A Survey of the Large Mammal Fauna of the Kwamalasamutu Region, Suriname

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Chapter 12

A survey of the large mammal fauna of the Kwamalasamutu region, Suriname

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INTRODUCTION

Historically, humans have used animals for food and a variety of other uses (Leader-Williams et al. 1990; Milner-Gulland et al. 2001). Examples all over the world show the effects of over-hunting from humans, causing population declines and extinction (Diamond 1989). Overexploitation was almost certainly responsible for historical extinctions of some large mammals and birds (Turvey and Risley 2006). Large mammals are more sensitive to hunting due to their slow reproductive rates, long development and growth times, and large food and habitat requirements (Purvis et al. 2000; Cardillo et al. 2005). Today, roughly two million people depend on wild meat for food or trade (Fa et al. 2002; Milner-Gulland et al. 2003), yet the majority of hunting is unsustainable (Robinson and Bennett 2004; Silvius et al. 2005).

Subsistence hunting of terrestrial vertebrates is a widespread phenomenon in tropical forests (Robinson and Bennett 2000). In many parts of Latin America, cracid (Aves: Cracidae) populations are declining (Thiollay 2005). Subsistence hunting is an important cause of these declines (Thiollay 1989; Ayres et al. 1991; Silva and Strahl 1991; Strahl and Grajal 1991; Vickers 1991; Hill et al. 2003). The direct impacts of hunting on animal populations and the subsequent effects of exploitation on the ecosystem make attaining sustainable harvests an international conservation priority (Fa et al. 2003; Milner-Gulland et al. 2003; Bennett et al. 2007). Thus, the first step in making harvests more sustainable is to determine current levels of harvest (Milner-Gulland and Akcakaya 2001).

Mammals as a group provide the main protein source for indigenous peoples of Amazonia. Indigenous tribes have lived in Amazonia for tens of thousands of years (Redford 1992) and many, including the Trio of Suriname, still remain within the forest and hunt mammals actively. Abundances of large mammals have decreased in areas where they have been hunted (Peres 1990; Cullen et al. 2000; Hill et al. 2003). Unmanaged hunting is commonplace in the Amazon and tends to deplete game populations, often to levels so low that local extinctions are frequent (Redford 1992; Bodmer et al. 1994). Overhunting then becomes a double-edged threat: to the biodiversity of the tropics and to the people that depend on those harvests for food and income.

At the present time, little information is available on the occurrence, spatial variability in richness, and sensitivity to hunting and other disturbances of medium and large mammals in Suriname. The goal of this survey was to assess the diversity and abundance of medium- and large-bodied mammals in the Kwamalasamutu region.

METHODS AND STUDY SITES

We surveyed medium- and large-bodied mammals by means of three main methods: camera trapping, searching for scat and animal tracks, and making visual and aural observations. We also characterized hunting habits of the Trio through interviews with residents of Kwamalasamutu.

Camera traps were set 500 meters apart along hunting and game trails, some of which were cut shortly before the RAP survey. The camera traps operated day and night, photographing all ground-dwelling mammals and birds that walked in front of them. Camera traps were attached to trees approximately 30 cm above the forest floor.

At the Kutari site 25 camera traps were set up, divided over 4 trails, and run for a total of 181 camera trap days. At the Sipaliwini site 12 camera traps were set up, divided over 3 trails, and were active for a total of 104 camera trap days. At Werehpai, there was no trail cutting due to preexisting trails and 10 camera traps were set up along 2 trails and run for 304 camera trap days. Cameras were placed in different habitats at each of the study sites. At the Kutari site 15 camera traps were set up in terra firme, five in swamp, four in flooded forest and one in a dry creek bed. At the Sipaliwini site nine camera traps were set up in terra firme, two in swamp and one in a creek. At the Werehpai site, eight cameras were set up in terra firme and two near creeks. Elevations of camera trapping points were similar among the three sites, ranging between 213 and 278 meters.

Photographs from camera traps were identified to species, and independent photographs were used as single occurrences for analysis. Independent photographs were those from different species or individuals, or any photographs taken at least 30 minutes apart (O'Brien et al. 2003). Rarefied species accumulation curves and biodiversity indices were calculated with program EstimateS 8.2 (Colwell 2009). Occurrences from photographs were compared with the nonparametric richness estimator Chao 1 among camps, and Simpson´s Biodiversity Index was also calculated per camp (Magurran 2004). Additionally, a relative abundance index was estimated per species for every 100 trap-nights (O'Brien et al. 2003).

