

Hunters and the Critically Endangered Dwarf Olive Ibis *Bostrychia bocagei*, endemic to São Tomé Island

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Summary

The island of São Tomé holds 20 bird species endemic to the Gulf of Guinea (central Africa), including the single-island endemic, and Critically Endangered, Dwarf Olive Ibis *Bostrychia bocagei*. This species has a very restricted distribution and its population is likely to be declining, highlighting the need to determine and address the current threats. Hunting has been suggested as a major threat to the species, but there is very limited information on its impact.

Improving our understanding of hunting of Dwarf Olive Ibis in São Tomé

To assess the potential impact of hunting on the Ibis, questionnaires were provided to 93 pig hunters from communities across São Tomé, which are known to be hunting in areas where the Ibis is present. The main aims of this study were to determine: (1) The drivers of hunting activity; (2) the target species; and based upon these results, (3) a strategy to reduce hunting impact. The responses from the hunters indicated:

- Most hunters could identify the Ibis and their knowledge of its ecology and distribution is similar to that of scientific literature.
- The Ibis was considered extirpated from fifteen locations, most of which are overlapping, or in the vicinities, of areas that have been deforested for oil palm. Seven hunters made a direct link between the species disappearance and the plantations.
- The majority of hunters perceived the Ibis population to be increasing; however, this perception was less common amongst hunters with more years of experience.
- Most hunters recognised the Ibis as important; however this was relatively split between hunters who felt it was important for being a unique beautiful Santomean bird; and hunters who felt it is important as a food source.
- Only seven hunters indicated Ibis as one of their target species, yet over 40% of the hunters surveyed indicated that they have killed Ibis previously, of which almost 30% hunt Ibis on a monthly basis.
- Hunting activity is highest around the south-eastern area of the Natural Park and buffer zone notably high around the Agripalma sites, partially covering the only area known to support Ibis outside of the ONP boundaries.

Identification of future action to reduce impacts of hunting on Ibis

From the results of the surveys, the hunters identified some different options for taking forward actions to reduce Ibis hunting. The results indicate that hunting of Ibis is opportunistic and for home consumption. The overwhelming majority of hunters (80%) suggested some form of education, through having workshops and meetings with collective groups to raise awareness, would be the most effective way of reducing hunting of Ibis. In March 2016, some initial scoping and awareness-raising was carried out in São Tomé, targeting the hunting communities known to hunt Ibis. The results of the surveys and the scoping exercise in March 2016 have resulted in the identification of potential future actions to work towards reducing the impact of hunting on Ibis in four key areas, these being (a) Awareness-raising; (b) Increased surveillance; (c) Legislative and (d) Incentives. Using these ideas, a Plan of Action has been drafted for 2016-17.

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Section 1: Improving our understanding of hunting of Dwarf Olive Ibis in São Tomé

Introduction

São Tomé and Príncipe (STP) are two oceanic islands of volcanic origin that constitute the second smallest country in Africa and are located in the Gulf of Guinea, central Africa. It is a biodiversity hotspot that supports a remarkable number of endemic species (Jones, 1994). Most of São Tomé Island is covered by biodiverse tropical forests, of which 235 km² (nearly a quarter of the island total area) have been designated as the Obô Natural Park (ONP) since 2006. Despite being protected by national laws, the ONP, which comprises one of the most important forests in the world for the conservation of biodiversity, particularly birds (Buchanan *et al.*, 2011; Rodrigues *et al.*, 2014), resources are limited and the park receives little active conservation management (Dallimer *et al.*, 2009).

The rapidly increasing human population, accompanied by a high youth unemployment rate, is putting increasing pressure on the natural resources of São Tomé Island (Africa Development Bank, 2015). Many activities in São Tomé come from or are related to forest resource extraction, namely hunting, palm wine tapping, logging, giant snail gathering, charcoal production and natural medicine collection (Africa Development Bank, 2015; Carvalho & de Lima, 2014). In 2009, Agripalma, a subsidiary of STP Invest and São Tomé investors, acquired a concession to recover and expand oil palm plantations (5,000ha) close to Monte Carno forests of the ONP and overlapping with the Natural Park's buffer zone (BirdLife, 2016). Most of the activities however, are based on informal unregulated markets, and even those markets that are intended to be regulated and monitored, such as commercial logging, are not due to the lack of enforcement capacity and resources (Africa Development Bank, 2015).

The island of São Tomé holds 20 endemic bird species endemic to the Gulf of Guinea (central Africa), of which three are classified as Critically Endangered: the Dwarf Olive Ibis *Bostrychia bocagei*, the São Tomé Fiscal *Lanius newtoni* and the São Tomé Grosbeak *Neospiza concolor*. Between 2013 and 2015, in partnership with the BirdLife International's São Tomé and Príncipe Initiative, systematic surveys of São Tomé's main forest block took place to determine the distribution and abundance of the three Critically Endangered birds (de Lima *et al.* *In press*). Of these, the Ibis was considered the most sensitive, facing diverse threats such as habitat destruction, degradation and disturbance and being restricted to a small area during the breeding season (Ward-Francis *et al.*, 2015; de Lima *et al.*, 2015). The surveys also increased our knowledge on the breeding ecology and habitat requirements of the Ibis (Ward-Francis *et al.*, 2015; Margarido, 2015). Further research into the threat of hunting was highlighted within the Species Action Plan for the Critically Endangered species of São Tomé (BirdLife International, 2014).

Reports of Ibis hunting on São Tomé have been ad hoc, and include 16 birds being killed in 1996-1997 (S. d'Assis Lima *in litt.* 2006), and six birds killed on a single occasion by one

hunter (del Hoyo *et al.* 1992). Hunting pressure is believed to be increasing in the Monte Carmo area of the Obô Natural Park, one of the main strongholds for the species, and a group of hunters were found with at least one ibis in April 2011 (R. Grimmett *in litt.* 2011, Anon. 2011). Hunting of other species on São Tomé has received more attention recently from researchers. There are three distinct groups of hunters, identifiable through their aligned motivations, techniques used and quarry species targeted (Carvalho *et al.*, 2015a). These hunting groups have been identified to specialize in hunting pigeons, monkeys or pigs. The hunting group specialising mainly in pigeons, which is a small group, doesn't require accessing very far inside the forest. The same is applicable for monkey hunters, which is one of the largest groups of hunters. The pig hunters have to travel further into the forest due to the availability of pigs. It has been suggested that pigs remain most common farther inside the forest, which is likely due to hunting pressure, resulting in hunters travelling increasingly larger distances to reach places where feral pigs can be found (Carvalho *et al.*, 2015a). To reach sites where pigs are available requires crossing the Ibis distribution area (Carvalho *et al.*, 2014a; Ward-Francis *et al.*, 2015). Feral pigs are scarce and not always easy to find, and as a result, some hunters prefer to opportunistically hunt endemic and native species rather than returning home without anything to eat (Carvalho *et al.*, 2015a).

