

## HABITAT SELECTION, HOME RANGE, AND ACTIVITY OF THE WHITE-NOSED COATI (*NASUA NARICA*) IN A MEXICAN TROPICAL DRY FOREST

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We investigated how white-nosed coatis (*Nasua narica*) cope with the extreme seasonality of a Mexican tropical dry forest by studying their activity, home ranges, and habitat selection in relation to climatic seasonality. From November 1994 to March 1997, we radiotracked 7 solitary adult males and 11 bands of females and juveniles. Males extended their activity more into night hours, were more active in both the dry and the wet seasons, and traveled a greater daily distance during the wet season than groups of coatis. Average total home range was 383.0 ha  $\pm$  32.86 SE and did not differ between sexes. Home ranges differed seasonally only in groups that used areas during the dry season that were twice as large as those used during the wet season. Three major habitats that differed in phenology were used by coatis. Both males and groups preferred arroyo forest to dry forest and semideciduous forests. These results illustrate the importance of behavioral traits that permit coatis to have access to habitats where sparse resources (e.g., food and water) are more available as a mechanism to cope with climatic seasonality. Our study provides a basis for design of management and conservation strategies for the Chamela–Cuixmala Biosphere Reserve. The population of coatis in this reserve may be considered as a model to predict the type of behavioral responses that other populations of coatis may use to cope with climatic seasonality in other tropical dry forests throughout México and Central America.

**Key words:** activity patterns, climatic seasonality, coati, habitat selection, home ranges, México, *Nasua narica*, tropical dry forest

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Tropical dry forests of western México are among the most seasonal tropical environments. These forests experience a marked phenological seasonality mainly related to the amount of rainfall. During the dry season, which lasts 4 to 8 months, almost all plants shed their leaves, and many disperse their seeds (Bullock and Solís-Magallanes 1990). Effects of such phenological changes on microclimatic conditions

and availability of food resources are profound (Ceballos 1995; Janzen and Schoener 1968; Lister and García 1992). Mammal species have different strategies to cope with environmental seasonality that include local and regional movements, changes in activity patterns, shifts in diet, seasonal accumulation of fat or food resources, and physiological adaptations to cope with the lack of water (Ceballos 1995; Ceballos and Miranda 1986; Fleming 1977; Janzen and Wilson 1983; Wilson 1971).

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We present data on habitat selection, activity patterns, and home-range size of the white-nosed coati (*Nasua narica*) to understand how this species responds behaviorally to effects of climatic seasonality in a tropical dry forest in western México. We chose to study this species because it is the most abundant carnivore in the region, it is diurnal, and it is the most social Neotropical carnivore. Adult females live in groups (hereafter called bands) of  $\leq 30$  individuals that include adult females and subadults of both sexes, but adult males are solitary. Coatis are omnivorous and eat mainly invertebrates and fruits (Gompper 1995); in our study site, fruits and arthropods represent 85% of their diet (Valenzuela 1998). Home-range size and activity of coatis are affected by seasonal changes in resource availability, and both parameters tend to increase where or when resources are sparse, such as during the dry season (Gompper 1997; C. Hass, in litt.; Russell 1982; Sáenz 1994). Previous studies in tropical forests have found that home-range sizes in males and bands do not differ, and they usually overlap considerably (Gompper 1997; Kaufmann 1962; Ratnayeke et al. 1994; Sáenz 1994). Reproductive energetics also could affect movements and size of home ranges. Pregnant females leave bands temporarily to give birth, and during nesting season they used smaller home ranges (Ratnayeke et al. 1994). It also had been noted that males could be more active at night than females (Smythe 1970).

