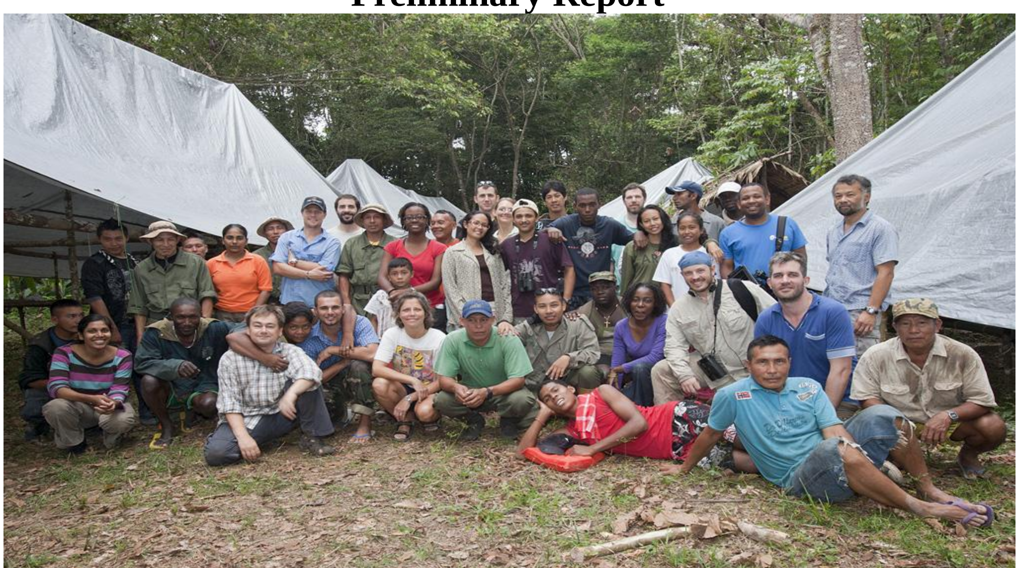
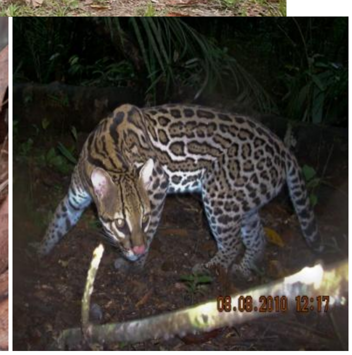





A Rapid Biological Assessment of the Kwamalasamutu Region, Suriname
August-September 2010
Preliminary Report



A collaboration of:

Conservation International – Suriname, Rapid Assessment Program (RAP), Center for Environmental Leadership in Business (CELB), Alcoa Foundation

Preliminary report produced and distributed
January 24, 2011
by Conservation International

TABLE OF CONTENTS

Preliminary Reports

Appendices: Preliminary Data and Species Lists

Acknowledgments

The RAP team extends our deepest gratitude to Granman Ashonko Alalaparoe and the people of Kwamalasamutu for granting us permission to study the biodiversity of their lands. We especially wish to thank John, Mope, Kupias, Koita, Dennis, Johnny, and Gracia for invaluable field and camp assistance.

We thank Natascha Veninga of CI-Suriname who offered unfailing support and logistical assistance at all stages of the RAP. Annette Tjon Sie Fat and Theo Sno also provided essential support and guidance.

The staff of Gum Air ensured safe transportation of our personnel, equipment, and supplies, and was always able to accommodate the diverse needs of our large team.

We are extremely grateful to the personnel of LBB/NB (Nature Conservation Division), especially Claudine Sakimin, for support in granting us the proper research and export permits. We thank the National Zoological Collection of Suriname and the National Herbarium of Suriname (Anton de Kom University of Suriname)for assistance with the permit application process.

The RAP botanical team gratefully acknowledges the support of the Suriname Forest Control Foundation (SBB), CELOS, and the National Herbarium of Suriname (BBS).

Special thanks to the Amazon Conservation Team (ACT) rangers, to staff from the LBB/NB Nature Conservation Division and SBB/Suriname Forest Service, and to the Surinamese students for joining the RAP team, for providing exceptional assistance to the researchers, and for sharing their knowledge with the team.

We thank Donnell Roy from CI's Center for Environmental Leadership in Business (CELB) and Lisa Famolare from CI's Guianas program for their help in obtaining funding for this work and for their collaborative support of biodiversity exploration in Suriname.

We thank the Alcoa Foundation for their generous financial support of this RAP survey and for their continued support of conservation and scientific capacity building in Suriname.

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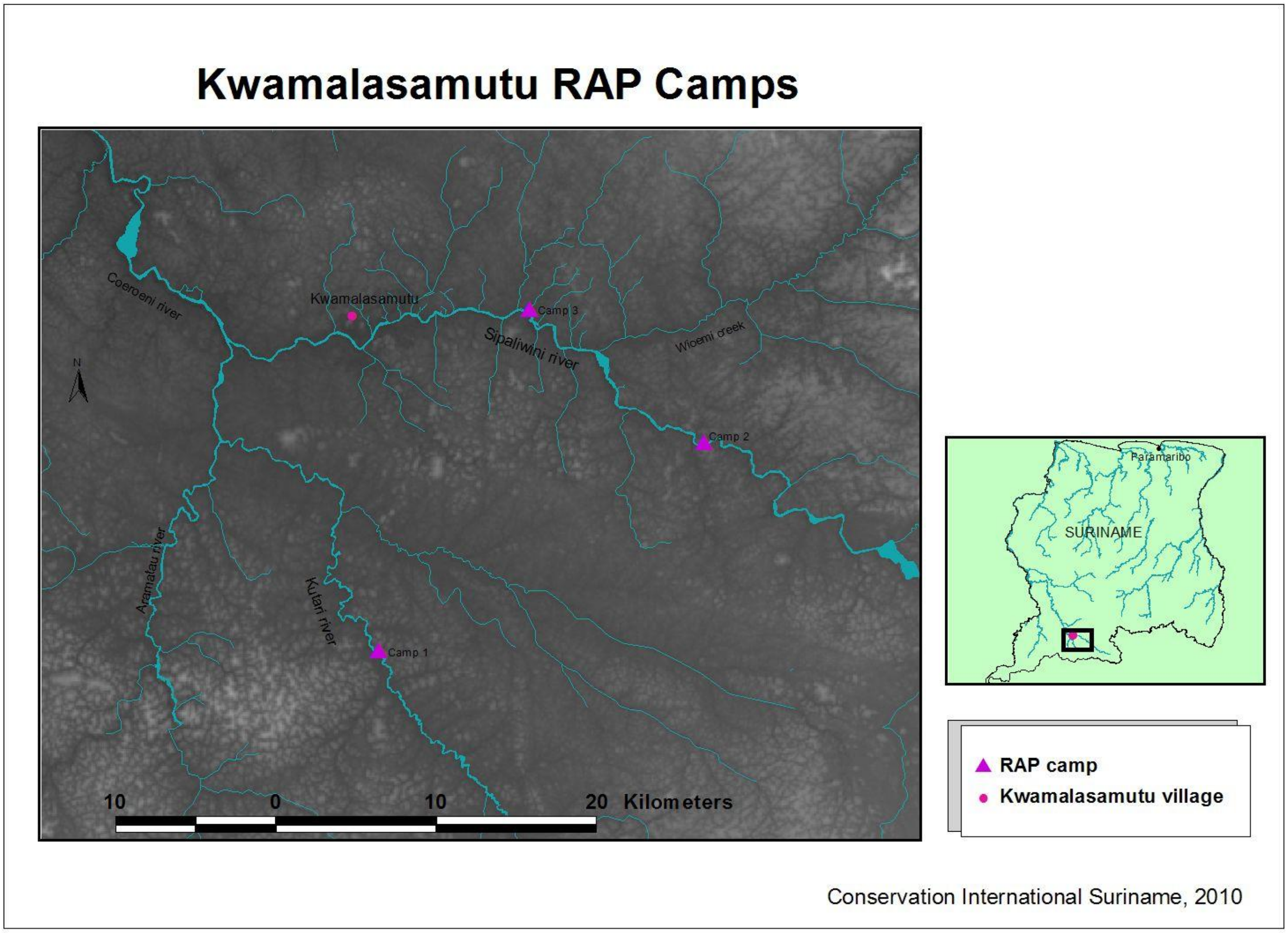
Kwamalasamutu RAP Camps
Kwamalasamutu
Camp 3
Camp 2
Camp 1
Coeroeni river
Sipaliwini river
Wioemi creek
Aramatau river
Kutari river
N
10 0 10 20 Kilometers
Paramaribo
SURINAME
RAP camp
Kwamalasamutu village
Conservation International Suriname, 2010

A Rapid Biological Assessment of the Kwamalasamutu Region, Suriname
August 18 -September 2, 2010

Introduction to the RAP Survey

The Guiana Shield is a vast tropical wilderness covering over 2.2 million square kilometers and encompassing all or part of six South American countries (Hammond 2005). The numerous biomes of the Guiana Shield have fostered the evolution of an exceptionally rich flora and fauna with many endemic species. More than 20,000 species of vascular plants, 1,000 species of birds, and 1,100 species of freshwater fishes are known from the Guiana Shield (Huber and Foster 2003; Hollowell and Reynolds 2005; Vari et al. 2009). The region's tumultuous cultural history and general remoteness from large population centers have effectively limited environmental degradation on a large scale. As a result, much of the Guiana Shield remains forested, presenting an invaluable opportunity to set conservation goals and develop ecologically and socially responsible strategies for resource use (Huber and Foster 2003; Hammond 2005).

Suriname is entirely contained within the Guiana Shield region and is mostly covered by lowland rainforest. Although most of the human population lives on the coastal plain, many Maroon and Amerindian communities are found in the interior - the former mostly along rivers in the eastern half of the country, and the latter primarily in the far southern and western regions. Much of central and western Suriname is sparsely populated, and wildlife is abundant.

The community of Kwamalasamutu is the political and cultural center for the Trio people of Suriname. Following establishment of the village in the mid-1970s, the population reached a maximum of over 2,000 people before slowly decreasing to its present size of approximately 800 (Teunissen and Noordam 2003). Residents of Kwamalasamutu subsist primarily on fish, bushmeat, and a limited variety of food crops, especially cassava. Sources of income are few, and many supplies must be flown in from the coast. In 2000, a cave with extensive petroglyphs was discovered near the village, prompting the inception of the 18,000-hectare Werehpai/Iwaana Saamu Sanctuary. Conservation International-Suriname has since been working with the community of Kwamalasamutu and several donor agencies to establish and maintain the sanctuary, which would serve as both an ecotourism site and game reserve.

The purpose of this RAP survey was to establish a baseline of information for local ecotourism and future monitoring efforts, focusing on Werehpai and the surrounding region. We also sought to gather information on plant and animal species important to the Trio people, and provide recommendations for sustainable harvest and management practices. The overall goal was to bring together the knowledge and expertise of local people with scientific knowledge to study and plan for monitoring of biological and cultural resources of the Kwamalasamutu region.

The scientific team included scientists from the Anton de Kom University of Suriname, Conservation International, Panthera, the Amazon Conservation Team, the Museum of Comparative Zoology at Harvard University, the Louisiana State University Museum of Natural Science, the Biodiversity Institute at the University of Kansas, the California State Collection of Arthropods, the Field Museum, the Royal Ontario Museum, and the National Herbarium of the Netherlands. The scientists were joined by seven students currently or formerly enrolled at the University of Suriname, many of whom participated on RAP training courses conducted by CI in Suriname in 2008. The RAP team collected data on water quality, plants, and the following groups of animals: ants, aquatic beetles, dung beetles, dragonflies and damselflies, katydids and grasshoppers, fishes, reptiles and amphibians, birds, small mammals, and large mammals. Most sampling occurred around three study sites: the first centered on the east bank of the Kutari River, approximately 44 river km from Kwamalasamutu; the second on the north bank of the Sipaliwini River, approximately 27 km upriver from Kwamalasamutu; and the third on the north bank of the Sipaliwini River at the beginning of the trail to the Werehpai petroglyphs.

Description of RAP survey sites

The RAP team surveyed around three main sites in the Kwamalasamutu region. Only the coordinates of the base camps are given here; most sampling was done within 5-10 kilometers of these camps. Certain groups sampled in other areas as well (e.g., along rivers between camps); please refer to individual chapters for sampling protocols and localities.

Site 1. Kutari River
N 02° 10' 31", W 056° 47' 14"
18-24 August 2010

The first camp was situated on the right bank of the Kutari River, approximately 44 km by river from Kwamalasamutu. The Kutari flows north from its source along the Suriname-Brazil border and joins the Aramatau to form the Coeroeni River; at our camp, the Kutari formed a meandering channel approximately 40 meters wide. The habitat at this site was a mix of terra firme and seasonally inundated forest, with the latter more extensive here than at our other sites. Away from the river the terrain was quite hilly and supported tall terra firme forest; low-lying areas between hills were often swampy and dominated by palms (*Euterpe oleracea*). At least one large patch of tall bamboo (*Guadua* sp.) was found here as well. Approximately six km of trails were cut at this site, and most terrestrial sampling was done along these trails.

Site 2. Sipaliwini River
N 02° 17' 24", W 056° 36' 26"
27 August - 2 September 2010

The second camp was situated on the right (north) bank of the Sipaliwini River, approximately 27 km upriver from Kwamalasamutu. Here the Sipaliwini formed a larger, straighter channel than the Kutari, and contained numerous boulders and rapids. The habitat around this site was primarily tall terra firme forest, with fewer palm swamps and generally less seasonally flooded forest than the Kutari site. The understory contained many spiny palms (*Astrocaryum sciophilum*). In some places, particularly on hilltops, the soil layer was very thin and supported a shorter forest with fewer large-diameter trees. From this site, we were able to access a small granitic outcrop, or inselberg, situated approximately 3 km from the camp. Many creeks flowed into the Sipaliwini around this site; some of these creeks had steep banks and formed channels up to 15 m across. At this site, we sampled primarily along the trail to the inselberg, and along a second trail that extended approximately 3 km northeast of the camp.

Site 3. Werehpai
N 02º 21' 47", W 056º 41' 52"
3-7 September 2010
The third camp was located on the north bank of the Sipaliwini, approximately 16 km downriver from the previous site. The river here was slightly wider than at the previous site. The camp itself was situated on an abandoned farm, and the habitat immediately surrounding the camp was mostly tall second-growth forest with an impenetrable understory. Away from the river, the habitat was similar to the previous site, though we did not find any inselbergs. Most sampling occurred along the well-established 3.5-km trail to the Werehpai caves. No other trails were cut at this site. From this camp, some groups (primarily the fish and water quality specialists) surveyed Wioemi Creek, a small river that flows into the Sipaliwini approximately 5 km upriver from Werehpai. Wioemi Creek was much like the Kutari River in many respects, and supported substantial areas of seasonally flooded forest.

Summary of Preliminary Results by Taxonomic Group

The Kwamalasamutu region is embedded within a vast forest matrix interrupted only by the Sipaliwini savanna, the western boundary of which is approximately 80 km east of Kwamalasamutu. Because there are few significant biogeographic barriers in this lowland region, we consider our results to be representative of the entire southwest corner of Suriname, including the watershed of the Sipaliwini River west of the Sipaliwini savanna; the upper Corantijn Basin, including the Kutari and Aramatau Rivers; and the region south and west of the Eilerts de Haan Gebergte and east of the Corantijn River. However, as this remains a very poorly known area from a scientific standpoint, we strongly encourage further survey work in the region, as we are certain that many more species occur here.

Water Quality

Three major areas were sampled intensively (total of 23 sites): the Kutari River, and two areas of the Sipaliwini River. We measured 13 physico-chemical parameters at each site: pH, dissolved oxygen, conductivity, temperature, alkalinity, total hardness, total phosphate, nitrate, chloride, tannin & lignin, ammonia, turbidity and secci depth. Both titrimetric and colorimetric methods were used to assess the parameters. The oxygen content and pH of the Kutari River were lower than those of the Sipaliwini River, probably due to the lack of rapids and the input of organic material from the surrounding forest, particularly after heavy rains, which occurred frequently at the Kutari site. All sites had clear water except the Wioemi Creek, which was very turbid. The parameters measured in the field revealed undisturbed river ecosystems without negative human impacts. However, high mercury levels were found in both sediment and piscivorous fishes from all sites. Further research is needed to clarify the origin of mercury in the rivers of southwest Suriname.

Plants
General plant collecting took place along trails in the forest and along the rivers (also between camps), and all flowering and fruiting plants encountered were collected. In high tropical rainforest on dryland, we created 1-ha plots and identified all trees above 10 cm dbh (diameter at breast height) in the plots. We also placed 0.1-ha plots in high tropical rainforest on dryland, and identified all tree species above 2.5 cm dbh. In total, six plots were established. In the RAP survey area, we discerned nine different vegetation types, namely: tall herbaceous swamp vegetation and swamp wood, seasonally flooded forest, (seasonal) palm swamp forest, high tropical rainforest on dryland (terra firme), tropical forest on laterite/granite hills, savannah (moss) forest, open rock (inselberg) vegetation, secondary vegetation, and bamboo forest. In total, 402 plants were collected, of which 183 had fruit and/or flowers. Based on provisional morphospecies identifications, we estimated that approximately 170 species were collected during the general plant surveys, whereas approximately 250 tree species were encountered in the plots. The Kutari plots had the most diverse forest, with values of Fisher's alpha comparable to the highest value calculated in Suriname to date. In terms of species composition all three sites were distinct. The forests showed some floristic affinities with adjoining regions of Guyana and Brasil. We found five species listed on the IUCN Red List: *Minquartia guianensis* (Near-Threatened), *Cedrela odorata* (Vulnerable), *Corythophora labriculata* (Vulnerable), *Aniba rosaeodora* (Endangered), and *Vouacapoua americana* (Critically Endangered). We found several tree species that are rare in Suriname, and one that is new for the country (*Bocoa alterna*).

Aquatic Beetles
In total, approximately 90 species in 48 genera were found. At the generic level, all three sites exhibited similar species diversity, with an estimated 57 to 69 species found per site. The majority of genera were found at all three sites. Of these 90 species, we estimate that approximately 20 are new to science. At a glance, the fauna was typical of lowland Guianan forests. Some taxa, such as the genera *Siolus, Guyanobius, Fontidessus,* and *Globulosis* are either endemic or largely restricted to the Guiana Shield. The fauna was very similar to what is known from southern Venezuela (south of the Orinoco) and Guyana. The water beetle diversity was expected given the complement of aquatic habitats available at each camp. The relatively high number of genera and species, which cover a variety of ecological and habitat types, suggest the area is largely undisturbed.

Dung Beetles
We found a total of 90 species and 4,391 individuals of dung beetles. Species richness was similar at all sites, but was highest at Sipaliwini (66 species), followed by Werehpai (63 species) and Kutari (58 species). Abundance differed strongly between sites, and was also highest at Sipaliwini and lowest at Kutari; 73% fewer individuals occurred at Kutari relative to Sipaliwini. Species accumulation curves for dung-baited pitfall traps estimated that we sampled 91% of all coprophagous species occurring in the area. Species composition and community structure varied strongly among sites. Sipaliwini and Werehpai were relatively similar in terms of community structure, but Kutari was distinct from both Sipaliwini and Werehpai, and contained many species not present at the other sites. At least 25 dung beetle species sampled during the RAP are associated primarily

with the Amazon region, whereas the remaining species are typical of the Guianas. We estimate that approximately 10-15% of the dung beetle species collected during this RAP (9-13 species) are new to science. The abundance and biomass of dung beetles in the Kwamalasamutu region was relatively high. This suggests that in addition to the pristine state of the forest, populations of large birds and mammals are relatively stable. However, dung beetle abundance was lower than expected based on surveys in other Neotropical primary forests where no hunting occurs. This is likely to reflect the relatively low abundance of spider monkeys, howler monkeys, and White-lipped Peccaries, which are among the most important species for dung beetles but are also preferred for bushmeat. The establishment of hunting-restricted reserves such as Iwaana Saamu is an excellent way to maintain sustainable populations of large mammals.

Ants

Ants were extremely abundant and conspicuous throughout the RAP. A survey of ant diversity was conducted only at RAP Site 3 (Werehpai). Ants were surveyed and collected using searching and Winkler methods. Ant specimens are still being processed and identified so no species list is yet available. Preliminary observations indicate a diverse and typical ant community for lowland rainforest, with no invasive species observed.

Katydids

The abundance of katydids encountered during this survey was often exceptionally low (although no formal structured sampling was conducted, the rate of katydid collection was often only 1 individual/hour, and during most nights no individuals were attracted to the UV light.). Also, many of the recorded species appeared only as nymphs, often in early developmental stages, which indicates a strong seasonality in their development. Of the three main camps, the first site (Kutari) had the lowest number of both species (24) and specimens (64) collected, presumably because of the heavy rains that still affected the activity of katydids at the end of the rainy season, when the survey began. Werehpai had the highest number of species (49), followed by Sipaliwini (44).

Dragonflies and Damselflies

Overall, 45 odonate genera belonging to 10 families were collected at the three sites, with a total of 93 morphospecies. They include lowland Amazonian odonates, and represent approximately one-third of the total number of odonate species reported for Suriname. They include 4 species likely new to science, and 13 species recorded for the first time for Suriname. Considering the number of morphospecies at each site, the preliminary results indicate that the three sites have a comparable richness, although the Werehpai site was slightly richer (64) while the Kutari site had the lowest number of morphospecies (52), and Sipaliwini was intermediate (57). In terms of odonate community composition, the three sites shared between 1/2 and 2/3 of the species with each other, with shared species showing usually different abundances at each one of them. The diversity of odonate genera and species found in this study characterizes well-preserved sites; most of the species found in the forest understory, creeks, and swamps in the three camps would not be present if the forest were disturbed. Therefore it is recommended to designate a large and legally protected nature preserve to conserve the high diversity of odonate species found in this study.

Fishes
Forty-three sites at the three camps were sampled. We preliminarily recorded 100 species of fishes. This diversity is high compared to the rest of the world, but is typical for the Guiana Shield. We collected five species of fishes potentially new to science, including a large catfish with spines along the body and a small catfish that lives in sand-bottomed creeks. We collected 52 species at Camp 1 (Kutari), 54 species at Camp 2 (Sipaliwini), and 55 species at Camp 3 (Werehpai). This is remarkably consistent, with no significant difference in diversity among camps. However, we did not necessarily find the same species at each camp. Creek assemblages were similar among the three sites. Juvenile fishes showed less habitat specificity than adults of their own species. Many young fishes were found in flooded forests, even if the adults lived in rivers or other habitats. Overall, large top-level predators were uncommon. The region is exhibiting the first stages of overfishing. Many fishes still occur in the Sipaliwini area, but there is a need to assess fishing pressure and implement management plans.

