Shipstern Nature Reserve: Mammals' Tracks

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Introduction:

A nature reserve is aimed at defending and helping all kinds of animals to survive and to reproduce. Shipstern Nature Reserve based in Belize is one of those. Animals are totally free, without barriers or anything that could prevent from moving. Endangered species can be protected in a reserve. Mammals are particularly vulnerable to hunters. After a time, an animal learns where it is safe to live as in a reserve where hunting is absolutely forbidden. This is also a positive point for tourist who can discover some rare species of fauna as well as flora. A nature reserve must first of all protect the habitats of animals.

Studies are regularly done to learn about the abundance and the distribution of animals and vegetation. Different approaches can be realized on that purpose. The simplest one is to observe and count all animals that have been observed. It is very basic but very useful. Watchers can use some equipment such as binoculars or lamps at night. Identification of tracks is one of the best things to do especially for mammals. It is not difficult and requires just a tracks' book and maybe a camera to keep evidence. Hair, feathers or evacuations on the ground are good signs too. Searching mammals' home as dens, nest or burrows give more information in particularly on the young. Every animal must drink water, so it is appropriate to stay near a water hole and observe. Sometimes, we use food to attract animals in a definite region or to dissuade them from eating in another area. Finally the best way to study animals might be to catch them and take some measures and/or pictures.

Unfortunately, some ill-disposed and unscrupulous people destroy nature and corrupt the government to continue their slaughters. For this reason we must react very quickly and protect the beauty that is around us.

Aim:

The aim of this report consists in finding mammals' tracks on the different trails or savannahs or even along the road (on the north part) of Shipstern Nature Reserve. Then pictures, position (with a GPS) and size of the tracks have been taken. Finally, tracks had to be identified.

With the data, a general distribution of mammals in the reserve can be done. This is a first approach of mammals' identification. It must be seen as a general method and not as a very specific one.

A secondary aim is to take pictures of live animals with two cameras traps. This work can help but it is not the principal goal of this survey.

Presentation of studied species:

Mammalian's class contains approximately 4'500 species. Three fundamental particularities distinguished Mammals from others classes. Firstly those animals have hairs. Secondly, they are homeotherm (warm-blooded). Thirdly mammals own a placenta so they give birth to live young (except for monotremes that lay eggs) and feed young on milk.

Mammals are found on every continent. However, with the difference of latitude and longitude, world regions follow each other but are not alike. With those changes of climate, vegetations, habitats, etc, animals' distribution varies too. Large mammals are quite common in Belize because this territory is sparsely populated.

Family of Felidae (better known as Cats' family) counts 37 species worldwide. In Central America, there are 6 species (Ocelot, Margay, Jaguarundi, Oncilla, Puma and Jaguar) and, except for Oncilla, all of them are present in Belize. Those animals are nocturnal and eat mammals, birds, reptiles, fish, amphibians and even insects. Cats are not very well distributed in the country because of their habitats' loss and hunting for their fur or just for fun. Margay doesn't like a disturbed forest contrary to Jaguarundi. Puma lives in forests, deserts and highlands but not in mangroves or flooded areas. Jaguar is now uncommon but still found in undisturbed evergreen forests, deciduous forests, mangroves and grassland. Ocelot is present in evergreen and deciduous forests, second growth and agricultural areas. All Central America cats have 4 weight-bearing toes on each foot, with retractile claws. Foot's width is usually different between the front foot and the hind foot. Front foot is always bigger for cats, except for Margay which is the same size and for domestic cat where this is the contrary. The size foot, for cats, is: Oncilla (28 mm, 22 mm). Margay (35 mm, 35 mm), Jaguarundi (55 mm, 40 mm), Ocelot (58 mm, 50 mm), Puma (85 mm, 80 mm) and Jaguar (120 mm, 95 mm). Usually Margay walks on his front track with his hind foot.

Procyonidae's family owns between 10 and 15 species set off again 6 genera. Belize owns 4 species: Northern Raccoon, Cacomistle, White-nosed Coati and Kinkajou. They are omnivorous and nocturnal, except for the Coati. Cacomistle's habitat is evergreen and deciduous forests, tall second growth and wet montane forests. Kinkajou is common in evergreen and deciduous forests, second growth, dry scrub and agricultural areas. Those two animals live essentially in trees. Raccoon can be found in coastal regions, mangroves, towns and rural areas with mixed habitats, but not in mature evergreen forests. Coati lives in deciduous and evergreen forests, second growth, and arid scrub. Some of them are still hunted. This family has 5 toes on each foot and claws are often visible. The size of Raccoon's foot is 50 mm for front foot and 55 mm for hind foot. Coati has smaller foot, 45 mm. Cacomistle leaves a track of 30 mm width. Kinkajou's foot size is 42 mm for the front foot and 40 mm for hind foot.

Canidae's family contains 36 species of dogs and foxes. Only 3 species are in Central America (Coyote, Gray Fox, and Bush Dog). Gray Fox is the only representative of this family in Belize. Common in deciduous and semi-deciduous forests, agricultural areas and arid regions, Gray Fox is active at night but also at day time. This mammal eats everything (fruits, small mammals, birds and reptiles). Easily seen along roads at night, this animal doesn't suffer from hunting. Each foot tracks shows 4 toes with claws usually visible. The front foot measures 30 mm and the hind foot 25 mm.

Family of Mustelidae has 64 species in 23 genera distributed in the entire World. Eight species lives in Central America. Long-tailed Weasel Greater Grison, Tayra and Neotropical River otter are presents in Belize but only Tayra has been seen in Shipstern Nature Reserve. In Belize there is Spotted Skunk and Striped Hog-nosed Skunk. Tayra is a diurnal mammal who eats fruits, invertebrates, lizards and even others mammals. Habitats are deciduous and evergreen forests, second growth and plantations. Diet's Skunk is omnivorous but with a preference for invertebrates in Striped Hog-nosed Skunk. Spotted Skunk is nocturnal and lives in farmland, open woodland and brush. Striped Hog-nosed Skunk is also nocturnal but prefers

tree fall gaps, clearings and pastures adjacent to evergreen forests. Mustelids have 5 toes on each foot. Skunks have same size for front and hind' feet: 35 mm for Striped Hog-nosed Skunk and 20 mm for Spotted Skunk. Tayra has also the same tracks' size: 55 mm.

Those four families belong to Carnivores' order.

Cervidae's family represents 42 species but only 3 species are situated in Central America (White-tailed Deer, Red Brocket and Gray Brocket). The last one is not present in Belize. Deer are ruminants and active at day time or at night. White-tailed Deer is found in a variety of habitats but prefers deciduous forests with patch of grassland and dislikes evergreen forests. Red Brocket favours mature evergreen forests. The two species are hunt and sometimes population can be eliminated of an area. Each foot has 2 weight-carrying hooves and 2 small hooves that do not touch the ground. Red Brocket's size foot is 26 mm whereas White-tailed Deer's size foot is 44 mm.

Family of Tayassuidae presents 3 species and 2 are common in Central America as well as in Belize (Collared Peccary and White-lipped Peccary). Those animals hunt for their food and are active at day time or at night, but usually quiet when the weather is hot. There are 4 hooflike toes on the forefront and 3 on the hind foot, but only 2 toes on each foot leave tracks. Contrary to White-lipped Peccary that lives in evergreen undisturbed forests, Collared Peccary is well adapted with disturbed habitats but both are hunting by humans. Tracks' size is 55 mm for White-lipped Peccary and 35mm for Collared Peccary.

Deer and Peccaries are included in the order of Artiodactyls.

Tapiridae's family is represented by 4 species in one genus but only one species is in Central America (Baird's Tapir). This animal eats trees, fruits, flowers and grass usually at night and rest in mud at day time. His habitat is evergreen and deciduous forests, second growth or swamps. Tapir is heavily hunted. The forefoot has 3 weight-bearing toes and a smaller outer toe while the hind foot has just 3 weight-bearing. The feet' size is the largest one of mammals in Central America: 180 mm. Tapir belong to Perissodactyla' order.

