

## Executive Summary

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# Executive Summary

## INTRODUCTION

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### **The Guayana Shield Region**

The Guayana Shield Region of northern South America (approx. 8°N, 72°W) was formed during the Precambrian era and is one of the most ancient landscapes in the world. The terms Guiana and Guayana are two universally accepted variants of an Amerindian word interpreted to mean “land of plenty water.” Participants of the Guayana Shield Priority Setting Workshop (Huber and Foster 2003) identified the Guayana Shield as the area bounded by the Amazon River to the south, the Japura-Caqueta River to the southwest, the Sierra de Chiribiquere to the west, the Orinoco and Guaviare rivers to the northwest and north, and the Atlantic Ocean to the east. This area covers 2.5 million km<sup>2</sup> of mountains, pristine forests, wetlands and savannahs, and is comprised of parts of Venezuela, Brazil and Colombia and all of Guyana, Suriname and French Guiana. The Guayana Shield occupies approximately 13% of the entire South American continent (Hammond 2005). Recognized as one of the world’s largest remaining areas of tropical wilderness, the Guayana Shield Region is also home to a wide variety of unique ecosystems (e.g. tepui or table-top mountains), harbors a large number of endemic fauna and flora, and supports a high level of cultural diversity with more than 100 indigenous ethnic groups, most of whose cultures remain relatively unblemished and are intimately dependent upon the natural resources of the region for their sustenance.

### **Guyana**

Guyana is located on the northern coast of South America and is bordered by the Atlantic Ocean to the north, Suriname to the east, Venezuela to the west and Brazil to the south and southwest. Several features distinguish Guyana’s forests from other regions of the world. A primary distinction is that 80% of the country is forested and 75% of this remains relatively intact. This is one of the highest percentages of pristine tropical habitat for any country. Other distinguishable features include the underlying geologically old Guayana Shield, close proximity to the biologically rich Amazon Basin, low population density and an interior that is relatively inaccessible. These factors have contributed to Guyana’s richness in biodiversity and biologically important habitats.

The temperature is tropical with average high daily temperatures of 25.9 °C and average high rainfall of 4400 mm per year. The major geographic regions include the narrow coastal strip (occupied by more than 75% of the national population) which is basically a floodplain that lies approximately 2 m below sea level at high tide and is dissected by estuaries of 16 rivers, streams, creeks and canals for drainage and irrigation, the hilly white sandy region lying just behind the coastal plain, the savannahs in the central and south-western parts of the country, and the highland regions of the Acarai, Imataka, Kanuku and Pakaraima mountain ranges.

Guyana’s large expanses of freshwater ecosystems include the Essequibo River – the third largest water source in South America. The numerous waterways intermix annually with tributaries of the Amazon River (for example, the Rio Negro and Rio Branco River) during the rainy season when the banks overflow and flood the Rupununi Savannahs. This connectivity facilitates trans-boundary migration of biodiversity – especially species seeking refuge from the more impacted places such as Roraima State in neighboring Brazil.

Additionally, Guyana has a wealth of species with many yet to be discovered and recorded. To date, knowledge of the country’s biodiversity includes more than 7,000 species of plants

(Funk et al. 2007), almost 800 species of birds (Braun et al. 2000), 225 species of mammals (Engstrom and Lim 2008), and about 320 species of reptiles and amphibians (Hollowell and Reynolds 2005). Many of these species are endemic, rare or vulnerable locally, and/or threatened in other parts of the world. For example, 173 plant species are considered endemic and 17 faunal species are already rare or threatened (IUCN 2008). The threatened species found in Guyana include the Black Caiman (*Melanosuchus niger*), Harpy Eagle (*Harpia harpyja*), Arapaima (*Arapaima gigas*), Giant River Turtle (*Podocnemis expansa*), the Giant River Otter (*Pteronura brasiliensis*), and large predators such as the Jaguar (*Panthera onca*) (IUCN 2008). Although the interior is relatively inaccessible and contains a low population density, there are a few current and perceived threats to the biodiversity in the country. Inherently rich in natural resources, Guyana is traditionally dependent upon extraction industries. Over the last 15 years the Government of Guyana (GOG) has been issuing licenses to many large local and multi-national logging and mining companies for concessions in the interior. Small-scale mining and logging are also occurring in various parts of the interior.

Because the cash economy within the indigenous communities is not well developed, employment opportunities are limited and poverty is widespread. Consequently, the residents are inclined to trade in wildlife and fish to supplement their income. Guyana's national borders with neighboring countries are open and unmonitored. This allows easy access by other nationals into the country to illegally extract and/or trade in natural resources. The bridging of the Takutu River and the development of a road linking Georgetown with Brazil and other parts of South America via the Trans-Amazonia Highway are expected to exacerbate this threat.

