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Strategies for the Conservation of Two Critically Endangered, Endemic Primates in Panama

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Abstract: Neotropical Primates are threatened because of deforestation and hunting. There are numerous species and subspecies of primates today restricted entirely to small forest patches. Many are poorly studied due to the remoteness of their ranges, political situations, or the expensive logistics required. Although population surveys are important to obtain baseline information for the conservation of threatened primates, there are opportunities where population censuses could be used in conjunction with rapid conservation strategies. In this report we encourage scientists to use collateral techniques that could positively impact local communities while undertaking scientific studies. They include the involvement of biology students from the target country, the use of informative material to divulge information on the natural history and conservation of the target species, and the creation of interest among community leaders so that a long-term conservation program can be established in the future.

Key Words: Primate conservation, Azuero Peninsula, Azuero howler monkey, Azuero spider monkey, environmental education, Panama

Resumen: Los Primates Neotropicales se encuentran en peligro debido a la deforestación y a la cacería. Existen diferentes subespecies de primates hoy en día restringidas solo a pequeños parches de bosques. Muchas han sido poco estudiadas dado a su rango de distribución remoto, situaciones políticas, o al costoso equipo requerido. Aunque censos poblacionales son importantes para obtener información de línea base para la conservación de primates amenazados, existen oportunidades donde los censos poblacionales podrían ser llevados a cabo en conjunto con estrategias rápidas de conservación. En este reporte incentivamos a los investigadores a utilizar técnicas colaterales para un impacto positivo en las comunidades locales mientras realizamos estudios de investigación. Ello incluye la incorporación de estudiantes de biología de los países visitados, el uso de material informativo para divulgar información de la historia natural y la conservación de las especies estudiadas, y el incentivo de un interés a líderes de las comunidades, de manera que se puedan desarrollar programas de conservación a largo plazo en el futuro.

Palabras Claves: Conservación de primates, Península de Azuero, mono aullador de Azuero, mono araña de Azuero, educación ambiental, Panamá.

Introduction

The Azuero Peninsula of southwest Panama, Central America, is an extensively deforested zone that has three provinces: Herrera (with 27,202 human dwellings and 183 secondary schools); Los Santos (with 25,052 human dwellings and 163 secondary schools); and the east of Veraguas (with 49,102 human dwellings and 518 secondary schools) FAO (2002). This area is home to two subspecies of primates endemic to Panama, the Azuero howler monkey (*Alouatta coibensis trabeata*) and the Azuero spider monkey (*Ateles geoffroyi azuerensis*). These subspecies are considered to be the two of the most endangered primates in Panama (Méndez-Carvajal 2011). Other primates such as the Panamanian white-throated capuchin (*Cebus imitator*) have been identified as at high risk regionally by the Fundación Pro-Conservación de los Primates Panameños (FCPP). This is due to factors such as very small remaining wild populations, their damaged

and fragmented habitats, regional endemism, and the lack of conservation plans (Jacobson *et al*. 2006; Méndez-Carvajal 2011). The primates are affected by exposure to crop spraying, the pet trade, agriculture, cattle ranching, hunting, mining, tourism, expansion of teak plantations, and, most recently, real estate investments (Méndez-Carvajal and Ruiz-Bernard 2010). The FCPP is a Panamanian non-profit organization that has initiated the first primate conservation plan for the Azuero Peninsula, monitoring the primate populations remaining in the area. The FCPP has developed an educational program to conserve the Azuero wildlife in accordance with previous conservation assessments (Horwich 1996; Rodríguez-Luna *et al*. 1996; Cowlishaw and Dunbar 2000; Rabinowitz 2003; Jacobson *et al*. 2006; Méndez-Carvajal *et al*. 2006). In this project, we attempt to maximize our approach any time we visit the study sites by involving local people, as they are the key to helping in the conservation of the native fauna of Azuero. We developed a questionnaire to evaluate each town surveyed (n = 150) and contacted community leaders to introduce our project and our main goal. The creation of good attitudes and practices in the local communities helps to mitigate the decline in primate populations living in forest fragments and the corridors of trees often extending from and between them (living fences) in the protected areas. To meet this goal we developed the following objectives:

- Provide information on the biology, ecological role and land use activities that affect the primates in their communities;
- promote the interest of the locals as volunteers for tracking and protecting the primates in their areas;
- involve Panamanian biologists interested in primates studies; and
- develop educational activities that can be used to evaluate the effectiveness of our presence in their areas.