Family Dasyproctidae consists of 2 genera and 14 species but there are just 4 species in one genus in Central America. The only representative specie in Belize is Central American Agouti. This animal is diurnal and eats essentially seeds and fruits but can also eat plants or fungi. His habitat is deciduous and evergreen forests, second growth and plantations. Unfortunately Agouti is heavily hunted. Hind foot possess 3 toes and measures 30 mm, whereas the front foot has one toe more and measures just 25 mm. Both feet have claws.

Family of Agoutidae is distributed in 2 species in one genus. Only one species, Paca, is present in all Central America. Nocturnal this small animal likes fruits, seeds and young plants that he finds in evergreen and deciduous forests, second growth and gardens. All of those areas are close from water. Hunters shot them a lot. Paca's front foot has 4 toes and hind foot has 5 toes but track is rarely left with the two small outer toes. Tracks' size is 45 mm for hind and 40 mm for front.

Erethizontidae's family (New World Porcupines) is represented by 15 species distributed in 4 genera. Only 2 species are current in Central America: Mexican Porcupine and Rotschild's Porcupine. However the last one is just present in Panama. Mexican Porcupine has nocturnal activities. Seeds, fruits, buds and young leaves are eaten by this animal. He lives essentially

in trees, in disturbed forests and second growth or in dry habitats. Mexican Porcupine is often killed by cars on road. Long and pointed claws are presents on the 4 toes on each foot of Mexican Porcupine. Hind foot is bigger than front foot (35 mm and 25 mm).

Rodentia' order contains, among others, the families Dasyproctidae, Agoutidae and Erethizontidae.

Central American opossums belong to the Didelphidae's family (order of Didelphimorphia). 8 genera and 13 species are presents in Central America. Those opossums are nocturnal. A majority is omnivore and lives more or less everywhere. Opossums' feet have 5 toes with opposable thumbs on the hind foot. Tracks' size is between 40 to 60 mm for the biggest and just 15 mm for the smallest.

Xenarthra's order, restricted to the New World, regroups 4 families with 13 genera and 29 species. Myrmecophagidae's family consists of 4 species in three genera but only 3 species live in Central America. Northern Tamandua and Silky Anteater are present in Belize but only the first one is found in Shipstern Nature Reserve. This animal is active at day time or at night in evergreen and deciduous forests, mangroves, second growth and savannah. The diet is ants, termites and sometimes bees. Forefoot has 4 claws (2 large and 2 small) whereas hind foot has 5 claws. Tracks' size is 55 mm in front and 40 mm behind. This animal lives in trees and doesn't leave a lot of tracks. Dasypodidae's family contains 8 genera and 20 species of armadillos. Only 2 species are present in Central America and just one in Belize. Nine-banded Armadillo is nocturnal but can also be active by day. Arthropods, small vertebrates, fruits and carrion are his food. Habitats' Nine-banded Armadillo are evergreen and deciduous forests, thorn scrub and savannah. This animal is hunted for his shell and killed quite often on road. Four claws equip the front foot but only two leave a track. The hind foot has got 5 claws but just 3 toes are visible. Tracks' width is 30 mm for front foot and 35 mm for hind foot.

Studied field:

Shipstern Nature Reserve is located in the north-east of Belize in Central America.

The International Tropical Conservation Foundation opened this reserve in 1989. Shipstern covers approximately 9’000 hectares.

Belize is at 7 meters above the sea. Temperature runs from 33° C to 16° C with an average of 25° C. Precipitations are less important in north than in south but it occurs every month with a pick during the wet season between Mai to December except during August. Average rainfall is approximately 2’000 litres per m^2 per year (1270 mm per year). Hurricanes are an important problem for Belizean coast from June to November. In 1955 Hurricane Janes devastated the area of Shipstern. All trees were destroyed and the monkeys disappeared. Now Shipstern is composed by mature second growth trees.

Shipstern surface include: high mangrove forest, fringe red mangrove forest, dwarf mangrove flats, mixed mangrove scrub, permanent mangrove swamp, drought deciduous coastal forest, tropical evergreen seasonal forest, high swamp forest, low swamp forest, semi deciduous Yucatan forest, evergreen scrub with legume-shrubs, milpa/shifting cultivation, salt marsh and a lagoon. Savannahs of saline mud-flats separate forests and the lagoon. Deciduous forests are unique in Belize and quite rare in Yucatan Peninsula.

The reserve houses an important wildlife: mammals, birds (200 sp), reptiles and amphibians (60 sp), butterflies (200 sp) and mosquitoes. Eight trails cross forests of Shipstern: New trail; Thompson trail (with a savannah); Main trail (leads to a savannah); Western survey line (leads to the same savannah of the Main trail); Eastern survey line; Xo-pol trail (leads to a savannah); Sarteneja National Tree Park trail; Shipstern landing trail. The reserve has also two tree-top hide and one overnight facility (Iguana Camp).

A road goes along the forest in the north part of the reserve and is used by vehicles. At three miles on the east side of the reserve is Sarteneja village with 1’600 people, fisherman essentially. Chunox, a hunting community, is located at 18 miles on the west part of Shipstern. Those populations sometimes hunt and fish illegally in Shipstern Nature Reserve.

Thomson trail and New trail are reached on foot from headquarter. Main trail and Western Survey Line are rejoined by car or bike and then the savannah on foot. To go to Eastern Survey Line and Sartenaja National Tree Park bike or car are fine. Xo-pol is half an hour from headquarter with a car. Farther on the same road is the boarding boat to go on the lagoon and reach Iguana camp or Shipstern landing[1].

Material and methods:

The materials used on field are:

- a digital camera (5.0 Mega Pixels Konica Minolta)
- a GPS (12 channels)
- 2 graduated rulers (300 mm/ 500 mm)
- a small writing pad
- a pen
- a mammals' tracks book
- 2 cameras' traps
- a bike, a car or a boat
- long pants and long sleeved shirts
- mosquitoes repellent
- a spring ring headnet (very useful !)

[1] See Appendix 4, a.

The eight trails have been travelled trough during 1 ½ month (13th July 2005 to 26th August 2005). In addition, the grove along the road (from headquarter to the Eastern and the Western survey line) has also been visited. Savannah after the Main trail and the Western survey line (same savannah), Xo-pol savannah and savannah after Thompson trail have been seen too. Most of the time I had to use a bike; sometimes I had to take a car or a boat.

The track was pictured twice with two graduated rulers as reference, identified and measured. The position of the track is recorded with a GPS. Measure and position are translated into a small writing pad. At the headquarter guards of Shipstern Nature Reserve look at the pictures to check the identification. The search of mammals' tracks is done alone or with guards.

In addition, two cameras' traps were located in strategic places in order to get some pictures of animals (at the beginning of the Thompson trail; on the Main trail; in the forest between the Main trail and the Western Survey Line).

In one day, I was able to do a trail or the grove Headquarter- Eastern survey line, but it took me four days to observe the grove Headquarter – Western survey line. The ground had to be muddy (no rocks and leaves).

Nothing was completed when it was raining or just after a heavy rain. This was particularly the case for savannahs.

Results[2]:

Firstly, the number of visits in the eight places has not been equal. Main trail received five visits for the tracks and six visits to put and take back the cameras' trap(s). Thompson trail has been controlled twice until the end, and eight times just at the beginning to put or take back the cameras' trap(s) but the majority of the tracks were found there. The west road was difficult to do! It took four days to explore the part along the road from headquarter to the entrance of the Western Survey Line. Consequently, some tracks have been forgotten. But at least the entire way has been done twice. The east road was easier to investigate. It has been completed tree times, as well as the Western Survey Line. The exploration of Xo-pol and Iguana camp has been realized twice and just one time for Shipstern landing trail and the Sarteneja Tree Park trail. Finally the New trail and the Eastern Survey Line have never been done.

Secondly, the chance was not equal every day. As an example, on the same part along the road from headquarter to the entrance of the Western Survey Line, six tracks have been found on July 28th, 2005, whereas no tracks have been discovered on July 30th, 2005.

White-tailed Deer is incontestably the animal who leaves most of the tracks everywhere except at Xo-pol and at Shipstern Landing. The majority of his tracks have been found in big open areas such as the savannah after the Main trail or along the road. On the contrary, the other deer's specie track (Red Brocket) has been observed just twice in the middle of the forest (between Main trail-Western Survey Line and at Shipstern Landing).

