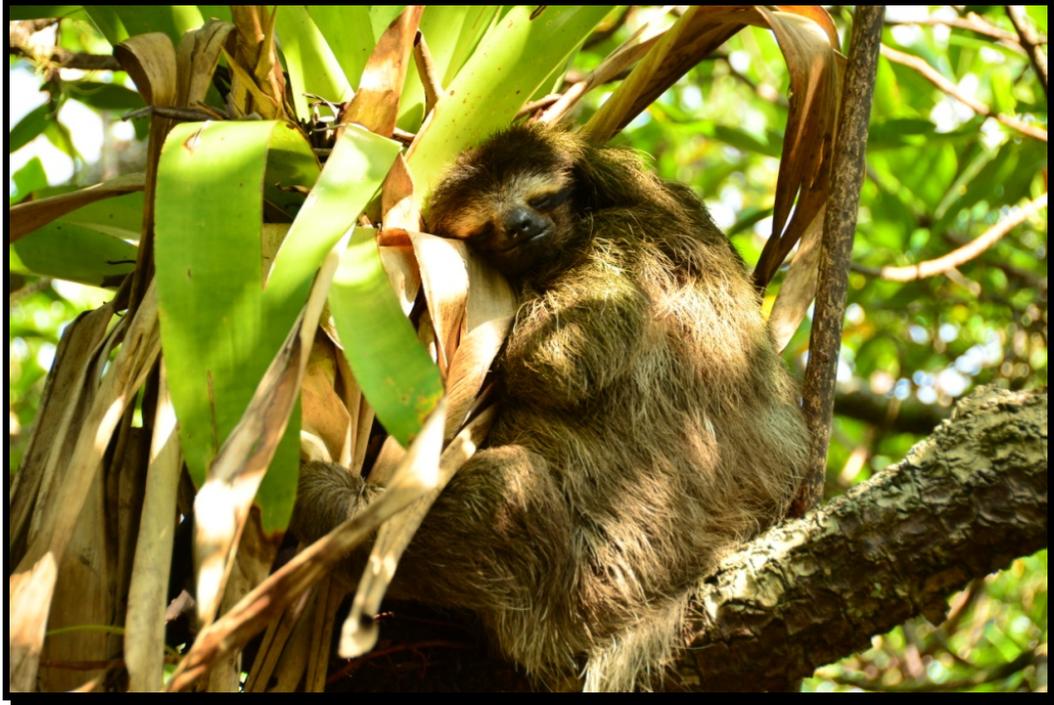


“Conserving the pygmy sloth”



**Dr. Nisha Owen
EDGE Programme Manager,
Zoological Society of London
&
Dr. Diorene J. Smith C.
EDGE Fellow,
Panama**

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Project Summary

The Critically Endangered pygmy sloth *Bradypus pygmaeus* is only found on the tiny island of Escudo de Veraguas in Panama. Although Escudo is protected, its natural resources are utilized by local communities and threatened by large-scale development. This project conducted detailed ecological surveys of pygmy sloths, combined with socio-economic questionnaire surveys in nearby fishing communities, to better understand the nature and impact of known threats to the pygmy sloth. This information was used to design targeted outreach programmes aimed at increasing local awareness, enhancing public support for conservation, and supporting local authorities in enforcing legal regulations to protect the pygmy sloth and its mangrove habitats.



Drone's eye view of Escudo © Bryson Voirin

Introduction

The pygmy three-toed sloth *Bradypus pygmaeus* is endemic to Isla Escudo de Veraguas, a 4.3 km² island 17km off mainland Panama. It is listed as Critically Endangered due to its small population size and restricted range. Described in 2001, it is considered to be Evolutionarily Distinct and Globally Endangered, ranked at #16 on ZSL's EDGE mammal list (www.edgeofexistence.org), and hence a global conservation priority.

Escudo is the only land mass in the 41,596ha Escudo de Veraguas-Dego Protected Sanctuary, part of the Ngobe-Bugle Indigenous Lands, designated in 2009 (Resolucion 0095-2009) by the National Environmental Authority (ANAM). Although uninhabited, there are seasonal visitors: indigenous fishermen and lobster divers, and occasional tourists. Local visitor numbers are increasing and they temporarily live on Escudo, utilizing the island's natural resources for fishing and cutting mangroves for charcoal and timber. There is also the threat of possible large-scale tourism development projects.

Historically there has been little conservation attention or support for this species, especially given stakeholder conflicts and mis-trust, and the IUCN Xenarthan (Anteater, Sloth and Armadillo) Specialist Group has identified a need to improve enforcement and raise awareness of the island's protected status. Further, as Escudo is part of the Ngobe-Bugle heritage, they wish to achieve a balance between their customs and culture and protection of the island. Thus, our aims are to integrate monitoring and assessment of conservation needs of the pygmy sloth, with a comprehensive community engagement programme to raise awareness, promote sustainable resource use and improve management of the island.

