

COUNTRY ECONOMIC MEMORANDUM
for São Tomé and Príncipe
Background Notes

Note #15 – Blue Economy and Environmental Resiliency

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I. Introduction: The Blue Economy potential in São Tomé and Príncipe

1. Oceans are an important source of wealth — at least 3 to 5 percent of global GDP is derived from the oceans, but their overall health is reaching a tipping point. Close to a third of fish stocks are fully fished or overfished, climate change is impacting coastal and marine ecosystems through a variety of vectors, unbridled development in the coastal zone is causing erosion, widespread desalination in semi-enclosed seas is threatening fauna and flora alike, and marine pollution—particularly from land-based sources—is reaching such a proportion that its impacts cannot even be accurately measured. The role of healthy oceans in stabilizing climate and keeping the planet cool is now better understood, and increasingly given the prominence and visibility it deserves in the global action arena. It is also known that business as usual in the different economic sectors associated with coastal and marine ecosystems will have great environmental and social impacts, which are expected to disproportionately affect vulnerable groups of the population, particularly women and girls. This is reflected in Sustainable Development Goal (SDG) 14 - Life Below Water, which calls to conserve and sustainably use the oceans, seas, and marine resources for sustainable development.

2. São Tomé and Príncipe (STP) is a Small Island Developing State (SIDS) with a large Exclusive Economic Zone (EEZ) that can contribute to STP’s long-term economic growth. The size of STP’s EEZ nearly 165,000 square kilometers and the accessibility to the ocean from all parts of the island group suggest that oceanic economic sectors can contribute significantly to STP’s long-term economic growth. However, not all oceanic activities are necessarily compatible, and in some cases decision makers are expected to carry out trade-offs between them, which in turn requires accurate valuation of the benefits generated by each.

3. In this context, the concept of the Blue Economy is particularly relevant and applicable to STP. Different institutions have different definitions of the Blue Economy, which is understood by the Bank as the sustainable and integrated development of oceanic sectors in healthy oceans. There is growing recognition that overfishing, marine pollution, and coastal erosion – among other issues – are pushing

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oceans to a tipping point to the detriment of the millions who depend on healthy oceans for jobs, nutrition, economic growth, and climate regulation. Central to the Blue Economy approach is the recognition that social benefits should be maximized over the long-term, ensuring that the economic drivers that result from the sustainable use of ocean resources are maintained.

4. **Main messages and roadmap**

II. **Review of the oceanic sectors in São Tomé and Príncipe**

1a. **Fisheries potential is hampered by overfishing (See also Background Note 15)**

5. **São Tomé and Príncipe's strong reliance on fisheries, combined with its vulnerability to shocks, make fisheries a lynchpin of STP's future growth potential.** In parallel to artisanal fishing, commercial fishing on an industrial scale is conducted in STP waters exclusively by foreign fleets that target large pelagic species. When fishing access agreements were initially signed in the mid-1980's, license fees were based on the amount of fish caught, which tended to incentivize under-reporting. Mismatch between reports to the European Commission and the International Convention for the Conservation of Atlantic Tuna (ICCAT) suggests that the actual fishing efforts are, and have been, substantially greater than indicated on reported catch records. An important related consideration is that STP currently does not have a deep-water harbor in its main port, which prevents foreign fishing fleets from landing their catches or being serviced or monitored, which prevents the country to benefit more from the commercial fisheries.

6. **The lure of relatively large revenues has provided a significant incentive for STP to sign fishing access agreements with foreign fleets, despite the country's low capacity for monitoring, control, and surveillance (MCS).** Without enforcement measures such as at-sea surveillance, quotas, landings control, and technology such as a satellite vessel monitoring system (VMS), regulations are extremely difficult to enforce. This contributes to overfishing in STP's national waters, straining an important resource on which coastal populations depend for nutrition and livelihoods, and reducing revenue from inaccurate reporting of foreign catches in domestic waters. Prior to 1987, the STP Coast Guard had a single 45-foot patrol vessel, which was often in port awaiting repairs funded by the United States. In 1992, the United States furnished STP with a single 28-foot patrol boat, without a deck canon, to fend off encroaching foreign fishing vessels. That vessel was presumably stolen after it disappeared from STP harbor in 2001 and was spotted later at a Nigerian Naval Base. Since then, there have been attempts to strengthen the country's MCS regime. An agreement with the United States signed in August 2005, for instance, has improved surveillance capabilities. Land based sea search RADAR, which detects and tracks surface ship contacts, and Automatic Identification System (AIS) were installed in STP in cooperation with the United States. However, even when violations have been detected at sea by the Port Authorities, STP simply does not have the means to enforce its exclusive sovereignty over marine living resources, or international regulations. The lack of enforcement extends to a limited ability to perform cursory inspection of fishing activities in the territorial waters, driving the overexploitation of marine resources, and resulting in foregone revenues for the country.

