PRIMATOLOGY

The Introduced Free-ranging Rhesus and Patas Monkey Populations of Southwestern Puerto Rico

JANIS GONZÁLEZ-MARTÍNEZ, Ph D

Rhesus (*Macaca mulatta*) and patas (*Erythrocebus patas*) monkeys escaped to the mainland of southwestern Puerto Rico (SWPR) from research colonies on small offshore islands during the 1960s and through 1982. A three year study (1990-1993) combined radio-telemetry with visual observations to collect information on population sizes, the composition of social groups, their daily movements, and their home ranges. Two populations of rhesus monkeys were identified in SWPR: one within the study area in Sierra Bermeja and a second population located 10 km north of the study area. The size of the Sierra Bermeja rhesus population was derived from escapees from research colonies and at the time of the study was 65-85 individuals. Within their home range area (3.7km^2) the density of this population was »18.9 individuals/ km^2. A second rhesus population was found in a mountainous region 10 km north of the study area. This population consisted of one (or two) heterosexual groups with a total of 40-45 individuals. Although a primary characteristic of this species in India is its ability to live as a commensal with humans, the rhesus monkey populations of SWPR are extremely shy and elusive, they avoid contact with humans. The patas monkey population consisted of »120 individuals in four heterosexual groups and several all-male bands. There was no evidence of patas monkeys outside the study area. Within their home ranges (26.8 km^2) the population density was 4.47 individuals/km^2). Patas monkeys have not previously been considered a territorial species, their behavior in SWPR suggested territoriality. In contrast to studies in Africa, where the amount of home range overlap between patas monkey groups is high, in SWPR the amount of range overlap between groups is small and each group uses areas with clearly defined boundaries.

Key words: Macaca mulatta, Rhesus monkeys, Erythrocebus patas, Patas monkeys, Free-ranging, Introduced populations.

Introduced rhesus (*Macaca mulatta*) and patas monkeys (*Erythrocebus patas*) have been free-ranging on the mainland of southwestern Puerto Rico for more than 30 years (1,2). Escapees of both species migrated from the La Parguera Primate Breeding Colony (LPPBC) to mainland Puerto Rico (Fig. 1). The LPPBC was established on the islands of Cueva and Guayacán in the Boquerón Commonwealth Forest in the early 1960s under the direction of the National Institutes of Health (NIH) and administered by the Caribbean Primate Research Center (CPRC), Medical Sciences Campus of the University of Puerto Rico, with permission from the government of the Commonwealth of Puerto Rico (3).

From the Caribbean Primate Research Center Medical Sciences Campus, University of Puerto Rico.

Address correspondence to: Janis González-Martínez, PhD, Deputy Director and Staff Scientist, Caribbean Primate Research Center, PO Box 1053,Sabana Seca, PR 00952-1053, Email:jagonzalez@rcm.upr.edu.

The dispersal of escapee rhesus monkeys to the mainland of Puerto Rico started soon after the initial stocking of animals on the islands of the LPPBC during the early 1960s (3). However, their migration intensified during the period from 1974 through 1977 as a result of a contract between the Food and Drug Administration (FDA) and the CPRC. The primary goal of the FDA contract was to increase the existing free-ranging rhesus breeding colony in order to provide monkeys for safety testing of poliovirus vaccines (4). As the number of new unrelated individuals introduced into previously established social groups increased, levels of competition and aggression increased dramatically and a large number of animals, probably several hundred, managed to escape to the mainland (5).

Until November 1971, the islands of the LPPBC only contained rhesus monkeys (6). However, between 1971 and 1979, 46 patas monkeys were released on the islands of Cueva and Guayacán. All animals were imported from Nigeria and had been loaned to the CPRC on a long-term

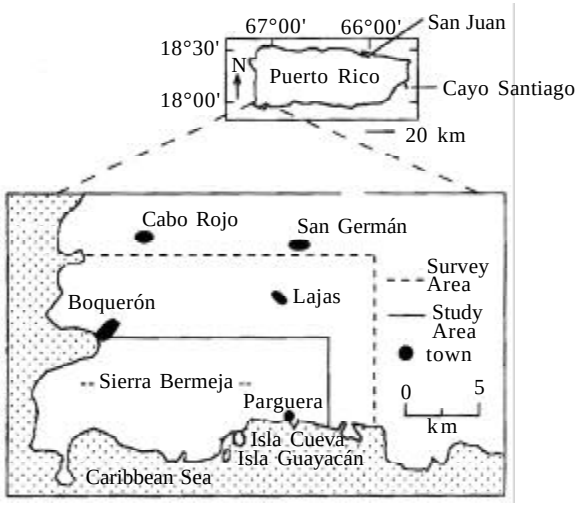

Figure 1. The La Parguera Primate Breeding Colony (LPPBC 1961-1982) consisted of the islands of Cueva and Guayacán. The total area surveyed for this study was ca. 220 km^2. Dashed lines delimit total area surveyed and the solid line delimits study area (ca. 125 km^2).

