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SRI LANKA: MANAGING COASTAL NATURAL WEALTH

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ACKNOWLEDGMENTS

The *Sri Lanka: Managing Coastal Natural Wealth* report was inspired by the country's aspiration and large potential for growing its blue-green economy. A major island state, Sri Lanka is dependent on the quality and availability of its coastal resources, and needs to exploit this natural capital sustainably while improving overall economic well-being and social equity.

The report was prepared by a multi-disciplinary team of World Bank Group staff and consultants that included Sebnem Sahin (Senior Environmental Economist and Task Team Leader), William Lane (Senior Fisheries Consultant), Indu Hewawasam (Senior CZM Consultant), Charlotte de Fontaubert (Senior Fisheries Specialist), Randall Brummett (Senior Fisheries Specialist), and Milen Dyoulgerov (CZM specialist) from Environment and Natural Resources Global Practice; Chantal Andriamilamia (Principal Investment Officer, IFC) and Grant Milne (Senior Natural Resources Management Specialist, Agriculture Global Practice).

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EXECUTIVE SUMMARY

Coastal areas are essential to Sri Lanka's economic development, accounting for the highest concentration of population and economic activity. Sandy beaches, dunes, lagoons, estuaries, fresh water marshes, minerals, mangroves and reefs enrich some 1,600 km of coastline that surrounds the "pearl shaped" island. Approximately 33 percent of Sri Lanka's population lives in coastal areas that support diverse livelihoods, from fishing to tourism to manufacturing and modern urban services. The coastal ecosystems are uniquely important as they enable multiple human activities.

Among all economic activities, tourism and fisheries are the most dependent on the natural resources of the coast. Together, these two sectors generate 10 percent of Sri Lanka's foreign exchange earnings and account for 6.7 percent of employment. Fisheries make an important contribution to food security, employment, and Gross Domestic Product (GDP), contributing close to 4.5 percent of Sri Lanka's total export revenue, with further significant growth potential. Nearly 90 percent of the total national fish catch comes from the marine and coastal fishery, and it supports the livelihoods of many artisanal fishermen and those who access or are in the value chain of the large pelagic fishery within the 200 nm Exclusive Economic Zone (EEZ). Along the coast, 20 formal fish harbors accommodate more than 4,000 single and multi-day fishing vessels. The fisheries sector is a major source of employment, providing approximately 500,000 formal and informal jobs.

While rich coastal resources gave rise to vibrant economies in the Southern and Western provinces, the economies in the Northern and Eastern provinces are much less developed. According to the official statistics (2013), there are 1.49 million people in Sri Lanka living below the poverty line, with higher rates of poverty concentrated in the Northern and Eastern areas. The most dynamic growth and lowest poverty levels occur around Colombo, Kandy, and Galle, and along the corridors connecting these cities within the Western province. The rest of the coast supports a primarily rural population that relies heavily on natural resources. Although coastal areas tend to be the poorest, many economic opportunities in these areas have yet to be utilized. This is partly due to the isolation of the Northern and Eastern regions, which is the result of the country's 30-year armed conflict that ended in 2009. In the Western and Southern provinces, the value of natural resources has diminished under pressure of competing uses, resulting in consumptive and sub-optimal exploitation, except in the Southwest where urbanized areas predominate.

Sri Lanka is highly vulnerable to the effects of natural disasters and climate change, which are likely to have a greater impact on those in the coastal areas who rely heavily on direct natural resource use. Growing development pressure and user conflicts are exacerbated by natural disasters and climate change. The devastating 2004 tsunami left nearly 35,400 casualties and US$ 1.3 Billion in damage and losses (EM-DAT), while periodic heavy coastal flooding continues to generate serious economic impacts. The Intergovernmental Panel on Climate Change (IPCC) report (2014) further predicts that current monsoon seasonal patterns will worsen by 2050. Temperature

increases will have significant implications for coastal and marine resources. Extreme weather events, such as typhoons and other storms, will become increasingly severe and cause more frequent and extensive coastal flooding. These impacts will have a direct and immediate impact on coastal resources and livelihoods. Climate-related hazards will directly impact near-shore ecosystems, threatening the economic base of poor coastal communities. They will also cause increased shoreline erosion, and higher costs of building and maintaining infrastructure.

The government of Sri Lanka has recognized the importance of unique coastal habitats and the ecosystem services they provide, including buffering the impacts of climate change. Sri Lanka is one of the first countries in the world to adopt integrated coastal zone management (ICZM) as a governing mechanism. In 2015, the government adopted a Blue-Green Development Strategy (Neela Harita Yugayak) which emphasizes "conservation and sustainable management of lands and oceans." The strategy acknowledges that healthy coastal ecosystems are central to safeguarding Sri Lanka's ocean-based economy. It further elaborates that, to reduce the environmental footprint of many economic activities, it is essential to deploy a sustainable management approach to coastal resources. It will require carefully tailored coastal zone management policies that cater to diverse economic interests and that reconcile competition for resources, integrate multiple sectoral considerations, and steer implementation and practice toward gains in long-term sustainability.

The objective of this study is to identify and present opportunities to increase the value of Sri Lanka's exceptional natural wealth in the coastal areas in a sustained and sustainable manner. It focuses on fisheries, aquaculture and mariculture, linkages between community tourism and fisheries, and critical inter-sectoral dependencies in the context of coastal zone management. The study is designed to provide Sri Lankan policy makers with analysis and recommendations in areas where strategies to attract business investors can be complemented by the benefits of governance reform, smart coastal spatial planning, and better monitoring and regulation of the impacts of economic policy. The report highlights several areas where changes could lead to better protection of environmental, coastal, and marine resources, and enhance the effectiveness of national policies to address current challenges and vulnerabilities.

HOW DOES DEVELOPMENT PRESSURE AFFECT COASTAL RESOURCES AND LIVELIHOODS?

Sri Lanka's coastal environment is vulnerable to, and already seriously affected by economic development and urbanization. Critical ecological services and biological values are being undermined. These include mangroves, coral reefs, rivers and estuaries, which protect and stabilize coastlines, are a source of urban water supply, storm mitigation, and are important as nursery areas for fish and crustaceans. These changes, brought about by development, are increasing the vulnerability of human populations, particularly those in low-lying coastal areas. Such vulnerability will be exacerbated by sea-level rise, storm surges, and tsunamis.

There are multiple concerns associated with the degradation of mangroves and coral reefs, seagrass beds and rich fish stocks, all of which have high ecological and economic value and support the livelihoods of millions. Mangroves cover about 160 sq. km along the Northwestern, Northeastern, and Eastern coasts. They contribute to coastline stabilization, serve as a buffer against storm surges and store carbon. Mangroves also provide critical ecological, environmental and biological services, such as nurseries for aquatic organisms, and nutrient and sediment traps. They are important for maintaining stable fisheries which are essential as a source of protein and livelihoods in coastal communities. Mangrove ecosystems also provide timber and non-timber products for domestic and commercial uses. Pressure on mangroves comes mainly from the clear-cutting of wood for fuel and from land clearing for shrimp farms. Additional drivers of mangrove loss include the failure of land use planning. For example, 64 percent of mangrove cover has disappeared from Puttalam Lagoon and 11 percent from the Dutch Bay because of unplanned and unregulated development. On the more positive side, in more recent years, mangrove and wetland-related tourism have gained prominence in Sri Lanka, making tourism a direct user of mangroves in their natural state. This needs to be better supported by the government.

Near-shore degradation of coral reef resources due to increasing population pressure is reaching serious levels. Human-generated pollution, including increased sedimentation from rivers and estuaries, has significantly exacerbated the negative impacts from extreme El Nino events and the 2004 tsunami. Reefs are similarly impacted by unsustainable fishing practices, such as the use of drag nets, foot traffic, and anchoring. Near-shore coral reefs in the Western and Southern provinces are most affected, while Kalpitiya, home to Sri Lanka's most unique coral reefs, is particularly vulnerable to climate risks because of the adjacent sand bars. Since coastal ecotourism often relies on healthy coral reefs that support diving and sport fishing, the loss of these extremely sensitive coral reef ecosystems is both ecologically and economically detrimental. The Bar Reef, the most extensive and unique coral system, has attracted community-based tourism focused on snorkeling, diving, dolphin watching, and kite surfing. But unless tourism activities are well managed, serious degradation caused by overexploitation of this invaluable natural asset may occur.

There are multiple risks to marine fisheries. Illegal, unreported, and unregulated (IUU) fishing is contributing to near-shore overfishing and the threat of overfishing of some species in the 200 nautical miles (nm) EEZ. Many coastal wetlands, which support important fisheries and mariculture activities, are affected by changes in water quality and eutrophication. Significant changes have already occurred in species composition and in the age and size structures of some fisheries. This is partly due to overfishing, and weak governance of the sector that has yet to establish an estimate of maximum sustainable yield for the coastal fishery accessed by single-day boats. This is likely to be aggravated by sea-level rise and increasing sea-surface temperatures linked to climate change, and potentially worsening existing vulnerabilities related to user conflicts and inadequate oversight.

Shrimp farming is rebounding after a near collapse in the past due to unsustainable practices. Small-scale farms, measuring approximately one hectare, were developed in clusters in the lagoon areas of the country, encroaching on ecologically sensitive areas such as mangroves, salt marshes, intertidal mud flats, coconut plantations, and other "conserved" areas. A general lack of effective environmental management of shrimp farms led to an outbreak of viral disease, with close to 100 percent mortality of prawn stock in many farms. The result was an unsustainable financial burden on many farmers in the 1990s. Improved farming practices and sanitation helped the industry mitigate the impact of the virus and production is beginning to rise again.

Historically, coastal erosion is a serious issue along the Southwestern-Northwestern monsoon axis. Near-shore ecosystems and "non-living" coastal assets are under increasing pressure from mining of sand and mineral deposits, and seashells. This results in a significant loss of sensitive areas and impacts large strips of beaches, spits, and dunes. These are ecologically important because they support unique aspects of the country's biological wealth, with many species still undocumented.

Excessive and inappropriate siting of sand mining in rivers contributes to shoreline erosion and beach retreat. Likewise, unplanned construction has exacerbated shoreline erosion and affected inland and coastal water bodies - another vital coastal asset. The demand for limestone from the construction industry and agriculture resulted in increased extraction of ancient fossilized coral reefs (coral rag) found inland. Lime production from live and dead corals is resulting in destruction of fringe reefs along the Southwest coast. The most exploited coral reefs are concentrated along the coastal belt from Akurala to Hikkaduwa, as well as in the Matara district on the Southern coast. Dam construction and river diversion has caused a reduction of sediment transport, thereby contributing to coastal erosion.

Degradation of coastal habitats and biodiversity is the result of unabated upstream pollution. The sources of pollution in Sri Lanka's coastal zone include sewage discharge, urban storm water runoff, poorly managed solid waste, organic waste from mismanaged aquaculture, and toxic and hazardous chemicals in industrial waste. These poorly treated discharges occur largely upstream and enter the rivers that eventually discharge at the coast. They diminish the value of coastal resources and the ecosystem services that they provide. For example, the Greater Colombo area generates 3,70,000 m^3 of wastewater of which only 90,000 m^3 is treated and discharged through deep-water outfalls. Worse

still, many secondary cities lack appropriate sewage systems altogether.

Weak regulation of near-shore tourism facilities in Hikkaduwa, Beruwela, and Unawatuna and untreated effluent discharge from large hotels along the coast pose a serious problem. This is made worse by fecal pollution from squatters attracted to tourism developments. Bilge clearing and spills from commercial shipping along the coast and around ports is also a problem. This leads to degradation of water quality, visual pollution of beaches, and near-shore waters. Unplanned expansion of tourism adds greater development pressure on Sri Lankan coastal resources. A study by the Greening Sri Lanka Hotels project under the European Union revealed that while 92 percent of large hotels possess sewage treatment plants, only 17 percent of the medium and small hotels own and operate such facilities.

ECONOMIC AND INSTITUTIONAL CHALLENGES TO BLUE-GREEN GROWTH

The impacts of unplanned and unregulated economic development on coastal resources are exacerbated by weaknesses of governance and institutional capacity. Unregulated economic activities increase the risk of overexploitation and wasteful use of coastal resources, thereby undermining their value. Government intervention in the wholesale fish markets and subsidies of fishing port operations cause operational inefficiencies and economic distortions in the market for fish, and may be indirectly linked to over-capacity of the fishing fleet, and thereby hinder competitiveness in the fisheries sector. Also, if tourism is to reach its planned potential and grow by 6.1 percent annually until 2024 to make Sri Lanka "the most sought-after tourist destination in South Asia," serious reforms are needed in coastal zone management policies, including reconciliation of user conflict between fisheries and mariculture and tourism development. Despite recent progress, environmental degradation in the coast remains an impediment to future growth, despite Sri Lanka's rich natural resources. Sri Lanka was ranked 93th in environmental sustainability and 64th overall among 139 countries, according to the World Economic Forum's Travel and Tourism Competitiveness Index (2017).

Fisheries

The fisheries sector is beset by many problems, including IUU fishing, value-chain inequalities, outdated subsidies, user conflicts and inadequate oversight. Subsidies for fishing port construction and operation hinder private sector involvement in fisheries support services, require sectoral cross-subsidies, and restrict capacities of fishing port managers. In order to ensure realization of the maximum sustainable value from this important natural resource, it is critically necessary to introduce greater transparency in government procedures, self-funding in the sector, regular fish stock assessments, and remove barriers to private involvement in the operation of fishing ports, fisheries support services, and other aspects of the fisheries value chain.

Subsidies in government-operated programs that support the fisheries sector need revisiting. The government funded program through the Ceylon Fisheries Corporation (CFC) under the Ministry of Fisheries targets fishermen operating day boats and smaller vessels. The program supports the purchase of fish not sold to the private sector or auctioned in wholesale fish markets at the end of the day, to maintain price levels. The fish is then sold in the retail market. This indirect price support encourages over-capacity and excessive pressure on fish resources. With the cost of this government program increasing over time and the CFC reporting an operating loss of approximately 35 million Rs./year ($240,000 USD), this approach will have an unwanted impact not only on the market, but also on near-shore and lagoon fisheries.

Likewise, there is a need to review and update user licenses and fees to access resources, limit over-exploitation and promote environmentally sustainable fishing. Currently, license fees charged for accessing coastal and marine fisheries resources are inadequate to cover management costs and may encourage over-exploitation. For example, the cost of licensing a vessel to access and capture an unlimited amount of fish from the 200 nm EEZ is Rs. 5,000 for a multi-day vessel. This is: (i) not proportional to the benefit captured by the operators; (ii) does not set catch limits, either economically by increasing access charges in proportion to catch or through a cap on catch; and (iii) does not cover the amount spent by the authorities on management of the large pelagic

fishery. This effectively means that other sectors of the economy must subsidize fisheries management.

Coastal Tourism

While enjoying positive trends since 2012, as well as future potential for developing its rich tourism assets, Sri Lanka has yet to fully exploit tourism as an engine of growth. In addition to the more traditional beach-oriented tourism, coastal tourism also encompasses deep-sea sport fishing, observing sea mammals, and sailing. The shallower reef waters attract divers, snorkelers, inshore leisure fishing, boating and numerous other recreational sport interests. This would require stepping up investments in shore-based infrastructure. Sri Lanka was the first country in South Asia to promote foreign direct investment in tourism development. The current investment strategy anticipates a growth in foreign arrivals from an estimated 1.8 million in 2015 to 3 million in 2020.

New land lease programs and initiatives for tourism development would benefit from better application of spatial planning. The government's development plans in new destinations are mainly based on the selection of sites in areas seemingly fit for beach-based tourism. Unfortunately, many sites are in some extremely sensitive areas and already experience tremendous development pressure. While there have been many large-scale isolated tourism developments in the past 50 years, the planned new initiatives would benefit from incorporating lessons learned from the sometimes-negative impacts of past developments.

Creating large-scale beach enclave tourism in new areas, where other forms of tourism are well suited, may increase unsustainable pressures on coastal resources and communities. Ecotourism, for instance, is a good fit for fishermen as additional or alternate employment, and can offer a sense of cultural authenticity to visitors. Some of these areas, particularly on the Bar Reef, have attracted community-based tourism focused on snorkeling, diving, dolphin watching, and kite surfing. The Bar Reef has the most extensive and unique coral cover in Sri Lanka. However, unless the activities are well managed, including the siting and type of hotels in operation, serious degradation and over-exploitation can result.

Coastal Zone Management

The core of Sri Lanka's coastal zone management policies is driven by the need to address several significant issues. These include depletion of natural habitat and resources, coastal erosion, loss and degradation of historical, cultural and archeological sites of national significance, and loss of physical and visual access to the ocean. As early as 1981, Sri Lanka enacted the Coastal Conservation Act, which defined the coastal zone as the area from 2 km seaward to 300 m inland. The primary mechanism for regulation of coastal economic activities is the permit system. It has evolved since the earlier top-down approach, but remains largely ineffective. Given extensive changes on the coast, including population pressure and unplanned investment, spatial planning as a precursor to development is critical to guide investment in coastal areas. Its significance remains vital for sustained growth of coastal economies. The current spatial planning systems fail to prevent resource-use conflicts and minimize environmental damage. Identification and protection of important terrestrial and aquatic resources and sites are poorly implemented in formal development planning.

Hence, establishing the concept of "limited use" and "non-use" in the spatial planning system is critical for safeguarding coastal resources. The role of local governments in spatial planning, particularly their ability to manage it effectively, should be strengthened. This could help improve the effectiveness of coastal management practice, improve transparency in development investment, and proactively address potential resource conflicts between fisheries and other sectors.

Disaster Risk Management

Coastal regions are heavily exposed to climate risks from rising ocean temperature and changing weather patterns. Climate-related disasters, such as more frequent storms, floods, landslides and droughts may negatively affect terrestrial forest cover, and the flora and fauna it supports. This diminishes the appeal to eco-tourists who visit the country for its biodiversity hotspots, and leads to a loss of prime land and beaches. After the disastrous tsunami in 2004, the government began proactively pursuing integration of disaster risk management in development policies. Given the high cost of infrastructure investment

in fisheries and tourism, it is gradually adopting measures to protect coastal investments through enhancing "blue infrastructure", namely, mangroves forests and coastal vegetation, sand nourishment, zoning for disaster risk prevention, modeling and forecasting. There is a strong demand for enhancing meteorological and hydrological services, following the impact of the May 2016 flooding, to guide timely disaster prevention and management in the coastal provinces. Development policies for the fisheries sector and port construction plans should also account for potential climate impacts.

A WAY FORWARD: OPPORTUNITIES AND PRIORITIES

Sustainable coastal development is fundamental to Sri Lanka's sustained economic growth and competitiveness, especially as it moves towards upper middle income status, and pressures on coastal resources increase. Yet, the value of Sri Lanka's coastal assets could diminish if adequate policy and institutional mechanisms to foresee, assess and manage long-term risks are not put in place. The issues related to the three most important areas discussed in this report, namely fisheries, coastal tourism and coastal zone management, call for differentiated interventions across geographic regions along two main axes:

- Improvements in the coastal fisheries, especially in the Northern and Eastern provinces; and
- Strengthening ICZM.

The need for improvements is recognized by the Government but not yet fully implemented. In this regard, reforms in managing coastal wealth should: (i) create an enabling environment for all-growth sectors; (ii) provide mechanisms to assess trade-offs; (iii) solve resource use conflicts among sectors where they are already occurring; (iv) proactively avoid sector conflicts when still possible, especially in the post-conflict areas in the Northern and Eastern parts of the country.

Importantly, policy reforms and interventions should address significant regional differentiations in development. A window of opportunity is narrowing to promote sustainable resource management in the Northern and Eastern provinces where coastal resources remain largely under-used and less affected by development. The report highlights that unregulated economic activity in an "open-access-to-resource" environment increases risk of over-exploitation of natural resources. In the absence of integrated spatial planning for coastal zone management, capacity strengthening, and sound investment planning, this window of opportunity can close fast. By the same token, Southern and Western provinces, which are more developed, would benefits from pro-active management of environmental challenges and climate risks.

Integrated management of fisheries, coastal zones, and coastal tourism can be a powerful tool for meeting the Blue-Green growth objectives. The traditional single-sector management approach of coastal areas and resources did not produce satisfactory results, this report argues. The coastal economy will benefit from a well-coordinated inter-sectoral approach with long-term focus on the capacity of coastal resources to support economic development in the face of climate and environmental challenges. To fully realize the economic opportunities of coastal areas and to minimize the risk of resource depletion, policy reforms could also focus on strengthening private sector investments through: (i) better equipping the private sector to weather price volatility in commodity markets; and (ii) providing incentives to local entrepreneurs for climate resilient investments. Spatial planning as a tool for ICZM for addressing climate and environmental climate risks, and for promoting social sustainability remains best suited to bridge many of the institutional and regulatory gaps.

INTRODUCTION

Sri Lanka's development policy vision titled, "Blue-Green Development Strategy (2015): Vision, Highlights, and Focus (Neela Haritha Yugayak)" identifies coastal and marine resources as key elements of future growth and development. Through this strategy the government has recognized the value of unique coastal habitats and the ecosystem services that they provide. The strategy acknowledges that healthy coastal ecosystems are central for safeguarding Sri Lanka's ocean-based economy. It further elaborates that mitigating environmental footprint of many economic activities is key to sustainable management of coastal resources. The highlights of the Neela Haritha Yugayak are outlined in Box 1.

This report focuses on policy and institutional reforms that are essential for accomplishing the national development goals in two priority areas of the Blue-Green Strategy, namely fisheries and coastal zone management. Certain aspects of coastal tourism and related issues concerning environmental and social sustainability are also analyzed, to the extent possible, in order to demonstrate the existing competing patterns of the use of coastal resources along with the possible socio-economic gains and losses.

Sri Lanka faces significant challenges and vulnerabilities -- from rising seas due to climate change impacts, to illegal fishing and inefficient resource use furthering the destructive pressure on coastal ecosystems, to a number of policy and governance challenges. The premise of the study is that natural phenomena and human-induced stress threaten sustainable growth and livelihoods.

The objective of this study is to identify and present opportunities to increase the value of Sri Lanka's exceptional natural wealth in the coastal areas in a sustained and sustainable manner. It focuses on capture fisheries, aquaculture and mariculture, linkages between tourism and fisheries, and critical inter-sectoral dependencies in the context of coastal zone management. The study is designed to provide Sri Lankan policy makers with analysis and recommendations in areas where strategies to attract business investors can be complemented by the benefits of governance reform, smart coastal spatial planning, and better monitoring and regulation of the impacts of economic policy. The report highlights several areas where changes could lead to better protection of coastal environmental and marine resources, and enhance the effectiveness of national policies to address current challenges and vulnerabilities.

