RESEARCH IN MEDIUM-SIZED MAMMALS AT RESERVA PLAYA TORTUGA

DIFFERENCE IN SPECIES, ABUNDANCE AND ACTIVITY PATTERNS OF MEDIUM-SIZED MAMMALS RECORDED IN 2013 AND 2016 AT RESERVA PLAYA TORTUGA

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8TH OF JULY, 2016
OJOCHAL DE OSA, COSTA RICA

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Ojochal de Osa, 8th of July 2016

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Internship abroad
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References cover photos:
Ocelot, retrieved from: jronsonwildcats.wordpress.com/187-2
Agouti, retrieved from: Rolandkays.com/agouti
Capuchin monkeys, own photo
Kinkajou, retrieved from: king-animal.blogspoot.com/2013/kinkajou.html#.V3VTv-HM2IU

FOREWORD

This research rapport is the final product of my internship at Reserva Playa Tortuga in Ojochal. The internship is part of my bachelor of applied biology. The aim of the research was to compare the recorded species of mammals, activity-patterns and abundance in 2013 to the recorded species of mammals, activity-patterns and abundance in 2016 at Reserva Playa Tortuga.

This internship took place at Reserva Playa Tortuga in Ojochal de Osa in Costa Rica. The total length of the research was 21 weeks. It took place from the 22nd of February 2016 until the 8th of July 2016. I would like to thank Deivi and Javier for helping me with placing the cameras and helping me with the active surveys. I also want to thank Oscar for his help with starting my report and for his feedback on my research proposal and research rapport.

I also would like to thank my teacher Jacomijn Schouten for answering al my questions.

Néomi Geurts, 8 July 2016, Ojochal.

ABSTRACT

Loss in biodiversity is a worldwide problem. Most of de decrease in biodiversity is due to human activities. Habitat loss and loss of plant diversity due to changing of land use is the biggest cause of biodiversity loss. Different studies found that a high biodiversity is important for the well-functioning of ecosystems.

Seed dispersal is important for restoration of biodiversity. In some tropical forests over 66% of the canopy trees have seed dispersal by animals. The removal of medium-, and large-sized mammals has his effects on the remaining mammals. These effects may have an effect on seed dispersal. In hunted areas 2% of the seeds under the canopy trees have a different mother tree, while in protected areas this percentage is 42. This means that having more different mammals in an area has an positive effect on the seed dispersal.

Costa Rica is known for its rich biodiversity. Around 6% of the world's population of mammals live in this country. Also in Costa Rica biodiversity loss and habitat loss are major problems. Since 1970 28% of the land is protected. Mammals are hard to observe because a lot of them are nocturnal or live in the canopy. That is why camera-traps are often used for mammal surveys in a certain area.

The aim of this study was to compare the species, abundance and activity-patterns of medium-sized mammals recorded in 2013 in Reserva Playa Tortuga to the species, abundance and activity-patterns of medium-sized mammals recorded in 2016 in Reserva Playa Tortuga. Reserva Playa Tortuga is an non-profit biological research and education center which protects 42 hectares of land. Camera-traps and active surveys were used to determine the species, abundance and activity-patterns of the mammals in the research area. Eight cameras were divided over the three different areas of Reserva Playa Tortuga. The cameras were active for twelve weeks from March 21st until June 3rd. They were active for twenty four hours a day.

In this study thirteen species of eleven families were recorded. In 2013 fifteen species of eight families were recorded. Eleven species were recorded in 2013 and in this study. The species that were not recorded in both studies were only recorded a few times, so they were easily missed on camera or during the surveys. Another possibility is that those mammals were only passing through the reserve. In both studies the *Dasyprocta punctate* was the most common specie and had the highest IRA. Some activity-patterns did not really match, due to the fact that less videos were recorded in 2013 than in this study. Activity-patterns recorded in other studies did match the activity-patterns of this study.

The differences between the results of this study and the results of 2013 are minor. The mammals in Reserva Playa Tortuga are reasonably stable, no substantial changes in the numbers or species were found. To keep the mammals in the reserve stable it is important to keep the reserve connected to forested corridors, so gene exchange between different groups of mammals can occur. This exchange is important to remain the biodiversity in Reserva Playa Tortuga.

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1. INTRODUCTION

Biodiversity has been decreasing worldwide for at least the last four decades (Butchart, 2010). Most of this decrease is due to human activities. Changes in land use has been and will be one of the biggest causes of biodiversity loss (figure 1.1). This is because these changes of land use lead to loss of habitat for different animals and loss of plant diversity in that area (Sala et al. 2000; Mang et al. 2000). Since 1980 research in biodiversity loss has increased, these previous studies suggested that a decrease in biodiversity could alter the structure and function of the whole ecosystem (Cardinale et al, 2012).

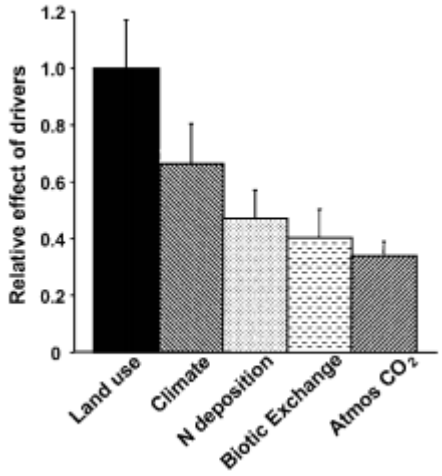

Figure 1.1 Relative effects of drivers of changes on biodiversity (Butchart, 2010).

