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A Census of Alouatta palliata and Cebus capucinus Monkeys In Santa Rosa National Park, Costa Rica

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RESUMEN

Los primates constituyen el grupo de mamíferos arbóreos más grande y numeroso del Nuevo Mundo. En algunos bosques tropicales ellos son los principales vertebrados frutívoros y folívoros que representan a una significativa proporción de la masa total de las especies y juegan un gran papel en la dispersión de su simiente (Terbough 1983, Milton 1980). No ha sido bien terminado el estudio de la participación de aquellos, en la ecología de los bosques secos, semi-caducos, como los del Parque Nacional Santa Rosa. Además, muchos primates del Nuevo Mundo, incluidas dos de las tres especies representadas en el Parque Nacional Santa Rosa, están clasificadas como en extinción o vulnerables (Hearn 1983). De este modo, se hace más urgente la necesidad de comprender el papel de estos, en la mantención de los sistemas ecológicos locales, ya que estas especies se molestan más y más con la actividad del hombre. Los estudios a largo plazo, de las historias de la vida, de los grupos y poblaciones en esas áreas, también deberían ser una ayuda para el personal de los parques, en sus objetivos de conservación del medioambiente y de la diversidad de especies.

Los bosques casi secos de las tierras bajas de la costa del Pacífico de Costa Rica, están ocupados por: Cebus capucinus, el capuchino de cara blanca, Ateles geoffroyi, el mono araña roja, y Alouatta palliata, el mono "congo". El número y la distribución de estas tres especies, se han visto seriamente afectados por la rápida deforestación, especialmente en el norte de la provincia de Puntarenas y de la provincia de Guanacaste. Los monos araña, por ejemplo, sobreviven actualmente, solo en unos pocos lugares en la provincia de Guanacaste, de los cuales, el Parque Nacional Santa Rosa es el más seguro, y por ende el más apropiado para el estudio de una población relativamente tranquila. Un primer paso en un estudio a largo plazo, es el inventario presentado más adelante.

Los monos caras blancas y los monos congos fueron empadronados por las observaciones directas de los grupos. Los grupos sociales fueron localizados repetidamente, clasificados por edad/sexo, y seguidos hasta donde era posible. De este modo, se confeccionó un mosaico o mapa por sectores del parque. Calculamos los rangos del ambiente de dos grupos vecinos de cada especie, y luego confiamos en sus extrapolaciones, en los individuos identificables, y en la exclusividad de los cálculos por grupos para asegurar la independencia de los grupos restantes. La independencia de los cálculos resultó ser el mejor modo de distinción entre vecinos y grupos menos conocidos. Los Alouatta palliata se ubicaron donde fue posible localizar la fuente de sus estridentes vocalizaciones especialmente en la mañana. Sin embargo, no todos los grupos chillaban regularmente y a algunos, en especial a los grupos pequeños, jamás se les escuchó chillar. Los gritos agudos de los congos lejanos no son fáciles de localizar, y como

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muchos grupos chillaban solo brevemente, a veces servia apenas para senalar una area general de busqueda. El parque esta atravesado por una gran red de senderos y de rios (los cuales estan secos la mayor parte del ano), de modo que todas los rincones del parque son accesibles. La composicion por edad y sexo y el calculo total se repitieron en diferentes ocasiones, hasta lograr estabilizarse, y en ese momento se consideraba completo el calculo del grupo. La naturaleza relativamente sedentaria de los monos congos facilito las reubicaciones poco despues del contacto inicial, en la majority de los casos.

Los monos caras blancas eran mas dificiles de reubicar, pero la majority de los grupos era cohesiva y en general, dos observadores eran suficientes para asegurar el calculo del numero total del grupo. Los observadores hicieron calculos sobre el mismo grupo, a veces individualmente, comparando cifras de edad y sexo posteriormente, y a veces juntas, en un esfuerzo por obtener cifras que fueran completas y confiables.

La ubicacion, la composicion del grupo y el tamaño del grupo total de cada grupo de monos Alouatta palliata que se conoció y se calculó en Santa Rosa, aparecen tabuladas en la Table 1. El número del grupo y la situación se refiere a su ubicación en el mapa de Santa Rosa, en la Fugura 1. Los 25 grupos tabulados dan un total de 342 monos congos en todo el parques, o una densidad de poblacion bruta de 3.4 monos congos por km².

La ubicacion, la composicion del grupo y el grupo total de cada grupo de monos Cebus capucinus localizados y encuestados, aparece tabulados en la Tabla 2. En la Figura 2, se aprecia la distribucion de los grupos. Los 27 grupos tabulados dan un total de 393 monos cara blancas en todo el parque, o una densidad bruta de poblacion de 3.9 por km².