It has been found that the abundance and distribution of São Tomé's pigeons has been influenced by hunting pressure (Carvalho *et al.*, 2015b), and therefore hunting may also be influencing other São Tomé endemic species. Therefore, despite not being the target species, it is possible that hunting is impacting Ibis abundance and distribution (Carvalho, pers. comm.). Information gathered from previous studies on hunting practices in São Tomé (Carvalho *et al.* 2015, Carvalho *et al.* 2015a), and informal conversations with people that use forest resources, has indicated that hunting may be impacting the Ibis. Furthermore, during the forest surveys between 2013 and 2015, hunting was found to be the most widespread activity in the forest, with notably more signs of hunting activity in the west of the island (Ward-Francis *et al.*, 2015).

In March 2016, the São Tomé and Príncipe Hunting Regulation came into force, which forbids hunting in protected areas (i.e. São Tomé Obô Natural Park) and the hunting of endangered species (FAOLEX, 2016). The Law also requires all hunters to be licensed, and details penalties for illegal activities (FAOLEX, 2016).

Currently, the hunting pressure and resulting impacts on the abundance and distribution of Ibis is all but unknown, with limited knowledge on how many people actively or opportunistically hunt this species. In this context, this study aims to gather the information needed to better understand the threat of hunting to the Ibis, and to use this information to make recommendations of appropriate measures for assessing and responding to this threat.

Methods

To develop our understanding of the potential threat of hunting on the Ibis, a questionnaire approach was used, based on a previous study focusing on São Tomé hunters (Carvalho *et al.* 2015a). Only hunters likely to enter the Ibis area of occurrence, i.e. mostly pig hunters, were surveyed. Using and expanding on a pre-existing list of hunters (Mariana Carvalho, pers. comm.), a total of 149 hunters were identified within the target group.

The hunters were interviewed following a semi-structured questionnaire (Annex 1), based on a previous study (Carvalho *et al.* 2015a). The questions were designed to ascertain the drivers of hunting activity, identify the target species, and to understand how the project could work with them to reduce their impact. The interviews were informal, based around these three themes. Experience of social scientists working in São Tomé, has shown this is the most successful method of getting the required responses (Carvalho *et al.*, 2015). To facilitate communication, the interviewer was accompanied by a local guide, familiar to most hunters in the island. To ascertain whether the hunters truly knew the Ibis, photographs were used as a method of identification throughout the surveys.

The objectives of the questionnaires were to: 1) evaluate hunter knowledge, behaviour and attitude towards the Ibis; 2) characterise the hunter's background, preferences and practices; 3) seek suggestions from the hunters on their recommended approach to reducing hunting pressure over the Ibis.

Results

Of the 149 hunters identified, we were only able to interview 93 during the field visit from 13th November 2014 to 6th March 2015. The majority (88.17%) of the hunters surveyed could identify the Ibis from photographs and descriptions. Eleven hunters misidentified the Ibis from the photographs. Of these eleven hunters, data was only collected from one hunter, who indicated they knew the species. Due to some difficulty with using the photographs as a method of identification throughout the surveys, the results from this individual hunter were included within the analysis.

Interviewees were living in 31 localities spread across São Tomé (Fig. 1). Claudino Faro was the community with the highest number of interviewed hunters (14%), followed by São João dos Angolares (9.7%), Monte Café and Agulha de Malanza (both with 8.6%) and Santa Catarina (7.5%). On average, the hunters were 37 years old, had started hunting when they were 18 years old, and had been hunting for 20 years. Only one of the interviewees was a woman.

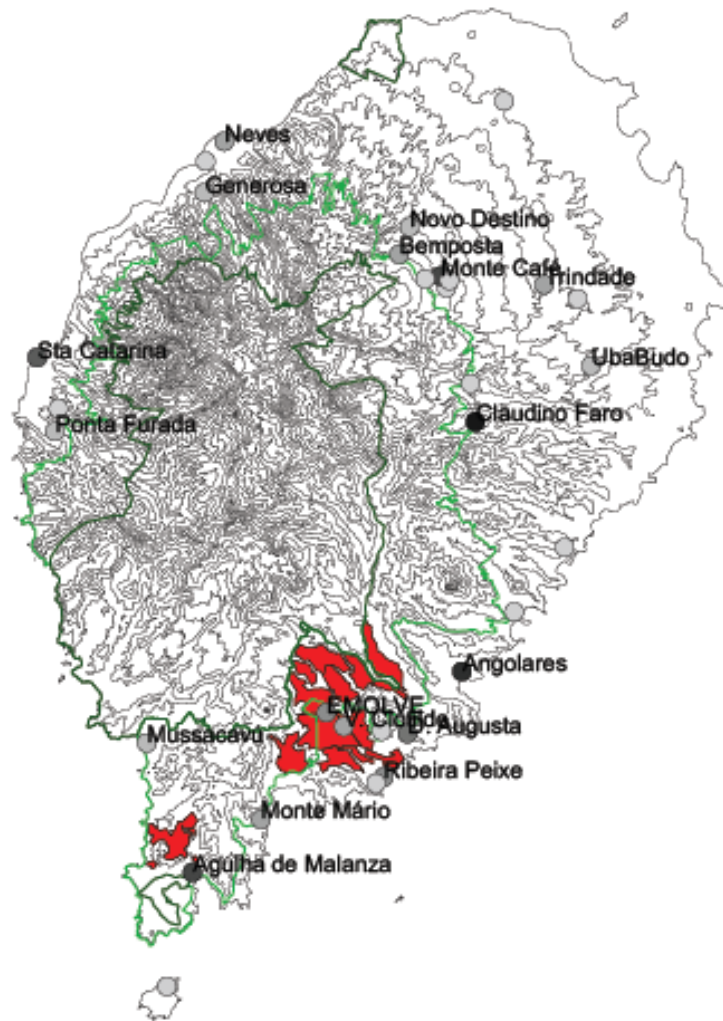


Figure 1 – Home locations of hunters across São Tomé. The grayscale dots represent the number of hunters from each locality, with darker colours indicating higher numbers of hunters. The sites labeled are home locations of more than one hunter. The green lines indicating Obo Natural Park boundaries (darker green = core park, lighter colour = buffer zone). Background black lines are 50m altitudinal isohyets.

(1) Hunters' knowledge of Dwarf Olive Ibis ecology

Regarding the habitat used by the Ibis, 66.66% (n=75) of the hunters stated that it is mostly found in primary forests, locally known as Obô, with 13 hunters specifying that it was found inside the Obô Natural Park. In terms of the Ibis distribution, São Miguel was the most mentioned location (24.29% of hunters; Fig. 2a; n=79), followed by Santelmo (15.07%), Mato Perdido (15.07%), Monte Carmo (15.07%), Duas Grotas (13.70%) and Vila Machado (12.34%). This roughly coincides with the known areas for the occurrence of the species (Fig. 2b).

