Analyzing human-wildlife conflict reports and public awareness and perceptions of *Solenodon paradoxus* and *Plagiodontia aedium*, Hispaniola's last endemic mammals (West Indies)

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DECLARATION OF OWN WORK

I declare that this thesis

Analyzing human-wildlife conflict reports and public awareness and perceptions on *Solenodon paradoxus* and *Plagiodontia aedium*, Hispaniola’s last endemic mammals (West Indies)

is entirely my own work and that where material could be construed as the work of others, it is fully cited and referenced, and/or with appropriate acknowledgement given.

Signature

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Name of Supervisor Richard Young/ Samuel Turvey/ Jose Nuñez-Miño

TABLE OF CONTENTS

LIST OF ACRONYMS

DR	Dominican Republic
EDGE	Evolutionary Distinct and Globally Endangered
GLMs	General Linear Models
HWC	Human Wildlife Conflict
IABIN	Inter American Biodiversity Information Network
IABIN I3N	IABIN Invasive Information Network
IUCN	International Union for Conservation of Nature
ZOODOM	National Zoological Park, Dominican Republic
ZSL	Zoological Society of London

ABSTRACT

The Hispaniolan solenodon (*Solenodon paradoxus)* and Hispaniolan hutia (*Plagiodontia aedium)* are the last surviving endemic mammals of Hispaniola, West Indies. They are rare species classified as Endangered in the IUCN Red List which extinction would mean the loss of an irreplaceable evolutionary distinctiveness. Due to charcoal burning and clearance for agricultural expansion their habitat is being degraded. The presence of both species near human settlements is becoming more common, increasing the level of human-wildlife conflict (HWC), which is suspected to be a widespread problem. This study assess the levels of public awareness of both species in the buffer zone of the Sierra de Bahoruco National Park and evaluates the extent of HWC. Significant differences in spatial and cultural patterns of knowledge were found for both species and the potential use of abundance perceptions and personal experience for monitoring the status of these species population was investigated. Predation by hunter and farmer dogs was found to be a major source of mortality. Levels of tolerance to damage by wildlife were analyzed, no finding difference between Dominicans and Haitians. However, they showed very different attitudes towards environment conservation. This study will contribute to better understand the conservation needs of both species and to design and implement effective public awareness raising campaigns.

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1. INTRODUCTION

As human population growths, demand for resources and access to land increases, boosting the competition for space and resources between wildlife and people (Pimm et al. 1995). As a consequence of this overlap of requirements, a human-wildlife conflict (HWC) occurs. This is a global problem, not restricted to a particular ecosystem or geographical region (Woodroffe et al. 2005). However, it is in rural communities from developing countries where the impact of HWC is more intense. Because people livelihoods (i.e. livestock holdings and agriculture) rely directly on natural resources, the costs they bare are higher.

HWC is a complex problem. It creates costs to both wildlife and human populations. Species which are most exposed to conflict are more prone to extinction (Ogada et al. 2003). As a consequence of habitat degradation wildlife populations are fragmented and confined to smaller and more distant patches of habitat. Besides, they are susceptible to human-induced mortalities either accidental or intentional. Indeed, HWC has become a serious threat to the survival of many species, especially endangered and endemic ones (Distefano, 2005). Human costs are mainly economical, through the damage of property and infrastructures, crop damage by raiding species and livestock predation. As a consequence of these losses, people take active action against wildlife through direct targeting by poison, shooting or hunting. However, the extent to what they do it depends on their level of tolerance towards the damaging species, which is not always in line with the real impact of the species on their livelihood (Frank et al. 2005). Therefore, understanding people perceptions and attitudes is essential to mitigate HWC situations.

Hispaniola is the second-largest island after Cuba and the only one in the West Indies shared by two sovereign states: Dominican Republic and Haiti. It is probably the least know, yet the most diverse island of the Great Antilles. Up to 25 endemic land mammal species comprising sloths, primates, insectivores and rodents could be found once living in it, of which, only two species have survived: the Hispaniola solenodon *Solenodon paradoxus* and the Hispaniola hutia *Plagiodontia aedium*.

1.1 *Solenodon paradoxus*

S. paradoxus and *Solenodon (Atopogale) cubanus* (endemic to Cuba) are the only surviving insectivores in the Caribbean. They are large, shrew-like animals that are nocturnal and display ancient unique features such as the capacity to inject venomous saliva into their prey via grooved lower incisors (Rabb, 1959). They are believed to have diverged from other insectivores 76 million years ago (Roca et al., 2004) during the Cretaceous period, when the dinosaurs still inhabited the Earth. This estimation for Solenodon divergence is substantially older than the basal divergence of most mammalian orders. Therefore the genus *Solenodon* could be regarded as one of the oldest and most basal placental mammal still alive (Varona, 1983). Both surviving species have always been considered rare and even believed at one time to be extinct (Taboada et al. 2007). Today, they are classified as Endangered and declining in population in the IUCN Red List (IUCN, 2010). Their extinction would mean the loss of an entire evolutionary linage along with its irreplaceable evolutionary distinctiveness. For this reason, they are listed among the top five priority mammal species for conservation by the ZSL's EDGE of Existence conservation initiative.

1.2 *Plagiodontia aedium*

The distribution of the genus Plagiodontia has been always restricted to Hispaniola and it is believed to be the oldest hutia lineage, diverging from other Capromydae genera around 20 million years ago (Nuñez-Miño, 2010, perm. comm.). Currently it only comprises one species, *P. aedium*, which is the only native rodent still present in the island. Since its discovery in 1823 by Cuvier it has been considered a rare species, believed to be extinct for nearly 100 years, until its 're-discovery' by Abbott in 1923 in Northeastern Dominican Republic. Today is classified as Endangered in the IUCN Red List (IUCN, 2010). Although there is still a lack of information on current population status, it has been estimated that with a business-as-usual scenario the population will have been reduced by over 50% over the past 2 generations (20 years) and one generation into the future (10 years) (IUCN, 2010). Being the only survivor of the oldest genus of a linage only found in the Caribbean, its extinction would mean the loss of an irreplaceable evolutionary heritage.

1.3 Threats to Hispaniola endemic land mammals

S. paradoxus and *P. aedium* are known to inhabit a range of forest types throughout the Dominican Republic and a small portion of Haiti. Although there is still a lack of data to establish with accuracy the current status of their populations (ZOODOM, 2000), there is no doubt that the geographical ranges of both species has declined drastically since the first human settlements in Hispaniola. Some of the largest Caribbean islands (i.e. Cuba, Hispaniola and Jamaica) have experienced some of the highest deforestation rates (4% annual forest loss) of all biodiversity hotspots (Brooks et al. 2002). Currently, 28% of Dominican Republic is forested whereas only 4% of Haiti is forested (World Bank, 2005). The deforestation is currently being driven mainly by charcoal burning and clearance for agricultural expansion and urban development. As a consequence their habitat is being degraded and destroyed, confining the survivors to smaller and more fragmented patches of forest often set in agricultural landscapes. Therefore, the presence of these species near human settlements is becoming more common, increasing the likelihood for a HWC, which is suspected to be a widespread problem. In fact, *P. aedium* is thought to cause crop damage by some local farmers and *S. paradoxus* has been blamed in some locations of killing local villager's chickens, a resource that is considered highly valuable. Whether locals are targeting these species as a consequence is currently unknown. The extent of the human-wildlife conflict has not been quantified, and this is vital to understand the conservation needs of the species.

In addition to deforestation and possible direct persecution by locals, the introduction of non-native species, mainly dogs, cats, rats and mongooses, represents another major threat, both directly and indirectly. Two different dog populations - domestic and feral - exist and they could be having a big impact in species numbers, as the killing of the two endemic mammals by dogs is not infrequently reported in the literature (e.g. Ottenwalder, 1991; Rams et al., 1989; Sullivan, 1985; Salazar 1977). Domestic dogs are sometimes trained for hunting or for the removal of damaging species from croplands and thus, allowed to roam free within the forest or near its edge, constituting a threat for *S. paradoxus* and *P. aedium*, especially at dawn and dusk when these species are active. Feral cats (Borroto-Paéz 2009; Varona, 1983) and mongooses (Turvey et al., 2008) are also believed to predate upon solenodons and hutias, although the impact of mongooses is likely to be considerable lower due to the fact that it is diurnal in its habits.

Mongooses, alongside with rats, may have their major impact through indirect means. They both prey on farmers' chickens and in addition, rats damage large extensions of croplands. The use of poisoned bait by locals to control these invasive species might be having an important impact on Hispaniolan solenodon populations as this species appears to have opportunistic feeding habits. The Hispaniolan hutia may also be affected if the poisoned bait used is a suitable food (e.g. poisoned corn used to control rats). The scope of this impact is currently unknown.

1.4 Aim and Objectives

The main objective of this project is to investigate public awareness levels of *S. paradoxus* and *P. aedium* in the buffer zone of the Sierra de Bahoruco National Park and to evaluate the extent of human-wildlife conflict between locals and both species. Knowing people's perceptions and the level of impact human activities have is essential to design effective conservation actions, evaluate the success of any management effort and make any future recommendation. It is articulated through three main core research questions:

A. Locals' awareness

The aim is to quantify to what extent local people are aware of solenodon and hutia and their perceptions of these species. Knowing about locals' attitudes towards environment and wildlife conservation is also part of the purpose. This information is essential for the design of well-focused public awareness campaigns. In addition, other objective is to assess whether locals' knowledge on where these species occur, through their personal experiences of direct observations of animals or signs, could be valuable data for the ongoing efforts to investigate the status and distribution of these endemic mammals

B. Crop and livestock damage and levels of tolerance

The objectives are:

(i) Estimate the perceived impact on local farmer's crops and livestock by (1) endemic mammals, and (2) invasive mammals.

(ii) Estimate locals' tolerance levels, i.e. the maximum level of impact by an animal after which locals take action against the species.

(iii) Establish whether *S. paradoxus* and *P. aedium* are being targeted (1) directly or (2) accidentally (i.e. through poisoned bait for invasive species).

The aim is to determine to what extent are endemic and invasive species believed by locals to damage their livelihoods and hence, the real scope for human-wildlife conflict. Besides, whether locals are being taking proactive action against endemic mammals is still unknown, but they do actively against invasive species. Understanding when and what motivate them to do so will help determine the factors that trigger an action against a species and a maximum threshold below which endemic mammals' impact might be regard as acceptable by locals. This is information is essential for the design of public awareness campaigns to minimize the human-wildlife conflict.

C. Levels of dog predation

The question is focused in the domestic dog population. The aim is to determine the extent to which domestic dogs predation is impacting upon *S. paradoxus* and *P. aedium.* In order to do so, it is necessary (1) define the different types of domestic dogs according to what they are used for by locals, (2) determine which type of dogs are a potential threat for the species and (3) estimate the numbers of dogs for each damaging group and the level of impact each one is having.

There is no doubt that knowing the impact of feral dogs is also necessary for the long-term survival of the species. However, this estimation would require an ecological field study to establish the numbers of feral dog present in the range distribution of *S. paradoxus* and *P. aedium*, which was outside the scope of this project.

2. BACKGROUND

Despite almost 200 years since the discovery of *S. paradoxus* and *P. aedium* they are still poorly known species. Research is limited to a reduced number of studies from few authors, mostly dating back to the 1970's and 80's. Their direct observation in the field is hampered by their nocturnal and secretive habits. Therefore, a large proportion of the information on their natural history is derived from captive individuals kept in zoos (e.g. Fanjul, 1977; Salazar, 1977; Eisenberg, 1975; Radden, 1968) and information about their status and range of occurrence relies heavily in local knowledge collected by researchers through interviews and informal talks (Turvey et al. 2008; Ottenwalder, 1985; Sullivan, 1983). In recent years, new efforts have been conducted to assess the status of these species (e.g. Turvey et al., 2008) and in 2009 a project led by Durrell Wildlife Conservation Trust was established in Hispaniola to build evidence and capacity for their long-term conservation.

2.1 Natural history of *Solenodon paradoxus*

Solenodontidae is the only family of insectivores in the Caribbean which still have extant species. It comprises only one genus – Solenodon – with four species: one living (*S. cubanus*) and one extinct (*S. arredondoi*) in Cuba, and one living (*S. paradoxus*) and one extinct (*S. marcanoi*) in Hispaniola.

S. paradoxus is a large (1 kg) insectivorous mammal with a long pointy snout, and a scaly tail that resembles a sturdy shrew. It can be found in a variety of habitats from lowland dry forest to highland pine forest. It likes to shelter in caves, hollow logs and borrows during the day. It is known to dig extensive tunnel networks in the forest ground which it uses to dwell and forage hidden from predators (Eisenberg & Gotera, 1985). It is a generalist feeder with a wide diet, primarily eating soil litter invertebrates such as insects, arachnids, land snails, and earthworms. It is also an opportunistic scavenger which feeds on small vertebrates (mainly amphibians and reptiles) as well carrion when available. It has been reported to prey occasionally on mice and chicks (Ottenwalder, 1999; Peña, 1977; Eisenberg, 1975). When foraging it leaves very distinctive conic excavations, referred to as “nose pokes”, which are used as signs of the presence of the species during field surveys. However, its most characteristic feature is probably the ability to secrete toxic saliva (Rabb, 1959).

Fig 2.1. *Solenodon paradoxus.* (Courtesy of The Last Survivors)

The reproduction and development of the Solenodontidae family is one of the most poorly known among insectivores. In fact, only one successful mating has ever been recorded in captivity (Ottenwalder, 1991). *S. paradoxus* lives in small family groups, consisting in one adult pair and their offspring. It shows a highly *K* selected strategy, giving birth to only one precocial young, which is born after at least 84 days of gestation (Ottenwlader, 1985, per.obs.). Litters of two young have been observed (Franjul, 1977; Ottenwalder, 1985) but are very uncommon. No evidence of reproductive seasonality has been found (Ottenwalder, 1991). Nonetheless, females seem to have a maximum of two litters per year, reaching sexual maturity around 18 months. Solenodon’s life expectancy is unknown, although it is believed to be long, based in the observation of an individual in captivity which lived for 11 years (Eisenberg, 1981). Based in this data Ottenwalder estimated that the maximum number of offspring a female may have in her lifespan is around 20 (Ottenwalder, 1991). As survival in the wild is generally lower than under optimum captivity conditions, this number is probably an overestimation of solenodon productivity.

According to local knowledge, in the past *S. paradoxus* it was very common at moderate elevations (Ottenwalder, 1985). However, today it is found mainly in mountainous areas up to 1500 meters. Its range of occurrence has probably been constrained by extensive deforestation for agriculture and coffee plantation (Ottenwalder, 1985). Due to its nocturnal habits and relatively large body size, its only known native predators are owls (*Tyto alba* and *Asio syigius*) and the Hispaniola boa (*Epicrates striatus*), although natural predation rates are believed to be low (Ottenwalder, 1981). Anthropogenic sources of mortality such as domestic dog predation, invasive mammals' impact through predation and competition or persecution by locals might be decimating the remaining population. Solenodon's resilience to human disturbance is unknown; although, it is likely to be higher than the suggested by its low fecundity rate.