Los monos congos y los caras blancas se encuentran en las areas boscosas a traves del Parque Nacional Santa Rosa. Solamente en dos areas, Los Perros (grupo F, Tabla 2), y en medio del area El Duende (grupo K, Tabla 2), una franja riberena rodeada de colinas de pastos, se encontro una sola especie, Cebus capucinus. En toda las areas restantes coexistian los monos congos y los caras blancas.

Las densidades de los grupos estudiados intensamente, cuyos rangos donde fue posible medirlos eran mas altas que la mediana del parque; 15.0 por km² en dos grupos de monos congos, y 10.0 por km² en dos grupos de monos caras blancas. Podria aventurarse la hipotesis que el area utilizable del parque es muy inferior al 70%, que, o hay espacio par mas expansion de ambas especies (las cuales puedan haberse expandido desde el establecimiento del parque, hace doce anos), o que la cifra en numeros por km² no es un buen indicador de la relacion entre especies y recursos en el Parque Nacional Santa Rosa.

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Los monos congos actualmente se han distribuido en una mayor amplitud y son mas numerosos de lo que eran hace 10 anos cuando Freese (Freese 1976a), los ubico solamente en la parte mas baja del parque. Mas aun, aunque los monos congos se han distribuido mas ampliamente, aun es posible encontrarlos en todas aquellas areas senaladas por Freese, de modo que no se observan disminuciones con respecto a los grupos anteriores. Freese llego a la conclusion de que los monos caras blancas se han expandido mas que los monos congos, pero el no designo grupos especificos, de modo que no es posible establecer comparaciones. El rango en el grupo de los monos caras blancas estudiado intensivamente por Freese, en 1972, es similar al que actualmente ocupa un grupo de caras blancas mas pequeno.

Pareceria que la poblacion de primates ha mostrado un crecimiento y expansion en el parque, desde la creacion de este hasta ahora, y constituye un importante "refugio" para los primates de Guanacaste. El censo actual se mantendra vigente en el futuro, en la medida que obtengamos informacion mas y mas precisa.

ABSTRACT

A direct count census of Alouatta palliata and Cebus capucinus monkeys in Santa Rosa National Park, Costa Rica, was carried out in July and August, 1983 and between March and May, 1984. A total of 25 Alouatta palliata groups totalling 342 individuals were counted, giving a park density of 3.4 howling monkeys per km². Twenty-eight Cebus capucinus groups were located, totalling 393 individuals and giving a crude density of 3.9 cebus monkeys per km². Population densities of intensively studied groups of known home range, were higher than the overall park density. Group totals, age and sex compositions, and locations in Santa Rosa are described.

INTRODUCTION

Primates are among the largest and most numerous arboreal mammals in the New World. In some tropical forests they are the major frugivorous and folivorous vertebrates, accounting for a significant proportion of the total biomass and playing a large role in seed dispersal (Terborgh 1983, Milton 1980). Their roles in the ecology of dry, semi-deciduous forests, such as those found in Santa Rosa National Park, are not well studied. In addition many New World primates, including two of the three species represented in Santa Rosa National Park, are classified as endangered or vulnerable (Hearn 1983). Thus the need to understand their part in the maintenance of local ecosystems becomes more urgent as these species become increasingly disturbed by human activity. Long term studies of the life histories of groups and populations in such areas also should help parks personnel in their goals of conservation of habitat and species diversity. A first step in one such long term study is the inventory presented below.

The lowland semi-deciduous forests of the Pacific Coast of Costa Rica are occupied by, Cebus capucinus, the white-faced capuchin, Ateles geoffroyi, the red spider monkey, and Alouatta palliata, the mantled howling monkey. The numbers and distribution of all three species have been severely affected by rapid deforestation, especially in northern Puntarenas Province and Guanacaste Province. Spider monkeys, for example, now survive in only a few sites in Guanacaste Province, of which Santa Rosa National Park is the most secure and thus the most appropriate for the study of a relatively undisturbed population.

As the first step in a long-term project to study the demography and behavior of the three primate populations in Santa Rosa National Park, a census was carried out in July-August 1983 and

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March-May, 1984, the results of which are presented below. Group compositions, locations and density estimates are reported for cebus and howling monkeys. Unfortunately, the changing and dispersed nature of spider monkey social organization and range use makes estimates drawn from the sampling of spider sub-groups potentially unreliable. Thus until we know more about the spider monkey communities in Santa Rosa, we withhold our estimation of population size. However, all Ateles subgroups encountered were censused, allowing us to make some very general comments about distribution and abundance. It is our hope that as our own project continues and as we receive additional information and sightings from other researchers working in the park, as well as from park personnel, we can complete and maintain accurate census records for all three species in the park.