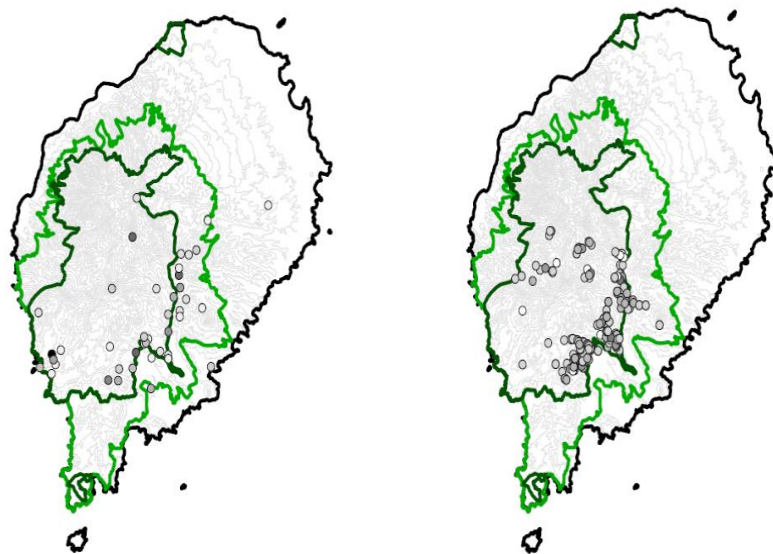


Figure 2: Distribution of the Ibis (a) as perceived by the hunters (n=79) and (b) as recorded in BirdLife's GPS locations' database. The dots with darker colours indicate (a) more mentions of a location or (b) larger group sizes. 100 m altitudinal isolines on the background. The dark green line represents the boundaries of the Obô Natural Park, and the light green that of the corresponding buffer zone.

Most of the hunters surveyed did not know the food preferences of the Ibis. Of those who had any perception of the Ibis food preferences, most referred them to be insects or other invertebrates and vegetation (fruit, seeds, flowers). However, the answers indicated that this species is often seen feeding on the ground, with 76.92% (n=52) of the hunters surveyed saying this, with 97.14% (n=35) of the hunters indicating that the Ibis is mostly found in flat areas. The hunters also identified that they regularly observe the Ibis in small groups, mostly pairs, with a median number of 2.25 birds (range: 1 – 10 birds). Four of the hunters surveyed said that Ibis were only observed at certain times of the year, suggesting that the Ibis may have seasonal movements.

In terms of breeding ecology, the hunters response to nesting preferences was varied, indicating that the Ibis nests in trees, but varying in height, with 23.63% of the hunters saying Ibis nest high (>10m), and 25.45% of the hunters saying Ibis nest low in trees (<10m) (n=55). Several hunters referred to the nest being made from small sticks and two hunters

said that the Ibis builds the nest on a bifurcating branch of the tree. Several hunters noted nest failure due to predation by monkeys (n=4) and snakes (n=1), and nests had been actively destroyed by four of the hunters. Of those who knew, the majority (48.48%; n=33) said Ibis have two eggs/chicks.

(2) Hunters' perceptions of Dwarf Olive Ibis population and status

Some (43.75%) of hunters suggested that the Ibis population is increasing, compared to 31.25% who suggested it was decreasing (n=63). However, it seems that the perception of the population status of this species changes with the length of time hunting (Fig. 3). Those who have been hunting for more than 20 years were, when they expressed an opinion, more likely to say the population is decreasing or stable when compared to those who have been hunting for fewer than 20 years (Fig. 3).

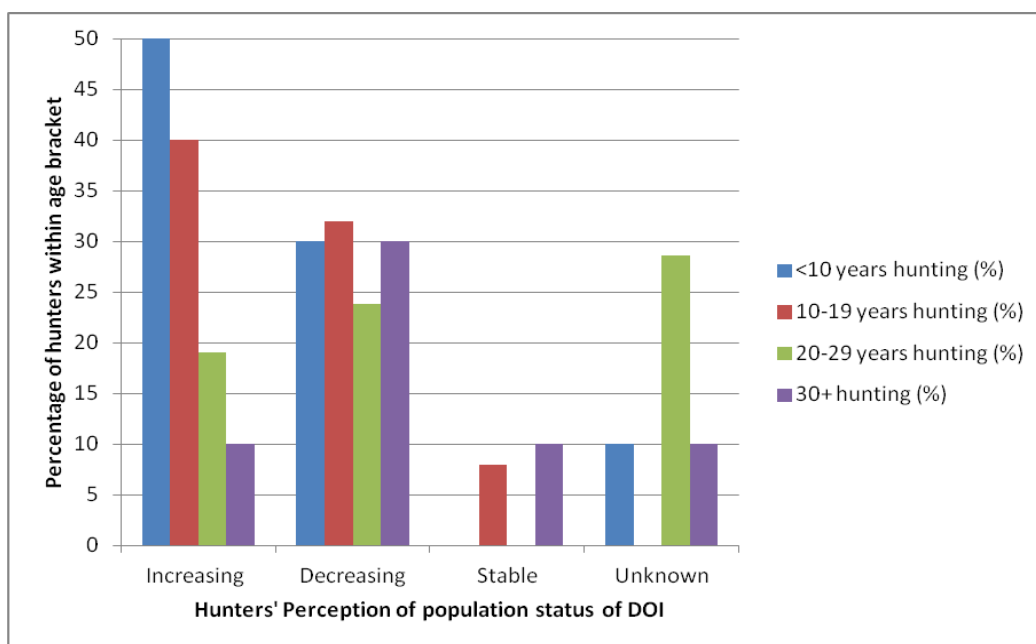


Figure 3: Hunters' perception of Ibis population status in relation to number of years spent hunting.

Many of the hunters surveyed did not think the Ibis is a threatened species (63.08%; n=63), however this may be partially due to them misunderstanding the meaning of this word when used in a scientific context. The majority of hunters considered the Ibis to be important; given the ability to choose just one option, 21 hunters (38.89%) think it is important for São Tomé as a unique beautiful bird, whilst 18 hunters considering the Ibis as important for food (33.34%) (n=54). Nine hunters noted that it must be important as foreigners were coming to look for it and could be important for ecotourism (16.67%).

Of the hunters who provided information on noticeable changes to the Ibis distribution, logging and oil palm plantations were considered the main reason for those changes (41.18%; n=34). Eleven locations were considered to have been extirpated of Ibis (Fig. 4), with seven of the hunters directly mentioning that in some locations this happened as a direct impact of deforestation for Agripalma's oil palm plantations. Another two mentioned

logging as the cause but didn't refer to any particular location. Overhunting and disturbance were also referred, by two hunters, as being responsible for changes in Ibis distribution. Two hunters also mentioned new locations (Rosário and Monte Fuji) where they can now find the Ibis where it was not present previously, one of which said the change in distribution was directly as a result of Agripalma's oil palm plantations.