The report uses as a background several technical papers. In addition, it reviews publicly available literature describing the status of the coastal environment and economy, and government policies. The Ministry of Fisheries and Aquatic Resource Development, and Ministry of Mahaweli and Environment and their staff have actively participated in the discussions leading to the analysis. Consultations with main stakeholders took place in September 2016, in Colombo and several provinces (Annex 1).

This report has four chapters. Chapter one describes the natural endowment and coastal resources of Sri Lanka and discusses key features of the coastal economy, specifically fisheries and coastal tourism, both

of which depend on marine and coastal resources. The analysis brings in the poverty dimension to emphasize the role of coastal resources in providing pathways out of poverty. Chapter two discusses the underlying institutional and environmental challenges to economic growth caused by environmental degradation, and diminishing resilience of coastal ecosystems as a result of climate change impacts. This is followed by a discussion on policy and institutional weaknesses that threaten the realization of coastal development opportunities. This includes an analysis of economic distortions affecting fisheries. Chapter three presents the opportunities and priorities for improvements in the fisheries sector, coastal tourism, disaster risk management, and coastal zone management. Chapter four summarizes the way forward for realization of the Blue-Green economic paradigm and growing the Sri Lankan coastal economy.

Box 1: Blue-Green Development Strategy (2015): Vision, Highlights, and Focus

- **Blue Development (Blue Economy/Ocean Economy)** to sustainably manage the attractive and resourceful sea coast of 1,600 km, without causing environmental pollution and degradation. Development opportunities include: (i) Oceanic fish resources harvested using sustainable strategies; (ii) other marine biological resources; and (iii) conservation of corals and other marine life.
- **Oceanic mineral resources** can be converted to value-added products for commercial purposes.
- **Oceanic navigation and port facilities.** Sound management of navigation and port facilities could lead to economic prosperity through use of eco-friendly approaches.
- **Coastal Tourism** using sustainable and eco-friendly means, including the promotion of beach and ocean sports.
- **Maritime Archaeology and Anthropology** research needs to be fully explored for economic benefits.
- **Security of the Ocean.** Several economic benefits could be obtained by turning attention to the sphere of protection of the ocean.
- **Oceanic Energy.** Feasibility of generating energy using sea waves and offshore wind power and Oceanic Thermal Energy Conversion (OTEC) should be assessed and developed.
- **Production of Medicine using Oceanic Resources.** The medicinal value of oceanic resources should be explored.

CHAPTER ONE

SRI LANKA'S COASTAL SPOTLIGHT

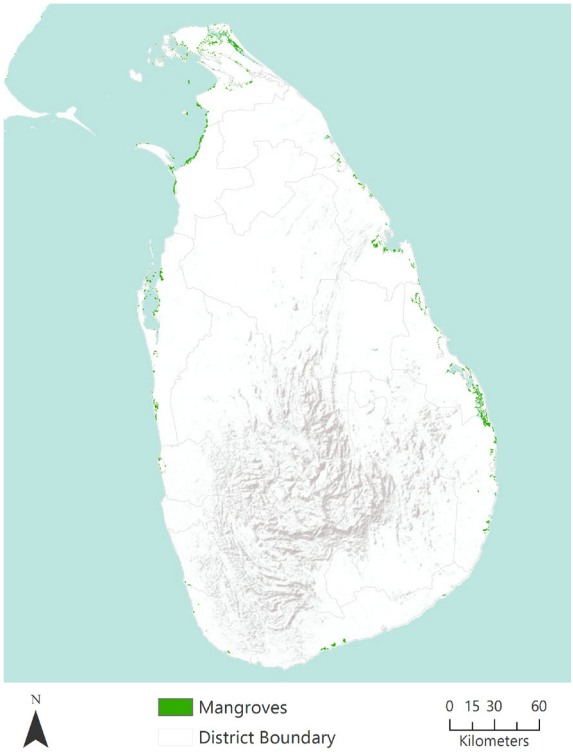
A. NATURAL ENDOWMENT

Coastal areas (that is land and sea areas bordering coastlines) make important contributions to Sri Lanka's economic development. The "pearl shaped" island is surrounded by 1,600 km of sandy beaches, coastal dunes, lagoons, estuaries, and fresh water marshes. Sri Lanka's coastal wealth includes mangroves, coral reefs, seagrass beds, and rich fish stocks. In addition to these living resources, a variety of "non-living" resources are equally important and include sand deposits and minerals (salt and large strips of beaches that include barrier beaches, spits (5,621 ha), and dunes (15,546 ha) (Joseph, 2003, Spalding et al. 2001).

Mangrove forests cover an estimated 160 sq. km scattered mainly along the Northwestern, Northeastern and Eastern coasts where they border lagoons and river estuaries (Figure 1). Mangroves make critical contributions to coastline stabilization, serve as a buffer to storm surges, provide nurseries for aquatic organisms, and trap nutrients and sediments. Mangroves are harvested by local communities for subsistence purposes, such as fuel wood, medicinal herbs, fruits, poles and posts for construction, and production of handicrafts. They also improve water quality by reducing biological oxygen demand (BOD). Mangrove sediments have high denitrification capacity (nitrate reduction), especially near sewage discharge outlets (Nedwell, 1975).

The Indian Ocean tsunami in 2004 demonstrated the natural protection afforded by coastal ecosystems.

FIGURE - 1: SRI LANKA MANGROVE MAP



Source: Compiled by authors with data from Hamilton and Casey (2016)

This tsunami was a rare event (with a probability of occurring every 50 years), but with a huge economic toll and loss of human lives. Hikkaduwa, Hambantota, and Tangalle are some of the largest coastal cities in the Southern Province of Sri Lanka that experienced severe damage from the disaster. A post-tsunami assessment conducted with the help of International Union for Conservation of Nature

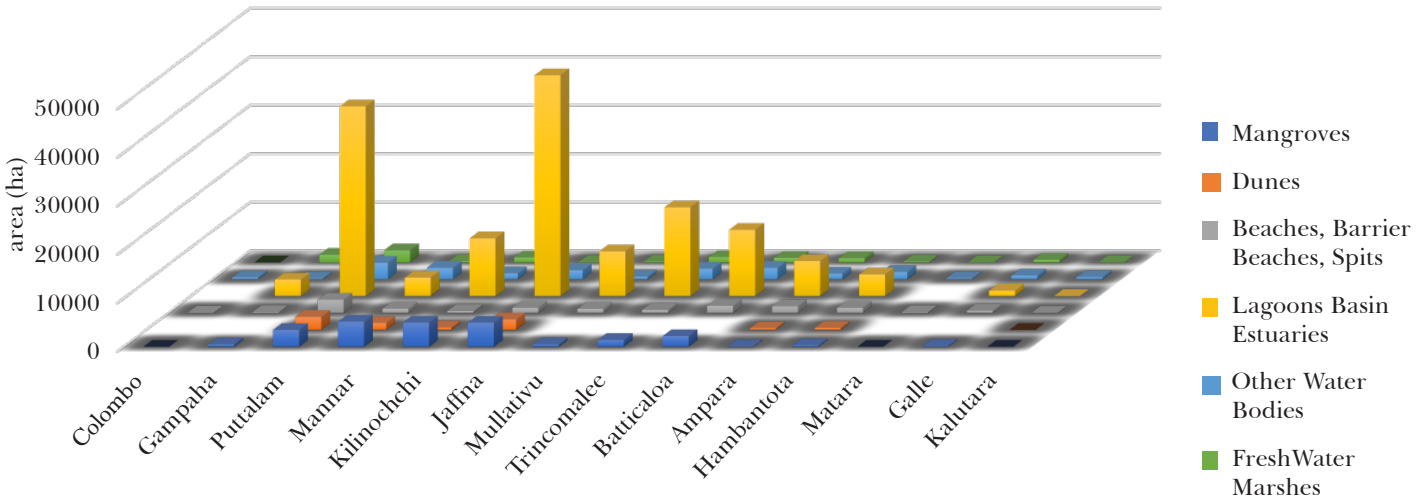
(2005) observed higher incidence of damage costs in areas with degraded mangrove vegetation. The costs of damage to livelihood and property in Waduruppa (US$ 1,377,975) were estimated to be ten times the costs of damage in Kapuhenwala (US$ 173,555). The estimated costs of damage avoided suggests that threatened mangroves reduce the protection afforded to inland properties, community infrastructures and livelihood by US$ 2,109/household. The estimate shows that areas with intact mangrove ecosystem generate greater economic benefits. The findings also indicate the economic rationale of including mangrove rehabilitation efforts in the post-tsunami reconstruction and rebuilding programs.

Coral Reefs comprise living coral, relic sandstone, and rocky reefs. The patchy coral reefs along the Northwestern coast as well as offshore in the Gulf of Mannar and west of the Kalpitiya Peninsula are the most extensive reef formations. Patchy coral reefs also have been found in the Western and Eastern coastal areas about 15-20 km from the shore, at an average depth of 20 meters. In the Southwest, Eastern, and Northern coasts, coral reefs adjacent to the shore grow from the sea floor, usually on a nucleus of rock (Rajasuriya and Premaratne, 2000).

Seagrass beds often occur in association with coral reef ecosystems or estuaries and lagoons, such as the basin estuaries and lagoons of Puttalam, Negombo, Mawella, Koggala, Kokilai, Jaffna, and Batticaloa (CRMP, 2002). Seagrass is a seed-bearing, flowering, rooted macrophyte that grows submerged in marine coastal waters and coastal wetlands. The leafy "canopy" of seagrasses slows water currents, trapping particles, nutrient-rich organic matter and pollutants in the water column that are washed from inland runoff into rivers and ultimately into coastal waters. Because of this, seagrass acts as a natural filter, clearing and cleaning coastal water. Seagrass, like mangroves, is important for fish breeding, rearing, and shelter, and often supports artisanal fisheries (accessed by small, non-motorized vessels). Additionally, local fishermen harvest juvenile sea cucumbers and other juvenile species of fish, crustaceans, and invertebrates, such as Bristle worms (Polychaeta), from seagrass beds as brood stock or feed for aquaculture. Seagrass communities have also been found near Trincomalee, Mannar, Hikkaduwa, and Puttalam.

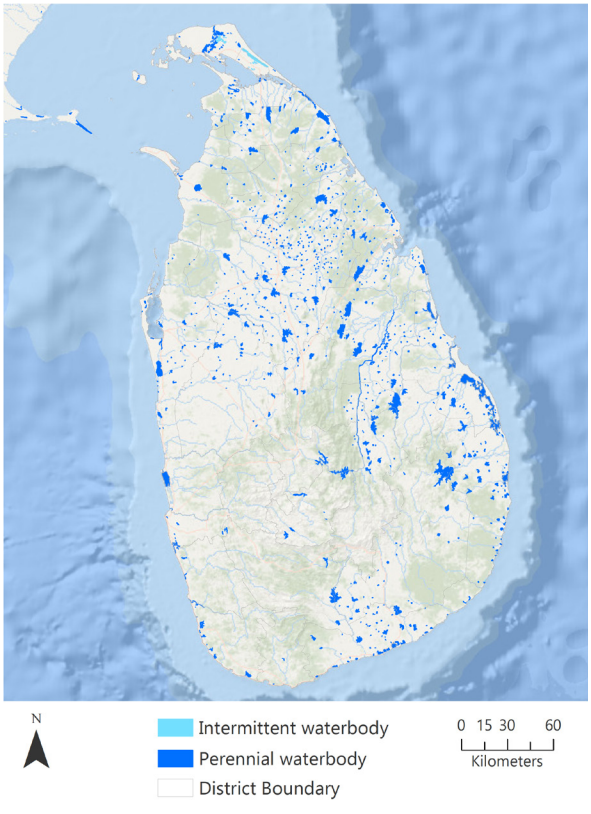
Fish stocks are a source of livelihood and food for coastal communities. The total fish catch in Sri Lankan waters in 2013 was 512, 840 metric tons. From an economic standpoint, the most important fish are tuna, swordfish, and marlin. These large pelagic fish are highly migratory and often straddle Sri Lanka's EEZ and those of other countries and/or the high seas. Sri Lanka also has a growing aquaculture and maricultural industry mainly focused on shrimp, but is now being diversified into invertebrates, such as sea cucumbers, fin fish and larger crustaceans (lobsters, langoustines, crabs).

FIGURE - 2: COASTAL HABITATS



Source: Compiled by authors with data from http://www.fao.org/docrep/field/383211.htm

FIGURE - 3: MAJOR WATER BODIES



Source: Compiled by authors from Esri data (World Water Bodies), DeLorme Publishing Company, Inc.

FIGURE - 4: LAND COVER IN SRI LANKA

Source: Compiled by authors from ESA-CCI Land Cover data (2015)

The "non-living" coastal resources are also an integral part of coastal livelihoods and are mostly located in the Northern and Eastern regions (Figure 2). Lagoons are coastal bodies of water that may be brackish, fresh, or hyper saline, and are separated from the sea over a very long period by barriers that restrict water circulation. Based on publicly available geo-referenced databases, there are 201 lagoons ranging from 3 ha to 7,589 ha. The total area of lagoons is 105,229 ha, with Jaffna having 30 percent of the country's lagoons, followed by Puttalam. In addition, there are 640 tanks/small water reservoirs covering an area of 1, 29,137 ha. Coastal areas contain about 63 percent of total tanks, which are mainly used for irrigation and aquaculture. Adjoining the estuaries and lagoons are low-lying delta lands in the Northeastern coastal districts. Figure 3 displays major water bodies (lagoons and tanks) in coastal and inland habitats by province.

The coastal area contains about 25 percent of the country's total croplands. Forest land is estimated at 2.385 million ha or 36 percent of the land area. The estimated natural forest land (Samaranayake, 2003) includes closed canopy natural forests, sparse forests, and mangroves. There are only 1,422 ha of this land cover remaining, indicating a rapidly declining trend. Figure 4 illustrates land cover including water bodies, forests, and lagoons.

Land in the coastal zone[1] potentially suitable for emerging natural resource-based industries, such as aquaculture, is estimated at 6,000 ha of which 57 percent is situated in the Northern and Eastern areas. The National Aquaculture Development Authority (NAQDA) estimates that only 25 percent of the suitable coastal land is used for aquaculture of various species, and several studies show that aquaculture can be undertaken in these areas with low biological risks.

1. Coastal zone is defined as a land extending 300 m inward (from mean - high water line) and 2 km seaward (from mean - low water line; Act No. 2, 1996). High and low mean water lines are defined based on tidal fluctuations (datum).

Sri Lanka's spectacular natural resources make it one of the top potential nature and eco-travel destinations in the world. The country boasts seven UNESCO World Heritage sites, 13 National Parks, a biodiversity park, and 93 other protected natural areas. These cumulatively define a natural resource base in support of eco-tourism that is of immense value. Tourist areas cover 10 percent of the coast, while fish landing sites, anchorages, and fishery harbors comprise 2 percent of the coast.

B. SRI LANKAN ECONOMY

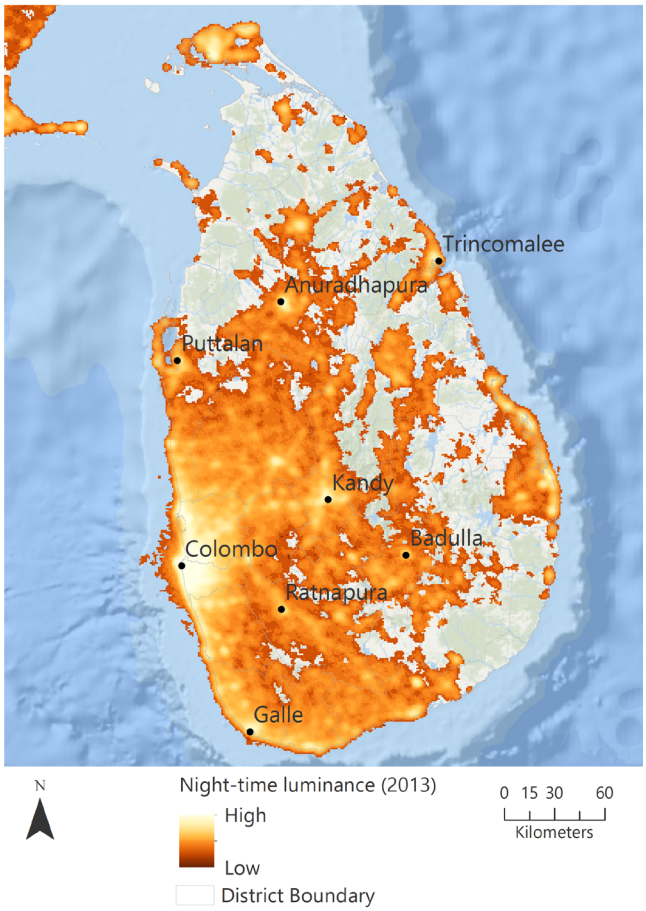
Sri Lanka's economy grew at an average of 6.4 percent between 2010-2015, reflecting a peace dividend and a policy orientation towards reconstruction and growth. Sustained growth brought the country to the cusp of becoming an upper-middle income economy, with a per capita income of US$ 3,912 (in 2015). Sri Lanka's economy has transitioned from a predominantly rural-based agricultural economy towards a more urbanized economy driven by services. In 2015, the services sector accounted for 62.4 percent of GDP, followed by manufacturing (28.9 percent), and agriculture (8.7 percent).

Sri Lanka is undergoing a transition from a rural economy to an economy based on services and manufacturing. Urbanization patterns are similar to other countries in South Asia where the urban centers – both large and small – are in floodplains and in coastal areas. Sri Lanka's urbanization rate is around 35 percent, which is on par with Pakistan, and higher than Nepal (15 percent) (Ellis and Roberts, 2016).

With the end of the armed conflict, the government estimated that the urbanization rate would accelerate and that by 2020,[2] approximately 60 percent of the population would be living in cities. Whether the expected acceleration is attainable, given past trends, is subject to debate, but urbanization will undoubtedly impact coastal areas where the most valuable resources are located.

Coastal areas are already transforming. Growth has taken place particularly around Colombo, Kandy, and Galle, including the corridors connecting these cities that fall within the Western Province. Urbanization projections using Night Light Maps (Figure 5) indicate that Colombo-Kandy and Galle-Matara corridors have emerged as rapid growth, multi-city, urban agglomerations. The Night Light images also suggest that smaller single-city agglomerations have emerged around Trincomalee, Batticaloa, Akkaraipattu, as well as a high growth potential in Jaffna.

FIGURE - 5: AGGLOMERATION ANALYSIS USING NIGHT LIGHT MAPS



Source: Compiled by authors from NOAA Night-time lights data from DMSP (2013)

Sri Lanka's Poverty at a Glance

Sri Lanka's poverty is low[3] by international standards. The spatial characteristics of poverty are linked to the

2. Sri Lanka's Urban Vision 2020, as defined in the government's development policy framework – the Mahinda Chintana.
3. Sri Lanka's national poverty line is equivalent to about USD 1.50 a day in 2005 PPP terms. This is moderate by regional standards, but below what one might expect from a country at Sri Lanka's level of development. The poverty line is based on consumption patterns in 2002, which is likely to have changed significantly in the last decade, making it important to update the current poverty line (Newhouse, et al. 2016).

country's economic geography, and are characterized by a concentration of economic production in large urban centers, along the main roads and in the coastal belt. Many of the poor live in peri-urban areas, and over half of the poor are estimated to live within 30 km of a main population center. According to official statistics (2013), there are 1.49 million poor people in Sri Lanka. Of the 1.8 million identified as poor, the majority (84.7 percent) live in rural areas. Roughly 30 percent of the workforce, and approximately half of the working poor toil in the agricultural sector.

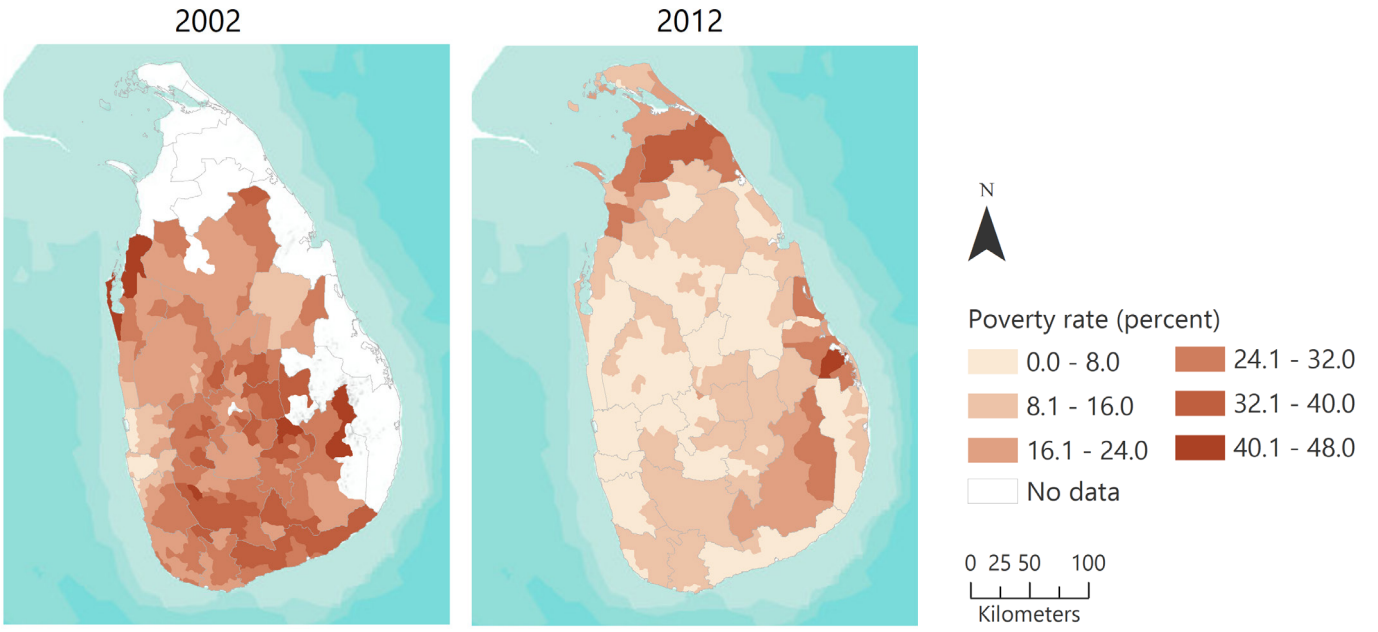
The highest numbers of poor people live in the coastal areas. Excluding the Northern and Eastern provinces, the poverty headcount rate fell from about 22.7 percent in 2002 to 6.1 percent in 2012. Batticaloa shows the highest incidence of poverty with an estimated 20.3 percent of the population living below the poverty line. Districts, such as Jaffna, Moneragala, and Badulla, are close behind. In contrast, Colombo, Gampaha, and Vavuniya districts have a poverty incidence of less than 5 percent (Department of Census and Statistics, 2015).