ZSL's EDGE of Existence Programme highlights the pygmy sloth as one of its flagship species, and is committed to building capacity for its conservation through supporting Panamanian conservationist, Dr. Diorene Smith, under a two-year Fellowship Programme of training and mentoring funded by PTES. As a direct result of our support, Diorene is now recognised as a champion for the pygmy sloth. She has joined the Xenarthan Specialist Group and has helped to establish a collaborative 'Committee for the Protection of the Pygmy Sloth' overseeing conservation and research activities.

Diorene is working collaboratively with local communities, NGOs, local and national authorities with the goal of conserving the pygmy sloth and advising on effective sustainable management of Escudo. Conservation of Escudo benefits not only the pygmy sloth, but other endemic species and subspecies including: the fruit bat *Artibeus incomitatus*, the Escudo rufous-tailed hummingbird *Amazilia tzacatl handleyi*, Escudo manakin *Manacus vitellus amitinus*, Escudo bay wren *Thryothorus nigricapillus oedipus* Escudo blue-gray tanager *Thraupis episcopus caesitia*, and maritime worm salamander *Oedipina maritime*.

ZSL scientists have undertaken an ecological assessment of the sloth population in the mangroves (in 2012 and 2013), estimating ~100 individuals remaining in the coastal mangrove habitats and documenting anthropogenic disturbance on the island. This project has developed a long-term monitoring protocol to detect any changes in population size, and further investigating the potential presence of sloths in interior tropical forests and swamps. Socio-economic surveys of local fishing communities and disturbance assessments have improved our understanding of the nature and impact of threats to the pygmy sloth from natural resource use such as mangrove cutting for fuel and possibly hunting, informing recommendations for Escudo management authorities.

Project aims and objectives

1. Conduct a population, distribution and ecological survey of pygmy sloths on Escudo de Veraguas, to generate a detailed density measure and population estimate for the species as well as an understanding of habitat use and behavioural ecology.
 - a. Generate a detailed density measure and population estimate for the species as well as an understanding of habitat use and behavioural ecology by conducting four three-week intensive field surveys and GPS-collaring five individuals for 12 months.
 - b. Identify and quantify the key pressures (social and economic) on the surviving pygmy sloth population through socio-economic questionnaire-based interviews with the Ngnobe Bugle indigenous people in five neighbouring mainland communities.
2. Determine the significance and nature of direct hunting by local communities and mangrove extraction as threats to pygmy sloths across Escudo, through associated field survey data and the use of socio-economic questionnaire surveys into local community resource consumption patterns.
3. Mitigate identified threats through the design and implementation of informed, targeted outreach programmes that increase local awareness, enhance public support for conservation, and support local authorities in enforcing legal regulations to protect the pygmy sloth and its mangrove habitat.
 - a. Implement informed, targeted outreach programmes in five neighbouring mainland communities (month 10 onwards).
4. Build in-country conservation capacity to safeguard the pygmy sloth and the future of Panamanian biodiversity more generally.
 - a. Provide training and mentorship for an in-country emerging conservationist through the EDGE Fellowship scheme. This project will help fund an EDGE Fellow (Diorene Smith Cabellos) who, with training and mentorship from ZSL, will lead the field activities detailed below.

Project partners and personnel

- Dr. Nisha Owen, EDGE of Existence Programme Manager, Zoological Society of London. Responsible for general oversight of the project, mentoring and technical support of the co-PI, Dr Diorene Smith, including training and development of ecological survey capacity in Diorene and her field assistants.
- Dr. Diorene Smith, ZSL EDGE Fellow, Instituto Conmemorativo Gorgas de Estudios de la Salud, Panama City. Responsible for co-ordinating: on the ground implementation of ecological (transects and satellite tagging) and socio-economic surveys; outreach activities, including the development of environmental education materials and training programmes in sustainable resource use; and coordinating and facilitating stakeholder collaborations and workshops with local communities, NGOs (Aprorenab), authorities, and the Committee for the Protection of the Pygmy Sloth. As a qualified veterinarian, Diorene will also ensure animal welfare is paramount in all ecological surveys.
- Ms Cassandra Murray, Discovery & Learning Evaluation Officer, Zoological Society of London. Responsible for oversight and support of the communication, education and public awareness aspects of the project, including training and development of social science capacity in Diorene and her field assistants.
- Hidalgo and field assistants from the local community of Kusapin. Responsible for assisting Diorene on the ground and liaising with local communities, and for participating in future long-term monitoring (both transects and monitoring of collared sloths) after training.
- Local staff: for the purposes of field visits we will employ local staff for boat transport to and from Escudo and for travel around the local communities, for cooking and general assistance.

