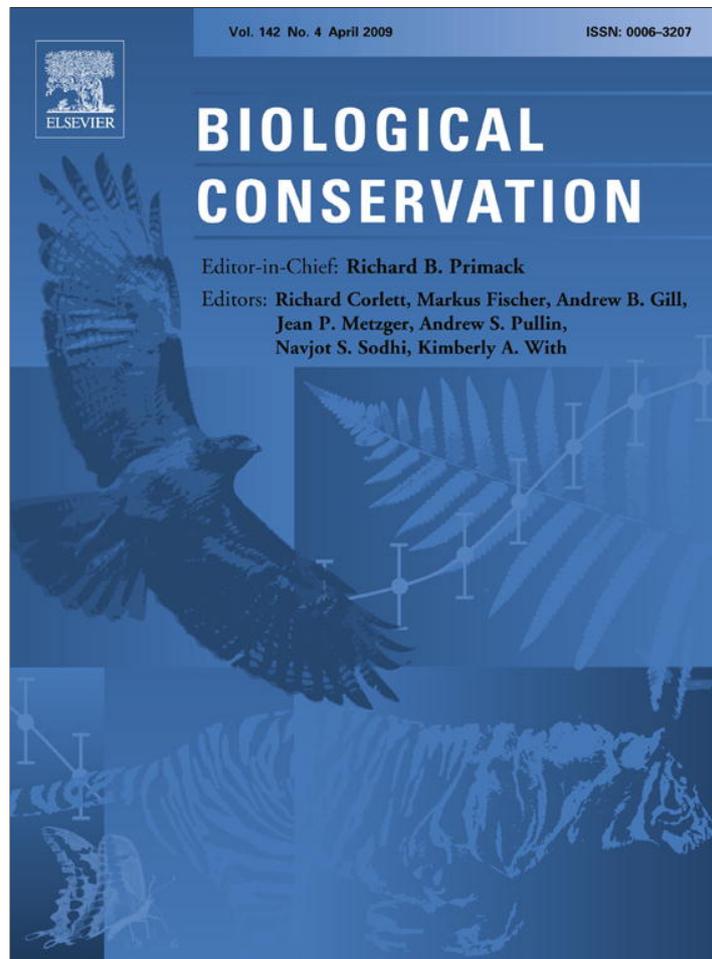


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## Knowledge and attitudes of children of the Rupununi: Implications for conservation in Guyana

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### ABSTRACT

Knowledge and attitudes of children towards wildlife and the environment were assessed through questionnaires given to 366 children in 9 schools in southwest Guyana. Children's responses revealed that they had a general knowledge of wildlife but knew few details about specific species. Respondents thought that wildlife was important but were nonetheless tolerant of several forms of environmental exploitation. Visits by conservation organizations, Conservation International and Foster Parrots, were shown to increase appreciation of wildlife and the need to set up more protected areas, but unless programmes were concentrated and sustained they had little effect on attitudes towards environmental utilization and exploitation. Experience of the natural world in terms of owning a domestic animal or pet, having visited a zoo, or being a member of a wildlife club had little impact on children's knowledge of wildlife and did not change attitudes to utilization and exploitation. Surprisingly, Guyanese children did not have particularly positive views about classic flagship species, such as jaguars, giant anteaters and tapirs, when compared to other species. Our findings suggest that zoos, wildlife clubs and conservation organizations could enhance the dissemination of their message through making more frequent and sustained visits, imparting more detailed knowledge, and exposing children to the potential dangers of utilization and exploitation; also that conservation organizations should reassess their use of standard flagship species in South America.

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## 1. Introduction

The conservation community has a special responsibility to foster conservation awareness in countries that have inordinately high levels of biodiversity. Aside from programmes aimed at increasing public awareness of conservation issues, through newspapers, magazines, radio and increasingly television and the internet, the main method is to promote con-

servation understanding among children through education in the classroom and field trips to zoos and wilderness areas. Focusing on children is important because life-long attitudes and behaviors towards all animals are based in large part on childhood experiences (Kidd and Kidd, 1989). The goal of these education programmes is to encourage a general interest in nature, generate sensitivity to environmental issues, bring about changes in opinions and attitudes where neces-

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sary, disseminate specific information, and provide training (Sutherland, 2000).