2.2 Natural history of *Plagiodontia aedium*

Capromyidae is a family of rodents restricted to the Caribbean which comprises a total of six genera, three extinct (*Hexolobodon, Isolobodon and Aphaetreus*) and three extant (*Capromys, Geocapromys and Plagiodontia*). From the four genera that once inhabited Hispaniola, only Plagiodontia has survived. The endangered *P. aedium* is its only extant species.

P. aedium is a large (1.3 kg) arboreal rodent with a robust body, broad head, small ears and short semi-prehensile naked tail. Some people have suggested that it resemble a large guinea pig. It lives in a range of different subtropical habitats up to 2000 meters, although its ecological niche is situated in humid areas. It lives in small family groups dwelling in cavities located in trees or crevices in rocky areas; it has never been reported to dig a burrow itself. Data on its diet has been provided mainly by observation of captive specimens and knowledge gathered from subsistence farmers. *P. aedium* is nocturnal and feeds on a wide variety of leaves, shoots, barks, fruit and roots. Its complete dependence on trees makes it especially vulnerable to deforestation. It also has been observed to consume staple crops such as corn, cassava and pigeon peas (Salazar, 1977). In agricultural landscapes this might provoke a conflict with farmers; although, there are no incidents recorded in the literature.

Fig. 2.2. *Plagiodontia aedium* adult individual in a tree branch. Pedernales province, southwestern Dominican Republic. (Courtesy of Eladio M.Fernández)

P. aedium breeds once a year, having a gestation period of 119 days (Salazar, 1977) and giving birth to only one, rarely two, precocious young (Sullivan, 1983; Oliver, 1977). This slow reproductive cycle is believed to hamper the ability of the Hispaniola hutia to adapt to changes in its environment. Thus, it is thought to be extremely susceptible to habitat degradation and invasive mammal predation and competition. However, in recent surveys carried out in Southwest areas of Dominican Republic *P. aedium* was found living very close to human settlements: This possibly indicates a greater tolerance of disturbance than previously thought. Nevertheless, the current status of the species is poorly known, relaying in scarce and indirect data, precluding the design and implementation of comprehensive conservation actions.

2.3 Current status of invasive mammals in the West Antilles and their impact on endemic mammals.

Invasive species are known to be one of the most important biodiversity loss drivers at a global scale, although, the worst impact occurs in geographically and evolutionary isolated systems such as islands. The small population size that characterizes island populations and their particular evolutionary history in isolation from mainland predators make insular species particularly vulnerable. In fact, invasive species are considered the greatest threat to biodiversity in the Caribbean region, over deforestation and habitat loss (Kairo et al. 2003). However, research and understanding on the impact of introduced species, particularly mammalian predators, is still very scarce for the West Indies (Borroto-Paéz, 2009).

A total of 20 exotic species of mammals have been reported in the Caribbean, out of which 18 have become naturalised and/or invasive (Kairo et al., 2003). Generalist predators such as domestic dogs (*Canis familiaris*), feral cats (*Felis catus*) and, mongooses (*Herpestes auropunctatus*) together with black and brown rats (*Rattus rattus; Rattus norvegicus*) are among the most damaging and widespread, occurring in up to 29 islands (Horst et al. 2001). They were introduced by the first European colonist - intentionally like dogs or accidentally like rats - with the exception of mongooses, which were introduced in an attempt to control rats in the sugarcane fields, a widely cited example of bad biological control practice. Generalist predators, once introduced, spread rapidly occupying various habitats and niches since there are no other competeting carnivores and no natural enemies. However, they seem more common in rural human dominated landscapes and cultivated areas than mountain forested areas. Nonetheless, feral dogs and cats have been reported inside National Parks and other protected areas (e.g. Borroto-Paéz, 2009), questioning the value of these as a refuge for endemic mammals.

Dogs have been widely cited as a threat to endemic mammals (e.g. Kairo et al., 2003; Ottenwalder, 1991) and their role as a source of mortality is discussed in the section below. The predatory abilities and impacts of cats and mongooses on island have been well documented (e.g. Engeman et al., 2006; Nogales et al., 2004). Cats might have the biggest impact since they are nocturnal as are solenodons and hutias. In the case of arboreal hutias, cats may compete for the same structural niche, disturbing the ecological niche and predating upon litters or unaware adults. There is not direct evidence in the literature of cat predation upon solenodons or hutias. However, they have been cited as an important threat to the survival of both *S. cubanus* and *S. paradoxus* (Varona 1983).

Although mongooses have been involved in the extinction of an undetermined number of species in the Caribbean, it is unlikely that the decline of solenodon populations in areas where both species occur is related to predation. In fact, the only record found in the literature corresponds to a death *S. paradoxus* individual with cranial damage suggestive of mongoose predation in Haiti (Turvey et al., 2008). The primarily source of conflict might be competition for food resources (Ottenwalder, 1985). Rats may have had an important role in the extinction of some Caribbean endemic mammals in the past such as *Nesophontes* and *Mesocapromys* species. However, they were the smallest native terrestrial mammals. Surviving solenodons and hutias have a larger body size which suggests they are out of rats' prey range. In wild areas they might be affected through competition for refuges as rats have been reported to occupy abandoned solenodons' dwelling tunnels (Borroto-Paéz, 2009). *Rattus* sp. has been cited as a strong competitor for *P. aedium*, with the potential to displace the hutia from its areas of distribution (Sullivan, 1983).

Invasive mammals can also have indirect impacts on endemic mammals. For example, an indirect source of mortality for solenodon and/or hutia populations could be the poisoned baits used by locals to target rats and mongooses, believed to be a crop pest and poultry eaters respectively. However, no research has been done in this area, and these indirect impacts have not been considered relevant in previous investigations. In fact, reference to it has been found only in one study in which it is said that solenodons are blamed by locals for the damage caused by rodents as the tracks of both species are very similar and easily confused (Ottenwalder, 1991).

There is a lack of information about management, monitoring, control, and eradication of invasive mammals in the Caribbean. Baited tracking plates and live traps, and paraffin monitoring blocks are the most common methods to monitor populations of cats, rats and mongooses (e.g. Engeman et al. 2006). In addition, remote cameras are used to verify tracks and identified individuals. Removal of animals is conducted mainly by using poisoned bait stations and trapping. A number of attempts have been carried out in the Caribbean to eradicate non-indigenous mammals, mainly focus in small islands located in the Lesser Antilles with different grades of success (Lorvelec & Pascal, 2005). In larger islands attempts have been restricted to certain protected areas (e.g. Engeman et al., 2006), as removal at a global scale would be logistically infeasible or prohibitively expensive.

The Caribbean is a geopolitically highly complex region, with a great diversity of political systems under which each sovereign country is administered. This translates to an unevenly distributed institutional capacity and willingness to address environmental problems across the different nations. Some have conducted primary assessments, although the existing data is still scarce. Even when there is available data, there is often a lack of relevant regulations, enforcement or infrastructures are not in place. Another problem is the limited capacity in terms of expertise and a lack of access to quantitative data on economic and ecological impacts and management options at a national and regional across the entire region Besides, control policies in the Caribbean focus on invasive species as a pest for public health and agriculture, neglecting wild areas, weakening the role of protected areas as refuge for threatened species and potentially turning them into reservoirs of invasive mammals.

The situation in Hispaniola is particularly complex due to the differences between Dominican Republic and Haiti national capacities and political willingness. Dominican Republic, together with Bahamas and Jamaica, is part of the IABIN I3N network, an inter-American initiative to exchange information on invasive species in the Americas, revealing the Dominican understanding of the importance of developing frameworks for capacity building, and raising stakeholder awareness. In fact, conservation programs have been supported for decades in the country in a long-term commitment to create sound programs for the protection of biodiversity; Whereas, Haiti is a state with no historical experience in the stewardship of natural resources characterized by short-sighted policies, political instability, inadequate low resources and a lack of priorities which suffers a difficult socioeconomic hardship. As Hispaniola is a connected system and thus, endemic and invasive species occur at both sides of the border, collaborative efforts are required if natural ecosystems and endemic mammals are to be protected. Although enhanced regional cooperation is still lacking , some joint actions have been undertaken on the Haitian-Dominican frontier zone, such as La Selle/Bahoruco area and Anse-a-Pitres/Jaragua National Park ecological complex (Sergile & Woods, 2001), providing a good starting point.

2.4 Domestic dog predation as a source of mortality in scarce populations in human-dominated fragmented landscapes.

One consequence of habitat fragmentation by anthropogenic disturbance is an increased proximity of wildlife populations to human settlements. In rural landscapes dogs are kept by locals and allowed to roam free in many cases. Thus, higher proximity to human dominated rural areas is correlated with higher influx of free-roaming domestic dogs into remaining patches of habitat, boosting the possibility of dog-endemic mammal encounters, a proven source of mortality. In addition, there might be an increase in feral dog numbers as well, as they may benefit from consuming human waste for subsistence. A large number of species are affected by free-roaming dogs. Predation on wild mammal populations has been reported extensively in the literature, with small and medium-sized mammals being the most commonly consume prey (e.g. Silva-Rodriguez et al., 2009; Manor & Saltz, 2003), but larger animals such a primates can be also targeted (e.g. De Oliveira et al., 2008). In addition, the impact on endemic threatened mammals is intensified by their already restricted population size. Therefore, for species with so depleted populations such as *S. paradoxus* and *P. aedium*, even infrequent predation by dogs could have serious consequences for their survival. Domestic dogs might be especially harmful to native fauna. As they are partially fed by households and not depend on wildlife for subsistence, they may not show a density dependent response to declining prey populations, keeping predation pressure constant until extinction of the species.

Dogs are common throughout Hispaniola and are often used as guard dogs (house and cattle), for hunting (mainly pigs and goats) and removal of damaging animals. In the past they are thought to have been used for hunting hutias for human consumption (Sullivan, 1983) although the exploitation for food by subsistence farmers seems to have stopped. Today, locals are more interested in hunting pigs and goats, and do not target endemic mammals. However, when dogs are allowed to roam free, especially at night, *S. paradoxus* and *P. aedium* can be an easy prey as they have evolved in the absence of such efficient predators. This human-wildlife conflict is not limited to forest edges near human settlements. Dogs have been found within the boundaries of National Parks, suggesting that protected areas are not been effective in the protection of native fauna. There are numerous reports of solenodon and hutia individuals killed by dogs (e.g. Ottenwalder, 1991; Rams et al. 1989; Ottenwalder, 1985; Sullivan, 1983; Varona, 1983) and since the first studies it has been considered to be one major threat to the survival of the species along with deforestation. In Haiti, only one population of *S. paradoxus* is believed to have survived, confined to a small area in the Duchity region of the Massif de la Hotte (Western Haiti). The almost complete absence of dogs in the region as a consequence of a cull in the late 70s has been suggested as a significant factor in the survival of this population (Turvey et al. 2008)

It is difficult to estimate the real impact that predation by dogs might be having on solenodon and hutia populations. The fact that both species live in small family groups could increased their vulnerability, as killing of more than one individual by a single dog might not be infrequent. For his study on the habitat and distribution of *S. paradoxus* Ottenwalder interviewed a large number of locals who reported on solenodon encounters and deaths, based in which he estimated that conservatively around 200 individuals were killed by dogs every year in the Dominican Republic (Ottenwalder, 1985). However, no other attempt to quantify the impact of dogs has been done. Thus, it is uncertain how reliable this estimation is. In addition, the current level of predation might be very different from 25 years ago, as many influential factors have changed such as forest cover, habitat connectivity and human density. Nonetheless, it may provide the best attempt to establish a coarse baseline in the lack of better and update data.

2.5 Study area

The study area comprises 9 villages located North and South of the National Park Sierra de Bahoruco (18º 10’ N, 71º 31’ W), near the Haitian-Dominican border in the west limit of *S. paradoxus* and *P aedium* distribution range within the DR (Figure 2.3; Appendix 1). Sierra de Bahoruco is a Dominican mountain range which continues into Haiti where it is known as Massif de la Selle. It has three peaks exceeding elevations of 2000, villages had an altitudinal range from 362 meters in Puerto Escondido to 1632 in Los Arroyos. This national park represents one of the geographic areas with the highest environment diversity and ecological gradients of the island, with vegetation varying from lowland dry forest, to humid subtropical forest, to extensive pine forest in high altitudes. The soil is dominated by limestone with some sedimentary rocks. The combination of all these factors determines a high endemism rate in the area.

Figure 2.3. Map of the location of the 9 surveyed communities in the study area in the buffer zone of National Park Sierra de Bahoruco, Southern Hispaniola.

3. METHODS

3.1 Interviews

Fieldwork to investigate the current awareness and perceptions on Hispaniola’s only surviving terrestrial endemic mammals as well as on damaging invasive species was performed from 5 May to 23 June 2010. Questionnaires have been increasingly used, not only in social research, but also in ecology when information is needed from a human target population. They have been shown in the literature to be useful tool for obtaining quantitative data on human behaviour, such as the use of natural resources (e.g. Jones et al. 2008), perceptions of wild species (e.g. Turvey et al., 2010), public awareness (e.g. Shiping et al., 2006) or experiences and attitudes in human-wildlife conflicts (e.g. Weladji & Tchamba 2003). In addition, when information has to be collected from a large number of sites, questionnaires often provide the best means of obtaining enough data (White et al. 2005).

3.1.1 Questionnaire design

Interviews were conducted in nine communities along the Dominican Republic-Haiti border, covering the distribution area of *S. paradoxus* and *P. aedium* near the National Park Sierra de Bahoruco in Southern Hispaniola (Figure 2.3) Two different ethnic groups were targeted; Dominicans and Haitians, and three profiles were presented in the study: Dominicans inhabitants, Haitians living in Dominican Republic (who normally do not own the land they farm) and Haitians living in Haiti (who normally own their land). Prior to departure, interview methods were established and a questionnaire developed. Standard LEK (local ecological knowledge) techniques and RRA (Rapid Rural Appraisal) tools described in the literature (e.g. Chambers 1992; FAO 1989; Grandstaff & Grandstaff 1987) were used. Recommendations for interview design and best practice from the literature were also applied (e.g. Jones et al. 2008; White et al. 2005).