To mitigate against these threats and protect the country's invaluable biodiversity, the GOG has declared its commitment to the development of a national protected areas system and is currently coordinating mechanisms for its implementation. To date, five areas have been identified for protection, one of which is in the Southern Region where the Konashen Indigenous District is located. As Guyana develops its system of protected areas, Conservation International (CI) has been identified by the GOG as the lead agency in the process. CI is therefore collaborating with the GOG and building partnerships with local stakeholders to develop protected areas in the Kanuku Mountains and Southern Guyana Region. Other organizations including the World Wildlife Fund, the Guyana Marine Turtle Conservation Society and Flora and Fauna International are also participating in the process of developing protected areas in other priority sites. The Iwokrama Centre and the Kaieteur National Park Board have the responsibility for developing and overseeing the implementation of management plans for the Iwokrama Forest and the Kaieteur National Park respectively.

### **The Konashen Community Owned Conservation Area (COCA)**

The Konashen Community Owned Conservation Area (COCA) lies within the Konashen Indigenous District (1°11' to 2°2'N and 58°18' to 59°39'W) in the tropical wilderness area of remote southern Guyana. The Konashen COCA is 625,000 hectares of pristine rainforests and is considered by many to be the last of the pristine frontier rainforests remaining in Guyana. It encompasses the watershed of the Essequibo River (Guyana's major water source) and the tributaries of the Kassikaityu, Kamoia, Sipu and Chodikar rivers. The site contains the Wassarai, Yahore, Komoa and Kaiawakua mountains with elevations as high as 1200 m a.s.l. The pristine state of the area is due its extremely low population density (about 0.032 humans/km<sup>2</sup>) and the difficult terrain, which negatively affects the accessibility and economic viability of potential extractive industries. Only one community – Masakenari – inhabited by fewer than 300 people, mainly of Wai-Wai ancestry, exists in the area.

Most of the forests in the Konashen COCA are tall, evergreen hill-land and lower montane forests, with large expanses of flooded forest along major rivers. Except for the flora, the biodiversity of the site is poorly understood. Challenges in accessibility are the main reason for lack of knowledge on the area. The Smithsonian Institution has identified nearly 2,700 species of plants from this region, representing 239 distinct families (Hollowell et al. 2001).

The forests of the Konashen COCA protect the southern watersheds of the headwaters of the Essequibo River, which forms part of the northern Amazon ecosystem. Hence the area is of great importance to the provision of quality freshwater to downstream communities and the entire country as a whole. Of great importance is the potential role of the Konashen COCA to the formation of a southern Guyana biodiversity corridor along the Essequibo River linking with the proposed one million hectare Conservation Concession expansion, North Rupununi Wetlands, the Kanuku Mountains Protected Area, the Iwokrama Rainforest Reserve and the Kaieteur National Park. Konashen is also of strategic importance to the long-term vision of Conservation International, which is to link this southern Guyana corridor with other protected areas in the region to create a mega-Guyana Shield Tropical Wilderness Corridor.

In February 2004 the GOG issued to the residents of the Konashen Indigenous District an Absolute Title to their lands making them the legal guardians of the area. In order to mitigate perceived threats to their culture and resources, the community made a decision to manage their lands for biodiversity conservation and economic development. Recognizing that they lack the required skills and other forms of capacity for conservation management, they sought and gained the support of the both the GOG and Conservation International-Guyana (CIG) to develop a sustainable plan for their lands. In November 2004 the three parties signed a Memorandum of Cooperation (MOC), which outlined a plan for sustainable use of Konashen COCA's biological resources. In the MOC, the Wai-Wai of the Konashen Indig-

enous District and CIG specifically agreed to cooperate as follows:

- to jointly evaluate the ongoing resource needs of the Wai-Wai and the impact of traditional land uses on biodiversity and ecosystems.
- to jointly conduct surveys and other activities necessary to collect data for an adequate evaluation.
- to work together to increase local, national and global awareness of the importance of biodiversity and ecosystems on the Wai-Wai land.
- to jointly develop land-use practices that satisfy Wai-Wai needs while also preserving ecosystems and biodiversity.
- to develop an appropriate strategy for managing resource use and for identifying and addressing threats to the integrity of the area.
- to identify and formulate income-generating projects and potential sources of funding of the same.
- to work together to establish the Wai-Wai lands as a Wai-Wai owned and managed conservation area for future recognition and incorporation by the national protected area system.
- to work together to identify and secure adequate funds to finance the implementation of this collaborative process.
- to regularly collaborate to update the GOG, through the Ministry of Amerindian Affairs, regarding the implementation of the process, in order to benefit from its insight and contribution.

For more than seven years, CIG has been working with the community of Masakenari to build local capacity for assessment, monitoring and managing of their natural resources. Prior to the RAP survey, CIG trained six members of the local Wai-Wai community to survey the species richness of fishes, mammals and birds. The training included techniques to enumerate mammals through the use of camera photo-traps, surveying fishes with nets, and the identification of birds. The primary focus of this training was on species that are captured and used by the Wai-Wai as food sources or in trade. This exercise created a cadre of trained Wai-Wai community members at Masakenari who can now lead in the management of a subsequent long-term biological monitoring program for the Konashen COCA.

#### **RAP Survey of the Konashen Community Owned Conservation Area (COCA)**

Residents of the Konashen COCA depend upon the area for their sustenance and have recognized that their need for resources is increasing and, if not well managed, there may serious negative impacts in the future. Therefore, to ensure that there is sustainable utilization of their biological re-

sources, they expressed an interest to collaborate with CI to conduct a RAP survey of their local biodiversity.