Tracks and scat were also recorded when walking the trails to set up and pick up the camera traps. The tracks were identified with the help of local guides that accompanied the field excursions, and the tracks that could not be identified in the field were photographed and identified with the help of field guides. Visual and aural observations were important for the primates, because this group of animals is not captured by the camera traps, have diurnal habits and do not leave tracks on the forest floor. Interviews were conducted with hunters and elders from the area. We sought information on hunting habits, frequency, weapons, and the abundance of preferred and actual prey.

RESULTS

We detected 29 species of medium- and large-bodied mammals (Appendix). We recorded 22 mammal species from the Kutari site, including all eight primate species that occur in Suriname. At the Sipaliwini site we found 18 mammal species, including four primate species; at Werehpai we found 21 mammal species including five primate species.

The large caviomorph rodents, especially Paca (*Cuniculis paca*), Red-rumped Agouti (*Dasyprocta leporina*) and Red Acouchy (*Myoprocta acouchy*), were the most frequently photographed by the camera traps (Table 1); this group was assumed to include the most common medium- and large-bodied nonvolant mammals in the area. The Brazilian Tapir (*Tapirus terrestris*) was recorded by the camera traps at all three sites and was observed by several of the RAP scientists. A large number of tracks were found on the trails, indicating that the Brazilian Tapir is common in the area.

Of the six species of cats known to occur on the Guiana Shield, the Jaguar (*Panthera onca*), Puma (*Puma concolor*) and Ocelot (*Leopardus pardalis*) were found during the survey. Ocelot was the most frequently recorded cat species during this survey and is common in the area. The Jaguar and Puma were each recorded by the camera traps only once, both in the Werehpai area (Table 1). Tracks of Puma were also found at the Kutari site. It is very likely that the Jaguar also occurs in the Kutari and Sipaliwini area, but was only recorded in the Werehpai area because the trail system at Werehpai is used frequently by large cats. The Trio do not actively hunt cats, but they occasionally kill the large cats when they encounter them in the forest, because they are afraid of being attacked.

In all three camps both the Red-brocket and Grey-brocket Deer (*Mazama americana* and *M. gouazoubira*) were recorded by the camera traps and detected by tracks. Tracks of the Collared Peccary (*Pecari tajacu*) were found at all 3 camps, and this species was also recorded frequently by the camera traps. The White-lipped Peccary (*Tayassu pecari*) was only photographed once by the camera traps in the Werehpai area, and seems to be uncommon in the Kwamalasamutu region.

Three armadillo species were found during the RAP: Great Long-nosed Armadillo (*Dasypus kappleri*), Nine-banded Armadillo (*Dasypus novemcinctus*), and Giant Armadillo (*Priodontes maximus*). The Giant Anteater (*Myrmecophaga tridactyla*) was recorded by the camera traps only once at the Kutari site. Four species of ground-dwelling birds were recorded by the camera traps and observed during the RAP: Black Curassow (*Crax alector*), Grey-winged Trumpeter (*Psophia crepitans*), Variegated Tinamou (*Crypturellus variegatus*), and Great Tinamou (*Tinamus major*).

All surveys were incomplete. Species accumulation curves from photographs at the three sites show that more species could be expected to occur at the sites (Fig. 1). The Chao 1 diversity estimator confirms this, showing the expected number of species available for detection (Fig. 2). Chao 1 estimates that the survey of the Kutari site was close to completion, with less than 5% of expected species remaining to be detected. In contrast, the Sipaliwini and Werehpai site surveys appeared to be far from complete, with more than 27% of expected species at Sipaliwini and 53% at Werehpai remaining to be detected. The slope of the curve denotes the detection rate, which was highest at the Sipaliwini site (m = 0.9), followed by the Kutari site (m = 0.5) and finally Werehpai (m = 0.2; Fig. 2). This is congruent with Simpson's diversity index, for which Werehpai had the least even species abundance distribution (d = 3.4), whereas the Kutari and Sipaliwini sites had very similar and more even abundances of species (d = 8.7 and d = 9.5, respectively).

Table 1. Total independent photographs and relative abundance indices (RAI) for all vertebrate species detected by camera traps per RAP site.

