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RESEARCH ARTICLE

Human–Nonhuman Primate Interactions Amongst Tikuna People: Perceptions and Local Initiatives for Resource Management in Amacayacu in the Colombian Amazon

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This study assesses the impact of hunting on the densities of nonhuman primates in two indigenous Tikuna territories (Mocagua and San Martı´n), overlapping Amacayacu National Park in the Colombian Amazon. Large-bodied primates were once favored prey by Tikunas, but are now rarely hunted owing to the diminishing primate populations. We evaluate the effect of a hunting ban on woolly monkeys (Lagothrix lagothricha) by the residents of Mocagua, using qualitative and quantitative methods. Hunting records showed that from February 2005 to February 2009, a total of 25,142 kg of mammal bushmeat were harvested in Mocagua and San Martı´n. Primates constituted 345 kg of the total harvest. From 223 kg of large-bodied primates extracted for subsistence purposes, 160 kg were hunted in San Martı´n and 64 kg in Mocagua. Large-bodied primates made up 70% of the total primate biomass in Mocagua (398 kg/km2) and 22% in San Martı´n (199 kg/km2). From dietary records, we found bushmeat constituted 30% of protein consumption in Mocagua and 37% in San Martı´n. Primates were absent in records from Mocagua, and appeared only three times in those from San Martı´n suggesting inconsistencies with hunting data. Despite its moderate consumption, bushmeat was identified as a highly valued food source during focus group activities. Primate pet-keeping and part utilization were observed in San Martı´n but not in Mocagua, possibly as a consequence of fewer primates being hunted. We suggest that Mocagua provides an example of how community-based conservation strategies can be achieved, where opportunities for employment in tourism and alternative food sources are available.
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Key words: **primate conservation; ethnoprimatology; resource management; subsistence hunting; cultural change**

INTRODUCTION

Throughout the Amazon Basin, the establishment of Protected Areas (PAs) has been a common strategy to provide protection for natural wildlife habitat that is high in biodiversity. Usually, PAs are created on indigenous territories where inhabitants rely on wildlife to fulfill their protein requirements [Alvard, 1994; Robinson & Bennett, 2000]. In the Colombian Amazon, 374,681km² of PAs overlap indigenous territories, complicating legislation applied to regulate resource use. Studies have shown a negative relationship between hunting intensity and wildlife biomass in the Brazilian and Colombian Amazon [see also, Cowlishaw & Dunbar, 2000; Defler & Maldonado, in revision; Palacios & Peres, 2005; Peres, 2000]. Densities of large primates appear consistently low in areas where hunting occurs, with the ateline primates (e.g. spider monkeys (Ateles spp.), woolly monkeys (Lagothrix spp.), and howler monkeys (Alouatta spp.)) most heavily impacted.

The hunting of wild primates may be limited by a number of factors: a reduction in primate population density and biomass; the availability of alternative protein sources; cultural adaptations; changes in the daily routine of local people; and the perceived

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economic benefits gained by protecting wildlife. Although nonhuman primate densities must be assessed in areas where humans and primates coexist, such data have limited conservation value without an understanding of the significance of primates in local peoples' lives [Hill, 2002]. Primates are captured or hunted by humans for various uses, such as prey items, pets, ingredients in traditional medicines, parts in arts and crafts, and as subjects of biomedical research [Fuentes, 2006]. Human's use for and perceptions of primates are created by the cultural setting in which they exist. For example, Sponsel et al. [2002] report that male macaques are captured and trained in parts of southern Thailand to pick coconuts, whereas in Asia and Africa apes are considered important status pets [Fuentes, 2006], as well as being heralded significant flagship species for conservation [Dietz et al., 1994]. These varied and complex connections form an intricate web of human–primate interactions and thus should be approached with an equally dynamic and multifaceted stance [Fuentes, 2006].

In this article, we present a preliminary assessment of a hunting ban on Lagothrix lagothricha, implemented by one community located inside Amacayacu National Park (ANP), Colombia. Primate density, biomass estimates, and extracted biomass are compared at two Tikuna communities where local hunting practices differ. Hunting pressure is influenced by ecological, biological, and cultural factors; thus, we consider the local situation from biological and anthropological point of view [Cormier & Urbani, 2008; Sponsel, 1997], using a variety of qualitative and quantitative methods. People's perceptions of primates are explored, in order to gain a more complete understanding of human–primate interactions and to determine the inclination for sustainable resource management by the local people.

