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Conservation Implications of Primate Hunting Practices Among the Matsigenka of Manu National Park

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Introduction

Much ink has been spilled recently in the debate over whether indigenous people are "ecologically noble savages" — natural-born conservationists — or whether they pose a threat to biodiversity in the Amazon and other ecosystems (Redford, 1991; Alcorn, 1993; Alvard, 1993; Redford and Stearman, 1993; Robinson, 1993; Terborgh, 1999; Schwartzman *et al.*, 2000). Tropical biologists and ecological anthropologists alike have brought important empirical data and theoretical perspectives to the debate, including estimates of game animal densities, rates of harvest and consumption by indigenous and other hunting communities, alteration in species composition and depletion or extinction of vulnerable species under different intensities of hunting, and models to estimate sustainability of hunting practices and catchment area sizes (Hames, 1980; Hames and Vickers, 1982; Bodmer *et al.*, 1988; Peres, 1990; Mitchell and Ráez-Luna, 1991; Vickers, 1991; Bodmer *et al.*, 1994; Robinson and Redford, 1994; Ráez-Luna, 1995; Alvard *et al.*, 1997).

Though often overlooked, the sociocultural, economic and political dimensions of hunting and resource use are also critical for assessing sustainability and establishing management and conservation strategies (Campos *et al.*, 2001; Ráez-Luna, 2001; Shepard, 2002). In this paper, we present data on the species preferences and sex ratios of primates taken by a sample of Matsigenka hunters during a one-year period. We also note sociocultural beliefs and practices relevant to primate hunting among the Matsigenka (see Shepard, 2002), and provide suggestions for long-term monitoring and community-based management of game animals in these and other native communities.

Research for this paper was carried out in the Matsigenka native community of Yomybato, approximately 450 m above sea level on a small tributary that joins the Río Manu some 30 km upriver from the Cocha Cashu Biological Station (EBCC), located in Manu National Park, Department of Madre de Dios, southeastern Peru (Terborgh, 1990). The vegetation around Yomybato is mostly *terra firme* forest, dissected by streams (Shepard *et al.*, 2001).

The Matsigenka are an indigenous people numbering more than 11,000, distributed among some three dozen small communities settled throughout tributaries of the Ríos Urubamba, Madre de Dios and Manu. During the 1960s, an American Protestant missionary organization contacted isolated populations throughout Madre de Dios and settled them in the community of Tayakome on the upper Río Manu (d'Ans, 1981). After the creation of the Manu National Park in 1973, the missionaries were expelled by the Peruvian government, as their commercial activities (sale of animal pelts to support operations) and provisioning (with shotguns, ammunition, Western clothes and medicines) among the Matsigenka were seen as contrary to the park's goals of natural and cultural preservation. The small airstrip and bilingual school at Tayakome were abandoned, while shotguns, commercial extraction, and other market economic activities were prohibited. About half of the approximately 200 Matsigenka in Tayakome at that time accompanied the missionaries on their exodus from Manu to the adjacent Río Camisea. Driven by internal social conflict, as well as fear of attacks by the hostile Nahua (Yora) people of the Manu headwaters, another segment of the population left Tayakome around 1978 to establish the community of Yomybato, some 30 km inland from Tayakome up the tributary stream Quebrada Fierro or *Yomuivaato* (see Shepard *et al.*, in press, for a detailed history). The community of Yomybato has grown from 92 inhabitants in 1986 to 218 in 2005, owing both to population increase and migration

Table 1. Non-human primate species of Manu; for more information see Pacheco *et al.* (1993).

English Common Name	Matsigenka Name	Latin Name	Hunting Preference	Weight (kg)
Spider monkey	*Osheto*	*Ateles paniscus*	High	7.5 – 13.5
Woolly monkey	*Komaginaro*	*Lagothrix lagotricha*	High	3.6 – 10.0
Red howler monkey	*Yaniri*	*Alouatta seniculus*	Medium	3.6 – 11.1
Brown capuchin	*Koshiri*	*Cebus apella*	Medium	1.7 – 4.5
White-fronted capuchin	*Koakoaniro, Makere*	*Cebus albifrons*	Medium	1.2 – 3.6
Squirrel monkey	*Tsigeri*	*Saimiri boliviensis*	Medium	0.6 – 1.4
Owl monkey	*Pitoni*	*Aotus nigriceps*	Medium	0.8 – 1.2
Monk saki	*Maramponi*	*Pithecia irrorata*	Low	2.2 – 2.5
Dusky titi	*Togari*	*Callicebus brunneus*	Low	0.9 – 1.4
Saddleback tamarin	*Potsitari tsigeri*	*Saguinus fuscicollis*	Low	0.3 – 0.4
Emperor tamarin	*Tsintsipoti, Chovishishini*	*Saguinus imperator*	Low	0.4
Goeldi's monkey	*(Marapito?)*	*Callimico goeldii*	Low	0.5
Pygmy marmoset	*Tsigeriniro, Tampianiro, Tampiashitsa*	*Cebuella pygmaea*	Low	0.1 – 0.2

from isolated Matsigenka settlements in the Manu headwaters (Ohl, 2004).