Project partners and the main points of contact who will be closely involved in the development of the project and the implementation of outreach and training activities are:

- Israel Tejada and Eligio Castillo, of the National Environmental Authority (Mi Ambiente), Department of Wildlife and Protected Areas. Responsible for oversight of law enforcement to protect Escudo, and to implement conservation management plans for both the pygmy sloth and Escudo, in conjunction with the Ngobe-Bugle traditional authorities. Will participate in the development of the conservation management plans and be ultimately responsible for implementation.
- Fishermen's Association and artisanal divers, Kusapin District. Responsible for organising and managing the local fishermen and divers. Will participate in training and workshops and are receptive to the need for sustainable use and management of Escudo's resources, and the need for conservation of the pygmy sloth habitat.
- Panama Ministry of Education, Department of Student Affairs. Responsible for education in the districts of Tobobe, Kusapin and Bahia Azul. Teachers will participate in promoting environmental education to raise awareness of Escudo and the pygmy sloth, and the importance of conservation, to elementary level students, as part of the school curriculum.
- Mr. Teófilo Santiago and Ausencio Ramos, Ngobe-Bugle Association for the Protection of Renewable Natural Resources (APRORENAB). Local NGO with Ngobe-Bugle members. Will encourage the active participation of members in training, environmental education activities, and workshops.

- Francisco Herrera and Daniel Holness, CEASPA (Centro de Estudio y Acción Social Panameño). Founded in 1977, CEASPA is a nonprofit organization that promotes and supports national proposals that contribute to economic growth equity, participation, democracy and environmental development of mostly indigenous communities.

Methodology

Ecological research

Diorene Smith and this project have led on the majority of research on the pygmy sloth to date. The pygmy sloth was only recognised and described in 2001 (Anderson & Handley 2001), and is IUCN red-listed as Critically Endangered (Anderson et al. 2011) due to a small population size and restricted range. This species is of particular importance due to its Evolutionary Distinctiveness and Global Endangerment (Collen et al. 2011), resulting from its unique dwarfism evolved in an insular environment (Anderson & Handley 2002).

Recent population surveys in 2012 and 2013 focused only on the coastal mangrove habitats and estimated ~100 individuals in approximately ~1.5km² of mangroves (Kaviar et al. 2012, Curnick et al. in prep). However, local knowledge has indicated the presence of sloths in the tropical forests and swamps around the island, despite scientists previously believing that sloths were ecologically restricted to mangrove habitats, which ZSL has confirmed for the first time in this project. This project has established a baseline for continued long-term monitoring, to enable the detection of any population declines.

Encounter rates produce estimates of relative abundance, which can be compared to identify core areas of habitat with greater numbers of sloths, and to detect any changes in abundance over time. If sufficient sloths are recorded, the Distance sampling protocol (Buckland et al. 2001), will in future allow an estimate of the population density to be calculated. This methodology has already been successfully trialled on Escudo (Curnick et al. in prep), yielding more than 60 sightings over seventy 50m transects, and all mangrove patches on the island have now been identified and mapped. This method therefore yields sufficient data for population estimation using Distance software, meeting the minimum requirements of 60-80 sightings.

Now that the long-term monitoring protocol is established, surveys continue to be conducted twice per year, in March and October, as this is the best time to visit Escudo, due to stormy weather during the rest of the year. Multiple line transects were surveyed either on foot or by kayak, randomly distributed throughout the mangrove habitat and in the interior forests. Transect data recorded includes standard observations (e.g. date, time, transect ID), and any pygmy sloth sightings measure distance from observer, height above ground, compass bearing from observer and to transect, habitat type, numbers, age and sex of sloths, behavioural notes, and GPS locations for every sloth.

Data was also collected on anthropogenic disturbance throughout Escudo, both in standardised formats on transects and presence / absence surveys, and anecdotally, when encountered. Anthropogenic use is primarily deforestation and mangrove cutting, and data was recorded on the extent, age, and location of such incidents. Data was collected on other types of human disturbance, such as fires, paths, litter, signs of hunting, or other activities. Ongoing data collection through socio-economic surveys assesses resource use, attitudes, knowledge, and behaviours around and on Escudo. Surveys have continued to record disturbances in the mangroves and forest caused by human activities, which have been increasing with each visit.

Given the limited information currently known about the pygmy sloth, this combination of population estimates with more detailed ecological data from the use of radio collars, will ultimately enable us to understand the dynamics of this species within their small range, threats

to both the sloths and their habitats, and their conservation needs, as a sound scientific basis for conservation planning and appropriate management.

Welfare & ethics: This project has obtained a scientific research permit granted by the National Environmental Authority (ANAM) for all proposed activities. The pygmy sloth *Bradypus pygmaeus*, like its closest relative *Bradypus variegatus*, are quiet species that allow simple and brief handling for placement of the collars. They do not require the use of anaesthetics or sedatives. The radio collars have a weight of 45 grams and will not hinder natural behaviours. The placing of collars will take a maximum of 20 minutes, minimising the level of stress generated by human disturbance. Collars were placed on 5 adult individuals in March 2015, identified by size and weight as adults, and males have a bright orange patch on the back, while females do not. Collared animals were relocated in Oct 2015 and examined to check for any impacts of the collars, and none were found. No other methods will be invasive or require any handling or interference with animals. Survey observers will maintain quiet conditions and will not disturb any individuals.