METHODS

Study Site

ANP is the only PA located in the extreme southern part of Colombia (Colombian Amazon trapezium) at 31020–31470S and 691540–701250W in the municipality of Leticia, Amazonas department. It covers an area of 2,935km2, comprising highly seasonal rainforest located mainly on terra firme oligotrophic soils [Rudas et al., 2005] (Fig. 1). The precipitation distribution regime is unimodal biseasonal, with an annual average of 3,270mm. The annual average temperature is 26.21C and the average relative humidity is more than 86% [Rudas et al., 2005]. Fieldwork took place in the territories of two Tikuna indigenous communities, Mocagua (population5511) and San Martı´n (population5480), whose boundaries lie within the borders of ANP.

A research license was obtained from the Colombian Special Parks Unit (UEASPNN) for research to be carried out in the ANP. Signed permission was acquired from the people of Mocagua and San Martı´n agreeing for research to be conducted, with the inclusion of participants from the aforementioned communities and for data to be used in any subsequent publications. Anthropological protocols followed the ethical guidelines proposed by the Association of Social Anthropologists in the United Kingdom and Commonwealth for Good Research Practice (March 1999).

The predominant ethnicity in Mocagua and San Martı´n is Tikuna, with a minority of Cocama and Yagua ethnic groups [PNNA, 2006]. San Martı´n and Mocagua provide a comparison of two communities undergoing different rates of environmental and cultural change. Mocagua's strategic geographical location, next to the visitor's lodge in ANP, brings steady economic benefits to local people through work in tourism and research. San Martı´n is located 13km from the visitor's lodge, and owing to high fuel costs and limited transport availability, access is often difficult resulting in fewer benefits from tourism.

Under Colombian legislation, subsistence hunting by indigenous people is permitted inside Pas while commercial hunting is illegal [PNNA, 2006]. In the ANP, Mocagua is the only community to have implemented the hunting ban on woolly monkeys. The ban was initiated in 2003 as part of an environmental management strategy, undertaken by six indigenous communities located nearby or inside ANP, in collaboration with Dr. Sara Bennett. Since 2005, Dr. Bennett has managed a primate rescue center next to the visitor's lodge, with local employees from Mocagua [Bennett, 2000].

Data Collection

Hunting assessment

Hunting pressure was determined by quantifying the total biomass extracted by hunters over a 48-month period, from February 2005 to February 2009, at the four sampling sites (Bacaba and Pucacuro in Mocagua, and Agua Blanca and Agua Pudre in San Martı´n). Local coordinators kept a log of: hunted species, sex/age, weight, body measurement (centimeters), hunter's name, place of hunting event, who consumed or bought the meat, and price per kilo [Bodmer & Puertas, 2000]. In 2005, the collection of harvest data was conducted as semi-structured interviews (n546) by two local co-investigators, as requested by the Tikuna communities. In San Martı´n, the interviews were conducted in Tikuna language, whereas in Mocagua interviews were conducted mainly in Spanish, as the hunters from this community have a different ethnical background (e.g. Cocama and Yagua