The Azuero Peninsula

Land use

Cattle ranching first began in Panama in 1521, when the colonial administrator, Pedro Arias de Ávila, brought 50 cows from Jamaica (Gligo 1999; Castro 2004). In the middle of the 17th century, the people who lived in Panama City started to migrate west to start up ranches, and cattle ranching quickly became the main economic activity of the country (Heckadon-Moreno 1998, 2001). The Spaniards developed Azuero as one of the first production centers in Panama, growing rice, sugar cane, corn, pineapple and, most importantly, raising cattle. This was made easier by the flat terrain that was partially covered by savannas (Suárez 1981; Gligo 1999). Panamanians in this region also hunted wildlife for subsistence (Heckadon-Moreno 2001). Today, the Azuero Peninsula is a mixed landscape with extensive pastures and secondary and remnant forests, as well as mature primary and secondary forests in the mountains. Some of the forests are protected as national parks, forest reserves, and other categories by the Panama National Environmental Authority (ANAM 1999). This interaction with the environment was a fundamental element of the lifestyles of the Azuerense (people native to the Azuero Peninsula), who are known today as outstanding hunters, farmers and cowboys. Traditional farming practices involve conserving native forest patches or "Chapas," which serve as a resource for medicines, fruits and firewood, together with living fences (Brandaris 1983). "Living Fences" consist of specific trees that the campesinos use to support their needs, timber for construction, fruits, and shelter for cattle (Suárez 1981). The living fences have created effective corridors for the dispersal of wildlife between the forest patches (Méndez-Carvajal 2008). As new generations of Azuerenses are getting better education in careers not related to agriculture, most of the farming areas are now being abandoned, overused or sold to immigrants. Consequently other farm owners hire indigenous people to work on their lands, creating another pressure on the primates living in the area as they eat monkeys as part of their culture. Azuerenses are also looking for more land to expand and "develop" cattle ranches, and since the 1980s have been migrating to forested regions such as Colon Province, Chagres and Darien (eastern side of Panama). The impact of their regional culture is now threatening the remaining forested areas in Panama and the lack of environmental education campaigns in Azuero in the past years is resulting in them making the same mistake of extreme deforestation. FCPP thus considers Azuero to be in need of permanent exposure to conservation activities, as is true of other regions in Panama.

Environmental aspects

Environmental variables such as cold spells with extended periods of rain have a great influence on the Azuero primate populations. In addition to being susceptible to the cold spells, Azuero howlers are suffer from parasitism by the howler botfly (*Cuterebra baeri*) (Méndez-Carvajal and Ruiz-Bernard 2009). The most prolonged episodes of rain and cold are normally in October and November. They can be a cause of mortality in a number of species, including howler and spider monkeys, as has also been reported in Costa Rica (A. Bustamante pers. comm) (Fig. 1).

Methods

To evaluate the situation of the Azuero primates, the authors carried out surveys and interviews around the towns, areas of cattle ranching, rivers, and mountains that contain remnant forests (Méndez-Carvajal 2011). The survey project was begun in April 2001 in order to establish a long-term population project to assess the primate communities and their ecology. The environmental education activities began shortly after support was gained from international

Figure 1. The Azuero landscape, showing cattle pastures bordered with living fences, one of the remaining vegetation types where it is still possible to find native primates.

institutions (Ruiz-Bernard *et al.* 2010). Each year, different strategies were adopted for these surveys, including the following.

Training students from the Biology School of the University of Panama

This training is provided free, and includes teaching different techniques for surveying primates, specifically for *Cebus*, *Alouatta*, and *Ateles*. The curriculum includes methods for the collection of field data on primate group structure, mapping and compass use, and the calculation of distances and heights for habitat descriptions. After five hours of theory, the project offers the students the opportunity to practice these methods in the field by acting as volunteers in five to ten day surveys (see "youtube" site "atelesaz"). Field training includes the use of GPS, recording equipment to study vocalizations, fecal sampling and observational techniques. The goal of this initiative is to develop the interest of senior biology students in primate research for their bachelors theses, while also supporting our project with their fieldwork.

Educational activities in the primary and secondary schools in Azuero

Educational talks have been developed to offer basic information to the children in the regional schools in the northeastern areas of Azuero. Here the remaining Azuero howler and capuchins monkey populations live close to the villages and are at greater risk. In these presentations, we talk about primate biodiversity, the Azuero primates, and the characteristics that humans share with them as part of the same mammalian order. We also talk about how similar we are in our anatomy, the social and family structure, and daily necessities (for example, food, refuge, and use of plants). The talks also touch on basic information about primate food, their importance in the ecosystem as seed dispersers and pollinators, and how they contribute to the survival of wild animals (for example, deer, paca, agoutis, and peccaries). We normally conclude with ten minutes of questions or drawing activities, where we measure the knowledge of the students after each talk and answer any remaining questions that they might have. We give each school a poster with information on the three subspecies of Azuero primates, indicating how they can help to minimize the risk of their extinction. The initiative also gives away t-shirts that have images of the most endangered non-human primates in Azuero and a message on the back of how they can help the primates, which are a part of their heritage and responsibility.

