in ecology, obtained in Brazil, was on the effects of human occupation on the extinction of large mammals. He has devoted his career to the study of large mammals, particularly the puma and jaguar, but has had many other outdoors experiences. He was a professional jungle guide in the Amazon forest in 1986 at age 21. He has attended many national and international workshops, and published relevant articles. His studies have made his work well known, and early in his career he was invited to be a member of the International Union for Conservation of Nature (IUCN) Cat Specialist Group with one of his projects listed as a priority in the World Wide Cat Action Plan. He has travelled extensively, living in the United States and Peru, and has surveyed lions in Botswana and Arabian leopards in Oman.

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1.6. Expedition Leader

Ronald Seipold graduated from the University of Berlin with a Masters Degree in Business Administration and then spent several years working in different branches of industries leading organisational and IT related projects. He then decided to go for a total change of career & lifestyle and focus on his passion for travelling, wildlife and the outdoors. After a 100 day intensive training course with COLT (Canadian Outdoor Leader Training) he qualified as an outdoor leader, radio operator, sea kayak and canoeing guide, backcountry first-aider, etc.. Ronald then began leading and instructing groups in the outdoors primarily in Scandinavia and Canada as well as working for outdoor camps and lodges. Ronald joined Biosphere Expeditions in 2007 and participated as staff in the expeditions of Oman and Azores. His favourite activities are mountaineering, canoeing and climbing.

1.7. Expedition Team

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

From left to right and from back to front: Reinhold Gahlnann (Germany), Marcelo Mazzolli (expedition scientist, Projeto Puma, Brazil), Marianne Danielsen (Denmark), Marion Westphal (Germany), Alistair Smith (South Africa), Michael Paull (Australia), Catharine Muenzel (Germany), Sheila Boughton (UK), Natalie Priest (UK), Nália Alves (cook, Brazil), Neuza dos Santos (cook, Brazil), Sandra Fischer (Germany), Ronald Seipold (expedition leader, Germany).

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1.8. Expedition Budget

Each team member paid towards expedition costs a contribution of £1190 per two week slot. The contribution covered accommodation and meals, supervision and induction, a permit to access and work in the area, 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 these contributions were spent are given below.

Income	£
Expedition contributions	13,866
Expenditure	
Base camp and food includes all meals, base camp equipment	2,036
Transport includes fuel, vehicle maintenance	729
Equipment and hardware includes research materials, research gear	351
Biosphere Expeditions staff includes salaries, travel and expenses to Novosibirsk?	2,414
Local staff includes salaries, travel and expenses, Biosphere Expedition tips, gifts	3,187
Administration includes bribes, registration fees, sundries, etc	540
Income – Expenditure	4609
Total percentage spent directly on project	66%

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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, Land Rover, Cotswold Outdoor and Motorola for their sponsorship.

Projeto Puma, Biosphere Expeditions' local partner for this project, and its founder Dr. Marcello Mazzolli were crucial to the success of the expedition. Thank you also to Daniel Contrucci of Projetcto Baggagem who initiated the whole project by establishing contact between Projeto Puma and Biosphere Expeditions and still gives support to the expedition from São Paulo.

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.

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2. Puma & Jaguar Survey

Marcelo Mazzolli
Projeto Puma

2.1. Introduction

Biosphere Expeditions started working in Brazil in 2006 with the first expedition running to Guaratuba bay with access by boat only. During that year, fourteen species of mammals were recorded, including jaguar *Panthera onca* and the puma *Puma concolor* (Mazzolli & Hammer 2007). The reduced presence of target species, difficult access, swampy trails and state of facilities present in the area encouraged us to change base camp site for the 2007 and 2008 expeditions.

In the 2007 expedition, collared and white-lipped peccaries were added to the list of recorded species. In August 2008, a local expedition with students from Brazilian universities surveyed the vicinities of the Harbour Base, the Quintilha trail by the Saint Hilaire/Lange National Park (PNSH/L), and a trail in the Morro Alto location connecting PNSH/L to the neighbouring mountain ranges of Serra do Mar (see map above in item 1.4).

Figure 2.1a. Harbor base at the southern tip of Saint Hilaire/Lange National Park. This base was used during the local August 2008 expedition.

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During this survey, a reduced number of signs of mammals were found, although it is worth mentioning the occurrence of tapirs and peccaries in the Morro Alto by the Limeira road. These findings corroborate the previous hypothesis, based on low human disturbance, that the area may provide the best wildlife connection between the Saint Hilaire/Lange National Park and the western mountains of Guaricana, Candongas, and Canasvieiras, or put shortly, the connection between the general area of Biosphere Expeditions' base camp in 2006 with those of 2007 and 2008.

Eight camera traps were installed during the local August 2008 expedition, remaining in the field for several months. Although five of the cameras were stolen, those retrieved revealed the presence of several species, including margay, tayra, and paca (see below), all of which had not been recorded thus far (Fig. 2.1b).