7. **Fisheries resources must also be managed sustainably, with a clear understanding of the level of fishing that targeted stocks can sustain.** As fishing effort in STP reached Maximum Sustainable Yield

(MSY) for some species of large and small pelagic fish around the early 2000s¹, non-commercial fishermen have come under increasing strain, with a fairly large spillover effect into other sectors of the national economy. The MSY is estimated around 12,000 tons per year². Surveys estimate the number of artisanal fishers in 2014 at around 3,000 primarily in non-motorized pirogues and total employment in the sector around 5,500 (see Background Note 15). An ongoing census will provide updated results by June 2019. These figures consider any open deck, fiberglass boat between 12 and 15 meters as “semi-industrial”. As a result of the increased pressure on fish stocks, fishermen have to travel farther than ever before, some with limited navigational and safety equipment. They are also employing increasingly destructive methods of fishing, including the use of hand grenades or small mesh net, especially in coastal fisheries³. These practices result in significant damage to ecosystems, increased risk to life, and overfishing. Further pressure on already overexploited fish stocks has caused the price of fish to rise at local markets. Given the central importance of fish as a source of protein for the population, these pressures are especially alarming (88 to 98 percent of STP households consume fish regularly, which represent 85 percent of their protein intake) and there have been reports that higher fish prices have encouraged locals to catch sea turtles on the beaches for meat⁴. Because of the benefits of the symbiotic relationship between sea turtles, mangrove forests, and coral reefs, decreases in the sea turtle population threaten coastal ecosystems and industries that depend upon them, including tourism.

Ib. Oil activity, with potential prospects for additional incomes, even at the exploration stage can have negative second order effect on other oceanic sectors. (see also Background Note 4)

8. **São Tomé and Príncipe is surrounded by oil-producing neighbors, but haven’t found commercially viable oil in its territory so far.** São Tomé and Príncipe (STP) is surrounded by major oil producing countries including Nigeria, Equatorial Guinea, and Gabon, but there has not been any commercial oil or gas discoveries in the country’s waters yet

9. **São Tomé and Príncipe’s Exclusive Economic Zone (EEZ) is a frontier area for oil and gas exploration, with low discovery probability, and in very early stage of prospection.** Its subsoil has not been drilled yet, not even for exploration or appraisal wells. The best-case scenario for the first exploration/ quantification well to be drilled is 2022. Thus, based on the lifecycle of E&P projects and on the most optimistic scenario, and oil production would only start in 2030.

10. **However, the current trend in increased oil exploration and eventual extraction could have negative second order effects on other oceanic sectors, including fisheries and coastal tourism.** First and foremost, among these risks are seismic and environmental impacts from drilling, including accidental and operational discharges, which are particularly difficult to avoid and manage because hydrocarbon resources are located at greater depth. Any related increase in maritime traffic will also have impacts, such as deck spillover washing up on beaches, increased risk to marine life, and damage from pollutants and debris both to the local population and to shipping. The potential of a large oil spill is equivalent to

¹ Fisheries Partnership Agreement Framework FISH, 2003.

² Plan National d’Investissement Agricole de Sécurité Alimentaire et Nutritionnelle, 2015

³ Fisheries of São Tomé and Príncipe, A Catch Reconstruction, 2015 and Fourth National Report on Biodiversity, 2009.

⁴ Fourth National Report on the Biodiversity, 2009.

the aggregate risk across the entire industry as exploration and extraction will be executed by a combination of international corporations and smaller local firms. However, small scale oil leaks, which are constant, can be costlier to the local environment⁵. Fish can be exposed to oil if it becomes mixed in the water column. Adult fish may then suffer from reduced growth and reproduction impairment among other complications while eggs and larva have reduced chances of survival.