	Kutari		Sipaliwini		Werehpai	
	Photos	**RAI**	**Photos**	**RAI**	**Photos**	**RAI**
Proechymis sp.	9	7.2	4	4.5	4	1.6
Neacomys sp.	3	2.4	1	1.1	1	0.4
Cuniculus paca	5	4	7	7.9	10	3.9
Dasyprocta leporina	6	4.8	6	6.7	1	0.4
Myoprocta acouchy	19	15.2	4	4.5	10	3.9
Dasypus kappleri	2	1.6	2	2.2	1	0.4
Dasypus novemcinctus	2	1.6	0	0.0	1	0.4
Priodontes maximus	0	0	1	1.1	2	0.8
Mazama americana	4	3.2	2	2.2	4	1.6
Mazama gouazoubiria	1	0.8	2	2.2	0	0.0
Metachirus nudicaudatus	3	2.4	0	0.0	2	0.8
Philander opposum	2	1.6	0	0.0	0	0.0
Didelphis marsupialis	3	2.4	1	1.1	0	0.0
Psophia crepitans	20	16	0	0.0	0	0.0
Pecari tajacu	4	3.2	2	2.2	0	0.0
Tapirus terrestris	2	1.6	0	0.0	2	0.8
Eira barbara	0	0	0	0.0	1	0.4
Nasua nasua	1	0.8	0	0.0	1	0.4
Leopardus pardalis	3	2.4	0	0.0	7	2.7
Panthera onca	0	0	0	0.0	1	0.4
Puma concolor	0	0	0	0.0	1	0.4
Total photos	**89**		**32**		**49**	

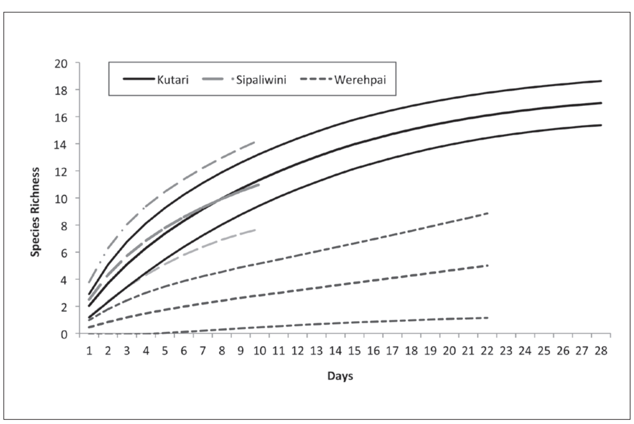

Figure 1. Observed species accumulation curves with confidence intervals (95%; upper and lower) from camera trap pictures.

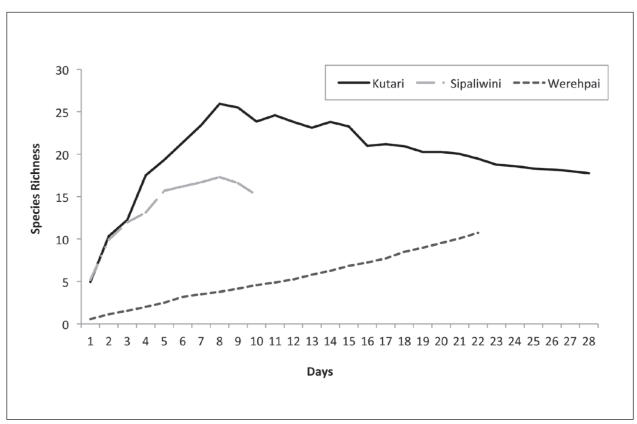

Figure 2. Chao 1 estimator of expected species to be detected by camera traps at each RAP survey site.

INTERVIEWS

The interview data provided an overview of the hunting areas, hunting techniques, frequency of hunting, and species hunted. All hunters interviewed were men from the village of Kwamalasamutu. Hunting techniques are generally learned at the age of 10–15 from the father or grandfather. Most of the interviewed men first learned to hunt with bow and arrow and later (at age 14–16) with a gun. All of the interviewed men hunt to supply their families with food, and sometimes the meat is sold on the market or given to other family members. They normally hunt once a week, and a hunting trip generally lasts one day and one night (24 hours). Hunting is done alone or with a family member or friend. Most of the hunters first go two hours by boat upstream or downstream from Kwamalasamutu, and then walk several hours into the forest to hunt. Black curassow (*Crax alector*) was the preferred species among interviewees. Other large ground-dwelling bird species, such as tinamous (*Tinamus major*; *Crypturellus* spp.) and Grey-winged Trumpeters (*Psophia crepitans*), were also favorites. Paca (*Cuniculus paca*), Collared Peccary (*Pecari tajacu*), and Red Acouchy (*Myoprocta acouchy*) were the preferred mammal species.