Community outreach and education

The Ngobe-Bugle authorities govern through local ‘caciques’, and a national and county-level regional Congress. As Escudo is part of the country, all research requires the approval of local chiefs, hence dissemination of our results is vital. General outreach activities included talks and focus groups with the multiple local communities to share results on the population, ecology and habitat needs of the pygmy sloth. These discussions on each visit have been integral to the development of our project, creating trust between Diorene and the local communities, inspiring community participation, enabling acceptance of the study by the district authorities, and incorporating feedback from schools and learning institutions as to how to develop further educational activities.

Schools educational programme

The aim of the educational programme in elementary schools is to raise awareness of the importance of the pygmy sloth and Escudo both in terms of ecosystem services, such as the provision and maintenance of natural resources, and as a part of the Ngobe-Bugle heritage; in doing so, we aim to engender support for conservation.

Materials centre around environmental tools to guide classroom activities with teachers in schools, as a supplement to courses in natural resources and/or extracurricular activities. These are targeted towards school children at elementary level, from 3rd – 6th grade between the ages of 5-12 years. Diorene’s previous social surveys have indicated that children in this age group are often taken to Escudo by their parents, who are local fishermen and divers using the resources around Escudo, to learn the craft of artisanal fishing and diving at a very early age. Hence these children are the next generation who will need to sustainably manage Escudo’s resources, and also able to influence current practices by their parents and families.

Environmental education was undertaken in conjunction with the Departments of Environmental Education and Student Affairs, Ministry of Education. Teachers from this institution have collaborated on the development of these materials and will be trained in delivery. Monitoring and evaluation will be carried out using pre- and post-intervention surveys sampling at least 30 students across the schools, to assess changes in knowledge, attitudes and behaviours before and after the environmental education programme. As a result of this, recommendations for

continuing environmental education with the Ministry of Education post-project will be developed, to ensure that activities can be adapted for future use where necessary.

Fishermen and divers sustainable use programme

Traditionally, local communities have told myths and stories about Escudo for generations, about the spirits of the island and ancient indigenous inhabitants who protect important parts of the island. However, these stories are dying out and unsustainable resource use is growing. Highlighting the cultural importance of Escudo and emphasising local ownership will encourage the establishment of economic livelihood activities based on the sustainable use of resources. Education includes raising awareness of the level of protection of Escudo and what activities are permitted, sustainable management of local tourism, and management of inorganic waste that arrives on Escudo. Monitoring and evaluation will again be carried out using pre- and post-intervention surveys, to assess changes in knowledge, attitudes and behaviours before and after the sustainable use programme, sampling at least 30 fishermen and/or divers.

The workshops are held in conjunction with the NGO APRORENAB Ngäbe-Bugle and CEASPA, the National Environmental Authority, and the Aquatic Resources Authority. Community activities initially commenced based on 2013 data collected from fisherman and divers from the communities of Paterson island, Kusapin, Bucori and Punta Escondida, conducted both in groups and individually. Based on the information gathered, workshops were developed to highlight the work on Escudo with the pygmy sloths, and present this to communities throughout Kusapin District, as well as the National Environmental Authority (ANAM), other authorities and NGOs.

Stakeholder engagement and capacity building

Facilitation of stronger links between APRORENAB (Ngobe-Bugle Association for the Protection of Renewable Natural Resources) and the fishermen and divers (through participatory workshops) have inspired a sustainable mindset within the Fisherman's Association, and empowered the Ngobe-Bugle community to more independently manage their own natural resources. This continues to be achieved through wider participation and facilitation of interactions within outreach activities and the sustainable use programme, to encourage the Fisherman's Association to become affiliated with APRORENAB as a recognised non-profit organisation to inspire support for conservation.

Building in-country capacity

Conservation can be best achieved through empowering and developing in-country conservationists. This project has developed Diorene's capacity through the EDGE Fellowship Programme: a two-year programme of mentorship and support, providing £10,000 of funds plus training courses in conservation tools and conservation leadership, and ongoing advice and support combined with project visits.

Training was also undertaken with local field assistants to continue data collection and monitoring, fishermen and divers and APRORENAB members to assess sustainable resource use and anthropogenic activities on Escudo, to ultimately empower local communities to be capable of contributing towards conservation management of Escudo through inclusion in management planning and implementation. This is particularly important on Escudo where the Ngobe-Bugle manage Escudo with little intervention from the National Environmental Authority, under the continuing threat of large-scale tourism from foreign interests.

Results to date

Ecological research: Conduct a population, distribution and ecological survey of pygmy sloths on Escudo de Veraguas, to generate a detailed density measure and population estimate for the species as well as an understanding of habitat

Practical activities on Escudo de Veraguas island are limited by sea conditions to 2 seasons per year, March/April and September/October, which is when the local fishermen and divers also visit the island.

