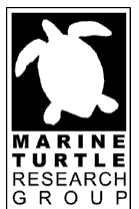




Marine Conservation Priorities São Tomé and Príncipe

Scoping Report | March 2015



Acknowledgements:



The scoping visit and report was made possible through the support provided by the Príncipe Trust (Alexandra Marques) and the Darwin Initiative Project 20009 "*Delivering an MPA network for biodiversity and fisheries for Central Africa (Republic of Congo and Gabon)*" funded through the Department for Environment, Food and Rural Affairs (Defra) in the UK.

Suggested citation:

Nuno, A. Metcalfe, K. Godley, B.J. & Broderick, A.C. (2015). Marine Conservation Priorities São Tomé and Príncipe Scoping Report. University of Exeter. 41 p.

Contact details:

Dr Ana Nuno: a.m.g.nuno@exeter.ac.uk;

Dr Kristian Metcalfe: kristian.metcalfe@exeter.ac.uk;

Professor Brendan Godley: b.j.godley@exeter.ac.uk;

Dr Annette Broderick: a.c.broderick@exeter.ac.uk

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Executive summary

Researchers from the Marine Turtle Research Group at the University of Exeter, UK, conducted a scoping visit to the island of Príncipe in São Tomé and Príncipe in order to: (1) assess conservation priorities, particularly regarding coastal and marine natural resources; (2) identify key stakeholders and assess institutional interplay; and (3) provide recommendations on possible ways to protect biodiversity whilst promoting sustainable development and poverty alleviation in the area.

A two-week field visit was conducted in March 2015 as part of a scoping study for the development a marine biodiversity action plan for the island of Príncipe. A wide range of stakeholders, from fishers and fish traders to NGO staff and policy-makers, were asked about their perceived conservation and management priorities for coastal and marine natural resources, allowing us to identify challenges and understand the potential for future initiatives.

Based on key challenges identified during our visit, our main recommendations are intended to promote effective conservation interventions at scales which are meaningful at an ecologically and socio-economic level. We suggest a 2.5-3 year dedicated project to develop a Marine Biodiversity Action Plan for Príncipe with a focus on the following:

- Sustainable development and planning: develop integrated approaches that promote the sustainable use of marine resources whilst ensuring conservation goals are achieved;
- Assessment and evaluation: assess social and ecological impacts associated with spatial and temporal changes in fishing practices over time, link monitoring activities to specific goals and develop monitoring and evaluation strategy;
- Capacity building (staff): Identify key skills and expertise required. Target local actors and organizations to enhance institutional capacity and legacy;
- Capacity building and training (local communities): improved training and capacity for fishers and traders to improve fisheries profitability, improve safety at sea and increase resilience to changing conditions, specifically addressing the empowerment of women to increase gender equity;
- Environmental awareness: investment in long-term activities through school curriculum should be promoted.

Scoping visit: purpose, study area and methodology

The Príncipe Trust invited and funded researchers from the Marine Turtle Research Group at the University of Exeter, UK, to conduct a scoping visit to the island of Príncipe in São Tomé and Príncipe in order to: (1) assess conservation priorities, particularly regarding coastal and marine natural resources; (2) identify key stakeholders and assess institutional interplay; and (3) provide recommendations on possible ways to protect biodiversity whilst promoting sustainable development and poverty alleviation in the area.

Given the interdisciplinary nature of the required tasks, the visit was conducted by Dr Ana Nuno and Dr Kristian Metcalfe, both conservation scientists with a complementary skillset in social dimensions of conservation, fisheries, spatial ecology, social-ecological systems and wildlife monitoring.

A. Study area

The Democratic Republic of São Tomé and Príncipe consists of two small oceanic islands located in the Gulf of Guinea, off the western equatorial coast of Central Africa. These islands are part of a volcanic chain originating at Mount Cameroon and finishing with the island of Annobon (Equatorial Guinea). São Tomé lies 255 km, and Príncipe 220 km, off the coast of Gabon; the former is the larger covering 859 km² whilst the latter is smaller covering 142 km². São Tomé and Príncipe currently has a population of *ca.* 179,000 inhabitants with population density unevenly split between islands (Príncipe has around 7500 inhabitants) with annual population growth approximately 2.45% (INE 2012).

These islands remained completely forested and with no permanent human settlements until being colonized by the Portuguese in the late 15th century (de Lima et al. 2013). After colonization and until independence in 1975, sugar cane, coffee and cocoa plantations were the main types of land use but much of the area formerly covered with plantations has subsequently reverted into secondary forest (Peet & Atkinson 1994). São Tomé and Príncipe has a largely agrarian based economy with much of the population reliant on subsistence farming for their livelihood, with approximately 62% of the population below the poverty line and a mean GDP of 1,610 US dollars per capita in 2014 (The World Bank 2015). The tourism sector is still in its infancy and the

government is also hoping that investment in offshore oil exploration will lead to commercially viable production.

With a high degree of endemism across many taxa, around 55% of the country's land surface is found within the Obô natural parks of São Tomé and of Príncipe, which are classified as IUCN's national parks (Directorate General of the Environment 2009). The island of Príncipe has been designated as a UNESCO Biosphere Reserve since 2012, and has gained the attention of several foreign investors in the last decade, leading to relatively rapid change in terms of development, population growth and tourism potential. The economic activities in the Biosphere Reserve are essentially fishing and agriculture, besides small tourism developments that are consigned to old coffee and cocoa concessions.

B. Methodology

Prior to our visit, Skype and face-to-face meetings with Alexandra Marques (Príncipe Trust) were used to delineate overall goals and opportunities for our analysis. Documents made available by Príncipe Trust and online resources were also reviewed to identify past and ongoing interventions in Príncipe, where available.

A two-week field visit was conducted in March 2015 to interview key informants and identify challenges and opportunities for the use, conservation and management of coastal and marine natural resources on the island of Príncipe. Snowball sampling was used to select informants, using recommendations from interviewees to establish contact with others most relevant to the visit (Newing 2011). This purposive sampling approach is suitable for identifying stakeholders and capturing the widest range of perspectives (Reed *et al.* 2009). In addition, interviews were undertaken with fishers and traders at three permanent fishing communities (Praia Burra, Praia Abade and Praia Sundy) and a semi-permanent fishing community (Praia Seca), the four largest of a total of nine fishing communities in Príncipe. These visits were not arranged prior to our visit and so those interviewed represent only those who were available and willing to participate in group discussions. A list of key informants contacted during our study is provided in Appendix 2.

Discussions with informants were undertaken individually or in groups. These discussions focused on assessing the informants' perceived conservation and natural

resource management priorities, particularly regarding coastal and marine resources, identifying challenges and understanding potential for future initiatives; the discussions were thus semi-structured while allowing for each participant to share their personal opinions and experiences regarding their own roles in the system (e.g. fishers were predominantly asked about catch, fishing practices and threats to their livelihood, while NGO staff were asked about ongoing initiatives and implementation issues). Information presented in this report has been anonymized and the results presented herein summarize multiple issues and insights discussed by the informants.