basis by NIH (7). The first evidence of migration of escapee patas monkeys to the mainland occurred in 1974 when the body of a young male was found in the bottom of a well (8).

In January 1981, a group of 85 additional patas monkeys was added to the existing free-ranging population at LPPBC. This group consisted of 82 females and 3 males. The majority (79%) had been caught in Africa and the rest had been born in NIH laboratories (9). During January 1981, the free-ranging patas monkey population of the LPPBC consisted of 149 individuals. During March 1982, when the LPPBC was closed, a total of 106 patas were moved from the islands of Cueva and Guayacán to CPRC headquarters. At that time, approximately 54 animals (26 females, 22 males, and 6 infants) were unaccounted for and the total number of patas monkeys residing on the mainland was unknown. Thus, the dispersal of patas monkeys from the LPPBC islands was a gradual process which started in 1974 and peaked in 1981.

Currently, most of the rhesus and all patas monkeys on mainland Puerto Rico are escapees and direct descendants of escapees from the LPPBC. Although other research had been done on these species on the two small islands on which they were intentionally introduced (6,9,10,11,12, 13,6,14,15,16,17,18,19,20,21), ecological research had not been done previously on the populations which dispersed to the Puerto Rican mainland. This study documents the population sizes, distribution, home range, and general ecology of introduced rhesus and patas monkeys in southwestern Puerto Rico.

Materials And Methods

Study sites. The study area (*ca.*125 km^2) is here defined as the area in which monkeys had been sighted or reported, whereas the survey area (*ca.* 220 km^2) is the region that was intensively scanned in search of evidence indicative of primate populations (Fig. 1). Primate activity occurred mainly within the Sierra Bermeja hills and adjacent areas. The Sierra Bermeja is a range of two parallel east to west running chains of hills 4.5 km northwest of the islands of the LPPBC. It is also the oldest land mass in the Caribbean (ca.195 MY) and is the site of numerous endemic plants (22). The maximum elevation of the hills is 301 m in the northern hills and 250 m in the southern hills. The average annual temperature in the area is 25°C, ranging from a January average of 28°C to a July average of 31°C. The rainy season is from August through November, when 10 to 15 cm of rain per month are received. A very short period of heavy rains is common during mid-May or early June. During the dry season, (Dec-Apr), average rainfall per month is about 5 cm. Annual precipitation averages 86 cm throughout the basin, but is greater than 102 cm along the northern hills of the Sierra Bermeja, and less than 76 cm along the southern edge (23). Rainfall decreases in a gradient southwards towards the coast.

The vegetation in the area could be classified into four major types: mesquite woodland, secondary scrub, semideciduous woodland, and *Clusea* thickets. The mesquite woodland areas were characterized by continuous growth of climax trees of *Prosopis juliflora*, interspersed with native úcar (*Bucida buseras*), guayacán (*Guaiacum officinale*), *Pithecellobium dulce*, *Boureria succulenta*, and exotic tamarind (*Tamarindus indicus*), with an understory of various grasses, shrubs, and herbaceous plants. The dominant overstory trees in secondary scrub areas were *Bursera simaruba, Hymanea courbaril, Bourreria succulenta, Capparis baducca, Leucaena leucocephala* some *Plumeria alba*, as well as, "úcar", "guayacán", and mesquite surrounded by a dense shrub layer. The semideciduous woodland areas consisted of small patches of deciduous or semideciduous trees, mainly *Bucida burseras, Tamarindus indicus, Melicoccus bijugatus,* and *Mangifera indica. Clusea* thickets were characterized by dense growths of *Clusea rosea* trees, *Guapira fragans*, and *Licaria parvifolia*.

Land use in the area was primarily cattle grazing, hay production, and small produce plantings. However, the entire area is under intense pressure for urban development. Water is available to the monkeys from small ephemeral streams in ravines and from troughs and ponds maintained for the cattle.

