Mangroves for the Future
INVESTING IN COASTAL ECOSYSTEMS

Conservation and Sustainable Use of Biodiversity in the Islands and Lagoons of Northern Sri Lanka

Devaka Weerakoon, Sampath De A. Goonatilake, Tharanga Wijewickrama, Arjan Rajasuriya, Naalin Perera, Terney Pradeep Kumara, Gyan De Silva, Sriyanie Miththapala and Ananda Mallawatantri

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Preface

Coastal communities in many parts of Asia are particularly vulnerable to the impacts of climate change, with increased severity of extreme weather events directly affecting the lives of millions of people and damaging the ecosystems and resources they rely on for everyday survival.

This report has been produced as part of the Mangroves for the Future (MFF) initiative. MFF is a unique partner-led initiative to promote investment in coastal conservation for sustainable development. Co-chaired by IUCN and UNDP, MFF works to restore the health of coastal ecosystems as a contribution to building resilience in coastal communities in Asia. The emphasis is on generating knowledge, empowering local communities and governments, and working to promote policy solutions that will support best practice in integrated coastal management.

Moving forward, MFF will increasingly focus on building resilience of coastal communities by promoting ecosystem-based approaches and by showcasing the climate change adaptation and mitigation benefits that can be achieved with healthy mangrove forests and other types of coastal vegetation.

Healthy coastal ecosystems play a major role in helping coastal communities to adapt to climate change impacts. Mangroves and other coastal vegetation support biodiversity conservation and enable improvements in livelihoods and human well-being, while also providing cost-effective risk reduction against such threats as coastal erosion, storm surges and tsunamis. Mangroves also offer potential for mitigating climate change impacts through their high carbon storage capacity, thereby contributing to the Reducing Emissions from Deforestation and Degradation (REDD+) process.

At the same time, MFF is working to improve the effectiveness of governance and management of coastal resources by promoting models of co-management, payment for ecosystem services and similar resource-sharing mechanisms that will benefit traditional coastal communities. This is particularly important given that conservation may often appear to have high opportunity costs when other uses of natural areas (notably aquaculture) are more profitable in the short term, and that the local communities most affected by natural resource decision making may not have a voice.

This report is one of many which highlight ecosystem-based approaches being developed and tested around Asia. It is being produced and shared by MFF in order to serve as a resource and learning tool for coastal management practitioners, but also to help in raising awareness of the many issues and challenges which surround the protection of Asia’s coastlines and the communities they support.

Executive Summary

After the three decade-long civil war was over, the Government of Sri Lanka commenced an accelerated programme to develop the Northern Province. If not properly planned, these developmental projects will result in the loss of biological diversity and, in particular, the consequent loss of services that ecosystems provide humans. One of the important considerations in any plan that looks towards economic and social development of the North, is that it must place a heavy emphasis on promoting livelihood options of coastal communities through new business opportunities that are focused on sustainable use of coastal resources — such as nature-based, sustainable tourism.

Therefore, documenting the biodiversity that is found within coastal and nearshore areas, as well as the offshore islands of the Northern Province, was identified as a timely need. Such documentation will help both planners and conservation biologists alike, as then, the development that is planned for the Northern Province can be carried out in a manner that sustains these coastal resources.

To achieve the above, IUCN, International Union for the Conservation of Nature, together with the Urban Development Authority (UDA), Sri Lanka Tourism Development Authority (SLTDA), and the Marine Environment Protection Authority (MEPA) collaborated to conduct a baseline assessment of the biodiversity of the coastal areas in the Northern Province, including the offshore islands.

The goal of this study was to assess the biodiversity of the coastal islands in the North, as well as the lagoon ecosystems found in the northern coastal area, to support the formulation of a strategic development planning framework that takes into consideration the need for environmental safeguards and conservation of biodiversity. In addition, this study aims to assess the resource base for the promotion of sustainable tourism.

Field visits were carried out during the months of November 2015 and March 2016, by a group comprising officers from the UDA, SLTDA, CC&CRMD, MEPA and IUCN.

This report presents the results of a rapid biodiversity assessment of a 949 km stretch from Mannar to the Kokkilai Lagoon, including 22 coastal islands, five coastal stretches and four lagoons. This surveyed area extended across four districts (Jaffna, Mannar, Kilinochchi and Mullaittivu), 20 Divisional Secretariats Divisions and 264 *Grama Niladhari* Divisions.

The report also details the drivers of anthropogenic change facing this area and provides recommendations for the conservation of certain areas with high biodiversity value, as well as other recommendations for redressing these drivers of change. Proposed actions, proposed improvements and tourism carrying capacities are also given for areas assessed.

Chapter 1 provides background information about the Northern Province. The Northern Province encompasses 40% of Sri Lanka's coastline and is endowed with rich coastal and offshore resources. The coast itself is composed of a rich assemblage of marine ecosystems, such as coral reefs, seagrass meadows, tidal flats, beaches and mangroves.

Parts of these ecosystems are characteristic species assemblages, some of which can only be encountered in this region. Many of the species restricted to the Northern Province are found in coastal and nearshore habitats. Therefore, the coastal and nearshore areas in the Northern Province function as critical habitats for many species of fauna and flora. The coastal area is also rich in archaeological monuments and traditional legends. The area is also very beautiful.

In terms of geology, the dominant tertiary sedimentary rocks from the Miocene age are thick limestone deposits that are found underlying the Jaffna Peninsula, the islands surrounding it, and the north-western coastal zone of the country.

Sri Lanka sits on a continental shelf that surrounds the island, on which is also situated the Indian subcontinent. This continental shelf is widest surrounding the Jaffna Peninsula and shallowest in the Palk Strait where Adam's Bridge and Pedro Banks are located. In the west, the Gulf of Mannar is over 1,820 metres deep.

Three types of soil — red-yellow latosols, grumüsol and solodized solonetz — have been identified from the Jaffna Peninsula and the islands around it. Of these three types, Calcic red latosols are the main soil type present in the region.

Two types of aquifers — shallow karstic and coastal sands — are found in the area. The shallow aquifers of the peninsula occur in the channels and cavities (karsts) of the underlying Miocene limestone of the area. All the shallow groundwater found within the karstic cavities originate from the infiltration of rainfall, forming mounds or lenses floating over the saline water. A shallow aquifer on coastal spits and bars is found in the Kalpitiya Peninsula and Mannar Island in the north-western region of Sri Lanka.

The northern area is in the arid zone of the island and receives less than 1,250 mm of sharply seasonal rainfall.

During the Late Proterozoic (600 Mya), the Gondwana supercontinent separated, resulting in India and Sri Lanka shifting into the Asian region. During the Miocene period, the Tethys Sea that encroached the land surface between India and Sri Lanka converted Sri Lanka into an island for the first time. The Miocene limestone deposit underlying the whole of the Jaffna Peninsula contains a varied assemblage of fossils representing foraminiferans, gastropods, echinoids, corals, calcified algae, and vertebrates.

Between 35,000 YBP and the present, the sea level fell by about 130 m and rose again to the present level. The riverine floodplain in the North was created by two large rivers which joined together during the middle Pleistocene. This large river created a series of riverine flats that existed for about 22,000 years. This land connection facilitated movement of fauna and flora, including humans, between Indian mainland and Sri Lanka during the Pleistocene to the early Holocene.

A Palaeolithic tool discovered from Manikkai, close to Point Pedro is believed to have belonged to the Palaeolithic man who was the earliest to come to the island. Upper Palaeolithic and Mesolithic human settlement sites were identified along the coastal belt, especially near the river mouths.

The area is referenced in legend and ancient chronicles. The Indian name for Adam's Bridge is Rama Sethu and is a reference to the Indian legend Ramayanaya. The name Adam's Bridge was given by a British mapmaker and referred to the legend which said that Adam of the old testament of the Bible, crossed from Sri Lanka along this bridge to go *via* India back to the Middle East.

The Sri Lankan coastal belt of the Gulf of Mannar and Palk Bay goes back beyond the beginnings of Sri Lankan history to the legend of the north Indian Prince Vijaya who landed in *Tambapanni* or *Tammanna Nuwara* — which lies somewhere between the mouth of Moderagam Aru and Kudiremalai. Also noted as important ports are Mantai and Uratota (Kayts), mentioned in the 5th century BC.

Ptolemy's map of Taprobane, made during the 2nd century AD, named Anarismoundou (now called Kalpitiya Peninsula), Hipporos (now called Kudiremalai), Margon (now called Pukkulam), the River Phasis (now called Malwatu Oya or Aravi Aru), Matota (now called Mantai) and Galiba for Kalmunai.

Nagadeepa, Mandaitivu and Karaitivu are also mentioned in ancient texts.

The reefs *of Musal tivu, Valai tivu*, and others are a line of reefs spreading between Silavatturai and Vankalai and their extensions across the Gulf. On these reefs, there are pearl banks on which pearl oysters thrived in association with corals and sponges. Currently, these banks have been over-fished.

Several Portuguese and Dutch forts and churches are located beyond Arrippu in Mannar through the North.

Chapter 2 presents the specific objectives of the study, which were to: document site-specific information on habitats, species; and the potential for sustainable tourism for the islands and lagoons in the northern coastal belt; and identifying comprehensive studies that are essential to further understand the resource base, defining potential carrying capacities and identifying types and levels of development appropriate for specific sites.

Chapter 3 presents the methodologies used for the study. Initially, a desk review of all published reports pertaining to fauna, flora, climate, geography etc. in the study area was carried out to document the available information, as well as to identify gaps in information that need to be addressed during the detailed field surveys. This review was followed by two field visits to collect information on identified data gaps. These field visits were carried out during the months of November 2015 and March 2016, by a group comprising officers from the UDA, SLTDA, CC&CRMD, MEPA and IUCN. During these field visits, the primary focus was to collect information on habitats and species observed within each habitat, document site-specific threats to biodiversity, and to identify potential sustainable tourism attractions in each site surveyed, with respect to biodiversity, archaeology or any other significant cultural or social attribute. Rapid line transects were used for flora, visual encounter surveys were used for selected groups of fauna: land snails, scorpions, dragonflies and damselflies, butterflies, freshwater fish, amphibians, reptiles, birds and mammals. Each observed habitat and ecosystem type was sampled *via* a series of transects. Animal species observed opportunistically outside each transect were also recorded separately to ensure that the field data gathered was as comprehensive as possible. Both direct and indirect observations (such as animal signs) were used.

For marine ecosystems, a rapid coral reef survey was carried out in the coastal waters of Palk Bay and Palk Strait. The aim of the survey was to collect information on reef quality by identifying good coral reef sites that can be used for tourism related activities and to identify reefs that need protection. The survey was conducted from 1st to 8th November 2015 and from 4th to 10th March 2016. Underwater visual estimation methods, as specified in the *Survey Manual for Tropical Marine Resources* (English et al., 1997), were used to assess the quality of the reef habitats. The survey was carried out by snorkelling at several coral reef sites around islands and on the fringing reefs along the mainland coast. Inventories of species were limited to hard and soft corals, reef fish and large invertebrates such as molluscs, echinoderms and crustaceans.

Chapter 4 presents the results of the study. Natural terrestrial ecosystem diversity included arid mixed evergreen forests; Palmyra woodlands; seashore scrublands; dead coral beaches; sand dune scrublands; sandy seashores; mangroves and associates; salt marshes; tidal flats; lagoons and estuaries. Semi-natural ecosystems included dry zone grasslands (wet and dry pasture lands); while man-made ecosystems included home gardens.

A total of 342 different plant species which comprised 102 tree species, 53 shrub species, 59 climber species, 111 herbaceous species and three epiphytes, were recorded during the field survey. Of these, seven species are endemic to Sri Lanka, while 33 species are listed as Threatened (Table 6). This included two species *Suriana maritima* and *Fimbristylis dipsacea* listed as Critically Endangered (Possibly Extinct) and two species, *Sesamum prostratum* and *Cyperus conglomerates* listed as Critically Endangered. Further, 28 species, listed as Near Threatened, were also recorded. Notable species included: Bay Cedar (*Suriana maritima),* a rare, native, coastal shrub, was found for the third time in Sri Lanka after 125 years; Octopus bush (*Tournefortia argentea*), a very rare plant that was found in Kachchativu Island; *Sesamum prostratum*, hitherto recorded only from the east coast; Baobab trees (*Adansonia digitata*) (native to the African continent); and Palmyra (*Borassus flabellifer*), ubiquitous in the region and the most traditionally important and respected tree in the Jaffna Peninsula.

In total, 349 species of fauna were recorded within the islands and the coastal areas surveyed. This included nine endemic species: the Lesser albatross (*Appias galane*); Devaka's fanthroat lizard (*Sitana devakai*); Common lankaskink (*Lankascincus fallax);* Flowery wolf snake *(Lycodon osmanhilli*), Checkered keelback (*Xenochrophis asperrimus)*, Checkered keelback (*Xenochrophis cf. piscator*); Sri Lanka Jungle Fowl (*Gallus lafayetii*), Sri Lanka Pompadour green-pigeon (*Treron pompadora*); and the Sri Lanka Toque monkey (*Macaca sinica*). Of the 169 bird species recorded, 78 were migrants to Sri Lanka. Notable species included the native land snail, *Trachia vittata*, Bright babul blue (*Azanus ubaldus*); Indian courser (*Cursorius coromandelicus*) and Saunder's tern (*Sterna saundersi*), all listed as Critically Endangered. A further five species — Sri Lankan chameleon (*Chamaeleo zeylanicus*), Bibron's sand skink (*Eutropis bibronii*), Oriental pratincole (*Glareola maldivarum*), Fin Whale (*Balaenoptera physalus*) and Asian elephant (*Elephas maximus*) — are listed as Endangered. There are also 21 species listed as Vulnerable, 13 species Near Threatened and five Data Deficient species also recorded from the surveyed area. Also found here are the famous Mannar ponies and donkeys.

Considering marine diversity, fringing coral reefs were present in the Palk Bay and Palk Strait along the northern coast of the Jaffna Peninsula, around the islands and from Devil's Point to Kiranchi. They are about 300 m wide. The maximum depth along the seaward margin is about eight metres. The only offshore patch reef is the Maldiva Bank located in the south-eastern section of the Palk Bay. The reef lagoons were mainly filled with coral rubble, small living coral colonies of *Favia, Favites, Echinopora, Leptoria, Porites* and species of *Acropora* and *Montipora*. The reef lagoons also contain many species of algae including Sargassum and *Turbinaria* sp. Fifty-seven species of hard corals were recorded in the Palk Bay and Palk Strait. Colonies of *Porites, Goniastrea, Platygyra, Leptoria* and *Favi*a have formed large domes over one metre in diameter. Large colonies of *Porites lutea* and *P. lobata* exceed three to four metres in diameter; they are common, especially along the northern coast of the Jaffna peninsula and on the fringing reef from Erumaitivu to Kakkativu. Dead coral and coral rubble areas were widespread on many islands including Delft, Mandaitivu, Pungudutivu, Palaitivu, Kakerativu, and Kachchativu, as well as on the reef tract from Kakkativu to Kiranchi. Soft corals are common especially along the northern coast of the Jaffna Peninsula. Sea fans and gorgonians were very rare in the Palk Bay. Scattered small colonies were present in the Palk Strait. Overall, coral diversity was higher in the Valvettithurai and Point Pedro section of the Palk Strait than in the Palk Bay and the islands.

The main seagrass meadows in the North are found in the Palk Bay from Mannar Island to Kiranchi along the coast and between the islands of the Jaffna Peninsula. Eleven species of seagrass belonging to genera *Cymodocea, Enhalus, Thallasia, Syringodium, Halodule,* and *Halophila* have been recorded from the Palk Bay. Eighty-six species of hard corals, 11 species of seagrasses and 172 species of reef fish were recorded during this survey. Among them, 25 species of hard corals and six species of reef fish are listed as Near Threatened, while five species of hard corals, one species of seagrass and one species of reef fish are listed as Vulnerable.

Notable marine species included *Montipora hispida,* first recorded in 2014 and 2015, and again in this survey, in the Palk Bay and Palk Strait, not yet included in the list of coral of Sri Lanka. Certain species of reef fish — such as Eight-banded Butterflyfish (*Chaetodon octofasciatus*) and Bengal Sergeant (*Abudefduf bengalensis*) — are restricted to the north-western and northern waters. The Yellowtail Mullet (*Sicamugil cascasia*) has been recorded only from the fringing reefs along the northern shore of the Jaffna Peninsula.

Twelve species of molluscs, seven species of crustacean and four species of echinoderms were observed during the marine surveys. Lagoon aquatic invertebrates were not surveyed.

Dugongs (*Dugong dugon*), although historically found in the Gulf of Mannar, Palk Strait and the islands off the north and north-western coast, are now believed to be confined to the waters south of Adam's Bridge to the Puttalam Lagoon in the Gulf of Mannar.

This study did not survey marine fauna, but other authors have recorded sperm whale (*Physeter macrocephalus*), blue whale (*Balaenoptera musculus*), the Minke whale (*Balaenoptera acutorostrata*), Brydes whale (*Balaenoptera edeni*), the humpback whale (*Megaptera novaeangliae*), melon-headed whale (*Peponocephla electra*), false killer whale (*Pseudorca crassidens*) and dwarf sperm whale (*Kogia sima*). Smaller cetaceans such as the Indo-Pacific humpback dolphin and the Indo-Pacific finless porpoise, bottlenose dolphin (*Tursiops truncatus*) and Indo-Pacific humpback dolphin (*Sousa chinensis*) inhabit the nearshore areas.

Chapter 5 lists the threats to natural resources and biodiversity in the study area. <u>Habitat destruction</u> is rampant, particularly in mangroves, in the study area. A road has been built on the island of Chirutivu, destroying the lush mangrove vegetation there, while in Vidattaltivu Lagoon, mangroves are being cut down for use in brush piles to aggregate fish and squid. Mangrove wood is also being extracted in Thondaimanaru.

In Sarasalai and Nagarkovil, mangroves have been cleared for coconut cultivation, even though the latter is a Nature Reserve under the jurisdiction of Department of Wildlife Conservation. Sand is being extracted heavily from the large sand dune in Manatkadu and the Pooneryn Peninsula resulting in the lowering of the sand dune. In Puliyantivu, Jaffna, most of the natural terrestrial habitats were destroyed during the civil war but are now being used for cultivation instead of letting the vegetation revert naturally. The damage inflicted on these ecosystems results in the degradation of many ecosystem services.

Lagoons and estuaries are also threatened by poor construction — for example, improper construction of roads, across lagoons blocking the through-flow of water resulting in different salinities in the partitioned sections of the lagoons. Changing salinities affect species composition, promoting salt-tolerant species in areas of high salinity and freshwater species in areas of low salinity. Such partitioning has occurred in many places on the peninsula: the reconstruction of the Jaffna-Pannai road has blocked the free flow of water in the northern part of the Jaffna Lagoon; another road constructed for Mandaitivu village divided a rich mangrove ecosystem, with consequences for species within this wetland. Barrages built across the mouth of the Thondaimanaru Lagoon in the 1950s and the Arialai bridge, across part of the Jaffna Lagoon, restricting the natural ebb and flow of the tides. In the space of a decade after the barrage was built, 32 of the 47 identified fish species found in this lagoon disappeared. In addition, cross-roads have been built across other parts of the Thondaimanaru Lagoon, as well as in Kayts and Uppu Aru Lagoons, causing degradation of mangroves in these areas.

<u>Over-exploitation</u> was also observed. <u>Destructive and illegal fishing practices</u> — such as push and pull nets; trammel nets; use of nets on coral reefs; gill nets; purse seine, spearfishing and fish kraals — are all being used in the Gulf of Mannar, Palk Bay and Palk Strait. Boat propellers cause damage to seagrass meadows in shallow areas where boats are constantly moving. This occurs in the Gulf of Mannar, Palk Bay and the seagrass meadows among the islands near the Jaffna Peninsula. It has been established that a fleet of about 2,500 South Indian bottom trawlers are fully or seasonally dependent on Sri Lankan waters to secure a profitable shrimp catch. These encroachments create severe threats to security, exploitation of fisheries resources and irrecoverable loss to ecosystems such as seagrasses and coral reefs.

Boat propellers cause damage to seagrass meadows in shallow areas where boats are constantly moving. This occurs in the Gulf of Mannar, Palk Bay and the seagrass meadows among the islands near the Jaffna Peninsula.

The use of small-meshed nets — *Sangili* nets and nylon monofilament nets — is common in the northern region. Another form of over-exploitation is waste from by-catch. Many fishers target specific species, such as shrimps and those which are not target species are accidentally caught in the net and discarded, often while the species are still alive, instead of releasing them back into the sea or lagoon.

There is also <u>targeted over-harvesting of species</u> such as Indian chanks (*Turbinella pyrum*) (Silavatturai and Arrippu) and Branched murex (*Chicoreus ramosus*) (in the Gulf of Mannar, Silavatturai, Arrippu and Vankalai and on Mannar Island) and sea cucumbers (Mannar Island).

Dugongs are <u>poached</u> — directly by harpooning (Gulf of Mannar, Palk Bay and Palk Strait) and indirectly by the use of gillnets, bottom-set nets, trawling and blast fishing.

<u>Pollution</u> is another major threat. Solid waste pollution is an increasing threat to the biodiversity of the islands. Waste is dumped by roadsides, or on undeveloped or open land. In addition, this solid waste is often washed to the ocean and carried away by littoral drift, polluting coastal waters. Solid waste has been observed in marine surveys of Valvettithurai, Point Pedro and Manatkadu and the Gulf of Mannar; in the coastal stretches from Pooneryn to Sangupiddy and Valvettithurai to Point Pedro, Mullaittivu, and Pudumathalan Beach; the banks of Thondaimanaru Lagoon, the banks of the Jaffna Lagoon near Vaddukkoddai, Arialai in Kayts and on Mannar Island. In Iranaitivu South, the beach was covered with waste originating elsewhere in the Palk Strait.

A recent study of the Jaffna Lagoon shows that in the areas of Navanthurai, Pannai, Guru Nagar, Columbuthurai and Pasaiyur, there are increased phosphate levels and a high occurrence of *Escherichia coli*, indicating pollution from agrochemicals and dumping of sewage into the lagoon.

Five species of <u>invasive alien species</u> of plants, as well as feral dogs, feral cats and Tilapia were observed in many locations of the study area.

Predictive modelling related to climate change revealed that several areas — such as Periya Kalapu and Vankalai Lagoon, Palaitivu, Parititivu, part of the Chundikulam Lagoon and a part of coastline could be inundated by 2025.

The impacts of an El Niño event — coral bleaching — was observed in Mandaitivu. The major role that coral reefs play in fisheries will be affected by this bleaching.

Chapter 6 provides ten recommendations for the sustainable management and conservation of the study area.

<u>Recommendation 1 is to conserve natural ecosystems.</u> Based on this study, it is strongly recommended that certain areas be set aside as conservation areas. These are: the marine area surrounding the islands of Erumaitivu and Kakkativu; marine areas surrounding Iranaitivu

North and South; all of Kachchativu Island, including a small coral patch off the north of the island; coral reefs off the north and north-western parts of Kakerativu; the south-western part of the coral reef off the island of Karaitivu; all areas of natural ecosystems (salt marshes, tidal flats) of Mandaitivu Island; marine areas south of Delft National Park; and all of Palaitivu Island, including a patch of coral reefs on the north-west. Maps are provided for reference.

<u>Recommendation 2 is to carry out further region in-depth, detailed biodiversity assessment studies</u>, extending over several seasons to capture seasonal variation. In particular, studies of Iranaitivu North, Iranaitivu South, Eluvaitivu, Kachchativu, Karaitivu, Kayts, Mandaitivu, Delft, Palaitivu, Erumaitivu and Kakeraitivu are essential to identify under which category and at which level, protection is afforded to those areas.

Inter alia, these studies should focus on species — such as threatened species and migratory species identified during this study— assessing species richness, abundance as well as other Essential Biodiversity Variables (EBV) such as species interactions, behaviour, taxonomic diversity, phenology, extending over several seasons to capture seasonal variation. Studies should also focus on ecosystems, assessing parameters not only such as net primary productivity, habitat structure, but also measuring ecosystem services such as harvested wild goods; cultivated goods; global climate regulation (estimating carbon sequestration, estimate greenhouse gas emissions); assessing flood protection services; estimating water quantity provision for domestic and industrial purposes; measure water quality services; and assessing nature-based recreation (estimating annual number of visits made for tourism and recreation purposes; estimating annual total income from tourism and recreation; estimating annual tourism income from nature-based activities). From such ecosystem service studies, meaningful ecosystem valuation can be carried out. Yet other studies should be carried out to quantify and prioritise threats discussed in Chapter 5; so that remedial measures can be formulated.

In addition, it is strongly recommended that similar detailed studies are also carried out for the lagoons of the northern area, in particular Jaffna, Thondaimanaru, Nanthi Kadal, Nayaru and Kokkilai Lagoons, which are surrounded by heavy human settlements and anthropogenic change. In particular, the salinity regimens of these lagoons must be studied in depth, over time, as there have been many hydrological alterations made in these lagoons. Current fish diversity, fish harvest (type and quantity of fish harvested) are also needed for comparison with earlier available data. Many of the northern lagoons serve as feeding grounds for migratory species and also are extremely important to fisheries-related livelihoods.

Also needed are detailed archaeological explorations to understand the ancient maritime trade in this area and to preserve the archaeological sites in the area.

From such studies, integrated management plans for the above-mentioned areas targeting the protection of threatened species, preventing the degradation of ecosystems, and identifying the players and their roles can be formulated.

<u>Recommendation 3 is to shift to an inter-sectoral approach to management</u>. One of the major institutional flaws in Sri Lanka is that there is a multitude of policies and laws, as well as numerous organisations, each with their own mandates and agendas, working in the same area, with little or no reference to each other. There is also a lack of knowledge about and

mainstreaming of the links between ecosystem well-being and human well-being. Multi-Stakeholder Platforms, that include government officials from relevant organisations, the private sector and communities, are recommended to ensure a holistic approach.

Recommendation 4 is to manage solid waste and other forms of pollution. It is recommended that a solid waste management programme is established to ensure that the generation of waste is a) minimised, b) collected effectively (separated into reusable, recyclable, non-degradable and biodegradable waste) as well as in time, by municipal/local government authorities; and d) disposed of responsibly.

Studies carried out to assess water quality along part of the coast in other parts of the island have shown that there is eutrophication, high faecal contamination, industrial effluents and sedimentation in many areas. A small study of the Jaffna Lagoon revealed that the lagoon, at various points, was polluted with faecal matter and agrochemicals. Similar studies of the northern coastline, as well as the lagoons of the study area, are urgently needed before development activities increase and with them, water pollution.

Air and noise pollution standards must also be maintained as stated in the regulations under the National Environmental Act. Knowledge of (creation of awareness) and enforcement of laws and regulations related to water pollution is also essential.

Recommendation 5 is to minimise overexploitation. The main issues of overexploitation are associated with fisheries. Observations from this study, showed that the use of illegal fishing gear and targeted over-harvesting of species is rife in the study area. In collaboration with the Department of Fisheries and Aquatic Resources and the Department of Wildlife Conservation, it is essential that, as for other threats, concerted programmes to create awareness are conducted about which gear is permissible, which species have controls placed on fishery, and which species cannot be harvested, targeting fishermen, the Sri Lankan Navy, and hoteliers. Enforcement of relevant laws will also be essential.

Recommendation 6 is to control Invasive Alien Species (IAS). The presence on feral dogs on Sand Bar IV of Adam's Bridge is an imminent threat to the rare breeding residents who nest (on the ground) in Sand Bar III. It is recommended that to control IAS, a plan for managing the identified IAS should be developed and should include a) training for the personnel of the divisional secretariats and local government authorities who will be involved in on-the-ground action in identifying these IAS species; b) detailed methodology for management (deciding whether eradication or control is practical); c) monitoring to prevent re-infestation and d) early detection of eradicated species should they re-establish.

Recommendation 7 is to mitigate the impacts of and adapt to climate change. Through an integrated approach, stringent energy conservation measures, improving energy supplies, optimising equipment to work at 100% efficiency and the use of renewable energy — such as solar power — should be promoted actively. In addition, there should be stringent adherence to air quality parameters required by the CEA for vehicle emissions and ambient air quality parameters. It is recommended that Iranaitivu North, Iranaitivu South, Eluvaitivu, Kachchativu, Karaitivu, Delft, Paraitivu and Analaitivu are developed as emission free islands. Often overlooked in Sri Lanka as a means of reducing emissions, is the protection of forests and coastal ecosystems.

Restoring degraded ecosystems; managing invasive alien species that degrade land; agricultural management (using climate-resilient species, crop rotation and diversification); promoting water and soil conservation measures (such as rain water harvesting, drip irrigation and management of livestock grazing respectively); planting a tree when felling one is inevitable —should be routinised in development and livelihoods-related projects, as means to adapt to climate change.

<u>Recommendation 8 is to ensure adherence to environmental laws.</u> Weak enforcement of environment-related laws is rampant in Sri Lanka, for a number of reasons. Prime among these is a lack of knowledge about these laws. Thus, there is a need for more rigorous enforcement of environment-related laws and targeted creation of awareness about environment-related laws (such as what can/cannot be done; where it can/cannot be done) is urgently needed for a wide range of sectors — such as tourism, development, fisheries, aquaculture, provincial and municipal councils, and developmental agencies to reduce *ad hoc* development that damages ecosystems and their services.

<u>Recommendation 9 is to carry out extensive awareness programmes about the area's natural wealth</u>. As important as the previous recommendations, is the creation of awareness among the gamut of stakeholders such as government agencies, local government politicians, district secretaries, divisional secretaries, *grama niladharis*, the armed forces and police, non-governmental organisations, the private sector, school children, media personnel, the general public and targeted communities such as fishing communities. Such awareness should focus on creating a clear understanding about the need for biodiversity conservation and the links between ecosystem well-being and human well-being; conservation as a multi-sector, value-added, and benefit-sharing effort to on-going development efforts; increasing knowledge about environmental laws.

Such creation of awareness will foster and augment inter-sectoral cooperation and ensure a 'buy in' from communities and the general public that will, in turn, promote participation in conservation activities.

<u>Recommendation 10 is to ensure responsible tourism.</u> This includes addressing all of the drivers of change such as habitat destruction from activities such as off-roading, irresponsible snorkelling, diving, jet-skiing and boating; preventing over-visitation which is a form of overexploitation; preventing pollution from irresponsible littering in areas where there are nature trails in protected areas, or if they are snorkelling near coral reefs or seagrasses; and ensuring that hotels landscape gardens using species native to the area, thus minimising the risk of introducing IAS.

The use of green building practices is strongly recommended during construction of tourism infrastructure, including siting and structure design efficiency; energy, water and material efficiency; enhancement of indoor environmental quality; optimising operations and maintenance and waste reduction through reducing, reusing and recycling waste at all stages of building as well as climate-proofing any tourism project.

Detailed information for the 22 islands surveyed, including maps of ecosystems, land use, existing and proposed protected areas, special attributes, proposed actions and improvements and carry capacity for visitors are provided in an annex. Similar information is also provided for the coastal stretches and lagoons visited.

In conclusion, the report notes that the northern coastal stretch from Mannar to Kokkilai has been untouched by development for over three decades, retaining some pristine ecosystems, a collection of range-restricted species and has several feeding areas for migrating birds. These ecosystems also provide the residents of these coastal areas with life-sustaining ecosystem services.

It is imperative, therefore, that future development is planned in an integrated manner, ensuring that sensitive ecosystems and species of concern (such range-restricted, rare and threatened species and rare migrants and breeding residents) are conserved and ecosystem services so needed by humans are retained through minimising overall damage to ecosystems.

Sustainable, nature-based tourism, if planned and implemented will be an appropriate development strategy for the area, for the improvement of livelihoods. However, it cannot be over-emphasised that incorporating stringent environmental safeguards is essential.

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Acronyms

ASTER	Advanced Space borne Thermal Emission and Reflection Radiometer
BOBLME	Bay of Bengal Large Marine Ecosystem
BP	Before Present
BrR	Breeding resident
BrRWV	Breeding Resident/Winter Visitor
BRW	Black and Red Ware
CBD	Convention on Biological Diversity
CC&CRMD	Coast Conservation and Coastal Resources Management Department
CEA	Central Environmental Authority
CGF	Conservator General of Forests
COD	Chemical Oxygen Demand
CoS	Conservation Status
CR	Critically Endangered
CR (PE)	Critically Endangered (Possibly Extinct)
CZMP	Coastal Zone Management Plan
DD	Data Deficient
DFAR	Department of Fisheries and Aquatic Resources
DMC	Disaster Management Center
DSD	Divisional Secretariat Division
DWC	Department of Wildlife Conservation
EbA	Ecosystem-based adaptation
EIA	Environmental Impact Assessment
EN	Endangered
END	Endemic
ENSO	El Niño-Southern Oscillation
EX	Exotic
FARA	Fisheries and Aquatic Resources Act
FCO	Forest Conservation Ordinance
FD	Forest Department
FFPO	Flora and Fauna Protection Ordinance
GIS	Geographical Information Systems
GISD	Global Invasive Species Database
GoM	Gulf of Mannar

HIV	Human Immunodeficiency Virus
IAS	Invasive Alien Species
IBA	Important Bird Area
IEE	Initial Environmental Examination
IN	Indigenous
IPCC	Intergovernmental Panel on Climate Change
ISEA	Integrated Strategic Environment Assessment
IUCN	International Union for Conservation of Nature
LC	Least Concern
MASL	Mahaweli Authority of Sri Lanka
MEA	Millennium Ecosystem Assessment
MEPA	Marine Environment Protection Authority
MFF	Mangroves for the Future
MoE	Ministry of Environment
MoMD&E	Ministry of Mahaweli Development and Environment
MSDW	Ministry of Sustainable Development and Wildlife
MSP	Multi-Stakeholder Platforms
NARA	National Aquatic Resources Research and Development Agency
NE	Not Evaluated
NGO	Non-Governmental Organisation
NOAA	National Oceanic and Atmospheric Administration
NSAP	Sri Lanka National Strategy and Action Plan
NT	Near Threatened
ORCA	Ocean Resources Conservation Association
PM	Passage Migrant
R	Resident
RAP	Rapid Assessment Programmes
SLLR&DC	Sri Lanka Land Reclamation and Development Corporation
SLTDA	Sri Lanka Tourism Development Authority
SpS	Species status
STAP	Scientific and Technical Advisory Panel
STP	Sewage Treatment Plants
SU	Status Unknown
SV	Summer Visitor
TEEB	The Economics of Ecosystems Biodiversity
Ubr	Uncertain Breeding Resident

UDA	Urban Development Authority
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations International Children's Emergency Fund
UWV	Uncertain Winter Visitor
Va	Vagrant
VCWV	Very Common Winter Visitor
VES	Visual Encounter Survey
VOC	Volatile Organic Chemicals
VU	Vulnerable
WCMC	World Conservation Monitoring Centre
WGS	World Geodetic System
WV	Winter Visitor
Wva	Winter Vagrant
WWF	World Wide Fund for Nature

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Chapter 1: Introduction

Water birds in Mandaitivu © IUCN/Sampath de A. Goonatilake

Sri Lanka is a moderate-sized continental island, listed as the 25th largest island in the world extending over 65,610 km^2 (Calder, 2009). In addition to the main island, there are also 61 islands located within the territorial waters of Sri Lanka, totalling a land area of 337.77 km^2 (KRI, 2004). These islands vary in extent from 0.000 1 km^2 (Pigeon Island, in the north-east) to 1.26 km^2 (Mannar Island, in the north-west). Of these islands, 28 (45.9%) are in the Northern Province (KRI, 2004). Of those in the Northern Province, 19 are in the Jaffna District and 16 in the Jaffna Peninsula (KRI, 2004). Many of these islands support a characteristic biodiversity (both terrestrial and marine) resulting in the declaration of several protected areas — such as Adam's Bridge National Park and Delft Island National Park — in the area (MSDW, 2015).

Some of the smaller islands have not been inhabited by people, but are being used transiently by fishermen, as fishing camps. Some of the medium-sized islands have been inhabited in the past but were abandoned during the three-decade long armed conflict that persisted in the northern region of Sri Lanka. Yet others — such as Mannar, Delft, Kayts and Mandaitivu, which are large, have been inhabited for a long time, and there are many archaeological monuments found on these islands representing different periods of history.

However, other than the larger islands, the biodiversity of the rest of the islands remains largely unexplored, especially because these islands were inaccessible during the armed conflict that prevailed in the area until 2009.

The Northern Province also encompasses 40% of Sri Lanka's coastline and is endowed with rich coastal and offshore resources. The coast itself is composed of a rich assemblage of marine ecosystems, such as coral reefs, seagrass meadows, tidal flats, beaches, lagoons, estuaries and mangroves. Parts of these ecosystems are characteristic species assemblages, some of which can only be encountered in this region. Some of these species included birds —such as the spot-billed duck (*Anas poecilorhyncha*), crab plover (*Dromas ardeola*), long-tailed shrike (*Lanius schach*), Indian courser (*Cursorius coromandelicus*); butterflies — such as the yellow pansy (*Junonia hierta hierta*), bright babul blue (*Azanus ubaldus*), crimson tip (*Colotis danae*), large salmon Arab (*Colotis fausta*), and joker (*Byblia ilithyia*); and marine mammals —such as the dugong (*Dugong dugon*). Many of the species that are restricted to the Northern Province are found in coastal and nearshore habitats. Therefore, the coastal and nearshore areas in the Northern Province function as critical habitats for many species of fauna and flora. However, these ecosystems and their species remain understudied, for the same reasons listed in the previous paragraph. The coastal area is also rich in archaeological monuments and traditional legends. The area is also very beautiful.

After the three-decade long civil war was over, the Government of Sri Lanka commenced an accelerated programme to develop the Northern Province. If not properly planned, these developmental projects will result in the loss of biological diversity and, in particular, the consequent loss of services that ecosystems provide (Box 1).

Box 1. Ecosystem Services

'Ecosystem services are the benefits people obtain from ecosystems. These include **provisioning services** such as food and water; **regulating services** such as flood and disease control; **cultural services** such as spiritual, recreational, and cultural benefits; and **supporting services**, such as nutrient cycling, that maintain the conditions for life on Earth' (MEA, 2005). Ecosystem services directly and indirectly affect human survival and quality of life (TEEB, 2017).

One of the important considerations in any plan that looks towards economic and social development of the North, is that it must place a heavy emphasis on promoting livelihood options of coastal communities through new business opportunities that are focused on sustainable use of coastal resources — such as nature-based, sustainable tourism. Such a focus will ensure the resilience of coastal ecosystems, which will, in turn, reduce the vulnerability of coastal communities in the face of impending changes brought about by climate change. It will also ensure the sustainability of the livelihoods of coastal communities. This is also in line with the concept, adopted by the present government, of a Blue-Green Economy, which places heavy emphasis on building resilient marine ecosystems, as a means of achieving global sustainability, climate mitigation and poverty eradication.

Therefore, documenting the biodiversity that is found within coastal and nearshore areas, as well as the offshore islands of the Northern Province, was identified as a timely need. Such documentation will help both planners and conservation biologists alike, as then, the development that is planned for the Northern Province can be carried out in a manner that sustains these coastal resources.

To achieve the above, IUCN, International Union for the Conservation of Nature, together with the Urban Development Authority (UDA), Sri Lanka Tourism Development Authority (SLTDA), and the Marine Environment Protection Authority (MEPA) collaborated to conduct a baseline assessment of the biodiversity of the coastal areas in the Northern Province, as well as of the offshore islands.

General Description of the Study Area

There are 43 islands located in the region of the Gulf of Mannar and the Palk Strait. Most of these islands were omitted from the national development agenda during the internal civil war. Because most of the islands are uninhabited and have untouched clear blue seas and golden beaches, a great opportunity exists to develop these islands, in a well-planned and sustainable manner, as nature-tourism destinations.

The study area covers a 949 km stretch from Mannar to the Kokkilai Lagoon, including 22 coastal islands, five coastal stretches and four lagoons (see Figure 1).

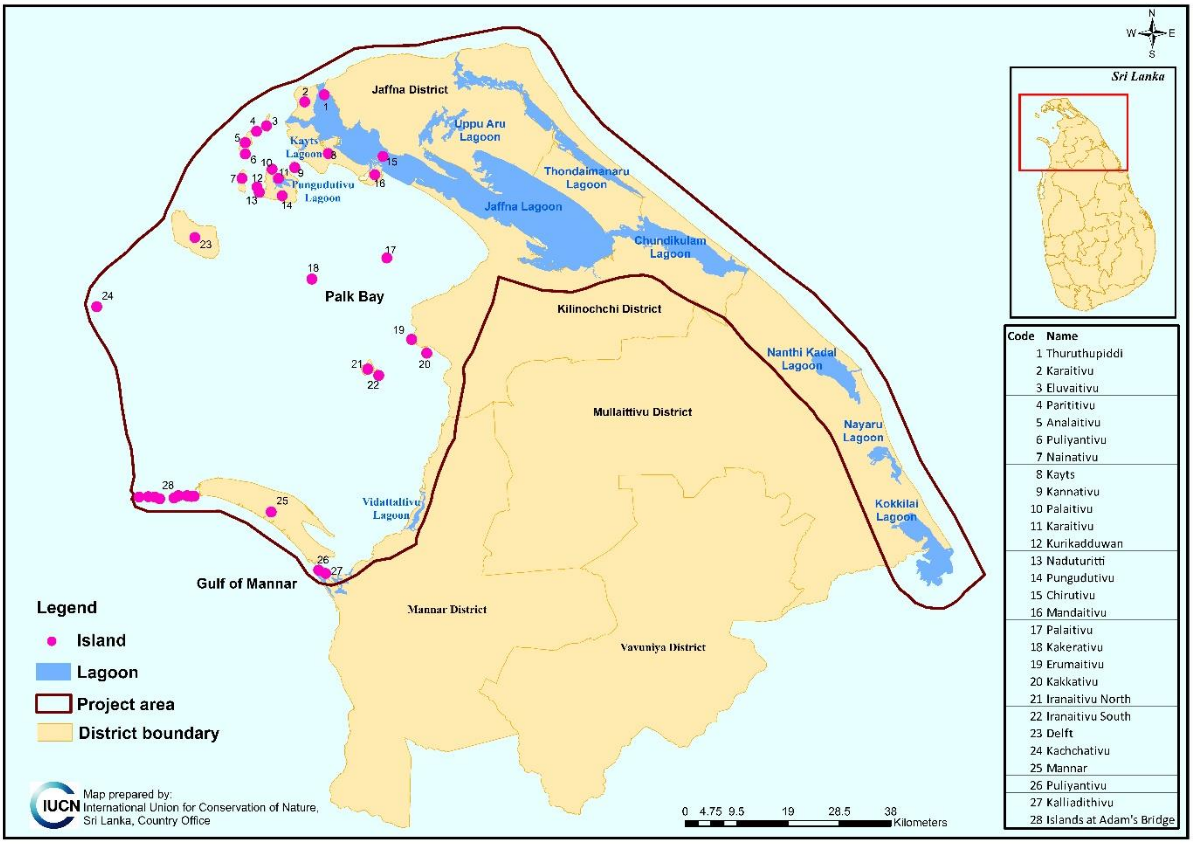

Figure 1.Study area showing the islands in Northern Sri Lanka

This surveyed area extends across four districts (Jaffna, Mannar, Kilinochchi, Mullaittivu), 20 Divisional Secretariat Divisions and 264 *Grama Niladhari* Divisions, as shown in Table 1.

Table 1. Districts, Divisional Secretariats and *Grama Niladhari* Divisions in the Study area

Districts	Divisional Secretariats	No of *Grama Niladhari*
Jaffna	Delft	6
	Island South (Velanai)	30
	Jaffna	14
	Karainagar	9
	Kayts (Island North)	15
	Kopay (Valikamam East)	2
	Nallur	2
	Thenmaradchchi (Chavakachcheri)	11
	Vadamaradchi East	17
	Vadamaradchi North	18
	Valikamam North (Tellippalai)	7
	Valikamam South-West (Sandilipay)	7
	Valikamam West (Chankanai)	8
Kilinochchi	Kandavalai	3
	Karachchi	1
	Panchchilaipalai	5
	Poonakary	15

Districts	Divisional Secretariats	No of *Grama Niladhari*
Mannar	Mannar	40
	Mantai West	12
Mullaittivu	Maritime Pattu	24
Total	**20**	**246**

Geology and Geomorphology, Soil and Hydrology

Geology

The dominant tertiary sedimentary rocks from the Miocene age are thick limestone deposits that are found underlying the Jaffna Peninsula, the islands surrounding it, and the north-western coastal zone of the country (Kehelpannala, 2007). These beds are fossiliferous and Wayland and Davies (1923) have dated fossils from the Puttalam–Jaffna limestone as being Upper Miocene age.

The Jaffna series extends from near Puttalam on the west coast, and widens toward the North, to cover the Jaffna Peninsula (Kehelpannala, 2007). Southward, the limits of this limestone can be seen in outcrops of Precambrian rock found at Madhu Road Station on the Mannar railway line; north of Mankulam on the Jaffna road; and between Mankulam and Mullaittivu. Generally, the Jaffna series comprises fossiliferous lime stone which contains chert[1] nodules and is hard, compact, and off-white to greyish-coloured (Erb, 1963). This is capped by a series of areno–argillaceous[2] beds (Erb, 1963). In the Kudiremalai area these latter beds are overlain by resistant, red sandstone (Erb, 1963). Wadia (1945) states that the Jaffna limestone appears to be similar in age to the Quilon and Workalli beds of the Quilon (south-west) coast of Travancore and Cochin in India, that belong to the Middle Miocene period (Erb, 1963).

Coastal Geomorphology

Sri Lanka is situated on a continental shelf that surrounds the island, on which is also situated the Indian subcontinent (Madduma Bandara, 2007) (Figure 2). This continental shelf has an average width of 20 km, narrowest in the south, and widens north of the Kalpitiya Peninsula to its widest surrounding the Jaffna Peninsula (Madduma Bandara, 2007). The shallowest part of the continental shelf is in the Palk Strait where Adam's Bridge and Pedro Banks are located. The area around Palk Bay has a shallow and flat basin with an average depth of around 9-15 m (Madduma Bandara, 2007). The outer margin of the shelf is approximately along the 100-fathom line (182.88 m) and from there the bottom drops off rapidly to over 1,828.8 metres. In fact, seas around Sri Lanka are, except for the Palk Strait, oceanic in nature. On the west, the Gulf of Mannar is over 1,820 metres deep.

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[1] fine-grained sedimentary rock composed of microcrystalline or cryptocrystalline silica

[2] A combination of a sedimentary rock composed of sand, as well as clay

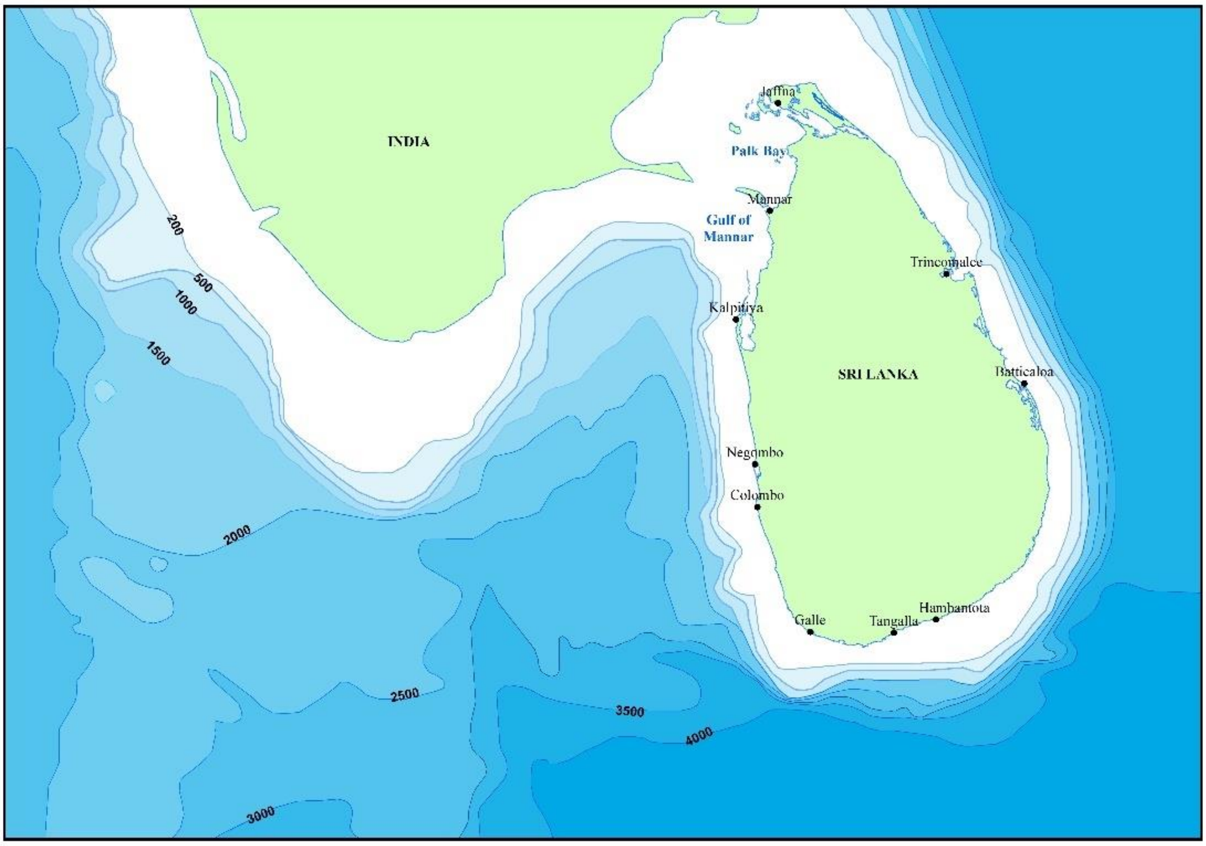

Figure 2. The Continental Shelf and Bathymetry around Sri Lanka
(Source: Ariyawansa, 2007)

Adam's Bridge is a chain of limestone islands covered with sand, as well as sand islands, stretching from India's Pamban Island (also known as Rameshawaram Island) to Sri Lanka's Mannar Island (Figure 3). Adam's Bridge, therefore, forms a causeway joining Sri Lanka and India, which are, at this point, approximately 32 km apart. The depth of water over the submerged part of Adam's Bridge averages well under 11 m, and this, in combination with the strong, monsoon-controlled currents, results in the formation of numerous shifting sand bars, which are characteristic of the area. Another elevation in the continental shelf extends from north-east of the Jaffna Peninsula to the vicinity of Karaikal and Calimere Point in India and is known as Pedro Bank.

South of Adam's Bridge, between Mannar Island and Karaitivu Island, a third rise in the shelf forms the once famous pearl fishing banks. The surface of the shelf at this point and elsewhere in the Palk Strait area, as evidenced by fragments of rock brought to the surface by trawlers operated by the fisheries research group, consists of limestone well-pitted with solution cavities (Erb, 1963).

Soils

Three types of soil — red-yellow latosols, grumüsol and solodized solonetz — have been identified from the Jaffna Peninsula and the islands around it. Of these three types, the type Calcic red latosols are the main soil type present in the region (Panabokke, 1996).

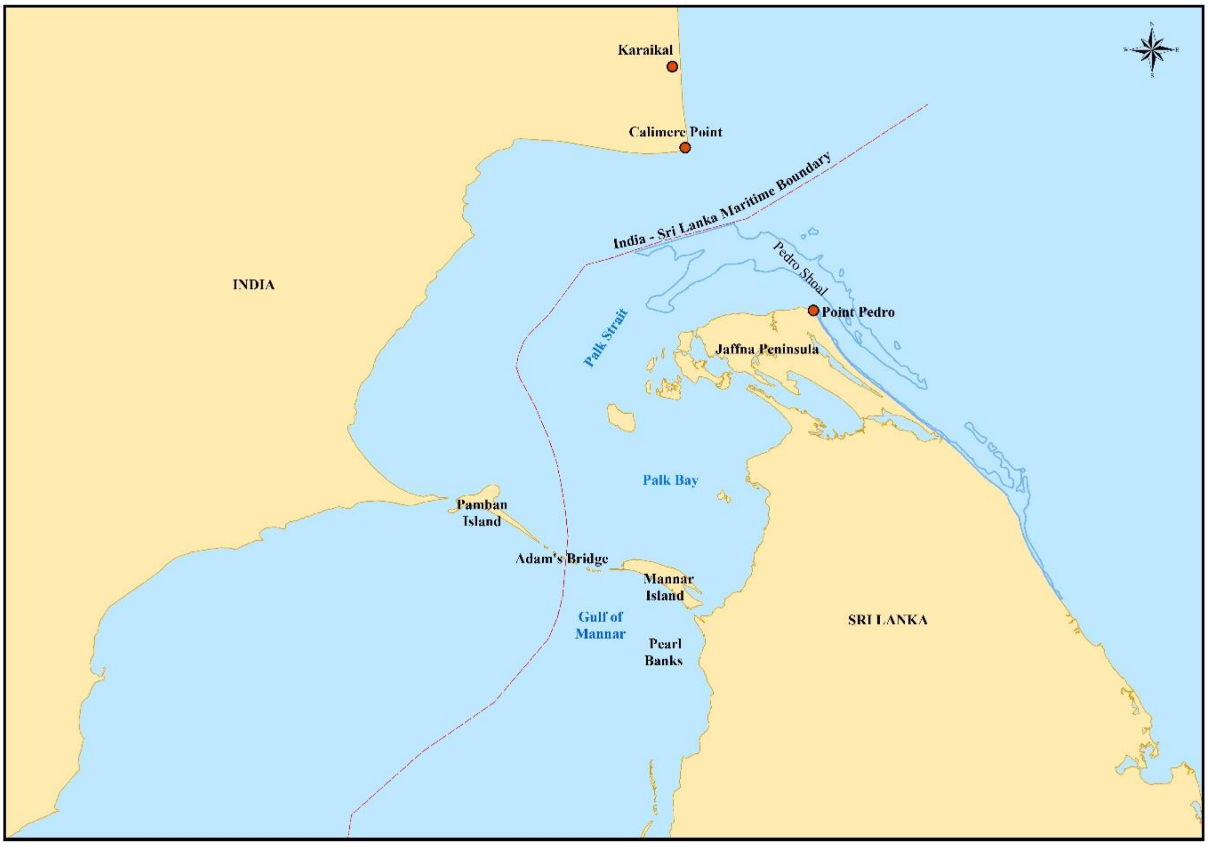

Figure 3. Adam's Bridge and its Surrounds

Red-yellow latosols (sub group: *calcic red latosol*): This type of soil is dominant in open shrub and grass-covered areas. These soil layers are formed from the parent material of the remnants of old alluvium and are mixed with limestone fragments (Miocene vacuolary limestone). Topographically, this soil type is found on a micro-mound, about 0.6-1.2 m above the flat limestone plain with numerous limestone outcrops (barrocal relief) varying between elevations of 6-9 m (Moorman and Panabokke, 1961). The calcic subgroup in the Jaffna Peninsula is by far one of the most intensively cultivated soils in the country. Extreme land pressure is compelling farmers to reclaim small plots of land from stony areas (Panabokke, 1996).

Grumüsol: This type of soil is dominant in areas covered with short grass savannahs, thorny scrubs and scattered trees. It was formed on the parent rock of ponded sub recent clayey-alluvium over decomposed quartzitic Archaean rock (Khondalite series). The topography is a flat, slightly digressional plain with distinct gilgai relief (Moorman & Panabokke, 1961).

Solodized Solonetz: This type of soil is dominant in areas covered with short grass with many bare spots, some halomorphic species and scattered trees (*Manilkara hexandra*). Parent material is semi-recent marine clayey alluvium. Topographically, it occurs on flat tidal plains that are no more inundated by the sea and have slight but distinct gilgai relief with an elevation up to six metres (Moorman & Panabokke, 1961).

Hydrology

The geomorphologic and hydro-geological setting of two types of aquifers — shallow karstic[3] and coastal sand — have been studied adequately and characterised, and their location and distribution patterns have also been delineated and mapped at different levels of intensity.

Shallow Karstic Aquifers of the Jaffna Peninsula: The whole Jaffna Peninsula is underlain by Miocene limestone formations, which are generally 100 to 150 m thick, distinctly bedded, well-jointed and highly karstified. The shallow aquifers of the peninsula occur in the channels and cavities (karsts) of this Miocene limestone. All the shallow groundwater found within the karstic cavities originates from the infiltration of rainfall, and this shallow groundwater forms mounds or lenses floating over the saline water. These water mounds or lenses reach their peak during the monsoon rains of November–December. According to Balendran et al., (1968), around 50% of the annual re-charge of rainwater (between 10 to 20 x 10^7 m^3) eventually drains out to sea and the remainder is used for agriculture and domestic purposes. Monitoring studies have confirmed a significant imbalance between the draw-off and re-charge rates, as reported by Balendran (1969).

Coastal Sand Aquifers: Three main types of coastal sand aquifers have been recognised and characterised in Sri Lanka, of which one is a shallow aquifer on coastal spits and bars and is found in the Kalpitiya Peninsula and the Mannar Island in the north-western region of Sri Lanka. These aquifers are re-charged mainly during the three to four months of rain in the wet *maha* season, and water in these aquifers is then collected in the form of a freshwater 'lens' floating above the denser saline water. The volume of fresh water in these aquifers usually expands during the rainy season and contracts during the dry season with fluctuating brackish and saline boundaries. Any over-extraction from these fresh water lenses results in the coning or entering of the underlying brackish water into fresh water (Panabokke & Perera, 2005).