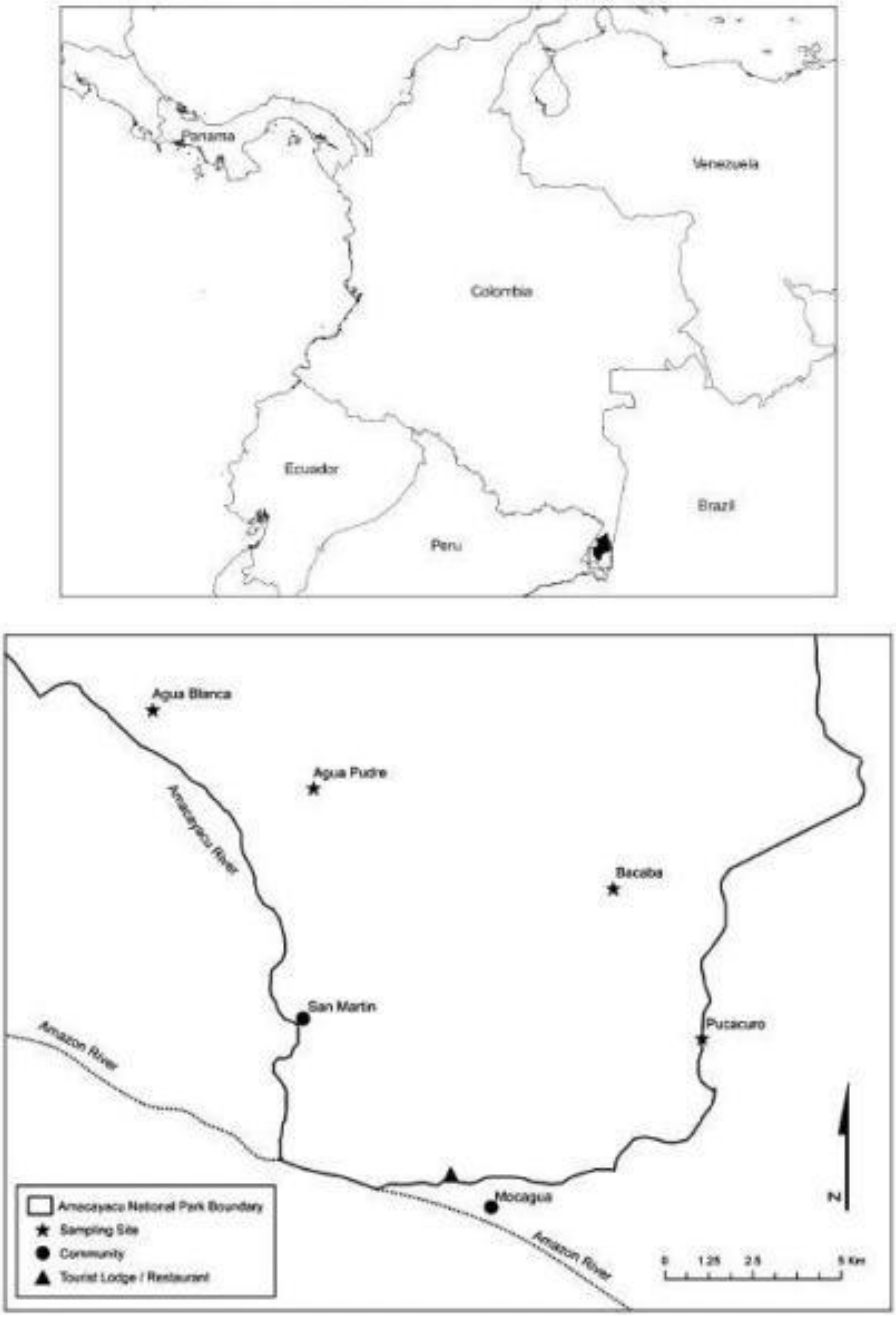

Fig. 1. Geographical location of sampling sites and communities in relation to the Amacayacu National Park, Southern Colombian Amazon.

indigenous groups). With the approval of local indigenous authorities, AM repeated 50% of the interviews in Spanish from 2006 to 2008, in order to triangulate the data elicited by the two local coinvestigators [Beebe, 1995]. Interviews were semistructured including a total of 31 questions, meaning they were flexible and allowed new questions to be brought up as a result of what the interviewee said. Each interview lasted an average of 45 min.

Quantitative criteria for ranking hunting sites included the total biomass of game species extracted by hunters at each site and number of hunting trips. Thus, hunting pressure was ranged from 1 (lowest hunting pressure) to 4 (highest hunting pressure) [Peres & Dolman, 2000] (Table I).

Census techniques

Following standardized census protocols [Buckland et al., 2001; Peres, 1999], line transects were conducted on a monthly basis over a period of 36 months from June 2005 to June 2008, to assess primate densities at the four sampling sites. Data were collected for a total of 203 days of effective fieldwork and a total walked distance of 2,067 km (Mocagua51,117 km and San Martı´n5950 km). A total of 14 transect lines more than 57km were monitored: 8 transects of 4km in Mocagua and 6 transects of 4–5 km in San Martı´n.

Information recorded included: climatic conditions, date, time, primate species, group size, perpendicular distance to the center of the group (when possible) or perpendicular distance to the first animal sighted, height of primate group above ground, location along the trail, and detection cue. Additional information, such as group composition, activity (traveling, foraging, resting, social behavior), diet, and association with other species, was recorded when possible. Census speed was 1.2 km/hr and observers stopped every 100m to listen and look around. Censuses were cancelled when it rained.

Dietary assessment

Dietary logs were recorded by women in Mocagua (n517, representing 14% of the adult female population) and SanMartı´n (n523, representing 17% of adult females) from November 2007 to June 2009. Three to four female participants from different households in each community recorded protein intake on a daily basis, using a set of weighing scales to record the amount of meat and fish consumed in their home. Semi-structured interviews [Huntington, 1998] and group discussions [Morgan & Spanish, 1984] were carried out 2–3 times a week with the women, to elaborate on quantitative data and share ideas. Women's activities were conducted away from men to avoid male-dominated participation, which is common in indigenous communities [Richards, 2006]. It offered a chance to better understand each others perspectives, and revealed the collective insight of the group while preserving individual preferences [Threlfall, 1999].

Species use

Study participants were split into four focus groups in each community. These were: children aged 5–14 years, males aged 15–59 years, women aged 15–59 years, and village elders aged 601 years (Table II). Participants were asked to make lists of wild and

TABLE I. Quantitative Criteria Used to Rank the Hunting Pressure at Different Sites

Study site [coordinates]	Total frequency of hunting trips	Total extracted biomass (kg)	Distance from nearest village (km)	Hunting pressure rank
Bacaba [31450S,700130W]-MOC[a]	113	2,957	11.6	1
Pucacuro [31470S, 701120W]-MOC	165	3,657	7.8	2
Agua Blanca [31410S, 701200W]-SM[b]	180	6,139	12.5	3
Agua Pudre [31430S, 701180W]- SM	369	13,956	6.7	4

[a]MOC: Mocagua.
[b]SM: Martı´n.