We defined 3 types of habitats in our study area. The dominant habitat was tropical dry forest, but 2 more humid and more productive areas were semideciduous forests and arroyo forests. The latter were distributed in small patches or stripes across the area. Humid habitats may be a key resource during the dry season, when water availability is extremely limited. Based on the climatic and plant conditions of our study site, we made several predictions. First, we expected to find seasonal differences in activity patterns, with larger daily

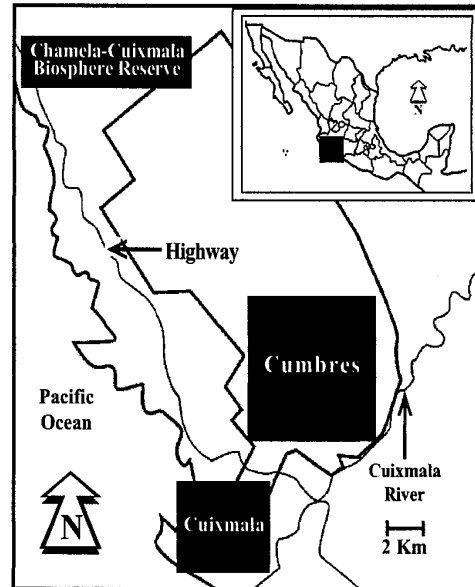


FIG. 1.—Location of the Chamela–Cuixmala Biosphere Reserve, Jalisco, México, and the study site at Cumbres.

distances traveled and higher intensity of activity in the dry season compared with the wet (rainy) season. Second, we predicted that home-range size would vary seasonally, with larger sizes during the dry than in the wet season, and no differences between sexes. We also anticipated an extensive home-range overlap in both sexes. Finally, we expected that coatis should exhibit habitat selection by including the humid habitats in their home ranges in a larger proportion than expected by chance.

#### MATERIALS AND METHODS

*Study area.*—The Chamela–Cuixmala Biosphere Reserve is located on the coast of Jalisco, México, between 19°22' and 19°35'N and 104°56' and 105°03'W (Fig. 1). The reserve is composed of 13,141 ha, with topography of hills and coastal floodplains from sea level to 400 m elevation. Our study was done in the central part of the reserve, known as Cumbres (Fig. 1), a hilly terrain where tropical dry forest is the dominant vegetation type. Climate is strongly seasonal with rainfall concentrated from late June to October, followed by a prolonged drought with no rain from November to early June. An-

nual average rainfall in the reserve varied between 700 and 1,000 mm. Annual average temperature was 24.9°C (Bullock 1986). Ceballos and García (1995) gave a detailed description of the reserve.

*Capture and radiotracking.*—Coatis were captured using Tomahawk live traps baited with sardines. Radiotransmitters (HLPM-2140; HLPM-2140A, with activity sensor; HLPM-3140; 164.000 MHz; Wildlife Materials, Inc., Carbondale, Illinois) were fitted to 11 adult females from an equal number of bands (based on home ranges and distance between females in simultaneous locations) and 7 adult solitary males. Radiotelemetry data were collected from November 1994 to March 1997. Signals of radiocollared animals were located  $\geq 2$  times per week and also during 12-h monitoring sessions, with the use of handheld radiotelemetry equipment and 3 fixed receiving stations (peak-null systems, with 11 element antennas; AVM, Inc., Livermore, California) located on the highest points of the reserve. Location error of those stations was determined to be, on average,  $< 2^\circ$ , and signals as far as 8 km could be received clearly. The average error polygon of the radiolocations was 3.60 ha  $\pm$  0.26, 95% CI ( $n = 1,070$ ). Activity patterns and locations of coatis were determined during 18 nocturnal (1900–0800 h) and 18 diurnal (0800–2100 h) monitoring sessions, in January to November 1995, when we had 10 individuals radiocollared simultaneously. Every 30 min during the monitoring sessions, we recorded presence or absence of all signals and azimuths and whether the animal was active or inactive. A coati was considered active if the activity sensor indicated so or, in the case of transmitters without activity sensor, if the intensity of its signal varied constantly during a 30-s interval. Thus, the active condition could indicate traveling or other activities without substantial displacement, such as grooming or movements in a tree. We analyzed activity in 3 ways: daily pattern, determined from the frequency of the proportion of individuals active per hour intervals throughout the day; intensity, determined as the proportion of active locations over the total number of locations for each hour; and daily distance traveled by individual coatis, measured as the sum of all distances between consecutive points in a complete 12-h diurnal session. Data were analyzed by sex and season and for all

tracking sessions (considering as a sample each complete sequence of consecutive points).