Figure 2.1b. Species camera trapped during the August 2008 survey with local teams near and in the Saint Hilaire/Lange National Park. From top left clockwise: red deer, tyara, paca, collared pecari and margay. The deer was photographed by the harbour base, the pecari and tayra on the Limeira road by Morro Alto, and the paca and margay near the Quintilha trail.

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Study area

The area sampled during November 2008 by Biosphere Expeditions was the same as that surveyed in 2007, except that the base camp location was not the same, and that the area sampled expanded a few kilometres northwards. It was located 13 km west of the PNSH/L border and was encompassed by the APA of Guaratuba, a reserve of sustainable use, where productive activities of low impact are allowed. The area surveyed comprised 11 contiguous cells 2 x 2 km in size, consisting mostly of large (over 5,000 ha) private (e.g. Simões land) and public properties (e.g. Ambiental Reflorestadora, Copel), which were patrolled by guards hired to protect the areas against encroachment by landless people, poaching, and illegal harvesting of palm-heart *Euterpe edulis*.

Base camp was located 12 km from the federal road BR-277 connecting the capital Curitiba to the harbour town of Paranaguá. It took approximately 1.5 hours using four-wheel drive vehicles on a track crossing several wooden bridges and two rivers to reach the expedition base camp. Although the surrounding mountains reach over 1,500 m in altitude, the area sampled was between 150 to 450 m in altitude. The vegetation consisted mostly of montane and sub-montane broadleaved Atlantic Forest.

In addition to covering the area around base camp, two exploratory Land Rover-based surveys were conducted to the Graciosa mountains to the north (where jaguars had been recorded prior to 1997), and by Land Rover and boat to an island of the Guaratuba Bay to the south of base camp (where jaguars had been recorded in 2006) (Figure 2.1b).

Figure 2.1b. Boat preparing to leave with team members to survey an island by the Guaratuba Bay area where a jaguar had been recorded in 2006.

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2.2. Methods

Training of team members

For the first two days team members were given talks and practical lessons, learning the use of GPS (Global Position System) and general data collection and equipment usage procedures. The first excursions into the forest were done under the supervision of Biosphere Expeditions staff. After a few days, team members were able to navigate in the forest, install camera traps and record tracks and signs of mammals in small groups without direct supervision.

Figure 2.2a. Team members being briefed on the base camp varanda about data entry and other study protocols.

Ecological sampling

Data on mammalian presence were collected from field surveys in continuous quadrats 2 x 2 km each coded by a combination of letters and numbers.

Resampling of quadrats were carried on when possible, taking into account that mobile 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 established with repeated sampling (Table 2.2a).

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Table 2.2a. Quadrat resampling scheme showing quadrat codes. Numbered columns marked with X represent the number of sampled occasions.

Quadrat	Number of times resampled					
	1	2	3	4	5	6
9i	X	X	X	X		
9j	X	X	X			
10h	X	X				
10i	X	X	X	X		
10j	X	X	X	X		
10k	X					
11h	X	X	X			
11i	X	X	X	X	X	
11j	X					

Data collection procedures included camera trapping and recording of any mammal sign, vocalisation or sighting in the quadrats sampled. Data were recorded in pre-formatted data sheets taken to the field and animal signs were photographed and photos brought to camp for correct identification. Team members carried GPS pre-loaded with coded quadrat grids, which helped them to locate themselves and the areas where data had to be collected, avoiding aggregated sampling (spatial autocorrelation). Every animal sign was recorded along with the coordinate and quadrat code. This allowed for observed species' occupancy (number of quadrats present or absent) and frequency (also referred to as 'relative abundance' in the literature).

Most trails were 3 km in length and had sufficient mud coverage to display prints of animal tracks. This made track recording possible in most circumstances without the need for track traps. Track traps were set in the few trails where tracks did not record naturally.

Two overnight surveys were carried out at the same location, each time volunteers walked a trail during the night for one to two hours, imitating a jaguar with a jaguar caller.

Camera trapping

Eleven cameras, three of which were digital, were placed in the study area. Total camera trap sampling effort was 63 camera trap nights (Table 2.2b) in four quadrats.

Cameras were not set or removed all at once, so the period they stayed in the field varied. As there was only one expedition slot in 2008, the sampling period was short.

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Table 2.2b. Sampling history of individual cameras (ID column), including date of installation and removal, quadrat installed and working period.