3.1.2 Pilot study

A pilot study was carried out to reveal deficiencies in the questionnaire design. 12 respondents from the locality of Mencia representing both ethnic groups (8 Dominicans and 4 Haitians) were interviewed. No major problems were identified in the questionnaire design but some minor problems arose, which meant that the order of questions was altered. Initially questions related to the impact of species on local's livelihoods (i.e. crop damage and livestock loss) were placed before ecological questions related to *S. paradoxus* and *P. aedium.* The interview was structured this way to avoid people's susceptibility to potentially sensitive questions so to minimize the risk of unreliable information. Thus, the questionnaire was introduced as interested in the impact of invasive species on local's livelihoods, to afterwards include questions on endemic land mammals. However, during the pilot study respondents found easier to report about their knowledge of these endemics species right after been shown the cue cards at the beginning of the interview rather than at the end, and the questions were not considered of special sensitiveness. A lack of information regarding respondents' relations with the forest (e.g. use, frequency of visits) was spotted. Data on forest use and frequency of visits is essential to estimate the potential for endemic mammals-human conflicts in forested areas. As informants did not show or indicate to be tired at the end of the questionnaire in any way, the gap was corrected by adding a few more questions. Also, more explicit recall periods were introduced to help informants in the recalling process. Finally, one question from the Attitudes Questions section was discarded for being to difficult and four more were reformulated to allow a better understanding. Initially the interviewees were asked to answer if they agree with a certain statement using a scale from 1(strongly disagree) to 5(strongly agree). However, informants found it very difficult to adjust their answer to this format. A more simple yes or no answer with an option for further comments was preferred. A copy of the final questionnaire used in the main study can be found in Appendix 2.

Pilot studies are an essential to indentify practical problems and minimize the inaccuracy of the collected data due to deficiencies in the interview design or misunderstandings of questions among respondents. This can be especially necessary when using the same questionnaire to target two ethnic groups with great cultural differences, as it is the case between Dominican and Haitian communities. However, there are also some limitations. A common problem is deciding whether to include pilot participants or site in the main study. For social scientists an essential feature of a pilot study is not include data from the pilot with data from the actual study when analysing or reporting the results (Peat et al. 2002). If there were problems with the chosen research method and this should be changed, data from the pilot study could be inaccurate. Or if a new protocol or procedure were being tested, it could be the concern that those informants who have already been exposed to an intervention may respond differently from those who have not previously experienced it. As the methodological tool used suffered no changes and there were no reasons to believe that exposure to the interview process would influence respondents' answers to the new set of questions (i.e. forest related questions), respondents of the pilot study were interviewed again to ask only the added questions and were used in the final analysis. However, they were discarded for the analysis of the Attitudes Questions section. Four statements needed to be reformulated for a better understanding of the concept which was being asked and in-depth discussion was carried out with pilot respondents for this purpose. Thus, there was a risk of a bias between pilot interviewees and not pilot interviewees, as the former might have gained insights from the discussion process.

3.1.3 Interviewees

Interview data were collected approximately evenly across the nine communities and across the two ethnic groups, with a mean of 30 respondents per community. In those communities where Dominicans and Haitians coexist (i.e. communities in the Dominican Republic side of the border) it was aimed to conduct 50% of the interviews within each ethnicity. This allowed the analysis of differences in awareness, perceptions and attitudes between informants from different ethnic background. Farmers, livestock farmers and hunters were considered to be the informants who were more likely to be knowledgeable about *S. paradoxus* and *P. aedium* as well as about invasive species as they have more contact with the forest and crop lands. A few other informants with livelihoods connected to the area ecosystem, such as park staff from the Sierra Bahoruco National Park and Haitian women who crossed the border through areas were *S. paradoxus* and *P. aedium* are known to occur, were also interviewed. Informants from each community were identified by a local research assistant. In three communities (Puerto Escondido, Sapotén and Boucan Ferdinand), which the local research assistant was not familiar with, local staff of the Ministry for the Environment and Natural Resources from each locality helped in the identification of suitable respondents.

All informants were interviewed on a one-to-one basis in relaxed, informal settings, usually their house or the village's *colmado (*i.e. small store, sometimes located in part of someone's house, which sells foodstuff, alcohol, cleaning supplies, and other commodities. It is as well a social meeting point for locals where they drink and play domino). A standard anonymous questionnaire was used. Although initially it was aimed to record the name and contact of the interviewees in case it would be required to contact them for further research, anonymity was necessary to maximize data truthfulness, especially among Haitians respondents who were more susceptible. Only one family member was interviewed from each household because living in the same land it is likely they might have similar experiences. Most of the times, the interviewee was the male head of the family, as men are mainly responsible for farming and hunting activities in these communities. There was only one exception. A large proportion of Haitians women who live in Haiti next to Dominican Republic cross the border to sell products in market days. In the Northern part of Sierra de

Bahoruco, women from the Haitians villages of Sapotén and Boucan Ferdinand walk long hours over night through the National Park to arrive to the market. They have very different histories of experiencing *S. paradoxus* and *P. aedium*, and thus they were interviewed regardless whether their husbands were interviewed as well. This approach ensures that data collected were independent.

Interviews with Dominicans were conducted by the author as she is a fluent Spanish speaker. For Haitian interviewees, the process was facilitated by a native Spanish-Haitian Creole speaker. The questionnaire included descriptive, structured and contrast questions. If all the sections were applicable, it took approximately 20-30 minutes to complete. Informants were provided with photographic cue cards of *S. paradoxus* and *P. aedium* as well as some species catalogued as invasive (IABIN, 2002): rat (*Rattus rattus*), mongoose (*Herpestes auropunctatus)*; feral cat (*Felis catus);* feral dog (*Canis lupus familiaris)*; wild boar (*Sus scrofa)* and rabbit (*Oryctolagus cuniculus);* and endemic species: Hispaniola boa (*Epicrates striatus*); ashy-faced barn owl (*Tyto glaucops*); white-necked crow (*Corvus leucognaphalus*) and rhinoceros iguana (*Cyclura cornuta*) all known to damage locals' crops or livestock. Two species were used as control: nine-banded armadillo (*Dasypus novemcinctus)* and the common raccoon (*Procyon lotor*). The cue cards allowed checking the accuracy of respondents in the identification of the species and thus the validity of their responses. Particularly care was taken to ensure informants identification of *S. paradoxus* and *P. aedium* was accurate as they are easily confused with rats, rabbits and guinea pigs by locals. The key diagnosis characteristics such as the elongated snout of *S. paradoxus* were emphasized to interviewees. At the end of the interview, a short talk (2-3 minutes) was given to the interviewee stressing the importance of solenodon and hutia conservation.

3.2 Analyses

Data were managed and coded with Microsoft Excel and analysed using R v.2.11.1 (R Development Core Team, 2010). Differences in responses between communities and ethnicities for each species were examined using non-parametric chi square tests. It was also used to test for differences between both species. A series of univariate analysis were performed using General Linear Models (GLMs) with binomial distribution and logit link (Crawley, 2007) to analyze (1) the effect of ethnicity on attitudes towards solenodon and hutia conservation and general perceptions on the environment; and (2) whether ethnicity influences local's levels of tolerance of crop damage and livestock loss.

Two multivariate analysis were carried out to determine (1) the effect of ethnicity and community on awareness of S. paradoxus and P. aedium and whether any interaction existed between these two explanatory variables; and (2) the effect of the level of damage and the nature of the damaging species (i.e. endemic/invasive) on level of tolerance and whether any interaction existed between these two explanatory variables. Maximal models were simplified when appropriate by deleting non-significant terms and by merging levels within factors. Significance was determined for all analyses at $p=0.05$ ($p>0.1$ "n.s."; $p<0.1$ "•"; $p<0.01$ "*"; $p<0.05$ "**"; $p<0.001$ "***").

4. RESULTS

A total of 360 informants were interviewed during the survey evenly across the 9 communities. However, not all informants answered all questions on the questionnaire. All of them (n=360) provided information about their knowledge of *S. paradoxus* and *P. aedium;* 50% (n=181) answered question on crop damage and livestock and poultry loss, and the same number of respondents gave data on dog abundance and predation. Up to 48% (n= 176) answered attitudes questions.

4.1 *Solenodon paradoxus* and *Plagiodontia aedium* awareness

4.1.1 Identification

The number of respondents who were correct in identifying S. *paradoxus* differed greatly among communities (χ^2=22.55, d.f.=8, p=**) and between ethnicities (χ^2=32.94, d.f=1, p=***) (Fig. 4.1A). Local knowledge on *P. aedium* also showed major differences across communities (χ^2=52.87, d.f=8, p=***) and ethnic groups

(χ^2=40.73, d.f=1, p=***) (Fig. 4.2B). Overall difference in levels of awareness between species was also very significant (χ^2=55.48, d.f.=1, p=***).

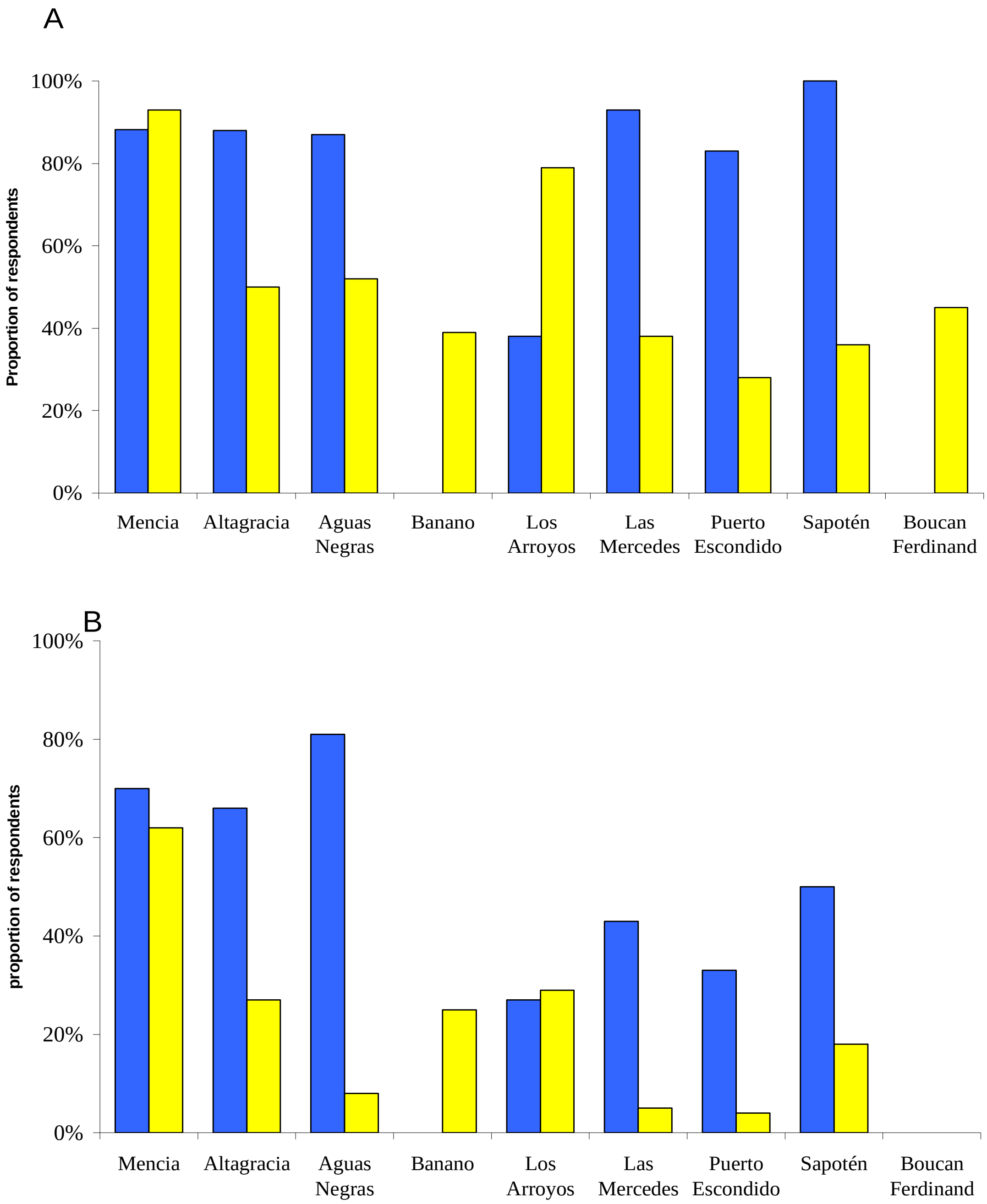

Figure 4.1. Percentage of Dominicans (blue bars) and Haitians (yellow bars) respondents in each of the 9 surveyed communities who correctly identified (A) *Solenodon paradoxus* and (B) Plagiodontia aedium.

S. paradoxus and *P. aedium* were confused with other species by some locals. The Hispaniola solenodon was misidentified by 11% of respondents (n=39), mainly with a rat. In the case of the Hispaniola hutia 16% (n=57) mistaken it with other species, which varied with the ethnicity of the informant; most Dominicans reported it as a big rat, whereas Haitians believed it was a guinea pig.

4.1.2 Names

Local names for the Hispaniola solenodon and the Hispaniola hutia differ between DR and Haiti. Most Haitians living in DR used the Creole names to refer to the species, despite the number of year they had been living in their neighbouring country, suggesting a strong attachment to their cultural background.

4.1.2.1 *Solenodon paradoxus*

The species is known in the Dominican Republic as *solenodon* or as a second type of *jutia* (different from *P. aedium*), being the latter the most widely used (Fig 4.2). Other names include c*omadreja* (weasel), used mainly in the locality of Aguas Negras, and *conejillo de indias* (the Spanish term for guinea pig) used by some locals in Parque del Este, Eastern DR.

Most Haitians referred to the species as *kombee*, a creole term that differed from previous published ones (*nen long, bouche long, zagouti bouche long, cochon dinjue nen long*) from the Duchity Region in Massif de la Selle, West-south Haiti (Turvey et al., 2008). Nonetheless, some respondents used the term *kochondeen*, which is just an alternative version of *cochon dinjue.*

Only an 8% of informants knew the species but was unable to name it.

4.1.2.2 *Plagiodontia aedium*

The Dominican name is *jutia* or *futia*. However, a small proportion of respondents known it as *solenodon* or as a special type of rat. In Haiti, hutias has previously been referred to as *zagouti* (e.g. Turvey et al., 2008). However, when asked, no Haitian in the study reported this name. Instead, they used mainly *kochondeen,* which resembles very close the term *cochon d'inde,* the French name for guinea pig. Although the term is very similar, respondents who used it gave precise key characteristics of the species during its identification, ensuring they were not confusing both species, legitimizing the used of the term. Other names were *kombee* and *rat*.

It is worth to note that a relatively large proportion of informants (20%) knew the species but did not know how to name it.