11. **If oil exploitation moves forward, STP needs to ensure that the cost of decommissioning oil rigs when they become obsolete is covered by the oil companies, and in compliance with the highest standards.** By continuing to systematically disclose extractive data online, as well as publishing oil agreements that are signed, STP can avoid the pitfalls of its neighbors that have been stuck covering the costs of clean-up and decommissioning of oil wells and rigs. The details of the leases to deposits often matter more than the prices and profits extracted from oil production. Decommissioning rigs is complicated and costly and, especially for developing nations, companies have sometimes shifted the legal burden of clean up and decommissioning squarely on the host nation once the monetary benefits have dried up. In the North Sea, where Britain is decommissioning 250 rigs, the cost of decommissioning per rig was initially estimated at around 200 million USD, but that estimate was recently revised upwards to 312 million USD per rig. Additionally, the process of decommissioning an oil platform is complicated and fraught with hazards to the local ecology. Just removing the physical structure can harm fish habitats that have developed around the artificial reef, but leaving toxic waste contained within them and on the floor could release the hazardous materials into the water column and eventually the food chain. As such, detailed analysis of costs, including projected ecological growth in the equatorial waters, as well as the hazards of decommissioning the specific infrastructure to be installed must be carried out, understood, and considered prior to finalizing the relevant agreements.

1c. A new or revamped port could reduce some risks to the ocean sectors, but careful cost-benefit analysis is needed. (see also Background Note 6)

12. **STP's maritime connectivity is constrained by its weak port infrastructure.** Because the major port, located in São Tomé, is not deep enough (less than 2.5 m at low tide), current practice requires vessels of moderate to deep draft to anchor 1.5 mile offshore, with poor protection from wind and swell, and work cargo on and off-shore via lighters to a single pier. Smaller ships may pull into the harbor but there is no pilot available, increasing the risk to ships. Once cargo is at the pier, items must be individually offloaded in an overcrowded receiving area.

13. **As an isolated SIDS, STP's main options to minimize its trade costs and increase its access to international markets depend on its connectivity to major regional and international ports.** STP is located far from other international maritime gateways in West Africa, which causes STP to have poor connections to potential export markets and imports countries. Good connectivity to international hubs

⁵ After the 1991 sinking of an Oil Barge Vesta Bella of the coast of Barbados, the National Oceanic and Atmospheric Administration (NOAA) did an immediate cleanup of St. Johns island and then returned one year later to study the effectiveness of oil clean up procedures and the lasting effects. That study found that a majority of oil and tar balls that effected the ecology of St. Johns and Puerto Rico were actually from, "small, unrelated transportation spillages... a significant number of tar balls were related and matched to unknown source D, which may represent a 'mystery spill' of tens to as much as thousands of gallons of oil."

is as important as physical distance from the hubs for small islands states to ease business, especially to export.

14. **As STP considers its options for a new port to improve maritime connections, decision-makers must be aware of potential trade-offs such a port would require, as investment costs for a deep sea port might not be justifiable.** A new port or improvement of the existing one, including dredging would significantly streamline commerce and cargo transfer on and off-shore. Larger vessels would be able to transport goods to and from STP at significantly reduced costs. Additionally, a renovated port facility could provide space and warehouse facilities for the use of offshore oilfield support contractors. Longer-term benefits include moorages, refueling and waste services for larger commercial vessels, and support for an offshore fishing fleet improving monitoring and regulation of fishing licensing and state revenues. With standard regulation, these improvements would mitigate pollution from vessels currently dumping at their anchorages offshore and could improve ecology, wildlife, and tourism in the area while allowing for increased vessel traffic. However, costs associated with the construction of new port are important and should be properly considered. Recent examples in other countries (e.g. Sri Lanka's Hambantota port) have shown that the investment required for the construction of a deep-water port may not be justified when compared to the economic benefits it is expected to generate.