ID	Date installed	Date removed	Quadrat	X	Y	Trap nights
D1	29/10/08	06/1108	11i	721784	7161840	7
A8	29/10/08	06/11/08	11i	721674	7161903	7
D2	28/10/08	06/11/08	11i	None	None	8
A31	31/10/08	06/11/08	9i	717063	7161481	6
D3	31/10/08	05/11/08	9i	717002	7161674	5
A32	30/10/08	06/11/08	11h	720493	7163601	7
A30	30/10/08	05/11/08	9/10i	717872	7161142	6
A21	02/11/08	06/11/08	i12?	721925	7161357	4
A06	02/11/08	06/11/08	i11/12?	721683	7161376	4
A20	1/11/08	05/11/08	9j	717335	7159539	4
A40	31/10/08	05/11/08	9J	717961	7159757	5
					Total trap-nights	**63**

2.3. Results

Training and performance

Training the expedition team on navigation through the forest was considered very successful. After a few days groups consisting of two to four team members went for long walks to perform their tasks by themselves. Some of the groups explored new trails that had not been visited before. The fact that they were able to return in the scheduled time was proof that their navigation skills were excellent. Camera traps installed by team members performed well, indicating that installation was good. Data recording and entry was also satisfactory.

Species occurrence

During the Biosphere Expeditions survey, armadillo, brocket deer, capuchin monkey, crab-eating fox, collared peccary, jaguar, opossum, puma, racoon, and tapir were recorded. As in 2007, tapir was the species recorded most, in number of quadrats (n=6) and in frequency (n=8). Puma was the second most recorded species, found in three quadrats and on five occasions (Table 2.3a).

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Table 2.3a. Species recorded during the Biosphere Expeditions survey, with information on quadrat number and type of record (vestige, sighting, vocalization, camera trap).

Species	Latin name	Local name	Quadrats	Type of record	Number of records
Armadillo	*Dasypus novemcinctus*	Tatu-galinha	9j, 10i	Track	02
Brocket deer	*Mazama sp.* (likely *americana*)	Veado-mateiro	11h, 11i	Sighting, camera trap	02*
Capuchin monkey	*Cebus nigritus*	Macaco-prego	10k	Sighting	01
Crab-eating fox	*Cerdocyon thous*	Graxaim	9i, 10i	Track	01
Collared-peccary	*Pecari tajacu*	Cateto	9h	Hair	01
Jaguar	*Panthera onca*	Onça-pintada	9j	Track	01
Opossum	*Monodelphis marsupialis*	Gambá	10i	Sighting, track	02
Puma	*Puma concolor*	Onça-vermelha, leão	9i, 10j, 10k	Track, camera trap	05
Racoon	*Procyon cancrivorous*	Mão-pelada	9i, 10i	Track	03
Tapir	*Tapirus terrestris*	Anta	9i, 10i, 10j, 10k, 11i, 11h	Track, camera trap	08

* Additional to those recordings there were numerous other of (undentified species of) deer.

Only two species, deer and tayra were recorded with camera traps, the remaining species were recorded by their tracks. Results in species composition from 2008 differed from 2007 by the recording of jaguar, capuchin monkey, opossum, and the absence of ocelot and agouti.

Jaguars did not reply to the jaguar caller during overnight camps, and were thus only recorded by tracks. Jaguar and puma tracks are difficult to distinguish in some instances, particularly when puma tracks expand in deep mud, as it was possible to observe during this expedition. To avoid misinterpretations, and confirm that the track found was unquestionably that of a jaguar, puma and jaguar tracks were digitalized and scaled to natural size (Fig. 2.3a).

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Figure 2.3a. Jaguar (top) and puma prints in the mud highlighting differences in size and shape. Actual sizes, ruler in centimeters. The only jaguar print was found on the "donkey trail", revealing that the animal headed downhill. Puma tracks were found on five occasions.

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GIS mapping

Two maps were produced. The first was limited to the 2008 base and surroundings, included quadrat coding and contained the trails and camera trap locations. It was extracted from Geopro maps produced by Pró-Atlântica in the background and overlaid with data obtained in the field and transferred using the software TrackMaker (www.gpstm.com).