Manu National Park hosts thirteen non-human primate species (Terborgh, 1983; Emmons and Feer, 1990; Pacheco *et al.*, 1993; Shepard, 2002; see Table 1). Of these, spider monkeys and woolly monkeys are preferred by Matsigenka hunters. Howler monkeys and two species of capuchins are also hunted, but less frequently, while the owl monkey is considered a delicacy by some hunters. Other small primate species such as squirrel monkeys, emperor and saddle-back tamarins, dusky titis and monk sakis may be taken on occasion, either as substitute prey on unsuccessful forays or by younger or less skilled hunters. An unidentified primate species known as *marapito* (possibly the rare Goeldi's monkey) is also taken occasionally. The tiny pygmy marmoset has never been observed to be hunted, and is attributed magical powers by some hunters.

Due to the firearms prohibition, the Matsigenka hunt mostly with palm-wood bows and bamboo-tipped arrows, using visual and auditory cues to locate monkey troops. Hunters also exchange information about recent sightings. Hunters imitate woolly and spider monkey calls well enough to elicit responses or even attract naïve troops. Upon encountering a monkey troop, hunters try to position themselves for a nearly vertical shot as high as 30 m. Hunters try to pick out the large adult males or *kurakas* (a Quechua loan word meaning "leader") as targets for their first arrows. If the first arrow does not hit the animal in the chest, or if the troop is scared off, the hunter must pursue the fleeing animals, often targeting the slower-moving females burdened by young. Even fatally wounded monkeys are often able to climb into a tall tree and get a firm grip on a branch, and hence do not fall when they die. Hunters frequently recover their prey by climbing high into the canopy, and falls causing severe injuries or death are known to happen. Other noted hunting accidents include being struck by a stray arrow and snakebite (Shepard, 1999a; Izquierdo and Shepard, 2004).

Methods

This study uses a participatory methodology of hunting returns that has been used with success elsewhere (Bodmer, 1994; Townsend, 1997). In December 1998, we asked three Matsigenka bow hunters, living in two different settlements in Yomybato (one near the central village area, one at a distance of some 6 km), to store the skulls of all mammals hunted and killed for the ensuing year. We returned to the community in December 1999 to collect the data and evaluate the success of the exercise. We did not pay the informants on a per-skull basis or offer other incentives that might distort hunter effort. However, upon our return, we did give a nominal, unsolicited reward, a kitchen knife or machete, in appreciation of the informants' efforts. Da Silva examined and photographed each set of skulls and carried out an interview with the hunters (translated from the Matsigenka by Shepard) concerning the species, sex, age class, and approximate kill date for each skull. The hunters were frequently able to remember, in the case of female animals, whether they were pregnant or burdened by young when hunted.

We present here only the data on primate species preference. We had initially planned, following Bodmer (1994), to study species preferences for all large animals based on skull collection data. However, this proved difficult because of sociocultural beliefs and practices specific to the Matsigenka. Matsigenka men do not eat meat from the heads of animals they themselves have killed, believing that they will "lose their aim" if they do so (see Shepard, 2002). For this reason the heads of large ungulate prey are frequently gifted to close kin to "suck/finish off the meat of the head" (*tsogitotagantsi*). This practice resulted in all three hunters' ungulate skull collections being incomplete. Because primate heads are relatively small, a hunter's wife and children can easily "suck off the meat," and the skull thus remained in the hunter's skull collection. Such sociocultural considerations are of fundamental importance in designing appropriate monitoring strategies in different local communities (see Shepard *et al.*, in press).

Results

Prey profiles

From the 1998–99 collection, we identified 17 woolly monkeys, 14 spider monkeys, three capuchins and one howler monkey, a clear reflection of Matsigenka dietary preferences (for an explanation of the low preference for howler monkeys, see the Discussion). One of the hunters continued collecting skulls from 1999 to 2000, and his profile remained similar, though there was a slight shift toward smaller species: 11 woolly monkeys, six spider monkeys, and one each of owl, dusky titi, and squirrel monkeys. Approximately ten years earlier, Alvard and Kaplan (1991) found a similar prey profile in a study by direct observation of a broader sample of hunters throughout a full year (1988–89): 24 woolly monkeys, 17 spider monkeys, three capuchins and two howlers. Following Rowcliffe *et al.* (2003), a simple way to detect game depletion—and thus unsustainable hunting at the local scale—is to assume that hunters are optimal foragers who hunt additional species as their preferred prey becomes scarce. Comparison of the two datasets reveals no significant change in prey frequencies more than a decade later (Monte Carlo RxC contingency table [Engels, 1988]: 1988–1999 data only, $p = 0.975 \pm 0.001$ s.e.; 1988–2000 data pooled, $p = 0.993 \pm 0.001$ s.e.). This is despite the fact that the population of Yomybato had grown by approximately 78% during that time, due partly to immigration from isolated Matsigenka settlements in the Manu headwaters (Ohl, 2004).