Reptiles and Amphibians
We found an estimated 43 amphibian and 14 reptile species. These numbers may be adjusted upwards after further analysis in our labs. Of the amphibian species documented, one species of frog and one species of caecilian may be new to science. We also found one individual of a rare frog species (*Scinax proboscideus*), the second individual known from Suriname. The reptile survey was very fruitful and yielded two new records for Suriname: a snake (*Xenodon werneri*) and an amphisbaenian (*Amphisbaena slevini*). We also encountered *Geochelone denticulata* (Yellow-footed Tortoise), listed as Vulnerable on the IUCN Red List. We discovered that certain expected species that are quite common in other areas in Suriname were either not found or found in very moderate numbers on the RAP survey. On the other hand, we found certain generally rare species to be quite common.

Birds
Our list for the Kwamalasamutu area includes 323 species: 289 species were observed at the three RAP sites, and 13 species were observed in the area during the reconnaissance trip (3-8 May 2010) but not during the RAP survey. We also include 21 species observed only in the vicinity of Kwamalasamutu itself. The avifauna was typical of lowland forests of the Guiana Shield. Three species represent new distributional records for Suriname: *Crypturellus brevirostris* (Rusty Tinamou), *Dromococcyx pavoninus* (Pavonine Cuckoo), and *Ramphotrigon megacephalum* (Large-headed Flatbill). The overall species list was highest for the Sipaliwini camp (242 species), followed by Werehpai (221 species) and Kutari (214 species). 149 species, or approximately 52% of those encountered at the three sites, were observed at all sites. The Kutari site had the most distinctive avifauna of the three sites. We estimate that a minimum of 350 bird species, or roughly half of the number known to occur in Suriname, may be found in the Kwamalasamutu area. Although no species listed on the IUCN Red List were encountered during the survey, at least one (*Harpia harpyja*, Harpy Eagle, Near-Threatened) is known to occur in the area.

Small Mammals
In total, preliminary field identifications indicated 41 species of small mammals: 26 species of bats, 13 species of rats and mice, and 2 species of small opossums. The species diversity and relative abundance of rats in the Kwamalasamutu region were the highest documented in 20 years of small mammal surveys throughout Suriname and Guyana by the Royal Ontario Museum. Kutari was the most successful site for rats, indicating a healthy source of prey species for predators such as cats, owls, and snakes. In contrast, Werehpai was the most successful for bats but this might be due in part to the well-established trail to the petroglyphs, which functioned as a flyway that was more conducive for capture success. A water rat (*Neusticomys oyapocki*) and a brush-tailed rat (*Isothrix sinammariensis*) collected at Kutari represent the first occurrences of these species in Suriname.

Large Mammals
We detected 29 species of medium- and large-bodied mammals, of which the large caviomorph rodents were the most frequently encountered in the camera traps. The Kutari site was the richest in species, especially primates. The Brazilian Tapir (*Tapirus terrestris*, IUCN Vulnerable) was recorded by the camera traps at all three sites and was observed by several of the RAP scientists. Of the six species of cats known to occur on the Guiana Shield, the Jaguar (*Panthera onca*, IUCN Near-Threatened), Puma (*Puma concolor*) and Ocelot (*Leopardus pardalis*) were found during the survey. The White-lipped Peccary (*Tayassu pecari*, IUCN Near-Threatened) was only photographed once by the camera traps in the Werehpai area and seems to be uncommon in the area of Kwamalasamutu. In addition to the species mentioned above, four additional species listed on the IUCN Red List were encountered: *Ateles paniscus* (Guianan Spider Monkey, Vulnerable); *Myrmecophaga tridactyla* (Giant Anteater, Vulnerable); *Priodontes maximus* (Giant Armadillo, Vulnerable); and *Pteronura brasiliensis* (Giant Otter, Endangered). The number of mammal species found during this survey does not differ much from what was expected. The difference in number of species per site suggests that hunting pressure in the different areas varies. The results of this RAP cannot provide an accurate indication of the population status of the different large mammal species, because we were not able to calculate species densities or relative abundance from the data that was gathered during the survey. Nevertheless, the most significant current threat to medium- and large-bodied mammals in the area is hunting from Kwamalasamutu village. Recommended studies include more camera trapping and a sustainability evaluation of wild meat hunting.

Summary of Preliminary Conservation Recommendations

Conservation Action
Establish protected areas to maintain the intact ecological condition of the area's forests and rivers. Monitor and prevent illegal mining activity in the Kwamalasamutu region.

The preliminary results of our survey indicate that the Kwamalasamutu region is in near-pristine ecological condition. The area supports high species diversity, including many species found only in extensive regions of undisturbed forest. We found no evidence of substantial anthropogenic impacts on water quality or forest structure away from the village itself. As the forested landscape of this area extends unbroken far beyond the borders of Suriname, the Kwamalasamutu region represents the nucleus of a vast biological treasure of global significance. Although not immediately threatened, effective conservation in the region will require active and continuous assessment of potential threats and international cooperation to adequately manage the region's resources.

We attribute much of the region's high species diversity to small-scale habitat heterogeneity and intact connections between habitats used by animals in different stages of their life cycles. This mosaic of diversity is typical of large, undisturbed regions of tropical forest, and can be profoundly impacted by human modification of the landscape. At a large spatial scale, road construction and resource extraction (e.g., logging, mining) should be carefully controlled to avoid disrupting processes vital to maintenance of ecosystem integrity. At a smaller scale, guidelines should be developed for establishing protected areas that consider fine-scale environmental heterogeneity as well as the seasonal movement of animals among different habitats, particularly aquatic and terrestrial habitats.

Of particular concern is the continuing encroachment of small-scale gold miners in the region, which can be expected to accelerate with the construction of highways currently planned for interior Suriname and adjacent northern Brazil. The clean and abundant water flowing from the upper Corantijn Basin is an extremely valuable asset, both for the people who depend directly on the rivers for sustenance and for the people of coastal Suriname. Pollution of rivers by small-scale miners, a persistent problem elsewhere in the Guianas, has the potential to cause major ecological and social upheaval in the Kwamalasamutu area if miners gain access to the region. Already there are concerns among residents of Kwamalasamutu about gold mining activities in the upper reaches of the Aramatau River, and our data suggest that mercury pollution may already be affecting the region's watercourses (see Water Quality report, page 19). Aside from mercury contamination, any increase in mining activity would contribute to erosion and sedimentation, negatively impacting fish stocks upon which the people of the region depend.

Environmental Protection and Sustainable Harvesting

Develop and implement a plan to manage bush meat hunting and fishing in the Kwamalasamutu region.

Effective conservation in the Kwamalasamutu region will require active management of wildlife and their habitats to protect them from overexploitation. This is particularly important if the community desires to pursue ecotourism as a source of revenue (see below). Already there are signs that wildlife has been impacted, especially near the village. Our strongest evidence for this is the observation that large, predatory fishes, many of which are prized for food (e.g., *Hoplias aimara*, *Cichla ocellaris*), were generally scarce even at the most remote camp, and virtually absent in the vicinity of Kwamalasamutu. Although the camera traps and dung beetle surveys respectively provided direct and indirect evidence for a rich mammal fauna, the general scarcity and shyness of wildlife (particularly monkeys, peccaries, and curassows) at all sites was suggestive of hunting pressure. Populations of game animals in the region are probably sustained by dispersal through the vast and largely uninhabited forest matrix that surrounds the Kwamalasamutu region, where we presume wildlife is more abundant. However, this does not justify local depletion of wildlife, as many game animals and fishes play important roles as predators and seed dispersers in the ecosystem, and as such are vitally important for forest dynamics.

We suggest that a thorough assessment of bushmeat hunting and fishing pressure be undertaken to promote establishment of, and adherence to, hunting and fishing quotas or seasons for particular species. Ideally, this would incorporate information on the ecology and reproductive habits of target species, already well known to many residents of the region. Alternatively, certain areas could be designated as non-hunting zones for at least a portion of each year, following the model of the Iwaana Saamu game reserve, but the effectiveness of these protected areas depends on diligent local enforcement of activities within them. By either of these mechanisms, the regulation of bush meat hunting would benefit the residents of Kwamalasamutu by allowing wildlife populations to replenish themselves, thereby lessening the need for expensive hunting excursions far from the village. Chickens and other domestic animals also provide a good alternative protein source.

Ecotourism: Promotion & Implementation

Continue developing the Iwaana Saamu ecotourism facilities, focusing on the region's cultural history.

Ecotourism has great potential to provide the village of Kwamalasamutu with much-needed income. To this end, the community should enhance the existing facilities at Iwaana Saamu and work to highlight the uniqueness of the area, manifested in the petroglyphs at Werehpai and elsewhere. Protection of wildlife (see above) would also help increase the area's appeal to tourists, many of whom will require some incentive to choose to visit Kwamalasamutu in lieu of less expensive destinations closer to Paramaribo. Protection of fish stocks could allow the development of sport fishing tourism. Adventure tourism (e.g. trekking) could also be promoted by taking advantage of the existing network of trails used by residents of the region to move between settlements.

Scientific Capacity Building

Develop research facilities to promote the exchange of information between residents of Kwamalasamutu and scientists from Suriname and abroad. Develop and implement a water quality monitoring protocol.

The Kwamalasamutu community would benefit from the development of facilities for Surinamese and foreign researchers. The region supports a high diversity of aquatic and terrestrial habitats and is relatively free of large-scale anthropogenic degradation, rendering it highly suitable for ecological research. We consider the area to be particularly promising for research on the ecological role of humans in tropical lowland forest, given the region's long history of occupation by the Trio. To this end, researchers could employ and train residents of Kwamalasamutu in a mutually beneficial relationship, whereby researchers gain valuable field assistance and indigenous knowledge in exchange for site-specific recommendations for management of natural resources to promote long-term social and environmental stability. In particular, we recommend that residents of Kwamalasamutu be trained to implement a water quality monitoring program to empower them to detect and act upon the first signs of degradation of this vital resource.

One of the greatest potential threats to the region is the erosion of traditional knowledge among young people. We recommend creating educational materials – for example, picture guides to common species of birds, fishes, and mammals – to be translated into Trio and used in area schools. These guides could also be used by tourists visiting the region.

Further Studies

Conduct additional biodiversity surveys at different times of the year.

Although we found a high diversity of species in the Kwamalasamutu region, our survey was only the first step toward a thorough knowledge of the region's biodiversity. Beyond documenting species new to science, biodiversity surveys provide critical baseline information about the distribution, ecology, and habitat requirements of tropical organisms. Many tropical plants and animals are poorly known from a scientific perspective; this is particularly true for the species new to science that we encountered on this survey. We therefore recommend additional surveys, focusing on under-sampled habitats (e.g. inselbergs), different seasons, and other sites within the region, to gain a better understanding of the biodiversity of the Kwamalasamutu region and southwest Suriname in general. We suspect that many undescribed species remain to be discovered.

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PRELIMINARY REPORT – WATER QUALITY

Gwendolyn Landburg and Mercedes Hardjoprajitno

Introduction

Water is important for all living creatures. The type and quality of water determines which organisms will be found in a certain habitat. Assessment of water quality is needed to identify species-habitat relationships and to identify possible sources of pollution or disturbance within the ecosystem. Human disturbance was not expected in the area assessed by the Kwamalasamutu RAP survey, but previous studies have discovered mercury pollution in other pristine areas of Suriname. It has been hypothesized that mercury might be transported by the northeast trade winds from gold mining sites in southeast Suriname to the southwestern region of the country (Landburg 2005, P.E. Ouboter *unpubl. data*), in which case the mountain ranges in central Suriname could serve as a barrier, resulting in mercury deposition on the windward side of the mountain range and no deposition on the leeward side. A primary goal of this study was to provide baseline information on mercury levels in southwest Suriname to further evaluate this hypothesis.

Brief methods and description of study sites

Three major areas were sampled intensively (total of 23 sites): the Kutari River, and two areas of the Sipaliwini River. The Kutari River can be characterized as a clear water river without major rapids at the time of sampling. The river extends into the forest when the water level increases, resulting in major floodplains in the area. Big creeks flowing into the Kutari River have steep banks and smaller floodplains. The two sampled areas of the Sipaliwini River share many characteristics including steep river banks, clear water, and much turbulence in the water, caused by the many rapids in the river. The Wioemi Creek is a large creek with especially turbid water, fairly steep banks, a strong current, and moderately extensive floodplains. Other creeks flowing into the Sipaliwini River are clear water streams, with steep banks and weak currents. We also sampled one site near the mouth of the Aramatau River, which was similar to the Kutari River but had steeper banks.

We measured 13 physico-chemical parameters at each site: pH, dissolved oxygen, conductivity, temperature, alkalinity, total hardness, total phosphate, nitrate, chloride, tannin & lignin, ammonia, turbidity and secci depth (Appendix 1). Both titrimetric and colorimetric methods were used to assess the parameters. At selected sites water samples were saved for later analysis of mercury, iron and aluminum at the University of Suriname in Paramaribo. For mercury analyses, sediment and fish tissue samples were taken opportunistically. All stored samples were kept under refrigeration in the field.

Preliminary results and general impressions

Kutari and Aramatau Rivers. The oxygen content in the Kutari River and tributary creeks was lower than the other sites (4.2-5.4 mg/L), probably a result of the lack of rapids and the input of organic material from the land. The pH was lower at these sites as well (5.6-5.9). Nutrient input comes mainly from the land, as evidenced by the higher nutrient levels measured in the water after heavy rain (phosphate: 0.03-0.1 mg/L; ammonia: 0.26-0.72 mg/L). High levels of mercury were found in both sediment (0.25-0.28 µg/g) and piscivorous fishes (0.05-0.98 µg /g). These values are higher than the international norm for mercury in aquatic ecosystems (water: 0.1 µg/L, sediment: 0.14 µg/g; fish: 0.5µg/L). From the one site sampled in the Aramatau River, low levels of nutrients were measured (phosphate 0.04 mg/L; nitrate: 0.00 mg/L) except for ammonia (average: 0.43 mg/L). The water at this site was found to be very soft (hardness: 0.35 mg/L). High mercury levels were found in the sediment (average: 0.19 µg/g).

Sipaliwini River. At the sites in the Sipaliwini river and tributary creeks, high nutrient levels were measured (phosphate: 0.045-0.145 mg/L; ammonia: 0.51 mg/L average). We also found high levels of iron (0.98-1.29 mg/L). Mercury levels were high (water: 0.03 – 0.08 µg/L; sediment: 0.12-0.20 µg/g; fish: 0.28-1.17 µg/g) and exceeded the international norms.

Wioemi Creek. The strong current and consequent erosion of the steep banks at the time of sampling probably contributed to high turbidity (average turbidity: 22.08 NTU) and nutrient loads (average nitrate: 0.013 mg/L; average phosphorus: 0.105 mg/L; average ammonium: 0.85 mg/L), as well as high aluminum (1.00-1.16 mg/L) and iron (1.54-1.73 mg/L). Mercury levels in the water were low (0.00-0.03 µg/L), while mercury levels in sediment were high (0.18-0.25 µg/g).

Preliminary conclusions

In general, our data revealed river ecosystems with relatively clear water (except Wioemi Creek), high nutrient loads from the surrounding flooded forests, and high levels of metals. High levels of iron and aluminum are usually attributed to natural erosion of the bedrock or anthropogenic activities. Because the area sampled is largely free of large-scale anthropogenic disturbance, the levels of these metals are probably a natural consequence of eroded bedrock material entering the aquatic system.

The high mercury levels found in the ecosystem suggest that small-scale gold mining in the east of Suriname is affecting this area. We know of no gold mining activities in the Kwamalasamutu region, though some residents of Kwamalasamutu expressed their concerns about gold mining upstream of the Aramatau River. This needs further investigation. The high mercury levels measured in the other rivers indicate that mercury is probably transported through the atmosphere and is being deposited in these systems. Further research is needed to confirm this. Deposition of mercury in these areas may result in accumulation of mercury in the food chain, causing health concerns for residents of Kwamalasamutu.

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PRELIMINARY REPORT - PLANTS

Olaf Bánki and Chequita Bhikhi

with Klassie Etienne Foon, Sheinh A. Oedeppe, Aritakosé Asheja, Reshma Jankipersad, Willem Joeheo, Tedde Shikoei, and Jonathang Sapa

Introduction

Plants, and especially trees, are the building blocks of natural ecosystems as they enable conditions for other life. In turn, plants respond to their environment; plant species composition and plant diversity are partly driven by environmental conditions. Plant species composition and diversity often respond to geological formations (e.g. different soil types). Plants are therefore an essential biological element to determine the natural value of an area. Trees in tropical forests also store a vast amount of carbon. The estimation of biomass (as proxy for the amount of carbon storage) could inform decisions to conserve the standing tropical rainforest in an area. We determined the natural value in terms of plants in the surroundings of Kwamalasamutu by performing general plant surveys and plot inventories.

Methods and study sites

At Site 1 (Kutari River), Site 2 (Sipaliwini River), and Site 3 (Werehpai and Wioemi Creek), the same sampling methods were used. General plant collecting took place along trails in the forest and along the rivers (also between camps), and all flowering and fruiting plants encountered were collected. In high tropical rainforest on dryland, we created 1-ha plots and identified all trees above 10 cm dbh (diameter at breast height) in the plots. We also placed 0.1-ha plots in high tropical rainforest on dryland, and identified all tree species above 2.5 cm dbh. Preliminary identification of trees in the field were made with the assistance of tree spotter Klassie Etienne Foon of SBB, and by ACT personnel, especially Sheinh A Oedeppe and Aritakosé Asheja.

In total, six plots were established (see Table 1). The Kutari plots (1 & 2) were established in high mature tropical rainforest on loamy sands. Soils were deep and well drained, and there were no boulders or traces of hard parent rock in the plot. The Sipaliwini plots (3 & 4) were placed on a hill approximately 200 to 300 meters above sea level. The forest was standing on loamy sandy soils on top of the hard parent rock of the Guiana Shield basement complex. At the back of the plots, the forest was transitioning into liana forests and low savannah forest due to large boulders and the hard parent rock reaching the surface. The Werehpai plots (5 & 6) were placed in mature tropical rain forest on sandy soils that were intersected by large boulders throughout the plots. Soils were deep at some points, but predominantly shallow on the hilltops.

General Observations and Notes on Plant Diversity

In the RAP survey area, we discerned the following nine vegetation types (following Lindeman & Moolenaar 1959):

Tall herbaceous swamp vegetation and swamp wood. This vegetation type was abundant in the bends of rivers and creeks, and was found around all three study sites. The herb layer consisted mostly of dense stands of *Montrichardia arborescens* (mokumoku, Araceae) intertwined with cyper grasses, grasses, and vines. Most of the shrub and tree layer consisted of *Inga spp.* (watra switibonki, Fabaceae). Dense stands of *Inga* trees could occur in the river bends, but *Inga* shrubs dominated the river edges frequently as well. Solitary and clumped palm trees with spiny trunks (*Bactris sp*., Arecaceae), solitary trees of *Cordia* (Boraginaceae, tafrabon) with table like crowns, and solitary trees of *Cecropia sp.* (Cecropiaceae, bospapaja) occurred in swampy areas in the river bends. At Wioemi Creek and the Sipaliwini River (but not at the Kutari River) individual *Triplaris surinamensis* (mira udu, Polygonaceae) trees also occured in this vegetation type. At the Kutari River we observed an *Erythrina fusca* (kofimama, Fabaceae) tree in the swamp wood.

Seasonally flooded forest. We observed seasonally flooded forests with quite different species composition. At the margins of the black waters of the Wioemi Creek and the Kutari River we observed forests dominated by *Tachigali paniculata* (mira udu, Fabaceae), *Alexa wachenheimii* (neku or paku nyannyan, Fabaceae), *Eperua rubiginosa* (Fabaceae, oeverwalaba), Myrtaceae, Sapindaceae, Meliaceae, and Annonaceae. Along the Wioemi creek we observed trees of *Elizabetha princeps* in the forest at the river edge. Large areas of seasonally inundated forest were found along both the Wioemi and the Kutari. Along the Wioemi, this forest was dominated by *Astrocaryum sciophilum* (bugru maka, Arecaceae), *Licania sp.* (fungu, Chrysobalanaceae), *Vouacapoua americana* (bruinhart, Fabaceae), *Terminalia* (djindja udu, Combretaceae), *Eschweilera corrugata* (umabarklak, Lecythidaceae), *Eperua falcata* (walaba, Fabaceae), Burseraceae, *Goupia glabra* (Goupiaceae), and *Ceiba pentandra* (kankantri, Malvacaea). The composition of this seasonally flooded forest seemed to resemble the composition of the high tropical rainforest on dryland (terra firme).

We sampled along the Kutari River downriver from our first site (towards the Aramatau) and found that the composition of the forest at the river margin changed. In addition to the aforementioned tree species found at Wioemi and Kutari, trees of *Virola sp.* (babun udu, Myristicaceae), *Triplaris surinamensis* (mira udu, Polygonaceae), *Ceiba pentandra* (kankantri, Malvaceae), and palm trees (*Attalea spp.*) appeared in the forest. We found a similar species composition along the Sipaliwini River, despite the higher river banks.

Downstream from the confluence of the Kutari and Aramatau Rivers, we found stretches of flood plain forest with a swampy character. *Astrocaryum sciophilum* did not occur in this area, indicating that soils could be wet throughout the year. The forest composition was dominated by trees of *Virola sp. (babun udu, Myristicaceae), Alexa wachenheimii* (neku or paku nyannyan, Fabaceae), and *Bixa orellana (*kusuwe, Bixaceae). Along the Sipaliwini River this floodplain forest only occurred where the river banks were low.

(Seasonal) palm swamp forest. Close to our camp at the Kutari River site we observed patches of *Euterpe oleracea* (pina palm) swamp forest, with occasional *Geonoma baculifera* (taspalm). At the back of the camp at Site 2 (Sipaliwini River) we also found a swamp of *Geonoma baculifera* (taspalm).

High tropical rainforest on dryland (terra firme). The high tropical rainforest on dryland at the first study site (Kutari River) was dense and dominated by *Astrocaryum sciophilum* (bugru maka, Arecaceae). Soils in general appeared to contain a higher proportion of loam and clay than sand. Some other frequently encountered species were *Vouacapoua americana.* (Fabaceae), *Bocoa prouacensis* (Fabaceae), *Croton matourensis* (Euphorbiaceae), *Protium* and *Tetragastris spp.* (Burseraceae), *Licania spp.* (Chrysobalanaceae), *Eschweilera spp.* (Lecythidaceae), several Meliaceae and Lauraceae species, *Pausandra martini* (zwarte taja udu, Euphorbiaceae) and *Bixa orellana* (kusuwe, Bixaceae).

At Werehpai, we encountered many creeks along the main trail to the Werehpai caves. The forest along this trail was diverse, shifting between swampy, low, open vegetation and high forest over short distances. The high tropical rainforest was dominated by *Astrocaryum sciophilum*, *Eperua falcata*, *Lonchocarpus sp*., *Licania spp*., *Bocoa viridiflora*, *Carapa guianensis*, *Eschweilera* and *Lecythis spp.*, *Protium* and *Tetragastris spp.*, *Inga spp*., *Guarea grandifolia* (Meliaceae), and *Couratari stellata* (Lecythidaceae).