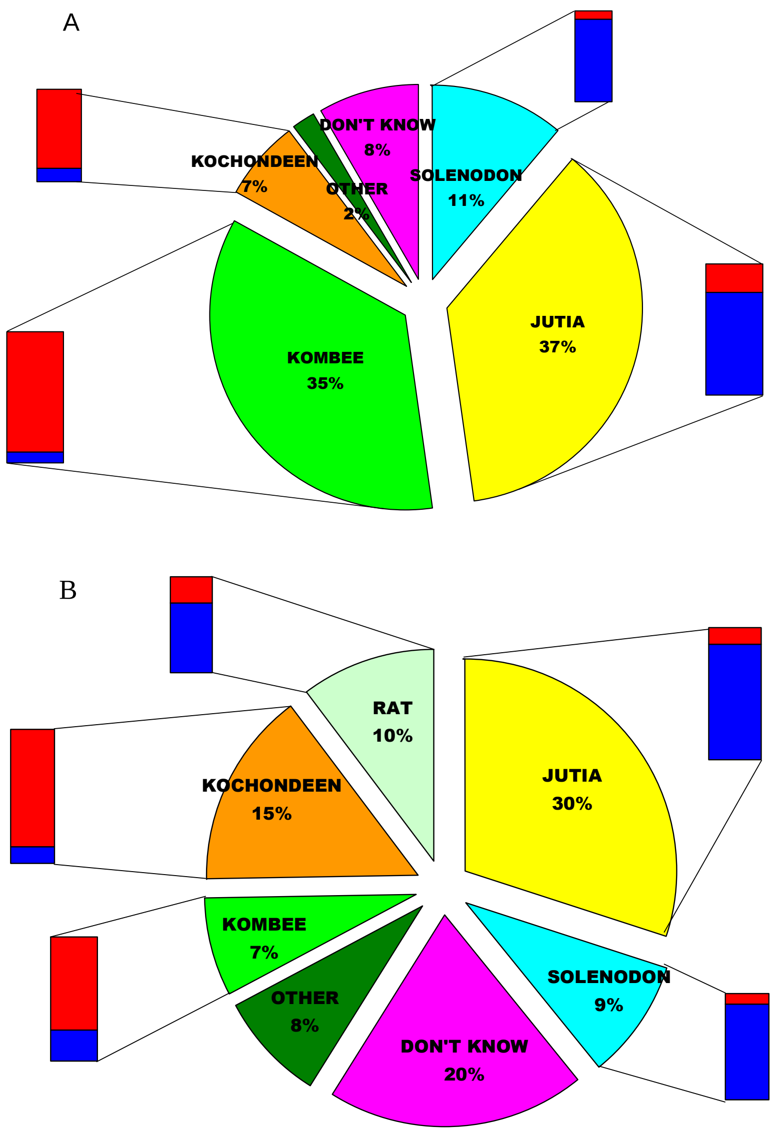

Fig 4.2 Names given to (A) *S. paradoxus* and (B) *P. aedium* by respondents who correctly identified the species. The chart represents the total percentage of respondents who gave each name; rectangles represent percentage of Dominicans (blue) and Haitians (red) respondents within each category.

4.1.3 Community and Ethnicity as awareness predictors: a multivariate analysis

To determine the relevance of differences in locals' awareness across community and ethnicity a multivariate analysis was performed. Informants' capacity to identify species was modelled as a function of community and ethnicity in a maximal model per each species.

For *S. paradoxus* model simplification was attempted but the maximal model with the interaction between community and ethnicity was found to be the simplest to better explain the variation in the data (Appendix 4, Table A4.1).

For P. aedium, through model simplification no interaction was found between community and ethnicity. Therefore, the minimum adequate model included both terms as explanatory variables but without interaction between them (Appendix 4, Table A4.2).

These results demonstrate a different spatial and cultural pattern of knowledge about each species across communities and ethnicities.

4.1.4. Abundance and Occurrence

Informants who were aware of the species and correctly identified them were asked about their perceptions on the abundance of each species (Fig. 4.3).

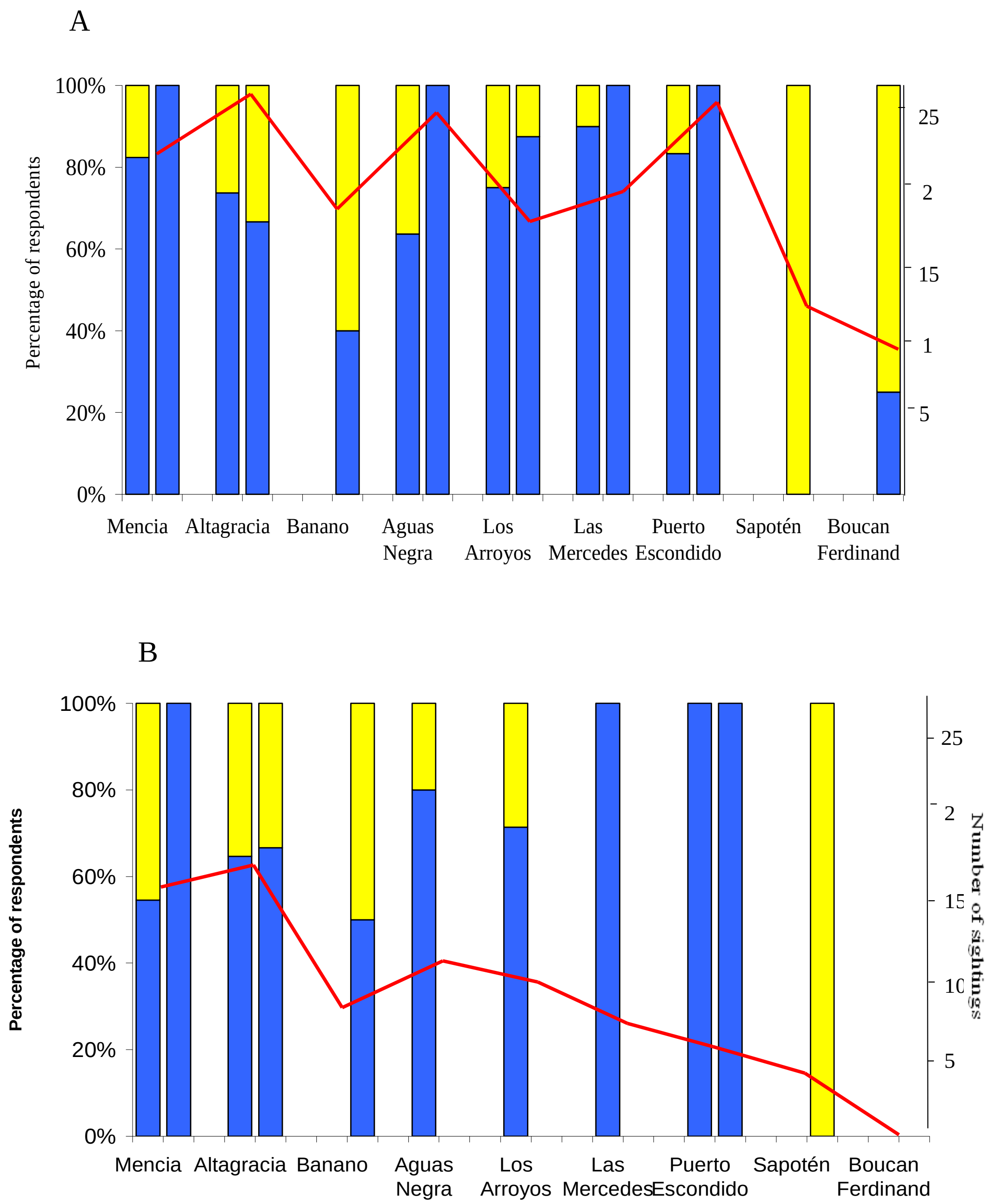

Fig 4.3. Percentage of Dominicans (left bar) and Haitians (right bar) who considered the species common (blue bars) and rare (yellow bars) per community. (A) *Solenodon paradoxus*; (B) *Plagiodontia aedium*. The red line represents the number of sightings in each community.

Although some data is missing for *P. aedium*, a trend can be observed, where respondents from communities located in the Haitian side of the border (i.e. Banano, Sapotén and Boucan Ferdinand) tend to consider both species rarer than villagers in Dominican localities (*S. paradoxus* (χ^2=64.98, d.f.=1, p=***); *P. aedium* (χ^2=37.28, d.f.=1, p=***)). Besides, the total reported number of encounters in Haiti was much lower than in DR for both species. However, number of sightings per respondent who correctly identified the species was higher among Haitians living in Haiti. Indeed, when controlling for this factor, a significantly difference was found in the number of sightings between countries (*S. paradoxus* (χ^2=22.13, d.f.=1, p=***); *P. aedium* (χ^2=9.52, d.f.=1, p=**)) and across communities (*S. paradoxus* (χ^2=72.78, d.f.=8, p=***); *P. aedium* (χ^2=64.61, d.f.=8, p=***)).

Within DR, abundance perception is not even distributed (*S. paradoxus* (χ^2=20.19, d.f.=6, p=**); *P. aedium* (χ^2=88.23, d.f.=6, p=***)). Although Haitians living in DR considered both species more abundant than Dominicans do, with the exception of Altagracia, not significantly difference was found between ethnicities in Dominican localities (*S. paradoxus* (χ^2=5.35, d.f.=1, p=n.s.); *P. aedium* (χ^2=5.18, d.f.=1, p=n.s.)). Comparing perceptions on both species, locals seem to consider *P. aedium* as abundant as *S. paradoxus* (χ^2=2.48, d.f.=1, p=n.s.), although the number of personal sightings is remarkably fewer.

Interviewees were asked if they had seen any of the species and if so where and when. A total of 170 sightings were reported for *S. paradoxus* and 78 for *P. aedium*. The majority of encounters occurred near the surveyed communities. However, a small number corresponded to locations outside the study area, where some informants used to live before (Fig. 4.4).

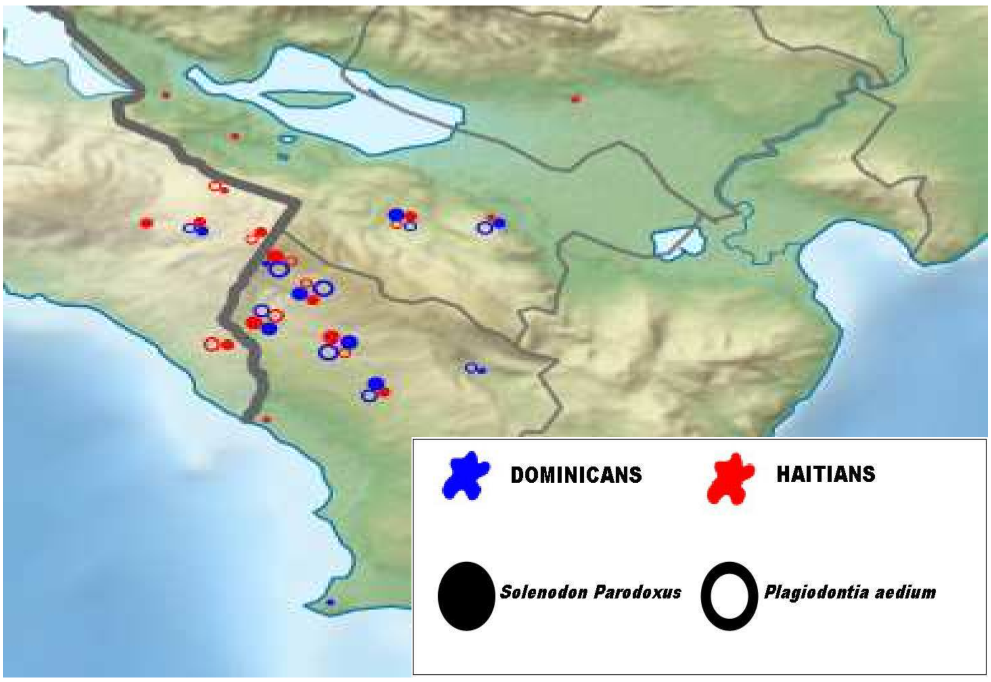

Fig 4.4. Map of the distribution of encounters between 200-2010 reported by locals.

4.1.5 Damage

Informants who correctly identified the species were asked whether they considered *S. paradoxus* and *P. aedium* made any damage, and if so what type of (Fig. 4.5). No significant correlation was found between ethnicity and perceptions for any of the species (*S. paradoxus* (χ^2=0.5459, d.f=1, p=n.s.); *P. aedium* (χ^2=0.627, d.f=1, p=n.s). However, there was an important variation between communities (*S. paradoxus* (χ^2=194.17, d.f=8, p=***); *P. aedium* (χ^2=228.38, d.f=8, p=***)). No significant difference was found between species (χ^2=2.03, d.f=1, p=n.s). For both species the main type of reported damage was crop loss with a mean of 33% ± 7% for S. paradoxus and 23% ± 7.5% for P.aedium. Interestingly, livestock predation was also mentioned for both species, although in fewer number of occasions, with a mean of 4% ± 1% for *S. pardoxus* and 3% ± 1.8% for *P. aedium*. No other type of damage was recorded, with the exception of some hunters who reported to have lost some dogs as consequence of being bitten by a solenodon.

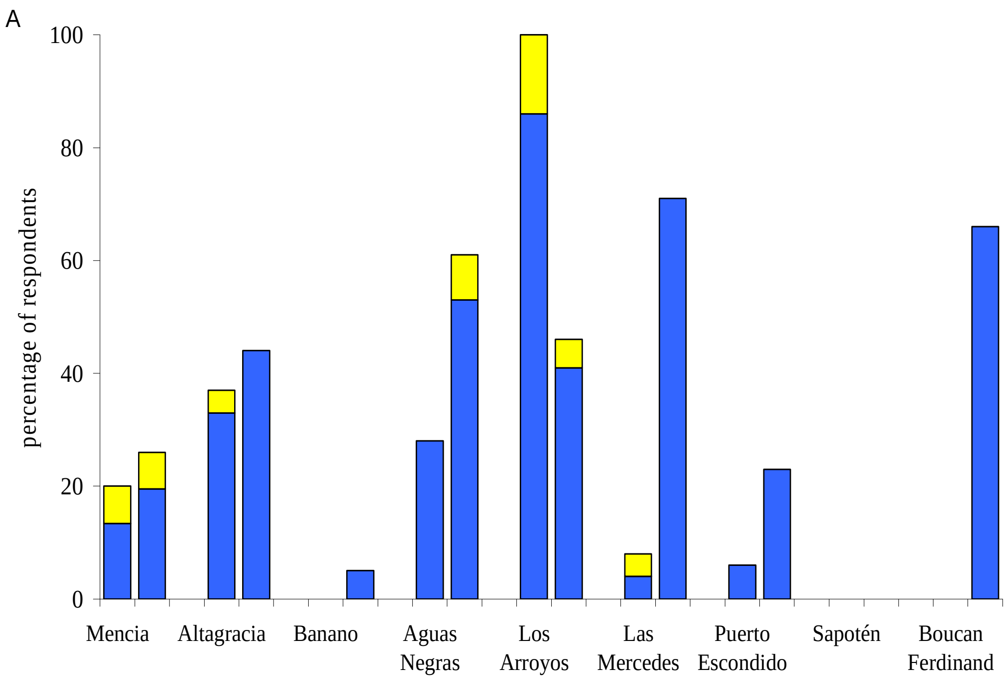

Fig 4.5A Percentage of respodents who correctly identified *Solenodon paradoxus* who believed it caused damaged across the 9 surveyed communities. Blue represents crop damage and yellow livestock predation. In each community left bar represent Dominicans and right bar Haitians.