During this visit we also undertook boat based surveys of Príncipe's coastline to identify and record the location of each of the marine turtle nesting beaches and the fishing communities (as identified by Alexandra Marques from previous field surveys) to gain a better understanding about the spatial distribution of these communities on the island and their potential overlap.

Institutional context and key actors

There is a strong regulatory and legal framework regarding conservation, resource management and sustainable development in São Tomé and Príncipe with the following main national policies and regulations of particular relevance to future policy decisions in the marine and coastal environment:

- National Strategy and Action Plan for Biodiversity;
- National Sustainable Development Plan (PNADD);
- National Strategy for Poverty Alleviation;
- Law regulating the Fauna, Flora and Protected areas;
- the Fisheries Law;
- the Laws regulating the Natural Parks of Obô in São Tomé and in Príncipe;
- the Decree regulating Environmental Impact;
- the Decrees protecting sea turtles in São Tomé and in Príncipe;
- Decree regulating protection, exploitation and management of marine resources from national EEZ.

São Tomé and Príncipe is also a signatory of the Convention on Biological Diversity (CBD), the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

The key actors playing a role in the use, management and conservation of coastal and marine natural resources in São Tomé and Príncipe are presented in Table 1.

Table 1. Key actors playing a role in the use, management and conservation of coastal and marine natural resources in the Príncipe Island, and their main roles.

Name	Type	Main roles
Fish consumers	Independent	Demand for fish and seafood at multiple scales (local, regional, national and international). Average annual fish consumption in the country is one of the highest in Africa (27.2 kg per person; FUS 2013).
“Artisanal” fishermen	Independent though some part of associations	Mainly responsible for catching fish and other seafood.
Palaiês (Fish traders)	Independent though some part of associations	Mainly responsible for preparing, transporting and selling fish and other seafood within their local communities and at market.
Artisans	Independent though some part of cooperatives	Typically involved in the arts and craft trade, including turtle shell products.
Turtle Poachers	Independent	Involved in the illegal take of adult female marine turtles and eggs from nesting beaches and both males and females at sea. Illegal take also occurs opportunistically in local communities and by fishers.
International fishing fleets	External actors	Harvest both legally (through international agreements) and illegally.
Regional government	Government	The Príncipe Island is an autonomous region since 1995, with a regional Parliament and Government.
National Fisheries Department	Government	Directorate-General for Fisheries within Ministry for Economy and International cooperation.
Regional Fisheries Department	Government	Regional sector of Directorate-General for Fisheries.
Environment Department	Government	Directorate-General for Environment within Ministry for Natural Resources and Environment. Conducts research.
Port Authority and Coast guard	Government	Military branches of Ministry of Defence; responsible for monitoring use of coastal and marine systems, safeguarding safety and enforcing regulations.
Obô Natural Park management team in Príncipe	Government	Created in 2006 to provide legal protection to forests. The park and its buffer zone cover approximately one third of the island extending to the coastal and nearshore environment.
Biosphere	Mixed (members from	Biosphere Reserves are areas designated

Reserve management team	Government and NGOs)	<p>under UNESCO's Man and the Biosphere (MAB) Programme to serve as places to test different approaches to integrated management of terrestrial, freshwater, coastal and marine resources and biodiversity.</p> <p>http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/africa/sao-tome-and-principe/the-island-of-principe/</p>
Príncipe Trust	Foundation	Working towards the sustainable development of Príncipe and biodiversity conservation by promoting nature conservation tourism and raising environmental awareness.
Marapa (Sea, Environment, and Artisanal Fishing)	NGO	<p>Promote sustainable development of artisanal fisheries, through support to local fishing communities, poverty alleviation and development of alternative approaches for fisheries in São Tomé and Príncipe.</p> <p>http://www.marapa.org</p>
ATM (Association for Sea Turtles)	NGO	<p>Conservation, environmental awareness and research about sea turtles. Currently only working in São Tomé (but also active in Príncipe in the past).</p> <p>http://tartarugasmarinhas.pt</p>
Sea Turtle Commission	Working group (local communities, experts, government)	<p>Sea turtle research and conservation, sustainable development of Príncipe, ecotourism. Mainly active in the past, although still functioning.</p> <p>http://tartarugas-principe.blogspot.pt</p>
Tourism investors	Private	Promoting development of Príncipe and conservation and sport fishing tourism, with active tag and release programs for a number of sport fish.
Researchers from overseas	External actors	Research and environmental education in the area during the last decades (e.g. the California Academy of Sciences started conducting biodiversity expeditions in the country 14 years ago).

Conservation and natural resource management priorities

A number of issues related to the terrestrial ecosystems of the country were described by multiple informants (e.g. illegal logging, hunting of protected bird species, invasive flora and fauna, deforestation for palm oil plantations). However, additional work is required to enhance the management of the marine environment as several informants mentioned that, given the heavy reliance on fish for consumption in the country and the extent of marine vs. terrestrial territories (EEZ: 165,364 km² vs. land surface: 1,001 km²), greater attention should be given to coastal and marine natural resources. The following priorities were described:

1. Sustainable development and planning

The majority of people are dependent on fishing (directly and indirectly) and there is a need to fully consider local communities with a particular emphasis on food security and human wellbeing. Consequently, there is a need to develop integrated approaches that promote the sustainable use of marine resources whilst ensuring conservation goals are achieved. There was also emphasis on the development of a marine spatial plan that incorporates the objectives of both national and regional governments whilst ensuring the livelihoods of local fishing communities are not compromised.

2. Assessment and evaluation

Assess social and ecological impacts associated with spatial and temporal changes in fishing practices over time as fishers are currently operating further from the coast and have reported using longer nets with smaller mesh sizes. Further, research is also required to investigate the effectiveness of ongoing and potential restrictions, such as legal requirements on gear types, mesh sizes, licenses and exclusion zones. A number of government institutions also discussed the need to explore the potential role of management strategies that promote fisheries whilst protecting biodiversity, such as seasonal or dynamic closures. However, most cited the lack of baseline data, expertise and engagement with local communities as a barrier to assessing the feasibility of these strategies over alternative options such as no-take marine protected areas.

3. Training (Government Institutions)

There was a particular emphasis on developing local expertise in the areas of fisheries data collection, biodiversity monitoring, and marine spatial planning. National and regional agencies particularly cited the need for more scientific based training to

manage and analyse data (such as GIS, VMS, GPS and database management) to inform policy decisions. In addition, they highlighted the need to improve knowledge on the distribution of key species of commercial and conservation concern as the impacts of current levels of exploitation are lacking.

4. Capacity building and training (local communities)

Training and capacity for fishers and traders to improve fisheries profitability and safety at sea. For example, GPS units were provided to some fishers to enhance maritime safety at sea but applications are limited by their ability to use the units correctly. Many fishermen have limited education (7.2% of men and 15.3% of women aged 15 or older in Príncipe are illiterate; INE 2012). Additionally, further research is required to identify alternative livelihoods or sources of income that could complement existing roles, specifically addressing the empowerment of women to increase gender equity. This is of particular importance as changes in climate could affect viability of fishing as local livelihood.