During the time of the funding, we made four visits to Escudo – March 2014, October 2014, March 2015 and October 2015. During each visit, we are able to consolidate and extend the system of permanent transects for long-term monitoring of the pygmy sloth. We have now surveyed a total of 118 transects, of approximately 7km, in both the mangroves and the forest habitat (figure 1). This enables us to calculate a relative abundance estimate of sloths per kilometer of transect per survey visit. To date, 73 pygmy sloths have been recorded, 22 outside of the systematic transects and 51 in the transects. We have now established a baseline that will allow us to detect changes in pygmy sloth abundance, while allowing for conditions such as heavy rain and wind, because during these times the sloths move to the woods bordering the mangroves for protection.

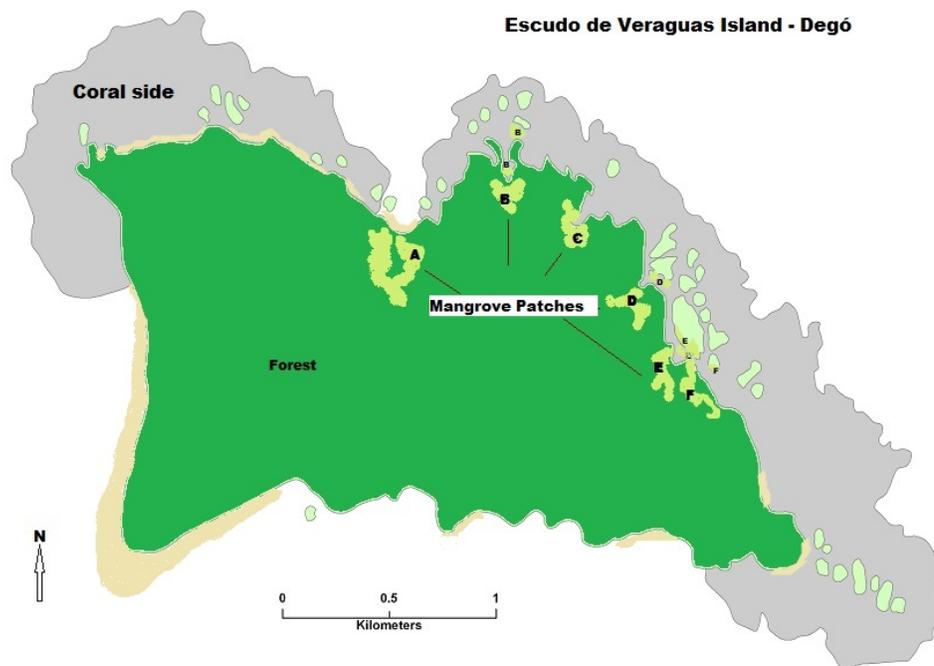


Figure 1: Mangrove patches on Escudo

For every transect (and for pygmy sloths observed outside of the systematic transects), data recorded includes GPS point, number of pygmy sloths observed, sex, estimated age, activity, weight, morphometric measurements (weight, head body length, claw length), weather conditions, time/date, forest cover, tree height, dominant tree species, visibility along transect.

All anthropogenic disturbances are also recorded, such as mangrove cutting, timber cutting, species, number/size of cut stems, date and GPS point. The data collected each field visit is being consolidated to produce a baseline GIS map and figures for ongoing monitoring.

In October 2014, the presence of the pygmy sloth was officially confirmed for the first time ever deep in the forests, when a female pygmy sloth was observed on a tree on one of the forest transects (figure 2). Previously they were believed to inhabit only the mangroves so this was evidence that they move and feed within the forest habitat as well. To investigate this, in March/April 2015, we collared 5 adult pygmy sloths (figure 3; 3 males and 2 females, greater than 3kgs, and not pregnant), in an attempt to record their movements, activity, and GPS locations over the next six months, using radio collars (ATS Tracking, M1940) combined with tracking devices called 'Mataki' tags (mataki.org). These tags enable downloading of information to handheld devices, so the sloths do not need to be recaptured, and are lighter and more economical than satellite collars. In October 2015, we relocated 3 of the collared individuals, but were disappointed to find that the tags had detached from the animals, most likely due to the extreme humidity and salt-water corrosion present within the mangroves. The 3 relocated individuals were weighed and checked to ensure no adverse effects from the collars or tags were present. The 2 other collared individuals were located within the forest habitat again, but could not be accessed. Unfortunately, we were not able to pick up any data signal from these two individuals either despite setting out multiple base-stations over the time the island is accessible. However, we plan on repeating the tagging but using an improved attachment mechanism that will bypass the problems we have experienced to date and enable us to collect data on their movements, which is even more vital now that we know 2 of the collared individuals were within the forest.