Educational activities around natural reserves and villages in Azuero

The Azuero Peninsula has three main natural zones under government protection: El Montuoso Forest Reserve in the north of the Herrera province, Cerro Hoya National Park at the southwestern part of the peninsula (eastern part of Veraguas province), and La Tronosa Forest Reserve at the southern end of Los Santos province. We have contacted members of the ANAM and the forest rangers of these protected areas every year before and during our field work. Our visits with the forest rangers include an open discussion where we exchange information about our results, what we do in Azuero, their experiences seeing monkeys and conservation issues in the area. We give them new information, and also t-shirts with conservation messages. Our goal is focused on obtaining information on the ranger's needs and how they work to improve the protection of the natural areas under their charge. That information is used to evaluate the effectiveness of the parks and reserves (see Rodríguez-Luna *et al*. 1996), and make recommendations to the ANAM's directors for the future management of the parks and reserves of the zones. As we visit the remote areas of the peninsula, we inform the communities about what we are doing and also obtain information from them that can facilitate our encounters with primates. We are interested in knowing their point of view about having primates close to their houses, as well as the past history of the occurrence of the primates and local extinctions of isolated populations. With this information and contacts, our goal is to involve local people and have them participate in our activities. We want to obtain information about the history of the fauna, native plant knowledge, and the presence and problems related to the primates.

Road signs, 'youtube' videos, and newspaper articles

The information obtained is passed to the general public beyond the scientific community by putting signs along the roads, posting videos with conservation messages on the internet, and publishing articles in national newspapers. After realizing that groups of Azuero primates can be found in gallery forests along some secondary roads and close to bridges, we have posted some signs beside the roads and bridges to warn people not to feed the monkeys. Feeding monkeys is practiced in some areas by people thinking that feeding them is a good and humanitarian thing for them to do. However, other local people feed them poisoned foods, arguing that

they damage their crops and plantations, and believing it is a way to protect their cattle from the larvae of the botfly (*Cuterebra baeri*) that they see on the howler monkeys.

Some locals used to put out bananas and leftovers from restaurants to feed the monkeys on the bridges, causing digestive problems for the primates. There have been at least three food-related instances that led to the death of nine or ten monkeys in the past three years. Azuero howlers in those areas have also been killed by electrical installments, and cars when they walk on the bridges looking for food placed there by people. Our yearly visits and the volunteers visiting the community are now helping to protect the monkeys in these vulnerable areas of Azuero.

Most of the younger generation in northeastern Azuero now use the internet. Secondary school students who are very familiar with the internet are now less familiar with the primates living in their own town. FCPP has posted videos with topics related to environmental education on <youtube.com>. This is done every year to keep the students and the general public informed about the fauna and flora in the region. By viewing these videos the students can also learn about our activities around the peninsula. Newspaper articles providing general information related to this project and the Azuero primates are also important. This information is accessible to the local community where we work and encourages the conservation of the fauna and flora in the region (Fig. 2).

Figure 2. Environmental education activities developed for the Fundación Pro-Conservación de los Primates Panameños-FCPP, Azuero Peninsula, Panama. These include the following: road signs, informative talks to primary and secondary schools, creating educational tools such as masks and paintings related to the primates and their habitat, informative posters, and educational talks with the forest rangers of the reserves.

Results

We have evidence of positive effects of the program on the local people who await our annual visits and collect anecdotal information for us. Based on our recent questionnaires, the people are showing an increase of 30% in basic knowledge related to the monkeys, and owners of agricultural lands are avoiding unnecessary tree-felling. The knowledge of the land owners has further improvement of (71% for 2011) compared with the first pre-survey (42% for 2001), but more people have to be reached. As this program has been supported by local biologists, their interaction with the local community has created an excellent way to teach conservation practices. In addition, the children respect them as leaders of their communities (Fig. 3).

Training of students from the Biology School of the University of Panama

Ten undergraduate students have participated in the program; three represented Panama in the XI Mesoamerican Congress of Biology and Conservation at Oaxtepec, Morelos, Mexico, and the First Scientific Congress of the Azuero University Regional Center (CRUA) in Azuero, Panama in 2007. Other students have assisted primatologists visiting Panama and some others have been part of our environmental education team, giving talks in secondary schools around the Azuero Peninsula. FCPP organized an international primate symposium in 2012, in the XVI Mesoamerican Society for Biology and Conservation Congress held in Panama City.