Santa Rosa National Park was established in 1970. Shortly thereafter a preliminary census of numbers and distribution of the three primate species and an intensive study of the behavioural ecology of one cebus group was carried out (Freese, 1976a,b; 1978). Since then no further studies of the primates in Santa Rosa have been published. The census method used in the present study (total count of the members of all groups) is different from that employed by Freese (1976a), making direct comparisons with his figures impossible. However, some general comparative statements about population distribution, and change in the park during the intervening ten years, can be made.

The park is situated approximately 35 kms northwest of Liberia in Guanacaste province, Costa Rica. It lies between the Pan-American highway and the Pacific Ocean and covers approximately 10,800 ha. It consists of a number of stepped plateaus which start at an elevation of 300m and gradually drop down to a coastal plain, which includes beach front, mangrove swamp, and flood plains. Rainfall in the park has averaged 1630.5 mm (range 900 mm to 2200 mm) annually (Janzen pers. comm.), most of which falls in the rainy season between early May and mid-December. During the dry season many of the non-riparian tree species lose their leaves. The park consists of a mosaic of distinct habitat types which result from the past land use patterns and from naturally varying environmental conditions. Originally the park was covered by a semi-deciduous, species-rich forest with patches of oak forest (Quercus oleoides) along the highest and eastern side (Janzen 1982). However, over the past 300 years, 50% of the upper plateau has been cleared for cattle pasture and planted with Hyparrhenia rufa, and the remaining forests have been selectively logged. With the establishment of the park, cattle were gradually removed, and the pastures have been reverting to woody vegetation. The mosaic of habitat types which has resulted from this diverse land use pattern includes various serial stages of dry

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deciduous forest, dominated by Spondius mombin, Luehea candida, Guazuma ulmifolia, Bursera simaruba, Ficus sp., Chlorophora tinctoria; evergreen to semi-evergreen forest of relatively pristine nature with a canopy between 10m and 25m in height dominated by Hymenaea courbaril, Masticodenron capiri, Manilkara zapote; and abandoned pastures, which are almost entirely Hyparrhenia rufa, but contain patches of trees such as Crescentia alata and Guazuma ulmifolia scattered throughout (Bonoff and Janzen 1980, Janzen pers. comm.).

Within this mosaic, forested patches have sharp boundaries and are semi-isolated. As a consequence, primate ranges are sometimes linked only by narrow "corridors" of trees, along quebradas (ravines) or ridges. By being semi-isolated, these patches of forest may limit the range of many groups and restrict emigration and immigration largely to these corridors. An extreme example is Playa Nancite, where a small, heavily wooded area of approximately 0.5km² supports groups of howling and cebus monkeys which appear to be isolated from the rest of the park by the surrounding dry and brush-covered hills. Another consequence of the park having these semi-isolated patches is a significant reduction in the area of the park available to, or suitable for, primates. Approximately 70% of the park's 10,800 ha can be described as useable primate habitat.

METHODS

Census counts

Cebus and howling monkeys were censused by direct observations of groups. Social groups were repeatedly located, counted by age/sex class and followed where possible. In this way, a mosaic, or group map of the park was constructed. Since we were covering a large, yet well-bounded area in Santa Rosa (10,800 ha), ranging information was more important in establishing the number and exclusivity of groups, than in measuring range overlap. We calculated home ranges for two adjacent groups of each species, and then relied upon extrapolations from them, identifiable individuals, and the exclusivity of group counts to ensure the independence of the remaining groups. The independence of counts proved the best way of distinguishing between neighboring and lesser known groups. Neighboring groups with similar counts were carefully re-checked, and simultaneous contact with both groups was made by different observers whenever possible. In some cases the presence of one or more readily identifiable individuals (because of facial scars, short tails, broken limbs, piebaldism, etc) also helped to distinguish between the neighboring groups of similar size. In these ways, we established the

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identity of each of the groups we counted, but it is of course possible that we missed one or several groups, especially small ones, of each species. We expect that the on-going nature of this project will allow us to delimit the ranges of an increasing number of groups and to refine the census results presented here.

The census was carried out in three stages. In July and August, 1983 (wet season) three observers located and counted groups of cebus and howling monkeys throughout the park, and began estimation of home range size of groups of both species in a selected area. The following March and April of 1984, (dry season), two observers completed the mapping of home ranges in this area. Finally, in May 1984, four observers attempted to relocate and recount the groups censused in 1983, looking for previously missed groups and following up reports of sightings in areas where no group had been located.