5. Education and awareness raising

Despite a heavy reliance on natural resources, there is a lack of environmental education and awareness about the local environment, and so this has been identified as a key priority by the Regional Department for Education, who at present has requested support from the Príncipe Trust to develop education material about marine resources for schoolchildren (currently there are 10 schools in Príncipe with a total of around 2300 students). Furthermore, some interviewees felt that the current school syllabus could be made more relevant to national biodiversity and conservation issues to improve engagement with students, as the current teaching material is largely adapted from the Portuguese curriculum.

Other ongoing or potential threats affecting coastal and marine systems that were mentioned and/or observed during the scoping visit included: sand extraction; pollution affecting coral reefs; coastal development; piracy; and poor monitoring of foreign fishing fleets that operate within the islands' exclusive economic zone.

Local communities and fishing

According to the both national and regional government agencies there is almost no national industrial fishing within the São Tomé and Príncipe's exclusive economic zone. Fishing is largely restricted to small-scale artisanal fisheries, with approximately 30 fishing communities on the island of São Tomé and 9 on Príncipe. The following section provides a brief summary of fishing communities on Príncipe (Fig. 1).

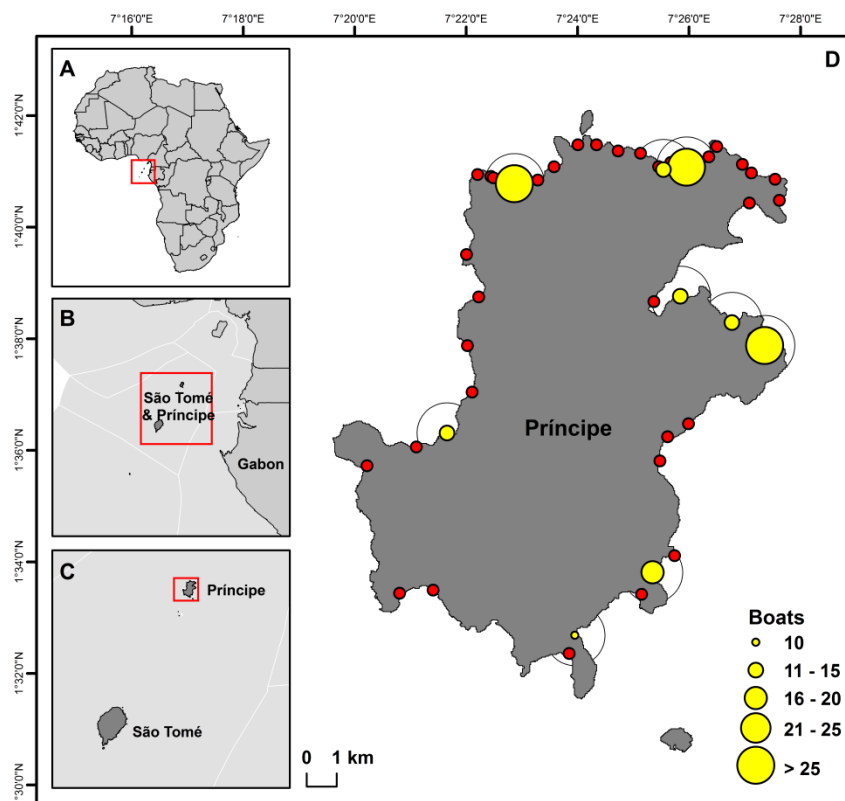


Figure 1. Location of small-scale artisanal fishing communities and marine turtle nesting beaches on Príncipe island. Fishing communities (yellow circles) are scaled by number of boats recorded at each site. Solid lines represent average distance travelled (~ 1km) by fishers from landing sites derived from surveys undertaken in four fishing communities. Red circles indicate location of marine turtle nesting beaches.

1. Fishing communities

Of the 9 communities on Príncipe, 7 are considered permanent and 2 are temporary where families migrate seasonally to fish (Fig. 1), with approximately 500 licensed fishers currently employed in this sector (3,000 registered nationally). The permanent fishing communities are typically located along the edge of the coast in small villages

with road access to the capital São António, whereas the seasonal communities are located at sites typically accessed by boat with dwellings located on the beach and constructed from poor quality materials and so have limited and/or no access to electricity or sanitation (Figure 2). The population size from the four visited fishing communities ranged from 50 to 200+ adults, with 15 to 50 fish traders per community. Permanent communities had mostly wooden dwellings with roofs often constructed from corrugated metal sheeting and/or palm thatch, whereas seasonal communities had mostly wooden dwellings with roofs constructed from plastic sheeting and/or palm thatch. Neither had access to electricity.



Figure 2. Typical dwellings in a fishing community, Príncipe. Photo by A. Nuno

Whilst the majority of these communities depend on fishing as a source of employment and for their livelihoods, they still undertake a variety of other activities to supplement their income such as farming and rearing pigs. However, it is worth noting that an unknown number of people from other communities also fish and so it is likely that fishing makes an important contribution to the livelihoods of an even greater number of people than those who are currently registered as fishers. Moreover, a fishing license requires payments to the Port Authority (around 90 000 dobras per year; £2.7 per year)

and potential non-compliance (i.e. unlicensed fishing) may mean that the current number of fishermen is underestimated.

2. Equipment

During the boat based survey of the island, we observed a total of 225 boats (Fig 1), with the number of boats per site ranging between 10 and 78 (mean boats per site: 25 ± 22 CI: 11 - 39; $n = 9$). In the four communities where interviews were conducted, number of boats ranged from 12 to 78 (also, one village had 16 engines and another 18). Boats typically varied in size from small wooden boats operated by paddles (~4m in length) to larger wooden or fiberglass boats (~8m in length) equipped with engines between 5 and 50 HP. Each boat is usually operated by 1 person though larger boats are often operated by 2 persons. Pirogues are sometimes shared among fishermen. Fishers revealed that they used a range of gear types during the season from bottom set nets to large surface drift nets between 1 and 2 km in length (Figure 3). Table 2 below presents an overview of fishing techniques currently used on Príncipe.



Figure 3. Fisherman storing fishing nets in a fishing community, Príncipe. Photo by A. Nuno.

Table 2. Overview of fishing techniques currently used in Príncipe as described by fishers during visit to four fishing communities.

Fishing techniques
<ul style="list-style-type: none"> ▪ Free diving ▪ Diving tanks ▪ Spear fishing / snorkelling (e.g. for octopus, turtles, seabass) ▪ Dynamite ▪ Gillnets for surface fishing (drift net; "rede voador") ▪ Gillnets for bottom fishing ▪ Purse seine nets (for small pelagic species; "cerco") ▪ Purse seine nets targeting specifically Balao halfbeak ("rede maxipombo") ▪ Hand line for bottom and surface fishing ▪ Fish aggregating devices

3. Seasonality and effort

Fishers revealed that not all fishers and/or sites operate throughout the year. In particular, fishing effort tended to decrease during the dry season (May – August) due to unfavourable conditions (increased wind and swell) and according to the availability of target species. Most fishers are currently not sufficiently equipped to operate far from their landing sites; fishers from the surveyed communities stated that they typically travelled up to 1 km from their landing sites, with some reporting fishing for up to 18-20 hours (Fig 1). In terms of catch, surveyed fishers revealed that on average they catch around 10kg but they can catch between 50 and 60 kg in a good day, although catches with purse seine nets can be up to 300 kg a day and around 80 kg with hook and line.