[2] For details, see Appendix 1, 2, 3 and 4.

Both species of Peccaries (Collared Peccary and White-lipped Peccary) have left just a few tracks. We identified, just once (for both of them) a track at Shipstern Landing, and three times the Collared Peccary's tracks on the Main trail.
Baird's Tapir is quite common and leaves a lot of tracks at Xo-pol but just a few on the savannah after the Main trail, one at the beginning of Thompson trail and one along the road Headquarter- Eastern Survey Line. The last one is interesting because no Tapir' tracks have been found along the road Headquarter- Western Survey Line.

Cats' family is well represented with twenty-three tracks. However, it has been found only on the Main trail, the Thompson trail and on both sides along the road. As data show us, all cats crossed the road. Jaguar is the only one who came very close to headquarter on the Thompson trail. But one has to be careful with cats' tracks because they are very similar. A bird's carcass has been found near Xo-pol's savannah.

Spotted Skunk crossed just one time the Western Survey Line. The other Skunk (Striped Hog-nosed Skunk) never left a track.

Northern Raccoon's tracks have been found essentially on the Main trail and once along the road on the East side. White-nosed Coati's tracks are more common with eight of them, on the Main trail and on the both area of the road. Kinkajou and Cacomistle' tracks have been observed nowhere.

Gray Fox' tracks have been found three times (one on the Main trail, one along the East part and one on the West part of the road) only during the month of July.

Paca left a track at Shipstern landing and a very nice one on the Main trail. Central American Agouti's track has been identified, once, at Iguana Camp.

Nine-banded Armadillo walked along the road Headquarter- Western Survey Line and left seven tracks. Twice along the road near Xo-pol area, Armadillo left some good tracks. On the Main trail, the animal left claws' print only.

The observation of an Opossum's track has been done once and it is impossible to know which opossum it was.

Finally Northern Tamandua, Mexican Porcupine and Tayra' tracks have not been observed.

The best places to find mammals' tracks[3] are, in order:

- Main trail and savannah (average of 6 tracks per visit);
- Shipstern Landing (average of 4 tracks per visit)
- Xo-pol and savannah (average of 3 tracks per visit)
- Along the road: Headquarter- Eastern Survey Line (average of 3 tracks per visit)
- Along the road: Headquarter- Western Survey Line (average of 2 tracks per visit)
- Iguana Camp (average of 1,5 tracks per visit)
- Western Survey Line & savannah (average of 1,33 tracks per visit)
- Sarteneja Tree Park trail (average of 1 track per visit)
- Thompson trail "and savannah" (average of 0,7 tracks per visit)

[3] See Appendix 2.

On the Main trail and savannah, and then on both sides of the road, we have found the most mammals' species with respectively 13 and 10 (West) + 7 (East) species. On the contrary, Xo-pol and savannah (2), Iguana Camp (2), Western Survey Line and savannah (2) and Sarteneja Tree Park trail (1) have a low number of species. In the middle we find 4 species at Shipstern Landing for one visit and only 3 species on Thompson trail and savannah[4].

At last, the number of visits in one place doesn't seem to be in correlation with the number of species discovered during each trip. In fact 4 species has been found in one journey at Shipstern Landing while an average of 0,33 species has been observed during each visit at Thompson trail[5].

No picture could been taken by the two cameras' traps[6] !

Discussion[7]:

Searching tracks was not an easy exercise! For Shipstern Landing and Iguana Camp it was necessary to use a car and a boat. Consequently it was not possible to go to those places a lot of times. The eight places were not fairly explored. The ground's structure was another difficulty. Leaves (or other things) on the ground, rocks, etc, prevent animals to leave tracks that can falsify results' interpretation. New Trail and Eastern Survey Line had the ground covered by leaves. It was then impossible to find any tracks. Trails at Sarteneja Tree Park and at Iguana Camp were hidden by leaves, trees, vegetation, etc but it was possible to watch some tracks. Western Survey Line had just two nude parts where it was possible to observe tracks. Mammals could leave tracks just at the beginning of the Thompson Trail where it was muddy. On the Main Trail there were about six mud-covered patches (done by car's passages and rain) but only three had something interesting. Those last three trails had a savannah at their end. The biggest difficulty with this part was flood due to rain. Four sunny days were necessary for good water's evaporation. Shipstern Landing Trail was very affected too. In fact, rain was a terrible thing. It "destroyed" Xo-pol's savannah that stayed under water during all the time[8]. When there was a huge rain the edge of the road was impassable. In addition drops effaced all tracks and rain could damage the digital camera. Usually it was raining at dawn, but sometimes rain felt all day long. Emily hurricane was a possible danger for the reserve until he changed direction !! Sun was a difficulty when I worked along the road and limited the investigation's time. It took me four days for the West part of the road. Obviously some tracks were forgotten. Furthermore sometimes the sun dried the mud and, consequently, animals left no more tracks. Finally I was "out of duty" for one week-end, due to a raging fever.

Mammals were "another problem" due to their habits or fears (crossing of a road, a trail, a muddy patch or even walking on the ground). If an animal smelt the human's odour, he was afraid and didn't return where the human had been ! It's obvious that animals' weight and tracks' size play a important role and influence the results.

[4] See Appendix 2, third column.
[5] See Appendix 2, sixth column.
[6] See Appendix 3.
[7] For details, see Appendix 1, 2, 3 and 4.
[8] See Appendix 4, a.

For those reasons, the distribution of mammals is not perfectly exact. Besides, the survey was just based on tracks and didn't include search of dens, nest, food' places or water holes. Therefore my research must be considered as a first general approach.

The high numbers of tracks found at Main trail and savannah (with a total of 32 tracks) and along the road: Headquarter- Western Survey Line (with 26 tracks) can be explained by the good patches of mud. Moreover savannah after the Main trail is huge and not completely flooded. There is a long way off between headquarter to Western Survey Line and an animal is forced to cross this part to go out or into the reserve's forest. Habitats of founded animals can also explain this result. Those places have been mostly visited. Therefore they have more tracks than the other trails. Xo-pol's savannah has been put aside after August 3rd, 2005, because of permanent land's flood[9].

The abundance of mammals per area (tracks' number per visit) and the number of species per area (species' number per visit) are very instructive[10]. In fact it seems that there are more animals on Main trail and savannah than at Thompson trail and savannah. The explanation may come from the type of forests which grow in those two sectors[11]. Evergreen forest is located around the Main trail while deciduous forest covers Thompson trail's area. But one has to remember the area's size! The Main trail and savannah's area is bigger than the Thompson trail and savannah. In addition there are more muddy patches on the Main trail than on Thompson trail. Thus I had more chances to find tracks. The species' number is very interesting. Although Shipstern Landing trail has been done just once, we found 4 species of mammals whereas the part along the road Headquarter- Western Survey Line has been done 13 times, what represents only 0,33 species per visit. This can be explained with the localisation of those sites. Shipstern Landing is a fully protected place accessible to reserve's guards only and by boat. On the contrary, the road is obviously frequented by a lot of people using cars or buses. It could be that species are more careful near the road and tend to hide themselves.

According to Meerman (1993) White-tailed Deer was uncommon in Shipstern Nature Reserve whereas in this survey this animal's tracks were the most observed. Cats and Baird's Tapir are rare in 1993 and well observed (tracks) in 2005. Even the local population can see Jaguar quite often. Those changes could be explained by a possible increase of Mammals' number in Shipstern Nature Reserve.

Red Brocket is not rare even if only two tracks have been found in one and a half month. In fact this deer lives principally in the middle of the mature evergreen forest (between Main Trail- Western Survey Line and at Shipstern Landing) and doesn't cross a lot a savannah. Those places were not on the studied trails. Furthermore this animal is quite small (maximum of 750 mm shoulder's height) and not very heavy (32 kilos).

White-tailed Deer must be present everywhere in Shipstern and the absence of tracks at Xo-pol and at Shipstern Landing is explained by the type of forest there: evergreen forest that this Deer not particularly likes and/or by inundation of those parts. The twenty-five identified tracks show either a big number of White-tailed Deer or a large quantity of moving in the reserve. Some tracks of young White-tailed Deer have been observed, as well as male and female adults. This could prove that the specie is not in danger.