While most would agree that it is important to be sensitive to children's knowledge and attitudes to conservation in order to tailor conservation education programmes effectively, very little attempt has been made to determine the effectiveness of such conservation education projects. This is especially pertinent for developing countries where wildlife and conservation curricula are still being developed. Specifically, it would be helpful to know whether conservation knowledge and attitudes change as children get older, whether there are differences according to gender, and whether conservation education has positive impacts on these outcome variables.

We set out to test the effects of these variables in Guyana, a country with a very low human population (751,223) and low population density (3.5 per km, Bureau of Statistics, 2002) that still has a large percentage of its land covered with primary rainforest with many large unexploited rivers, and hence holds much of the biodiversity characteristic of Amazonia (Mittermeier et al., 2003). In addition, Guyana has a relatively long Atlantic coastline, and a special *cerrado* savannah on the interior plateau in the southwest of the country (the Rupununi). Nonetheless, Guyana has only a handful of protected areas, the most famous of which, Kaieteur Park, covers just 224 square miles (62,700 hectares). Exploitation of the rainforest is occurring at an increasing rate, because of large government-leased logging concessions, extraction of gold using mercury, and the capture of birds and mammals for the pet trade and zoological institutions. We thus believed that it was timely to collect data on children's perceptions of wildlife and conservation issues in a country with so much to lose, yet, potentially, so much to gain if support can be built up for conserving this nation's biodiversity in an effort to "build constituencies for conservation" (Borgerhoff Mulder and Coppolillo, 2005).

We focused our attention on the Rupununi, the southwestern region of Guyana that consists of rolling savanna grasslands, extensive riverine tracts, and mountain ranges, notably the Kanukus and the Pakaraimas which have recently been characterized as harbouring extraordinarily high levels of biodiversity (Montambault and Missa, 2002). Average annual rainfall on the Rupununi is 1400 mm/year (Iwokrama Centre for Rain Forest Conservation and Development, 2003).

Various conservation organizations have worked in the Region, and currently there are programmes run by Conservation International (CI), Foster Parrots (Boston) and (peripherally) the Iwokrama International Centre for Rain Forest Conservation and Development; in terms of zoos there is a small menagerie of local mammals and birds at Anai, 97 km from Lethem, the regional capital. The national zoo is in the capital, Georgetown, 420 km from Lethem.

The outreach programme of CI in Guyana is sited in Lethem, and focuses primarily on villages next to the Kanuku range. Its programme is based on an expansive educational document "Exploring Biodiversity: a Guide for Educators around the World" which is divided into four sections: 1. What is Biodiversity (all the world's a web; the web of life; bioblitz), 2. Biodiversity Connections (the spice of life; biodiversity performs); 3. The State of Biodiversity (the rare scare; space for

species); and 4. Biodiversity Conservation (thinking about tomorrow; community connections; taking action) (Conservation International/WWF, 2002). Thus their focus is on the value of biodiversity. According to Ajay Baksh (pers. comm., July 8 2008) "(o)ur work in Rupununi has been centered on two major pillars: exploring and learning about biodiversity in general; and learning about the protected areas in Guyana and the drive to create protected areas in Guyana. The work in the region has been focused through a group of teachers who were trained via teacher training workshops facilitated by CI Guyana". CI materials were pinned to the walls in some classrooms we visited.

Foster Parrots is a small local programme based in Lethem. Its goals are to rescue parrots from situations in which they are abused and neglected, act as a placement service, serve as an educational resource, provide a permanent sanctuary for birds not suitable for adoption, and protect all parrots (<http://www.fosterparrots.com/mission.html>, accessed 3rd June 2008). In regards to education, they seek to be a resource for schools on the care and responsibilities of sharing life with an animal as a pet. Their Project Guyana programme includes developing ecotourism through a lodge located in the village of Nappi, and developing native handicrafts. Their impact in the area has been geographically more narrow than that of CI, focused principally in a single village, where their presence (infrastructure, teachers' comments) was well in evidence.

We sampled children's knowledge and attitudes towards Guyanese wildlife and the environment in order to assess how various forms of education, wildlife clubs, visits to zoos, conservation organization outreach, and even family ownership of a domestic animal affect children's interest in and tolerance of a western-based conservation message. In addition, we also wanted to know whether Guyanese children valued protecting certain species over others. Since national conservation organizations and foreign non-governmental organizations often try to promote conservation awareness and support for new protected areas using a small set of flagship species, we wanted to determine whether the classic flagships for South America were actually those that children preferred. For these reasons we did not expand our focus to ethnobotanical and ethnozoological knowledge.