Tilman (2000) found that higher biodiversity is important for well-functioning ecosystems. A higher biodiversity will make the ecosystems more stable than with a lower biodiversity (Tilman, 2000). This stability is due to three different causes. First of all, different species respond differently to environmental changes. If there are more species, the loss in biodiversity will be less (Doak et al, 1998). Second, most species often compete with each other. If one of the competing species decline, the other is freed from competition and will increase. This leads to less variability of the whole ecosystem (Tilman, 1998; Tilman, 1999). At last there is a ratio between community abundance and diversity. If abundance increases, biodiversity also increases. This is also a measurement of stability (Tilman, 1999).

Seed dispersal is important for biodiversity restoration. In most tropical regions seed dispersal by animals is the predominant form of dissemination of propagules (Wunderle, 1997). In some forests over 66% of the canopy trees species has seeds dispersed by animals. In more temperate zones wind is the more dominant form of seed dispersal. Approximately 33% of these trees have seeds dispersed by animals (Howe & Smallwood, 1982). In a study conducted by Wunderle (1997) it is shown that the removal of medium-, and large-sized mammals effects the behavior of the remaining individuals. These effects may in turn have consequences for seed dispersal. Wang (2007) found that in hunted areas only 2% of seeds found below the canopy of 'mother' trees have a different mother. While in protected areas 42% of the seeds have a different mother.

Costa Rica is a land that is rich in biodiversity. It is rich in birds, mammals, reptiles, amphibians, butterflies, moths and other invertebrates (Henderson, 2011). Around 223 terrestrial mammals live there, representing 6% of the world's population of mammals (Wainwright, 2007). Given the small size of the country this is a high concentration of diversity compared to other countries. For example; Minnesota is four times bigger than Costa Rica. This part of the USA only inhabits 80 different species of mammals (Henderson, 2011). Also, in Costa Rica habitat loss and loss of biodiversity are major problems. Due to deforestation, development and pollution many habitats are lost. Also, hunting has caused a large number of mammals to be on the verge of extinction. Since 1970 Costa Rica works with a national park system. Since this allows for 28% of the land in Costa Rica to be protected in some way (Evans, 1999).

The mammals are hard to observe because most of them are nocturnal or live in the canopy. Only 30 of the mammals that live in Costa Rica are active during the day. It can be hard to observe mammals, because 25% of the mammals are only active during the night and 75% of the mammals fly or live high above in the canopy, underground or in the water. Many of the mammals are very shy (Brenes, n.d), so camera-traps are often used for determination of mammals living in a certain area.

The aim of this study was to compare the species, abundance and daily activity patterns of medium-sized mammals recorded in 2013 in Reserva Playa Tortuga, to the species, abundance and daily activity patterns of medium-sized mammals in 2016. In 2013 17 different species were recorded in 8 different families. For this study camera-traps were used. Eight cameras were divided over the same three areas of Reserva Playa Tortuga. The cameras were activated for twelve weeks from March 21st until June 3rd. Since camera-traps only detect 70-80 % of the species recorded in an area, also active surveys were conducted (Todler et al., 2008). The study was carried out in Reserva Playa Tortuga in Ojochal de Osa, Costa Rica. This is a non-profit biological research and education center formed in 2009. The reserve protects 42 hectares of land. It is important for the reserve to know if the number of species, abundance and activity patters remained the same, or if there are any changes. With this information they can see if the way the land is protected is effective, or if there are any adjustments needed to keep the biodiversity as high as possible.

2. MATERIALS AND METHODS

2.1 AREA DESCRIPTION

Reserva Playa Tortuga is a reserve in the south west of Costa Rica (West 83◦40'3.36", North 9◦ 4'32.16") (figure 2.1). It is a non-profit biological research and education center formed in 2009 and they protect 42 hectares of land. It is part of the National wetlands of Térraba Sierpe (figure 2.2). Most of the reserve is mangrove wetland, but there are also areas with riparian forest, regenerating forest and secondary forest. The climate is hot with a high humidity. The average temperature ranges from 23-27 °C and the annual rainfall is ranging between 2050 and 3420 mm. The dry season runs from January until May and the rainy season runs from May until December (Brenes et al., N.D.). The area used for this research is the same area that was used for the research in 2013. The reserve is divided into three different areas by a road and a river. Area 1 is about 7,09 hectare, area 2 is about 2,10 hectare and area 3 is about 2,51 hectare (figure 2.3). To determine the size and the coordinates of the areas a Garmin Etrex 10 version 3.30 is used. Area 1 contains riparian forest, during the rainy season there are a lot of swamps and pounds that are dry during the dry season. Area 2 and 3 contain more regenerating and secondary forest.