Regional disparities

Compared to the vibrant coastal economies in the Southern and Western provinces, the economies in the Northern and Eastern provinces are much less developed. According to the latest official statistics (2013), 1.49 million people in Sri Lanka live below the poverty line, with higher rates of poverty concentrated in the Northern and Eastern coastal provinces. The most dynamic growth and lowest poverty levels occur around Colombo, Kandy, and Galle, and along the corridors connecting these cities within the Western province. The rest of the coast supports a primarily rural population that relies heavily on natural resources. This often leads to a complex and often confrontational interaction between nature, society, and development. Although coastal areas tend to be the poorest, many economic opportunities in these areas have yet to be realized. This is partly due to the isolation of the Northern and Eastern coastal provinces, resulting from the country's 30-year conflict that ended in 2009 (Figure 6).

The increasing vulnerability of the coast to natural disasters has high socio-economic cost, which calls for a shift in development planning to integrate environmental and social sustainability and disaster risk management. To maximize future economic benefit from the coastal zone, policy makers need to develop proactive policies to deal with present and future impacts of climate change and the resultant increase in sea level. Likewise, an efficient and environmentally sustainable land use policy

FIGURE - 6: EVOLUTION OF POVERTY RATE (2002 V 2012)



Source: Compiled by authors from WBG small area estimates and data from the Department of Census and Statistics (2005; 2015), Sri Lanka

that supports high-density urban development and reduces the vulnerability of coastal ecosystems to rural and urban human activities, would help maximize the economic benefit from coastal natural assets. Such an approach should factor in regional differentiation and lessons from past developments.

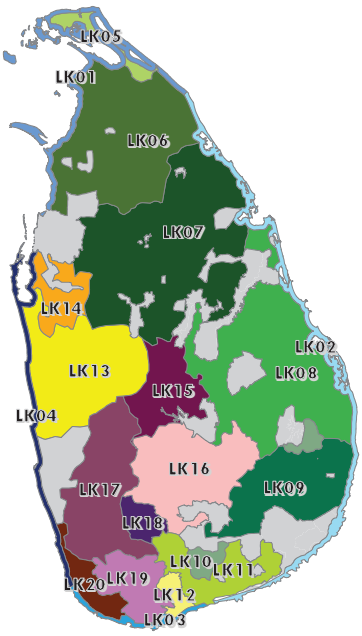
The issues facing the Southern and Western coastal provinces differ significantly from the Northern, Eastern, and Northwestern provinces, and require a differentiated approach. Development, including tourism, expanded significantly in the Southern and Western provinces, creating multiple environmental problems. Prolonged conflict in the Northern and Eastern provinces, and to a lesser extent in the Northwestern provinces, isolated these areas for several decades from excessive development pressure. The Southern and Western coastal provinces require proactive management, which is responsive to both environmental and social challenges and helps address current and future risks related to displaced people and conflicts between the resource users over natural assets. The less developed Northern and Eastern provinces, on the other hand, provide an opportunity to attract investments that take cognizance of sustainability concerns and do not alter the natural environment while supporting local livelihoods.

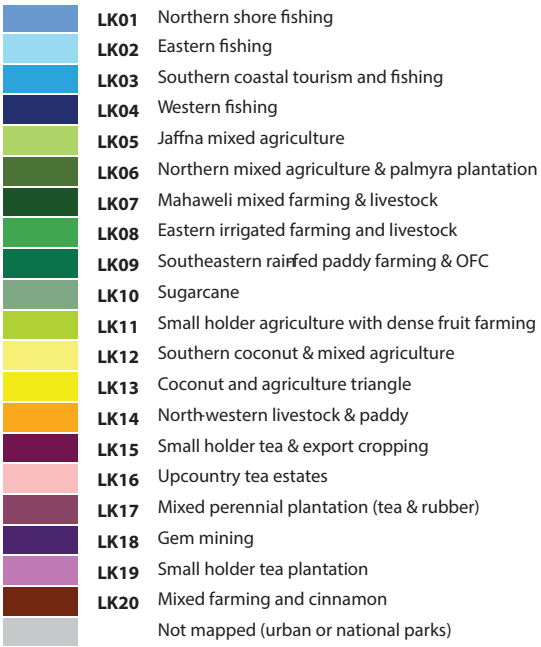
C. COASTAL ECONOMY

Sri Lanka's coastline is a critical lifeline that anchors the country's social and economic development. The majority of the coastal population depends on coastal natural resources for food, livelihoods, and shelter. The coastal zone accounts for 24 percent of the total land area and is home to 33 percent of the population of Sri Lanka. Sixty-five percent of the country's urbanized areas are situated in the coastal zone, and these built-up areas are home to 45 percent of the coastal population. Overall, in Sri Lanka, the coastal zone contributes 40 percent of GDP, holds half of built infrastructure, and is the source of 90 percent of manufacturing and fish production.[4]

Off–shore and near-shore fisheries and tourism are the most important economic sectors in the coastal economy (Figure 7) and together generate 10 percent of Sri Lanka's foreign exchange earnings and account

FIGURE - 7: LIVELIHOOD ZONES OF SRI LANKA, INCLUDING TOURISM, FISHING, AND AGRICULTURE

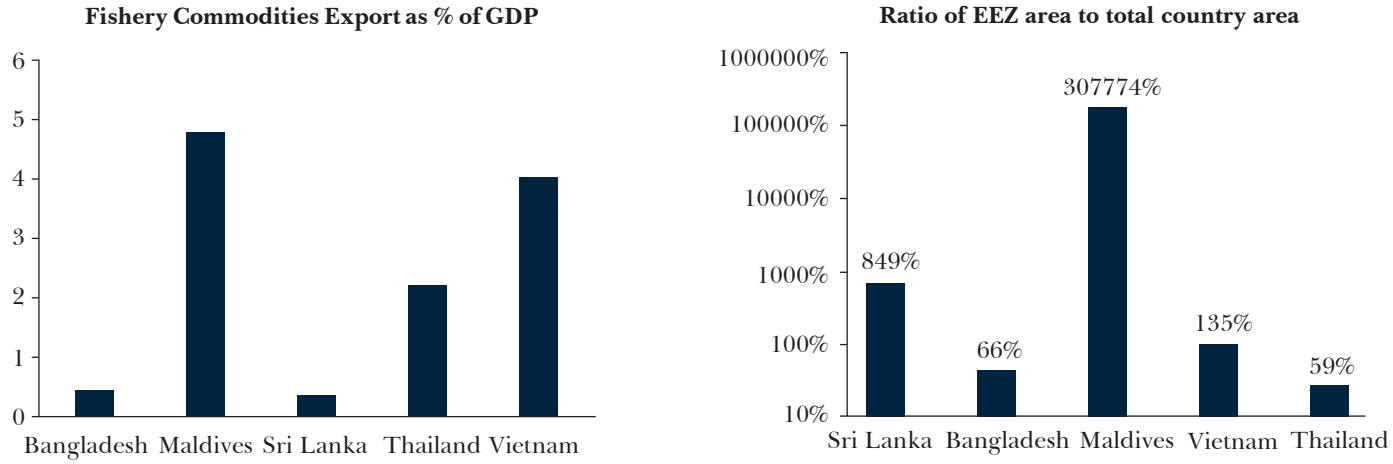




Source: WFP and Ministry of Economic Development (2010)

4. World Bank calculations based on Ministry of Environment, Government of Sri Lanka data, 2011.

FIGURE - 8: CONTRIBUTION TO GDP FROM FISHERIES COMMODITIES EXPORTS (LEFT) AND RATIO OF EEZ TO LAND AREA (RIGHT)



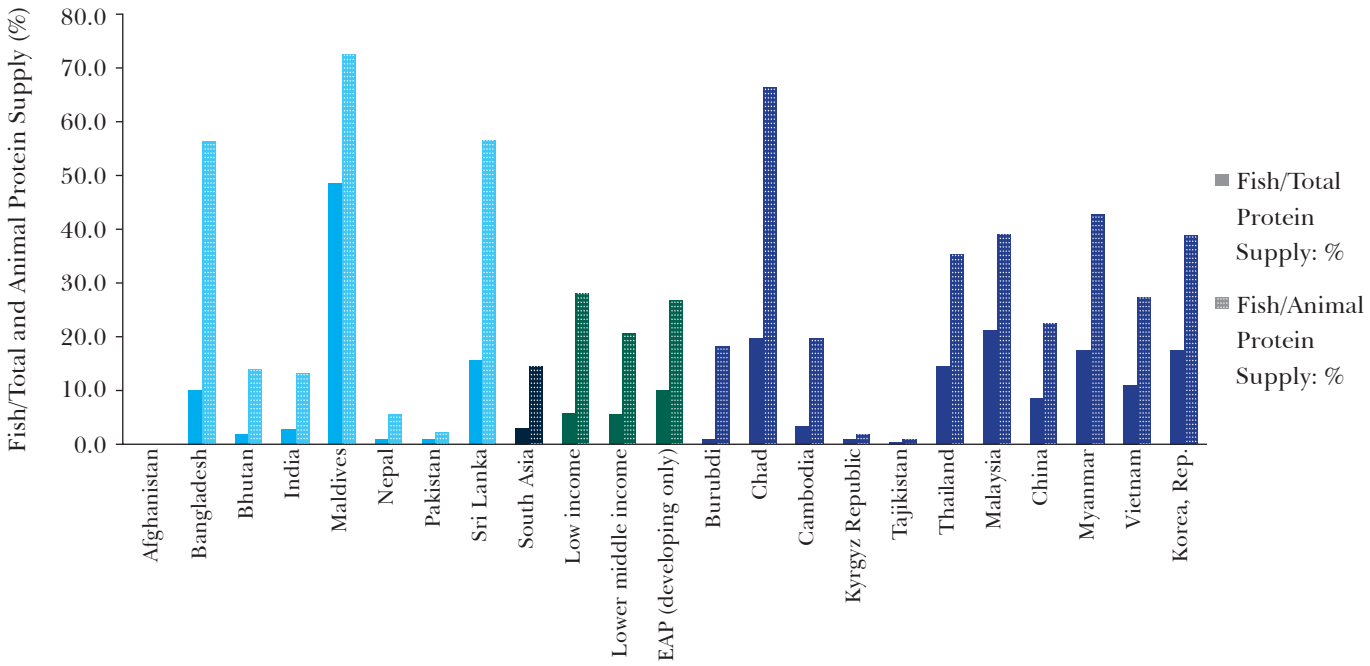
Source: FAO (2014) and World Bank Development Indicators (2012)

for 6.7 percent of employment. Tourism, which was one of the major foreign exchange earners for decades, took off significantly once the civil war ended. The total value of the tourism sector grew five times with revenue totaling US$ 3 billion in 2015 (Central Bank of Sri Lanka, 2016). While value added in the fisheries sector decreased, it increased in the tourism sector, resulting in an improvement of about 0.1 percent of GDP

Fisheries and aquaculture

In Sri Lanka, fish comprises over 50 percent of the animal protein in human consumption, one of the highest percentages among comparable countries (Figure 9). Its contribution to the economy is diversified and supports a significant value chain. Over the years, Sri Lanka has developed international standards organization (ISO) compliant processing infrastructure in the fisheries sector, which permits

FIGURE - 9: FISH CONTRIBUTION TO TOTAL AND ANIMAL PROTEIN SUPPLY IN 2011



Source: FAO (2014) and World Bank Development Indicators (2012)

export of high-value fish and fish products in large quantities to international markets willing to pay a premium price. According to a 2012-13 household income and expenditure survey, fisheries generate about 500,000 formal and informal jobs. Fishing and fish processing activities are a significant source of employment for the Eastern and Northern regions.

Fisheries include three main types of activities:

- inland, coastal, and brackish water artisanal capture;
- aquaculture and mariculture; and
- semi-industrial and industrial marine capture.

From a sector perspective, the most economically important species are tuna, swordfish, and marlin. These large pelagic fish are highly migratory and often straddle Sri Lanka's EEZ and those of other countries, as well as the high seas. These species and some near-shore neritic tuna and tuna-like species constitute the bulk of the fish export.

Under the United Nations Convention on the Law of the Sea, Sri Lanka has exclusive jurisdiction rights over marine living resources in three internationally recognized zones. These include:

- the Territorial Sea, which extends from the coastline to 12 nm (nautical miles);
- the Contiguous Zone, which extends another 12 nm; and
- the EEZ, which extends up to 200 nm.

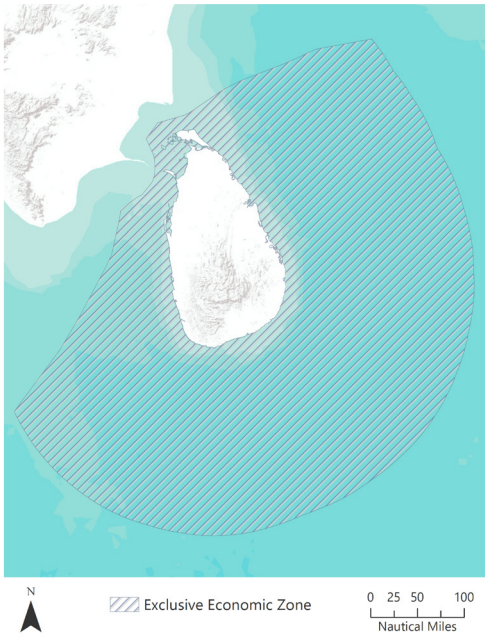
In the areas where the Sri Lankan EEZ overlaps with that of India, the international maritime boundary is agreed upon following an equidistant line between the two countries (Figure 10).

The total fish catch in Sri Lankan waters during 2013 was estimated at 512,840 metric tons valued at US$ 1.2 billion. The growth rate in the value of the catch between 2012 and 2013 was 15.8 percent at current market prices, although the total catch increased by only 5 percent. Table 1 summarizes Sri Lankan fish production from 2009, whereby:

- Inland fisheries represent about 14 percent of the total catch; and
- 86 percent is taken from marine waters, of which:
  - (i) 36 percent originates in coastal and territorial waters; and
  - (ii) the remaining 50 percent comes from deep-sea fisheries in the rest of the EEZ.

Coastal fisheries are key for food security and livelihoods of small-scale artisanal and semi-industrial fishermen along the coast.

FIGURE - 10: AREA OF SRI LANKA'S EXCLUSIVE ECONOMIC ZONE



Source: Compiled by authors with data from www.marineregions.org

TABLE - 1: HISTORICAL FISH PRODUCTION FROM SRI LANKAN WATERS

Annual Fish Production		2009	2011	2012	2013	2014	2015	2016 Jan-Mar	2015-16 Jan-Mar (% change)
Marine Sector	**MT**	**293,170**	**385,270**	**417,220**	**445,930**	**459,300**	**452,890**	**115,010**	**-3**
Offshore/Deep Sea Waters	MT	112,760	162,920	159,680	177,950	180,450	183,870	43,150	-6
Coastal Waters	MT	180,410	222,350	257,540	267,980	278,850	269,020	71,860	0
Inland and Aquaculture Sector	**MT**	**46,560**	**59,560**	**68,950**	**66,910**	**75,750**	**67,300**	**10,590**	**-22**
Inland Capture Fisheries	MT	39,030	50,050	58,680	55,020	68,820	57,060	9,180	-28
Aquaculture Fisheries	MT	3,980	5,360	6,960	7,460	1,780	3,150	210	17
Shrimp Farms	MT	3,550	4,150	3,310	4,430	5,150	7,090	1,200	126
Total	**MT**	**339,730**	**444,830**	**486,170**	**512,840**	**535,050**	**520,190**	**125,600**	**-5**

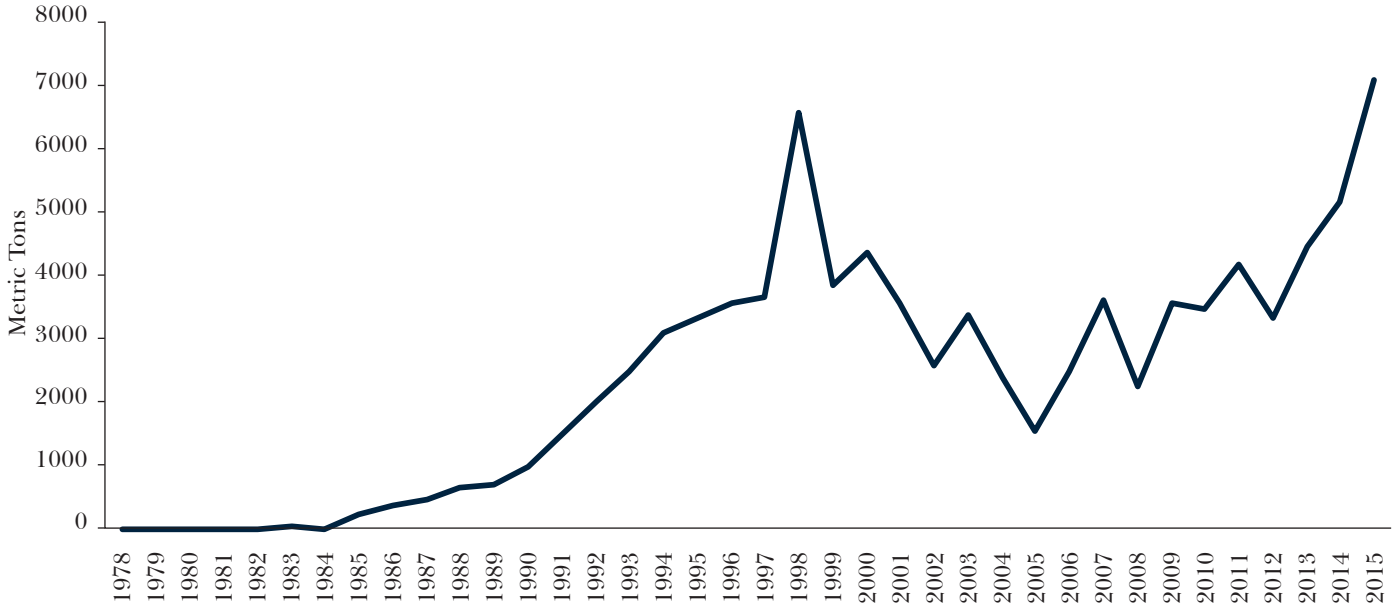
Source: FAO (2014) and World Bank Development Indicators (2012)

Fishing assets in the coastal area include 45,963 fishing vessels, of which 4,227 are multi-day boats that operate from 20 formal harbors and target high-value, export-oriented fishing. While coastal fishing by "one-day boats" (ODB) and other small motorized vessels that access the near-shore up to 10 nm offshore have increased substantially, multi-day boats can operate farther within the 200 nm EEZ and on the high seas.

Mariculture has grown by 330 percent over the past decade. The government has identified 158,000 ha of coastal lagoons and estuaries suitable for development of mariculture. In September 2015, there were 14,170 businesses, supporting 17,000 direct and value-chain related jobs in ancillary businesses. Mariculture is also a big job creator. It currently provides 40,000 jobs, both directly and indirectly, in support of industries, such as fiberglass manufacturers, feed outlets, machinery supply, repair facilities, hardware stores and laboratories. This represents 11 percent of the total employment in the fisheries sector and offers significant growth potential, in contrast to traditional capture fisheries.

Shrimp farming has rebounded after a near collapse in the past due to unsustainable practices. Small-scale farms (approximately 1 ha) were developed in clusters in lagoon areas around the country and encroached on ecologically sensitive areas, such as mangroves, salt marshes, intertidal mud flats, coconut plantations and other "conserved" areas. A general lack of proper environmental management of shrimp farms led to an outbreak of viral disease with close to 100 percent mortality of prawn stock in many farms. The result was an unsustainable financial burden on many farmers in the 1990s. Improved farming practices and sanitation helped the industry mitigate the impact of the virus and production is beginning to rise again (Figure 11). The government plans to double or triple the shrimp sector and thus provide another 100,000 new jobs. Additionally, seaweed farming can generate steady incomes, and sea cucumbers are attractive species for aquaculture especially in locations where transportation is an issue (Annex 2 has further information on aquaculture potential in Sri Lanka).

FIGURE - 11: SHRIMP PRODUCTION IN SRI LANKA (1978 – 2015)



Source: Compiled by authors with data from FAO FishStat database, http://www.fao.org/fishery/statistics/en

Sri Lanka also has 35 EU-approved, ISO-certified, fish processing plants that serve both the local and international markets. These plants are supplied primarily by landings from the Sri Lankan fishing fleet and only partially by foreign fishing vessels holding trans-shipment licenses issued by the Defense Federal Acquisition Regulation (DFAR).

Coastal Tourism

Domestic and international tourism is the cornerstone of Sri Lanka's coastal economy, with positive trends since 2012. The tourism sector has grown steadily in recent years largely due to Sri Lanka's exceptional natural resources, wildlife, and cultural heritage. Coastal beach tourism, representing 60 percent of total sector revenues, offers a rich gamut of value added products. These include deep sea sport fishing, observing sea mammals, sailing, diving of varying types, boating and numerous recreational sports, sun bathing, and turtle watching in the shallower reef waters. In 2012, the number of international tourists visiting Sri Lanka reached 1 million for the first time. In 2013, it rose to 1.3 million, representing an increase of 26.7 percent. In 2013, the direct contribution from tourism receipts was approximately US$ 2.6 billion, equal to 3.9 percent of GDP. Tourism was the fifth largest source of foreign exchange earnings in the national economy in 2012 (over US$ 1.3 billion in 2012). It also attracted significant Foreign Direct Investment (FDI). Tourism is also a relatively labor intensive industry, directly supporting 286,000 jobs (3.5 percent of total employment) in 2013, and forecast to rise by 2.5 percent per year to 360,000 jobs (4.3 percent of total employment) by 2024.

However, tourism is yet to reach its full potential, for which a leading role is played by improved management of natural resources that attract tourists. For example, Sri Lanka ranks 64th out of 139 countries on the World Economic Forum's Travel and Tourism Competitiveness Index (2017), while holding 42nd place in world ranking on natural resources endowment. Among the critical issues frequently highlighted by investors and operators is the lack of growth-inducing tourism infrastructure and a sufficiently qualified workforce. Environmental degradation, which is occurring in the main tourism areas, also impacts growth in tourism revenue.