4. Species composition

Whilst a detailed collection and analysis of catch data and effort is needed, preliminary findings from site-based surveys revealed that fishers caught a range of species (see Table 3). Some of the species identified by fishers are currently of conservation concern and are being harvested at uncertain levels, including marine turtles, sharks, rays and dolphins. Despite the fact that the sale and harvest of marine turtles and marine mammals is illegal, it is still present. However, sharks are provided with no national protection and so are harvested if caught. Further discussions revealed that if sharks are caught they are finned, and then subsequently transported to São Tomé for export, which is illegal for some species under CITES such as hammerhead sharks. Shark fin

prices reflected the species and amount and ranged from 100,000 to 400,000 dobras per kilogram (equivalent to between £4.50 and £12.00 per kilogram). In addition, there is increasing harvest of sea cucumbers for the international trade with very little known about where these are collected or the quantity. Anecdotal evidence also suggests that sea turtle shells are still being traded internationally. Table 3 below presents a summary of species caught by fishers.

Table 3. Non-exhaustive list of species caught in Príncipe as described by fishers during visit to four fishing communities. English common name followed by Portuguese or local name; translations based on fishbase.org and Afonso et al. (1999).

Non-exhaustive list of species caught
<ul style="list-style-type: none"> ▪ Sand shark (tubarão-areia) ▪ Hammerhead shark (tubarão-martelo/totó) ▪ Bull shark (tubarão-touro) ▪ Unidentified shark (tubarão-lagaia) ▪ Rays including manta rays (raias) ▪ Several turtle species (tartarugas) ▪ Several dolphin species (golfinhos) ▪ Sea cucumbers (pepinos-do-mar) ▪ Octopus (polvo) ▪ Atlantic emperor (bica) ▪ Balao halfbeak (maxipombo/macho-pombo) ▪ Bigeye scad (carapau) ▪ Blue runner (bonito) ▪ Bluespotted seabream (pargo) ▪ Flying fish (peixe-voador; one of the most common) ▪ Great barracuda (barracuda) ▪ Grouper (cherne; one of the most expensive) ▪ Mackerel scad (cavala) ▪ Sailfish (peixe-andala) ▪ Sea bass (corvina) ▪ Unidentified fish (bobó) ▪ Wahoo (peixe-fumo)

5. Transformation and commercialisation

In terms of roles within these communities, fishers are responsible for the catch, whilst women are typically in charge of processing and selling the catch from one or multiple fishermen (fish vendors are called “palaiês”). Fish is typically dried and salted (Figure 4), and sold at the beach, other villages or at the main market in São António. Sometimes catch is sold fresh if possible. However, weather conditions and fish availability play a major role in market supply.



Figure 4. Typical fish drying facilities and dwellings in a fishing community, Príncipe. Photo by K. Metcalfe

6. Perceived threats to livelihoods and wellbeing

According to multiple interviewees from the four surveyed fishing communities, the key issues affecting artisanal fishing as a viable livelihood and their wellbeing related to: access to equipment; transportation and infrastructure; conflict; alternative livelihoods;

and government support. Table 4 provides additional information and specific examples for each of these issues.

Table 4. Key issues affecting artisanal fishing as a viable livelihood and human wellbeing according to interviewees from four surveyed fishing communities in Príncipe

Type of issue	Examples
Access to equipment	<ul style="list-style-type: none"> ▪ lack of refrigeration units so often fish has to be dried instead of being sold fresh in town (which would generate more money) ▪ access to better fish drying and preparation facilities needed for increasing quality of goods ▪ more and better fishing gear needed for increasing harvest efficiency ▪ fishing not always safe due to weather conditions and quality of equipment, affecting viability of this livelihood (e.g. a lot of storms from April to July)
Transportation and infrastructure	<ul style="list-style-type: none"> ▪ access to cheap transportation needed to take fish into town, where fish is sold at higher prices ▪ due to remoteness and lack of infrastructure, some communities without electricity and phone network coverage, making it hard to cope with accidents ▪ desire for more industrialized fisheries
Conflict	<ul style="list-style-type: none"> ▪ in the past, “big boats” (potentially trawlers) were seen in the areas where artisanal fishers go and used to take a lot of fish. After complaining to the Port Authority, they weren’t seen again ▪ communities do not have fishing agreements with others meaning that every community can go anywhere and may overlap spatially and temporally ▪ an unknown number of fishers travel from São Tomé to Príncipe and may be practicing a more industrialized type of fishing, potentially outcompeting Príncipe’s artisanal fishers. Some interviewees felt the port authority should control timings and spatial overlaps with boats coming from São Tomé

	<ul style="list-style-type: none"> ▪ sea turtles occasionally damage nets but request for compensation is not allowed ▪ income loss due to relatively recent legislation protecting sea turtles and making harvest and sale illegal ▪ tree cutting not allowed but wood needed for building dwellings and pirogues ▪ no perceived benefits from compliance with conservation rules (<i>"We are told we can't cut trees and kill turtles. We don't and we don't see any benefits!"</i>)
Alternative livelihoods	<ul style="list-style-type: none"> ▪ some people would like their kids to be fishermen (<i>"My grandfather did it, my father did it, I do it...if my kids don't do it, then who goes fishing?"</i>) but many commented it is a risky and dangerous business ▪ sometimes people have other occupations besides fishing (e.g. farming, driving) but complained they don't get enough income to stop fishing
Government support	<ul style="list-style-type: none"> ▪ lack of institutional support (<i>"You protect the turtles but who protects us?"</i>) ▪ limited access to fishing gear because shop managed by government has been empty of stock for a long time ▪ institutional inertia (lack of improvements despite promises by government and other agencies) ▪ more government support to fish traders needed

Past and ongoing interventions

A number of projects have been undertaken that, directly or indirectly, may contribute to a better understanding, management or conservation of coastal and marine resources in São Tomé and Príncipe. While our aim is not to provide an exhaustive list of all past and ongoing interventions related to the topic, we identified those that may be of particular interest due to either the data obtained and/or potential outcomes (Table 5).

Table 5. Summary of key past and ongoing interventions in São Tomé and Príncipe that may be of particular interest due to either the data obtained and/or potential outcomes in terms of understanding, managing and conserving coastal and marine resources. Areas of interventions are often overlapping but are presented separately for clarity.