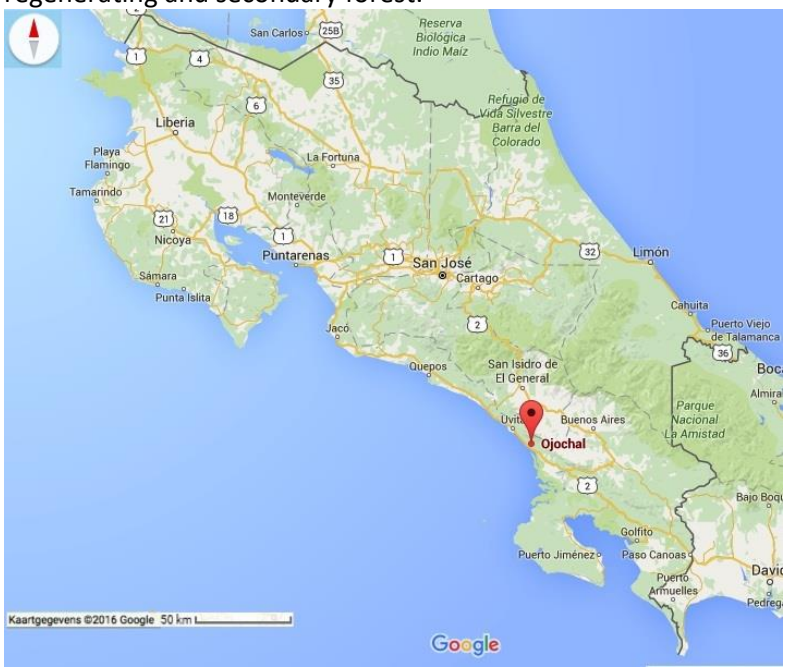

Figure 2.1 The study is carried out in the place Ojochal de Osa, that it the red spot (Google Maps, https://www.google.nl/maps).

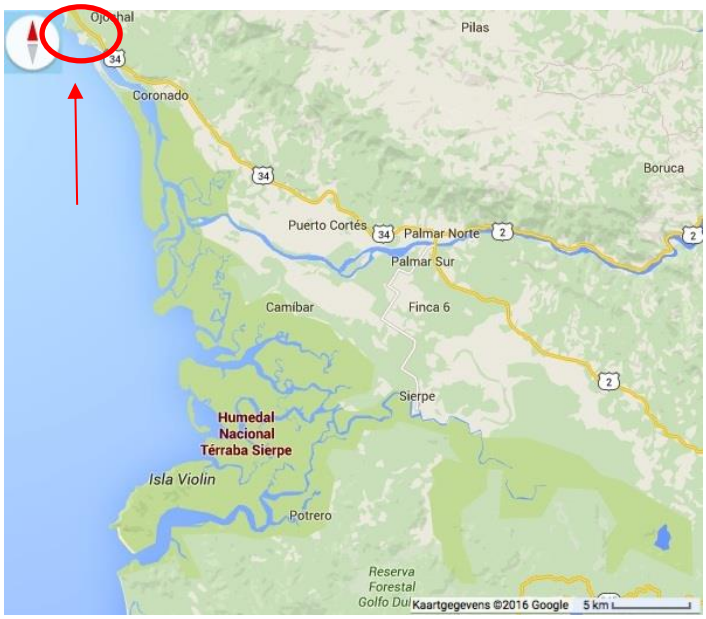

Figure 2.2 The National Wetland Térraba-Sierpe. The red circle is Reserva Playa Tortuga (Google Maps, https://www.google.nl/maps).

Figure 2.3 Study areas. The blue lines are rivers and the blue cameras are the point where the camera-traps will be placed (O. Brenes, personal communication, February 19, 2016).

2.2 METHODS

The mammals were observed using two different methods. The first method was with camera traps. There were eight cameras divided over the three different areas (figure 2.3). The coordinates of the cameras were determined by using the Garmin GPS Map 62, version 5.90. In order to distribute the cameras equally within the research area, four cameras were placed in area 1, two cameras in area 2 and two cameras in area 3. Each camera was attached to a tree at a height of ± 45 centimeters above the ground. In a study conducted by Tobler et al (2008) it could be concluded that one camera per station is enough to monitor all the species. Further-more, they found that the camera spacing has a low significance, but it is important to keep in mind that it is possible to catch the same mammal on two different cameras. So it is relevant to document at what time the animal was at a specific station. The cameras were placed with a spacing of 200 meters (figure 2.3). If the same species of mammal showed on the same camera in one hour, the video was excluded because it is likely that it is the same animal (Tobler et al., 2008). The cameras were operating twenty-four hours a day for twelve weeks, every week the batteries of the cameras were checked and the SD cards were taken out to check the videos. The information recorded when reviewing the videos was: camera number, date, time and the number of animals on the video. The datasheet that was used is shown in appendix I. Small mammals like mice and other rodents are hard to identify through videos, this is the reason why small-sized mammals are not included in this study. In this area no large-sized mammals are present, this is why this study only included medium-sized mammals.

Since camera-traps detect only 70-80% of the species in an area (Tobler et al., 2008), active surveys were also conducted. With these surveys the trails of Reserva Playa Tortuga were walked three times a week, one time in the morning around 6.00 am, one time in the afternoon, around 3.00 pm and one time at night, around 7.00 pm. To prevent habituation of the animals, the trials were walked a different day each week. During the walks every mammal of medium size that was observed was recorded. The datasheet that was used for the active surveys is shown in appendix II.

2.3 PROCESSING OF THE DATA

With all the data that was collected, tables and graphs were made to show which species and how many species were recorded in this study and the species recorded in the previous study. Also, tables were made to show the difference between the abundance of animals recorded in this study and the abundance recorded in the previous study.

Also, graphs were made to show at what time the certain specie was more active. To determine the indicator relative abundance of the mammals (IRA), the number of videos of a certain species (A_i) was divided by the camera-nights (N) multiplied by 100 (Sollmann et al, 2013). The camera-nights are the nights the cameras were active multiplied by the number of cameras.

$$IRA = \frac{A_i}{N} * 100$$

3. RESULTS

3.1 SPECIES AND ABUNDANCE

Table 3.1 shows the species and families of all the mammals recorded in this study and in the study of 2013. These are mammals recorded with the camera traps and recorded with the active surveys. In this study a total of thirteen different species were recorded out eleven families. In 2013 fifteen different species were recorded out eight families. The *Bradypus variegatus* and the *Aloutta palliata* were recorded in this study and not in 2013. The *Conepatus semistriatus, Galactis vittata, Lontra longicaudis* and *Puma yagouaroundi* were recorded in the study of 2013 and not in this study (table 3.1).