Climate

The northern area is in the arid zone of the island and receives less than 1,250 mm of sharply seasonal rainfall (MoMD&E, 2016a) (Table 2).

Table 2. Air Temperature and rainfall variations within the northern districts
(Source: Northern Provincial Council, 2016)

District	Air Temperature (ºC)	Rainfall (mm)
Jaffna	26.3 - 30.9	1,811.8
Kilinochchi	25.0 - 30.0	1,178 - 1,822
Mannar	28.0 - 33.0	1,003
Mullaittivu	23.0 - 39.3	1,300 - 2,416

[3] An area of irregular limestone in which erosion has produced fissures, sinkholes, underground streams, and caverns (The Free Dictionary, 2017).

Historical Background

The north-western and northern coastal belt directly faces the lowermost tip of the Indian subcontinent, which is only 32 km across the narrow Adam’s Bridge. According to Swan (1983), the coastal belt of the Northern Palk Bay is subdivided into seven sections, each with distinctive physical attributes. These sections can be identified as Point Pedro–Thiruvadiniliyam, the Jaffna Islands, the lagoon country of Jaffna, the Pooneryn Peninsula, Palli kulam–Mantai, Mannar Island, and Adam's Bridge. These geographical distinctions are a direct cause of Sri Lanka’s biological, cultural, ethnic and political diversity. During the historical period, Roman, Arabic and Chinese merchants, travellers, explorers, scholars, religious dignitaries, royalty and pirates sailed from west to east using this narrow strip.

The area along the coastal belt and the islands of Palk Bay can be grouped under four categories based on archaeological and cultural significance:

(a) Paleontological and bio-geographical;
(b) Prehistoric human migration (Palaeolithic, Mesolithic and Megalithic);
(c) Folklore and chronicles; and
(d) Ancient settlements, ports and colonial forts.

These sites are inter-connected with the oceanographic nature (geomorphology, current pattern) of the Gulf of Mannar and Palk Bay (Goonatilake, 2007b).

Area of Paleontological and Bio-geographical Significance

During the Late Proterozoic (600 Mya), the Gondwana supercontinent separated, resulting in India and Sri Lanka shifting into the Asian region (Dissanayake & Chandrajith, 1999). During the Miocene period, the Tethys Sea that encroached the land surface between India and Sri Lanka converted the latter into an island for the first time (Senanayake, 1990). A Miocene limestone deposit underlines the whole of the Jaffna Peninsula and extends southwards along the north-western coast up to the Puttalam area as a narrow belt (Goonatilake, 2001). This deposit contains a varied assemblage of fossils representing foraminiferans, gastropods, echinoids, corals, calcified algae, and vertebrates (Cooray, 1984; Deraniyagala, 1958). During the 1960s, Deraniyagala described several fossil species from this deposit.

The Pleistocene has been identified as the period of radiation and speciation for Sri Lankan biota, while Holocene events also played a part in creating the present biogeographic patterns. This global phenomenon, termed the Holocene transgression, resulted in a sea level of approximately the same level as that can be seen today, around 35,000 YBP. However, between 35,000 YBP and the present, the sea level fell by about 130 m and rose again to the present level (Senanayake, 1990). The riverine floodplain in the North was created by two large rivers which joined together during the middle Pleistocene (Deraniyagala, 1958, Senanayake, 1990). They remained during the early and latter phases of the Holocene. One river was an extension of the Malwatu Oya (Aruvi Aru) while the other drained the watersheds of Kal Aru, Modaragam Aru, Kala Oya and Mi Oya. This large river created a series of riverine flats that existed for about 22,000 years. This land connection facilitated movement of fauna and flora, including humans, between Indian mainland and Sri Lanka during the Pleistocene to the early Holocene (Figure 4). This is supported by the fact that Pleistocene fossils of Sri Lanka (rhinoceroses, hippopotamuses, tigers, lions and gaur) are related to the Shivalik fossil fauna of India (Deraniyagala, 1958). According to Deraniyagala (1958), a flooded forest belonging to the Pleistocene period is located south of Karaitivu Island in the Gulf of Mannar, but it has not been excavated yet.

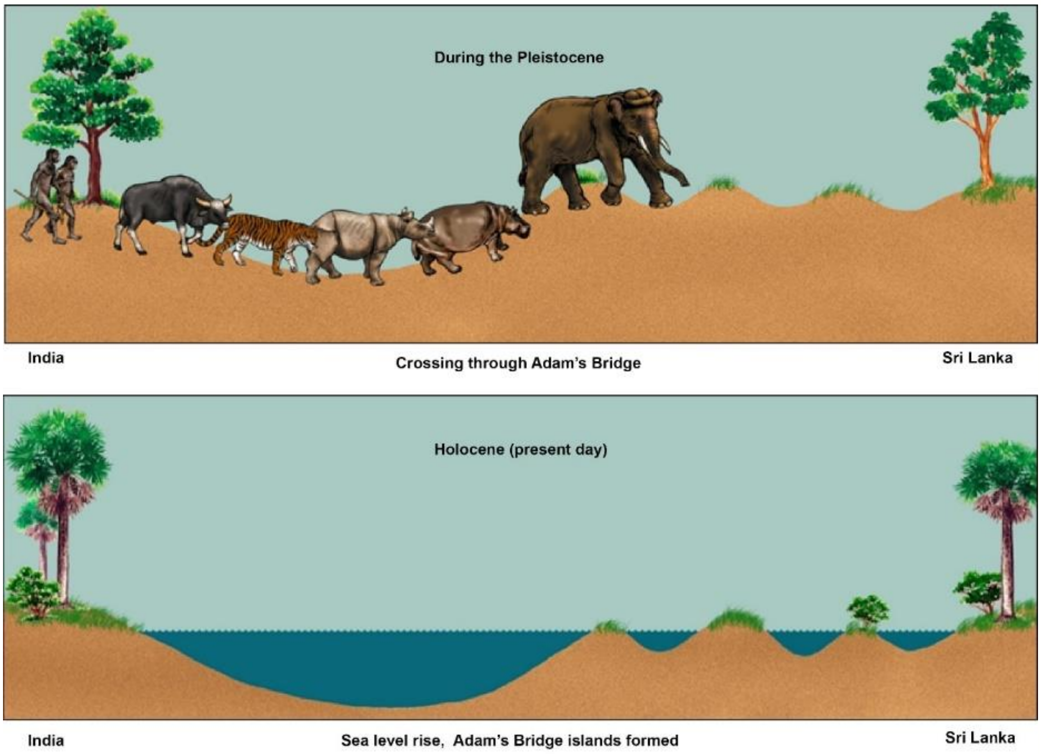

Figure 4. The migration of megafauna to Sri Lanka during the Pleistocene period
(Illustration: Thusitha Premaratne)

Area of Prehistoric Human Migration (Palaeolithic, Mesolithic and Megalithic)

During the Pleistocene and Holocene periods, humans migrated by crossing the land bridge and using water craft (boats and ships). A Palaeolithic tool discovered from Manikkai, close to Point Pedro in 1984, is believed to have belonged to the Palaeolithic man who was the earliest to come to the island. Upper Palaeolithic and Mesolithic human settlement sites were identified along the coastal belt, especially near the river mouths (Brohier, 1929; Carswell & Prickett, 1984; Goonatilake, 2006). However, neither proper excavations nor exploration has taken place at any of these sites or in any of the islands in the Palk Bay. A Megalithic cemetery bordering Modaragam Aru and Kala Oya, a few kilometres from the coast, was excavated by Deraniyagala (1957, 1958), and Begley (1967). According to Begley's findings, the burial ground covered an area of about 1.2–1.6 km^2 and an estimated 8000 burials are found at this site. It also contained the remains of about 10,000–12,000 humans (Sitrampalam, 1990).

Area of Folklore and Legends

The Indian name for Adam's Bridge is *Rama Sethu* and is a reference to the Indian legend

Ramayanaya. The bridge is supposed to have been built for the Indian Prince Rama to cross from India to Sri Lanka to rescue his wife Sita from Ravana, the king of Sri Lanka (Goonatilake, 2007b). The name Adam's Bridge was given by a British mapmaker and referred to the legend which said that Adam (the first man in Christianity and Islam who was banished from Eden and fell onto Adam's Peak) crossed from Sri Lanka along this bridge to go back to the Middle East via India.

Ancient Ports

According to the ancient chronicles *Deepavansa*, *Mahawansa*, and *Rajawaliya*, the Sri Lankan coastal belt of the Gulf of Mannar and Palk Bay goes back beyond the beginnings of Sri Lankan history to the legends and traditions associated with the original arrival of the northern Indian Prince Vijaya who founded the first civilised settlements on the island (Geiger, 1960). The exact location of the landing place — *Tambapanni* or *Tammanna Nuwara* — lies somewhere between the mouth of Moderagam Aru and Kudiremalai. The red soil of Kudiremalai lends credence to this belief, as the word *Tambapanni* is derived from the red soil (which stained the hands and feet of the travellers) and Kudiremalai has red soil (Figure 5).

Figure 5. Kudiremalai Point
(© Sriyanie Miththapala)

Also along the Mannar coastline, is Mantai (also called Manthai, and Mahatita, Maha tota, Matota, Maha tiththa in Sinhala), historically known as Manthottam/Manthoddam, which was an important port as far back as the 5th century BC, with traders from Greece, Rome, Arabia, Ethiopia, and Persia, as well as Japan and Burma, docking at this important port.

An ancient marine silk route ran through the Palk Bay and the Gulf of Mannar. Mantai Port, which played an important role in the exchange of goods between east and west, served as a main port of Sri Lanka for over 1500 years (Bandaranyake,1990). Therefore, the ports along the coastal passage of this region were linked with countries such as Arabia, China, Ethiopia, Greece, India, Java, Persia, Phoenicia, and Rome. During the colonial period, the Portuguese and Dutch invaders built several forts along the coastal belt because of the economic and security importance of the region. Because of the importance of these sites, the British rulers also used and maintained some of these ports. At present, there is an urgent need for marine archaeological studies to document the ancient maritime trade routes, ships and fishing communities, in this marine and coastal region.

The available evidence belonging to the Megalithic (BRW), early historic (rouletted ware, thin grey ware, BRW) and Medieval period (grey stoneware heavy jars, Chinese colour ware, Sasanian and Islamic ware) indicates that Mantai Port operated at its best during the period 6 BC to 14 AD. The relationship between this evidence and Chinese, Greek, Persian, Roman, Syrian and South Indian evidence has also been confirmed (Prematilake, 2003).

Tirukesvaram Kovil, currently located about 450 m from the coastal belt, is believed to have been situated inside the ancient Mantai Fort. Several inscriptions found on the island also support the claim that the ancient kovil was situated inside Mantai Port (Goonatilake, 2007b).

Mantai port also played an important role in the history of Sri Lanka. The South Indian Pandyan King Vijaya, invaded Sri Lanka at the end of the 13^{th} Century AD, *via* this port, which remained a part of the Pandyan Empire for two decades.

Additionally, two inscriptions by King Kassapa V indicate that four villages were donated to the two Buddhist monasteries located at Mantai. Parakramabahu I fought two naval battles here and built a fortress at a place called Pilavasu to retain his hold on this region (Goonatilake, 2007b).

The narrow channel between the island of Mannar and the mainland, and the Pamban Channel between the island of Rameswaram and the Indian mainland, may have allowed the passage of slightly large boats, but certainly not the ocean-going vessels used for long distance international trade. It is therefore evident that Mantai represented a terminus for westbound traffic. From this point, goods would either have been carried overland to the west, or trans-shipped through the Mannar Channel in smaller boats to large boats waiting out at sea.

The tides in the Gulf of Mannar and the tides in Palk Bay are very different: there is almost a twelve-hour difference in the tides, although they are close together. Because of this, there is a water depth differential on either side of Adam's Bridge, driving strong currents through the gaps between the islands. These currents change direction as the tide changes. This means that little boats would be carried through the channel in either direction simply by the tidal flow.

At the Mantai port, the surface mound is covered with open scrub and occasional trees, with a few Baobab trees (*Adansoniya digitata*) (Vandercone et al., 2004), a native of tropical Africa, which, by legend, was imported by Arab seafarers (Goonatilake, 2007b).

Another important ancient port is Uratota (Kayts), which was mentioned in the *Rajavaliya* during the reign of King Panduwasudeva in the 5th century BC. However, the first reliable evidence on the existence of Uratota, is the landing of the Vallabha expeditionary force at this port, also called Sukaratitta and Huratota, during the reign of Mahinda IV (956-972 AD).

In 1976, a hoard of Chinese porcelain and pottery was discovered on Kayts Island. It was clear from the location of the Chinese material in the heart of the dune, and the fact that it was in no way connected with traces of occupation, that the hoard was the result of a single deposit, probably as the result of a shipwreck or some other disaster. More than 6,000 shards found from the site were cleaned and sorted and it was possible to identify 443 vessels of more than 35 different types (Goonatilake, 2007b).

The ports of the Jaffna Peninsula were less commercially important in ancient times than Mantai, but they were used by South Indian invaders to make landings (Nicholas, 1963). Jambukola patuna port was used to bring the Sri Mahabo tree during the 3rd century BC. This was identified as Sambilturai, near Kankesanturai (Goonatilake, 2007b).

A map showing these ancient ports is presented below, in Figure 6.

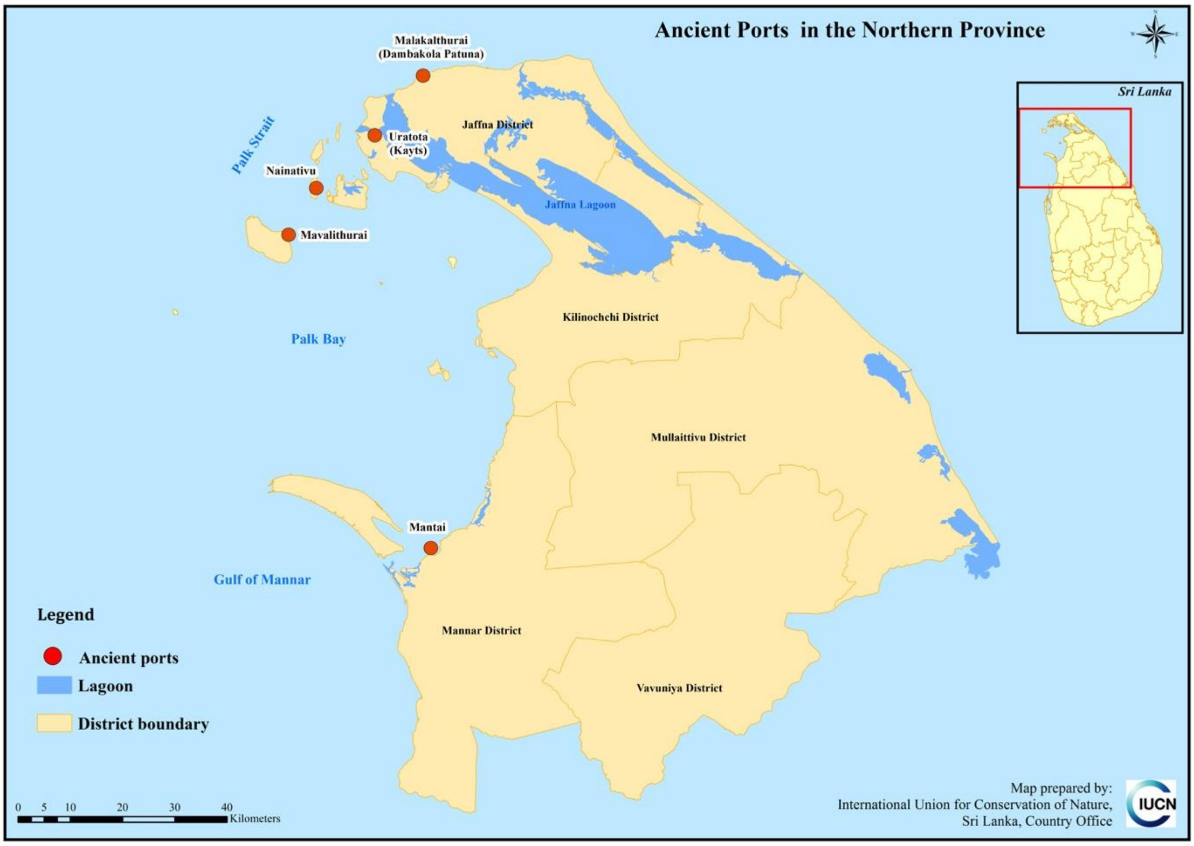

Figure 6. Ancient ports of Northern Sri Lanka
(Source: Ponnampalam, 1987)

Areas Recorded in Ancient Chronicles

Ptolemy was the first foreigner to prepare a detailed map of Sri Lanka (then known as Taprobane) during the 2nd century AD. However, he had not visited Sri Lanka and he collected his material from sailors and merchants. The ports, towns, marts, and capes important to sailors and merchants were included in his descriptions. Several place names which Roman and Greek merchants sailed to in the island could be identified along the Gulf of Mannar and the Palk Bay sea coast. These were Anarismoundou for Antarapara smudda (now called Kalpitiya Peninsula), Hipporos for Acha giri or Horse Mountain (now called Kudiremalai), Margon for Magana (now called as Pukkulam), the River Phasis for an ancient river that flowed through Pelivapi gama (now called as Malvatu Oya or Aravi Aru), Mouduuttou for Matota (now called Mantai), and Galiba for Kalmunai in Jaffna (meaning mountain people) (Weerasinghe, 1985).

The reefs *of Musal tivu, Valai tivu*, and others are a line of reefs spreading between Silavatturai and Vankalai and their extensions across the Gulf. On these reefs, there are pearl banks on which pearl oysters thrived in association with corals and sponges. Most of these banks lie 10-20 km offshore and in water depths of 10-20 m. These banks have attracted eastern and western merchants to the area since early historic times (Figure 7). Currently, however, these banks have been over-fished.

The archaeological or cultural importance of this area has not been explored or excavated yet (Goonatilake, 2007b).

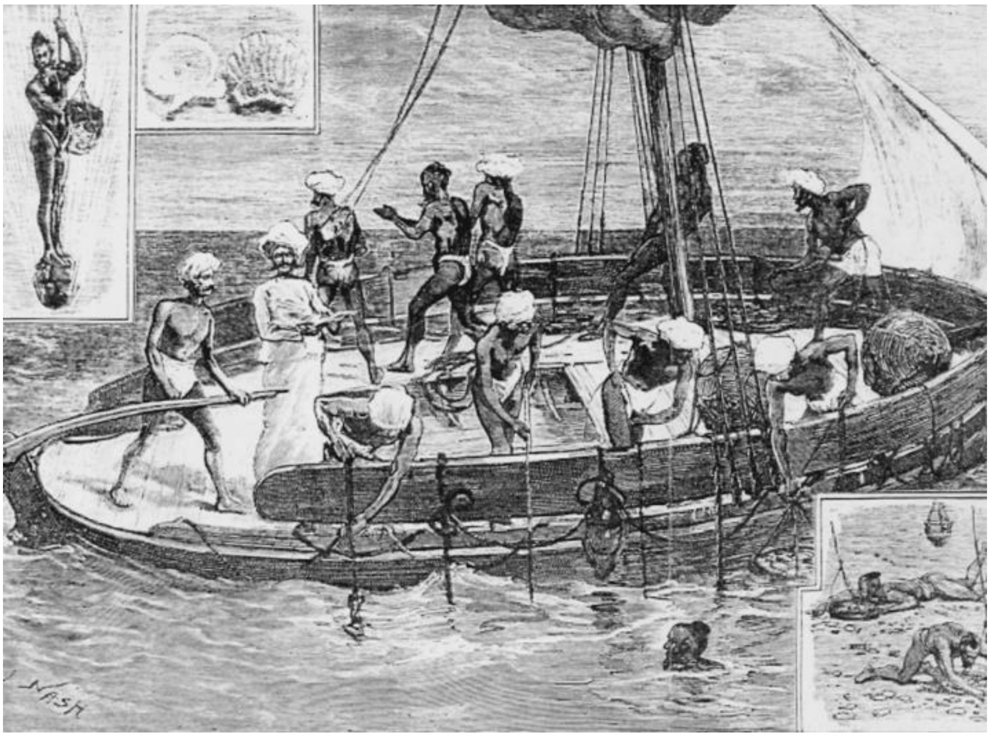

Figure 7. Pearl-fishery in Ceylon (The Graphic, October 22, 1887)
(Source: http://anywater.ru/pubs/the-history-of-freediving/)

Ancient chronicles such as *Sihalavaththupakaranya* and *Rasavahinya* mention a place named Ariyala at Nagadipa in the present Velanai (Kayts) Island. The story is that the person called Ariyalatissa offered an almsgiving to bhikkhus (monks) from Mandapadeepa (Mandaitivu) and Puvagudeepa (Pungudutivu) (Buddhatta, 2006).

Another ancient Buddhist site mentioned in the Nampotha as *Karadivayina* was later changed to *Kaaraitheevu*. The name change occurred in the late 19th century after the construction of the Punnalai causeway but was accepted officially only in 1922. Dutch records refer to the island as *Nieuw Amsterdam*. However, its oldest name was *Kaaradeepa*, which was also referred to as *Ahideepa*, as stated in the Buddhist Akitti Jaathaka, which relates the story of the Buddhist recluse Akitti who came to *Kaaradeepa*. Akitti lived on a diet of Kaara leaves. Hence, the name may have arisen from *kaara*, a thorny shrub. The Pali name *kaara* was used even in South Indian inscriptions. Further, Tamil inscriptions (Udayendiram copper plates) refer to kaara trees (*Webera tetrandra;* Tamil: *karai*). Even at present, an ancient Buddhist site known as *Vearppiddi* (Veherapitiya), is found in Karaitivu Island. In addition, Megalithic burial sites are found at Chaththirantai (Chatrangana is an area for hoisting flags) in Karaitivu Island.

Legend holds that the Buddha visited Nagadeepa. The ancient reference seems to be to the whole of the Jaffna Peninsula, where a vihara and a city centre existed. This was an important territory of the Naga tribe in pre-Buddhist times. The capital of Nagadeepa was Nagapura, or Nakpur which later became known as Nallur (Dharmawardana, 2006). Thus, modern Nallur was the capital of the Nagas. They worshipped the Naka Deva, or Natha Deva. An inscription at Mihintale refers to this Naka Indra. The Naka Deva was adopted by Hindus, who built a temple named Naka-poshani, while Buddhists also adopted the Natha Deva as a Bodhisatva (Dharmawardana, 2006).

The island presently called Pungudutivu was referred to in Mahakam's Nampotha as *Pongardiva* which is also documented by Baldaeus (1658). This is an ancient name and possibly based on a type of tree known as Puvangu (*Myristica horsfieldia*, and *Aglaia roxburghiana*) (Dharmawardana, 2006).

The ancient Uratota, presently known as Kayts was, also referred as *Uraturai* and *Urkavalthurai*. It is an ancient, pre-Christian Buddhist site. It is referred to in the Nampotha as Tannidivayina. It was a major naval base under Parakramabahu I (12th century AD). The military history of the Uratota is mentioned in the Nainativu inscription (written partly in Tamil) installed by King Parakramabahu. It is also mentioned in the *thovila* ritual *Kohombakankariya*. During the Portuguese period, it was known as Cais [meaning quay], which gave rise to its current English name. Baldaeus (1658) used the name 'Ourature' (Dharmawardana, 2006) for Kayts Island.

Areas of Historical Colonial Ruins and Buildings (Portuguese and Dutch Forts and Churches)

Forts

There are several Portuguese and Dutch forts located beyond Arrippu in Mannar. Among those that still have remains are:

- Jaffna Fort — originally built by the Portuguese as Nossa Senhora dos Milagres in 1560, and strengthened by the Dutch around 1680;
- Hammenhiel Fort — originally built by the Portuguese as Fortaleza do Cais dos Elefantes and later taken over by the Dutch in 1658. Hammenhiel means 'heel of ham' in Dutch, which the Dutch thought resembled Sri Lanka. It is situated between Karaitivu and Kayts (Figure 8);
- Fort Eyrie (Urundi Fort or Kayts Fort) — built by the Portuguese but taken over by the Dutch and then neglected;
- Pooneryn Fort — probably built originally by the Portuguese and later taken by the Dutch;
- Fort Beschutter — built by the Dutch near the village of Kovilvayal;
- Fort Elephant Pass — built by the Dutch on the northern shore of the lagoon on the Jaffna Peninsula;
- Mannar Fort —built by the Portuguese in 1560, taken over and rebuilt by the Dutch in 1686 (Fabry et al., 2006).

Churches

During colonial times, the Portuguese, Dutch and British spread Christianity throughout the region, so that churches are easily visible. These include:

- The Groote Kerk or Krurys or Dutch Church inside Jaffna Fort, only remains of walls are found now, built in 1730, destroyed during the civil war;
- St Mary's Cathedral, built in 1789 by the Dutch, found in Gurunagar;
- Vaddukoddai Portuguese Church, built originally by the Portuguese in the 1660s, later modified by Dutch commander Laurens Pyls Anno in 1678. It then passed to the American Ceylon Mission and is now the seat of the Jaffna Diocese of the Church of South India;
- The ruins of a Portuguese Church at Atchuvely, (construction date unknown), but with typical Portuguese architecture; and
- St. Lucia's Church in Pallimunai, constructed using limestone (Fabry et al., 2006).

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Figure 8. Sunset at Hammenhiel Fort seen from Karaitivu
(© IUCN/Sampath de A. Goonatilake)

Chapter 2: Objectives of the Study

Western Reef Egret (*Egretta gularis*), Mannar Island © Sriyanie Miththapala

Goal of the Study

The goal of this study was to assess the biodiversity of the coastal islands in the North, and the lagoon ecosystems found in the northern coastal area, to support the formulation of a strategic development planning framework that takes into consideration the need for environmental safeguards and conservation of biodiversity. In addition, this study aims to assess the resource base for the promotion of sustainable tourism.

Specific Objectives of the Study

The specific objectives of the study are to:

- Document site-specific information on habitats, species; and the potential for sustainable tourism for the islands and lagoons in the northern coastal belt; and
- Identify threats to the biodiversity of the area, identify comprehensive studies that are essential to further understand the resource base, define potential carrying capacities for each island and provide-detailed recommendations to conserve the biodiversity of the area.

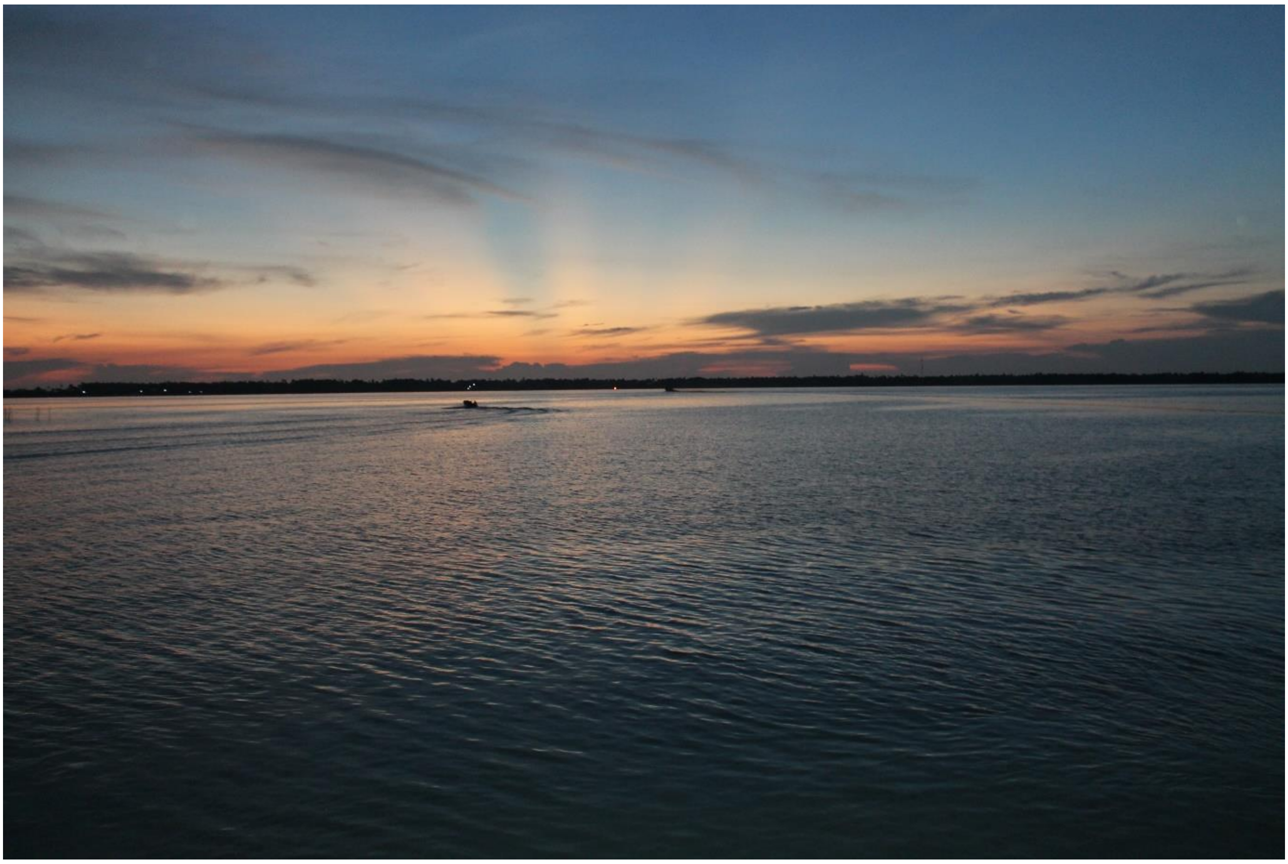

Figure 9. Sunset over the Jaffna Lagoon
(© IUCN /Sampath de A. Goonatilake)

Chapter 3: Methodological Approach


Field assessments, Kakaretivu © IUCN/Sampath de A. Goonatilake

Methodology Used for the Terrestrial Biodiversity Survey

Initially, a desk review of all published reports pertaining to fauna, flora, climate, geography etc. in the study area was carried out to document the available information, as well as to identify gaps in information that need to be addressed during the detailed field surveys. This review was followed by two field visits to collect information on identified data gaps. These field visits were carried out during the months of November 2015 and March 2016, by a group comprising officers from the UDA, SLTDA, CC&CRMD, MEPA and IUCN.

During these field visits, the primary focus was to collect information on habitats and species observed in each habitat, document site-specific threats to biodiversity, and identify potential sustainable tourism attractions in each site surveyed, with respect to biodiversity, archaeology or any other significant cultural or social attribute.

Twenty-one islands, five coastal stretches and four lagoons were surveyed during these two field visits, through rapid assessments[4] (Figure 10). This study used rapid biodiversity assessments to identify selected groups of flora and fauna present in the area.

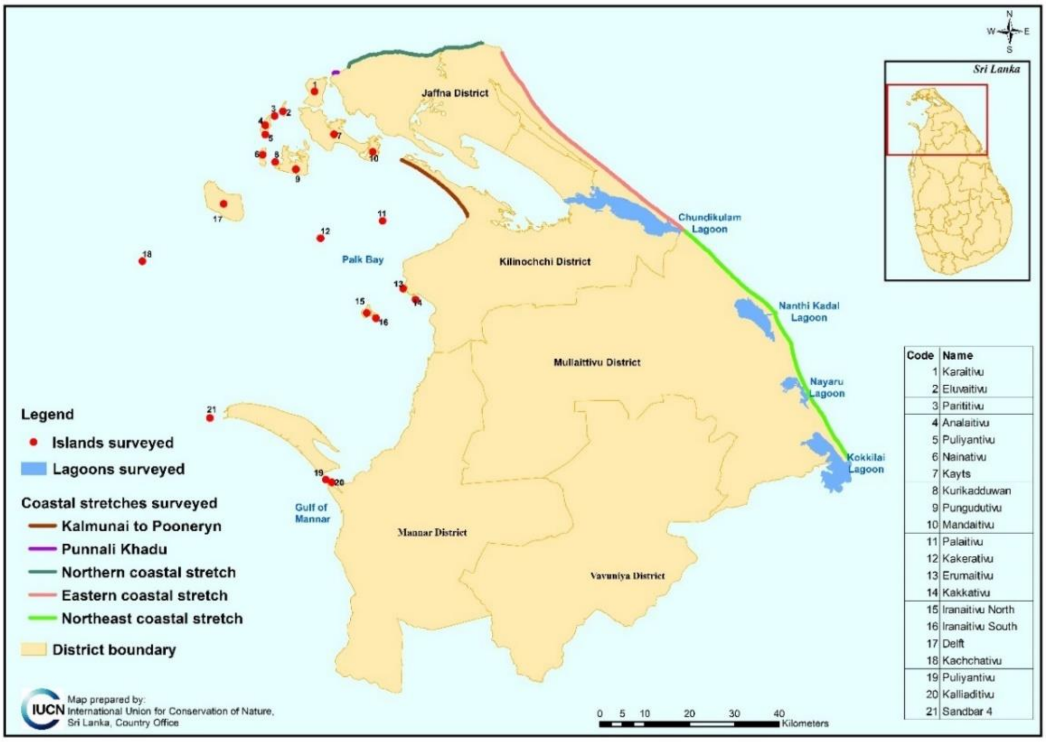

Figure 10. Islands, coastal stretches and lagoons in the Northern Province sampled during this survey

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[4] *Standard field research takes years, but political leaders will not usually wait that long to make decisions affecting the most biologically important areas of Earth. [Rapid Assessment Programmes] RAP gathers relevant scientific information quickly enough to aid in protecting such places from irreversible damage that can occur on a very short time scale.'* (Source: Murray Gell-Mann, Professor, Santa Fe Institute, and 1969 Nobel Prize recipient)

Flora Survey

A rapid line transect method was used to assess terrestrial floristic species richness in each island/inland coastal site. Forty-five line transects were carried out at one-kilometre intervals.

Because there were different vegetation types and land use patterns between one island/site and another, the length of transects varied and depended on the vegetation types and extent of land use patterns of each island. Apart from transect surveys; visual observations on all islands/sites were also used throughout to obtain inventories of floristic diversity. All known species observed during the survey were recorded and photographed. Specimens of unknown species were collected using standard herbarium techniques and herbarium sheets were prepared for later identification. Standard texts were used for nomenclature (Table 3).

Fauna Survey

A biodiversity assessment of terrestrial fauna was carried out on each island. Fauna were sampled within each island using the Visual Encounter Survey (VES) method. Vertebrate groups found within each site (amphibians, reptiles, birds and mammals), as well as selected invertebrate groups (scorpions, land molluscs/land snails, dragonflies and butterflies), were recorded as part of the faunal assessment. Aquatic assessments of freshwater fish and molluscs were not carried out because of time limitations. Each observed habitat and ecosystem type was sampled *via* a series of transects. Animal species observed opportunistically outside each transect were also recorded separately to ensure that the field data gathered was as comprehensive as possible.

Both direct and indirect observations (animal signs such as pellets, tracks, sounds and food remains) were used to document animals, especially mammals present within the study area. Bird identification was carried out directly, as well as indirectly by their calls. The identification and classification of faunal species were based on the most recently published field guides and taxonomic keys (Table 3) (Figure 12).

Table 3. Taxonomic guides and other publications used for species identification and nomenclature

Subject	Taxon	Source
Taxonomic Identification	Flora	Ashton et al., (1997); Dassanayake & Fosberg (1980 - 1991); Dassanayake et al., (1994 - 1995); Dassanayake & Clayton (1996 - 1999); Dassanayake, M. D., Clayton, W. D. and Shaffer-Fehre, M. (2006); de Vlas & de Vlas (2008).
	Invasive species	MoMD&E, (2016b)
	Freshwater crabs	Bahir & Yeo (2005)
	Scorpions	Kovařík et al., (2016)
	Land snails	Naggs & Raheem (2000)

Subject	Taxon	Source
	Dragonflies	Bedjanic et al., (2007); Bedjanic et al., (2014)
	Butterflies	D' Abrera (1998); van der Poorten & van der Poorten (2016); Jayasinghe et al., (2015)
	Freshwater fish	Goonatilake (2007a); De Silva, et al., (2015)
	Amphibians	Manamendra-arachchi & Pethiyagoda (2006)
	Reptiles	Somaweera (2006); Somaweera & Somaweera (2009)
	Birds	Harrison (1999); Warakagoda, et al., (2012)
	Mammals	Phillips (1935, 1981a, b,c); Kotagama & Goonatilake (2013)
Nomenclature	Flora/Fauna	Senaratna (2001); MoE (2012)
Redlist Status	All	MoE (2012); IUCN (2017)

Methodology Used for the Marine Biodiversity Survey

A rapid coral reef survey was carried out in the coastal waters of Palk Bay and Palk Strait. The aim of the survey was to collect information on reef quality by identifying good coral reef sites that can be used for tourism related activities and to identify reefs that need protection. The survey was conducted around the islands of Iranaitivu, Erumaitivu, Kakkativu, Kakerativu, Palaitivu, Mandaitivu, Pungudutivu, Kachchativu and Delft and the fringing reefs from Kayts Island to Point Pedro on the northern coast of the Jaffna Peninsula (Figure 11). The survey was conducted from 1st to 8th November 2015 and from 4th to 10th March 2016. Underwater visual estimation methods, as specified in the Survey Manual for Tropical Marine Resources (English et al., 1997), were used to assess the quality of the reef habitats. The survey was carried out by snorkelling at several coral reef sites around islands and on the fringing reefs along the mainland coast. Inventories of species were limited to hard and soft corals, reef fish and large invertebrates such as molluscs, echinoderms and crustaceans.

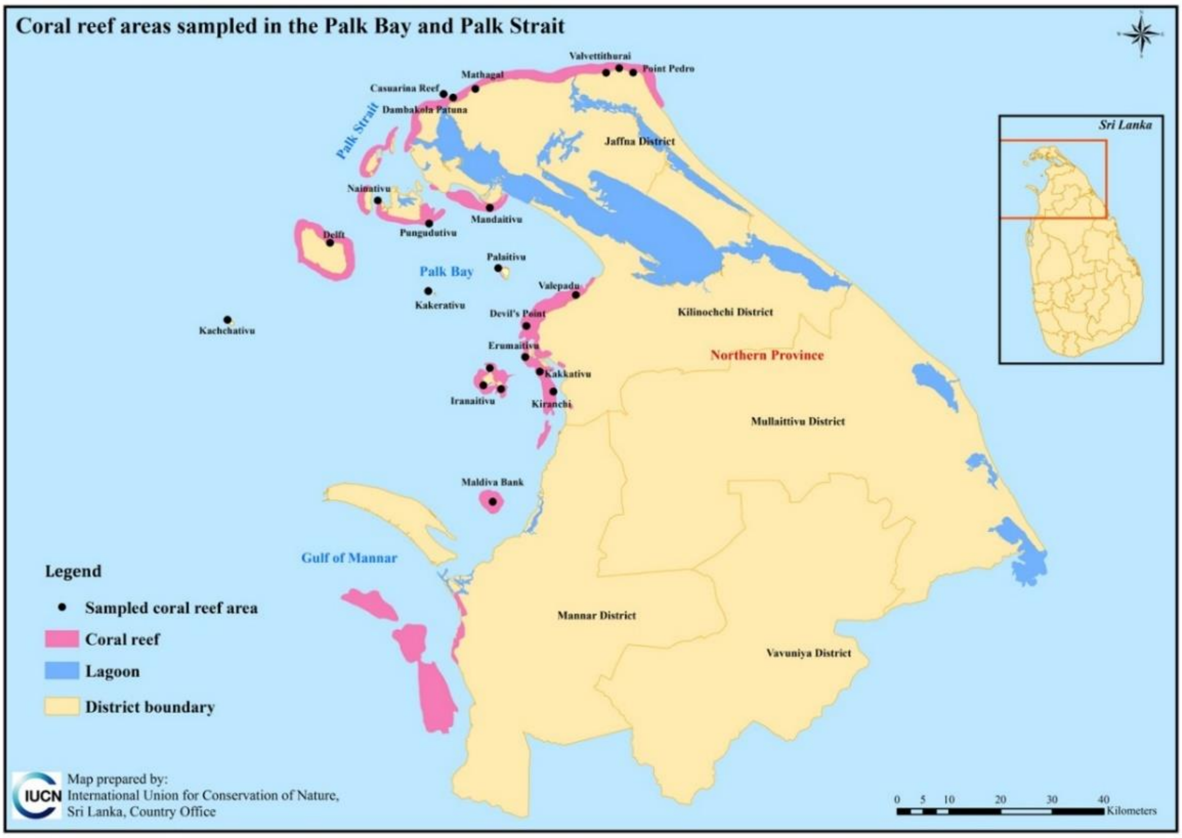

Figure 11. Coral reef areas sampled in Palk Bay and Palk Strait

Figure 12. Top: Examining the island map, Iranaitivu South; bottom: Field assessment Kachchativu

(Top © IUCN/Sampath de A Goonatilake; bottom: © IUCN/Naalin Perera)

Figure 13. Top: The team disembarking at Palaitivu; bottom: Returning from marine surveys

(© IUCN/Sampath de A Goonatilake)

Chapter 4: Results of the Study

Common garden lizard (*Calotes versicolor*), Iranaitivu North
(© IUCN/Sampath de A. Goonatilake)

Ecosystem Diversity in the Study Area

Terrestrial and Coastal Ecosystem Diversity

Based on field observations, terrestrial ecosystem diversity[5] of the islands and the coastal zone of the northern area can be divided generally into three major categories, namely, natural, semi-natural and man-made ecosystems.

Natural Ecosystems

The natural vegetation of this area and its distribution has been shaped by its semi-arid climate and coastal saline conditions. For example, natural coastal ecosystems — such as mangroves, salt marshes, sandy seashores and seashore scrublands — were distributed towards more saline and coastal/sandy conditions, while arid mixed evergreen forests were found more inland, in less saline conditions.

Arid Mixed Evergreen Forests

The main tree/shrub dominant vegetation in the islands was arid mixed evergreen forests, which were found mostly as isolated fragments surrounded by grasslands. These forests are also called thorn scrubs and this name is derived from the spiny characteristics of the stems of species found in these scrubs — such as *Dichrostachys cinerea*, *Flueggea leucopyrus*, *Azima tetracantha*, *Toddalia asiatica*, *Carissa spinarum* and *Scutia myrtina*. Thorn scrubs are characterised structurally by the presence of a few, scattered, short trees with low and spreading crowns in the uppermost stratum, consisting mainly of species such as *Salvadora persica*, *Manilkara hexandra*, *Thespesia populnea* and *Ziziphus mauritiana*.

As a continuous layer, shrubs are more abundantly spread than trees and are mainly composed of *Senna auriculata*, *Dichrostachys cinerea*, *Flueggea leucopyrus*, *Carissa spinarum*, *Calotropis gigantea*, *Atalantia ceylanica*, *Gmelina asiatica*, *Diospyros vera*, *Ziziphus oenopila* and *Capparis* spp.

The ground layer of thorn scrub ecosystems consists of a herbaceous plant community that is composed mainly of *Tridax procumbens*, *Euphorbia rosea*, *Phyla nodiflora*, *Launaea sarmentosa*, *Leucas zeylanica*, *Boerhavia diffusa*, and *Hybanthus enneaspermus*.

Many plant species in thorn scrubs show xerophytic characteristics.

[5] Ecosystem categories are as given in MoMD&E (2016a)

Fauna found in this ecosystem include the Vulnerable land snail *Cryptozona semirugata*; dragonflies, such as the Pruinosed bloodtail (*Lathrecista asiatica*) and the Green skimmer (*Orthetrum sabina*); butterflies, such as the Tailed jay (*Graphium agamemnon*) and Small salmon Arab (*Colotis amata*); amphibians, such as the Common bull frog (*Kaloula taprobanica*) and Balloon frog (*Uperodon systoma*); reptiles, such as the Star tortoise (*Geochelone elegans*) and Common garden lizard (*Calotes versicolor*); birds, such as the Grey francolin (*Francolinus pondicerianus*) and Green bee-eater (*Merops orientalis*) and mammals, such as the Grey langur (*Semnopithecus priam*) and the Grey mongoose (*Herpestes edwardsii*).

See Figure 14 for a photograph of this ecosystem.

Palmyra Woodlands

The Palmyra palm (*Borassus flabellifer*) has long been an economically and culturally important tree species in the Jaffna Peninsula. Even though Palmyra is associated generally with human settlements, it has spread naturally into natural habitats and dominates some scrublands, which are therefore, referred to as 'Palmyra Woodlands'. Field observations showed there were some modifications in the structure and composition of Palmyra woodlands compared to natural thorn scrubs found in the area. Scattered scrub patches were distributed unevenly as the undergrowth of Palmyra woodlands. A few trees and herbs are found among the scrub vegetation. Although Palmyra is the dominant species, others — such as *Phoenix pusilla*, *Flueggea leucopyrus*, *Morinda coreia*, *Azadirachta indica*, *Cissus quadrangularis*, *Dodonaea viscosa*, *Ziziphus oenopila*, *Jatropha glandulifera*, *Carissa spinarum*, *Ficus benghalensis*, *Dichrostachys cinerea*, *Canthium coromandelicum*, *Ehretia microphylla*, *Toddalia asiatica* and *Amorphophallus sylvaticus* were found commonly among this vegetation type. (See Figure 14 for a photograph of this ecosystem.)

Fauna found in Palmyra woodlands include dragonflies, such as the Blue Pursuer (*Potamarcha congener*) and Sociable glider (*Tramea limbata*); butterflies, such as the Little orange tip (*Colotis etrida*) and African babul blue (*Azanus jesous*); reptiles, such as Devaka's fan-throated lizard (*Sitana devakai*) and Saw-scaled viper (*Echis carinatus*); birds, such as the Asian palm swift (*Cypsiurus balasiensis*) and Black drongo (*Dicrurus macrocercus*) and mammals such as the Antelope rat (*Tatera indica*) and Black-naped hare (*Lepus nigricollis*).

Seashore scrublands

Seashore scrublands occupy the interface between inland and coastal ecosystems of the islands. The structurally discontinuous vegetation of seashore scrublands is a mixture of some inland flora, some mangrove-associated flora, some sand dune flora and some plant species that are characteristic of seashore scrublands. Fleshy and thick stems or leaves that help the plants to store water and survive in harsh conditions are found in some of the shrub species of this ecosystem. *Scaevola taccada*, *Pemphis acidula*, *Dichrostachys cinerea*, *Flueggea leucopyrus*, *Calotropis gigantea*, *Guettarda speciose* and *Thespesia populnea* were the dominant species observed in the seashore scrubland ecosystems. *Aloe vera* and *Opuntia dillenii* were exotic herbs that were observed in this ecosystem.

See Figure 15 for a photograph of this ecosystem.

Fauna of this ecosystem includes butterflies, such as the Tawny coster (*Acraea violae*) and Common sailor (*Neptis hylas*); reptiles, such as the Rat snake (*Ptyas mucosa*) and Land monitor (*Varanus bengalensis*); birds, such as the Ashy-crowned sparrow lark (*Eremopterix grisea*) and Red-vented bulbul (*Pycnonotus cafer*); and mammals such as the Brown and Grey mongoose (*Herpestes fuscus* and *H. edwardsii*, respectively).

Dead Coral Beaches

At first, although dead coral beaches and seashore areas appear to be barren and without vegetation, they supported several species of plants — such as *Spinifex littoreus*, *Ipomoea pes-capre, Launaea sarmentosa, Citrullus colocynthis* and *Bulbostylis barbata,* which grow in isolated clumps. High temperatures during the day, incessant salt spray and lack of a fertile substrate make it impossible for other plant life to be sustained in these habitats. Beach sediment and organic debris are continually flushed by sea water into the spaces within these rocky habitats. This creates an ideal environment for some species of marine fauna. The rocky areas are also occupied by burrowing animals, such as crabs and worms. These animals hide among coralline rocks to avoid detection by predators and escape the strong wave action. (See Figure 15 for a photograph of this ecosystem.)

Fauna found in this ecosystem include reptiles, such as Bibron's sand skink (*Eutropis bibronii*); birds such as the Common sandpiper (*Actitis hypoleucos*), Great crested tern (*Sterna bergii*), Little egret (*Egretta garzetta*) and Western reef egret (*Egretta gularis*); as well as several species of littoral zone molluscs and arthropods.

Sand Dune Scrublands

Sand dune scrublands are very dynamic coastal ecosystems, highly influenced by wind and tidal actions. The eastern coast of Jaffna Peninsula is an area of high winds and is home to fairly large extents of sand dunes.

Wind-blown accumulations of sand create dunes that maintain a unique structure and composition of flora and fauna that result in coastal sand dune scrublands. Sand dune scrublands cover these accumulated sands in dunes and increases their stability. Starting from eastern Point Pedro, discontinuous sand dunes extend along the coast up to Chundikulam. In addition, in the Pooneryn and Palk Bay areas, are found huge sand dunes. *Calotropis gigantea*, *Borassus flabellifer*, *Bauhinia racemosa*, *Caesalpinia bonduc*, *Flueggea leucopyrus*, *Cissus quadrangularis* and *Aloe vera* are common plants found on sand dunes. In addition to natural sand dune scrubs, a large extent of sand dunes associated with human settlements has been planted with *Casuarina equisetifolia*. (See Figure 16 for a photograph of this ecosystem.)

Fauna of these scrublands include butterflies such as the Small salmon Arab (*Colotis amata*) and Common gull (*Cepora nerissa*); reptiles such as Devaka's fan-throated lizard (*Sitana devakai*) and Land monitor (*Varanus bengalensis*); birds such as the Common kestrel (*Falco tinnunculus*), Paddyfield pipit (*Anthus rufulus*) and Green bee-eater (*Merops orientalis*); and mammals such as the Black-naped hare (*Lepus nigricollis*) and Antelope rat (*Tatera indica*).

Figure 14. Top: Arid mixed evergreen forests at Kakerativu Island; bottom: Palmyra woodlands at Karainagar
(© IUCN /Sampath de A. Goonatilake)

Figure 15. Top: Beach front scrub at Kakerativu Island; bottom: Coral rock and seashore vegetation at Parititivu Island
(© IUCN/ Sampath de A. Goonatilake)

Sandy Seashores

This vegetation type has a very simple structure and species composition. Only salt-tolerant herbaceous species (up to 30 cm in height), such as *Citrullus colocynthis, Ipomoea pes-capre, Launaea sarmentosa, Spinifex littoreus, Catharanthus roseus*, *Sesuvium portulacastrum*, *Atriplex repens, Lablab purpureus* and *Pupalia lappacea* were observed in this habitat. Often, pure populations of *Spinifex littoreous* provided shelter in the highly unstable seashore, exposed to heavy winds. These sandy areas attract a host of burrowing animals — such as bivalves, crabs and other marine invertebrates. These animals hide in the sand in order to escape from predators and strong waves.

Many avian species — such as the Kentish plover (*Charadrius alexandrines*), Lesser sand plover (*Charadrius mongolus*), Eurasian curlew (*Numenius arquata*), Lesser crested tern (*Sterna bengalensis*) — that prey on these invertebrate species can be seen feeding in this habitat type.

See Figure 16 for a photograph of this ecosystem.

Mangroves and Associates

The Jaffna Lagoon opens into Palk Bay and there are mangroves on the shores of both the mainland and the islands of Palk Bay. As the dominant species of this ecosystem, *Avicennia marina* was widely distributed and was found associated frequently with salt marshes in the area. The height of the clumps of *Avicennia marina* rarely extended over one metre and thus, formed a stunted mangrove community. In addition to *Avicennia marina,* some true mangrove species such as *Rhizophora mucronata*, *Bruguiera cylindrica*, *Ceriops tagal* were found within mangrove ecosystems. *Sonneratia alba* was rarely observed near a few tidal flats in the islands. Apart from the salt marsh species associated with mangroves, some species considered to be mangrove associates — such as *Thespesia populnea*, *Clerodendrum inerme*, *Premna obtusifolia*, *Pemphis acidula* and *Excoecaria agallocha* were also observed among the mangrove habitats found along the sea shore or islands. See Figure 17 for a photograph of this ecosystem.

Dragonflies, such as the Marsh skimmer (*Orthetrum luzonicum* and Orange-winged groundling (*Brachythemis contaminata*); butterflies such as the Lemon emigrant (*Catopsilia pomona*) and Leopard (*Phalantha phalantha*); reptiles such as the Common garden lizard (*Calotes versicolor*) and Dog-faced water snake (*Cerberus rynchops*); birds such as the White-throated kingfisher (*Halcyon smyrnensis*), White-bellied sea-eagle (*Haliaeetus leucogaster*) and House crow (*Corvus splendens*) and mammals such as the Flying fox (*Pteropus giganteus*) and Sri Lanka toque monkey (*Macaca sinica*) are found in mangroves.

Mangrove ecosystems provide breeding and feeding grounds for several commercially important fin fish and shellfish.

Figure 16. Top: Sand dune scrub; bottom: Sandy seashore vegetation
(© IUCN/ Sampath de A. Goonatilake)

Figure 17.Top: Mangroves and associates at Puliyantivu Island; bottom: Salt marshes at Kayts
(© IUCN/ Sampath de A. Goonatilake)

Figure 18. Top: Mat of cyanobacteria in a tidal flat, Mannar Island; bottom; a Common redshank (a common winter visitor) feeding on invertebrates on a submerged tidal flat, Mannar Island

(© Sriyanie Miththapala)

Salt Marshes

Salt marshes are coastal wetlands in the upper inter tidal zone, which are subjected to regular inundation by seawater because of tidal action. Several extensive salt marshes can be seen in the islands of Palk Bay and some of these were associated closely with clumps of *Avicennia marina*. Salt-tolerant herbaceous plants, belonging to the family Amaranthaceae, dominated salt marshes in the area. *Suaeda maritima* and *Salicornia brachiata* are the commonly occurring species in this ecosystem. *Halosarcia indica* was observed as few small isolated populations. *Suaeda monoica* was rarely observed in the area and it differed from other salt marsh species by its bushy habit. Salt marshes are found on higher ground than tidal flats.

See photograph of this ecosystem in Figure 17.

Found in salt marshes is a large number of macro and micro invertebrate species. Feeding on these invertebrates are birds such as the Little egret (*Egretta garzetta*), Black-winged stilt (*Himantopus himantopus*), Common redshank (*Tringa totanus*) and Green sandpiper (*Tringa ochropus*).

Tidal Flats

Along coastlines, there is a range of coastal ecosystems: sand dunes; mangroves; salt marshes; tidal flats; lagoons and estuaries. Each of these ecosystems is interconnected and interdependent on others and forms a mixture of interconnected environments (Kallesőe et al., 2008). In the Jaffna Peninsula, mangroves, salt marshes and tidal flats form a mosaic of ecosystems. Some of these tidal flats are extensive (as in the Jaffna Lagoon and north of Mannar Island). Tidal flats are found on the shores of lagoons and estuaries in intertidal areas (areas that are flooded at high tide and exposed at low tides) (Smithsonian Institution, 2010). They are always exposed during low tide. Although tidal flats look barren, they are in fact, teeming with life (Miththapala, 2013a). Cyanobacteria are the autotrophs of tidal flats and often form a velvety mat — called 'lab-lab' — visible on the surface of tidal flats. These cyanobacteria provide the food base for a range of invertebrates — such as crustaceans, molluscs, flatworms and roundworms. Feeding on these invertebrates are birds such as the Black-winged stilt (*Himantopus himantopus*), Common redshank (*Tringa totanus*), Eurasian spoonbill (*Platalea leucorodia*), Great crested tern (*Sterna bergii*) and Green sandpiper (*Tringa ochropus*).

See photograph in Figure 18.

Lagoons and Estuaries

The coastline defined in this report has 10 lagoons, including the Jaffna Complex, which is the largest brackish water system in the island (Silva et al., 2013). Lagoons in Sri Lanka are of recent origin and came into existence during the Holocene Period (10,000 years BP) (NSAP, 2009).

Lagoons and estuaries, lying at the boundary between the ocean and land, house a unique mosaic of habitats from sea to land. Apart from lagoons and estuaries, there may be barrier islands, spits, beaches, sand dunes, salt marshes, seagrasses within lagoons and estuaries, as well as mangroves fringing their shores (de Wit, 2011 in litt. Miththapala, 2013b). This high ecosystem diversity within the immediate landscape of lagoons and estuaries, gives rise not only to high species diversity but also to the creation of ecotones — areas of transition between two habitats. Therefore, lagoons and estuaries — through the diverse habitats they house — support a high level of biodiversity (de Wit, 2011; Kennish and Paerl, 2010 in litt. Miththapala, 2013b) and are often feeding grounds for many migratory birds — such as the Greater flamingo (*Phoenicopterus roseus*) and Black-headed gull (*Larus ridibundus*) — and breeding residents such the Indian and Little cormorant (*Phalacrocorax fuscicollis* and *P. niger*), Spot-billed pelican (*Pelecanus philippensis*) and Brahminy kite (*Haliastur indus*). See Figure 19 for a photograph of this ecosystem.

One hundred species of fin fish, 28 species of molluscs, six species of crabs and seven species of prawns have been identified in catches from the Jaffna Lagoon (MFF, 2015a).

Semi-natural Ecosystems

Most of the islands in Palk Bay had been influenced strongly by anthropogenic activities including the three-decade long civil war, settlements, and fisheries. As a result, many natural ecosystems have been degraded over a long period of time. Some of these degraded ecosystems have been regenerated by secondary growth of vegetation and therefore, are found as semi-natural ecosystems. These semi-natural ecosystems are extensively distributed in abandoned lands, influenced by human activities.

Dry Zone Grasslands

Two sub-types have been observed.