## 2. Materials and methods

We worked in Region 9 (Upper Takatu-Upper Essequibo), known locally as the Rupununi, in the vicinity of Lethem, the administrative centre that lies in the north of the Region. While accessible by a plane from Georgetown, travel on the unpaved road is slow and unreliable. The people of the North Rupununi are principally Amerindian in origin (primarily Carib-speaking Makushi and Arawak-speaking Wapishana), although there is heavy migration into the area from the coast, mainly by people of African descent and East Indians (Bureau of Statistics, 2002) who tend to stay in the urban centres. There is also a ranching community, whose members are locally known by the Portuguese term as *vaqueiros*, with whom there has been some history of land conflict.

The area lags in national development, especially since the collapse of cattle ranching and the balata trade as major eco-

conomic activities in the 1970s. Communities are very poor (Allcock, 2003), relying for subsistence primarily on shifting cassava cultivation, fishing, hunting and gathering (Fernandez, 2005; Shackley, 1998); income comes primarily from seasonal employment in Brazil and illegal wildlife trapping: black caiman (*Melanosuchus niger*), giant river otter skins (*Pteronura brasiliensis*) and arapaima fish (*Arapaima gigas*, Fernandez, 2005). There is also an active semi-legal trade in species of parrots, toucans and giant anteater (*Myrmecophaga tridactyla*). Under the guidance of the North Rupununi District Development Board (NRDDB), a regional community-based NGO assisted by the Amerindian Peoples Association, there has been some success in managing both the arapaima harvest, as well as a new fresh water aquarium trade (Fernandez, 2005).

In June and September 2007, we visited a total of nine schools (one in Lethem, eight within a 60 km radius, Fig. 1); the latter were rural, though unlike some rural schools were accessible by vehicle in the rainy season. The questionnaire was initially discussed with teachers and local individuals interested in conservation issues. It was then pre-tested in one classroom and revised accordingly for the purposes of the study. After a formal introduction from the Regional Education Office to all of the schools we had selected for accessibility, we introduced ourselves to the head teacher and then to each classroom, distributed paper and pencils, and read out our questions (Appendix 1). Together with the teachers we checked that children understood the question, gave translations in the local languages where necessary, and ensured that the children were numbering their responses correctly. This approach was considered superior to distributing questionnaires since we could repeat questions, provide further explanations, and help groups of children avoid confusion with their task. A total of 366 students were surveyed, of which only 10 students provided responses that were unusable (mis-numbered questions, illegible, or just playfully nonsensical). The children ranged in age from 6 to 16 years, with 95% between 8 and 14 years; 50.3% were boys. The classrooms we worked in included children from forms (grades) 3–10, with 77.0% of them in forms 4, 5 and 6.

Following questions regarding background variables, including experience of animals and membership in wildlife clubs, the rest of our questions fell into three categories: knowledge of Guyanese wildlife and protected areas, attitudes to exploitation and protection, and attitudes to selected prominent species. In regards to the first, we asked children questions about well-known Guyanese species and the protected areas in the country (Questions 5–8,15, See Appendix 1); in regards to the second, we asked them about their attitudes to the utilization and exploitation of wildlife and habitat (Questions 9–14). In exploring attitudes towards hunting, burning, selling animals, logging, etc., we do not assume these activities to be necessarily destructive; indeed with regard to fishing there is some evidence that with the help of NRDDB communities are sustainably managing their offtake of arapaima (Fernandez, 2005). We are simply interested in children's tolerance to harvest and exploitation, recognizing that such tolerance complicates conservation initiatives that ban consumptive uses, especially as human populations increase in the Northern Rupununi and non-locals (e.g., loggers and miners) obtain harvesting rights.