Sex ratios

In addition to their detailed memory about hunting expeditions, even months later, Matsigenka hunters also appear able to differentiate between male and female skulls of primates and other species of game animals, using cranial features such as canine size, robustness of the sagittal crest and supraorbital margins, and overall skull size (cf. Ramirez,

1988; Corner and Richtsmeier, 1993). According to the interviews with the hunters, conducted during da Silva's examination of the skulls (1998–99 data only), 13 of 14 spider monkeys killed (93%) were female. Alvard and Kaplan (1991) noted a similar pattern: females represented 15 of 17 (88%) spider monkeys taken during their observations. The pooled dataset (n = 31) finds a significant female bias (two-tailed binomial test, p = 0.026) when compared to the spider monkeys' naturally female-biased sex ratio of 73%, as registered nearby at Cocha Cashu Station on the Río Manu (McFarland Symington, 1987). For woolly monkeys, the sex ratio in our dataset was close to parity: 8 of 17 (47%), contrasting with Alvard and Kaplan's (1991) data showing 18 of 24 kills (75%) to be female. Woolly monkeys have not been well studied in Manu, but populations in Venezuela show roughly equal sex ratios varying from 80 to 120 males per 100 females (Nishimura and Izawa, 1975; Izawa, 1976; both cited in Alvard and Kaplan, 1991). Assuming an equal sex ratio, there is a weak indication that woolly monkey kills by Matsigenka hunters are female-biased (two-tailed binomial: pooled, n = 41, p = 0.088; Alvard and Kaplan [1991] data only: p = 0.015). Any female kill bias probably represents a balance between expressed hunter preference for the larger adult males and easier access to females burdened by young. We should note, however, that these sex ratios represent only successfully retrieved kills; about half of the large monkeys shot with arrows escape capture, although many of them probably die afterwards (Ohl *et al.*, in preparation). If we assume that males (larger and unburdened by young) are more likely both to be shot and to escape, then the female bias in the skull data could at least partially represent a post-shot retrieval bias, and the sex ratio of all killed animals could be closer to parity.

Discussion

Prey profile data taken more than ten years apart suggest that hunters experienced no primate prey depletion between 1988 and 2000. Following Rowcliffe *et al.* (2003), we infer that primate hunting around Yomybato village was sustainable during this time, and continues to be sustainable in 2005 (Ohl *et al.*, in prep.), despite a doubling of the Matsigenka population. In fact, large primates are still commonly hunted within five km of the central village area. During our 1999 stay, we encountered apparently naïve and unafraid spider monkeys at a distance of only eight km from the central village area, and less than two km from the nearest household-garden compound. These observations support the suggestion that primate populations are sustained by immigration from troops living in adjacent, non-hunted areas (Alvard *et al.*, 1997; Novaro *et al.*, 2000; Peres, 2001; Peres and Nascimento, in press; Shepard *et al.*, in press). It is well-established in ecological theory that predator-prey dynamics are stabilized by prey refuges (May, 1978; Joshi and Gadgil, 1991; Lewis and Murray, 1993), and much of the rest of Manu Park appears to be such a refuge.

This conclusion contrasts with the results of calculating sustainability via the standard method of estimating minimum catchment areas (Robinson and Redford, 1991). We calculate a catchment area estimate using Alvard and Kaplan's (1991) data for a historical Matsigenka population of approximately 105 people for Yomybato only, and then extrapolate to the current total Matsigenka population of 420 in the two settled communities of Manu Park, Tayakome (not studied by Alvard and Kaplan) and Yomybato. The catchment area is defined as the area needed to sustain the *per capita* consumption rate reported in Alvard and Kaplan (1991), assuming the maximum sustainable harvest rates from Robinson and Redford (1991). The measured *per capita* consumption rate is doubled in order to count wounded but escaped animals that eventually die (see Ohl *et al.*, in prep.).