TABLE II. Focus Group Participant Demographics, Mocagua (n5511) and San Martı´n (n5480), Southern Colombian Amazon

Focal group	Age group	Mocagua		San Martı´n	
		n	% of population[a]	n	% of population
Children	5–14	70	31	44	18
Males	15–59	12	8	6	6
Females	15–59	17	15	23	19
Elders	60+	11	52	17	74
Total		**110**	**22**	**90**	**19**

[a]Data from Reyes [unpublished].

domestic animals under six categories to determine the uses and importance of vertebrate taxa (mammals, birds, fish, reptiles, and amphibians) [Mena et al., 2000]. Categories were chosen according to their relevance in Tikuna life. These were food, pets, medicine, crafts, tourism, and folklore. To eliminate discrimination through illiteracy during these activities, pictorial charts were made using pictures of a selection of animals present in the area [Sheyvens & Storey, 2003]. It was ensured that at least one person in each group was able to write. They were nominated scribe when compiling the lists. At the end of each session, all the main points were summarized and fed back to the group, offering an opportunity for knowledge sharing and discussion [Morgan & Spanish, 1984].

Participant observation

Occurrences of human–primate interactions in the home (e.g. pet-keeping, use in traditional medicines, and crafts) and forest (e.g. during hunting trips and expeditions with tourist groups) were recorded through direct observation and participation by HP. This method allowed the researcher to become acclimated to the cultural setting, build rapport with informants, and understand local culture from the insider's perspective [Collings, 2009]. Semi-directive interviews [Huntington, 1998] during social visits acted as a catalyst for relaxed discussions with children and young people, men, women, and village elders. This approach encouraged people to talk openly about social, cultural, and economic influences, and provided a context from which to analyze data sets.

Data Analysis

Estimates of population densities

From data obtained during the line transect surveys, only visual detections were included in analyses, with the exception of howler monkeys, a species for which acoustic cues are the most effective method of detection owing to their cryptic habits in Amazonia [Defler & Pintor, 1985]. Data were analyzed with the software DISTANCE 5.0, using the half normal and uniform models with cosine adjustment [Buckland et al., 2001; Thomas et al., 2005]. When observation numbers were greater than 20, unstratified analyses were derived [Buckland et al., 2001].

With sample sizes of less than 20, all the observations for each species were pooled in order to post-stratify the global model to derive new detectability models and therefore new density estimates by site [C. Peres, personal communication].

In order to improve the reliability of the estimates, perpendicular distances were truncated in order to avoid outliners. The truncation was based on the lowest Akaike's Information Criterion values and the best fit of curve. In most cases, truncation was made at 10% [L. Thomas, 2009, personal communication]. In order to obtain average population densities (ind/km2) at each site, group densities derived from DISTANCE 5.0 were multiplied by the mean group size calculated from reliable group counts. Following Peres [1993, 1997], biomass was calculated by multiplying 80% of adult body weight, estimated as the midpoint of the average weights reported in Emmons [1999] and Peres [1997] for males and females. Diurnal primate species were ordered by increasing adult body mass and were grouped in three size categories:

Small-bodied species (o1.5 kg): Pygmy marmoset (Cebuella pygmaea), black-mantled marmoset (Saguinus nigricollis), squirrel monkey (Saimiri sciureus), and titi monkey (Callicebus torquatus).

Medium-bodied species (1.5–4.0 kg): Saki monkey (Pithecia monachus) and white fronted capuchin (Cebus albifrons).

Large-bodied species (44 kg): Red howler monkey (Alouatta seniculus) and woolly monkey (L. lagothricha) [Peres & Dolman, 2000].

RESULTS

Harvest of Primates and Dietary Assessment

A total of 2,101 hunting events were registered at Mocagua and San Martı´n, with a total extracted biomass of 26,708 kg. Mammals represented 94% of the total extracted biomass, whereas birds and reptiles represented only 2 and 4%, respectively. From the total harvest of mammals (1,713 kg) (Table III), only

TABLE III. Total Harvest of Mammals at Mocagua and San Martı´n, ANP, Presented by Mammal Order