Wet Pasture Lands

Structurally, as well as functionally, wet pasture lands are more or less similar to dry pasture lands, with the exception of their species assemblage, which differs. Often, short plant species belonging to the sedge (Cyperaceae) family — such as *Bulbostylis barbata, Cyperus arinarius, Cyperus bulbosa, Cyperus conglomaratus, Cyperus pygmaeus, Cyperus rotundus*, *Fimbristylis argentea* and *Fimbristylis dipsaceai* — were observed commonly in wet pasture lands. *Phyla nodiflora* was the dominant plant species seen in the wet pasture lands of the islands. Other commonly occurring species in this habitat included *Cressa criteca, Cynadon dactylon, Eragrostis maderaspatana, Peplidium maritimum, Evolvulus alsinoides*, *Sphaeranthus indicus, Sporobolus spicatus, Pedalium murex* and *Zoysia martella.* Wet pasture lands favour lands that show a slight depression and therefore can hold water. These depressions can retain rainwater during the rainy season, during which they become shallow water bodies.

See a photograph of this ecosystem in Figure 20.

These grasslands provide feeding habitat for migratory bird species including the Pacific golden plover (*Pluvialis fulva*), Black-tailed godwit (*Limosa limosa*), and the Common snipe (*Gallinago gallinago*); as well as breeding residents such as the Black-headed ibis (*Threskiornis melanocephalus*) and Painted stork (*Mycteria leucocephala*).

Figure 19. Top: Greater flamingo and Eurasian wigeon (both migrants) in Kayts Lagoon; bottom: Egrets, cormorants, and a Grey heron in Kokkilai Lagoon
(Top: © Luxshmanan Nadaraja; bottom: © IUCN/Kumudini Ekaratne)

Dry Pasture Lands

Dry pasture lands were characterised by a dense growth of short grasses (up to 5 cm in height) forming a green carpet that spreads over large areas of the islands' landscapes. The structure and floristic composition of the grassland system is influenced considerably by grazing pressure, trampling, high salinity and drought. The dominant grass species observed in this habitat included *Bulbostylis barbata, Cressa critica, Cyperus iria, Eragrostis maderaspatana, Fimbristylis argentea, Fimbristylis feruginea, Peplidium maritimum, Sporobolus tremulus* and *Zoysia martella*. Species dominance and species composition appear to be determined by site-specific moisture levels. Dry pastures are indispensable, given the important role they play in sustaining the wild pony and cattle populations of the islands. As with other open vegetation types, dry pasturelands stabilise the soil, as they produce a mat-like vegetation cover, while the roots of these grasses hold the soil together, preventing erosion. These pasturelands also function as water efficient filters and trap surface run-off.

Birds such as the Ashy-crowned sparrow lark (*Eremopterix grisea*), Oriental skylark (*Alauda gulgula*), Paddyfield pipit (*Anthus rufulus*), Yellow-wattled lapwing (*Vanellus malabaricus*) and Great thick-knee (*Esacus recurvirostris*) can be found commonly in this ecosystem**.** See a photograph of this ecosystem in Figure 20.

Man-made Ecosystems

Man-made ecosystems are human-influenced landscapes that are extensively spread across islands with human settlements. Although there were some agricultural ecosystems found on the islands, only home gardens were studied during this field survey.

Home Gardens

Home gardens are found immediately around homesteads and are the result of long-term human manipulation. Home gardens were dominated by multi-purpose tree species that were arranged into different vertical levels. Well-developed, multi-storey home gardens were located on the islands with human settlements. While the Palmyra palm was the dominant species in most home gardens, other tree crop species such as *Cocos nucifera*, *Mangifera indica*, *Gliricidia sepium, Moringa oleifera, Musa x. paradisiaca* and *Sesbania grandiflora* were also found. Also common was *Azadarichta indica.* There were also a few ornamental tree species such as *Plumeria obtusa, Thespesia populnea* and *Hibiscus rosa-sinensis*. These home gardens were protected by different types of live fences using native plants such as *Commiphora berryi*, *Thespesia populnea* as well as dead parts of Palmyra plants such as leaves and rachis without the leaf blade. Apart from their aesthetically attractive nature, these fences perform the function of optimally protecting and demarcating the boundary. Dead plant parts were used in different fences surrounding home gardens. See a photograph of this ecosystem in Figure 21.

Among the fauna of home gardens are dragonflies, such as the Blue percher (*Diplacodes trivialis*) and Wandering glider (*Pantala flavescens*); butterflies, such as the Lime butterfly (*Papilio demoleus*) and Mottled emigrant (*Catopsilia pyranthe*); amphibians, such as the Common house toad (*Duttaphrynus melanostictus*) and Skipper frog (*Euphlyctis cyanophlyctis)*; reptiles, such as the Common garden lizard (*Calotes versicolor*) and Common house-gecko (*Hemidactylus frenatus*); birds, such as the Oriental magpie robin (*Copsychus saularis*) and Red-vented bulbul (*Pycnonotus cafer*) and mammals such as the Common rat (*Rattus rattus*) and Palm squirrel (*Funambulus palmarum)*.

Figure 20. Top: Wet pasture lands at Iranaitivu North Island; bottom: Dry pasturelands at Punnalai Khadu

(top ©/Sampath de A. Goonatilake; bottom © IUCN/Naalin Perera)

Figure 21. A home garden at Eluvaitivu Island
(© IUCN/Sampath de A Goonatilake)

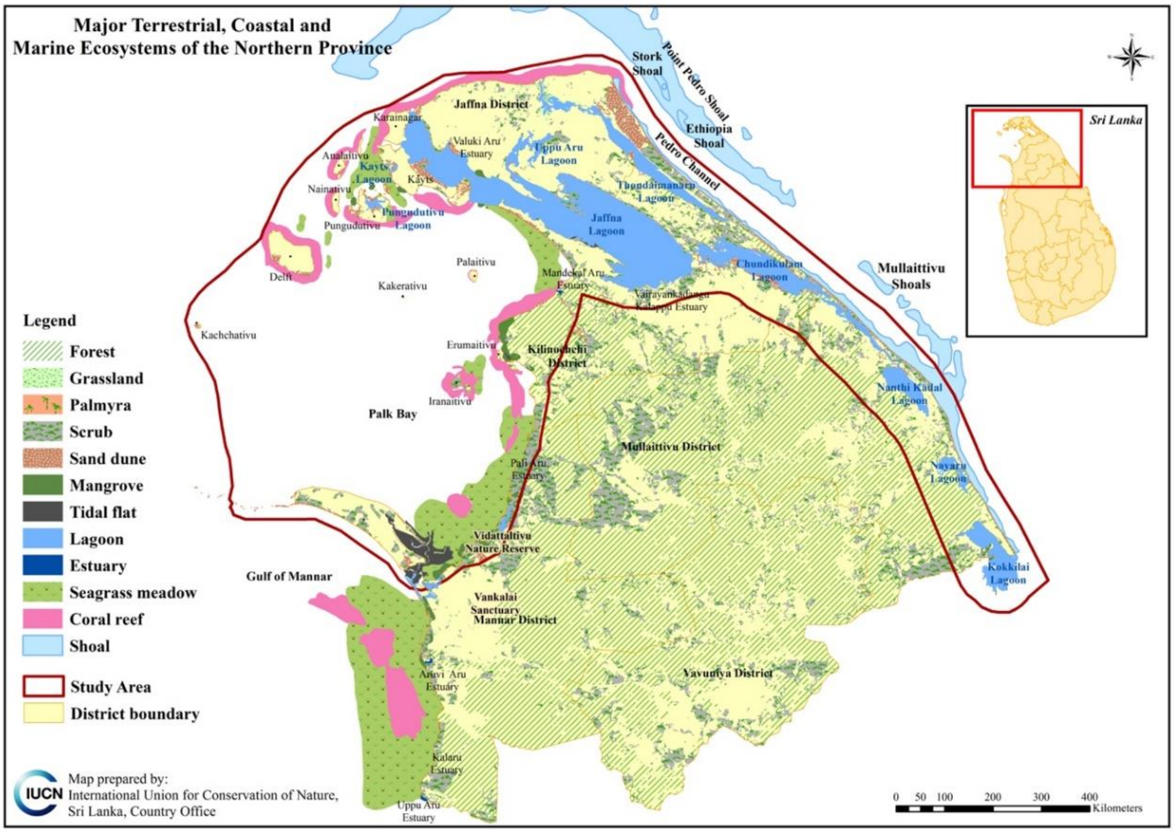

Figure 22. Map of terrestrial, marine and coastal ecosystems of the study area

Detailed maps of terrestrial, marine and coastal ecosystems are given in Annex 1.

Terrestrial Species Diversity

Floristic Diversity of the Islands

A total of 342 different plant species which comprised 102 tree species, 53 shrub species, 59 climber species, 111 herbaceous species and three epiphytes, were recorded during the field survey (Table 4). Of these, seven species are endemic to Sri Lanka (Table 5), while 33 species are listed as Threatened (Table 6). This included two species *Suriana maritima* and *Fimbristylis dipsacea* listed as Critically Endangered (Possibly Extinct) (CR(PE)) and two species, *Sesamum prostratum* and *Cyperus conglomerates* listed as Critically Endangered (CR). Further, 28 species, listed as near threatened (NT) were also recorded.

A complete list of flora observed in this study is presented in Annex 2.

Table 4. Summary of flora recorded during the field survey

HABIT	TOTAL	SPECIES STATUS				CONSERVATION STATUS					
		Indigenous	Endemic	Exotic	IAS	CR (PE)	CR	EN	VU	NT	DD
Trees	104	57	4	42	2	0	0	5	3	7	0
Shrubs	54	47	0	6	1	1	0	1	3	7	0
Herbs	108	96	0	9	1	1	2	2	3	8	0
Vines and Climbers	65	55	3	3	1	0	0	4	7	4	0
Epiphytes	2	2	0	0	0	0	0	0	1	0	0
Total number of Species	342	237	7	60	05	02	02	12	17	26	0

Table 5. Endemic flora recorded during field survey

Family	Species	Sinhala name	Tamil name
Asteraceae	*Vernonia zeylanica*	*Papula, Wal-Pupula*	*Marlumutta*
Celastraceae	*Cassine balae*	*Neraloo*	*Perun / Piyaree*
Celastraceae	*Cassine glauca*	*Neralu*	*No name known*
Convolvulaceae	*Argyreia populifolia*	*Girithilla*	*Sindu-kodi*
Fabaceae	*Derris parviflora*	*Kala-wel*	*No name known*
Melastomataceae	*Memecylon capitellatum*	*Dedi-Kaha*	*Katti kaya / Venkali-kaya*
Sapindaceae	*Gleniea unijuga*	*Wal-Mora*	*No name known*

Table 6.Threatened[6] flora recorded during field survey

Family	Species	Sinhala name	Tamil name	Conservation Status
Cyperaceae	*Fimbristylis dipsacea*	No name known	No name known	CR (PE)
Surianaceae	*Suriana maritima*	No name known	No name known	CR(PE)
Cyperaceae	*Cyperus conglomeratus*	No name known	No name known	CR
Pedaliaceae	*Sesamum prostratum*	No name known	No name known	CR
Boraginaceae	*Cordia subcordata*	No name known	No name known	EN
Boraginaceae	*Tournefortia argentea*	Karan	No name known	EN
Capparaceae	*Cadaba fruticosa*	No name known	No name known	EN
Celastraceae	*Salacia oblonga*	*Himbutu, Gal Himbutu*	No name known	EN
Convolvulaceae	*Ipomoea coptica*	*Karunkali*	No name known	EN
Ebenaceae	*Diospyros ebenum*	*Kaluwara*	No name known	EN
Fabaceae	*Crotalaria prostrata*		No name known	EN
Fabaceae	*Vigna marina*	*Karal-li-me, Lee ma*	*Kodippayaru/ Kodeppayam*	EN
Lythraceae	*Sonneratia alba*	*Kirala*	*Kinnai*	EN
Menispermaceae	*Cocculus hirsutus*	*Lunuketiya wel*	*Kattukkodi/ Sirungattukodi*	EN
Phrymaceae	*Peplidium mariticum*	No name known	No name known	EN
Rhizophoraceae	*Bruguiera cylindrica*	*Heen Mal Kadol*	No name known	EN
Amaryllidaceae	*Crinum zeylanicum*	No name known	No name known	VU
Apocynaceae	*Gymnema sylvestre*	*Masbedde*	*Shirukurinja*	VU
Apocynaceae	*Heterostemma tanjorense*	No name known	No name known	VU
Celastraceae	*Cassine glauca*	No name known	No name known	VU
Cucurbitaceae	*Citrullus colocynthis*	*Yak-komadu, Thiththa labu*	*Peykkomaddi/ Peykkomakki*	VU
Fabaceae	*Dalbergia candenatensis*	No name known	No name known	VU
Fabaceae	*Indigofera oblongifolia*	*Nari Mun*	No name known	VU
Loranthaceae	*Taxillus courtallensis*	No name known	No name known	VU

[6] According to IUCN Red List of Threatened Species, the categories Critically Endanaged (CR), Endangered (EN) and Vulnerable (VU) are considered Threatened species.

Family	Species	Sinhala name	Tamil name	Conservation Status
Menispermaceae	*Pachygone ovata*	*No name known*	No name known	VU
Menispermaceae	*Tinospora cordifolia*	*Rasa-Kinda*	*Chintil*	VU
Poaceae	*Aristida adscensionis*	*Boleela / Teli tana*	No name known	VU
Poaceae	*Sporobolus maderaspatanus*	No name known	No name known	VU
Rhamnaceae	*Colubrina asiatica*	*Mauirmanikkam, Tel hiriya*	*Mayirmanikkam*	VU
Rubiaceae	*Guettarda speciosa*	*Nil-Pitcha*	*Panir*	VU
Rubiaceae	*Psilanthus wightianus*	No name known	No name known	VU
Rutaceae	*Chloroxyclon swietania*	*Burutha*	*Moodudad-marum / Muritai*	VU
Sapotaceae	*Manilkara hexandra*	*Palu*	*Palai*	VU

Notable Species

In the following section are descriptions of notable terrestrial flora recorded during the Jaffna island survey.

Bay Cedar (*Suriana maritima*)

Bay Cedar, *Suriana maritima,* is a rare, native, coastal shrub that is the only member of the Surianaceae family found in Sri Lanka[7]. Apart from its taxonomic significance, Bay Cedar is listed as a species that is Critically Endangered (Possibly Extinct) CR (PE) (MoE, 2012). According to the botanical history of Sri Lanka, this plant was first discovered in 1885 at Foul Point, and then subsequently in 1890 at Small Fox Island, Jaffna. This is the third time this species has been recorded after 125 years: *Suriana maritima* was recorded at Palaitivu Island and the Kavutharimunai coastal stretch, during this field survey in 2015. Thus, it was an extremely significant finding. This plant was found in isolated islands, coral islets and atolls and is distributed in the Pacific and Indian Oceans. (See a photograph in Figure 23.)

Octopus Bush (*Tournefortia argentea*)

Octopus bush, *Tournefortia argentea* belongs to the family Boraginaceae. It is a very rare plant that was found in Kachchativu Island, during this field survey. It is listed as an Endangered (EN) species (MoE, 2012). This plant is called ‘Octopus bush’ because of the tentacle-like appearance of the inflorescence of the plant. The Octopus bush can grow up to 5 m and is found rarely as a small tree with densely silk-pubescent leaves in the crowded near tips of branches. As this plant grows in sandy saline soils near coastlines, the silk-pubescent layer of the leaves helps it to survive the salt spray due to sea waves. According to the botanical history of Sri Lanka, *Tournefortia argentea* has not been recorded in the country since 1939. This native plant was recorded previously at Trincomalee and Tangalle before 1939. Therefore, this is the first record of *Tounefortia argentea* since 1939. It should be noted, however, that the Octopus bush is common in the Indo-Pacific region. (See a photograph in Figure 24.)

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[7] Therefore, *Suriana* is a monotypic genus in Sri Lanka.

Sesamum prostratum

Sesamum prostratum is a strong smelling, prostrate herb that grows on the sandy seashore. It bears reddish to pinkish-violet flowers from May to August, and possibly throughout the year. According to the botanical history of Sri Lanka, this species is remarkable because it has only been recorded in the Eastern Province around Panama. Therefore, the species has been listed as Critically Endangered (CR) (MoE, 2012). This is the first record outside Panama, where *Sesamum prostratum* was recorded on the sandy coast of Chundikulam. (See a photograph in Figure 24.)

Sea Trumpet (*Cordia subcordata*)

This is another inhabitant of coastal areas and is commonly known as the 'Sea trumpet' because of its trumpet-shaped flower. The plant belongs to the family Boraginaceae. The height of the tree ranges between 3-10 m. The flowers are orange in colour and the petals are wrinkled. The fruits are dispersed by water, enabling the plant's distribution throughout the Indian Ocean and Pacific Islands. This plant is found in sunny, dry coastal areas. This is also a very rare species in the coastal areas of Sri Lanka and has been recorded only in a few localities, such as Foul Point, Norway Point, Aruwakalu and Karaitivu in the Ampara District. It is, therefore, listed as an Endangered (EN) species (MoE, 2012). *Cordia subcordata* was recorded in Palaitivu Island during this field survey. This was the first record of this plant in the Northern Province. (See a photograph in Figure 25.)

Beach Gardenia (*Guettarda speciosa*)

Guettarda speciosa, a native shrub that belongs to the family Rubiaceae, is a common inhabitant of beachfront scrub ecosystems. The distribution of the species ranges from East Africa to Malaysia, Micronesia and the South Pacific. The species is listed as Vulnerable (VU) as the plant has been recorded previously only from a few locations (MoE, 2012). However, during this field survey, this species was recorded at Palaitivu, Kakerativu and Kachchativu islands. The fragrant flowers of this plant open after sunset. (See a photograph in Figure 25.)

Palmyra (*Borassus flabellifer*)

Palmyra is the most traditionally important and respected tree in the Jaffna Peninsula. Although *Borassus flabellifer* is a cultivated tree in Sri Lanka, it has naturally spread into other natural ecosystems in the Northern Province and North-western Provinces. All the parts of the Palmyra tree are used extensively by local people. For example, the trunk is used for timber, leaves for thatching; the leaf-base fibre for making brushes; and split leaves for weaving mats and baskets. Inflorescences are used to make jaggery and toddy. The pulp of ripe fruits is used to make juice and also to make sweets. Roots are boiled and eaten. The dried and powdered root is used to make the traditional seafood soup of the North — *kool* (See a photograph in Figure 26.)

Baobab (*Adansonia digitata*)

Baobab trees (*Adansonia digitata*) are trees native to the African continent, and are thought to have been brought to Sri Lanka by Arab traders around 700 AD. It is believed that these Arab traders, who brought camels, also brought baobab trees — whose leaves were used to feed these animals. These trees, also known as 'Upside down trees' are so named because their sparse foliage and meagre crowns give the trees the appearance of bearing roots instead of branches. These trees are tall (up to 30 m), and their swollen trunks are colossal. The oldest (reported to be over 700 years old) and the largest individual baobab tree in Sri Lanka, found at Pallimunai on Mannar Island, has an information board next to it that says its circumference is 19.5 m. The baobabs of Sri Lanka are protected by gazette notification, under the Antiquities Ordinance of 1940 (Figure 26).

Species in Salt Marshes

The salt marshes of the islands comprise of species such as *Suaeda maritima, Suaeda monoica, Salicornia brachiata* and *Halosarcia indica,* which belong to the family Amaranthaceae. Although *Suaeda monoica* occurs less in marshy habitats and is like a small bush, the other three species, are herbs more frequently found in marshy areas. These species were seen in different compositions and structures from island to island. *Suaeda maritima* and *Salicornia brachiata* were more abundantly present than the other two species in the northern area. The edible young leaves of *Suaeda maritima* are used as a vegetable (Figure 27).

Mangrove Species

During the field survey, five true mangrove species were recorded. *Avicennia marina* is the most commonly occurring mangrove species. Other species such as *Bruguiera cylindrica, Ceriops tagal, Rhizophora mucronata* and *Sonneratia alba* were rarely found and were unevenly distributed among marshy vegetation. Among those five species, *Rhizophora mucronata* and *Sonneratia alba* are listed as Endangered (EN) species (MoE, 2012). The branches and wood of some of these mangrove species are used for making boats, as brush-piles for fishing, as fuel-wood and also for medicinal purposes (Figure 27).

Figure 23. Bay cedar (*Suriana maritima)* listed in the 2012 Red List as Critically Endangered, Possibly Extinct
(© IUCN/Sampath de A. Goonatilake)

Figure 24.Top: Octopus bush (*Tournefortia argentea*), an Endangered species; bottom *Sesamum prostratum* listed as Critically Endangered
(© IUCN/Sampath de A. Goonatilake)

Figure 25.Top: Sea trumpet (*Cordia subcordata*), an Endangered species; bottom: Beach Gardenia (*Guettarda speciosa*), listed as Vulnerable
(© IUCN/Sampath de A. Goonatilake)

Figure 26. Top: the ubiquitous Palmyra (*Borassus flabellifer*); bottom: Baobab (*Adansonia digitata*), protected by the Antiquities Ordinance
(© IUCN/Sampath de A. Goonatilake)

Figure 27.Top: *Avicennia marina*, the dominant mangrove species of the area, Mandaitivu; bottom: *Suaeda maritima*
(Top: © Tharanga Wijewickrema; bottom: © IUCN/Sampath de A. Goonatilake)

Faunal Diversity of the Islands

In total, 347 species of fauna were recorded within the islands and the coastal areas surveyed (Table 7). This included nine endemic species: the Lesser albatross (*Appias galane*); Devaka's fanthroat lizard (*Sitana devakai*); Common lankaskink (*Lankascincus fallax);* Flowery wolf snake *(Lycodon osmanhilli*), Checkered keelback (*Xenochrophis asperrimus)*, Checkered keelback (*Xenochrophis cf. piscator*); Sri Lanka Jungle Fowl (*Gallus lafayetii*), Sri Lanka Pompadour green-pigeon (*Treron pompadora*); and the Sri Lanka Toque monkey (*Macaca sinica*). Of the 169 bird species recorded, 78 were migrants to Sri Lanka.

In addition, the faunal assemblage recorded included seven domestic species and two exotic species, Tilapia (*Oreochromis mosambicus*) and the feral domestic water buffalo (*Bubalis bubalis*), the latter listed as a potential Invasive Alien Species (IAS) in Sri Lanka (MoMD&E, 2016b).

Table 7. Summary of fauna recorded during the field survey

GROUP	TOTAL	SPECIES STATUS			
		Endemic	Migrant	Domestic	Exotic
Land snails	2	0	0	0	0
Scorpions	3	0	0	0	0
Dragonflies	15	0	0	0	0
Butterflies	62	1	0	0	0
Fishes	1	0	0	0	1
Amphibians	13	0	0	0	0
Reptiles	48	5	0	0	0
Birds	169	2	78	0	0
Mammals	34	1	0	7	1
Total	**347**	**9**	**78**	**7**	**2**

A complete list of fauna observed in this study is presented in Annex 3.

Notable Species

Also encountered were 30 threatened fauna species (Table 8). Four species of the recorded fauna — the native land snail, *Trachia vittata,* Bright babul blue (*Azanus ubaldus*); Indian courser (*Cursorius coromandelicus*) and Saunder's tern (*Sterna saundersi*) are listed as Critically Endangered (CR) (MoE, 2012).

A further five species — Sri Lankan chameleon (*Chamaeleo zeylanicus*), Bibron's sand skink (*Eutropis bibronii*), Oriental pratincole (*Glareola maldivarum*), Fin Whale (*Balaenoptera physalus*) and Asian elephant (*Elephas maximus*) are listed as Endangered (EN).

There are also 21 species listed as Vulnerable (VU), 13 species, Near Threatened (NT) and five Data Deficient (DD) species also recorded from the surveyed area (MoE, 2012).

Table 8. Conservation status of the faunal species[8] recorded in the study area

Animal Group	Conservation status of the recorded species				
	CR	EN	VU	NT	DD
Land snails	1	0	1	0	0
Scorpions	0	0	0	0	0
Dragonflies	0	0	1	4	0
Butterflies	1	0	5	4	0
Fishes	0	0	0	0	0
Amphibians	0	0	1	0	0
Reptiles	0	2	3	0	3
Birds	2	1	7	6	0
Mammals	0	2	3	2	2
Total	**4**	**5**	**21**	**16**	**5**

Bright Babul Blue (*Azanus ubaldus*)

This is a Critically Endangered species found among scrublands in the northern and north-western region (van der & van der Poorten, 2016). This species is threatened by loss of habitats as a consequence of agriculture and settlements and over-grazing by livestock in the region (van der Poorten & van der Poorten, 2016) (Figure 28).

Large Salmon Arab (*Colotis fausta*)

This is a rare and seasonal species found only in the scrub forests of the north-western coast and in the Jaffna Peninsula and is listed as Vulnerable (van der & van der Poorten, 2016) (Figure 28).

Sri Lankan Chameleon (*Chamaeleo zeylanicus*)

This is the only chameleon found in Sri Lanka and is restricted to the arid zone in the north-west and in scattered areas of the dry zone, found burrowing under decaying leaves, near sand dunes. This species, like many other species in Sri Lanka is affected by habitat loss and degradation and is listed as Endangered (Figure 29).

Bibron's Sand Skink (*Eutropis bibronii*)

This species of skink is found in the arid and dry areas of the northern and eastern coast (Somaweera & Somaweera 2009). This species too is affected by habitat loss and degradation and is listed as Endangered. (See a photograph in Figure 29.)

[8] Near Threatened (NT) and Data Deficient (DD) species are added to this table as NT species are becoming Threatened , and nothing is known about DD species, which means they could well be threatened.

Indian Courser (*Cursorius coromandelicus*)

This is a lapwing-like bird which is a rare breeding resident found in the coastal areas of the north and north-west (Kotagama & Ratnavira, 2010). It is found along edges of lagoons and estuaries and in open areas of the coast. The loss and degradation of wetland habitats are major threats to this species. It is listed as Critically Endangered (MoE, 2012) (Figure 30).

Siberian Stonechat (*Saxicola maurus*)

This is a rare vagrant observed in grasslands in various parts of the country (de Silva Wijeyeratne, 2017) (Figure 30).

Saunder's Tern (*Sterna saundersi*)

This is a rare breeding resident found in the coasts of the dry zone and in estuaries, lagoons and reservoirs (Kotagama & Ratnavira, 2010). The loss and degradation of wetland habitats are major threats to this species. It is listed as Critically Endangered (MoE, 2012). (There is, unfortunately, no photograph of this species.)

Crab Plover (*Dromas ardeola*)

This is a rare breeding resident, restricted to tidal flats in the north-western and northern coasts (de Silva Wijeyeratne, 2017), listed as Critically Endangered (MoE, 2012) (Figure 31).

Indian Spot-billed Duck (*Anas poecilorhyncha*)

A rare breeding resident of the northern region (de Silva Wijeyeratne, 2017), listed as Critically Endangered (MoE, 2012) (Figure 31).

Delft Ponies (*Equus caballus*)

Delft ponies are larger than regular ponies but are smaller than normal horses. The wild ponies are thought to be a legacy of the Portuguese and then the Dutch, and later the British, who used the island to breed horses. They now roam free and are wild, depending on nature for their food. However, during the dry months, they have to compete with livestock for food and water. (See a photograph in Figure 32.)

Feral Donkeys (*Equus asinus*)

Also found on some islands (Puliyantivu and Mannar for example) are feral donkeys, thought to have been brought to Sri Lanka by Araba traders. (See a photograph in Figure 32.)

Figure 28. Top: Bright Babul Blue (*Azanus ubaldus*), a Critically Endangered species, restricted to the north and north-west of the island; Bottom: Large salmon Arab (*Colotis fausta*) listed as Vulnerable
(© IUCN/Sampath de A. Goonatilake)

Figure 29. Top: Sri Lankan chameleon (*Chamaeleo zeylanicus*), an Endangered species; Bottom: Bibron's sand skink (*Eutropis bibronii*), an Endangered species
(Top © IUCN/Sampath de A. Goonatilake; bottom: © IUCN/Naalin Perera)

Figure 30. Top: Indian courser (*Cursorius coromandelicus*), a Critically Endangered species; Bottom Siberian stonechat (*Saxicola maurus*), a rare winter vagrant
(Top: © Milinda Wattegedara; bottom: © IUCN/Sampath de A. Goonatilake)

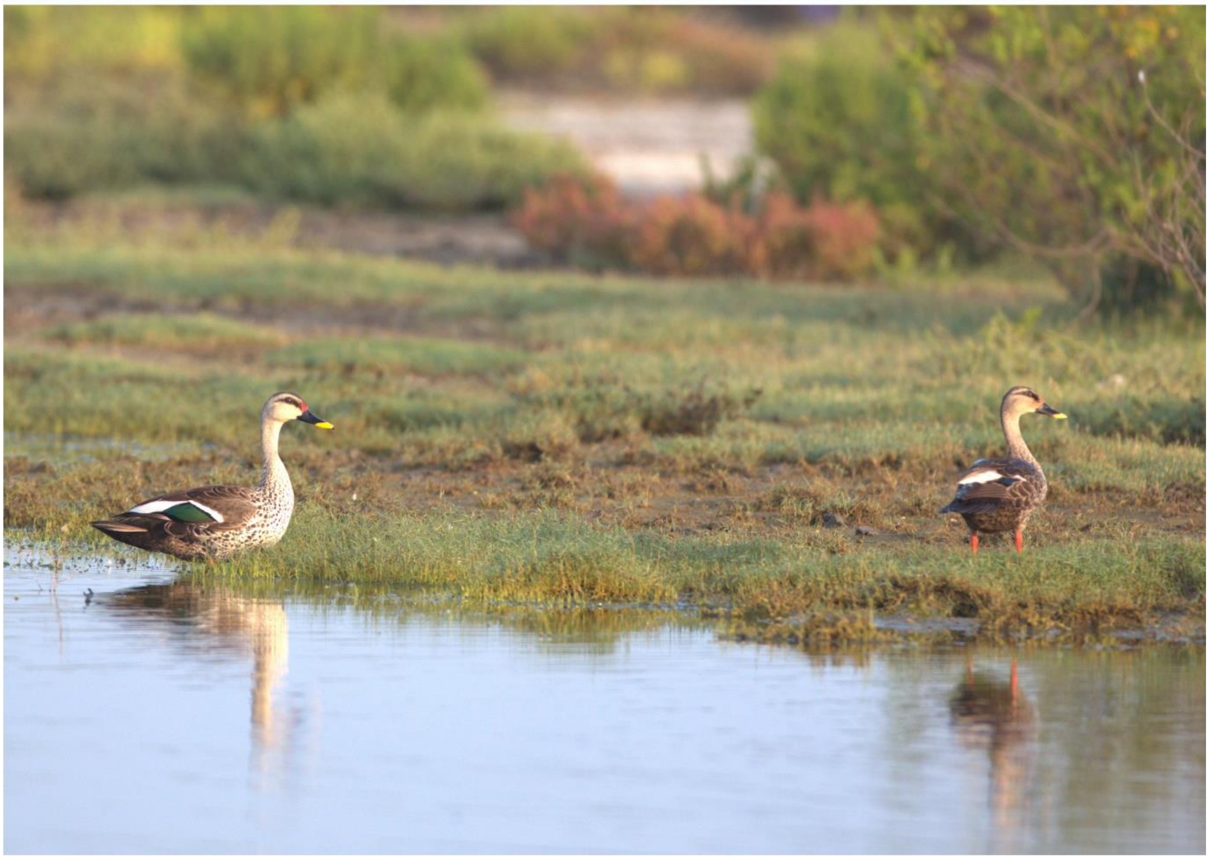

Figure 31. Top: Crab plover (*Dromas ardeola*); Bottom: Indian spot-billed duck (A*nas poecilorhyncha*), both rare breeding residents of the northern region
(© Luxshmanan Nadaraja)

Figure 32. Top: Delft ponies (*Equus caballus*); Bottom: Feral donkeys (*Equus asinus*)
(© IUCN/Sampath de A. Goonatilake)

Marine Ecosystem Diversity

Coral Reefs

Palk Bay and Palk Strait are shallow, with a maximum depth of about 20 m. Sedimentation is high in the Palk Bay waters and as a result, water transparency is low. Both north-east and south-west monsoons have a profound influence on water transparency. During the peak periods of both monsoons, visibility is less than two metres. During the calm periods, water clarity increases up to about five metres. Therefore, environmental conditions for the growth of coral are relatively poor and coral reefs are restricted to shallow nearshore waters to about eight metres in depth. Fringing coral reefs are present in the Palk Bay and Palk Strait along the northern coast of the Jaffna Peninsula, around the islands and from Devil's Point to Kiranchi. They are about 300 m wide. The maximum depth along the seaward margin is about eight metres. The only offshore patch reef is the Maldiva Bank located in the south-eastern section of Palk Bay (Figure 22).

The fringing reefs have the typical zonation of fringing reefs with a narrow reef lagoon, a reef crest and a seaward reef slope. The reef lagoons were mainly filled with coral rubble, small living coral colonies of *Favia, Favites, Echinopora, Leptoria, Porites* and species of *Acropora* and *Montipora*. The reef lagoons also contain many species of algae including *Sargassum* and *Turbinaria* sp. (Figure 33). Reef lagoons were absent in areas where the fringing reef is part of the ancient coral reef that makes up the coastline. Such reefs can be seen on sections of several islands including Delft and Kakerativu. A clear reef zonation was not present along Erumaitivu and Kakkativu, as well as on the Maldiva Bank where the average depth was two metres throughout the width of the reef. Coral growth is poor along the coast from Point Pedro to Mullaittivu.

Fifty-seven (57) species of hard corals were recorded in the Palk Bay and Palk Strait. The main growth forms were branching, foliose, massive and tabulate (Figure 34 and Figure 35). Colonies of *Porites, Goniastrea, Platygyra, Leptoria* and *Favi*a have formed large domes over one metre in diameter. Large colonies of *Porites lutea* and *P. lobata* exceed three to four metres in diameter; they are common, especially along the northern coast of the Jaffna Peninsula and on the fringing reef from Erumaitivu to Kakkativu. Dead coral and coral rubble areas were widespread on many islands including Delft, Mandaitivu, Pungudutivu, Palaitivu, Kakerativu, and Kachchativu, as well as on the reef tract from Kakkativu to Kiranchi (Figure 22).

Soft corals are common especially along the northern coast of the Jaffna Peninsula. Large colonies of leather corals (*Sarcophyton* spp., *Sinularia* spp.) over one metre in diameter were present (Figure 33).

Sea fans and gorgonians were very rare in the Palk Bay. Scattered small colonies were present in the Palk Strait. Overall, coral diversity was higher in the Valvettithurai and Point Pedro section of the Palk Strait than in the Palk Bay and the islands.

See Figure 36 for a photograph of a coral reef.

Figure 33.Top: Algae species *Sargassum* and *Turbinaria* spp.; Bottom: Soft coral *Sarcophyton* spp.
(© IUCN/Arjan Rajasuriya)

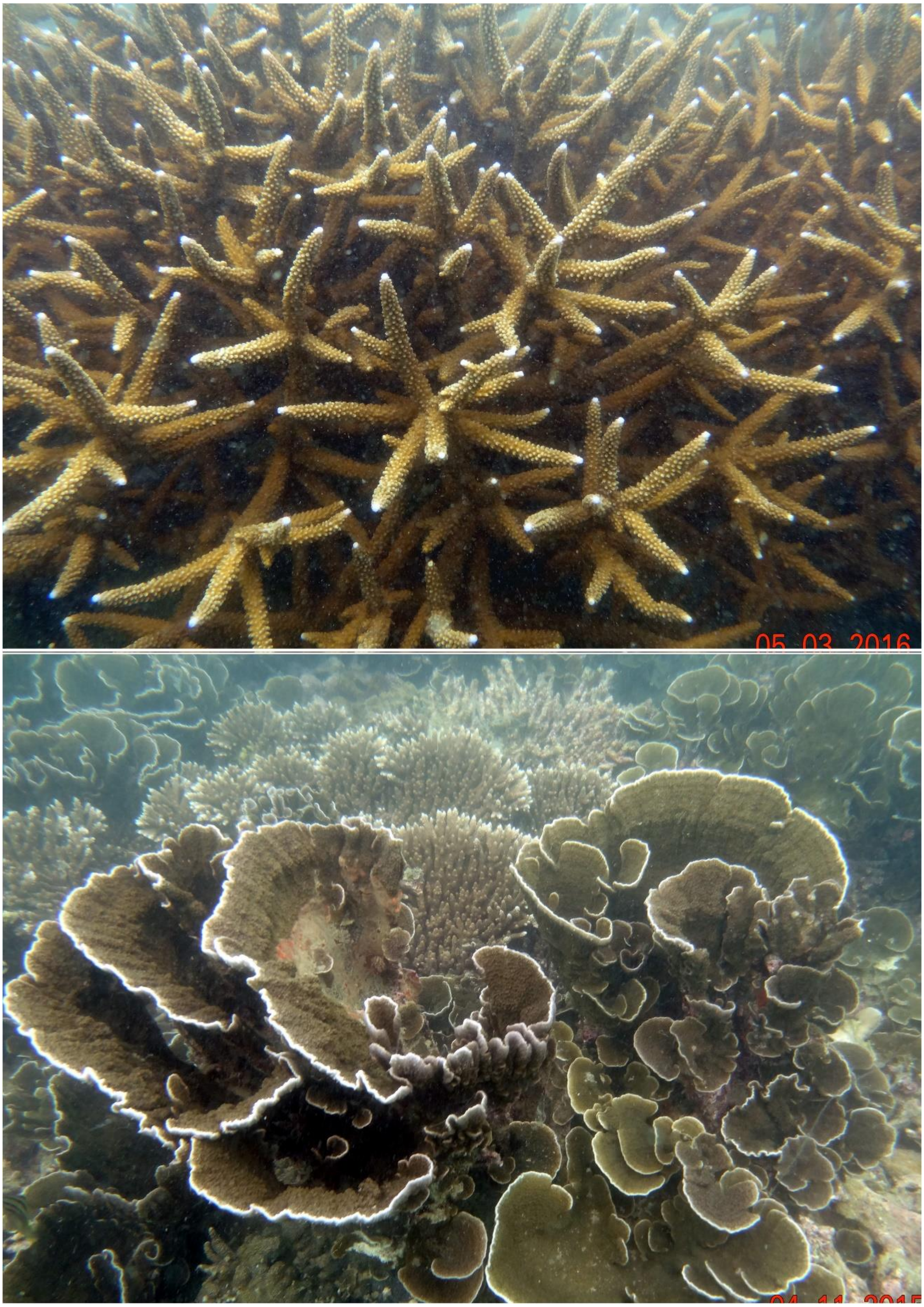

Figure 34. Top: Branching coral (*Acropora formosa*), Kiranchi; Bottom: Foliose coral (*Montipora aequituberculata*), Palaitivu

(© IUCN/ Arjan Rajasuriya)

Figure 35. Top: Massive coral (*Platygyra sinensis*), Iranaitivu; Bottom: tabulate coral (*Acropora latistella* in the foreground and *A. formosa* in the background), Palaitivu
(© IUCN/ Arjan Rajasuriya)

Seagrass Meadows

Seagrasses depend on light for photosynthesis and therefore, they generally grow only in clear, shallow waters. Many edible fish are found living in seagrass meadows, which provide feeding, breeding and nursery grounds for many commercially important fish, shellfish and marine invertebrates. These meadows also provide protection. Because of this, seagrasses are critical in sustaining coastal fisheries (Spalding et al., 2003).

The main seagrass meadows in the north are found in the Palk Bay from Mannar Island to Kiranchi along the coast and between the islands of the Jaffna Peninsula. These waters are generally full of sediment. However, seagrasses grow well because of the shallowness of the waters of the area. The maximum depth is about three metres. Eleven species of seagrass belonging to genera *Cymodocea, Enhalus, Thallasia, Syringodium, Halodule,* and *Halophila* have been recorded from the Palk Bay (Pradeep Kumara & Udagedara, 2013).

See Figure 36 for a photograph of a seagrass meadow.

Marine Species Diversity

Two hundred and eighty species (280) were recorded under the major categories of corals, reef fish, sea cucumber, seagrasses and seaweeds. They include 86 species of hard corals, 11 species of seagrasses and 172 species of reef fish. Among them 25 species of hard corals and six species of reef fish are listed as Near Threatened (NT) in the IUCN Red List. Five species of hard corals, one species of seagrass and one species of reef fish are listed under the Vulnerable (VU) category (Table 9).

Table 9. Summary of marine species recorded during the field survey

GROUP	Number of Species	CR	EN	VU	NT	DD	LC	NE
Corals	86	0	0	5	25	1	38	17
Seagrasses	11	0	0	1	0	0	10	0
Reef fish	172	0	0	1	6	1	89	75
Sea cucumber	6	1	0	0	0	1	3	1
Seaweeds	5	0	0	0	0	0	0	5
Total	**280**	**1**	**0**	**7**	**31**	**3**	**140**	**98**

A complete list of corals observed in this study is presented in Annex 4.

There are many species of hard corals that are growing well in the Palk Bay and Palk Strait; the majority of reef building corals belong to the families of Poritidae, Faviidae and Acroporidae.

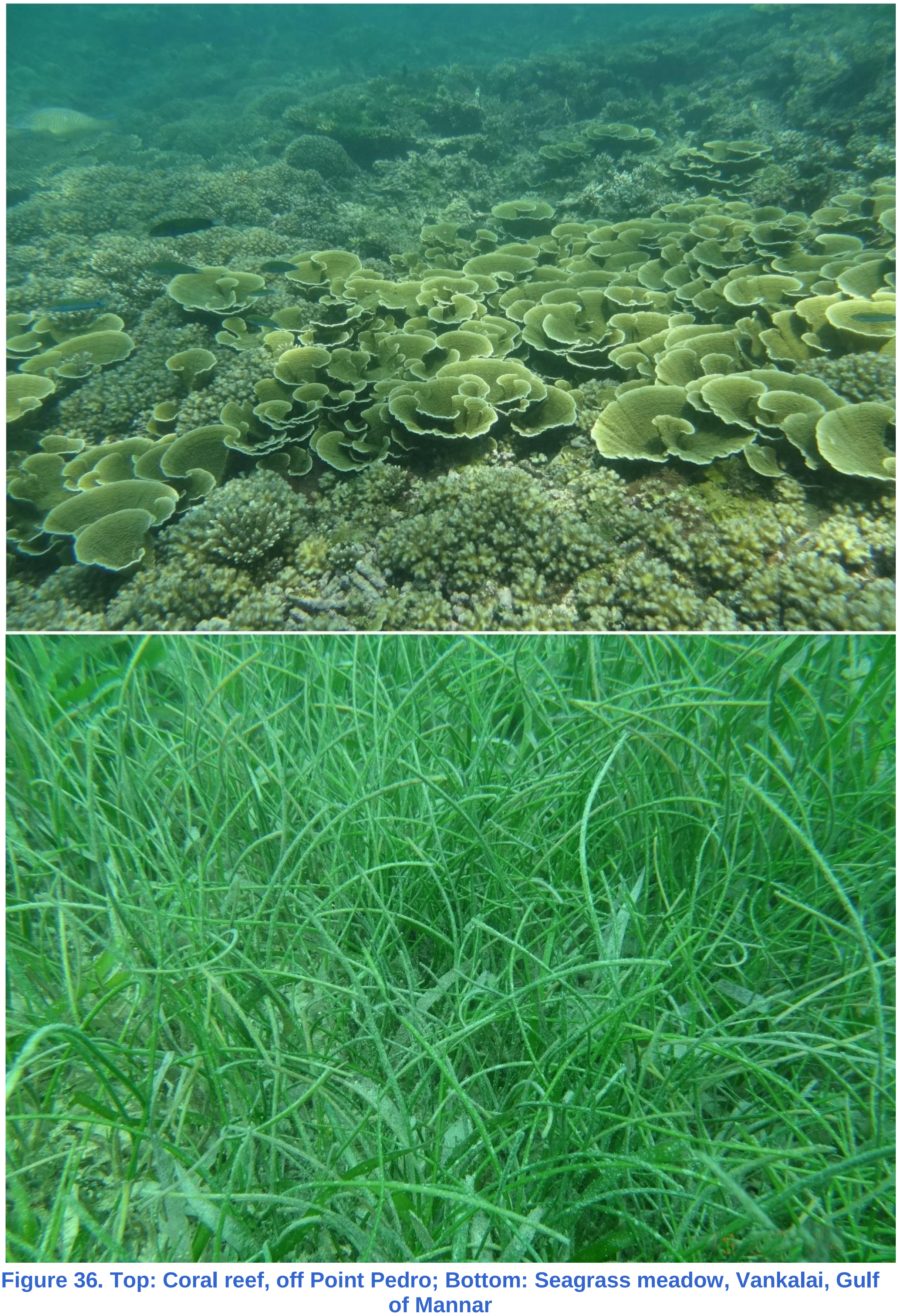

Figure 36. Top: Coral reef, off Point Pedro; Bottom: Seagrass meadow, Vankalai, Gulf of Mannar

(© IUCN/ Arjan Rajasuriya)

Notable Species

Corals

Montipora hispida was recorded in the Palk Bay and Palk Strait during the present survey (Figure 37). It was also recorded in 2014 and 2015 in the Gulf of Mannar (Rajasuriya, unpublished data). However, it has not been included in the checklist of stony corals previously recorded for Sri Lanka by Rajasuriya (2007). The previous records of stony corals for Sri Lanka included 208 species of hard corals. With the addition of *Montipora hispida,* the number stony corals species for Sri Lanka becomes 209, divided among 71 genera in 19 families.

Reef Fish

One hundred and twenty-four (124) reef and reef associated fish from 44 families were recorded during the underwater surveys conducted in the Palk Bay and Palk Strait. The following list does not include species from fish landing sites and from the Gulf of Mannar. IUCN (2011) reported 48 different kinds of fish from the Gulf of Mannar and Palk Bay.

The range of some species — such as Eight-banded Butterflyfish (*Chaetodon octofasciatus*) and Bengal Sergeant (*Abudefduf bengalensis)* — is restricted to the shallow coral habitats within the north-western and northern waters extending from Gulf of Mannar to Point Pedro (Figure 37). The Yellowtail Mullet (*Sicamugil cascasia*) has been recorded only from the fringing reefs along the northern shore of the Jaffna Peninsula. Trigger fish were not observed during these surveys although this is a common group in other reef areas in Sri Lanka. Wrasses were also scarce, and no cleaner wrasses were observed. The abundance of reef fish was generally low. Only three species of parrotfish (*Scarus ghobban, S. niger and S. rubroviolaceus*) and three species of groupers (*Epinephelus longispinis, E. malabaricus and E. merra*) have been recorded. The low abundance can be attributed to extensive use of passive fishing gear such as fish kraals (stake nets) which continuously trap all reef fish including small-sized species due to the small mesh size of the net.

Angelfish were rare. Only two species (*Pomacanthus annularis and P. semicirculatus*) of angelfish were recorded. Pygmy angelfish (*Centrypyge* spp) were not observed within the study area.

A list of reef fish observed in this study is presented in Annex 7.

Selected Invertebrates

Twelve species of molluscs, seven species of crustacean and four species of echinoderms were observed during the marine surveys. A list of these species is presented in Annex 8. Lagoon aquatic invertebrates were not surveyed.

Dugong (*Dugong dugon*)

Dugongs are marine mammals which graze on seagrasses, found in tropical and subtropical coastal areas in the Indo-Pacific region (Illangakoon, 2011). It is found on both sides of the Gulf of Mannar, Palk Bay and Palk Strait. Historically, dugongs were commonly found in the

Gulf of Mannar, Palk Strait and the islands off the north and north-western coast (Illangakoon, 2011). Very little is known about this species in Sri Lanka, and it is believed that it is now confined to the shallow coastal waters in the Gulf of Mannar and Palk Bay where extensive seagrass meadows are found (Jones, 1967; Pilcher et. al., 2014).

This is a transboundary species and the population is shared by India and Sri Lanka. However, there are no estimates for the existing population.

These animals are listed as globally Vulnerable as they face many anthropogenic threats across their geographical range.

Whales and Dolphins

This study did not survey marine mammals and the information included in this report is from other studies, cited in the following text. Strandings have been recorded of large whales along the coast of Gulf of Mannar and the Palk Strait: sperm whale (*Physeter macrocephalus*), blue whale (*Balaenoptera musculus*) and the Minke whale (*Balaenoptera acutorostrata*) Brydes whale (*Balaenoptera edeni*), and the humpback whale (*Megaptera novaeangliae*). The melon-headed whale (*Peponocephla electra*), and false killer whale (*Pseudorca crassidens*), dwarf sperm whale (*Kogia sima*) have also been recorded (De Silva, 1987; Broker and Ilangakoon, 2008) (Figure 38).

Smaller cetaceans such as the Indo-Pacific humpback dolphin and the Indo-Pacific finless porpoise inhabit the nearshore areas. De Silva (1987) also reports of an Indo-Pacific finless porpoise (*Neophocaena phocaenoides*) caught by Smithsonian Carangid Survey Team from the Wadge Bank in 1970 and listed this record for Sri Lanka. However, the Wadge bank belongs to India. More recently Nanayakkara et al. (2017) reported the Indo-Pacific finless porpoise from the Palk Bay.

Also recorded are bottlenose dolphins (*Tursiops truncatus*), Indo-Pacific humpback dolphin (*Sousa chinensis*) and spinner dolphins (*Stenella longirostris)* (Figure 38). More recent information indicates that the killer whale (*Orcinus orca*) is observed in the Gulf of Mannar off the Kalpitiya Peninsula (Nanayakkara pers. comm.).

As with other marine mammals, these whales face a multitude of anthropogenic threats such as noise pollution in the sea — from ships, sonar and other human activities — which appear to disrupt whale and dolphin communication. In addition, these animals often swim in polluted — sometimes toxic — waters, and often accumulate these toxins into their bodies. Another major threat to cetaceans is accidental entrapment in fishing nets (WWF, 2017).

Table 10. Conservation status of whales and dolphins found in the northern waters of Sri Lanka

Scientific name	Common name	Sinhala name	Tamil name	Conservation status
Balaenoptera musculus	Blue whale	*Nil thalmasa*	*Neela thiminkalam*	EN
Balaenoptera acutorostrata	Minke whale	*Minki thalmaha*	*Minke thimingilam*	LC
Balaenoptera brydei	Bryde's whale	*Brydige thalmaha*	*Broodes thimingilam*	DD

Scientific name	Common name	Sinhala name	Tamil name	Conservation status
Megaptera novaeangliae	Hump-backed whale	*Molli thalmaha*	*Koon muthuku thimingilam*	LC
Physter macrocephalus	Sperm whale	*Manda thalmaha*	*Vinthu Thimingilam*	VU
Kogia sima	*Dwarf sperm whale*	*Mitimunda thalmasa*	*Kuttai kular thimikalam*	DD
Peponocephala electra	Melon-headed whale	*Puhulolu thalmaha*	*Mulaam palath thalai-thiminkalam*	LC
Orcinus orca	Killer whale			
Pseudorca crassidens	False killer whale	*Boru minimaru thalmaha*	*Poli kolaith-thiminkalam*	DD
Neophocaena phocaenoides	Finless porpoise	Not known	Not known	NE
Sousa chinensis	Indo-pacific hump-back dolphin	*Kabara mulla*	*Koonmuthuhu tholpin*	NT
Stenella longirostris	Spinner dolphin	*Sannali mulla*	*Neel munchi sulal ongil*	DD
Tursiops truncatus	Bottle nosed dolphin	*Digasubu mulla*	*Kuppi mukkinai oonjia*	LC

Figure 37. Top: *Montipora hispida*, Arippu; Bottom: from left to right: Indo-Pacific Sergent (*Abudefduf vaiginensis*) Indian vagabond butterflyfish (*Chaetodon decussatus*) Blubberlip snapper (*Lutjanus rivulatus*), Andaman butterflyfish (*Chaetodon andamanensis*) Point Pedro
(© IUCN/ Arjan Rajasuriya)

Figure 38. Top: Melon-headed whale (*Peponocephala electra*); Bottom Spinner dolphins (*Stenella longirostris*)
(© Anouk Illangakoon)

Chapter 5: Threats to Natural Resources and Biodiversity in the Study Area

Solid Waste Pollution, the Jaffna-Punnalai-Point Pedro Road (© IUCN/Naalin Perera)

Many potential threats to the natural resources and biodiversity of the areas have been observed in the study area. These are described below.

Habitat Destruction and Degradation

Clear Felling Areas and Destroying Habitats

Habitat destruction results in the loss or reduction of life-sustaining ecosystem services.

For example, mangroves, which are adapted uniquely to the regular movement of tides are, therefore, also able to withstand stronger forces of waves and wind energy that occur with extreme weather events. They, therefore, provide physical protection from coastal storms and cyclones. In addition, mangrove roots and organic matter in the mud function to trap sediment, and act as sponges to absorb flood waters (UNEP-WCMC, 2006). In addition, many aquatic animals use mangroves as permanent or temporary habitats, but they also serve as hatcheries and nurseries for many commercially important finfish and shellfish.

A road has been built on the island of Chirutivu, destroying the lush mangrove vegetation there (MFF, 2015b) while in Vidattaltivu Lagoon, mangroves are being cut down for use in brush piles to aggregate fish and squid, by people who come from Pallimunai on Mannar Island. Mangrove wood is also being extracted in Thondaimanaru.

In Sarasalai and Nagarkovil, mangroves have been cleared for coconut cultivation, even though the latter was declared as a Nature Reserve under the Department of Wildlife Conservation in 2016 (Gnaneswaran, 2015).

Sand dunes also provide protection against flooding from storm surges. Intact sand dunes were the most effective barrier against tsunami waves that affected the coastal zone of Sri Lanka in 2004 (Bambaradeniya et al., 2006). The sediment in sand dunes protects the land behind them from storm erosion and potential sea level rise. Yet, sand is being extracted heavily from the large sand dune in Manatkadu, and the Pooneryn Peninsula resulting in the lowering of the sand dune.

In Puliyantivu, Jaffna, most of the natural terrestrial habitats were destroyed during the civil war but are now being used for cultivation instead of letting the vegetation revert naturally.

The damage inflicted on these ecosystems results in the degradation of the ecosystem services such as those mentioned above.

Changing the Physical Configuration of Lagoons and Estuaries

Because lagoons and estuaries are ecotones (see Chapter 4), they often have a larger number of species and larger population densities than species in rivers or inland water bodies in the sea. Therefore, they support a high level of biodiversity (de Wit, 2011; Kennish and Pearl, 2010 both in litt. Miththapala, 2013b), many species of which are important, such as edible shell fish and finfish. Lagoons and estuaries are, therefore, extremely important in the sustenance of coastal fisheries. The relatively calm habitats of lagoons allow for the practice of traditional and artisanal fisheries (Bjork et al., 2008 in litt. Miththapala, 2013b). They also function as buffer zones, protecting coastal communities from the full force of weather-related events — such as storm surges, floods and cyclones — by damping wave action, dissipating river discharge and temporarily storing water.

After the cessation of the civil war and the commencement of development activities, negative impacts on lagoon have already been observed, such as, for example, improper construction of roads, across lagoons blocking the through-flow of water (Gnaneswaran, 2015), resulting in different salinities in the partitioned sections of the lagoons. Changing salinities affect species composition, promoting salt-tolerant species in areas of high salinity and freshwater species in areas of low salinity. (See Box 2.)

Such partitioning has occurred in many places on the Peninsula: the reconstruction of the Jaffna-Pannai road has blocked the free flow of water in the northern part of the Jaffna Lagoon (MFF, 2015a). Another road constructed for Mandaitivu village divided a rich mangrove ecosystem, with consequences for species within this wetland (Gnaneswaran, 2015). Barrages built across the mouth of the Thondaimanaru Lagoon in the 1950s and the Arialai bridge, across part of the Jaffna Lagoon, restricting the natural ebb and flow of the tides (MFF, 2015b). In Thondaimanaru Lagoon, before the barrage was installed, the average annual fish catch in this lagoon was 150 tonnes; after the barrage was established the fish catch decreased drastically to 35 tonnes per year. In the space of a decade, 32 of the 47 identified fish species found in this lagoon disappeared (Piratheepa et al., 2016).

In addition, cross-roads have been built across other parts of the Thondaimanaru Lagoon, as well as in Kayts and Uppu Aru Lagoons, have caused the degradation of mangroves in these areas, as the free flow of water has been blocked (Gnaneswaran, 2015).

Box 2. Changing the ebb and flow of tides in a lagoon destroys it

One of the major impacts on lagoons and estuaries is the development of structures that change the physical configuration of a lagoon or estuary (Samarakoon & Samarawickrama, 2012). A normal flushing regimen in a lagoon or estuary involves freshwater inflow from rivers or surface runoff and the natural ebb and flow of tides. When structures impede this flow of water or isolate parts of the water body there are serious impacts, one of which is the exacerbation of flooding inland when the natural ebb of the tide, which could drain excess water from lagoons and estuaries, is obstructed (Samarakoon & Samarawickrama, 2012).

Changes to the flushing regimen also changes the salinity regimen. Species in lagoons and estuaries are adapted to daily changes in salinity. When this is disrupted, there often are changes in species composition, affecting fisheries, which, in turn, affects livelihoods.

The alteration of lagoons has a negative impact on nature-based tourism because of the loss of biodiversity, especially bird life.

Figure 39. Top: Road built across a mangrove ecosystem, Mandaitivu; Bottom: Mangroves clear cut for coconut cultivation, Sarasalai
(© Raji Gnaneswaran)

Destructive Fishing

Blast Fishing

Blast fishing uses dynamite to stun and kill fish so that they may be collected easily. Explosives are also used to stun schools of fish offshore during purse seine fishing operations.

Blast fishing is widespread both in the Palk Bay and Gulf of Mannar.