[9] See Appendix 2, second column.
[10] See Appendix 2, fifth and sixth columns.
[11] See Map, page 7.

The rarity of White-lipped Peccary, the loss of his habitat (already limited), an excessive hunting but also his slight weight could explain that only one track has been discovered in an evergreen forest, the habitat of White-lipped Peccary.

Collared Peccary didn't leave a lot of tracks. This could be explained by bad luck, by accident (the animal itself didn't want to walk on the "good" surface) or even by an excessive hunting. However the tracks were observed at two distant points but with the same vegetation (evergreen forests) in Shipstern. This can indicate a good number of Collared Peccary.

Baird's Tapirs might be rare in Central America but apparently well represented in his favourites places (evergreen forests, deciduous forests and swamps) in Shipstern Reserve and especially at Xo-pol. The presence of water at Xo-pol can explain this. However it can also be that two individuals left all tracks at Xo-pol. In the savannah after the Main trail, young Tapirs' tracks were found. It is a positive sign. The non-presence of Tapir along the road Headquarter- Western Survey Line has no explanation, except bad luck. Finally this animal is very easily identifiable because of his weight (180-300 kilos) and his foot's size.

Cats seem to be common in this area but every individual covers a big territory (tens or even hundreds square kilometres). Therefore, it is possible that distant tracks could have been done by the same animal. Tracks observed along the road can indicate that a cat has a territory which extends beyond the reserve. This situation may be critical for the animal that is in risk to be shot. Jaguar left some tracks very close to headquarter on Thompson trail because he was attracted by the dog's barks. The day of July 18th, 2005, was a lucky day for Cats' tracks. Shipstern' cats seem to prefer deciduous forests but it doesn't show something specific. Finally one has to remember that all tracks (except the best ones) raise interrogations because of the difficulty to identify which cat it is.

Skunks' tracks like opossums' tracks are very difficult to find. They are very light (500 grams to some kilos) and the tracks are very small. Consequently if by chance an animal left something it could be easily erased. Those results are not very significant and I don't think opossums or skunks are rare or in danger in this part of Belize.

Gray Fox's results are quite strange. Staffs of Shipstern and I have seen a lot of Gray Fox near the road and even crossing the Headquarter during the months of July and August. The only explanations for these small number of tracks' observations (only during July) are bad luck and/or the fact that it is a light animal with tiny feet. Direct observations of Gray Fox prove that he is not in danger.

Paca and Agouti didn't leave a lot of tracks despite the fact that they are common. Explanations must be the same as for Gray Fox. The short size of Agouti can explain a refusal to cross a muddy patch.

Northern Raccoon and With-nosed Coati are not afraid of mud. Even if they are not very heavy they leave some interesting tracks. A supposition can be done with regard to the results: Coatis are less afraid of crossing the road than Raccoons. The more limited habitat of the Raccoon can explain this. However the majority of Raccoon's tracks were found in evergreen forest, whereas this animal doesn't live in those types of forests! The evergreen forest near the muddy patches on the Main trail is maybe a little bit different and can explain this. No tracks have been observed at Xo-pol, Shipstern Landing and Iguana Camp. This is strange for the

Coati, but not really for the Raccoon, with the exception of the Iguana Camp (mangrove) where both of them are supposed to live.

Nine-banded Armadillo seems to appreciate roads' sides even if it is dangerous ! This animal should prefer to walk in the middle of the forest and not cross trails as Western Survey Line, Thompson trail or Main trail. However all tracks were found near his favourite places (scrub and deciduous forests).

Finally Kinkajou, Cacomistle and Northern Tamandua' tracks have not been observed because those animals live in trees and go rarely on the ground. Unfortunately, I could not observe any tracks.

We found some excellent tracks of Jaguar and White-tailed Deer in front of the camera traps: those one didn't take any pictures! The explanation is very simple: a wrong contact that could not be repaired ![12]

Conclusion:

By way of conclusion, I notice that even a small and simple work like this one can bring some interesting information. At first sight, we could say that the population of White-tailed Deer, Cat and Tapir has increased during the last 12 years. However prudence is necessary, because the study was based on tracks only and did not include direct observation of dens, nests and burrows. More investigation is thus required in order to know if there are really more individuals.

The work was pleasant and taught me a lot. However, it could have been better. Had I had more time and transportation when needed, less heavy rains and fewer mosquitoes to work in peace (!), I would have been able to observe more tracks and gather more information on mammals. In addition, if mammals had crossed muddy patches correctly, I would have seen tracks of a better quality…

Working with different techniques, such as mammals' tracks and habitats, is the best way to study and understand exactly what happens in the reserve.

For Shipstern's sake, the research must go on and develop around the population of fauna and flora, including all techniques, on a long period of time.

[12] See Appendix 3.

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To Professor R. Bshary
To mammals that let me some good tracks…
To hurricanes to have deviated their trajectory!
To my family
To my friends

Appendixes:

Appendix 1: Results of the observed mammals' tracks

PLACE	SPECIE	DATE	GPS'S POSITION	TRACKS' SIZE (+/- 1 mm)	REMARKS
Main trail & savannah	White-tailed Deer (*Odocoileus virginianus*)	18th July 2005	N 18°17' 02.1'' W 88°12'53.6'' +/- 6 m	Length: 70 mm Width: 50 mm	savannah; female (near male track)
Main trail & savannah	White-tailed Deer (*Odocoileus virginianus*)	18th July 2005	N 18°17'02.1'' W 88°12'53.6'' +/- 6 m	Length: 74 mm Width: 50 mm	savannah; male (near female track)
Main trail & savannah	White-tailed Deer (*Odocoileus virginianus*)	20th July 2005	N 18°17' 03.1'' W 88°12'54.5'' +/- 4 m	Length: 80 mm Width: 50 mm	Savannah; male
Main trail & savannah	White-tailed Deer (*Odocoileus virginianus*)	2nd August 2005	N 18°17'24.7'' W 88°12'51.0'' +/- 24 m	Length: 62 mm Width: 45 mm	end of Main trail
Main trail & savannah	White-tailed Deer (*Odocoileus virginianus*)	2nd August 2005	N 18°17'23.6'' W 88°12'51.2'' +/- 8 m	Length: 74 mm Width: 44 mm	
Main trail & savannah	White-tailed Deer (*Odocoileus virginianus*)	2nd August 2005	N 18°17' 01.7'' W 88°12'55.7'' +/- 5 m	Length: 80 mm Width: 45 mm	
Main trail & savannah	White-tailed Deer (*Odocoileus virginianus*)	15th August 2005	N 18°17'03.1'' W 88°12'55.1'' +/- 6 m	Length: 60 mm Width: 50 mm	savannah
Main trail & savannah	White-tailed Deer (*Odocoileus virginianus*)	15th August 2005	N 18°17'05.9'' W 88°12'52.6'' +/- 5 m	Length: 40 mm Width: 35 mm	savannah; young
Main trail & savannah	White-tailed Deer (*Odocoileus virginianus*)	26th August 2005	N 18°17'28.7'' W 88°12'52.2'' +/- 17 m	Length: 60 mm Width: 40 mm	end of Main trail
Main trail & savannah	White-tailed Deer (*Odocoileus virginianus*)	26th August 2005	N 18°17'10.9'' W 88°12'50.6'' +/- 9 m	Length: 45 mm Width: 35 mm	end of Main trail
Main trail & savannah	White-tailed Deer (*Odocoileus virginianus*)	26th August 2005	N 18°17'03.3'' W 88°12'55.4'' +/- 6 m	Length: 75 mm Width: 45 mm	savannah
Main trail & savannah	Red Brocket (*Mazama Americana*)	4th August 2005	N 18°17'46.5'' W 88°12'58.3'' +/- 6 m	Length: 35 mm Width: 30 mm	in the forest between Main trail and Western Survey Line