Tabel 3.1 Families and species recorded in the researched area in 2013 and 2016.

	Family	Specie	2013	2016
	Didelphidae	*sp.*	x	x
	Myrmecophagidae	*Tamandua mexicana*	x	x
	Bradypodidae	*Bradypus variegatus*		x
	Dasypodidae	*Dasypus novemcinctus*	x	x
	Cebidae	*Cebus capucinus*	x	x
	Atelidae	*Aloutta palliata*		x
	Dasyproctidae	*Dasyprocta punctata*	x	x
	Cuniculidae	*Cuniculus paca*	x	x
	Procyonidae	*Procyon lotor*	x	x
		Nasua narica	x	x
		Potos flavus	x	x
	Mustelidae	*Eira barbara*	x	x
		Galactis vittata	x	
		Lontra longicaudis	x	
	Mephitidae	*Conepatus semistriatus*	x	
	Felidae	*Leopardus pardalis*	x	x
		Puma yagouaroundi	x	
Total			15	13

The *Dasyprocta punctata* has the highest number of videos in 2013 and in this study, also the IRA of the *Dasyprocta punctata* is the highest. In 2013 the *Tamandua Mexicana* had the lowest presence on video, namely three times. In this study the *Eira barbara* had the lowest presence on video. No videos were recorded of *Aloutta palliate*, *Cebus capucinus*, *Potos flavus* and *Bradypus variegatus*. No sightings of *Eira barbara*, *Leopardus pardalis*, *Tamandua Mexicana* and *Nasua narica* were recorded during the active surveys in 2016. Sightings of *Aloutta palliate* and *Bradypus variegatus* were recorded in 2016 but not in 2013. Sightings of *Lontra longicaudis, Nasua narica* and *Eira barbara* were recorded in 2013 but not in 2016. In 2013 the *Tamandua Mexicana* has the lowest number of IRA. In 2016 the *Eira barbara* has the lowest number of IRA (table 3.2; table 3.3).

Table 3.2 number of videos and RAI of 2013 and 2016.

Specie	Videos '13	Videos '16	IRA '13	IRA '16
Didelphidae sp.	6	13	1,47	1,93
Tamandua mexicana	3	3	0,74	0,45
Dasypus novemcinctus	5	6	1,22	0,89
Dasyprocta punctata	58	117	14,22	17,41
Cuniculus paca	6	7	1,47	1,04
Procyon lotor	15	28	3,68	4,17
Nasua narica	7	2	1,72	0,30
Eira barbara	4	1	0,98	0,15
Leopardus pardalis	19	29	4,66	4,32

Table 3.3 number of sightings in 2013 and in 2016.

Specie	Sightings '13	Sightings '16
Aloutta palliate	0	2
Cebus capucinus	2	12
Potos flavus	4	15
Bradypus variegatus	0	2
Lontra longicaudis	3	0
Dasyprocta punctata	4	6
Didelphidae sp.	2	26
Dasypus novemcinctus	2	1
Nasua narica	3	0
Eira barbara	2	0

In 2013 more species were recorded than in this study. Fourteen species were recorded in area 1 and fourteen species in area 3. In 2016 ten species were recorded in area 1 and area 3. In both years the least number of species was recorded in area 2, ten species were recorded in 2013 and six species were recorded in 2016 (figure 3.1).

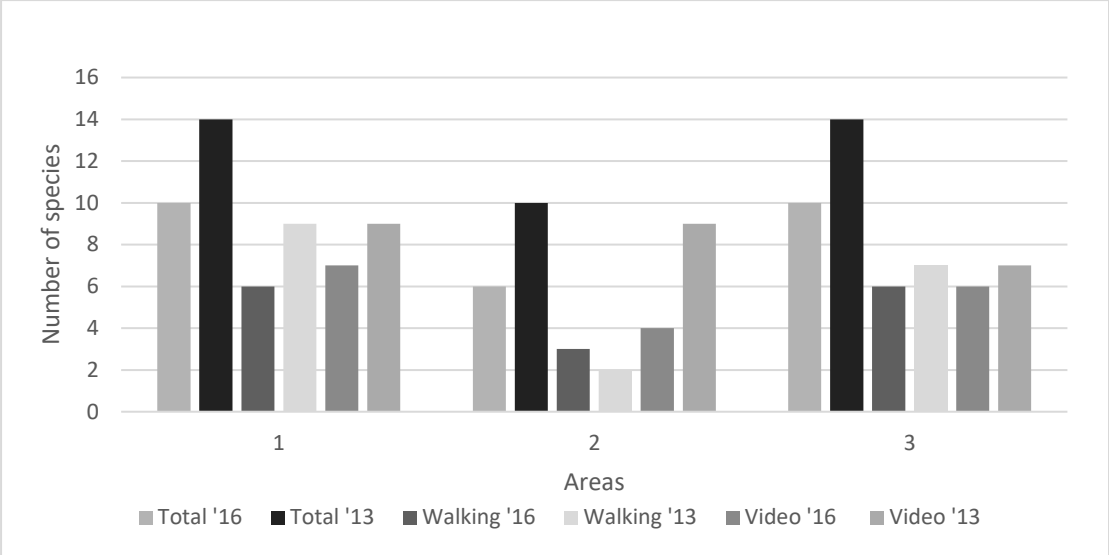

Figure 3.1 Number of species recorded per area per method in 2013 and 2016.