15. **Also, a detailed tourism survey and complete environmental and social assessment need to be completed to understand the physical impact of port facilities on the island and on other sectors, including the potential tourism sector competing for the same waterfront property.** Similarly, data studies need to be commissioned to analyze any increased maritime activity from the port facility, and the potential knock-on effect on other economic activities in the country. The currently identified area for a deep-sea port, Fernão Dias, North of São Tome, would require the construction of a whole sets of infrastructures, in addition to the port. A potential alternative would be the rehabilitation of the current port, with dredging and improvement of the facilities, to accommodate bigger vessels and improve port activities efficiency.

III. Land-Based Agricultural Production and Tourism

16. **STP needs to continue watching negative externalities of agricultural development on the environment, which are diffuse and sometimes difficult to identify, development which would boost overall productivity and economic potential by preserving natural resources and tourism potential.** The particular soil of STP allows streams of water to penetrate deeply into the rocks causing frequent landslides. So far, the environmental protection laws and regulations (especially in the Island of Príncipe), as well as the high costs of agriculture inputs, have resulted in agriculture practices, often environmentally friendly, with little to no use of chemical fertilizers and pesticides. However, effort should be maintained to ensure that expected gains in agriculture performance are not obtained through the use of agricultural tools contain agrochemicals and plant protection products. As some land is cleared for more agricultural production, trees are felled for firewood and for construction, which decreases shade for cocoa trees and hurts overall yield. The combined effects of contaminating freshwater sources, damage downstream ecology, as well as counterproductive efforts to expand farm and ranching, could be damaging and requires government coordination. Specific and conscious decisions need to be made either to favor agricultural production or ecology and tourism in specific areas, specifically along rivers and waterflows.

17. **It is important for STP to understand both its natural environment and resources to maximize their economic value.** The certification of the Biosphere reserve on Príncipe Island distinguishes it as a leader in sustainable tourism and could be a major and perpetual economic driver for the country. Parts of the tourism is driven by natural experiences, such as bird or whale watching, which should be preserved to support the development of tourism. Protected areas covered around 30% of the country's superficity. It is imperative to provide education, technical assistance, and information-sharing to the local population so that they understand their role and responsibilities and can contribute more effectively to growth and private sector development initiatives in order to share its benefits. As tourism increases, damage to natural resources could also increase if not properly managed. Management is critical to keep them viable for future generations. Increased tourism requires increased clean water and sanitation efforts, as well as a larger food supply, either domestically raised or imported. Effective management of the industry needs to be in place to ensure that the natural resources and population that the Eco-tourist industry depends upon will remain robust.

Id. Infrastructure and Industry

18. **High rates of coastline erosion exacerbate the threat to STP's coastal resources as well as infrastructure.** Because the lion's share of the economic activity and population lies along the coast, a large part of the national road network also hugs the shoreline, but stronger and increasingly unpredictable spring storm surges, combined with extensive illegal sand mining for construction, have led to high rates of coastline erosion of about 0.2-1.2 meters a year⁶, which exacerbates the threat to STP's coastal resources as well as infrastructure. Because of their location on a volcanic chain of islands, STP's population and economic activities are mainly located along the coastline, away from to the steep inland slopes that comprise the rest of the islands. Tourism has so far been associated with these coastal areas and remains an important source of revenue for the national economy. These coastal roads and increased tourism activity along them exacerbate the damage done by coastal erosion and increase the economic costs from loss.

19. **The overexploitation of sand for construction is a clear example in which the full costs to the ocean economy were not considered.** The low price of sand illegally extracted from the beach allows for affordable construction, which does not take account the cost of increased coastal erosion from sand mining and attendant beach destruction. The result is that the market price of sand used for cement does not incorporate the environmental cost and second order effects that these costs impose on other oceanic sectors, which leads to the destruction of natural capital and potentially lost revenue. Detailed studies of the rate and weight of sand removed from the coastline, and a detailed price comparison, availability and feasibility of building materials and their respective marginal productivities, should be carried out.