Educational activities around natural reserves and villages in Azuero

The educational talks given during our surveys took place mostly at the following schools and colleges of Herrera province: Rafael Quintero Villarreal from Ocú El Calabazal School, School Cristina R. de Pinzón of La Polonia, School Aleida Agustina from Llano Grande; Los Santos province: La Miel of Las Tablas, and the Agronomy School of Tonosi. Educational guides, t-shirts, posters, stickers and bookmarks have been distributed to the Llano de Piedras School, El Montuoso School, La Corocita School, El Cacao of Tonosi School, Canajaguas School, Valle Rico School, besides other public centers around Azuero. FCPP have addressed around 300 students per year. We have visited the El Montuoso Forest Reserve (seven rangers) and Arenas ANAM station (four rangers) in Veraguas, Cerro Hoya. Our evaluation of the natural reserves is presented in Tables 1 and 2.

Road signs, youtube videos, and newspaper publications

We have put up signs that provide basic information related to the primates living in the area, along with our contact information and messages that inform the public not to feed the monkeys, and basic biological information in English and Spanish. Signs were placed along the ríos Oria and La Palma (Los Santos). Another two were placed near the Río Cañas in Tonosi (Los Santos), and two along the Río Pavo in Veraguas province. Two road signs alerting people to reduce speed were placed on the Tonosi road in Los Santos Province. Since 2001 we have published ten articles on the critical

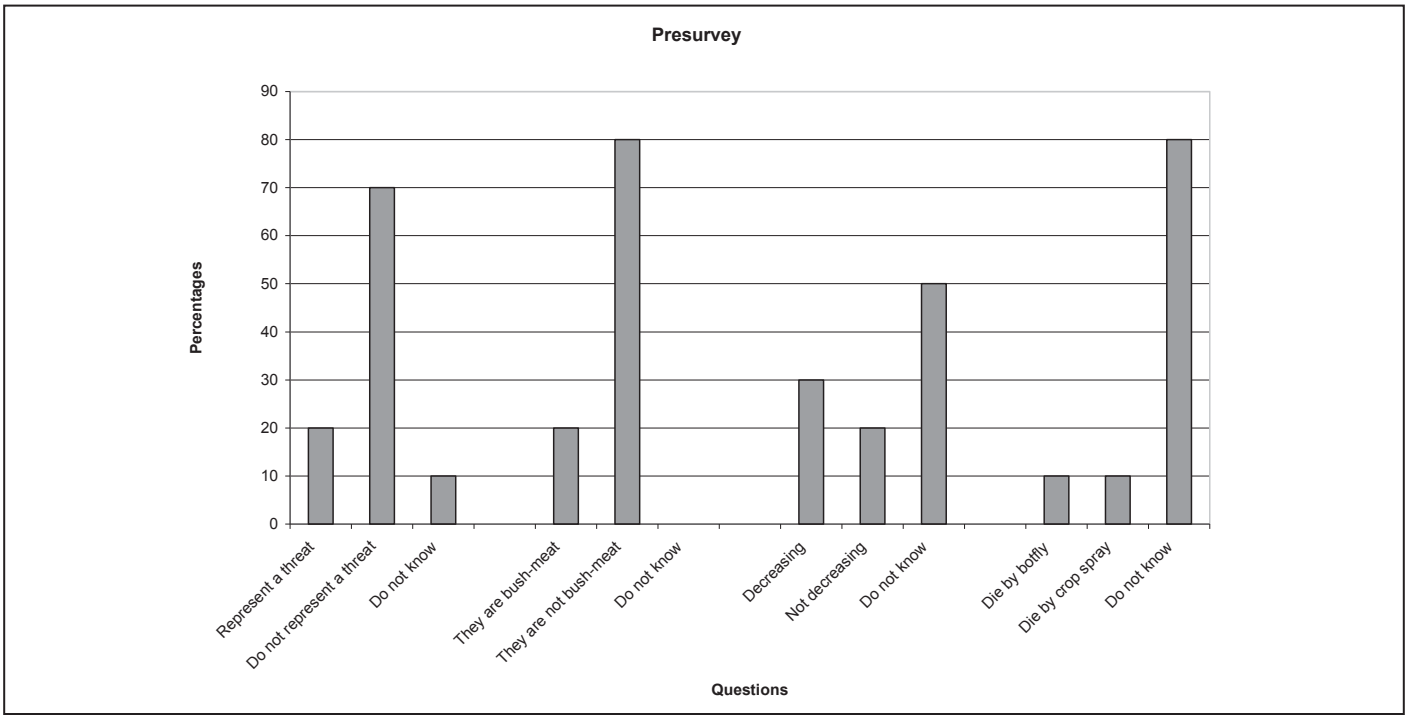

Figure 3. Pre-survey to evaluate basic knowledge about the primates in Azuero, n = 150, April–May 2001 (20 questions). The preliminary evaluation detected that there was rather little interest in hunting primates for food, although interviewees said that monkeys are shot sometimes as an easy target in hunting practice. They had little notion of the ecological role of primates in the forest. The local people considered the white-faced capuchin (*Cebus imitator*) to be a serious threat to their crops, but otherwise showed considerable interest in learning more about the conservation of the peninsula's primates.

situation of the monkeys in the area and one regarding the vocalization behavior of the Azuero howlers.