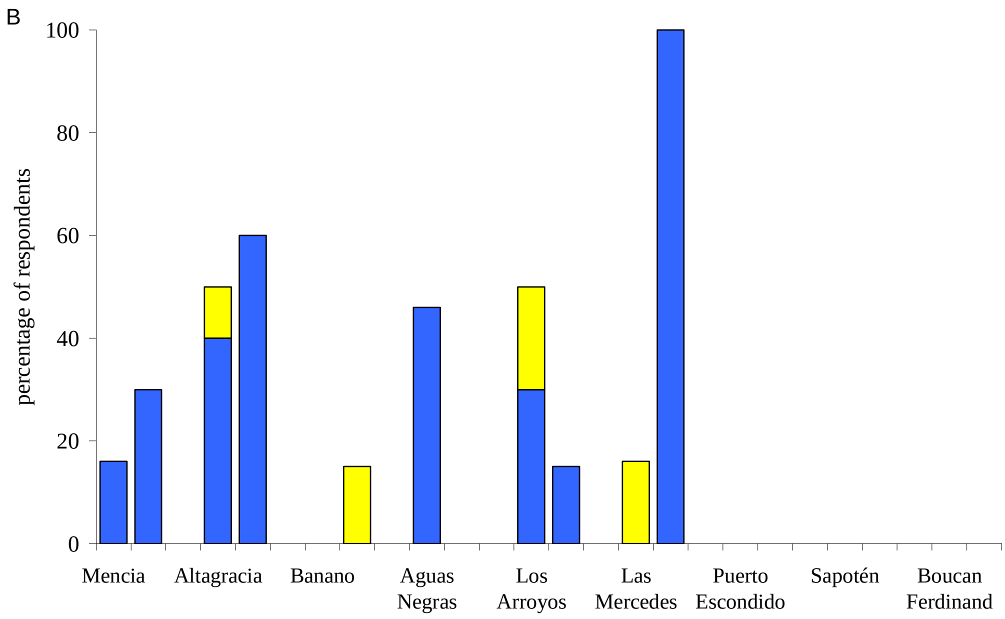

Fig 4.5B Percentage of respodents who correctly identified *Plagiodontia aedium* who believed it caused damaged across the 9 surveyed communities. Blue represents crop damage and yellow livestock predation. In each community left bar represent Dominicans and right bar Haitians.

4.2 Crop Damage and Livestock Loss

4.2.1 Levels of damage and loss

4.2.1.1 Crop damage

All villages were subject to annual crop loss by wild animals. Although drought was also mentioned as a source of damage, animal depredation was reported to be the main issue in most of the communities (Fig. 4.6)

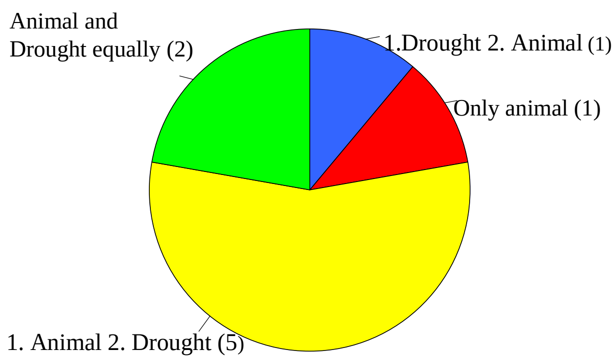

Fig. 4.6. Causes of crop loss across the surveyed communities (1=most important, 2= less important). The number in brackets represents the total villages in each category.

On average, subsistence farming was the primary source of income for 96% ± 2%(n=181) of respondents. Farmers grow two types of crops: (1) short-cycle crops, which can be harvested in 3 months (e.g. beans, corn, taro, cassava) and (2) long-cycle crops, which need more than 6 months to yield (e.g. coffee, banana, sugar cane, citrus). All communities reported that short-cycle crops, especially beans and corn, were the principal crops consumed by raiding species. From the long-cycle crops category coffee seemed to be the preferred by damaging species. Within communities, the number of farmers affected ranged from 70% to 100% with a mean of 85% ± 3.5% (n=9). Overall, the average annual reported loss of crops to animals ranged from 25% to 75% with a mean of 42%±6% (n=9). Indeed, there is a significant difference in reported crop loss levels between communities (χ^2=104.47, d.f.=8, p=***).

4.2.1.2. Livestock loss

Although in a second place of importance as a source of income, tenure of livestock is widely spread through the study area. This refers to poultry, which was on average owned by 86% ± 3.5% (n=9) of farmers within communities. Other species such as goats and cows were less common, with only 11% ± 4% (n=9) of farmers reporting them. Exposure to harmful species in terms of level of impact and array of species is expected to be different depending on the type of habitat the chickens are located. Poultry was kept only in the household yard in a 51% ± 6.5 %(n=181), whereas 32% ± 5%(n=181) kept them only in their land and 16% ± 7%(n=181) in both. Within communities, the number of farmers who reported to suffer livestock loss to wildlife ranged from 66% to 100% with a mean of 86% ± 3% (n=9).

4.2.2 Endemic vs. Invasive as damaging species

Reported levels of damage varied amongst species (Fig. 4.7). Rats were seen by far as the most damaging species. The endemic red tail hawk ranked second, followed closely by the Hispaniolan solenodon. Endemic birds, with the exception of the red tail hawk (i.e. Ashy-faced barn owl, and White-necked crow), were mentioned to have the lowest impact. Interestingly, comparing endemic and invasive mammals, the former were thought to produce same or even higher levels of damage than the latter.

The percentage of respondents who took active action against species ranged from 65%, in the case of the rat, to 0%, for the white-necked crow. A larger number of locals took action against invasive species than against endemic species, regarding of the level of damage (Fig. 4.7)

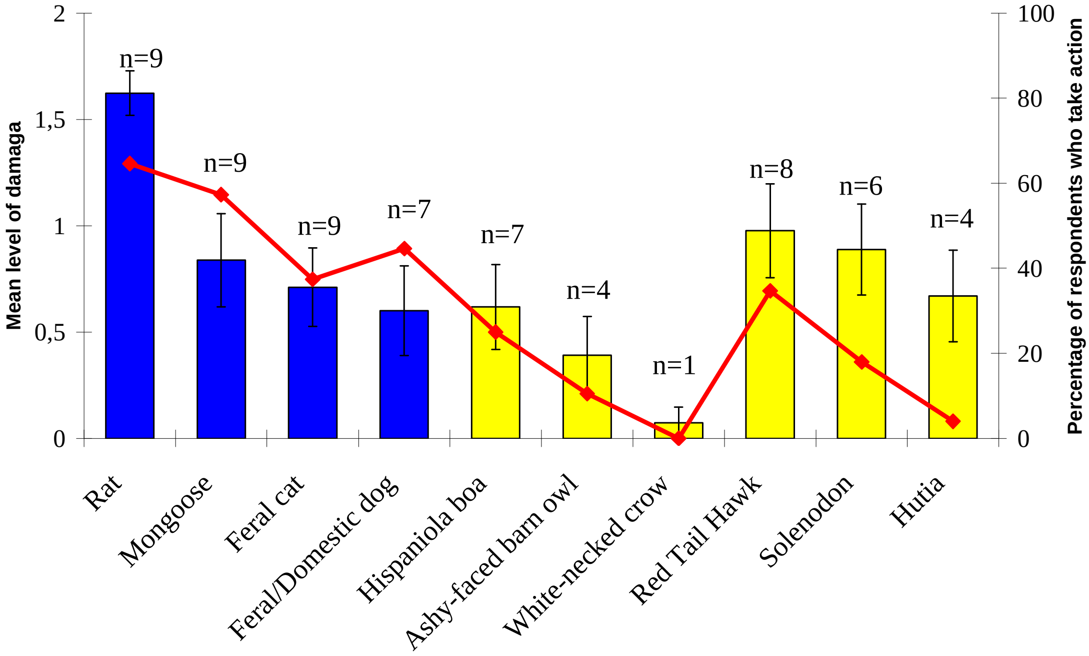

Fig 4.7. Mean level of crop damage and livestock reported by respondents caused by invasive species (blue bars) and endemic species (yellow bars) where 0=no damage, 1= medium damage; 2=high damage. Error bars represent the standard error of the mean; "n" represents the total number of communities which mentioned the particular category. Red points represent the percentage of respondents who take action against the species.

4.2.3 Action taken

4.2.3.1 Types of Action

There are four major actions locals can take against damaging species: (1) location of traps; (2) poisoned bait; (3) remove them with dogs; and (4) shoot them.

No significant difference was found for the use of traps (χ^2=4.8, d.f.=1, p=n.s) or the use of dogs (χ^2=1.28, d.f.=1, p=n.s.) between ethnicities. The number of respondents who shot damaging species was significantly low than the other methods (χ^2=6.94, d.f.=1, p=**). A significant difference was found in the use of poisoned bait between ethnicities (χ^2=31.14, d.f.=1, p=***). 90% of Dominicans who reported to take active action against damaging species, used this method, whereas only 54% of

Haitians chose it. However, no difference was found in the type of poisoned bait used. The most common used were crops (29%), mainly rice and corn, meat (26%), mainly salami, and injected eggs (25%) (Fig. 4.8.).

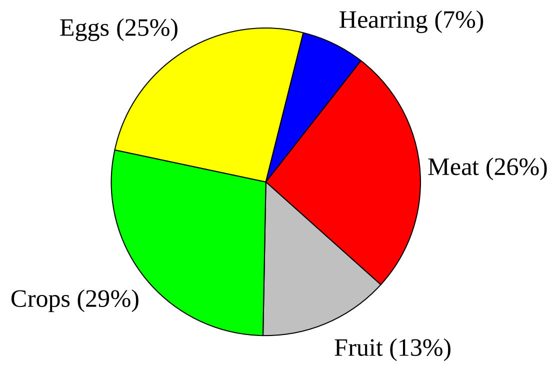

Fig. 4.8. Percentage of type of poisoned bait used by locals to target damaging species.

4.2.3.2 Reasons not take action

Respondents who suffered crop damage and/or livestock loss but reported not to take action, where asked the reason why not (Fig. 4.9). A significant difference was found between ethnicities (Fisher's exact test, p=***). The most common reason was the high price or the difficult obtaining of poison and tramps, although only 48,6% of Dominicans mentioned it compared to 80,9% of Haitians. Not using poison because it was dangerous for poultry and people, and not taking action because the level of damage was consider low, were the second and third most reported reasons respectively. Nonetheless, again the percentage differ greatly between communities, with 19.8% ± 2.4% Dominicans and 6.4% ± 0.68% Haitians considering it dangerous; and 19.1% ±2.3% Dominicans and 4.4% ±0.87 Haitians reporting damage was too low.

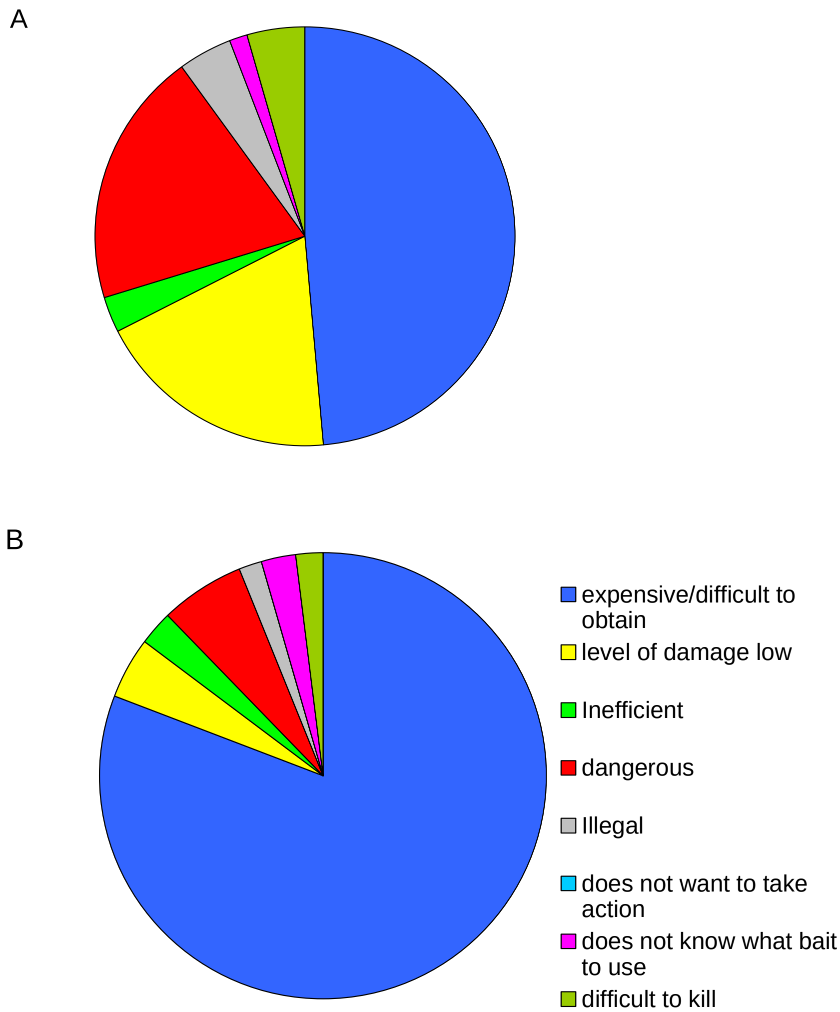

Fig. 4.9. Percentage of respondents who suffered crop damage and/or livestock loss who report each reason not take action. (A)Dominicans; (B) Haitians.

4.2.4 Locals' tolerance levels

Informants' reports were analysed to determine whether Dominicans and Haitians differ in their levels of tolerance of crop damage and livestock loss. No significant difference was found (Appendix 4, Table A4.3.) To established whether locals were more prone to take action against damaging species depending on their nature (i.e. endemic or invasive) and the level of damage (i.e. low, medium, high), the data was fitted into a maximal model. The model was simplified to the minimum adequate model (Appendix 4, Table A4.4). A correlation was found between the level of locals' respond and the level of damage suffered, with higher number of actions at medium and high levels of damage. In addition, the type of species was highly correlated with levels of tolerance. Invasive species provoked significant higher number of actions than endemic species.