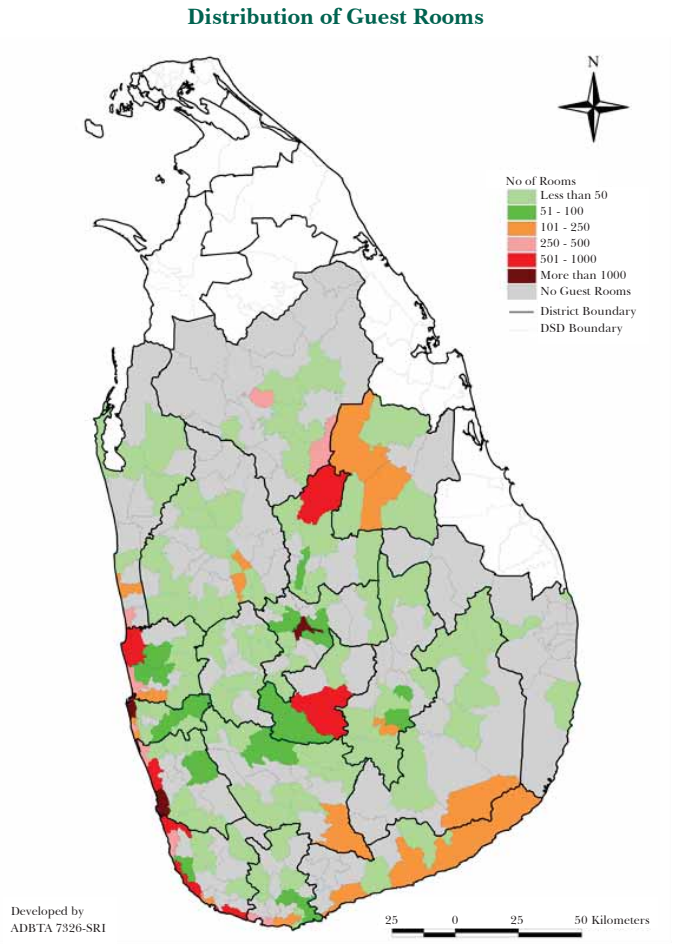
Sri Lanka ranked 93rd in environmental sustainability, among 139 countries according to the same index.

The distribution of tourism infrastructure is unevenly spread across Sri Lanka (Figure 12). Over 62 percent of tourist hotels and about 41 percent of guest houses and hotel rooms in the country are located in the coastal zone. The main tourism areas on the coast are situated in Colombo City and Greater Colombo, the Southwest coast, and the East coast.

But this is slowly changing and the country's position as a tourism destination is shifting to a more diversified product base, with increasing emphasis on nature and cultural tourism inland. The conservation of fauna and flora as a tourism attraction is a priority in the national tourism development strategy (2011-16).

The Sri Lankan tourism sector is expected to grow by 6.1 percent per year from 2014- 24. The coastline will remain central to planned investment in tourism development, with emphasis on the unexploited potential of the Northern and Eastern areas. With coastal tourism representing 60 percent of total sector revenues, expansion into suitable areas in the Northern and Eastern areas of the country remain an important aspect of further economic growth in the country.

FIGURE - 12: COASTAL TOURISM - ROOM CAPACITY



Source: Ministry of Environment (2011)

CHAPTER TWO

INSTITUTIONAL AND ENVIRONMENTAL CHALLENGES

Sri Lanka is yet to realize the full potential of its coastal and marine living resources. The economic inputs from coastal areas are likely to grow with the development of commercial and fishery harbors, transport, and recreational tourism. The development potential in the coastal and marine environment will be significantly enhanced[5] by economic and infrastructure development. Attention to carrying capacity of coastal resources, while planning infrastructure development, would augment their beneficial impact.

Growth in capture fisheries and mariculture in lagoons and sheltered coastal areas requires investment in infrastructure, technical inputs, and significant private capital. In recent years, however, the needs appear to be changing, especially regarding investment in the capture fisheries sector. This is driven by the difference between perceived demands of the sector rather than what can be economically justified. For example, after the tsunami, the number of vessels in the fishing fleet exceeded those before the tsunami. This was largely due to uncoordinated support from foreign donors that focused on replacing damaged fishing vessels without considering the natural carrying capacity of fish stock that those vessels would access.

As of 2013, there were 20 formal fish harbors accommodating more than 4,000 single- and multi-day fishing vessels. However, these harbors are not large enough to accommodate large fishing vessels operated under joint ventures with Sri Lankan companies or those looking to trans-ship fish locally. There is insufficient data on:

- how many large foreign fishing vessels trans-ship in commercial ports;
- whether any of these use local fishing harbors;
- how frequently trans-shipment occurs; and
- how much fish is trans-shipped at the individual species level.

Trans-shipment on the high seas is prohibited, and all Sri Lankan-licensed vessels, foreign or local, operating in Sri Lankan waters are required to land their catch in the country. However, inadequate infrastructure is an impediment to sustainable development of Sri Lankan fisheries. Addressing such infrastructure impediments should be a matter for consideration in future investment. Likewise, "port-state" monitoring the compliance by local and joint venture vessels should extend into commercial ports in which the Ministry of Fisheries currently has a poor representation.

The value chains associated with natural resource management, namely tourism, agriculture, fisheries, and mining are such that little of the retail value of harvested resources remains with coastal communities. This inefficiency presents opportunities for:

(i) leveraging changes in the value chains to promote more local processing; and

[5] See Joseph (2003), BOBLME National Report for Sri Lanka, p. 29.

(ii) greater direct access to national and regional markets, and other product "value addition" that would result in increased employment opportunities in the coast. This, in turn, would promote poverty alleviation in the coastal areas, which are generally more impoverished than elsewhere in the country.

Coastal ecosystems are also under enormous natural and development pressure. Future economic growth of the coastal economy will depend on proactive action to avert environmental degradation. The Ministry of Environment has identified five areas of concern in this respect, namely:

- land degradation;
- untreated waste disposal;
- pollution of inland waters;
- loss of biodiversity; and
- deterioration of coastal ecosystems.

The deterioration of coastal resources, particularly in the Western and Southern regions, is due to the concentration of population, industry, and urban development in limited coastal space. This is often accompanied by unsustainable practices, such as mangrove and seagrass harvesting, sand-mining, collection of corals, and removal of the buffering coastal vegetation. Several threats to mangroves remain from the emergence of shrimp farms, which required deforestation to build saltwater ponds. Other impacts of mangrove destruction include reduced fish catch, fewer opportunities for eco-tourism, and associated loss of income and livelihoods. At many sites, coral reefs are degraded due to natural causes and anthropogenic pollution. In addition to natural and human-induced pressures, regulatory inefficiencies, and institutional, governance and technical weaknesses exacerbate resource management inefficiencies.

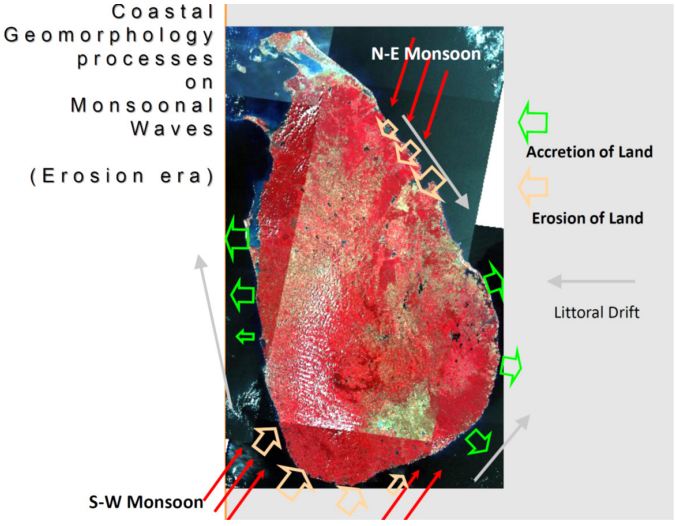
A. RESOURCE DEGRADATION

Shoreline stability is threatened by both natural causes and human interventions. Sri Lanka's dynamic shoreline undergoes continual retreat and accretion; some changes are seasonal, while others are more permanent. By and large, the economic impacts are significant and become manifest in the loss of beaches and landscape quality, damage to property and businesses, loss of infrastructure and private dwellings.

The processes contributing to coastal erosion are linked to land use, natural disasters, and climatic conditions. Sri Lanka's coastal climate is dominated by the Southwest and Northeast monsoons and characterized by four seasons: (i) inter-monsoon (March-April); (ii) southwest monsoon (May–September); (iii) second inter-monsoon (October–November); and (iv) the northeast monsoon (December–February).

The rainfall pattern is influenced by the monsoon winds of the Indian Ocean and the Bay of Bengal. The mean annual rainfall varies from below 900 mm in the driest areas, namely Southeastern and Northwestern, to over 5,000 mm in the wettest areas that comprise the western slopes of the central highlands. Figure 13 illustrates the processes of accretion or erosion on coastal land.

FIGURE - 13: COASTAL EROSION, LAND USE, AND NATURAL DISASTERS IN THE COUNTRY ARE STRONGLY LINKED TO TROPICAL MONSOONS



Source: CCD (2016)

Coastal erosion is accelerated by economic activities which include:

- salt and sand mining in the beaches;
- in the rivers by coral mining, removal of coastal vegetation, location of buildings too near the shoreline; and
- construction of dams and irrigation schemes inland.

The cumulative impact of erosion is significant along the Western and Southwestern coasts from Kalpitiya to Hambantota, where the Coastal Conservation Department (CCD, 2016) has estimated the pace of land loss at 1, 75,000-2,85,000m^2/year. The resulting pressure from erosion, creates major coastal resource management issues, especially in the Western and Southwestern coastal regions, beset with concentration of economic activity and infrastructure. The CCD[6] also identified the occurrence of coastal accretion along the Southeastern coast at rates comparable with those in the Southwestern and Northeastern coastal regions.

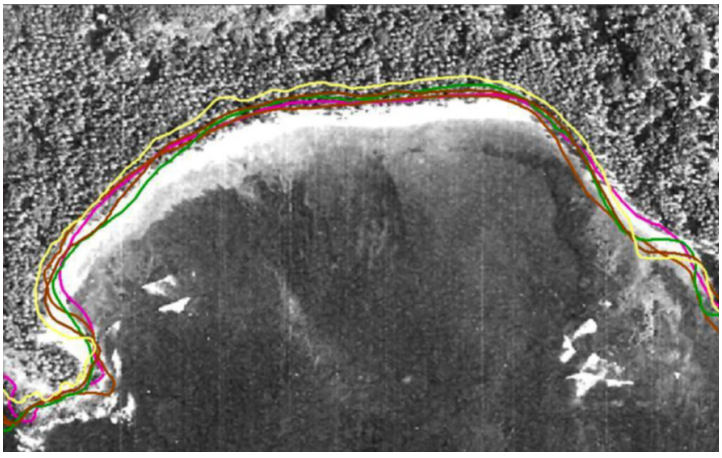
It may also be remembered that the transformation of the natural shoreline also depends on adjacent land uses.

Excessive and inappropriate siting of sand mining operations in rivers contributes to shoreline erosion and beach retreat (CCD, 2016). River sand is an essential raw material in the construction industry, and sand mining draws its workforce from the rural population. Sand and seashell mining have expanded dramatically – in some rivers as much as 2.5 times more than the original mining sites. This expansion is related to the boom in the construction industry following the 2004 tsunami.[7] However, removal of sand from the rivers reduces the quantum of material reaching coastal beaches.

Sand extraction from the coast is largely unregulated. The process of sand mining is mainly mechanized and has serious negative consequences due to large quantities being rapidly extracted. Excessive sand mining, especially along the Southwestern and Northwestern coast, has proved devastating as these areas are naturally prone to erosion. There has been significant loss of green areas and coastal sand due to unregulated development from 1956 to 2007, thus affecting Galle Harbor (Figure 14).

Coral mining for construction material causes coral reef degradation and depletion. Limestone from fossil

FIGURE - 14: LOSS OF GREEN COVER AND SANDY BEACH IN GALLE HARBOR



1956

2007

Source: CCD (2016)

6. CCD (1997), CCD (2016), pp.14-16.
7. Excessive sand mining deepens riverbeds and can be environmentally hazardous. It causes salt-water intrusion upstream and damage to important habitat for fish and other aquatic biota..

coral reefs is used in the construction industry, which accounts for nearly 92 percent of the lime used in Sri Lanka. Lime is also used in agriculture to reduce soil acidity.

There are two types of coral mining, namely:

- traditional mining of ancient fossilized coral reefs (coral rag) found inland and below the ground; and
- harmful mining of both live and dead corals.

Coral mining has destroyed most of the fringe reefs along Sri Lanka's coast, especially the near-shore coral reefs in the Western and Southern coastal areas. Despite the ecological importance of corals, little effort has been made to conserve the coral reefs remaining in the coastal zone. Losing the reefs, which are a natural attraction, will impact the tourism sector and product segment focusing on snorkeling and diving. Many coral reefs are spawning grounds for fish species important for coastal fisheries. Near-shore degradation of coral reef resources due to increasing population pressure is reaching serious proportions, undermining the reefs' resilience to increasing climate change-induced coral bleaching events.

Salt mining is another activity with significant environmental impact. Salt is extracted mainly in the Bata-Atha and Puttalam salterns. In 2013, the Kingdom of Raigam, a holding of private companies, reported that within the next two to three years it expects to stop importing salt and became self-sufficient in salt production. The holding invested 1 billion rupees (US$7.64 million) to construct the largest salt refinery in Puttalam and has announced plans to expand the dry salt plant and increase production to 500,000 metric tons per year by 2015.

New salt mining activities by the private sector are being strictly monitored and regulated in the coastal areas.

Impacts on the coast are exacerbated by unplanned construction and development, often contravening ICZM regulations on established setbacks. Land reclamation for housing construction within sand dune areas, and port and harbor development exacerbate shoreline erosion. Upstream dams trap sediments and reduce sand supply to coastal beaches, as in the Southern Province and in the southern part of the Eastern Province, resulting in receding shorelines. Construction of groynes and jetties cause erosion down-drift of the structure within 5-10 years. Removal of dune vegetation and mangroves exposes low energy shorelines to increased energy and reduced sediment stability, thus causing even greater erosion. Ironically, investment in protective seawalls and groynes often leads to **erosion generating beach scouring.**

Lack of resources and institutional capacity hinders effective construction permitting and enforcement to prevent unauthorized or inappropriate siting of buildings in the coastal zone. This results in further stress on vulnerable coastal systems and displacement of natural resource-dependent coastal population. Urban planners are challenged by the increasing incidence of climate disasters causing landslides, floods, and drought. In the short term, careful management and factoring in of environmental impact, and climate adaptation in spatial planning, would be particularly important in the coastal areas in order to reduce human and economic losses.

B. COASTAL POLLUTION

The vitality of coastal systems is threatened by waste and effluent pollution entering the water bodies and coastal waters. Degradation of coastal habitats and biodiversity are the result of unabated upstream pollution. The sources of pollution in Sri Lanka's coastal zone include sewage discharge, urban storm water runoff, poorly managed solid waste, organic waste from aquaculture activities, and toxic and hazardous chemicals in industrial waste and effluents. Pollutants enter the rivers upstream and eventually discharge at the coast, negatively affecting the ecosystem services provided by coastal resources. For example, the Greater Colombo area generates 370,000 m^3 of wastewater of which only 90,000 m^3 are treated and discharged through deep-water outfalls[8] (Joseph, 2003). Many secondary cities lack appropriate sewage systems

8. BOBLME (2013) conducted an analysis of the main sources of pollution in the coastal areas. This included sewage discharges from point and non-point sources, solid waste and water pollution from poorly managed aquaculture activities.

altogether. Colombo's sewage system is about 100 years old, with one deep-sea outfall at Mutuwal and another at Wellawatte. Hence, both need constant repairs.

Lack of solid waste management affects the quality of coastal waters and beaches. Disposal sites are usually unregulated open dumps, located in low-lying marshes of coastal areas. In 2005, it was estimated that the total volume of solid waste collected in Sri Lanka was about 2,840 tons per day, 58 percent of which was collected in the Western Province (NSWMSC, 2007). Besides, coastal lagoons often serve as open dumps (Figure 15).

Less than 5 percent of the population has sewage treatment facilities. In rural areas, 3 percent of the population lacks sanitation facilities. Rivers carry sewage from non-point sources into coastal areas.

Recent initiatives that address water policy issues and inadequate standards for waste water discharge and treatment have the potential to reverse coastal waters degradation. Waste water treatment plants within the municipal ambit and in special economic zones are in operation mainly in the South and Southwest areas including Colombo, Raddolugama, Kataragama, Soyzapura, Kandy, Bandarawela, Hikkaduwa, Kogalla, and Jaffna. These capacities are limited to meeting the growing needs of the municipal sector and the tourism industry.

Weak regulation of tourism expansion in Hikkaduwa, Beruwela and Unawatuna and the lack of environmental infrastructure has led to water quality degradation and visual pollution of beaches and near shore waters. Squatter settlements emerging organically around hotels and resorts contribute to fecal pollution which threatens recreational activities such as nautical sports in coastal waters. A study by the Greening Sri Lanka Hotels project, under the aegis of the European Commission Switch Asia Program, sampled 276 hotels (61 large hotels, i.e. those with more than 50 rooms) in Sri Lanka and revealed that while 92 percent of the large hotels had Sewage Treatment Plants (STPs), only 17 percent of the medium and small hotels (those with less than 50 rooms) hotels had these facilities (SWITCH-Asia, 2013).

Excessive use of agrochemicals, inland and in coastal areas, affect inland water courses and coastal waters, as well as ground water. Chemicals-based pollution in lagoons from shrimp farms caused a collapse of the shrimp industry and threatened livelihoods in the 1990s. Shrimp farms used to draw water and discharge effluents to the same water body, thereby creating ideal conditions for pollution and disease. Feed and shrimp waste produced high BOD levels (BOD560-180 mg/l) and high concentrations of suspended solids (200-600 mg/l) (Dayaratne et al., 1997). Suspended solids can obstruct respiration of aquatic organisms and smother the eggs of aquatic

FIGURE - 15: SOLID WASTE DUMPED IN A LAGOON

Source: © K.Banuu / The Catamaran. Used with the permission of The Catamaran (www.the-catamaran.org). Further permission required for reuse.

fish species. In addition, some farms have reportedly been using chemicals including chlorine, pesticides, and antibiotics to increase production and control parasites and diseases. The buildup of nitrogen and phosphorus and siltation from shrimp farms has been observed in the Dutch Canal area (Corea et al., 1995 in Dayaratne et al., 1997) and the canals feeding the Puttalam Lagoon in the Northwest, causing fish kills and otherwise negatively affecting the ecosystems upon which many poor households depend for nutrition and income (IUCN, 2011). Poorly planned expansion of shrimp aquaculture in ecologically sensitive areas has led to reduced water quality and diseases, driving 90 percent of shrimp farms out of business and highlighting the critical need for sustainable environmental management of this sector.

Many coral reefs are degraded by human-generated pollution, in addition to natural causes, further reducing the tourism value proposition. Coral reefs were impacted by an El Nino effect in the 1970s and the tsunami in 2004. Reefs are also impacted by unsustainable fishing practices, such as use of drag nets, foot traffic, anchoring, pollution and sediment loads from rivers and estuaries. Near-shore coral reefs in the Western and Southern provinces are the worst affected and Kalpitiya, home to Sri Lanka's most unique coral reefs, is particularly vulnerable to climate risks because of its geomorphology including sand bars. Since coastal ecotourism often relies on healthy coral reefs that support diving and sport fishing, the loss of these extremely sensitive coral reef ecosystems is both ecologically and economically serious. The Bar Reef, which is the most extensive and unique coral system, has attracted community-based tourism focused on snorkeling, diving, dolphin watching, and kite surfing. However, unless tourism activities are well managed, serious degradation caused by over-exploitation of this invaluable natural asset may occur.

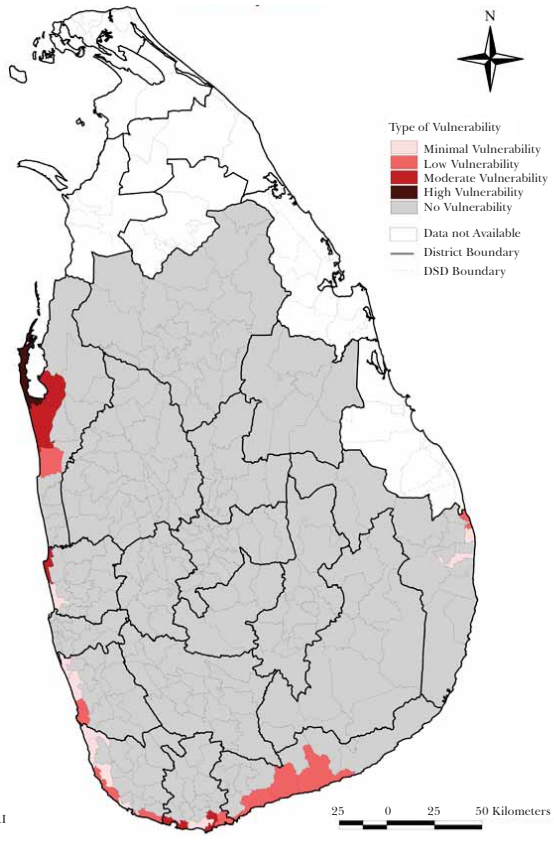
C. COASTAL RESILIENCE AND DISASTER MANAGEMENT

The impacts of climate change on coastal areas have physical, economic, and social dimensions. Sea level rise is a major concern because the majority of productive assets and population are located in the coastal area. The effects of sea level rise have multiple dimensions, ranging from:

- increased inundation of coastal lands, causing loss of life and property;
- saltwater intrusion in fresh and groundwater sources, thus reducing the supply of fresh water in coastal towns; and
- altered tidal range in estuaries and tidal river systems which may destroy estuarine ecosystems and change in sedimentation patterns.

Based on an analysis by the Ministry of Environment (2011), the activities most vulnerable to climate change are tourism and fisheries. Potential risks for fisheries include a loss or change of coastal habitats and species distribution (Figure 16). For example, rapid rise in sea levels would cause landward migration of coastal

FIGURE - 16: MARINE FISHERY SECTOR VULNERABILITY TO SEA LEVEL RISE EXPOSURE



Source: Ministry of Environment (2011)

wetlands which would result in the loss of freshwater and brackish water habitats such as mangroves and coral reefs which are important for coastal and marine fisheries. Inland wetlands which are important for the food chain, may be adversely affected by temperature anomalies with resultant changes in water quality that could cause fish kills associated with eutrophication (Box 2).