Order	Mocagua			San Martı´n		
	Total harvest	Total extracted biomass (kg)	No. harvested	Harvest biomass (kg)	No. harvested	Harvest biomass (kg)
Artiodactyls	350	8,383.1	73	1,566.2	277	6,816.90
Carnivores	88	361.3	39	161.5	49	199.80
Perissodactyls	65	7,358.0	13	1,471.6	52	5,886.40
Primates	94	345.1	38	120.7	56	229.20
Rodents	936	7,299.2	309	2,453.5	627	4,845.70
Xenarthrans	180	1,395.1	74	459.6	106	935.50
Total	**1,713**	**25,141.8**	**546**	**6,233.1**	**1,167**	**18,913.50**

TABLE IV. Primates Harvested from February 2005 to February 2009 in Mocagua and San Martı´n, ANP

Primate species	Average body weight	Total harvest	Total extracted biomass (kg)	Hunted monkeys by study site				Extracted biomass by study site (kg)			
				San Martı´n		Mocagua		San Martı´n		Mocagua	
				AB	AP	BAC	PUC	AB	AP	BAC	PUC
Small body size (01.5 kg)											
Saguinus nigricollis[a]	0.6	6	3.6	0	5	0	1	0.0	3.0	0.0	0.6
Saimiri sciureus[a]	1.4	11	15.4	0	6	2	3	0.0	8.4	2.8	4.2
Medium body size (1.5–4.0 kg)											
Aotus spp.	1.6	22	35.2	4	8	8	2	6.4	12.8	12.8	3.2
Callicebus torquatus	2.2	12	26.4	0	5	2	5	0.0	11.0	4.4	11.0
Pithecia monachus	2.8	6	16.8	0	4	2	0	0.0	11.2	5.6	0.0
Cebus albifrons	3.5	7	24.5	2	2	2	1	7.0	7.0	7.0	3.5
Large body size (44.0 kg)											
Alouatta seniculus	6	18	108.0	0	9	4	5	0.0	54.0	24.0	30.0
Lagothrix lagothricha	9.6	12	115.2	3	8	1	0	28.8	76.8	9.6	0.0
		94	345.1	9	47	21	17	42.2	184.2	66.2	52.5
Total per community					56		38		226.4		118.7

[a]Weight obtained from Emmons [1999].
Extracted biomass was estimated using the average body weight of hunted animals, including females and males from all age classes at Mocagua and San Martı´n.

94 primates were registered, with an extracted biomass of 345 kg (Table IV). Hunting records included only bushmeat eaten in the communities, excluding hunting by outsiders, loggers, consumption during hunting trips and meat sold to the nearest municipality, Puerto Narin˜o. Primates were absent from corresponding dietary records in Mocagua and appeared on only three occasions in records supplied by San Martı´n, suggesting some inconsistencies with hunting data. Bushmeat consumption comprised 30% of the local diet in Mocagua and 37% in San Martı´n. This is relatively low in comparison to fish which represented 460% for both communities (Table V). Subjects identified bushmeat as a highly valued food source in both communities, despite its moderate consumption indicating resource harvest may be driven by availability rather than preference. Participants reported that food was the most important use for local vertebrates. Bushmeat accounted for 79 and 84% of the items on the list of species identified as ''food'' by focus groups from Mocagua and San Martı´n, respectively (Table VI).

Primate Communities and Population Densities

A total of 895 visual detections of primates were recorded at Mocagua and San Martı´n (Table VII). The aggregate population density at each community did not present significant differences. Primate population densities in Mocagua (183 ind/km2) and San Martı´n were very similar (179 ind/km2). However, collective biomass showed marked variations between communities. Mocagua had a total primate biomass of 398 kg/km2, where large-bodied primates made up 70%, whereas large-bodied primates constituted 22% of the total biomass in San Martı´n (199 kg/km2).

Large-Bodied Species

In the large-bodied primate size class, estimated total densities at Mocagua were significantly higher than those at San Martı´n (43 and 8 ind/km2, respectively) (Fig. 2). Unexpectedly, the moderately hunted site (rank 2) at Mocagua (Pucacuro) contained the highest biomass across all sites (136 kg/km2). Densities of L. lagothricha at Pucacuro represented 43% of the total biomass of large-bodied primates. Mocagua accounted for 85% of the total aggregate biomass of large-bodied primates in overlapping areas at ANP. During the 33 months, L. lagothricha was detected only once at Agua Pudre (a heavily hunted site rank 4) (Table VII).

Primates as Food

Adult and child participants from both communities identified howler monkeys (A. seniculus) and woolly monkeys (L. lagothricha) as important food sources during group

exercises on species use. Dietary records showed no proof of either species being consumed during the research period, although L. lagothricha meat was observed being offered at a traditional ceremony on one occasion in San Martı´n. Primate meat was consumed very rarely in San Martı´n (n53) and never in Mocagua. During group discussions with women (n540), the majority of participants suggested that primate meat is still considered an important protein source in the community, but people's diets are changing in accordance with resource availability. Kinkajous (Potos flavus), three-toed sloths (Bradypus variegatus), and two-toed sloths (Choloepus didactylus) appeared in dietary records; yet, during group discussions with village elders in both communities (n528), participants suggested these meats were traditionally considered ''inedible.''