Locations of the coatis were obtained by triangulation, plotted on a map of the area, and scanned into a map file for use with telemetry software. Radiotelemetry data were processed with the TRITEL program (Biggins et al. 1992) and analyzed with the TRACKER program (Camponotus 1994) to calculate daily distance of movements and home ranges. Each individual sequence of points from complete 12-h diurnal sessions was considered a sample to estimate the average daily distance. For home-range calculations, we determined statistical independence of successive telemetry locations (Swihart and Slade 1985), and it was achieved with 4-h intervals. From each total point sequence, total home ranges were estimated using minimum convex polygons (MCP—Mohr 1947), removing the outer 5% locations to exclude possible outliers (White and Garrott 1990). Because of its relevance for animal movements, we also estimated seasonal home ranges during the 2 climatic seasons and also in 4 biological periods: mating period (April), gestation period (May–June), nesting period (1 July–15 August), and nonreproductive period (16 August–31 March).

We evaluated habitat selection as the distribution of animal locations in each habitat type in relation to habitat availability during certain periods of time. We defined our study area by plotting all independent radiolocations for all coatis on a map of the area (1:50,000) and obtaining an MCP of those locations. We superimposed a 200- by 200-m cell grid on this map. A total of 744 cells were included inside the polygon or crossed by the polygon line and were assigned to habitat type. We considered the proportion of those 744 cells, classified on each habitat category, as the habitat availability in the study area. Based on vegetation maps of the area, 3 habitat types were defined: the dominant tropical dry forest (TDF) that covered most of the area, the semideciduous forest (SF) that was found in small patches in areas with relatively high humidity, and the arroyo forest (AF), a plant community very similar to SF but distributed as a strip along main water drainages. We considered a 60-m width on average to define this latter plant community. A cell was assigned to TDF or SF habitats when more than half the cell was covered by that vegetation and to AF when the demarcation of that vegetation crossed

the cell completely. The same procedure was used to estimate habitat availability in each home range but using the 95% MCP home range obtained from all the independent radiolocations of each studied animal. Habitat selection was evaluated at gross and fine scales or approximations (equivalent to the broad view of an animal's requirement and to the detailed view of resource use, respectively—Aebischer et al. 1993). At a gross scale, we evaluated whether home ranges included the 3 habitats in the same proportion to their availability in the study site. At a fine scale, we estimated whether locations of coatis were distributed among habitat types randomly or whether locations tended to be congregated in certain areas.

Differences between sexes and seasons in daily pattern of activity were evaluated with the Kolmogorov–Smirnov test, and differences in intensity of activity were evaluated using the sign test. Differences between sexes and seasons in daily distance traveled and in home-range size were evaluated with *t*-tests and analysis of variance. Selection of habitats was assessed with *G*-tests and Bonferroni simultaneous confidence intervals (Allredge and Ratti 1986; Byers and Steinhorst 1984; Neu et al. 1974). All tests were 2-tailed at  $P < 0.05$ , and means and standard errors are provided.

## RESULTS

**Activity.**—Of the 3,524 telemetry locations available for analysis of activity, 2,494 were for females and 1,030 for males. Coatis were active mostly during the day, with some activity at night (Fig. 2a). As expected, daily patterns of activity differed between males and bands because males exhibited more nocturnal activity (Kolmogorov–Smirnov test,  $D = 0.08$ ,  $P < 0.001$ ; Fig. 2a). Daily pattern of activity in bands did not differ between seasons ( $D = 0.03$ ,  $P = 0.544$ ; Fig. 2b). Males exhibited differences between seasons and showed a higher concentration of activity during the day in the wet season ( $D = 0.06$ ,  $P = 0.011$ ; Fig. 2c).

The intensity of activity (sign test,  $P = 0.271$ ; Fig. 2c) and the daily distance traveled (wet season,  $4,588 \pm 693.24$  m,  $n = 6$ ; dry season,  $4,268 \pm 450.8$  m,  $n = 11$ ;  $t$