20. **STP is rich with mangrove habitats along its coastline, which have occasionally been converted into land for agriculture uses or harvested for firewood and charcoal.** These factors have converted natural mangrove resources into short-term gains for local population. However, mangrove forests are a pillar of the coastal ecology and affect both wildlife and preserve the physical coastline. Cutting down or removing mangroves removes wave protecting structure and roots systems to trap sediment to keep

⁶ São Tomé e Príncipe Transport Sector Development and Coastal Projection Project, The World Bank Group, 2017.

shore levels with sea-level rise. Additionally, as the mangrove ecology changes, biotope fauna and flora species that live within them will decrease, hurting potential revenues from tourism and fisheries. Mangrove destruction may also have direct deleterious effects on the populations of sea turtles already impacted by overfishing.

1e. Sea pollution caused by plastic is a threat to clean water in STP

21. Plastics swirl in the world's oceans and accumulate in five large subtropical gyres: North and South Pacific, North and South Atlantic, and the Indian Ocean. These areas have high concentrations of plastic particles between 1 mm and 5 mm (microplastics) that accumulate at the sea surface and are suspended throughout the water column. Species such as plankton, fish, shellfish, seabirds, turtles, and whales all ingest plastic. Plastic consumption is both direct and indirect as it accumulates in the food chain. While most marine plastic waste originates on land, ship-based sources are also significant. As maritime traffic might increase near STP due to oil exploration and extraction, plastic pollution would increase as well. Many vessels do not adhere to best practices of storing their plastic waste to return to shore, simply dumping them into the sea as dunnage. Plastic pollution in the ocean affects ecology and wildlife and hinders shipping and transportation. Vessels can be disabled by plastics blocking water intakes, entangling their propellers, and collide with larger debris representing a navigational hazard.

22. The negative effects of plastic pollution in STP may have consequences at the ecosystem level. Microplastics adsorb man-made chemical pollutants like Persistent Organic Pollutants (POPs). These chemicals include flame-retardants, dichloro diphenyl trichloroethane (DDT), which is a common insecticide that manages malarial infected mosquitos, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs). When microplastics that have absorbed these chemicals enter the food chain, like when malaria nets are washed in rivers, they become a toxic risk to fish and humans. This could be especially problematic for STP where a large percentage of the population consumes fish for protein. Like oceanic currents, rivers transport plastics through the inland waterways out to sea and contribute an estimated 1.15–2.41 million tons of plastic annually⁷. Near STP, the Benguela Oceanic Current runs north along the eastern coast of Africa, off the coast of the Congo River delta, hits STP, and then turns west at the equator. Similarly, one of those 10 most pollutive rivers in the world, the Niger River, empties out just north of STP and its contents are carried south to STP by the Guinea current before similarly turning west at the equator. The currents bring plastic runoff from the rivers into the Atlantic and carry them into the surrounding seas and onto the shores of STP, where they affect everything from agriculture, to wildlife, and from tourism to public health. Once onshore those plastic debris transport microorganisms and invertebrates that are invasive species. Pathogenic microorganisms concentrate in plastics overtime and can affect STP's agriculture industries as well as the human population.

23. In response to this growing threat, STP has taken a leadership position on plastic pollution. In coordination with making the island of Principe a bio-reserve, the island of Príncipe has banned all plastics from the island and intends to make it entirely plastic-free by 2020⁸. While a large portion of plastic

⁷ River Plastic Emissions to Test the World's Oceans, Nature Communications, 2017.

⁸ Zero plastic on Príncipe. (2016, December, 27). Retrieved from <https://www.dw.com/en/zero-plastic-on-principe/a-36859781> on March 31, 2019.

pollution affecting the archipelago comes for external sources, reducing the use of plastics on the islands is a critical step towards maximizing the real value of the country's marine natural capital. By taking a leading role in combating plastics, STP is maximizing Príncipe's value as an ecotourist attraction. There are costs associated with more expensive consumer goods by choosing alternatives to plastics, however there are benefits to the ecotourism of STP, shipping, wildlife, and fishing populations, which will likely have a greater and more sustainable economic effect.