Tropical forest on laterite/granite hills. This forest type was especially dominant at the Sipaliwini River site (Site 2). *Astrocaryum sciophilum* was dominant where soils were deep and the understorey was relatively open, Also common here were *Lonchocarpus sp*. (neku udu, Fabaceae), *Vouacapoua americana.*, *Inga spp*., *Protium* and *Tetragastris spp.*, *Licania spp*., *Eschweilera* and *Lecythis spp.*, *Carapa guiananensis*, and *Bocoa alterna*. On small granite hills with relatively shallow soils, we observed *Sterculia sp.* (okro udu, Malvaceae), *Zanthoxylum rhoifolium* (pritjari, Rutaceae), *Lacmellea aculeate* (zwarte pritjari, Apocynaceae), *Hevea sp.* (Euphorbiaceae), *Jacaranda copaia* (gubaja, Bignoniaceae), *Eschweilera corrugata* (umabarklak, Lecythidaceae), *Sloanea sp.* (rafunyannyan, Elaeocarpaceae), *Cupania sp.* (gawetri, Sapindaceae), *Licania ovalifolia* (santi udu, Chrysobalanaceae), and *Geissospermum sericeum* (bergi bita, Apocynaceae).

Savannah (moss) forest. At Site 2, we encountered savannah forest with a low canopy dominated by many lianas (e.g. Bignoniaceae) in areas where boulders and hard parent rock were at the surface, causing shallow soils. At Werehpai we encountered some patches of this forest type along the main trail to the petroglyphs. Near the inselberg at Site 2, we found a small, narrow stretch of savannah forest with some moss coverage and grasses, and a low canopy forest with trees of *Neea sp.* (Nyctaginaceae) and Myrtaceae.

Open rock (inselberg) vegetation. The small inselberg at Site 2 had vegetation similar to that found on the Voltzberg in Central Suriname. On the rocky outcrop itself, we observed many plants such as *Furcraea sp*. (Agavaceae), some orchids, Gesneriaceae, Myrtaceae, grasses, *Clusia sp.* (Clusiaceae), Bromeliaceae, *Neea sp.* (Nyctaginaceae), *Cissus verticillata*, *Cissus erosa* (Vitaceae) and *Cochlospermum orinocense* (Cochlospermaceae).

Secondary vegetation. The third camp at Werehpai was established on an old abandoned farm. The forest around this camp was dominated by secondary forest with *Cecropia sp.* and bamboo (*Guadua* sp.) and domesticated plants such as *Musa sp*. (Musaceae). Along the Sipaliwini River we also observed open areas completely covered by vines.

Bamboo forest. At all three study sites, and especially along the Sipaliwini River, patches of bamboo (*Guadua sp*.) occurred in forests along the river edge. From the air it could be seen that some bamboo patches formed squares in the forest, suggesting that bamboo had colonized areas cleared previously by humans. Bamboo was less common along Wioemi Creek.

Plant collections and plot inventories

A preliminary species list is provided in Appendix 2. In total, 402 plants were collected of which 183 had fruit and/or flowers. The rest of the collections were sterile. Based on provisional morphospecies identifications, we estimated that approximately 170 species were collected during the general plant surveys, whereas approximately 250 tree species were encountered in the plots. Based on the data from both 1-ha and 0.1-ha plots, the Kutari site had the most diverse forest, meaning the highest Fisher's alpha (a diversity index describing the relation between the amount of individuals and species in a plot). The forest plots at Werehpai were the least diverse. The Fisher's alpha values for the Kutari plots are comparable to the highest value calculated in Suriname to date (from a plot in the Lely Mountains; Bánki 2010). The values of Fisher's alpha for the Werehpai plots are in the range that is typically calculated for savannah forests (Bánki 2010). In terms of species composition all three sites were distinct. In the Sipaliwini and Werehpai plots, the species composition changed instantly when the soils were shallow due to the hard parent rock underneath. These forests could be described as savannah forests with a lower canopy height, fewer large trees, and the occurrence of tree species that are usually found in more dry and mountainous forests. Thus although the forests at Werehpai have a relatively low diversity, the forest composition may be quite unique for Suriname. Further analyses should investigate the difference in species composition between the forests in the surroundings of Kwamalasamutu and the rest of Suriname and the Guianas. Based on the plot data we also expect to produce the first biomass estimates for southern Suriname.

Table 1. Metadata for the plots established at each site during the RAP.
N = number of individuals, S = number of species, Fa = Fisher's alpha.

Plot Name	Ha	Dimension	N	S	Fa	UTM (21N)
Kutari River Plot 1	1	250 x 40 m	529	140	62.15	0240430
Kutari River Plot 2	0.1	100 x 10 m	142	81	78.3	0250291
Sipaliwini River Plot 3	1	250 x 40 m	443	116	51.14	0252458
Sipaliwini River Plot 4	0.1	100 x 10 m	123	54	36.74	0253000
Werehpai Plot 5	1	250 x 40 m	454	104	42.19	0262851
Werehpai Plot 6	0.1	100 x 10 m	158	46	21.8	0262640

Interesting plant species and genera

We found several plant species that are worthwhile to note. In the plots we encountered one new tree species for Suriname (*Bocoa alterna;* Fabaceae), and several species that may be new records for the country. We collected the second specimen of the tree species *Duguetia cauliflora* (Annonaceae) for Suriname. A collection of *Mosannona discolor* is the fourth for Suriname, and the tenth collection for this species in general. Noteworthy observations included an uncommon Myristicaceae tree species (*Osteophloeum platyspermum*) with amber-colored latex in the bark. Some rare plant species we encountered are: *Herrania kanukuensis* (Malvaceae), a small tree with a flower of long purple petals on the stem; *Bocoa* sp., a rare legume tree with unifoliolate leaves; and *Cochlospermum orinocense*, a tree restricted to rocky outcrops that has large showy yellow flowers. Further identification should shed more light on these and other species and help us determine if they are new to science or show floristic affinity with Guyana or Brasil.

We encountered five tree species listed on the IUCN red list, namely:
Aniba rosaeodora EN A1d+2d ver 2.3 (1994)
Cedrela odorata VU A1cd+2cd ver 2.3 (1994)
Corythophora labriculata VU D2 ver 2.3 (1994)
Minquartia guianensis LR/nt ver 2.3 (1994)
Vouacapoua americana CR A1cd+2cd ver 2.3 (1994)

We encountered three tree species protected under Surinamese law:
Aniba rosaeodora (rozenhout)
Dipteryx odorata (tonka)
Manilkara bidentata (boletri)

A significant observation from the forests in our study areas was that we did not encounter large numbers of commercial timber trees.

Conservation recommendations
With regard to the plants and forest in the Kwamalasamutu region, some conservation recommendations can be made:

- The forests at the Kutari have one of the highest tree diversity values for Suriname. Within the whole study area the landscape is quite heterogeneous potentially causing a high species turnover (beta diversity) between habitat types. These forests seem to have a high conservation value. Further inventories are recommended.

- In areas where the parent rock is close to the surface and the soils are shallow, impacts on the forest, such as forest clearings, could lead to the enhancement of dense liana forests and the degradation of soils.

- Bamboo forests occur frequently in the Kwamalasamutu area. Impacts on the rainforests could promote the proliferation of bamboo forests. Many old farms are dominated by bamboo forest, and this hinders the natural regeneration of the rainforests.

- During the RAP we observed that the extent of the agricultural fields of Kwamalasamutu is large. The agricultural fields have an impact on the tropical rainforests in the direct vicinity of Kwamalasamutu. In the long term, this practice is likely not sustainable.

- We only investigated a small open rock area, but there are larger open rock areas in the surroundings of Kwamalasamutu that could have a high conservation value with respect to the plants that potentially could occur on these open rock patches. We were informed by the Trio that a larger inselberg is situated a day's walk from the Sipaliwini camp (Site 2). This and similar inselbergs should be investigated and inventoried.

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PRELIMINARY REPORT – AQUATIC BEETLES

Andrew Short and Vanessa Kadosoe

Introduction

Aquatic beetles represent a significant portion of freshwater aquatic macroinvertebrate communities. At present, aquatic beetles are represented by nearly 12,000 described species distributed worldwide – a guild slightly richer in species than birds. These species are distributed across approximately 20 beetle families in four primary lineages: Myxophaga, Hydradephaga, aquatic Staphyliniformia (Hydrophiloidea & Hydraenidae) and the Dryopoidae (or aquatic Byrroids). Members of Myxophaga are small beetles that feed largely on algae as larvae and adults. The Hydradephaga (including the diving and whirligig beetles) are largely predators as adults and larvae; the aquatic Staphyliniformia are largely predators as larvae but scavengers as adults; the dryopoids are largely scavengers or eat algae as both larvae and adults.

Aquatic insects in general (including several groups of aquatic beetles) are often used to assess water quality in freshwater rivers and streams. The dryopoids are most frequently used for this purpose because they are most commonly found in these habitats and often have high-oxygen needs. Aquatic beetle communities are also effectively used to discriminate among different types of aquatic habitat (e.g. between lotic and lentic; rock outcrops, substrate, etc.).

No prior surveys in Suriname have focused on aquatic beetles, and the fauna of the country as well as the Guiana Shield region in general, remains very poorly known.

Methods

We collected aquatic beetles at all three main sites on the RAP (Site 1: Kutari; Site 2: Sipaliwini; Site 3: Werehpai). We also collected small, incidental samples at Iwaana Saamu. We employed a variety of passive and active collecting techniques to assemble as complete a picture of the aquatic beetle communities as possible. Passive techniques are advantageous because they often allow large amounts of material to be collected in quantitative ways at one time and with little effort, but they provide little ecological or habitat data—and thus we do not gain new insights into the water quality requirements of insects collected in this manner. In contrast, active collecting methods (i.e. by hand) provide a richer source of information on the microhabitat and water quality requirements of species, but are more time intensive, qualitative, and may suffer from collector bias.

Traps and other passive methods. On most nights, we collected in the evening hours until approximately 10 p.m. at a UV light mounted on a white sheet erected on the periphery of each camp. We also used flight intercept traps (FITs) to sample the beetle fauna. These traps collect flying insects, including dispersing aquatic beetles. At Site 1 we used two FITs, each composed of a 2-meter wide by 1.5- meter high screen, with aluminum pans filled with soapy water as a collecting trough. At Sites 2 and 3, we used three FITs.

Active methods. For active collection of swimming insects, we used a large aquatic insect net to probe larger and deeper pools and river margins. We also targeted insects that float on the water's surface using small metal strainers to collect in micropools and marginal areas. We also collected in several ‘niche’ habitats, including the phytotelmata of *Heliconia spp*. at Site 3, the rock face seeps and damp soil on the inselberg at Site 2, and damp leaf litter at Site 3. For the latter, we submerged the leaf packs in a tub of water and collected the insects that floated to the surface.

Because aquatic beetles are very small (most <5 mm) and many require examination under a microscope for species identification, we collected and preserved samples of these insects from each camp to take back to the laboratory for processing. Material collected in FITs was not examined in the field; thus any taxon collected only by this method is not included in the preliminary species list.

Results

A preliminary species list is provided in Appendix 3. In total, approximately 90 species in 48 genera were found. At the generic level, all three sites exhibited similar species diversity, with an estimated 57 to 69 species found per site. The majority of genera were found at all three sites. Of these 90 species, we estimate that approximately 20 are new to science. Species level determination will be done over the next year as samples can be processed, mounted, and in some cases dissected.

At a glance, the fauna was typical of lowland Guianan forests. Some taxa, such as the genera *Siolus*, *Guyanobius*, *Fontidessus*, and *Globulosis* are either endemic or largely restricted to the Guiana Shield. The fauna was very similar to what is known from southern Venezuela (south of the Orinoco) and Guyana.

The species found on and around the inselberg at Site 2 are restricted to this habitat, and all likely represent new species that have a restricted range (perhaps endemic to Suriname and its periphery). Despite the presence of the inselberg at Site 2, no species of Myxophaga were found. We suspect the isolation or lack of running water over rock contributed to the absence of this group.

Recommendations

The water beetle diversity was expected given the complement of aquatic habitats available at each camp. The relatively high number of genera and species, which cover a variety of ecological and habitat types, suggest the area is largely undisturbed. Differences between the communities found at each camp are largely due to either the presence of rare species (‘singletons’) or habitats found at some but not all camps. For example, only a few specimens of an unusual species of *Vatellus* were found at Site 2 in a detrital creek, but as this group is very rare and probably patchy in its distribution, it does not reflect poorly on Sites 1 and 3. Similarly, the genera *Oocyclus*, *Fontidessus*, and *Platynectes* were only collected at Site 2, but these taxa are usually restricted to rock outcrops. Since no outcrops were present in the vicinity of Sites 1 and 3, these species were not found.

No differences in the water beetle communities between the sites could be attributed to anthropogenic disturbance. Rather, these minor differences reflect natural differences between sites and species patchiness. Interestingly, there are several aquatic beetle taxa that we did not collect, such as the water scavenger beetle genus *Berosus* and the widespread species *Tropisternus lateralis* and *T. collaris*. All are widespread in northern South America, and also recorded from Suriname. These species are often found in open, vegetated standing waters (including ditches, ponds, and marshes). The fact that these often common species were not found further supports the conclusion that our study sites were undisturbed and had intact canopies.

PRELIMINARY REPORT – DUNG BEETLES

Trond H. Larsen

Introduction

Dung beetles (Coleoptera: Scarabaeidae: Scarabaeinae) are an ecologically important group of insects. By burying dung as a food and nesting resource, dung beetles contribute to several ecological processes and ecosystem services that include: reduction of parasite infections of mammals, including people; secondary dispersal of seeds and increased plant recruitment; recycling of nutrients into the soil; and decomposition of dung as well as carrion, fruit and fungus (Nichols *et al.* 2008). Dung beetles are among the most cost-effective of all animal taxa for assessing and monitoring biodiversity (Gardner *et al.* 2008), and consequently are frequently used as a model group for understanding broad biodiversity trends (Spector 2006). Dung beetles show high habitat specificity and respond rapidly to environmental change. Since dung beetles depend primarily on dung from large mammals, they are excellent indicators of mammal biomass and hunting intensity. Dung beetle community structure and abundance can be measured rapidly using standardized transects of baited traps, facilitating quantitative comparisons among sites and studies.

Methods

Dung beetles were sampled at all three sites (Kutari, Sipaliwini, and Werehpai) using standardized pitfall trap transects. Ten traps baited with human dung were placed 150 m apart along a linear transect at each site (see Larsen and Forsyth 2005 for more details). Traps consisted of 16-oz plastic cups buried in the ground and filled with water with a small amount of liquid detergent. A bait ball wrapped in nylon tulle was suspended above the cup from a stick and covered with a large leaf. At each site, traps were collected every 24 hours for four days, and were re-baited after two days. Three flight intercept traps were set at each site to passively collect dung beetle species not attracted to dung. We also placed additional pitfall traps whenever possible with other types of baits that included rotting fungus, carrion, and dead invertebrates. We opportunistically collected dung beetles encountered in the forest, usually perched on leaves, during both day and night.

From 19-24 August 2010, we surveyed dung beetles at the Kutari site in primary forest characterized by small hills and several swampy areas. From 27 August – 4 September 2010, we surveyed dung beetles at the Sipaliwini site in primary forest with small hills and relatively dry, hard soils with high bedrock. From 2-7 September 2010, we surveyed dung beetles at the Werehpai site in primary forest as well as in bamboo (1 dung trap) and secondary forest (1 dung trap). Beetles were identified and counted as they were collected in the field, and voucher specimens were stored in ethanol for further study and museum collections. Beetle specimens will be deposited at the National Museum of Natural History at the Smithsonian Institution in Washington, DC, USA and at the National Zoological Collection of Suriname in Paramaribo.

To estimate total species richness at each site and assess sampling completeness, we compared the observed number of species with the expected number of species on the basis of randomized species accumulation curves computed in EstimateS (version 7, R.

K. Colwell, http://purl.oclc.org/estimates; Colwell & Coddington 1994). Two abundance-based coverage estimators (Chao1 and ACE) were used because they account for species abundance as well as incidence, providing more detailed estimates. We also used EstimateS to calculate similarity among sites, using the Morisita-Horn similarity index which incorporates species abundance as well as incidence.

Results

90 species and 4,391 individuals of dung beetles were found during the RAP (Table 1, Appendix 4). Species richness was similar at all sites, but was highest at Sipaliwini (66 species), followed by Werehpai (63 species) and Kutari (58 species; Table 1, Figure 1). Abundance differed strongly between sites, and was also highest at Sipaliwini and lowest at Kutari; 73% fewer individuals occurred at Kutari relative to Sipaliwini (Table 1, Figure 1). Low abundance at Kutari may have been influenced by the large areas of swamp and flooded forest at the site, conditions which negatively affect many dung beetle species whose larvae develop in the soil. However, diversity, measured by the Shannon index, was highest at Kutari because of greater evenness of species' abundance distributions (Table 1).

Species accumulation curves for dung-baited pitfall traps estimated that we sampled 91% of all coprophagous species occurring in the area. However, sampling completeness was lowest at Werehpai where we sampled only 73% of the dung-feeding species likely to occur at the site (Table 1, Fig. 1). Sixteen species were sampled only in flight intercept traps (Appendix 4); many of these species are poorly represented in collections because they are difficult to sample and, in some cases, their diet is unknown. Some of these species show unusual specializations, such as millipede predation or colonization of leaf-cutter ant nests.

Species composition and community structure varied strongly among sites (Table 2). Sipaliwini and Werehpai were relatively similar in terms of community structure, showing a high Morisita-Horn index. Kutari was very distinct from both Sipaliwini and Werehpai, and contained many species not present at the other sites. At least 25 dung beetle species sampled during the RAP are associated primarily with the Amazon region, whereas the remaining species are typical of the Guianas. Many of the Amazonian species were locally rare and sampled at Kutari, the southernmost site sampled during the RAP. The Kwamalasamutu region may encompass the northern range limit for these species.

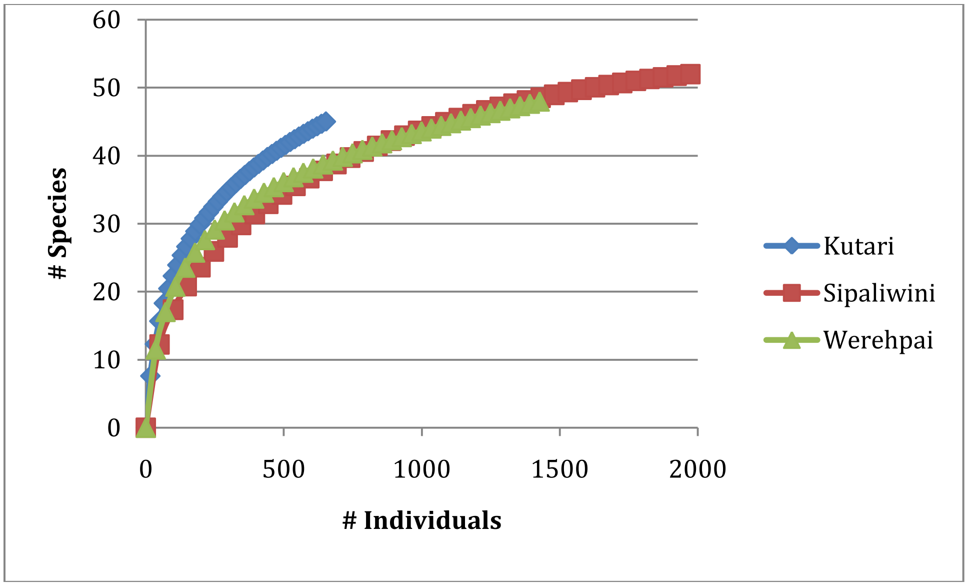

Figure 1. Species accumulation curves for each site based on dung-baited pitfall traps.

Table 1. Diversity and abundance of dung beetles at each site.

	Kutari	**Sipaliwini**	**Werehpai**
Species richness (all samples)	58	66	63
Abundance (all samples)	777	2090	1524
Species richness (dung traps)	45	52	48
Estimated richness (ACE) (dung traps)	55	58	66
Shannon diversity (H) (dung traps)	2.86	2.59	2.79

Table 2. Dung beetle community similarity among sites.

1st	2nd	S 1st	S 2nd	Shared S	Morisita-Horn
Kutari	Sipaliwini	45	52	36	0.535
Kutari	Werehpai	45	48	30	0.588
Sipaliwini	Werehpai	52	48	39	0.902

Interesting Species

We estimate that approximately 10-15% of the dung beetle species collected during this RAP (9-13 species) are new to science. However, most of these genera have never been revised, and determination of these undescribed species will require further comparisons with other museum collections. We sampled 21 species of *Canthidium* in the Kwamala area. *Canthidium* is a hyper-diverse yet very poorly known genus, and many of these species are almost certainly new to science. The genera *Ateuchus* and *Uroxys* are also very poorly known and several species from the RAP are likely to be new.

Several large-bodied dung beetle species, such as *Coprophanaeus lancifer* (the largest species of Neotropical dung beetle), *Oxysternon festivum*, and *Dichotomius* *boreus*, were sampled at all three sites. These species move long distances and require large, continuous areas of forest to persist. Their presence at the sites is indicative of the intact, contiguous forest landscape around Kwamala. These large dung beetle species are also the most ecologically important for burying seeds and controlling parasites.

Four species (*Anomiopus* sp 1 & 2, *Dendropaemon* sp 1, and *Deltorrhinum* cf *batesi*) were only sampled in flight intercept traps and their distinctive morphology, with strongly reduced tarsi and stout, compact bodies, suggest that they are associated with ant nests, as are several other dung beetle species. *Deltochilum valgum* is a highly specialized predator of millipedes, and adults decapitate and feed on millipedes that are much larger than themselves. This unusual behavior was only discovered and described last year (Larsen *et al.* 2009). We found one individual of *Uroxys gorgon*, a species which is phoretic in the fur of sloths.

Conservation Recommendations

The Kwamalasamutu region supports vast tracts of intact primary forest, which is important for many dung beetle species. Consequently, we found extremely high species richness of dung beetles in the area (90 species). To put this diversity into perspective, during a RAP survey at the Nassau and Lely plateaus in Suriname, only 24 and 33 species were sampled at each site respectively (Larsen 2007), and only 41 species were found during extensive sampling in lowland forest around Lago Guri in Bolívar, Venezuela (Larsen *et al.* 2008). Preventing mining operations and other drivers of deforestation from entering the Kwamalasamutu area will be important for maintaining this high biodiversity.

In addition to high overall species richness, we found high Beta diversity at the sites across very small spatial scales, and Kutari supports a distinct dung beetle community relative to the other sites. Consequently, it is important to protect the diversity of soils and habitats that occur in the Kwamalasamutu region even at small spatial scales. Plans for protected areas or reserves should incorporate this small-scale spatial heterogeneity.

Tropical ectotherms, such as dung beetles, are among the most sensitive organisms on Earth to climate change (Larsen *et al.* in press). Climate warming is forcing many species to shift their distribution poleward or upslope, and these effects are strongest at the edge of species' ranges. Since the Kwamalasamutu region contains many Amazonian species near the edge of their range limit, there exists an excellent opportunity to monitor the response of populations and species' distributions to climate change.