Figure 1: Female pygmy sloth in the forest transect © Diorene Smith / ZSL



Figure 2: Collared pygmy sloth © Nisha Owen / ZSL

Anthropogenic threats

We also recorded levels of human disturbance to the island during surveys, which continues to increase from season to season. The fishing and diving seasons are when most indigenous people use the island, March/April and Sept/October, and activities during that time also seem to be increasing. The main threats identified to date are unsustainable use of natural resources, including illegal activities. Mangrove cutting (figure 4) and logging (figure 5) for local use is relatively small-scale, which seems to be primarily for building temporary huts and cooking areas. Species targeted include *Ferruginea Vochysia*, *Manilkara spp.* *Rhizophora mangle*. It appears that logging activities are increasing, and the numbers of huts being constructed are increasing. Wood may also be being removed from the island, as stacks of planks were photographed on the beach, ready for loading into a boat (figure 6). Sacks of coconuts for removing from the island were also photographed, which is another illegal collection activity. Field visits have also discovered the activities of unlicensed 'researchers' and collectors who visit Escudo to take specimens. Likewise, there is little control over the presence of yachts and tourist boats. Pollution is a major issue because of the scale of litter (figure 7), as there is very little in the way of waste disposal in the region. Some of the indigenous Ngäbe usually bring their pets (dogs and cats) and farm animals (chickens, pigs) which pose a risk to the local flora and fauna. In March 2015 we also recorded shark fin collection and drying (figure 8), counting over 30 fins. The fine meshed nets used by fishermen also catch a great deal of by-catch, and are frequently discarded on the island or in the waters (figure 9).

We intend to include environmental laws in the educational and community engagement activities, and have already taken steps to improve reporting of illegal activities, by all stakeholders, to the National Environmental Authority. This will ultimately also support measures for sustainable resource use, so a monitoring system can be in place to ensure over-exploitation is reduced and limits can be enforced.

However, we are now accompanied each season by a Ministry ranger, who is able to take action whenever we encounter illegal activities. At this initial stage, this has been a discussion of legal and illegal activities, to ensure people are aware that certain activities are illegal, prior to taking enforcement action. For example, fishermen also attempted to sell us a hawksbill turtle, which we confiscated and released back into the sea (figure 10). We are therefore confident that our continuing visits with the Ranger will see a reduction in illegal activities due to increased awareness and the knowledge that the Ranger will be present. The cost of visiting Escudo is so high that the Ministry currently does not have funds for regular patrols. During every visit to Escudo island, talks were held with all of the fishermen and divers present and the active participation of the Ministry ranger, so that they were aware of the study activities and the importance of the island and sloths.



Figure 3: Mangroves cut by chainsaws and machetes © Diorene Smith / ZSL



Figure 4: Logging in the forest © Diorene Smith & Nisha Owen / ZSL



Figure 5: Stacks of logs waiting on the beach © Nisha Owen / ZSL



Figure 6: Increased garbage in fishing seasons © Nisha Owen / ZSL



Figure 7: Shark fins © Nisha Owen / ZSL



Figure 8: Use of fishing mesh © Diorene Smith / ZSL



Figure 9: Hawksbill turtle confiscated and released © Nisha Owen / ZSL

Community outreach: mitigate identified threats through the design and implementation of informed, targeted outreach programmes that increase local awareness, enhance public support for conservation, and support local authorities in enforcing legal regulations to protect the pygmy sloth and its mangrove habitat.

Outreach

Communications between the different groups of divers and fishermen that use the island continues to be divided by internal conflicts between communities. This has led to a more advanced strategy for raising awareness and establishing communications between the groups. A new collaboration has recently been developed between ZSL and a non-profit organization, Panamanian Studies and Social Action Centre (CEASPA), which started to work in the area in 2014. CEASPA has a solid track record in environmental education in the Ngabe Bugle indigenous communities, and will enhance the trust and credibility of our project within the communities that utilize Escudo's resources. This, along with our already established relationships with the Association for the Protection of Renewable Resources APRORENAB, and the Ngäbe Bugle Comarca, has facilitated our community engagement and the participatory process, allowing us to expand our remit to include even more communities in the coming year.

Our community activities began with the data collected from fisherman and divers from the communities of Paterson island, Kusapin, Bucori and Punta Escondida, conducted both in groups and individually (figure 11). They were asked about the pygmy sloth, management of natural resources, knowledge of Escudo, local perceptions on changes in the ecosystem, and organizational capacity to sustainably manage their natural resources. Photographs, posters,

and maps were used to facilitate understanding, and conducted in Ngobere translated by Hidalgo Taylor, and indigenous Ngäbe and research assistant. This information was then used to prepare the workshops held in 2015.



Figure 10: Community interviews (c) Craig Turner / ZSL

Key information obtained was:

- The association of artisanal fishermen and divers of Kusapin stressed the need to organize as an association (legal entity) and encourage active participation and union of fishermen and divers to join the association.
- They expressed their concern as divers and fishermen in Isla Escudo de Veraguas, that the study could disrupt or limit the use of the island.
- They presented their needs as fishermen and divers and the risks of their work and what it costs them to get resources when they go to the island.
- The need for more effective communication with the Ministry of Environment and Aquatic Resources Authority of Panama on the regulations for the seasonal closure of the lobster fishery, and fishing and diving techniques.
- They expressed their concern about the future of the Escudo de Veraguas Island and ignorance of the importance of protecting the island and its ecosystem.

A high level of poverty and lack of employment opportunities outside the fishing and artisanal diving is very characteristic of the communities in the district of Kusapin. Families are primarily comprised of a father who obtains food and an income, and a mother who cares for children and housework. The number of children per family is usually three or more, and they usually attend the community school.