Future plans include engaging the Panama Ministry of Education (MEDUCA) as a collaborator in the creation and distribution of an educational guide for school teachers. Other governmental institutions such as the Gorgas Commemorative Institute (ICGES) and the Health Ministry of Panama (MINSA) have contacted FCPP to obtain assessments and information about our primate monitoring program around Panama. The document "Guía Didáctica por la Conservación de los Primates de Azuero" prepared by FCPP includes topics related to the primates and to the yearly study plan for those communities. Measures of the effectiveness of these conservation activities include the continual monitoring and evaluation of primate populations and vegetation in old and new forest patches. To date, all the primate groups that have been identified and censused since 2001 have survived, and their habitats have been almost untouched. This could be considered an important achievement of our project. Future projects include the measurement and comparison of forest expansion and regeneration. This will be done using advanced techniques of GIS. We will also study the correlation between fragment regeneration and the presence of primates and other mammals.

Discussion

These activities were all begun to study and conserve two endemic and Critically Endangered primates from southwestern Panama (Azuero Peninsula); the Azuero howler and spider monkeys. However, direct access to the community

Table 1. Achievements of FCPP's environmental educational activities from 2001 to 2013.

Past situation	Activities developed (2001–2013)	Improvement	Actual situation/needs
Lack of basic information in the local communities	1. Environmental education talks to schools, farmers and local people in general, University of Panama 2. Distribution of: stickers, posters and bookmarks with information 3. Educational Guide 4. Local publication in newspapers 5. Basic webpage 6. Road signs 7. Cultural activities 8. Local TV participation	1. Stopped feeding monkeys with bananas. 2. Wrong perception of abundance due to overcrowded population 3. Monkeys are not good for pet campaign 4. Local observers 5. Environmental Guide printed first set of 100 6. At least one article related with primates is published yearly in a local newspaper 7. Basic webpage	• Lack of better webpage • Lack of enough environmental material • Budget to print our guides • More video or visual material • Lack of documentary informing about our projects • Improve quality of road signs
Lack of scientific information	1. Population surveys 2. Distribution map 3. Vocalization studies 4. Behavior studies 5. We expanded our projects to Coiba Island, Darien, Boquete, Burica Peninsula, Panama Canal Zone and San Blas Mountain Chain	1. Informed about total population, group's structure, birth and mortality rate per area 2. Accuracy in right distribution 3. Actual biological information 4. First evaluation of vocalization structure for *A. coibensis trabeata*	• Ecological projects related to study the seed dispersers and pollinators in Azuero Peninsula • Budget to monitor actual groups found • Expand our surveys
Lack of support and interest from national and international organizations in Panama	1. Communicate with new people 2. Train ourselves and look for international training related with primates	1. University of Panama has been interested in cooperating with our organization 2. We have produced: 1 master thesis, 5 newspaper articles, 7 scientific articles, 1 educational guide, 1 book chapter, 7 contributions at an international level	• Standardize methods. • PhD and Masters on Primatology or Anthropology from Panama are in need
Lack of funds	1. Generate scientific proposals 2. Develop activities to obtain support 3. Government opportunities	1. We have generated more than 100 proposals, received support from more than 10 organizations 2. We did bookmarks representing each species of Panamanian primates for sell and distribute for free in local villages	• Seeds funds available
Lack of biology students interested in primatology	1. Talks to the University of Panama 2. Visits to branches of the Universities. 3. Contacting Biology professors	1. 10 students trained in surveying primates. 2. Participation in two regional congresses, and three international congresses 3. Organized the first Primatological symposium in Panama, the III for Mesoamerica	• Lack of funds to support our trained students and do not lose their valuable skills
Lack of a conservation plan	1. Elaborate a conservation plan through an environmental education and a long-term survey	1. We created our own plan for conservation following an action plan suggested by Rodríguez-Luna *et al*., (1996)	• Achieved
Lack of a national entity dedicated to study and conserve the Panamanian primates	1. Legal process to create a NGO. 2. Expand studies of non-human primates to the rest of Panama	1. We created the For-Conservation Foundation of Panamanian Primates (FCPP).	• Achieved

and interaction with the local people have called our attention to other species that can be positively impacted by our work, helping in the end, the entire native flora and fauna (Ruiz-Bernard *et al*. 2010). The capuchin *Cebus imitator* that is Vulnerable according to Cuarón *et al*. (2013) is one of the species that could be considered as Endangered at the regional level, if we take into account the significance of this monkey for the local people. It is a crop-raider, and when there was no action from the government to mitigate the problem, farmers decided to hunt them to extermination. Our research and direct observations in the area have shown us that the only way to save this species is through our efforts and activities. The participation of the local biologists and support from national and international institutions is crucial to keep up this long-term effort.