Area of intervention	Brief description	Type of data	Organizations/ Source
Biodiversity monitoring and data	Several biodiversity expeditions conducted in the country, particularly in the island of São Tomé	Biodiversity checklists. For example, latest update of coastal fish species in São Tomé and Príncipe lists 244 species	e.g. California Academy of Sciences and Birdlife. Coastal fish: Wirtz et al. (2007)
	Sea turtles: monitoring and conservation activities have been running in the country since 1996	This includes collection of data on nesting females and translocation of turtle eggs to hatcheries	Initially, this was coordinated by Marapa but it is currently run by ATM (in São Tomé) and Príncipe Trust (in Príncipe)
	Ongoing research on the distribution and abundance of the sea turtle populations in Príncipe, including their connectivity with other foraging and breeding areas	Some spatial information on turtle nesting and distribution in Príncipe obtained through nesting and in-water census, telemetry, and isotopic and genetic analyses	Rogério Ferreira (independent PhD candidate)
	Cetaceans: research and monitoring undertaken since 2002	Spatial information on distribution of cetaceans in waters surrounding São Tomé. No data available in Príncipe	Marapa in collaboration with the Association for the Sciences of the Sea (Associação para as Ciências do Mar, Portugal)
Development projects	Multiple communities have been targeted by past or ongoing development projects (e.g. malaria eradication project, infrastructure development)	To our knowledge, there was no monitoring and evaluation strategy	e.g. by Taiwan cooperative
	Sustainable development plan for Príncipe	Ongoing and planned tourism and development initiatives to be reviewed by experts	Plan by Essentia (Consultancy team) and implementation coordinated by HBD/

			Príncipe Trust
Engagement, education and awareness raising	Engagement with local fishing communities and environmental awareness activities in Príncipe, particularly focusing on sea turtle conservation (e.g. school visits to turtle nests, posters placed in public spaces, publication of booklet about sea turtles).	To our knowledge, there was no monitoring and evaluation strategy for any of these initiatives	Príncipe Trust
	Ongoing engagement and environment education activities about turtles for children and other target in the country (e.g. drawing competition at schools)		ATM
	Project developing teaching material about environmental education for high school students		Marapa and the Portuguese Association for Environmental Education (Associação Portuguesa de Educação Ambiental (ASPEA))
	Engagement with local fishing communities and environmental awareness activities in Príncipe (e.g. theatre)		Sea Turtle Commission
Fisheries	Fisheries records collected every 3 years. Most recent report based on data collected in June 2014 is currently being produced	Number of fishermen and fish traders, type and amount of fishing gear	Fisheries Department
	Ongoing project has supported the collection of data in several fishing communities in the country (6 of them are in Príncipe) during two months in 2015	Fisheries catch data	Fisheries Department with GEF funding
	Programs to develop fishing infrastructure and techniques, such as the implementation of fish aggregating devices (FADs)	To our knowledge, there was no monitoring and evaluation strategy for any of these initiatives	Marapa and Fisheries Department with funding from the International Fund for Agricultural Development (IFAD)
	Interventions to promote and improve artisanal		Marapa and the Fisheries

	fisheries, including: providing fishing gear to communities (such as GPS for their increased safety in the sea)		Department with funding from the World Bank and the African Development Bank
	Ongoing program to: improve involvement by fishers and fish traders in fisheries policy decision-making; increase food security; develop skills and opportunities (e.g. access to microcredit and training on hygiene to fish traders)		Marapa, Fisheries Department and CETMAR (Spain) with funding from the European Union
Livelihoods	Generate revenue for turtle conservation or social projects from turtle watching tourism	To our knowledge, there is no monitoring and evaluation strategy	Príncipe Trust and Bombom resort
	Generate revenue for local communities from turtle watching tourism		ATM (in São Tomé) and Sea Turtle Commission (in Príncipe)
	Socio-economic information regarding harvest and sale of turtles in São Tomé	Supply chain composition and dynamics (e.g. number of people involved in trade, such as harvesters, middlemen, sellers, and prices)	ATM
	Projects investigating resilience of coastal communities to climate change	Still being planned/ under development	Department of Environment and Biosphere Reserve with funding from the Global Environmental Facility (GEF) and World Bank
	Ongoing initiative (Responsible Trust) aims to develop certification (e.g. fairtrade) of services and products in Príncipe	Still being planned/ under development	Biosphere Reserve
Socio-demographic	National census conducted approx. every 10 years (last one undertaken in 2012)	Age, gender, education level, main occupations, employment status, household size and composition	INE (2012)
	Village records	List of residents	Village representatives

Moving forward: some issues and recommendations

Ongoing or potential barriers to the effective conservation and management of coastal and marine resources in Príncipe, which are often interrelated, can be briefly described as follows:

- **Lack of data at the appropriate national, regional and local scales**
While the Príncipe Island is an autonomous region, with a regional Parliament and Government and many decisions being made independently from São Tomé, research, monitoring and development efforts have been disproportionately allocated to São Tomé. For example, several biodiversity monitoring initiatives have been undergoing for several years in São Tomé but very limited information is available for Príncipe. This makes linking regional policy decisions and local interventions to actual biodiversity outcomes extremely challenging.
- **Limited socioeconomic information**
Effective conservation and natural resource management are strongly dependent on socio-economic and cultural contexts and subsequent human behaviour but limited social information has been collected over time and space in Príncipe. While socio-demographic and fisheries catch data have been collected by the Fisheries and Statistics Departments, virtually no other type of information (such as resource users' perceptions, trade-offs between occupations, drivers affecting household choices, cultural and medicinal uses) has been collected.
- **Poor monitoring and enforcement**
Lack of resources (e.g. boats, manpower, funding) is a main barrier to effective enforcement and monitoring in the country. For example, the national coastal guard only has two boats. International fleets in São Tomé and Príncipe's waters are poorly regulated and there is limited data available on fisheries, although international agreements and quotas are agreed. Despite VMS (vessel monitoring systems) equipment being already available, the access to satellite data is not currently possible due to lack of funds. There are also challenges to monitoring artisanal fisheries as the fisheries department lacks sufficient staff and boats. With regard to marine biodiversity monitoring, this is largely

restricted to marine turtles at present. However, nesting beaches are primarily situated in remote and inaccessible locations and so are difficult to monitor regularly and/or have teams located on site during the nesting season. This makes it difficult to determine whether poaching is prevalent on all nesting beaches or just those located close to fishing communities or their associated fishing areas. There are a number of other species of conservation concern that also merit monitoring to generate baseline data to inform future resource management decisions, including seabirds, sharks and rays.

- **Insufficient local conservation capacity**

Reduced staff involved in conservation or natural resource management and their limited scientific expertise are key barriers to the successful implementation of initiatives in Príncipe. For example, several people have a number of roles (e.g. other jobs besides managing conservation projects), limiting their ability to focus on existing tasks.

- **Restricted data sharing and accessibility**

While there is some overlap between responsibilities and areas of action between different actors, data sharing and coordination in data collection is not being promoted. For example, several overseas researchers have worked in the region during the last decades but some have provided limited information after their work was done, not contributing to the institutional legacy and memory of local actors. In addition, sea turtle projects in the islands of São Tomé and Príncipe are being undertaken independently by different organizations; because both use databases that are similar in structure, national assessment of marine turtles is possible although this currently does not account for potential links between regional populations and market dynamics (i.e. inter-nesting movements and trade between islands). Nevertheless, the Biosphere reserve team is compiling available documents about management, conservation and research in Príncipe and aims to develop an online Biodiversity platform.

- **Limited implementation**

Institutional inertia and organizational turn-over are important factors potentially explaining issues related to limited project implementation. For example, plenty of terrestrial action plans have been developed for the Biosphere reserve and the natural park but most initiatives have never been

implemented. This is likely to have important consequences because: natural resources are therefore poorly protected; resources are wasted; and the limited ability of translating science and policy in action may be a source of frustration among actors, potentially leading to high staff turn-over and poor institutional memory.