Camera 1, 3 and 7 show the highest number of species, namely five species. Camera 8 shows the lowest number of recorded species, namely two (figure 3.2).

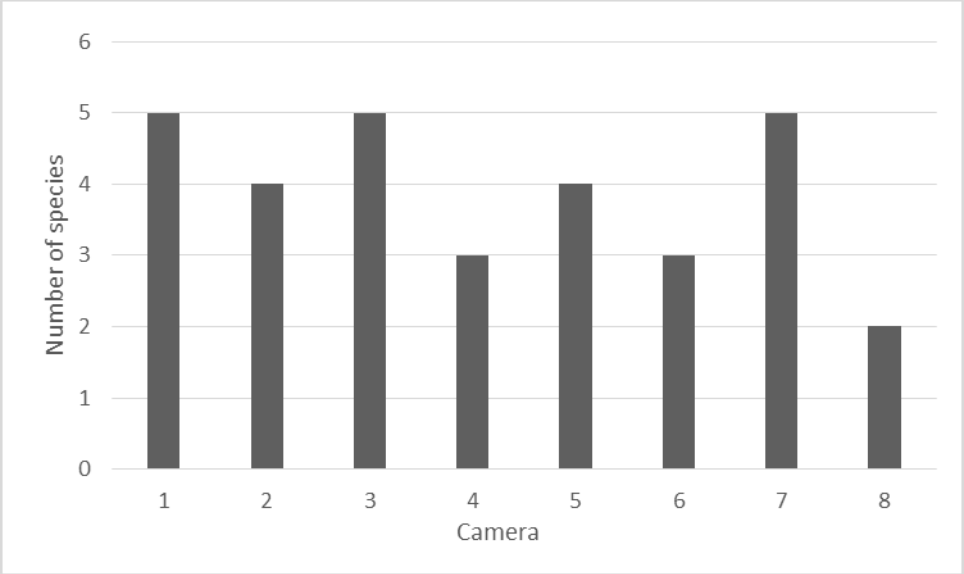

Figure 3.2 Number of species recorded per camera.

3.2 ACTIVITY

Dasyprocta punctata was the most active from 5.00 am until 5.00 pm. The most activity is recorded at 6.00 am and the least activity is recorded at 12.00 am. No activity is recorded from 6.00 pm h until 4.00 am. (figure 3.3).

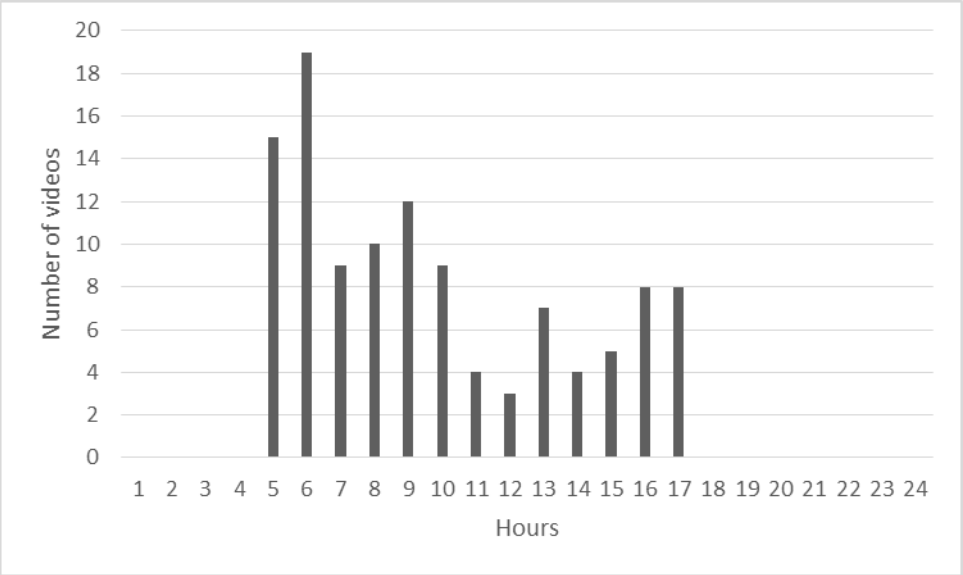

Figure 3.3 Activity of the *Dasyprocta punctata* during 24 hours, the number of videos per hour are shown.

The *Dasyprocta punctata* was the most active during week 10, twenty videos were recorded. They were the least active during week 5, three videos were recorded (figure 3.4).