The RAP data will be used to help the community to establish user-thresholds and allow for sustainable use of their traditional resources. The data collected will not only guide resource use but will also be used to guide zoning and management plans for the area which is being considered for legal protection status. An additional objective of the RAP survey was to build the Wai-Wai's capacity to facilitate their own data collection, analyses and presentation.

During October 6–28, 2006, CI's Rapid Assessment Program (RAP), in collaboration with CIG and the Smithsonian Institution, conducted a rapid biodiversity survey of selected sites in the Konashen COCA. The objectives of the RAP survey were 1) to collect baseline data on the biodiversity of the COCA for potential use in the development of a small-scale ecotourism industry managed by the Wai-Wai community; and 2) to use the information gathered on species used primarily for food and trade by the community to establish user-thresholds that ensure sustainable utilization of these resources. In addition, the RAP team assessed the water quality of rivers and streams in the vicinity of the community as well as the conditions of populations of animals hunted and fished by the Wai-Wai community.

The scientific team included scientists and students from the University of Guyana, the Smithsonian Institution, Conservation International, Oregon State University, Louisiana State University, University of South Florida and Fundación La Salle de Ciencias Naturales, Venezuela. Six Wai-Wai parabiologists assisted the scientists during the survey as a part of their forest ranger training. The team collected data on water quality and the following groups of animals: ants, katydids, dung and passalid beetles, decapod crustaceans, mollusks, fishes, amphibians, reptiles, birds, and large mammals. Most of data and specimen collecting took place at two main camps, the first located at the foothills of the Acarai Mountains along the Sipu River and the second located alongside Kamo River, approximately 15 km east of the foothills of the Kamo Mountains. The RAP team did not survey plants because plant collections had previously been made in the COCA by the Smithsonian Institution (D. Clarke, unpublished data).

#### **Conservation International's Rapid Assessment Program (RAP)**

RAP is an innovative biological inventory program designed to use scientific information to catalyze conservation action. RAP methods are designed to rapidly assess the biodiversity of highly diverse areas and to train local scientists in biodiversity survey techniques. Since 1990, RAP's teams of expert and host-country scientists have conducted over 65 terrestrial, freshwater aquatic (AquaRAP), and marine biodiversity surveys and have contributed to building local scientific capacity for scientists in 26 countries. Biological information from previous RAP surveys has resulted in the protection of millions of hectares of tropical forest, including the declaration of protected areas in Bolivia, Peru, Ecuador, and Brazil and the identification of biodiversity priorities in numerous countries.

Criteria generally considered during RAP surveys to identify priority areas for conservation across taxonomic groups include: species richness, species endemism, rare and/or threatened species, and habitat condition. Measurements of species richness can be used to compare the number of species between areas within a given region. Measurements of species endemism indicate the number of species endemic to some defined area and give an indication of both the uniqueness of the area and the species that will be threatened by alteration of that area's habitat (or conversely, the species that may be conserved through protected areas). Assessment of rare and/or threatened species (IUCN 2008) that are known or suspected to occur within a given area provides an indicator of the importance of the area for the conservation of global biodiversity. The confirmed presence or absence of such species also aids assessment of their conservation status. Many of the threatened species on IUCN's Red List carry increased legal protection thus giving greater importance and weight to conservation decisions. Describing the number of specific habitat types or subhabitats within an area identifies sparse or poorly known habitats within a region that contribute to habitat variety and therefore to species diversity.

## RAP SURVEY AREAS

**Site 1: Acarai Mountains, N 01° 23' 12.5" W 058° 56' 46.0"; elevation: 251 m a.s.l.  
6 – 17 October 2006**

The first site was situated at the base of the Acarai Mountains, located at an elevation of approximately 270 m, and characterized by sandy, oligotrophic (low nutrient levels) soils, with lowland evergreen, deciduous forests. The DBH of most trees was small (less than 50 cm), although widely scattered emergents with very large DBH (more than 100 cm) were also present at the site. It appeared that the forest here did not inundate seasonally nor did it inundate every year. Consequently, the leaf litter layer in the forest was rich in soil mesofauna, including nests of several species of fungus-growing ants. In addition to deciduous vegetation this site also included a small patch of native bamboo forest (*Guadua* sp.). A satellite camp was also established near the top of the Acarai Mountains in terra firme, or upland forest, at an elevation of approximately 500 m (see New Romeo Camp on Map). From here, the peak of the Acarais, approximately 1,100 m elevation, could be accessed but only ants and passalid beetles were collected there. The higher species richness documented at Site 1 for these groups could be a result of this elevational gradient and the greater sampling effort.

**Site 2: Kamo River, N 01° 31' 51.8" W 058° 49' 42.4"; elevation: 240 m a.s.l.  
18 – 27 October 2006**

The second main camp was established on the north bank of the Kamo River at an elevation of 250 m. The lowland forest at the site was annually inundated with areas of palm

swamp and extremely oligotrophic (nutrient poor), clay soils. Inland from the river, the transition from inundated forest and palm swamp to terra firme moist forest (~300 m) was clearly demarcated. The DBH of most trees at the site was small, and the leaf litter layer was poorly developed.