- **Lack of monitoring and evaluation strategies**

Given the frequent lack of monitoring and evaluation strategies for several past and ongoing interventions, the effectiveness of those same interventions cannot be assessed, reducing their potential and wasting the opportunity for lessons to be learned. This is particularly relevant for initiatives involving local communities, given the reduced population size and number of communities in Príncipe and that they are likely to be upset by a constant change in conditions (e.g. due to new interventions) and subsequent expectations not always being met.

- **Uncertainty about how to effectively achieve behavioural change**

Although several past and ongoing interventions ultimately aim to improve management and conservation of coastal and marine resources through human behavioural change (e.g. enforce harvest regulations to conserve sea turtles), little consideration has been given to understanding the socio-economic dynamics and cultural context in which such interventions may or may not work. While this issue is widespread over conservation interventions worldwide, a better understanding of social-ecological factors and processes is essential for achieving effective conservation interventions that lead to desired behaviour change and positive biodiversity outcomes.

- **Limited dissemination of environmental information and fisheries regulations**

Despite a heavy reliance on natural resources, there is a lack of education and awareness about the local environment. Although local fishing communities seemed generally aware that catching turtles is illegal, questions remain about to what extent they are familiar with other fisheries regulations. For example, information about harvest regulations was not widely available throughout public spaces. In addition, there is a weak focus on conservation and natural resource management at a curricular level.

Príncipe island is currently benefiting from attention from private investors and conservation actors, including a few development, tourism and conservation initiatives. Given its small size and early stage for multiple interventions, this represents great potential for achieving actual conservation and poverty alleviation outcomes, while using the area as a pilot project for other potential applications elsewhere. Table 6 provides information on overall recommendations we believe are essential for achieving effective conservation action in the area.

Table 6. Summary recommendations for improving management and conservation of coastal and marine resources in the area.

Recommended area of action	Brief description
Priority-setting	Priorities need to be identified and ranked so that study area can benefit from funding and human resources in a coordinated and efficient way to maximize conservation benefits and return-on-investment.
Data sharing and accessibility	Develop formal protocol for data sharing between organizations (e.g. memorandum of understanding). Develop online and local database compiling biodiversity records and other data.
Capacity building	Identify key skills and expertise required for successful implementation of conservation projects. Target local actors and organizations to enhance institutional capacity and legacy.
Integrated social-ecological approach	An integrated social-ecological perspective will provide a better understanding of systems involving people and natural resources. Ultimately, engaging with people and their wellbeing in conservation programmes will increase legitimacy, improve effectiveness and allow positive outcomes for people as well as nature.
Management	Fisheries co-management of artisanal fisheries should be promoted, being this responsibility shared between the user groups and the government so that both the community and the government are involved during decision-making, implementation and enforcement.
Environmental awareness	Awareness initiatives should be continued instead of short-term only. Investment in long-term activities through school curriculum should be promoted (based on school manuals, 3 rd and 6 th grade seem particularly suitable for being taught complementary information about local issues and relevance of conservation and natural resource management).
Implementation	Implementing conservation actions requires: an explicit consideration of multiple criteria and potential trade-offs; integration of existing theoretical and empirical understanding; and guaranteeing sufficient institutional support is available for action on the ground (see “capacity

	building”).
Monitoring (ecological and social variables) and evaluating effectiveness	Link monitoring activities to specific management and conservation goals and develop monitoring and evaluation strategy. This is essential for guaranteeing interventions are effectively producing desired biodiversity and development outcomes (or modified if they are not), whilst providing useful information and lessons for potential implementation elsewhere.

In particular, we recommend a 2.5-3 year dedicated project to develop a Marine Biodiversity Action Plan for Príncipe with a focus on: sustainable development and planning; assessment and evaluation; capacity building (staff); capacity building and training (local communities); and environmental awareness. Table 7 provides specific information about our recommendations and delineates key outcome (i.e. overarching objective), outputs (i.e. specific, direct deliverables) and indicators used to measure change. Finally, we provide some recommendations and highlight important research priorities for marine turtles in Príncipe, a field of research that currently comprises a significant proportion of the Príncipe Trusts targeted conservation efforts to date.

Table 7. Recommended steps and areas of action to develop and implement a Marine Biodiversity Action Plan for Príncipe.

Project summary	Measurable Indicators	Means of verification
Impact: Poverty alleviation, increased food security, and sustainable use of marine biodiversity through an effective marine management model in Príncipe.		
Outcome: To improve state of marine biodiversity and enhance wellbeing of coastal communities in Príncipe through effective management of marine resources.	0.1 Marine spatial plans implemented for at least 50% of Príncipe’s coastal areas by the end of the project. 0.2 Earnings by focal fishing communities (at least three) increased by 10% by year 3 (based on baseline established and re-examined as part of the project). 0.3 Harvest of protected resources and marine vertebrate bycatch by focal fishing communities reduced by 10% by year 3	0.1 Approval of the marine management plan; biodiversity monitoring data; technical reports; records of feedback from local stakeholders involved in the project; records of feedback from community members; marine management plan evaluation reports. 0.2 Data collection (household surveys to generate baseline and monitor effects of interventions) and analysis, peer-reviewed publication and reports. 0.3 Data collection (fisher

	(based on baseline established in year 1 and re-examined as part of the project in year 3).	surveys and stranding records), peer-reviewed publication and reports.
<p>Outputs:</p> <p>1. Capacity of local staff built to implement effective marine management model in Principe.</p>	<p>1.1 Technical capacity, training needs of local staff and gaps in community conservation capacity assessed and training programmes finalised by the end of year 1.</p> <p>1.2 Training programmes delivered by Q2 year 2 and trainee skills for marine management assessed and evaluated annually.</p>	<p>1.1 Workshops/interviews conducted, list of needs and gaps produced, training material produced.</p> <p>1.2 Workshops delivered, number of participants trained, capacity assessment scores.</p>
<p>2. Distribution and modes of operation of artisanal fisheries are improved as a result of more effective and sustainable fisheries practices, based on participatory research, co-management of fisheries and implementation in focal communities.</p>	<p>2.1 Fisher engagement in research and co-management of fisheries facilitates multiple aspects of the project with participatory research underway in year 1 (minimum 10 fishers in each of 3 focal fishing communities).</p> <p>2.2 Data for baselines and future comparison are assembled by end of year 1 (minimum 10 fishers in each of 3 focal fishing communities) and potential interventions are piloted to improve fisheries profitability.</p>	<p>2.1 Workshop reports, interim field reports, project website.</p> <p>2.2 Workshop reports, interim field reports, project website. Artisanal Fisheries Action Plan by end year 2.</p>
<p>3. Household specific alternative livelihoods sources identified through participatory methods with individual beneficiary households, specifically targeting female headed households</p>	<p>3.1 Capacity and training needs of local community members assessed by the end of year 1.</p> <p>3.2 Vocational training tailored for community members developed by end of year 1.</p> <p>3.3 Training programmes delivered by Q2 year 2,</p>	<p>3.1 Workshops/interviews conducted, list of needs and gaps produced.</p> <p>3.2 Training material produced.</p> <p>3.3 Workshop reports, interim field reports, project website. Adoption rates and household socio-economic surveys.</p>