The abundance and biomass of dung beetles in the Kwamalasamutu region was relatively high. This suggests that in addition to the pristine state of the forest, populations of large birds and mammals are relatively stable. However, dung beetle abundance was lower than expected based on surveys in other Neotropical primary forests where no hunting occurs. This is likely to reflect the relatively low abundance of spider monkeys, howler monkeys, and white-lipped peccaries, which are among the most important species for dung beetles but are also preferred for bushmeat. Reduced hunting on these key species would help to stabilize ecosystem dynamics not just for dung beetles, but for seed dispersal and other ecological processes as well. The establishment of hunting-restricted reserves such as Iwaana Saamu is an excellent way to maintain sustainable populations of large mammals.

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PRELIMINARY REPORT – ANTS

Leeanne E. Alonso

Introduction to Group

Ants are an important group of social insects (Insecta: Hymenoptera: Formicidae). To date, over 14,000 ant species (www.antweb.org) have been recorded in the world but experts believe that there are at least that many more yet to be discovered. The Neotropical regional is a key region for ants; it has a high number of ant genera and species and the greatest number of endemic ant genera (Fisher 2010). Sosa-Calvo (2007) estimates that over 350 ant species have been documented from Suriname, with many more likely to be added to the list. Ants are distributed everywhere in terrestrial environments except the two poles of the earth and above snow-level. They are important members of the ecosystem, with high biomass and population size, and provide key ecological functions such as aerating and turning soil, dispersing plant seeds, consuming dead animals, and controlling pest insects. Ants are also an important group for monitoring and evaluating environmental conditions and biodiversity.

Methods

Due to availability of the researcher, ants were studied only at the third RAP camp at Werehpai caves (2°21'47.1"N, 56°41'51.5"W) from 4-8 September 2010. Ants were surveyed by applying search-collecting methods and the Winkler method (Agosti et al. 2000). In the search-collecting method, the ants nesting under stones, under or inside decayed wood and those foraging on ground, litter, tree trunk and plants were searched for and collected. In the Winkler method, a sifter was used to obtain 10 litter samples along a 100 meter transect through the forest. Every 10 meters a $1m^2$ quadrat of leaf litter was sifted and combined with the other samples, to produce one sample per transect. Each litter sample was hung in a mesh bag inside a separate Winkler sac over a period of 48 hours. Four winkler transects were done in the forest along the main trail between the RAP camp and the Werephai caves. Ants were also searched for and collected in and around camp.

Preliminary observations on the ant fauna

Ants were abundant and conspicuous at the third RAP site. Many RAP team members remarked on the seemingly high abundance of ants throughout the forest and around camp, which seemed higher than usual. Ants were abundant in rotting logs and twigs, as well as in the soil and on trees. Many arboreal ants were observed, especially from the genera *Pseudomyrmex* and *Cephalotes*. The spectacular *Gigantiops predator,* a large fast-moving ant with enormous eyes, was common. Several large *Atta* sp. nests were observed around camp and along the trail.

The ant specimens are currently in the process of being sorted, pinned and identified using the collections at the Smithsonian Institution (SI). SI entomologist, Dr. Ted Schultz, and his students are conducting an ongoing program of the "Ants of the Guiana Shield" and thus have a very good reference collection to allow identification of that ants from Suriname.

Conservation Recommendations

Our preliminary assessment suggests that no invasive (tramp or non-native) ants species were present at this site. Invasive or tramp (cosmopolitan) ant species often invade areas that have been disturbed so their absence is a good sign of a healthy ant fauna and ecosystem. Some native species become more abundant in disturbed areas and can distrupt the ant and other animal communities (especially since they are big predators of other insects). It is recommended to survey and monitor the ant fauna at the boat landing on a regular basis (e.g. every 6 months) to detect any of the invasive ant species before they invade and become established along the trail and in the forest. Identification guides to the most dangerous invasive ant species can be developed for and used by the Kwamalasamutu community.

Many ant species require closed canopy forest to maintain the appropriate microclimate they need to survive. These species are found only at pristine sites. Preliminary indications of the ant fauna at the third RAP site indicate the presence of many forest species among the ant fauna.

A full analysis of the ant species, once identified, will reveal whether any ant species are of conservation concern and also how some ant species can serve as indicators of the health of the ecosystem.

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PRELIMINARY REPORT – KATYDIDS

Piotr Naskrecki

Introduction

Katydids (Insecta: Orthoptera: Tettigoniidae) have long been recognized as organisms with a significant potential for use in conservation practices. Many katydid species exhibit strong microhabitat fidelity, low dispersal abilities (Rentz 1993), and high sensitivity to habitat fragmentation (Kindvall and Ahlen 1992) thereby making them good indicators of habitat disturbance. These insects also play a major role in many terrestrial ecosystems as herbivores and predators (Rentz 1996). It has been demonstrated that katydids are a principal prey item for several groups of invertebrates and vertebrates in Neotropical forests, including birds, bats (Belwood 1990), and primates (Nickle and Heymann 1996). While no Neotropical katydids have been classified as threatened (primarily because of the paucity of data on virtually all species known from this region), there are already documented cases of some Nearctic katydids being threatened or endangered, or even extinct (Rentz 1977.)

Despite the recent increase in the faunistic and taxonomic work on katydids of the Neotropics, forests of the Guiana Shield remain some of the least explored and potentially interesting areas of South America. Collectively, over 190 species of the Tettigoniidae have been recorded from countries comprising the Guiana shield (e.g., Venezuela, Guyana, Suriname, and French Guiana), but this number clearly represents a small fraction of the regional species diversity, and at least 300-500 species can be expected to occur there. Sixty-one species have been reported from Suriname. Virtually all of these records are based on material collected in the 19th century, and no targeted survey of the katydid fauna of the country has ever been conducted. Most of the species from Suriname were described in the monographic works by Brunner von Wattenwyl (1878, 1895), Redtenbacher (1891), and Beier (1960, 1962). More recently Nickle (1984), Emsley and Nickle (2001), Kevan (1989), and Naskrecki (1997) described additional species from the region.

The following report presents preliminary results of a survey of katydids conducted between 17 August and 9 September 2010 at selected sites in the Kwamalasamutu region of southern Suriname.

Methods and study sites

During the survey 3 methods were employed for collecting katydids: collecting at an ultraviolet (UV) light at night, visual searching at night and during the day, and detection of stridulating individuals using an ultrasound detector (Petersson 200) at night. Representatives of all encountered species were collected and voucher specimens were preserved in 95% ethanol or as dry specimens layered between thin paper tissue and desiccated with silica gel. Upon completion of their identification, voucher specimens of all collected species will be deposited in the National Zoological Collection of Suriname, Paramaribo, while remaining specimens will be deposited in the collections of the Museum of Comparative Zoology, Harvard University and the Academy of Natural Sciences of Philadelphia (the latter will also become the official repository of the types of any new species encountered during the present survey upon their formal description.)

In addition to physical collection of specimens, stridulation of several acoustic species was recorded using a Marantz PMD661 digital recorder with a Sennheiser directional microphone. Virtually all species encountered were photographed, and these images will be available online in the database of the world's katydids (Otte and Eades 2010).

Katydids were surveyed at the following five sites:

(1) Kutari, Site 1 (2°10'31.3"N, 56°47'14.1"W) – 18-25 August 2010
(2) Iwana Samoe (2°21'46.6"N, 56°45'17.9"W) – 25-26 August 2010
(3) Sipaliwini (Kinoroime Eni), Site 2 (2°17'24.1"N, 56°36'25.6"W) – 27 August – 2 September 2010
(4) Inselberg nr. Sipaliwini river (2°17'56.4"N, 56°36'37.3"W) – 31 August 2010
(5) Werehpai, Site 3 (2°21'47.1"N, 56°41'51.5"W) – 2-8 September 2010

Results

A detailed discussion of the results and conservation recommendations will be included in the final report. For the purpose of this preliminary report only a few interesting species are mentioned, and a tentative list of species is provided (Appendix 6). It is worth mentioning that the abundance of katydids encountered during this survey was often exceptionally low (although no formal structured sampling was conducted, the rate of katydid collection was often only 1 individual/hour, and during most nights no individuals were attracted to the UV light.). Also, many of the recorded species appeared only as nymphs, often in early developmental stages, which indicates a strong seasonality in their development. It seems that in such species egg hatching must take place in the last weeks of the rainy season, and maturation takes place during the dry season.
Of the three main camps, the first site (Kutari) had the lowest number of both species (24) and specimens (64) collected, presumably because of the heavy rains that still affected the activity of katydids at the end of the rainy season, when the survey began. Werehpai had the highest number of species (49), followed by Sipaliwini (44).

Conehead katydids (subfamily Conocephalinae)

The Conocephalinae, or the conehead katydids, include a wide range of species found in both open, grassy habitats, and high in the forest canopy. Many species are obligate semenivores (seed feeders), while others are strictly predaceous. A number of species are diurnal, or exhibit both diurnal and nocturnal patterns of activity. Seventeen species of this family were recorded.

Vestria sp. 1 – Four species of this genus are known from lowland forests of Central and South America. These insects, known as Crayola katydids because of their striking coloration, are the only katydids known to employ chemical defenses, which are effective at repelling bird and mammalian predators. Specimens of *Vestria* collected at Sipaliwini and Werehpai most likely represent a species new to science.

Daedalellus sp. 1 – A single species of this genus was recorded from all three camps on this survey. It appears to be new to science, and is the only known species of the genus with fully developed wings (all 7 previously described species of the genus *Daedalellus* are brachypterous and flightless.)

Loboscelis baccatus Nickle et Naskrecki – This arboreal, most-likely predaceous species was previously known only from Amazonian Peru, but a single individual was found at Werehpai. This record represents a significant extension of its range, and the first record of the genus *Loboscelis* in the Guiana Shield.

Leaf katydids (subfamily Phaneropterinae)

The Phaneropterinae, or leaf katydids, represent the largest, most speciose lineage of katydids, with nearly 2,700 species worldwide, and at least 550 species recorded from South America. All species of this family are obligate herbivores, often restricted to a narrow range of host plants. Probably at least 50-75% of species found in lowland rainforests are restricted to the canopy layer and never descend to the ground (females of many species lay eggs on the surface of leaves or stems, and the entire nymphal development takes place on a single host plant.) For this reason, these insects are difficult to collect, and the only reliable method for their collection is a UV or mercury-vapor lamp, or canopy fogging. Very few species can be encountered during a visual or acoustic search in the understory of the forest.

Twenty-two species of leaf katydids were recorded during the present survey, virtually all attracted to the UV light at the camps. At least one species *(Dolichocercus* sp. 1) is likely new to science. Several species of the genera *Anaulacomera* and *Phylloptera* may also be new.

Sylvan katydids (subfamily Pseudophyllinae)

Virtually all members of tropical Pseudophyllinae occur only in forested, undisturbed habitats, and thus have a potential as indicators of habitat changes. These katydids are mostly herbivorous, although opportunistic carnivory has been observed in some species (e. g., *Panoploscelis)*. Many are confined to the upper layers of the forest canopy and never come to lights, and are therefore difficult to collect. Fortunately, many species have very loud, distinctive calls, and it is possible to document their presence based on their calls alone, a technique well known to ornithologists. Thirty-five species of this family were collected during the present survey.

Gnathoclita vorax (Stoll, 1813) – This spectacular species is a rare example of a katydid with strong sexual dimorphism manifested in strong, allometric growth of the male mandibles. It was found at Werehpai, although all collected specimens were nymphal. This species is known only from southern Guyana and southern Suriname.

Eubliastes cf. *adustus* – Three individuals of this large katydid species were collected at Sipaliwini. Although superficially similar to *E. adustus* Bolivar known from Ecuador, the morphology of the male external genitalic structures indicates that these specimens may represent a species new to science.

Gen. 5 sp. 1 – Numerous individuals of this apparent new genus and species of sylvan katydids were collected at all three camps of the survey. It is a large insect, with striking blue markings on its face and hind legs, and was found feeding on low branches of various trees and the spiny palm *(Bactris* sp.) This species, while still undescribed, was collected near the Kamoa Mountains during the 2006 southern Guyana RAP.

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PRELIMINARY REPORT – DRAGONFLIES AND DAMSELFLIES

Natalia von Ellenrieder

Introduction

Dragonflies and damselflies (Order Odonata) are widespread and abundant on all continents with the exception of Antarctica, with centers of species richness typically occurring in tropical forests. They spend their larval life in aquatic habitats and use a wide range of terrestrial habitats as adults. Larvae are sensitive to water quality and aquatic habitat morphology such as bottom substrate and aquatic vegetation structure. Adult habitat selection is strongly dependent on vegetation structure, including degrees of shading. As a consequence dragonflies show strong responses to habitat change such as thinning of forest and increased erosion. Common species prevail in disturbed or ephemeral waters, while pristine streams, seepage, and swamp forests house an array of more vulnerable, often localized species. Different ecological requirements are linked to different dispersal capacities: species with narrow niches often disperse poorly, while pioneers of temporal habitats, often created by disturbance, are excellent colonizers. Thus, Odonata are useful for monitoring the overall biodiversity of aquatic habitats and have been identified as good indicators of environmental health (Corbet 1999; Kalkman *et al.* 2008). Due to their low species numbers relative to other insects (about 5,700 species worldwide) they also constitute an ideal target group for a rapid assessment because it is feasible to fully document their species diversity for a particular area in a relatively short period of time.

Brief Methods and Study Sites

Odonata species from the Kwamalasamutu region, in the Sipaliwini District of southwest Suriname were investigated by applying search-collecting methods. Odonates were surveyed from 19-24 August 2010 in the area surrounding the Kutari river (Site 1: 2°10’27”N 56°54’25”W, 263 m); from 28-31 August in the area adjacent to the Sipaliwini river (Site 2: 2°19’48”N 56°39’20”W, 264 m); and from 2-7 September in the surroundings of Werehpai (Site 3: 2°21’45”N 56°41’54”W, 252 m). Odonates were also recorded at Iwana Saamu (2°21’46”N 56°45’18”W, 255 m) on 28 August, and at a vegetated ditch in Kwamalasamutu on 8 September (2°21’17”N 56°47’11”W, 211 m).

Searching, photographing, and collecting of adult odonates with an entomological aerial net was carried out around each camp, in terra firme forest, forest swamps, streams, creeks, varzea forest, and rivers. Presence/absence information of species was recorded in a spatial-relational database.

Results and General Impressions

Overall, 45 odonate genera belonging to 10 families were collected at the three sites, with a total of 93 morphospecies. They include lowland Amazonian odonates, and represent about a third of the total number of odonate species reported for Suriname (280 species according to Belle 2002). They include 4 species likely new to science, and 13 species recorded for the first time for Suriname. In detail, 10 families, 31 genera, and 57 species were collected at the Kutari site; 10 families, 28 genera, and 52 species at the Sipaliwini site; and 10 families, 34 genera, and 64 species at the Werehpai site (see Appendix 6). Considering the number of morphospecies at each site, the preliminary results indicate that the three sites have a comparable richness, although the Werehpai site was slightly richer while the Kutari site had the lowest number of morphospecies.

In terms of odonate community composition, the three sites shared between 1/2 and 2/3 of the species with each other, with shared species showing usually different abundances at each one of them (*i.e.*, common species at a site being rare at another one; see Relative Abundance in Appendix 7). Werehpai hosted seventeen species not found at the other two camps: *Acanthagrion* sp. 2, *Perilestes* sp. 1, *Brechmorrhoga sp*., *Orthemis* sp. 2 (in rivers), *Archaeogomphus sp*., *Progomphus sp*., *Macrothemis* sp. 4 (in forest creeks and streams), *Metaleptobasis* sp. 1, *Metaleptobasis* sp. 2 (in forest swamps), *Gynacantha* sp. 2, *Gynacantha* sp. 3, *Gynacantha* sp. 4, *Misagria* sp. 1, *Misagria* sp. 2, *Orthemis* sp. 3, *Uracis* sp. 1, and *Uracis* sp. 4 (along forest trails and in forest clearings). Twelve species were found only at the Kutari site: *Acanthagrion* sp. 3, *Argia* sp. 1, *Ebegomphus sp.*, *Macrothemis* sp. 1 (in rivers), *Mnesarete sp*., *Macrothemis* sp. 5 (in creeks and streams), *Argia* sp. 7, *Psaironeura sp.*, *Argyrothemis sp.* (in forest swamps), *Mecistogaster* sp. 2, *Erythrodiplax* sp. 1, and *Gynothemis sp*. (along forest trails and clearings). Seven species were only present at the Sipaliwini site: *Phyllocycla sp*. (in rivers), *Neoneura* sp. 4, *Protoneura* sp. 1, *Elga sp.*, *Macrothemis* sp. 3 (in forest creeks and streams), *Triacanthagyna sp*., and *Macrothemis* sp. 2 (along forest trails and clearings). Five of the species found at Kwamalasamutu (at a vegetated ditch) were unique to this site: *Miathyria sp*., *Micrathyria* sp. 1, *Nephepeltia sp*., *Oligoclada* sp. 3, and *Tauriphila sp.*

Interesting Species and Genera

The genus *Argia* is the most species-rich within the family Coenagrionidae in the New World. This genus shows its prevalence in all three sites, being not only the richest in species (eight morphospecies), but also wide in distribution, with all but one species shared among the three sites. Most likely at least some of the morphospecies found for this genus will be new to science after revisionary taxonomic work. *Neoneura* is the most species-rich genus within the Neotropical Protoneuridae, and it is represented by six species in this study.

All odonates are predatory, both as adults and as larvae. Adults usually have spiny legs, which form a functional ‘cage-net’ to trap insects they catch in flight. Adults of *Heliocharis* (Dicteriadidae) are an exception, as they have only minute spines on their legs. They use their unusually large mouthparts instead to catch and hold their prey. Adults of *Mecistogaster* and *Microstigma* (Pseudostigmatidae) present an interesting biology. They fly in the understory of the rainforest, and can be observed gleaning spiders and other insects caught in spider webs. They have a very long abdomen, which is an adaptation for oviposition in phytotelmata (species-specific: water-filled tree holes, bamboo internodes, bromeliads, or fallen fruit or nut husks).

No odonates are listed on the CITES appendices. The conservation status of approximately one-quarter of the Neotropical species was recently assessed by the Odonata Specialist Group of IUCN (Claustnitzer et al. 2009) and it is possible that some of the morphospecies collected will be included among those assessed once identified specifically.

Conservation Recommendations

The diversity of odonate genera and species found in this study is typical of well-preserved sites; most of the species found in the forest understory, creeks, and swamps around the three RAP survey sites would not be present if the forest were disturbed.

Odonata are largely unaffected by hunting or trade, unlike birds, mammals or other invertebrates, notably butterflies. However, many odonate species require closed canopy forest to maintain the appropriate vegetation structure they need as adults. Human activities such as deforestation and mining would most likely affect their occurrence in the area and produce a marked decrease in their diversity, since deforestation affects the vegetation structure needed by the adults, and subsequent alteration of water bodies by erosion and siltation would be detrimental for their larvae. Mining would lead to increased turbidity and siltation of streams, changing the substrate and reducing the quality of habitats needed by odonate larvae. Claustnitzer et al. (2009) found that the threat level is generally higher for forest species, most often due to increased human pressures on species restricted to forest fragments, mountaintops, and island localities, whereas species inhabiting large forest blocks are usually subjected to lower risk.

Therefore, the main conservation recommendation is to include an area as large as possible, encompassing at a minimum the three visited sites and intervening areas, as a legally protected nature preserve to prevent mining and logging activities and thus conserve the high diversity of odonate species found in this study. If a nature preserve is not created and development activities do take place within the Kwamalamasutu region, it is recommended to leave broad buffer zones of undisturbed vegetation along rivers and creeks, in order to minimize the damage to the watershed and consequently to the odonate community.

It is also recommended to conduct further biodiversity studies in the area to increase the knowledge of several poorly known and rare species that occur in these pristine forests, and to gain knowledge about the possible seasonality (dry –rainy season species assemblages) of the odonate community of SW Suriname. If further surveys are conducted, it is suggested to include some sites close to human settlements to provide the framework needed to assess which species are affected by human disturbance and thus possibly identify indicator species of pristine environments for this region.

Initial involvement of local communities in dragonfly and damselfly observation is encouraged, by providing them with educational color picture guides to the most common species in order to increase their appreciation and knowledge of this group, which could eventually be used by them as part of both ecotourism and monitoring programs in the future.

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PRELIMINARY REPORT - FISHES

Philip W. Willink, Kenneth Wan Tong You, and Martino Piqué

Introduction

Fishes are a critical source of protein in the Kwamalasamutu region. They are a common component of many meals. However, relatively few species are routinely eaten. Most species are small and often ignored by people, but they are actually an important part of the aquatic ecosystem. Smaller fishes forage on aquatic insects and serve as prey for larger fishes, caiman, and birds. Fish diversity reflects the health of the river systems.

Study sites and Methods

Fishes were collected with a 3-meter fine-mesh seine, 5-meter seine, dip nets, 30-meter trammel net, 40-meter experimental gillnet, and hook and line. Forty-three sites at the three camps were sampled. We also talked extensively with our Trio guides about their knowledge of local fishes, and to discern what they were catching during the expedition. Every habitat was sampled with as many methods as practical in order to rapidly assess the diversity of the region and maximize the number of species observations. Rocks in rapids were scraped. Submerged logs were cut open. Leaf litter was searched. Seines were pulled through patches of vegetation, as well as over sandy beaches. Dip nets were dragged through flooded tree branches. Canoes were used to travel extensively up and downstream from the camps. We also walked through the forest to survey creeks and swamps. Most individuals were released, but representative specimens were preserved in formalin and later transferred to 70% ethanol for long-term storage at the National Zoological Collection of Suriname in Paramaribo and The Field Museum in Chicago, USA. This enables species identifications to be verified by experts at a later date.

The Kutari River at Site 1 was approximately 40 meters wide and meandered extensively. There was a significant flood plain, and much of the vegetation along the river was submerged during the time of the expedition. No rocks, rapids, or beaches were apparent due to the high water levels. Current was fast flowing. Creeks were usually sampled well inside the forest and distant from the main channel of the Kutari River. No people were seen, but there were scattered abandoned fishing / hunting campsites along the river.

The Sipaliwini River at Site 2 was approximately 75 meters wide and the primary river channel was relatively straight. Large boulders were common, and rapids were present, although most were still submerged during the time of the expedition. Aquatic plants grew on rocks in the rapids. Islands and sand beaches were beginning to emerge as the river level dropped. A few people were observed fishing, using gillnets and hook and line. Creeks were usually sampled near their confluence with the Sipaliwini River.

The Sipaliwini River at Site 3 (Werehpai), downstream from Site 2, was very similar. The river was larger at this site, approximately 150 meters wide, and eddies and bays were also larger. There were several adjacent swamps. Creek morphology was similar to the other two sites. Wioemi Creek is better described as a small river, almost as large as the Kutari and very similar geomorphologically. Many people were observed fishing in this area.

Results

We preliminarily recorded 100 species of fishes (Appendix 8). This is typical for the interior of Suriname; for example, the Coppename RAP (Mol et al. 2006) recorded 112 species, and a similar rapid assessment of the upper Essequibo River in Guyana yielded 110 species (P. Willink *unpubl.data*). This diversity is high compared to the rest of the world, but is typical for the Guiana Shield. There are still many species in the area that we probably did not collect due to the high water and seasonal effects. More surveys need to be done at different times of the year.