Main trail & savannah	Margay (*Leopardus wiedi*)	18th July 2005	N 18°17'06.8'' W 88°12'52.3'' +/- 27 m	Length: 45 mm Width: 50 mm	savannah; old track, not good one
Main trail & savannah	Jaguar (*Panthera onca*)	2nd August 2005	N 18°17'10.3'' W 88°12'51.2'' +/- 49 m	Length: 92 mm Width: 65 mm	
Main trail & savannah	Puma (*Puma concolor*)	26th August 2005	N 18°17'10.9'' W 88°12'50.6'' +/- 9 m	Length: 75 mm Width: 70mm	end of Main trail
Main trail & savannah	Ocelot (*Leopardus pardalis*)	15th August 2005	N 18°17'23.9'' W 88°12'50.8'' +/- 5 m	Length: 50 mm Width: 42 mm	very difficult to recognize, no sure
Main trail & savannah	Collared Peccary (*Tayassu tajacu*)	18th July 2005	N 18°17'08.5'' W 88°12'50.9'' +/- 27 m	Length: 45 mm Width: 30 mm	end of Main trail
Main trail & savannah	Collared Peccary (*Tayassu tajacu*)	18th July 2005	N 18°17'47.0'' W 88°12'57.9'' +/- 7 m	Length: 40 mm Width: 30 mm	between Main trail and Western Survey Line
Main trail & savannah	Collared Peccary (*Tayassu tajacu*)	15th August 2005	N 18°17'05.9'' W 88°12'52.6'' +/- 5 m	Length:50 mm Width: 38 mm	savannah
Main trail & savannah	Baird's Tapir (*Tapirus bairdii*)	20th July 2005	N 18°17'03.5'' W 88°12'54.0'' +/- 4 m	Length:100 mm Width: 60 mm	savannah; old track
Main trail & savannah	Baird's Tapir (*Tapirus bairdii*)	2nd August 2005	N 18°17'23.6'' W 88°12'51.2'' +/- 8 m	Length: 50 mm Width: 50 mm	very young
Main trail & savannah	Baird's Tapir (*Tapirus bairdii*)	12th August 2005	N 18° 17'46.6'' W 88°12'58.2'' +/- 5 m	Length:180 mm Width: 170 mm	in the forest between Main trail and Western Survey Line
Main trail & savannah	Baird's Tapir (*Tapirus bairdii*)	15th August 2005	N 18°17'05.9'' W 88°12'50.6'' +/- 5 m	Length: 95 mm Width: 80 mm	young
Main trail & savannah	Baird's Tapir (*Tapirus bairdii*)	26th August 2005	N 18°17'23.3'' W 88°12'50.8'' +/- 5 m	Length: 45 mm Width: 40 mm	end of Main trail; very young
Main trail & savannah	Northern Raccoon (*Procyon lotor*)	18th July 2005	N 18°17'03.1'' W 88°12'53.8'' +/- 6 m	Length: 50 mm Width: 45 mm	savannah
Main trail & savannah	Northern Raccoon (*Procyon lotor*)	20th July 2005	N 18°17'23.7'' W 88°12'52.1'' +/- 16 m	Length: 60 mm Width: 50 mm	end of Main trail
Main trail & savannah	Northern Raccoon (*Procyon lotor*)	2nd August 2005	N 18°17'10.3'' W 88°12'51.2'' +/- 49 m	Length: 55 mm Width: 55 mm	
Main trail & savannah	Northern Raccoon (*Procyon lotor*)	26th August 2005	N 18°17'10.9'' W 88°12'50.6'' +/- 9 m	Length: 75 mm Width: 55 mm	end of Main trail
Main trail & savannah	White-nosed Coati (*Nasua narica*)	27th July 2005	N 18°18'21.5'' W 88°12'40.6'' +/- 6 m	Length: 65 mm Width: 45 mm	entrance of Main trail

Main trail & savannah	White-nosed Coati (*Nasua narica*)	2nd August 2005	N 18°17'24.7'' W 88°12'51.0'' +/- 24 m	Length: 52 mm Width: 40 mm	
Main trail & savannah	Paca (*Agouti paca*)	26th August 2005	N 18°17'10.9'' W 88°12'50.6'' +/- 9 m	Hind track: Length: 45 mm Width: 45 mm Front track: Length: 40 mm Width: 40 mm	end of Main trail; hind and front tracks
Main trail & savannah	Gray Fox (*Urocyon cinereoargenteus*)	18th July 2005	N 18°17'23.6'' W 88°12'44.8'' +/- 34 m	Length: 30 mm Width: 30 mm	end of Main trail
Main trail & savannah	Nine-banded Armadillo (*Dasypus novemcinctus*)	18th July 2005	N 18°17'08.5'' W 88°12'50.9'' +/- 27 m	Length: 30 mm Width: 20 mm	short size due to claws only
Western Survey Line & savannah	White-tailed Deer (*Odocoileus virginianus*)	24th July 2005	N 18°18'09.9'' W 88°13'04.5'' +/- 5 m	Length:60 mm Width: 40 mm	entrance of Western Survey Line
Western Survey Line & savannah	White-tailed Deer (*Odocoileus virginianus*)	24th July 2005	N 18°18'09.9'' W 88°13'04.5'' +/- 5 m	Length: 75 mm Width: 40 mm	entrance of Western Survey Line
Western Survey Line & savannah	White-tailed Deer (*Odocoileus virginianus*)	11th August 2005	N 18°16'48.3'' W 88°13'15.6'' +/- 5 m	Length: 60 mm Width: 30 mm	savannah; young
Western Survey Line & savannah	Spotted Skunk (*Spilogale putorius*)	29th July 2005	N 18°17'52.8'' W 88°13'06.7'' +/- 47 m	Length: 40 mm Width: 25 mm	
Thompson trail & savannah	White-tailed Deer (*Odocoileus virginianus*)	27th July 2005	N 18°18'15.2'' W 88°11'06.9'' +/- 7 m	Length: 45 mm Width: 38 mm	savannah
Thompson trail & savannah	White-tailed Deer (*Odocoileus virginianus*)	7th August 2005	N 18°18'54.7'' W 88°10'58.1'' +/- 9 m	Length: 47 mm Width: 45 mm	beginning of Thompson trail (near the headquarter)
Thompson trail & savannah	Jaguar (*Panthera onca*)	27th July 2005	N 18°18'55.2'' W 88°10'57.3'' +/- 7 m	Length: 95 mm Width: 90 mm	beginning of Thompson trail (near the headquarter)
Thompson trail & savannah	Jaguar (*Panthera onca*)	18th August 2005	N 18°18'55.2'' W 88°10'57.4'' +/- 5 m	Front foot: Length: 90 mm Width: 100 mm Hind foot: Length: 80 mm Width: 80 mm	beginning of Thompson trail (near the headquarter)

Thompson trail & savannah	Jaguar (*Panthera onca*)	18th August 2005	N 18°18'54.8'' W 88°10'57.8'' +/- 4 m	Front track: Length: 90 mm Width: 95 mm Hind track: Length: 80 mm Width: 80 mm Separation between the front foot and the hind foot: 400 mm	beginning of Thompson trail (near the headquarter); Same Jaguar who left tracks on Thompson trail the 18th August 2005
Thompson trail & savannah	Cat	12th August 2005	N 18°18'55.5'' W 88°10'57.3" +/- 12 m	Length: 40 mm Width: 30 mm	beginning of Thompson trail (near the headquarter); impossible to know which cat
Thompson trail & savannah	Baird's Tapir (*Tapirus bairdii*)	4th August 2005	N 18°18'54.9'' W 88°10'57.7'' +/- 8 m	Length:195 mm Width: 165 mm	beginning of Thompson trail (near the headquarter)
Along the road: Headquarter-Eastern Survey Line	White-nosed Coati (*Nasua narica*)	26th July 2005	N 18°19'08.8'' W 88°10'57.5'' +/- 40 m	Length: 60 mm Width: 45 mm	
Along the road: Headquarter-Eastern Survey Line	White-nosed Coati (*Nasua narica*)	26th July 2005	N 18°19'12.3'' W 88°10'52.7'' +/- 19 m	Length: 60 mm Width: 35 mm	
Along the road: Headquarter-Eastern Survey Line	White-nosed Coati (*Nasua narica*)	17th August 2005	N 18°19'11.2'' W 88°10'52.7'' +/- 5 m	Length: 65 mm Width: 45 mm	
Along the road: Headquarter-Eastern Survey Line	Northern Raccoon (*Procyon lotor*)	1st August 2005	N 18°19'08.9'' W 88°10'56.3'' +/- 7 m	Length: 80 mm Width: 45 mm	
Along the road: Headquarter-Eastern Survey Line	Gray Fox (*Urocyon cinereoargenteus*)	26th July 2005	N 18°19'12.3'' W 88°10'52.7'' +/- 19 m	Length: 26 mm Width: 35 mm	
Along the road: Headquarter-Eastern Survey Line	Jaguar (*Panthera onca*)	1st August 2005	N 18°19'11.6'' W 88°10'52.3'' +/- 5 m	Length: 85 mm Width: 75 mm	not 100% sure