Methods

The study was conducted from May 1990 through July 1993; (specifically, mid-May to late August 1990, June through December 1991, from April through December 1992, and from January through July 1993). Data and observations from all months of study in all years were combined to construct a composite year for use in describing seasonal phenomena. Data used for the analyses of reproductive activity were collected from April 1992 to July 1993. The field observations typically began at 0630 hrs. When the monkeys, were sighted we continued our observations until the animals either reached their midday resting site or until they were out of view. Afternoon observations usually were conducted from 1400 hrs. until dusk.

Fiften monkeys were captured (six rhesus and nine patas) and fitted three of the rhesus monkeys and eight patas monkeys with radio-collars. At least one focal individual from each heterosexual social group was captured and radio-collared. Radio-telemetry of these focal individuals was used primarily as an aid in finding monkeys in order to make visual observations aimed at collecting information on entire social groups, their daily movements, home range, habitat use, and population size (1, 2).

Monkeys were caught in a trap similar to a modified Clover single-gate deer trap (24). The traps measured 183 X 61 X 61 cm and were baited with ripe bananas and/or mangoes. Once in the trap, the monkey was coaxed into a squeeze-cage and restrained by injecting ketamine hydrochloride (Ketaset®) intramuscularly at a dose of 5.0 to 10.0 mg/kg. The typical duration of restraint was approximately 40 min. During this time the animal was physically examined, weighed, and fitted with a radio-collar and released soon after he recovered from the effects of ketamine.

The radio telemetry equipment used consisted of battery-powered radio transmitters, a radio tracking receiver, and two 3-element Yagi antennas - a hand-held folding antenna and an additional antenna mounted on the roof of a four-wheel-drive vehicle (Wildlife Materials Inc., Carbondale, Il.). Each transmitter was mounted on an adjustable 25 cm nylon webbing collar with an enclosed whip antenna that encircled the animal's neck. Transmitters and battery packs were mounted onto thermoplastic plates curved to fit the contour of the animal's neck. Each transmitter was set to a unique identifying frequency. The mounted mass of each collar was 80-100 g, with an estimated battery life of 1,090 to 1,163 days. The monkeys were followed on foot, on horseback, or by four-wheel-drive vehicle; they were also observed through 10X,50mm and 20X,80mm binoculars. Indirect radio telemetry observations of focal animals (radio-collared individuals) was used to locate and follow the groups to determine abundance, home range, and dispersal of groups from direct visual censusing of focal animals and the other group members. The daily travel distance of a group consisted of the straight-line distance between the two most remote points in a day's travel and was calculated from positional data obtained by radio-tracking. At least three sample days per month for each heterosexual patas monkey group were used to calculate the average daily travel distance. Distances were measured directly from United State Geological Surgery topographical maps.

An estimate of fruit availability by weekly visits to several locations used by the rhesus and patas monkey groups was obtained. Use of an area was established by radio-tracking and direct observations. Items of plant and animal food were identified and categorized in the following categories: fruits, flowers/buds, leaves, stems, animal matter, and unidentified items.

For area use analyses, the home range was defined as the area regularly frequented by the groups. To determine home range, the Minimum Polygon Area (MPA) method was used (25). The MPA method joins together the outermost points of all locations. The locations obtained from the radio-tracking data were recorded as UTM coordinates (26). These coordinates were based on grid lines extended contiguously westward from the UTM coordinate system applied to the 1982 revisions of the USGS topographic maps for central Puerto Rico. Each major grid square covered a map area of 1 km^2 (100 ha) and was divided into 100 1-ha squares (10 1-ha squares to a side). For statistical analyses we used standard parametric and non-parametric procedures. For all statistical tests, the alpha level selected was 0.05.

Results

***Macaca mulatta*.** Two populations of rhesus monkeys were found in southwestern Puerto Rico. In the Sierra Bermeja, two heterosexual groups and an indeterminate number of peripheral males were detected. The size of the Sierra Bermeja rhesus population was between 65 and 85 individuals. The overall composition of this population was approximately 49% adult females, 17% adult and subadult males, and 34% juveniles and infants.

The Sierra Bermeja rhesus population used a home range area of 3.7 km^2, characterized by three different habitat types: secondary scrub, *Clusea* thicket, and semideciduous woodland. The population density within the home range area was 18.9 individuals/km^2 but only 0.68 individuals/km^2 in the overall study area close to 125 km^2). The home range area of the Sierra Bermeja rhesus

population is surrounded by the home range areas of two of the four heterosexual patas monkey groups (Fig. 2).