24. Like many SIDS, STP is also constrained by the amount of potable water available on the islands.

Even if rainfall could exceed 5,000 mm a year in some areas, it is surprisingly variable, and annual precipitation drops below 900 mm in the north east of São Tomé. The geography of the islands gives rise to multiple short rivers extending radially out from the volcanic peaks in the center and flowing into the Atlantic. The river volumes are sensitive to rainfall and easily flood. While much of the population has access to river water, regular supplies of clean water are more variable. Disposing solid waste and washing clothes, including impregnated mosquito nets, pollute downstream water not only deprives the population of clean water, but it damages tourism prospects as well as some of the food. Importantly, there is a clear linkage between with clean water and malaria. The recent reduction of malaria infections is due to an effective program of control and eradication using impregnated nets. While the reduction of malaria infections is objectively positive, the nets are frequently washed out in the rivers and contribute significantly to water pollution. Infrastructure investment that improves water sanitation is a short-term cost for a long-term gain. Through waste management programs and educating the population on how to properly dispose of waste as well as clean nets, STP can boost access to clean water and boost economic growth.

IV. Impacts of Climate Change: Observed and Anticipated

25. STP is particularly vulnerable to the effects of climate change and sea-level rise, including severe coastal erosion and shoreline loss, droughts, storms. The negative impacts of climate change are apparent in all sectors of the national economy, and adaptation and risk reduction should be a priority. The Government of STP has taken steps to identify measures to reduce national greenhouse gas emissions and improve resilience, but, as a small nation, its individual actions can only have limited impact on the global Greenhouse Gases concentration, and STP must therefore focus on adapting to the effects of climate change.

26. The understanding of the impacts of climate change on fisheries can be organized around several main "vectors": acidification, sea-level rise, higher water temperatures, and changes in ocean currents. These different vectors, however, are unequally known and hard to model, both in terms of scope – where they will occur, where they will be felt the most – and in terms of severity. For instance, whilst not as well understood as the other impacts, and more difficult to measure, the impacts of acidification are likely to be the most severe and most widespread, essentially throughout any carbon-dependent ecological processes. Likewise, the effects of sea-level change will be felt differently in different parts of the world, including depending on the ecosystems around which it occurs. In spite of this uncertainty, the current state of knowledge is sufficient to understand that these impacts will be felt at two fundamental levels: first on fish stocks themselves, and second, and perhaps more importantly, on the critical marine and coastal ecosystems on which they depend.

27. **Most of STP’s infrastructure is located in low-lying areas along the coast, and fortifying infrastructure will be costly, but may have secondary benefits.** The port, airport, oil reservoirs, and hotels are all directly exposed to sea-level rise and coastal flooding. Commercial, industrial, and residential developments in the coastal area, whenever formally planned, are often based on plans written in the colonial period and do not take into account the changes in mean sea level (MSL) and other natural pressures. This is illustrated in the fact that the road connecting the airport to the city center was washed away by the sea thirty years ago. The current road section was rebuilt 30 meters further inland, but still remains exposed to future impacts of climate changes. Protecting roads against coastal hazards is a challenge, as it requires significant investments. The country’s coastal roads and waterfront of São Tomé City are especially exposed to erosion and flooding. The current coastal protection structures between the international airport and the city center are degraded and no longer provides adequate protection. There are a few local temporary fixes, but not at the scale needed to protect the road over the long term.

28. **Protecting São Tomé’s seafront will contribute to future tourism development as the waterfront area has significant economic potential.** Currently, the seafront is regularly flooded (about 10 times per year) with waves breaking over the seawalls. Due to poor maintenance and a lack of large-scale rehabilitation projects, the transport infrastructures have been extensively damaged, preventing full exploitation of the country site’s touristic potential, especially for the capital waterfront. . While reinvesting in nearly all of the nation’s transportation and commercial infrastructure to build their resilience is vastly expensive, it will in the long run reduce the impact of climate change avoid disruption to the national economy, and support tourism development. The strengthening of the country resilience should be aligned with the development strategies, using as nature-based solutions and proper coastal zone management to combine economic development and attractiveness of the countries, with promoting its natural capital and giving it the opportunities to face threats from a changing climate.

V. Policy Recommendations and Investments

29. **In order to facilitate the trade-offs that must be carried out between different oceanic sectors, STP should use a number of tools and instruments that help integrate various ocean-based activities.** Enabling a transition from current practices, in which activities are often undertaken with no regard to the serious negative environmental and social impacts that threaten long-term development to a resilient Blue Economy requires significant up-front investments to understand current trends and emerging threats and identify the appropriate policy (governance, fiscal, financial) and investment solutions. To that end, key steps include:

- (i) developing a more accurate picture of the potential value of the ocean economy;
- (ii) identifying pathways to sustainably realize this potential value, thereby generating more economic activity from blue sectors; and
- (iii) identifying the steps needed to sustain a healthy ocean and build resilience against the impacts of climate change.