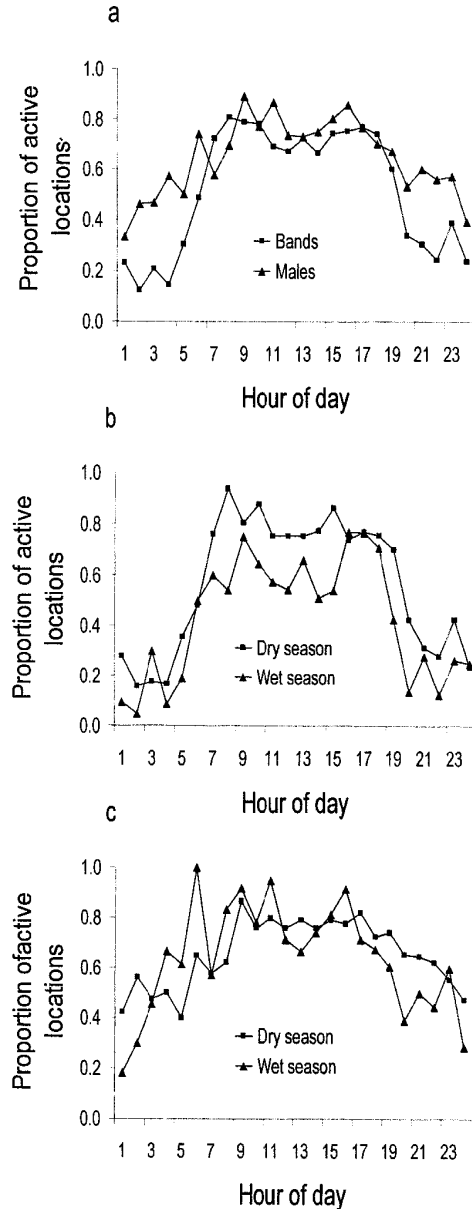


FIG. 2.—Daily pattern (frequency distribution of the proportion of individuals active per hour interval throughout the day) and intensity of activity (proportion of active locations on each hour category): a) annual pattern, b) seasonal patterns for bands, and c) seasonal patterns for solitary males.

= 0.404,  $d.f. = 15$ ,  $P = 0.692$ ) did not differ seasonally for males. In contrast, there were differences related to season in both parameters in bands. Intensity of activity

TABLE 1.—Home ranges of coatis at the Chamela–Cuixmala Biosphere Reserve. Total and seasonal areas were estimated as the 95% minimum convex polygon (MCP).

Coatis name	No. of fixes	Total 95% MCP (ha)	Dry 95% MCP (ha)	Wet 95% MCP (ha)	Observations
<b>Bands</b>					
Alba	37	361.2	318.8	32.6	Radio lost
Aura	106	246.0	247.6	122.8	Died of unknown cause
Beba	82	329.7		329.7	
Karen	138	685.2	513.8	365.6	
Lore	90	556.7	480.7	311.9	
Luna 1	48	299.3	208.5	175.9	
Luna 2	60	374.7	345.6	207.9	
Maga	56	349.7	340.0	117.8	Radio failure
Mar	58	362.5	350.3	26.3	Killed by jaguar ( <i>Panthera onca</i> )
Mili	46	245.8	245.8		Killed by jaguar
Band $\bar{X}$ (SE)		381.0 (43.58)	339.0 (34.42)	187.8 (42.99)	
<b>Males</b>					
Ares <sup>a</sup>	77	400.5	394.2	49.0	
Canelo	36	293.0	293.0		Killed by jaguar
Che	71	594.4	594.4		
Italo	65	217.9	103.2	183.3	Radio lost
Moro	54	508.0	503.1	114.8	Killed by jaguar
Nahual	50	451.2			Radio failure
Oso	23	234.5	234.5		Killed by jaguar
Male $\bar{X}$ (SE)		385.6 (54.04)	353.7 (73.61)	115.7 (38.77)	
Total $\bar{X}$ (SE)		383.0 (32.86)	344.9 (34.41)	169.8 (33.45)	

<sup>a</sup> Data were collected in the same period by C. López in a carnivore ecology study in the reserve; thus, that male was included only in the home-range analysis.

decreased during the wet season ( $P = 0.008$ ; Fig. 2b) when bands traveled less distance by day ( $2,299 \pm 187.3$  m) than during the dry season ( $3,912 \pm 310.5$  m;  $t = 4.11$ ,  $d.f. = 42$ ,  $P < 0.001$ ). There were differences between males and bands because males exhibited a higher intensity of activity than bands in both seasons (wet season,  $P = 0.001$ ; dry season,  $P = 0.011$ ; Figs. 2b and 2c). Males also traveled a greater daily distance than bands during the wet season (males,  $4,268 \pm 450.8$  m,  $n = 11$ ; bands,  $2,299 \pm 187.3$  m,  $n = 19$ ;  $t = -4.69$ ,  $d.f. = 28$ ,  $P < 0.001$ ).