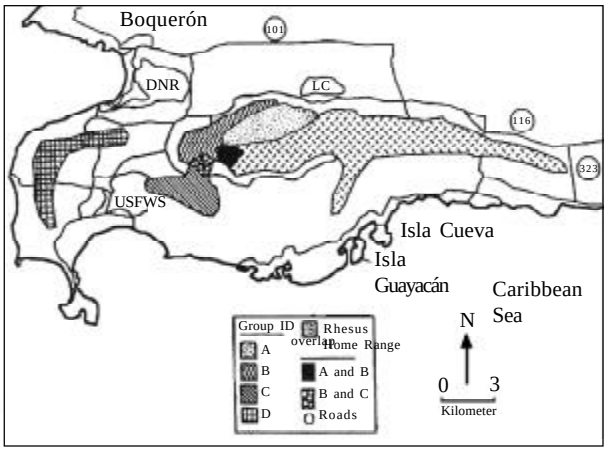

Figure 2. Home range areas of the heterosexual patas monkey groups and the Sierra Bermeja rhesus monkey population. Road numbers are circled. DNR = Department of Natural Resources Bird Refuge; LC = Laguna Cartagena National Wildlife Refuge; USFWS = US Fish and Wildlife Caribbean Islands National Wildlife Refuge.

Mating activity of the Sierra Bermeja rhesus population took place between November and March (Fig. 3). The presence of newborn infants was more apparent during the months of April through August. However, birth activity seemed to peak during the months of June and July. An additional rhesus population was detected in the Cotuí sector of San Germán, located approximately 10 km north of Sierra Bermeja (Fig. 1). This area is characterized by limestone hills vegetated with moist forest. The Cotuí population consisted of one or two heterosexual groups with a total of approximately 40 and 45 individuals. Unfortunately, due to the rugged terrain and dense vegetation it was not possible to obtain a more precise census of this population.

Erythrocebus patas. Four heterosexual groups of patas monkeys were found in Sierra Bermeja and adjacent areas. During the course of this study, the size of the patas population, including lone males and all-male bands,

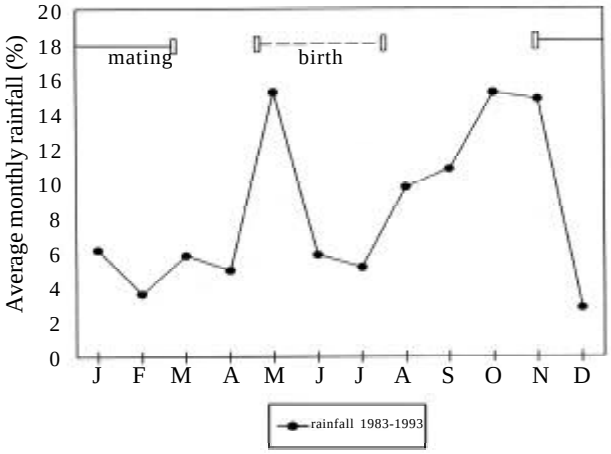

Figure 3. Long-term annual distribution of rainfall (1983-1993) and reproductive activity for the Sierra Bermeja rhesus monkey population.

consisted of approximately 120 individuals with an overall composition of approximately 42% adult females, 16% adult and subadult males, 29% juveniles, and 13% infants (Table 1). Also present in the area were various solitary or lone males and four to five bands of all-male groups. Group sizes in the all-male bands ranged from two to seven individuals and averaged three individuals.

The population density of patas monkeys in the study area (125 km^2) was 0.96 individuals/km^2 but within the overall area used by the patas (27 km^2), the population density was 4.47 individuals/km^2. Home range size among the four heterosexual groups varied from 3.72 km^2 to 15.39 km^2 and overlap between the home ranges of the four

Table 1. Size and composition of patas monkey groups (1991-1993).