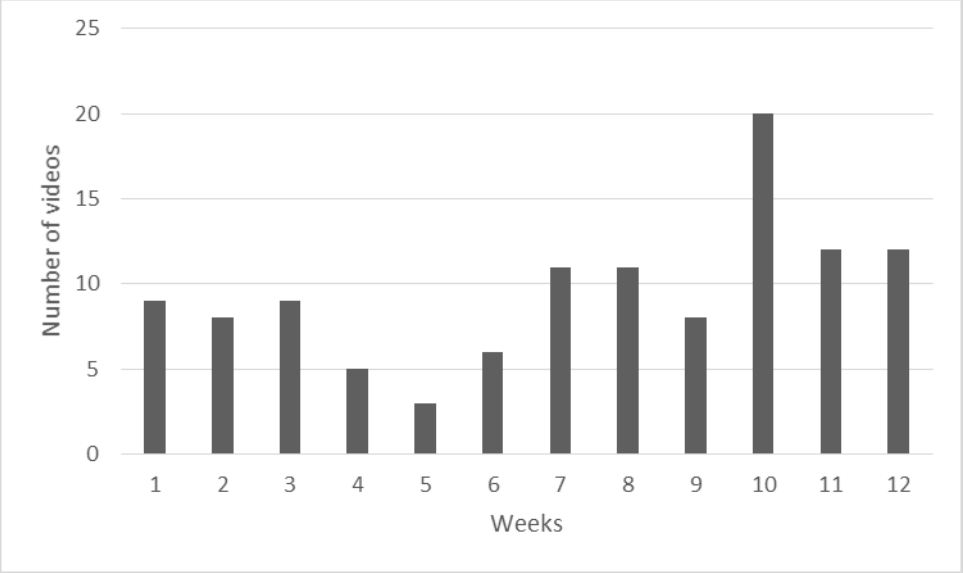

Figure 3.4 Activity of the *Dasyprocta punctata* during the 12 weeks of data collection, the number of videos per week are shown.

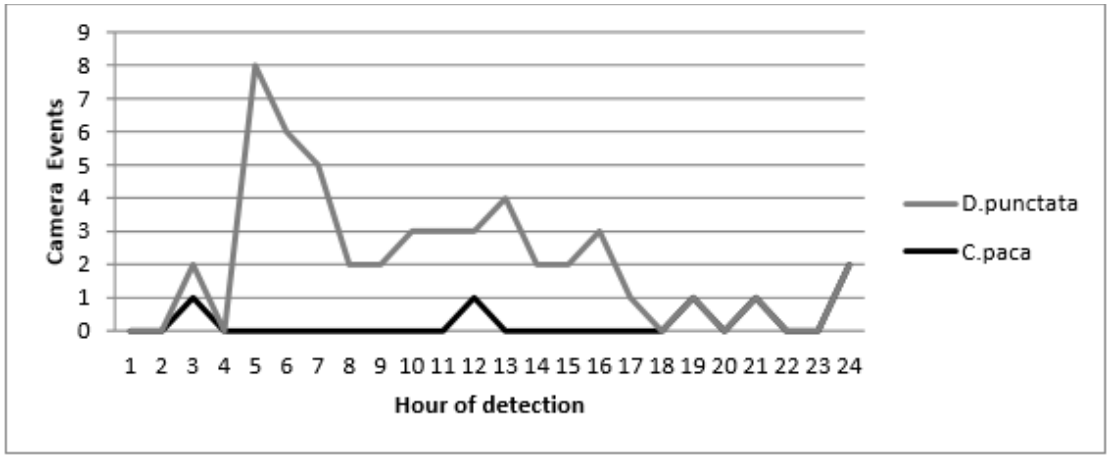

Figure 3.5 Activity-pattern of *Dasyprocta punctata* and *Cuniculus paca* recorded in 2013 (Brenes, nd).

Leopardus pardalis was the most active at 2.00 am and 4.00 am in 2016. They were not active from 5.00 am until 5.00 pm and at 7.00 pm. They were the least active at 6.00 pm, 11.00 pm and 12.00 pm in 2016. (Figure 3.6) In 2013 the *Leopardus pardalis* was the most active at 5.00 pm and 8.00 pm. No activity was recorded from 1.00 am until 12.00 am (figure 3.7).

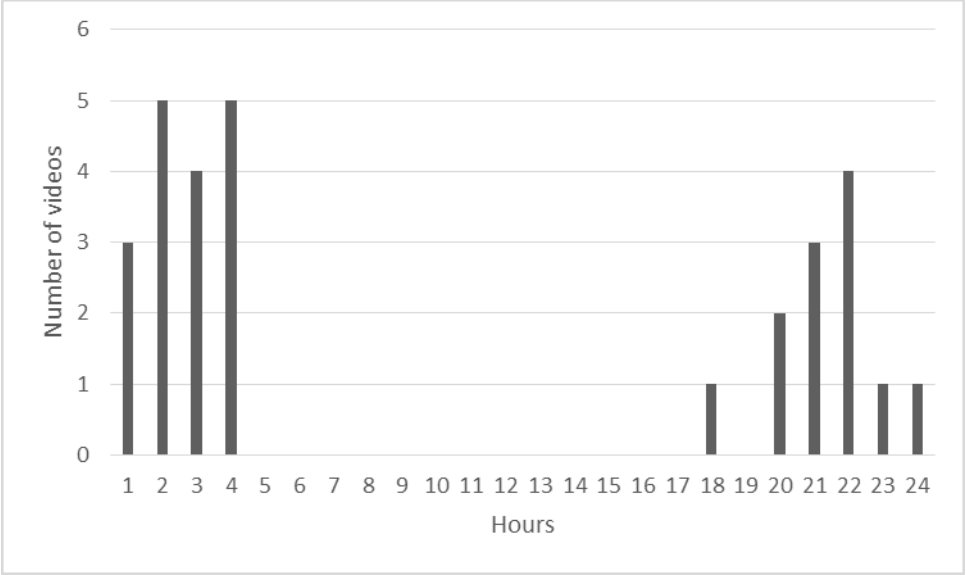

Figure 3.6 Activity of the *Leopardus pardalis* during 24 hours. The number of videos per hour is shown.