Areas previously supporting Ibis	No. Records
Assentada Grande	3
Burnay	1
Dona Eugénia	4
Monte Carmo	2
Mufucu	1
Santelmo	1
Guayaquil	1
Campo Grande	1
Maria Fernandes	1
Ermelinda	1
Sarracinda	1

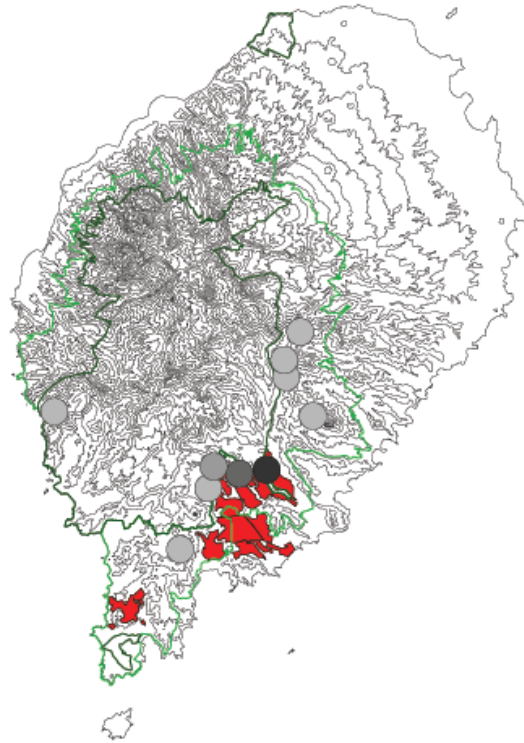


Figure 4: Location of areas mentioned by the hunters as having been extirpated of Ibis. The dots with darker colours indicate more mentions of a location. The red polygons indicate areas that have been planted for oil palm by Agripalma. 100 m altitudinal isolines on the background. The dark green line represents the boundaries of the Obô Natural Park, and the light green that of the corresponding buffer zone.

(3) Hunting pressure on Dwarf Olive Ibis

The most mentioned hunting locations include: Agrião (22.58% of hunters), São Miguel (22.6%), Guayaquil (17.2%), Caué (17.2%), Santelmo (17.2%) and Vila Machado (15.05%) (Fig. 5; n=93). The majority of hunters would travel back every night after hunting and would only occasionally sleep over in the forest.

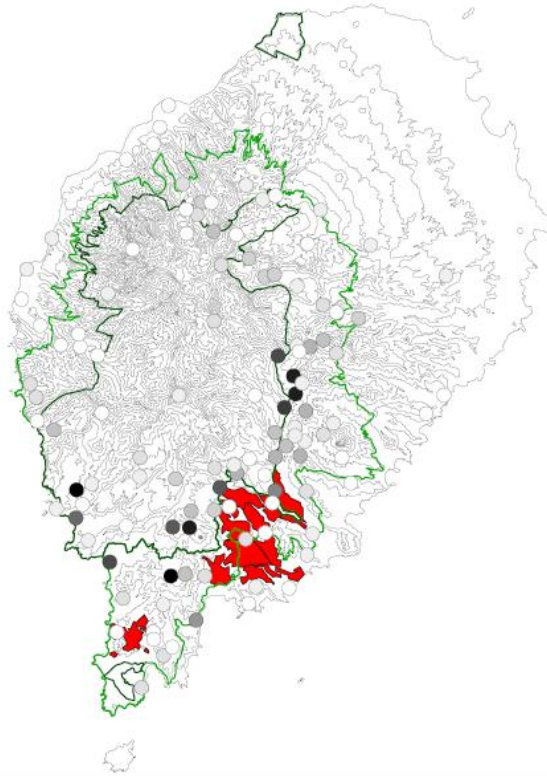


Figure 5: Distribution of hunting locations in São Tomé. The dots with darker colours indicate more mentions of a hunting location. 100 m altitudinal isolines on the background. The dark green line represents the boundaries of the Obô Natural Park, and the light green that of the corresponding buffer zone.

When hunters were asked which species would they usually target, most affirmed pig (93.18%) and monkey (69.32%) but also many admitted to hunt civet (32.95%), pigeons (26.14%), fruit-bats (26.14%) and Ibis (7.95%) (Fig. 6; n=88).

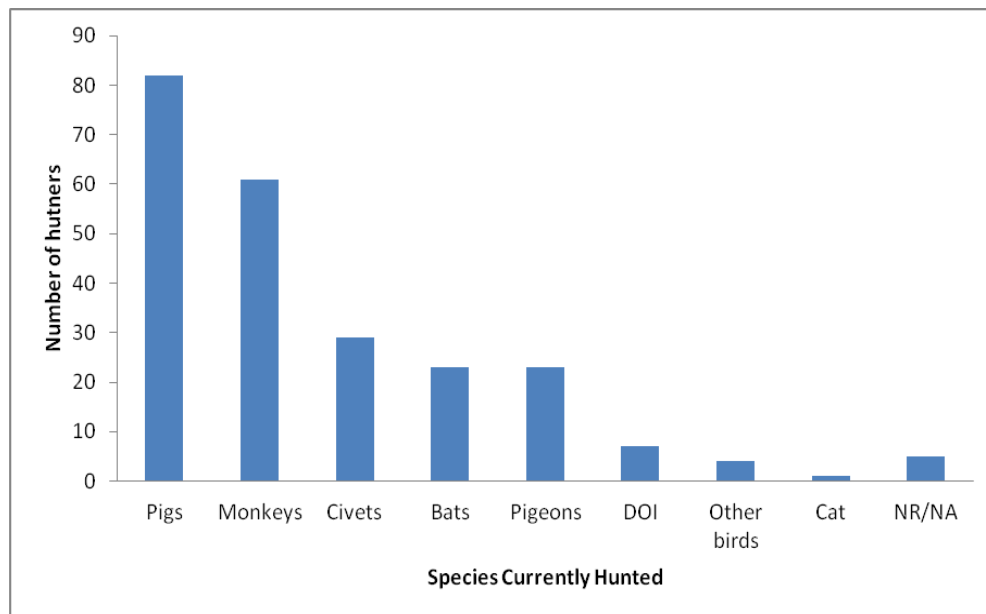


Figure 6: The species actively hunted in São Tomé by cohort of hunters surveyed (n=88). DOI indicates dwarf olive ibis.

When hunters were directly asked if they had ever killed Ibis, 46.91% said they had never killed it (n=81). Of the 40.86% who have killed this species, 19 hunters affirmed to have only killed it occasionally, with less than 10 individual overall. However, 28.40% of the hunters surveyed said they kill Ibis on a regular basis; of which 11 hunters kill between 1 and 5 per month, normally when no other food is available; and 12 hunters regularly targeting Ibis, with more than five killed each month (Fig. 7). One individual hunter, who had affirmed to have killed Ibis, did not quantify how many. Only two of these 81 hunters mentioned the Ibis being sold for meat, for between 2 euros a bird and 4 euros per kilogram. Furthermore, four hunters confirmed they had destroyed an Ibis nest, and over the last year two hunters are known to have collected live young birds.