**Home ranges.**—Home ranges averaged  $383.0 \pm 32.86$  ha for all animals ( $n = 17$ ; Table 1). No differences were found between average size of total home ranges for bands and males ( $t = -0.0663$ ,  $d.f. = 15$ ,  $P = 0.948$ ; Table 1 and Fig. 3). A 2-way analysis of variance for seasonal home

ranges revealed no difference between sexes ( $F = 0.274$ ,  $d.f. = 1, 23$ ,  $P = 0.606$ ), a significant difference between seasons ( $F = 12.569$ ,  $d.f. = 1, 23$ ,  $P = 0.002$ ), and no significant interaction of those factors ( $F = 0.626$ ,  $d.f. = 1, 23$ ,  $P = 0.437$ ). Home-range size for males did not differ between season. However, home-range size for bands during the dry season was greater than home-range sizes for both bands and males during the wet season ( $P < 0.05$ ).

Average area used during the dry season represented 90% of the average total home range. Spatial distribution of total home ranges overlapped extensively in both sexes (Fig. 3). Overlap of home range in bands occurred in 91% (82) of dyads and was, on average, about 35% of the total home-range size. Home-range overlap in males occurred in 53% (16) of dyads and was about 44%. Average home-range overlap did not differ

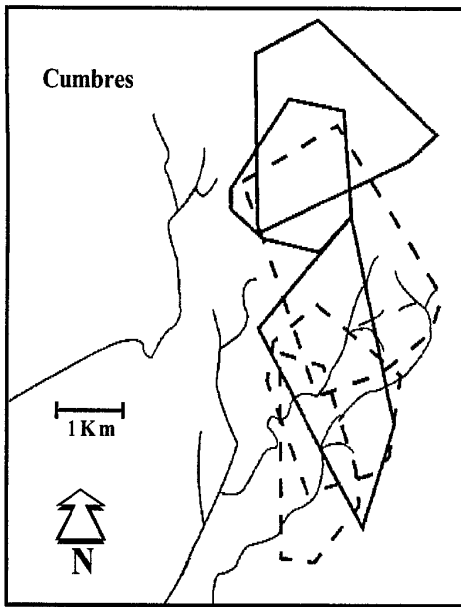


FIG. 3.—Total home ranges of 3 bands of females (dashed lines) and 3 solitary males (unbroken lines) from the Chamela–Cuixmala Biosphere Reserve. The thin branched lines in the central part of the figure represents the temporal streams along which the arroyo forest is distributed in the study site.

between sexes (Mann–Whitney test with normal approximation,  $Z = -1.225$ ,  $d.f. = 82$ ,  $16$ ,  $P = 0.222$ ).

Bands used on average  $329 \pm 46$  ha ( $n = 10$ ) outside the reproductive period,  $218 \pm 38$  ha ( $n = 10$ ) during gestation period, and  $145 \pm 19$  ha ( $n = 6$ ) during nesting season. A 1-way analysis of variance revealed a significant difference in areas used during these periods ( $F = 4.75$ ,  $d.f. = 1$ ,  $23$ ,  $P = 0.01$ ), and a post hoc comparison revealed that areas used during nesting season were smaller than those used outside the reproductive period ( $P < 0.05$ ). The average area used by males outside the reproductive period ( $336 \pm 50$  ha;  $n = 5$ ) did not differ from the area used by females during the same period ( $t = -0.07$ ,  $d.f. = 13$ ,  $P = 0.9$ ).

**Habitat selection.**—The most abundant vegetation type was TDF (62%), followed by AF (31%), and SF (Table 2). Habitat se-

lection in bands and males contrasted at different scales. Bands select a particular habitat configuration in their home ranges that included AF in a higher proportion and SF in a lower proportion than expected by chance; TDF was used in proportion to its availability. Males did not exhibit such a pattern (Table 2). Distribution of activity in the habitats inside the home range of bands and males showed seasonal variation in habitat selection (Table 3). Males and bands selected particular habitat during the dry season and used AF more and TDF less than expected. That trend was observed exclusively in males during the wet season. Although the  $G$ -test for bands during the wet season suggested differential use of habitat, the trend was not detected by the confidence intervals.