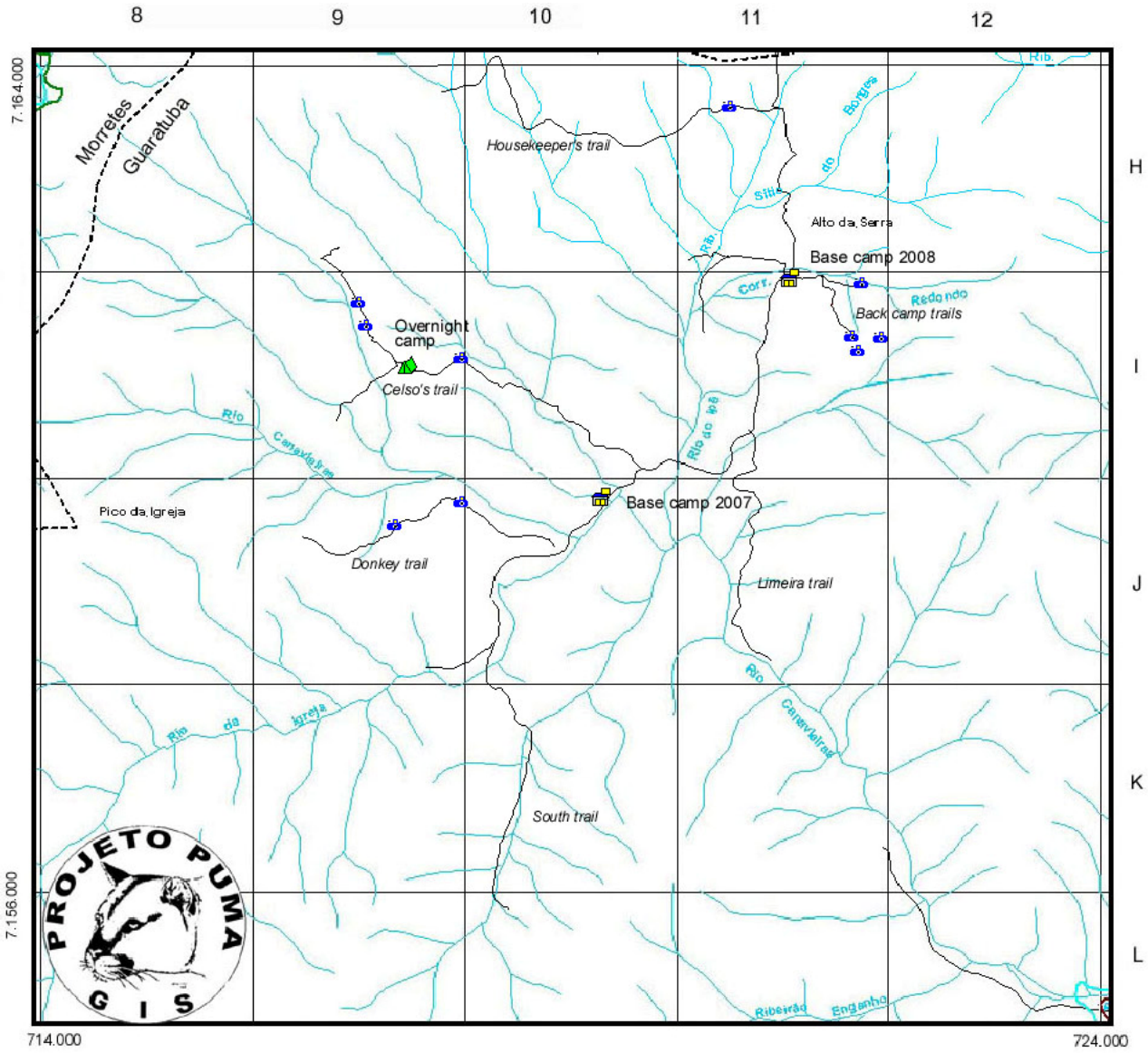

Figure 2.3b. Map of the study area. Map includes position of camera traps, river systems, quadrat coding (letter and number) and trails. Coordinates are in UTM, datum SAD 69.

The second map was produced by Projeto Puma displaying the entire 'Jaguar Corridor' study area. It displays the locations of the 2008 exploratory surveys using Land Rovers to the Graciosa Mountains and by boat to Guaratuba Bay. It also summarises locations where jaguars have been found prior to 1997 and from 2006-2008, base camps, main roads, and contours of protected areas (Fig. 2.3c).