During the coral reef survey in the Mandaitivu Island, the sound of a blast was heard underwater.

Coral reefs are extremely productive ecosystems and provide humans with many services. For example, it is estimated that nearly 500 million people depend — directly and indirectly — on coral reefs for their livelihoods, food and other resources (Wilkinson, 2004). Like other coastal habitats, coral reefs protect the shoreline from extreme weather events.

Destructive Fishing Gear

Fishing is a major economic activity in the area and many different types of fishing gear are used.

Many types of fishing gear have the potential to be destructive depending on how and where they are used. For example, some fishing gear— such as drag nets; trammel nets; push nets and pull nets — damage and destroy ecosystems such as seagrasses, and are extremely detrimental to demersal and benthic organisms, as well as other species that are found in these ecosystems, because they drag against the bottom substrate.

Various fishing gear are being used in the Gulf of Mannar, Palk Bay and Palk Strait. These are described in Table 11.

Table 11. Types of potentially destructive fishing gear

Type of gear used	Used where
Push and pull nets	Used on seagrass meadows, damages seagrass. Between islands in the Jaffna Peninsula.
Trammel nets	This is widespread as it is underwater and cannot be seen. It gills, entangles everything its wake, irrespective of sizes, so it is very damaging,
Use of nets on coral reefs	Bottom set nets are used freely on reefs to catch spiny lobsters and reef fish throughout the study area. According to the Fisheries and Aquatic Resources Act (1996 as amended by 2016) one should not lay nets on hard substrates such as reefs.
Shark/skate gill nets	These are especially designed to catch skates, rays and sharks. These nets have a large mesh size from about 22-45 cm. These are death traps for dugongs and large fish. These nets are used widely throughout the Gulf of Mannar and the northern waters. Currently, saw fishes are threatened with extinction in Sri Lanka because of these nets.

Type of gear used	Used where
Purse seine	This type is not allowed in coastal waters because it interferes with artisanal fishers. It is widely used throughout the study area, but mostly in the Gulf of Mannar. Here, the use of this net, coupled with the use of scuba, has nearly wiped out most aggregating shoals of trevallies (Scientific name: *Caranx*; Sinhala: *Paraw*; Tamil: *Parai)* and barracuda (Scientific name: *Sphyraenal;* Sinhala: *Jeelawa*; Tamil: *Seela).* Sometimes, this type of net is coupled with dynamite when shoals are large. Dynamite is used to control or kill fish in the net so that the net can be hauled in.
Spear fishing	This is presently banned but the ban is not enforced. (Regulation was gazetted in 2017). Used mainly in the Gulf of Mannar in the study area. This type of fishing is also a major problem throughout the west, south and east coasts of Sri Lanka.
Fish kraals	This passive fishing gear causes immense damage to the reef fish population and also traps sea turtles. As these are permanently fixed on seagrass beds and coral reefs, they trap reef fish continuously. In the Palk Bay, there is a serious decline of reef fish, even in areas where the coral is good such as in Erumaitivu and Kakkativu islands in line with Iranaitivu, Guf of Mannar, Palk Bay and Palk Strait (not along the northern coast of the Jaffna Peninsula) (Figure 40 and Figure 41).

Figure 40. Stake net (fish kraal) at Iranaitivu
(©IUCN/Arjan Rajasuriya)

Figure 41. Stake net (fish kraal) fixed on reefs using metal pipes. This shows how reefs and seagrass meadows can be damaged
(© IUCN/ Arjan Rajasuriya)

Scuba diving also has detrimental impacts of natural resources and biodiversity. (See Box 3.)

Box 3. The detrimental impacts of scuba diving

Scuba diving is used to catch sea cucumber and chanks mainly in the Gulf of Mannar. Scuba diving was not encountered in the Palk Bay, although it may be used occasionally to collect sea cucumber. The use of scuba for resource harvesting is highly detrimental to the resource as it allows the diver to stay longer underwater, harvesting more of the target species. In addition, scuba diving allows access to many different types of resources such as chank, sea cucumber, lobster, and ornamental fish. If not properly monitored, there is a danger that a diver with a license for only one type of resource may end up illegally harvesting other resources types too.

Combined with nets that are legally permitted scuba diving contributes to overharvesting of demersal fish resources (Figure 42).

Figure 42. Scuba diving equipment used for chank and sea cucumber harvesting
(© IUCN/ Arjan Rajasuriya)

Shrimp Fishery

Shrimp fishery in Sri Lanka dates back 200 years (Long et al., 2010). It is reported that one of the first records of commercial fishing in 1926 was from Pedro Bank, and that there were offshore trawling grounds in Pedro Bank and the Gulf of Mannar (Long et al., 2010). The mud banks of Palk Bay and off the coast of Mullaittivu are among Sri Lanka's main shrimp concentration areas.

It has been reported that a fleet of about 2,500 South Indian bottom trawlers are fully or seasonally dependent on Sri Lankan waters to secure a profitable shrimp catch (Madanayaka, 2015). This is calculated to be 1557.7 tonnes of shrimp annually foregone for Sri Lankan fishermen (Madanayaka, 2015), estimated at a cost of over 750 million USD annually (Hettiarachchi, 2007, in litt. Madanayaka, 2015). These encroachments create severe threats to security, exploitation of fisheries resources and irrecoverable loss to ecosystems such as seagrasses and coral reefs and has been labelled a non-traditional security threat to the country (Madanayaka, 2015).

The impact of damaging coral reefs has been described in the section on blast fishing. The destruction of seagrass meadows also affects coastal fisheries because, they, like mangroves, are nursery areas for many finfish and shellfish (Heck et al., 2003, in litt. Miththapala 2008a).

Boat Propellers

Boat propellers cause damage to seagrass meadows in shallow areas where boats are constantly moving. This occurs in the Gulf of Mannar, Palk Bay and the seagrass meadows among the islands near the Jaffna Peninsula (Figure 43).

Galvanised Iron Pipes Offshore as Kraals

Instead of using wooden stakes, fishermen now use galvanised iron pipes offshore to set up permanent stake nets (fish kraals) fixed on coral reefs and seagrass meadows that damage such ecosystems. (See Figure 41.)

When turtles are caught in different types of nets, they are often put into the pens made by stake nets (discussed in the section above) and left until it is time to sell (when someone places an order). This provides access to fresh meat. This occurs mainly in the Gulf of Mannar on the southern side of Mannar Island where turtles heading north encounter various fishing gear.

Olive Ridley turtles (*Lepidochelys olivacea*) are considered the most abundant of the marine turtle species, and the largest nesting site for this species is the coast of Orissa in India (WWF, 2017). Their migratory route to Orissa is *via* the Palk Strait and thus, they are often netted and caught. This occurs even though this species is listed as Endangered in the national Red List (MoE, 2012) and is also protected by law through the Fauna and Flora Protection Ordinance of 1939 as amended in 2009.

Overexploitation of Natural Resources

Overexploitation affects provisioning services, mostly that of food. In coastal areas, this is often related to fisheries, so in addition to a decrease in food species because of overexploitation (resource depletion), there is also loss of livelihoods. Overexploitation also alters species composition and results in the alteration of entire ecosystems.

Much of the overexploitation observed in the study is centred on fisheries, given its importance in the areas.

Use of Small-meshed Nets

Sangili nets and nylon monofilament nets are small-meshed, and catch not only target species, but juveniles as well. Thus, these nets have significant negative impacts on various species. Hence, their use is prohibited (Figure 43).

Use of such illegal fishing gear is common in the northern region. For example, fishermen in Aralithturai and Punnalai along the Jaffna Lagoon were found to be using small-sized mesh nets (MFF, 2015a).

Apart from the waste stemming from by-catch (see section below) many air breathing species such as marine reptiles (for example, marine turtles) and mammals (for example, dugongs and dolphins) are accidentally netted by such illegal nets and drown (Figure 44).

Figure 43. Top: Fisherman with a boat showing how propellers have damaged seagrasses, Mannar. Note the shredded leaves on the sand; Bottom: Fishermen using banned mono-filament nets, Vallaipadu
(© IUCN/ Arjan Rajasuriya)

Use of Kraals

Kraals contribute to overexploitation of fish as all the reef fish end up inside the nets. As a result, the reefs are devoid of large reef fish. Reef fish are one of the main attractions for tourists and their absence make the reefs barren and unattractive to visitors. Kraals were observed in Iranaitivu.

Overexploitation through Waste of By-catch

Another form of over-exploitation is waste from by-catch. Beach seine, bottom-set nets, bottom trawling, non-selective fishing gear in general, generates by-catch. Many fishers target specific species, such as shrimps and those which are not target species — such as jacks (Carangidae), goatfish (Mullidae), emperors (Lethrinidae) and ponyfish (Leiognathidae) — are accidentally caught in the net. Often, they are juveniles and are too small to be commercially important. Therefore, they are discarded, often while the species are still alive, instead of releasing them back into the sea or lagoon (Figure 44).

By-catch also includes many bottom dwelling organisms such as molluscs. Large mounds of discarded molluscs can be observed in many fishing villages in the North (See Figure 44.)

This results in a significant waste of resources and an unnecessary depletion of marine species diversity and is also detrimental to commercial fisheries. (See Figure 43.)

Large piles of shells of the molluscs, including the branched murex, have also been observed, discarded. (See Figure 43 and section below.)

Targeted Over-harvesting

Indian Chanks

Indian chanks (*Turbinella pyrum*), found in the area, are valued ornamentals for the export industry (Long et al. 2010). Chank fishery is not new and has been going on since the early 1800s. It was reported that 1,669,745 chanks were exported in 1937 and 1,592,120 in 1939 (Deraniyagala, 1938 and 1940, in litt. Long et al., 2010). Sacred chanks are used as religious objects and also to make bangles and baubles (De Bruin et. al., 1994, in litt. Long et al., 010). (See Figure 44.)

Chanks that have left-handed whorls are rare (1:1000s) and have considerable value as lucky charms. These are known as Sacred Chanks and are called *valampuriya* in Sinhala and *valampuri* in Tamil and have an extremely high market value (Long et al., 2010).

Long et al. (2010) report that because chank collectors incorrectly believe that every chank egg case contains an immature left-handed chank, they collect every egg case and every chank they find, resulting in the diminishing of chank populations.

Chanks are collected in Silavatturai and Arrippu. See a photograph in Figure 46.

Other Molluscs

The operculum from the Branched murex (*Chicoreus ramosus*) is known to be extracted from live individuals and the molluscs are thrown back in the sea. (See Figure 43.) Fishermen believe that the operculum grows back. Although technically, the operculum can grow, the mollusc is highly vulnerable without the operculum and is devoured by predators. In addition, the damaged flesh may not be capable of regenerating the operculum and therefore this form of fishing is highly destructive.

Another highly damaging method is to use bottomset nets to entangle the molluscs, such as *Chicoreus ramosus* and *Cassis cornuta,* the latter which is a protected species under the FFPO. As these are large molluscs, they have flesh that can be dried and sold, and the fresh meat can also be marketed locally or exported. The meat is extracted by smashing the shell with a hammer and the shells are then discarded. (Figure 45). This occurs mainly in the Gulf of Mannar, Silavatturai, Arrippu and Vankalai and on Mannar Island itself.

Sea Cucumbers

Sea cucumbers (Holothurians) are collected from sandy bottoms and seagrass meadows, processed (graded, cleaned, eviscerated, boiled; stored in salt; boiled again and dried) prior to export. The entire catch is exported as *bêche de mer*, considered a culinary delicacy. (See Figure 45.)

They are collected easily as they can be hand-picked. Records from the Kalpitiya Peninsula indicate that fishermen selectively collect high-valued species, and the populations of these species are decreasing (Long et al., 2010).

Sea cucumbers are picked up by skin divers in the coastal and offshore areas of the Jaffna Lagoon. In Guru Nagar, fishermen fish off trawlers for sea cucumbers. After the war, there has been uncontrolled overexploitation. A study examining the abundance of sea cucumbers in Jaffna Lagoon, found that between 1980 and 1981, there were 20-160 individuals of high-value *Holothuria nobilis* (English: Black teat fish; Sinhala: *Polanga attaya*; Tamil: *Kal attai*) per square metre. However, a study a few years back revealed that only 10 locations in the Jaffna Lagoon had any sea cucumbers at all (MFF, 2014).

Nationally, the sea cucumber fishery is considered unsustainable

Poaching of Species

Dugongs

There is active hunting of the legally protected dugong and there are many records of dugongs being killed (by harpooning) in the recent past, as dugong meat is considered a delicacy. (See Figure 45.)

The dugong is also faced with multiple threats from fishing activities, especially the use of gillnets, bottom-set nets, trawling and blast fishing.

Madu del[9] (Tamil name: *Thirikkawala*) — large mesh-sized gill nets placed closed to the sea floor in coastal areas, used specially for demersal skates and rays — trap dugongs as well, who then drown. This type of net is widely used throughout the Gulf of Mannar, Palk Bay and Palk Strait.

Destruction and damage to seagrass meadows are also serious indirect threats to this rare marine mammal.

In Sri Lanka, the conservation status of dugongs has not yet been evaluated nationally but they are listed as Vulnerable in the global list.

Poaching of bird species such as ibis and open bills was reported by communities in Kokkilai Lagoon and occasionally on the north-east coast.

Sea cucumbers are picked up by skin divers in the coastal and offshore areas of the Jaffna Lagoon. In Guru Nagar, fishermen fish off trawlers for sea cucumbers. After the war, there has been uncontrolled overexploitation. A study examining the abundance of sea cucumbers in Jaffna Lagoon, found that between 1980 and 1981, there were 20-160 individuals of high-value *Holothuria nobilis* (English: Black teat fish; Sinhala: *Polanga attaya*; Tamil: *Kal attai*) per square metre. However, a study a few years back revealed that only 10 locations in the Jaffna Lagoon had any sea cucumbers at all (MFF, 2014).

Nationally, the sea cucumber fishery is considered unsustainable.

[9] Sawfish populations in Sri Lanka have also been depleted seriously as consequence of *madu del*.

Figure 44. Top: A dead marine turtle, Casuarina Beach, Karainagar; Bottom: Discarded by-catch
(© IUCN/ Arjan Rajasuriya)

Figure 45. Top: Discarded by-catch, including Spider conchs, Sea urchins and, *Murex* shells; Bottom: a huge pile of discarded molluscs

(Top: © IUCN /Arjan Rajasuriya; Bottom: © IUCN /Naalin Perera)

Figure 46. Top: A skin diver holding a Sacred Chank he has picked up, Vankalai, Mannar; Bottom: harvested Branched *Murex*
(© IUCN/ Arjan Rajasuriya)

Figure 47. Top: Killed Dugong, caught off Battalangudu, photographed in Mollikulam; Bottom: Drying sea cucumbers, Pallimunai, Mannar

(Top: © Sajith Subashana, Ocean Resources Conservation Association (ORCA); bottom: © Terney Pradeep Kumara)

Pollution

Pollution, in any form, degrades ecosystems and, often, affects species. Solid waste pollution is not only unsightly and detrimental to human health but is also damaging to ecosystems and species. Water pollution, from point and non-point sources, is a serious issue for most coastal ecosystems such as lagoons, and estuaries, as well as marine ecosystems, such as coral reefs and seagrass meadows (Joseph, 2004). Excessive use of agro-chemicals inland, is the cause of much of this pollution (Imbulana et al. 2006). In the southern areas of Sri Lanka, such pollution has been reported in many coastal areas as well as in inland water bodies (Imbulana et al., 2006).

Solid Waste Pollution

Solid waste pollution is an increasing threat to the biodiversity of the islands. Waste is dumped by roadsides, or on undeveloped or open land. Unplanned and *ad hoc* waste management also contributes to solid waste pollution.

In addition, this solid waste is often washed to the ocean and carried away by littoral drift, polluting coastal waters.

Apart from being aesthetically unpleasing, solid waste pollution has serious impacts on terrestrial biodiversity.

Firstly, ecosystems such as seagrasses are affected by solid waste pollution as seagrasses are smothered and unable to photosynthesise. This was observed in the Gulf of Mannar (Pradeep Kumara & Udagedara, 2013).

Secondly, species — such as the iconic Delft ponies and dugongs, and other marine mammals — can die from eating plastic, as their bowels become impacted (that is, obstructed).

The CBD studied the impacts of marine debris on marine species and found that over half of these were entanglements or ingestion (CBD & STAP, 2012). Their reports states that ‘all known species of sea turtles, about half of all species of marine mammals, and one-fifth of all species of sea birds were affected by entanglement or ingestion of marine debris . . . that 15% of these species were on the IUCN Red List™ and . . . 80% of these impacts were due to plastic’ (CBD & STAP, 2012).

Thirdly, hazardous chemical residues in dumped solid waste can leach into the soil and affect plant growth. Studies in other countries have shown decreased plant diversity in sites in which the soil is contaminated with heavy metals (Ali et al., 2014).

Solid waste has been observed in many places in the study area. During marine surveys, solid waste was observed in Valvettithurai, Point Pedro and Manatkadu and the Gulf of Mannar.

Solid waste is being dumped in the coastal stretches from Pooneryn to Sangupiddy and Valvettithurai to Point Pedro, Mullaittivu, and Pudumathalan beach.

Waste is also being dumped on the banks of Thondaimanaru Lagoon, the banks of the Jaffna Lagoon near Vaddukkoddai, Arialai in Kayts and Mannar Island.

In Iranaitivu South, the beach was covered with waste originating elsewhere in the Palk Strait.

See photographs of solid waste pollution in Figure 48.

Water and Marine Pollution

Pollution in the coastal areas of Sri Lanka is high, given that there is a higher concentration of people living along the coast, as well as other development activities such as tourism and industries (CZMP, 2006, in litt. BOBLME, 2013). Faecal pollution, nutrients such as nitrogen and phosphorus, organic (non-toxic and toxic) and heavy metal pollution, oil pollution and thermal pollution and thermal pollution are all types of pollution that can affect coastal areas (CZMP, 2006, in litt. BOBLME, 2013).

A recent study of the Jaffna Lagoon shows that in the areas of Navanthurai, Pannai, Guru Nagar, Columbuthurai and Pasaiyur, there are increased phosphate levels and a high occurrence of *Escherichia coli*, indicating pollution from agrochemicals and dumping of sewage into the lagoon (MFF, 2015a).

Seagrasses are very sensitive to changes in the quality of water, particularly eutrophication resulting from nutrient loading (from fertilisers, animal and domestic waste) and sediments that settle and block sunlight and prevent photosynthesis. When polluted, seagrass meadows deteriorate quickly and die (Bjork et al., 2008, in litt. Miththapala, 2008a).

Figure 48. Top: Solid waste pollution in seagrass meadows in the Gulf of Mannar; Bottom: solid waste near Kora kulam, Mannar Island, where rare winter visitors are found

(Top: © Susantha Udagedera: Bottom: © Sriyanie Miththapala)

Invasive Alien Species

Five species of invasive alien flora were observed in various locations as shown in Table 12.

Table 12. List of invasive alien flora found in the study area

Family	Scientific name	Common name	Sinhala name	Tamil name	Listed in national priority/ potential IAS list[10]	Listed in Global invasive species database[11]	Location found
Fabaceae	*Prosopis juliflora*	Mesquite	*Katu-siyambala/ Kalapu andara*	*Valikkathan*	Priority IAS	Yes	Kayts
Verbenaceae	*Lantana camara*	Lantana	*Gandapana*	*Arisimalar*	Priority IAS	Yes, and also listed in the 100 worst IAS of the world	Akkarai beach, Delft, Karaitivu, Kavutharimunai, Kayts, Mandaitivu, Nanthi Kadal, Valvettithurai
Cactaceae	*Opuntia dillenii*	Prickly pear	*Katupathok*	*Kalli*	Priority IAS	Yes, and also listed in the 100 worst IAS of the world	Analaitivu, Chundikulam, Delft, Eluvaitivu, Erumaitivu, Iranaitivu North, Iranaitivu South, Kakkativu, Kalliaditivu, Kayts, Nainativu, Nanthi Kadal, Nayaru, Palaitivu, and Valvettithurai

[10] MoMD&E, 2016b.
[11] Lowe et al., 2004., GISD, 2005

Family	Scientific name	Common name	Sinhala name	Tamil name	Listed in national priority/ potential IAS list[10]	Listed in Global invasive species database[11]	Location found
Asteraceae	*Mikania cordata*	Mile-a-minute	*Gam palu, Kehel palu*	*Tuni-kodi*	No, but is a species of concern see next column	Yes, and also listed in the 100 worst IAS of the world	Nanthi Kadal
Fabaceae	*Leucaena leucocephala*	Wild tamarind/ Ipil-Ipil	*Ipil-Ipil*	*Nattucavundal*	Priority IAS	Yes, and also listed in the 100 worst IAS of the world	Delft, Kakkativu, Pungudutivu, Valvettithurai

Tilapia (*Oreochromis mosambicus*), although used a common food fish to stock inland water bodies in Sri Lanka, is a known IAS in tropical countries and is listed as one of the 100 worst IAS of the world (Athauda, 2010). It is a superior competitor, a generalist in terms of environmental tolerance, an opportunistic omnivore that feeds on a wide range of faunal and flora species, breeds rapidly, and causes turbidity in water bodies as it digs up the substrate (Athauda, 2010). Tilapia was observed on Mandaitivu Island.

Feral dogs (*Canis familiaris*) are listed as potential IAS on the national list (MoMD&E, 2016b). Feral dog populations were found on Iranaitivu North and South, Kakkativu, Karainagar, Kayts, Mandaitivu, Nainativu and in Mannar Island. Feral dogs are known to prey on wild species — such as wild reptiles, birds and small mammals (Marambe et al., 2011) — and, therefore, are listed as potential IAS on the national list (MoMD&E, 2016b). Therefore, they may negatively affect the local biodiversity of the islands. For example, feral dogs are found in Sand Bar IV, Adam's Bridge. If they spread to Sand Bar III, they can eat the eggs of breeding resident seabirds such as sooty tern (*Onychoprion fuscatus*), bridled tern (*O. anaethetus*), little tern (*Sternula albifrons*), common tern (*S. hirundo*) and greater crested tern (*Thalasseus bergii*), as well as the eggs of the rarer brown noddy (*Anous stolidus*), Saunders's tern (*S. saundersi*), Roseate tern (*Sterna dougallii*) which nest there (Seneviratne et al.,2015) (Figure 50).

Feral cats, also on the list of potential IAS species (MoMD&E, 2016ba) were found in Karainagar. Again, cats are very efficient predators and pose a serious threat to native wildlife (Marambe et al., 2011).

Several migrant birds, who breed in Sri Lanka as well as rare breeding residents are found on Mannar Island — for example, the Gull-billed tern (*Sterna nilotica*), Roseate tern (*Sterna dougallii*), Bridled tern (*Sterna anaethetus*), Saunders's tern (*Sterna saundersi*), Caspian tern (*Charadrius asiaticus*) and the Little tern (*Sterna albifrons*). The Brown noddy (*Anous stolidus*), a rare migrant, was observed in Vidattaltivu. Many of these lay their eggs on the ground, and therefore, are highly vulnerable to predation by feral dogs. Figure 49 shows feral dogs in Sand Bar IV. If they spread to Sand Bar III, they can eat the eggs of rare breeding residents.

Climate Change

Climate change is an overarching anthropogenic driver of ecosystem change that has synergistic effects on all other drivers of change (MoMD&E, 2016a). The impacts of climate change on coastal areas and ecosystems of Sri Lanka will be significant and will include sea level rise, salt water intrusion, changes in rainfall patterns and temperature, increasing ocean acidity and changes in the frequency and severity of extreme weather events (MoMD&E, 2016a).

Sea Level Rise

Figure 51 shows the impacts of sea level rise on the coastline and islands of the Northern Province. Figure 51 shows that several areas — such as Periya Kalapu and Vankalai Lagoon, Palaitivu, Parititivu, part of the Chundikulam Lagoon and a part of coastline could be inundated by 2025.

Accompanying sea level rise and coastal inundation is salt water intrusion. This will alter the salinity regimen in coastal ecosystems such as mangroves, salt marshes, tidal flats, lagoons and estuaries, which will, in turn, change species composition in these ecosystems, favouring more salt-tolerant species. Given that several of these ecosystems have within them, commercially important fin and shell fish, such changes will have profound negative consequences, as the freshwater from the land will not flow freely into the sea and pools of brackish and fresh water will remain as ideal grounds for the breeding of mosquitoes.

Figure 49. Top: Mesquite (*Prosopis juliflora*) growing in Vankalai Sanctuary; Bottom: Feral dogs (*Canis familiaris*), Sand Bar IV

(Top: © IUCN/Naalin Perera; Bottom: © IUCN/Sampath de A. Goonatilake)

Figure 50. Top: A nesting Brown Noddy (*Anous stolidus*) on Sand Bar Island III; Bottom: Gull-billed tern (*Sterna nilotica*) in Iranaitivu, both rare breeding residents
(Top: © Sampath Seneviratne; bottom © IUCN/ Sampath de A. Goonatillake)

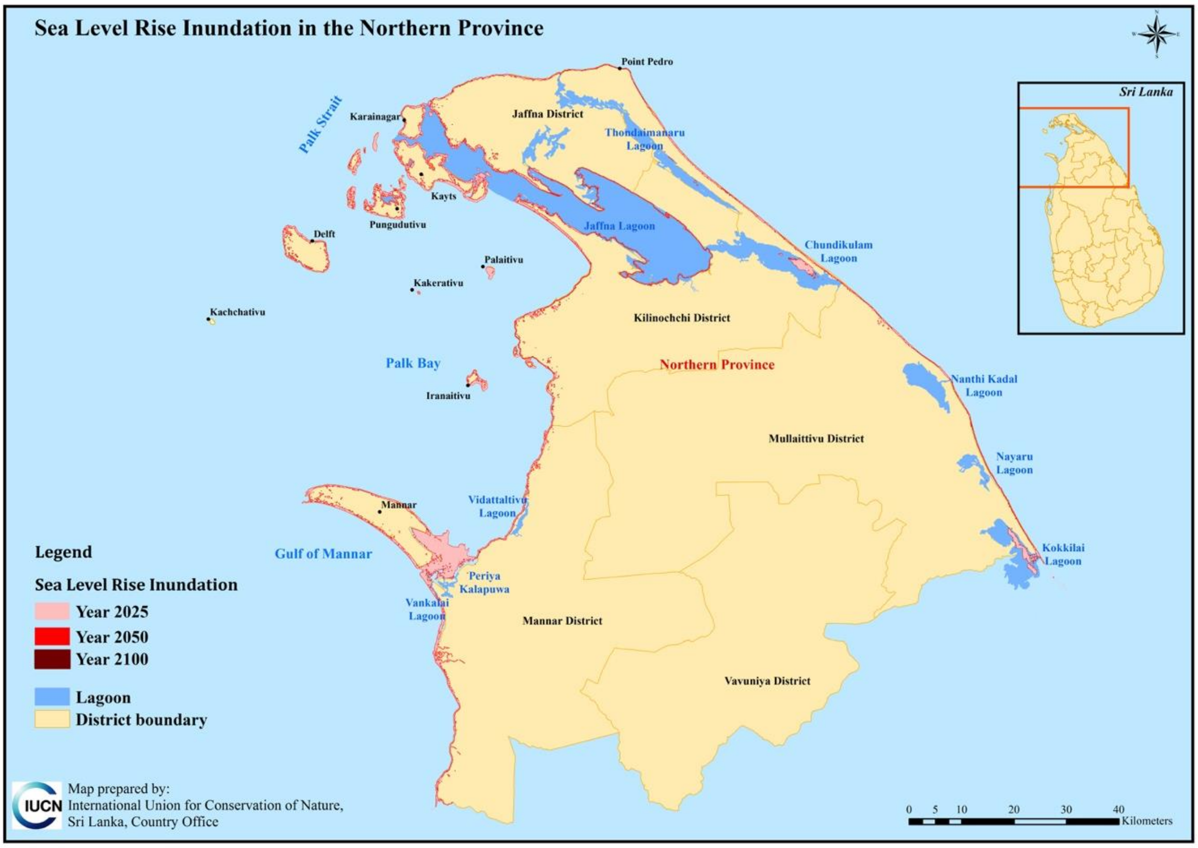

Figure 51. Predicted sea level rise in northern Sri Lanka

(Source: DMC, 2012. IPCC 2007 temperature predictions for the B2 scenario and elevation data from the Improved Advanced Space borne Thermal Emission and Reflection Radiometer (ASTER) were processed in a GIS system using 1984 WGS datum to estimate the sea level rise in 2025, 2050 and 2100 years. Respective coastal inundations were estimated using the Bruun rule using estimated sea level rise.)

El Niño

Another major impact of climate change is the worsening of the effects of El Niño and La Niña episodes. See Box 4 for a description.

Box 4. What is El Niño?

El Niño is Spanish for ‘the little boy’, referring to the Christ child, because this event is noticed usually around Christmas time. It is a fluctuation of the ocean-atmosphere system in the tropical Pacific Ocean that is important for the world’s climate. In normal, non-El Niño conditions, trade winds (prevailing tropical winds) blow towards the west across the tropical Pacific, piling up warm surface water in the west Pacific, so that the sea surface is about 0.5 m higher in height and 8° C warmer at Indonesia than at Ecuador. The waters off South America are cool because of an upwelling from the deep (called the Humboldt current) and are nutrient-rich, with high marine primary productivity which supports fisheries.

During El Niño, the air pressure over the Indian Ocean, Indonesia, and Australia rises, but drops over Tahiti and the rest of the central and eastern Pacific Ocean. The trade winds in the South Pacific weaken. Warm air rises near Peru causing rain in its deserts, while warm water spreads from the West Pacific and Indian Ocean to the East Pacific Ocean. When it spreads, it takes the rain with it, causing rainfall in normally dry areas and drought in normally wet areas. El Niño also results in less upwelling of the Humboldt current, less nutrients, warmer sea surface temperatures (+0.5°C) and decreased marine primary production along the west coast of South America.

La Niña means 'the little girl' in Spanish, meant to reflect that its effects are the opposite to that of El Niño. Here, the result is a lowering of sea surface temperatures by about 0.5°C. It usually follows an El Niño event.

Together El Niño and La Niña are known as the El Niño-Southern Oscillation (ENSO) cycle. Thus, ENSO is an irregular, periodic variation of the winds and sea surface temperatures, where, together, El Niño is the warming phase and La Niña is the cooling phase.

(Source: NOAA, 2008 in litt. Miththapala 2008, extracted directly)

Coral Bleaching

Reef-building corals (hermatypic corals) obtain their food from one-celled organisms called zooxanthellae. Zooxanthellae are single-celled organisms that use sunlight for photosynthesis and transfer 95% of the food they produce to coral polyps. Both coral and the zooxanthellae benefit from this association (a mutualistic association). Because of this association with zooxanthellae that need sunlight to produce food, hermatypic corals are dependent on sunlight and only grow in clear shallow waters less than 60m deep, which have a temperature range between 25° and 30°C.

Because reef building coral species can live only within a small temperature range, even a tiny change in temperature causes seriously detrimental effects, as exemplified by the wide-scale coral bleaching of 1998 and 2015-2016, as a result of an El Niño event. When hermatypic corals are stressed — such as with an increase in temperature — the critical balance that maintains their mutualistic relationship with zooxanthellae is lost. The coral may lose some or most of their zooxanthellae, a major source of nutrition and colour. In this condition, corals are referred to as 'bleached.' In some species, even their life cycles are disrupted.

Bleached coral reefs were observed in Mandaitivu.

Coral reef ecosystems are important in fisheries, providing about a quarter of the total fisheries catch as providing food for about one billion people in Asia alone (Moore and Best, 2001). They are also a source for medicines: already extracts from coral reef organisms are being used in treatments for diseases like cancer and HIV (WWF, 2017). In Sri Lanka, coastal tourism accounts for 70% percent of the total tourism infrastructure in the country and a significant portion of the national economy. (SLTDA, 2013). Coral reefs form natural physical barriers that protect shorelines from the impacts of extreme weather event, the eroding forces of the sea. It is estimated that more than 150,000 km of shoreline in 100 countries and territories receive some physical protection from reefs (Burke et al., 2011). When corals are bleached, these services are foregone.

Loss of Carbon Sequestration

Carbon sequestration is the process by which plant life removes carbon dioxide (CO_2) from the atmosphere and stores it as biomass. Plants and oceans are, therefore, called carbon sinks. Coastal ecosystems —such as mangroves, seagrasses and tidal flats — are carbon sinks. (See Box 5 for a description.)

Box 5. The importance of coastal ecosystems in carbon sequestration

- Perera et al. (2012, in litt. MoMd&E, 2016b) estimated that mangroves in the estuaries of Kala Oya, Malwatu Oya and the Batticaloa Lagoon have carbon stocks of 204, 165 and 150 t/ha respectively.
- There are no studies of carbon sequestration in seagrass meadows in Sri Lanka, but globally, it has been estimated that seagrass ecosystems could store as much as 4.2-8.4 19.9 petagrammes of organic carbon (Fourqurean et al., 2012). At the present rate of loss of seagrasses, the destruction of these ecosystems could release up to 299 teragrammes of carbon per year (Fourqurean et al., 2012).
- A striking difference among carbon sequestration in coastal, marine and terrestrial ecosystems is the capacity in coastal ecosystems to store, for a very long period of time, carbon in their sediments. It has been estimated that the amount of carbon sequestered in the sediments of many coastal ecosystems is as much as 50 times higher than the carbon stored in land sinks (Pidgeon, undated).

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When coastal ecosystems are destroyed (See Chapter 5), this supporting ecosystem service provided by these ecosystems is lost.

Other Impacts of Climate Change

The impacts of climate change on other ecosystems is summarised in Table 13.

Table 13. Impact of climate change on ecosystems
(Source: MoMD&E, 2016a, extracted from Miththapala, 2008a, 2008b, 2008c, 2008d, 2013a and 2013b)

Effect of climate change	Ecosystem	Impact on ecosystem
Ocean acidification	Open ocean, coral reefs	There could be profound changes in marine food webs, affecting food security — such as slowing down of calcification critical for coral growth, coral bleaching; ocean acidity is corrosive to marine shelled organisms. This will worsen the impact of other effects such as temperature.
Changes in ocean wave currents	Open ocean, coral reefs, seagrasses beaches, mangroves, tidal flats	There can be profound changes in marine food webs, affecting food security; hypoxic zones form; there is nutrient mixing including upwelling of nutrients from deep waters. Beaches, tidal flats and mangroves will also be affected, as erosion and accretion patterns will change due to shifts in the transport of sand and sediment on the

Effect of climate change	Ecosystem	Impact on ecosystem
		ocean floor, particularly in nearshore areas. This means current models predicting the movement of sand and erosion/accretion may no longer be valid.
Changes in rainfall patterns	Mangroves, terrestrial forests, grasslands, villus, lagoons, estuaries, rivers and streams	Causes changes in species composition in mangroves, terrestrial forests, grasslands; land degradation due to erosion; results in increasing landslides; affects soil formation and soil quality; causes changes in the soil-water environment. Changes in rainfall will affect inflow (either an increase or decrease) into floodplains, villus, lagoons, estuaries, rivers and streams, changing their natural hydrological patterns.
Changes in temperature on land	Terrestrial ecosystems will be affected. Aquatic ecosystems Open ocean	Changes in species composition because of changes in photosynthesis and other biological reactions; decrease in species populations due to disruption of life cycles and change in behavioural patterns; heat waves and related impacts; fires; changes in oxygen balance. Evaporation will increase in aquatic systems such as rivers, reservoirs, lagoons and estuaries. In coastal brackish-water systems, salinity could increase. Changes in wave currents, drying up of waterways, steams, changes to biodiversity and established food webs. Economic impacts can be serious, as people’s livelihoods may change.
Changes in ocean temperature	Coral reefs (El Niño events) Open ocean Seagrasses	Coral bleaching, damaging whole ecosystems including seagrasses, Changes in ocean oxygen levels, wave currents, nutrient cycling Ocean stratification resulting in phytoplankton booms and reduction in productivity. Higher water temperatures will affect directly growth, reproduction and general metabolism of seagrasses (Short and Neckles, 1999; Bjork et al., 2008 both in litt. Miththapala 2008a).
Increase in extreme weather events (such as tropical cyclones, droughts, flash floods, landslides, forest fires, and heat waves)	All ecosystems	Physical damage and increased erosion in coastal ecosystems; salinity increase in coastal ecosystems and paddy fields; habitat loss and decrease in species populations.

Chapter 6. Recommendations for the Sustainable Management of Natural Resources and the Conservation of Biodiversity of the Study Area

Kachchatiivu Island © IUCN/Arjan Rajasuriya

Current development activities in the northern regions are often being carried without the inclusion of environmental safeguards that protect ecosystems and the services they provide to humans. It is essential that development is made sustainable through the inclusion of such safeguards, in a planned and integrated manner, and that it uses multi-sectoral collaboration.

Recommendation 1: Conserve Natural Ecosystems

Based on this study, it is strongly recommended that certain areas be set aside as conservation areas. These are shown in the figure below and presented in detail in

Annex 1

The coastal islands of the northern region — except for a few large islands such as Delft — have not been studied previously. The conservation areas proposed in this study are based on additional information gathered during the study, and the conservation value of the area. The justification for these additional conservation areas are presented in Table.

However, the second recommendation in this report (see below) is that further detailed studies should be undertaken so that exact boundaries can be demarcated based on their conservation value, as well as impact on local livelihoods on such a declaration and ownership of the land. This will ensure that declaration will have minimum social impacts.

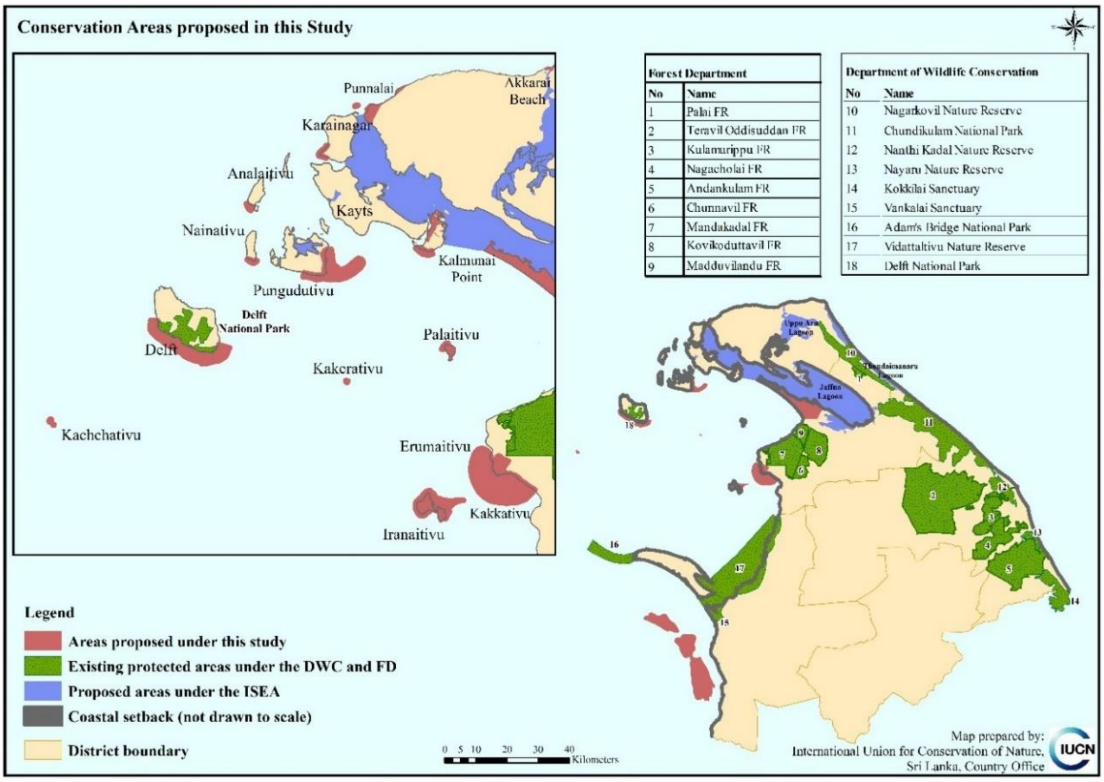

Figure 52. Map of existing conservation areas, areas proposed under the ISEA and areas proposed under this study

Table 14. Areas proposed in this study as conservation areas, justification for their conservation and ranked priorities for actin

(1=Very high priority; 2= High priority; 3 =Medium priority; 4= Low priority)

Island	Terrestrial	Coastal and Marine	Area	Justification	Rank
Analaitivu		√	Small fringing coral reef along the western and south-western sides	Small reef area with massive corals, mainly species belonging to the genera *Porites, Goniastrea, Favia* and *Favites* (marine diversity is high). Provisioning (important for fisheries productivity) and protective services to the island.	3
Erumaitivu and Kakkativu Islands		√	Coral reef along the western side of the islands of Erumaitivu and Kakkativu. Seagrass on the eastern side of the islands between the mainland and islands.	Erumaitivu has the best coral reef in the Palk Bay. Provisioning (fisheries productivity from coral reefs and seagrasses) and protective services, as well as aesthetic appeal.	1
Iranaitivu North and Iranaitivu South Islands		√	Area north, west, and north-west of the island. Seagrasses on the western side of the island	Coral reefs and seagrass meadows. Provisioning (important for fisheries productivity) and protective services to the islands, as well as aesthetic appeal.	1
Kachchativu		√	Coral reefs on the northern side. Other reef habitats are in poor condition	Coral reefs and whole island, because of threatened flora present. But there is a need to zone the island for different activities (for example, for visitation by pilgrims). Provisioning and protective services to the island as well as aesthetic appeal	1
Kakerativu		√	Coral reefs to the north and north-west of the island	Along with Erumaitivu for its coral reef. See a under Erumaitivu.	2
Karaitivu		√	Coral reefs to the south-west of the island	A fringing reef with large coral domes, high marine diversity. Provisioning (important for fisheries productivity) and protective services to the island as well as aesthetic appeal.	2

Island	Terrestrial	Coastal and Marine	Area	Justification	Rank
Mandaitivu	√	√	Much of the coastline containing rich mangroves and salt marshes and a small marine area with coral reef in the south and south-west of the island	It is already an Important Bird Area along with Kayts. Important for migratory birds. Important for fisheries productivity and marine biodiversity.	1
Nainativu		√	Fringing coral reefs around the island with the best coral area in the south of the island	Presence of a fringing reef. Provisioning (important for fisheries productivity) and protective services to the island as well as aesthetic appeal.	3
Neduntivu		√	Fringing coral reef around the island, The marine area adjacent to the National Park is included in the MPA	For prevention of erosion of the coastline. Important for fisheries productivity and marine biodiversity	2
Palaitivu	√	√	The entire island, as well as a small north-western part of the marine area	High ecosystem and species diversity, this island also has aesthetic and scenic value	1
Ponneryn Peninsula	√		Much of the peninsula which has sand dunes and other sand dune related ecosystems	Large sand dunes, only area with mature *Pandanus* along the western coast. Unique ecosystem with dune forests, protection for the Jaffna Lagoon	1
Punnalai Khadu	√		The headland and a small strip	Salt marshes, important for water birds	2

It should be noted that although the historical custodians of the island's biodiversity have been the Department of Wildlife Conservation (DWC) and Forest Department (FD), the Central Environmental Authority (CEA), Coast Conservation and Coastal Resource Management Department (CC&CRMD) and the Department of Fisheries and Aquatic Resources (DFAR) also have areas where sustainable management of the use of natural resources is practised (MoMD&E, 2016a). A diagram showing these different managed areas is presented in Figure 53.

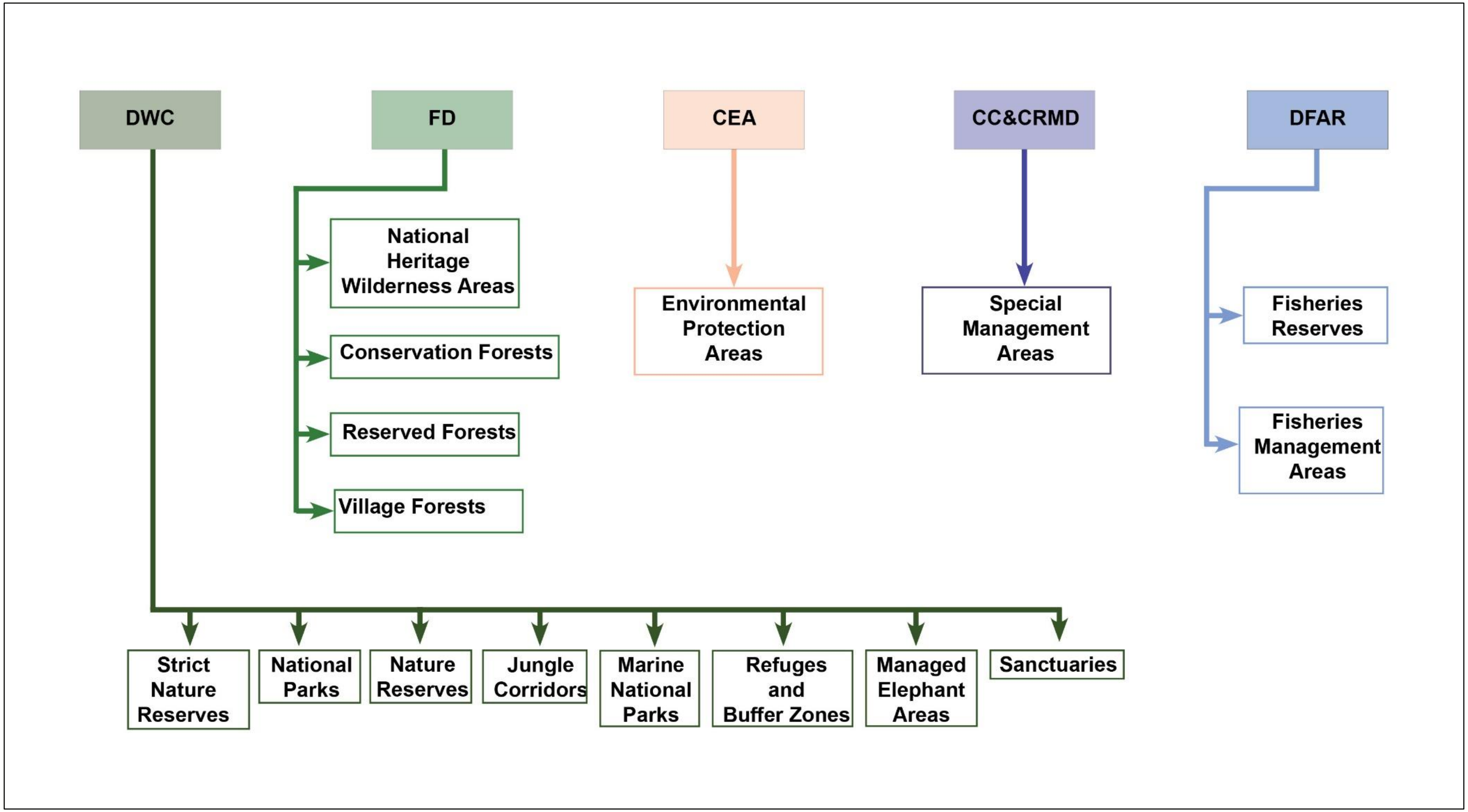

Figure 53. Diagram showing the different organisations and the different categories of areas managed for the conservation of natural resources

Each of these areas has a different level of protection, and activities which are prohibited within. (See Table 14.)

Table 15.Types of areas managed for conservation and brief details
(Source: MoMD&E, 2016a, Blackhall Publishing, 2014)

Type of managed area (number in parentheses)	Level of protection afforded	Permitted activities	Land ownership
Under the jurisdiction of the DWC			
Strict Nature Reserve	Highest possible	Entry and development activities are prohibited. Construction within one-mile radius of a SNR needs permission from the Department of Wildlife Conservation.	State land
Nature Reserve	High	No person shall enter or remain within any nature reserve except under the authority and in accordance with the condition of a permit issued by the prescribed officer on payment of the prescribed fee. Entry and development activities are prohibited. Construction within one-mile radius of a national reserve needs permission from the Department of Wildlife Conservation. However, traditional practices situated within the limits of any national reserve or state land in any sanctuary, if being practised before the declaration of such protected area, are permitted to continue.	State land
National Park	High, entry only by permit and designated area for disembarking	Entry is only by permit and fee as well as under regulated conditions for the specific purpose of viewing wildlife. Development activities are prohibited here. Construction within one-mile radius of a national park needs permission from the Department of Wildlife Conservation However, traditional practices situated within the limits of any national reserve or state land in any sanctuary, if being practised before the declaration of such protected area, are permitted to continue.	State land
Jungle corridor	High	Development activities are prohibited here. Construction within one-mile radius of a jungle corridor needs permission from the Department of Wildlife Conservation. However, traditional practices situated within the limits of any national reserve or state land in any sanctuary, if being practised before the declaration of such protected area, are permitted to continue.	State land
Marine National Park	High	Entry is only by permit and under regulated conditions for the specific purpose of viewing wildlife. Development activities are prohibited here. Construction within one-mile radius of a national park needs permission from the Department of Wildlife Conservation. However, traditional practices situated within the limits of any national	State owned

Type of managed area (number in parentheses)	Level of protection afforded	Permitted activities	Land ownership
		reserve or state land in any sanctuary, if being practised before the declaration of such protected area, are permitted to continue.	
Refuges and Buffer zones (not yet declared)	High	Development activities are prohibited here. Construction within one-mile radius of a nature reserve needs permission from the Department of Wildlife Conservation. However, traditional practices situated within the limits of any national reserve or state land in any sanctuary, if being practised before the declaration of such protected area, are permitted to continue.	State land
Managed Elephant Areas	Low	Managed Elephant Reserves are declared to ensure that both humans and elephants can live in harmony and not in conflict with each other. They are meant to strike a balance between different needs, rather than acquiring such lands to resettle people and declare national reserves.	Both state and private land
Sanctuaries	Lowest	Hunting, trapping animals, collecting of eggs of wild birds and reptiles, disturbing any nest of any bird, and firing a gun in any sanctuary is prohibited. On state land in of the sanctuary, to carry, or possess a gun, or a cartridge or other explosive of any description is prohibited except by permission of the DWC. On state land within a sanctuary, it is also against the law to destroy plants, clear areas for cultivation or mining, create fires, construct infrastructure or roads, dispose of or discharge waste or fill land.	Both state and private land
Under the jurisdiction of the FD			
Conservation Forests	High	No entry except under the authority of a permit issued by the Conservator General for scientific or observation purposes. Extractive use of any kind is prohibited; so is firing a gun, possessing or using a trap, weapon, tool, explosives or poisonous substances; kindling, keeping or carrying any fire or causing the kindling of any fire or allows any fire to keep burning or to spread; clearing or breaking up soil or digging any land for cultivation or for any other purpose or cultivating any such cleared land or erecting a hut or doing any other activity on it; and construction.	State land
Reserved Forests (Forest Reserves)	High but less than the above	As above, but certain activities may be permitted with the approval of the CGF	State land

Type of managed area (number in parentheses)	Level of protection afforded	Permitted activities	Land ownership
Village Forests	Low	Areas that are used for different uses by a community or several communities and certain kinds of extractive practices can be carried out inside such areas. There is a certain degree of protection in these forests as some activities are regulated. However, polluting of water, setting fires, injuring, cutting or felling any protected (reserved) trees and clearing is still prohibited.	State land
Under the jurisdiction of the CEA			
Environmental Protection Areas	High	An important feature of this Act is that there can be regulations to prohibit, restrict, regulate and approve certain types of activities within such areas and these are implemented through these regulations.	Both state and private land
Under the jurisdiction of the CC&CRMD			
SMA	Low	Restricted to the coastal zone. Management and planning are carried out with the assistance of communities	Both state and private land
Under the jurisdiction of the DFAR			
Fisheries Reserves	Medium	To ensure sustainable management of a particular area. Any development activity within a fishery reserve requires the permission and approval of the Department of Fisheries and Aquatic Resources. Fishing, mining, collecting or processing of coral or other aquatic resources, dredging or extracting sand or gravel; discharging or depositing waste or any other polluting matter or in any other way disturbing, interfering with or destroying, fish or other aquatic resources or their natural breeding grounds or habitat within such reserve is prohibited without a permit by the Director of Fisheries and Aquatic Resources. Similarly, construction or erection of any building or other structure on or over any land or waters within such reserve is also prohibited without a permit from the director.	State
FMA	Low	Protects a particular resource or the resources that are found in a particular area by restricting and controlling the activities that are allowed in such an area.	State

Recommendation 2: Carry out Further Detailed Studies of the Biodiversity of the Region

The previous recommendation presented areas for conservation. However, further in-depth, detailed studies of the biodiversity of the region, are essential. In particular, studies of Iranaitivu North, Iranaitivu South, Eluvaitivu, Kachchativu, Karaitivu, Kayts, Mandaitivu, Delft, Palaitivu, Erumaitivu and Kakeraitivu are required to identify under which category and at which level, protection is afforded to those areas.

Inter alia, these studies should focus on species — such as threatened species and migratory species identified during this study— assessing species richness, abundance as well as other Essential Biodiversity Variables (EBV) such as species interactions, behaviour, taxonomic diversity, phenology, extending over several seasons to capture seasonal variation.

Box 6. Essential Biodiversity Variables (EBV)

Essential Biodiversity Variables (EBV) are 'defined as the derived measurements required to study, report, and manage biodiversity change, focusing on status and trend in elements of biodiversity should play the role of brokers between monitoring initiatives and decision makers. They provide the first level of abstraction between low-level primary observations and high-level indicators of biodiversity' (GEO BON, 2018). EBVs are the basic building blocks that allow for higher level (regional, national, global) assessments through predictive modelling.

Studies should also focus on ecosystems, assessing parameters not only such as net primary productivity, habitat structure, but also measuring ecosystem services such as harvested wild goods; cultivated goods; global climate regulation (estimating carbon sequestration, estimate greenhouse gas emissions); assessing flood protection services; estimating water quantity provision for domestic and industrial purposes; measure water quality services; and assessing nature-based recreation (estimating annual number of visits made for tourism and recreation purposes; estimating annual total income from tourism and recreation; estimating annual tourism income from nature-based activities) (Peh et al., 2017). From such ecosystem service studies, meaningful ecosystem valuation can be carried out.

Yet other studies should be carried out to quantify and prioritise threats discussed in Chapter 5; so that remedial measures can be formulated.

From such studies, integrated management plans for the above-mentioned areas targeting the protection of threatened species, preventing the degradation of ecosystems, and identifying the players and their roles can be formulated.

In addition, it is strongly recommended that similar detailed studies are also carried out for the lagoons of the northern area, in particular Jaffna, Thondaimanaru, Nanthi Kadal, Nayaru and Kokkilai Lagoons, which are surrounded by heavy human settlements and anthropogenic change. In particular, the salinity regimens of these lagoons must be studied in depth, over time, as there have been many hydrological alterations made in these lagoons. Current fish diversity, fish harvest (type and quantity of fish harvested) are also needed for comparison with earlier available data. Many of the northern lagoons serve as feeding grounds for migratory species and also are extremely important to fisheries-related livelihoods.

Also largely ignored is the archaeological wealth in the study area. Detailed studies are also needed in this area. (See Box 7.)

Box 7. The need for marine archaeological expeditions

The northern region has immense archaeological and cultural significance since the prehistoric period. The ancient marine Silk Route also runs through this narrow sea passage that was used by ancient Chinese, Arabic, Persian, Greek and Roman traders. Marine archaeological expeditions are lacking in this region and therefore, only a few artefacts have been recovered in this region. Therefore, future detailed explorations are also needed to understand the ancient maritime trade in this area and to preserve the archaeological sites in the area.

Recommendation 3: Shift to an Inter-sectoral Approach to Management

One of the major institutional flaws in Sri Lanka is that there is a multitude of policies and laws, as well as numerous organisations, each with their own mandates and agendas, working in the same area, with little or no reference to each other. This is exemplified in the coastal zone, where the Coast Conservation and Coastal Resources Management Department has primary jurisdiction over all coastal areas in Sri Lanka; the Department of Wildlife Conservation manages marine and coastal protected areas, while the Forest Department has jurisdiction over mangroves, which are also found in coastal areas (Joseph, 2004; IUCN, 2011a). Fisheries resources in lagoons come under the aegis of the Department of Fisheries and Aquatic Resources. Added to the mix of organisations are, *inter alia*, local and provincial governments, the Sri Lanka Tourism Development Authority[12] and the Urban Development Authority. Each of these institutions often works largely in isolation of the others. The users of the coastal zone — communities, developers and others are rarely included in management.

There is also a lack of knowledge about and mainstreaming of the links between ecosystem well-being and human well-being (MoMD&E, 2016a).

Therefore, it is essential that an integrated, inter-sectoral approach is used for planning. Multi-Stakeholder Platforms (MSPs), that include government officials from relevant organisations — such as the CEA, DWC, FD, CC&CRMD, DFAR, Department of Land Use Planning, UDA, SLTDA — to ensure a holistic approach, the private sector — such as hoteliers and other service providers — as well as communities, safeguard their rights — have been proven to be effective in many areas of the island. These MSPs are convened under the Chairmanship of the District Secretary (the highest-ranking government officer in the area) (Miththapala, 2011a). Such MSPs are recommended for the study area too.

[12] Coastal tourism accounts for 70% percent of the total tourism infrastructure in the country and a significant portion of the national economy (BOBLME, 2013).

It is heartening to note that recent amendments to some legislation (for example, Fisheries and Coast Conservation Acts, Forest Conservation Ordinance) provide a legal basis for inter-sectoral (inter-agency) collaboration to promote resources management and environment conservation. It is hoped that these new amendments will provide the impetus for better integration of management.