## Additional Focal Areas: Water Quality and Fish Surveys

The RAP fish and water quality teams sampled areas near main channels of the Essequibo, Sipu and Kamo rivers and their smaller tributaries, as well as primary waterways near the Masakenari village. Fishes and aquatic macroinvertebrates were surveyed at 18 sampling stations within five focal areas: 1) Focal Area 1 – Sipu River; 2) Focal Area 2 – Acarai Mountains; 3) Focal Area 3 – Kamo River; 4) Focal Area 4 – Wanakoko Lake/Essequibo River; and 5) Focal Area 5 – Essequibo River at Akuthophono and Masakenari Village.

## OVERALL RAP RESULTS

The data collected during the RAP survey indicate that the forests of the Konashen COCA are in very good condition and support rich biodiversity. Water quality was high, with no evidence of pollution. Typical of the forests of the Guayana Shield, abundance levels of species of most groups were low, but species diversity was remarkably high. These forests also exhibit low species endemism, yet the potential for finding new taxa here is high due to the lack of prior scientific exploration.

During the survey the RAP team recorded the presence of 319 species of birds, including a species new to Guyana – a bamboo specialist, the Large-Headed Flatbill (*Ramphotrigon megacephalum*). Remote camera trapping, combined with spoor tracking and interviews with Wai-Wai hunters recorded the presence of over 20 species of large mammals, including 5 species of monkeys, tapirs, giant ant eaters, and jaguars. Sixty species of amphibians and reptiles were recorded, including threatened species such as *Dendrobates azureus* (VU) and *Geochelone denticulata* (VU). Both the observed diversity and abundance of amphibians was low due to the dry season conditions during the survey, and the actual amphibian species diversity at the visited sites is probably itself greater than 70 species. Fish diversity was also affected by low water levels, but nonetheless over 100 species of fish were recorded, including 3 species of catfish likely new to science. Ant diversity was very high, with estimated numbers of 200+ species in the leaf litter alone. At least one species is likely new to science (a leaf cutting *Trachymyrmex*) and one genus (*Mycetarotes*) was recorded for the first time outside of the Amazon Basin. Katydid diversity was also high, with 72 species recorded. Of these at least seven are likely new to science and at least 57 are new records for Guyana. The results of dung beetle sampling are not finalized, but at least 50 species of beetles were collected and at least one species of passalid beetles is likely new to science.

Population levels of species hunted and fished by the Wai-Wai community were high, and did not exhibit symp-

toms of overharvesting, although species abundance of certain frequently hunted species (e. g., black caimans and wood tortoises) were significantly lower in the immediate vicinity of the Wai-Wai village of Masakenari.

## RAP RESULTS BY TAXONOMIC GROUP

### Katydids (Orthoptera)

Seventy-three (73) species of katydids (grasshopper relatives, order Orthoptera) were recorded, 58 of which (79%) are new records for Guyana, and at least seven are likely new to science. The RAP survey increased the known katydid fauna of Guyana by 130% for a total of 101 species, yet this number probably represents only about 30% of the actual diversity of katydids in the country. More katydid species were collected at Site 1 Acarai Mountains than at Site 2 along the Kamoia River. However, population densities were low at both sites, which is typical of a pristine, undisturbed primary growth forest. Almost all of the katydid species recorded during the RAP survey are indicative of undisturbed forest habitats.

### Ants (Hymenoptera: Formicidae)

Because several years' time is necessary for sorting and preparing the estimated 25,000 specimens collected, we are not yet able to provide a detailed report on the results. A preliminary review indicates that ant diversity was very high, with estimated numbers of 200 species in the leaf litter alone (pending final identifications). At least one species is likely new to science (a leaf cutting *Trachymyrmex*) and one genus (*Mycetarotes*) was recorded for the first time outside of the Amazon Basin. Using hand collecting techniques, the ant team recorded 34 ant genera representing 9 subfamilies (of 21 subfamilies currently defined for the family Formicidae (see Appendix 1)). Site 1 contained the larger number of genera (33), whereas Site 2 contained 22 genera. It is important to note that there was a greater sampling effort by the ant team at Site 1 than at Site 2. Both sites shared 22 genera out of the total of 34 collected. Site 1 contained a higher number of exclusive ant genera (11), i.e., genera not shared with Site 2, whereas Site 2 contained only one of the non-shared genera.

### Beetles (Coleoptera: Scarabaeidae)

The results of the beetle sampling are not yet finalized, but at least 50 species of dung beetles were collected and at least one species of passalid beetles appears to be new to science. Initial impressions indicate that Site 1 (Acarai Mountains) supports a more diverse assemblage of species and genera than does Site 2 (Kamoia River). At Site 1, the following genera were observed: *Deltochilum*, *Ateuchus*, *Dichotomius*, *Ontherus*, *Canthon*, *Eurysternus*, *Oxysternon*, *Phanaeus*, and *Cryptocanthon*. At Site 2, no *Phanaeus*, *Deltochilum* nor *Cryptocanthon* were seen in the initial assessments of the traps although some specimens will likely be found when examined more carefully in the lab. The multiple elevations assessed at Site 1 support distinct scarabaeine faunas although a few species, such as *Oxysternon festivum*, were common at all sites, irrespective of elevation.