Along the road: Headquarter-Eastern Survey Line	Jaguarundi (*Herpailurus yaguarondi*) or Ocelot (*Leopardus pardalis*)	17th August 2005	N 18°19'15.7'' W 88°10'46.4'' +/- 12 m	Length: 40 mm Width: 30 mm	impossible to know if it is a jaguarundi or an ocelot
Along the road: Headquarter-Eastern Survey Line	White-tailed Deer (*Odocoileus virginianus*)	17th August 2005	N 18°19'18.9'' W 88°10'44.5'' +/- 7 m	Length: 50 mm Width: 35 mm	
Along the road: Headquarter-Eastern Survey Line	Baird's Tapir (*Tapirus bairdii*)	17th August 2005	N 18°19'19.5'' W 88°10'43.8'' +/- 5m	Front foot: Length:45 mm Width: 44 mm Hind foot: Length: 50 mm Width: 40 mm Separation between the 2 tracks: 150 mm	young; 4 toes for front track 3 toes for hind track
Along the road: Headquarter-Western Survey Line	Cat	22nd July 2005	N 18°18'20.2'' W 88°12'03.4'' +/- 10 m	Length: 30 mm Width: 25 mm	impossible to know which cat
Along the road: Headquarter-Western Survey Line	Jaguar (*Panthera onca*)	25th July 2005	N 18°18'21.0'' W 88°12'44.4'' +/- 7 m	Length: 85 mm Width: 75 mm	maybe a male
Along the road: Headquarter-Western Survey Line	Jaguar (*Panthera onca*)	25th July 2005	N 18°18'20.5'' W 88°12'47.3'' +/- 8 m	Length: 75 mm Width: 75 mm	maybe a female
Along the road: Headquarter-Western Survey Line	Jaguar (*Panthera onca*)	6th August 2005	N 18°18'26.9'' W 88°11'30.6'' +/- 6 m	Length:115 mm Width: 85 mm	near the headquarter
Along the road: Headquarter-Western Survey Line	Margay (*Leopardus wiedi*)	28th July 2005	N 18°18'58.8'' W 88°11'09.6'' +/- 4 m	Length: 36 mm Width: 36mm	very close to the headquarter; hind track on front track
Along the road: Headquarter-Western Survey Line	Margay (*Leopardus wiedi*)	6th August 2005	N 18°18'22.4'' W 88°11'41.0'' +/- 8 m	Front track: Length:30 mm Width: 35 mm Hind track: Length: 30 mm Width: 25 mm	near the headquarter; hind track on front track
Along the road: Headquarter-Western Survey Line	Margay (*Leopardus wiedi*)	18th August 2005	N 18°19'02.4'' W 88°11'06.8'' +/- 5 m	Size total of front track and hind track: Length:45 mm Width: 30 mm	very close to the headquarter; hind track on front track

Along the road: Headquarter-Western Survey Line	Ocelot (*Leopardus pardalis*)	22nd July 2005	N 18°18'18.5'' W 88°12'25.0'' +/- 9 m	Length: 55 mm Width: 50 mm	not 100% sure
Along the road: Headquarter-Western Survey Line	Ocelot (*Leopardus pardalis*)	7th August 2005	N 18°18'16.0'' W 88°12'14.9'' +/- 10 m	Length: 60 mm Width: 50 mm	half way between headquarter-Main trail
Along the road: Headquarter-Western Survey Line	Ocelot (*Leopardus pardalis*)	19th August 2005	N 18°18'42.4'' W 88°11'15.3'' +/- 13 m	Length: 80 mm Width: 60 mm	near the headquarter
Along the road: Headquarter-Western Survey Line	Ocelot (*Leopardus pardalis*)	22nd August 2005	N 18°18'18.7'' W 88°12'23.0'' +/- 7 m	Length: 85 mm Width: 60 mm	half way between headquarter-Main trail
Along the road: Headquarter-Western Survey Line	Ocelot (*Leopardus pardalis*)	22nd August 2005	N 18°18'18.3'' W 88°12'23.0'' +/- 6 m	Length: 55 mm Width: 50 mm	near the entrance of the Main trail
Along the road: Headquarter-Western Survey Line	Jaguarundi (*Herpailurus yaguarondi*)	18th August 2005	N 18°18'16.0'' W 88°12'14.9'' +/- 10 m	Length: 35 mm Width: 30 mm	very close to the headquarter
Along the road: Headquarter-Western Survey Line	Jaguarundi (*Herpailurus yaguarondi*)	18th August 2005	N 18°19'01.5'' W 88°11'07.6'' +/- 7 m	Front foot: Length: 30 mm Width: 30 mm Hind foot: Length: 28 mm Width: 25 mm	very close to the headquarter
Along the road: Headquarter-Western Survey Line	Puma (*Puma concolor*)	18th August 2005	N 18°18'58.4'' W 88°11'10.2'' +/- 9 m	Length: 80 mm Width: 65 mm	very close to the headquarter
Along the road: Headquarter-Western Survey Line	White-tailed Deer (*Odocoileus virginianus*)	28th July 2005	N 18°18'58.5'' W 88°11'09.8'' +/- 5 m	Length: 45 mm Width: 40 mm	very close to the headquarter
Along the road: Headquarter-Western Survey Line	White-tailed Deer (*Odocoileus virginianus*)	28th July 2005	N 18°18'58.5'' W 88°11'09.8'' +/- 5 m	Hind track: Length: 63 mm Width: 46mm Front track: Length: 55 mm Width: 40mm Separation between the 2 tracks: 475 mm	very close to the headquarter

Along the road: Headquarter-Western Survey Line	White-tailed Deer (*Odocoileus virginianus*)	6th August 2005	N 18°18'35.5'' W 88°11'25.1'' +/- 4 m	Length: 65 mm Width: 45 mm	near the headquarter
Along the road: Headquarter-Western Survey Line	White-tailed Deer (*Odocoileus virginianus*)	7th August 2005	N 18°18'16.3'' W 88°12'16.7'' +/- 12 m	Length: 60 mm Width: 45 mm	half way between headquarter-Main trail
Along the road: Headquarter-Western Survey Line	White-tailed Deer (*Odocoileus virginianus*)	12th August 2005	N 18°18'20.2'' W 88°12'32.7'' +/- 5 m	Length: 60 mm Width: 45 mm	half way between headquarter-Main trail
Along the road: Headquarter-Western Survey Line	White-tailed Deer (*Odocoileus virginianus*)	20th August 2005	N 18°18'21.8'' W 88°11'47.5'' +/- 7 m	Length: 40 mm Width: 26 mm	young female; less than half way between headquarter-Main trail
Along the road: Headquarter-Western Survey Line	Nine-banded Armadillo (*Dasypus novemcinctus*)	25th July 2005	N 18°18'20.6'' W 88°12'48.9'' +/- 5 m	Length: 63 mm Width: 45 mm	half way between Main trail- Western Survey Line
Along the road: Headquarter-Western Survey Line	Nine-banded Armadillo (*Dasypus novemcinctus*)	25th July 2005	N 18°18'18.8'' W 88°12'54.5'' +/- 10 m	Hind foot: Length: 60 mm Width: 45 mm Front foot: Length: 45 mm Width: 45 mm Separation between the 2 tracks: 115 mm	half way between Main trail- Western Survey Line
Along the road: Headquarter-Western Survey Line	Nine-banded Armadillo (*Dasypus novemcinctus*)	28th July 2005	N 18°19'03.6'' W 88°11'05.9'' +/- 4 m	Length:43 mm Width: 43 mm	very close to the headquarter
Along the road: Headquarter-Western Survey Line	Nine-banded Armadillo (*Dasypus novemcinctus*)	5th August 2005	N +8°18'53.5'' W 88°11'10.7'' +/- 7 m	Length: 65 mm Width: 35 mm	near the headquarter
Along the road: Headquarter-Western Survey Line	Nine-banded Armadillo (*Dasypus novemcinctus*)	18th August 2005	N 18°19'03.5'' W 88°11'05.7'' +/- 5 m	Length: 50 mm Width: 40 mm	very close to the headquarter
Along the road: Headquarter-Western Survey Line	Nine-banded Armadillo (*Dasypus novemcinctus*)	23rd August 2005	N 18°18'18.5'' W 88°12'5.4'' +/- 12 m	Length: 55 mm Width: 45 mm	very close to the entrance of Western Survey Line