Based on the "Action Plan for the Mesoamerican Primates", prepared by Rodríguez-Luna *et al.* (1996), the Primate Specialist Group has classified the two most important steps toward the conservation of these primates. They are the Study Priorities (E) and the Conservation Actions (AC). Taking this document as a guide, the FCPP has achieved the following: E1 – Identify and monitor populations in protected areas; E2 – Determine densities and population growth; E3 – Determine actual distribution; E8 – Habitat preferred; E9 – Long-term evaluations and viability of populations. However we still need to complete the following steps, which are: E4 – Taxonomic studies; E5 – Measurement of hunting impact; E6 – Habitat transformation effects; E7 – Habitat fragmentation effects (already underway) (Tables 1 and 2).

For Conservation Actions, we have accomplished the following: AC1 – Encourage and promote more primatologists to study the primates and continue long-term projects; AC6 – Advise governmental authorities in the management of the primates and their habitat; AC7 – develop an environmental education program that promotes the collaboration between local people and the primate conservation plan. Regarding AC4 (develop more protected areas), what we have seen while working in the communities is that people reject the idea of strictly protected areas, not because they do not care about the species but because they depend on them for their subsistence needs. This was discussed by Cowlishaw and Dunbar (2000), who mentioned the implications of restricting the use of land by local people without incentives. We do not recommend the idea of creating more natural reserves in zones that are already being heavily exploited such as the Azuero Peninsula; it is not a priority for Azuero. The people of Azuero have the capacity to conserve their natural resources and fauna. This can be carried out through a program of intense environmental education. Our yearly monitoring of primates and our educational efforts in the area will encourage the cooperation of the locals and help us to stay vigilant to any changes. Our idea moreover, is to improve the use of living fences, which is already a cultural practice, and promote the connectivity of patches of forest with gallery forest and reserves already established (recommended also by Oates 1996).

The three most important natural reserves in Azuero Peninsula were evaluated based on the criteria of Mackinnon *et al*. (1986), proposed by Rodríguez-Luna *et al*. (1996). The information obtained reflected the commitment and effectiveness of the administration in El Montuoso Forest Reserve; however, spider monkeys are no longer found there. The Azuero spider monkey was hunted out about 20 years ago (Méndez-Carvajal 2011).

These point to weaknesses in the laws and the extent of population pressure on the protected area (see Pimbert and Pretty 1995). The effectiveness of La Tronosa Forest Reserve was lowest in the evaluation due to its greater accessibility to locals and also by people from the city, but this reserve still has Azuero howler and spider monkeys. Cerro Hoya Natural Park is a remote location and is difficult to reach, and is the best and safest place for Azuero howlers and spiders monkeys to survive (Table 2).

Table 2. FCPP's evaluation of the management of three natural protected areas in Azuero Peninsula, Panama, according to the guidelines suggested by Rodríguez-Luna *et al.* (1996). The three reserves fall in the Medium Point Level. EMFR: El Montuoso Forest Reserve; CHNP: Cerro Hoya National Park, LTFR: La Tronosa Forest Reserve.

Category	EMFR	CHNP	LTFR
Legislation	4	4	4
Mammal inventory	1	1	1
Bird inventory	1	1	1
Reptile/amphibian inventory	1	1	1
Fish inventory	1	1	1
Plant inventory	1	1	1
Vegetation map	1	1	1
Invertebrate inventory	1	1	1
Geographic maps	1	1	1
Soil map	1	1	1
Climatic data	1	1	1
Hydrology data	1	1	1
Topographic maps	1	1	1
Aerial photos	0	0	0
Bibliography	1	1	1
Studies of fauna/flora	0	0	0
Population studies	0	0	0
Rel. wildlife/habitats	0	0	0
Predator/prey studies	0	0	0
Carrying capacity studies	0	0	0
Parasite information	0	0	0
Ecological succession	0	0	0
Life history information	0	0	0
Management plans	3	2	2
Limits	2	2	2
Natural resources protection	1	1	1
Research level	3	3	3
Formal education	4	3	3
Educational offers	3.5	1.5	0
Political support	4	4	4
Local participation	2	4	2
Benefits for locals	3	2	1
Budget	2	2	2
Personnel/training	2	2	2
External support	2	2	2
Score	**48.5**	**42.5**	**41**

Conclusion

The conservation activities for these species have been developed with the strong support of volunteers from the local communities, the University of Panama, and the support of national and international organizations. The objective of this article is to encourage native biologists or primatologists from developing countries to promote similar plans in order to protect their threatened species and obtain accurate data for their conservation. Efforts for conservation do not have to start with large sums of money. Instead, they should start with real commitment allied with voluntary efforts to work for the conservation of these species and their ecosystems. Money, however, is crucial for long term presence of these activities in target areas. One of the important steps in this conservation project has been the education of the communities and the understanding of their needs. We have also tried to take into account recommendations of conservation practices, which state that: "involvement of the local people into the conservation activities will promote good opportunities and actions for and from them, making the locals feel like a real part of the solution" (Horwich 1996; Rabinowitz 2003; Curtis and Valdez 2009). Our activities have caught the attention of the Panamanian authorities, international scientific institutions and NGO's, stimulating possibilities for new projects related to the conservation of the Azuero primates; the Azuero Earth Project is an example; see Metzel (2011).