In regard to the third category, we asked children whether they were in favour of protecting various species (Question 17). For this list we chose species that are large and/or charismatic species (giant river otter, tapir (*Tapirus terrestris*), jaguar (*Panthera onca*), manatee (*Trichechus manatus*), giant anteater, scarlet ibis (*Eudocimus ruber*), toucan (*Rhynchops tito*), harpy eagle (*Harpyia harpyja*), cock of the rock (*Rupicola rupicola*), red and yellow macaw (*Ara macao*), giant water lily (*Victoria amazonica*), red howler monkey (*Alouatta seniculus*)), and orchids (*Orchidaceae*). We also chose edible animals (agouti (*Dasyprocta leporina*), arapaima fish, tapir (much hunted by Makushi) and red howler (more rarely hunted in this area)), useful plants (rubber tree (*Hevea brasiliensis*), crabwood tree (*Carapa guianensis*)), dangerous species (tarantula spider (*Avicularia avicularia*), black caiman, anaconda (*Eunectes murinus*), freshwater stingray (*Potamotrygon*), bullet ants (*Paraponera clavata*)) and innocuous species (insects, land snails); frogs might have been treated as dangerous (poisonous) or innocuous.

## 2.1. Analyses

Variables were checked for co-linearity (age was dropped because of its covariance with form (or class in school)). Form was recoded such that the small number of students in forms 7–10 comprised a single category, and the very small number of students in form 3 were incorporated into form 4. This was done because these children were encountered in the classroom, and because it was obvious (due to a shortage of teachers) that small classes were often taught together with larger classes. The sample size for different questions varies due to some missing responses.

To determine the factors associated with differential knowledge of and attitudes to nature, logistic regressions were run because all dependent variables were coded in binary fashion (Yes or No). Variables entered into the model were club membership, reported experience of a visit by a conservation organization within the last year, keeping one or more domestic animals, having visited a zoo, gender, and form. We asked about domestic animals using the widely recognized term “pet”, but appreciate that relationships with dogs, cats, parrots and monkeys are not necessarily those as implied by the term “pet”, and that animals, typically dogs, are often harshly treated. We were simply interested in their first hand experience of living with animals. School was entered as a dummy variable, with the larger and most ethnically diverse primary school in Lethem (Arapaima) set as the reference category; however separate analyses were run comparing Nappi village to others, to determine effects of the more intensive outreach in that village. We used STATA SE 10.0 for these analyses.

Factor analysis was used to determine the common factors that can reconstruct the answers to the students regarding their attitudes to protection of the 26 species listed in question 17. This analysis was run using STATA SE 10.0, and the number of factors was limited to those with eigenvalues >1. Reconstruction is typically defined in terms of prediction of the covariance matrix of original variables, unlike principal components, where reconstruction means minimum residual variances summed across all equations. Since factor analysis



**Fig. 1** – Location of the nine schools used in this study. Lethem is the Regional capital. Inset shows location of Guyana in South America.

only uses complete responses (i.e. across all 26 species) and there were many missing responses, the number of students' responses used in this analysis was 186.

### 3. Results

#### 3.1. Background data

We found that 93.3% of children kept a domestic animal, principally a dog or cat. We found that 65.4% of schoolchildren re-

ported that they remembered having been visited by a wildlife organization in the last year, 30.1% were members of a wildlife club, and 28.9% had visited a zoo (principally in the capital Georgetown).

Turning to knowledge of wildlife, 78.0% of the 291 children knew Guyana's largest bird was the harpy eagle, and 76.2% ( $n = 248$ ) knew that the national bird was a Canje pheasant (*Opisthocomus hoazin*). Only 36.6% ( $n = 295$ ), however, knew that giant anteaters were black and white (allowing brown/white and black/gray as a correct answer);

and only 27.8% ( $n = 281$ ) knew that a manatee was neither a fish nor a whale. Only 36 out of 159 (22.6%) respondents were able to identify the name of at least one nationally protected area.

Regarding children's attitudes to wildlife, 83.0% ( $n = 336$ ) thought that wildlife was important to Guyana, and 81.5% of 320 children thought that more national parks should be established in Guyana, with 66 out of 116 (56.9%) identifying the Rupununi savannahs as a place that these should be set up.

Nonetheless, the school children were very tolerant of natural resource utilization: 54.9% of respondents ( $n = 337$ ) thought that people should be allowed to hunt, 39.0% ( $n = 331$ ) thought that people should be permitted to sell wildlife to foreigners, 44.8% ( $n = 337$ ) thought that it was acceptable to cut and sell large timber, and 53.2% ( $n = 336$ ) that it was acceptable to mine for gold in forests. Nonetheless, only 13.7% ( $n = 336$ ) of children thought that it the burning of savannahs (in which they live) should be allowed.