According to these calculations, a Matsigenka population of 105 people (Yomybato only) would have needed 7.0% and 4.3% of Manu Park to support their offtake of woolly and spider monkeys, respectively. (Note that the park covers an area of 17,165 km^2, larger than the U.S. state of Connecticut.) By linear extrapolation, the current population of 420 (Tayakome and Yomybato) should be using 28.0% and 17.2% of Manu Park, respectively. These are large numbers, and they project that at least all of Manu Park would be needed to sustain spider monkey offtake for a population of merely 1500 human consumers. Given that several isolated indigenous groups currently reside within park boundaries, and that nine Westernized native communities are situated around the park's borders (see Shepard *et al.*, in press), the number of human consumers currently exploiting the park's game animal resources certainly approaches if not exceeds 1500. Thus, we might expect that spider monkeys, at least, should already show signs of large-scale depletion. However, the results presented here, as well as ongoing participatory research with Matsigenka hunters (Shepard *et al.*, in press; Ohl *et al.*, in prep.), provide no such evidence.

Clearly, a linear extrapolation does not take into account the fact that human hunters are central-place foragers, typically traveling less than six km from their homes on hunting forays (Ohl *et al.*, in prep.). An important implication is that for each game species, the rate of mortality due to hunting should scale up more slowly than does human population growth, eventually stabilizing at a level equal to the rate of immigration of animals from the "source" populations (non-hunted areas of the park) into the "sink" of the hunting zone (see also Sirén *et al.*, 2004). Such source-sink dynamics are credited with maintaining viable game animal populations within the larger indigenous reserves across the Amazon, despite local hunting pressure (Novaro *et al.*, 2000; Peres, 2001; Peres and Nascimento, in press). Manu and other large parks in the Amazon almost certainly act as game refuges, contributing to the food security of any native inhabitants or neighboring human populations, though this important benefit is rarely acknowledged by local peoples (who tend to see parks as hindering their economic interests) or conservation scientists and policy-makers (who would rather not think about charismatic megafauna going to the soup pot; see Shepard, 2002).

Certain native beliefs and practices reflect traditional socio-environmental concepts that have conservation implications (Posey, 1999). This is especially the case for primates, many species of which have mythological or symbolic importance and are subject to taboos, restrictions or dietary avoidance among diverse Amazonian peoples (Shepard, 2002; Cormier, in press). Matsigenka hunters mostly avoid taking woolly and spider monkeys from the peak dry season (July–August) through the early rainy season (November–December) when fruits are scarce and monkey meat is lean and tough, and thus likely to provoke disparaging comments by their wives. Instead, monkey-hunting is concentrated in the late rainy season and beginning of the dry season (March–June) when monkeys are fat. The Matsigenka believe that certain monkeys (especially large adult males) and other game animals have vengeful spirits that can "take revenge" on the hunter's family, causing illness to young children. Matsigenka women use special fragrant herbs to protect newborn babies from the musk-smelling, vengeful spirits of monkeys and other game animals (Shepard, 2004). Hunters may also practice sexual abstinence, behavioral taboos, and ritual purification by purgative and hallucinogenic plants in order to ensure "good aim" (*kovintsari*) and to maintain good relations with the invisible spirits who guard and multiply game animals (Shepard, 1998, 1999b).

Such beliefs imply a system of checks and balances between humans and the natural world, implicit in many Amazonian cosmologies (Reichel-Dolmatoff, 1976). A good example of how culture impinges on hunter behavior is found in the case of the howler monkey (see also Shepard, 2002). Based on a specific mythical narrative, Matsigenka hunters often refer to howler monkeys as shaman/sorcerers (*seripigari*). This represents a somewhat humorous reference to the howler's loud "singing," but also implies a potential threat on the spiritual level. Howler monkeys are also considered to be lazy; this undesirable character trait could be passed on to children who consume their meat. In more practical terms, howler monkeys are also known to be infested with botfly larvae, rendering their meat less attractive. Together, these beliefs and attitudes result in a greatly reduced hunter preference for howler monkeys, despite body weights comparable to spider and woolly monkeys and high local abundance. (Authors' personal observations: howler monkey troops can be heard vocalizing near many Matsigenka settlements in Manu.)

In short, culturally mediated beliefs and practices affect hunter behavior, sometimes in ways that run contrary to "optimal foraging" analyses based solely on protein or caloric profitability (e.g., Alvard and Kaplan, 1991; Alvard, 1993). Thus, traditional socio-environmental concepts could provide the ideological framework for future conservation measures (Shepard, 2002). Still, long-term sustainable management of game animals will require policy intervention by the Manu Park administration as well as commitment and participation by the Matsigenka themselves (Shepard *et al.*, in press). An understanding of hunting practices, hunter preferences, and their sociocultural underpinnings will be crucial in developing and maintaining a productive dialogue on game management and primate conservation.

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