TABLE V. Percentage of Protein Consumption in 40 Different Households in Mocagua (n517) and San Martı´n (n523) for 175 days, from November 2007 to February 2009

	Bushmeat %	Fish %	Domestic %[a]	Other %[b]
Mocagua	29.6	65.1	1.3	4.0
San Martı´n	36.7	61.4	1.7	1.1

Primates as Pets

During group activities monkeys, were identified as popular pets by participants from both communities (n5200); yet, the only observations of ''primate pet-keeping'' made during the study occurred in San Martı´n. Black-mantled tamarins (S. nigricollis) were by far the most frequently captured species. During informal conversations over the course of the study, a number participants (n511) from both communities talked about having had or having known someone who had reared woolly (L. lagothricha), howler (A. seniculus), owl (Aotus vociferans), and saki monkeys (P. monachus). The most recent incidences occurred in 2007 in San Martı´n. Followup discussions with individuals (n510) suggested that infant primates were usually kept as pets following the death of their mothers, which had, typically, been hunted for food.

TABLE VI. Percentage of Edible Species Identified as Valuable Sources by Participants from Mocagua (n5110) and San Martı´n (n590) Listed According to Protein Type

	Focal groups from Mocagua					Focal groups from San Martı´n				
	Children	Males	Females	Elders	Overall %	Children	Males	Females	Elders	Overall %
Bushmeat %	46	100	81	89	79	53	95	89	100	84
Fish %	44	0	8	11	16	43	3	9	0	14
Domestic[a]%	9	0	11	0	5	5	3	2	0	2

[a]Domestic animals include chickens, pigs, and goats.

TABLE VII. Primate Population Densities and Biomass Estimates at Mocagua and San Martı´n

	Density (groups/km^2)				Density (ind/km^2)				Biomass (kg/km^2)			
	San Martı´n		Mocagua		San Martı´n		Mocagua		San Martı´n		Mocagua	
Small (o1.5 kg)												
Cebuella pygmaea	0.10	0.58	0.03	0.01	0.56	3.28	0.15	0.56	0.05	0.31	0.01	0.05
Saguinus nigricollis	4.38	6.26	6.86	5.47	23.21	30.05	34.30	29.21	8.54	11.06	12.62	10.75
Saimiri sciureus	1.04	0.47	0.70	0.57	24.55	10.20	13.90	10.04	18.46	7.67	10.45	7.55
Callicebus torquatus	10.00	4.80	2.24	2.30	31.20	14.98	6.88	6.90	29.95	14.38	6.60	6.62
Medium body size (1.5–4.0 kg)												
Pithecia monachus	2.46	3.29	3.80	1.46	9.84	13.16	15.62	5.34	17.32	23.16	27.49	9.40
Cebus albifrons	0.78	0.42	1.25	0.78	7.58	2.52	11.51	5.11	16.98	5.64	25.79	11.44
Large body size (44.0 kg)												
Alouatta seniculus	0.48	0.89	2.43	1.48	1.80	4.01	10.06	7.03	9.36	20.83	52.31	36.56
Lagothrix lagothricha	0.12	0.03	0.80	0.87	1.77	0.44	11.68	14.27	12.30	3.05	81.29	99.31
Total	19.36	16.74	18.11	12.94	100.51	78.64	104.10	78.46	112.96	86.10	216.56	181.68

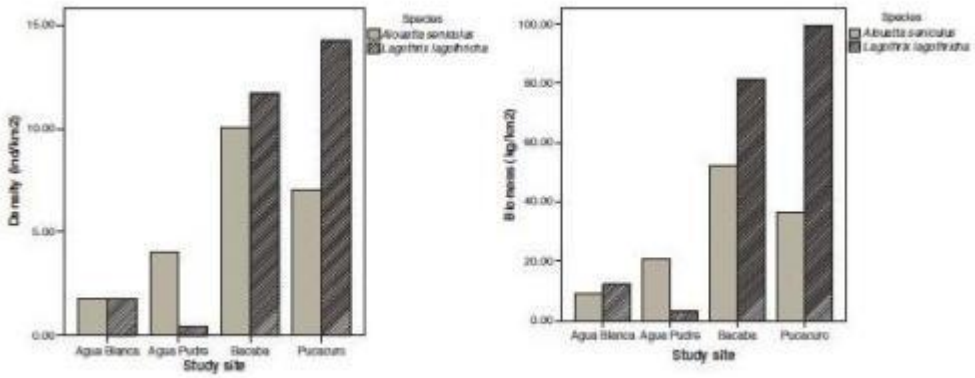

Fig. 2. Density and biomass of large-size primates at Mocagua (Bacaba and Pucacuro) and San Martı´n (Agua Blanca and Agua Pudre), Southern Colombian Amazon.