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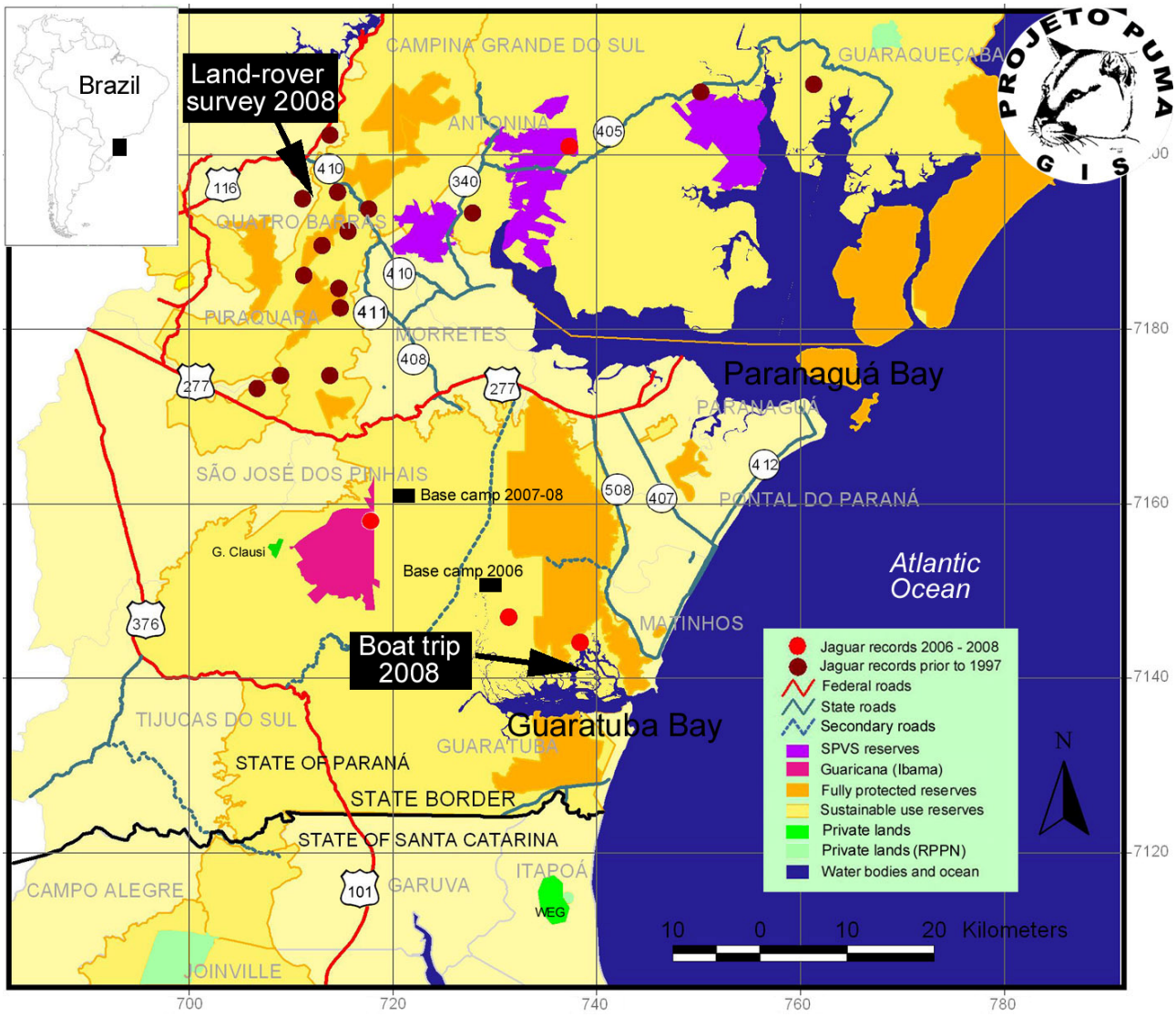

Figure 2.3c. The entire jaguar corridor area, extending from the State of Santa Catarina to the State of Paraná. This map was generated from GIS features kindly provided by several organizations, namely the Environment Foundation (Fatma - Santa Catarina), Paraná Institute of Environment (IAP), Brazilian Institute of Environment and Renewed Resources (IBAMA) and Society for Wildlife Research and Environmental Education (SPVS). Jaguar records prior to 1997 have been mapped by M.R. Leite (Leite M.Sc. thesis, 2000). Coordinates in UTM, datum SAD69.

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2.4. Discussion & Conclusions

Species presence and habitat integrity

The most remarkable finding during this years' Biosphere Expeditions survey was, no doubt, the jaguar track. The species was not found during 2007, either by Biosphere Expeditions or by local teams. In spite of that, it was presumed that the species was present due to the presence of species that are found to be rare elsewhere, such as the tapir and peccaries, and the general good condition of the environment. This new jaguar record proves the assumption to have been correct.

Again, however, the jaguar has proved to be an uncommon species in the study area. Since Biosphere Expeditions surveys began in 2006 it has been recorded only three times by Biosphere Expeditions and Projeto Puma, with an additional record made by the staff of the NGO SPVS in the Cachoeira reserve. In addition, enquiries made to the environmental police of Morretes during the current expedition regarding presence of jaguar or jaguar depredation on livestock yielded no addition records, nor did enquiries to a landkeeper of an area in the Graciosa mountains (during the Land Rover survey) belonging to the company Diana, where jaguars had been recorded prior to 1997. Only rumours of the presence of jaguar were obtained in the Graciosa mountains. Factual, recent evidence of jaguars in the Graciosa mountains was absent

Other differences in presence of species from last year, such as the absence of agouti and recording of capuchin monkey and opossum, may only be taken as chance variations. Ocelot absence during this year, on the other hand, may not be a result of random variation. The species was recorded eight times in 2007 and not at all in 2008. In 2007 it was recorded often on roads that are now being frequently used by vehicles. In fact, traffic of vehicles has increased at the far end of the road that leads to the Canasvieiras area, due to increased use of the area by three private landowners, one for implementation of a new palm-heart and 'pupunha' (amazonian palm-heart) *Bactris gasipae* plantation, one for maintenance of an older plantation of the same species, and the third for 'recreational' purposes. The traffic may have interfered in the habits of ocelots, but the recurrent presence of pumas, recorded more often than last year, may also have pushed the ocelot to use other trails.