### Water Quality

The water quality team measured and collected water samples from the Sipu, Essequibo and Kamoia rivers and associated tributaries, creeks and the Masakenari village well and taps. The rivers and creeks are used for domestic purposes and only in Masakenari is drinking water obtained from a well. The average water temperature was 25 °C and ranged from 23 °C to 25.9 °C. The pH values of the majority of creeks, rivers and isolated pools were similar to river water values observed in the Amazon basin and ranged from 4.74 to 6.4. These were lower than the secondary (non-enforceable) drinking water standards of the WHO or USEPA while those of the village well were close to the minimum requirement of 6.5 pH units. Alkalinity of samples was between 7.5 and 27.5 mg/L as CaCO<sub>3</sub>, indicating low buffer capacity waters. For all of the samples, arsenic and aluminum concentrations were within USEPA primary drinking water standards. Basic water quality data and observations show that the main rivers and creeks of the Konashen COCA are free of human or industrial pollution.

### Fishes

A total of 113 species of fishes were identified, representing six orders and 27 families. The order Characiformes (tetras, piranhas, etc.) with 61 species (51.7%) was the most diverse, followed by Siluriformes (catfishes) with 32 species (27.1%), and Perciformes (cichlids, drums) and Gymnotiformes (electric or knife fishes) with nine species each (15.3% respectively). Family Characidae contributed the most species, with 31 species collected (27.4%) followed by Loricariidae with 13 species (11.5%).

Focal Area 5 exhibited the highest fish species richness, with 53 species (46.9%), followed by Focal Areas 1 (48 species), 3 (45 species), 4 (33 species) and 2 (32 species). According to the distribution of fish species, and based on the similarity index and physicochemical variables, Focal Areas 1 and 3 exhibited the highest similarity (0.67), and can be viewed as possessing similar ichthyological communities. The remaining Focal Areas exhibited lower values, between 0.4 and 0.26, and are therefore considered to be of moderate similarity.

Nearly half of the fish species recorded are considered important subsistence fish resources; 20% are of sport fishing interest and approximately 75% have ornamental value. Four species of fishes are likely new to science: *Hoplias* sp., *Ancistrus* sp., *Rivulus* sp., and *Bujurquina* sp.

### Aquatic Macroinvertebrates

Ten species of aquatic macroinvertebrates were identified, belonging to three classes (Crustacea, Gastropoda, and Bivalvia), of which Crustacea was the most diverse with three families. Of these, Palaemonidae showed the highest richness (4 species), followed by Pseudothelphusidae (3 species), and Trichodactylidae (2 species). The classes Gastropoda (snails) and Bivalvia (mussels) were represented by one species each. The greatest species richness was found in Focal Areas 2 and 3, with five and six species of aquatic macroinvertebrates

respectively, while three species were collected in each of the remaining focal areas, except for Focal Area 5 where four species were recorded.

### Reptiles and Amphibians

A total of 26 species of amphibians and 34 species of reptiles were recorded. The amphibians include representatives of the orders Gymnophiona (caecilians) and Anura (toads and frogs). More than half of the recorded anurans were treefrogs (Hylidae) with 13 species (54% of all recorded species), followed by the Leptodactylidae with five species. Within reptiles, 2 species of crocodylians, 3 turtles, 14 lizards and 16 snakes were recorded. The blind snake *Typhlophis ayarzaguenai* represents the first record of this species for Guyana. The aquatic lizard *Neusticurus cf. rudis*, the snake *Helicops* sp., and the caecilian may also represent new records for the Guyana herpetofauna, but require additional taxonomic reviews.

The three sites explored during this survey differed in the composition of the reptile and amphibian fauna. The surveyed region appears intact and in pristine condition, particularly the Acarai Mountains and the flooded forests adjacent to the main channels of the Kamoia and Sipu rivers. The area of the Essequibo River closest to Masakenari and Akuthopono villages showed a lower abundance of medium-to-large bodied reptiles, turtles and caimans, which are a part of the Wai-Wai diet, but populations of other reptiles and amphibians seemed to be in good condition.

### Birds

Bird species richness was high at both RAP sites; a combined total of 319 species was tallied over the study period. The avifauna was typical of Guianan lowland forest, including 32 species endemic to the Guayana Shield. There was a high degree of habitat heterogeneity within each site, thus the avian diversity was higher than expected for the size of the area surveyed. It is probable that at least 400 bird species, or more than half of the number known to occur in Guyana, may be found in the Konashen COCA.