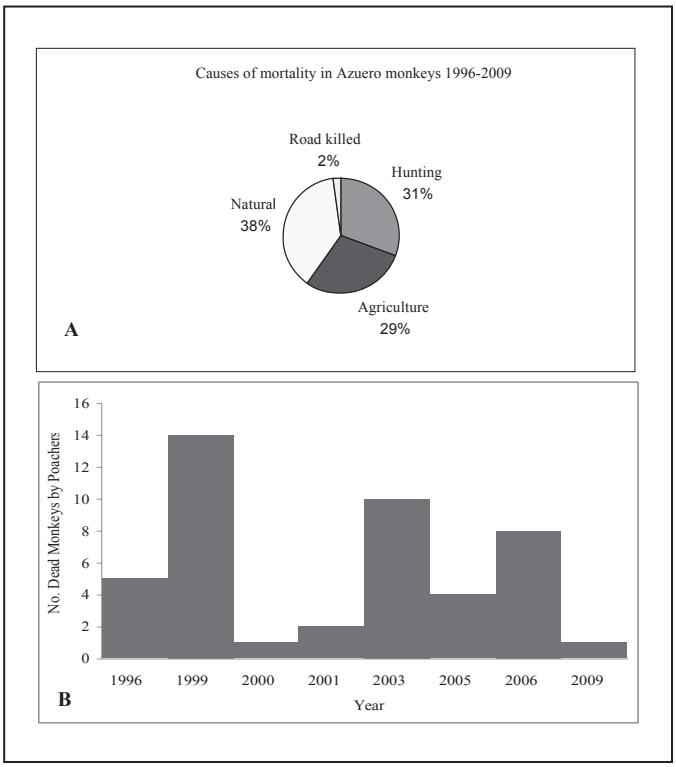

Figure 4. A) Percentage of the more important threats of Azuero primates expressed in a pie graph, for the period of 1996 to 2009. Natural factors have been influencing primate populations and other fauna probably due to the climate changes by deforestation. B) Incidence of poaching on the howler population per year.

However, our experience working with the Azuero communities has also suggested that our substantial efforts to conserve these species could come to naught without collaboration and alignment from new research initiatives and other organizations, such that are equally committed to our cause. Diverse initiatives with differing goals and methodologies could well confuse the local communities and undo the goodwill and understanding that we have fostered. Even creation of environmental laws, 25 critically endangered species lists, or national parks or reserves will not help in conservation if we do not deal with the people and inform them directly, so local people need to be trained and supported if we really want to save a species.

Panamanian newspapers have been very supportive, with local papers reporting hunting events that take place in Azuero. A series of articles written by the newspapers *La Prensa de Panamá*, *Día a Día*, *La Crítica Libre de Panamá*, and *El Panamá América* (Día "D" Supplement), has reported on hunting activity, the deaths of monkeys and their causes, helping us focus our research and conservation plans (Fig. 4). We hope that this long-term environmental education project will help with ideas for the conservation of other Neotropical primates.

Recommendations

Azuero howler and spider monkeys are endemic subspecies not only at the country level but also at the regional level, which placed them as "Maximum Priority" for conservation measures in the Mesoamerican Primate Action Plan (Rodríguez-Luna *et al*. 1996). They are ranked as Critically Endangered on the IUCN Red List (Cuarón *et al*. 2013). The only official report on their conservation status has estimated only 145 Azuero spider monkeys still surviving in the wild (Méndez-Carvajal 2011). About 3,000 Azuero howler monkeys remain in the wild (Méndez-Carvajal 2011). Considering that these calculations include infants and juveniles, the reproductive population (adults) for these primates is considerably less. With these low numbers, we recommend that any invasive method employed to study these primates, including the use of radio collars, be avoided. For our organization, it is great to share our achievements and our future goals not only for Azuero primates, but for all the non-human primates living in Panama (Tables 1 and 2).

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Literature Cited

ANAM. 1999. Estrategia Nacional Ambiental. Análisis de la Situación Ambiental de Panamá. Report, Ministerio de Economía y Finanzas, Banco Interamericano de Desarrollo, ANAM (Autoridad Nacional del Ambiente), Panama.