Howling monkeys were located whenever possible by tracing the source of their loud vocalizations, especially in the morning. However, not all groups called regularly and some, especially small groups, were never heard to howl. Distant Alouatta loud calls are not easy to localize, and since many groups howled only briefly, it sometimes served just to indicate a general area for searching. All trails and river beds and all wooded areas were walked several times. The park is crossed by an extensive network of trails and rivers (which are dry most of the year), so that all parts of the park are accessible. Park guards patrol the fence lines regularly and were helpful informants, as were other researchers working in specific areas of the park. Age and sex class composition and total count were repeated on different occasions until stable, at which time a count of a group was considered complete. Some group counts were more stable than others and we have indicated in the results section those groups whose counts we consider incomplete. The relatively sedentary nature of howling monkeys made relocations soon after initial contact quite easy in most cases.

In contrast, the mobile cebus monkeys were more difficult to relocate, but most groups were cohesive and two observers generally were sufficient to assure complete coverage of a group for a count. Observers made counts of the same group, sometimes individually, comparing age/sex counts afterwards, and sometimes together, in an effort to obtain counts that were both complete and reliable. Cebus groups showed variable tolerance of observers, some habituating rapidly to our presence, others maintaining a distance, or fleeing, even after several encounters. Park officials report some hunting of monkeys and other animals on some of the park boundaries, but boundary groups were not noticeably

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shyer or more fearful of people than some centrally located ones

Alouatta palliata age-sex classes

The sexing of adult howling monkeys presents no difficulties for the observer: the fully developed, white scrotum of the adult male is clearly visible and distinctive. Similarly, adult females can be readily identified by size and external genitalia. However, the development of the scrotum is variable in young male howling monkeys, with some two-year old males having fully descended testicles and thus a large scrotum, while others are still poorly developed at age three (Glander, pers. comm.). At earlier ages, and before the scrotum is full sized, young males and young females can be confused. Only in the intensively studied groups of the present study, were immature howling monkeys classified by sex. In the results presented below, immatures and infants are not divided into sex classes.

Cebus capucinus age-sex classes

The sexing of infant and immature white-faced cebus is difficult. The scrotum in subadult males is not easily seen except at very close range and younger animals are even more difficult to sex by external genitalia. Only in the intensively studied groups of the present study, were immature cebus monkeys classified by sex. In the results presented below, immatures and infants are not divided into sex classes. Patterns of facial and head hair growth have been used to identify adult female cebus in previous studies (Oppenheimer 1968), and were found to be useful indicators in the present census. The shape of the head and absence of facial hair helped to identify adult males. In particular, the lower face becomes very square looking when canines become fully developed in the adult males. The prominent tufts of facial hair common in adult females, are usually lacking in adult males but increased hair growth around the shoulders and upper arms gives them a noticeably robust appearance. Adult males are more visible when a group is first contacted, they often approach an observer, give loud calls, break branches and threaten.

It is not clear yet whether there is a seasonal or yearly birth pulse in the Santa Rosa cebus monkeys, however for well studied groups it is possible to designate 3 infant stages, I₁, I₂, and I₃ as other researchers have done. I₁ refers to a very young, grey, clinging infant in the first month of life, carried across the mother's shoulders. I₂ is an intermediate stage, often called dependent infant, one who frequently leaves the mother to explore, play, and even forage, but will ride dorsally during troop travel. I₃ infants are quite independent and travel as well as forage, etc. alone. However, they still have the large head to body proportions that characterize infants, and may, when the troop is alarmed,

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travel on their mothers' backs. In counting groups that are not intensively studied, the latter categories can be problematic, and for the present census, all infants are grouped in one class, corresponding to the first 12 months of life.

The juvenile or immature class which covers the age period from about 1 year to puberty (4 to 5 years) has been divided into two parts, as it was possible with a good amount of agreement to distinguish small and large juveniles or "immatures". Since a large immature female becomes adult on having her first infant, this boundary is a difficult one: some females with infants, hence adult, seemed very small and would have been difficult to classify in the absence of the infant. Subadult males (males of 4+ years) with fairly well developed scrota, but lacking the full development of face and shoulders, were not frequent in groups of either species.

RESULTS

Alouatta palliata

The location, composition, and total size of each howling monkey group contacted and counted in Santa Rosa, is listed in Table 1. The group number and location refers to its position on the Santa Rosa map in Figure 1. The 25 groups listed give a total of 342 howling monkeys for the whole park, or a crude population density of 3.4 howling monkeys per km². However, since, as we have noted, only some 70%, at most, of the habitat in the park is available to the monkeys, the ecological density (density in utilizeable habitat), is closer to 4.9 howling monkeys per km².

Cebus capucinus

The location, composition, and total of each cebus monkey group located and counted, is listed in Table 2. The distribution of the groups is shown in Figure 2. The 28 groups listed give a total of 393 cebus monkeys in the whole park, or a crude population density of 3.9 per km² and an ecological density of 5.6 cebus monkeys per km².