Recommendation 4: Manage Solid Waste and other Forms of Pollution

Solid waste management has become a serious national issue in the recent past, after the tragic events at Meethotamulla. An effective solution is yet to be implemented nationally. It is recommended that a solid waste management programme is established to ensure that the generation of waste is a) minimised, b) collected effectively (separated into reusable, recyclable, non-degradable and biodegradable waste) as well as in time, by municipal/local government authorities; and d) disposed of responsibly. (For garbage segregation to work, a finely-tuned and smoothly operating collection system is also essential.)

To this end, recycling facilities, identified land fill areas, and *repeated* training for local government authorities, communities, businesses and all stakeholders will be essential. Such a programme is needed urgently, particularly if activities such as tourism are being promoted.

Sewage, agrochemicals from agriculture and aquaculture, sedimentation, industrial effluents, and heavy metals all cause water pollution in other parts of the island (BOBLME, 2013).

Even though Sri Lanka ranks highest in Asia in relation to good sanitation, this national figure masks geographical discrepancies, as the urban poor, coastal and fishing communities, and estate/plantation workers still lag behind in sanitation (UNICEF, 2017). Data specific to the northern region are still hard to come by.

Irresponsible disposal of fish waste and by-catch in fisheries harbours and fish landing sites can cause high pollution throughout the coast. This, in turn, can cause high Chemical Oxygen Demand (COD)[13] levels in associated coastal waters (CZMP, 2006 in litt. BOBLME, 2013).

Studies carried out to assess water quality along the south-western, southern and eastern coastlines have shown that there is eutrophication, high faecal contamination, industrial effluents and sedimentation in many areas (BOBLME, 2013). A small study of the Jaffna Lagoon (see Chapter 5) revealed that the lagoon, at various points, was polluted with faecal matter and agrochemicals.

Similar studies of the northern coastline, as well as the lagoons of the study area, are urgently needed before development activities increase and with them, water pollution.

[13] Higher COD levels mean a greater amount of oxidizable organic material in the sample, and therefore, COD assesses organic pollution.

Knowledge of and enforcement of laws and regulations related to water pollution (primarily the National Environmental Act No. 47 of 1980, its amendments of 1998, 2000 and 2005 and regulations) is also essential (CEA, 2013).

As above, creating awareness about these laws is of paramount importance.

Air and noise pollution standards must also be maintained as stated in the regulations under the National Environmental Act (CEA, 2013).

Recommendation 5: Minimise Overexploitation

The main issues of overexploitation are associated with fisheries. Firstly, it should be noted that fishing was restricted severely during the three decade-long war. The release of this restriction, post-war, without regulation, can lead to over-fishing in coastal waters as seen in other parts of the island. Secondly, observations from this study, showed that the use of destructive and often illegal fishing gear and targeted over-harvesting of species is rife in the study area.

Thus, there is an urgent need to introduce fisheries management to reduce overexploitation of resources and the use of illegal and destructive fishing gear.

In collaboration with the Department of Fisheries and Aquatic Resources and the Department of Wildlife Conservation, it is essential that, as for other threats, concerted programmes to create awareness are conducted about which gear is permissible, which species have controls placed on fishery, and which species cannot be harvested, targeting fishermen, the Sri Lankan Navy, and hoteliers.

Enforcement of the FFPO and the FARA will also be essential.

Recommendation 6: Control Invasive Alien Species (IAS)

Five species of invasive alien flora and one potential invasive alien fauna species were observed in the study area. The Convention on Biological Diversity (CBD) defines IAS as: '. . . species whose introduction and/or spread outside their natural past or present distribution threatens biological diversity.' (CBD, undated).

Box 8. The characteristics of IAS and their impacts on natural ecosystems

Invasive alien species have several intrinsic characteristics:
a) they have a history of invasiveness outside their natural range;
b) they have a wide distribution in different habitats;
c) they are generalists;
d) they grow and mature fast but can live long;
e) they reproduce efficiently and have effective means of dispersing;
f) they can endure harsh conditions and have many adaptations to overcome environmental hardships; and
g) they are superior competitors and can cause the extinction of native species.

Their impacts on natural ecosystems are very detrimental as they
a) alter ecosystems;
b) destroy and deplete native species;
c) can cause severe damage in agricultural lands;
d) can transmit diseases and can cause illness and/or death;
f) can facilitate the spread of forest fires;
g) can cause pollution of water bodies; and
h) are costly to control and eradicate, once they have been established (Wittenberg & Cock, 2001).

A good example of the impacts of IAS can be seen in the Hawaiian archipelago, isolated in the middle of the Pacific Ocean. This archipelago has many endemic and native species. Of the 140 species of indigenous birds, half are now extinct because rats, wild boar, goats and mongooses introduced either deliberately, or accidentally to these islands devastated the native flora and fauna of Hawaii (IUCN & MASL, 2014).

Given the damage that IAS can wreak on natural system (see Box 8) it is in important that attempts are made to control or eradicate the species listed in Chapter 5. Particular attention should be given to feral cats and dogs which feed on native species. The presence on feral dogs on Sand Bar IV of Adam's Bridge is an imminent threat to the rare breeding residents who nest (on the ground) in Sand Bar III.

To this end, a plan for the management of these species should be developed and should include a) training for the personnel of the divisional secretariats and local government authorities who will be involved directly in identifying these IAS species; b) detailed methodology for management (deciding whether eradication or control is practical); c) monitoring to prevent re-infestation and d) early detection of eradicated species should they re-establish[14].

It is recommended that a university or research organisation be co-opted for assistance in this endeavour.

[14] It is strongly recommended that even though Tilapia is not listed as an IAS in Sri Lanka, given its biology and known invasiveness in Sri Lanka, it is eradicated from Mandaitivu as the coastal waters of the island have been proposed as a protected area.

Recommendation 7: Mitigate and Adapt to Climate Change

Mitigation

Climate change mitigation refers to efforts to reduce or prevent emission of greenhouse gases.

Through an integrated approach, stringent energy conservation measures, improving energy supplies, optimising equipment to work at 100% efficiency and the use of renewable energy — such as solar power — should be promoted actively. In addition, there should be stringent adherence to air quality parameters required by the CEA for vehicle emissions and ambient air quality parameters (CEA, 2013).

Alternative modes of transport — such as bullock carts and electrical golf carts — should be considered for tourism activities on islands, so that certain islands can remain emission free. For example, it is recommended that Iranaitivu North, Iranaitivu South, Eluvaitivu, Kachchativu, Karaitivu, Delft, Paraitivu and Analaitivu are developed as emission free islands.

Often overlooked in Sri Lanka as a means of reducing emissions, is the protection of forests and coastal ecosystems (See Chapter 5). The role of such ecosystems in climate change mitigation must be highlighted (Box 8).

Box 9. The role of ecosystems in climate change mitigation

- Green plants, through the process of photosynthesis, absorb atmospheric carbon and release oxygen as a by-product. Because of this, forests serve as carbon sinks to absorb large quantities of carbon dioxide. It is reported that in the past few decades, the forests of the world have absorbed as much as 30% every year (2 petagrams of carbon per year) of the world's carbon emissions (Pan et al., 2011).
- Coastal ecosystems such as mangroves, seagrass meadows and tidal marshes are estimated to sequester carbon dioxide at a significantly higher rate than rain forests. Of this 'blue carbon' stored, 50–99% is located in the soils below ground, up to six metres deep (Blue Carbon Initiative, 2017). The dramatic difference between carbon absorption in coastal marine and terrestrial ecosystems is the capacity in coastal ecosystems for long-term carbon sequestration in their sediment.

Protection of such ecosystems has been recommended in the first section of this chapter as because of their biodiversity and ecosystems. The above reveals a second reason for the conservation of terrestrial, coastal and marine systems.

Adaptation

Climate change mitigation, however, alone will not be enough. Even if greenhouse gas emissions are reduced drastically, the current effects of climate change will be felt for several decades more. Therefore, a second strategy for dealing with climate change — adaptation — also becomes essential (Miththapala, 2008e). 'Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts' (UNFCCC, 2018). Simply stated, adaptation is accepting that climate change will occur, and preparing for it. At a local level, the single most important response to climate change is adaptation.

Ecosystem-based adaptation (EbA) uses 'biodiversity and ecosystem services into an overall adaptation strategy to help people to adapt to the adverse effects of climate change' (Lo, 2016). While not yet mainstreamed into development agendas, case studies have proven that EbA a) provides protection from extreme elements; b) contributes to climate change mitigation by restoration of natural habitats and c) provides innovative agricultural solutions to adapt to climate change (Lo, 2016). The above reveals a third reason for the conservation of terrestrial, coastal and marine systems.

EbA activities — such as restoring degraded ecosystems; managing invasive alien species that degrade land; agricultural management (using climate-resilient species, crop rotation and diversification); promoting water and soil conservation measures (such as rain water harvesting, drip irrigation and management of livestock grazing respectively); planting a tree when felling one is inevitable — as well as other such EbA activities should be routinised in development and livelihoods-related projects.

Recommendation 8: Ensure Adherence to Environmental Laws

Embedded in the constitution of Sri Lanka is the protection of the country's natural wealth and the services it provides humans, and this is buttressed by several ordinances, acts, regulations and policies (MoMD&E, 2016a). There are many laws related to management of natural resources, but these can be culled to 24 key laws that have bearing on the drivers of ecosystem change (See Annex 9 for details). These laws have been enacted to 'regulate human behaviour so that ecosystems and species, and thereby the services provided by them, are conserved. This, in turn, ensures the protection of livelihoods. Failing to uphold these laws and regulations leads to many far reaching and damaging impacts, including increased vulnerability to extreme weather events, decreased agricultural production, and diminishing natural resources, including fish stocks. Laws also ensure that our natural capital is managed sustainably and equitably' (IUCN, 2006).

Weak enforcement of environment-related laws in rampant Sri Lanka, for a number of reasons. Prime among these is a lack of knowledge about these laws. There is also a lack of integrated planning (addressed in a previous section); a multiplicity of agencies and several ministries; weak or lack of communication among these agencies and ministries; lack of capacity and lack of mainstreaming of 'key concepts such as the relationships among biodiversity and development, ecosystem services and human well-being into medium and long-term planning (MoMD&E, 2016).

Thus, there is a need to more rigorous enforcement of environment-related laws and targeted creation of awareness about environment-related laws (such what can/cannot be done; where it can/cannot be done) is urgently needed for a wide range of sectors—such as tourism, development, fisheries, aquaculture, provincial and municipal councils, and developmental agencies to reduce *ad hoc* development that damages ecosystems and their services.

Recommendation 9: Carry out Extensive Awareness Programmes about the Area's Natural Wealth

The National Biodiversity Strategic Action Plan 2016-2022 (MoMD&E, 2016) states that 'In post-conflict Sri Lanka, there has been a strong and urgent thrust for infrastructure development, with less focus on the conservation of natural capital. In this current climate the paradigm of biodiversity conservation as we know it has to change. Conservation can no longer be relegated to the mandated custodians of biodiversity such as the Department of Wildlife Conservation, the Forest Department and the Central Environmental Authority but must be the responsibility of every single citizen of Sri Lanka. It is, therefore, imperative that all stakeholders be made aware of the actions proposed in the [plan], so that a larger group of stakeholders may assist in/support these conservation actions.'

As important as the previous recommendations, is the creation of awareness among the gamut of stakeholders such as government agencies, local government politicians, district secretaries, divisional secretaries, *grama niladharis*, the armed forces and police, non-governmental organisations, the private sector, school children, media personnel, the general public and targeted communities such as fishing communities.

Such creation of awareness should focus on

- 'Creat[ing] a clear understanding about the need for biodiversity conservation and the links between ecosystem well-being and human well-being among all stakeholders' (MoMD&E, 2016). This is crucial, as people need to understand the immediate and long-term benefits that ecosystems provide (i.e. what is the benefit for themselves from for example, conserving mangroves);
- 'Mainstream[ing] biodiversity conservation as a multi-sector, value-added, and benefit-sharing effort to on-going development efforts' (MoMD&E, 2016); and
- As noted in the previous recommendation, increase the knowledge about environmental laws.

Such creation of awareness will foster and augment inter-sectoral cooperation and ensure a 'buy in' from communities and the general public that will, in turn, promote participation in conservation activities.

Recommendation 10: Ensure Responsible Tourism

Many of these northern islands are ideal for nature-based tourism (See Annex 1). However, tourism can place heavy, additional stresses on an environment already seriously overused and overstretched, as daily, it consumes immense quantities of resources (for example, energy for lighting, cooling rooms and cooking; water for laundry and filling swimming pools); generates excessive waste and pollution; destroys natural habitats during construction; forces local people to compete for essential resources with tourists and hotels; and contributes hugely to global warming through air travel (Miththapala, 2011b).

Since the civil war in Sri Lanka ended, there has been a robust growth in the number of foreign tourists. In 2016, there were 2,050,832 arrivals showing an increase of 14% from 2015 (SLTDA, 2016). In 2016, tourism ranked third as a foreign exchange earner (SLTDA, 2016). Nature-based tourism is important in Sri Lanka and many of these visitors visit national parks and in 2016, 1,967,138 local and foreign tourists visited national parks (SLTDA, 2016). However, nature tourism can damage the very environment that tourists are coming to see, if tourism is unregulated and tourist behaviour becomes irresponsible (Box 9).

Box 10. The impact of unregulated tourism

Yala is a good example of such damage, as visitation increased from 43,368 visitors in 2008 to 658,277 visitors in 2016, well beyond the carry capacity of the park (which has not changed), resulting in severe overcrowding (MoMD&E, 2016a). This can be observed in the photographs — of traffic jams of jeeps lined up at the entrance or surrounding a leopard — that are circulated commonly in social and regular media.

Accompanying this overcrowding is irresponsible behaviour — such as speeding — which has resulted in the death of leopards and jungle cats (MoMD&E, 2016a).

Prevent Over-visitation and Overexploitation

Over-visitation is a form of overuse. In Annex 1, clear recommendations are given for the carrying capacity of each island recommended for nature-based tourism. These recommendations should be followed strictly.

Often coupled with over-visitation is irresponsible behaviour, which disrupts natural animal behaviour or contributes to over-exploitation. Such behaviour includes the

- use of lures (taped bird calls) to entice birds into the open;
- the purchase of species protected by law (shells, trinkets made of tortoise shell);
- the consumption of protected species (turtle or dolphin meat, lobsters during season); and
- disruption of the nesting behaviour of species.

Many of these activities occur because of the lack of awareness about responsible behaviour and species which are protected by law or threatened with extinction. Local government officers, district level officers, communities, hoteliers, tour guides, developers, law enforcement officers and all stakeholders should be provided with good conservation education.

To this end, it is recommended that a capacity building/communication plan be developed with different messages and training as needed for each target group, as well as targeted communication materials (such as clear signboards), so that all stakeholders are aware of, *inter alia*, what can and cannot be done and where, what use is permissible and not.

Secondly, it is essential that existing laws related to the environment are enforced properly (see above) and that all law enforcement officers are made aware of them.

Prevent Habitat Sestruction

Off-roading can cause damage to terrestrial ecosystems.

Irresponsible snorkelling, diving, jet-skiing and boating can cause direct physical damage to coral reefs and seagrass meadows. For example, when visitors walk on reefs, they cause physical damage to the reef structure, stirring up sediment. Boats can drop anchors directly onto reefs while the propellers of jet skis and boats can damage and destroy seagrass meadows.

Tourism infrastructure, if built without integrated planning and consideration for environmental laws, can cause habitat destruction. For example,

- forests and wetlands are clear-felled, and sand dunes levelled to build infrastructure;
- seagrasses are destroyed to build jetties, piers and erosion defence structures;
- lagoon and estuarine hydrology are negatively affected when infrastructure is built across the mouths of such water bodies.

As Kalliaditivu and Puliyantivu Islands are located inside the Vankalai Sanctuary, permanent infrastructure should be avoided.

As with the above section, it will be essential to create awareness about the impacts of habitat destruction, and also ensure that relevant laws are enforced strictly (for example, the constraints on built infrastructure in relation to protected areas, according to the FFPO).

Prevent Pollution

When hotels or related infrastructure are constructed, it is essential that there are, in place, adequate and approved measures for sewage management, solid waste management and waste water and water pollution management.

A study by the Greening Sri Lanka Hotels project, under the aegis of the European Commission Switch Asia Program, sampled 276 hotels (61 large= ≥ 50 rooms; medium and small= <50 rooms) in Sri Lanka and revealed that while 92% of the large hotels had sewage treatment plants (STP), only 17% of the medium and small hotels had STPs (Switch Asia, Greening Sri Lanka Hotels Project, 2013, in litt. BOBLME, 2013).

The CZMP of 2016 noted that '*[In] many coastal resorts where there are clusters of restaurants and guest houses, and other major tourist centers. The near shore waters receive untreated sewage, sullage in the form of kitchen and laundry wastewater, and solid waste including plastics. This causes pollution problems, as apparent in most major tourist centres along the south, southwest and east coasts. Tourism expansion in Hikkaduwa, Beruwala, Unawatuna and Arugam Bay areas has led to water quality degradation as well as visual pollution of beaches and near shore waters. . . It is clearly evident that the qualities of the near shore coastal waters in the vicinity of tourism centers have been significantly degraded due to discharge of effluents.*'

It is, therefore, imperative that any tourism infrastructure that is built is carried out in conformity to CEA regulation standards and SLTDA (2017) development standards.

Tourists, particularly local tourists, should be advised against irresponsible littering in areas where there are nature trails in protected areas, or if they are snorkelling near coral reefs or seagrasses. To this end, clear signage and awareness are essential.

Prevent the Spread of IAS

Ensure that the spread of invasive alien species is not increased. Building equipment is known to be a pathway through which IAS spread.

In addition, when tourism infrastructure is constructed, it should be ensured that the landscaping of gardens that often follows, uses species native to the area, thus minimising the risk of introducing IAS.

On the sandbar islands declared as the Adam's Bridge National Park, it is crucial that tourism is regulated by the Department of Wildlife Conservation. Access to the islands must be controlled strictly, especially for those islands used by birds for breeding. If access is not controlled, the bird breeding colonies could be destroyed due to the introduction of predatory species like feral dogs.

Use Green Building Practices during Construction

'Green Building, also known as green construction or sustainable building, is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and deconstruction' (Environment and Ecology, 2017). The aim of green building is:

- *Siting and structure design efficiency*: the objective is to minimise the total environmental impact associated with all life-cycle stages of the building project;
- *Energy efficiency*: this includes maximising use of natural light and ventilation and use of alternative energy — such as solar power for heating water and for lighting.
- *Water efficiency*: this includes recycling grey water for flushing toilets; using water-conserving fixtures such as low-flush toilets and low-flow shower heads; ensuring thorough maintenance that spots and fixes leaks immediately.
- *Materials efficiency*: this includes obtaining wood from plantation forests; reusing materials from demolished buildings, sourcing and using local material.
- *Indoor environmental quality enhancement*: this includes the use of environmentally-friendly cleaning agents; refraining from use of chemical air fresheners; and ensuring that anything containing volatile organic chemicals (VOC) are not used.
- *Operations and maintenance optimisation*: this includes ensuring that a framework for ensuring environmental management is established during construction and maintained through training and internal audits (Miththapala, 2011b).

- *Waste reduction*: this includes ensuring that sewage and grey water are treated before release into the environment; ensuring reducing, reusing and recycling waste at all stages of building so that the amount going into landfill is minimised (All of the above adapted from Environment and Ecology, 2017).

Ensure Mitigation and Adaptation to Climate Change

Many of the principles of green building address climate change mitigation and adaptation.

Other measures are operational measures that include ensuring all vehicles are serviced on a regular schedule to ensure optimum performance and minimum emissions; buying locally to avoid food miles[15]; making efforts to plant trees[16] on the premises with native plants of the region, when felling of trees in unavoidable and using landscaping as a means to cool the premises (Miththapala, 2011b).

It should be ultimately ensured that any tourism project that is commenced is climate-proofed.

A sister document to this, titled 'Sustainable Ecotourism Development Plan for Coastal Islands in Palk Bay and Gulf of Mannar' is currently being developed, which will take the recommendations from this report, and build upon it (IUCN, in preparation).

Conclusion

The northern coastal stretch from Mannar to Kokkilai has been untouched by development for over three decades, retaining some pristine ecosystems, a collection of range-restricted species and has several feeding areas for migrating birds.

These ecosystems also provide the residents of these coastal areas with life-sustaining ecosystem services.

It is imperative, therefore, that future development is planned in an integrated manner, ensuring that sensitive ecosystems and species of concern (such range-restricted, rare and threatened species and rare migrants and breeding residents) are conserved and ecosystem services so needed by humans are retained through minimising overall damage to ecosystems.

Sustainable, nature-based tourism, if planned and implemented will be an appropriate development strategy for the area, for the improvement of livelihoods. However, it cannot be over-emphasised that incorporating stringent environmental safeguards is essential.

[15] Food miles are the distance food travels from where it is grown to where it is ultimately purchased or consumed

[16] Each tree planted in the humid tropics absorbs 22 kg of carbon dioxide every year.

Figure 54. Top: Fishermen, Kokkilai Lagoon; Bottom: Toddy tapping, Delft
(Top: © IUCN/Kumudini Ekaratne; bottom: © IUCN/Naalin Perera)

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Fishermen in Thailaimannar © Sriyanie Miththapala

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Annex 1. Profiles of the Islands Surveyed

(in alphabetical order)


Coral wall, Delft Island © IUCN/Arjan Rajasuriya

Analaitivu Island (Sinhala: *Annaladoova*; Dutch: *Rotterdam*)

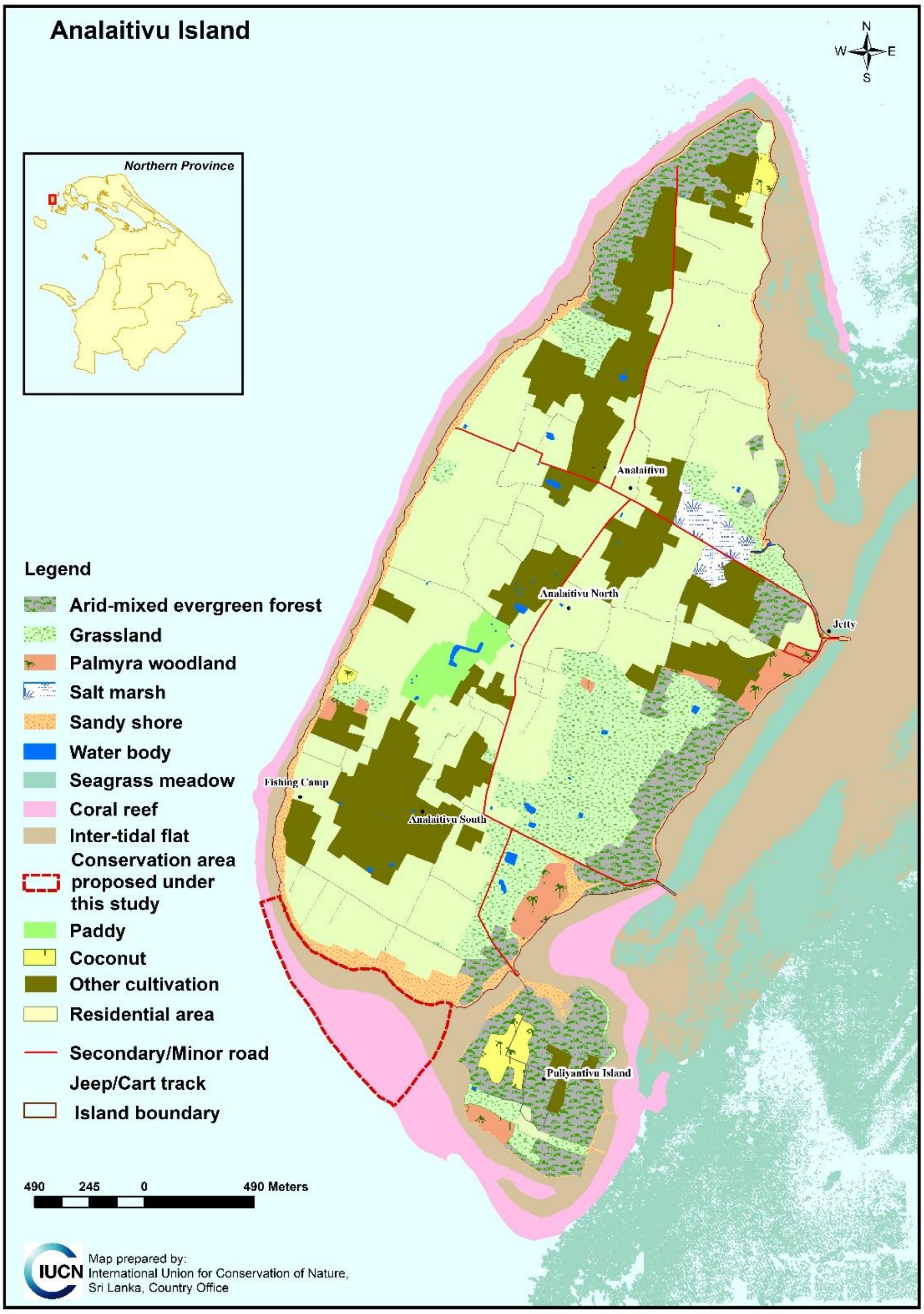

Figure 55. Map of Analaitivu Island, showing ecosystems, land use and proposed conservation area

Location	The island has an extent of about 4.8 km^2 and belongs to the islands' North (Kayts) Divisional Secretariat in the Jaffna District. It is highly populated, and the current population is around 1,773. Analaitivu Island was called 'Donna Clara' by the Portuguese and 'Rotterdam' by the Dutch. It was also called '*Kotedhasi*'. The first kovil in the island was named '*Elumangei Nachchimarei'*. During the Dutch period, a church named 'Mādā' was built for the Catholic community, which is the only church that is present in the island (Bassett, 1997) (Figure 55).
Ecosystems	**Terrestrial Ecosystems** The ecosystems found on the island include arid mixed evergreen forests, seashore scrubland, dead coral beaches, sandy seashore, home gardens and cultivated lands. Seashore scrubland are dominated by Hopbush (*Dodonaea viscosa*). A total of 71 plant and 42 animal species, respectively, were recorded from the island. The Palmyra tree (*Borassus flabellifer*) was the most notable terrestrial plant recorded on the island and is found in different ecosystems from home gardens to arid mixed evergreen forests. The endemic plant species *Cassine balae*, was also found in the arid mixed evergreen forests. The faunal assemblage comprised a land snail, two dragonfly, ten butterfly, four reptiles, 23 birds and two mammal species, respectively. **Marine ecosystems**: Analaitivu[17] has a fringing reef along the western side of the island and seagrasses on the eastern side. The reef is a narrow belt about 50 m in width. There is a narrow back reef area about one metre in depth. The reef crest consists of dead coral and rubble overgrown by seaweeds (*Caulerpa, Halimeda, Turbinaria* and *Sargassum*). The upper margin of the seaward reef slope had tabulate *Acropora* spp. dominated by *Acropora hyacinthus*. Colonies were relatively small, with a maximum diameter was about one metre. The reef slope contained massive corals, mainly species belonging to the genera *Porites, Goniastrea, Favia* and *Favites*. Soft corals (*Sarcophyton* and *Sinularia*) were common (Rajasuriya, 2007). The diversity and abundance of reef fish were relatively low. Surgeonfish (Acanthuridae) and damselfish (Pomacentridae) were common. Small clumps of seagrasses were present in the narrow back reef. Extensive seagrass meadows were present on the eastern side of the island. *Cymodocea* and *Enhalus* were common.
Special attributes	**Notable terrestrial; fauna** Notable species of terrestrial fauna found on the island include one endemic species —the Lesser albatross (*Appias galane*); one nationally Critically Endangered species, a land snail (*Trachia vittata*); and four nationally Vulnerable species

[17] This island was not visited during the present survey for marine assessment. Data are extracted from Rajasuriya, 2007.

	— Plain orange tip (*Colotis aurora*), the Saw-scaled viper (*Echis carinatus*), Little ringed plover (*Charadrius dubius*) and Kentish plover (*Charadrius alexandrinus*). **Notable marine fauna** Notable species include the Bengal sergeant (*Abudefduf bengalensis*) that occurs only in the northern areas of Sri Lanka from the northern Gulf of Mannar to the north-east coast. Among the dominant species of hard corals *Acropora hyacinthus* (NT), *Favites halicora* (NT), *Favites chinensis* (NT), *Favia matthai* (NT), *Porites lobata* (NT) and *Turbinaria peltata* (VU) are listed under the Red List of Threatened Species (MoE, 2012).
Proposed actions	A small marine area in the south of the island is proposed as a conservation area (Figure 55). The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6. Palmyra woodlands and scenic views on the northern end of Analaitivu Island present opportunities for nature-based tourism. Coral reefs and seagrass meadows nearby can be an added attraction, as activities such as snorkelling and wind surfing can be promoted. Analaitivu Island has a rich cultural diversity, as well as many archaeological monuments (for example, a survey beacon) and therefore, there is opportunity to promote cultural tourism as well. The presence of human settlements and a road network provide opportunities to develop home stays. Tourism activities will promote further livelihood opportunities for the inhabitants.
Proposed improvements	Currently, the island does not have any infrastructure facilities. Tourism specific infrastructure — such as nature trails, a boat deck, snorkelling areas will also have to be developed, while ensuring that environmental safeguards are included. (See Chapter 6.)
Carrying capacity for tourism activities	Up to 25 visitors can be accommodated in the island at a given time.

Eluvaitivu Island (Sinhala: Eluvadoova)

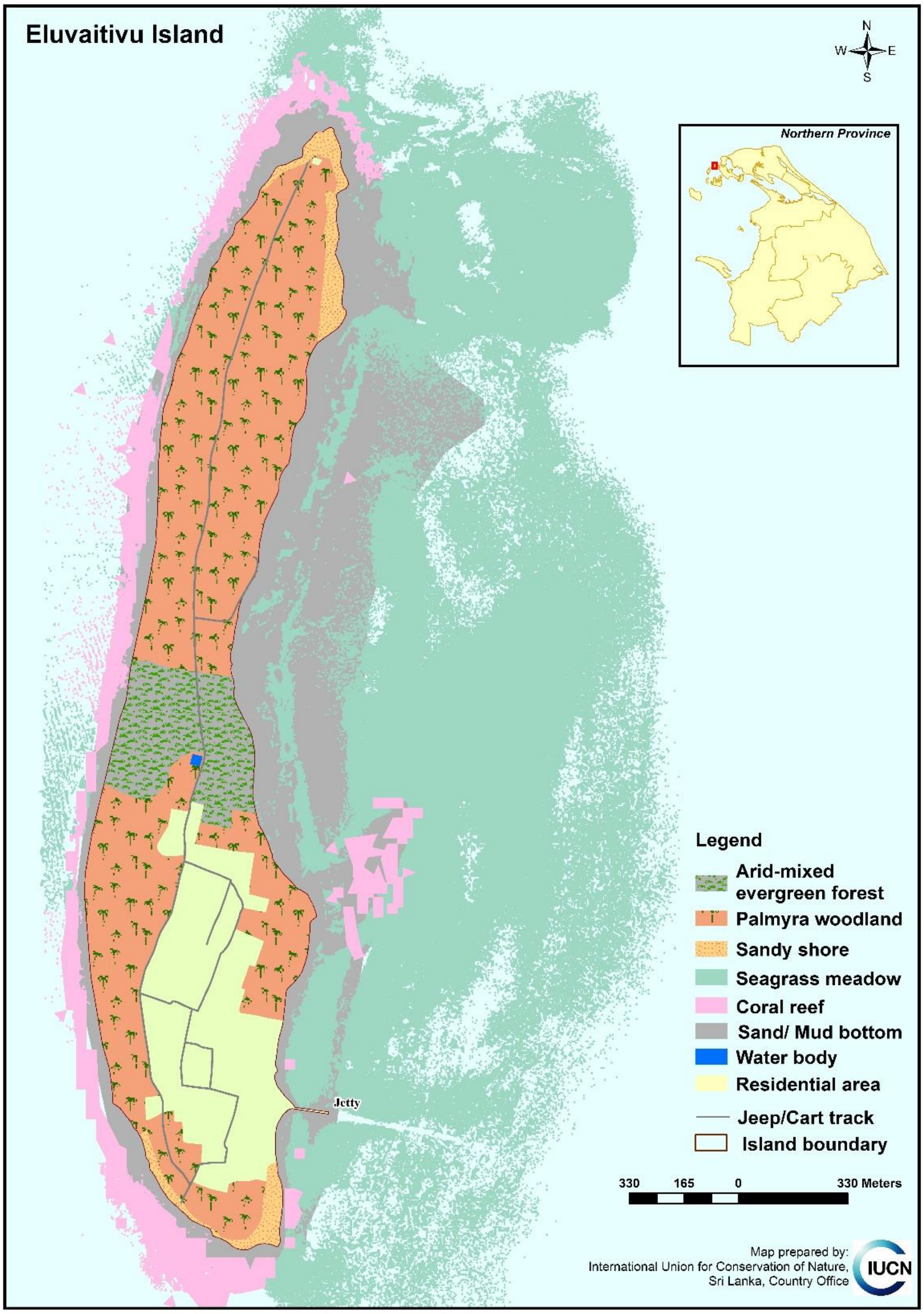

Figure 56. Map of Eluvaitivu Island, showing ecosystems and land use

Location	The island has an extent of about 1.4k m^2 and is located in the Islands North (Kayts) Divisional Secretariat of the Jaffna District. The island has a human population of 663 (Figure 56).
Ecosystems	**Terrestrial ecosystems** Palmyra woodlands, sandy seashores and home gardens are the ecosystems found on the island. A total of 47 plant species and 50 animal species were recorded from the island. The faunal assemblage observed on the island comprised one land snail, four dragonfly, eight butterfly, two amphibian, six reptile, 26 birds and three mammal species, respectively. **Marine Ecosystems** Eluvaitivu[18] has coral reefs and seagrass meadows. A narrow fringing reef about 50 m in width was present along the length of the western coast of Eluvaitivu Island. The depth at the seaward margin of the reef is about seven metres. A narrow strip of water with the back reef is present. The reef crest is like Analaitivu reef. It contains dead corals and coral rubble covered by seaweeds (*Caulerpa, Halimeda, Turbinaria* and *Sargassum)*. Small clumps of seagrasses were found in the back-reef area. There are extensive seagrasses on the eastern side of the island. A total of 23 species of hard corals have been recorded (Rajasuriya, 2007). The main coral genera were *Acropora*, *Goniastrea, Favia, Favites, Platygyra* and *Porites*. Tabulate *Acropora* species dominated the reef at Eluvaitivu. Reef fish diversity was low, only 19 species have been recorded including four species of butterflyfish (*Chaetodon auriga*, *C. collare*, *C. decussatus* and *C. octofasciatus*). Middle and lower seaward reef slopes had *Turbinaria* and *Sargassum* seaweeds (Rajasuriya, 2007).
Special attributes	Inhabitants of this island are either Catholics or Hindus. There are three churches (St. Thomas church being the main one) and five kovils, (*Murugan kovil* also known as *Muruga Murthi kovil* being the main, and the others, *Arulmagu Nnayanavira pathira*, *Sdhayi vaaivraver, Nnayana vaaivraver* and *Naresinha vaaivraver*). These churches and kovils can be used as cultural attractions of the island. **Notable terrestrial species** The notable species of terrestrial flora recorded on the island include *Commiphora berryi* used as live fences around home gardens and Palmyra (*Borassus flabellifer*), which is the most abundant plant species on the island, found in Palmyra woodlands located (in the northern part of the island), on roadsides and in home gardens.

[18] This island was not visited during the present survey for marine assessment. Data are extracted from Rajasuriya, 2007.

	Notable species of terrestrial fauna recorded on the island include two species that are listed as Nationally Vulnerable — the land snail *Cryptozona semirugata* and the Saw-scaled viper (*Echis carinatus*); and two species that are listed as Nationally Near Threatened — the Marsh skimmer (*Orthetrum luzonicum*) and the Great crested tern (*Strena bergii*). **Notable marine species** Notable species include the Bengal sergeant (*Abudefduf bengalensis*). Among the dominant hard corals *Acropora hyacinthus* (NT), *Favia matthai* (NT), *Favites halicora* (NT), *Porites lobata* (NT) and *Diploastrea heliopora* (NT) are listed in the Red List of Threatened Species (MoE, 2012).
Proposed actions	Currently, there are visitor facilities available in the Eluvaitivu Island. However, there is a potential to develop nature-based and cultural tourism on the island. The presence of a Palmyra forest provides an opportunity to showcase the Palmyra palm, including activities such as toddy-tapping and making handicrafts. Coral reefs, seagrass beds and shallow seas around the island provide opportunities to develop activities such as snorkelling and wind surfing. Because the island is inhabited, it will be possible to develop a home stay programme on the island.
Proposed improvements	If tourism development is to take place in the island, basic infrastructure must be improved. Tourism specific infrastructure — such as nature trails, a boat deck, snorkelling areas, home stays, restaurants will also have to be developed, while ensuring that environmental safeguards are included. (See Chapter 6.)
Carrying capacity for tourism activities	At any given time, up to 25 visitors can be accommodated on the island because of its small size.

Erumaitivu Island (Sinhala: *Mahisadoova*)

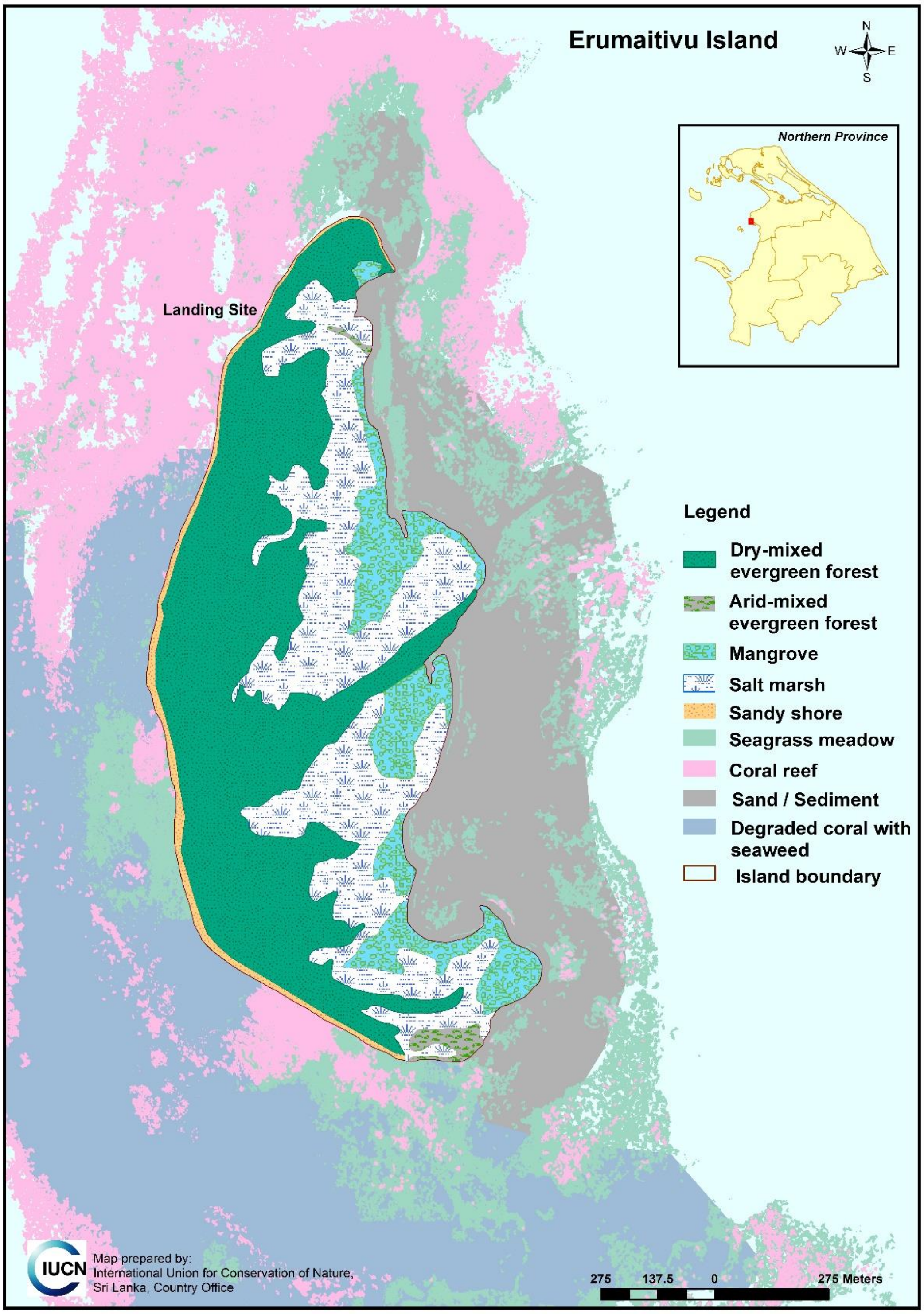

Figure 57. Map of Erumaitivu Island, showing ecosystems and land use

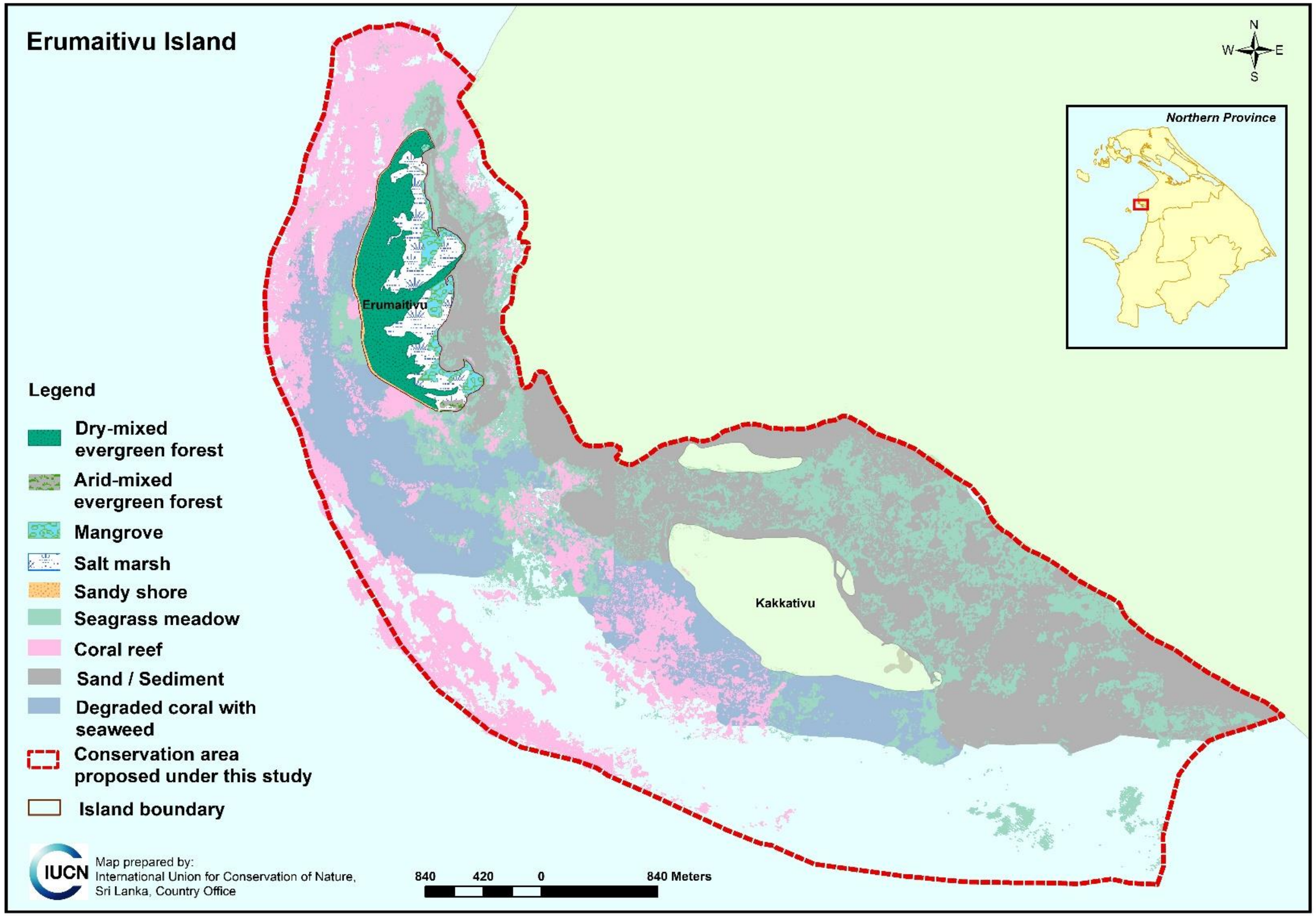

Figure 58. Map showing the proposed conservation area encompassing Erumaitivu and Kakativu Islands

Location	This island has an extent of about 1 km^2 and is located in the Poonakary Divisional Secretariat of the Kilinochchi District. The island is uninhabited even though it is close to the mainland (Figure 57).
Ecosystems	**Terrestrial ecosystems** Arid mixed evergreen forests, seashore scrublands, mangroves, salt marshes are the main ecosystems of this island. In addition, seagrass meadows and coral reefs are found in the immediate surroundings of the Erumaitivu Island. Arid mixed evergreen forests are dominated by Helicopter Trees (*Gyrocarpus americanus*) and Mustard trees (*Salvadora persicaI).* A total of 35 species of flora and 84 species of fauna was recorded from this island. The faunal assemblage was represented by one species of dragonfly, 14 butterflies, four reptiles, 61 birds and six mammals. **Marine ecosystems** Corals and seagrasses are found in the shallow coastal waters from Pooneryn Peninsula to Vellankulam. Erumaitivu is located approximately in the centre of this coastal stretch. Mangroves are found in small patches on Erumaitivu on the eastern side and along the coast of the mainland. Erumaitivu has the best coral reef in the Palk Bay. The width of the fringing reef varies from about 600 m to 1.5 km. The seaward margin of the reef is at depth of about 7 m. There were extensive patches of seagrass and sand in the back-reef area at varying depths from one to two metres. There were patches of live corals containing *Echinopora lamellosa, Montipora aequituberculata, M. digitata, Acropora formosa, Porites spp., and Favia spp.* Corals on the seaward reef included *Echinopora lamellosa*, branching and tabulate *Acropora* spp., *Montipora aequituberculata*, *M. digitata, M. hispida*, *M. foliosa* and massive corals including *Platygyra daedalea, P. lamellina*, *Leptoria phrygia*, *Symphyllia radians*, *Porites lobata*, *P. Lutea*, *Favites halicora*, *Favia speciosa*, *F. pallida* and *F. matthai*. The width of the reef was about 100 m on the west of Erumaitivu. The reef was dominated by tabulate and branching *Acropora* species on the north-western side of the island. Other common species belonged to the genera *Porites, Favia, Favites, Platygyra* and *Porites*. The common genera of seagrasses were *Cymodocea, Enhalus, Halodule and Thallasia*. The reef fish population was extremely low. Large reef fish such as groupers, snappers and parrotfish were not observed.
Special attributes	Notable species of terrestrial fauna recorded on the island include the endemic Pompadour green pigeon *(Treron pompadora*), Critically Endangered Bright babul blue (*Azanus ubaldus*), Endangered Asian elephant (*Elephas maximus*), Vulnerable Saw-scaled viper (*Echis carinatus*), Little ringed plover (*Charadrius duius*), and Kentish plover (*Charadius*

	alexandrinus). Another two species that are listed as Near Threatened — the Grey francolin (*Francolinus pondicerianus*) and Barking deer (*Muntiacus muntjak*) — were also recorded on the island. The sightings of wild elephants were particularly significant. They reach the island by crossing the narrow sea passage between the mainland and the island.
Proposed actions	A conservation area encompassing the coastal waters around this island and Kakkativu is proposed (Figure 58). The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6. The island has a high potential to be developed as a nature-tourism destination because there is high ecosystem and species diversity and is close to the mainland. Nature tourism activities such as nature trails and bird watching can be developed easily on the island.
Proposed improvements	A detailed biodiversity study must be conducted to document the natural resource base. It is also recommended that a zonation plan is developed for all the ecosystems and the island, including the coral and seagrass meadows in the surrounding areas declared as a protected area as shown in Figure 58, to ensure long-term viability of the rich biodiversity found on this island.
Carrying capacity for tourism activities	At a given time, the island can support up to 50 visitors. Construction of permanent structures in the island is not recommended.

Iranaitivu North Island (Sinhala: *Erandoowa*; Dutch: *Enkhuizen*)

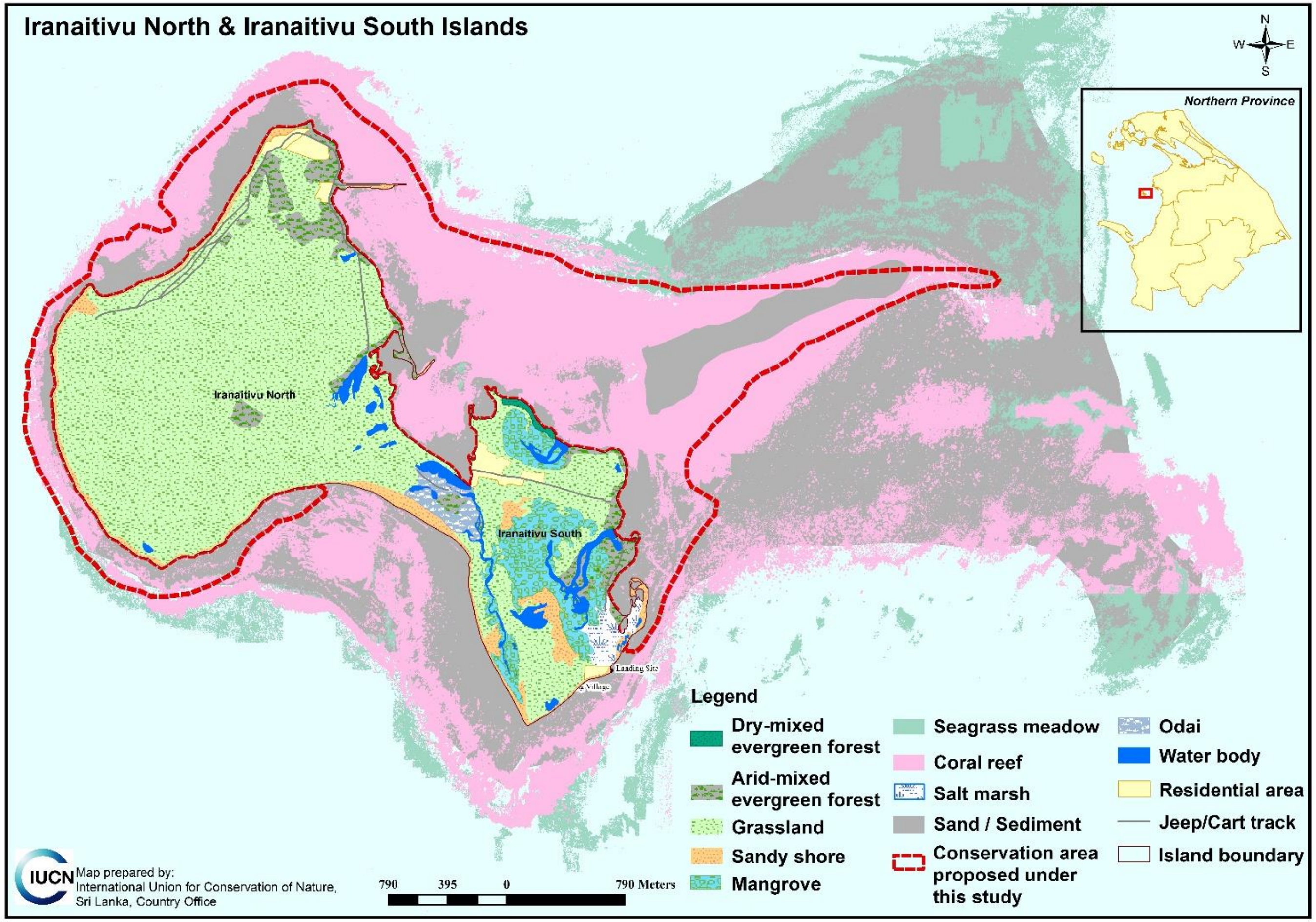

Figure 59. Map of the Iranaitivu North and Iranaitivu South islands, ecosystems, land use and proposed conservation area

Location	This island has an extent of 4.22 km^2 and is located in the Poonakary Divisional Secretariat of the Kilinochchi District (Figure 59).
Ecosystems	**Terrestrial ecosystems** Grasslands are the main type of natural ecosystem in the island. In addition, a small patch of scrubland, salt marshes are also found. A total of 49 floral and 47 faunal species were recorded from this island. Fauna species are represented by one land snail, two dragonflies, eight butterflies, three reptiles, 31 bird species and two mammal species. **Marine ecosystems** Although there are two islands Iranaitivu North and South, they should be considered as a single island for describing the marine area. Coral reefs and seagrass meadows are the main underwater ecosystems. The main coral areas were in the southern and western sides of the island. The fringing reef has a reef lagoon, which is about 300 m at its widest point in the northern areas of Iranaitivu North Island. The average width of the reef is about 150 m and the seaward margin is at a depth of about eight metres. The following species of corals were recorded on the fringing reef; *Acropora cytherea, A. formosa, A. valenciennesi, Porites lutea, Porites lobata, Goniastrea pectinata, Favia speciosa, Montastrea valenciennesi, Goniastrea retiformis, G. edwardsi, Echinopora lamellosa, Montipora hispida, Montipora foliosa, M. aequituberculata, Turbinaria mesenterina, Echinopora lamellose* and *Leptoria phrygia*. Most corals were in poor condition. There was much dead coral covered by *Turbinaria* seaweed and other algae.
Special attributes	Four faunal species — the landsnail *Cryptozona semirugata*, Saw-scaled viper (*Echis crinatius)*, Little ringed plover (*Charadius dubius*), and Kentish plover (*Charadius alexandrinus*) — listed as Vulnerable and two species — Little Branded swift (*Pelopidas agna*) and Great Crested tern (*Sterna bergii*) — listed as Near Threatened, were recorded on the island. In addition, there is a herd of feral cattle roaming freely.
Proposed actions	A marine area shown in Figure 59 is recommended as a conservation area. The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6. Iranaitivu North has an aesthetic appeal because of its expanse of grasslands. The feral cattle found here can be used to transport tourists within the island *via* bullock carts. The island's surrounding shallow sea and sandy beaches can support activities such as sunbathing, kite surfing and wind surfing. The areas of salt marshes on island are frequented by wading birds, thus providing opportunities for bird watching. The island also offers opportunities for cultural tourism, connected with religious and fishing activities. There is also the potential for snorkelling and research-based tourism on the island, because of coral reefs and seagrass meadows in the surrounding sea.

Proposed improvements	A nature trail covering different habitats can be established and used for nature interpretation. It is recommended that the areas recommended in Annex 5 within this island are protected. Providing lodging facilities for visitors will also be critically important. These will have to be developed ensuring that environmental safeguards are included. (See Chapter 6.)
Carrying capacity for tourism activities	The island cannot support more than 50 tourists at a given time.

Iranaitivu South Island (Sinhala: *Uoona Duwa*; Dutch: *Hoorn*)

Location	Iranaitivu South Island has an extent of 1.71 km^2 and belongs to the Poonakary Divisional Secretariat in the Kilinochchi District. There are no permanent inhabitants on the island. As in the case of Iranaitivu North, this island was inhabited by people in the past and remnants of their old houses can still be seen in the north-western end of the island. A small fishing village and a landing site are found in the south-eastern end of the island, used by fishermen during the fishing season. The Sri Lanka navy operates a small camp near the fishing village (Figure 59).
Ecosystems	The main ecosystems found on the island include grasslands, *Avicennia marina*-dominant mangroves, salt marshes are also found. Altogether, 22 floral species and 40 faunal species were recorded during the survey. The faunal assemblage observed on the island comprised one land snail, two dragonflies, six butterflies, two reptiles, 27 birds and two mammals.
Special attributes	**Terrestrial ecosystems** The attraction of this island is the large mangrove patch found in the centre of the island. Mangrove flora include two species — *Bruguiera cylindrica* and *Sonneratia alba* — both listed as Endangered. Further, three Vulnerable species — the land snail (*Cryptozona semirugata*), Large salmon Arab (*Colotis fausta*) and Saw-scaled viper (*Echis carinatus*) —and two Near Threatened species faunal species — Little branded swift (*Pelopidas agna*) and the Great crested tern (*Sterna bergii*) — were also recorded on the island. **Marine ecosystems** The marine area of both Iranaitivu North and South should be considered as a marine area. The eastern side of Iranaitivu South had a long shallow patch of sand containing patches of seagrass and coral rubble.
Proposed actions	A marine area shown in Figure 59 is recommended as a conservation area. The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6. Iranaitivu South also has a population of feral cattle (*Bos indicus)* and these animals can be used to transport tourists within the island *via* bullock carts. The occurrence of Saw-scaled viper *Echis carinatus,* which is one of the five fatally poisonous snakes in Sri Lanka, is a feature to attract scientists. The presence of threatened species on the island can also promote nature tourism and attract researchers. The attractive scenery of grasslands, salt marshes, marshes and mangroves, with wading migratory birds present opportunities for bird watching. Sandy beaches, shallow waters and the hot sun can support activities, such as sun bathing, wind surfing and kite surfing. The seagrass meadows and coral reefs in the vicinity provide opportunities for snorkelling.