We collected five species of fishes potentially new to science, including a large catfish with spines along the body and a small catfish that lives in sand-bottomed creeks. This number of new species is typical for Neotropical rivers that have not been well surveyed by fish biologists. We encountered some species of fishes known only from the Sipaliwini River and nearby drainages (e.g., *Corydoras sipaliwini* and *Crenicichla sipaliwini*). Other species, such as *Moenkhausia collettii* and *Hoplias malabaricus*, are widespread throughout the Guianas and much of South America.

We collected 52 species at Site 1 (Kutari), 54 species at Site 2 (Sipaliwini), and 55 species at Site 3 (Werehpai). This is remarkably consistent, with no significant difference in diversity among sites. However, we did not necessarily find the same species at each site. For example, *Hoplias aimara* was most common in the meandering flooded Kutari River. Knifefish diversity was higher in the Kutari as well. In comparison, at Site 2 the Sipaliwini River had more rapids and flowing water, and this was even more the case at Site 3. Piranhas and larger catfishes were more common at these camps. Tucunaré (*Cichla ocellaris*) and large characids were present. Wioemi Creek was similar in geomorphology and species composition to the Kutari River, indicating that habitat plays an important role in species distribution.

Particular species were found in particular habitats. For example, creeks were characterized by *Pyrhulina*, *Jupiaba abramoides*, *Rineloricaria*, and *Rivulus*. Rapids were characterized by *Pseudancistrus*, *Lithoxus*, and *Guianacistrus*. Larger rivers held *Schizodon*, *Hemisorubim*, and *Prochilodus*. Creek assemblages were similar among the three sites. Juvenile fishes showed less habitat specificity than adults of their own species. Many young fishes were found in flooded forests, even if the adults lived in rivers or other habitats. This is because many fishes spawn at the beginning of the rainy season, which was several months ago. The RAP survey began at the end of the rainy season, so we found many fishes that were only a few months old. This demonstrates the importance of seasonal flooding and the interconnection of terrestrial and aquatic habitats. If anything negatively impacts the forest, it will also impact the fishes in the river.

We recorded a small number of very large piranhas around Sipaliwini (Site 2). We found numerous piranhas nearer to Kwamalasamutu, but they were almost all juveniles or small adults. Large catfishes were rare, as were tucunaré. Small tetras were abundant at Sipaliwini and Werehpai, but far less so in the Kutari River (where the large predator *Hoplias aimara* was most common). Usually there are fewer small tetras in areas with many predators. This is consistent with what we observed. Overall, large top-level predators were uncommon. In pristine environments, these types of fishes are abundant, but they are the first to disappear when there is excessive fishing pressure. We often saw people fishing along the river, and nearly every household had a gill net. The region is exhibiting the first stages of overfishing. Many fishes still occur in the Sipaliwini area, but there is a need to assess fishing pressure and implement management plans.

The primary threat to the fishes of the Sipaliwini River is overfishing. Fishes are an important source of protein in the region, and people in Kwamalasamutu have to travel hours from the village in order to find large fishes. Fish diversity is still high, but popular food fishes are decreasing in size, and some are becoming less common (e.g., red-tailed catfish). Logging would have negative impacts by increasing erosion and decreasing the amount of food that falls into the water, especially when the rivers flood. We are unaware of any imminent plans to deforest the region. We are also unaware of any plans for gold or bauxite mining. However, diamond exploration concessions exist in a watershed well upstream. Excessive mining would result in erosion and sedimentation, negatively impacting fishes, especially those that live along the bottom.

Conservation Recommendations

- Assess which fish species are used for food. Determine amount caught and eaten. Study life-history of these species to determine how fast they reproduce and grow.
- Determine amount of fish that can be sustainably harvested. Set catch limits and/or seasons if necessary to avoid overfishing.
- Create picture guides of fishes, especially colorful species and fun-to-catch species, in order to increase appreciation and knowledge of fishes among the general public.
- Maintain forests along rivers, especially in areas that flood. This is to prevent erosion and maintain the amount of nutrients (i.e., insects, leaves, fruits, etc.) that fall into the water and act as fish food. Flooded areas, such as Kutari River and Wioemi Creek, are important breeding grounds for fishes.
- Additional scientific surveys are necessary to document the fish biodiversity. There are species present that we did not collect, and there could be new species to science yet to be discovered. Additional surveys should be conducted at different times of the year, especially when river levels are lower. These surveys could also explore further upstream and downstream than we traveled.

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PRELIMINARY REPORT – REPTILES AND AMPHIBIANS

Rawien Jairam, Cindyrella Kasanpawiro, and Paul E. Ouboter

Introduction

The group of species we studied on this RAP were amphibians and reptiles, commonly known as herpetofauna. This inventory is important because it gives us an idea of the known and unknown species of this particular area which can be an important indication for a healthy ecosystem.

Methods and study sites

The RAP of the Kwamalasamutu region included three study sites: Site 1 (Kutari River), Site 2 (Sipaliwini River) and Site 3 (Werehpai and Wioemi Creek). The method used to capture or view species for the RAP was walking line transects which were usually cut beforehand or on demand. We also surveyed areas adjacent to transects to have a broader view of the area. Species seen in the studied area were noted with scientific names and the numbers of individuals of these species. Species of particular interest (rare, endangered, or new) were captured and preserved for further analysis in Paramaribo. Apart from the existing line transects in the three camps, we also studied swampy areas, creeks and creek beds. The reason to include all these areas was that certain species may be found primarily or only in these areas.

Preliminary results and impressions

We found an estimated 43 amphibian and 14 reptile species (Appendix 9). These numbers may be adjusted upwards after further analysis in our labs. Of the amphibian species we captured, we have one species of frog and one species of caecilian that may be new to science. We also caught one individual of a rare frog species (*Scinax proboscideus*), the second individual known from Suriname.

The reptile survey was very fruitful and yielded two new records for Suriname: a snake (*Xenodon werneri*) and an amphisbaenian (*Amphisbaena slevini*).

We discovered that certain expected species that are quite common in other areas in Suriname were either not found or found in very moderate numbers on the RAP survey. On the other hand, we found certain generally rare species to be quite common.

Preliminary conservation recommendations

The surveyed areas appeared to be pristine, aside from human impacts in a few places. There is a chance that new species found at the survey sites may occur only in these specific sites. To be certain of this, we recommend that further research be done and this area be conserved until the distributions of these new species are better assessed.

PRELIMINARY REPORT – BIRDS

Brian J. O'Shea and Serano Ramcharan

Introduction

Birds are excellent indicators for rapid biological assessments – they are primarily diurnal, they are generally easy to detect and identify, and the richness of bird communities tends to correlate positively with other measures of biodiversity. Birds are important food sources for other animals and people, and healthy populations of large-bodied frugivores and predators are indicative of a relatively intact, undisturbed ecosystem. Since many species are conspicuous when they are common, it is comparatively easy to assess their population status, even within the constraints of a rapid inventory.

In contrast to many other taxonomic groups, the avifauna of Suriname is well known (Ottema et al. 2009), though new records for the country continue to accumulate as more interior localities are inventoried (O'Shea 2005; K. Zyskowski et al. *in prep.).* Most of the interior of Suriname is covered by unbroken tropical moist forest and is sparsely populated. Accordingly, the avifauna is diverse, and many sites support healthy populations of species that are of global conservation concern, such as large raptors, cracids, and parrots.

The Kwamalasamutu region encompasses the upper Corantijn drainage in the southwest corner of Suriname, including a portion of the disputed "New River Triangle" to the west of the Coeroeni and Aramatau Rivers. It is one of the most remote lowland regions of the Guiana Shield; much of the human population is concentrated in Kwamalasamutu itself, with human presence elsewhere limited to occasional hunting and fishing parties or boats traveling between communities along the major rivers. The region's vast forest matrix continues unbroken far into Brazil, and is similarly isolated from that country's infrastructure. However, the planned construction of highways across northern Brazil and through the interior of Suriname poses a potential threat to the biodiversity of the Kwamalasamutu region. Illegal miners are a persistent presence throughout the interior regions of the Guianas, a situation that can be expected to worsen around Kwamalasamutu if roads allow easier land access to the region. Although current levels of human pressure on Suriname's natural resources are rather low, the need to identify areas of exceptional biodiversity within the country becomes ever more urgent as Suriname's infrastructure continues to develop.

We surveyed birds around three sites in the Kwamalasamutu area between 18 August and 8 September 2010. The purpose of the surveys was to obtain a baseline estimate of the avian species richness of the area and to provide information on the population status of several bird species important to the Tirio people.

Study Sites and Methods

We surveyed the avifauna at three localities in the Kwamalasamutu area between 19 August and 7 September 2010:

Site 1. Kutari River, 19-24 August.

Site 2. Sipaliwini River, 27 August -2 September.
Site 3. Werehpai, 3-7 September.

The habitat at all sites was a mosaic of tall terra firme and seasonally flooded forest, with the latter type most extensive at the Kutari River site. Within this mosaic were small patches of other habitat types, including so-called savanna forest, swamps dominated by *Euterpe oleracea* palms, xerophytic vegetation on granitic outcrops (inselbergs), and bamboo (*Guadua sp.*). Birds were surveyed on foot for 1-2 hours before dawn, and during all daylight hours of each day. Throughout the study period, we attempted to identify and survey as many different habitats as possible. The dates of the survey were chosen to fall within the long dry season, but the rainy season extended later than usual in 2010, and rain was frequent at the first site. Although local rainfall diminished substantially at the second and third sites, river levels remained high throughout the survey, indicating rain in the surrounding region.

At all sites, 200-meter transects were established, generally perpendicular to (and with the starting point on) whatever trails existed at the sites. The only criterion for transect placement was that they be at least 500 meters apart, but we attempted to separate them by as much distance as the trail systems allowed. Although we intended to place transects in as many different habitats as possible, we found that habitats other than tall forest were so limited in extent that none could entirely contain a 200-meter line. As a result, several transects passed through more than one habitat type. We sampled five transects at each of the first two sites (Kutari and Sipaliwini), and three transects at the Werehpai site.

Birds were sampled along transects for 30 minutes, starting at first light (typically 6:35). Transects were partitioned into 50-m sections and exactly 7.5 minutes were spent in each section to ensure even coverage. All birds seen or heard were counted. Each transect was surveyed once. Species totals and numbers of detections were compiled for all transects. Mated pairs and groups of single species (family groups or flocks) were counted as single detections – the former to avoid confusion of mated pairs with separate territory holders, and the latter because it was seldom possible to determine the exact number of birds in a group.

After transects were completed, the remaining morning hours were spent walking along trails to locate and identify birds, with an emphasis on locating concentrated food sources (e.g., fruiting and flowering trees), mixed-species foraging flocks, and vantage points where large areas of canopy or sky could be viewed. Birds were observed opportunistically at all other times of the day, generally in the vicinity of the camps.

Birds were documented using a Marantz PMD-661 digital recorder with a Sennheiser ME-62 omnidirectional microphone and Telinga parabolic reflector for individual birds, and a stereo microphone pair that was operated remotely for 2-3 hours at dawn on several mornings. Recordings will be deposited at the Macaulay Library at the Cornell Lab of Ornithology in Ithaca, New York, USA.

Results

Analyses of transect data will be presented in the final report. Our list for the Kwamalasamutu region (Appendix 10) includes 323 species: 289 species were observed at the three camps, and 13 species were observed in the area during the reconnaissance trip (3-8 May 2010) but not during the RAP survey. We also include 21 species observed only in the vicinity of Kwamalasamutu itself; these species are probably restricted to the human-modified habitats around the village. We estimate that a minimum of 350 bird species, or roughly half of the number known to occur in Suriname, may be found in the Kwamalasamutu area.

The overall species list was highest for the Sipaliwini camp (242 species), followed by Werehpai (221 species) and Kutari (214 species). 149 species, or approximately 52% of those encountered at the three sites, were present at all sites. The Kutari site had the most distinctive assemblage of the three sites: although it had the fewest species, it had the most unique species (26) and shared fewer species with the Sipaliwini and Werehpai sites (174 and 162, respectively) than those sites shared with each other (199 species). Fifty species were observed at both the Sipaliwini and Werehpai sites but not at Kutari. The differences among sites were due in part to unequal distribution of certain habitats (e.g., *Guadua* bamboo; inselberg vegetation) and their associated bird species (see below), but we attribute most of the differences to general rarity and the vagaries of sampling. This impression is corroborated by the observation that the majority of species not encountered at all sites are either relatively rare (e.g., birds of prey) or are most likely to be seen around widely dispersed resources that we were able to locate at some camps but not others (e.g., fruiting trees). We therefore suspect that although the Kutari site did have a noteworthy number of unique species, the three sites share a similar avifauna.

The avifauna of the Kwamalasamutu region was typical of lowland forests of the Guiana Shield. Of the 52 families encountered, three families of suboscine passerines (Furnariidae, Thamnophilidae, and Tyrannidae) accounted for over 30% of species observed. Due to the relative scarcity of fruiting and flowering trees during the survey, diversity of hummingbirds (Trochilidae) and tanagers (Thraupidae) was lower than expected. Although species composition was broadly similar among the three sites (more than half were observed at all sites), relative abundances of many species varied substantially among the camps. In particular, species that occur primarily or only in seasonally flooded forests were more common at the Kutari site, where this habitat type was most extensive. For other species, variation may have been more apparent than real; for example, changes in singing behavior associated with the onset of the dry season may have made certain species seem more or less common as the RAP progressed. However, we suspect that most differences among sites could be attributed to variation in the distributions of microhabitats favored by particular species. Since many of these microhabitats are not stable over time in any particular place (e.g. treefall gaps), we do not consider our perceptions of variation in abundance to have any significant import for regional conservation.

We observed 15 species of parrots (Psittacidae), which is typical for a lowland region of the Guiana Shield. No species seemed especially common, and macaws (*Ara spp.*) were particularly scarce. Although we suspect that larger species of parrots are hunted on an opportunistic basis, we could not attribute their low abundance at the time of the survey to hunting pressure. Parrots track their preferred food sources and their abundance at a single site can vary dramatically over the course of a year – for example, two species were observed daily on the May reconnaissance trip but not at all during the RAP (see Appendix 10). The relative scarcity of parrots was likely an effect of limited food availability in the region at the time of our survey.

Guans (*Penelope spp.*) and especially Black Curassow (*Crax alector*), arguably the most important birds in the Trio diet, were less common in the Kwamalasamutu region than we have found them in other areas with little hunting pressure. Although they were observed at all of the sites, our records were often limited to second-hand reports and images from the camera traps.

Noteworthy observations

Three species represent new distributional records for Suriname: *Crypturellus brevirostris* (Rusty Tinamou), observed on two occasions at the Kutari site; *Dromococcyx pavoninus* (Pavonine Cuckoo), observed daily in secondary growth around the Werehpai camp; and *Ramphotrigon megacephalum* (Large-headed Flatbill), found in *Guadua* bamboo at both the Kutari and Werehpai sites. All three species are known from the Upper Essequibo region of extreme southern Guyana (Robbins et al. 2007; O'Shea 2008) but apparently do not occur farther north in the country. Although *C. brevirostris* and *D. pavoninus* are known to occur in adjacent northern Brazil, *R. megacephalum* is not; the Guyana record (O'Shea 2008) was the first for any of the Guianas and represented a 900-km range extension to the east (see Hilty 2003). Our observations further extend the range of this species, which should be expected to occur in patches of *Guadua* bamboo elsewhere in the region.

Other notable records are as follows:

Nyctibius aethereus (Long-tailed Potoo) and *N. leucopterus* (White-winged Potoo). We heard both of these species (and recorded the latter) at the Kutari site. These potoos are rare and infrequently reported; in Suriname, the Kutari site is the third known locality for *N. aethereus* and the second for *N. leucopterus* (Ottema et al. 2009).

Deconychura longicauda (Long-tailed Woodcreeper). This species is rare in Suriname and appears to be absent from large areas of the country. We recorded a very vocal individual at the Kutari site.

Thamnophilus punctatus (Northern Slaty-Antshrike). This species was observed only on the inselberg at the Sipaliwini site, and in the Kwamalasamutu region it is probably restricted to the xerophytic vegetation typical of such rock outcrops.

Conservation Recommendations

The Kwamalasamutu region is situated within a vast, intact block of tropical forest that faces no immediate threats. All of the species encountered on this survey also occur in the surrounding region, and the global populations of most are not threatened. However, some species, notably large-bodied predators and frugivores that require large areas of intact habitat for long-term population viability, probably maintain healthier populations here than elsewhere in their ranges. Care should be taken to preserve ecosystem integrity on the largest possible scale to forestall declines in their populations. To this end, the following guidelines should be adopted by the community of Kwamalasamutu:

- Aggressively exclude small-scale gold miners from Trio lands.

- Avoid trapping birds, particularly parrots, for export to coastal markets.

- Develop and implement a rotation system to distribute the effects of subsistence hunting over as large an area as possible; or, alternatively, designate more protected areas and enforce hunting bans.

- Increase production and consumption of domestic fowl as an alternative to bush meat.

- Enhance existing facilities to attract tourists to the area.

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PRELIMINARY REPORT – SMALL MAMMALS

Burton K. Lim and Sahieda Joemratie

Introduction

Small mammals (bats, rodents, and opossums) comprise 80% of the mammalian species diversity in the Guianas. However, they are poorly known in comparison to the more charismatic and conspicuous larger species such as monkeys and cats. Approximately 200 species of mammals have been reported from Suriname. Small mammals are particularly important for conservation because many are seed dispersers responsible for natural forest succession, pollination of flowers, and control of insect populations through their foraging behavior and diet. High species diversity and relative abundance make small mammals an ideal group for rapid assessment program (RAP) surveys and long-term monitoring. This is particularly important for regions such as the Kwamalasamutu area that have not been thoroughly surveyed for biodiversity and conservation purposes.

Study Sites and Methods

We surveyed three sites in the Kwamalasamutu region: Kutari River (N 2.17538, W 56.78786), surveyed for 6 nights from 18-23 August; Sipaliwini (N 2.28979, W 56.60708), surveyed for 5 nights from 27-31 August; and Werehpai (N 2.36271, W 56.69860), surveyed for 5 nights from 2-6 September. Mist nets were also set at the caves on the last night at the Werehpai site.

To survey small mammals during the RAP, we used Sherman live traps for sampling terrestrial and arboreal rats and small opossums, and mist nets to sample bats. Traps were set approximately 5 meters apart along transects within the forest, both on the ground and in trees. Trapping effort varied among the sites with a maximum of 179 traps set at the Sipaliwini site. Mist nets were set approximately 100 meters apart along the transect across trails, over creeks, in swamps, near tree fall gaps, and by rocky outcrops where bats were typically flying. A maximum of 26 mist nets were set during the RAP.

Voucher specimens were prepared as dried skins with carcasses temporarily preserved in ethanol for later cleaning of the skulls and skeletons, or as whole animals fixed in 10% formalin with later long-term storage in 70% ethanol. This will enable examination of both osteology and soft anatomy. Tissue samples of liver, heart, kidney, and spleen were frozen in the field with liquid nitrogen and for later storage in a –80^{o}C ultra-cold freezer. Muscle samples were dabbed onto filter cards to stabilize DNA for sequencing in the international Barcode of Life project (www.barcodinglife.org) and also preserved in ethanol as a tissue backup precaution.

A reference collection of voucher specimens deposited at the National Zoological Collection of Suriname and the Royal Ontario Museum will serve as documentation of the biodiversity of mammals in southern Suriname, and will be available for study by the scientific community.

Results

In total, preliminary field identifications indicated 41 species of small mammals represented by 375 individual captures, of which 251 were kept as voucher specimens

(124 individuals were released unharmed; Table 1). More specifically, 26 species of bats were represented by 223 individuals (146 specimens), 13 species of rats and mice were represented by 146 individuals (100 specimens), and 2 species of small opossums were represented by 6 individuals (5 specimens). A preliminary species list is given in Appendix 11.

At Kutari, we documented 29 species of small mammals represented by 105 individuals including 16 species of bats (52 individuals), 12 species of rats (52 individuals), and 1 species of opossum (1 individual). At Sipaliwini we documented 22 species of small mammals represented by 84 individuals including 14 species of bats (47 individuals), 7 species of rats (36 individuals), and 1 species of opossum (1 individual). At Werehpai we documented 29 species of small mammals represented by 186 individuals including 23 species of bats (124 individuals), at least 5 species of rats (58 individuals), and 1 species of opossum (4 individuals). Because the collecting permit limit of 100 rodent specimens was reached during the beginning of the Werehpai survey, individuals were released that could have potentially represented 3 additional species.

Although not many opossums were captured, 5 individuals of the short-tailed opossum (*Monodelphis brevicaudata*) were documented, which is the highest success rate compared to other similar surveys conducted over the past 20 years in the Guianas. The short-tailed opossum is interesting in that it is active during the day searching for invertebrate prey such as insects and worms on the ground, whereas all other small mammals are active only at night. The most common non-flying small mammal was the terrestrial rice rat (*Oryzomys* spp.); however, there are at least 2 species that are difficult to identify in the field. Skull morphology from prepared specimens or DNA data are needed to verify identifications. Rice rats are some of the most important seed predators in Neotropical rainforest.

For bats, the commonest species was the larger fruit-eating bat (*Artibeus planirostris*), which is a fig-eating specialist. However, the botanists found only a few fruiting fig trees during the RAP, suggesting that either these bats rely on other fruits when figs are not masting or they are flying long distances from their day roost to fruiting fig trees. Other species in this genus have been radio-tracked flying over 10 km in a night to feed at a fruiting tree.

The species diversity and relative abundance of rats in the Kwamalasamutu area were the highest documented in 20 years of small mammal surveys throughout Suriname and Guyana by the Royal Ontario Museum. In particular, Kutari was the most successful site for rats, indicating a healthy source of prey species for predators such as cats, owls, and snakes. In contrast, Werehpai was the most successful for bats but this might be due in part to the well-established trail to the petroglyphs, which functioned as a flyway that was more conducive for capture success. The other 2 camps had lower bat diversity and abundance more typical of undisturbed forest, because transects were cut just before our arrival and were not functioning as flyways for bats.

Interesting Species

A water rat (*Neusticomys oyapocki*) was collected at Kutari that represents the first documentation of this species in Suriname. The ears and eyes are reduced in size as an adaptation for aquatic behaviour. There are very few specimens of this species and not much is known of its ecology or role in the ecosystem.

Another interesting species was a brushed-tailed rat that was found by the large mammal camera trapping team. It was discovered dead with wounds on the head and shoulders on a part of the trail they had just recently walked. Indications are that they had startled a raptor that had killed the rat, which was then dropped on the trail. This represents the first report of a brush-tailed rat in Suriname; fewer than 10 specimens are known from the Guianas.

Conservation Recommendations

The Kutari site was furthest from the village of Kwamalasamutu and the most remote of the 3 camps, which may partially account for the high species diversity and relative abundance of rats. This taxonomic group is primary prey for many top-level nocturnal predators such as cats, snakes, and owls. A healthy predator-prey relationship is a good indicator of the conservation status of forest habitat. Kutari would be a good candidate area for a nature reserve within the Kwamalasamutu region.