We were able to identify the primary communities that depend on the resources of Escudo de Veraguas: Tobobe, Cayo Paloma, Paterson Island, Bucori, Ensenada, Red Beach, Punta Siraín Green Beach, Pueblo Nuevo, Punta Escondida, and Blue Bay. The community of Rio Caña does not engage in artisanal fishing and diving, but as it is only 45 minutes from the island it is the headquarters of the Ngäbe Bugle NGO, Aporenab.

Based on the information gathered, workshops were launched in May 2015 to highlight the work on Escudo with the pygmy sloths, and present this to communities throughout Kusapin District, as well as the National Environmental Authority (ANAM), other authorities and NGOs.

Four workshops were delivered in Kusapin district, in collaboration with the Ministry of Environment of the Comarca, in the communities of Punta Siraín, Tobobe, Playa Roja and Bucori. These were attended by district authorities, representatives of the regional Congress Ño Kribo and general Congress, as well as the Mayor of the District of Kusapin. Each workshop included the following, using simple language and visual aids: an overview of the pygmy sloth and Escudo de Veraguas island, an explanation of the study and preliminary results, and a discussion of the possible threats to the conservation of the island (including waste management, timber/mangrove cutting and collection, and the presence of pets) and potential solutions.

Each workshop was attended by between 40-60 people, mostly fisherman and divers, some women, seniors, and some children and teachers. Afterwards, participants completed a simple questionnaire to analyse changes in perceptions. Most attendees requested that the workshops be expanded to other communities, such as Playa Verde, Cayo Paloma, Punta Nispero, and others close to the Island, which we plan to do in the coming year. The Ministry of the Environment used the workshops as an opportunity to discuss regulations and laws concerning the hunting of turtles, diving and fishing prohibited species, and indiscriminate felling.

Based on the successful outcomes achieved during the PTES-funded duration of this project, in 2016 a further workshop will be held following this protocol. In 2017, three further training workshops (for 90 people) will be held for the communities on:

- waste management and recycling,
- sustainable tourism in small communities,
- traditional craft activities and using recycled materials.

These workshops will be led by groups of female indigenous Ngäbe Bugle from other areas, who through effort, dedication and initiative have succeeded in these activities. Historically, it has not been easy for fishermen and divers to find alternative livelihoods. These workshops will be able to show participants that other communities have been able to organize and practice sustainable resource use, and utilize alternative livelihoods, encouraging them to take up these practices. Workshops will be held in locations accessible to as many different communities as possible, open to men and women, and in conjunction with the Ministry of Environment, Regional Congress and local authorities. These will finally allow us to implement alternative livelihoods and economic development, building on ground work to date.

These activities with the communities and the collaboration with the Ministry of Environment authorities, have laid the foundations for progressing with our plans to develop a participatory management plan for Escudo and conserve the pygmy sloth. This is particularly important when we consider the difficulty of working with individuals in the community, who are frequently reluctant to give information in personal interviews for fear of any consequences, or to fill in participant details in workshops, which caused much controversy as they believe this information can be misused. We are slowly establishing trust and collecting this data.



Figure 11: Workshops

Environmental Education

In April 2014 we visited the following schools to meet with and discuss an environmental education curriculum with directors and teachers, and to establish numbers and ages of students attending: Kusapin School C.E.B.G., Buena Vista School (Paterson Island), Telebásica School of Bucori School and Basic Education Center of Bahía Azul. However, there are some problems with the administration of the existing educational system, in that one school had not yet named a new director after the previous one departed, and at another school the director could not be located. Despite this, we discussed which age groups to target, and materials and visual aids needed, to produce a workbook for students and an instruction guide for teachers, and established a point of contact at each school to work with, as well as conducting some introductory sessions with students (figure 12). However, the ability to work with the teachers in this area is limited, as it is difficult to access and the Ministry of Education do not maintain permanent staff there. Hence there is constant turnover, limited communication, and a lack of internet and telephone lines, so progress in developing the materials was slow. The majority of work is conducted during the seasonal visits to the region, with boat access to many of the communities limited to favourable weather.



Figure 12: Introductory environmental education sessions (c) Nisha Owen

Materials centre around environmental tools to guide classroom activities with teachers in schools, as a supplement to courses in natural resources and/or extracurricular activities, with a comprehensive classroom based workbook on living things, ecosystems, and conservation, which covers:

- Module A: Living things and their functions
 - Plants, invertebrates, fish, reptiles, amphibians, mammals,

- Living things important in Escudo de Veraguas
- Module B: Ecosystems
 - Water, land, and ecosystem services
 - Care and protection of ecosystems
 - Escudo de Veraguas, a treasure to be protected
- Module C: Practicing Conservation
 - What are sloths
 - What is the pygmy sloth on Escudo and why is it important
 - How I can help protect the pygmy sloth?