Increase in temperature has significant implications for coastal, marine and inland fisheries as well as aquaculture, in the distribution and composition of marine and coastal species, and fish stocks. Likewise, increased rainfall, prolonged drought and flooding can affect inland fisheries. In dry and arid zones, higher temperature would lead to increased evaporation, which would impact

Box 2: Climate Change Impact on Urban Wetlands

Urban wetlands of the Colombo basin are exceptional for biodiversity in a capital city. There is a range of habitats for numerous plants and animals, including the endangered Fishing Cat. The rich biodiversity provides a wealth of benefits. It provides an opportunity for sensitively managed nature tourism and recreation, increasing income in the Colombo basin. Wetlands provide livelihoods support for local residents through fishing, rice cultivation and other activities. They also are important for keeping flood waters in check, storing carbon to lower temperatures and filtering debris and other pollutants. However, rapid economic growth and investment from the public and private sectors in flood-prone areas, changes in land-use, namely agriculture, transportation, housing development, and new rainfall patterns tied to climate change will heighten future flood risk in the Colombo basin. If land use planning is absent or deficient, this threat will continue.

For instance, by 2050, the intensity of extreme rainfall events may double, raising the possibility that disasters like the unusually severe flooding that paralyzed Colombo in November 2010 could occur every 20 years according to the IPCC. Without wetlands, the World Bank estimates that greater Colombo would risk losing 1 percent of its GDP on average annually due to flooding, similar to the damage experienced six years ago.[9]

A World Bank analysis quantified the economic benefits of conserving wetlands in the Colombo basin, and identified the trade-offs concerning alternative strategies under various urban development and climate hydrological conditions (Rozenberg et al. 2015). Using state-of-the-art decision support tools and consultations with the government and civil society, the analysis demonstrated that conserving all urban wetlands in the Colombo basin today is a robust strategy.

The analysis recommended: (i) putting in place innovative solutions to manage and protect urban wetlands; (ii) establishing legal protection for the urban wetland complex to ensure that encroachment ceases; (iii) classifying of all wetland areas in the lower and upper catchment as “No Development Zones” within the Megapolis Plan and in all future urban planning initiatives; (iv) a transformation of urban policy to formally integrate wetland areas into urban landscape designs; (v) creation of a network of wetland parks within Colombo to provide people with managed access to wetland areas and opportunities for learning and recreation; (vi) creating incentives for the community and private sector to participate in wetland management; and (vii) restoration and awareness raising.

Additional steps, including zoning policies, early-warning systems, green infrastructure and social protection will be required in the near future to ensure that Colombo’s high growth levels remains sustainable and inclusive.

9. http://www.worldbank.org/en/news/feature/2016/06/17/preserving-beddagana-wetlands-flood-protection-conservation-education-improved-quality-life

inland fisheries, for example, lower yields in seasonal tanks. Flooding also adversely impacts inland aquaculture and capture fisheries through pollution, loads of sediments and worsened surface water quality. Climate change impact on fisheries has serious implications on rural nutrition and incomes of dependent communities.

Rising ocean temperatures and changing weather patterns can have significant impact on coastal habitats and alter the quality of tourism products.[10] Changing temperatures may also affect terrestrial forest cover and the flora and fauna which it supports, thus diminishing the appeal to eco-tourists visiting the country. Weather-related natural disasters such as floods could disrupt transport and tourism infrastructure, thus reducing the tourism attractiveness of affected areas for a long time. The management regimes of areas heavily exposed to storm surges, and coastal flooding, with high concentration of beach hotels, should be adequately trained to ensure the visitors' and local population's safety when storms and hurricanes occur. Further, development setbacks may need revision to secure future development vis-a-vis sea level rise, avoiding loss of assets, tourism revenue and employment opportunities as climate change impacts worsen.

In the Western region, Colombo District is the most vulnerable to floods, followed by Beruwala (Kalutara District). The tourism sector is most vulnerable along the Western and Southwestern coastline of Colombo, reflecting its concentration of tourism activities (Figure 17). These represent 15.8 percent of national capacity, whereby 13,810 jobs are directly dependent on tourism and associated industries. The picture is however, incomplete because there is no data for the Northern and Eastern Provinces. Available statistical data shows that coastal hazards resulting from climate change directly impacts the livelihoods of poor coastal populations. (Barbier, 2015). Near-shore ecosystems sustain coastal communities in many ways and their livelihoods are impacted when coral reefs are bleached or degraded with rising temperature. Similarly, coral reefs are nurseries for numerous fish species and rising sea levels lead to loss of the shoreline which is where fishermen moor their boats. Additionally, coastal tourism is also impacted by the loss of beachfront.

New planned tourism development in Kalpitiya (Puttalam District) and along the Eastern coastline should also factor in vulnerability to sea level rise. Kalpitiya, where 1,500 hotel additional rooms are planned, hosts Sri Lanka's most unique coral reefs and is predicted to have the highest impact due to its geomorphology such as sand bars. Vulnerability can be measured by the potential loss of 5,938 jobs and 43 fisheries landing sites. An additional five districts in the South are moderately vulnerable. This would account for 10,408 jobs in fisheries and 115 landing sites at risk. The rapid rise in tourism, and community-based tourism in particular, can draw sustainable advantage from the large dolphin populations, snorkeling, diving and kite surfing activities but are at risk from even a moderate rise in sea levels (Figure 17). This risk could be exacerbated by plans to expand tourism activities, some of which are structured around fragile sand bars.

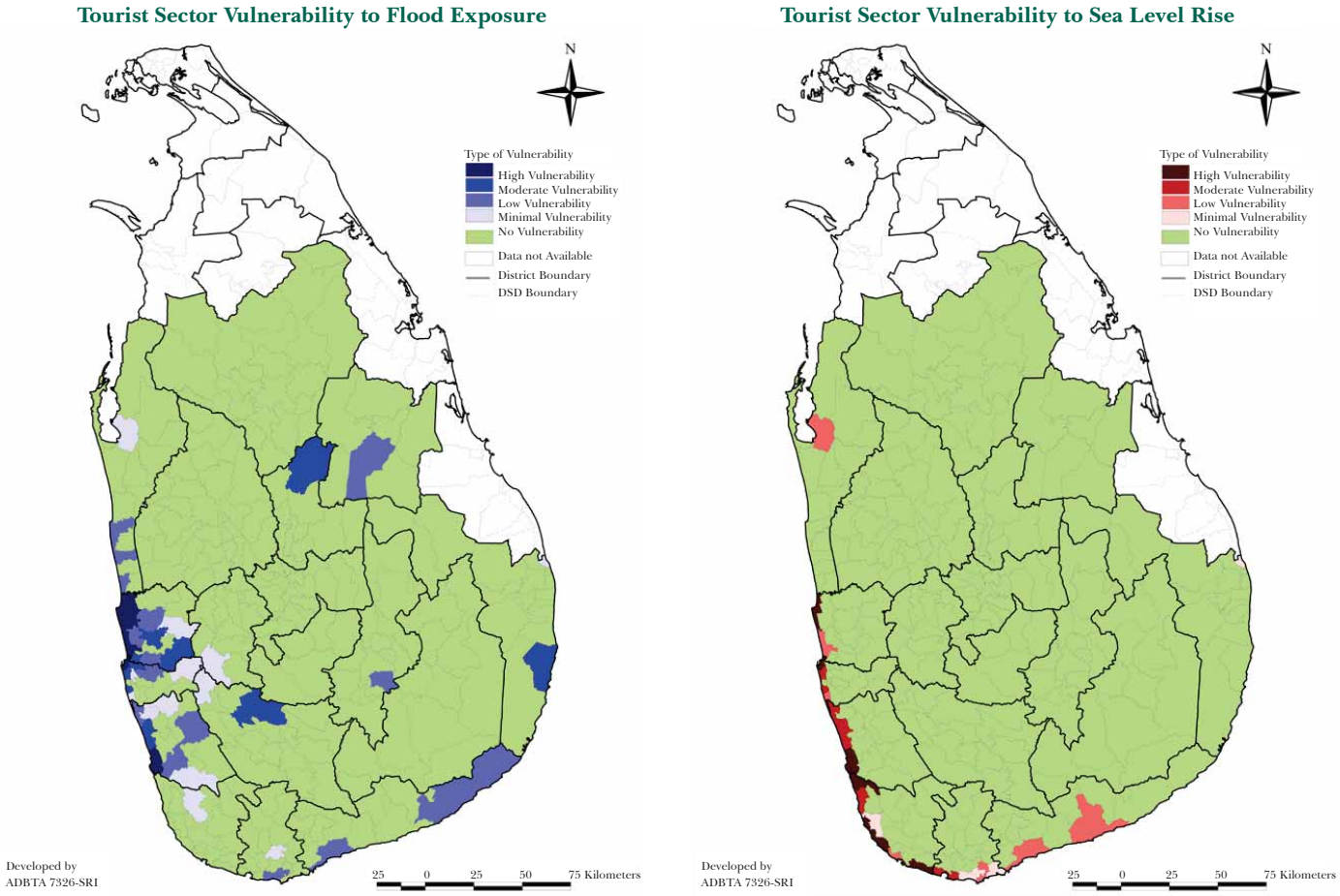
There is a strong case for protection and restoration of coastal vegetation, particularly mangroves which provide critical ecological, environmental, and biological services. Mangroves serve as:

- nurseries for aquatic organisms, nutrient and sediment traps;
- important assets for maintaining stable fisheries, which are essential sources of protein and livelihoods for coastal communities; and
- ecosystems that provide timber and non-timber products for domestic and commercial uses.

Pressure on mangroves comes mainly from clear-cutting of wood for fuel and from land clearing for shrimp farms. Additional drivers of mangrove loss include the failure of land use planning. For example, 64 percent of mangrove cover has disappeared from Puttalam Lagoon and 11 percent from Dutch Bay because of unplanned and unregulated development. Somewhat encouragingly, mangrove tourism and wetland-related tourism have recently

[10] This increase will not be felt uniformly because of differential heating of the ocean, ocean dynamics (winds and currents), the sources and geographical locations of ice melts as well as subsidence or uplifting of continental margins. This means that a rise of one meter or more by the end of the century might be possible, an assumption supported by a 2012 World Bank report suggesting that a warming approaching 4°C by 2100 may lead to median estimates of sea-level rise of nearly 1 m above the levels during the period 1980–1999.

FIGURE - 17: TOURISM SECTOR VULNERABILITY TO FLOOD AND SEA LEVEL RISE EXPOSURE



Source: Ministry of Environment (2011)

gained prominence in Sri Lanka, making tourism a direct user of mangroves in their natural state, and this is best supported by the government, in line with distribution of mangrove areas by district (Table 2).

D. REGULATION AND MANAGEMENT

Pressure from the effects of climate change, overexploitation and mismanagement of coastal resources can be addressed through policies and regulatory instruments. These and other complex issues in the coastal zone are likely to intensify not only due to natural factors but also when management solutions are not tailored to address the challenges. Three challenges, in particular, need attention from a policy and regulatory perspective:

- illegal fishing;
- economic distortions in the fishery sector; and
- lack of coastal zone management.

Illegal fishing

The large and lucrative industrial pelagic fishery is not fully regulated and managed, and its Monitoring, Control, and Surveillance (MCS) remain weak. This regulatory weakness contributes to high fishing pressure and potential overfishing which is affecting the health of large pelagic fish stocks throughout their biological range. In 2015, IUU fishing by Sri Lankan vessels on the high seas and in the EEZ of other nations, and IUU fishing by foreign vessels in Sri Lankan waters led the EU to impose a ban on fish imports into the EU from

TABLE - 2: DISTRIBUTION OF MANGROVE AREAS BY DISTRICT

District	Location	Mangrove area (ha)
Western	Gampaha	634
	Kaluthara	75
Eastern	Baticaloa	2071
	Trincomalee	2395
	Ampara	618
Southern	Matara	39
	Galle	406
	Hambanthota	692
North-eastern	Puttalam	1958
Northern	Jaffna	2505
	Kilinochchi	1885
	Mannar	1351
	Mulativu	1041

Source: Forest Cover Map, FAO (2010)

Sri Lanka, though reversed in 2016, is a prominent example of the manner in which weak governance impacts the economy.

A simulation of the 2015 EU ban points to a contraction of the fisheries sector by 2.5 percent, and an increase in the poverty level by 3 percent.[11] These economic losses were borne primarily by processors and exporters because of the lower prices in alternative markets such as Japan and the USA. Notwithstanding an EU export ban, fishermen can still catch the same quantities of fish and are somewhat buffered from the impact of such a ban, even if sale prices are reduced.

Based on Sri Lankan customs data, the EU ban caused a loss of USD $70 million in export revenues (Table 3). It is also reported that medium-sized processors were the biggest losers. Large export processors could shift their export destinations to non-EU countries such as the USA and Japan while medium-sized exporters found it difficult to quickly find new trade partners. This illustrates the vulnerability of Sri Lanka's fisheries sector to external shocks.

The existence of a Vessel Monitoring System (VMS) alone is not sufficient to solve all management issues. As a member of the Indian Ocean Tuna Commission (IOTC), headquartered in Seychelles, Sri Lanka agreed to accelerate investment in modern marine monitoring technology. The MFAR's Inspection Department is in the process of implementing a VMS, which allows it to follow the location of fishing vessels licensed by Sri Lanka at any given time. Until now, approximately 20 percent of the 5,000 multi-

TABLE - 3: FISH AND CRUSTACEANS EXPORTS OF SRI LANKA 2013-2015 (USD MILLION)

Country/Grouping	2013	2014	2015
European Union	103.5	108.2	35.3
Other Countries	141.0	157.1	145.6
Total	**244.5**	**265.3**	**180.9**
Netherlands	17.8	18.8	11.3
Germany	16.8	14.0	7.7
Italy	20.2	25.5	4.9
United Kingdom	24.1	20.4	4.9
France	12.5	18.4	3.6
Belgium	6.6	4.4	1.1
Other EU	5.4	6.5	1.9

[11.] Authors' calculations.

day boats based in Sri Lanka have transponders that enable them to be followed by the VMS. However, other measures to prevent the IUU and overfishing are not being properly implemented. For instance, the Inspection Department is poorly equipped to identify unlicensed vessels, which do not have VMS transponders, fishing illegally in its waters. Similarly, the vessel observer program called for in the license agreements is not well implemented. In turn, this impedes identification of illegal fishing practices, adequate by-catch measurement, as well as the collection of biomass data by species, time, and location that is needed by the IOTC to determine the status of the stocks.

Other issues requiring action include:

- ability to identify unregistered vessels fishing in Sri Lankan waters;
- developing the capacity for timely arrest, charge, and successful prosecution of vessels fishing illegally; and
- development of a licensing mechanism that sets realistic charges for resource use (resource rent) and regulates the species that can be harvested by licensed vessels.

Economic Distortions

The fisheries sector is beset by many vulnerabilities due to weak governance, outdated subsidies that create conditions for economic distortions, and ineffective enforcement. Several aspects need attention. A government program, established through the Ceylon Fisheries Corporation (CFC) under the Ministry of Fisheries, supports fishermen operating day boats and smaller vessels. The program supports purchase of fish not sold to the private sector at the end of the day, or participating in auctions to drive up prices in wholesale fish markets, and then selling these fish stocks in the retail market. This artificial price support sends a distorted signal to fishermen about market demand for fish. If all fish are sold, there is an artificial appearance of an unfulfilled demand which can lead to overcapacity and increased fishing pressure beyond the sustainable level at which the stock can be maintained. The cost of this program to the government is continuously increasing over time, with the CFC now reporting annual operating losses of about 35 million Rs/year ($240, 000 USD). The latter reflects the degree to which fish prices are being subsidized. Such an approach may have an unwanted impact on markets, and near-shore and lagoon fisheries.

Since the CFC operation gives the impression of unfulfilled demand, new fishermen, and existing fishermen buying additional boats, continue to enter the industry, the resultant pressure on limited fish stock increases. In the absence of reliable stock assessment data, there is a high risk that the CFC's activities could lead to overfishing which goes unnoticed until the fisheries stock collapses. (Appendix, Table 3 shows fish prices in Sri Lankan markets in 2012).

Government subsidies for port construction and operation also create an inefficient pricing mechanism for berthing tariffs. The largest and most important fisheries stock off the coast of Sri Lanka is the large industrial pelagic fisheries component in the 200 nm EEZ, accessed by multi-day fishing vessels ranging between 35 and 45 feet in length. These vessels, like the smaller single-day fishing boats, require berthing and support facilities, including ice, fuel, boat and engine repair, net mending, and offloading facilities. In Sri Lanka, these services are provided largely in dedicated fishing ports operated by the government-owned Ceylon Fisheries Harbors Corporation (CFHC). Such ports are essential to the industry because of the generally exposed nature of Sri Lanka's coastline and their efficient management is critical for sustaining the sector's performance and growth. Importantly, the fishing ports should be financially self-sustaining, with recurrent costs and revenues balanced among:

(a) revenue generated;

(b) asset value (land and harbors);

(c) operating capital (government treasury, donors-but mainly harbor fees); and

(d) operation and maintenance cost (dredgers, buildings, vehicles, quays, fuel infrastructure, roads, staff salaries, slipways, and hauling equipment).

However, the operation of these fish harbors (actual berthing fees, cost of fuel and other support services, and the cost of capital investment in new facilities and replacement of old ones) suggests that the

treasury is subsidizing fishing ports, which may be further aggravated by financial cross support from "profitable" to "unprofitable" fishing ports. This far from a preferred "user pays" system instead of the low level of charges paid by fishing vessels for berthing in fishing ports (Table 4).

License fees charged for the use of coastal and marine fisheries resources are inadequate to cover management costs and may encourage over-exploitation. If natural resources, such as fisheries are to be utilized in an environmentally and socially sustainable manner -- without requiring one sector of the national economy to subsidize a completely unrelated one -- realistic resource "rentals" in the form of licenses and fees must be collected and allocated to the management of these resources. An efficient "user pay" system is based on a scientifically justified limit of resource exploitation that is apportioned through a fixed number of licenses with catch limits attached to each license. The cost of managing the resource should be recovered from those benefiting by the use of that resource. This, in turn, should be obtained from a reasonable fee, based on the cost of research and management needed to ensure resource use sustainability, and charged for the right of access, namely resource rental.

However, this is not currently the case in Sri Lanka. For example, offshore industrial fisheries represents about 4.5 percent of the foreign export earnings of the country. Nonetheless, the cost of licensing a vessel to access and capture an unlimited amount of fish from the 200 nm EEZ is only Rs 5,000 for multi-day and high seas vessels. This does not cover the amount spent by the government on management of the large pelagic fisheries operation. Likewise, there is no charge for registering fishing boats smaller than multi-day boats (less than 35 feet), which are single-day and motorized or non-motorized artisanal vessels), leaving open the question of how to pay for research and management of these near-shore resources.

TABLE - 4: BERTHING TARIFFS (EXCLUDING DIKOWITA FISHERY HARBOR) – MONTHLY CHARGE FOR REGISTERED VESSELS

No	Boat/Vessel Length (in feet)	Tariff (as of 2014-01-01)
1	**ORU**	Rs 250
2	**OBM**	Rs 250
3	28'-29'	Rs 500
4	30'-34'	Rs 900
5	35'-39'	Rs 1,400
6	40'-44'	Rs 2,000
7	45'-49'	Rs 2,750
8	50'-54'	Rs 3,625
9	55'-60'	Rs 4,625
10	Non-Registered VALLAM (daily charge)	Rs 75
11	Boat/Vessels used for commercial purposes (daily charge) (only Kalptiya)	Rs 200

Source: Ceylon Fisheries Harbors Corporation, 2016 data.

Coastal Zone Management

While Sri Lanka was among the pioneers of ICZM, the future holds new challenges for which current policies and approaches may not provide adequate solutions. The core of Sri Lanka's coastal zone management policy is driven by the concerns to address four significant issues: (i) depletion of natural habitat and resources; (ii) coastal erosion; (iii) loss and degradation of historical, cultural, and archeological sites of national significance; and (iv) loss of physical and visual access to the ocean. The ICZM as a governance tool is used to assess: (i) dynamic interaction between land and sea during prolonged time periods; (ii) impact and development of sectors traditionally seen to be separate; and (iii) integration between the local, national, and international levels of governance. It promotes a coordinated effort between institutions in government, civil society, and the private sector and has the potential to integrate, within the development umbrella, planning issues such as climate change, population growth, as well as concerns associated with conflicts among user groups, and current social, economic, and environmental conditions.