The survey recorded Large-headed Flatbill (*Rampho-trigon megacephalum*), a new record for Guyana and a range extension of approximately 900 km. Populations of parrots, guans, and curassows, all of which are important to the Wai-Wai inhabitants of the region and are of global conservation concern, seemed healthy. Fourteen species of parrots were observed, including Scarlet Macaw (*Ara macao*), a CITES Appendix 1 species and Blue-cheeked Parrot (*Amazona dufresniana*), considered Near Threatened (IUCN 2006). Some of the larger parrot species are hunted by local people, but the effects of this hunting appear to be negligible. Spix's Guan (*Penelope jacquacu*) and Black Curassow (*Crax alector*) were common at both survey sites, suggesting that their regional populations are not threatened by current levels of hunting pressure from the local community.

### Large Mammals

Twenty-one species of large mammals were recorded during the RAP survey, with a total of 42 large mammal species expected for the area. Five species of conservation concern were recorded: the Brown-bearded saki monkey (*Chiropotes satanas*) and the Giant otter (*Pteronura brasiliensis*) listed as Endangered, and the Giant armadillo (*Priodontes maximus*), Bush dog (*Speothos venaticus*), and Brazilian tapir (*Tapirus terrestris*) considered Vulnerable (IUCN 2006). Both RAP study sites are utilized as hunting areas for two weeks per year by the local people, but otherwise appear to be pristine, undisturbed tropical rain forest. The RAP results suggest that the sites sampled contain the full complement of the large mammal species characteristic of the Guayana Shield. Because this region has a very low human population density (0.032 humans/km<sup>2</sup>) the forests of the Konashen Indigenous District are likely to contain an intact faunal assemblage of large mammals.

## CONSERVATION CONCLUSIONS AND RECOMMENDATIONS

The sites visited by the RAP team in the Konashen COCA belong to some of the most pristine and least populated areas in South America. Because the human density is low and pressure on natural resources is carefully managed by Wai-Wai community leaders, the flora and fauna of the Konashen COCA is currently intact and secure. The remoteness of the Konashen COCA has no doubt served to protect it and presently most of the area is under very little threat and anthropogenic disturbances are negligible. However, the Wai-Wai and their partners must be vigilant in protecting and managing the forests and their biodiversity to avoid species declines and to maintain the pristine condition of the forests.

### I. Address Potential Threats: Prevent Illegal Logging and Mining

While there are no known factors immediately threatening the forests of the Konashen COCA, the development of roads in the neighboring regions of Brazil could result in encroachment through illegal logging or gold mining. Infrastructure development in Lethem, in the form of the Linden-Lethem road and the Takatu Bridge that will connect Brazil and Guyana, make the establishment of anti-logging/anti-mining guidelines even more timely and urgent.

#### 1. Establish guidelines that inhibit mining and logging activities in the Konashen COCA and the wider Konashen Indigenous District.

Since illegal mining appears to pose the greatest potential threat, the Wai-Wai community should adopt a set of guidelines that exclude illegal mining and logging in the COCA. As this threat to biodiversity is likely to come from external sources far beyond the Wai-Wai community, it is essential that the Wai-Wai community leadership continues to manage their resources in a sustainable manner and prevents outsiders from jeopardizing the ecological integrity of the area.

## 2. Monitor the Konashen COCA to detect encroachment by illegal gold miners and loggers.

The ongoing construction of a highway across northern Brazil will likely exacerbate the current problems associated with illegal miners in the interior of the Guianas. If necessary, the Wai-Wai should enlist the help of the Government of Guyana and other partners to implement a program of patrols to discourage illegal miners and loggers from entering their territory. Frequent patrols of the borders of the COCA may be necessary to detect encroachment.

## II. Sustainably Manage Natural Resources

The Wai-Wai community of Masakenari in the Konashen COCA is Guyana's most remote village and residents have minimal external contacts. As such, most of the raw materials for their food, housing, craft and medication come from the area. In addition, the major form of economic activity for the Wai-Wai is international wildlife trade. As good custodians of their environment, the Wai-Wai residents have recognized that their needs for resources are increasing and if not well managed there may be serious negative impacts in the future. A management plan for the Konashen COCA is in development. Recommendations from the RAP survey include the following related to 1) Sustainable Harvesting, 2) Monitoring, 3) Species Protection, and 4) Capacity Building. The Wai-Wai currently hunt and harvest a wide variety of forest animals, including fishes, large reptiles, birds, and mammals. Some of the species often hunted or harvested by the Wai-Wai that should be the target of the activities described below are listed in Table 1.

### Sustainable Harvesting

#### 1. Conduct further studies of key species most utilized by the Wai-Wai.

The species most hunted and harvested by the Wai-Wai should be intensively studied to determine their current population sizes and their distributions within the COCA, and to evaluate the extent to which they can be sustainably harvested in each part of the COCA. This can be done by developing and continuing collaboration between the Wai-Wai community members and scientists who can advise on research techniques, data analysis and harvesting analyses. The Wai-Wai rangers who have received training from CI-Guyana and Iwokrama should continue to be trained in further techniques so that they can conduct the research and monitoring programs.

#### 2. A sustainable management plan should be designed and implemented, using the data from the RAP survey and additional studies recommended above.