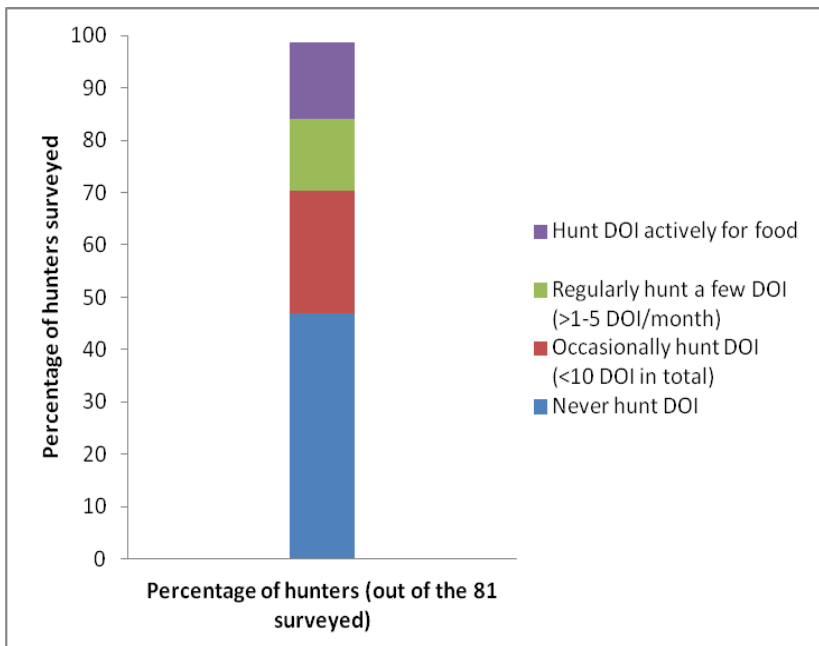


Figure 7: The percentage of hunters surveyed that have never hunted Ibis, occasionally hunt it and those who regularly/actively do it (n=81).

The locations most frequented by the hunters are situated around the south-eastern limit of the ONP, namely the area around Agripalma's oil palm plantations (see Fig. 5), with many locations being referred (e.g. Dona Eugénia, Umbugu River, Monte Carmo, Ermelinda, Pico Cão Grande, Agrião).

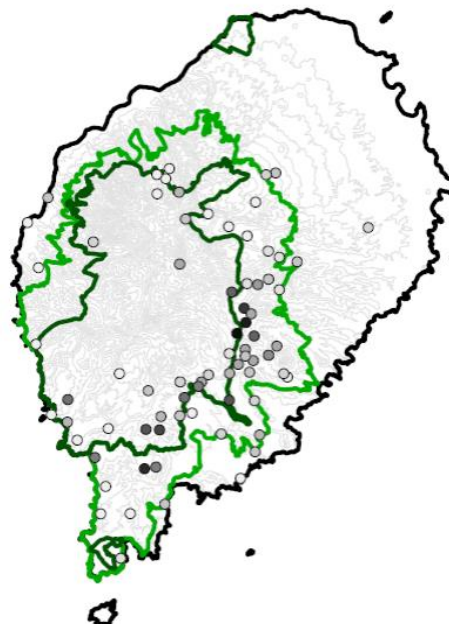


Figure 8: Distribution of Ibis hunting pressure in São Tomé, as indicated by the cohort of hunters surveyed (n=76). The dots with darker colours indicate higher number of hunters using the area. 100m altitudinal isolines on the background. The dark green line represents the boundaries of the Obô Natural Park, and the light green that of the corresponding buffer zone.

When asked how the hunters could reduce or stop the hunting of the Ibis, three main methods were suggested by the hunters: (1) pay compensation to the hunters; (2) education; and (3) legal action - protect the Ibis legally; enforce surveillance and confiscate guns without licenses (Fig. 9). Of the 70 hunters who gave a response, 80% suggested some form of education would be an effective way to stop the hunting of Ibis, through talks and community events.

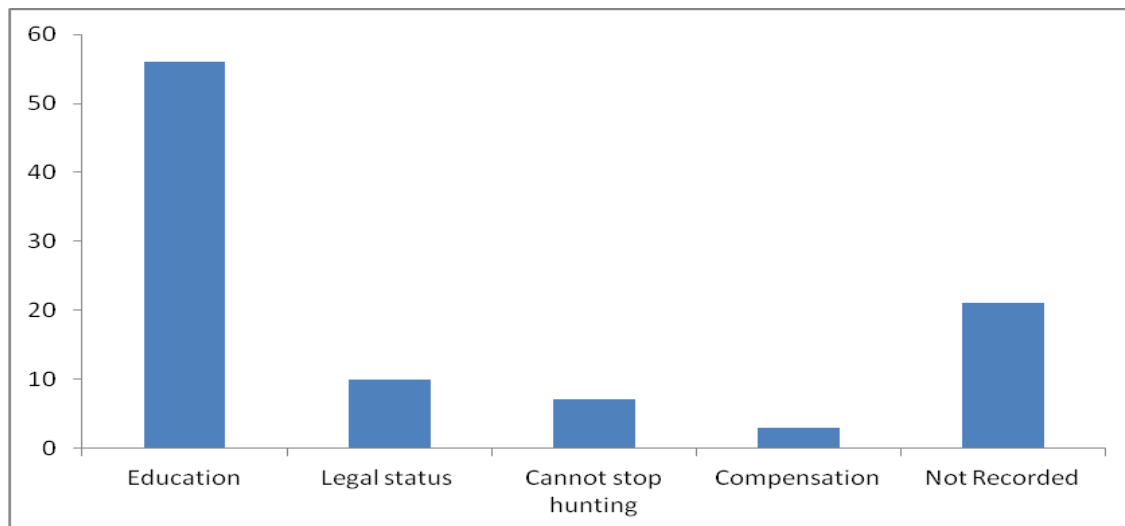


Figure 9: The suggested methods and actions required by the hunters to enable a reduction in the number of Ibis killed (n=70).

Discussion

From the cohort of hunters surveyed, it was evident that the hunters have a similar understanding of the species ecology to scientific literature (de Lima *et al.*, *In press*). The hunters perceived the Ibis to be important, yet not threatened overall (although the use of the word threatened may be affected by cultural differences), and overall believed the Ibis to be increasing. The south-eastern area of the Park/buffer zone is particularly under high hunting pressure, as is discussed below. Notably, this includes some of the locations where hunters have observed that Ibis were previously present here, and are now no longer. It is therefore highly likely that hunting of Ibis is opportunistic, for home consumption, and is having a negative impact on the Ibis population. Hunting activity is highest around the south-eastern area of the Natural Park and buffer zone notably high around the Agripalma sites, partially covering the only area known to support Ibis outside of the ONP boundaries.

(1) Hunters' knowledge of Dwarf Olive Ibis ecology

The initial process of the surveys indicated that most of the hunters interviewed were able to identify the Ibis and that they are fairly knowledgeable of the species ecology and distribution. The information obtained from the surveys indicates that the hunters' perceptions of Ibis ecology are very similar to that of scientific literature in terms of distribution and range, with the locations with Ibis described by the hunters overlapping with the Ibis locations observed in the BirdLife GIS database, as displayed in Figure 2 (Ward-Francis *et al.*, 2016). Interestingly, seasonal movements of Ibis were mentioned by several hunters, which had not been recorded until recently (de Lima *et al.*, *in press*). Predation by invasive species, such as monkeys and cobras, may represent a significant threat to the Ibis. Although highlighted by several hunters, the impact of this predation has not yet been confirmed by scientific surveys.