	potential interventions piloted during year 2, and additional or improved cash-generating practices adopted by 25% of targeted households by the end of the project.	
4. Harvest of protected resources (e.g. sea turtles), marine vertebrate bycatch in focal fishing communities and illegal international trade are reduced.	<p>4.1 Baselines of illegal harvest and bycatch levels for future comparison are assembled by end of year 1 (minimum 10 fishers in each of 3 focal fishing communities) and potential interventions are piloted to reduce bycatch.</p> <p>4.2 Research and participatory mitigation results in a publishable case study in assessment and reduction of illegal fishing and bycatch in artisanal fisheries with a paper by year 3.</p>	<p>4.1 Workshop reports, interim field reports, project website.</p> <p>4.2 Peer reviewed publication on assessment and mitigation of illegal fishing and bycatch by year 3.</p>
5. 50% of the population of Principe and all relevant decision makers have increased awareness about marine resource management and sustainable resource use.	<p>5.1 Baseline levels and characterization of awareness about local marine resources and best fisheries practices are assessed by end of year 1. Target public includes adults and schoolchildren.</p> <p>5.2 Educational needs and training tailored for community members developed by end of year 1. Training of school teachers to incorporate educational content into their curricular activities.</p> <p>5.3 Educational programmes delivered during year 2 and awareness re-evaluated after administration.</p>	<p>5.1 Awareness assessment surveys and scores; records of feedback from community members.</p> <p>5.2 Educational material produced.</p> <p>5.3 Dissemination sessions delivered, awareness scores, records of feedback from community members, peer reviewed publication on cross-age transmission of environmental contents and subsequent changes in behaviour.</p>

Refining the Marine Turtle Nest Monitoring Regime on Príncipe

Marine turtle monitoring has been ongoing for some 10 years and the Príncipe Trust would like to increase the robustness and the utility of the program. Before designing an updated programme it is essential to reflect on what questions the project is seeking to answer. We recommend the following are core:

- What species nest in Príncipe and what is their seasonality?
- What is the abundance of nesting at different sites around the island?
- What is the trend in nesting numbers?
- What are site specific threats experienced?
- What is the hatching success?

What are the monitoring options?

When undertaking monitoring there are a number of options that can be considered:

1. **Exhaustive** efforts allow enumeration of every single nesting activity. Although this can be carried out at night as part of any more hands-on research it is more efficiently carried out at dawn each morning in coolest temperatures and with best light. If night time monitoring has been undertaken, it is useful to carry out a dawn check. This is how work is carried out at our main study site in Northern Cyprus (Alagadi; Broderick et al 2002, 2003; Stokes et al 2014).
2. **Monitoring every 2-3 days** allows enumeration of almost all nesting activities unless nesting is either very dense, human usage is very high or there are high levels of wind, rain or tidal wash. Long term monitoring in Cayman Islands and all other beaches at our study site in Cyprus (excluding Alagadai) are carried out in such a manner (Broderick et al 2002, 2003; Bell et al 2007).
3. **Staccato sampling** with interpolation. This is the least intensive approach, where beaches are surveyed infrequently during the peak months of the season. These data can be corrected for missing values in time between samples (per our work on Ascension Island (Godley et al 2001; Weber et al 2014) and at the start and end of the season (per our work in Gabon Metcalfe et al 2015), allowing an overall estimate to be derived for the nesting population.

4. A **Stratified regime** involving multiple elements 1-3 above.

For Príncipe, we suggest a stratified regime based largely on 1 and 2 above (Table 8). Where daily surveys slip, method 2 can be used at more intensive survey sites. First, however it is important to consider a few key issues that will influence the amount of time and resources that can be expended in monitoring across the project.

Data collection

There are also some additional factors to consider when collecting marine turtle monitoring data, these include:

1. **Night monitoring or not?** There are some dividends to working at night. In particular, nesting females can be accessed for tagging/genetics sampling and presence on the beach has been shown to reduce predation by animals/illegal take by humans. It is, however, labour intensive and can, in many cases, be replaced by morning surveys which invariably need to occur to ensure all nesting activities were recorded from the previous night. In addition, the survey team can monitor multiple sites by day that would not be possible at night.
2. **To tag or not?** Tagging can increase nocturnal workload as well as increase annual costs associated with the purchase of equipment and maintenance. Therefore, before embarking on tagging it is important to consider what are the questions being asked of the tagging? Are the results worth the additional effort? Could they be gathered more effectively using other methods? We would suggest that in many non-research intensive projects that tagging is not really worthwhile (See research recommendations below).
3. **What data to gather?** It is clear from existing efforts and the marine turtle monitoring database that the Príncipe Trust are currently gathering key data to inform future and targeted efforts. However, central to a monitoring programme is the use of handheld global positioning system (GPS) receivers to record the locations of all nests. This is important as it allows data to be analysed spatially and inference to be made as to the likely impacts of proposed coastal developments and climate change (See research recommendations below).

Suggested Monitoring Regime for Príncipe

We have collated information from the Príncipe Trust on current monitoring strategy as well as the total number of activities recorded for each species during the 2014/2015 nesting season to help guide the first design of a stratified monitoring programme (Table 8) into intensive and extensive sections:

1. **Intensive:** In essence, we suggest intensive monitoring of all beaches thus far highlighted as important for nesting turtles. The Príncipe Trust should aspire to daily monitoring exhaustively across the whole season, at least at 1-2 key sites for each species. It is these seasonal curves that will be used to scale up extensive monitoring data to help derive estimates of the size of the nesting population. This may need redeployment of resources in the north to focus more on the day work and a dedicated campaign to enhance capacity and existing efforts in the south, where possible developing community buy-in to help with monitoring efforts.
2. **Extensive:** For all other beaches we suggest a weekly survey process across the four main months of the nesting season November to February, inclusive. Some key aspects that must be considered in developing this regime would be the need for enhanced boat support thus increasing resolution of data collected in the biosphere reserve and logistical redundancy, recording of zero counts in the database (so that it is clear when no nests have been recorded), attempting to age tracks on each survey and erasing of all tracks once surveyed. The beach list we have is not quite exhaustive but any other minor sites can be incorporated into the extensive survey regime. It is important to be adaptive. It may be that based on more robust monitoring some intensively studied beaches are considered of insufficient priority for intensive resources, and *vice versa*, therefore we recommend that an annual review of the strategy to help inform targeted efforts on the ground.

Table 8. Recommended marine turtle monitoring regime for Príncipe based on marine turtle monitoring data recorded during 2014/2015 nesting season (CM: *Chelonia mydas*; EI: *Eretmochelys imbricata*; and DC: *Dermochelys coriacea*).