4.3 Dog Predation

Locals reported to have seen the species death in a total of 57 occasions, 38 individuals of *S. paradoxus* and 19 *P. aedium* (Table 4.10A, Appendix 2). 40 events were recent, ranging from 2005 to 2010; for 16 encounters informants were not able to provide the exact year, but they took placed within the decade 2000-2010. 14 cases more were mentioned, although they were discarded for this analysis as they dated from 2 o more decades ago and were inaccurate in the location and/or number of individuals.

Dog predation was the most important source of mortality, explaining 73% of deaths (Table 4.10B, Appendix 3). 57% of reported dogs were dogs trained for locals to remove mongooses and feral cats from their cropland. They were allowed to roam free equally at dawn, dusk and night than during daytime. Death events reported by hunters with dogs accounted only for 12% of the total. However, impact was uneven distributed between both species (χ^2=6.21, d.f.=1, p=*). Indeed, 62% of dog predated individuals were solenodons. Reports of two or more animals killed by one dog were not uncommon, especially among hunters' dogs.

A

Location	**Number**			
	Solenodon paradoxus		*Plagiodontia aedium*	
Altagracia	7		4	
Aguas Negras and Ávila	11		7	
Bávaro	0		3	
Las Mercedes	5		2	
Los Arroyos	2		2	
Mencia	5		1	
Puerto Escondido	2		0	
Sierra Bahoruco	5		0	
Total	**38**	27 year 2005-2010 11 Unknown (within 2000-2010)	**19**	13 year 2000-2010 1 year 2000 5 Unknown (within 2000-2010)

Table 4.10.A Number of *Solenodon paradoxus* and *Plagiodontia aedium* death individuals reported by locals.

B

Reason	**Number**		
	Solenodon paradoxus	*Plagiodontia aedium*	
Dog	24	15	39
Poison	2	2	4
Cat	1	0	1
Car/Truck	2	0	2
Other	2	1	3
Unknown	7	1	8

Table 4.10B Reason of *Solenodon paradoxus* and *Plagiodontia aedium* deaths reported by respondents.

Aguas Negras, Altagracia, Las Mercedes and Mencia were the communities with the highest number of deaths, with 18, 11, 7 and 6 respectively. However, not all were caused by dogs. Indeed, for this mortality source 11, 8, 6 and 2 events were respectively recorded. Three communities were surveyed to estimate the number of dogs and their impact on the species: Aguas Negras, as it was the locality with the highest number of deaths by dogs (n=11), Las Mercedes, which ranked the third with 6 deaths reported, and Puerto Escondido, which together with Las Mercedes are the only villages of the study known to still host active hunter groups.

Although Aguas Negras had a hunting tradition, it was found that hunters and trained dogs for hunt were scarce. In fact, only 3 hunters remained in Aguas Negras, of which only one owned dogs; and 2 hunters in Ávila. The size of pack hounds was small, with no more than 2-3 dogs. It is estimated than no more than 6-10 hunter dogs are present in the area. Dogs trained to kill mongoose and feral cat are more abundant, although less common than in past times. 27 dogs were reported during the interviews with 41 informants. Based in the community number of households (80-90), a total of 50-60 dogs for removing invasive species are estimated to be owned in this locality.

Las Mercedes was found to be experiencing the same process of leaving the game than Aguas Negras, although in an earlier stage. Number of hunters is estimated to be 8-10 individuals. The size of pack hounds was bigger, on average composed by 3-5 dogs. No more than 50 hunter dogs might remain in the area, although this number is likely to be lower.

Puerto Escondido is the last remaining active hunting community in the study area. Most of the hunting activity is illegal, as it takes places in within the National Park Sierra de Bahoruco limits, mainly in an area known as Los Pinos, and reports were difficult to obtain. Thus, it is hard to estimate the number of hunters in the region and their impact on the endemic mammals. Nonetheless, at least 15-20 hunters were present in the locality during the survey. Although, this is a very conservative estimation, and the number is likely to be much higher. The size of pack hounds was the biggest out of the three communities ranging from 5 to up to 10 with a mean of 7 ± 1.7 dogs per hunter. Dogs trained to kill mongooses and feral cats were not estimate in this community. Most croplands are located far from the forest edge and are managed as intensive crops. Encounters with *S. paradoxus* and *P. aedium* or indirect signs of their presence were scarce, as the species seem to seclude in the mountains of the National Park Sierra de Bahoruco around Puerto Escondido. Therefore, the impact of roaming free dogs in the croplands is likely to be low.

On average, hunters reported to go hunting twice per month, as they argued dogs need to rest and heal between campaigns. The length of a typical trip varied from one day to up to a week; although the most common answer was 2-3 days. The number of endemic mammals killed varied greatly amongst respondents and between communities. Therefore, it is difficult to make an estimation of the mean impact. Based in informants' answers, hunters might kill on average a solenodon or hutia once every 4-5 hunting trips, which would account for 5-7 death animals per year. However, this number refers to deaths per campaign and not per individual hunter, as they tend to go hunting in groups. Based on this, it could be conservatively estimated that a minimum of 40 individuals are killed per year by hunter dogs in the study area.

Impact of trained dogs to kill mongooses and feral cats on endemic mammals is harder to estimate, as they are owned widely throughout the study area, and there is likely a significant variation in levels of impact among communities. Besides, it is unknown to what extent events are being reported by locals. Based in locals reports, it could be conservatively estimated that a minimum of 50-60 individuals are killed every year by this type of dogs in locals' croplands in the study area, although this estimation is less reliable than the estimation for hunters' dog impact

4.4. General attitudes towards environment and wildlife conservation

Informants were surveyed on their attitude towards solenodon and hutia conservation and general perceptions on the environment. Three groups were defined to determine differences among them: Dominicans, Haitians living in DR and Haitians living in Haiti. (Fig. 4.11)

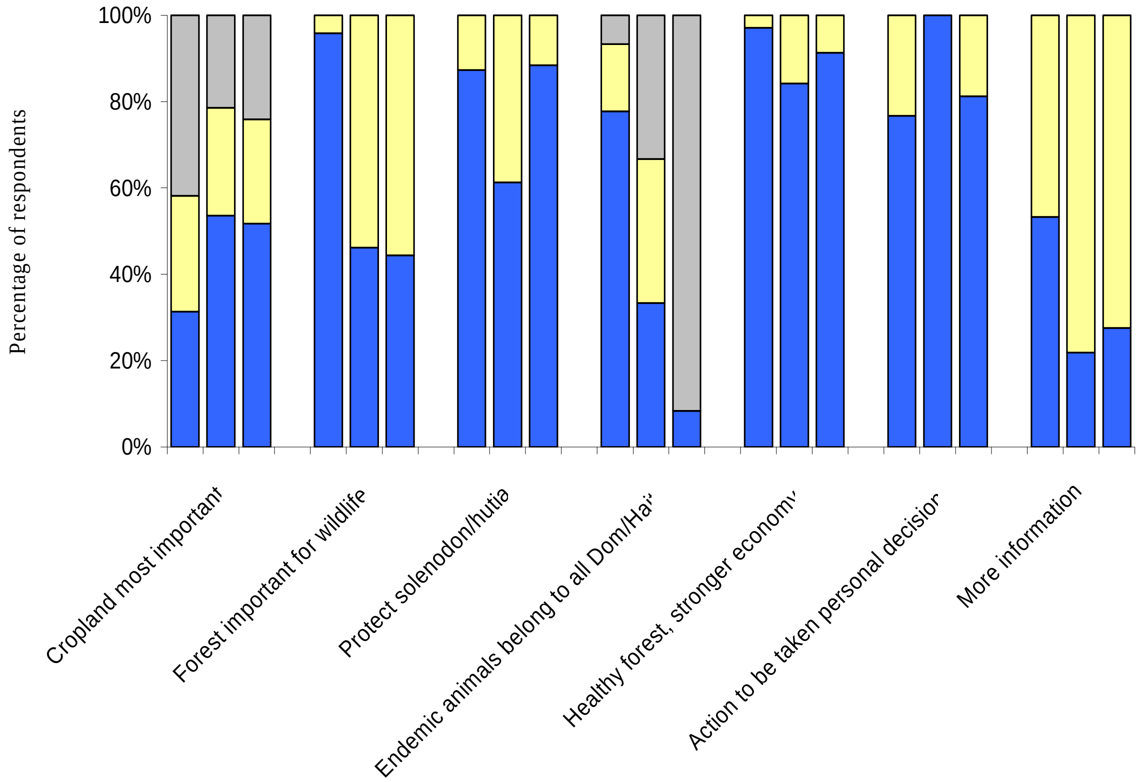

Fig. 4.11. Percentage of respondents who agree (blue bars), disagree (yellow bars) and gave a different answer (grey bars). Bars in each question are ordered from left to right as Dominicans, Haitians living in DR and Haitians living in Haiti.

On average, a correlation was found between responds and ethnicity (i.e. Dominicans vs. Haitians), but not within ethnicity (i.e. Haitians living in DR vs. Haitians living in Haiti), as no relevant difference was observed between Haitians, regardless of the side of the border they lived in (Appendix 4, Tables A4.5). Dominicans had a more positive attitude on the importance of protecting the environment. They showed a stronger concern in wildlife and conservation issues, being more interested in receive information about *S. paradoxus* and *P. aedium*. In addition, they displayed a bigger sense of national heritage, agreeing that endemic species belonged to all Dominicans and that they had a strong responsibility for their conservation. Haitians were not attached to their endemic fauna, not reporting a sense of ownership or responsibility on them.

All groups reported the same attitude towards crop damage and livestock loss, considering the establishment of tolerance levels a personal issue. There was only one question where a significant difference was found between Haitians (Appendix 4, Table A4.5C)Those who lived in DR disagree significantly more in protecting solenodon and hutia than Haitians living in Haiti, who showed similar levels of acceptance as Dominicans.

5. DISCUSSION

5.1 Public awareness and attitudes

A significant difference was found in the levels of awareness between ethnicities and across communities. Haitians were less aware of both species than Dominicans, suggesting a variation in the cultural pattern of knowledge. There was one exception: in Los Arroyos the percentage of Haitians who correctly identified both species was remarkably higher. However, this difference on level of awareness is not likely to be reflecting a difference in attitudes between this and the rest of the surveyed localities. Indeed, it is probably a consequence of the fact that a large proportion of Dominicans who own lands in this locality live in Pedernales, a nearby city, travelling to Los Arroyos only once or twice per week, whereas Haitians live on site. Therefore, the chances to interact with wildlife are uneven. In the rest of the communities both ethnicities live *in situ*.

One explanation to this difference in knowledge could be differences in number of encounters with the targeted species. The more time an individual is in an area where the species occurs, the higher is the probability to see it. Thus, rate of sightings is likely to be related to time spend in forest or cropland. Interestingly, Dominicans tend to live in the centre of the locality’s area, whereas Haitians live right inside the croplands. Therefore, the latter would be expected to have more chances to sight the species. Differences on levels of environmental concern and attitudes between ethnicities might be a more plausible explanatory factor Haitians were less concern about wildlife and environment issues showing less interest in being informed about *S. paradoxus* and *P. aedium*. Besides, they were not attached to their endemic fauna, and did not report a sense of ownership or responsibility towards them. This may translate into lower levels of awareness. It is likely that even when prompted with encounters with the targeted species a large proportion of Haitians might pay no attention to them, considering it to be a rat or guinea pig instead of the real species.

The fact that Haitians displayed a less positive attitude on the importance of protecting the environment needs to be stressed so it is taken into account when designing public awareness raising campaigns. Nonetheless, no relevant difference was found between Haitians who live in DR and who live in Haiti in their general attitudes towards environment. This suggests that both groups could be targeted in the same way. However, a significant difference was found in their willingness to protect the Hispaniola solenodon and Hispaniola hutia. Haitians in DR reported to suffer remarkably higher levels of crop damage and livestock than in Haiti. This difference in perception might be the underlying reason. Therefore, especial focus should be placed in Haitians living in Haiti in relation to this.

There was a significant difference in levels of awareness among some communities, showing a spatial variation in the pattern of knowledge. However, the factors underlying this variation need to be further investigated. Understanding what influences the levels of knowledge across communities would increase the effectiveness of public awareness raising campaigns.

5.2 Abundance and Occurrence: local knowledge as a source of information

A significant difference in the number of reported encounters was found across communities and between countries for both species. Indeed, the three communities in Haiti (i.e. Banano, Sapotén and Boucan Ferdinand) reported the lowest number of sightings. However, because a large number of locals were aware of the species in Dominican localities, there was a higher probability of an encounter being reported.

Indeed, when controlling for this factor, the mean number of events per local who was aware of the species was significantly higher in Haiti. Despite almost all respondents in Haiti had seen the species, they still regarded the animal as scarce, suggesting that abundance perception might not be influenced as much by personal as by community experience. If this is true, it could increase the effectiveness of using public awareness raising campaigns. However, comparing between species, although the number of solenodon encounters was remarkably higher than hutia, locals saw them equally abundant. One reason could be that even though numbers of encounters are higher, the difference is not big enough as for locals to consider it relevant.

Interestingly, the Haitian part of the study area has the highest level of habitat degradation, especially North of Sierra de Bahoruco National Park, where sightings dropped by up to 50%. This could suggest that, within an area, real abundance may be correlated to rate of encounters. If this is so, local knowledge could be used as a proxy, or at least as a coarse baseline, of abundance for *S. paradoxus* and *P. aedium.* In fact this is not a new approach, as local ecological knowledge has been previously used to assess the status and distribution of rare species (e.g. Turvey et al. 2010; Turvey et al.2008); Although using anecdotal occurrence data for scarce species, especially in the absence of conclusive physical data, could lead to bias and error (McKelvey et al. 2008). Nonetheless, 57% of reports were from events occurred within the last 12 months, reducing the potential inaccuracy associated with this recall method. However, comparing between species, despite the number of solenodon encounters was remarkably higher than hutia, locals saw them equally abundant. One reason could be that even though numbers of encounters are higher, the difference is not big enough as for locals to consider it relevant, establishing a threshold. All species which fell below it would be classified in the same category and regarded as rare, not accounting for the difference among them. If this is true, the use of local knowledge as an abundance proxy could be of limit use to establish differences in population size between the two species.