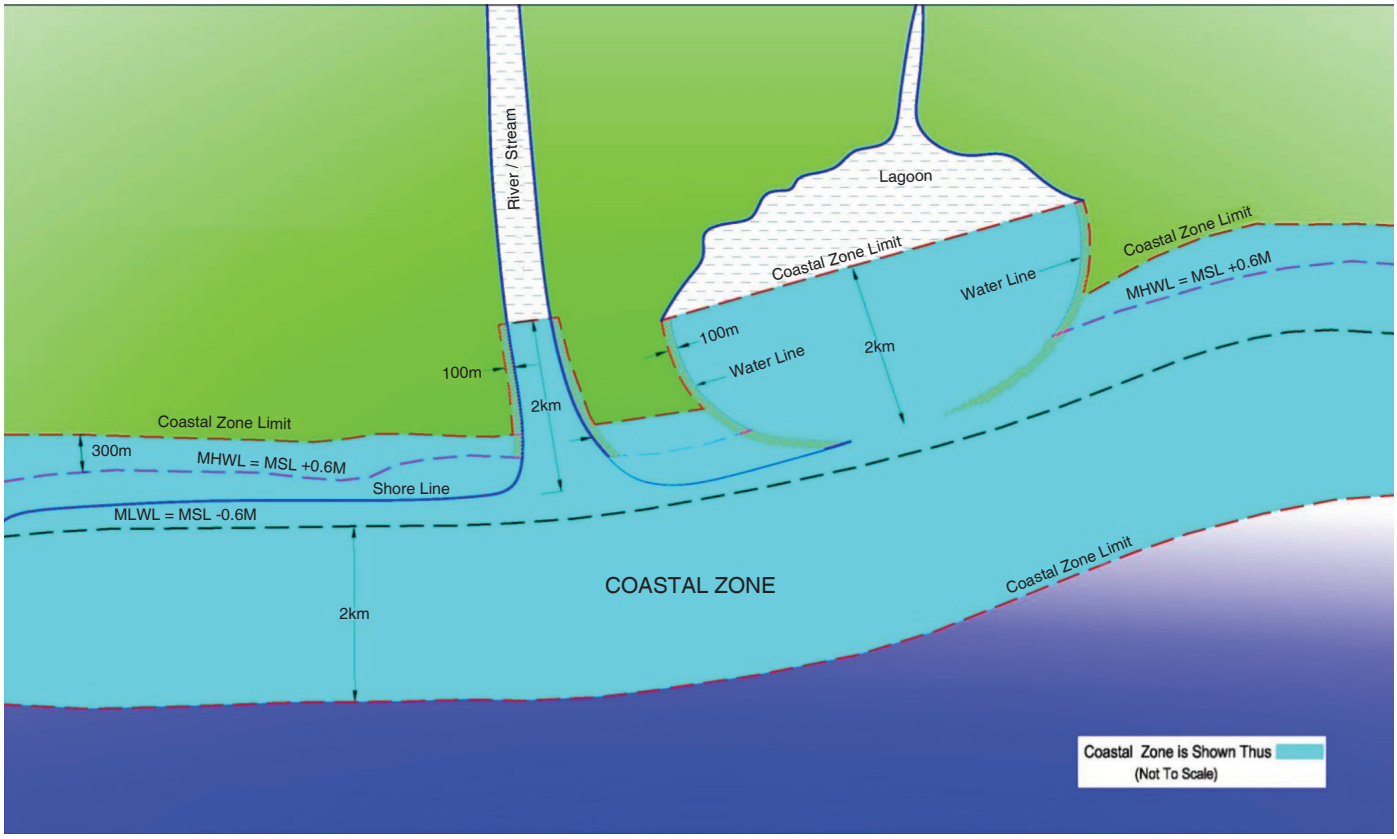
As early as 1981, Sri Lanka enacted the Coastal Conservation Act which defined the parameters of the coastal zone as 2 km seaward and 300 m inland from the high tide waterline (Figure 18). The mechanism

for regulation of coastal economic activities is the permit system, which has evolved since the earlier top-down approach, but remains ineffective due to weak governance. As population pressures and infrastructure investments along the coast increase, particularly in tourism, there is a critical need for coastal zone management supported by spatial planning tools that can avert pressures and guide sustainable development. This is vital for the sustained growth of the coastal economy. Spatial planning in the coastal region is particularly challenging due to the ongoing development pressure on fragile ecosystems, rising sea levels, and land use.

Under the provisions of the Coast Conservation Act (No. 57) of 1981, the CCD was established to implement coastal zone management through national level policies and coastal zone management plans, including local Special Area Management (SAM) plans for specific sites. During the implementation of the coastal management program, future needs have been identified to regenerate and improve the quality of coastal zone resources. The enactment of the 13th Amendment to the Constitution in 1987 recalibrating administrative units and merging town councils, which were considered rural, into the Pradeshiya Sabha, does not allow for a true comparison of urbanization over periods of time. These transformations are important since they affect the mandates and responsibilities in the management of coastal resources and ICM planning.

The protection of important terrestrial and aquatic resources and sites is poorly implemented in formal development planning. Therefore, establishing the concept of "limited use" and "non-use" in the special planning system is critical to safeguard coastal resources. The local government's role in spatial planning and its ability to effectively manage spatial plans should be strengthened. This could help improve the effectiveness of coastal management practice and proactively address potential resources

FIGURE - 18: GRAPHIC ILLUSTRATION OF THE COASTAL ZONE AND ITS LIMITS



Source: CCD (2016).

conflict between fisheries and other sectors depending on coastal resources.

Sri Lanka has more than three decades of experience with ICM projects. Nonetheless, the experience in sustainable development of coastal assets remains mixed. The weaknesses include: (i) setting short-term project objectives; (ii) unmet expectations of participating coastal communities; (iii) low level of commitment to ICM; (iv) institutional fragmentation; (v) decentralization of management functions unsupported by human capacity and financial resources; and (vi) political interference in the permit process which is the main mandate of the CCD.

Many ICM initiatives were not fully tailored to the welfare of coastal communities. For instance, in the process of resettlement of fishing communities displaced by tourism, fishermen were not provided with access to the beach to moor their boats. They also needed skills that add value to their products as well as access to markets, and credit finance. Besides, identification of appropriate financial instruments for strategic partnerships with the private sector remains to be tackled.

Institutional Coordination

Inefficiencies in the implementation of ICM policies are mostly due to institutional fragmentation and lack of coordination. As social and political pressure increased over the competition for and access to coastal resources, successive governments responded by expanding the institutional framework. Currently, there are over 100 line ministries and institutions which have overlapping responsibility over the coast and its assets. The CCD, the Urban Development Authority, the Department of Wildlife Conservation, the Ministry of Forestry and Environment, the Ministry of Environment and Natural Resources, the Central Environmental Authority, the Ministry of Fisheries and Ocean Resources, the Department of Fisheries and Aquatic Resources, the Ministry of Local Government, Housing and Construction, the Marine Pollution Prevention Authority, the Marine Environmental Protection Authority, the National Aquaculture Development Authority, and the National Aquatic Resources Research and Development Agency are some of the institutions at the central level that are responsible for management of coastal and marine resources and areas.

Overlapping mandates often lead to stalled initiatives and inefficient use of resources. The management of coastal ecosystems and protected areas is mandated to the Department of Wildlife including those categorized as SAM under the Coastal Conservation Act. An integrated ecosystem approach is particularly important for fisheries. However, depending on the level of capacity and support of partner organizations, Marine Protected Areas (MPAs) are managed at different levels. The SAM plans have a broader scope than the marine sanctuaries and may include marine sanctuaries within the SAM. This arrangement is similar to a buffer zone regime where use levels are limited. The designing of MPAs needs coordination across multiple institutions, such as fisheries, land use, environment, agriculture, spatial planning, and transportation so as to optimally consider social impacts alongside economic and environmental impacts. Moreover, an important aspect of marine spatial plans is to identify areas for development opportunities where different activities can co-exist.

Addressing past weaknesses and reforming the ICZM Act and regulations is necessary, albeit challenging. While the government has acknowledged the need for reform in the ICM, a key requirement is to complement the decentralization and devolution of management responsibilities with clear mandates for agencies at all levels. At the provincial and district level, the national structures are replicated with an added complication, namely the participation of members of Parliament who may have differing expectations from the line agencies (Annex 3: Schematic structure). The lack of human and financial resources and capacity hinders the capability of "devolved" authorities and prevents them from executing their management functions or to act independently. Devolution also means that the ICM needs to address the priorities of many segments of the coastal populations.

CHAPTER THREE

OPPORTUNITIES AND PRIORITIES FOR IMPROVEMENT

A. COASTAL FISHERIES

There is significant room for improving efficiency of near-shore fisheries across the entire value chain. Industry can benefit from progressive reforms in areas where there are: inadequate resource rentals, overcapacity in fishing fleets, economic distortions, and weak control of illegal fishing. Long-term threats from sea-level rise and increased temperatures pose a separate set of challenges to the sector. These may exacerbate risks to the sustainability of its resource base and underscore the need for a long-term strategy in consonance with international best practice.

The basic factors preventing effective management of fisheries include: (i) excessive institutional fragmentation and overlapping mandates for coastal resources management; (ii) inadequate linkage between government research bodies and programs to develop a scientifically sound regulatory environment over exploited natural coastal resources; (iii) antiquated economic support protecting the supply and demand-side users of the coastal natural resource base that cause harmful economic distortions in sustainable resource use; and (iv) dependence of a large number of low-income households involved in artisanal capture fisheries which, combined with limited alternative livelihood sources, increases the risk of over-exploitation in the current poorly regulated and open resource access environment.

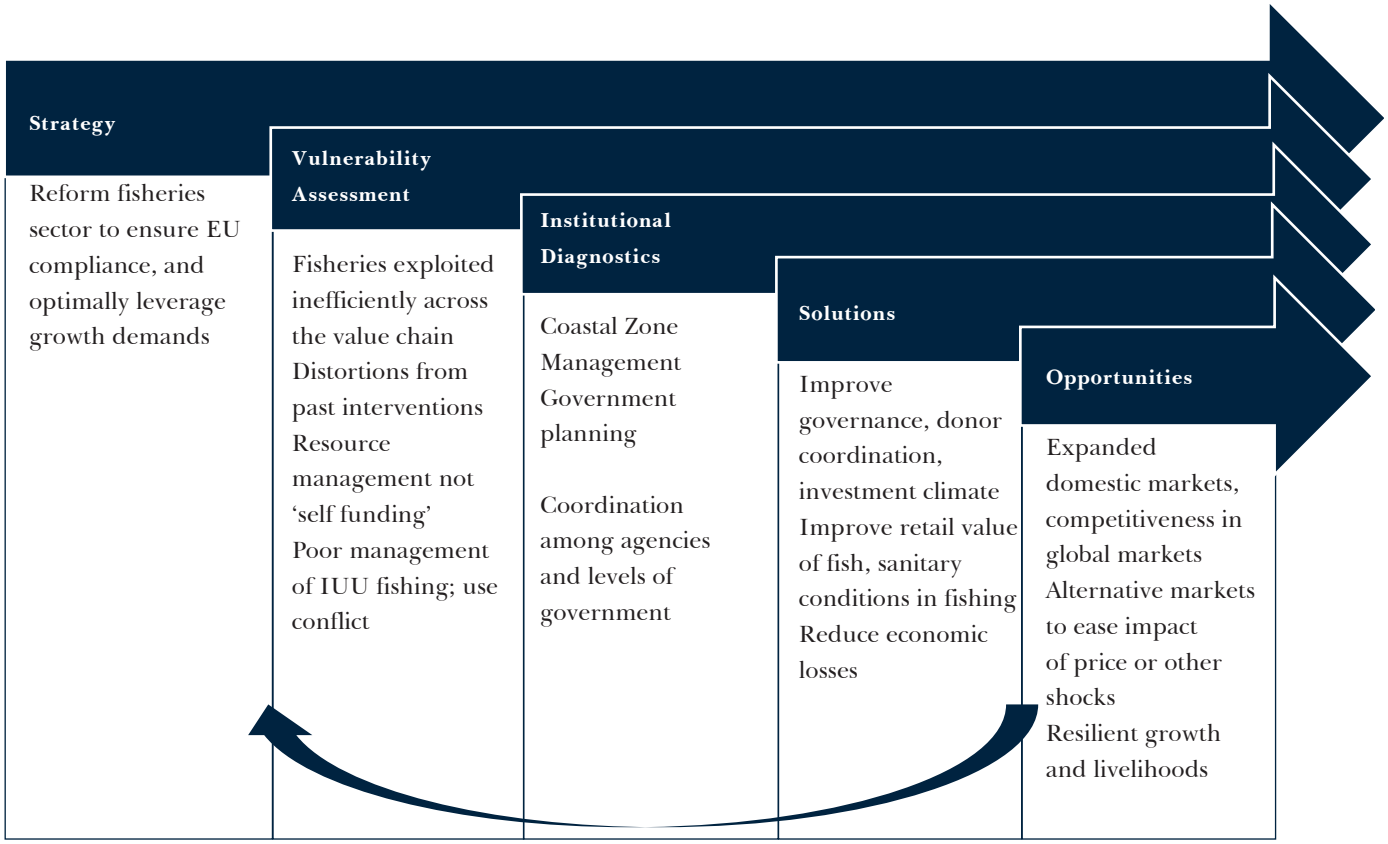
Although the EU ban on fish exports imposed in 2015 was lifted in 2016, the issues that led to the ban, mainly linked to IUU fishing, are far from resolved. To avoid similar occurrences, two main areas need attention: (i) fisheries governance, including strengthening MCS and financial self-sufficiency of management; and (ii) promoting joint ventures for improved monitoring and data sharing among all stakeholders. The roadmap for reforming the fisheries sector (Figure 19) highlights the critical areas where current polices would benefit from a change to effectively manage risks.

Short-term measures for improving the sustainability of capture fisheries include:

Institutions, Regulations, and Enforcement

- Developing the capacity of the Ministry of Fisheries, particularly the Fisheries Management Department and its local offices, to better manage the inland, coastal, near shore, and 200 nm EEZ fisheries.
- Developing and strengthening legislation for the licensing of fishing vessels, particularly those that fish in the 200 nm EEZ and High Seas, including license charges and catch limits that are commensurate with the value of the resource being exploited.
- Improving the efficiency and effectiveness of enforcement of fishing regulations, particularly identification, apprehension, prosecution and application of appropriate penalties associated with IUU fishing.

FIGURE - 19: ROADMAP FOR REFORMING FISHERIES



- Strengthening legislation that prescribes a "user pay" system of management by, among other things, reforming license structure and cost to more adequately reflect a true "user pays" system, and to legislate a license fee retention scheme for the Ministry of Fisheries.
- Carrying out exploratory and regular state-of-stock assessment research of existing and potentially new and exploitable fisheries to establish Maximum Sustainable Yield (MSY), annually assess impact of fishing pressure on stocks, minimize by-catch and post-harvest losses, including market assessment to identify new markets and market products.
- Improving the efficiency and sustainability of near-shore catch by moving away from a multi-species fisheries regime that suffers from high by-catch, to more targeted fisheries of commercially valuable fish in the multi-species fishery. Stock assessments of the multi-species near-shore fisheries should focus on identifying commercial species in the multi-species fisheries category, which is comprised mainly of pelagic fish, and establishing MSYs for each species, better targeted catch methods that reduce by-catch, and identifying opportunities to diversify the catch, by assessment of demersal and crustacean species that might be commercially exploitable. The objective is to ensure that the higher value species bear scientifically justified levels of fishing pressure, and other fish with little or no commercial but high ecological value, as part of the food chain, remain in the sea.
- Engaging in a dialogue with India on the issues of trawling in the Palk Straits that has serious impacts on the ecology, on the species including by-catch, and on the economy of the poor fishing community in the Northern Province of Sri Lanka. Trawling should also be banned in both near-shore and offshore.

Markets and Economic Incentives

- Improving the retail value of fish caught along the coast through improved sanitary conditions and offloading methods at landing sites, upgrading

fish markets, promoting research on less damaging fish capture methods, improving on-vessel storage of fish, and improving storage and transport of fish to enable marketing in higher-priced outlets, such as hotels and restaurants. If appropriately handled and processed, some species in the near-shore fisheries can also have export potential.

- Reducing economic losses caused by changes in local, regional, and international market demand, and price fluctuations associated with the sale of higher value fish such as tuna and billfish. Cutting these losses can be done by supporting development of alternative markets for existing and new products. The lesson from the recent EU ban is that market diversification is important, and investments in marketing would help insulate the country from unexpected impacts in one or more of its traditional export markets.
- Reforming non-performing state institutions such as the Ceylon Harbor Corporation, along with a gradual removal of the existing subsidy scheme to improve fiscal balance and resource sustainability.
- Create an enabling environment for focusing investment on maximizing the value of the resource. This should include provision and incentives for including non-use that targets biodiversity, disaster mitigation, water supply, ecosystem services, or similar purposes; moving more of the retail value of the resource to the sites of harvest and use, equitably addressing resource use conflicts, and minimizing resource losses. International experience shows that when the institutional environment ensures efficient and sustainable natural resource management, private investment in beneficial resource uses becomes possible. (Annex 4).
- Support development of aqua/mariculture of non-traditional species. Global demand for sea food is growing and Sri Lanka aims to become a major player in aquaculture in the region. The private sector is already undertaking small-scale farming of sea bass, sea cucumber, and seaweed; other species could be farmed as well. Research, including spatial planning to determine appropriate areas for culture, and establishment of culture limits to minimize pollution, would need to be supported before large-scale aquaculture and mariculture initiated. Aquaculture has been defined as a government priority, so this report does not make additional recommendations.

Livelihoods and Social Inclusion

- Support comprehensive alternative livelihoods programs in areas where fisheries-dependent communities contribute to near-shore overfishing. Such programs could include aquaculture development, value chain interventions, promotion of rural micro-enterprise and social protection initiatives, among others, which would benefit from coordinated design and implementation.
- Focusing on increasing the share of women in fisheries-related coastal and value chain activities to better align with the national average and promote social inclusion. Currently, the share of women in the fisheries sector is low; only 15 percent of those employed in the sector, with 4 percent involved in fishing and 11 percent employed in fish processing. On the average, 35 percent of all working individuals in the country are women, and the percentage of women in agriculture, for example, is aligned with the national average. International experience shows that programs to expand women's participation in aquaculture can help address the gender imbalance (Annex 4).

B. COASTAL TOURISM

The growth of coastal tourism will remain focused on pristine natural environments. It encompasses deep-sea sport fishing, observing sea mammals and sailing - all of which require shore-based infrastructure. The shallower reef waters attract divers, snorkelers, in-shore leisure fishing, boating and numerous recreational sports. Sri Lanka was the first country in South Asia to promote foreign direct investment in tourism development. After decades of cheap mass tourism as a base, the government and some private sector initiatives now intend to focus on more sophisticated and niche forms of tourism. The current investment strategy anticipates a growth in foreign arrivals from an estimated 1.8 million for 2015 to 3 million in 2020; with graded approved rooms during the same time span rising from 26,000 to 46,000.

Creating large-scale beach enclave tourism in new areas requires caution and careful consideration, especially in areas of ecological sensitivity. The government's development plans appear to be based on selection of sites seemingly suitable for beach-based tourism in new destinations. Unfortunately, several of these sites, such as the Bar Reef, are in ecologically sensitive areas. Some previous problems remain un-addressed such as development of a land-lease program for tourism development and initiatives unsupported by spatial planning. Eco-tourism, for instance, is a good fit for fishermen as additional or alternate employment, and can offer a sense of cultural authenticity to visitors. Some of these areas, particularly in the Bar Reef, have attracted community-based tourism focused on snorkeling, diving, dolphin watching, and kite surfing. The Bar Reef has the most extensive and unique coral cover in Sri Lanka. Unless the activities are well managed, including the siting and type of hotels, serious degradation and over- exploitation could continue to the point of no return.

The private and public sector both have roles and these roles should be clarified and complement each other. The private sector should remain a dominant player in tourism development. At the same time, the role of the public sector to direct socio-economic, ecological and cultural management and spatial planning needs to be strengthened to reverse the pressure and degradation of coastal resources. This is particularly important in SAMs and other sensitive areas to avoid resource use conflicts, and strengthen the enabling environment for responsible investments. Activities should be planned and located in the most appropriate coastal areas after assessment of long-term economic viability and sustainability, ecological and socio-economical soundness, cultural and nature-based considerations as well as strategies that provide equitable benefits to user groups and the private sector.

In developing new coastal regions, consideration must be given to what the intended growth objectives are at the local level. This should occur within the context of growing and adding value to national tourism objectives, vulnerability of the area to climate change, inundation due to sea level rise, and the need to control and manage pollution of the marine ecosystem from point and non-point sources. In many coastal areas, the sea and shoreline, nature reserves, religious and cultural tourism, and economic assets co-exist, or are in reasonable proximity. Tourism plans should recognize the value of these multiple uses through integrated special spatial planning.

Developing the tourism industry in a manner that supports the Blue-Green development paradigm would require enhanced institutional coordination among line ministries. For example, the Ministry of Fisheries and Aquaculture can provide technical and financial support for sustainable tourism around marine resources; the Urban Development Authority can facilitate increased private sector investment in infrastructure such as hotels and roads. The Ministry of Environment and the Central Environmental Authority should focus on improving control of pollution by tackling discharge of pollution loads with effluents and drainage, preventing pollution incidents related to water transport, and augmenting capacity of spill response teams. Likewise, strengthening the systems for cargo and tanker monitoring, spill trajectory modeling and identification of environmentally sensitive areas along the coast would contribute to effective spill contingency plans and responses.

D. CROSS-SECTORAL AREAS

Disaster Risk Management

Following the 2004 tsunami, establishment of an early warning system and disaster management and response capabilities quickly emerged as important priorities. At a management and technical level, including provisions of infrastructure services such as sewage treatment, waste management, potable water, electricity supply, roads and other transportation components in the disaster risk management plans will help mitigate economic loss and enhance the ability to cope of local communities affected by weather related disasters. The plans should include redesigning built infrastructure and, if necessary, relocating coastal population.

At a strategic and policy level, vulnerability risks call for an integrated approach to disaster and climate risk in the management and economic development of coastal areas. Given the high cost of investment for

FIGURE - 20: HARD AND SOFT MARAWILA BEACH SAND NOURISHMENT FOR COASTAL PROTECTION

Source: CCD (2013)

disaster prevention and post-disaster reconstruction, augmenting "hard" coastal defenses with "soft" measures promoted by the Coastal Conservation Department such as increasing mangrove forests and coastal vegetation, sand nourishment and disaster risk zoning is becoming increasingly important (Figure 20). Furthermore, the introduction of a user fees policy in locations that reflects the value of resource use can provide a sustained source of funding to protect sandy beaches.

The capability of the meteorological and hydrological services to provide quantitative information in order to guide timely decision making in disaster management needs strengthening. For example, a publicly available and accessible database of hydrological and meteorological parameters is urgently required for the development of a range of warning and forecast services related to extreme weather and flood events that impact all sectors of the economy. This includes prioritized building of coordinated capacity in the Department of Meteorology, the Hydrology Division of the Department of Irrigation and the Disaster Management Center to provide forecasts and warnings of the main meteorological hazards.

In the fisheries sector, harbor and port construction plans need to take account of the risks of increasing storms and sea level rise. Climate change risks should be integrated in fisheries management reforms in the face of existing pressure on fish stocks from overfishing. Looking forward, when establishing catch-limits, it is important to improve and use knowledge of potential climate impact on fish biomass, fish reproduction, feeding and migration.

Spatial Planning and Integrated Coastal Management

Where fisheries and tourism at the coast compete for the same resource and space, spatial planning can support preferred use of that resource with the participation of local stakeholders. Hence, Spatial Development Plans ought to precede investment for avoiding resource use conflicts, minimizing environmental damage, maximizing the wholesale value of harvested natural resources, and ensuring that local stakeholders benefit fairly from the use of that local resource, be it tourism, fisheries or any other. Thus, ICM at its core involves "integration and coordination" of institutions mandated with the governance of coastal ecosystems and resources.

In order to strengthen the role of ICM and to implement spatial planning as a decision-making tool, the Sri Lankan authorities should consider:

- **Concept of "limited use" and "non-use" as an underlying foundation of spatial planning to safeguard coastal resources from over-exploitation.** Currently, identification and protection of important terrestrial and aquatic

resources and sites, including archeological assets, are poorly implemented in formal development planning in coastal areas. Implementing the "no/limited" use approach in planning will require research to identify these areas, capacity building to enable their inclusion in spatial development planning, and support for designating and financing marine and coastal-terrestrial protected areas and parks. Spatial planning could help mitigate the effects of inorganic farming in coastal lagoons and ecosystems by evaluating the aspect of possible pollution.