This is supplemented by a poster per school, as requested in initial consultation with the community and teachers. Finally, a puppet play and storytelling dramatization has been developed, bringing this for the first time to these remote communities, and ensuring the conservation message is conveyed in a fun and interactive way.

These materials have been developed during the PTES-funded duration of this project, and will be implemented in 2016 in four schools in four communities, reaching 100 students: School Telebásica (Bucori), School Kusapin (Kusapin), Center for Basic Education (Blue Bay), and College Buena Vista (Isla Paterson). This will be expanded in 2017 to three further schools and communities (Red Beach, Rio Caña, Tobobe). Additionally, in 2017 a contest for student conservation will be held in the fifth year of secondary school (the year with highest attendance and student numbers, and where social work is a mandatory educational component), where groups of 5 students submit a proposal for raising awareness of the pygmy sloth in their community, and conduct this as part of their social work school activities. The most impactful group will win the opportunity to visit Escudo and assist Diorene in field work, directly learning about the pygmy sloth and fostering their continued interest in the natural world and conservation.

Capacity building: build in-country conservation capacity to safeguard the pygmy sloth and the future of Panamanian biodiversity more generally.

Dr Diorene Smith (figure 13) successfully completed her EDGE Fellowship from 2012 until December 2015. Diorene has received extensive training in implementation of ecological and social activities on the Conservation Tools training course (Nov 2012), three field-visits (March 2013, March 2014, March 2015) for one-to-one training in ecological monitoring and social science, and attended a 2-week Conservation Leadership training course at ZSL (Sept 2014). We plan to continue this with ongoing mentorship from ZSL and inclusion in training and networking opportunities, allowing her to engender further conservation support from amongst the indigenous people, and successfully implement a comprehensive conservation programme centred on the pygmy sloth.



Figure 13: Dr Diorene Smith, EDGE Fellow (c) Bryson Voirin

A Scientific Committee has been set up, which includes Dr Diorene Smith, to review all scientific activities happening on the island, in conjunction with the Comarca. APROENAB members have been actively involved in the workshops, and the workshops have been a mechanism to start developing the network of stakeholders with interests in Escudo and the pygmy sloth. We are also involving more and more community members in conducting monitoring activities when they go to Escudo. The visits in 2014 and 2015 included multiple members from Kusapin, Tobobe and Rio Bonito communities, as well as Ministry rangers, who were trained and able to actively participate in the transects, observing and counting pygmy sloths.

Looking to the future

Given the threat of tourism development, and existing mis-trust between stakeholders such as the local communities, foreigners, and ANAM, we considered it vital for us to work towards facilitating and develop a network of stakeholders with interests in Escudo and the pygmy sloth, to ensure inclusion and participation in all related activities, to promote conservation and sustainable practices on and around Escudo. This is ongoing through stakeholder workshops bringing together the scientific community, local communities around Escudo including the fishermen and divers, the Ngobe-Bugle chiefs and Congress, the National Environmental Authority and the Aquatic Resources Authority. Only once this is achieved can participatory actions for conservation be developed and supported.

Diorene has already made headway in this through building links with all stakeholder groups and encouraging multi-stakeholder activities, which will continue to be developed throughout the lifetime of the project. To date however, this process has not been easy due to internal conflicts between the different community groups, as there is competition and distrust between the fishermen and divers, hence the need to build trust and relationships between these stakeholders.

These activities with the communities and the collaboration with the Ministry of Environment authorities, have laid the foundations for progressing with our plans to develop a participatory management plan for Escudo and conserve the pygmy sloth. This is particularly important when we consider the difficulty of working with individuals in the community, who are frequently reluctant to give information in personal interviews for fear of any consequences, or to fill in participant details in workshops, which caused much controversy as they believe this information can be misused. We are slowly establishing trust and collecting this data.

There has been a growing interest in developing a conservation management plan for the pygmy sloth and Escudo, with interest from the Committee for the Protection of the Pygmy Sloth, various NGOs, the National Environmental Authority, members of the Ngobe-Bugle indigenous community, and scientific researchers. Further funding is being sought by ZSL, CEASPA, the National Environmental Authority and Ramsar's Regional Centre for the Western Hemisphere from the Global Environment Fund and Defra's Darwin Initiative for future implementation of this plan. This project also links to ANAM's "Corredor Biológico Mesoamericano del Atlántico Panameño" (CBMAP) project and the Panamanian Government's "Proyecto de Desarrollo Rural Sostenible de la Comarca Ngobe Bugle", a development project funded by the International Agricultural Development Fund (IFAD) focused on addressing indigenous peoples' poverty in the Ngobe-Bugle Indigenous Territories. However, the process of developing a participatory plan is essential to ensure that it is supported by all stakeholders, particularly the local communities. We propose to facilitate and co-ordinate workshops with all stakeholders to disseminate the conservation needs of the pygmy sloth, and develop participatory recommendations for sustainable use and continued protection of Escudo. Ultimately, this participatory initiative will be the first of its kind in the region, and Diorene has already made significant progress in building relationships and networks between stakeholders despite the presence of mistrust and conflicts.

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