Although the majority of encounters occurred near the surveyed communities, interestingly a small number corresponded to locations outside the study area, where some informants used to live before. Two villages, Nan Fougère and Chote, were reported consistently by Haitians. Other two localities, Mare Double and Oriani, were also reported in a number of occasions, including two dog predation events on *S. paradoxus* within the last 12 months. Locals claimed to have seen both species. All four are situated in Haiti, west of National Park Sierra Bahoruco. *P. aedium* is believed to occur in this area, but previous estimations of *S. paradoxus* distribution in Haiti had only recorded its presence from the Duchity region of the Massif de la Hotte. This data suggests solenodon population might be occurring farther west, inside Haiti, than expected. Independently field surveys would be necessary to confirm this.

5.3 Levels of tolerance

The study revealed that damage caused by invasive species triggers a larger proportion of locals to take action. However, it does not necessarily reflect a higher level of tolerance towards endemic species. Indeed, this result might be a consequence of the difference on the easiness to target them. All the invasive species reported by locals were land mammals, whereas the array of endemic comprised a large number of birds. Available methods to remove damaging species are more suited for land animals (i.e. traps, poison bait, hunting with dogs). Subsistence farmers targeted birds and snakes by shooting or throwing stones at them. This technique is significantly less efficient, as well as time consuming, requiring the direct sight of the damaging individual. Thus, the tolerance threshold may be correlated with a cost-benefit ratio, in terms of needed effort, rather than the nature of the species.

S. paradoxus and *P. aedium*, the only surviving endemic land mammals, experienced less levels of proactive action than invasive, even when compared to species considered less harmful. However, again this might not indicate differences in tolerance. In general, locals lack knowledge on the natural history of the species including their diet, reporting not to know what to use as bait as a main reason to not take action. Thus, caution should be taken when implementing awareness raising campaigns, to avoid providing key information on the biology of the species in those communities were they are still perceived as damaging by farmers.

One preferred method to target damaging species was the use of poisoned bait, widely spread throughout the study area. The proportion of Dominicans who used it was almost one-fold of magnitude bigger than Haitians. However, the factor that hampers their use of poison is a lack of resources rather than an environmental attitude. Poison is not easily accessible in the Haitian side of the border. In fact, many Haitians reported to have to buy it in DR. In addition, Haitians have significantly less economic resources than Dominicans, regardless of the country they live in. If economic conditions in rural Haiti were improved, their access to poison would be increased and their use could boost, with unknown consequences for solenodon and hutia populations.

The percentage of informants who reported to take action against *S. paradoxus* was fairly higher than against *P. aedium* in despite no significant difference was found between species in the number of locals who considered them harmful. Nonetheless, the level of damage provoked by solenodon was regarded by farmers as much higher than hutia’s, which probably explains the difference in the level of action taken. Although, there is no evidence that could suggest solenodon damages larger amount of crops, neither was this reported by interviewees. However, the fact that solenodon is believed to predate upon chicks by some locals might decrease the level of tolerance toward the species. Despite poultry not being a primary source of income, it has a high cultural value. Cock fighting is a major part of the culture in the study area and locals discuss about their chickens in the same way cattle is discussed in some African cultures. Thus, they may be more prone to target a species at lower levels of damage than they would for crop loss. This should be taken into account for the design of public awareness raising campaigns if they are to be successful in the protection of *S. paradoxus*.

5.4 Dog predation as a source of mortality: remarks for the near future

In previous researches (e.g. Ottenwalder, 1991; Sullivan, 1983) dog predation was already mentioned as the second threat in importance after habitat loss for *S. paradoxus* and *P. aedium* survival. Results found in this study corroborate it as a main source of mortality. It is remarkably that reports were significantly uneven distributed between species, being solenodon deaths more frequent. This suggests *S. paradoxus* may be more vulnerable than *P. aedium* As it does not display arboreal habits as hutia does, they might be an easier prey for dogs, especially if chased far from a dwelling or crevice where to find shelter. In total, it is conservatively estimated than 90-100 individuals could be killed per year in the study area. The only previous estimation established a loss of 200 individuals (Ottenwalder, 1985). Though, it referred only to the Hispaniola solenodon for its whole range of distribution in the DR. Despite, using it as a coarse baseline for comparison, the new estimation might be plausible, as large areas of habitat have been loss since the 80's, and dog-endemic land mammals conflict is expected to have increased. However, not all dogs were likely to have the same impact. Domestic dogs kept for only house guarding do not go into the forest by themselves and since endemic mammals tend no to approximate to villages beyond croplands, the conflict between them is probably minimal. Dog populations which should be of concern for conservation actions are trained hunters' and farmers' dogs.

5.4.1 Hunters' dogs

Although three communities used to host active hunting groups in the past, the situation is changing, with potential consequences in the near future. Hunting activity in Aguas Negras seems to have stopped. In occasions dogs predates upon farmers' goats, and thus they are being actively targeted with poison bait by some locals. As consequence, mortality of dogs was reported to have been remarkably high in previous years. Hunting dogs are costly to train and buy, especially for subsistence farmers, who usually suffer from a lack of economic resources. For this reason, locals seemed to have left the game activity. Indeed, none of the reports from the last decade was attributed to hunters' dogs. Las Mercedes seemed to be undergoing the same phenomenon, although still in an earlier stage. Thus, hunters' dog could be expected to have very little impact in Aguas Negras and suffer a significantly decline in Las Mercedes.

On the contrary, the situation in Puerto Escondido is more worrying. Hunters are still active, with large sizes of pack hounds and appear to be well coordinated. The aggravating factor is that hunting is taking place within the limits of the National Park Sierra Bahoruco; the only area with still has a relatively extensive amount of appropriate habitat for solenodon and hutia populations, questioning its role in the protection of the endemic mammals. Recommended actions would include implementing an awareness raising campaign specially targeted to hunters. Hunting groups are generally compound by Dominicans, although in some occasions a few Haitians may join in. Besides, dogs belong mainly to Dominicans, as Haitians can not afford them. Therefore, effectiveness of public awareness raising campaigns would be increased if focus in the Dominican ethnicity. Interestingly, some were aware of *S .paradoxus* venom-loaded bite, reporting dogs which died after being bitten. For this reason, some hunters said to try to avoid encounters with the species while hunting. It could be useful to highlight this characteristic to deter hunters. Strengthen law enforcement within the National Park would be an essential measure. However, this is linked with a lack of institutional capacity and ultimate solutions might still delay in time. Nonetheless, actions are already being taken under a project led by Durrell Wildlife Conservation Trust.

5.4.2 Farmers' dogs

Impact of trained dogs to kill mongooses and feral cats on endemic mammals is harder to estimate, as they are more widely present throughout the study area, and it is difficult to assess to what extent events are being reported by locals. As removing damaging animals from croplands is not an illegal activity it could be assumed that percentage of deaths from this source is higher reported than deaths by hunting dogs. Nonetheless, a great variation in levels of predation was recorded among communities. Whether this is reflecting a real underlying variation in mortality or it is consequence of differences in awareness levels across localities needs further research. Although, it is likely that other factors are also affecting this variation. For example, croplands in Aguas Negras are located nearer forest edges and amongst more remaining patches of suitable habitat than in Puerto Escondido, where crops are grown in extensive areas intensively managed. Thus, impact of farmers' dogs is expected to be significantly higher in Aguas Negras. Further research is needed to investigate the factors that might influence this pattern of spatial variation through the study area and their correlations.

Based in locals reports, a minimum of 50-60 individuals are estimated to be killed every year by this type of dogs. However, this estimation is less reliable than the estimation for hunters' dog impact and should be taken with especial caution. Further research would be necessary in this particular area. Public awareness raising campaigns need to be designed to target this group. It would be particular relevant for the communities of Aguas Negras and Altagracia, followed by Los Arroyos, as they have the highest reports of deaths by farmers' dogs.

5.5 Feral cats: a real threat?

Although feral cats has been repeatedly mentioned as a threat for the survival of the Cuban solenodon (e.g. Silva et al., 2007; Varona, 1983), and they are common in the study area, no evidence has been found in the study that could suggest an impact on Hispaniola solenodon or hutia populations. Indeed, only one report was recorded of an individual killed by a cat. This is consistent with previous investigations (Ottenwalder, 1985). Therefore, no conservation action is required. Nonetheless, impact should no be complete discarded until populations sizes of the endemic mammals are estimated, as even anecdotic predation could have a relevant impact if population sizes are extremely small.

5.6 Concluding Remarks

Overall, this study contributes to better understand the human aspect of the HWC between locals and the Hispaniolan solenodon and Hispaniolan hutia. Differences in perceptions and awareness levels have been found across communities. Further research will help to understand which factors are driving this spatial pattern, allowing taking more comprehensive conservation actions. A strong correlation between ethnicity and attitudes has been shown, highlighting the necessity of designing different public awareness raising campaigns for each target group. A deeper understanding of people tolerance levels to wildlife damage has been gained, suggesting no difference between invasive and endemic species. Thus, the strategy of emphasizing the endemic nature of both species might be not as effective as previously thought for raising awareness towards its conservation. Dog predation has been confirmed as a major threat to the survival of the species. Monitoring schemes would be useful to check the evolution of predation by hunters' dog, expected to decrease. As for farmers' dogs, further research will be necessary to (1) analyze factors underlying spatial variation between localities and (2) assess its impact more accurately.

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APPENDIX 1.Communities information

Community	GPS location	Altitude (meters)
Mencia	18° 10' 0N 71° 43' 60W	575
Altagracia	18° 10' 60N 71° 43' 60W	695
Banano	18° 8' 60N 71° 43' 60W	524
Aguas Negras	18° 8' 60N 71° 42' 0W	645
Los Arroyos	18° 15' 0N 71° 43' 60W	1632
Las Mercedes	18° 4' 60N 71° 39' 0W	384
Puerto Escondido	18° 19' 0N 71° 34' 0W	362
Sapotén	18° 19' 0N 71° 43' 0W	1476
Boucan Ferdinand	18° 21' 0N 71° 43' 0W	875

Table A1.1 Geographical information of the 9 communities surveyed in the study

APPENDIX 2. Questionnaire

Awareness and perceptions of Hispaniola's endemic land mammals. Questionnaire survey (2010).

Basic Information

- Date:
- Respondent number:
- Locality:
- Ethnicity:

A. Background Information

1. Male / Female

2. How old are you?

3. How many members are in the household?

4. What do you do for a living? (tick all choices that are applicable)

☐ Agriculture ☐ Livestock ☐ Hunter

☐ Seller ☐ Park Staff ☐ Other (specify)

5. Have you always lived in this locality?

If NO: a) When did you move here?

b) Where did you live previously?

6. Do you go into the forest?

If YES, When? :

☐ Early morning ☐ Morning ☐ Afternoon ☐ Evening ☐ Night

B. Basic Solenodon questions

7. Do you know this animal? (show picture)

8. What is its name?

9. Have you ever seen it?

If Yes,

a) How many times have you seen it?

b) When was the last time?

c) Where did you see it?

10. How abundant do you think this animal is in this area?

☐ Very common ☐ Common ☐ Not common ☐ Rare ☐ Don't know

11. Do you think it makes any damage?

If YES,

a) What type?

☐ Crop damage ☐ Livestock damage ☐ Other (specify)

b) Level of damage

☐ Low ☐ Medium ☐ High

Additional comments

C. Basic Hutia questions

12. Do you know this animal? (show picture)
13. What is its name?
14. Have you ever seen it?

If Yes,

a) How many times have you seen it?

b) When was the last time?

c) Where did you see it?

15. How abundant do you think this animal is in this area?

☐ Very common ☐ Common ☐ Not common ☐ Rare ☐ Don’t know

16. Do you think it makes any damage?

If YES,

a) What type?

☐ Crop damage ☐ Livestock damage ☐ Other (specify)

b) Level of damage

☐ Low ☐ Medium ☐ High

Additional comments

17. Record if they recognize the control animals

☐ Armadillo ☐ Racoon

D. Crop Damage Questions

18. Do you own the land?
19. Do you farm the land?

a) Does someone else farm the land?

20. How many tareas do you own?
21. How many tareas do you farm?

22. What type of crop do you plant?

a) Short-cycle crops (i.e. 3-4 months cycle; e.g. corn, beans, taro, cassava)

b) Long-cycle crops (i.e. >6 months cycle; e.g. coffee, banana, sugar cane, citrus)

23. How far is your land from the village?
24. How far is your land from the forest?
25. Is farming your primary source of income?
26. How long have you been farming the land you currently farm?
27. Have you experienced crop damage from wildlife in the past 12 months?
28. What species were responsible for damage to your crops? (show photos)

Species

☐ Rat ☐ Iguana ☐ Solenodon ☐ Hutia

☐ Snail/Slug ☐ Insects (e.g. broca, cricket, midge) ☐ Birds ☐ Other

29. How many tareas do you estimate were damaged by each species? And How much would it be its market value? (table 1)
30. What is the level of damage caused by the species? (table 1)

☐ High ☐ Medium ☐ Low

31. Did you take any action to correct the problem? (table 1)

If YES: a) What actions did you take? and against which species?

i. Removed animals by trapping
ii. Removed animals by poisoned bait
iii. Fumigated
iv. Removed animals by hunting with dogs/cats
v. Shot/kill by hand animals
vi. Other (please describe)

If NO:

a) If you didn't use tramps, why did you decide not to?

i. Not own them/difficult to obtain
ii. Level of damage not enough high to take action
iii. Not effective
iv. Not allow to kill them
v. Other (specify)

b) If you didn’t use poisoned bait, why did you decide not to?

i. Expensive/difficult to obtain

ii. Dangerous for people/other animals

iii. Level of damage not enough high to take action

iv. Do not know which bait to use

v. Not effective

vi. Not allow to kill them

vii. Other (specify)

32. If you fumigate,

a) What product do you use to fumigate?

b) How often do you fumigate?

33. If you used poisoned bait, (table 2)

a) What type of bait did you use for each of the targeted species?

b) What poison did you use?

c) What dosage did you use?

d) How many numbers of poisoned baits do you normally use?

e) Where do you put the poisoned bait?

f) Do you leave it all day and night or do you removed it at daytime?

g) Where do you get the poison from?

h) How much does it cost?

34. Have you ever found any of these animals dead near poisoned bait which was placed for other species? (show hutia and solenodon photos)

☐ Hutia

a) How often?

☐ Often ☐ Sometimes ☐ Rarely

b) Where and When? (record all details)

c) What was the type of bait used? and For which species was used?

☐ Solenodon

a) How often?

☐ Often ☐ Sometimes ☐ Rarely

b) Where and When? (record all details)

c) What was the type of bait used? and For which species was used?

35. In your opinion, how did the amount of damage due to wildlife that you experienced this past year compare to x years ago?

☐ Higher ☐ Same ☐ Lower

If it is higher or lower, what do you think is the cause?