Tapir was found to be relatively common still in the area, and widespread over the quadrats surveyed. This result is positive, as the species is not able to stand hunting pressure at any level due to its slow reproductive rate. Any population crash would take many generations to recover densities to the current level.

Sampling and study design

Study design considerations should always take into account the relationship between the amount of data obtained and the effort spent during the survey. Ideally a greater number of quadrats should be surveyed more frequently. During the 2008 Biosphere Expeditions survey, nine quadrats were covered in contrast with only four in 2006 and twelve in 2007. The drop in number of quadrats covered from 2007 to 2008 are the results of rainy weather during 2008, which made crossing the many rivers and creeks that intersect the study area difficult. Despite this, sampling and re-sampling of quadrats may be considered satisfactory considering that fewer than two weeks were available for sampling.

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Management implications

This year it was possible to expand the intensive survey near base camp northward, exchange information with the environmental police in Morretes, and involve other stakeholders in our project. Stakeholders are willing to cooperate with our expeditions, and their involvement is key to reducing encroachment from landless people, hunting, and other illegal activities that may harm the local environment and fauna of the Canasvieiras area. The jaguar track recorded this year provides renewed perspectives for the continuation of the project in the area.

Management recommendations

As mentioned in the last report, the good condition of the habitat in the study site are largely due to frequent patrolling by stakeholders, some of them employees of companies that are owned or partially owned by the government of Paraná, such as Copel and Lavrama. Management of the area should therefore take that into account, providing means to stakeholders to manage their properties in a sustainable manner.

A local stakeholder that participates as a member of the community committee of the APA of Guaratuba stated that the municipality of Guaratuba receives over one million Reais (approximately US$ 500,000) per year from the 'ecological tax', relative to the extent of protected areas.

The 'ecological tax' is derived from the 'Tax of Merchandise Exchange' (ICMs). The ICM tax is collected at state level and distributed to municipalities in accordance with a series of criteria. One of the criteria that enables the municipality to receive a larger share of this fund is to have large protected areas. The more protected areas the municipality has, the more of this fund it is entitled to.

There is no information so far on how this funding is used, but it is obvious that the areas surveyed so far do not receive any direct benefit. It is recommended that application of this fund should be revised and means should be implemented so that it can go to payment of rangers and incentives for sustainable use of forest products, such as for example the extraction of fruits of the palm heart to produce juice, rather than to cut down the tree (which is illegal and also detrimental for wildlife).

As also mentioned in previous reports, rough estimates show that the fruit and juice production may be up to fourty times more lucrative, than the extraction of palm heart.

Priorities for next expedition

The 2008 base camp area should be sampled further in 2009 to guarantee that it will be given further attention, due to its great potential as jaguar habitat. Land Rover and boat based surveys should be repeated to learn more about jaguar presence along the jaguar corridor. Efforts should be put into the project so that expeditions last longer and more results can be accumulated.

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Appendix 1. Bird list

There were no ornithologists, amateur or professional, on the current expedition team. However, several birds were very conspicuous, and frequently caught our attention. Some members of the team, particularly Catharine Muenzel, recorded these species in the small list of birds below.

Common name	Latin name
MANTLED HAWK	*Leucopterius polionota*
EARED PIGMY-TYRANT	*Myiornis auricularis*
CAATINGA BLACK-TYRANT (?)	*Knipolegus franciscans*
GLITTERING-BELLIED EMERALD BLACK-JAKOBIN	*Melanotrochilus fusca*
WHITE-RUMPED SWALLOW	*Tachycineta leucorrhoa*
DUSKY-LEGGED GUAN	*Penelope obscura*

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Appendix 2. Expedition diary by Ronald Seipold

15 October

The start of this year's Brazil expedition is looming and I, Ronald (your expedition leader), would like to tell you about my first steps to get the show on the road.

Having prepared the long to-do-list, I have left for Sao Paulo, where I will meet Daniel from Biosfera Brasil (our local partner). During the next few days we will pick up our Land Rovers, get all the equipment together and organise some additional supplies, finally to meet Dr. Marcelo Mazzolli (your expedition scientist). Together we will then set up our base camp, get everything in place, check all the technical equipment and prepare the paperwork.

I'll keep you updated on our progress and look forward to meeting you soon.

Ronald Seipold
Expedition Leader

23 October

I'm sending you this diary from Matinhos where we are picking up some supplies and food.

My experience over the last few days is that Brazil can beat even the Germans regarding procedures and formal paperwork. You need to be very patient and all the planning up front does not really help you in the end. So, the delivery of our cars had to be postponed until today. In the meantime I travelled by bus to Matinhos where I met our scientist Marcelo. Marcelo had already organized a pickup truck and so we made our way into the research area where we started setting up base camp. Besides a breakdown of our car in the middle of nowhere that caused us some trouble, we managed to get things started and should be all ready for you by the time you arrive (I hope!). Most of the platforms for our tents are done and, very importantly, a cook has also been hired, so you don't need to starve :). Step by step the house is getting into shape. There are two days left to get everything ready and I have to admit that we are glad about it. Our expedition is on its way!