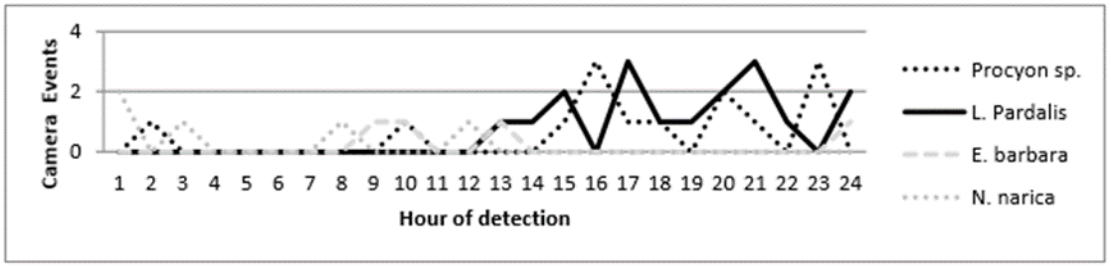

Figure 3.7 Activity-pattern recorded of the *Procyon sp., Leopardus pardalis, Eira barbara* and *Nasua narica* in 2013 (Brenes, nd).

The *Leopardus pardalis* was the most active during week 5 and the least active during week 7 and 8. During week 8 and 12, no videos of *Leopardus pardalis* were recorded (figure 3.8).

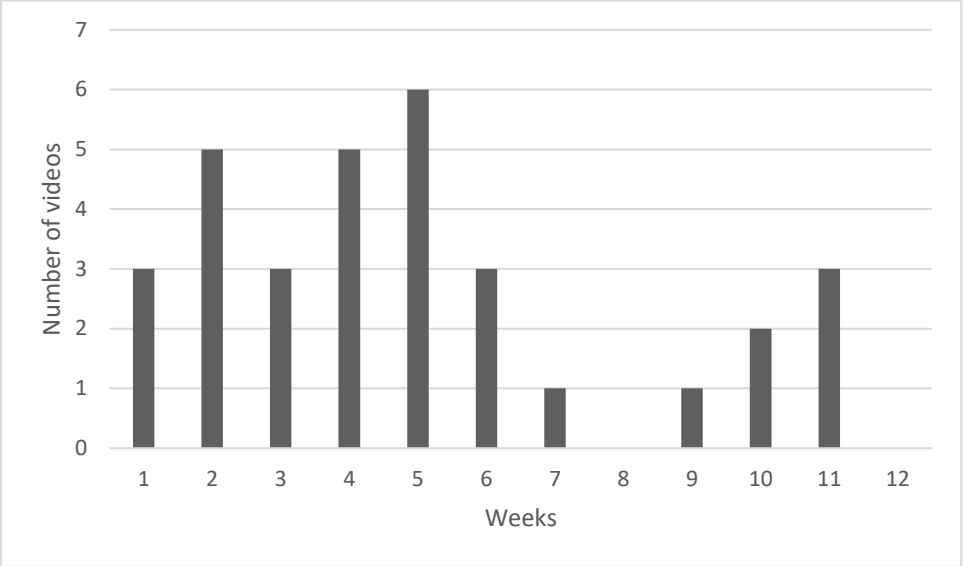

Figure 3.8 Activity of the Leopardus pardalis during the 12 weeks. The number of videos per week is shown.

The *Procyon lotor* was the most active in 2016 at 7.00 pm and the least active at 5.00 am, 7.00 am and 8.00 pm. They were not active at 6.00 am, from 8.00 am until 5.00 pm and from 10.00 pm until 12.00 pm (figure 3.9). In 2013 the *Procyon lotor* was the most active at 4.00 pm and 11.00 pm (figure 3.7).

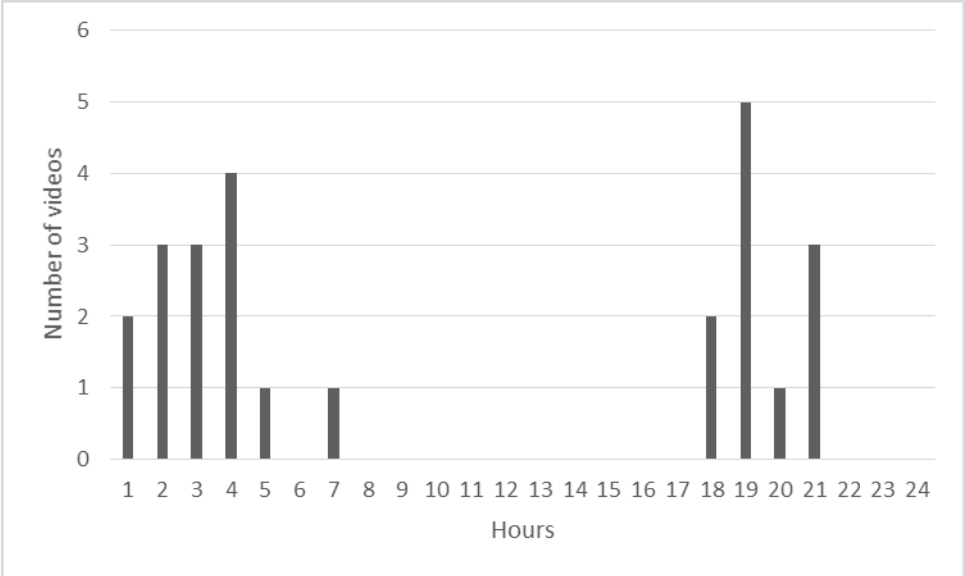

Figure 3.9 Activity of the *Procyon lotor* during 24 hours. The number of videos per hour is shown.

The *Procyon lotor* was the most active during week 3. They were the least active during week 8. They were not active during week 2, 5, 9 and 12 (figure 3.10).