Date	Group ID	Adult Females	Adult Males	Subad. Males	Juveniles	Infants	Range of Group Size	Time* (hrs.)	X ± S.D.
1991									
Jul - Dec	A	13-23	1-7	0-1	10-12	0-2	23-45	42.5	36 ± 8.5
	B	9-17	1-8	0.1	2-9	0-2	23-35	60	28 ± 5.1
	C	9-13	1-7	0.1	3-9	0	15-31	9	23 ± 6.4
	D							2	
1992									
Apr - Dec	A	15-27	1-7	1-2	8-14	1-13	32-43	97	38 ± 4.2
	B	6-17	1-7	0-1	5-9	0-11	15-37	34.5	22 ± 7.8
	C	10-15	1-2	0-2	6-9	0-7	23-33	11	25 ± 4.7
	D	10-13	1-5	0-1	5-6	0-4	18-21	10	20 ± 1.7
1993									
Jan - Jul	A	12-18	1	0-1	9-16	4-9	31-42	26.5	35 ± 4.0
	B	8-13	1	0-1	6-8	0-3	17-23	10	20 ± 2.3
	C	10-15	1-2	0-1	6-19	0-7	22-39	73	28 ± 6.4
	D	7-9	1	0-1	6-9	0-4	18-23	18	20 ± 1.8

* Time in hours with direct contact with the monkeys.

groups was minimal, on the order of 5% (Table 2; see Fig. 2).

The daily ranging patterns were also variable among the four heterosexual groups. The daily distance traveled ranged from 0.8 to 2.0 km. The difference in distance traveled daily between the groups was significant (ANOVA $F = 12.0537$, $p < 0.00001$; Kruskal-Wallis, $X^2 = 64.2621$, $p < 0.00001$). However, there was no significant difference ($t = -1.0254$, $df = 136$, $P > 0.05$) between the average distance traveled daily by all groups during the rainy season (Aug-Nov) and the average distance traveled daily during the dry season (Dec-Jul). There was no correlation between the average distance that the groups traveled daily and group size or with the size of each group's home range (Spearman Rank Correlation, $r_s = -0.2$, $p = 0.8$). However, there was a strong positive correlation between group size and size of home range ($r_s = 1$, $p < 0.0001$).

Table 2. Home range and ranging patterns of the heterosexual patas monkey groups

Group ID	Group Size	Home Range Size	Minimum Daily Travel Distance (km)	Range of Minimum Daily Travel Distance	Percent of HomeRange Overlap
	X ± s.d.	(ha)	X ± s.d.	(km)	
A	36.3 ± 1.5	1,539	1.8 ± 1.5	0.6 - 9.4	5.8% with group B
B	23.3 ± 4.2	377	0.8 ± 0.3	0.4 - 1.4	23.1% with group A and 12.5% with group C
C	26.0 ± 2.6	394	1.7 ± 0.5	0.9 - 2.6	11.9% with group B
D	20.0 ± 2.0	372	2.0 ± 0.4	0.8 - 3.0	0 %

Heterosexual group size varied according to the reproductive cycle, largely due to recruitment and dispersal of males. The number of adult males present in a group at a given time and the observation of copulation were used as indicators of the mating period. Male attendance in groups increased after the short period of heavy rains in mid-May. The number of adult males present in heterosexual groups was positively correlated with average monthly rainfall ($r_s = 0.52$, $p = 0.08$) and with cumulative total rainfall ($r_s = 0.62$, $p = 0.03$). During the main rainy season (Aug-Nov), up to eight adult males could be observed within a heterosexual group. However, after the mating/conception period, only one or two adult males would remain as residents in a group. In all groups the number of adult females remained fairly stable throughout the study period.

Birth activity coincided with the principal dry season (Jan-May) and the majority of births occurred in March and April. The number of adult males present in the groups was negatively correlated with the presence of infants less than 3 months old (Pearson Correlation = -0.7740, p = 0.0031). Infants less than 3 months old were only observed during the principal dry season. Thus, both direct and indirect evidence indicates that reproductive activity in the patas monkey population was closely and predictably linked to the distribution of rainfall (Fig. 4).

The primary food sources for rhesus and patas monkeys consisted of 23 plant species of 14 different plant families. Most of the primary food items were products of native plant species (65%) and the rest were derived from introduced plants (35%). Most of the primary food items were fruits of trees which were patchily distributed within each group's home range. The monkeys appear to coordinate their movements primarily in relation to the appearance of ripe fruits and pods of *Tamarindus indica, Melicoccus bijugatus, Mangifera indica, Prosopis juliflora, Leucaena leucocephala*, and *Bourreria succulenta*. In addition, some patas groups, particularly all-male groups, occasionally raided small agricultural plots, particularly of melons, squash, and occasionally sweet corn.