Brandaris, M. C. E. 1983. Estrategia de las Adaptaciones Ecológicas de Grupos de Aulladores (*Alouatta palliata trabeata*) en un Hábitat Reducido de Vegetación Escasa. Tesis de Licenciatura, Universidad de Panamá, Panamá.

Castro, G. 2004. *Para una Historia Ambiental Latinoamericana*. Instituto Cubano del Libro, Editorial de Ciencias Sociales, Impreso en Colombia.

Cowlishaw, G. and R. I. M. Dunbar. 2000. *Primate Conservation Biology*. University of Chicago Press, Chicago, IL.

Cuarón, A. D., A. Morales, A. Shedden, E. Rodríguez-Luna and P. C. de Grammont. 2013. *Ateles geoffroyi* ssp. *azuerensis*. In: IUCN Red List of Threatened Species. Version 2013.1. Website: <www.iucnredlist.org>. Accessed: 2 November 2013.

Curtis, M. and U. Valdez. 2009. Incorporating community education in the strategy for Harpy Eagle conservation in Panama. *J. Environ. Educ.* 40: 3–15.

FAO. 2002. *Estado Actual de la Información Forestal de Panamá*. Organización de las Naciones Unidas para la Agricultura y la Alimentación (FAO), Rome, Italy.

Gligo, N. 1999. *La Dimensión Ambiental en el Desarrollo de América Latina*. Comisión Económica para América Latina y el Caribe (CEPAL), Santiago, Chile.

Heckadon-Moreno, S. 1998. *Naturalistas del Istmo de Panamá*. Instituto Smithsonian de Investigaciones Tropicales, Editorial Santillana, San José, Costa Rica.

Heckadon-Moreno, S. 2001. *Panamá: Puente Biológico*. Instituto Smithsonian de Investigaciones Tropicales-Panamá. Imprelibros-Colombia, Cali, Colombia.

Horwich, R. H. 1996. Effective solutions for howler conservation. *Int. J. Primatol.* 19: 579–598.

Jacobson, S. K., M. D. McDuff and M. C. Monroe. 2006. *Conservation Education and Outreach Techniques*. Oxford University Press, Oxford, UK.

MacKinnon, K., G. Hatta, H. Halim and A. Mangalik. 1996. *The Ecology of Kalimantan*. Periplus Editions, Singapore.

Méndez-Carvajal, P. G. 2008. Living fences: a farmer strategy that keeps the Azuero primates surviving in fragmented habitats. *Canopy* 6(2): 9–11.

Méndez-Carvajal, P. G. 2011. Population size, distribution and conservation status of howler monkeys (*Alouatta coibensis trabeata*) and spider monkeys (*Ateles geoffroyi azuerensis*) on the Azuero Peninsula, Panama. *Primate Conserv.* (26): 1–12.

Méndez-Carvajal, P. G. and I. Ruiz-Bernard. 2009. Estudio poblacional del mono araña de Azuero (*Ateles geoffroyi azuerensis*), Península de Azuero, Panamá. *Tecnociencia* 11: 24–44.

Méndez-Carvajal, P. G., M. Curti and K. Herrera de Montuto. 2006. *Las Aves Rapaces: Guía Didáctica de Educación Ambiental*. Fondo Peregrino Panamá, Panama City, Panama.

Metzel, R. 2011. Azuero Spider Monkey (*Ateles geoffroyi azuerensis*). Community Action Plan. URL:<http://www.mbzspeciesconservation.org/grant-files/reports/report-586.pdf>. Downloaded: 20 September 2011.

Oates, J. F. 1996. *African Primates. Status Survey and Conservation Action Plan.* Revised edition. IUCN/SSC Primate Specialist Group, Gland, Switzerland.

Pimbert, M. P. and J. N. Pretty. 1995. *Parks, People and Professionals: Putting "Participation" into Protected Area Management*. UNRISD-IIED-WWF, Discussion Paper (57): 60pp.

Rabinowitz, A. 2003. *Manual de Capacitación para la Investigación de Campo y la Conservación de la Vida Silvestre*. Wildlife Conservation Society, Bronx, New York.

Rodriguez-Luna, E., L. Cortes-Ortiz, R. A. Mittermeier and A. B. Rylands. 1996. Plan de Acción para los Primates Mesoamericanos. UICN SSC Grupo Especialista de Primates, Sección Neotropical. Xalapa, Veracruz, Mexico.

Ruiz-Bernard, I., Y. González, G. De León, and P. G. Méndez-Carvajal. 2010. Integración de programas de educación ambiental en proyectos de conservación de primates. Congreso Mesoamericano de Biología y Conservación, p.118. San José, Costa Rica, 8–12 November 2010. (Abstract)

Suárez, J. O. 1981. *Hombres y Ecología en Panamá*. Ed. Universitaria, Instituto Smithsonian de Investigaciones Tropicales, Panamá.

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