When children were asked which species they were in favour of protecting most responded with the Arapiaima fish, toucan, macaw and cock of the rock; nearly 90% of respondents supported these species (Fig. 2). They were least in favour of tarantulas, anacondas, and stingrays, but surprisingly still over 45% of the children were sympathetic to these species. Interestingly, species that are treated as flagship species for Latin America by western conservation donors and NGOs were not especially favoured for protection, with positive evaluations given by less than two thirds of the students (jaguars 62%, howler monkeys 64% and tapirs 60%); though favoured by a majority of students, note that these species fall clearly in the mid level of preference.

### 3.2. Factors affecting knowledge of wildlife

Logistic regression models found that form had a significant effect on correctly identifying the pelage colour of giant ant-

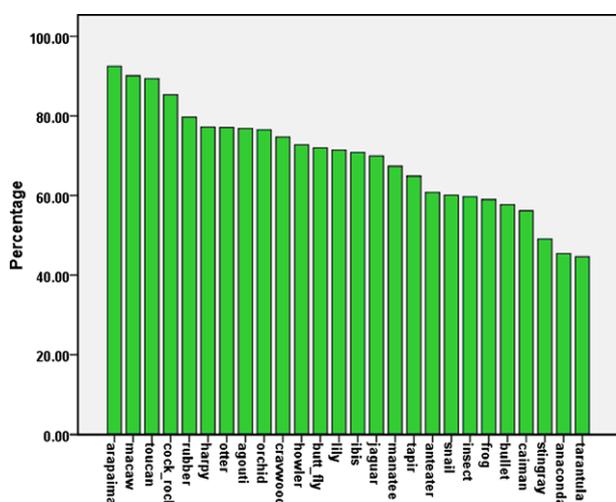


Fig. 2 – Percentage of school children in favour of protecting selected species.

eaters, the largest bird in the country, and the national bird, and a marginally significant effect on being able to name protected areas in the country (Table 1). Gender was also a factor with boys being able to identify the largest bird significantly more than girls, and the national bird marginally more significantly, and girls knowing the taxonomic status of the manatee more than boys. Experience of animals had rather little effect on knowledge of wildlife: visiting a zoo marginally reduced the likelihood of knowing an anteater's colour, having a domestic animal reduced correct identification of a manatee, whereas membership of a wildlife club increased knowledge of a manatee, and visits by a conservation organization marginally increased correct identification of the national bird. When in a separate analysis we examined schoolchildren from Nappi, focus of a sustained single-village conservation programme, we found that they had marginally better knowledge of the largest bird (odds ratio, 3.000,  $p = 0.062$ ), and national bird (2.776,  $p = 0.087$ ), but significantly less knowledge of manatee taxonomy (0.103,  $p = 0.004$ ) than other schools.

### 3.3. Factors affecting attitudes to wildlife and its exploitation

A visit from a conservation organization had a marginally significant impact on children thinking that wildlife was important for the nation and a significant effect on more protected areas being warranted (Table 1). Owning a domestic animal significantly increased children valuing wildlife for Guyana (Table 1). Nappi did not differ from the other villages in wildlife attitudes.

Table 1 also shows some expected effects on attitudes of children towards exploitation of natural resources. Boys were more positively disposed towards hunting than girls. Similarly, membership of a wildlife club had the effect of making children less approving of hunting wild animals, and visits by a wildlife organization significantly decreased their willingness to burn the savannahs. Other results are more idiosyncratic. For example visits from a wildlife organization increased children's support for selling animals to zoos and foreigners; owning a domestic animal made children more sympathetic to tree cutting, and form reduced children's willingness to burn savannahs.

Conservation education showed clearer outcomes when comparing attitudes towards exploitation between Nappi and other villages in a separate analysis. Nappi students were between a sixth and a third less supportive of hunting (odds ratio, 0.390,  $p = 0.027$ ), tree cutting (0.293,  $p = 0.006$ ), mining (0.230,  $p = 0.001$ ), and savannah burning (0.154,  $p = 0.021$ ) than those at other schools.