Primates in Medicine and Crafts

Adult (n558) and child participants (n5111) from San Martı´n and Mocagua described primate pelts being dried and stretched to make traditional drum skins, during focus group activities. Drummaking was observed on two occasions in San Martı´n using skins from P. monachus, but never in Mocagua. Informants from Mocagua said that most people do not know how to make or play drums and, therefore, no longer use animal skins for this purpose. The only other utilization of monkey parts, referred to during this exercise, was the use of howler monkey throat sacs as a medicinal cure for laryngitis, but there was no evidence that this activity still takes place in either community.

Primates in Tourism

Participant responses and our observations suggest that tourism is one of the most important economic opportunities for local people in the area. Local people are aware of the benefits of conserving wildlife and children are learning about conservation in schools. Focus groups of all ages and from both communities classified primates as being important for local tourism, recognizing the possible economic gain in protecting wildlife and attracting tourists to the area. During class discussions in Mocagua, children suggested monkeys were popular with tourists because people liked to see animals they could not encounter at home, and monkeys are not dangerous or ugly unlike some species, such as jaguars (Panthera onca), boas (Boa constrictor), and frogs (e.g. Phyllomedusa spp.). Several children in Mocagua proceeded to express an understanding of biological conservation, commenting on the survival of primates and forest conservation.

Primates in Folklore

It was suggested by some participants that nonhuman primates still hold a significant place in Tikuna culture, particularly for elders. Village elders spoke about the importance of sustaining primate populations with respect to traditional beliefs and folkloric representation. One example, provided by a village elder from San Martı´n, was the key role of primates during the Pelazo´n ceremony—a festivity to celebrate the first menstruation of young women in the community. To initiate the ceremony, a member of the community, adorned in traditional costume made from chambira (a palm fiber dried and woven tightly, to make a strong parchment which can be cut and sown) to represent a white-fronted capuchin monkey (C. albifrons), performs a humorous dance. White-fronted capuchin symbolizes an important character from Tikuna folklore—a monkey who kidnaps a young girl from her community and keeps her trapped in the forest forever. Performances such as these portray primates as intelligent and jovial characters, fostering a respect for the species among local people, which can have a positive outcome for conservation.

DISCUSSION

Hunting Practices and Food Choice

A lack of veracity was reflected in the harvest data, mainly from the San Martı´n community. For instance, hunted primates were not reported in the data sheets by the local co-investigators, but were recorded by AM or volunteers while staying at the community. This occurred most commonly where hunting was carried out by relatives of those recording the data. Similarly, women's dietary records did not match hunting records. Hunting records showed 38 primates were hunted in Mocagua and yet their

consumption did not appear in the local dietary logs kept by women. These findings suggest that control systems ruled by kinship ties may reduce data reliability [Garcia & Lescuyer, 2008] and highlights the benefits of using a combination of methods. Conversations with local hunters confirmed that primates are still eaten on occasion, but people are more selective according to the perceived benefits of harvesting or conserving species. In Mocagua, women discussed how L. lagothricha was considered a prized protein source, but is no longer hunted owing to local decisions to protect the species for wildlife conservation and tourism.

Another factor influencing the harvest of primates is adaptations in people's daily activities. Participants from Mocagua suggested that fishing is favored above hunting nowadays, as it is less time consuming and less dangerous. Additionally, many elder participants felt that young people have lost their connection with the forest and are unwilling to learn how to hunt, as most are distracted by finding careers in tourism or commerce. Although it may be true that certain traditional activities have become less of a priority, many young people are beginning to take more of an interest in the conservation and management of the forest, as a result of being involved in research projects and through jobs in ecotourism. During the study, it became evident that school children in Mocagua are fostering a capacity for forest conservation through school lessons and contact with the local primate rescue center.

Local Perceptions of Primates

The community's decision to protect woolly monkeys appears to be having a powerful influence on the perceptions of people in Mocagua toward primates.

Although primates are still considered an important source of protein, consumption records were low. This may be explained by the suggestion that rare foods are considered more valuable than foods which are readily available [Mena et al., 2000]: meat was eaten less frequently than fish, and yet ranked higher in food choice. Alternatively, it may indicate a reluctance to eat primate meat with respect to the community's decision to sustain primate populations and benefit through alternative activities. A number of studies suggest local people have little interest in resource management and monitoring when introduced by external stakeholders [e.g. Poulsen & Luanglath, 2005, in Laos; van Rijsoort & Jinfeng, 2005, in China]. Locally driven resource management, on the other hand, creates a sense of autonomy amongst those involved, reflect in people's moralistic judgment, and their daily interactions and coexistence with other species.