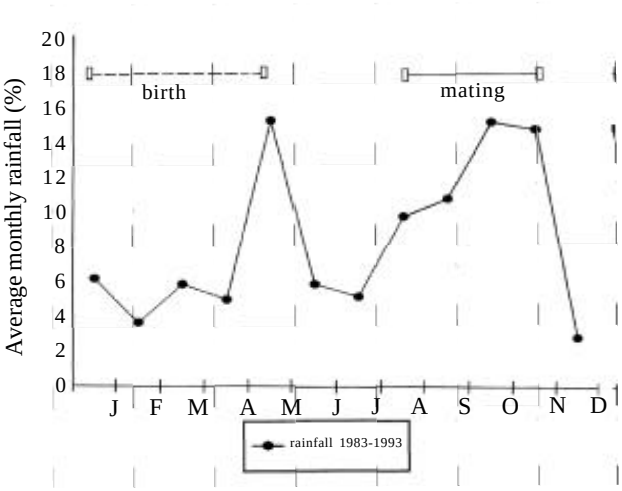

Figure 4. Long-term annual distribution of rainfall (1983-1993) and reproductive activity of the patas monkey population.

Discussion

The rhesus and patas monkeys of southwestern Puerto Rico are extremely shy and elusive, the average flight distance for both species was approximately 80 meters. However, the patas groups were more tolerant of the presence of an observer than were the rhesus groups. This is in sharp contrast to what has been typically reported for rhesus monkeys in India, where a

distinguishing characteristic of this species is its ability to live as a commensal with humans (27,28,29). Population surveys of rhesus monkeys in north central India during 1959-60 and in 1990-91 showed that more than 80% of the total population sampled lived in commensal or semi-commensal habitats (28). In southwestern Puerto Rico, however, the rhesus avoided contact with humans. If the monkeys detected an observer the animals quickly retreated to areas of dense vegetation, mainly *Clusea* thickets.

During this study, the Sierra Bermeja rhesus population was not observed to leave the immediate area of the Sierra Bermeja. However, it is likely that as urban development increases in areas currently occupied by rhesus monkeys and should their presence be tolerated by the new human residents then the rhesus populations of southwestern Puerto Rico may adapt to human populations in the same manner as rhesus in India, by increasing commensalism.

The origin of the rhesus population in the Cotuí sector of San Germán is uncertain. Some local residents report that this rhesus population has been in the area for over 14 years. Some of the same people believe that a number of animals was transported to this area, and subsequently escaped. Another possibility, however, is the emigration from Sierra Bermeja to the Cotuí sector of San Germán by means of a bamboo (*Bambusa vulgaris*) forest along the banks of Quebrada de Los Llanos. Intense trapping pressure in the Sierra Bermeja and adjacent areas during the early to mid 1980s could have been the cause of this migration. In addition, Vandenbergh commented on the presence of monkeys in this area prior to the establishment of the La Parguera Primate Breeding Colony in the early 1960s (personal communication). He believed that this group of monkeys originated from a small, defunct zoo and private owners in the area. Currently, this population has been intensively trapped to supply the illegal pet trade throughout Puerto Rico and the animals have become very shy and elusive.

Although patas monkeys generally have not been considered a territorial species, their behavior in southwestern Puerto Rico would indicate otherwise. One could speculate that a pronounced territorial pattern of behavior has developed in the Puerto Rico patas population because the immediate environment contains a relatively abundant supply of food, thereby eliminating the need to range over large areas. The smaller home range areas in Puerto Rico, with their richer food resources, are defended from other conspecific social groups.

Many behavioral features observed during this study are similar to those reported (30,31,32) in Uganda, Cameroon, and Kenya, respectively. The role of the resident adult male in the southwestern Puerto Rico groups was generally similar to that reported for the Kenya and Cameroon groups, i.e., socially and spatially peripheral during the non-mating period, but actively aggressive and defensive during the mating period.

The number of individuals in the heterosexual patas groups in southwestern Puerto Rico were similar to those reported in Uganda and Cameroon. In Uganda, Hall (30) reported that group sizes ranged from nine to 31 individuals and averaged 15. In Cameroon, group sizes ranged from seven to 34 individuals and averaged 21 (31). In Kenya, Chism and Rowell (32) observed groups averaging in size from 13 to 61 individuals. In southwestern Puerto Rico, heterosexual group sizes ranged from 20 to 38 individuals with an average of approximately 26 individuals.