The most hunted mammal is the Guianan Red Howler Monkey (*Alouatta macconnelli*), because this species is easily spotted in trees along the river. Other frequently hunted species are White-lipped Peccary (*Tayassu pecari*), Red-rumped Agouti (*Dasyprocta leporina*), Red Acouchy (*Myoprocta acouchy*), Paca (*Cuniculus paca*), and Black Curassow (*Crax alector*). Large mammals that are less common, but hunted for food when encountered in the forest, are Brazilian Tapir (*Tapirus terrestris*), Red-brocket Deer (*Mazama americana*), Giant Armadillo (*Priodontes maximus*), and Giant Anteater (*Myrmecophaga tridactylus*). With the exception of Red-brocket Deer, all of these animals are listed on the IUCN Red List of Threatened Species.

Some of the interviewed hunters also mentioned that they use a traditional hunting calendar and hunt different species in different seasons. These hunters said that they do not hunt when the animals are "fat"; meaning that they do not kill animals when it is visible that they are in the gestation period.

CONSERVATION RECOMMENDATIONS

The number of mammal species found during this survey does not differ much from what was expected. Most of the large terrestrial mammal species expected to occur in the region were recorded by the camera traps. The difference in number of species per site suggests that hunting pressure in the different areas varies. The Kutari site was the richest in species, especially primates, suggesting limited hunting pressure. This site also had a high value of Simpson's Index from the camera trap data, indicating a high diversity and abundance of medium- and large-bodied terrestrial mammals, as well as presence of some sensitive bird species such as Gray-winged Trumpeter (*Psophia crepitans*), and the highest relative abundance index for Brazilian Tapir of any of the three sites (Table 1). We attribute the richness of the Kutari mammal fauna to its isolation from Kwamalasamutu, relative to the Sipaliwini and Werehpai sites. Of the three sites, the Sipaliwini site had the highest value of Simpson's Index, but also the smallest number of species recorded by camera traps, tracks and observations, suggesting higher hunting pressure in the area. The value of Simpson's Index for this site was a result of the even abundance of several species of rodents, as well as deer (*Mazama* spp.), which tolerate disturbance quite well; only one photograph of a sensitive species (Giant Armadillo) was obtained at this site. This area is used as a hunting ground by the local people, and hunting trails were encountered during camera trap setup. During the RAP, several shots from hunters were heard near the Sipaliwini camp. The Werehpai site was within the indigenous protected area established by the local village authority in 2004. We found more species at Werehpai than at Sipaliwini, even though it is only ten kilometers from Kwamalasamutu. Werehpai had a low value of Simpson's Index, due to the high abundance of two species of rodents, but we did record both Brazilian Tapir and Jaguar at this site.

The results of this survey suggest that richness and evenness of the medium- and large-bodied mammal fauna both increase with distance from Kwamalasamutu. Nevertheless, the presence of species sensitive to hunting and disturbance, such as tapir, jaguar, curassows and large primates, suggests that hunting pressure is not pervasive. Hunting is probably limited by reduced river access to some areas in the dry season, and more generally by distance from Kwamalasamutu. The concentration of the Trio in Kwamalasamutu reduces hunting pressure on large vertebrates in the region as a whole. The extensive surrounding forest acts as a source to offset local population depletion due to hunting, up to a point. The current village is relatively large with an estimated 700–800 people who all depend on the surrounding forest for sustenance. This puts much pressure on the medium- and large-bodied mammals in the area surrounding the village. Our interview results indicate that the effort required to find desired prey (i.e. large vertebrates) is increasing, and hunters reported that they often have to travel far from Kwamalasamutu to hunt successfully. Prey depletion around the edges of hunting villages is an expected phenomenon. The size of the area affected by hunting can be expected to increase as human population density forces more frequent long-distance hunting expeditions. Therefore, uncontrolled hunting from Kwamalasamutu represents the most significant potential threat to the mammal species in the region. Declaring the Werehpai area as a protected area is a good initiative by the village authority to conserve the species on which they depend for food, but this is only a small area compared to the hunting areas. More monitoring is required to determine if the Werehpai protected area is sufficient to maintain populations of medium- and large-bodied mammals in the surroundings of Kwamalasamutu. Further, it is recommended that all hunters from Kwamalasamutu use hunting seasons, map zoning areas and set quotas for hunting on the different species to maximize long-term viability of game populations in the area. These hunting seasons should be developed together with the people from Kwamalasamutu, with traditional local knowledge augmenting a scientific approach. Zoning must be established to achieve population source (e.g. game reserves) and sink (i.e. hunting) areas for wild meat, ensuring a permanent supply for subsistence (Novaro 2004). Sale of meat should be restricted to the village. Hunting quotas should be based on sustainability measures (Wilkie et al. 1998; Robinson and Bennett 2004; Payan 2009) and harvest profiles. Small- and medium-bodied rodents and species with high reproductive rates should be favored, whereas hunting of large animals (e.g., tapir) and other less resilient species should be highly controlled (Bodmer 1995).