	At present, landowners have abandoned the island but with nature-tourism development, there can be livelihood opportunities.
Proposed improvements	A detailed biodiversity survey of the island should be conducted, and areas proposed in Annex 5 should be declared as a protected area. Nature trails within the mangroves and salt marshes should be also be developed.
Carrying capacity for tourism activities	The site can support up to 25 day visitors at a given time. Lodging facilities are not recommended

Islands at Adam's Bridge

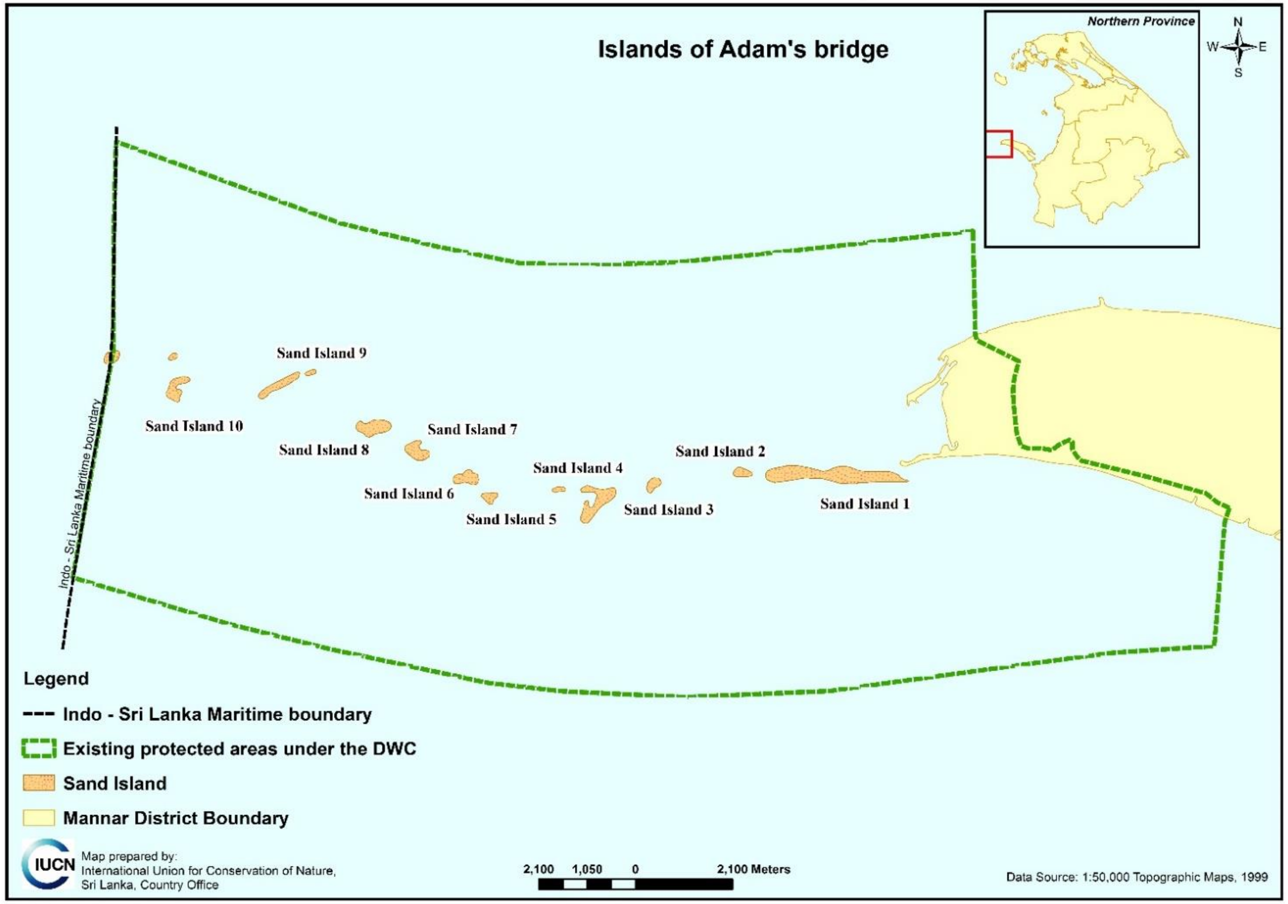

Figure 60. Map of the Adam's Bridge Islands showing existing protected area boundary

Location	Adam's Bridge[19] is a chain of limestone shoals that are connected loosely to Rameswaram Island, off the south-eastern coast of Tamil Nadu, India, and to Mannar Island, off the north-western coast of Sri Lanka. The first nine islands of the Adam’s bridge from the Mannar Island lie within the territorial waters of Sri Lanka. They do not come under any administrative boundaries (Figure 60).
Ecosystems	**Terrestrial ecosystems** Apart from the first island which has vegetation, the rest of the islands are covered by sandy seashores, dominated by Goat’s foot (*Ipomoea pes-caprae*) and Shoreline purslane (*Sesuvium portulacastrum*), *Spinifex littoreus* and few scattered trees such as the Fish poison tree (*Barringtonia asiatica*), Country almond (*Terminalia catappa*) and Screwpine (*Pandanus odorifer*). A total of six plant and 22 fauna species, respectively, were recorded on these islands. The fauna were represented by three dragonfly, two butterfly, 16 bird and one mammal species respectively. Marine ecosystems were not surveyed. It has been reported that Indo-Pacific humpback dolphins, dugongs and sea turtles are found in the waters on either side of the Adam’s Bridge.
Special attributes	The third island serves as the only known breeding site for several species of critically endangered birds such as including the Sooty Tern (*Onychoprion fuscatus*), Bridled Tern (*O. Anaethetus*), Little Tern (*Sternula albifrons*), Saunders’s Tern (*S. Saundersi*), Roseate Tern (*Sterna dougallii*), Common Tern (*S. Hirundo*), Greater Crested Tern (*Thalasseus bergii*) and Brown Noddy (*Anous stolidus*) (Seneviratne et al., 2015).
Proposed actions	Adam’s Bridge was declared as a National Park in 2015. Currently, there are no infrastructure facilities — such as boats — and *ad hoc* boat tours are run by the SL navy. Necessary infrastructure should be developed by the DWC and tours operated from the Thalaimannar pier of Mannar Island). As bird watching and nature tourism are the major activities that are possible within the Adam’s Bridge, it is essential that breeding sites are not disturbed. Sand Island II ‘is probably the most important for breeding seabirds in Sri Lanka’ (Seneviratne et al., 2015). This island should not be open for visitation, as this would disturb the breeding birds. These are all ground nesting birds, so there is also the potential that egg predators — such as feral dogs — could be introduced/ as all of these are ground nesting birds.
Proposed improvements	No development should be permitted on these islands.
Carrying capacity for tourism activities	Tourists should be allowed access only during the non-breeding season. Even during the non-breeding season, the DWC should introduce regulations related to how many boats, how close to the islands they can pass etc.

[19] Only Sand bar IV was surveyed from terrestrial systems and species.

Kachchativu Island (Pali: *Kachchatheetha*; Sinhala: *Kachchadoova*)

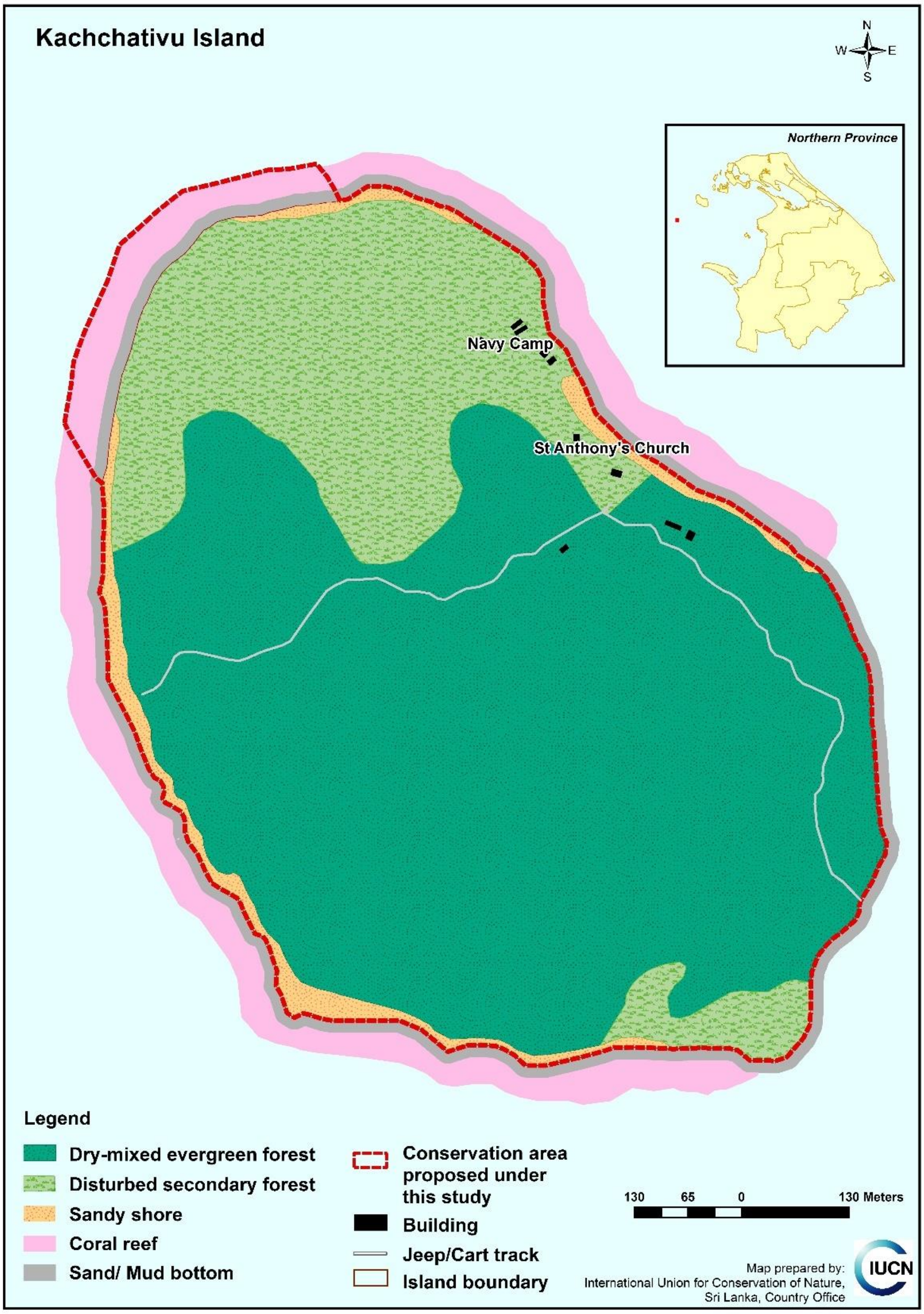

Figure 61. Map of Kachchativu Island, ecosystems, land use and proposed conservation area

Location	The island has an extent of about 0.68 km^2 and belongs to the Neduntivu (Delft) Divisional Secretariat of the Jaffna District (Figure 61). The only building located in the island is an old church (St. Anthony's Church) (Figure 62), which dates to the Dutch period. According to the Sirima-Shastri agreement signed on the 24th June 1974, construction of permanent buildings or permanent human inhabitations is not allowed in the island. Annually, this church hosts a festival to St Anthony, the patron saint of fishermen. Participation for the 2018 festival was estimated to be about 1,920 devotees from Tamil Nadu and over 4,000 locals from various parts of the island.
Ecosystems	**Terrestrial ecosystems** Dry mixed evergreen forests, arid mixed evergreen forests, sandy seashores and small extents of seashore scrublands are observed on the island. *Manilkara hexandra* and Helicopter tree (*Gyrocarpus americanus*) are the most abundant plants observed in arid mixed evergreen forests; while Beach Naupaka/Half flower (*Scaevola taccada*), *Pemphis acidula* and *Premna obtusifolia* are the dominant plant species observed in seashore scrublands. The sandy seashores were covered with Goat's foot (*Ipomoea pes-caprae*) and Shoreline purslane (*Sesuvium portulacastrum*). A total of 50 plant and 34 fauna species, respectively, were recorded on the island. The faunal assemblage comprised one land snail, two dragonfly, 12 butterfly, three reptile, 14 bird and two mammal species, respectively. **Marine ecosystems** A small coral area is found on the northern end of the island. The reef quality is poor with low coral cover and few species of fish. The main coral species were *Acropora hyacinthus, A. cytherea*, *Montipora aequituberculata*, *Pocillopora damicornis* and *Favia* sp. Three species of marine bivalves divided among 3 families and about 20 species of marine gastropods divided among 20 families were identified from specimens collected on the beach. Movement of sand underwater is relatively high and therefore reef development is poor around the island. Erosion was also high especially along the southern shore.
Special attributes	The Octopus bush (*Tournefortia argentea*) recorded near the western coast of the island is a very rare plant in Sri Lanka even though it is a common species in the Indo-Pacific region. It is listed as nationally Endangered and has not been recorded in the country since 1939. Several notable species of terrestrial fauna were also recorded on the island. These include Bibron's sand skink (*Eutropis bibronii*) listed as a nationally Endangered species; *Cryptozona semirugata* and Ferguson's toad (*Duttuphrynus scaber*) listed as a nationally Vulnerable species; and Great crested tern (*Sterna bergii*) listed as a nationally Near Threatened species.

Proposed actions	A small marine area in the northern part of the island is recommended as a conservation area (Figure 61). The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6. The presence of several interesting flora and fauna on Kachchativu Island presents opportunities to promote nature-based tourism. The island's cultural and religious events/festivals provide value-addition for tourism development. Coral reefs, sandy beaches and shallow seas around the island can be used snorkelling and wind surfing.
Proposed improvements	During the festival season, human actions should be managed. Regulations should be issued to prevent solid and other pollution during the festival season as well as preventing the wanton cutting of trees. (See Chapter on Recommendations for more details.) The island should be zoned so that certain areas are protected from people entering those areas.
Carrying capacity	Carrying capacity for this island cannot be discussed as it had been the long-term home of an annual festival to St. Anthony. It is the management of human behaviour that needs attention as noted in the row above.

Figure 62. Kachchativu Church, where an annual festival is held, with pilgrims from both India and Sri Lanka

Kakerativu Island (Sinhala: *Sakkaradoova*; Dutch: *Calienye*)

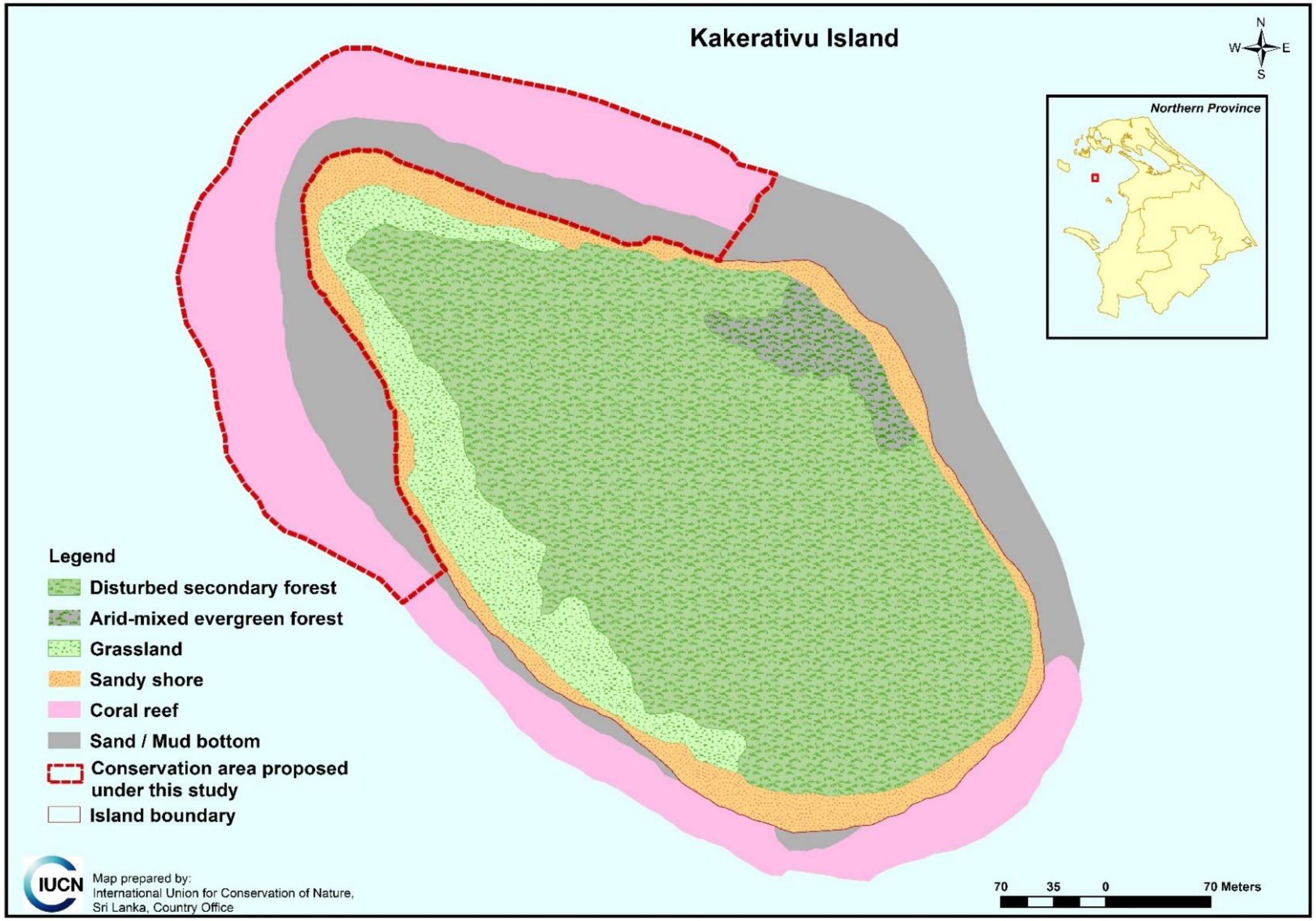

Figure 63. Map of Kakerativu Island, showing ecosystems, land use and proposed conservation area

Location	This island is about 0.14 km^2 and belongs to the Neduntivu (Delft) Divisional Secretariat in the Jaffna District (Figure 63).
Ecosystems	**Terrestrial ecosystems** Sandy seashores and seashore scrublands are found on the island. A total of 32 plant and 31 fauna species, respectively, were observed on the island. The fauna observed in the island comprised one dragonfly, two land snail, five butterfly, one reptile, 20 bird and two mammal species, respectively. **Marine ecosystems** Coral patches occur around the island. A small coral area was investigated on the north-western corner of the island. The common living corals were *Acropora hyacinthus*, *Montipora digitata, M. aequituberculata, Goniastrea retiformis, Platygyra daedalea, Favia matthaii, Favites halicora* and *Porites* spp. Damselfish (Pomacentridae) were common but no other large reef fish were observed in the investigated area.
Special attributes	*Guettarda speciosa* is the only notable plant species found in the seashore scrubland of the island. The nationally Critically Endangered snail, *Trachia vittata;* as well as the nationally Vulnerable land snail *Cryptozona semirugata* and Little-ringed plover (*Charadrius dubius)*; the Near Threatened Dark blue tiger (*Tirumala septentrionis*) and the Great-crested tern (*Sterna bergii*) were recorded in the island.
Proposed actions	A marine area in the north-western part of the island is recommended as a conservation area (Figure 63). The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6. Sandy seashores, coral reefs and seagrass meadows provide opportunities to promote beach-based activities and snorkelling. As there are notable species on this island, nature-based tourism could also be promoted. In addition, the island has a survey beacon, which is an archaeological monument that could also be used as an attraction.
Proposed improvements	Tourism specific infrastructure facilities will have to be constructed if the island is to be promoted as a major tourism destination. This will include identification of tourism zones, specific tourism attractions and further development of these with proper interpretation, establishing a visitor centre to create awareness among visitors about the type of attractions available in and around the island, establishing nature trails, bird watching facilities, boating decks, snorkelling facilities. All these will have to be carried out ensuring the integration of environmental safeguards as listed in Chapter 6.
Carrying capacity for tourism activities	Up to 25 visitors can be accommodated in the island at a given time.

Kakkativu Island (Sinhala: *Kaakadoova*)

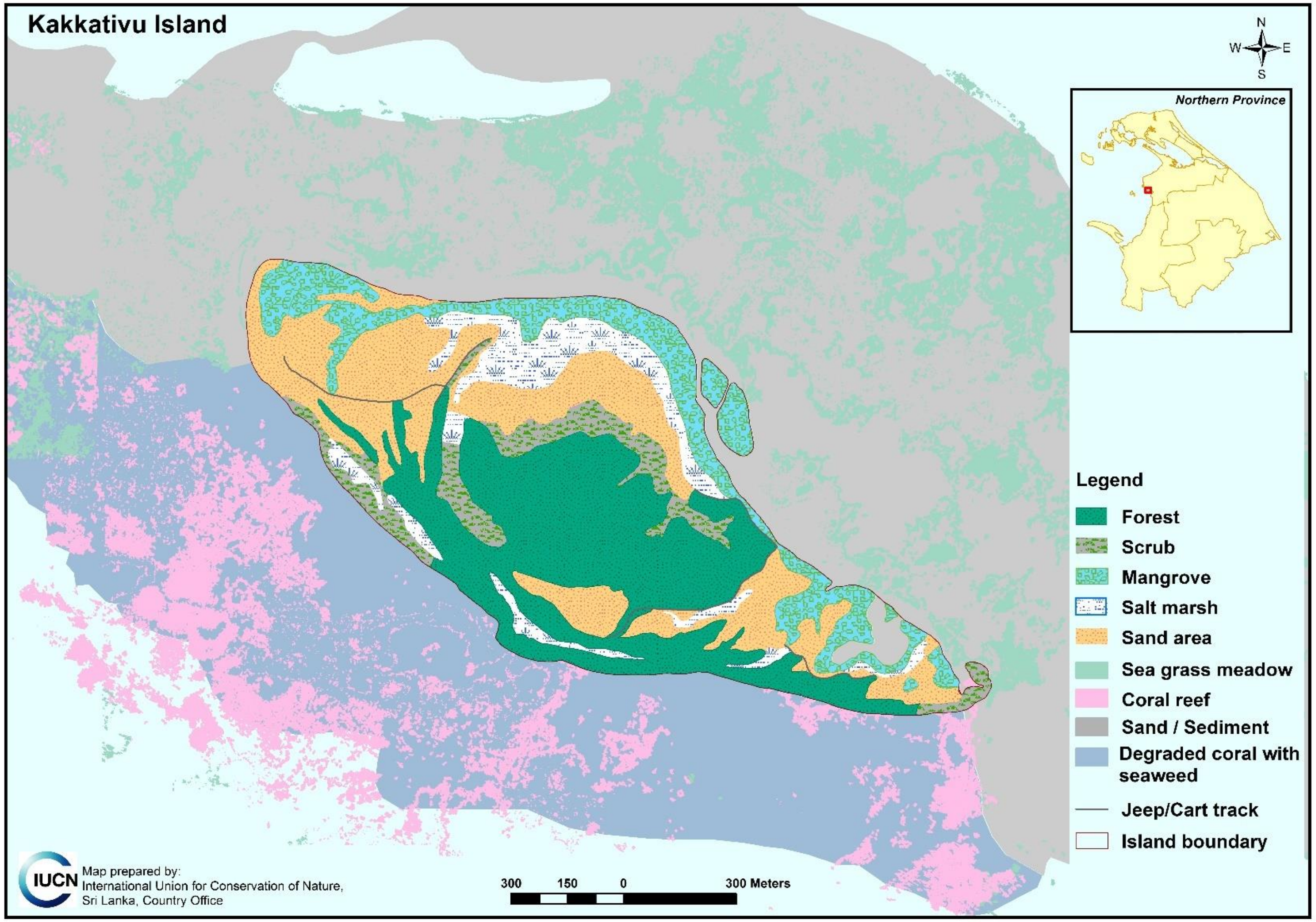

Figure 64. Map of Kakkativu Island, showing ecosystems and other land use

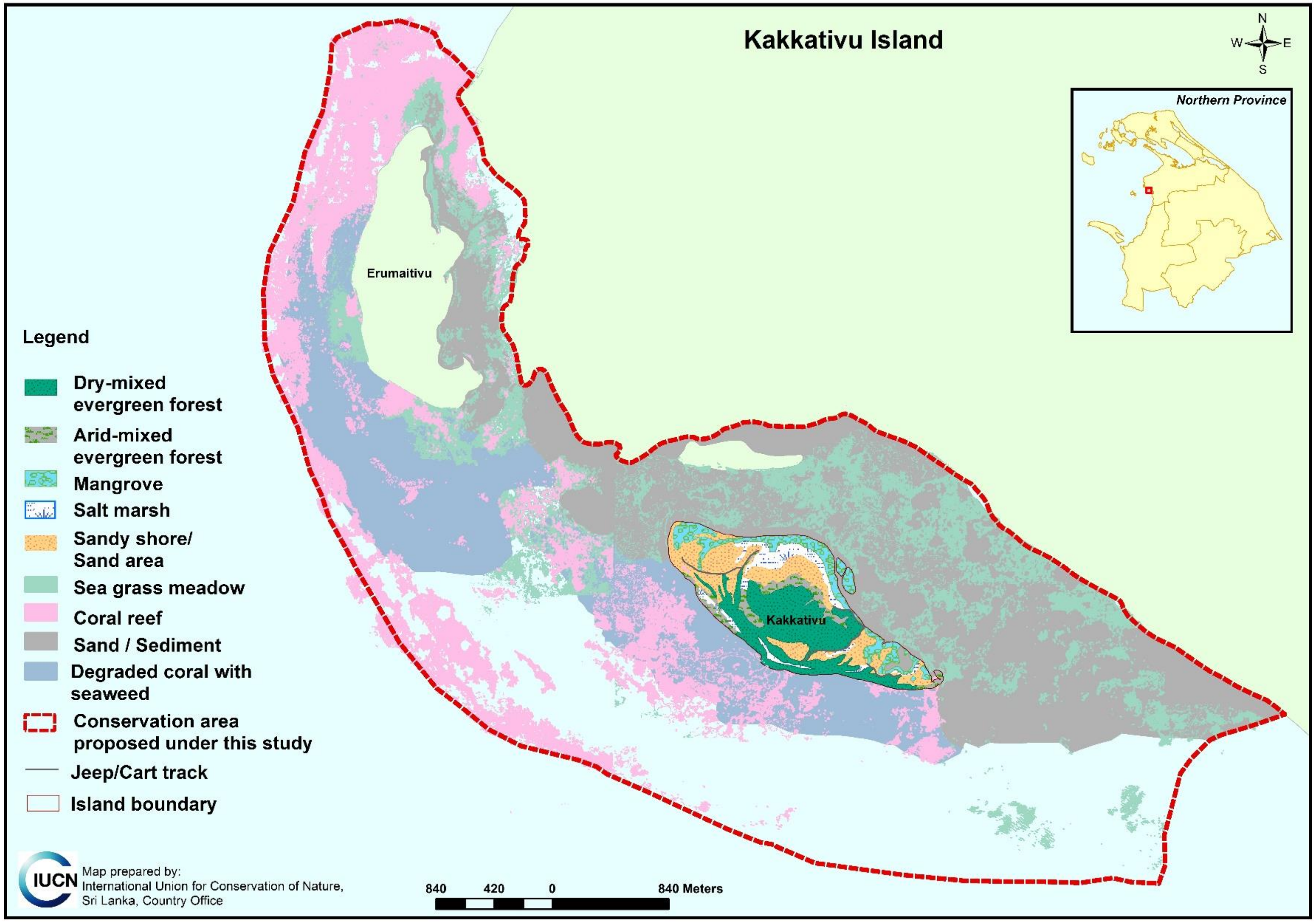

Figure 65 Map showing the proposed conservation area encompassing Erumaitivu and Kakativu Islands

Location	The island is about 1.1 km^2 and belongs to the Poonakary Divisional Secretariat in the Kilinochchi District (Figure 64).
Ecosystems	**Terrestrial ecosystems** Arid mixed evergreen forests, mangroves, seashore scrublands, grasslands, and salt marshes are found on this island. A total of 48 plant and 29 fauna species were recorded on the island. The faunal assemblage comprised four dragonfly, 12 butterfly, 12 bird and one mammal species, respectively. **Marine ecosystems** Corals in good condition were present on the western and southern sides of the island. This section of the coral reef is the southern section of the coral reef of Erumaitivu. Unlike the reef at Erumaitivu, this section is dominated by large domes of *Favia speciosa, Favia matthaii, Favites halicora, Porites lutea* and other *Porites* species. There were small patches of branching *Acropora* spp including *A. Formosa, Montipora digitata, M. foliosa and M. aequituberculata*. The southern section of the reef was in relatively poor condition with patches of dead coral. Fish were scarce in this section of the reef. The most abundant species was the Indian damselfish (*Pomacentrus indicus*).
Special attributes	*Colubrina asiatica* and *Manilkara hexandra* are the notable plant species observed on the island. Elephant (*Elephas maximus*) (EN); Little Ringed Plover (*Charadrius dubius*) (VU) and Plain orange tip (*Colotis aurora* (VU), Barking deer (*Muntiacus muntjak*) (NT), Great Crested Tern (*Sterna bergii*) (NT), Dark blue tiger (*Tirumala septentrionis*) (NT) were observed on the island.
Proposed actions	A conservation area encompassing the coastal waters around this island and Erumaitivu is proposed (Figure 58). The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6. The high ecosystem and species diversity provide opportunities to develop nature-based tourism activities.
Proposed improvements	Tourism specific infrastructure facilities will have to be improved if the island is to be promoted as a major tourism destination. This will include identification of tourism zones, specific tourism attractions and further develop of these with proper interpretation, establishing a visitor centre to create awareness among visitors about the type of attractions available in and around the island, establishing nature trails, bird watching facilities. All these will have to be carried out ensuring the integration of environmental safeguards.
Carrying capacity	Up to 50 visitors can be accommodated in the island at a given time.

Kalliaditivu Island (Sinhala: *Galadi Doova*)

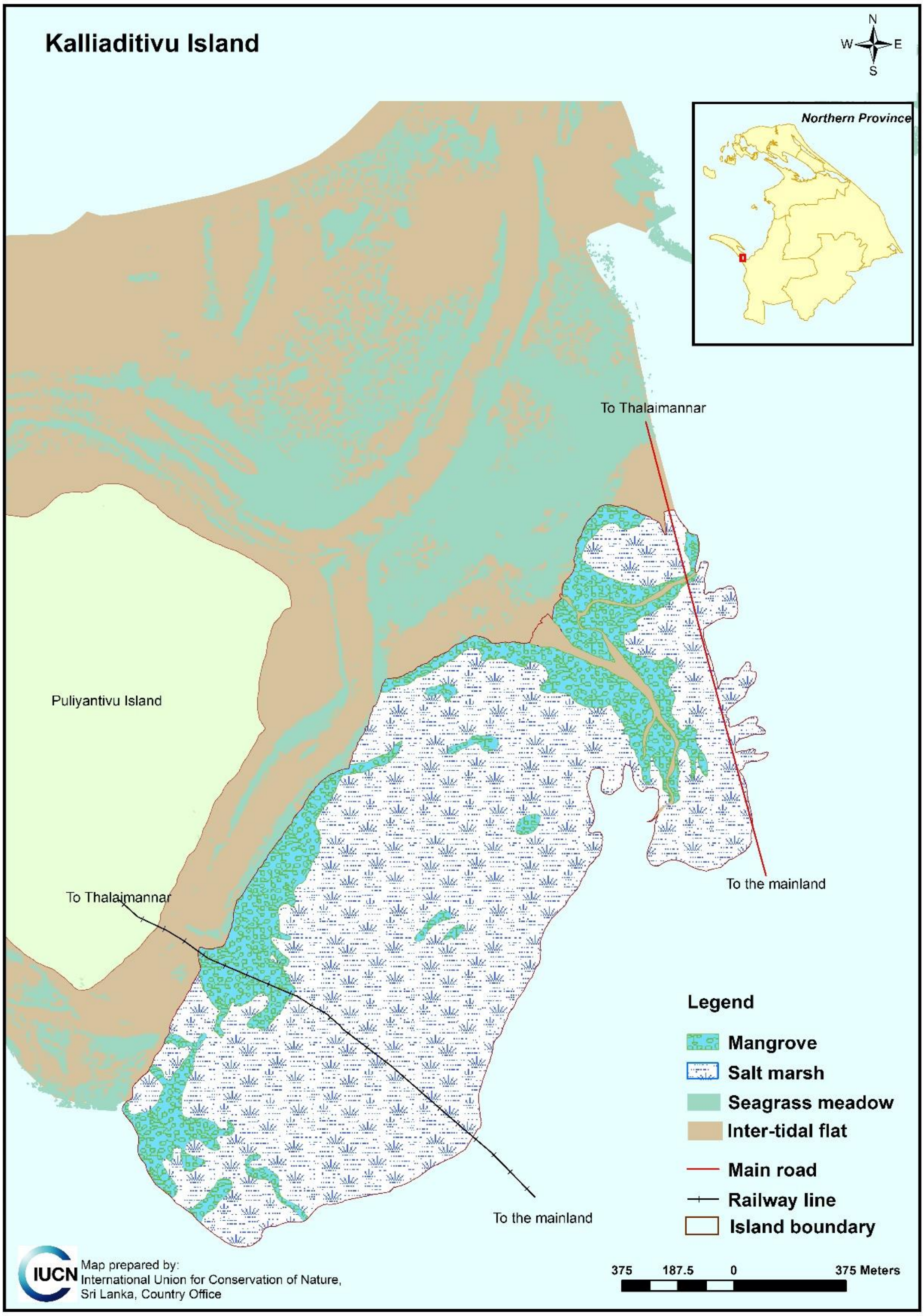

Figure 66. Map of the Kalliaditivu Island, showing ecosystems and other land use
(Note that the entire island is within a DWC protected area, please refer to Figure 52)

Location	Kalliaditivu Island extends over 1.71 km^2 and belongs to the Mantai Divisional Secretariat in the Mannar District. The island is not inhabited by people. The only land access is *via* the railway line, although the island can also be reached by boat (Figure 66).
Ecosystems	**Terrestrial ecosystems** Mangroves and salt marshes are the dominant ecosystems observed on the island. Around the island re tidal flats. Kalliaditivu has a high level of biodiversity compared to other areas because of these ecosystems and its location within the Vankalai Bird Sanctuary. A total of 14 flora species recorded from the site. The dominant plants are *Suaeda maritima, Salicornia brachiata* and *Avicennia marina, and Rhizophora mucronata*. Further, 120 terrestrial faunal species represented by five species of dragonflies, four butterflies, 20 reptiles, 81 birds and ten mammals were recorded in the island. **Marine ecosystems** were not surveyed.
Special attributes	Among the notable terrestrial species recorded in the island includes three species of endemic snakes — the Flowery wolf snake (*Lycodon osmanhilli*), Checkered keelback (*Xenochropis asperrimus* and *Xenochrophis cf. piscator)*. Another five species found on the island — the Wart snake *(Acrochordus granulates*), Greater painted snipe *(Rostratula benghalensis*), Kentish plover *(Charadrius alexandrines*), Small pratinocole *(Glareola lacteal*) and the Indian pipistrel (*Pipistrellus coromandra*) — are listed as nationally Vulnerable (VU). Further, three species listed as nationally Near Threatened — the Paddy field parasol *(Neurothemis intermedia*), Eurasian collared dove *(Streptopelia decaocto*) and Black-crowned night heron *(Nycticorax nycticorax*). Two species listed as nationally Data deficient (DD) — the Rainbow mud snake *(Enhydris enhydris*) and Bombay gulf sea snake *(Hydrophis mammilaris*) — were also recorded in the island.
Proposed actions	The islands and its surrounds were declared in 2016 under the Fauna and Flora Protection act as a nature reserve that extends up to and includes Vidattaltivu Lagoon. However, facilities — such as boats — have not yet been provided by the DWC and the area is still under the control of the SL navy. Bird watching is the best nature-based tourism activity that can be carried out in the island. Boat rides among the mangrove and salt marsh ecosystems, surrounded by the shallow sea could also be promoted, but these will have to be managed by the DWC.
Proposed improvements	Kalliaditivu is located within the Vankalai Bird Sanctuary, and therefore, establishing nature trails, including raised walkways and canopy walks is possible on the island. Further, the island is used as a feeding ground by many migratory birds and therefore, hides and towers can be established to facilitate bird watching. Non-motorised boats are recommended.
Carrying capacity for tourism activities	The site can support up to 100 bird watchers during the migratory season. Only day trips should be permitted.

Karaitivu Island (Sinhala: *Karaduva*)

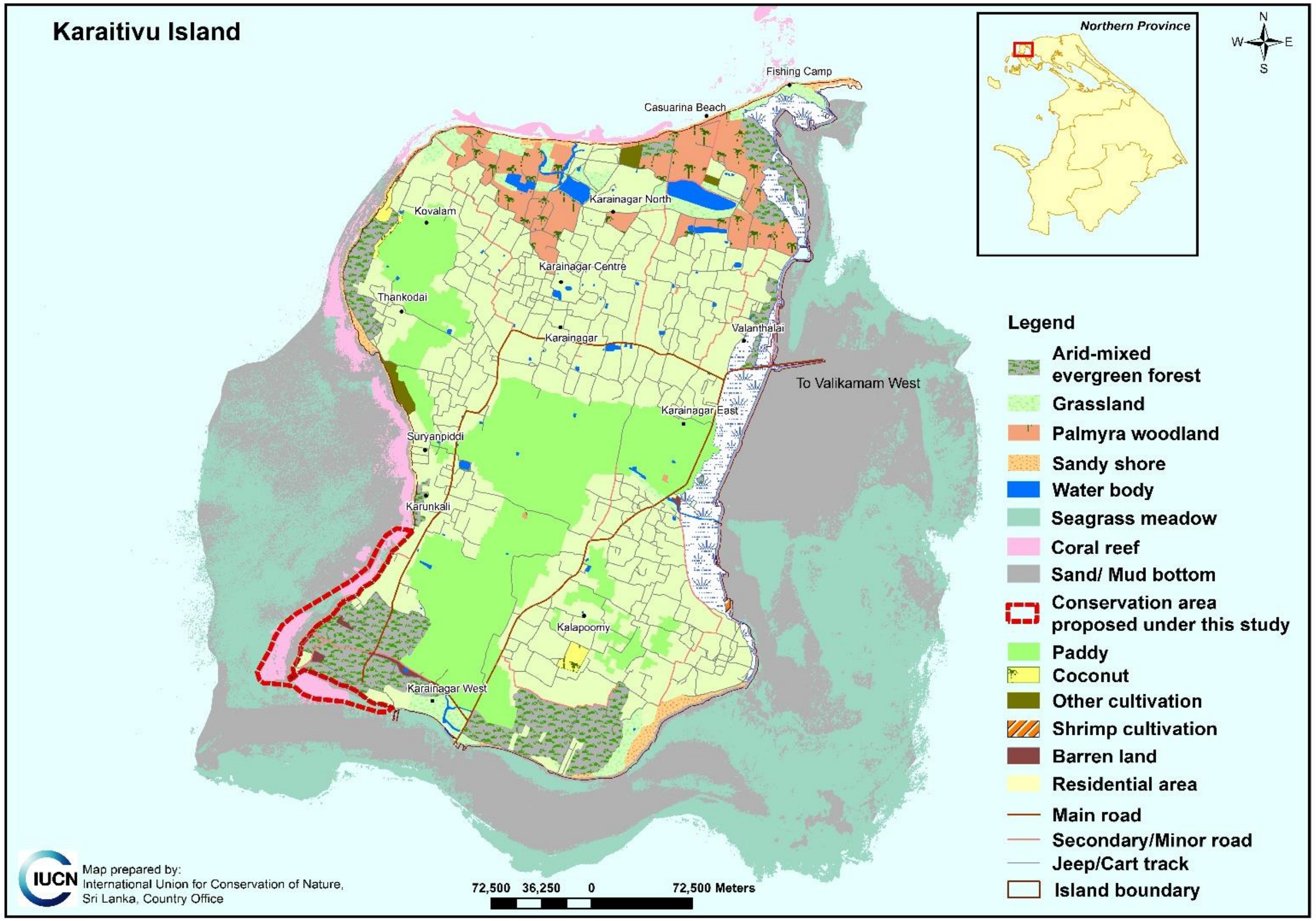

Figure 67. Map of the Karaitivu Island, showing ecosystems, land use and proposed conservation area

Location	Karaitivu Island has an extent of about 22.95 km^2 and belongs to the Karainagar Divisional Secretariat of the Jaffna District, with a resident population of 10,596 (Figure 67). It is an ancient site mentioned in the Nampotha by the name of 'Karadivayina'. It was known even in Tamil as 'Kaaraitheevu'. The name change occurred with the construction of the Punnalai causeway in the late 19th Century, and officially in 1922. Dutch records refer to the island by the name 'Nieuw Amsterdam'. However, its oldest name is 'Kaaradeepa'. The island is also referred to as 'Ahideepa' in the Buddhist Akitti Jaathaka, which relates the story of the Buddhist recluse Akitti who came to Kaaradeepa (Dharmawardana, 2006). The name Karainagar is thought to be derived from *karai,* from the Tamil name for *Canthium coromandelicum* (Sinhala: *kara*). It is said that during famines, monks used to survive on the fruits of this plant.
Ecosystems	**Terrestrial ecosystems** This is a highly developed island with patches of Palmyra woodland found in the north and north-east, and scrublands in the south and south-west. In the north there is a stretch of beach planted with Casuarina trees called Casuarina Beach. A total of 64 plant species and 65 faunal species were recorded from the island. The faunal species are represented by two species of dragonfly, one land snail, three scorpion, 16 butterfly, one reptile, 39 bird and three mammal species. **Marine ecosystems** A fringing reef like the fringing reef of Analaitivu is present along the western and northern coast side of the island. In addition, an offshore coral patch is present approximately 1 km north-east of Casuarina Beach. The dominant species of hard corals include tabulate and branching *Acropora* spp., *Goniastrea retiformis*, *G. pectinata*, *Platygyra daedalea*, *Echinopora lamellosa* and *Porites* spp. The average depth on the shoreward side was about 2 m. The northern (seaward reef slope consisted of large coral domes belonging to the families of Faviidae (*Favia, Favites, Goniastrea, Platygyra,* and *Leptoria*) and Poritidae (*Porites lutea* and *P. lobata*). Snappers (Lutjanidae), damselfish (Pomacentridae) and butterfly fish (Chaetodontidae) were present.
Special attributes	Casuarina beach is a popular bathing spot. *Cassine balae,* an endemic species found near the beach is the only notable plant species observed in the island. Notable faunal species observed in the island include the endemic Sri Lanka toque monkey (*Macaca sinica*), *Trachia vittata,* a land snail listed as a Nationally Critically Endangered species, Large salmon Arab (*Colotis fausta*), Little ringed plover (*Charadrius dubius*) and Kentish plover *(Charadrius alexandrines)* listed as Nationally Vulnerable species and the Dark blue tiger (*Tirumala septentrionis*) and Grey francolin (*Francolinus pondicerianus*) listed as nationally Near Threatened species.

	Access to Fort Hammenheil is through this island. It is also a Special Management Area (SMA) under the CCZRMP (2016).
Proposed actions	A small marine area in the south-west of the island is proposed as a conservation area (Figure 67). The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6. Karaitivu holds cultural and archaeological monuments (such as Fort Hammenheil), thereby presenting opportunities for cultural tourism. Its broad beaches and shallow seas are good for sun bathing, snorkelling and boat rides. As the island serves as a feeding ground for migratory birds, bird watching could also be promoted. Additionally, human settlements and road networks are present in the island that can help tourism development in the island.
Proposed improvements	Tourism specific infrastructure facilities will have to be improved if the island is to be promoted as a major tourism destination. This will include identification of tourism zones, specific tourism attractions and further develop of these with proper interpretation, establishing a visitor centre to create awareness among visitors about the type of attractions available in and around the island, establishing nature trails, bird watching facilities, boating decks and snorkelling facilities. All these will have to be carried out ensuring the integration of environmental safeguards. (See Chapter 6.) It is also essential that a solid waste management programme is established immediately for the waste generated by tourists (both local and foreign) who come to Casuarina Beach and to see the Fort. Mooring points for boats carrying tourists should be established on the offshore.
Carrying capacity for tourism activities	Over-crowding should be prevented. Mass scale-tourism should not be conducted here.

Kayts or Velanai Island (Sinhala: *Uruthota* or *Bellana*; Dutch: *Leiden*)

Figure 68. Map of Kayts Island, showing ecosystems, other land use and important bird area (IBA)

Location	Kayts extends over about 64 km^2 and belongs to the Divisional Secretariats Atuvan (north island Kayts) and Velanai Islands South (Velanai) in the Jaffna District. It is a highly populated island with a population of 16,865 people (Figure 68). The island has a rich history. Kayts was known as 'L*eiden*' by the Dutch and '*Urkavaththurai*' by Tamil citizens. It was also known as '*Urathota*' and '*Tannidivayina*' in the '*Nainathivu*' inscriptions by Parakramabahu I (12th century AD) and in the '*Nampotha*'. In addition, it is mentioned in the 'Thovila' ritual as '*Kohombakankariya*'. The name '*Kayts*' first came to use as the island looked like a kite. The historian Baldaeus (1658) used the name '*Ourature*' when referring to Kayts (Dharmawardana, 2006).
Ecosystems	**Terrestrial ecosystems:** Seashore scrublands, salt marshes, Palmyra woodlands, home gardens, sandy sea shores and wet pastures are the main ecosystems recorded on the island. A total of 68 floral species was recorded from the island. Among the floral species, Palmyra (*Borassus flabellifer)* is one of the dominant plants found in the island that forms Palmyra woodlands, on roadsides and in home gardens. In addition, 74 species of terrestrial fauna were recorded, represented by three dragonfly species, 25 butterflies, four reptiles, 40 birds and two mammals. **Marine ecosystems** were not surveyed.
Special attributes	Kayts, along with Mandaitivu, is an Important Bird and Biodiversity Area (IBA)[20] (Birdlife International, 2017a) (Figure 71). Large populations of Lesser sandplover (*Charadrius mongolus*) and Marsh sandpiper (*Tringa stagnatilis*) have been observed here (Birdlife International, 2017a). It is also a haven for migratory ducks and other shorebirds, as well as greater flamingos (*Phoenicopterus roseus*). About 25,000 ducks — including northern pintail (*Anas acuta*), garganey (*Spatula querquedula*), Eurasian wigeon (*Anas penelope*) — were reported one year near the Jaffna-Kayts causeway; over a 1,000 including the common teal (*Anas crecca*) and the northern shoveller (*Anas clypeata*) in Uppu Kuli and over 1,000 black-tailed godwits (*Limosa limosa*) in Mudali kuli (Kotagama et al., 2009). Among the fauna species observed, four — the Plain orange tip *(Colotis aurora*), Saw-scaled viper (*Echis carinatus),* Little-ringed plover (*Charadrius dubius*), and Kentish plover *(Charadrius alexandrinus*) — are listed as nationally Vulnerable, while another four species — the Light-tipped demon *(Indothemis carnatica*), Dark blue tiger *(Tirumala septentrionis*), Grey francolin *(Francolinus pondicerianus*) and Great crested tern *(Sterga bergii*) — are listed as nationally Near Threatened (NT). The presence of many bird species makes this island an ideal place for bird watching.
Proposed actions	At present, a few sites of the island are used for local tourism. However, there is a high potential to develop the island as a nature or cultural tourism destination.

[20] Based on IBA criterion A4 which is that it is known to have predicatable congregations ≥ 1% of the global population of a species (Birdlife International, 2017b).

Proposed improvements	As Kayts has mangroves, nature trails — such as raised walkways and canopy walks — can be established in this island. The presence of salt marshes at Ariyalai and wading migratory birds provide opportunities to develop bird watching, with hides and towers. The beach and shallow sea have the potential to promote beach tourism, as well as boat rides. Kayts also holds several archaeological monuments and traditional fishing activities, presenting opportunities to add a cultural flavour, as well. The presence of human settlements and a well-defined road network provide excellent opportunities to establish home stays, hotels or resorts. These improvements will have to be made while ensuring that environmental safeguards are included. (See Chapter 6.) It should be noted however, that more infrastructure facilities are needed if the island is to be promoted as a tourism destination.
Carrying capacity for tourism activities	The Arialai area can support many bird watchers during the bird migratory season.

Figure 69. Migrant black-headed gulls (*Chroicocephalus ridibundus*) in Kayts

Kurikadduwan Island (Sinhala: *Kiralakatuvana*)

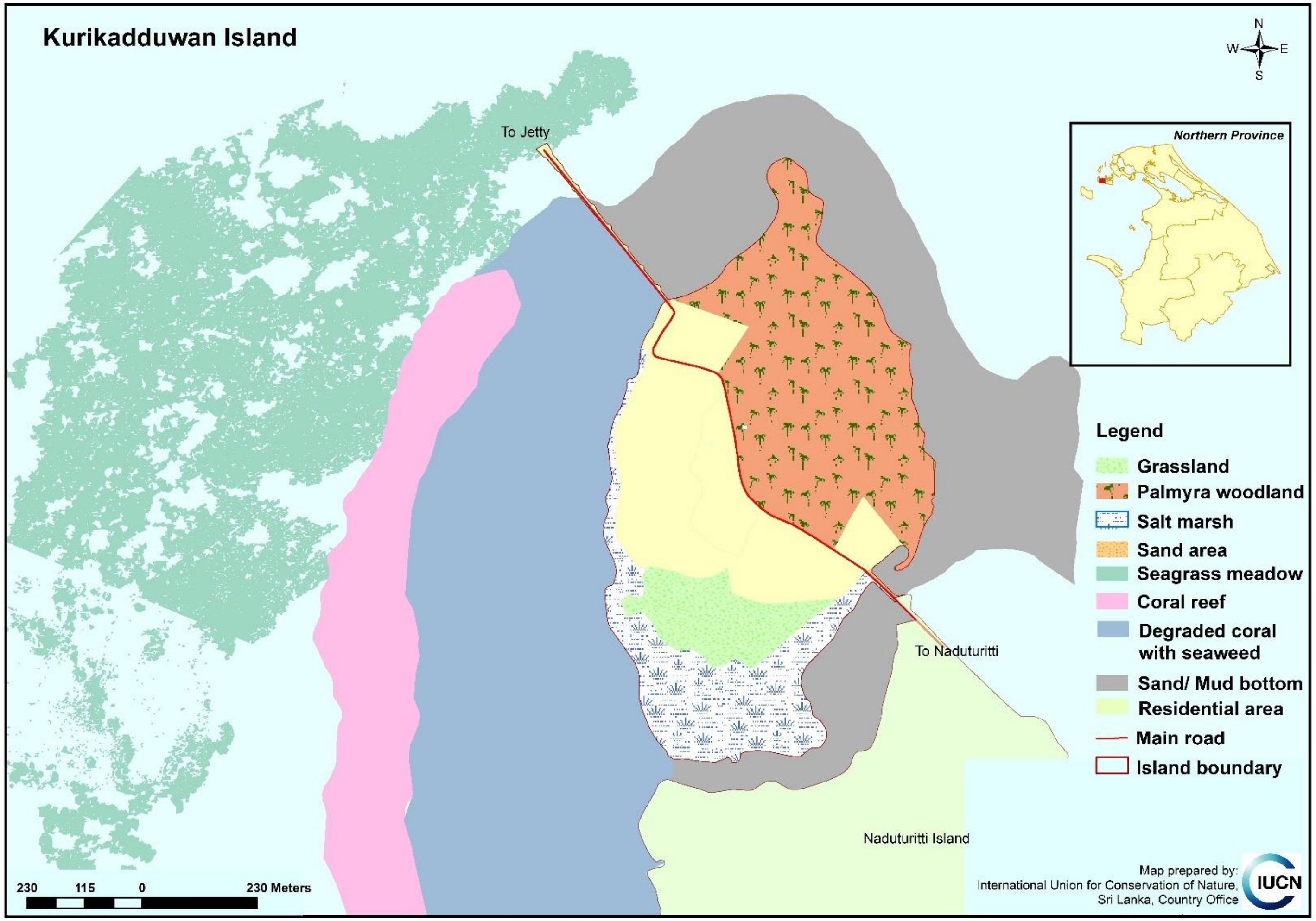

Figure 70. Map of Kurikadduwan Island, showing ecosystems and land use

Location	The island has an extent of about 0.38 km^2 and belongs to the Islands South (Velanai) Divisional Secretariat of the Jaffna District (Figure 70).
Ecosystems	**Terrestrial ecosystems** This a populated island, with strands of Palmyra and some salt marshes in the south. A total of eight plant and six fauna species, respectively, were recorded from the island. All six species of fauna were birds recorded on the Kurikadduwan causeway. There were notable species such as the nationally Vulnerable Little ringed plover *(Charadrius dubius*) and salt marsh species such as *Salicornia brachiata* and *Suaeda maritima* observed along the causeway. **Marine ecosystems** were not surveyed in this assessment but a study by NARA (2017) mapped seagrass meadows and coral reefs to the west of the island.
Special attributes	This island provides the link to Delft and Nainativu.
Proposed actions	This island should be developed to support tourism to Delft.
Proposed improvements	Home stays, small guest houses and restaurants should be developed in accordance to the recommendations provided in Chapter 6.
Carrying capacity for tourism activities	Over-crowding should be prevented.

Mandaitivu Island (Sinhala: *Mandadoova*)

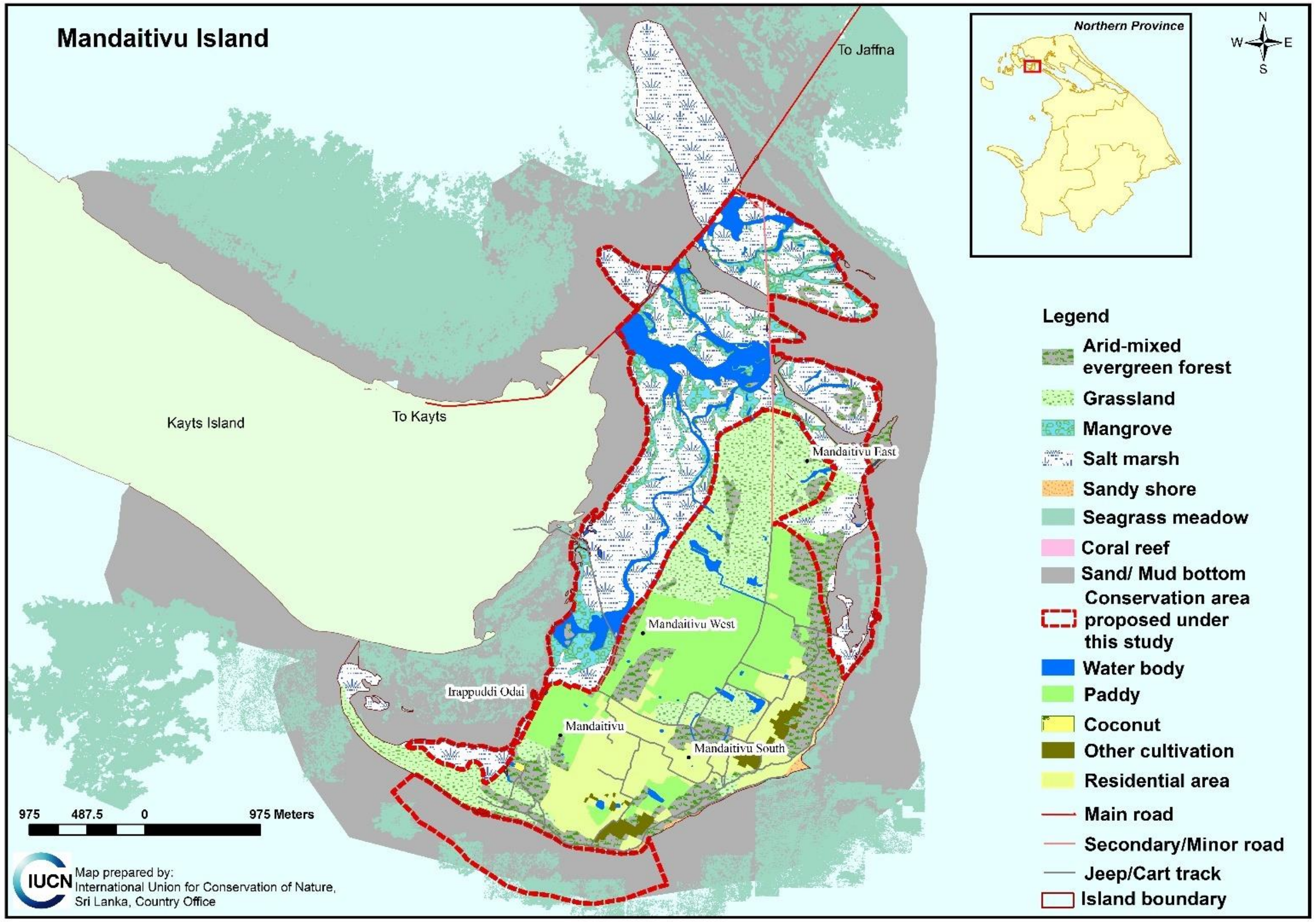

Figure 71. Map of Mandaitivu Island, showing ecosystems, land use and proposed conservation areas

Location	This island extends over 7.56 km^2 and belongs to the Islands South (Velanai) Divisional Secretariat in the Jaffna District. Mandaitivu is another highly populated island in the Jaffna Peninsula, with a human population of 1616 (Figure 71).
Ecosystems	**Terrestrial ecosystems** A broad spread of mangrove swamps is found on the island and are associated with salt marshes. Seashore scrublands, sandy seashores, home gardens and abandoned paddy fields are the other major land use types that can be seen on the island. A total of 52 floral species was recorded in the island. The notable species of terrestrial flora recorded here include *Suaeda maritima* and *Salicornia brachiate,* found in salt marshes and *Commiphora berryi* and Palmyra *(Borassus flabellifer*) associated with the home gardens and roadsides. A total of 61 species of terrestrial fauna were recorded represented by two species of land snails, two scorpions, two dragonflies, 28 butterflies, one exotic freshwater fish, two reptiles, 22 birds and two mammals. **Marine ecosystems** Mandaitivu had a fringing reef along the southern and western coasts. There were numerous small coral patches dominated by species belonging to the families of Acroporidae, Faviidae and Poritidae. The common species were *Acropora formosa, A. anthocercis, A. hyacinthus, A. cytherea, A. digitifera, A. aspera, A. aculeus and A. humilis*. Other common species were *Porites lutea, P. lobata, P. rus, Montipora digitata, M. foliosa, M. aequituberculata, M. verrucosa, Platygyra daedalea, Favia pallida, F. Speciosa, F. Matthaii, Favites chinensis, F, abdita, Diploastrea heliopora and Leptoria phrygia*. Corals were in good condition. Reef fish abundance was low; there were mainly Rabbit fish (Siganidae), Damselfish (Pomacentridae), Wrasses (Labridae) and Mullets (Mugilidae) were present.
Special attributes	Mandaitivu, along with Kayts is Important Bird and Biodiversity Area (IBA) (Birdlife International, 2017a). (See section on Kayts for more details of species.) It is also a Special Management Area (SMA) under the CCZRMP (2016). Notable terrestrial fauna recorded from the island include two endemic species — the Lesser albatross *(Appias galane*) and Devaka's fanthroat lizard (*Sitana devakai*). Among the recorded species are *Trachia vittata* and the Bright babul blue *(Azanus ubaldus)* which are listed as nationally Critically Endangered. Four other species — *Cryptozona semirugata* and the Large salmon Arab (*Colotis fausta*), Devaka's fanthroat lizard (*Sitana devakai*) and the Indian pipistrel (*Pipistrellus coromandra*) — are listed as nationally Vulnerable.
Proposed actions	Much of the coastline containing natural ecosystems and a small marine area in the south of the island are proposed as a conservation area (Figure 71). The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6.