A common characteristic in all African countries where patas monkeys have been studied is their low population density. In Puerto Rico, within the combined home range area (the area the groups regularly used) of 27 km^2, the density of the patas monkey population consisted of 4.47 individuals/km^2, the highest ever reported for any patas population. However, when the population density is analyzed as a function of the size of the overall study area (the entire area in which reports or sightings had ever occurred) of 125 km^2, the density of the Puerto Rican population (0.96 individuals/km^2) is comparable to population densities in Africa.

The breeding group structure of patas monkeys has typically been portrayed as including just a single male, white others erroneously mention patas monkeys as a classic example of a harem polygynous mating system. However, in Kenya (33,34), in Cameroon (35) and in southwestern Puerto Rico, heterosexual groups contained one or two resident adult or subadult males during the non-mating period, but multiple males were observed to mate in the groups during the mating period. In both Africa and in southwestern Puerto Rico, patas are seasonal breeders with birth periods during the dry season.

In general, rhesus and patas monkeys tended to avoid each other. Although the rhesus home range was surrounded by the home ranges of two heterosexual patas groups, they used habitat differently and seldom encountered one another. Patas monkeys were never observed to enter areas of *Clusea* thickets, a preferred rhesus monkey habitat type (1). However, during fruiting periods of commonly used food items, the typical pattern was one of exploitation competition. This type of competition arises from competitors using up part of a common resource without directly meeting (36). Feeding activity between rhesus and patas monkeys seldom occurred simultaneously. In shared feeding areas, patas foraged early in the morning whereas rhesus usually descended from the high ravines to the lower slopes to

forage during late morning or in the afternoon. When the two species coincided at an area, the rhesus always displaced the patas (N =10).

In other locations where they have been introduced, species of Cercopithecidae are known for their ability to survive and even thrive in their new homes. Examples include long-tailed macaques (*Macaca fascicularis*) on the island of Mauritius, Barbary macaques (*Macaca sylvanus*) at Gibraltar, vervet (*Cercopithecus aethiops*) and mona monkeys (*Cercopithecus mona*) in the Caribbean (37,38,39,40,41). At the time of this study, the introduced rhesus and patas monkey populations of southwestern Puerto Rico did not pose extensive ecological problems either of crop depredations or impact on native biota. Both species, however, have the potential for such harmful effects if their numbers or ranges were to increase substantially. It may be too late for fully successful eradication options because these populations have become so well established in relatively inaccessible areas on privately owned lands. The long-term effects that these introduced primate populations may have in Puerto Rico are yet to be seen.

Conclusions

The numbers of free-ranging rhesus and patas monkeys in southwestern Puerto Rico are less than expected. At the time of this study, the total number of both species of monkeys in the Sierra Bermeja and adjacent areas was approximately 200 individuals.

The primary area used by the monkeys measured 27 $km^{2,}$ including the Sierra Bermeja and adjacent areas.

There were two populations of rhesus monkeys in southwestern Puerto Rico. The Sierra Bermeja population of approximately 65 to 85 monkeys, consisted of two heterosexual groups and an undetermined number of peripheral males. The Cotuí rhesus population was approximately 40 to 45 individuals within two heterosexual groups.

The home range area of the Sierra Bermeja rhesus population consisted of densely vegetated areas, mainly *Clusea* thickets, within the steep ravines of the northern hills of the Sierra Bermeja. The population density within this area (3.7 km^2) was close to 18.9 rhesus monkeys/km^2, but only 0.68 individuals/km^2 in the total study area (125 km^2).

The patas monkey population consisted of approximately 120 individuals within four heterosexual groups and several all-male bands. Group sizes ranged from 20 to 38 and averaged 26 individuals.

The population density of patas monkeys in the study area (125 km^2) was 0.96 individuals/km^2, but 4.47 individuals/km^2 within their home range areas (27 km^2).

At the population levels observed during this study, the introduced rhesus and patas monkey populations of southwestern Puerto Rico did not present extensive ecological problems either of crop depredations or the impact on native biota. Both species, however, have the potential for such harmful effects if their numbers or ranges were to increase substantially.

Acknowledgement

This study was supported in part by a Compton Foundation Student Research Fellowship in Conservation and Sustainable Development, a Caribbean Primate Research Center Fellowship of University of Puerto Rico, Medical Sciences Campus and USPH contract grant number RR-03640.

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