A management and sustainable-use plan should be developed for each species that is heavily hunted or harvested by the Wai-Wai. Research by the Wai-Wai for development of the Management Plan for the Konashen COCA (in prep) includes maps of the Wai-Wai fishing and hunting grounds within the COCA. The Wai-Wai currently harvest about 20

fish species from 13 fishing grounds within the COCA using harpoons (bow and arrow) and seines. The effectiveness and impacts of current fishing practices should be evaluated and managed. Mammals are usually hunted within 15 km of Masakenari using traps, shotguns and arrows. Plant and other resources, including stones, Brazil nuts, fruits and wood for building are also harvested along the main rivers.

#### 3. Develop and implement a rotation system to distribute the effects of subsistence hunting over as large an area as possible.

Hunting should be done judiciously by distributing hunting activity over as large an area as possible, such that the majority of the Konashen area is not used for hunting at any given time. This simple system would ensure that local populations have time to recover following brief periods of intense hunting. Cracids (guans and curassows) are arguably

**Table 1.** Species often hunted and harvested by the Wai-Wai in the Konashen COCA.

Fishes
Haimara ( <i>Hoplias macrophthalmus</i> )
Tiger fish ( <i>Pseudoplatystoma fasciatum</i> )
Kururú ( <i>Curimata cyprinoides</i> )
Pakuchí or Catabact pacú ( <i>Myloleleus rhomboidalis</i> )
Reptiles
Dwarf Caiman ( <i>Paleosuchus trigonatus</i> )
Black Caiman ( <i>Melanosuchus niger</i> )
Tortoises: <i>Rhinoclemmys punctularia</i>
<i>Chelonoidis carbonaria</i>
<i>Chelonoidis denticulata</i>
Birds
Scarlet Macaw ( <i>Ara macao</i> ) - for international trade
Red-and-green Macaw ( <i>Ara chloropterus</i> )
Blue-and-yellow Macaw ( <i>Ara ararauna</i> )
Blue-cheeked Parrot ( <i>Amazona dufresniana</i> )
Orange-winged Parrot ( <i>Amazona amazonica</i> )
Red-fan Parrot ( <i>Deroptryus accipitrinus</i> )
Spix's Guan ( <i>Penelope jacquacu</i> )
Black Curassow ( <i>Crax alector</i> )
Gray-winged Trumpeter ( <i>Psophia crepitans</i> )
Mammals
Monkeys (7 species)
Golden-handed tamarin ( <i>Saguinus midas</i> )
Brazilian tapir ( <i>Tapirus terrestris</i> )
Deer ( <i>Mazama</i> spp. and <i>Odocoileus virginianus</i> )
Paca ( <i>Agouti paca</i> )
Agouti ( <i>Dasyprocta agouti</i> )
Collared and White-lipped peccaries ( <i>Tayassu</i> spp.)



the most important birds in the diet of the Wai-Wai. They have low reproductive rates and tend to disappear when subjected to heavy hunting pressure. The cracid populations in Konashen are currently healthy, and it is likely that local population depletion (due to hunting) is a temporary phenomenon in most cases.

*4. If necessary, establish hunting/collecting quotas using the data from the aforementioned population monitoring studies.*

Assistance from expert scientists and natural resource managers would be helpful in determining and developing limits and quotas, if they become necessary, on the number of animals hunted/harvested for the COCA.

### Monitoring

*1. Develop and implement a plan to monitor and assess the species populations that are the Wai-Wai community's most valuable food, hunting and trade resources.*

Though the current populations appear to be secure, the Wai-Wai community should implement and manage a long-term monitoring program to detect any changes in the occurrence or abundance of the species listed above, especially those that are listed by IUCN as threatened or by CITES as of concern in international trade.

The Wai-Wai rangers should continue their camera-trapping, fish and bird monitoring programs and analyze the data to detect trends and predict future scenarios. The data should be published and also made accessible to those involved in conservation and development in Guyana. A database of the biological information for the Konashen COCA should be developed and maintained within Guyana.

*2. Establish a water quality monitoring program of the major rivers of the COCA.*

Such a program should be conducted on a quarterly basis at selected sampling sites along the Essequibo River and in the village. This quarterly monitoring should provide two samples each, during the dry and wet seasons. Water quality monitoring should be extended to include microbial analysis in the more populated area. Sites used to collect aquatic species as well as any new sites identified by the Wai-Wai community should also be monitored for water quality on at least an annual basis.

Well water should be monitored on a consistent basis as the well sits downstream of the village garbage holes and latrines, which are unlined. In Akuthopono, water is collected from the river, and garbage is dumped in a hole used by the village as a well until the year 2000. This activity could potentially affect the groundwater quality and plans should be made to provide clean drinking water at the site if it is to be developed as an income-generating ecotourism visitor center.

### Species protection

*1. Continue to avoid trapping parrots for the pet trade, and deny trappers entry to the Konashen COCA.*

The Guianas contribute a substantial number of parrots to the international pet trade, and trappers often travel great distances to harvest the most valuable species. This has led to dramatic declines in the populations of some species in Guyana in accessible areas closer to the coastal plain than the Konashen COCA. The remoteness of the Konashen COCA has no doubt served to protect it from such exploitation. Parrots and large game birds, though not currently threatened at a regional level, are of global conservation concern. Care should be taken to forestall local declines in their populations. Monitoring of parrots and large game birds is not recommended at the present time, since these species are not amenable to standardized survey methods.