### 3.4. Factors affecting preferences for various species

The unrotated factor analysis produced three principal factors with eigenvalues greater than 1 (Table 2). The first factor affects the responses to all questions "positively" as shown by the signs in the first column of the table. This can be thought of as identifying a considerable group of children that generally liked nature. The second factor appears to pick up negative responses to certain species, such as tapirs, tarantulas,

**Table 1 – Odds ratios of dependent variables on students' (a) knowledge and (b) attitudes to wildlife and the environment. Odds ratios >1 denote a positive effect; <1, a negative effect. Significant p-values are shown in brackets.**

	Wildlife club	Conservation organization visit	Domestic animal owner	Visit to a zoo	Form	Gender
<i>A. Knowledge</i>						
Anteater colouration	1.122	0.660	1.026	0.536 (0.072)	1.774 (<0.0001)	0.864
Largest bird in Guyana	1.213	1.357	0.340	0.757	1.746 (<0.0001)	2.411 (0.012)
Manatee taxonomy	3.334 (0.014)	1.344 (0.020)	0.158 (0.027)	0.852	0.985	0.418 (0.005)
National bird of Guyana	1.776 (0.071)	2.726 (0.010)	4.152 (0.060)	1.641	1.519	2.079
Naming protected areas	2.384	1.897	–	2.091	1.694 (0.062)	0.649
<i>B. Attitudes</i>						
Wildlife important	0.888	2.151 (0.061)	4.664 (0.022)	0.956	1.233	1.318
More protected areas	1.606	2.452	0.874	1.505	1.012	1.012
<i>Environmental exploitation<sup>a</sup></i>						
Hunting	0.397 (0.021)	1.057	2.884	0.953	0.870	1.900 (0.017)
Selling animals	1.045	3.274 (0.001)	2.758	1.460	0.871	1.017
Cutting timber	0.588	0.597	6.667 (0.009)	0.912	1.044	1.284
Mining	0.893	0.832	1.362	0.959	0.988	1.304
Burning savannahs	0.961	0.179 (0.001)	3.030	1.397	0.700 (0.014)	0.601

a If odds ratios >1 then children favour the type of exploitation indicated.

**Table 2 – Factor loadings and unique variances for 26 species.**

Variable	Factor 1	Factor 2	Factor 3	Uniqueness
Giant otter	0.4181	0.2018	–0.1575	0.7597
Giant water lily	0.4986	0.0770	0.0753	0.7398
Tapir	0.4890	–0.1393	–0.1872	0.7064
Rubber tree	0.2577	0.1910	0.1710	0.8679
Tarantula	0.5776	–0.3752	–0.2196	0.4774
Caiman	0.5522	–0.3619	0.0476	0.5618
Arapaima	0.3098	0.2573	0.1187	0.8237
Orchid	0.4634	0.3112	–0.1307	0.6713
Ibis	0.3665	0.2270	0.0024	0.8141
Snail	0.5741	0.1567	–0.1632	0.6192
Insect	0.6016	0.0444	–0.1462	0.6147
Toucan	0.2597	0.1923	0.3332	0.7845
Anaconda	0.6586	–0.2736	–0.0852	0.4842
Jaguar	0.5721	–0.0743	0.2541	0.6026
Harpy eagle	0.4907	–0.0824	0.3812	0.6071
Agouti	0.3865	0.2269	–0.1327	0.7815
Butterfly	0.4826	0.2142	–0.0663	0.7168
Manatee	0.6049	0.0086	–0.0726	0.6287
Frog	0.5962	–0.1054	–0.1095	0.6215
Giant anteater	0.6508	–0.0420	0.3382	0.4604
Crabwood tree	0.3895	0.1119	0.0241	0.8352
Stingray	0.5418	–0.1861	–0.1235	0.6566
Bullet ant	0.6517	–0.1338	–0.2431	0.4983
Cock of the rock	0.2647	0.2906	0.1299	0.8286
Macaw	0.3314	0.4092	–0.2173	0.6754
Baboon	0.5775	–0.1249	0.4225	0.4724

caimans, anacondas, jaguars, harpy eagles, frogs, anteaters, stingrays, bullet ants, and howler monkeys, whereas the third factor is difficult to interpret. Since interpretation of the first two factors is relatively straightforward no rotations to explore the data further were attempted.

Uniqueness in Table 2 (column 4) refers to the percentage of variance that is not explained by the three factors, and consists of both measurement error and something reliably measured for that particular species but not for any other. The greater the uniqueness, the more likely it is that the variable is truly unique. Typically, variables  $>0.6$  are considered rather unique or, in other words, poorly predicted by the retained factors. From this we can see that questions pertaining to tarantula, caiman, anaconda, bullet ant and red howler monkey are best predicted by factors in the model.