(2) Hunters' perceptions of Dwarf Olive Ibis population and status

The majority of the hunters recognized that the Ibis has importance in some way. The reasoning of importance was relatively split between those hunters who felt it was important as a source of food, and those who felt it was important as a unique beautiful bird. The latter response is possibly as a result of awareness raising actions that have been developed in the past, namely focusing on threatened endemic biodiversity (mostly birds), which took place even in small and isolated communities (Carvalho & de Lima, 2014). The hunters also suggested that it must be an important species because foreign people are purposefully coming to São Tomé to look for it.

Many hunters however, did not perceive the Ibis as threatened, which is possibly due to a misunderstanding of the meaning of this word when used in a scientific context. The majority of the hunters however, also felt that the Ibis was increasing. This may be indicative of increased movement of Ibis into areas already supporting the species, resulting in increased sightings, thus giving the impression of an increasing population. If this is the case, this could mean the Ibis is in fact becoming more threatened. The results also show that with increasing number of years hunting, the hunters' perception of the Ibis status changes, with fewer hunters believing the Ibis is on the increase. Scientific monitoring of the population is essential if population trends are to be accurately assessed.

Most of the locations highlighted by the hunters as previously supporting Ibis, but now do not, either directly overlapped with the areas cleared for oil palm by Agripalma, or are in close vicinity to these sites (Figure 4). Additionally, one hunter directly related the movement of Ibis into new locations as a result of the clearance for Agripalma. It is quite possible that other associated factors associated with land use change may have contributed to the disappearance of Ibis from these areas (e.g. changes in local climate and increased movement of invasive species), in addition to the direct impact of habitat loss and disturbance (de Lima *et al.*, 2015). There were several other locations referred to by the hunters as previously supporting Ibis but now do not, that are not adjacent to Agripalma sites; notably Guayaquil, Maria Fernandes, Mufucu and Santelmo. The hunting activity appears to be highest in the south-eastern area of the Obo Natural Park/buffer zone, which is suggestive that overhunting and human disturbance may have contributed to the disappearance of Ibis from these areas.

(3) Hunting pressure on Dwarf Olive Ibis

Only seven hunters indicated Ibis as one of their target species, yet over 40% of the hunters surveyed indicated that they have killed Ibis previously, of which almost 30% hunt Ibis on a monthly basis (Fig. 7). Socially it is considered important to bring prey back home following a hunting trip (M. Carvalho, pers.comm.); therefore, due to the conspicuous nature of the Ibis and the relative ease of dispatching the birds (i.e. hunters have said they are able to kill Ibis just using a stone), it is possible that the Ibis is an easy species to opportunistically target. Only two hunters mentioned the Ibis being sold for meat, for between 2 euros a bird and 4 euros per kilogram, which is an equivalent cost to other meats available, such as pork. It is therefore highly likely that hunting of Ibis is opportunistic, for home consumption, and is having a negative impact on the Ibis population.

Hunting activity is highest around the south-eastern area of the Natural Park and buffer zone (Fig. 8). The main areas of high hunting activity (e.g. Guayaquil, Vila Machado and Santelmo) are located in the eastern limits of the ONP, and close to these there are many other important hunting locations identified by hunters for hunting Ibis (e.g. Cruzeiro, Maria Fernandes, Água João). The high hunting activity over the south-eastern buffer zone area is around Agripalma's oil palm plantations, with many locations being referred (e.g. Dona Eugénia, Umbugu River, Monte Carmo, Ermelinda, Pico Cão Grande, Agrião). These areas of high hunting activity partially overlap with the only area known to support Ibis outside of the ONP boundaries, known to be especially important for the Ibis during the breeding season (Fig. 8; Ward-Francis *et al.*, 2015). Additionally, this area coincides with some of the locations referred by hunters as having been extirpated of Ibis. This further indicates that overhunting may be limiting Ibis distribution and abundance.

The majority of the cohort of hunters surveyed specifically target species such as pigs and monkeys, which are introduced invasive species. These invasive species are highly likely to be having a negative impact on the forest ecosystem, through directly preying on native wildlife and changing the vegetation structure. Therefore, it is possible that the hunters may have a positive impact to the native wildlife by suppressing the populations of introduced invasive species. It is not clear however, if their hunting practices are actually of a sufficiently high pressure to impact the populations of these species in any meaningful way. A positive outcome for conservation would be the sustainable hunting of introduced invasive species (such as pigs and monkeys) such that it had an effect in reducing their populations, along with discouragement of Ibis hunting.

The majority of the hunters surveyed in this study, which have killed Ibis, could not provide reliable figures in terms of the number of birds killed. Therefore it was not possible to evaluate and quantify hunting pressure and estimate an accurate figure of Ibis killed. Although further research is required to investigate the numbers of Ibis being killed, and to produce accurate and reliable estimates of how many birds are being killed by hunters per year, from this study we have enough evidence to indicate that this species is targeted on a regular basis by more hunters and hunted in higher numbers than previously recorded (S. d'Assis Lima *in litt.* 2006; del Hoyo *et al.* 1992; R. Grimmett *in litt.* 2011, Anon. 2011). Hunting should therefore be considered a serious threat to the Ibis, potentially impacting the population size, distribution and reproductive success of this Critically Endangered species.

In early 2016, the São Tomé Hunting Law was enacted (FAOLEX, 2016). This recent current legislation states that hunting licenses are required; it is illegal to hunt endangered species (including the Ibis); and forbids hunting in protected areas, i.e. São Tomé Obô Natural Park (FAOLEX, 2016). Penalties for offences in relation to this legislation are also detailed (FAOLEX, 2016). The current or potential impact of this legislation on the conservation of the endemic species of São Tomé is currently unknown. Similarly however, the planned communication of this legislation to the hunting community and enforcement of this legislation by the the ONP authorities/ Forestry Department is not known at present. Currently the approval of this Law has not been clearly communicated to the appropriate officials, and therefore it is unlikely to provide any benefits to the native wildlife in the short term.

Section 2: Identification of future action to reduce impacts of hunting on Ibis

As outlined in the discussion above, it is possible that the current levels of hunting are unsustainable for the Ibis and may be impacting the population distribution and reproductive success of this species. From the results of the surveys, the hunters identified some different options for taking forward actions to reduce Ibis hunting. The overwhelming majority of hunters (80%) suggested some form of education, through having workshops and meetings with collective groups to raise awareness, would be the most effective way of reducing hunting of Ibis. Other options included compensation approaches and the Government enacting law and enforcement (Fig. 9).

Ibis hunting is now illegal (FAOLEX, 2016). However, as hunters are killing Ibis to meet subsistence needs and are generally hunting Ibis opportunistically rather than targeted, it is currently unclear how the ONP authorities/ Forestry Department will undertake law enforcement. We speculate that working directly with hunters to reduce hunting pressure will be the most appropriate approach. In addition, the suggestive evidence that previous awareness raising activities on São Tomé have made a positive impact indicates that this method would be the best initial approach.