Beach	Current Regime	Nesting Activities 2014/2015 (CM;EI;DC)	Suggested Regime	Support Needed
Grande	1-2 days	509 (478, 20, 11)	Daily	Enhanced daytime effort
Boi	2-3 days	39 (27, 12, 0)	Daily	Enhanced daytime effort
Sundy	1-2 days	15 (11, 4, 0)	Daily	Enhanced daytime effort
Margardia	1-2 days	9 (9, 0, 0)	Daily	Enhanced daytime effort
Marmita	1-2 days	21 (5, 16, 0)	Daily	Enhanced daytime effort
Izé	1-2 days	29 (12, 17, 0)	Daily	Enhanced daytime effort
Micotó	1-2 days	48 (32, 16, 0)	Daily	Enhanced daytime effort
Macaco	Weekly	3 (2, 0, 1)	Weekly	Structured weekly survey
Uba	Weekly	5 (2, 3, 0)	Weekly	Structured weekly survey
Bom Bom	Daily	No data	Daily	? Data gathering support
Banana/Caju	None	10 (4, 5, 1)	Weekly	Structured weekly survey
Burra	None	1 (1, 0, 0)	Weekly	Structured weekly survey
Campanha	None	No Data	Weekly	Structured weekly survey
Iola	1-2 days	8 (4, 4, 0)	Weekly	Structured weekly survey
Lappa	None	No Data	Weekly	Structured weekly survey

Grande do Infante Seca	Occasional	No Data	Daily	Build community support and capacity/establish a camp
Praia Abade	Occasional	No Data	Weekly	Structured weekly survey
Portinho	Occasional	No Data	Weekly	Structured weekly survey
Prainha	Occasional	2 (0, 2, 0)	Weekly	Structured weekly survey
Cabinda	Night guarding	10 (4, 6, 0)	Daily	Enhanced daytime effort
Cemitério	Night guarding	6 (3, 3, 0)	Daily	Enhanced daytime effort
Abelha (Bumbo)	Night guarding	No data	Daily	Enhanced daytime effort
Areia	Occasional	No data	Weekly	Structured weekly survey
Candeia	Occasional	No data	Weekly	Structured weekly survey
Rio São Tomé	Occasional	No data	Weekly	Structured weekly survey

Clearly the above regime will require investment in personnel, equipment and fuel as well as training and community liaison. This will lead to constraints that may curtail some of the ambition of the planned regime. This can be nuanced and adaptive over time.

Research Priorities for the future

Other than setting up the monitoring regime there are number of research priorities that should also be considered when both establishing a marine turtle monitoring program and developing an annual research and monitoring budget, the most important of which are:

1. **Understanding turtle use patterns:** The monitoring regime above will give insights into the relative distribution of nesting effort and may afford insights into current levels of illegal take of adults and eggs.

2. **Defining interesting habitat use, nest site fidelity & clutch frequency:** Satellite telemetry data has been shown to give great insights into all of these parameters, largely replacing traditional flipper tagging studies which are demanding of personnel and resources. Limited deployments would provide important information that could inform future marine spatial planning efforts by allowing us to:
 - Define interesting habitat use eg Maxwell et al 2011, Revuelta et al 2015
 - Test the benefits of site specific protection and or gear restrictions in fisheries.
 - Measure nest site fidelity and clutch frequency eg Rees et al 2010, Weber et al 2013
 - Ascertain connectivity between key nesting beaches, including between São Tomé and Príncipe.
 - Possibly inform location of population sinks as well as illegal captures, informing priority 1. detailed above.

3. **Migration routes and key foraging:** It is likely that the vast majority of animals will leave Príncipe after the completion of nesting. As part of priority 2. detailed above, animals can be tracked to help define migratory corridors and key foraging areas. This will allow elaboration of key threats and begin to highlight key multinational stakeholders and potential conservation allies at sites overseas. Eg Fossette et al 2014, Pikesley et al 2014, 2015, Hart et al 2015, Stokes et al 2015

4. **Understanding the likely impacts of climate change:** With predicted climate change, there are two main concerns that should be the focus of further research, these are:
 - Sex ratios: Given there is variation in nesting beach sand colour and long nesting seasons in Príncipe there is likely to be variation in sex ratios. Therefore, temperature monitoring and incubation durations could

provide insights that can be subject to modelling future climate scenarios
eg Fuller et al 2013

- Beach erosion: With sea level rise and increased storminess some nesting habitats could be lost. Beaches should thus be profiled in three dimensions and nests located with a handheld GPS receiver to investigate the impacts associated with future climate projections.

5. **Molecular profiling:** Sampling at key nesting beaches for each species will allow us to build a DNA fingerprint for the Príncipe populations which can:

- Help ascertain whether Príncipe hosts discrete populations (eg Carreras et al 2013).
- Provide baselines which will allow assessment of impact of turtle fisheries and incidental bycatch elsewhere.
- Used to track individual females and build family trees of relatedness.

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Appendix 2. List and contact details for key informants.

Name	Organization and role	Contact information
Alexandra Marques	Príncipe Trust, Conservation and Research Project Manager	xanapica@hotmail.com
Ana Besugo	ATM, volunteer in São Tomé	www.facebook.com/ana.besugo
Ana Cabral	Petisqueira Simão e Pedro, local restaurant owner	N/A
Arlindo Carvalho	Department of Environment, Director	arceitacarv@yahoo.com.br
Bastien Loloum	MARAPA, Project coordinator	marapastp@gmail.com ; zuntabawe@gmail.com
Bobby Bronkhorst	Makaira Lodge (fishing resort), Operations manager	bobby.bronkhorst@makaira-holdings.com
Carlos Albuquerque	GEF, Consultant	Carlos.albuquerque@gmail.com
Estrela Matilde	Príncipe Trust, technical assistance to Biosphere Reserve projects	estrela.matilde@hbd.com ; estrela23785@gmail.com
Fish sellers at Príncipe's local market	Independent	N/A
Jaconias Pereira	Regional Fisheries Department and Marapa, Príncipe's representative	N/A
Joana Hancock	ATM, scientific board member	joana.hancock@gmail.com
João Pessoa	National Fisheries Department, Director	jpessoa61@hotmail.com
José Cassandra	Regional Government of Príncipe, President	N/A
Multiple Praia Abade community members	Fishermen and fish sellers (independent)	N/A
Multiple Praia Burra community members	Fishermen and fish sellers (independent)	N/A
Multiple Praia Seca community members	Fishermen and fish sellers (independent)	N/A

Multiple Praia Sundy community members	Fishermen and fish sellers (independent)	N/A
Valentim	Regional Government of Príncipe, Chief of President's Cabinet	N/A
Paul Hotham	FFI, Regional Director of Eurasia Programme	paul.hotham@fauna-flora.org
Plácida Lima	Regional Government of Príncipe, Biosphere reserve coordinator and teacher	placidaunb@gmail.com
Ricardo Lima	University of Lisbon, postdoctoral researcher	rfaustinol@gmail.com
Rita Alves	Príncipe Trust/HBD, anthropologist	rita.alves@hbd.com
Rogério Ferreira	University of Algarve and Archie Carr Center for Sea Turtle Research, PhD student	coriacea@gmail.com
Sara Vieira	ATM, project coordinator in São Tomé	saralexvieira@gmail.com
Sérgio Campos	teacher	www.facebook.com/sergiotcampos
Sophie Benbow	FFI, Eurasia project manager (Marine and ecosystem services)	sophie.benbow@fauna-flora.org
Damião Matos	Regional Fisheries Department, Director	N/A
Victor Jimenez	ATM, volunteer in São Tomé	www.facebook.com/marramiaiu.miau.7