Sipaliwini had the lowest species diversity and relative abundance, but also the most homogeneous forest habitat along the right fork of the transect that was the primary small mammal survey area. The left transect passed through swamp and led to an inselberg rock outcrop, but it was not thoroughly surveyed for terrestrial small mammals. A variety of microhabitats such as swamp forest and rocky outcrops were present and surveyed for small mammals near the other sites, and usually are associated with more diverse and abundant small mammal faunas. Small mammal results from Sipaliwini were typical of non-flooded forest in the Guianas.

Werehpai had the highest bat diversity and abundance suggesting that this taxonomic group adapts well to minor habitat changes such as the establishment and maintenance of trails in the forest. Flyways act as convenient routes within the forest for greater access to food resources such as fruits, flowers, and insects. However, over-development such as permanent buildings causes changes to the community ecology of bats and alters their impact on the environment in terms of forest composition associated with seed dispersal and pollination.

PRELIMINARY REPORT – LARGE MAMMALS

Krisna Gajapersad, Angelique Mackintosh and Esteban Payán

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 overhunting from humans causing population decreases 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 requirements of food and habitat (Purvis et al. 2000; Cardillo et al. 2005). Today, about 2 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 native Amazonians. Indigenous peoples have lived in Amazonia for tens of thousands of years (Redford 1992) and many, including the Trio indigenous ethnic group of Suriname, still remain within the forest and hunt mammals actively. In areas where they have been hunted, abundance of large mammals has decreased (Peres 1990; Cullen et al. 2000; Hill et al. 2003). Unmanaged hunting is commonplace in the Amazon and is depleting game populations, often to levels so low that local extinctions will become 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.

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 Tirio 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. At the Sipaliwini site 12 camera traps were set up, divided over 3 trails. At Werehpai, there was no trail cutting due to preexisting trails and 10 camera traps were set up along 2 trails. 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 285 meters.

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.

Preliminary results and impressions

We detected 29 species of medium- and large-bodied mammals (Appendix 12). 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 4 primate species; at Werehpai we found 21 mammal species including 5 primate species.

The large caviomorph rodents were the most frequently photographed by the camera traps; this group was assumed to be the most common group of medium- and large-bodied nonvolant mammals in the area. The rodent species most frequently photographed by the camera traps were Paca (*Cuniculis paca*), Red-rumped Agouti (*Dasyprocta leporina*) and Red-acouchy (*Myoprocta acouchy*). 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 frequent 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. 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 these large cats. The local people do not actively hunt cats, but they occasionally kill the large cats when they encounter them in the forest, because they are afraid to be 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 area of Kwamalasamutu.

Three armadillo species were found during the RAP, including 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*). Interview data are currently under analysis.

Preliminary conservation recommendations

The medium- and large-bodied mammals found during this RAP are likely to be distributed throughout southern Suriname and most of the greater Guiana Shield, since the medium and large mammal fauna (primates excepted) is generally consistently distributed throughout the Amazon Basin. The number of mammal species found during this survey does not differ much from what was expected. Most of the expected large mammal species were recorded by 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 is also the least accessible and furthest from Kwamalasamutu compared to the Sipaliwini and Werehpai sites. The Sipaliwini site had the smallest number of species recorded by camera traps, tracks and observations, suggesting higher hunting pressure in the area. This area is used by the local people as a hunting area, and hunting trails were encountered during camera trap setup. During the RAP several shots from hunters in the area were heard near the camp. The Werehpai area was pronounced as an indigenous protected area by the local village authority in 2004. We found more species at Werehpai than at Sipaliwini, even though it is only 10 kilometers from Kwamalasamutu.

The results of this RAP cannot provide an accurate indication of the population status of the different large mammal species, because we were not able to calculate species densities or relative abundance from the data that was gathered during the survey. 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 absence of a market and the concentration of the Trio in Kwamalasamutu both reduce 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. Nevertheless, the most significant current threat to medium- and large-bodied mammals in the area is hunting from Kwamalasamutu village. Designating the Werehpai area as protected was a good initiative by the village to conserve the species upon 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 adequate to maintain mammal populations in the surroundings of Kwamalasamutu. Recommended studies include more camera trapping and a sustainability evaluation of wild meat hunting.

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APPENDIX 1. PRELIMINARY WATER QUALITY DATA

Location	Location name	Cond (µS/cm)	pH	DO (mg /L)	DO (%)	Alkalinity (mg/L $CaCO_3$)	Hardheid (mg/L CaCO3)	Tannin Lignin (mg/L)	PO4 3- (mg/L)	NO3-N (mg/L)	Ammonia (mg/L)	Chloride (mg/L)	Turbidity (NTU)	Secci (cm)
01-01	big creek downstream Koetari river	14.4	6.415	6.25		7.25		1.3	0.1	0.01	1	2.5	13.25	current too strong
01-02	Koetari river downstream camp 1a	11.4	5.625	5.15		4.85		1.1	0.045	0.035	0.72	2.85	9.425	current too strong
01-03	creek downstream camp 1	10.6	5.785	4.5		3.4	2.85	1	0.06	0.045	0.415	3.7	10.01	56.75
01-04	creek upstream camp 1	11.2	5.805	4.2		6.45	2.35	1.05	0.015	0.02	0.26	4.8	6.835	83.75
01-05	upstream Koetari river	11.4	5.725	5.2		5.6	1.25	1.05	0.03	0.01	0.315	4.6	7.39	current too strong
01-06	Koetarir river downstream camp 1b	11.9	5.87	5.4		5.5	1.3	1.15	0.075	0.005	0.7	3.65	8.82	current too strong
01-07	Aramatau river downstream	12.2	6.23	6.5		5.7	0.35	1.05	0.04	0	0.425	4.65	4.615	1.2
02-01	Upstream Sipaliwini river camp 2	20.6	6.775	7.1	90	8.1	1.95	1.05	0.125	0.01	0.535	6	0.535	0.535
02-02	creek upstream camp 2	16.9	6.58	6.85	84.5	7.35	1.85	0.65	0.085	0.01	1.055	8.5	1.055	110
02-03	upstream river Sipaliwini	21	6.655	7.2	92	9.3	2	1.15	0.08	0.01	0.585	6.55	4.275	current too strong
02-04	downstream camp 2a	21.3	6.545	7.7	98.5	8.9	2.6	0.95	0.065	0.025	1.15	7.85	1.15	current too strong
02-05	creek left downstream camp 2 (a)	15.45	5.725	6.3	76	7.05	1.65	1	0.045	0	0.395	7.6	3.75	77.5
02-06	creek left downstream camp 2 (b)	18.2	6.175	6.75	82.5	8.35	2.4	1.4	0.08	0.01	0.375	7.9	0.01	0.01
02-07	downstream camp 2(b)-upstream island rapid	21.4		7.1	91	8.55	2.35	0.85	0.11	0.02	0.21	7.8	4.99	current too strong
02-08	creek left downstream camp 2 ©	20		6.6	82	9.75	2.25	0.85	0.065	0	0.765	6.55	0	90

Location	Location name	Cond (µS/cm)	pH	DO (mg /L)	DO (%)	Alkalinity (mg/L $CaCO_3$)	Hardheid (mg/L CaCO3)	Tannin Lignin (mg/L)	PO4 3- (mg/L)	NO3-N (mg/L)	Ammonia (mg/L)	Chloride (mg/L)	Turbidity (NTU)	Secci (cm)
03-01	Upstream camp 3-downstr rapid	21.4	6.905	7.1	90	8.9	2.8	0.85	0.09	0.01	0.27	8.2	5.21	current too strong
03-02	Up stream camp 3	22.2	6.42	6.85	87	8.45	2.65	1.25	0.12	0.015	0.755	9.65	5.79	66.25
03-03	Creek rechts down stream camp 3-Maripa eku	20	6.31	6.6	80	8.85	4.6	1.3	0.055	0.01	0.285	7.45	6.695	66.25
03-04	down stream camp 3	21.8	6.79	6.7	85	10.4	3.4	0.95	0.145	0.005	0.705	8.35	10.9	current too strong
03-05	Creek Wioemi creek mid stream left	21.7	5.695	2.7	33	8.75	2.25	0.85	0.08	0	0.45	7.6	8.855	67.5
03-06	Wioemi up stream	22.9	6.29	6.35	78.5	10.65	2.4	1.1	0.145	0	1.04	7.3	20.55	40
03-07	Wioemi down stream	22.7	6.2	5.9	73	10.4	2.45	1.15	0.065	0.025	0.66	8.8	23.6	45
03-08	Creek Wioemi downstream	16.5	5.76	5.6	72	9.55	2.2	0.85	0.065	0.015	0.535	6.95		97.5

APPENDIX 2. PRELIMINARY PLANT SPECIES LIST

Family	Genus	Species
Anacardiaceae		spp.
Annonaceae	*Duguetia*	sp.
Annonaceae		spp.
Annonaceae	*Unonopsis*	sp.
Annonaceae	*Xylopia*	sp.
Apocynaceae	*Aspidosperma*	sp.
Apocynaceae	*Cynanchum*	*blandum*
Apocynaceae	*Fosteronia*	sp.
Apocynaceae	*Geissospermum*	*sericeum.*
Apocynaceae	*Odontadenia*	*macrantha*
Apocynaceae	*Pacouria*	*guianensis*
Apocynaceae	*Tabernaemontana*	*undulata*
Apocynaceae		spp.
Asteraceae	*Hebeclinium*	sp.
Asteraceae		spp.
Bignoniaceae		spp.
Bixaceae	*Bixa*	*orellana*
Boraginaceae	*Cordia*	sp.
Boraginaceae	*Tournefortia*	sp.
Burseraceae	*Protium*	spp.
Burseraceae	*Trattinnickia*	sp.
Burseraceae		spp.
Cecropiaceae	*Cecropia*	spp.
Cecropiaceae	*Pourouma*	sp.
Celastraceae	*Cheiloclinium*	sp.
Chrysobalanaceae	*Licania*	spp.
Chrysobalanaceae	*Hirtella*	*racemosa*
Chrysobalanaceae	*Hirtella*	sp.
Chrysobalanaceae	*Parinari*	sp.
Chrysobalanaceae		spp.
Clusiaceae	*Rheedia*	sp.
Clusiaceae	*Tovomita*	spp.
Cochlospermaceae	*Cochlospermum*	*orinocense*
Combretaceae	*Combretum*	*rotundifolium*
Combretaceae	*Combretum*	*laxum*
Combretaceae		spp.
Commelinaceae	*Commelina*	sp.
Convolvulaceae	*Ipomoea*	sp.
Convolvulaceae		spp.
Dichapetalaceae		spp.
Elaeocarpaceae	*Sloanea*	spp.
Erythroxylaceae	*Erythroxylum*	sp.
Euphorbiaceae	*Conceveiba*	spp.
Euphorbiaceae	*Croton*	sp.
Euphorbiaceae	*Pausandra*	*martinii*
Euphorbiaceae		spp.
Fabaceae	*Dioclea*	*virgata*

Family	Genus	Species
Fabaceae	*Eperua*	*rubiginosa*
Fabaceae	*Inga*	spp.
Fabaceae	*Macrolobium*	*acaciifolium*
Fabaceae	*Senna*	*quinquangulata*
Fabaceae	*Swartzia*	spp.
Fabaceae	*Tachigali*	*paniculata*
Fabaceae	*Vouacapoua*	*americana*
Fabaceae	*Zollernia*	sp.
Fabaceae		spp.
Goupiaceae	*Goupia*	*glabra*
Lauraceae	*Aniba*	sp.
Lauraceae		spp.
Lecythidaceae	*Eschweilera*	sp.
Lecythidaceae	*Gustavia*	spp.
Lecythidaceae		spp.
Loganiaceae		sp.
Malpighiaceae	*Byrsonima*	spp.
Malpighiaceae	*Heteropteris*	*macrostachya*
Malpighiaceae	*Stigmaphyllon*	sp.
Malpighiaceae		spp.
Malvaceae	*Apeiba*	*tibourbou*
Malvaceae	*Apeiba*	sp.
Malvaceae	*Herrania*	*kanukuensis*
Malvaceae	*Tilia*	sp.
Melastomataceae	*Miconia*	spp.
Melastomataceae		spp.
Meliaceae	*Guarea*	spp.
Meliaceae		spp.
Meliaceae	*Trichilia*	sp.
Memecylaceae	*Mouriri*	spp.
Menispermaceae	*Orthomene*	sp.
Moraceae	*Ficus*	spp.
Moraceae		spp.
Myristicaceae	*Osteophloeum*	*platyspermum*
Myristicaceae	*Virola*	spp.
Myrtaceae	*Eugenia*	sp.
Myrtaceae	*Myrcia*	sp.
Myrtaceae	*Psidium*	sp.
Myrtaceae		spp.
Nyctaginaceae		sp.
Ochnaceae		sp.
Opiliaceae	*Agonandra*	*silvatica*
Piperaceae	*Piper*	spp.
Poaceae	*Orthoclada*	*laxa*
Poaceae		spp.
Polygalaceae	*Securidaca*	spp.
Pteridophyte		spp.
Quiinaceae		sp.
Rubiaceae	*Posoqueria*	*longiflora*

Family	Genus	Species
Rubiaceae	*Genipa*	sp.
Rubiaceae	*Psychotria*	sp.
Rubiaceae	*Spermacoce*	sp.
Rubiaceae	*Sipanea*	*pratensis*
Rubiaceae		spp.
Salicaceae	*Casearia*	sp.
Salicaceae		sp.
Sapindaceae	*Matayba*	*camptoneura*
Sapindaceae	*Matayba*	sp.
Sapindaceae	*Paullinia*	sp.
Sapindaceae		spp.
Sapindaceae	*Toulicia*	spp.
Sapotaceae	*Pouteria*	spp.
Sapotaceae		spp.
Solanaceae	*Brunfelsia*	sp.
Solanaceae	*Cestrum*	*latifolium*
Solanaceae		sp.
Violaceae	*Corynostylis*	sp.
Violaceae	*Rinorea*	spp.
Viscaceae	*Phoradendron*	sp.
Vitaceae	*Cissus*	*erosa*
Vitaceae	*Cissus*	*verticillata*

APPENDIX 3. PRELIMINARY AQUATIC BEETLE SPECIES LIST

Genus	Kutari	Sipaliwini	Werehpai	TOTAL
Family Noteridae				
Notomicrus	2	1	2	**2**
Siolus	1	-	1	**1**
Suphisellus	2	1	1	**2**
Family Gyrinidae				
Gyretes	2	1	2	**2**
Family Dytiscidae				
Andonochilus	1	1	1	**1**
**Copelatus*	5	5	7	**7**
Derovatellus	1	1	1	**2**
Desmopachria	3	3	3	**3**
**Fontidessus*	-	1	-	**1**
Hemibidessus	1	1	1	**1**
Hydaticus	1	1	1	**1**
Laccodytes	1	-	-	**1**
Laccomimus	1	-	-	**1**
**Laccophilus*	3	3	4	**5**
**Platynectes*	-	1	-	**1**
Thermonectus	1	1	2	**2**
Vatellus	1	1	1	**2**
OTHER genera	4	3	4	**5**
Family Hydraenidae				
Hydraena	3	2	2	**3**
Family Hydrophilidae				
Anacaena	1	1	1	**1**
**Cetiocyon*	1	-	-	**1**
**Chasmogenus*	2	2	2	**3**
Derallus	2	2	2	**2**
**Enochrus*	3	4	4	**5**
**Epimetopus*	-	-	2	**2**
**Globulosis*	1	-	1	**1**
**Guyanobius*	1	-	-	**1**
**Helochares*	2	2	3	**3**
Hydrobiomorpha	1	1	1	**1**
Hydrochus	3	1	1	**3**
Hydrophilus	-	-	1	**1**
Moraphilus	1	1	1	**1**

Genus	**Kutari**	**Sipaliwini**	**Werehpai**	**TOTAL**
Other Megasternini	?	?	?	**?**
**Notionotus*	1	1	2	**2**
**Oocyclus*	-	1	-	**1**
Phaenonotum	1	1	2	**2**
Phaenostoma	1	1	1	**1**
**Tobochares*	-	1	-	**1**
Tropisternus	2	3	3	**4**
Family Dryopidae				
Pelonomus	1	-	2	**2**
Family Elmidae				
Stegoelmis	1	1	1	**1**
*Other genera	5	7	5	**7**
Family Lutrochidae				
Lutrochus	-	-	1	**1**
TOTAL	**63**	**57**	**69**	**90**

*Species new to science confirmed or very likely in these genera

APPENDIX 4. PRELIMINARY DUNG BEETLE SPECIES LIST

	Abundance			Diet[1]
Species	**Kutari**	**Sipaliwini**	**Werehpai**	
Agamopus castaneus	0	8	23	D
Anomiopus sp 1	1	0	0	FIT
Anomiopus sp 2	0	0	1	FIT
Ateuchus aeneomicans	0	2	1	FIT
Ateuchus cf *cereus*	2	0	0	D, C
Ateuchus cf *pygidialis*	0	0	3	D
Ateuchus cf *setulosus*	4	15	9	D
Ateuchus murrayi	23	35	6	D
Ateuchus simplex	0	211	74	D, C
Ateuchus substriatus	0	12	42	D, C
Ateuchus sp 1	2	7	0	D
Ateuchus sp 2	0	0	2	D
Ateuchus sp 3	1	6	8	D, C, F
Ateuchus sp 4 (aff *pygidialis*)	1	3	1	D
Ateuchus sp 5 (aff *substriatus*)	0	1	0	FIT
Canthidium bicolor	12	2	3	D
Canthidium cf *angusticeps*	2	8	6	C, I
Canthidium cf *chrysis*	0	19	1	C, I
Canthidium cf *gracilipes*	0	0	1	FIT
Canthidium cf *guyanense*	29	3	2	D
Canthidium cf *quadridens*	3	2	1	FIT
Canthidium cf *tricolor*	3	2	0	D
Canthidium deyrollei	13	71	32	D, C
Canthidium dohrni	3	4	0	D
Canthidium funebre	1	4	1	D
Canthidium melanocephalum	19	12	7	D
Canthidium splendidum	0	0	11	D
Canthidium sp 1	2	0	0	D
Canthidium sp 2	6	0	1	D
Canthidium sp 3	0	0	2	D
Canthidium sp 4	0	0	1	FIT
Canthidium sp 5	0	2	0	D
Canthidium sp 6	0	1	1	D
Canthidium sp 7	0	1	0	FIT
Canthidium sp 8	0	0	1	D
Canthidium sp 9 (aff *bolivianum*)	0	2	0	FIT

	Abundance			Diet[1]
Species	Kutari	Sipaliwini	Werehpai	
Canthon bicolor	7	32	31	D
Canthon doesburgi	1	4	3	C, I
Canthon quadriguttatus	1	0	0	D
Canthon semiopacus	0	1	0	D
Canthon sordidus	20	0	12	D, C
Canthon triangularis	150	155	184	D, C
Canthon sp 1 (aff *doesburgi*)	1	5	0	C, I
Canthonella sp 1	0	1	0	FIT
Canthonella sp 2	0	1	0	FIT
Coprophanaeus jasius	2	1	2	D, C
Coprophanaeus lancifer	2	1	1	D
Coprophanaeus parvulus	0	1	0	FIT
Deltochilum carinatum	4	0	0	D
Deltochilum guyanense	2	3	1	D, C
Deltochilum icarus	3	1	7	D, C
Deltochilum septemstriatum	4	4	6	D, C
Deltochilum valgum	2	0	1	FIT
Deltorrhinum cf *batesi*	1	0	0	FIT
Dendropaemon sp 1	1	0	0	FIT
Dichotomius boreus	52	123	44	D
Dichotomius cf *lucasi*	38	168	153	D, C, F
Dichotomius cf *nimuendajui*	1	0	0	D
Dichotomius mamillatus	2	1	1	D
Dichotomius robustus	1	1	1	D
Dichotomius sp 1	1	2	1	D
Dichotomius sp 2	1	0	1	D
Dichotomius sp 3	0	0	2	D
Dichotomius sp 4	0	1	0	D
Eurysternus balachowskyi	0	2	1	D
Eurysternus caribaeus	21	125	150	D, C
Eurysternus cf *cambeforti*	8	35	42	D, C
Eurysternus cf *ventricosus*	1	2	0	D
Eurysternus cyclops	1	0	0	D
Eurysternus foedus	4	5	4	D
Eurysternus hamaticollis	0	2	0	D
Eurysternus sp 1	0	6	2	D, C
Eurysternus sp 2	0	4	0	D
Hansreia affinis	25	53	19	D

Species	Abundance			Diet[1]
	Kutari	Sipaliwini	Werehpai	
Onthophagus haematopus	37	589	294	D
Onthophagus rubrescens	132	128	25	D
Onthophagus sp 1 (*clypeatus* grp)	11	6	1	D, C
Oxysternon durantoni	29	19	8	D
Oxysternon festivum	4	9	26	D
Oxysternon spiniferum	1	1	1	FIT
Phanaeus bispinus	0	1	0	D
Phanaeus cambeforti	5	5	31	D
Phanaeus chalcomelas	40	131	165	D
Sulcophanaeus faunus	1	0	0	D
Sylvicanthon candezei	0	4	1	D
Trichillum pauliani	0	2	20	D
Uroxys gorgon	0	0	1	D
Uroxys pygmaeus	18	7	14	D
Uroxys sp 1	11	13	15	D
Uroxys sp 2	4	2	12	D, C

[1]*D: dung, C: carrion, I: dead invertebrates, F: rotting fungus, FIT: flight intercept trap (diet unknown)*

APPENDIX 5. PRELIMINARY KATYDID SPECIES LIST (ORTHOPTERA:TETTIGONIIDAE)

Species	Kutari	Iwana Saamu	Sipaliwini	Inselberg	Werehpai	Possibly new
Conocephalinae						
Agraecia sp. 1	x				x	
Eschatoceras bipunctatus					x	
Eschatoceras sp. 1					x	
Paralobaspis sp. 1			x		x	
Subria sp. 1			x		x	x
Uchuca sp. 1 (Suriname)	x	x	x		x	
Uchuca sp. 2					x	x
Conocephalus sp. 1				x		
Acantheremus elegans			x			
Acantheremus sp. 1			x		x	
Copiphora longicauda	x		x		x	
Daedalellus sp. 1						
Loboscelis baccatus					x	
Neoconocephalus sp. 1	x				x	
Neoconocephalus sp. 2				x	x	
Neoconocephalus sp. 3					x	
Vestria sp. 1	x		x		x	x
Listroscelidinae						
Phlugis teres					x	
Listroscelis armata	x		x		x	
Phaneropterinae						
Dysonia sp. 1	x					
Dolichocercus sp. 1			x			x
Steirodon sp. 1			x		x	
Anaulacomera sp. 1	x		x		x	
Anaulacomera sp. 2	x		x		x	
Anaulacomera sp. 3	x				x	
Anaulacomera sp. 4			x			
Anaulacomera sp. 5					x	
Ceraia sp. 1			x			
Euceraia atryx					x	
Grammadera sp. 1			x			
Hetaira smaragdina			x		x	
Hyperphrona sp. 1			x		x	
Microcentrum sp. 1			x			
Microcentrum sp. 2			x			
Microcentrum sp. 3					x	
Phylloptera sp. 1			x			
Phylloptera sp. 2			x		x	
Phylloptera sp. 3			x		x	
Proviadana sp. 1			x			
Viadana sp. 1			x		x	
Viadana sp. 2	x					