- **Expansion of the local government's role in spatial planning and its implementation.** This can be achieved with help from central bodies such as Economic Planning (Ministry of Finance) and the Physical Planning Departments (Ministry of Construction Engineering Services, Housing and Common Amenities). Local governments should have the planning capacity and the ability to effectively manage spatial plans once prepared. This would help them to identify and effectively address, in a proactive manner, resource use conflicts between the fisheries, tourism and other sectors. Empowering the lower tiers of government for planning, coordinating and enforcing the law needs to be combined with greater support to the provinces in terms of staff and other resources for monitoring.
- **While current coastal policies highlight the importance of community involvement in ICZM, there is scope for improvement.** The SAM concept, which involves an adaptive and flexible approach to resource management within a defined geographic area, is now an integral component of national coastal zone management policy. The SAM process addresses the adverse impacts of increasingly rapid economic growth in environmentally sensitive areas, such as coastal wetlands, which require new management tools and greater collaborative effort with other agencies and the public. The SAM process involves communities in a participatory manner but must also involve representatives of all resource user groups of the area to agree on the activities being planned and implemented at different levels, such that they become complementary and mutually re-enforcing, whether at the national, regional, or site-specific levels.
- **Definition of the coastal zone needs to be expanded to reflect the latest understanding of natural and socio-economic dynamics of the coastal zone.** In this respect, timely government action and institutional reforms would help close the gaps between development plans and ground impacts. Similarly, degradation of estuaries and bays through point and non-point sources of pollution may require redefinition of the boundary that includes tributaries and vulnerable coastal habitats such as mangroves. In this context, demarcation of a 1 km landward urban development zone, over which the Urban Development Authority has oversight, may need to be reviewed.
- **Developing the capacity to produce high-resolution coastal and marine spatial visual data would offer a solid foundation for ICZM and economic development planning.** This would be invaluable in identifying and resolving the likelihood of future user conflict, for example between tourism and aquaculture development in lagoons, when setting up longer-term coastal development priorities. It will also provide a transparent framework within which the private sector may operate in consultation with local stakeholders, such as in the Bar Reef area where multiple use conflicts can easily arise when all users focus their activities in the same marine area.
- **Integration of climate change in coastal management** will require leadership, knowledge, and incentives to encourage both the government and private sector to seek innovative ways to integrate climate change in mainstream sectoral policies, regulations, and programs, as experienced in other countries. This in turn necessitates simultaneous top-down and bottom-up institutional approaches, already well recognized and applied in Sri Lanka's CZMPs.

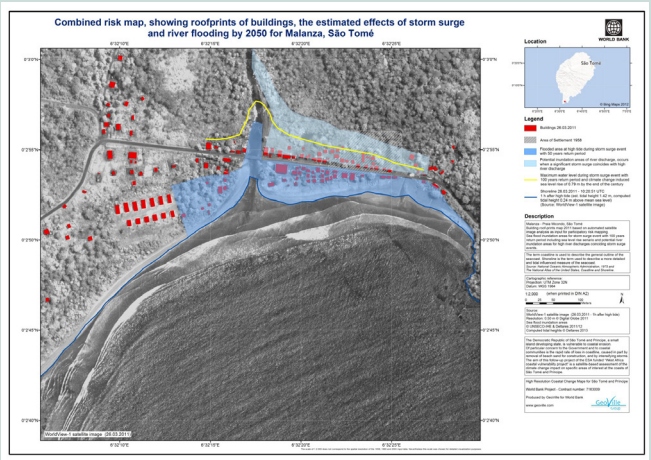
Pioneering adaptation initiatives of island states like Samoa or Sao Tome and Principe show how the pursuit of such integration provides a platform for institutional strengthening and addressing broader coastal development challenges (Box 3).

Box 3: São Tome and Príncipe: A robust approach to managing coastal erosion and climate change risks

With most of its population living on the coast, the small island state of Sao Tome & Principe (STP) located in the Gulf of Guinea, is facing coastal erosion and climate risk issues similar to those in Sri Lanka. Fishing and, increasingly, coastal tourism, are major pillars in that island state's economy. Critically, the combination of STP's historic coastal erosion as accelerated by unchecked sand mining and, more recently, by climate change-driven shifts in storm surge and river flood patterns, is increasingly triggering heavy floods that threaten multiple coastal communities. In close collaboration with the World Bank, STP is now implementing a comprehensive, cost-effective strategy to help the coastal communities better adapt to climate change and to become more climate-resilient in the longer run.

The essence of this long-term adaptation strategy is to effectively integrate short-term coastal defense measures with managed, voluntary, and gradual retreat and redirection of future development from high-risk coastal zones to safer, higher grounds. This approach reflects the coastal communities' expressed requests for moving to safer areas after unusually heavy and damaging storms in 2014-2015—a situation made worse by the fact that people had started to return and construct new housing in the very same high-risk locations that were devastated by the storms.

The strategy combines extensive community consultations with high-resolution coastal vulnerability analysis and spatial planning to identify safer areas for retreat and future development expansion (vector-based development). Historic erosion and flood analysis is expanded to include projected climate change impacts, enabling a clear illustration (see Figure below) of the vulnerabilities facing the coastal communities, the assets and infrastructure at risk, as well as the alternatives for "safer" retreat and future expansion. Active local consultations allowed for building common understanding of the risks and considering retreat and relocation as an acceptable method to prevent damage and losses in the future. The local communities were similarly actively involved in the mapping of vulnerable households and identifying the level of support to be extended to the poorest households.



Photograph and figure from Nicolas Desramaut, World Bank 2018.

Based on this analysis, and in partnership with the coastal communities, the government is following up with concrete measures to: (i) strengthen the short-term protection of critical infrastructure, such as the coastal road; while (ii) allocating or intermediating the purchase of land for managed retreat and re-direction of future community expansion. In turn, this approach is anchored in the new coastal spatial and management plans that are being prepared and adopted to delineate protective set-back zones and guide ongoing enforcement and future development and permitting action by both the local and the central government agencies.

Source: The World Bank (2018)

Institutional Development

Improving governance and rationalizing institutional responsibilities in the coastal area is urgently needed, in the face of growing competition among sectors for scarce resources. The key reason behind the increasing lack of proper monitoring and enforcement of existing plans and regulations is the fragmentation of management responsibilities, with overlapping institutional mandates and inadequate coordination. For instance, multiple layers of stakeholders are involved in managing the pressure on valuable coastal habitats. Mangroves and reefs are severely damaged by pollution of estuaries and bays from lack of sanitation, untreated effluents, and waste materials, which, if unchecked, will hamper tourism. The reefs in marine sanctuaries are managed by the Department of Wildlife, while other reefs are mostly unmanaged. Beach clean-up activities are carried out by Pradeshiya Sabha, that is local governments, which have limited resources to carry out regular clean-up and prevent waste dumping in the ocean. Sustaining these resources for boosting tourism in the short term and supporting growth over the long term requires an effective mechanism for cross-agency coordination and clearer responsibilities.

Short-term actions that would help improve institutional coordination may include:

- Reviewing, consolidating and streamlining of the mandates of agencies that have responsibilities over development planning and management of coastal natural resources.
- Strengthening the linkages and collaboration between the Coastal Conservation Department and the Department of Physical and Urban Planning to undertake demand-driven, bottom-up and transparent spatial development planning for the coastal zone at the district and village levels.
- Developing the capacity of government, academia, research institutes and think tanks for effective response to the needs of agencies responsible for natural resource management, the private sector, and coastal communities.

The coastal economy will benefit from a well-coordinated inter-sectoral approach with long-term focus on the capacity of coastal resources to support economic development. Spatial planning as a tool of ICZM to address climate and environmental risks remains best suited to bridge many of the institutional and regulatory gaps.

CHAPTER FOUR

A WAY FORWARD

"As an island nation, Sri Lanka wishes to make maximum use of the ocean with new light on ocean research, tourism, fisheries and marine resources."

President Maithripala Sirisena's address at the United Nations (New York, 2016).

Sri Lanka is well positioned to build on its strong record of commitment to sustainable development. The country's development policies emphasize "the need for present generations to employ appropriate measures to limit natural resource use for sustainable production and consumption to benefit future generations." The country made considerable progress towards the Millennium Development Goals (MDGs). Thus, according to the "MDG Country Report 2014 – Sri Lanka", out of a total of 26 indicators, which had clear targets, only two indicators were not on track for being achieved by 2015. Besides, Sri Lanka is one of the few countries with a dedicated ministry for achieving the Sustainable Development Goals (SDGs), this being a challenge which[12] will require unprecedented effort by the government, civil society, the private sector, as well as the people, in a large part due to cross-cutting issues and inter-sectoral linkages embedded in the goals. Many of those linkages are representative of the coastal management issues discussed in this study and will require involvement of several agencies for coordinated implementation and monitoring.

Moving forward, the following opportunities deserve priority attention:

- **Focus on development sectors with large potential for resilient livelihoods and jobs in the coastal areas, particularly in the Northern and Eastern regions.** Sustainable fisheries, including aquaculture, and community-based tourism have the potential to transform livelihoods in those areas, which have the country's highest rates of poverty and unemployment. Other important sectors with under-tapped potential are agriculture and forestry. Promoting small-scale, low-impact tourism, agriculture and fisheries could be a "Blue-Green" alternative to repeating over-exploitation of coastal resources, which has already happened in the Western and Southern regions, as also the Northern and Eastern areas. Additionally, enabling sustainable private sector participation in order for economic growth fuels corresponding revenue growth is important to meet the development needs in the longer term.
- **Realize a historic opportunity for integrated coastal zone development in the Northern and**

[12] At the UN Sustainable Development Summit on 25 September 2015, world leaders adopted the "2030 Agenda for Sustainable Development," which includes a set of 17 SDGs. To monitor the progress of these 17 goals, 169 targets have been identified and they are to be achieved by 2030. The SDGs and associated targets, which came into effect on the 1st of January 2016, will guide the decisions that will be taken on development over the next 15 years.

Eastern provinces. Because major investments have not yet occurred in these provinces, they are at a development juncture that allows for pursuing their coastal zone development spatial planning, along with needed institutional reforms and sound investment planning, in an integrated manner. As new investments in that region accelerate, however, the window of opportunity for maximizing the benefit from ICZM approaches is closing fast. Stepped-up capacity building at the local level for robust coastal zone planning and enforcement is essential to allow the authorities and the private sector to better assess the potential economic benefits of competing land uses and investment. Extending the climate vulnerability analysis that has been carried out for most Sri Lankan provinces in the Northern and Eastern provinces would further help robust decision making.

- **The Southern and Western provinces, which are more developed, lay emphasis on proactive management of environmental challenges and climate risks.** This requires strong mechanisms for assessing, monitoring, updating and communicating risks to sustainable use of natural resources, collection of climate information, and identification of an effective mix of regulatory and financial instruments that incorporate climate and environmental risks in the development equation. In addition to strengthening inter-agency coordination, it is also useful to promote coordination among development partners and other organizations.
- **Exploring innovative financial instruments and incentives to stimulate public and private sector investments in a sustainable coastal economy.** There are several examples of innovative financing to bridge the long-term financial gaps for investments in ecosystem-based climate adaptation and protecting the marine environment (Box 4: Example from Seychelles' Blue-Green Economy approach).

Among maritime nations, Sri Lanka can become a global leader in advancing the sustainability of coastal areas while enhancing their economic potential, building on its successes in reducing poverty, pioneering the ICZM approach and taking actions on issues that stall coastal development. This report specifically calls for intervention along two main axes: (i) improvements in the coastal fisheries, particularly in the Northern and Eastern areas of the country; and (ii) strengthening ICZM. The need for these interventions is already recognized as a priority by the Government of Sri Lanka, but not yet fully implemented. In this regard, recommended reforms in managing Sri Lanka's coastal natural assets aim to: (i) create an enabling environment for all growth sectors; (ii) provide a mechanism to assess trade-offs; (iii) solve resource use conflicts among sectors where they are already occurring; and (iv) be proactive in avoiding them when still possible, especially in the post-conflict areas in the Northern and Eastern parts of the country.

Box 4: Blue Economy in the Seychelles

The Seychelles Initiative is aimed at supporting the sustainable and long-term use and health of marine resources throughout the Seychelles EEZ. The initiative is a participatory process, bringing together multiple users of the seascape. It includes input from the major sectors such as industry, conservation, tourism and energy sectors, as well as the government, to provide guidance and direction on the allocation and use of marine resources throughout Seychelles. The process strives to reduce user conflict and to minimize the impacts of human activity on the ocean.

The Ministry of Finance, Trade and the Blue Economy has developed a number of innovative economic mechanisms, the first one being a debt swap. The Nature Conservancy (TNC), a conservation organization, is facilitating a debt swap between the Government of Seychelles and its Paris Club creditors in exchange for government commitment to enhance marine conservation and climate adaptation.

The debt buyback agreement is worth USD $30 million with the Paris Club group of creditors and South Africa. Paris Club has also offered an additional 5 percent debt forgiveness on the original loan. The debt will be transferred to the locally managed Seychelles Conservation and Climate Adaptation Trust, which will purchase and restructure the debt, manage the endowment and enforce the terms of the debt forgiveness agreement. The creation of this trust, facilitated by TNC, is still on-going. As part of this debt swap, the government has committed to a Marine Spatial Planning (MSP) Initiative, expanding Marine Protected Areas (MPAs) to cover 30 percent of the EEZ (400,000 km^2), with 15 percent designated as no-take areas.

ANNEX 1
STAKEHOLDER CONSULTATIONS – PERSPECTIVE OF PROVINCES

During the preparation of this study, the opinions and views of key stakeholders in Sri Lanka has been sought on the priorities for sustainable coastal development. The visits to the provinces and group discussions provided a wealth of information which complemented the valuable contributions from the central level and available documentation. Many of the views that were shared matched the concerns about the current status of coastal resources. Responses to the provincial priorities will need a customized approach, including: (i) focus on the Northern and Eastern provinces to prevent haphazard development and degradation of ecosystems; (ii) priority actions in the Southern province where frustrations are increasing due to growing social inequity, displacement and loss of livelihoods. In summary, some of the priorities highlighted during the consultations were:

Eastern Province – Trincomalee

- Promote Aquaculture (Sea Bass, Sea Cucumber, and Seaweed);
- Strengthen CCD District office to enable closer monitoring of implementation of permitting system;
- Support to CCD District office to implement SAMPs; and
- Promote the development of tourism services in the areas of Passikudah and Arugam Bay.

Northern Province – Jaffna

- Promote aquaculture;
- Support CCD to implement the permit system and SAM plans;
- Study the feasibility of promoting the northern islands including Delft for tourism (snorkeling, diving);
- Assess participatory and other modalities to resolve the conflict between Sri Lankan and Indian fishermen over fishing methods and boundary disputes;
- Address solid waste and sanitation issues as priorities with support from different donors;
- Through the World Bank supported Secondary Cities Project promote tourism infrastructure development; and
- Provide training in hospitality services and tourism school in collaboration with the University of Jaffna and Jetwing Jaffna.

Northwestern Province –Kalpitiya/Puttalam

- Strengthen CCD to enforce permits and SAM plans including the regulations that ban construction of permanent building structures on sand bars and other fragile ecosystems;
- Strengthen the management of the Bar Reef Marine Protected Area to conserve the very large dolphin community and other marine life. The Bar Reef has the largest coverage of unique coral species which need protection through zoning to ensure their sustainability for tourism associated values as well as for fish aggregation and spawning;
- Promote eco-tourism along the Kalpitiya coast to cater to the growing tourist industry with a focus on kite surfing and wind surfing; and
- Strengthen the Wildlife department and fishermen's associations to fully collaborate in the approved methods for construction, location, siting, waste disposal, and rotation of boats engaged in dolphin watching to protect the valuable marine life and ecosystem that attracts the tourists.

Southern Province

- Collaborate with the World Bank supported Secondary Cities Project to reduce the conflicts between the tourism sector and fisheries through the provision of sufficient fisherman landing sites. This may mean expanding the existing fisheries harbors in consultation with the relevant authorities and fishermen's associations and CCD and UDA;

- Support the establishment of a Blue Whale Sanctuary to protect the Blue Whales that seasonally come to Mirissa to feed, nest, and mate;
- Regulate the number of boats that take tourists for whale watching; and
- Conserve the valuable reefs important for tourism as well as for fish spawning areas, building on collaboration of the boat operators' association, the tourism authorities, Wildlife department, UDA (for planning) and the hotels association, the Chamber of Commerce and the Pradeshiya Sabha and NGOs such as the IUCN in the design of a marine sanctuary.

ANNEX 2
AQUACULTURE POTENTIAL IN COASTAL SRI LANKA

Shrimp farming in coastal lagoon areas grew quickly under the impetus of success in shrimp farming in other Asian economies. Black tiger prawn *(Penaeus monodon)* is the main shrimp species grown in Sri Lanka. There was rapid and uncontrolled development in the shrimp farming industry during the period 1992-96. There were enterprises that produced 8000-9000 kg per ha per year, stocked at 3—40 shrimp per m^3 in classical earthen ponds. Small-scale farms were developed in clusters, often encroaching on lagoons, reserves and ecologically sensitive areas such as mangroves, salt marches, inter tidal mud flats and coconut plantations. The total number of farms reached almost 1,400 with over 70 hatcheries and with a total area of 4,500 ha. Senarath and Visvanathan (2001) estimated that 47percent of all farms, on the average smaller than 2 ha, were operating without licenses.

Shrimp production peaked in 1998, followed by a decline due to a major outbreak of two viral diseases precipitated by the lack of proper environmental management. The mortality of shrimp culture reached almost 100 percent in farms along the Puttalam Lagoon and the disease spread rapidly to brackish water systems whereby about 90 percent of the farms collapsed or were heavily impaired within three months. The resulting financial burden fell debilitatingly on farmers. Since 2005, improved management has gradually returned the industry to a sustainable trajectory (Amarasinghe, 2013). Production reached some 6,500 tons in 2015, of which approximately 2,000 tons were exported at a value of US$ 20 million.

Seaweed farming can help fishing communities rebuild livelihoods and generate steady incomes. Two years ago, Hayleys Agriculture Holdings Ltd., with technical assistance from Vietnam, initiated a pilot project of seaweed (Kappaphycusalvarezii[13]) farming to support fishing communities in the Mannar District. In 2015, Hayleys, in partnership with UNDP, expanded the project to Analaitivu, Eluvaitivu, and Nainaitivu islands in Jaffna District. In 2015, there were 3,500 seaweed racks deployed, each being 12m x 12 m in size. Seaweed farming provided income to over 1,000 farmers with a target of reaching 5,000 farmers by the end of 2016. Hayleys contributed to marketing through technical support and buy-back arrangements with each farmer. In 2015, the company exported 180 tons of dry seaweed worth Rs 9.4 million. Individual farmers netted about US$1,100 per year as producers of raw dried seaweed. However, with proper culture and harvest techniques, the benefits could be much larger. There are opportunities for value added processing to occur at the site of harvest since this would allow much more of the benefits of seaweed harvest to be captured locally, the product extracted from seaweed being carrageenan.[14] The value addition through local processing to intermediary products such as the Alkaloid Treated Chips (ATC) or semi-refined carrageenan (SRC) could have significant financial benefits. Both are dry products[15] and are valued more than five times the price of raw seaweed.

Sea cucumbers are attractive species for aquaculture especially in locations where transportation is an issue. If properly located and managed, sea cucumber farms can produce a marketable product with wholesale price between US $100-400 per kg of dried product.[16] Currently, China is the major producer and consumer of sea cucumber. Some 22 private sea cucumber farms have been established in Thewanpitti, Mannar south bay, Ambupuram, Valaipaduaand, and Nachchikuda areas. The production of sea cucumber

[13] Previously known as *Euchemiacottonii*

[14] Seaweed, and more particularly the possible locally extracted semi-refined carrageenan, is among products of interest for Sri Lanka. Carrageenan is used in a variety of food products, pharmaceuticals and cosmetics. As such the demand for carrageenan is essentially open ended, especially for the type of carrageenan that has high gel strength.

[15] The Alkaloid Treated Chips (ATC) and semi-refined carrageenan (SRC) are intermediary products. The only real difference between the two is bacteria contamination which would occur in poor processing conditions.

[16] Product with 10-20 percent moisture.

is done in ponds or fenced lagoons, where the animals feed naturally on detritus. Despite abundant suitable sites, insufficient seed supply is a major constraint to sea cucumber aquaculture. Hatchery operations are also technically complicated. Adults are captured from the wild and induced to spawn with a temperature shock. Like most marine species, sea cucumber larvae feed on microalgae, transitioning to seaweed powder as they grow.

Fingerling production costs vary by species and size, ranging from $6 to $44 per 100 individuals in Japan and $7.50 to $30 per 100 kg in China. To supplement fingerling supply some stock is being imported from the Maldives and other Asian countries. The National Aquaculture Development Authority, under a technical assistance agreement with Vietnam, is trying to address this shortfall and produced some 300,000 juveniles in 2015.

Artisanal mud crab fisheries constitute an important means of income generation for coastal communities. However, the increase of coastal populations, ease of crab collection in shallow coastal waters along with introduction of fattening for soft shell crabs, have together caused overfishing of adult crabs, leading, in turn, to a gradual shift to aquaculture rather than "fattening" of wild-caught crab. In 2013, the government reported 1,400 kg of crab production to the FAO. Oyster farming in shared lagoons is relatively new and promising for the communities in the Northwest provinces. (Box 5).

Marine fish farming is expanding rapidly. Investment in fin-fish mariculture increased since 2007, growing by over 800 percent in the past 10 years. In August 2013, the first large commercial marine fish farm opened as a joint venture between Ocean Pick of Scotland and the Board of Investment of Sri Lanka. The farm is located in the open sea off Trincomalee on the Northeastern coast and produces sea bass (barramundi locally known as "modi"). The enterprise plans to reach a capacity of 1,000 tons over the next few years. The total investment in this project is around US$4 million, and aims to provide over 100 jobs, and to pave the way for import substitution and development of value-added products.

Senura Aquaculture Project Lanka (Pvt) Ltd (SAPL), a joint venture between AR Aquaculture Projects, Israel and Ryder Holdings, Sri Lanka raises barramundi (modi) which is mainly exported to Europe, Israel, Japan, and the United States. The FAO also funded nine demonstration cages of sea bass in Batticaloa in which 10,020 sea bass juveniles were stocked. There are also about 80 smaller scale, private sector, sea bass investments in Negombo Lagoon, Town Bay, Puttalam, and Galle from which 27 metric tons of sea bass was harvested in 2015.