Cultural adaptations and the loss of traditional beliefs also affect people's perceptions of animals. With relation to food consumption, elders spoke of how deer (Mazama sp.) were once feared by their ancestors, according to their representation of demonic iconography in Tikuna folklore. People were afraid to eat deermeat, and yet during the study both grey and red deer were witnessed as popular food choices in both communities. Similarly, as one of the few remaining villages that still performs the Pelazo´n, the community of San Martı´n stands alone in considering primate meat an important offering in this ceremony.

Although it was suggested that people no longer know how to make drums in Mocagua, children and adults were able to categorize primate pelts as being the most suitable material for this purpose. Primate skins are acquired as a by-product of hunting; therefore, the absence of traditional drum making could be explained as a consequence of the hunting ban. In fact, the only drums observed in Mocagua were made from synthetic materials bought from the nearby town of Leticia. In contrast, pelts from P. monachus were observed being used as drum skins in San Martı´n. It is also likely that few people keep primate pets in Mocagua as a result of the hunting ban. Pet-keeping usually takes place as a by product of hunting, i.e. offspring of mothers hunted for meat are taken back to the community to be reared [Peres, 1990, 1991], so less hunting reduces the opportunities to capture primate infants. These findings suggest that people in San Martı´n not only consider primates important for their meat, but primates are also fundamental for their use in traditional activities, such as crafts, ceremonies, and pet-keeping.

Limitations

The use of focus groups provided access to key individuals of various ages and backgrounds; however, two limitations were identified with this method. During focus group sessions, some participants were domineering, thereby minimizing contributions made by other individuals. This was especially true when working with mixed-sex/age groups of children, but owing to restrictions on staff availability and space these limitations were unpreventable. Activities took place in the school and typically consisted of boys and girls of various ages and abilities being taught in one classroom. It was noticed among adult focus groups that existing relationships between individuals caused some participants to self-censor remarks given in the presence of others. This was dealt with as best as possible by researchers intercepting particular individuals on occasion for one-to-one exchanges but, again, was largely unavoidable owing to cultural norms.

CONCLUSIONS

Bearing in mind that forest structure and soil fertility are homogenous in the southern part of ANP

[Rudas et al., 2005], our results suggest that hunting pressure seems to be the main cause for differences in primate biomass between Mocagua and San Martı´n. This argument is supported by historical data: elder hunters from both communities affirmed that woolly monkeys were common 30 years ago no more than 3 km from their communities, and atelines were more heavily targeted during the early 1900s, as they were used as bait for hunting big cats during the skin trade. This was also reported by Defler [1983] in the Miritı´-Parana´, Colombian Amazon.

Mocagua's ban on hunting L. lagothricha has been applied for 6 years. Already, the total primate biomass in the vicinity of Mocagua is twice that of San Martı´n (398–199 kg/km2, respectively). Although the current time period is too short to assume the recovery of large-bodied primate populations as a direct result of the hunting ban, current density and biomass assessments in Mocagua indicate that primate groups are once again using an area of forest earlier unutilized owing to high hunting levels. When compared with earlier studies in the area, these indications also appear to be true. A 4-month study conducted by van Leijsen and Vleut [2005] in Mocagua in 2004, reported densities of L. lagothricha as 3.2 ind/km2, whereas a 12-month study carried out 4 years later [Barrera et al., 2008] found L. lagothricha densities to have increased up to 4.3075.33 ind/km2. Both studies employed line transect methods. This evidence supports the suggestion that selective hunting assists the success of large bodied primates [Cowlishaw & Dunbar, 2000; Peres, 1990, 1991].

The income resulting from protecting biodiversity often fails to ensure sufficient economic gain for local people [Garcia & Lescuyer, 2008]. Placing a hunting ban on L. lagothricha provides revenue for people from Mocagua through tourism. Additionally, 90% of the staff employed at the visitor's lodge and restaurant are from Mocagua [PNNA, 2006]. This has allowed people to make the transition from a traditional community dependent on forest resources to one economically supported by local tourism. San Martı´n's geographical location fails to provide these opportunities, as few alternative economic benefits are accessible.

This situation in Mocagua provides an example of short-term human–primate coexistence. Resources are being successfully managed, meeting the requirements of local people and assisting in the conservation of preferred prey species. However, cultural adaptation is occurring at a high rate in both communities. As traditional knowledge is lost and replaced, the values associated with wildlife utilization are transformed. The situation is volatile, influenced by numerous extrinsic and intrinsic factors prone to continuous change. Care needs to be taken, therefore, in the management and ongoing assessment of these resources, to ensure their long term viability.

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