#### 4. Discussion

The children of the Rupununi had a good general knowledge of wildlife but knew few details about specific species. They were also positively disposed to the conservation of a wide array of species and protected areas. They nevertheless showed little antipathy towards the exploitation of natural resources, unless they were subject to sustained exposure to a conservation organization, as in Nappi. Here we discuss first the students' knowledge, then their attitudes, then their views on utilization and exploitation, and finally their species specific preferences regarding protection.

Most children in the North Rupununi knew their national bird and that the enormous harpy eagle was the country's largest bird. Yet, deeper knowledge – of anteater colouration, of the taxonomy of the manatee, and of protected areas – was lacking. It was not surprising that form, closely correlated with age, increased a child's knowledge of wildlife and protected areas (Table 1); also that boys knew more about some aspects of wildlife than girls although not exclusively. Strangely, there were few marked effects of any type of experience of animals or conservation education on children's knowledge of wildlife. One possible inference from this is that zoos, wildlife clubs and conservation organizations do a poor job of conveying specific details about animals to school children (similar to the findings of Kidd and Kidd, 1996). Another is that that our questions were inappropriate, perhaps being too difficult; this is possible since children's knowledge generally increased with age. A third is that our questions addressed different topics than those promoted by outreach programmes, wildlife clubs, and zoos. This may be true for Foster Parrots, who focus primarily on the pet trade, but for CI seems unlikely given the programme objectives outlined in Section 1.

Attitudes to wildlife were mixed: most children thought wildlife was important for the nation, and that more national parks should be established, but they failed to make a connection between wildlife and environmental exploitation insofar as most students were tolerant of hunting, trading wildlife, logging and mining, all activities with potentially negative environmental outcomes. Only burning of savannahs was consistently seen as a bad thing; this ap-

pears to reflect a long campaign by government and conservation organizations to limit fires set both by villagers and vaqueiros. Clearly there has been some change in attitudes towards fire since Myers' (1936) citation of sources that refer to the aboriginal Indians as "inveterate burners". More incongruously ownership of a domestic animal made children more sympathetic to tree cutting, perhaps because children living in rural households with animals were used to seeing tree felling.

Attitudes toward hunting deserve special mention. Boys were almost twice as tolerant as girls, no doubt reflecting the male bias to this activity, and membership of a wildlife club reduced children's willingness to hunt wild animals. Otherwise there were no effects of visits from a conservation organization, nor any other variable, on attitudes towards hunting. This is perhaps unsurprising. In rural areas hunting is an important part of food security. Furthermore as many have noted (Bergerhoff Mulder and Coppolillo, 2005; Berkes and Adhikari, 2006) indigenous groups often seek control over their lands and their traditional economic enterprises as a way of achieving self-governance and identity. Unless hunting is ecologically unsustainable, there is no reason for conservation organizations to try to stop these activities, especially if they have other important positive consequences.

In general, a visit from a conservation organization changed children's attitudes by helping them understand the importance of wildlife and of protecting areas, but strangely these visits made children more willing to sanction capture and selling of wild animals. Perhaps this is an unintended consequence of learning from these same conservation organizations the value of some species in the pet trade, although of course as with all relationships we cannot prove that correlations imply causation. Children in Foster Parrots focal village, Nappi, however were different, in so far as they were sensitive to the dangers of environmental exploitation. This suggests that children from rural villages require repeated or more sustained exposure to conservation issues before they accept the potential dangers of utilizing wildlife and natural resources. In short, there was a strong effect of visits by wildlife organizations on children's views of the importance of wildlife and setting up protected areas, but wildlife organizations had only limited effects on attitudes to utilization unless they became almost permanently represented in the village.

The factor analysis addressing species that children thought were important to protect showed that many children really like nature (consistent plus signs); some of these students came to talk to us after the survey and drew the glowing admiration of their teachers. The second factor showed that there are also a group of children who deem some species as not worthy of conservation, particularly those that are dangerous (e.g., tarantula, bullet ant) or destructive (e.g., jaguar). Finally it should be pointed out that there is a great deal of uniqueness in students' ratings of conservation merit, particularly with respect to species that are not seen as dangerous; this probably reflects personal preferences with unknown etiology.