You might also be interested in the weather. Describing it in one word: wet! It has been raining here for several days without a break. The terrain is muddy and the rivers running high are a challenge in themselves (we had to cross some of them with our Land Rovers). Two days ago it stopped raining and yesterday we have even seen some sun in Matinhos! Note also that because of all this water and mud, we will bring for you some pairs of rubber boots to the assembly point.

Not having internet access (or even a signal for mobiles) there is no chance of sending you more information before you will arrive. So, hopefully you will be getting ready too, bracing yourself for things to come! We are looking forward to meeting you all at the assembly point Curitiba Holiday Inn, 07.00 on Sunday 26. Safe travels.

28 October

The team arrived, but Marianne's luggage did not. But it doesn't seem to be a big problem for her. All team members are willing to help: some socks here, a T-shirt from somebody else, a hammock with a cover and a view to the sky – what else do you need in a rain forest :)

The weather changed at the right moment: it was sunny and warm for the first two days, giving us the chance to do our training sessions outside on the veranda of our cabin (with this awesome view over the rainforest towards a mountain range). After a pleasant first night we continued our training and we were out for our first walks around base camp.

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Today the *rain*forest made a comeback with heavy rain. Braving the weather, we practiced making a track trap and we learned to install a camera trap as we found a very promising place with peccary tracks. In the afternoon we split into two groups, studying trails in the area.

Tomorrow some team members will drive to Morretes to pick up the missing luggage, we hope, buy some rubber boots and send this diary to you. The others are looking forward to staying a full day in the field: one group is going on a reconnaissance mission to explore one trail west of base camp leading up to a mountain range and a second team will head for the Limeira road trail of last year's expedition.

Besides all the work we have done so far it's good to see that the team is gelling well, with a great team spirit. So nothing short of a great start for the expedition.

3 November

After some more training on data sheets and data entry we split in two groups. One of them left in the afternoon for a reconnaissance trip west of our camp site. The rain had washed out all tracks (except a tapir one) and crossing a river had become impossible. After preparing a track trap, we had to return earlier than we had hoped. The other group explored the range behind our site, setting another camera trap. Back at the camp and sitting on our veranda, I had a glimpse of a fox passing the road at the end of our front yard – was it really a fox?

Wednesday turned out to be a good day even though we had heavy rain all day long. Those without rubber boots went to Morretes to buy some (Alistair having UK size 44 was successful as well!) and Marianne finally got her luggage back. In the afternoon this group went out on another trail, setting two more camera traps. A second group continued the trail walked the day before to finally cross the river. But they had to return after it was not possible to find any access point to the promising mountain range. On their way back, Sandra spotted a deer.

Katharina, Reinhold and I stayed out a whole day on the so-called Limeira Road Trail, a trail that had been worked on already last year. Very muddy terrain limited the distance we could do. Besides one a track, possibly of an armadillo, we had to return without any clear sightings. Although everybody's clothes are now wet (and it's difficult to get them dry in this humidity) the mood is still upbeat. All team members are enjoying the cabin, the food and this awesome location.

The following day was unexpectedly dry and from time to time the sun got a chance of shining through the roof of trees. One group headed towards a new trail located about 15 minutes by car north of our site. It didn't take long to find several tapir and other tracks that we couldn't identify. So we installed a camera and a track trap at this promising spot. Shortly afterwards a coral snake crossed our path. Further west on this rarely used trail we were surprised to find an old banana plantation, located in the middle of nowhere. Some cartridges, a fire place and some other signs of human disturbance were found. As we returned in the evening, the second group was back already but without the second Land Rover. They had been heading up Celso's Trail when the car got stuck on one of the very rarely used bridges. Not being able to get the Land Rover out they decided to continue walking. During the day they explored several trails close to one of the peaks and found a puma track! This finding gave everybody the extra lift they needed for a long walk back to the house – even though the Land Rover could be manoeuvred from the bridge, the car got stuck again on the next bridge and had to be left behind over night.

Left with just one car, we had to face a new logistics issue. But despite this one group got a ride close to Donkey Trail south-west of the camp, whilst the second group prepared an overnighter at Celso's.

The first challenge on the way to the Donkey Trail is a river. Loaded with our daypacks, carrying boots and pants we balanced our way barefoot to the other side of the stream. The slippery, muddy trail up the hill needed physical and mental strength to conquer, but we were pretty soon rewarded by several types of animal tracks such as tapir and opossum. So we decided to place a track trap and later on a camera trap. Half an hour further up we couldn't believe our eyes: we clearly saw a big cat print. But no further prints could be found anywhere around. The print seemed to be too big for a puma but what else could it be – a jaguar? In the evening we met Marcelo, who picked us up behind the river, showing him our photos. It took him a while to ensure what he himself couldn't believe: this must have been a jaguar.