	At present, there is no tourist infrastructure on the island. Mandaitivu Island is endowed with rich mangrove and salt marsh ecosystems, within which nature trails could be established. The mangroves, salt marshes, shallow sea and paddy fields of the island serve as feeding grounds for wading birds, most of which are migratory, thus presenting an opportunity for bird watching. The beaches and shallow seas allow for boat rides and sun bathing. Coral reefs found here, with a high diversity of *Acropora* spp., can be accessed easily and therefore, presents opportunities for snorkelling. Also, Mandaitivu's cultural diversity, including traditional fishing activities and archaeological monuments, could promote cultural tourism. The presence of human settlements, a well-developed road network and other infrastructure presents opportunities to develop home stays and resorts.
Proposed improvements	Development of home stays hotels, resorts, nature trails, and bird watching towers and hides. Mooring points for boat anchoring must be established. All these will have to be carried out while ensuring that environmental safeguards are included. (See Chapter 6.)
Carrying capacity for tourism activities	The northern sector of the island can support many bird watchers during the bird migratory season.

Mannar Island (Sinhala: *Mannaram Doopatha,* Tamil: Mannār)

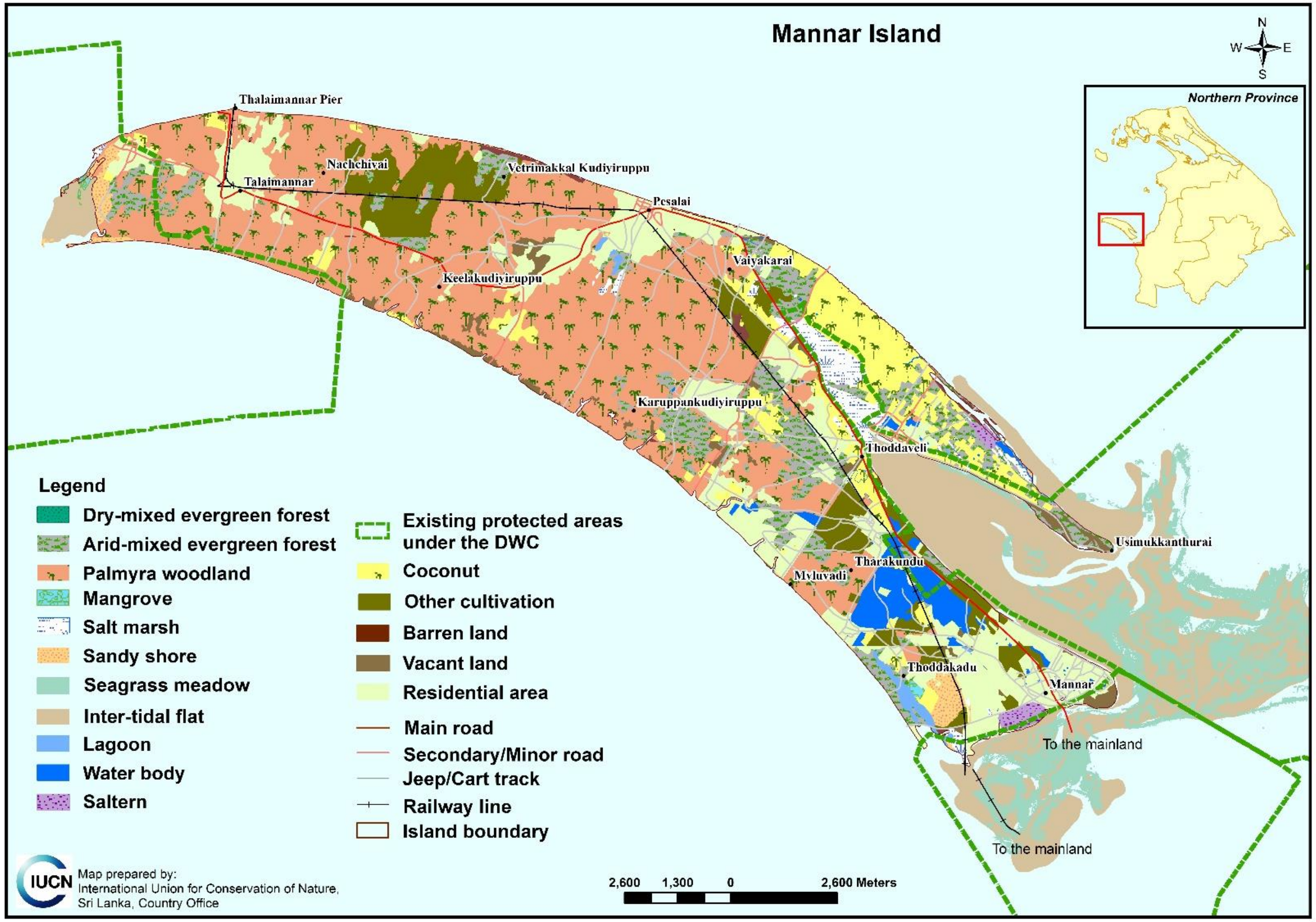

Figure 72. Map of Mannar Island, showing ecosystems and other land use
(Note that DWC protected area boundaries extend beyond the extent of this map)

Location	This island extends about 126.46 km^2 and belongs to the Mannar Town Divisional Secretariat in the Mannar District (Figure 72). The population of the island is 4,528. The name is derived from the term Mann-aru, which is a river that is supposed to have separated the island from the mainland (Gnanam, 2017). Mannar Island falls within the arid zone of Sri Lanka where the annual rainfall, is sharply seasonal, and less than 1000 mm. The area experiences heavy rains from October to December, during north-east monsoon. Mantai, on the mainland, in the Mannar District, was a major trading port in ancient times (See Chapter 1). From 5-13 AD, Mannar was part of the Rajarata Kingdom and later became part of the Jaffna Kingdom (Gnanam, 2017). In the mid-16th century, the Portuguese conquered the Jaffna Kingdom, and with it, Mannar Island. Subsequently, the Dutch gained control, and finally, the British. Remnants of the forts and churches that these colonists built were described in Chapter 1.
Ecosystems	**Terrestrial ecosystems**[21]: Mannar is a populated island. There are patches of scrubland and extensive Palmyra woodlands, as well as coconut plantations and home gardens. Also found around the island are tidal flats and small patches of salt marshes (where) as well as sand dunes near the tip of the island and in Nadukuda. **Marine ecosystems** The sea around Mannar Island supports seagrass meadows. Seagrass meadows are seen in Adam's Bridge, Thalaimannar and Pallimunai.
Special attributes	The presence of Baobab trees (*Adansonia digitata*), native to Africa, is a unique feature of the Mannar Island. These trees were introduced to the island by Arab sailors to feed camels. In addition, the island supports a rich biodiversity including number of threatened and endemic species. Mannar Island is visited/inhabited by many water birds, including annual migrants travelling on the Central Asian Flyway, which use this area as an entry point to Sri Lanka, a major wintering site, as well as a staging point before they exit Sri Lanka. More than 30% of the birds recorded in Sri Lanka (more than 150 species) have been recorded on the island.

[21] Although Mannar was not assessed during this study, data are available from IUCN, 2001b and Miththapala, 2012.

	The island is inhabited by some of the rarest species of birds recorded in Sri Lanka such as Spot-billed Duck (*Anas poecilorhyncha)*, Black drongo (*Dicrurus macrocercus*), Long-tailed Shrike *(Lanius schach*), Eurasian Collared-dove *(Streptopelia decaoto*), Grey Francolin (*Francolinus pondicerianus*), Black Kite *(Milvus migrans*), Crab-plover *(Dromas ardeola*), Great Black-headed Gull *(Larus ichthyaetus*), Eurasian Wigeon *(Anas penelope*) and the Black-tailed Godwit *(Limosa limosa*). Also found in the waters around Mannar island are Endangered dugongs and marine turtles. Recently discovered in the waters off the tip of Mannar island is Indo-Pacific finless porpoise (*Neophocaena phocaenofides*), a globally Vulnerable species (Nanayakkara et al., 2017). Also in Mannar are several historical sites such as the Dutch Fort, Doric House and the oldest Baobab tree (Figure 73).
Proposed actions	Mannar Island has a rich cultural diversity, as well as archaeological past. The island attracts many visitors whose focus is bird watching. The presence of human settlements and a road network provides an opportunity to develop home stays. Further, there are many small guest houses that have been established during the last few years.
Proposed improvements	Tourism specific infrastructure facilities will have to be improved if the island is to be promoted as a major tourism destination. This will include identification of tourism zones, specific tourism attractions and further development of these with proper interpretation, establishing a visitor centre to create awareness among visitors about the type of attractions available in and around Mannar Island, establishing nature trails, bird watching facilities, boating decks, snorkelling facilities. All these will have to be carried out ensuring the integration of environmental safeguards. Current trends of bird watching during the migratory season, indicate at increase in visitors without the establishment of environmental safeguards is becoming detrimental (Figure 48).
Carrying capacity for tourism activities	A maximum of 500 visitors can be accommodated in the island at a given time for bird watching. Victors for bird watching should be restricted.

Figure 73. Top: Dutch Fort, Mannar Island; Bottom, the oldest (reported to be over 700 years old) and the largest individual baobab (*Adansonia digitata*) tree in Sri Lanka, found at Pallimunai, Mannar Island

(© Sriyanie Miththapala)

Nainativu Island (Sinhala: *Nagadeepa*; Dutch: *Haarlem*)

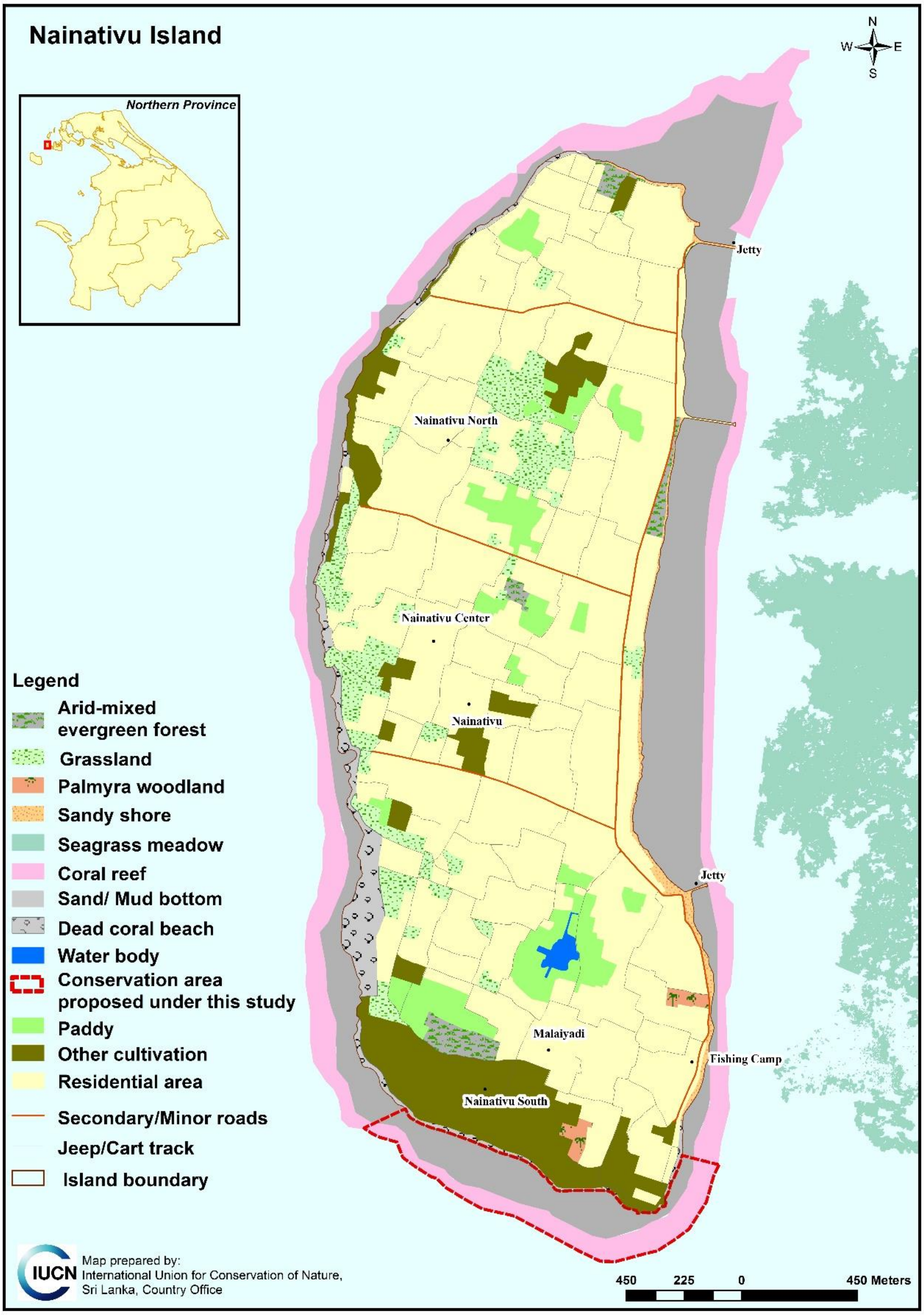

Figure 74. Map of Nainativu Island, showing ecosystems, land use and proposed conservation area

Location	The island extends over about 4.82 km^2 and belongs to the Islands South (Velanai) Divisional Secretariat in Jaffna district (Figure 75). The Dutch called Nainativu '*Haarlem'* and the island is also known by several other names such as *Nagadheepa*, *Naga Dhivayine*, *Nagthivu*, *Naga Nainarthivu*, *Nainarthivu* and *Maninagethivu*. The name Nagadeepa means '*Yapa Patuna'*, which comes from the term 'Jaffna Peninsula'. Its recorded that second visit of Lord Buddha was to Nagadeepa in 518 B.C (Geiger, 1912). The island has two important cultural buildings, the Nagadeepa Buddhist temple and the Naga pusheni amman Hindu kovil. The Hindu kovil was built for the Goddess Uma, is one of the 64 kovils built around the world for this Goddess and is the 48^{th} kovil out of the 64. The Goddess Uma has been known by 108 different names in different eras (Bassett, 1997).
Ecosystems	**Terrestrial ecosystems** Seashore scrublands, dead coral beaches, pasture lands (dry), Palmyra woodlands, agro-plantations (mixed culture and home gardens) are found on the island. A total of 42 plant and 22 animal species, respectively, were recorded from the island. The Palmyra tree (*Borassus flabellifer*) was the most abundant tree found all over the island. The animal assemblage comprised four butterfly, one dragonfly, 14 bird and three mammal species, respectively. **Marine ecosystems** Although this island was not assessed for marine diversity, a report from NARA (2017) shows that Nainativu has a fringing reef around the island. The width of the reef varies from 100 – 250 m. The reef is well developed in the south and in the north. To the east of the island are seagrasses.
Special attributes	This island has a rich historical background, which can be the main attraction for tourism development in the island. The biodiversity of the island does not offer a unique opportunity for tourism development but can be used for value addition. It is a Special Management Area (SMA) under the CCZRMP (2016).
Proposed actions	A small marine area in the south of the island is proposed as a conservation area (Figure 55). The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6. The island has a rich cultural diversity and is already visited by Buddhist pilgrims. The presence of human settlements and a road network provides opportunities to develop home stays. Tourism activities will promote further livelihood opportunities for the inhabitants.
Proposed improvements	Tourism specific infrastructure as well as general infrastructure will also have to be developed, while ensuring that environmental safeguards are included. (See Chapter 6.)

Carrying capacity for tourism activities	At any given time, more than 500 visitors should not be accommodated on the island, although this restriction may be difficult to enforce.

Neduntivu Island (Sinhala: *Maedundoova*; Dutch: *Delft*)

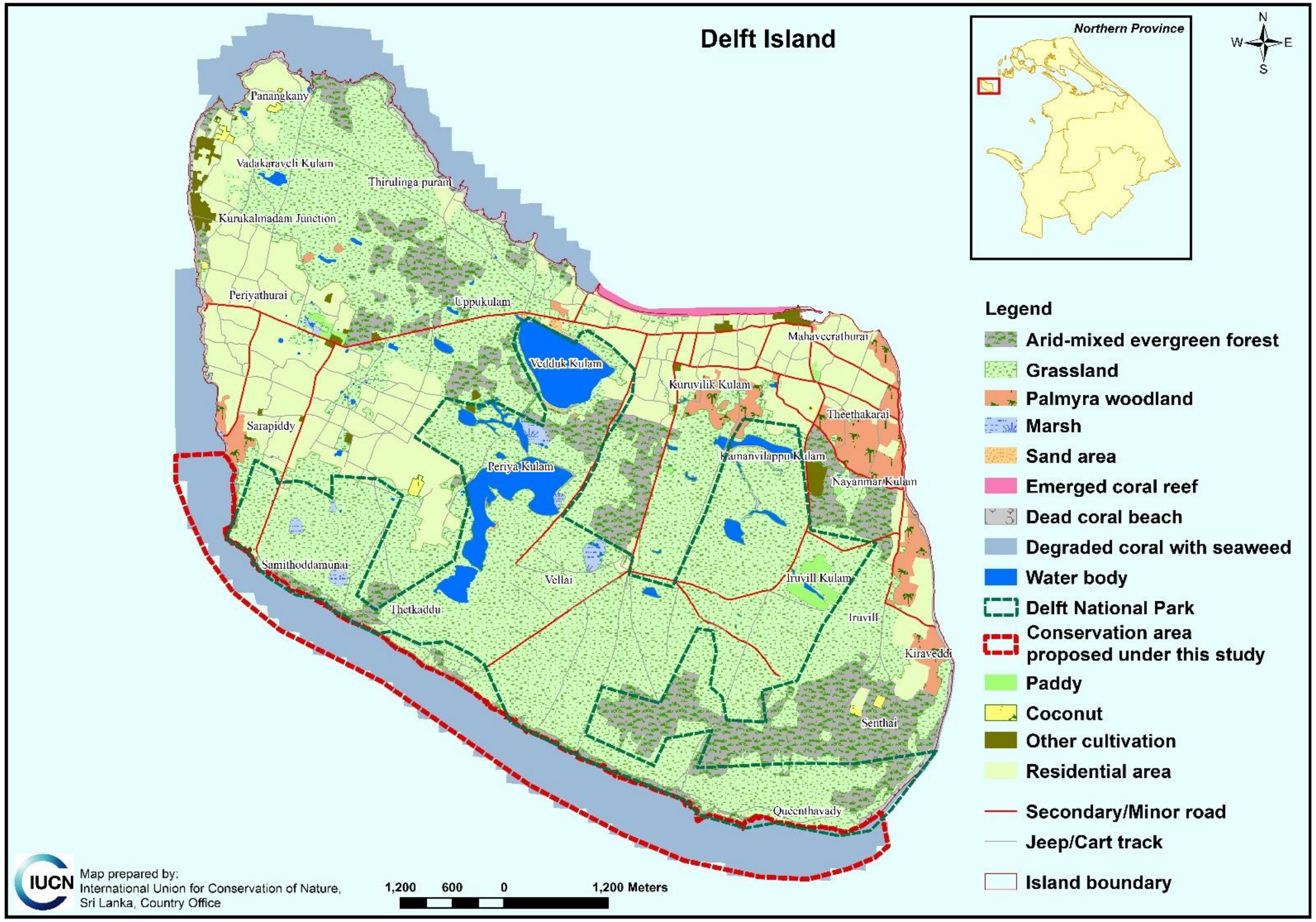

Figure 75. Map of Neduntivu Island, showing ecosystems, land use and proposed conservation area

Location	This island has an extent of about 47.17 km^2 and belongs to the Neduntivu (Delft) Divisional Secretariat of the Jaffna District (Figure 75). The population of the island is 4,528. The island was referred to by Baldaeus (1658) as *Nindundiva*, and *Nedointivo* by the Dutch according to VOC records. The name 'Delft' was given by the Dutch Governor Rijckloff van Goens (of the VOC 1678-1681). The Sinhalese names *Maedundoova* and *Diveldoova* have been given to the fishermen who inhabited the island. The Sinhala name is believed to have derived from the word *maedun* or *maedha*, indicating that the island is located more or less midway between the island of Rameshwaram and Jaffna Peninsula. The Tamil name may have also come from the same roots, and indeed, it may have derived from the Tamil word *naṭuttiṭṭam*, which also means ‘middle location’. During the Portuguese period, the name ‘cow island’ was used for the island. Ruins of an old Portuguese fort still exist in the island. A herd of wild ponies (approximately 600 ponies), first introduced during the Portuguese period, also survives in the island to date. Mr. D. T. Devendra, during a visit to Nedundoova in the 1940s, discovered a mound, which on closer examination turned out to be a Dageba. Other ancient ruins have also been discovered from the island. Remnants of a *Chola* Hindu temple (12- X 3 metres) belonging to the 11th century have also been found in the Island (Dharmawardana, 2006).
Ecosystems	**Terrestrial ecosystems** Arid mixed evergreen forests, wet pastureland, dry pastureland, Palmyra woodlands, home gardens, dead coral rock and sandy seashores were observed on the island. A total of 191 plant and 102 animal species, respectively, were recorded in the island. The faunal assemblage is represented by eight dragonfly, 17 butterfly, one amphibian, one reptile, 64 bird, and 11 mammal species respectively. **Marine ecosystems** were not surveyed during this present study.
Special attributes	Notable plant species found on the island include the Critically Endangered, Possibly Extinct *Fimbristylis dipsacea;* the Critically Endangered *Cyperus conglomerates*; the *Endangered Cadaba fruticosa, Ipomoea coptica, Cocculus hirsutus,* and *Peplidium mariticum*. The Baobab tree (*Adansonia digitata*) is also present found on the island. Notable faunal species observed in the island include the Critically Endangered Indian courser (*Cursorius coromandelicus*), the Vulnerable Burmeister’s Glider (*Tramea basilaris*), Plain orange tip *(Colotis aurora*), Joker *(Byblia ilithyia*), Little-ringed and Kentish plovers (*Charadrius dubius* and *C. alexandrines,* respectively) and the Silverbill (*Lonchura malabarica*). Near Threatened species include the Pruinosed bloodtail (*Lathrecista asiatica*), Marsh skimmer (*Orthetrum luzonicum*), Paddyfield parasol (*Neurothemis intermedia*), Eurasian collared dove (*Streptopelia decaocto*) and the Black-crowned night heron *(Nycticorax nycticorax*).

	Further, the famous Delft ponies (*Equus caballus*), which roam freely around the island are a notable feature of the island's faunal assemblage.
Proposed actions	Part of the island is now a national park under the jurisdiction of the DWC. The marine area adjoining the national park is proposed as a conservation area (Figure 75). The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6. It is also a Special Management Area (SMA) under the CCZRMP (2016). The high habitat diversity, the Delft ponies in Delft National Park, presents tourism opportunities to established nature trails and hides for bird watching. Archaeological monuments, including ruins belonging to the Anuradhapura and colonial period (for example, the survey beacon) can be used to promote cultural tourism. Tourists could also have the opportunity use the beaches of the island, as well as dive in the dead coral habitat around the island. The shallow seas could also promote troll fishing, angling and water skiing (within designated areas). Meanwhile the coral reefs could promote snorkelling.
Proposed improvements	As the island is partly populated and home stays as well as guest houses could also be developed. Tourism activities will promote further livelihood opportunities in Delft, although, these activities will have to be developed with strict environmental safeguards (Chapter 6).
Carrying capacity for tourism activities	Visitors to the national park should be restricted to a maximum of 40-50 people in the morning and the same number in the afternoon.

Palaitivu Island (Sinhala: *Paludoova*; Dutch: *Galue*)

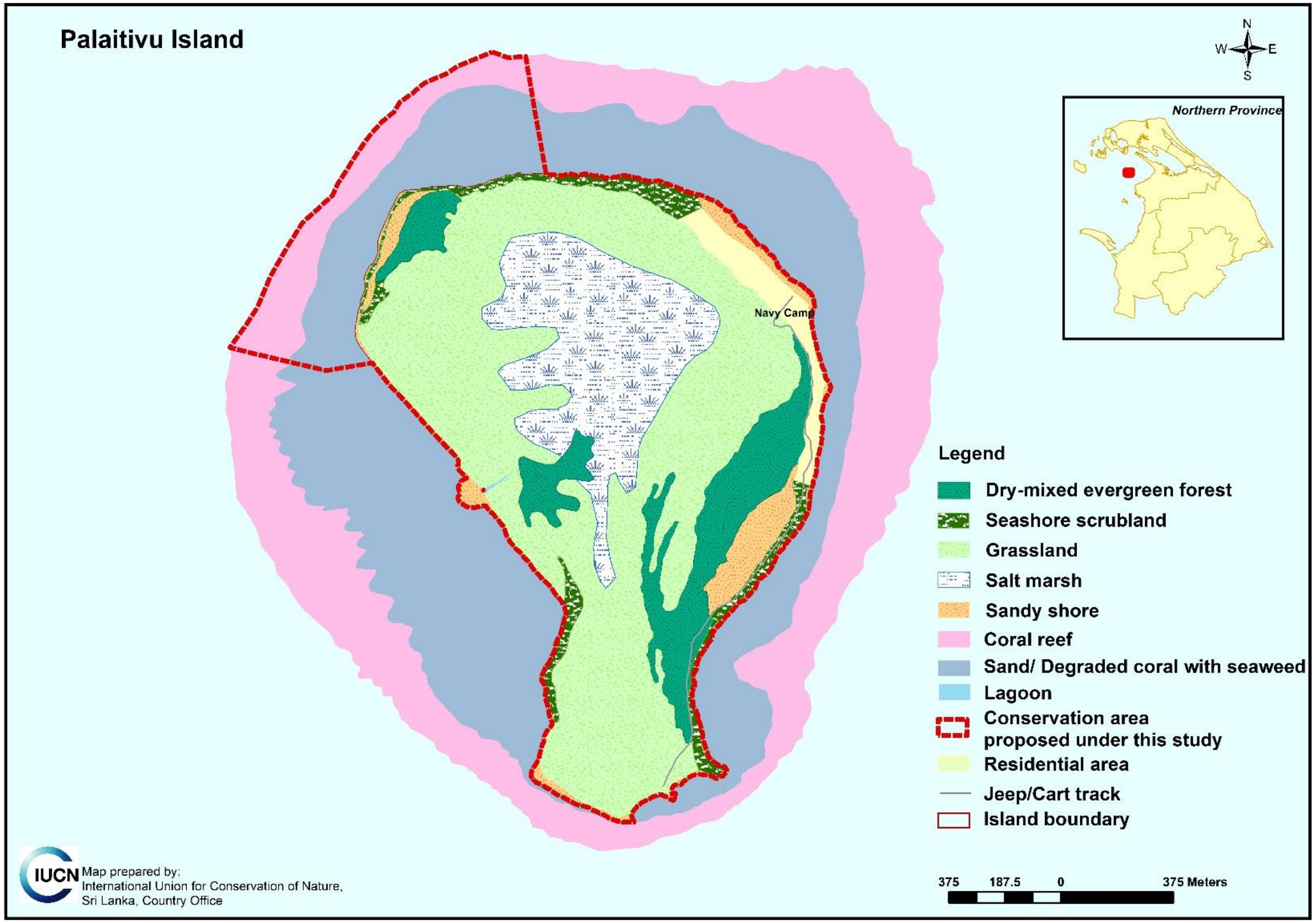

Figure 76. Map of Palaitivu Island, showing ecosystems, land use and proposed conservation area

Location	The island is about 1.81 km^2 in extent and belongs to the Poonakary Divisional Secretariat of the Kilinochchi District (Figure 76). In 1895, a Christian church was built with a statue of St. Anthony, who was considered the protector of fishermen. Palaitivu Island was named 'Galue' by the Dutch.
Ecosystems	**Terrestrial ecosystems** Dry-mixed evergreen forests dominated by *Manilkara hexandra* is an ecosystem found on the island. In addition, grasslands intermingled with salt marshes, seashore scrublands and sandy seashores are also found on the island. A total of 53 plant and 42 animal species, respectively, were recorded from the island. Fauna were represented by three dragonfly, ten butterfly, six reptiles and 23 bird species, respectively. **Marine ecosystems** A well-developed fringing reef is present around the island. The outer reef on the western side has a well-developed spur and groove structure. Reef condition was better on the north-western side of the island. A relatively extensive reef lagoon, which was about 500 m in width, was present on the western side of the island. The reef lagoon has very few live corals; seaweeds (*Sargassum* and *Turbinaria*) were abundant. There are small colonies of *Porites* spp in the reef lagoon. The reef slope is also degraded. The depth on the seaward margin was about seven metres. The coral reef in the north-western corner had the most amount of live corals with large domes of *Porites lutea* and *P. lobata*. Other common species of hard corals were *Acropora hyacinthus, Acropora formosa, Symphyllia radians, Platygyra daedalea, Leptoria phrygia, Favities chinensis* and *Favia speciosa*. Reef fish abundance was low; mainly damselfish (Pomacentridae) and wrasses (Labridae) were present.
Special attributes	Notable terrestrial plant species recorded on the island include the Sea trumpet (*Cordia subcordata*) and Bay cedar (*Suriana maritima*), which are very rare species. In addition, *Guettarda speciosa* was also observed near the coast. Notable fauna include the nationally Vulnerable include Plain orange tip *(Colotis aurora*), Saw-scaled viper (*Echis carinatus*), Little-ringed and Kentish plovers (*Charadrius dubius* and *C. alexandrinus* respectively) and the Near Threatened Marsh skimmer (*Orthetrum luzonicum*).
Proposed actions	The entire island, as well as a small north-western part of the marine area is proposed as a conservation area. The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6. In addition to the high ecosystem and species diversity, this island also has aesthetic and scenic value. Thus, tourism activities such as nature trails, bird watching, snorkelling and camping could be promoted on the island. The presence of an archaeological monument and a survey beacon can also be used as tourist attractions. The shallow seas and sandy beaches present around the island are opportunities for beach-based activities. All these will have to be promoted while ensuring environmental safeguards (Chapter 6).

Proposed improvements	Fresh water will be needed. Accommodation can be provided in Analaitivu for day trips.
Carrying capacity for tourism activities	Up to 20 day visitors only.

Parititivu Island (Sinhala: *Paludoova*)

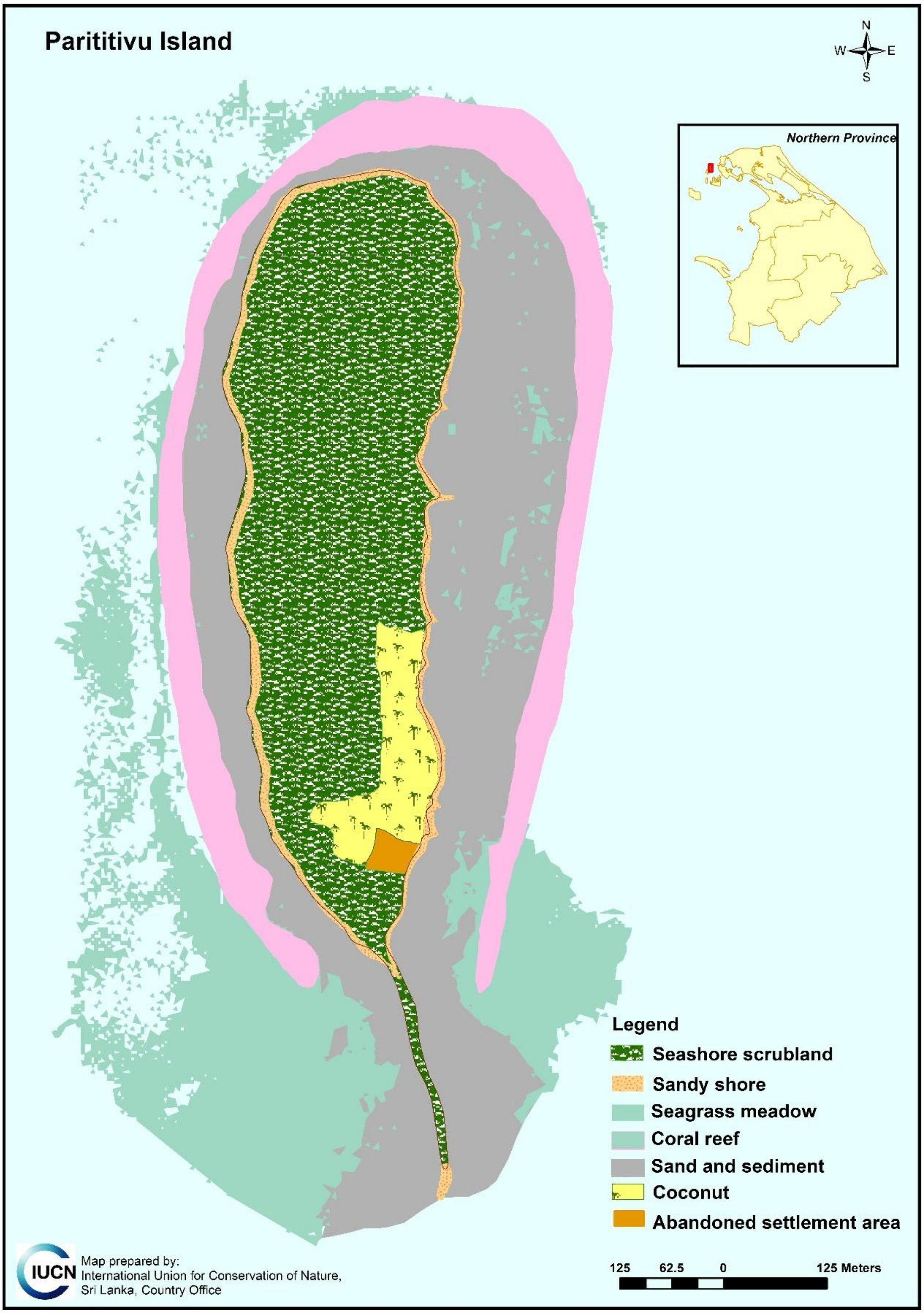

Figure 77. Map of Parititivu Island, showing ecosystems and land use

Location	This island has an extent of about 0.4 km^2 and belongs to the Islands North (Kayts) Divisional Secretariat in the Jaffna District (Figure 77). The island is not inhabited.
Ecosystems	Seashore scrublands and Palmyra woodland were seen across the island. A total of 50 plant species and 33 animal species were recorded on the island. The fauna recorded were represented by one land snail, one dragonfly, six butterfly, one reptile and 23 bird species, respectively.
Special attributes	**Terrestrial ecosystems** Notable species of terrestrial fauna recorded on the island include two species — the landsnail *Cryptozona semirugata* and Kentish plover (*Charadrius alexandrinus*) listed as nationally Vulnerable; and one species — the Dark blue tiger (*Tirumala septentrionis*) — listed as nationally Near Threatened. **Marine ecosystems** were not surveyed.
Proposed actions	Parititivu's scrub forest presents opportunities for establishing nature trails and camping sites (which can be operated from Analaitivu). The seagrass meadows around the island can be used for snorkelling. Because it is isolated, it provides an ideal site for strictly-controlled and managed, nature-based tourism development.
Proposed improvements	Currently, the island does not have any infrastructure facilities Tourism specific infrastructure — such as nature trails, a boat deck, snorkelling areas will also have to be developed, while ensuring that environmental safeguards are included. (See Chapter 6.)
Carrying capacity for tourism activities	At any given time, less than 25 visitors can be accommodated on this island.

Puliyantivu Island (Sinhala: *Kotidoova*) (Jaffna)

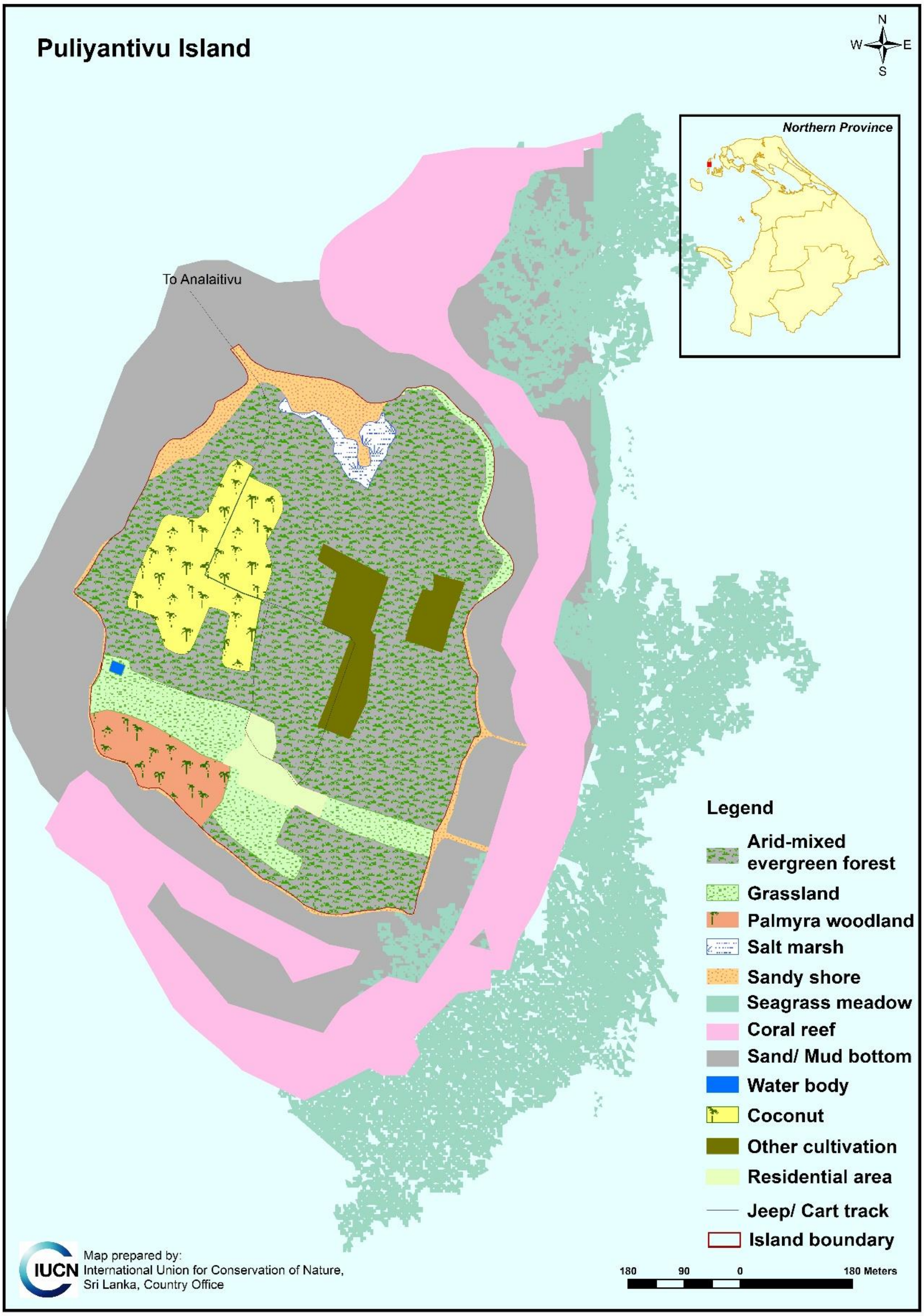

Figure 78. Map of Puliyantivu Island (Jaffna), showing ecosystems and land use

Location	The island has an extent around 0.44 km^2 and belongs to the islands' North (Kayts) Divisional Secretariat of the Jaffna District (Figure 78). The island was referred to as 'Juliyene' in the past. There is a historical kovil situated in the island that was known as 'Nage thambiranye', which was later changed to 'Kanegeshvern Shiven' kovil.
Ecosystems	**Terrestrial ecosystems** Arid mixed evergreen forests and sandy seashores were observed in the island. A total of 27 plant and 20 animal species were recorded from the island. The faunal species recorded were represented by three butterfly and 17 bird species, respectively. **Marine ecosystems** were not surveyed.
Special attributes	No notable terrestrial faunal species were recorded on this island.
Proposed actions	Nature trails can be established within the arid mixed evergreen forests/ The shallow seas and seagrass meadows around the island are suitable for snorkelling, while the sandy beach can also be used for tourism activities.
Proposed improvements	Camping sites (which could be operated from Analaitivu Island) and resorts could also be developed, while ensuring that environmental safeguards are integrated. (See Chapter 6.)
Carrying capacity for tourism activities	A maximum of 20-25 per day

Puliyantivu Island (Sinhala: *Kotidoova*) (Mannar)

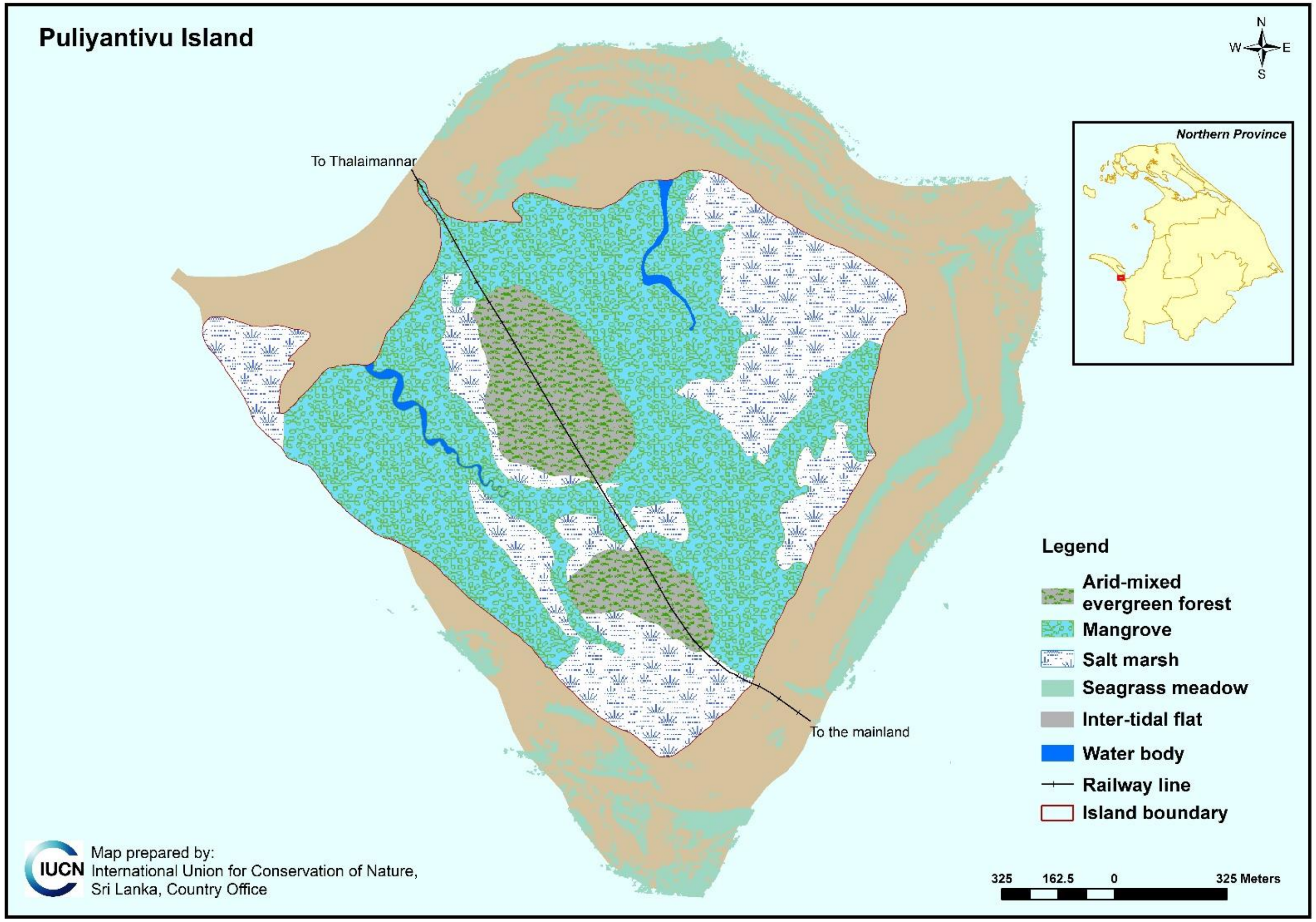

Figure 79. Map of Puliyantivu Island (Mannar), showing ecosystems and land use
(Note that the DWC protected area completely encircles this island and extends well beyond it)

Location	The island has an extent of about 0.9 km^2 and belongs to the Mantai Divisional Secretariat in the Mannar District (Figure 79).
Ecosystems	**Terrestrial ecosystems** Mangroves, salt marshes and arid mixed evergreen forests are found on the island. A total of 27 plant and 112 animal species were recorded in the island. The faunal assemblage of the island comprised two dragonfly, ten butterfly, one amphibian, 26 reptile, 65 bird and eight mammal species, respectively. This high diversity of bird species is likely because this island is closes to Vanakalai Bird Sanctuary. **Marine ecosystems** were not surveyed.
Special attributes	Notable terrestrial floral species recorded on the island include *Suaeda maritima* and *Suaeda monoica*, observed in salt marshes. Notable terrestrial faunal species observed in the island include three endemic species — Common lankaskink (*Lankascincus fallax*), Checkered keelback (*Xenochrophis asperrimus*) and Checkered keelback (*Xenochrophis cf. piscator*); one listed as nationally Endangered species — the Oriental pratincole (*Glareola maldivarum*); two listed as nationally Vulnerable species — the Kentish plover (*Charadrius alexandrinus*) and Small pratincole(*Glareola lactea*); and two listed as nationally Near Threatened — the Drongo cuckoo (*Surniculus lugubris*) and Eurasian collared dove (*Streptopelia decaocto*); and one listed as Data Deficient — Collared sea snake (*Hydrophis stricticollis*).
Proposed actions	As Puliyantivu is located within the Vankalai Bird Sanctuary, it provides opportunities for nature trails and bird watching.
Proposed improvements	Bird watching hides and towers could be especially promoted in this area, as it is a feeding ground for migratory birds. Pulliyantiivu is located within the Vankalai Bird Sanctuary, and therefore, establishing nature trails, including raised walkways and canopy walks is possible on the island. Further, the island is used as a feeding ground by a large number of migratory birds and therefore, hides and towers can be established to facilitate bird watching. Its unique mangrove and salt marsh ecosystems surrounded by shallow seas could also be used for tourism product development in the island. Boat rides among the mangrove and salt marsh ecosystems, surrounded by the shallow sea could also be promoted, while ensuring that environmental safeguards are integrated. (See Chapter 6.)
Carrying capacity for tourism activities	A maximum of 50 persons per day. Non-motorised boats should be used.

Pungudutivu Island (Sinhala: *Punguthdeepa*; Dutch: *Middleberg*)

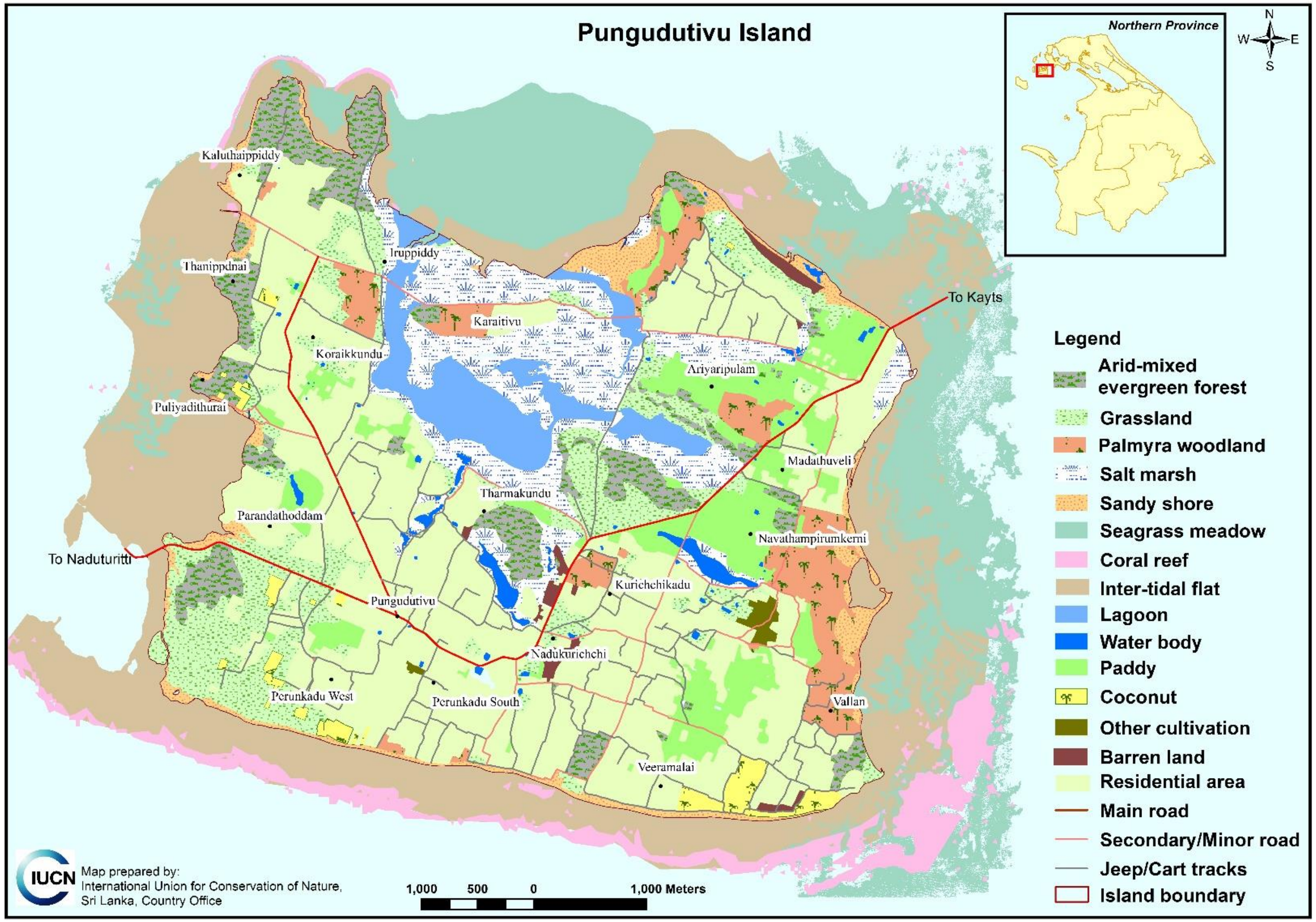

Figure 80. Map of Pungudutivu Island, showing ecosystems and land use

Location	This island has an extent of about 22.56 km^2 and belongs to the islands' South (Velanai) Divisional Secretariat of the Jaffna District (Figure 80). The island is densely populated, and its current population is 4107.
Ecosystems	**Terrestrial ecosystems** Arid mixed evergreen forests associated with small grasslands, salt marshes associated with tidal flats, Palmyra woodland and home gardens were found on the island. Extensive tidal flats are exposed at low tide (Kotagama et al., 2009). A total of 53 plant and 31 fauna species, respectively, were recorded from the island. The faunal assemblage of the island comprised 14 butterfly, 16 bird and one mammal species, respectively. **Marine ecosystems** Pungudutivu reef is located on the southern and south-eastern side of the island. It also extends about 4 km to the east towards Mandaitivu from the south-eastern corner of Pungudutivu. The outer reef slope was about 200 meters wide on the western side of the island and the maximum depth at the outer edge was about seven meters. The reef on the south-eastern side was about 4 km in width. However, much of it was in an extensive reef flat with numerous small coral colonies of *Goniastrea, Porites* and *Montipora*. *Acropora hyacinthus* and *A. formosa* patches were present. A series of spur and groove reef sections were present on the outer reef slope which consisted of *Acropora* rubble. The reef crest, inner reef lagoon and outer reef flats contained *Goniastrea* colonies. *Goniastrea retiformis* and *Goniastrea edwardsi* colonies about one metre across were observed. The spur and groove reef sections of *Acropora* rubble may be due to a previous coral bleaching event. There were large *Porites lutea* and *P. lobata* domes along the seaward edge of the outer reef slope. Some domes were about three metres in diameter and about two metres in height. Thirty-six species of hard corals were recorded for the Pungudutivu reef (Rajasuriya, 2007). Live hard coral cover was 53.12% while coral rubble amounted to 46.87% in 2005 (Rajasuriya, 2007). Soft corals were rare at this site. The middle reef slope had patches of *Turbinaria* and *Sargassum* seaweeds growing on coral rubble and limestone substrate. Extensive seagrass areas were found off the north-eastern and northern coasts of the island. Rajasuriya (2007), recorded thirty two species of reef fish including four species of butterflyfish [Threadfin butterflyfish (*Chaetodon Auriga);* Redtail butterflyfish (*C. collare);* Indian vagabond butterflyfish *(C. decussatus*); and Eight band butterflyfish (*C. octofasciatus*)]; rabbit fish [Streaked spinefoot (*Siganus javus*); White-spotted spinefoot (*S. canaliculatus*), Golden-lined spinefoot (*S. lineatus*); parrotfish [Ember parrotfish (*Scarus rubroviolaceus*); Blue-barred parrotfish (*S. ghobban*); sweetlips [Minstrel sweetlips (*Plectorhinchus schotaf*)]; and surgeonfish [Yellowfin surgeonfish (*Acanthurus xanthopterus*) Black-spot surgeonfish (*A. bariene*). However, reef fish were scarce during the present survey; large reef fish were absent.

Special attributes	Notable species recorded on the island included a nationally Endangered species *Cadaba fruticose*, three nationally Vulnerable species — *Indigofera oblongifolia*, Plain orange tip (*Colotis aurora*) and the Little-ringed plover (*Charadrius dubius*) as well as the endemic species, *Vernonia zeylanica* recorded in arid mixed evergreen forests. The Palmyra tree (*Borassus flabellifer*) is the most commonly seen plant in the island. The tidal flat also contained mangrove species such as *Avicennia marina* and *Salicornia brachiata*.
Proposed actions	Bird watching during the migratory season can be promoted.
Proposed improvements	Hides, nature trails, home stays, guest houses and small restaurants should be established but with environmental safeguards integrated. (See Chapter 6.)
Carrying capacity for tourism activities	Twenty to thirty at a time (morning/afternoon) for bird watching.