#### DISCUSSION

The climatic seasonality in the Chamela–Cuixmala reserve causes spatial and temporal variation in availability of resources for coatis. During the dry season, availability of water decreases, and water becomes restricted to a few highly scattered small waterholes (Valenzuela 1999). Litter arthropods are 2 to 3 times less abundant and 30% more dispersed in the dry season than during the wet season (Lister and García 1992). Resources strongly differ among habitats during this season. In general, it has been found that during the dry season in the AF, canopy cover, soil humidity, and arthropod abundance in the litter are greater than in the adjacent dry forest (Janzen and Schoener 1968; Martínez-Yrizar and Sarukhán 1990; Pearson and Derr 1986). Mid-day temperatures also may be as much as  $3^{\circ}\text{C}$  cooler in arroyo than in dry forests (K. Renton, pers. comm.), a trend similar to other dry forests in Central America (Janzen and Schoener 1968).

In the Chámela-Cuixmala Reserve, coatis coped with the intense dry-season changes with a set of behavioral responses that included changes in patterns of activity and home-range sizes that allowed them to have

TABLE 2.—Gross-scale habitat availability and selection by coatis. *G*-tests were used to determine significance of habitat selection; Bonferroni simultaneous confidence intervals were used to detect particular habitat selection; signs indicate a use greater (+), less than (-), or not different (0) than expected from chance at  $P < 0.05$ .

Habitat	Proportions in study site (availability)	Proportions in average home range of bands	Selection	Proportions in average home range of males	Selection
Arroyo forest	0.309	0.424	+	0.358	0
Tropical deciduous forest	0.617	0.548	0	0.571	0
Semideciduous forest	0.074	0.027	-	0.071	0
<i>G</i>		32.601		4.24	
<i>P</i>		<0.001		>0.05	

access to habitats where sparse resources (e.g., food and water) were more readily available. There were important differences between sexes. During the dry season, bands exhibited larger home-range sizes, traveled more distance daily, and presented a higher intensity of activity (distributed similarly in daylight hours) than during the wet season. Bands also showed habitat selection by including inside their home ranges more AF than expected by its availability. Arroyo forest had higher soil humidity, more food resources, and the only available water sources (Ceballos 1989; Valenzuela

1999). In contrast, home-range size of solitary males did not change seasonally, a result that could be attributed in part to a small sample size. Intensity of activity and distance traveled daily also did not differ seasonally in males.

Males showed more nocturnal activity than bands, particularly during the dry season. This behavior has not been reported in other studies (Gompper 1997; Sáenz 1994). Coatis that are heavily hunted tend to shift their activity to nocturnal hours (Gompper 1995). In our study site, however, coatis are not hunted, but we did observe consistently

TABLE 3.—Seasonal fine-scale habitat selection by coatis. *G*-tests were used to determine significance of habitat selection; Bonferroni simultaneous confidence intervals were used to detect particular habitat selection; signs indicate a use greater (+), less than (-), or not different (0) than expected from chance at  $P < 0.05$ .

Habitat	Proportions in average home range (availability)	Average proportions of band locations	Selection	Average proportions of male locations	Selection
Wet season					
Arroyo forest	0.400	0.455	0	0.432	+
Tropical deciduous forest	0.557	0.498	0	0.549	0
Semideciduous forest	0.044	0.047	0	0.019	-
<i>G</i>		7.349		26.948	
<i>P</i>		<0.05		<0.001	
Dry season					
Arroyo forest	0.400	0.482	0	0.478	+
Tropical deciduous forest	0.557	0.482	0	0.461	-
Semideciduous forest	0.044	0.036	0	0.061	0
<i>G</i>		7.088		23.329	
<i>P</i>		<0.05		<0.001	

nocturnal activity that sometimes included energy demanding activities, such as long distance travel. Males did not show habitat selection at a gross scale but did so in a fine scale, spending more time in the AF and using less TDF than expected during the dry season.