A more thorough study of the medium- and large-bodied mammal fauna of the Kwamalasamutu region is recommended, including a longer camera trapping study and a detailed sustainability evaluation of wild meat hunting.

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Appendix. List of large mammals observed during the Kwamalasamutu RAP survey. CT = camera trap; K = Kutari; S = Sipaliwini; W = Werehpai.
* Birds; included here for documentation of Trio names.

Scientific name	Common name	Trio name	Detection method	Site
Cuniculus paca	Paca	Kurimau	CT	K, S, W
Alouatta macconnelli	Guianan Red Howler Monkey	Aluatá	Heard	K
Ateles paniscus	Guianan Black Spider Monkey	Arimi; Tanonkonpe	Observed	K, S, W
Cebus apella	Brown Capuchin	Tarípi	Observed	K, S, W
Cebus olivaceus	Wedge-capped Capuchin	Ako	Observed	K, S, W
Chiropotes chiropotes	Guianan Bearded Saki	Isoimá	Observed	K
Dasyprocta leporina	Red-rumped Agouti	Akuri	CT	K, S, W
Dasypus kappleri	Great Long-nosed Armadillo	Kapai	CT	S
Dasypus novemcinctus	Nine-banded Armadillo	Kapai	CT	K, W
Eira barbara	Tayra	Ëkërëpukë	CT, observed	W
Leopardus pardalis	Ocelot	Pakoronko	CT	K, W
Mazama americana	Red Brocket Deer	Wikapao	CT, tracks	K, S, W
Mazama gouazoubira	Grey Brocket Deer	Kajaké	CT	K, S, W
Myoprocta acouchy	Red Acouchy	Pasinore	CT	K, S, W
Myrmecophaga tridactyla	Giant Anteater	Masiwë	CT	K
Nasua nasua	South American Coati	Seu	CT, observed	K, S, W
Panthera onca	Jaguar	Kaikui; Aturae	CT	W
Philander opposum	Common Gray Four-eyed Opossum	Aware	CT	K, S, W
Pithecia pithecia pithecia	White-faced Saki	Ariki	Observed	K
Priodontes maximus	Giant Armadillo	Morainmë	CT	S, W
Proechymis sp.	Spiny Rat	Kurimau	CT	K, S, W
Pteronura brasiliensis	Giant River Otter	Jawi	Observed	S
Puma concolor	Puma	Arawatanpa	CT, tracks	W,K
Saguinus midas	Golden-handed Tamarin	Makui	Observed	K, W
Saimiri sciureus sciureus	Guianan Squirrel Monkey	Karima; Akarima	Observed	K, S, W
Tapirus terrestris	Brazilian Tapir	Pai	CT, tracks	K, S, W
Tayassu pecari	White-lipped Peccary	Poneke	CT	W
Pecari tajacu	Collared Peccary	Pakira	CT, tracks,observed	K, S, W
Neacomys spp(?)	Mouse spp.		CT	S
Crax alector	Black Curassow*	Ohko	CT, observed	K, S, W
Crypturellus variegatus	Variegated Tinamou*	Sororsoroí	CT	K, W
Tinamus major	Great Tinamou*	Suwi	CT	K, W
Penelope spp.	Guan*	Marai	Observed	K
Psophia crepitans	Grey-winged Trumpeter*	Mami	CT	K, S, W

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