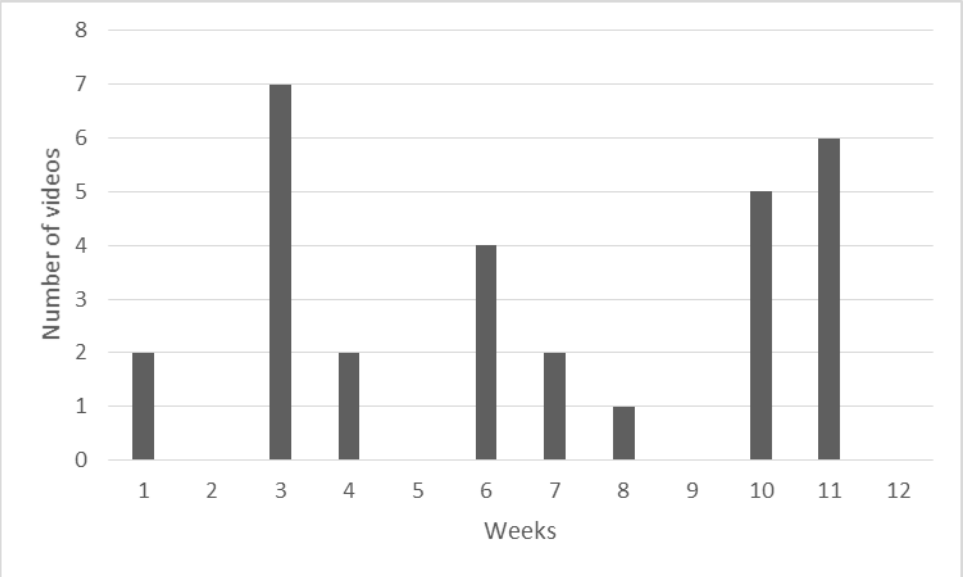

Figure 3.10 Activity of the *Procyon lorot* during the 12 weeks. The number of videos per week is shown.

In 66,67% of the morning walks *Cebus capucinus* were observed. 25% of the time they were observed during the afternoon walks. *Cebus capuchins* were never observed during the night walks.

Aluatta palliatas were not observed during the morning and night walks. In 16,67% of the afternoon walks *Aluatta palliatas* were observed.

The *Bradypus variegatus* were not observed during the morning and afternoon walks. In 16,67% of the night walks *Bradypus variegatus* were observed.

The *Didelphidae sp.* were not observed during the morning and afternoon walks. In 66,67% of the night walks the *Didelphidae sp.* were observed.

The *Potos flavus* were not observed during the morning and afternoon walks. In 58,33% of the night walks the *Patos flavus* were observed.

4. DISCUSSION AND CONCLUSION

Eleven species were recorded in both 2013 and 2016. Four species recorded in 2013 were not recorded in this study. Two species of mammals recorded in this study were not recorded in 2013. Overall these species were only recorded a few times. That might be a reason that they were missed on camera or during the active surveys. It is also possible that the mammals were only passing through the area in 2013 or in 2016. The most common species of mammals recorded in 2013 is the *Dasyprocta punctata.* This matches the result of this study, although the IRA of the *Dasyprocta punctata* in this study is higher than the IRA calculated in the research of 2013.

The activity-pattern of the *Dasyprocta punctata* in this study does not completely match the activity-pattern recorded in the previous study in 2013. The most activity is recorded around 5.00 or 6.00 in both studies. More videos were recorded in the current study (117), than in 2013 (58). Brenes (2015) found an activity-pattern of the *Dasyprocta punctate* that matches the results of this study. He recorded around 200 videos of the *Dasyprocta punctate,* so the activity-pattern Brenes (2015) recorded is probably more accurate than the activity-pattern recorded in 2013.

The activity-pattern of the *Leopardus pardalis* in this study does not match the activity-pattern recorded in 2013. In 2013 the *Leopardus pardalis* was only captured between 12.00 and 24.00. In the current study videos were recorded between 18.00 and 04.00. Di Bitetti et al. (2005) recorded that *Leopardus pardalis* were mostly nocturnal and crepuscular. That matches the activity-patterns recorded in this study.

The activity-pattern of the *Procyon lotor* of this study does not really match the activity-pattern recorded in 2013. The difference might be caused by the low number of videos of the *Procyon Lotor* recorded in 2013. The *Procyon lotor* is primarily nocturnal (Reid, 2009), which matches the results of the research in 2016.

In conclusion, the differences between the results of the research done in 2013 and the results of this research are not substantial. The differences in recorded species are mainly caused by mammals that were rarely recorded. This means that the mammals in Reserva Playa Tortuga are reasonably stable, there are no big changes in numbers of species recorded. It is important to make sure that the reserve stays connected to forested corridors. If the reserve were to get isolated, the maintenance of biodiversity would be difficult. Exchange of genes between different groups of mammals is important to keep the mammals in RPT healthy (Broadbent et al, 2012; Laurance et al, 2012). Because it is important for the mammals living in the reserve to stay in contact with other groups, it might be important to do an inventory research in mammals that live in the forested areas around the reserve. It is hard to protect an area when the surrounding areas are not in some way protected because if mammals get rare in the surrounding areas, gene exchange is hard which could lead to problems for the mammals in the reserve (Laurance et al, 2012). Repeating this research every two or three years might be a good way to check if the mammals stay stable or if there are any problems with decrease of mammals abundance or populations. In this way it is possible to make adjustments to the protection of the Reserve and keep the biodiversity in the area as high as possible.

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