Differences in the behavioral responses of males and bands could be explained in terms of differences in energetic requirements and different resource limitations. Home-range size is determined by energetic needs of an animal and availability and dispersion of resources in a given site (Bacon et al. 1991; Kruuk and Macdonald 1985; Macdonald 1983; Mace et al. 1984). Where or when resource availability decreases, animals must range more widely to obtain the same amount of energy. In general, a key factor determining home-range size in females is access to food; for males, it is food resources outside the mating season and access to females during the mating period (Mace et al. 1984; Sandell 1989).

The difference in activity patterns between sexes could be attributed, in part, to the larger size of solitary males (Gompper 1996; Valenzuela 1998) that have higher energetic requirements. Thus, as observed in the Chamela-Cuixmala forests, solitary males should have more hours of activity and less resting periods to meet energy requirements than bands of females. Similar seasonal changes in activity of coatis, which include increased activity and greater daily movement during the period of lower abundance of resources and more nocturnal activity of males, have been reported previously for the coati in the Central American tropics (Kaufmann 1962; Russell 1982; Sáenz 1994; Smythe 1970). Differences in activity patterns between coati males and bands also could arise from different foraging success. Solitary adult males have higher foraging success when feeding on fruit patches than females in bands. However, males may have lower foraging success when foraging for litter arthropods between fruit patches (Gompper 1996) or less

success in finding fruit patches than bands; thus, males need to wander more in search of food resources. However, as stressed by Gompper (1996), detailed information on foraging success while traveling between resource patches is needed to evaluate this hypothesis.

Reproductive behavior of coatis could explain the difference between sexes in seasonal home ranges. The nonreproductive season comprises most of the year, and during this period, home ranges do not differ between sexes. During the wet season, when births occur, water and litter arthropods are more abundant. It has been reported that during nesting season, female coatis reduce their home ranges (C. Hass, in litt.; Kaufmann 1962; Ratnayake et al. 1994; Russell 1982). We found similar results for some females that had smaller home ranges during the nesting season than outside the reproductive period, which could explain partially the reduction in average home-range size of bands during the wet season.

Differences in habitat selection between sexes could be related to differences in energetic requirements. Adult males tend to leave natal bands and use a home range that overlaps their natal home range (Gompper 1997; Gompper et al. 1998). The extent of this overlap must be a compromise between benefits of remaining in a familiar area with high competition for resources with individuals from the natal band or the cost of using unfamiliar or less productive areas. Our argument is that home ranges of males should include well-known and productive areas, where competition for resources with the natal band should be higher, and unfamiliar areas with lower probability of resource competition. Thus, at this gross scale, there is no habitat selection, and home ranges of males may have lower availability of resources than home ranges of bands. This condition could be balanced by using intensely richer habitats inside their home ranges (e.g., fine-scale habitat selection). Further studies on home-range



settlement of dispersing males and resource availability are required to substantiate evidence for this interpretation.

Home-range overlap in solitary males of carnivores is expected if female density is low and they have an aggregated distribution (Sandell 1989), as is the case for band-living female coatis. We found a relatively high overlap in home ranges of males, which has been observed elsewhere (Gompper 1997; Sáenz 1994). Latitude has been reported to be correlated positively with home-range size of carnivores (Gompper and Gittleman 1991), and home-range sizes of the coati apparently follow this trend. Home ranges estimated in our study area were 12 times greater than those reported for Panama (Gompper 1997), 2 to 3 times smaller than those reported for Arizona (C. Hass, in litt.), and similar to those reported for a tropical dry forest in north-western Costa Rica (Sáenz 1994).

Our results provide a general pattern of how coatis cope with seasonal changes in resource availability through behavioral plasticity, providing support to our initial predictions on spacing and activity patterns. Our study also highlights the relevance of arroyo forests as a key habitat for the survival of white-nosed coatis in this highly seasonal forest. Similar results also have been reported for other vertebrates in Chamela and other regions (Ceballos 1995). We recommend that this habitat be given priority in management and conservation strategies for the Chamela-Cuixmala Biosphere Reserve in particular and the tropical dry forests of the coast of Jalisco in general. Finally, the coati population in the Chamela-Cuixmala Biosphere Reserve may serve as a model to predict behavioral responses of other coati populations to cope with climatic seasonality in other habitats throughout México and Central America.

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