Solitary animals

In addition to the 25 howling monkey groups and 28 cebus groups located and counted, a total of 10 solitary howling monkeys and 4 solitary cebus monkeys were counted in different locations over both years of the census. Of the 10 solitary howling monkeys, 9 were adult and subadult males, one was a female. Only 4 solitary cebus monkeys were counted during the 2 census periods; all were males.

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Given the large numbers of howling and cebus groups in the park, it seems quite possible that the numbers of solitary animals is underestimated: they tend to be silent and discrete and are often unnoticed. Male and female immature howling monkeys are reported to leave their groups (Clarke and Glander 1974) and immature cebus males change groups. There could then, at least in theory, be a number of animals "between groups" at any time, some of which could have been missed in our census.

CONCLUSIONS

Howling and cebus monkeys are to be found in wooded areas throughout Santa Rosa National Park. In only two areas, Los Perros (group F, Table 2), and the mid El Duende area (group K, Table 2), a riverine strip surrounded by grassy hills, was only one species, Cebus capucinus, found. In all other areas howling and cebus monkeys were sympatric. Cebus monkeys however do appear to range more widely into the younger successional forest and even cross grassy, abandoned pasture in the dry season. The cebus home ranges we measured were, in most cases, larger than howling monkey home ranges, and included more semi-deciduous forest than the latter.

The densities of intensively studied groups whose home ranges were measured is much higher than the park average; 15.0 per km² for two howling monkey groups, 10.0 per km² for two cebus monkey groups. It could be hypothesised then that the utilizeable area of the park is a good deal less than 70% or, that there is room for more expansion of both species (they may have been expanding since the establishment of the park 12 years ago), or that the measure of numbers per km² is not a good indicator of the relationship of biomass to resources in Santa Rosa National Park.

In spite of the differences in methods between the present census and that carried out by Freese in 1972 (Freese 1976a), some comparisons can be made and some, albeit tentative, conclusions can be drawn. Howling monkeys are now more widely distributed and numerous than reported 10 years ago when Freese found them in the lower part of the park only. Yet, although more widely distributed, howling monkeys still are to be found in all the areas designated by Freese, so there has been no retreating from former ranges. Freese did find cebus monkeys to be more widespread than howling monkeys, but he did not designate specific groups, making direct comparisons impossible. The range of the group of cebus monkeys studied intensively by Freese in 1972 is similar to that occupied by a smaller cebus group today.

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Ateles association patterns consist of temporary parties of variable size which are usually sex segregated. Male groups are reported to travel further, over larger ranges than female groups (Fedigan and Baxter 1984). This fluidity and variable day travel makes Ateles communities or groups difficult to define and their populations difficult to estimate without individual identification of a large number of animals. We expect to obtain such identification in the future and to be able to give reliable estimates of the Ateles geoffroyi population in Santa Rosa National Park. Until then we can state only that spider monkeys are found in most areas of the park, but that, like howling monkeys, they are encountered less often than cebus monkeys in the areas of dry forest. In both census years overall encounter rates of spider monkeys were lower than those of howling monkeys and cebus monkeys, probably reflecting a lower overall density. However, given the variable fission-fusion association patterns of spider monkeys, encounter rates cannot be used to generate reliable population estimates.

It would appear that primate populations have been growing and spreading in the park since its creation until now it constitutes an important "refugium" for the Guanacaste primates. The present census will be maintained and updated as we collect and receive more, and more precise, information. These latter will allow us to not only maintain an up to date census, but to plot and predict the changes in the primate populations and the forces causing these changes.

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Table 1. Howling Monkey (Alouatta palliata) groups

MAP REFERENCE NO. NAME/LOCATION	ad m	ad f	BEST COUNT	
			large imm	small imm
1 R. Cuajiniquil gp 1.	4	5	2	2
2 R. Cuajiniquil gp 2.	3	6	1	2
3 R. Cartago/boundary rd.	3	7	2	1
4 Cruz de Piedra	1	3		
5 Upper Bosque Humido	8	18	1	4
6 Q. Puercos	3	3	2	1
7 Laguna Escondida 1	1	2	-	2
8 Laguna Escondida 2	2	4	1	-
9 Q. El Duende	3	7	2	2
10 Sendero/San Emilio	2	7	2	1
11 Upper Rio Calera	1	3	-	1
12 Q. El Guapote 1 (upper)	3	7	3	1
13 Q. El Guapote 2 (mid)	4	7	3	2
14 Q. El Guapote 3 (fenceline)	3	4	-	1
15 Q. Costa Rica	1	3	1	-
16 Lower Rio Calera	4	7	1	1
17 Estero Real	4	13	2	4
18 El Nisperal	4	5	3	2