In March 2016, some initial scoping and awareness-raising was carried out in São Tomé, targeting the hunting communities known to hunt Ibis (Annex 2). This scoping visit enabled some positive useful conversations with the key hunting communities, plus the identification of some communication techniques with these groups. From this visit, it was evident that it is important to continue raising awareness on these issues and engaging with the hunting communities.

The results of the surveys and the scoping exercise in March 2016 have resulted in the identification of potential future actions to work towards reducing the impact of hunting on Ibis. The four key ideas are discussed in more detail below. From these ideas listed below, a work-plan has been drafted (see Section 3: Plan of Action 2016-17).

(a) Awareness-raising

The key issue to address is that, although the majority of hunters considered the Ibis to be important in some way, some believe it is only important as a food source, and the perception of the status of the Ibis indicates that the majority of hunters do not believe the Ibis to be threatened with extinction. Future communication needs to focus on the message that the species is indeed important, and it is also threatened and could go extinct if we do not work together to address the current threats.

Educational activities were the most commonly raised idea by respondents and several hunters also made references to previous effective educational work. Educational activities are also the most feasible option to be achieved within short timeframe. Key messages for awareness-raising would be:

- Discourage Ibis hunting on the basis that it is unique to the country, endangered and faced with extinction;
- Raising awareness that the species is protected from hunting by the law;
- Advocating hunting non-native species; and
- Seeking to work in a collaborative way with hunters.

We suggest three approaches to awareness-raising:

- Building on existing interview / discussion based approach and rolling this out with the group of 93 and possibly expanding to further hunters;
- Undertaking radio interviews with hunters on local stations and on the discussion hour programme on national radio station; and
- Design promotional t-shirts / caps with positive message about protecting the Obo Natural Park and unique wildlife.

The identification of a few (1-3) obvious champions from the bigger group who could be first be engaged with to become 'conservation champions' (e.g. through consistent field work engagement) would be a sensible approach, and would enable some form of local ownership. In the short-term, the type of engagement needs to be targeted for hunting groups, generally focused at men in their late 30s who have been hunting for a significant period of time. There is also a need for a form of community engagement that can involve a wide range of ages (from 18 – 70 years old), structured in a way that will be applicable to those who have been hunting for up to 20 years. In the long-term, a school education based programme will help to ensure the next generations are aware of the importance of STP's endemic wildlife, including the Ibis.

This community engagement should be targeted at the main communities/hunting groups involved with Ibis hunting; notably those listed in Table 2 above and Annex 2.

(b) Increased surveillance

Another activity put forward to address hunting is to work with existing networks of identified and interested hunters in some of the key forest edge communities, who could be supported to become species champions. This would involve them recording any instances of the bird being killed and reporting these figures to the Forest Department and BirdLife Partnership representative. Their main role would be to promote protection of the Ibis, raise awareness on the legal protection and importance of the species. This effort could be targeted at park entrances and in communities identified above.

The individuals would likely need training in approach. In addition, consideration would need to be given to how these individuals would be recognised for their work. This would need to be discussed in-country.

Additionally, Forest Department staff should be given training in surveillance and awareness-raising for targeting hunters that kill the Ibis. This can only be achieved if a project for Natural Park management is financed.

(c) Legislative

In early 2016, the São Tomé Hunting Law was enacted (FAOLEX, 2016). This recent current legislation states that hunting licenses are required; it is illegal to hunt endangered species (including the Ibis); and forbids hunting in protected areas, i.e. São Tomé Obô Natural Park (FAOLEX, 2016). Penalties for offences in relation to this legislation are also detailed (FAOLEX, 2016). There is a provision within the law for control of invasive species, within the park. This could provide an interesting approach to promote to hunters, whereby BirdLife team support hunters to complete these applications and enable them to take this forward on the condition that they commit to not taking any endemic species.

The BirdLife team could also work on enabling the hunting group to make recommendations about revision of the hunting law to make it more fit for purpose.

(d) Incentives

Compensation payments were identified by a small number of the hunters surveyed, as a method for enabling the reduction in hunting of Ibis. However, a payments system would be extremely complex to manage and open to financial issues and mismanagement. A potentially more suitable approach utilized in other countries and trialed successful through existing projects in-country to support poverty alleviation and sustainable development is providing in-kind support to enable alternative livelihood development. Potential livelihood options could be sought from the hunters when engaging them during the awareness sessions. This could result in a more reliable and profitable income stream, however most likely would be dependent on international funding aid.

When investigating the drivers of pig hunting group however, the rationale is often due to the activity being enjoyable and for sport and therefore not about subsistence. Therefore, another incentivised approach has been put forward instead. Due to the recent changes within the law, the value in hunting groups becoming more organised and self regulating has increased. Currently, hunting is not regulated, monitored or organised in any way, which makes it difficult for interested stakeholders to work with hunters. Considering the changes to law, having a more organised hunting group structure, which takes more oversight of hunting policy implementation, regulation, licensing would enable hunters to have more

control over what happens next with the policy. The project could help facilitate this happening through supporting the first series of workshops to take place. In addition, project staff can help provide a bridge with the Forest Department and potential engagement in improvement in the law.

Section 3: Plan of Action for 2016/17

Activity	Timeline
<ul style="list-style-type: none"> ☐ Finalise hunting report ☐ Produce hunting report summary in Portuguese and share with Forest Department and Environment Department 	August/September 2016
<ul style="list-style-type: none"> ☐ Roll out follow-up meetings to hunters who have killed Ibis at priority communities. <ul style="list-style-type: none"> ☐ Promote idea of self-organising hunting group and highlight the development of hunting policy ☐ Investigate interest in support for application of licensing ☐ Identify potential champions based on influence and interest ☐ Get ideas on T-shirt designs ☐ Undertake initial radio interviews. Explore options of TV interviews. 	October/November 2016
<ul style="list-style-type: none"> ☐ Organise T-shirts to be made ☐ Develop plan for workshops and species champions 	December 2016/January 2017

<ul style="list-style-type: none"> ☐ Undertake more radio interviews ☐ Hold workshops at key communities for hunting pressure to initiate discussion on organisation of hunting group <ul style="list-style-type: none"> ☞ Discuss species champion idea with identified people and ask about how to take forward ☞ Identify potential structure and engagement approach with Forest Department ☞ Suggest approach to licensing for control of invasives ☐ Write short report on progress 	<p>February/March 2017</p>
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ANNEX 1: Questionnaire used during surveys of hunters (2014-15)

Acerca do caçador/ About the hunter:

Data/Day.

Nome/ Name.

Idade/ Age.

Localidade/ Place of living.

Há quantos anos caça/ How many years he's spent hunting.

Acerca da galinhola/About the Ibis:

O caçador consegue identificá-la bem?/ Can the hunter easily identify it from the pictures?

Em que locais/zonas da ilha costuma ver a espécie?/ In which places/regions of the island does he usually see this species?

Qual o tipo de habitat que usa?/ What type of habitat does it use?

Onde se alimenta, o que come?/ Where does it feed, what does it eat?