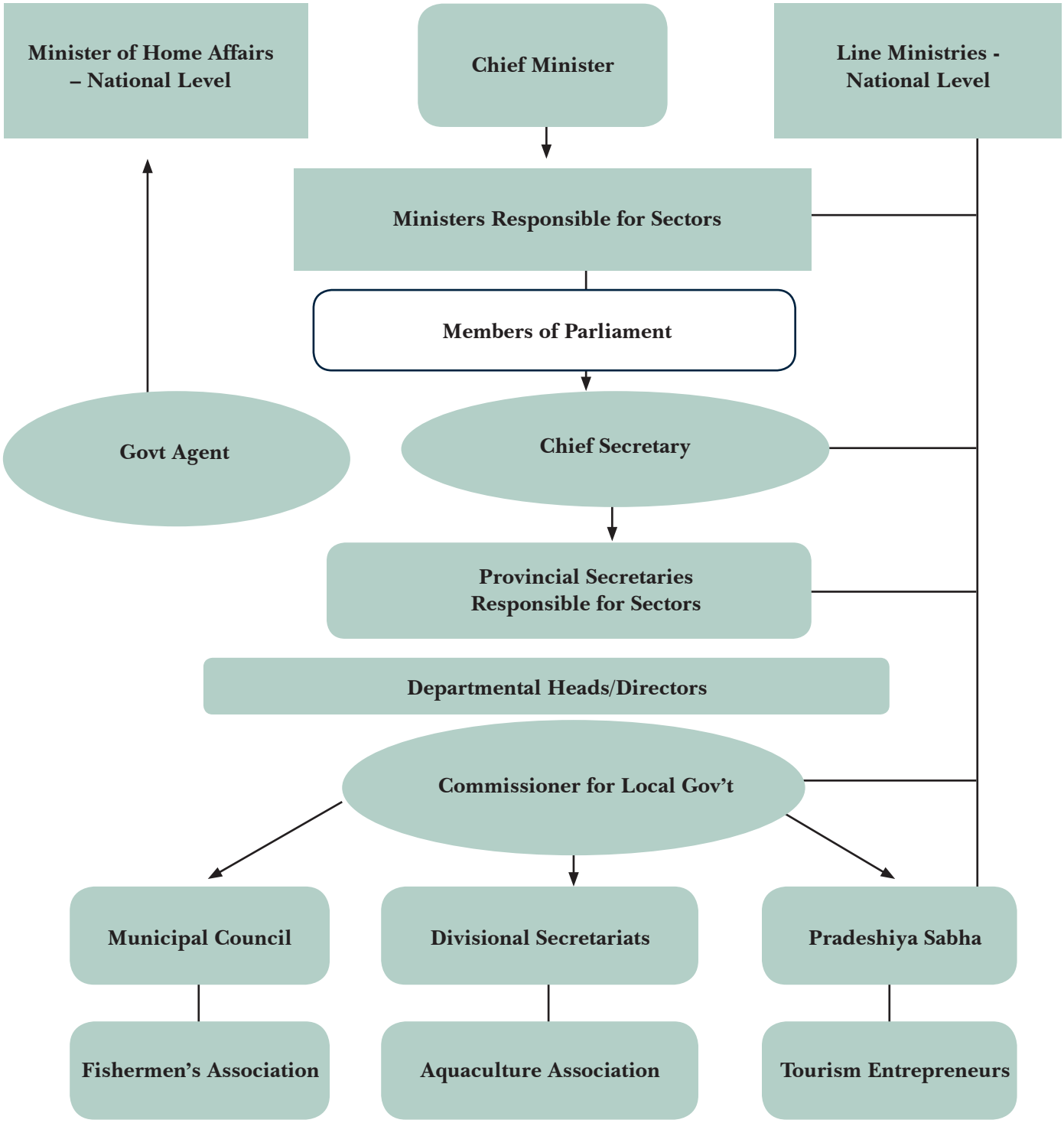
Government support for mariculture development is routed through supply of fingerlings. Some 300,000-juvenile seabass were produced in government hatcheries in 2015. Construction of a new marine finfish hatchery in Tharmapuram, Batticaloa District, at an estimated cost of Rs. 150 million funded by FAO, began construction in February 2016. The target species include milkfish *(Chanoschanos)*, barramundi/ Asian sea bass *(Latescalcarifer)*, grouper *(Epinephalus sp.)*, snapper *(Lutjanus sp.)*, silver promfret *(Pampus argenteus)*, sea bream *(Pagrus major)*, mahi-mahi *(Coryphaenahippurus)*, and cobia *(Rachycentroncanadum)*. This hatchery project aims to create direct and indirect livelihoods for 1,600 families in coastal communities, save equivalent foreign currency for import of fish seed, earn foreign exchange by exporting fish, keep the cost of seed at a minimum, and disseminate breeding technology.

Box 5: Oyster Production in Kandakuliya

A pilot project with participation of 26 families in Gange Wadiya, and 20 women from 10 families in Kandakuliya (Northwest Province) demonstrated that oysters can be successfully cultured to marketable sizes in 12 months or less using simple rack and pouch or tray systems, if set in suitable areas of a lagoon. The project tested the technical feasibility for resource-poor coastal communities to grow oysters using shared water resources. Community members formed two oyster farming organizations. Each were, linked to a private sector entrepreneur who provided technical support and equipment, purchased oysters, and developed domestic and export markets. At present, community members receive a farm gate price of about Rs.10 (US$0.07 each) and are slowly amassing equipment. The objective is to produce 200,000 oysters yearly, resulting in a projected net income of an additional Rs. 60,000 (US$460) per individual or household. This would increase average annual household income by 15-30 percent.

Source: Amarasinghe (2013)

ANNEX 3
INTER-INSTITUTIONAL ADMINISTRATIVE STRUCTURE FOR COASTAL ZONE MANAGEMENT AT THE NATIONAL AND PROVINCIAL LEVEL



ANNEX 4
INTEGRATED COASTAL ZONE MANAGEMENT – EXAMPLES OF SUCCESSFUL PRACTICE

The Integrated Coastal Zone Management (ICZM) programs implemented by island and coastal states in Africa were designed to strengthen capacities in developing and implementing ICZM (Box 6). These projects improved management and conservation of marine resources that support livelihoods and thus contribute to poverty alleviation. The programs have also incorporated community participation to build ownership and ensure gender equity.

Box 6:

ReCoMaP was designed to strengthen the regional capacities in developing and implementing ICZM including strategies and plans that would contribute to reducing these pressures and therefore to the sustainable exploitation of the region's coastal and marine resources. The program was implemented in the seven island and coastal states of the South West Indian Ocean; Comoros, Seychelles, Mauritius, Madagascar, Kenya, Tanzania, and Somalia.

The program's overall objective was to enhance sustainable management and conservation of natural coastal and marine resources thereby contributing to poverty alleviation among the coastal populations of the South Western Indian Ocean. More specifically, it sought to strengthen the capacity of local communities and public/private bodies in order to achieve sustainable ICZM.

Assessments of the program found it to be a success with significant impacts experienced among the communities involved. Substantial progress was made on ICZM policy design and implementation at a national level among the focal countries. All countries formally established ICZM committees and implemented national ICZM strategies or plans. The regional component of ICZM implementation continues to be strengthened with the preparation of an ICZM Protocol to the Nairobi Convention.

Lake Victoria, one of Africa's Great Lakes, is the second largest lake by surface area in the world. It also contains the largest freshwater fisheries stock in the world. But, it suffers from eutrophication driven by pollution related to land use and domestic and industrial waste. The Lake Victoria Environmental Management Project (LVEMP 1) was designed to understand the main catchment issues driving lake eutrophication, promote regionalization of fisheries management in the lake, including a strong commitment to joint management with local stakeholders, and pilot alternative land uses using CDD that benefited both the stakeholder and the water quality of the lake (Box 7).

Box 7: Lake Victoria Environmental Management Project - Phase 1

Fisheries Management Component Objective: To improve overall management and protection of fisheries resources in Lake Victoria by strengthening both national and regional institutional framework and promotion of conservation measures. The component, implemented by the fisheries department, had 7 sub-components with a focus on co-management, monitoring and establishing an information baseline. Outputs include:

(i) fisheries synthesis report prepared to capture information gathered under this component project;
(ii) functional database (three frame surveys were conducted, in 2000, 2002 and 2004, the former two being regionally harmonized) with data showing that high pressure has been observed in areas with high species diversity;

(iii) 245 functional Beach Management units (Kaloka being a star example), of which 40 were regulated in accordance with new fishing methods and enhanced management measures promoted by the project;
(iv) 98 of 113 identified fish breeding grounds were gazetted and are being protected by local communities;
(v) a 31 percent reduction in the number of fishers operating in Kenya since 2002 was observed together with a notable reduction in illegal fishing methods and gear;
(vi) move towards collecting information through BMUs and training local communities and officials.
(vii) aquaculture extension was conducted, and there were several scientific experiments and studies in aquaculture with limited outputs;
(viii) 64 of 69 micro-projects vis-à-vis the targeted 80, in health, water, sanitation and roads and bridges became operational;
(ix) post-harvest losses were substantially reduced from 20 percent in 1997 to about 5 percent in 2005.
(x) fish quality assurance and fish testing since 1999 resulted in lifting of the EU ban on fish imports from the lake, an outcome of strengthening of the fish quality laboratory in Kisumu with both equipment and improved procedures;
(xi) fish quality standards and codes have also been harmonized across the three countries; and
(xii) regional harmonization for the fish levy trust approved by the RPSC is likely to be operationalized under the fisheries development authority bill.

Micro-projects and Community Participation
Guidance principles for community participation were prepared. NGOs were brought in to provide communities with training. Gender considerations were introduced and a gender strategy was developed. A key issue in the operational areas was HIV and AIDS and the project supported various initiatives such as community awareness raising, dissemination of information, inclusion of affected persons in community groups supported by the project. Many initiatives for awareness and information dissemination were conducted including Lake Victoria Day annually for four years, use of media, namely radio, TV and development of documentaries in local languages. A beneficiary assessment showed that the project met and exceeded the originally targeted 60 micro-projects by implementing 81 in all, of which 80 are functional.

The Lake Victoria Environmental Management Project (LVEMP) was a regional project implemented through three interlinked, fully blended, projects in Kenya, Tanzania and Uganda. These were financed by credits from the IDA and a GEF grant and implemented from March 1997 to December 2005. The three projects together sought to address the issues of the lake in a regionally integrated way. While the project was multi-sectoral, the parts relevant to this ASA relate to fisheries and micro-projects. Box 8 outlines excerpts from the Project Implementation Completion Report.

Box 8: India: Hazard Line Mapping and Ecologically Sensitive Areas

The coastal areas of India include the nine states of the coastal peninsula bound by the Bay of Bengal, the Indian Ocean, and the Arabian Sea, as well as the union territories of Andaman, Nicobar and Lakshadweep Islands, and of Daman and Diu. About 47 percent of India's population lives in these coastal states and territories. Of them, more than 63 million people live in low-elevation coastal areas, making up 11 percent of the global population living in such low-elevation areas.

Critically, all 73 of India's coastal districts are vulnerable to coastal hazards, including tsunamis and super-cyclones. Every year, on average 5.2 depressions, 1.9 storms, and 1.4 severe storms affect the Indian coast, inflicting devastating damage. At times, the effects are further exacerbated by inland floods and inundation.

In a major step toward more resilient coastal development, the World Bank Group's India Integrated Coastal Zone Management project (ICZMP) is supporting the mapping, delineation, and demarcation of the coastal

sediment cells, hazard line, and ecologically sensitive areas of the country's mainland coast, which stretches nearly 5,500 km.

- Hazard line mapping is undertaken using Digital Stereo Aerial Photography, with a spatial resolution of 9cm GSD, covering a 7 km-wideband of shoreline that stretches along the entire mainland coast, including the intertidal zones. A flood line, derived by comparing the elevation of the coastal areas against projected sea level rise, and an erosion line, derived using a Digital Shoreline Analysis System (DSAS) modelling shoreline erosion/accretion changes for the next 100 years. This process allows incorporation of the effects of recurrent coastal hazards, including projected climate change impacts, in the definition of the coastal zone boundaries. This, in turn, establishes the planning and regulatory boundaries for state and local ICZM plans. The mapping and delineation of coastal sediment cells and sub-cells are further required to determine the lateral boundaries of these ICZM plans.
- In parallel, the project is also mapping, delineating, and demarcating the country's mainland coastal (ESAs) as defined under India's 2011 Coastal Regulation Zone (CRZ). The objective is to regulate more effectively developmental activities in order to protect and conserve sensitive coastal ecosystems. Contiguous areas containing such ESAs within the coastal management zone will be designated as areas to be protected under India's MoEFCC conservation oversight.

Upon completion of the hazard line demarcation, 66 million coastal communities in low-lying coastal areas of India will have improved indication of likely coastal hazards, which will enable them to better protect their lives, livelihoods, and property.

Ultimately, a Composite Hazard Line Map will expand the knowledge of hazards along the coast of India, informing decision making processes for planning and management, including for shoreline and cultural heritage protection measures and infrastructure projects, such as ports, coastal roads, and tourism development.

The experience of India in carrying out Hazard Line Mapping in Ecologically Sensitive Areas is also valuable for Sri Lanka which has a significant number of ecologically sensitive areas within the demarcated coastal zone and beyond.

There are approaches and tools to generate local employment while conserving environmental and cultural values, which also solves user conflict to promote resilient growth and livelihoods development in coastal areas where community mobilization benefited both coastal tourism and fisheries (Box 9).

Box 9: Community Based Tourism (CBT) as a Tool for Sustainable Coastal Resource Management and Cultural Empowerment

Koh Yao Noi is a small island, located in Phang Nga bay, southern Thailand. During the 1980s, large scale, illegal trawlers frequently entered traditional fishing grounds in Phang Nga Bay. These industrial fishers used illegal fishing equipment. These practices lead to serious degradation of the marine ecosystem, including coral and sea grass, which were nurseries for baby fish. As a result, fish stocks were depleted and local fisher families in Koh Yao Noi found it increasingly difficult to find fish and to feed their families. The Small Fishers Group worked with seven villages in the island; neighboring sub-districts, such as Koh Yao Yai and provincial movements in Krabi, Phang Nga and Phuket. Subsequently, the three provinces established an Andaman Network. The network acted as a forum for community members to share their problems and to communicate with the Thai government. Despite their action and solidarity, one of the main challenges faced by the small fishers was that, located over 1,000 km from the capital of Bangkok, their struggles were unknown to most people in Thailand. In the early 1990s, the Small Fishers' Group were assisted by The Responsible, Ecological, Social Tours Project, under the Thailand Volunteers Service (TVS-REST) to develop

"community-based tourism" as an innovative strategy to communicate their struggles with mainstream Thai society, and to demand more action and better law enforcement.

Tourists were invited to join host families at sea, to see and understand "traditional fishing", and learn how to fish using traditional wisdom, depending on low and high tides.

After assisting Koh Yao Noi community to solve the problem of illegal fishing, CBT has continued to contribute towards:

- community development;
- grassroots human resource development;
- preservation of local culture;
- environmental protection;
- sustainable natural resource management: and
- average increase of 10 percent in the annual income of participating families.

The CBT Group also has a further Community and Environment Fund, which is collected through a flat 100 Baht ($2.5 USD) charge per tourist per visit. This fund is used to sponsor sports activities in cooperation with the local administration.

The CBT club includes conservation as one of the activities in the CBT program. For example, organizing mangrove planting as an included activity, or organizing fishing with the small fisheries operators, in order for guests to understand the local lifestyle, and the challenges of fishing, and to create an understanding of environmental protection consciousness.

For more details see: http://cbtnetwork.org/?page_id=51)

APPENDIX WITH USEFUL DATA

TABLE - 1: COASTAL ECOSYSTEMS BY DISTRICT

District	Salt Marshes	Dunes	Beaches, Barrier Beaches, Spits	Lagoons Basin Estuaries	Other Water Bodies	Fresh Water Marshes
Colombo			112		412	15
Gampaha	497		207	3442	205	1604
Puttalam	3461	2689	2772	39119	3428	2515
Mannar	5179	1458	912	3828	2371	308
Kilinochchi	4975	509	420	11917	1256	1046
Jaffna	4963	2145	1103	45525	1862	149
Mullativu	517		864	9233	570	194
Trincomalee	1401		671	18317	2180	1129
Batticaloa	2196		1489	13682	2365	968
Ampara	127	357	1398	7235	1171	894
Hambantota	318	444	1099	4488	1526	200
Matara			191		234	80
Galle	185		485	1144	783	561
Kalutara		4	77	87	476	91
Total Area	**23819**	**7606**	**11800**	**158017**	**18839**	**9754**

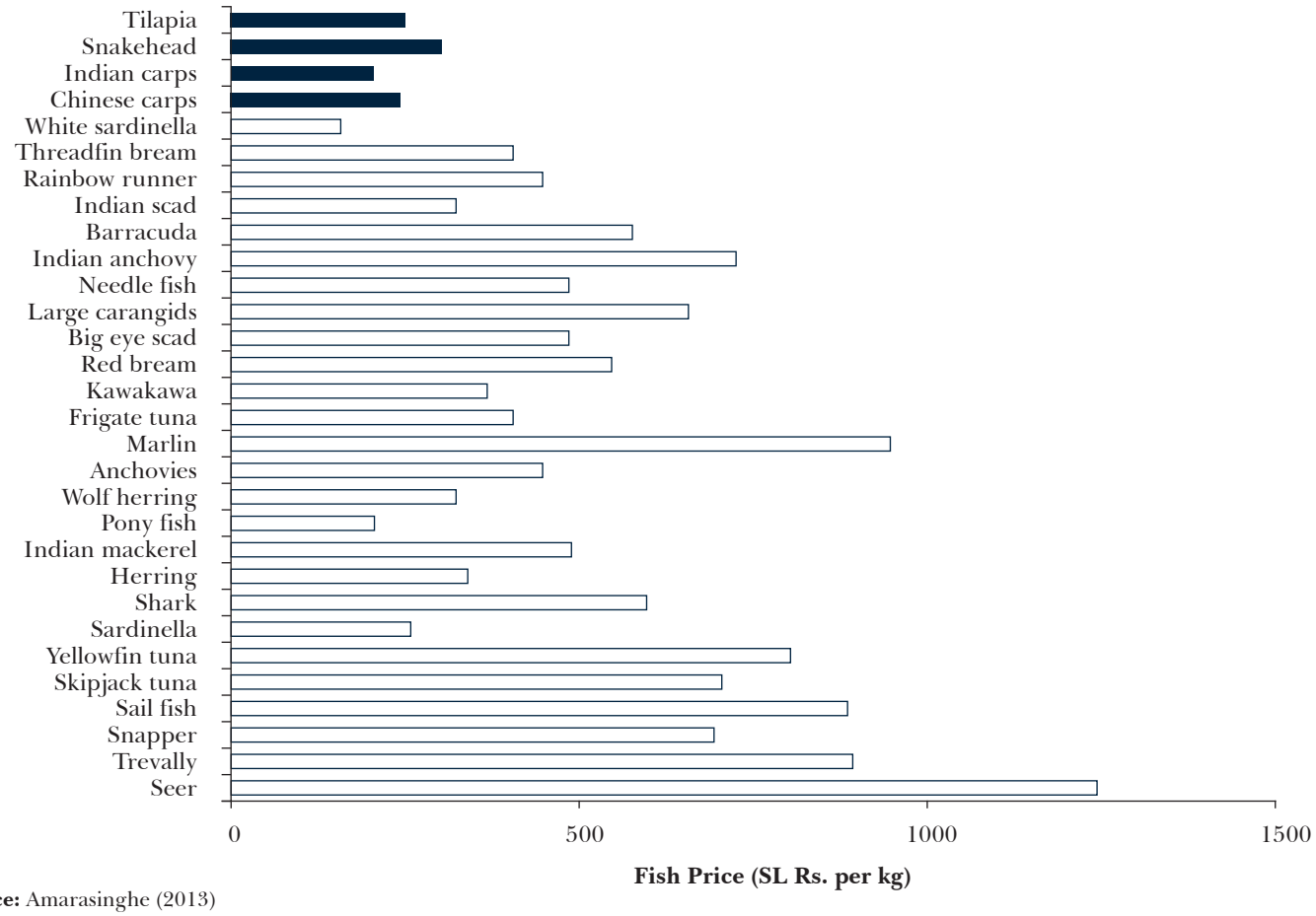
Source: http://www.fao.org/docrep/field/383211.htm

TABLE - 2: EXISTING BOATS AND DETAILS OF FISHERMEN AS OF JANUARY 31, 2016

	No. of boats								Total No. of Boats	No. of fisher families	No. of active fisherman	Population of fisheries Sector
	IMUL (Over 50 Feet)	IMUL (Below 50 Feet)	I DAY	OFRP	MTRB	NTRB	NBSB (Craft)	NBSB (Nets)				
Colombo	14	38	24	347	1	305	24	23	753	1483	1758	6174
Kalutara	0	388	3	367	0	335	35	34	1129	3613	4518	14167
Galle	0	485	17	405	246	285	51	37	1489	7299	11336	32327
Matara	0	1204	137	798	299	706	6	6	3150	8283	14416	37210
Tangalle	0	628	37	956	186	871	101	123	2779	8155	9557	33916
Kalmunai	0	117	168	707	239	880	144	164	2255	15695	17346	79170
Batticaloa	0	358	55	1322	7	3255	125	116	5122	23873	26916	85965
Trincomalee	14	115	43	2795	24	1282	220	124	4493	25125	30957	77041
Mullathivu	0	0	0	946	0	238	22	77	1206	4212	5060	15975
Kilinochchi	0	0	0	618	107	193	0	0	918	4156	3916	17318
Jaffna	0	39	209	3648	671	1795	191	191	6553	21177	22196	89017
Mannar	0	9	94	2440	406	714	14	32	3677	9542	9272	38587
Puttalam	0	50	0	2907	192	1439	197	102	4785	9484	14852	38673
Chilaw	3	405	1	2107	3	1571	15	19	4105	6942	9396	28186
Negombo	7	353	101	1758	6	1295	29	1	3549	8127	10298	36250
Total	**38**	**4,189**	**889**	**22,121**	**2,387**	**15,164**	**1,174**	**1,049**	**45,963**	**157,166**	**191,794**	**629,976**

Source: http://www.fao.org/fishery/countrysector/naso_sri-lanka/en

TABLE - 3: FISH PRICES IN SRI LANKAN MARKETS IN 2012



Source: Amarasinghe (2013)

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