In Santa Rosa National Park, Costa Rica 1984

COMMENTS

Inf	Total	COMMENTS
-	13	-Range over park boundary; heard frequently
2	14	-Between Cafetal trail and highway; heard frequently
1	14	-Range in area of large fruiting trees surrounded by bamboo thicket
1	5	-Small group on edge oak forest
9	40	-Under intensive study
1	10	-Lower Rio Puercos to fenceline and up smaller tributaries
2	7	-Range East and North of Laguna Escondida
1	8	
3	17	-Range between 2 arms of Que. El Duende near fence
2	14	-Under intensive study
2	7	-Near waterfall
2	16	-Range to fenceline (Hacienda Rosa Maria)
3	19	-Heard and counted on same day as group 12
1	9	-Range over park boundary
2	7	-Range East and South of waterfall
2	14	-Ranges North and South of intersection of beach road and Rio Calera
3	26	-Around junction of beach roads and Pozo Salada
1	15	-Range to edge of salt flats

19	Rio Nisperal (lower)	1	3	1	1
20	Playa Nancite	4	7	2	2
20a	Playa Nancite			3	
21	Lower Rio Pozo Salada	7	12	3	3
22	Bosque El Ojochal	5	8	2	2
23	Bejuco boundary	1	2	-	-
24	Laguna Limbo	2	3	1	-
25	San Luis boundary	1	2	-	1

- 6 -Both sides of beach road to Estero Real
- 4 19
- Separate group of all sub adult males
- 1 26 -Below junction of Rio Calera and Rio Pozo Salada
- 2 19 -Area of semi-evergreen forest bordering Rio Pozo Salada
- 3 -Probably range across park boundary into Hacienda Bejuco
- 1 8 -Range around the Ojo de Agua
- 1 6 -From Ojo de Agua to boundary with Hacienda San Luis

T = 342

Table 2. *Cebus capucinus* groups in Santa Rosa National Park,

MAP REFERENCE NO.	NAME/LOCATION	ad m	ad f	BEST COUNT			Total
				large imm	small imm	inf	
A	Finca Sta Elena Boundary	1	5	2	3	2	13
B	Cuajiniquil/upper Cafetal	2	6	2	3	1	14
C	Cuajiniquil/boundary rd.	2	4	3	5	1	15
D	Cruz de Piedra	2	6	2	1	1	13*
E	Lower Cafetal/Bosque Humido	4	10	4	5	3	26
F	Los Perros (upper Nisperal)	3	6	3	4	2	18
G	Queb. Puercos	2	4	2	4	3	16*
H	Q. Puercos/Finca Jenny	3	4	2	3	-	12
I	Guanacaste Bat site	3	5	1	4	2	15
J	Laguna Escondida	3	9	2	3	2	19
K	Quebrada El Duende 1	2	4	2	2	2	13
L	Quebrada El Duende 2	2	5	3	3	1	14
M	Sendero/San Emilio	3	2	2	2	1	10
N	Quebrada El Guapote I	4	6	2	5	3	20
O	Quebrada El Guapote II	2	5	1	3	1	12
P	Quebrada Costa Rica	3	6	2	2	2	16
Q	Upper Rio Calera	1	4	1	1	1	8

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COMMENTS

- From waterfall area
of Rio Cuajiniquil
- From Rio Cuajiniquil waterhole
Northeast to oak forest
- From Rio Cuajiniquil waterhole
West & North of boundary road
- West side of Rio Cuajiniquil
near the Cruz de Piedra
- Ranges in Bosque Humido to Mirador
Santa Elena; under intensive study
- Open grazing on 3 sides;
range down Nisperal (waterhole)
- One unid. animal (adult)

- Ranges over fenceline into
Finca Jenny (waterhole)
- From Guanacaste site area North to
Oja de Agua La Penca (waterhole)
- Around and West from the Laguna

- East side San Emilio, across
El Duende (waterhole) along East bank
- Along both arms El Duende (waterhole)
to boundary with Finca Jenny
- Under intensive study

- From upper Guapote to Casona and
campground some overlap with group M
- Mid Guapote to boundary (waterhole)
and to Hac. Rosa Maria (1 unid)
- From below waterfall to beach road

- Waterfall and upper reaches

R	Mid Rio Calera	2	5	2	2	1
S	Lower Rio Calera	2	6	-	2	1
T	La Cuesta	2	5	3	2	2
U	Le Pedregal	1	5	1	4	1
V	Rio Pozo Salada I	2	4	-	2	1
W	Rio Pozo Salada 2	1	3	1	1	-
X	Playa Nancite	2	3	3	4	1
Y	Estero Real	3	5	2	3	2
Z	Bosque El Ojochal	3	8	2	2	2
YY	Laguna Limbo	2	3	1	1	
ZZ	Hacienda Bejuco	3	5	3	5	3