Species	Kutari	Iwana Saamu	Sipaliwini	Inselberg	Werehpai	Possibly new
Pseudophyllinae						
Bliastes contortipes					x	
Eubliastes cf. *adustus*			x			x
Meroncidius sp. 1	x					
Gnathoclita vorax					x	
Panoploscelis scudderi	x		x		x	
Chondrosternum sp. 1	x	x	x		x	
Chondrosternum sp. 2	x	x	x		x	
Chondrosternum sp. 3			x			
Aemasia sp. 1	x		x			
Platyphyllum sp. 1			x			
Platyphyllum sp. 2	x					
Triencentrus sp. 1			x			
Triencentrus sp. 2					x	
Xiphophyllum sp. 1			x			
Acanthodis sp. 1	x		x		x	
Acanthodis sp. 2					x	
Gongrocnemis sp. 1					x	
Pleminia sp. 1			x			
Pleminia sp. 2					x	
Pleminia sp. 3					x	
Pleminia sp. 4					x	
Pristonotus sp. 1			x			
Rhinischia sp. 1	x					
Cycloptera sp. 1	x					
Pterochroza ocellata	x		x		x	
Roxelana crassicornis					x	
Typophyllum sp. 1	x		x		x	
Typophyllum sp. 2			x		x	
Diophanes sp. 1			x		x	
Gen_Teleutini sp. 1				x		
Gen_Teleutini sp. 2					x	
Gen. 5 sp. 1	x		x		x	x
Teleutias sp. 1	x	x	x		x	
Teleutias sp. 2			x		x	
Teleutias sp. 3			x			
TOTAL	**24**	**4**	**44**	**3**	**49**	**6**

APPENDIX 6. PRELIMINARY SPECIES LIST – DRAGONFLIES AND DAMSELFLIES (ODONATA)

Family	Species	Site			
		Camp 1 Kutari	**Camp 2 Sipaliwini**	**Camp 3 Werehpai**	Kwamala samutu/Iwana Saamu
		Relative abundance of species per site			
Calopterygidae (2 gen., 4 spp.)	*Hetaerina* sp. 1	C	C	C	F
	Hetaerina sp. 2	R	F	F	-
	Hetaerina sp. 3	R	R	-	-
	Mnesarete sp.	R	-	-	-
Coenagrionidae (4 gen., 15 spp.)	*Acanthagrion* sp. 1	-	R	F	F
	Acanthagrion sp. 2	-	-	R	-
	Acanthagrion sp. 1	R	-	-	-
	Acanthagrion sp. 2	F	F	F	-
	Argia sp. 1	R	-	-	-
	Argia sp. 2	F	R	-	-
	Argia sp. 3	F	C	F	C
	Argia sp. 4	F	F	C	F
	* *Argia* sp. 5	R	C	C	F
	* *Argia* sp. 6	C	R	R	-
	* *Argia* sp. 7	F	-	-	-
	* *Argia* sp. 8	F	R	-	-
	Inpabasis sp.	F	F	F	-
	Metaleptobasis sp. 1	-	-	R	-
	Metaleptobasis sp. 2	-	-	R	-
Dicteriadidae (1 gen., 1 sp.)	*Heliocharis* sp.	R	R	R	-
Megapodagrionidae (2 gen., 3 spp.)	*Heteragrion* sp. 1	F	R	F	-
	Heteragrion sp. 2	R	R	R	-
	Oxystigma sp.	-	-	F	-
Perilestidae (1 gen., 1 sp.)	*Perilestes* sp. 1	-	-	R	-
	* *Perilestes* sp. 2	R	R	F	-
	Perilestes sp. 3	-	R	R	-
Protoneuridae (5 gen., 11 spp.)	*Epipleoneura* sp. 1	R	F	F	-
	* *Epipleoneura* sp. 2	F	R	F	-
	* *Neoneura* sp. 1	R	-	R	-
	* *Neoneura* sp. 2	R	R	R	-
	Neoneura sp. 3	F	F	F	-
	Neoneura sp. 4	-	R	-	-
	Neoneura sp. 5	F	F	F	R
	Phasmoneura sp.	F	R	F	-
	Protoneura sp. 1	-	F	-	-
	Protoneura sp. 2	F	F	F	-
	Psaironeura sp.	R	-	-	-
Pseudostigmatidae (2 gen., 3 spp.)	*Mecistogaster* sp. 1	R	F	F	F
	Mecistogaster sp. 2	R	-	-	-
	Microstigma sp.	F	R	R	-
Aeshnidae (3 gen., 6 spp.)	*Gynacantha* sp. 1	-	R	R	-
	Gynacantha sp. 2	-	-	R	-
	Gynacantha sp. 3	-	-	R	-
	Gynacantha sp. 4	-	R	R	-
	Staurophlebia sp.	R	R	F	-
	Triacanthagyna sp.	-	R	-	-

Family	Species	Site			
		Camp 1 Kutari	**Camp 2 Sipaliwini**	**Camp 3 Werehpai**	Kwamala samutu/IS
		Relative abundance of species per site			
Gomphidae (6 gen., 7 spp.)	*Aphylla* sp.	R	-	R	-
	Archaeogomphus sp.	-	-	R	-
	Ebegomphus sp.	R	-	-	-
	Phyllocycla sp.	-	R	-	-
	Phyllogomphoides sp. 1	-	-	R	-
	Phyllogomphoides sp. 2	F	F	R	-
	Progomphus sp.	-	-	R	-
Libellulidae (19 gen., 39 spp.)	*Argyrothemis* sp.	F	-	-	-
	Brechmorrhoga sp.	-	-	R	-
	Diastatops sp.	R	F	R	-
	Dythemis sp.	-	R	F	-
	Elasmothemis sp. 1	F	F	F	-
	* *Elasmothemis* sp. 2	R	R	F	-
	Elga sp.	-	R	-	-
	Erythrodiplax sp. 1	R	-	-	-
	Erythrodiplax sp. 2	R	F	F	C
	Erythrodiplax sp. 3	R	R	R	R
	Fylgia sp.	R	-	R	-
	* *Gynothemis* sp.	R	-	-	-
	Macrothemis sp. 1	-	F	-	-
	Macrothemis sp. 2	R	-	-	-
	Macrothemis sp. 3	-	F	-	-
	* *Macrothemis* sp. 4	-	-	R	-
	Macrothemis sp. 5	R	-	-	-
	Miathyria sp.	-	-	-	C
	Micrathyria sp. 1	-	-	-	R
	* *Micrathyria* sp. 2	R	-	R	-
	Micrathyria sp. 3	R	R	-	-
	Misagria sp. 1	-	-	R	-
	Misagria sp. 2	-	-	F	-
	Nephepeltia sp.	-	-	-	F
	Oligoclada sp. 1	C	F	F	F
	Oligoclada sp. 2	F	-	F	-
	Oligoclada sp. 3	-	-	-	R
	Oligoclada sp. 4	-	F	R	-
	Orthemis sp. 1	R	F	F	-
	* *Orthemis* sp. 2	-	-	R	-
	Orthemis sp. 3	-	-	F	-
	Perithemis sp. 1	F	C	F	-
	Perithemis sp. 2	R	R	-	-
	Perithemis sp. 3	-	R	R	F
	Perithemis sp. 4	C	C	C	F
	Tauriphila sp.	-	-	-	F
	Uracis sp. 1	-	-	F	F
	Uracis sp. 2	F	-	R	-
	Uracis sp. 3	F	R	R	-
	Uracis sp. 4	-	-	R	-
10 families	93 spp.; 45 genera	57 spp.; 31 genera	52 spp.; 28 genera	64 spp.; 34 genera	18 spp.; 13 genera

Relative abundance: R (rare): 1-3 specimens seen; F (frequent): 4-20 specimens seen; C (common): 21-50 specimens seen. * **New for Suriname**

APPENDIX 7. PRELIMINARY SPECIES LIST – FISHES

Acestrorhynchus	*microlepis*
Ageneinosis	*inermis*
Anostomus	*ternezi*
Apistogramma	*ortmani*
Astyanax	*bimaculatus*
Bivibranchia	*simulata*
Brachychalcinus	sp.
Brycon	*falcatus*
Bryconops	*affinis*
Bryconops	*caudomaculatus*
Bryconops	*melanurus*
Carnigella	*strigata*
Chalceus	*macrolepidotus*
Characidium	*zebra*
Charax	*pauciradiatus*
Cichla	*ocellaris*
Corridoras	sp.
Corridoras	*sipaliwinsis*
Crenicichla	*sipaliwinensis*
Curimata	sp.
Cynopotamus	*essequibensis*
Cyphocharax	*spilurus*
Cyphocharax	*helleri*
Doras	sp.
Eigenmannia	*virescens*
Geophagus	*brachibranchus*
Guianacara	*owroewefi*
Guiancistrus	*brevispinis*
Gymnotus	*carapo*
Hartia	*maculatus*
Helogenes	*marmoratus*
Hemigrammus	*erhytetrazona*
Hemigrammus	*boesemani*
Hemigrammus	sp.
Hemiodus	*quadrimaculatus*
Hemiodus	*unimaculatus*
Hemisoribim	*platyrhynchus*
Hoplerythrinus	*unitaeniatus*
Hoplias	*aimara*
Hoplias	*malabaricus*
Hyphessobrycon	*erhytetrazona*
Hyphessobrycon	*rosaceus*
Hyphessobrycon	sp.
Hypostomas	sp. 1

Hypostomas	sp. 2
Hypostomas	sp. 3
Imparfinnis	*blackstripe*
Imparfinnis	sp.
Jupiaba	*meunieri*
Knodus	sp.
Leporinus	*fasiatus*
Leporinus	*friderici*
Leporinus	*megalepis*
Leporinus	*nijsseni*
Lithoxus	sp.
Melanocharacidium	sp.
Metaloricaria	*nijsseni*
Microglanis	*secundus*
Moenkhausia	*collettii*
Moenkhausia	*georgiae*
Moenkhausia	*grandisquama*
Moenkhausia	*hemigramoides*
Moenkhausia	*lepidura*
Moenkhausia	*oligolepis*
Moenkhausia	sp.
Moenkhausia	sp. 1
Moenkhausia	sp. 2
Moenkhausia	sp. 3
Myleus	*rhomboidales*
Myleus	*rubripinnis*
Myleus	sp.
Myleus	*gibbisses*
Otocinclus	sp.
Otocinclus	*vittatus*
Parauchinipteres	sp.
Parodon	*guianensis*
Phenacogaster	*microstictus*
Pimelodus	*albofaciatus*
Pimelodus	*blochi*
Pimelodus	*ortnates*
Pimolodella	*cristata*
Pimolodella	sp.
Poptella	*brevispina*
Potamotroygon	*boesemani*
Prochilodus	*rubrotaeniatus*
Pseudocetopsis	sp.
Psuedancanticus	*corantijnensis*
Pteradora	*aff. granulosis*
Pyrrhulina	*filamentosa*
Rhamphychtys	*rostratus*
Rhineloricania	*stewarti*

Rivulus	*amphoreus*
Rivulus	sp.
Roexodon	sp.
Schizodon	*fasiatus*
Serrasalmus	*rhombeus*
Synbrachus	*marmoratus*
Tatia	sp.
Tetragonopeterus	*chalceus*
Triporteus	*brachipomus*

APPENDIX 8. PRELIMINARY SPECIES LIST – REPTILES AND AMPHIBIANS

	Kutari	Sipaliwini	Werehpai	Iwana Saamu
Amphibia				
Adenomera hyeri	1	0	0	0
Adenomera sp.	9	6	8	0
Allobates femoralis	1	2	34	2
Allophryne ruthveni	4	2	4	1
Anolis sp.	0	1	0	0
Bufo guttatus	3	2	5	1
Bufo margaritifera (large ridges)	3	0	0	0
Bufo margaritifera (small ridges)	12	13	9	0
Bufo marinus	0	0	1	0
Caecilidae	1	0	0	0
Ceratophrys cornuta	0	0	2	0
cf.Hyla sp.	0	0	1	0
Colostethus baeobatrachus	13	7	7	0
Colostethus beebei	6	0	4	0
Colostethus granti	6	0	0	0
Dendrobates tinctorius	0	5	0	0
Eleutherodactylus chiastonotus	0	2	1	0
Eleutherodactylus sp.	0	0	2	0
Eleutherodactylus zeuctotylus	1	8	0	1
Epipedobates hahneli	0	1	7	0
Epipedobates sp.	0	0	1	0
Epipedobates trivittatus	8	2	11	0
Hamptophryne boliviana	3	2	2	5
Hyla boans	5	12	1	1
Hyla calcarata	1	18	0	6
Hyla fasciata	0	2	6	0
Hyla geographica	0	4	0	0
Hyla granosa	2	1	8	0
Hyla minuta	0	4	0	0
Leptodactylus bolivianus	0	2	0	0
Leptodactylus knudseni	1	2	1	0
Leptodactylus myersi	0	13	0	0
Leptodactylus mystaceus	9	6	14	9
Leptodactylus pentadactylus	2	2	1	0
Leptodactylus petersii	0	3	1	0
Leptodactylus rhodomystax	0	0	9	0

	Kutari	Sipaliwini	Werehpai	Iwana Saamu
Leptodactylus sp.	0	0	1	0
Microhylidae	0	0	2	0
Osteocephalus leprieuri	3	2	0	0
Osteocephalus sp.	0	0	0	1
Phrynohyas resinifictrix	0	0	2	0
Phyllomedusa bicolor	0	11	0	0
Phyllomedusa hypochrondialis	0	0	0	1
Scinax proboscideus	1	0	0	0
Reptilia				
Snakes and Amphisbaena				
Amphisbaena slevini	1	0	0	0
Anillius scytale	0	0	1	0
Atractus flammigerus	0	1	1	0
Atractus torquatus	1	0	0	0
Bothriopsis biliniata	0	0	1	0
Bothrops atrox	0	1	0	0
Dipsas catesbyi	0	1	0	0
Drymarchon curais	1	0	0	0
Eunectes murinus	0	0	1	0
Helicops angulatus	0	1	0	0
Hydrops triangulatus	1	0	0	0
Imantodes cf.cenchoa	0	1	0	0
Liophis typhlus	2	0	0	0
Siphlophis cervinus	0	0	1	0
Typhloplis sp.	1	0	0	0
Xenodon werneri	0	1	0	0
Lizards				
Anolis nitens	2	4	1	0
Anolis punctatus	0	0	1	0
Arthrosaura kocki	0	0	13	0
Coleodactylus amazonicus	13	1	0	0
Gonatodes annularis	0	0	1	0
Gonatodes cf.annularis	0	0	1	0
Gonatodes humeralis	0	0	2	0
Gymnopthalmus underwoodii	0	0	1	0
Kentropyx calcarata	5	3	9	0
Leposoma guyanenses	8	2	17	0
Mabuya nigropunctata	1	0	3	0

	Kutari	Sipaliwini	Werehpai	Iwana Saamu
Neusticurus bicarinatus	0	1	0	0
Plica plica	0	0	1	0
Plica umbra	0	1	1	0
Thecadactylus rapicauda	0	0	1	1
Tupinambis nigropunctata	0	0	1	0
Turtles				
Geochelone denticulata	1	0	0	0
Platymus platycephalus	0	0	1	0
Caimans				
Paleosuchus trigonatus	2	0	0	0

APPENDIX 9. PRELIMINARY SPECIES LIST – BIRDS

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
TINAMIDAE						
Great Tinamou	*Tinamus major*	X	X	X		
Cinereous Tinamou	*Crypturellus cinereus*	X	X	X		
Little Tinamou	*Crypturellus soui*			X		
Variegated Tinamou	*Crypturellus variegatus*	X	X	X		
Rusty Tinamou	*Crypturellus brevirostris*	X				
CRACIDAE						
Guan sp.	*Penelope jacquacu/marail sp.*	X	X	X		
Blue-throated Piping-Guan	*Pipile cumanensis*		X	X		
Little Chachalaca	*Ortalis motmot*		X	X		
Black Curassow	*Crax alector*	X	X	X		
ODONTOPHORIDAE						
Marbled Wood-Quail	*Odontophorus gujanensis*	X	X			
PHALACROCORACIDAE						
Neotropic Cormorant	*Phalacrocorax brasilianus*				X	
ANHINGIDAE						
Anhinga	*Anhinga anhinga*				X	
ARDEIDAE						
Rufescent Tiger-Heron	*Tigrisoma lineatum*	X	X	X		
Zigzag Heron	*Zebrilus undulatus*				X	
Striated Heron	*Butorides striata*	X	X	X		
Cattle Egret	*Bubulcus ibis*				X	
White-necked Heron	*Ardea cocoi*	X				
Capped Heron	*Pilherodius pileatus*		X	X		
THRESKIORNITHIDAE						
Green Ibis	*Mesembrinibis cayennensis*	X		X		

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
CATHARTIDAE						
Greater Yellow-headed Vulture	*Cathartes melambrotus*	X	X	X		
Black Vulture	*Coragyps atratus*		X	X		
King Vulture	*Sarcoramphus papa*	X	X	X		
PANDIONIDAE						
Osprey	*Pandion haliaetus*		X			
ACCIPITRIDAE						
Hook-billed Kite	*Chondrohierax uncinatus*				X	
Swallow-tailed Kite	*Elanoides forficatus*				X	
Plumbeous Kite	*Ictinia plumbea*		X			
White Hawk	*Leucopternis albicollis*	X	X			
Great Black Hawk	*Buteogallus urubitinga*		X			
Gray Hawk	*Buteo nitidus*		X	X		
Short-tailed Hawk	*Buteo brachyurus*					X
Black-and-white Hawk-Eagle	*Spizastur melanoleucus*		X			
Black Hawk-Eagle	*Spizaetus tyrannus*		X	X		
Ornate Hawk-eagle	*Spizaetus ornatus*		X			
FALCONIDAE						
Barred Forest-Falcon	*Micrastur ruficollis*	X				
Lined Forest-Falcon	*Micrastur gilvicollis*	X	X	X		
Slaty-backed Forest-Falcon	*Micrastur mirandollei*	X	X	X		
Collared Forest-Falcon	*Micrastur semitorquatus*	X	X	X		
Red-throated Caracara	*Ibycter americanus*	X	X	X		
Black Caracara	*Daptrius ater*		X	X		
Bat Falcon	*Falco rufigularis*	X	X			
PSOPHIIDAE						
Gray-winged Trumpeter	*Psophia crepitans*	X	X			

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
RALLIDAE						
Russet-crowned Crake	*Laterallus viridis*					X
EURYPYGIDAE						
Sunbittern	*Eurypyga helias*		X	X		
CHARADRIIDAE						
American Golden-Plover	*Pluvialis dominica*					X
SCOLOPACIDAE						
Spotted Sandpiper	*Actitis macularia*		X	X		
Solitary Sandpiper	*Tringa solitaria*		X	X		
COLUMBIDAE						
Common Ground-Dove	*Columbina passerina*					X
Blue Ground-Dove	*Claravis pretiosa*					X
Plumbeous Pigeon	*Patagioenas plumbea*	X	X	X		
Ruddy Pigeon	*Patagioenas subvinacea*			X		
White-tipped Dove	*Leptotila verreauxi*					X
Gray-fronted Dove	*Leptotila rufaxilla*	X	X	X		
Ruddy Quail-Dove	*Geotrygon montana*				X	
PSITTACIDAE						
Blue-and-yellow Macaw	*Ara ararauna*	X	X			
Scarlet Macaw	*Ara macao*	X	X	X		
Chestnut-fronted Macaw	*Ara severa*		X	X		
Red-bellied Macaw	*Orthopsittaca manilata*					X
White-eyed Parakeet	*Aratinga leucophthalma*		X	X		
Painted Parakeet	*Pyrrhura picta*	X	X	X		
Golden-winged Parakeet	*Brotogeris chrysoptera*	X	X	X		
Lilac-tailed Parrotlet	*Touit batavicus*				X	
Black-headed Parrot	*Pionites melanocephalus*	X	X			
Red-fan Parrot	*Deroptyus accipitrinus*	X	X	X		

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
Caica Parrot	*Pyrilia caica*	X	X			
Blue-headed Parrot	*Pionus menstruus*				X	
Dusky Parrot	*Pionus fuscus*	X	X	X		
Orange-winged Parrot	*Amazona amazonica*	X	X			
Mealy Parrot	*Amazona farinosa*	X	X	X		
CUCULIDAE						
Little Cuckoo	*Coccycua minuta*	X				
Squirrel Cuckoo	*Piaya cayana*	X	X	X		
Black-bellied Cuckoo	*Piaya melanogaster*			X		
Cuckoo sp.	*Coccyzus cf. euleri*	X				
Pavonine Cuckoo	*Dromococcyx pavoninus*			X		
Smooth-billed Ani	*Crotophaga ani*					X
STRIGIDAE						
Tawny-bellied Screech-Owl	*Megascops watsonii*	X		X		
Crested Owl	*Lophostrix cristata*	X	X	X		
Spectacled Owl	*Pulsatrix perspicillata*	X	X	X		
Black-banded Owl	*Ciccaba huhula*		X	X		
Amazonian Pygmy-Owl	*Glaucidium hardyi*	X	X	X		
NYCTIBIIDAE						
Great Potoo	*Nyctibius grandis*		X	X		
Long-tailed Potoo	*Nyctibius aethereus*	X				
Common Potoo	*Nyctibius griseus*		X	X		
White-winged Potoo	*Nyctibius leucopterus*	X				
CAPRIMULGIDAE						
Short-tailed Nighthawk	*Lurocalis semitorquatus*	X	X			
Common Pauraque	*Nyctidromus albicollis*	X	X	X		
Blackish Nightjar	*Caprimulgus nigrescens*		X			
Ladder-tailed Nightjar	*Hydropsalis climacocerca*		X			

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
APODIDAE						
Band-rumped Swift	*Chaetura spinicaudus*	X	X	X		
Chapman's Swift	*Chaetura chapmani*		X	X		
Swift sp.	*Chaetura cf. meridionalis*			X		
TROCHILIDAE						
White-necked Jacobin	*Florisuga mellivora*	X	X	X		
Rufous-breasted Hermit	*Glaucis hirsutus*					X
Reddish Hermit	*Phaethornis ruber*	X	X	X		
Straight-billed Hermit	*Phaethornis bourcieri*	X	X	X		
Long-tailed Hermit	*Phaethornis superciliosus*	X	X	X		
Black-eared Fairy	*Heliothrix aurita*		X			
Gray-breasted Sabrewing	*Campylopterus largipennis*		X			
Fork-tailed Woodnymph	*Thalurania furcata*	X	X	X		
Hummingbird sp.	*Amazilia cf. leucogaster*		X			
Rufous-throated Sapphire	*Hylocharis sapphirina*		X			
White-chinned Sapphire	*Hylocharis cyanus*		X	X		
TROGONIDAE						
Black-tailed Trogon	*Trogon melanurus*	X	X	X		
Green-backed Trogon	*Trogon viridis*	X	X	X		
Violaceous Trogon	*Trogon violaceus*	X	X	X		
Black-throated Trogon	*Trogon rufus*	X	X	X		
Collared Trogon	*Trogon collaris*	X	X	X		
ALCEDINIDAE						
Ringed Kingfisher	*Megaceryle torquata*	X	X	X		
Amazon Kingfisher	*Chloroceryle amazona*	X	X	X		
Green Kingfisher	*Chloroceryle americana*	X	X	X		
Green-and-rufous Kingfisher	*Chloroceryle inda*	X	X			
American Pygmy Kingfisher	*Chloroceryle aenea*	X	X			
MOMOTIDAE						