Additional comments

E. Poultry and Livestock Questions

36. Do you have poultry?
37. Where do you have the poultry?

☐ Home ☐ Farmland/Forest

38. Do you have livestock?
39. Is it your primary source of income?
40. Have you lost any livestock or poultry to predation by wildlife in the last 12 months?
41. Do you know what species were responsible? (show photos)

Species

☐ Rat	☐ Mongoose	☐ Solenodon	☐ Hutia
☐ Hispaniola boa	☐ Ashy-faced barn owl	☐ Feral cat	☐ Dog
☐ Guaraguao	☐ White necked crow	☐ Other (please specify)	

42. What livestock or poultry did you lose? and How much would be its estimated market value? (table 3)
43. What is the level of damage caused by the species? (table 3)

☐ High ☐ Medium ☐ Low

44. Did you take any action to prevent further loss? (table 3)

If YES: a) What actions did you take? and, against which species?

i. Removed animals by trapping

ii. Removed animals by poisoned bait

iv. Removed animals by hunting with dogs/cats

v. Shot/kill by hand animals

vi. Other (please describe)

If NO:

a) If you didn’t use tramps, why did you decide not to?

i. Not own them/difficult to obtain

ii. Level of damage not enough high to take action

iii. Not effective

iv. Not allow to kill them

v. Other (specify)

b) If you didn’t use poisoned bait, why did you decide not to?

i. Expensive/difficult to obtain

ii. Dangerous for people/other animals

iii. Level of damage not enough high to take action

iv. Do not know which bait to use

v. Not effective

vi. Not allow to kill them

vii. Other (specify)

45. If you used poisoned bait, (table 4)

a) What type of bait did you use for each of the targeted species?

b) What poison did you use?

c) What dosage did you use?

d) How many numbers of poisoned baits do you normally use?

e) Where do you put the poisoned bait?

f) Do you leave it all day and night or do you removed it at daytime?

g) Where do you get the poison from?

h) How much does it cost?

46. Have you ever found this animal died near poisoned bait which was placed for other species? (show solenodon and hutia photo)

☐ Hutia

a) How often?

☐ Often ☐ Sometimes ☐ Rarely

b) Where and When? (record all details)

c) What was the type of bait used? and For which species was used?

☐ Solenodon

a) How often?

☐ Often ☐ Sometimes ☐ Rarely

b) Where and When? (record all details)

c) What was the type of bait used? and For which species was used?

47. In your opinion, how did the amount of damage due to wildlife that you experienced this past year compare to x years ago?

☐ Higher ☐ Same ☐ Lower

If it is higher or lower, what do you think is the cause?

Additional comments

F. Dog predation questions

48. Do you or someone from your household own dogs?
49. How many?
50. What do you use them for?

☐ Hunting ☐ Remove damaging animal ☐ House-keeping ☐ Other (specify)

51. If they are used for hunting:

a) How often do you hunt with your dogs?

i. Length of a typical hunting trip (hrs)

ii. Number of days per week

iii. Number of days per month

b) Have any of your dogs ever killed/eaten these animals? (show photos)

☐ Hutia

If YES: a) How many?

b) When?

c) How many times have you seen one of your dogs killing one of these animals in the last week/month/year?

d) Where?

☐ Solenodon

If YES: a) How many?

b) When?

c) How many times have you seen one of your dogs killing one of these animals in the last week/month/year?

d) Where?

52. If dogs are used for removing damaging animals,

a) How often do you take the dogs with you to your land? (per week)

b) When are they allowed to roam free?

☐Early Morning ☐Morning ☐Afternoon ☐Evening ☐Night

c) Have any of your dogs ever killed/eaten these animals in your farmland? (show photos)

☐ Hutia

If YES: a) How many?

b) When?

c) How many times have you seen one of your dogs killing one of these animals in the last week/month/year?

d) Where?

☐ Solenodon

If YES: a) How many?

b) When?

c) How many times have you seen one of your dogs killing one of these animals in the last week/month/year?

d) Where?

53. Have you heard about someone else's dog killing a solenodon or hutia?

☐ Hutia

If YES,

a) How many?

b) When?

c) Where?

☐ Solenodon

If YES,

a) How many?

b) When?

c) Where?

Additional comments

G. Cat predation questions

54. Do you or someone from your household own cats?
55. How many?
56. What do you use them for?

☐ Remove damaging animals ☐ House-keeping ☐ Other (specify)

57. Do you keep them tied or they are allowed to roam free around the house?

If they are allowed to roam free, a) When?

☐Early Morning ☐Morning ☐Afternoon ☐Evening ☐Night

58. Do you take them with you to your farmland?

If YES, a) When they're allowed to roam free in the farmland?

☐Early Morning ☐Morning ☐Afternoon ☐Evening ☐Night

59. Have any of your cats ever killed/eaten these animals? (show photos)

☐ Hutia

If YES: a) How many?

b) When?

c) How many times have you seen one of your cats killing one of these animals in the last week/month/year?

d) Where?

☐ Solenodon

If YES: a) How many?

b) When?

c) How many times have you seen one of your cats killing one of these animals in the last week/month/year?

d) Where?

H. Attitudes Questions

Do you agree with the following statements?

60. Your farmland is more important than protecting the forest. (Economic growth is more important than protecting the environment)
61. I consider the forest near my village to be an important area for wildlife conservation
62. I agree not to kill and to preserve the solenodon and the hutia
63. Endemic animals (i.e. they are only found in Dominican Republic/Haiti) such as the solenodon and the hutia belong to all Dominicans/Haitians

64. Protect the forest near the village has benefits for the community. (A healthy environment will lead to a stronger economy)

65. Action to be taken in respond to crop damage and/or livestock loses are a decision to be taken by each household (without consultation)

66. I would like more information on solenodon/hutia

If YES, why?

a. Interested in wildlife

b. If a benefit can be obtain from solenodon/hutia

c. It will help to kill/control solenodon/hutia better

d. Other (specify)

If No, why?

a. Not important animals (not benefit can be obtain from them)

b. Other (specify)

Additional comments

Table 1. Crop Damage questions. Damage and actions.

Species	Tareas damaged & Market value	Level of damage	Actions taken	Actions not taken and Reasons why not
Rat				
Iguana				
Solenodon				
Hutia				
Snail/Slug				
Insects				
Birds				
Other (specify)				

Table 2. Crop Damage questions. Use of poisoned bait.

Species	Type of bait	Poison used	Poison dosage	N of poisoned baits	Where get poison from	Removal	Cost
Rat							
Iguana							
Solenodon							
Hutia							
Snail/Slug							
Insects							
Birds							
Other (specify)							

Table 3. Livestock and Poultry questions. Damage and actions

Species	Tareas damaged & Market value	Level of damage	Actions taken	Actions not taken and Reasons why not
Rat				
Mongoose				
Solenodon				
Hutia				
Hispaniola boa				
Ashy-faced barn owl				
Feral cat				
Feral/Domestic dog				
Guaraguao				
White necked crow				
Other (specify)				

Table 4. Livestock and Poultry questions. Use of poisoned bait questions

Species	Type of bait	Poison used	Poison dosage	N of poisoned baits	Where get poison from	Removal	Cost
Rat							
Mongoose							
Solenodon							
Hutia							
Hispaniola boa							
Ashy-faced barn owl							
Feral cat							
Feral/Domestic dog							
Guaraguao							
White necked crow							
Other (specify)							

APPENDIX 3. Reports of death animals

Species	Year	Location	Reason
Solenodon paradoxus	2010	Aguas Negras	Dog trained to kill mongoose/feral cat
		Ávila (Aguas Negras)	Unknown
		Ávila (Aguas Negras)	Killed by Haitian
		Mencia	Car/truck
		Oriani (Sierra Bahoruco, Haiti)	Dog
	2009	Aguas Negras	Dog trained to kill mongoose/feral cat
		Caña Honda (Mencia)	Unknown
		Cañada Barraco (Mencia)	Dog
		Cañada Barraco (Mencia)	Dog
		Las Mercedes	Hunter with dogs
		Las Mercedes	Hunter with dogs
		Las Mercedes	Hunter with dogs
		Las Mercedes	Hunter with dogs
		Mare Double (Sierra Bahoruco, Haiti)	Unknown
		Mencia	Killed by local
	2008	Altagracia	Dog trained to kill mongoose/feral cat
		Ávila (Aguas Negras)	Dog trained to kill mongoose/feral cat
		Las Rosas (Mencia)	Dog trained to kill mongoose/feral cat
	2007	Los Aguacates (Sierra Bahoruco, DR)	Unknown
	2006	Altagracia	Cat
		Bellavista (Altagracia)	Dog
		Aguas Negras	Dog trained to kill mongoose/feral cat
		Los Arroyos	Dog trained to kill mongoose/feral cat
	2005	Aguas Negras	Dog trained to kill mongoose/feral cat
		Aguas Negras	Dog trained to kill mongoose/feral cat
		Ávila (Aguas Negras)	Unknown
	Unknown	Altagracia	Dog
		Altagracia	Dog
		Altagracia	Dog

Species	Year	Location	Reason
Solenodon paradoxus	Unknown	Ávila (Aguas Negras)	Dog
		Ávila (Aguas Negras)	Dog trained to kill mongoose/feral cat
		Ávila (Aguas Negras)	Poison
		La Florida (Sierra Bahoruco, DR)	Dog trained to kill mongoose/feral cat
		Los Aguacates (Sierra Bahoruco, DR)	Unknown
		Los Arroyos	Poison
		Puerto Escondido	Hunter with dogs
		Puerto Escondido	Car/truck
		Sapotén	Unknown
Plagiodontia aedium	2010	Altagracia	Dog
		Las Mercedes	Dog
		Los Arroyos	Dog trained to kill mongoose/feral cat
	2009	Aguas Negras	Dog
		Ávila (Aguas Negras)	Killed by children
		Bávaro	Dog
		Bávaro	Dog
		Bávaro	Dog
	2008	Las Rosas (Mencia)	Dog trained to kill mongoose/feral cat
	2007	Aguas Negras	Poison
	2005	Aguas Negras	Dog trained to kill mongoose/feral cat
		Aguas Negras	Dog trained to kill mongoose/feral cat
		Los Arroyos	Dog trained to kill mongoose/feral cat
	2000	Altagracia	Dog
	Unknown	Altagracia	Dog
		Altagracia	Dog trained to kill mongoose/feral cat
		Aguas Negras	Poison
		Ávila (Aguas Negras)	Dog trained to kill mongoose/feral cat
		LasMercedes	Unknown

Appendix 4. Statistical Results

Table A4.1 GLM with binomial error for the interactions between community and ethnicity as explanatory variables of levels of awareness of *S. paradoxus* (minimum adequate model).

Explanatory factor levels	Estimate	Standard Error	z-value	p-value
Intercept (Dominicans; Mencia)	2.015	0.75	2.67	**
Haitian	0.69	1.28	0.54	n.s.
Community 1	0.0074	0.83	0.009	n.s.
Community 2	-1.81	0.876	-2.069	*
Ethnicity*Community1	-3.18	1.388	-2.379	*
Ethnicity*Community2	-1.041	1.37	-0.76	n.s.

Community 1: Altagracia, Aguas Negra, Las Mercedes, Puerto Escondido and Sapotén
Community 2: Banano, Los Arroyos and Boucan Ferdinand

Table A4.2 GLM with binomial error for the interactions between community and ethnicity as explanatory variables of levels of awareness of *P. aedium* (minimum adequate model).

Explanatory factor levels	Estimate	Standard Error	z-value	p-value
Intercept (Dominicans; Mencia)	1.895	0.453	4.183	***
Haitians	-2.09	0.28	-7.45	***
Community 1	-1.227	0.443	-2.765	***
Community 2	-2.69	0.514	-5.237	***

Community 1: Altagracia, Banano, Aguas Negras, Los Arroyos and Sapotén
Community 2: Las Mercedes, Puerto Escondido and Boucan Ferdinand

Table A4.3 GLM with binomial error for the association between ethnicity and level of tolerance.

Explanatory factor levels	Estimate	Standard Error	z-value	p-value
Intercept (Dominicans)	0.2063	0.1374	1.501	n.s.
Haitians	-0.2395	0.2025	-1.183	n.s.

Table A4.4 GLM with binomial error for the interactions between level of damage and nature of species (i.e. invasive/endemic) as explanatory variables of level of tolerance (minimum adequate model).

Explanatory factor levels	Estimate	Standard Error	z-value	p-value
Intercept (endemic; low damage)	-1.0068	0.2681	-3.756	***
Invasive	1.4123	0.3224	4.381	***
Damage(medium and high)	0.8309	0.3776	2.201	*
Species*Damage	-0.7759	0.4532	-1.712	n.s.

Table A4.5 GLM with binomial error for the association between ethnicity and attitudes towards environment (minimum adequate model)

A. Question 1. Your farmland is more important than protecting the forest.

Explanatory factor levels	Estimate	Standard Error	z-value	p-value
Intercept (Dominicans)	-0.7841	0.2634	-2.977	**
Haitians	0.8895	0.3738	2.380	*

B. Question 2. I consider the forest near my village to be an important area for wildlife conservation.

Explanatory factor levels	Estimate	Standard Error	z-value	p-value
Intercept (Dominicans)	3.1355	0.7222	4.342	***
Haitians	-3.3297	0.8073	-4.124	***

C. Question 3. I agree not to kill and to preserve *S. paradoxus* and *P. aedium*.

Explanatory factor levels	Estimate	Standard Error	z-value	p-value
Intercept (Dominicans)	1.929	0.3567	5.410	***
Haitians living in DR	-1.604	0.5096	-3.148	**
Haitians living in Haiti	0.0625	0.711	0.088	n.s.

D. Question 4. Endemic animals (i.e. they are only found in Dominican Republic/Haiti) such as the solenodon and the hutia belong to all Dominicans/Haitians

Explanatory factor levels	Estimate	Standard Error	z-value	p-value
Intercept (Dominicans)	1.6094	0.4140	3.887	***
Haitians	-2.7621	0.6251	-4.419	***

E. Question5. Protect the forest near the village has benefits for the community. (A healthy environment will lead to a stronger economy)

Explanatory factor levels	Estimate	Standard Error	z-value	p-value
Intercept (Dominicans)	3.5264	0.7174	4.915	***
Haitians	-1.5249	0.8612	-1.771	*

F. Question 6. Action to be taken in respond to crop damage and/or livestock loses are a decision to be taken by each household (without consultation)

Explanatory factor levels	Estimate	Standard Error	z-value	p-value
Intercept (Dominicans)	3.5264	0.7174	4.915	***
Haitians	-1.5249	0.8612	-1.771	*

G. Question7. I would like more information on solenodon/hutia

Explanatory factor levels	Estimate	Standard Error	z-value	p-value
Intercept (Dominicans)	o.1335	0.2315	0.577	n.s.
Haitians	-1.2756	0.3762	-3.391	***