*2. Avoid hunting and harvesting threatened species.*

Species that are considered threatened on the IUCN Red List of Threatened Species (2008) or on the CITES (2008) list of species at risk due to international trade should not be hunted or harvested. Threatened species documented during the RAP in the Konashen COCA are listed in the Report at a Glance of this report. Additional species of conservation concern, such as the Harpy Eagle (*Harpia harpyia*), were not documented during the RAP survey but are likely present in the Konashen COCA and should also be protected.

### Scientific Capacity Building

*1. Further develop and continue the formal training of Wai-Wai rangers and parabiologists in the study, conservation and management of aquatic and terrestrial resources.*

Continued and expanded training of the local Wai-Wai community in the study, management, conservation and valuation of their biological resources will be valuable in both species population monitoring and ecotourism projects. Development of a scientific research station in the Konashen COCA would greatly enhance the conservation and research potential of the area and serve as a local education facility for the rangers and parabiologists. It is a very attractive region for researchers and scientists and would provide another source of sustainable revenue for the area. Collaborations between the Wai-Wai rangers and expert scientists should be sought and developed to carry out in-depth studies of threatened species and species harvested by the Wai-Wai.

### III. Promote Sustainable Ecotourism

*1. Implement a basic eco-tourism infrastructure that supports research and education-based activities that will further enhance conservation efforts and biological knowledge of the Konashen Indigenous District.*

The pristine ecological condition of the forests of the Konashen Indigenous District supports great potential for research-based opportunities and education-based ecotourism. Such activities could generate revenue for the area's inhabitants while simultaneously encouraging biodiversity

protection and scientific research in the area. The largely undisturbed habitat and dazzling array of charismatic species such as the giant otter, caimans, tapir, large cats, the haimara and the outstanding bird diversity are major draws for ecotourists around the world. With continued formal training for the rangers and parabiologists, ecotourism of the area could easily be promoted in the Konashen COCA.

Plans should be made to provide clean drinking water at the site if it is to be developed as an income-generating ecotourism visitor center. Plans should also be made to quantify the water resources in the area, especially since the area experiences high levels of rainfall and is inundated for large periods of the year. This information will also assist with safer plans for water and sanitation in Masakenari and Akuthupono. Long-term monitoring of the environmental impact of ecotourism should be put in place to ensure the most sustainable practices are promoted and can be used to “certify” the area as an ideal destination for “sustainable ecotourism.”

In addition to the larger, well-known species of the Konashen COCA such as the sloth and primates, many invertebrates like the spectacular and rather common Peacock katydid (*Pterochroza ocellata*) or *Morpho* butterflies, have the potential to attract ecotourism. It is therefore important to continue training Wai-Wai parabiologists in recognizing some of the more iconic and “charismatic” invertebrates, which are becoming popular targets of the ecotourism industries in other parts of the world. Many of the amphibians and reptiles recorded during the RAP survey are also of great eco-tourism potential and/or are important in the pet trade.

#### IV. Conduct Further Research

1. *Conduct further, more extensive sampling during the rainy and dry seasons, paying particular attention to the aquatic biodiversity. Additional research needs have been identified for:*

**Fishes:** The lower section of the Essequibo River, from Masakenari to the Amaci Falls, is of great diversity and use to the Wai-Wai, and remains to be sampled. For this reason, it is fundamental to conduct a second sampling expedition in the low water season (November-December) on the Wai-Wai fishing grounds which include, but are not limited to Amaci Falls, Kanaperu, Mekereku and Wanakoko. This would result in a more comprehensive and accurate species list, particularly in regard to the smaller-sized species.

Among the fish species identified during the RAP survey, many species have high potential for aquarium and ornamental trade. However, to develop a plan that is sustainable and effective would require additional information on the present species’ distribution and abundance. Taking this into account, it is recommended to complete an inventory of the fish species, and subsequently continue biological, ecological and market studies of these species.

**Reptiles and Amphibians:** The results of this survey are preliminary, and we suspect that a much greater diversity of

amphibians and reptiles is to be found here. For this reason, we recommend more extensive sampling of the entire region, including sampling during both rainy and dry seasons. Also, particular attention should be given to the Acarai Mountains where we expect a high species richness and a possible center of endemism for amphibians and small reptiles. Specific studies of the use of large reptiles (e.g., black caimans and tortoises) by the Wai-Wai are also needed to develop sustainable harvesting plans.

**Water Quality and Resources Assessment:** Plans should be made to quantify the water resources in the area, especially since the area experiences high levels of rainfall and is inundated for large periods of the year. This information will also assist with safer plans for water and sanitation in Masakenari and Akuthupono.

**Invertebrates:** Based on the results of the katydid survey, we strongly recommend additional entomological surveys of the Konashen District, which are bound to yield many species of insects and other invertebrates that are new to science.

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