Box 1: The essential goals of a Blue Economy Approach

- Identify clear policies and objectives that combine consideration of economic, social, cultural, and environmental needs in the ocean area;
- Provide better guidance and clarity to decision-makers, and greater certainty to the private sector;
- Understand how marine and coastal resources are currently being used, the needs of different activities, how new technologies are emerging, and the nature of activities is changing;
- Protect valuable ecosystem services and natural resources, and better understand and manage the cumulative effects of different marine activities, both on the ecosystem and each other;
- Make more efficient use of available marine and coastal space, striking a considered balance between competing pressures, and consider how diverse activities can be better integrated in a shared space, for mutual benefit;
- Anticipate the predicted impacts of climate change on the marine environment, address how marine activities contribute thereto, and how they are likely to be affected; and
- Ensure that the views of all those with an interest in the marine environment (including women) are considered in deciding how ocean resources are to be used.

30. **With a comparative advantage in tourism, finding the balance between economic development and conservation is of primary importance to STP.** STP has taken great steps already by setting up the Island of Príncipe as a Biosphere Reserve in 2012 and starting the process of making the island plastic free. STP should continue to promote eco-tourism while instituting ecological management practices to limit the impacts of the expected increase in tourism.

31. **Protect infrastructure from climate change and damage while maximizing its use for tourism revenue and attract sustainable economic partnerships.** STP's road networks ringing the coastline are not only harming coastal ecosystems (especially mangrove forests) but are also at risk of being washed away from increasing floods and rising tides. While the needed infrastructure spending is expensive, the country should start planning to move the main roads off the coastline, away from the rising tide, away from the falling coastline, away from where tourists want to stay, and higher up the elevation gradient.

32. **Upgrade port facilities in a financially sustainable way to avoid a debt trap and use imported materials rather than sand-based cement.** The industrial fishing industry draws on one of STP's main natural resources, even though its contribution to GDP is limited (8 percent). Bringing some of the industry on land through a deep-water port facility will also bring new employment sectors to the island nation. The revamped port will have cross-cutting benefits in all sectors, especially in maritime enforcement as a required step to setting up a credible coast guard. Co-location of fishing fleet services, including maintenance, licensing and taxing, decreased import costs of all goods, and increased export revenues of all goods are all clear gains. While there are significant gains from a deep-water port facility, some pitfalls must be avoided. Chief among them are lasting and crippling debt depending tied to the various sources of financing, inadequate ecological services for lack of a recycling facility and use of sand-based cement in construction. In addition, the possibility of a revamped port should be considered in a regional context and existing facilities in neighboring countries.

33. **Improve waste collection and management practices through TIA and either transport the material to appropriate transformation facilities or develop those facilities in the country.** Waste management is not being conducted effectively. As tourism develops, the waste problem will grow exponentially. With its small land area, STP cannot afford for its environment and natural resources to be

damaged through increased plastic imports, without facilities to recycle or export waste effectively. Developing this capability is critical to building the tourism sector as well as preserving fisheries and economic growth in general.

VI. Data Gaps and Potential Directions for Empirical Analysis

34. There are a number of unknowns and data gaps in São Tomé and Príncipe, which must be addressed in order to make informed decisions on the optimal use of public funds. São Tomé and Príncipe faces many choices as it embarks on a path to development. A few have very little negative tradeoffs assuming standard regulatory practices and proper implementation like planting proper trees for construction, shade for agricultural crops, fuel for cooking, and habitats for bird populations and tourism. Similarly, plastic mitigation will have positive effects both ecologically and economically. Other investments, such as the use of more expensive packaging, water treatment and sanitation all have upfront costs but will produce potential benefits over time. For example, the cost of establishing a proper maritime surveillance system and enforcement of fishing and dumping laws has a high upfront investment but is likely to be recouped by the increased revenues and improved protection and rehabilitation of fishing stocks, natural wildlife, and the marine capital vital to tourism.