Tem conhecimento de ninhos (onde, em que altura do ano, a que altura do solo, como são, quantos ovos), quantas crias vê juntas?/ Have you ever seen their nests? Where and when can they be found? What are they like? How many chicks can they have?

Em que locais havia galinhola e deixou de haver ou vice-versa?/ Has it appeared or disappeared from some places?

Acha que a espécie é mais/igual/menos abundante do que antes?/ Are there more, less or the same number of Ibis than in the past?

Está ameaçada? Porquê?/ Is it threatened? Why?

É importante? Porquê?/ Is it important? Why?

Outros comentários/ Other comments.

Sobre a caça/ About hunting:

Que espécies costuma caçar?/ Which species does he hunt?

Caça ou já caçou galinhola?/ Do you hunt or have you ever hunted the Ibis?

Se sim, quantos indivíduos caça/caçou e porquê?/ If yes, how many birds and why?

Se vende carne de galinhola, quanto ganha com ela e que % do rendimento isso representa?/ If to sell, how much are they worth and how much does that represent of your earnings?

Qual a importância que ela tem para eles e se deixariam facilmente de a caçar. O que fazer para ele ou outros caçadores deixarem de caçar esta espécie?/ How important is the Ibis for you? How could you stop hunting this species?

Em que locais/regiões da ilha caça?/ Where do you go hunting?

Costuma dormir na floresta?/ Do you sleep in the forest?

Com quem caça./ Who he hunts with.

Outros comentários/ Other comments.

Contactos de outros caçadores/ Contacts of other hunters.

ANNEX 2: Awareness-raising visit summary (March 2016)

In March 2016 SPEA/BirdLife organised meetings with Ibis hunters in São Tomé Island as a follow-up of previous work developed with them between 13 Nov 2014 and 6 March 2015.

From first interviews we realised that continuing engaging with hunters would be crucial to understand how many Ibis are actually being killed and would be one of the best approaches to sensitise hunters to the fact this is a threatened species and therefore to convince them not to kill this species anymore. Additionally, since March 2015 some of the hunters interviewed have come to us asking for the results of this study and saying they were still waiting for us to meet with them again. Therefore, we tried to organise meetings with most of pig/Ibis hunters from our list, giving preference to the ones already interviewed by us and to those that admitted to kill this bird. We also gave preference to visiting communities where there are more hunters targeting the Ibis (Table 2).

Our team visited 11 communities and managed to meet with 66 hunters. From these 44 had participated in the first interviews, of which 23 admitted to have already killed Ibis (Table 2). According to the number of Ibis killed, hunters were included in 3 categories. Additionally to those 44 we also managed to meet with 22 hunters that hadn't been interviewed before. Communities where we were able to meet with more hunters were Claudino Faro (13), Angolares (9), Agulha de Malanza, Ribeira Peixe and Trindade/Milagrosa (all with 8).

We held meetings either with one hunter alone or with a group of hunters, accordingly to what was easiest to organise in each case.

Table 2: The community locations which experience Ibis hunting, and the number of hunters for each community location that have hunted this species. Whether this is occasional or regular hunting is also indicated.

Community	Number of hunters having killed Dwarf Olive Ibis	Dwarf Olive Ibises are regularly hunted	Meeting date in 2016
Angolares	8	Yes	17 th March
Claudino Faro	5	Yes	21 st March
Dona Augusta	4	Yes	16 th March
Ribeira peixe	4	Yes	16 th March
Vila Clotilde	3	No - occasional	16 th March
Agulha de Malanza	3	Yes	16 th March
Santa Catarina	3	Yes	18 th March
Emolve	2	No - occasional	16 th March
Monte Café	2	Yes	NA
Santo Antonio Mussacavu	1	No - occasional	18 th March
Angra Toldo	1	Yes	17 th March
Generosa	1	No - occasional	NA
Trindade (Obo Lombo)	1	No - occasional	22 nd March
Conde	1	No - occasional	NA

Neves (prédio)	1	No - occasional	NA
Novo Destino	1	Yes	NA

Meetings started by Hugo Sampaio briefing which information was gathered and what were the most important results obtained from the interviews, while acknowledging hunters for having given us this precious contribution.

Emphasis was given to:

- ☐ Number of hunters interviewed and which communities have had more hunters interviewed;
- ☐ ecology of the Ibis, regarding what hunters have told us and lauding them for knowing a lot about this species;
- ☐ Areas where they say the Ibis can be found and how close this is to the distribution area known by scientists;
- ☐ Telling them that half of the hunters interviewed don't know the Ibis is endangered of extinction and that they have independently referred 11 areas where they don't find the species anymore. We told them in some cases this was due to deforestation but that in other cases the probable cause was human disturbance (overhunting and palm-wine exploitation) as those places coincide with areas where more hunters admit to go hunting;
- ☐ High number of hunters that admitted to have already killed Ibis and that too many hunters admit they regularly kill this bird. We told them they aren't aware of the fact that there are too many hunters chasing this species in different areas of the island. Each of them doesn't hunt a lot of birds but altogether this is more than the species can stand. Therefore the Ibis will become extinct if they don't stop hunting it;
- ☐ Areas where there is more hunting pressure on the Ibis according to the hunters and how this coincides with important breeding areas;
- ☐ The ways they have told us we could reduce Ibis hunting, namely by awareness raising and education;
- ☐ After this briefing, Gabriel Oquingo would raise awareness by telling:
- ☐ How precious and important the species is as an unique bird and that many people are coming to São Tomé just to see it. It is worth much more alive than when they kill it for food;
- ☐ Those people that are coming to São Tomé just to see the Ibis, they spend their money in our country from the moment they arrive at the airport. They are not paying only for a guide to take them to the forest., they are spending money in restaurants, in transports, hotels, etc. The guide that is hired will then spend his money in his community and someone else will be gaining. After all we all are gaining with tourists that are coming to see birds;
- ☐ That nature is very important and the forest must be protected, as the Obô regulates climate and gives us many resources as food, water, oxygen, timber for house construction, medicinal plants, etc. This is their main richness;
- ☐ Those things are invaluable and priceless; no one can live without them. Animals are part of the ecosystem, for example birds are crucial to seed dispersion, bees are responsible for pollination, etc.

Those arguments would raise discussions but most of the times hunters ended up agreeing with us. Some would say they wouldn't have killed Ibis if they knew it was so important and unique. From now on they suggested that they would not kill it anymore and would tell other hunters to stop chasing it.

It was unclear if the team had fully taken the message on board, or if they were just agreeing with us at that moment but would then continue killing the Ibis. But what seems to be true is they like to have our attention. They are also interested in the fact that there are foreigners coming to São Tomé to work with a bird and to know they play an important role in that. They feel more important and respected because of that.

Therefore, even though this is a difficult group to work with and even if we think most of them will not stop killing the Ibis so easily, I would say our best option is to continue engaging carefully with them. But at each time we meet them we should go with something new (new information about the Ibis or the forest; to explain them the new hunting law; to offer them some material like t-shirts, to fix some posters about the Ibis in each community, etc.).