Along the road: Headquarter-Western Survey Line	Nine-banded Armadillo (*Dasypus novemcinctus*)	23rd August 2005	N 18°18'10.8'' W 88°13'03.7'' +/- 10 m	Length: 60 mm Width: 40 mm	very close to the entrance of Western Survey Line
Along the road: Headquarter-Western Survey Line	Gray Fox (*Urocyon cinereoargenteus*)	28th July 2005	N 18°19'03.6'' W 88°11'05.6'' +/- 5 m	Length: 30 mm Width: 25 mm	very close to the headquarter
Along the road: Headquarter-Western Survey Line	Opossum	25th July 2005	N 18°18'13.3'' W 88°13'01.7'' +/- 5 m	Length: 35 mm Width: 40 mm	half way between Main trail- Western Survey Line; impossible to know which opossum
Along the road: Headquarter-Western Survey Line	White-nosed Coati (*Nasua narica*)	28th July 2005	N 18°19'03.8'' W 88°11'05.3'' +/- 14 m	Length:110 mm Width: 50 mm	very close to the headquarter
Along the road: Headquarter-Western Survey Line	White-nosed Coati (*Nasua narica*)	29th July 2005	N 18°18'22.2'' W 88°11'58.0'' +/- 5 m	Adult: Length: 50 mm Width: 30 mm Young: Length: 30 mm Width: 24 mm	near the headquarter; set of adult and young' tracks
Along the road: Headquarter-Western Survey Line	White-nosed Coati (*Nasua narica*)	6th August 2005	N 18°18'22.4'' W 88°11'40.2'' +/- 10 m	Length: 60 mm Width: 45 mm	near the headquarter
Sarteneja Tree Park trail	White-tailed Deer (*Odocoileus virginianus*)	22nd August 2005	N 18°20'36.0'' W88°09'44.6'' +/- 54 m	Length: 45 mm Width: 25 mm	not a good track
Xo-pol & savannah	Baird's Tapir (*Tapirus bairdii*)	19th July 2005	N 18°15'53.4'' W 88°16'04.7'' +/- 4 m	Length:140 mm Width: 140 mm	savannah; young
Xo-pol & savannah	Baird's Tapir (*Tapirus bairdii*)	19th July 2005	N 18°15'53.4'' W 88°16'04.7'' +/- 4 m	Depth: 100 mm	savannah; young running
Xo-pol & savannah	Baird's Tapir (*Tapirus bairdii*)	19th July 2005	N 18°15'53.4'' W 88°16'04.7'' +/- 4 m	Length:140 mm Width: 150 mm	savannah; adult
Xo-pol & savannah	Baird's Tapir (*Tapirus bairdii*)	3rd August 2005	N 18°15'47.9'' W 88°16'13.1'' +/- 26 m	Length:195 mm Width: 185 mm	savannah;
Xo-pol & savannah	Nine-banded Armadillo (*Dasypus novemcinctus*)	19th July 2005	N 18°15'39.5'' W 88°16'29.8'' +/- 7 m	Length: 50 mm Width: 35 mm	on the road along Xo-pol area

Xo-pol & savannah	Nine-banded Armadillo (*Dasypus novemcinctus*)	3rd August 2005	N 18°15'33.4'' W 88°16'22.8'' +/- 17 m	Length: 35 mm Width: 25 mm	on the road along Xo-pol area; young
Iguana Camp	Central American Agouti *(Dasyprocta punctata*)	22nd July 2005	N 18°15'09.1'' W 88°09'28.8'' +/- 6 m	Length: 30 mm Width: 25 mm	near the house
Iguana Camp	White-tailed Deer (*Odocoileus virginianus*)	24th August 2005	N 18°15'07.5'' W 88°09'29.0'' +/- 10 m	Length: 55 mm Width: 35 mm	on the trail behind the house
Iguana Camp	White-tailed Deer (*Odocoileus virginianus*)	24th August 2005	N 18°15'07.0'' W 88°09'29.2'' +/- 6 m	Length: 45 mm Width: 40 mm	on the trail behind the house
Shipstern Landing	Collared Peccary (*Tayassu tajacu*)	25th August 2005	N 18°14'02.5'' W 88°11'13.8'' +/- 30 m	Length: 50 mm Width: 35 mm	at the beginning of the trail
Shipstern Landing	White-lipped Peccary (*Dicotyles pecari*)	25th August 2005	N 18°13'26.1'' W 88°10'32.7'' +/- 26 m	Length: 55 mm Width: 40 mm	on a survey line of Shipstern Landing
Shipstern Landing	Paca (*Agouti Paca*)	25th August 2005	N 18°14'02.5'' W 88°11'13.8'' +/- 30 m	Length: 40 mm Width: 30 mm	
Shipstern Landing	Red Brocket (*Mazama Americana*)	25th August 2005	N 18°13'26.1'' W 88°10'32.7'' +/- 26 m	Length: 40 mm Width: 25 mm	on a survey line of Shipstern Landing

Appendix 2: summary of results

Place	**Total Tracks**	**Mammals' species who leave tracks**	**Number of visits**	**Tracks' number per visit**	**Species' number per visit**
Main trail & savannah	32	13	5 (+ 6 when putting or taking back the cameras' trap(s))	6 without counting the 6 visits because tracks were in the middle of the forest and not on the "real trail"	2,6
Shipstern Landing	4	4	1	4	4
Xo-pol & savannah	6	2	2	3	1
Along the road: Headquarter-Eastern Survey Line	9	7	3	3	2,33
Along the road: Headquarter-Western Survey Line	26	10	13 parts (2 times all way)	2	0,77
Iguana Camp	3	2	2	1,5	1
Western Survey Line & savannah	4	2	3	1,33	0,66
Sarteneja Tree Park trail	1	1	1	1	1
Thompson trail "& savannah"	7	3	2 completely (+ 8 when putting or taking back the cameras' trap(s))	0,7 with the 8 visits because tracks were on the trail where almost all tracks were found	0,3

Appendix 3: Cameras' Traps

Main trail:

25th July 2005 and 26th July 2005:2 cameras' traps near the entrance of the Main trail
Night- Fast- 3 minutes to recharge:
N°1 looks in direction of the entrance
N°2 looks in direction of the savannah
GPS N 18°18'06.8''
W 88° 12'42.2''
+/- 20 m

28th July 2005 and 29th July 2005: 1 camera's trap near the entrance of the Main trail looks in direction of the savannah
Night- Fast- 30 seconds to recharge
GPS N 18°18'06.8''
W 88°12'42.2''
+/- 20 m

4thAugust 2005 to 12thAugust 2005: 1 camera's trap in the forest between Main trail and Western Survey Line. Camera looks in direction of the entrance of the Main trail.
Continuous- Fast- 30 seconds to recharge
GPS N 18°17'46.7''
W 88°12'58.2''
+/- 8 m

Thompson trail:

27th July 2005: 1 camera's trap at the beginning of the trail, near headquarter. Camera looks in opposite direction of headquarter.
Night- Fast- 30 seconds to recharge
GPS N 18°18'55.2''
W 88°10'57.3''
+/- 7 m

30th July 2005 and 31stJuly 2005: 1 camera's trap at the beginning of the trail, near headquarter. Camera looks in opposite direction of headquarter.
Continuous- Fast- 30 seconds to recharge
GPS N 18°18'55.2''
W 88°10'57.3''
+/- 7 m

4thAugust 2005 to 12th August 2005: 1 camera's trap at the beginning of the trail, near headquarter. Camera looks in opposite direction of headquarter.
Continuous- Fast- 30 seconds to recharge
GPS N 18°18'55.3''
W 88°10'57.4''
+/- 6 m

18th August 2005 to 27th August 2005: 2 cameras at the beginning of the trail, near headquarter.
Continuous- Fast- 30 seconds to recharge
N°1 looks in opposite direction of headquarter
N°2 near the pond, closer from the headquarter
GPS for N°1: N 18°18'55.1''
W 88°10'57.3''
+/- 11 m
GPS for N°2: N 18°18'57.6''
W 88°10'55.8''
+/- 7 m

No pictures have been taken with the two cameras' traps!!!