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
Blue-crowned Motmot	*Momotus momota*	X	X	X		
GALBULIDAE						
Brown Jacamar	*Brachygalba lugubris*	X	X	X		
Yellow-billed Jacamar	*Galbula albirostris*	X	X			
Green-tailed Jacamar	*Galbula galbula*		X			
Paradise Jacamar	*Galbula dea*	X	X	X		
Great Jacamar	*Jacamerops aurea*	X	X	X		
BUCCONIDAE						
Guianan Puffbird	*Notharchus macrorhynchos*	X	X			
Pied Puffbird	*Notharchus tectus*				X	
Collared Puffbird	*Bucco capensis*	X		X		
White-chested Puffbird	*Malacoptila fusca*	X	X			
Rusty-breasted Nunlet	*Nonnula rubecula*		X	X		
Black Nunbird	*Monasa atra*	X	X	X		
Swallow-winged Puffbird	*Chelidoptera tenebrosa*	X	X	X		
CAPITONIDAE						
Black-spotted Barbet	*Capito niger*	X	X	X		
RAMPHASTIDAE						
White-throated Toucan	*Ramphastos tucanus*	X	X	X		
Channel-billed Toucan	*Ramphastos vitellinus*	X	X	X		
Guianan Toucanet	*Selenidera culik*	X	X	X		
Green Aracari	*Pteroglossus viridis*	X	X	X		
Black-necked Aracari	*Pteroglossus aracari*	X	X	X		
PICIDAE						
Golden-spangled Piculet	*Picumnus exilis*	X		X		
Golden-collared Woodpecker	*Veniliornis cassini*	X	X	X		
Yellow-throated Woodpecker	*Piculus flavigula*	X	X	X		
Waved Woodpecker	*Celeus undatus*	X	X	X		

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
Chestnut Woodpecker	*Celeus elegans*	X				
Cream-colored Woodpecker	*Celeus flavus*		X			
Ringed Woodpecker	*Celeus torquatus*		X			
Lineated Woodpecker	*Dryocopus lineatus*		X	X		
Red-necked Woodpecker	*Campephilus rubricollis*	X	X	X		
Crimson-crested Woodpecker	*Campephilus melanoleucos*	X	X	X		
FURNARIIDAE						
Short-billed Leaftosser	*Sclerurus rufigularis*	X				
Rufous-rumped Foliage-gleaner	*Philydor erythrocercus*	X	X			
Cinnamon-rumped Foliage-gleaner	*Philydor pyrrhodes*			X		
Buff-throated Foliage-gleaner	*Automolus ochrolaemus*	X	X	X		
Olive-backed Foliage-gleaner	*Automolus infuscatus*	X	X	X		
Chestnut-crowned Foliage-gleaner	*Automolus rufipileatus*	X	X	X		
Rufous-tailed Xenops	*Xenops milleri*	X				
Plain Xenops	*Xenops minutus*	X	X	X		
Plain-brown Woodcreeper	*Dendrocincla fuliginosa*	X	X	X		
Long-tailed Woodcreeper	*Deconychura longicauda*	X				
Wedge-billed Woodcreeper	*Glyphorynchus spirurus*	X	X	X		
Cinnamon-throated Woodcreeper	*Dendrexetastes rufigula*	X		X		
Red-billed Woodcreeper	*Hylexetastes perrotii*	X				
Amazonian Barred-Woodcreeper	*Dendrocolaptes certhia*	X	X	X		
Black-banded Woodcreeper	*Dendrocolaptes picumnus*	X	X	X		
Striped Woodcreeper	*Xiphorhynchus obsoletus*	X				
Chestnut-rumped Woodcreeper	*Xiphorhynchus pardalotus*	X	X	X		
Buff-throated Woodcreeper	*Xiphorhynchus guttatus*	X	X	X		
Lineated Woodcreeper	*Lepidocolaptes albolineatus*	X				
Curve-billed Scythebill	*Campyloramphus procurvoides*		X	X		
THAMNOPHILIDAE						
Fasciated Antshrike	*Cymbilaimus lineatus*	X	X	X		
Black-throated Antshrike	*Frederickena viridis*	X				
Great Antshrike	*Taraba major*		X	X		

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
Black-crested Antshrike	*Sakesphorus canadensis*		X	X		
Mouse-colored Antshrike	*Thamnophilus murinus*	X	X	X		
Northern Slaty-Antshrike	*Thamnophilus punctatus*		X			
Band-tailed Antshrike	*Thamnophilus melanothorax*		X	X		
Amazonian Antshrike	*Thamnophilus amazonicus*	X	X	X		
Dusky-throated Antshrike	*Thamnomanes ardesiacus*	X	X	X		
Cinereous Antshrike	*Thamnomanes caesius*	X	X	X		
Spot-winged Antshrike	*Pygiptila stellaris*				X	
Brown-bellied Antwren	*Epinecrophylla gutturalis*	X	X	X		
Pygmy Antwren	*Myrmotherula brachyura*	X	X	X		
Guianan Streaked-Antwren	*Myrmotherula surinamensis*	X	X	X		
Rufous-bellied Antwren	*Myrmotherula guttata*	X	X	X		
White-flanked Antwren	*Myrmotherula axillaris*	X	X	X		
Long-winged Antwren	*Myrmotherula longipennis*	X	X	X		
Gray Antwren	*Myrmotherula menetriesii*	X	X	X		
Spot-tailed Antwren	*Herpsilochmus sticturus*	X	X	X		
Todd’s Antwren	*Herpsilochmus stictocephalus*	X	X	X		
Dot-winged Antwren	*Microrhopias quixensis*	X	X	X		
Guianan Warbling-Antbird	*Hypocnemis cantator*	X	X	X		
Ash-winged Antwren	*Terenura spodioptila*	X	X			
Gray Antbird	*Cercomacra cinerascens*	X	X	X		
Dusky Antbird	*Cercomacra tyrannina*	X	X	X		
White-browed Antbird	*Myrmoborus leucophrys*	X	X	X		
Black-chinned Antbird	*Hypocnemoides melanopogon*	X	X			
Silvered Antbird	*Sclateria naevia*	X				
Black-headed Antbird	*Percnostola rufifrons*	X	X	X		
Spot-winged Antbird	*Schistocichla leucostigma*	X	X			
Ferruginous-backed Antbird	*Myrmeciza ferruginea*	X	X	X		
Wing-banded Antbird	*Myrmornis torquata*	X	X			
White-plumed Antbird	*Pithys albifrons*	X	X	X		
Rufous-throated Antbird	*Gymnopithys rufigula*		X	X		
Spot-backed Antbird	*Hylophylax naevius*	X	X	X		
Scale-backed Antbird	*Willisornis poecilinotus*	X	X	X		

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
FORMICARIIDAE						
Rufous-capped Antthrush	*Formicarius colma*	X	X	X		
Black-faced Anttrush	*Formicarius analis*	X	X	X		
GRALLARIIDAE						
Variegated Antpitta	*Grallaria varia*		X			
Spotted Antpitta	*Hylopezus macularius*	X	X	X		
Thrush-like Antpitta	*Myrmothera campanisona*	X	X	X		
CONOPOPHAGIDAE						
Chestnut-belted Gnateater	*Conopophaga aurita*	X	X	X		
TYRANNIDAE						
Sooty-headed Tyrannulet	*Phyllomyias griseiceps*	X		X		
Yellow-crowned Tyrannulet	*Tyrannulus elatus*	X	X	X		
Forest Elaenia	*Myiopagis gaimardii*	X	X	X		
Yellow-crowned Elaenia	*Myiopagis flavivertex*	X	X			
Elaenia sp.	*Elaenia cf. parvirostris*					X
White-lored Tyrannulet	*Ornithion inerme*	X	X			
Southern Beardless-Tyrannulet	*Camptostoma obsoletum*	X	X	X		
Yellow Tyrannulet	*Campsiempis flaveola*					X
Ringed Antpipit	*Corythopis torquatus*	X	X	X		
Guianan Tyrannulet	*Zimmerius acer*	X	X	X		
Ochre-bellied Flycatcher	*Mionectes oleagineus*					X
McConnell's Flycatcher	*Mionectes macconnelli*	X		X		
Short-tailed Pygmy-Tyrant	*Myiornis ecaudatus*	X	X	X		
Double-banded Pygmy-Tyrant	*Lophotriccus vitiosus*	X	X	X		
Helmeted Pygmy-Tyrant	*Lophotriccus galeatus*	X	X	X		
Boat-billed Tody-Tyrant	*Hemitriccus josephinae*	X	X			
White-eyed Tody-Tyrant	*Hemitriccus zosterops*	X	X	X		
Common Tody-Flycatcher	*Todirostrum cinereum*					X
Painted Tody-Flycatcher	*Todirostrum pictum*	X		X		

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
Yellow-margined Flycatcher	*Tolmomyias assimilis*	X	X	X		
Gray-crowned Flycatcher	*Tolmomyias poliocephalus*	X	X	X		
Cinnamon-crested Spadebill	*Platyrinchus saturatus*	X	X	X		
Golden-crowned Spadebill	*Platyrinchus coronatus*		X	X		
White-crested Spadebill	*Platyrinchus platyrhynchos*	X	X	X		
Royal Flycatcher	*Onychorhynchus coronatus*	X				
Bran-colored Flycatcher	*Myiophobus fasciatus*					X
Sulphur-rumped Flycatcher	*Myiobius barbatus*	X	X			
Ruddy-tailed Flycatcher	*Terenotriccus erythrurus*	X	X			
Euler's Flycatcher	*Lathotriccus euleri*	X	X	X		
Drab Water-Tyrant	*Ochthornis littoralis*		X	X		
Piratic Flycatcher	*Legatus leucophaius*		X	X		
Rusty-margined Flycatcher	*Myiozetetes cayanensis*		X	X		
Dusky-chested Flycatcher	*Myiozetetes luteiventris*	X	X	X		
Yellow-throated Flycatcher	*Conopias parvus*	X	X	X		
Sulphury Flycatcher	*Tyrannopsis sulphurea*					X
Tropical Kingbird	*Tyrannus melancholicus*	X	X	X		
Grayish Mourner	*Rhytipterna simplex*	X	X	X		
Sirystes	*Sirystes sibilator*	X	X	X		
Dusky-capped Flycatcher	*Myiarchus tuberculifer*	X		X		
Short-crested Flycatcher	*Myiarchus ferox*	X	X	X		
Rufous-tailed Flatbill	*Ramphotrigon ruficauda*	X	X	X		
Large-headed Flatbill	*Ramphotrigon megacephalum*	X		X		
Cinnamon Attila	*Attila cinnamomeus*					X
Bright-rumped Atilla	*Atilla spadiceus*	X	X	X		
COTINGIDAE						
Guianan Red-Cotinga	*Phoenicircus carnifex*	X				
Guianan Cock-of-the-rock	*Rupicola rupicola*		X	X		
Purple-throated Fruitcrow	*Querula purpurata*	X	X	X		
Capuchinbird	*Perissocephalus tricolor*	X		X		
Spangled Cotinga	*Cotinga cayana*		X	X		
Screaming Piha	*Lipaugus vociferans*	X	X	X		

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
Pompadour Cotinga	*Xipholena punicea*		X			
Bare-necked Fruitcrow	*Gymnoderus foetidus*		X	X		
PIPRIDAE						
Tiny Tyrant-Manakin	*Tyranneutes virescens*	X	X	X		
White-throated Manakin	*Corapipo gutturalis*	X	X	X		
White-bearded Manakin	*Manacus manacus*		X	X		
White-crowned Manakin	*Dixiphia pipra*	X	X	X		
Golden-headed Manakin	*Pipra erythrocephala*	X	X	X		
TITYRIDAE						
Black-tailed Tityra	*Tityra cayana*		X	X		
Thrush-like Schiffornis	*Schiffornis turdina*	X	X	X		
Cinereous Mourner	*Laniocera hypopyrra*	X	X			
Black-capped Becard	*Pachyramphus marginatus*	X		X		
Glossy-backed Becard	*Pachyramphus surinamus*	X				
INCERTAE SEDIS						
Wing-barred Piprites	*Piprites chloris*	X	X	X		
VIREONIDAE						
Rufous-browed Peppershrike	*Cyclarhis gujanensis*	X	X	X		
Slaty-capped Shrike-Vireo	*Vireolanius leucotis*	X	X	X		
Red-eyed Vireo	*Vireo olivaceus*	X	X	X		
Lemon-chested Greenlet	*Hylophilus thoracicus*	X	X	X		
Buff-cheeked Greenlet	*Hylophilus muscicapinus*	X	X	X		
Tawny-crowned Greenlet	*Hylophilus ochraceiceps*	X	X	X		
HIRUNDINIDAE						
Black-collared Swallow	*Pygochelidon melanoleuca*		X	X		
White-banded Swallow	*Atticora fasciata*	X	X	X		
Brown-chested Martin	*Progne tapera*		X	X		
Gray-breasted Martin	*Progne chalybea*		X	X		

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
White-winged Swallow	*Tachycineta albiventer*	X	X	X		
Bank Swallow	*Riparia riparia*					X
Barn Swallow	*Hirundo rustica*		X	X		
Cliff Swallow	*Petrochelidon pyrrhonota*					X
TROGLODYTIDAE						
Coraya Wren	*Thryothorus coraya*	X	X	X		
Buff-breasted Wren	*Thryothorus leucotis*	X	X	X		
Musician Wren	*Cyphorhinus arada*	X				
POLIOPTILIDAE						
Collared Gnatwren	*Microbates collaris*	X	X	X		
Long-billed Gnatwren	*Ramphocaenus melanurus*	X	X	X		
Tropical Gnatcatcher	*Polioptila plumbea*		X	X		
Guianan Gnatcatcher	*Polioptila guianensis*	X				
TURDIDAE						
Cocoa Thrush	*Turdus fumigatus*	X	X	X		
White-necked Thrush	*Turdus albicollis*		X	X		
THRAUPIDAE						
Red-capped Cardinal	*Paroaria gularis*		X	X		
Red-billed Pied Tanager	*Lamprospiza melanoleuca*	X	X			
Fulvous-crested Tanager	*Tachyphonus surinamus*	X	X	X		
White-shouldered Tanager	*Tachyphonus luctuosus*			X		
Fulvous Shrike-Tanager	*Lanio fulvus*	X	X	X		
Silver-beaked Tanager	*Ramphocelus carbo*	X	X	X		
Blue-gray Tanager	*Thraupis episcopus*					X
Palm Tanager	*Thraupis palmarum*		X	X		
Turquoise Tanager	*Tangara mexicana*		X	X		
Paradise Tanager	*Tangara chilensis*	X				
Opal-rumped Tanager	*Tangara velia*			X		
Swallow Tanager	*Tersina viridis*			X		

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
Black-faced Dacnis	*Dacnis lineata*		X	X		
Blue Dacnis	*Dacnis cayana*		X	X		
Purple Honeycreeper	*Cyanerpes caeruleus*				X	
Red-legged Honeycreeper	*Cyanerpes cyaneus*	X				
Green Honeycreeper	*Chlorophanes spiza*	X		X		
INCERTAE SEDIS						
Bananaquit	*Coereba flaveola*	X	X	X		
Slate-colored Grosbeak	*Saltator grossus*		X	X		
Buff-throated Saltator	*Saltator maximus*	X	X	X		
EMBERIZIDAE						
Blue-black Grassquit	*Volatinia jacarina*					X
Pectoral Sparrow	*Arremon taciturnus*		X	X		
CARDINALIDAE						
Rose-breasted Chat	*Granatellus pelzelni*		X	X		
Yellow-green Grosbeak	*Caryothraustes canadensis*	X				
Blue-black Grosbeak	*Cyanocompsa cyanoides*		X	X		
PARULIDAE						
Tropical Parula	*Parula pitiayumi*	X				
Riverbank Warbler	*Basileuterus rivularis*	X				
ICTERIDAE						
Green Oropendola	*Psarocolius viridis*	X	X	X		
Crested Oropendola	*Psarocolius decumanus*	X	X	X		
Yellow-rumped Cacique	*Cacicus cela*	X	X	X		
Red-rumped Cacique	*Cacicus haemorrhous*		X	X		
Giant Cowbird	*Molothrus oryzivorus*					X
FRINGILLIDAE						
Euphonia sp.	*Euphonia cf. chlorotica*		X	X		

		Kutari	Sipaliwini	Werehpai	Recon only	Kwamala
Violaceous Euphonia	*Euphonia violacea*	X	X	X		
Golden-sided Euphonia	*Euphonia cayennensis*	X	X	X		
TOTAL		214	242	221		

Taxonomy and nomenclature follow the current version of the American Ornithologists' Union South American Checklist (www.museum.lsu.edu/~Remsen/SACCBaseline.html). "Recon only" indicates species observed only during the reconnaissance trip, 3-8 May 2010 (see Birds chapter). "Kwamala" indicates species observed only in or near the village of Kwamalasamutu. This list is tentative pending analysis of sound recordings.

APPENDIX 10. PRELIMINARY SPECIES LIST – SMALL MAMMALS

Numbers in parentheses include individuals that were released.

Species	Kutari	Sipaliwini	Werehpai	Individuals
Opossums:				
Gracilinianus emiliae	1			1
Monodelphis brevicaudata		1	3 (4)	4 (5)
Subtotal	**1**	**1**	**3 (4)**	**5 (6)**
Rats:				
Neusticomys oyapocki	1			1
Isothrix sinammariensis	1			1
Neacomys guianae	2			2
Neacomys paracou	1		1 (9)	2 (10)
Oecomys bicolor	1	1		2
Oecomys concolor	3		1 (2)	4 (5)
Oecomys rutilus	1			1
Oryzomys macconnelli	6	12	1 (10)	19 (28)
Oryzomys megacephalus	13	10	7 (30)	30 (53)
Oryzomys yunganus	15	4		19
Proechimys cuvieri	1	4	2 (7)	7 (12)
Proechimys guyannensis	7	4		11
Rhipidomys nitela		1		1
Subtotal	**52**	**36**	**12 (58)**	**100 (146)**
Bats:				
Anoura geoffroyi		1		1
Artibeus bogotensis	1		1	2
Artibeus gnomus	2		1	3
Artibeus lituratus	1	3	3 (12)	7 (16)
Artibeus obscurus	3	3	3 (6)	9(12)
Artibeus planirostris	14 (16)	9	7 (45)	30 (70)
Carollia brevicauda	1		2	3
Carollia perspicillata	2	2	1 (2)	5 (6)
Desmodus rotundus	1		2	3
Lionycteris spurrelli		2	2 (6)	4 (8)
Lonchophylla thomasi	3	2	2(4)	7 (9)
Lonchorhinua inusitata			2 (8)	2 (8)
Lophostoma silvicolum	6	8	1	15
Micronycteris megalotis			1	1

Species	Kutari	Sipaliwini	Werehpai	Individuals
Micronycteris minuta		1		1
Mimon crenulatum		1	2	3
Myotis riparius	1	1	1	3
Phyllostomus discolor			1	1
Phyllostomus elongatus	4	1	5 (8)	10 (13)
Phyllostomus hastatus			1	1
Platyrrhinus helleri	2		2	4
Pteronotus parnellii	6	11	3 (10)	20 (27)
Rhinophylla pumilio	1		3 (5)	4 (6)
Sturnira tildae			1	1
Trachops cirrhosus	2		2	4
Uroderma bilobatum		2		2
Subtotal	**50 (52)**	**47**	**49 (124)**	**146 (223)**
Total	**103 (105)**	**84**	**64 (186)**	**251 (375)**

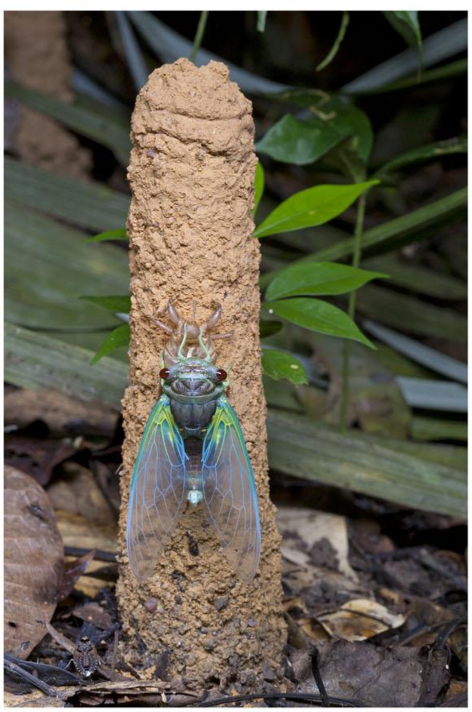
APPENDIX 11. PRELIMINARY SPECIES LIST – LARGE MAMMALS

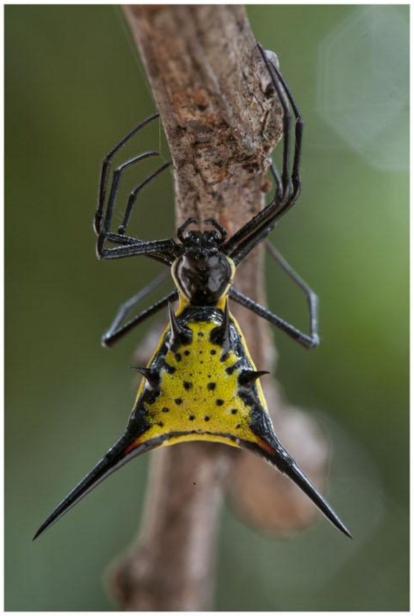
Scientific name	Common name	Trio name	Detection method	Site
Cuniculus paca	Paca	Kurimau	CT	K, S, W
Alouatta macconnelli	Guianan Red Howler Monkey	Aluatá	Heard	K
Ateles paniscus	Guianan Black Spider Monkey	Arimi; Tanonkonpe	Observed	K, S, W
Cebus apella	Brown Capuchin	Tarípi	Observed	K, S, W
Cebus olivaceus	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

Scientific name	Common name	Trio name	Detection method	Site
Crypturellus variegatus	Variegated Tinamou*	Sororsoroí	CT	K, W
Tinamus major	Great Tinamou*	Suwi	CT	K, W
Penelope marail	Marail Guan*	Marai	Observed	K
Psophia crepitans	Grey-winged Trumpeter*	Mami	CT	K, S, W

* Birds; included here for documentation of Trio names

Photos from the Kwamalasamutu RAP survey
All photos ©Piotr Naskrecki





Photos taken by camera traps during the RAP survey of the Kwamalasamutu region, 2010

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