Our findings about children's preferences for different species of wild animals and plants are instructive. Rather

than favour large mammals that are assumed by many western NGOs as being important tools in raising conservation awareness in South America, children were most concerned about other species – the huge Arapaima fish that is eaten locally, and species of brightly coloured birds (toucans, macaws and cock of the rock). Tapirs, anacondas, jaguars, harpy eagles, anteaters and howler monkeys were classified in the same category as tarantulas, caimans, frogs, stingrays, and bullet ants. While it is often suggested that flagship species in developed countries are not the same as those for developing countries (e.g., Leader-Williams and Dublin, 2000), we show it here systematically for the first time.

It is not clear whether children's favoritism towards the birds derives from exposure, or the possibility of their families making money from trade. Certainly, these species are featured prominently in wildlife education material in Guyana. But, more worrying, toucans and macaws are caught locally and sent out to Georgetown by airplane and bus for export to zoological institutions and collectors, principally in Europe; indeed Guyana is one of the last countries in South America where such a large legal trade in wildlife still flourishes. Thus, children may see financial benefits in these species or want them as pets themselves.

While children favoured noxious species least – tarantulas, anacondas, and stingrays – a surprisingly high percentage still thought them worthy of protection. This implies that children in Rupununi have a reasonably high affinity with many living things, perhaps because they live in rural communities.

The children of North Rupununi sampled here are not necessarily representative of all of Guyana, since Lethem has a much higher presence of conservation activities than most other areas in the interior and on the coast; indeed almost two thirds of the students reported having been visited by a conservation organization; furthermore Foster Parrots is attempting to foster relatively novel ecotouristic ventures. The results nevertheless suggest that there is huge potential for continued partnership between schools and conservation organizations in Rupununi, that the children are attentive and interested, and that they favour both the establishment of protected areas and the conservation of many of the species with whom they share their environment. More generally our findings suggest that zoos, wildlife clubs and conservation organizations could enhance the dissemination of their message through making more frequent and sustained visits, imparting more detailed knowledge, and (where appropriate) exposing children to the potential dangers associated with utilization and exploitation; this is particularly important as outside logging and mining interests gain access to the resources of the Rupununi. It is also clear that conservation organizations should reassess their use of standard flagship species in South America.

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### Appendix 1. Questionnaire

PLEASE PUT THIS AT THE TOP OF YOUR SHEET OF PAPER

Name  
Age  
School  
Form  
Ethnicity

1. Do you belong to a wildlife club? Y/N
2. Has a wildlife organization visited your school? Y/N
3. Does your family have a pet at home? Y/N What is it?
4. Have you ever been to a zoo? Y/N Where?

#### KNOWLEDGE OF WILDLIFE

5. What colour are giant anteaters?
6. What is the biggest bird in Guyana?
7. Is a manatee a fish, a whale, or neither?
8. What is the national bird of Guyana?

#### ATTITUDES TO WILDLIFE

9. Do you think that wildlife is important to Guyana? Y/N
10. Should people be allowed to hunt wild animals to eat? Y/N
11. Should people be allowed to sell wild animals and birds to foreigners as pets or for zoos? Y/N
12. Should people be allowed to cut big trees to sell for timber? Y/N
13. Should people be allowed to mine for gold in the forests? Y/N
14. Should people be allowed to burn the savannas Y/N Why?

#### PROTECTED AREAS

15. How many National Parks or reserves set aside to protect wild animals are there in Guyana? Can you name them?
16. Do you think there should be more places set aside wild animals in Guyana? If so, where: on the Coast Y/N, in the rainforest interior Y/N, in the Rupununi Y/N
17. Is it important to protect (Yes/No/Maybe)

A. Giant river otters (Water dog)	B. Giant water lilies	C. Tapirs (Bush cow)
D. Rubber tree plant (Balata)	E. Tarantula spider	F. Black caimans
G. Arapaima fish	H. Orchids	I. Scarlet ibis
J. Land snails	K. Insects	L. Toucans
M. Anacondas	N. Jaguar	O. Harpy eagles (Comodis)
P. Agoutis	Q. Butterflies	R. Manatees
S. Hylobatid tree frogs	T. Giant anteaters	U. Crabwood trees
V. Freshwater stingrays	W. Bullet ants	X. Cock of the Rock
Y. Red and yellow macaws	Z. Red howler monkeys (Red baboon)	

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