Appendix 4: pictures

a) Trails, savannahs and mammals:

Headquarter

Xo-pol Trail

Shipstern Landing Trail

Along the road: Eastern Survey Line- Headquarter

Thompson Trail's Savannah

Laure Despland

Xo-pol’s Savannah flood

Main Trail's Savannah

Lagoon

White-nosed Coati

Northern Raccoon

Leftovers from a Jaguar's meal

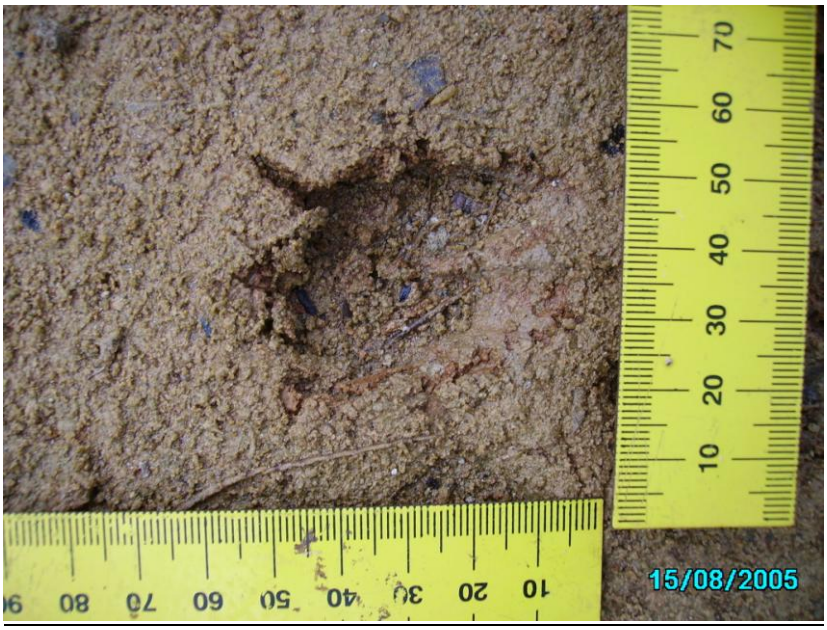
b) Tracks:

White-tailed Deer (*Odocoileus virginianus*) male
20th July 2005 Main trail's savannah
Length: 80 mm
Width: 50 mm

White-tailed Deer (*Odocoileus virginianus*) young female
20th August 2005 Along the road: Headquarter- Western Survey Line, less than half way between headquarter- Main trail
Length: 40 mm
Width: 26 mm

Red Brocket (*Mazama Americana*)

4th August 2005 in the forest between Main trail and Western Survey Line
Length: 35 mm
Width: 30 mm



Collared Peccary (*Tayassu tajacu*)

15th August 2005 Main trail's savannah
Length: 50 mm
Width: 38 mm

Baird's Tapir (*Tapirus bairdii*)

3rd August 2005 Xo-pol's savannah
Length: 195 mm
Width: 185 mm

Gray Fox (*Urocyon cinereoargenteus*)

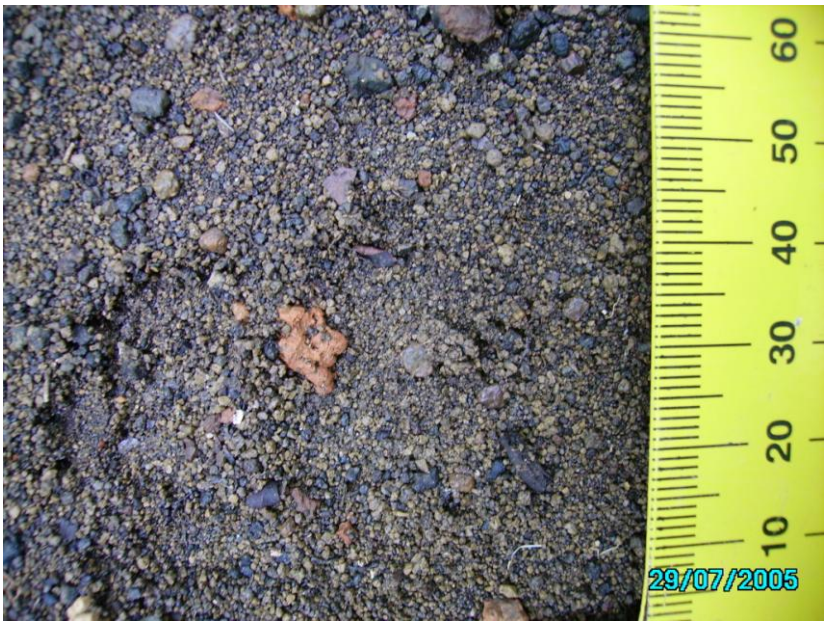
18th July 2005 end of Main trail
Length: 30 mm
Width: 30 mm

Paca (*Agouti paca*)

26th August 2005 end of Main trail
Hind track (left):
Length: 45 mm
Width: 45 mm
Front track (right):
Length: 40 mm
Width: 40 mm

Central American Agouti *(Dasyprocta punctata*)

22nd July 2005 Iguana Camp near the house
Length: 30 mm
Width: 25 mm



Spotted Skunk (*Spilogale putorius*)

29th July 2005 Western Survey Line
Length: 40 mm
Width: 25 mm

Nine-banded Armadillo (*Dasypus novemcinctus*)
25th July 2005 Along the road: Headquarter- Western Survey Line, half way between Main trail- WSL
Length: 63 mm
Width: 45 mm

Margay (*Leopardus wiedi*)
6th August 2005 Along the road: Headquarter- Western Survey Line, near the headquarter
Front track (above):
Length: 30 mm
Width: 35 mm
Hind track (below):
Length: 30 mm
Width: 25 mm

Puma (*Puma concolor*)
18th August 2005 Along the road: Headquarter- Western Survey Line, very close from the headquarter
Length: 80 mm
Width: 65 mm

Jaguarundi (*Herpailurus yaguarondi*)

18th August 2005 Along the road: Headquarter- Western Survey Line, very close from the headquarter
Length: 35 mm
Width: 30 mm

Ocelot (*Leopardus pardalis*)
22nd August 2005 Along the road: Headquarter- Western Survey Line, half way between Headquarter- Main trail
Length: 85 mm
Width: 60 mm

Jaguar (*Panthera onca*)
27th July 2005 beginning of Thompson trail (near the headquarter)
Length: 95 mm
Width: 90 mm

Jaguar (*Panthera onca*)
18th August 2005 beginning of Thompson trail (near the headquarter)
Front track (left):
Length: 90 mm
Width: 95 mm
Hind track (right):
Length: 80 mm
Width: 80 mm
Separation between the front foot and the hind foot: 400 mm

Northern Raccoon (*Procyon lotor*)

26th August 2005 Main trail
Length: 75 mm
Width: 55 mm

White-nosed Coati (*Nasua narica*)
29th July 2005 Along the road: Headquarter- Western Survey Line, near the headquarter
Set of adult and young' tracks

White-nosed Coati (*Nasua narica*)
29th July 2005 Along the road: Headquarter- Western Survey Line, near the headquarter
Adult:
Length: 50 mm
Width: 30 mm

White-nosed Coati (*Nasua narica*)
29th July 2005 Along the road: Headquarter- Western Survey Line, near the headquarter
Young:
Length: 30 mm
Width: 24 mm

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