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Meanwhile, our first overnight camp was established by Michael, Alistair, Nathalie and Marianne. It was located next to two huts on the Celso Trail west of base camp close to the mountain range. After having prepared all packs, they were driven in the Land Rover to the trail. After an hours hiking, they arrived at the camp site. In the afternoon they installed two more cameras on a trail leading to a nearby peak. After some warm food and drinks prepared on a fire, they started to call the jaguar from the peak with a special sound device. Each call lasts approx. 3 minutes with calls made at 15 minutes intervals. The rain and coldness prevented them from continuing all night long. Even after 6 calls and an additional one at 23:00 there was no answer from a "real" jaguar. An animal passed quite close by but the extremely dark night didn't allow them to see the animal. Unexpectedly on the decent the following morning (Saturday) three sets of puma prints were observed within close proximity of one of the camera traps. Let's hope we have a photo of a big cat next week!

Half of our expeditions is already over – time is racing on. Everybody is still ambitious to go and the spirit is amazing. But most important to me is that none of the team members had to face any major problems - besides a competition about who is in the lead regarding mosquito and tick bites. The second week will bring in more results – let's see …

Sheila, Reinhold, Katharina, Marion and I returned the next day to the Donkey trail to install one camera trap close to the jaguar print. Back from our "mission" we turned south to have a closer look at two trails that have been studied already last year. Unfortunately we couldn't add any interesting sightings to our list.

While the rain returned, we worked Sunday on our data sheets and updated our data entry. Those who felt a bit exhausted from the last day's walks went to Matinhos, whilst others explored one more trail up the hill behind the camp and to set up our last two cameras.

Monday started unexpectedly with almost clear skies and sunshine. No wonder that the first activity of the day was to get all those wet clothes hanged out to dry. Some of us left the camp to walk the Southern Trail as far as possible. We had to cross 6 main streams and several smaller brooks but we were rewarded by an almost uncountable amount of tracks such as deer, tapir, peccaries and two crystal clear puma prints! We saw another coral snake and two capuchin monkeys jumping over our heads from one tree to another!

A second group accompanied Marcelo driving to a region approx. 20 km west of Morretos to interview locals. Several years ago puma and jaguar sightings/tracks were registered there. Recent tracks, a sighting of a black jaguar and a puma attack on horses just two weeks ago might make it worthwhile to integrate this area too into future research plans.

11 November

We decided to have our "day off" on Tuesday. Instead of just relaxing, we went down to Guaratuba Bay. A boat took us out on a trip between the islands which are surrounded by mangroves. Behind the coastline, the hilly landscape completed the beautiful scenery. For a better understanding of this more or less "untouched" nature we added a one hour walk through the jungle on one the islands.

Wednesday and Thursday we split into groups again to get all cameras back. Once more one group spent the night at Celso's. This time it was not as cold, wet and dark as last time and a lot of noises of animals could be heard throughout the night. Katharine, Reinhold, Sheila, Marion and Marcelo took the chance to call the jaguar again but no reply could be heard. Unfortunately one camera had technical problems so no pictures were taken. The other analogue cameras indicated some shots were taken, but we have to be patient until the films get developed. On their way back to camp the group discovered more tracks such as raccoon, tapir, opossum, armadillo and, for the third time in this area, very recent puma tracks. They are around!

The camera trap on donkey trail, next to the jaguar print found last week, didn't take any pictures. Everybody was a bit disappointed, but the chance of getting a picture of a big cat within a few days, in a range of several meters is pretty small in reality. The track traps on our trails were more of a success: plenty of prints of opossum, tapir, deer and peccary could be entered on our data sheets.

On our way back, between camp site and housekeeper's trail, Natalie and I spotted a hawk as it took off the road behind a bend in front of our Land Rover. We could clearly see a snake in its claws.

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Thursday turned out to be the best day of our stay. The afternoon was used for data sheets, data entry, photo collection and starting to clear up equipment as well as personal stuff. All our work was rewarded by a very pleasant evening on the veranda, including a stunningly picturesque sunset.

It was dry again on Friday morning and the sun helped us to take down our tents dry. ith the assistance of all team members we managed to pack up camp by early lunch time. Nobody could believe that the expedition was already over – hadn't we just made it up the muddy road to our home, sweet home a few days earlier?

Eventually everybody got back to Curitiba. Despite the great time we had in the jungle, I guess some of us were looking forward to having a hot shower and a comfy bed …

Thanks to everybody to your contribution, great team spirit, patience, effort and flexibility. For Marcelo and me it was a real pleasure working with you and we hope that there will be a lot of good memories that will last for a long time. At least there will come the moment when you might hear a voice from the off yelling: "this is not good for you!!!" or "why???".

Please don't forget to upload and share your pictures via www.biosphere-expeditions.org/pictureshare.

Hope to see you again.

Cheers

Ronald

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