28 TOTALS (* includes unidentified animals)

of Rio Calera to plateaus

- 13* -(1 unid) Mid Calera North and South, (waterhole)
- 11 -Lower Rio Calera East & West to junction with Rio Pozo Salada
- 14 -North and South of Mirador and into Rio Calera
- 13* -(1 unid) From Codo del Diablo South and West into Rio Pozo Salada
- 10* -(1 unid) Rio Pozo Salada to boundary with Hac. Bejuco at Q. Los Dantas
- 7
- 13 -Dispersed range apparently cut off from rest of park
- 15 -Lower Nisperal to Estero Real
- 17 -Area of Bosque Humido between lower Rio Pozo Salada and dry hills to Southeast
- 7* -incomplete: area of Ojo de Agua Carbonal
- 19 -North from Oja de Agua Carbonal to boundary of Hac. Bejuco

FIGURE 1

Distribution of Cebus capucinus groups in Santa Rosa National Park, Costa Rica.

PARQUE NACIONAL SANTA ROSA

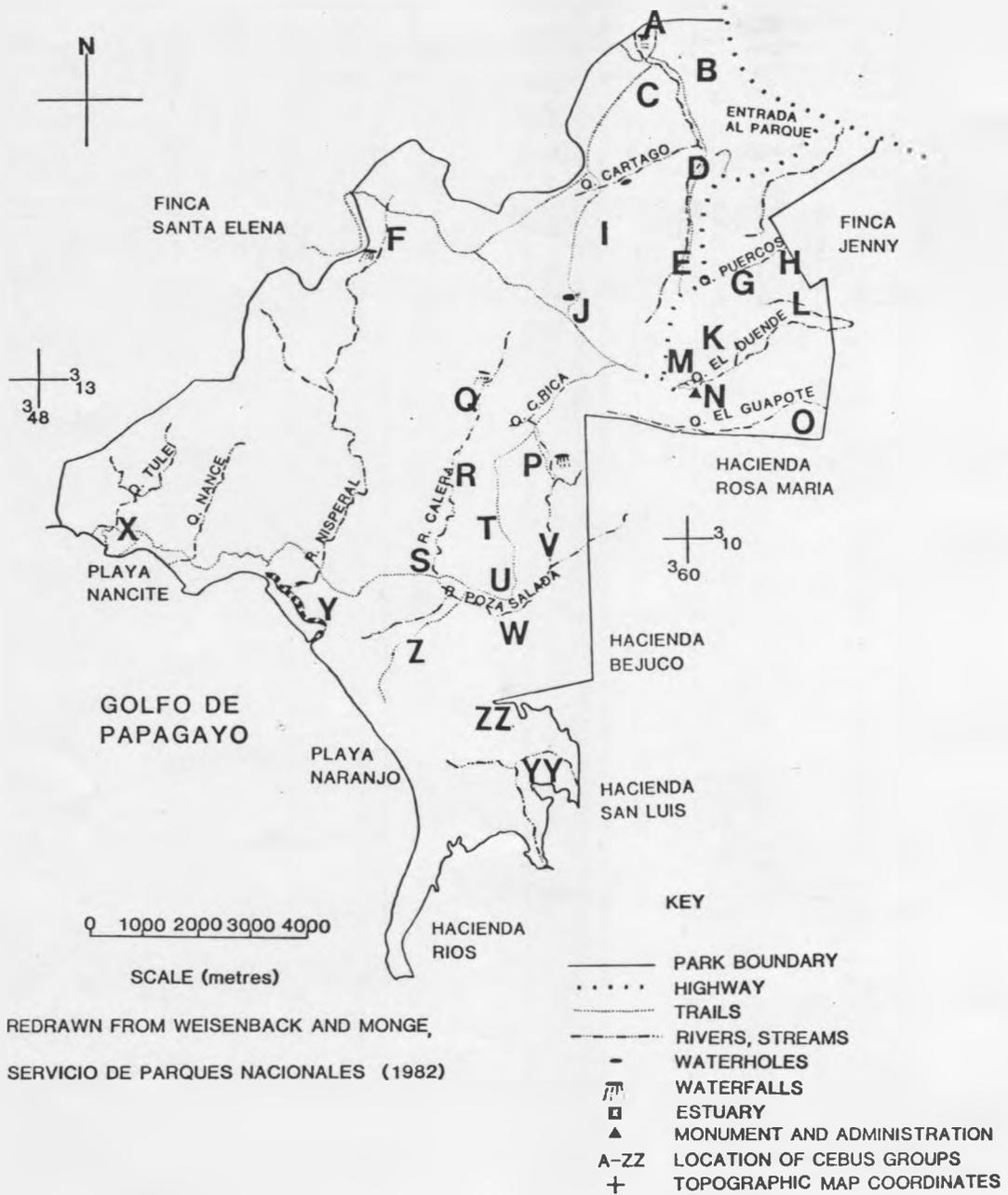
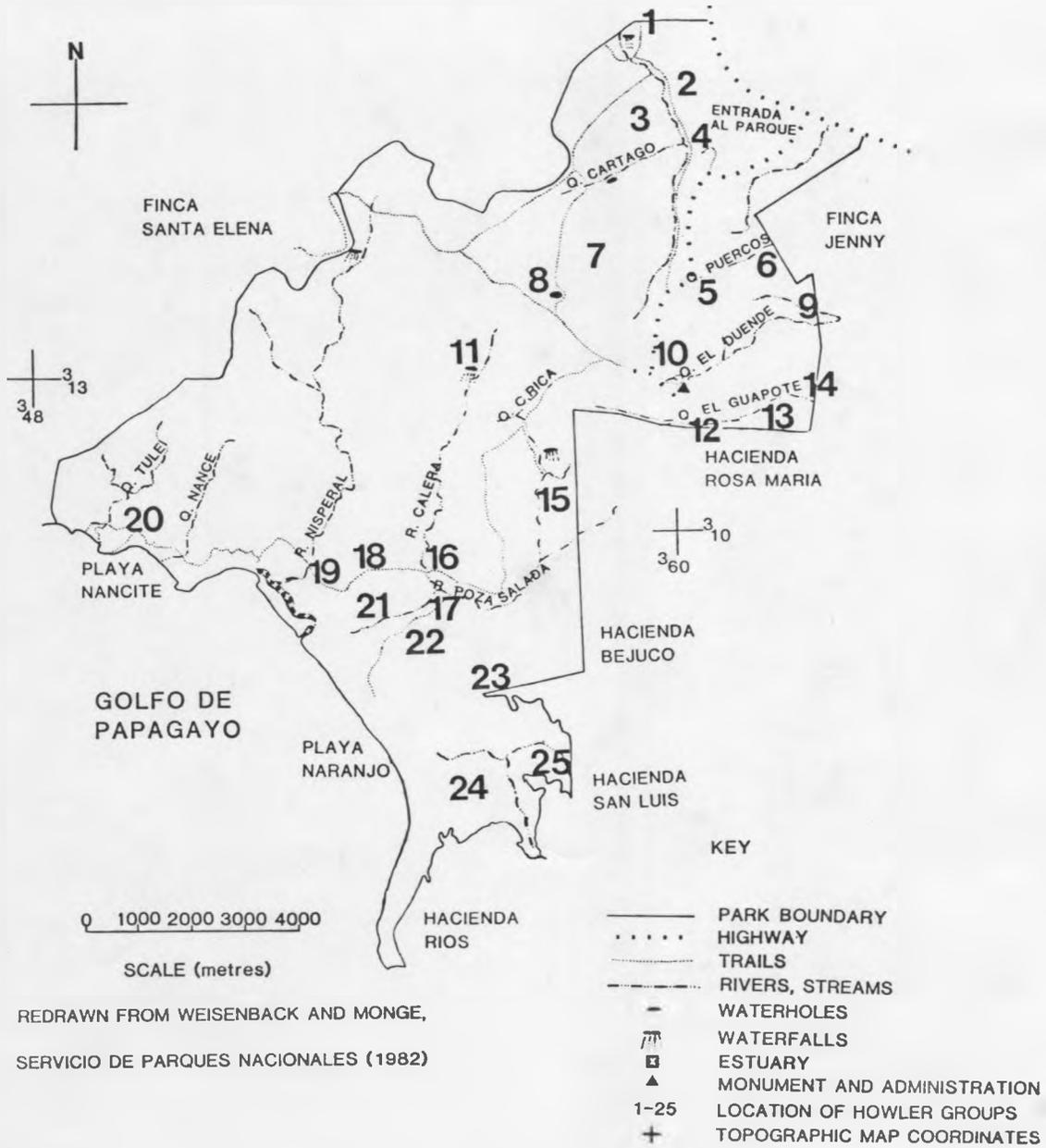


FIGURE 2
Distribution of Alouatta palliata groups in Santa Rosa
National Park, Costa Rica.

PARQUE NACIONAL SANTA ROSA



REDRAWN FROM WEISENBACK AND MONGE,
SERVICIO DE PARQUES NACIONALES (1982)