Annex 2. Profiles of Coastal Stretches Surveyed

Beach front view of dry-mixed evergreen forest at Mullaittivu © IUCN/Naalin Perera

Kalmunai to Pooneryn

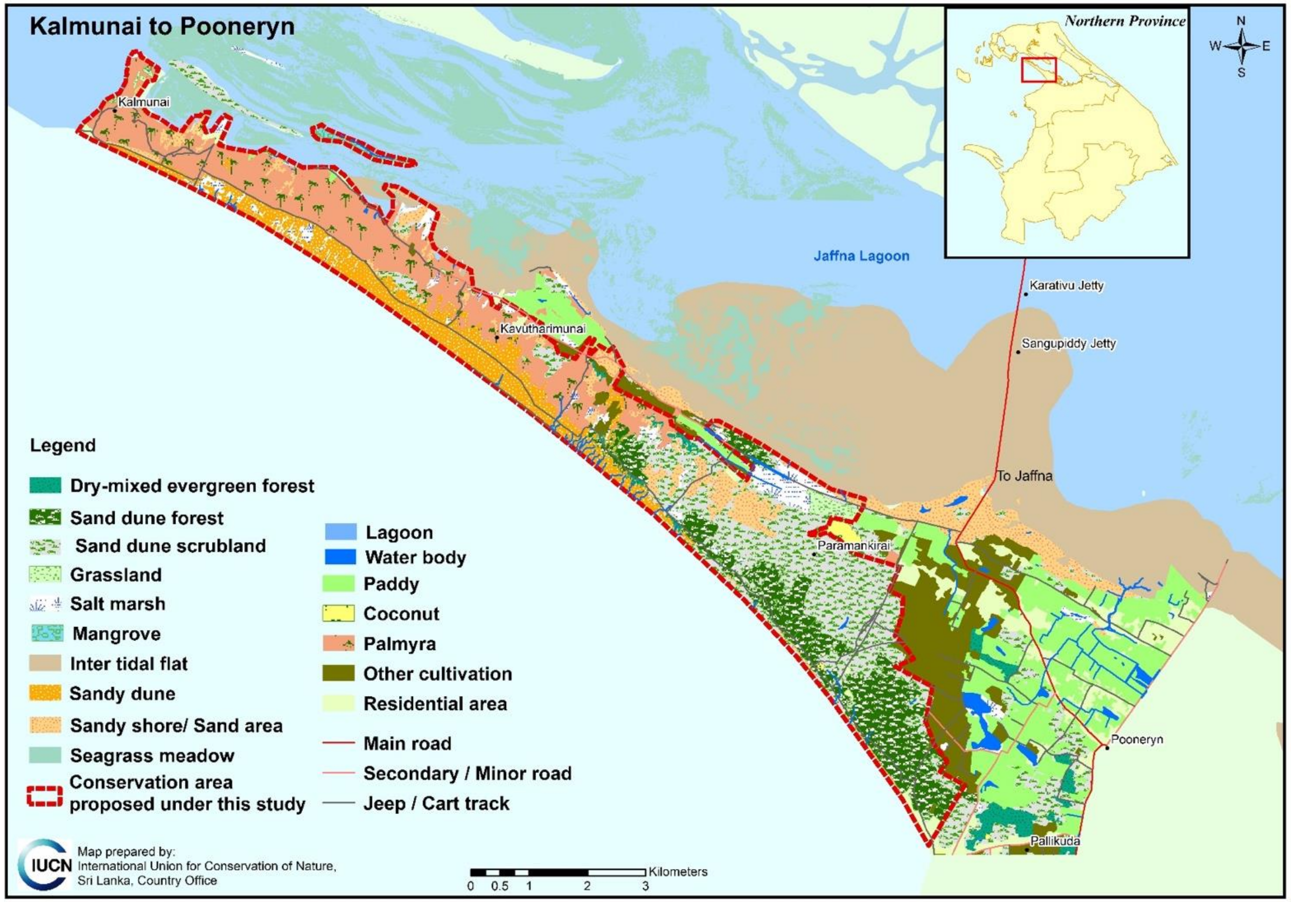

Figure 81. Map of the coastal stretch from Kalmunai to Pooneryn, showing ecosystems and land use

Location	This stretch starts at 9º 29'10.36" N; 80º 11' 07.88" E; and ends at 9º 34'47.63" N; 80º 05' 11.39" E and lies in the Poonakary divisional secretariat division in the Kilinochchi District (Figure 81).
Ecosystems	**Terrestrial ecosystems** Patches of sand dune forests, sand dunes and seashore scrubland, tidal flats, Palmyra woodlands, paddy lands and human habitation are found in this Peninsula. Species found here include black-naped hare (*Lepus nigricollis*), Jungle fowl (*Gallus lafayettii*), Rose ring parakeet (*Psittacula krameri*), Brahminy kite (*Haliastur indus*), Palm swift (*Cypsiurus parvus*), Star tortoise (*Geochelone elegans*), Sand lizard (*Sitana devakai*), Common pierrot (*Castalius rosimon),* and Common jezebel (*Delias eucharis).* Marine ecosystems were not surveyed, but other data (NARA, 2017) show seagrasses almost surrounding the Peninsula and extensive inter-tidal flats on the northern border of the Peninsula.
Special attributes	Waders such as sandpipers, plovers, curlews, whimbrels and scrubland birds such as pitpits, skylarks and partridges are seen along this stretch.
Proposed actions	Much of the peninsula is proposed as a conservation area to protect the sand dunes and associated ecosystems (Figure 81). The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6. Bird watching can be promoted during the migratory season, as well as camping and cycling.
Proposed improvements	Bird hides, and nature trails can be established as day trips arranged from Jaffna.
Carrying capacity for tourism activities	A maximum of 250 people per day,

Punnalai Khadu

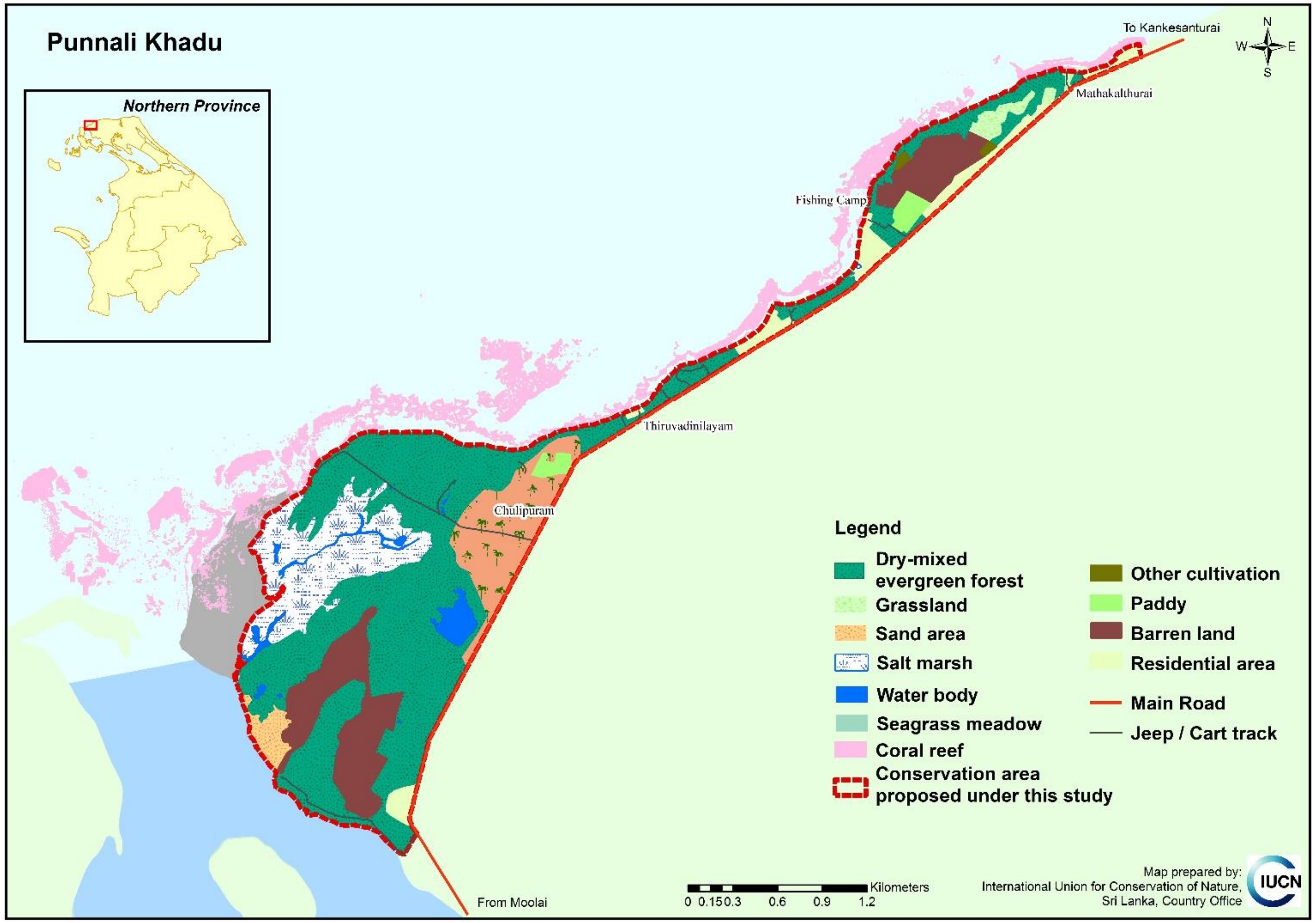

Figure 82. Map of the coastal stretch at Punnalai Khadu, showing ecosystems and land use

Location	This stretch starts at 9º 46' 30.10" N; 79º 54' 39.09" E and ends at End 9º 46' 31.28" N; 79º 55' 18.45" E and is in the Valikamam West (Chankanai) divisional secretariat division in the Jaffna District (Figure 82).
Ecosystems	**Terrestrial ecosystems** Terrestrial ecosystems observed in this stretch include dry-mixed evergreen forests, Palmyra woodlands, sandy shores, dry grasslands, ponds, salt marshes associated with tidal flats, and sandy seashores. The first two ecosystems mentioned are spread extensively over this coastal stretch. Home gardens were also found. A total of 48 plant and 37 animal species, respectively, were recorded in this coastal stretch. The fauna species were represented by 15 butterfly, two reptile and 18 bird species, respectively. **Marine ecosystems** were not surveyed.
Special attributes	This stretch has a sandy beach, fish landing sites, and small patches of salt marshes.
Proposed actions	The headland and a narrow strip are proposed as a conservation area (Figure 82). The type and degree of protection must be decided upon after detailed studies, as recommended in Chapter 6. Birdwatching can be promoted for scrubland birds and some waders in the small patch of salt marshes.
Proposed improvements	Nature trails, camping sites can be established, ensuring that environmental safeguards are also established (Chapter 6).
Carrying capacity for tourism activities	Twenty to forty persons per day.

Northern Coastal Stretch of the Jaffna Peninsula (from Thiruvadinilayam - Dambakolapatuna to Point Pedro)

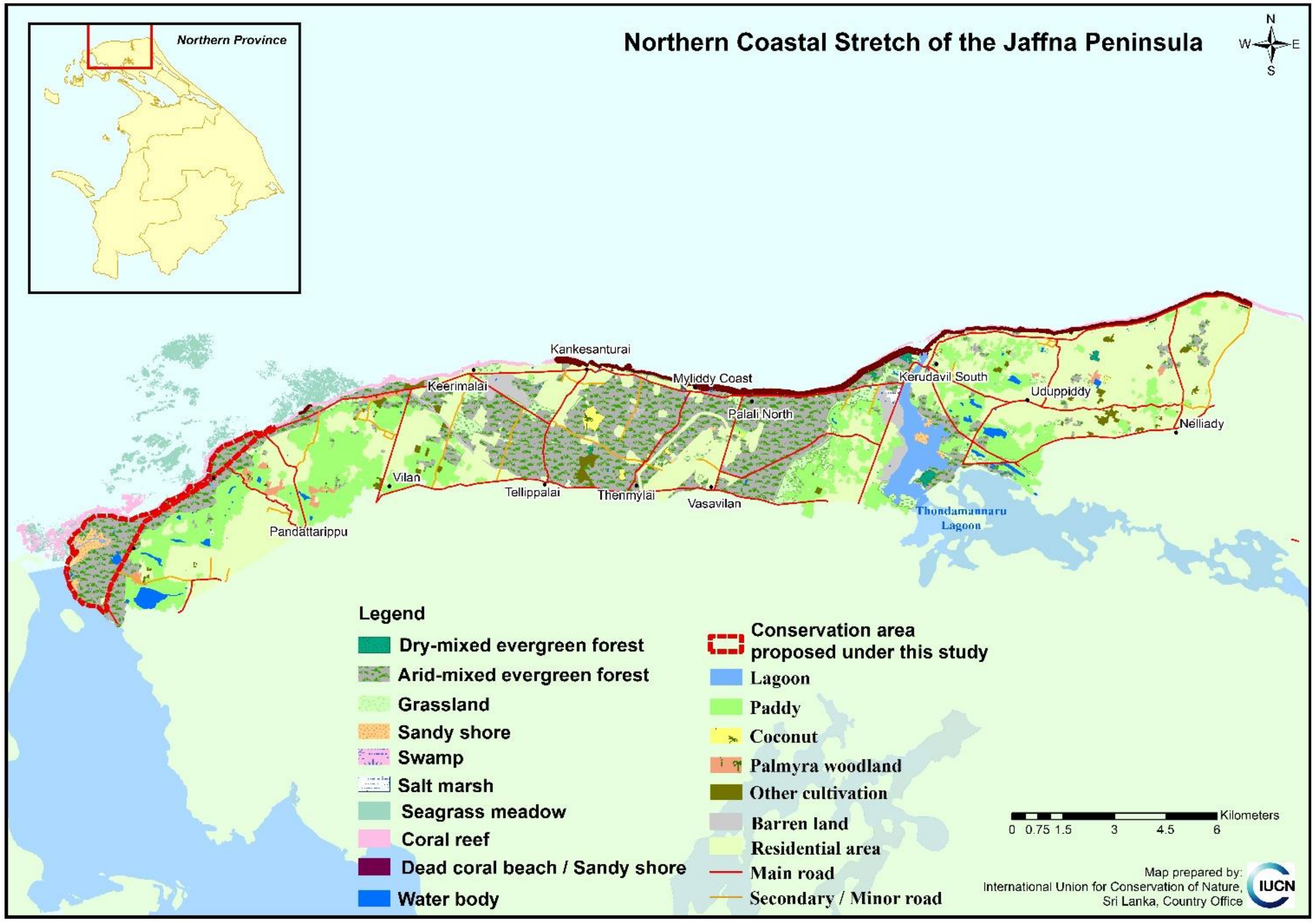

Figure 83. Map of the Northern Coastal Stretch of the Jaffna Peninsula (from Thiruvadinilayam - Dambakolapatuna to Point Pedro), showing ecosystems and land use

Location	This stretch starts at 9º 47' 11.16" N; 79º 56' 35.30" E and ends at 9º 50' 10.48" N; 80º 12' 44.13" E and includes parts of the divisional secretariat divisions of Vadamaradchi North (Point Pedro), Valikamam East (Kopay), Valikamam North (Tellippalai) and Valikamam South-West (Sandilipay) (Figure 83).
Ecosystems	**Terrestrial ecosystems** The coastal zone of the northern border of Jaffna Peninsula consists of limestone. It is noteworthy that the inter-tidal zone of this stretch comprises rubble and dead coral beaches, while the sub-tidal area is covered with rubble, and both dead and live corals. Terrestrial ecosystems observed along this stretch included dead coral beaches, sandy shores, small inland lagoons, home gardens (coastal) and built up areas. The Jaffna-Kankesanturai-Point Pedro main road lies along the coastal stretch of this area. The diversity of terrestrial flora and fauna observed along this stretch was low, as the area has built infrastructure. **Marine ecosystems** This coastal stretch has a continuous fringing coral reef from Dambakolapatuna to Point Pedro. The reef varies in width from about 50 m to 150 m. A narrow (10m) reef lagoon is present in several locations. The reef crest is exposed even at high tide and it is topped by dead coral pieces swept up by wave action. The reef crest is breached in several locations by fishermen to use as channels to bring in boats into the reef lagoon which is used as an anchorage. The water quality in the reef lagoon is generally poor where boats are anchored. There is much pollution in these areas due to discarded fish offal and pollution from the boats including oil. The seaward side of the reef crest has good coral cover. The coral reef is dominated by massive corals, mainly belonging to the families of Poritidae, Faviidae and Mussidae. The dominant species were *Favites halicora, F. chinensis, Favia matthaii, F. speciosa, F. pallida, Diploastrea heliopora, Platygyra lamellina, P. daedalea, Leptoria phrygia, Goniastrea retiformis, G. edwardsi, Porites lutea* and *Porites lobata*. Species of *Acropora* and *Montipora* were common but was limited to small colonies. Large soft corals of the genus *Sarcophyton* and *Sinularia* were common in the sector of the nearshore area. Many species of reef fish were observed in this area. Species diversity of reef fish, as well as corals, was higher than in the Palk Bay and the western part of the Palk Strait. Reef fish included surgeonfish (Acanthuridae), butterflyfish (Chaetodontidae), damselfish (Pomacentridae), wrasses (Labridae), snappers (Lutjanidae), sweetlips and grunts (Haemulidae), mullets (Mugilidae), rabbitfish (Siganidae) and parrotfish (Scaridae).
Special attributes	Notable plant species recorded on this coastal stretch included one nationally Endangered species, *Cadaba fruticosa* and three nationally Vulnerable species — *Crinum zeylanicum, Cassine glauca* and *Indigofera oblongifolia*. *Cassine glauca* is also endemic to Sri Lanka.

	Notable fauna recorded along this coastal stretch included two nationally Vulnerable butterfly species — the Plain orange tip (*Colotis aurora*) and Large salmon Arab (*Colotis fausta*) — and two nationally Near Threatened species — Little orange tip (*Colotis etrida*) and Eurasian collared dove (*Streptopelia decaocto).* The diversity of corals and well as fish is higher here than in Palk Bay. Notable reef fish include the Yellowtail mullet (*Sicamugil cascasia*[22]) The Dambakolapatuna, used as a port in historical times, is reported to be the place where There Sangamiththa landed with the Bo sapling; and where King Devanampiyathissa welcomed her. In commemoration of this event, the king built the Dambakolapatuna Viharaya (Jambokola Viharaya) (Figure 84). Keerimalai (Figure 84), also found in this coastal stretch, consists of two ponds that have been built next to the sea. Although the ponds are right next to the sea, their water is not saline but from an underground fresh water spring. Within the premises is Naguleswaram temple. Keerimalai literally translates to 'Mongoose Mound'. Legend has it a sage with a face like a mongoose bathed in these ponds and his face was turned into a human face. To this day, these ponds are believed to have curative properties.
Proposed actions	The proposed conservation area in Punnalai Khadu has been discussed in the previous table. It should be noted that under the CCZRMP (2016) the coastal area from Kankesanthurai and Keeramalai been declared a Special Management Area (SMA). Snorkelling and cultural tourism to Dambakolapatuna and Keerimalai can be promoted. Sport fishing (rod fishing) can also be promoted.
Proposed improvements	Home stays, guest houses, access road, safe bathing and snorkelling points all developed with the integration of environmental safeguard (Chapter 6).
Carrying capacity for tourism activities	A maximum of 1,000 per day

[22] This species is primarily a freshwater fish which occurs naturally in Pakistan, India and Bangladesh. Found naturally in Indus, Brahmaputra, Ganges, Jamuna and Patna rivers and introduced into the Cauvery River system. This is a migratory species which has not been recorded in other parts of Sri Lanka. According to Bruin et al. (1994), this species lives in coastal and marine environments, mainly adults are over mud banks and some over coral reefs, whiles juveniles are found in estuaries. There are two distinct spawning seasons; April to May and September to October, during which these fish are found in large aggregations. They are caught in castnets, beach seines and bottom setnets and sometimes fishermen use dynamite to catch them, but do not indicate locations.

Figure 84. Top: Dambakolapatuna Viharaya and bottom: Keerimalai tank, both found in the Northern Coastal Stretch of the Jaffna Peninsula
(© IUCN/Naalin Perera)

Eastern Coastal Stretch of the Jaffna Peninsula (Manatkadu to Chundikulam)

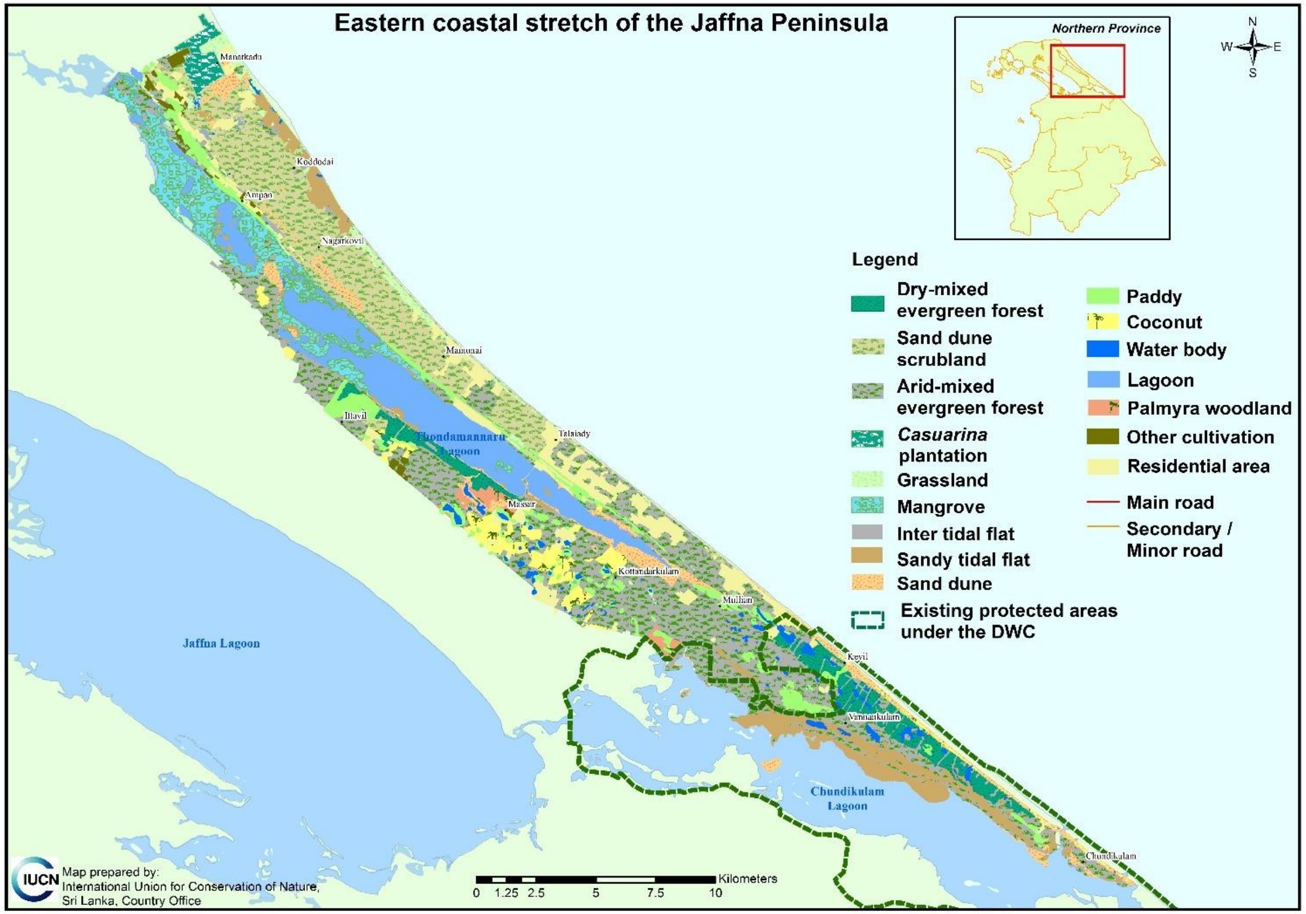

Figure 85. Map of the eastern coastal stretch of Manatkadu to Chundikulam, showing ecosystems, land use and existing protected areas

Location	This coastal stretch starts at 9º 48’ 57.17” N; 80º 15’ 19.76” E and ends at 9º 28' 47.89” N; 80º 35 30.01E. It lies within the Vadamaradchi East (Maruthnkerny) divisional secretariat division of the Jaffna District (Figure 85). The name Manatkadu means sand bush and is a reference to the vegetative growth on sand dunes found in this area. Manalkadu translates to sand-bush, referring to Sri Lanka’s longest chain of sand dunes that are partly overgrown by thicket.
Ecosystems	Ecosystems observed along this stretch included large patches of dry mixed evergreen forests mixed Palmyra, sand-dunes scrublands, sand dunes and sand dune forests, forest monoculture plantations (*Casuarina*), sandy shores and mangroves. The northern part of the area, known as Manatkadu, has extensive sand dunes — likely the longest stretch in Sri Lanka. Sand dunes narrow towards the south and finally turn into sandy beaches, with home gardens planted mostly with coconut. Within Thondaimanaru Lagoon are patches of mangroves. Found within this coastal stretch are two lagoons — Thondaimanaru and Chundikulam. Thondaimanaru Lagoon is located east of Jaffna Lagoon and separates Thenmaradchchi to the west of it from the Vadamaradchchi region to its east (Piratheepa et al., 2016). It is 74.5 km^2 in extent (Silva et al., 2013). It is a brackish water lagoon that extends south-east along the eastern side of the Peninsula for 45 km (Kotagama et al., 2009). It is also shallow — just two metres deep — and, during the dry season, much of the south-eastern section dries out (Kotagama et al., 2009). In 1953, in an attempt to provide fresh water to the Jaffna Peninsula, the Irrigation Department built a barrage close to the mouth of the lagoon. The intent was that by preventing the ebb and flow of the tides, a freshwater lake would be created (Piratheepa et al., 2016). On the edges of this lagoon are mangroves, salt marshes, tidal flats and submerged seagrass meadows (MFF, 2015b), as well as arid mixed evergreen forests, grasslands and beaches. There is a small area of urbanised land on the boundary of this lagoon. Because there is no opening to the sea (see below), this lagoon exists predominantly as a fresh water/ brackish water lake.
Special attributes	Chundikulam is now a national park.
Proposed actions	The park will be developed by the DWC, with bungalows and other infrastructure. Bird watching should be promoted in this park with hides and boat rides. For the rest of the area, home stays, beach walks, camping, recreational finishing, bird watching, boat rides can be promoted but with environmental safeguards proposed in Chapter 6.
Proposed improvements	Prime among the essential needs for this area is training for jeep drivers within the park, and integration of environmental safeguards discussed in Chapter 6.
Carrying capacity for tourism activities	This is a large stretch and could accommodate more than 500 people per day.

North-east Coast (Between Chundikulam to Kokkiliai Lagoon)

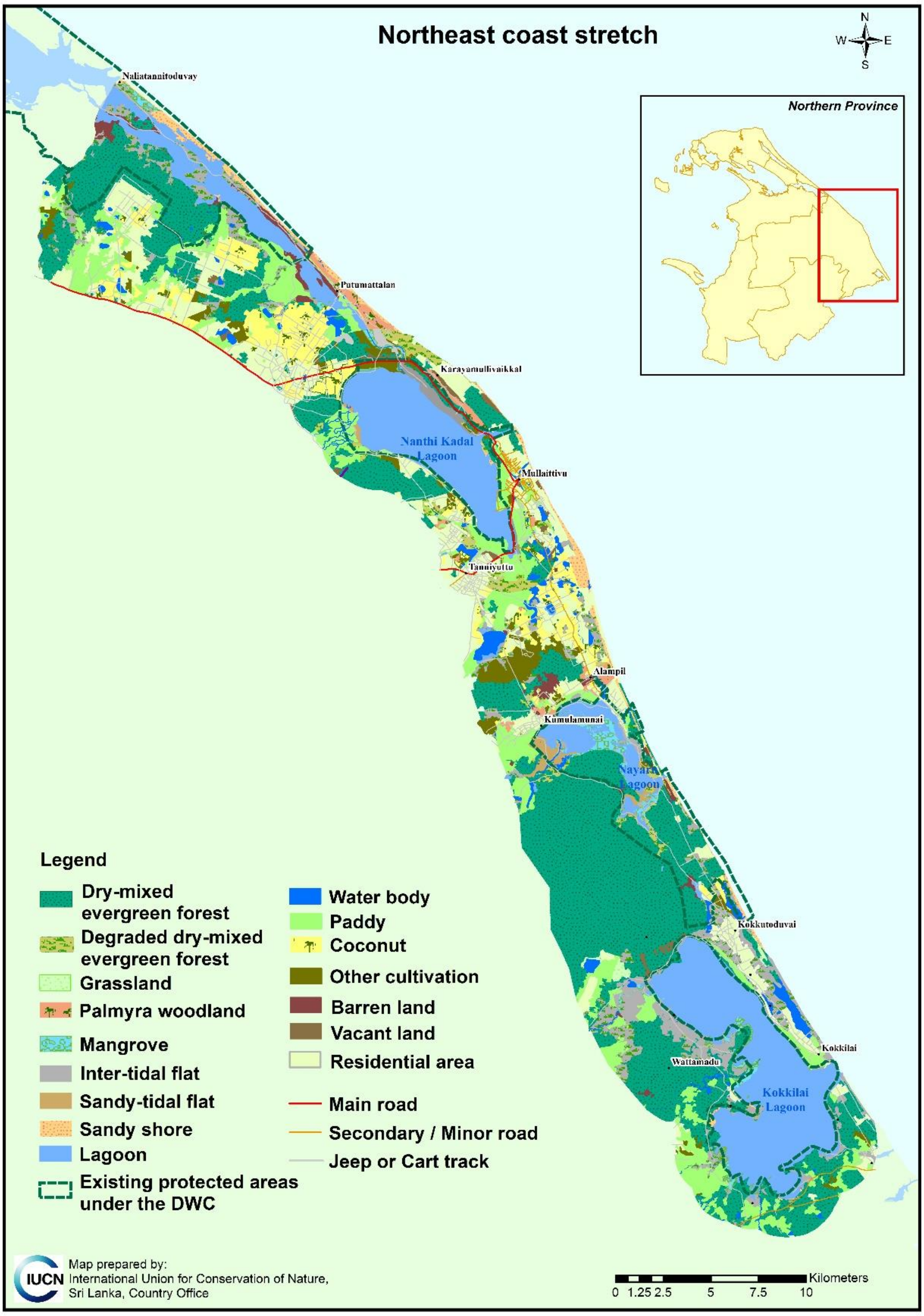

Figure 86. Map of the North-east coast (between Chundikulam to Kokkiliai Lagoon), showing ecosystems and land use

Location	This coastal stretch starts at 9º 28' 34.74" N; 80º 35 43.95E and ends at 8º 59' 16.40" N; 80º 35 43.95E. This 60 km coastal stretch is in the Maritimepattu divisional secretariat division of the Mullaitivu District (Figure 86).
Ecosystems	There are dry-mixed evergreen forests, sandy shores, gravelly shores, lagoons, mangroves, tidal flats, dry grasslands, coconut plantations, home gardens and towns in this coastal stretch. Nayaru, Nanthi Kadal and Kokkiliai are large lagoons found along this stretch. The stretch of dry-mixed evergreen forests between Mullaittivu and Kokkiliai is only one of its kind found along the north-east coast. Apart from the brackish water lagoons, found along this stretch, there are also are several freshwater wetland systems — such as, for example, Alampil Kulam. Many aquatic bids including ducks, cormorants, egrets, herons can be found in these wetlands.
Special attributes	The lagoons along this stretch are home to many plant and animal species, for example 330 plant, 28 fish, 24 butterfly, nine dragonfly, four amphibian, four reptile, 132 bird and 21 mammal species, respectively, have been recorded from Kokkiliai Lagoon. For more details, please refer to the next annex.
Proposed actions	Boat rides bird watching camping wildlife bungalows
Proposed improvements	Given that all these lagoons are now declared as protected areas under the DWC, it is expected that improvements will be made by the DWC commensurate with the level of protection afforded.
Carrying capacity for tourism activities	A hundred visitors per day

Annex 3. Profiles of Lagoons

Fisherman, Kokkilai Lagoon © IUCN/Kumudini Ekaratne

Introduction

Coastal lagoons are shallow water bodies separated from the ocean by a barrier, connected at least intermittently to the ocean by one or more restricted inlets and usually oriented parallel to the shoreline and often length exceeds the width (Kennish and Paerl, 2010 in litt. Miththapala 2013b). Because lagoons are relatively shallow (a few metres in depth) and sometimes have limited water flow (Kjerfve, 1994, in litt Miththapala, 2013b), they are highly susceptible to changes in precipitation, evaporation and wind which results in rapid changes in salinity and temperature (Kennish and Paerl, 2010). Discharges from rivers and tidal inflow from the sea are essential for these ecosystems and they are, therefore, vulnerable to changes in these flows (Samarakoon and Samarawickrama, 2012).

Most of the lagoons of Sri Lanka originated in the mid-Holocene period, about 10,000 years BP (Silva et al., 2013; NSAP, 2009). During this period, the sea level rose, forming barrier and developing spits, eventually, enclosing a body of water between the land and sea. Depending on the coastal stretch, littoral drift, river inputs and sediments transported with these inputs and the tides maintained the developed barrier (Silva et al., 2013).

'Lagoons and estuaries, lying at the boundary between the ocean and land, house a unique mosaic of ecosystems from sea to land. Apart from lagoons and estuaries, there may be barrier islands, spits, beaches, sand dunes, salt marshes, seagrasses within lagoons and estuaries, as well as mangroves fringing their shores (de Wit, 2011). This high ecosystem diversity within the immediate landscape of lagoons and estuaries, gives rise not only to high species diversity but also to the creation of ecotones — areas of transition between two habitats.' (Miththapala, 2013b). Therefore, lagoons — through the diverse ecosystems they house — support a high level of biodiversity (de Wit, 2011; Kennish and Paerl, 2010 in litt Miththapala, 2013b).

Lagoons are extremely important in the sustenance of coastal fisheries. Many edible shell fish and fish are found in lagoons, estuaries and their associated habitats such as mangroves and seagrasses. The relatively calm habitats of lagoons allow for the practice of traditional and artisanal fisheries (Bjork et al., 2008 in litt Miththapala 2013b). They also provide a suite of other ecosystem services, such as nutrient cycling, flood protection and carbon sequestration.

'Lagoons and estuaries are water-dominated ecosystems formed at the interface between the land and the sea. Hence, the attributes of water determine the life or death of estuaries and lagoons . . . '(Samarakoon and Samarawickrama, 2012). Lagoons are threatened by many anthropogenic activities both inland and on the coast (Kennish and Paerl, 2010 in litt Miththapala 2013b).

Hydrological changes to lagoons — changes in the natural inflow from rivers and ebb and flow of the tides — have profound impacts on the salinity regimen of lagoons (Kennish, 2002 in litt. 2013b) as does changes in water quality (pollution) (Kennish and Paerl, 2010 in litt Miththapala 2013b). Gnaneswaran (2015) details the concerns for the lagoons of the Northern Peninsula, and hydrological alterations appear to be rampant.

This study focussed only on four lagoons in the Northern Province — Chundikulam, Nanthi Kadal, Nayaru and Kokkilai — and this annex provides brief profiles of these lagoons. Information for Vidattaltivu is also provided from other IUCN data.

However, it should be noted that a detailed study about their ecosystems and species diversity (capturing seasonal variation) including the terrestrial systems that surround these lagoons, as well as the marine environment adjacent to these lagoons is necessary to fully understand their biodiversity, current status and drivers of ecosystem change, in order to develop strategies to conserve them.

It is strongly recommended that

Table 16. Names of the five lagoons detailed in this report their extents.

Name of Lagoon	Area (ha)
Vidattaltivu	386
Chundikulam	5,398
Nanthi Kadal	3,339
Nayaru	1,150
Kokkilai	5,474

Figure 87. Map of the Lagoons of the Northern Coastline

Although Jaffna and Thondaimanaru lagoons were not studied under this assessment, their importance is discussed using secondary data/information. Given the thrust of development in the north and the rapid destruction of mangroves, construction of causeways, roads and culverts across parts of these lagoon (Gnaneswran, 2015), detailed studies, not only of the ecosystems and species of these lagoons, but also of the salinity levels is critically important, as ongoing development changes will, indubitably, have profound impacts on these lagoon systems.

Table 17. Ecological and livelihoods value of two major lagoons in the Jaffna Peninsula

Location and Lagoon Characteristics	Ecosystems and Species	Ecological Value	Fisheries Value
Jaffna Lagoon			
Jaffna Lagoon, the largest lagoon in Sri Lanka, is a shallow (< 4 m in depth) with a water body extending over 441 km^2 (Silva et al., 2013). It straddles the Jaffna and Kilinochchi Districts [surrounded by Thenmaradchi (Chavakachcheri) of Jaffna, and Pachchilaipalli and Kandavalai DSDs]. This lagoon has multiple entrances: in the north-west, it opens between Karaitivu and Punnalai to Palk Bay; in the north, to Uppu Aru Lagoon; in the west between Kayts and Karaitivu, in the south-west between Mandaitivu and Kalmunai and in the south-east it connects with Chundikulam Lagoon (Chitravadivelu,1994; Silva et al., 2013). Draining into this large water body are Kalawalappu Aru and Akkarayan Aru (Silva et al., 2013). The amount of freshwater reaching the lagoon is not sufficient for proper mixing of the saline water brought in by the tides, so	The lagoon boundary comprises many human use-dominated areas, such as highly urbanised areas, paddy fields, coconut plantations, Palmyra plantations and shrimp cultivation. However, there are also extensive tidal flats. At low tide it is reported that 2,000 ha of tidal flats are exposed (Kotagama et al. 2009). The lagoon also has salt marshes, seagrass meadows, mangroves, some arid mixed evergreen forests, and grasslands (CEA and IUCN, 2006; MFF, 2015a). One hundred species of fin fish, 28 species of molluscs, six species of crabs and seven species of shrimps were identified in the catches from the Lagoon (MFF, 2015a). Seventy-seven species of birds (Wijesena, 2015), 13 species of amphibians (Balasubramaniam,	Jaffna Lagoon has been identified as an IBA based on the criteria that it is a) known or thought regularly to hold significant numbers of a globally threatened species; and b) known or thought to hold congregations of ≥1% of the global population of one or more species on a predictable basis (Birdlife International, 2017). Large populations of Spot-billed pelicans (*Pelecanus philippensis)* congregate here. As many as 5,000 greater flamingos (*Phoenicopterus roseus*) have been recorded here, as well as large populations of black-tailed godwits (*Limosa limosa*); little stints (*Calidris minuta*); curlew sandpipers (*C. ferruginea*); Eurasian wigeon (*Anas penelope*); northern pintails (*Anas acuta*) and garganeys (*Spatula querquedula*) (Kotagama et al., 2009). Jaffna Lagoon is also very significant for fisheries. Total annual fish landings in Jaffna Lagoon, are the highest for the island (5,754,990 kg) and second, for shrimp catches (2,629,400 kg) (Silva et al., 2013). It should be noted that under the CCZRMP (2016) the lagoon is near the town has been declared a Special Management Area (SMA)	Jaffna Lagoon is also very significant for fisheries. Total annual fish landings in Jaffna Lagoon, are the highest for the island (5,754,990 kg) and second, for shrimp catches (2,629,400 kg) (Silva et al., 2013).

Location and Lagoon Characteristics	Ecosystems and Species	Ecological Value	Fisheries Value
seasonally, this lagoon becomes hypersaline.	et. al., 2003) and 18 species of snakes (Abhirami and Shivashanthini, 2008) and three species of crabs *Neptunus pellagicius*, *Charydbis annulata* and *Scylla serrata* have been also been recorded (Chitravadivelu, 1994).		
Thondaimanaru Lagoon			
Thondaimanaru Lagoon is located east of Jaffna Lagoon and separates Thenmaradchchi to the west of it from the Vadamaradchchi region to its east (Piratheepa et al., 2016). It is 74.5 km^2 in extent (Silva et al., 2013). It is a brackish water lagoon that extends south-east along the eastern side of the peninsula for 45 km (Kotagama et al., 2009). It is also shallow — just two metres deep — and, during the dry season, much of the south-eastern section dries out (Kotagama et al., 2009).	On the edges of this lagoon are mangroves, salt marshes, tidal flats and submerged seagrass meadows (MFF, 2015b), as well as arid mixed evergreen forests, grasslands and beaches. There is a small area of urbanised land on the boundary of this lagoon. Because there is no opening to the sea (see below), this lagoon exists predominantly as a fresh water/ brackish water lake.	In 1953, in an attempt to provide fresh water to the Jaffna Peninsula, the Irrigation Department built a barrage close to the mouth of the lagoon. The intent was that by preventing the ebb and flow of the tides, a freshwater lake would be created (Piratheepa et al., 2016). Before the barrage was constructed, the annual fish catch was 152,407 kg; after the barrage was built, the fish catch dropped to 35,561 kg per annum (Piratheepa et al., 2016). A decade after the establishment of the barrage, there were 47 species of fish in the lagoon, but by the late 1970s, there were only 15 species (Atputhanathan & Chitravadivelu, 1968, in litt. Piratheepa et al., 2016). Currently, there are only 11 (Piratheepa et al., 2016). Thirty-eight species of molluscs were also found (MFF, 2015b). This lagoon is home to 13 species of migratory birds, including four species of sand piper, two species of plover and two species of ducks (MFF, 2015b). Under the CCZRMP (2016) the Manatkadu dunes in the area have been declared as Special Management Area.	The productivity of this lagoon (fish production per km2) is the lowest in the island (429 kg/km2) (Silva et al., 2013). This lagoon is a good example of what the consequences are of meddling with the natural hydrology of lagoons.

Chundikulam Lagoon

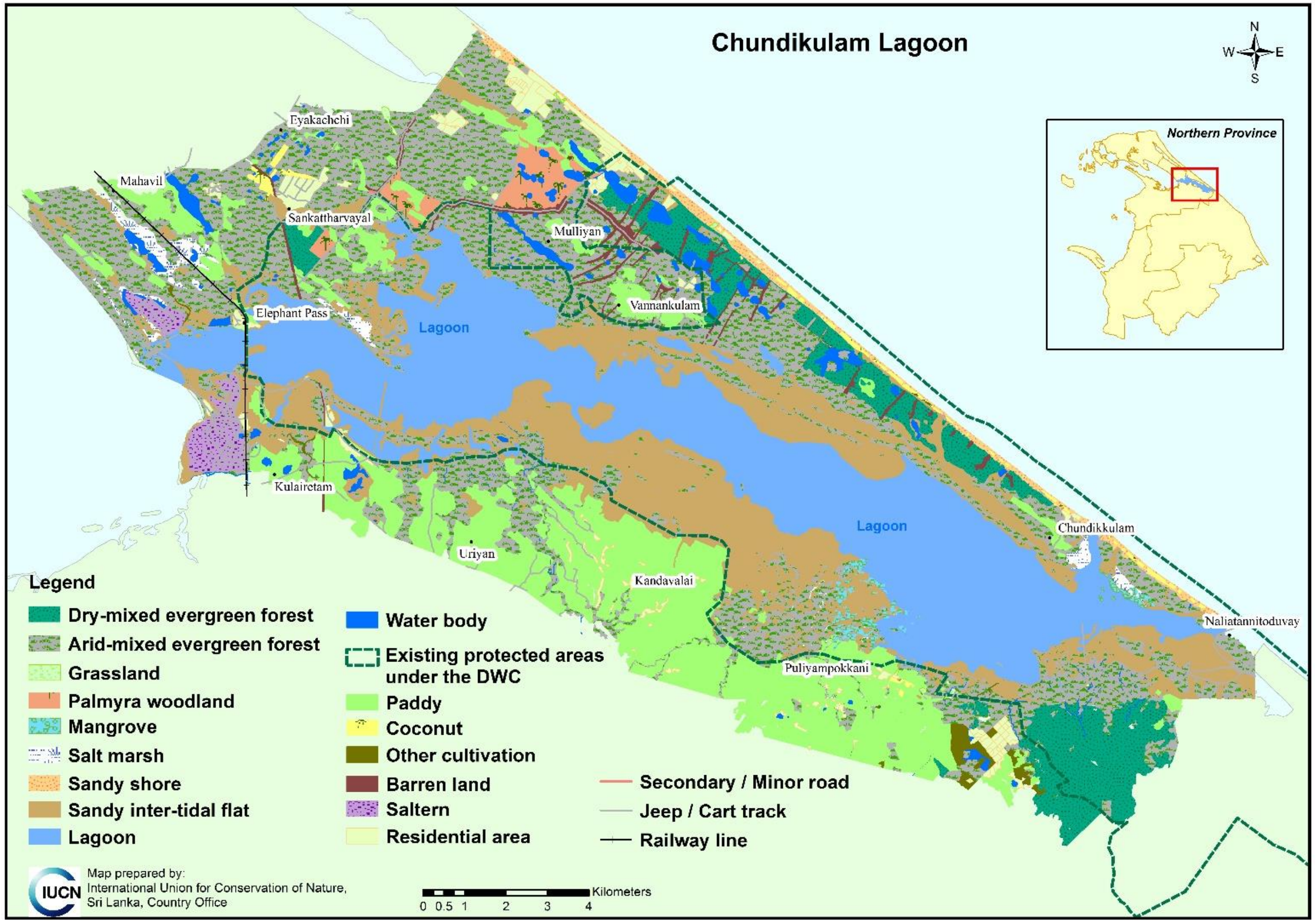

Figure 88. Map of Chundikulam Lagoon its surrounds, showing ecosystems, land use and existing protected areas

Data are augmented by information from Ekanayake and Fernando, 2015.

Location	Chundikulam Lagoon lies south-east of Jaffna Lagoon and straddles the districts of Jaffna and Kilinochchi (divisional secretariat divisions of Vadamaradchi East (Maruthnkerny) in Jaffna, and Pachchilaipalli and Kandavalai DSD of Kilinochchi), extending over 72.28 km^2 (Silva et al., 2013) (Figure 88). The brackish water lagoon is fed by number of small rivers from the south including Kanakarayan aru, Nethli aru and Theravil aru.
Ecosystems	Around Chundikulam Lagoon are wide sandy tidal flat, arid mixed evergreen forests, patches of dry-mixed evergreen forest and Palmyra woodlands. On the eastern coastal shore are sand dunes, sandy shores and sand dune forests[23]. Sand dune forests comprised *Syzygium cumini*, *Flueggea leucopyrus*, *Cissus quadrangularis*, *Croton bonplandianus* and *Ecbolium ligustrinum*. At the mouth of the lagoon are salt marshes. A total of 68 species of plants were observed in the Chundikulam area. Fringing the lagoon are mangroves and within are seagrass meadows (Kotagama et al., 2009). Also found in the western side are salterns. Sixty-three species of land and water birds were observed in one day in Chundikulam National Park. These birds included 30 winter visitors such as Eurasian wigeons (*Anas penelope*), Northern shovelers (*A. clypeata*), Northern pintails (*A. acuta*); garganey (*A. querquedula*), black-tailed godwits (*Limosa limosa*) Pacific golden plovers (*Pluvialis fulva*), common ringed plovers (*Charadrius hiaticula*), Kentish plovers (*C. alexandrines*), and lesser sand plovers (*C. mongolus*), as well as range restricted breeding residents such Saunder's tern (*Sterna saundersi*) and grey francolin (*Francolinus pondicerianus*) (Wijesena, 2015). It is also reported that leopards, sloth bear and spotted deer as well as both species of crocodiles (*Crocodylus palustris* and *C. porosus*) are found in this park (Abhayagunawardena, 2015; Santiapillai and Wijeyamohan, 2004).
Special attributes	The Elephant Pass causeway blocked the free-flow of water from Jaffna Lagoon, and this lagoon is therefore less saline than Jaffna Lagoon (Silva yet al., 2013) and large areas are reported to dry out during the dry season (Kotagama et al. 2009). Chundikulam was declared as a bird sanctuary in 1938. In 2015, its conservation status was elevated to a National Park (Figure 88). A healthy population of *Sesamum prostratum,* listed as a Critically Endangered species, a crop wild relative of gingelly (*Sesamum indicum* was observed across the sandy area between beach and sand dunes. This was the first discovery of the species outside the Panama area. In addition, several species of plants listed as nationally Endangered — such as *Salacia*

[23] These details are not seen in the current map because of the scale.

	oblonga, Ebony (Diospyros ebenum), Crotalaria prostrata and Beach pea (*Vigna marina*) were also observed. Several species of endemic plants such as *Vernonia zeylanica*, *Derris parviflora* and *Memecylon capitellatum* were also recorded on the sand dune. Palmyra was the dominant plant observed in many areas (Ekanayake and Fernando, 2015). Its range of wetland habitats are home to a variety of water birds (which is why it was originally declared a bird sanctuary), including migrants such as the Eurasian wigeon (*Anas Penelope*), Northern shoveller (*A. clypeata*), Northern pintail (*Anas acuta*), Garganey (*A. querquedula*), Common teal (*Anas crecca*), Pacific golden plover (*Pluvialis fulva*), Common ringed, Kentish, Lesser sand and Caspian plovers (*Charadrius hiaticula; C. alexandrines*; *C. mongolus*, and *C. asiaticus*, respectively), Bar-tailed and Black-tailed godwits (*Limosa lapponica* and *Limosa limosa*), Whimbrel (*Numenius phaeopus*), Eurasian curlew (*Numenius arquata*), Common redshank (*Tringa tetanus*) and Common greenshank (*Tringa nebularia*). Leopards, sloth bears as well as both mugger and saltwater crocodiles have been seen within the park. The shrimp catch in Chundukkulam Lagoon 600,000 kg per annum (Silva, et al., 2013).
Proposed actions	The DWC will develop the area as a national park with appropriate infrastructure.
Proposed improvements	Prime among the essential needs for this area is training for jeep drivers within the park, and integration of environmental safeguards discussed in Chapter 6.
Carrying capacity for tourism activities	The DWC will have to decide this but it is strongly recommended that the number of boats is regulated strictly to prevent overcrowding.

Kokkilai Lagoon

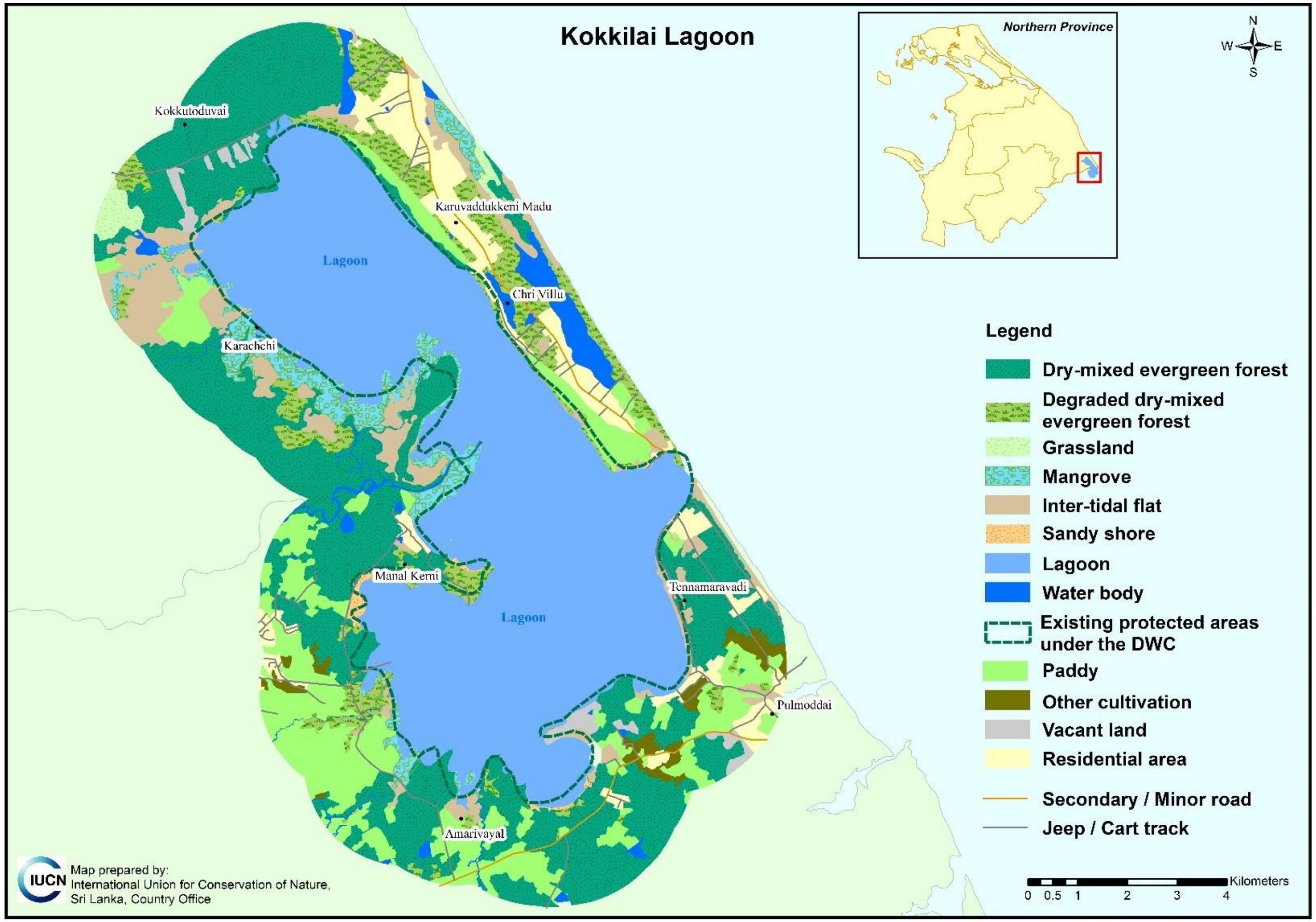

Figure 89. Map of Kokkilai Lagoon its surrounds, showing ecosystems and land use

The data for this lagoon are augmented by IUCN/MFF, 2018.

Location	Kokkilai, a large estuarine lagoon, has an extent of 29.95 km^2 (Silva et al., 2013) and is located in the Mullaittivu (Maritimepattu DSD) and Trincomalee (Kuchchaveli DSD) districts in the north-eastern Sri Lanka (Figure 89). This is a very shallow lagoon (1-2 m in depth) which receives a number of inflows from rivers such as Ma Oya, Mee Oya, Churiyan Aru and Chavar Aru. It is linked to the sea by a narrow channel that is often blocked by a sand bar. When this bar is not breached in some years, it is detrimental to shrimp fishery, as recruitment of adults from the marine waters is essential for its maintenance.
Ecosystems	One shore of this lagoon has human-dominated land use — such as paddy fields, other cultivation and densely populated human settlement. The land is used for shrimp fishing, paddy cultivation and some shifting cultivation. However, there are also dry-mixed evergreen forests, degraded dry mixed arid-mixed evergreen forests, mangroves, salt marshes and other marshes, extensive seagrass meadows within the lagoon, as well as inter-tidal flats, particularly along the western and southern shores. A total of 329 plants species belonging to 87 plant families were recorded in from the ecosystems around the lagoon. Of these, 11 plants are endemic, and 25 species are Threatened (Critically Endangered: 1, Endangered: 7 and Vulnerable: 17). A total of 283 vertebrate faunal species and 58 of invertebrates (Odonates and Lepidopterans) were recorded. Of these, 18 are endemic and 10 species are Threatened (Critically Endangered: 1; Endangered: 3 and Vulnerable: 6).
Special attributes	Declared as a wildlife sanctuary in 1952, for its birdlife and as a nature reserve in 2015, the lagoon is known to be an important feeding ground for migratory water birds, including the Lesser Sand Plover (*Charadrius mongolus*), Kentish Plover (*Charadrius alexandrinus*), Marsh Sandpiper (*Tringa stagnatilis*), Common Redshank (*Tringa tetanus*), Spotted Redshank (*Tringa erythropus*) and Little Stint (*Calidris minuta*) were common migrant waders observed in the lagoon area. Also observed were uncommon waders such Temminck's Stint (*Calidris temminckii*), Curlew Sandpiper (*Calidris ferruginea*) and Terek Sandpiper (*Xenus cinereus*). Five endemic bird species, Sri Lanka Junglefowl (*Gallus lafayetii*), Sri Lanka Grey Hornbill (*Ocyceros gingalensis*), Sri Lanka Green Pigeon (*Treron pompadora*), Sri Lanka Woodshrike (*Tephrodornis pondicerianus*) and Sri Lanka Brown-capped Babbler (*Pellorneum fuscocapillum*) were observed in the surrounds of the lagoon. In addition, seven Nationally Threatened species: Great Crested Tern (*Sterna bergii*), Oriental Honey-buzzard (*Pernis ptilorhynchus*), Black-wing Kite (*Elanus caeruleus*), Grey-headed Fish-eagle (*Ichthyophaga ichthyaetus*), Great Cormorant (*Phalacrocorax carbo*), Black-crowned Night Heron (*Nycticorax nycticorax*) and Woolly-necked Stork (*Ciconia episcopus*) are also present. The Grey slender loris (*Loris lydekkerianus*), a Nationally Threatened primate was observed residing in short trees and bushes by the lagoon.

	Among the reptiles were the endemic Black-spotted kangaroo lizard (*Otocryptis nigristigma*), and the Sand Lizard (*Sitana devakai*). Among the recorded fish species, Striped dwarf catfish (*Mystus nanus*), Walking catfish (*Clarias brachysoma*) and Giant seabass (*Lates lakdiva*) are endemic to Sri Lanka. Krishanthan et al., (2015) observed 55 fish species dominated by the families Cichlidae — such as the Banded etroplus (*Etroplus suratensis*) and Nile Tilapia (*Oreochromis niloticus*) and Tilapia (*Oreochromis mossambicus*) — Clupeidae — such as White sardinella (Sardinella albella) and Kelee shad (*Hilsa kelee*) — Leiognathidae — such as Common pony fish (*Leiognathus equalus*) and Short nose ponyfish (*Leiognathus brevirostris*). The lagoon in well-known for its mud crab (*Scylla serrata*) fishery carried out through the year (Krishanthan et al., 2015). The Blue swimming crab (Portunus *pelagicus*) is plentiful between July- October near the lagoon mouth and the Giant tiger prawn (*Penaeus monodon*) and other *Penaeus* sp. Are also seasonally abundant year (Krishanthan et al., 2015). Two exotic species: Nile Tilapia (*Oreochromis niloticus*) and Tilapia (*Oreochromis mossambicus*) were also recorded. *It was reported that straight after the war some 1,000 acres of forest and mangroves were cleared on the western side of the lagoon.*
Proposed actions	The Lagoon and its surrounds were declared as a nature reserve in 2015. The DWC will have set up necessary infrastructure, regulations and limitations.
Proposed improvements	Bird and wildlife watching, camping, boat tours and nature trails are some of the possible nature-tourism related activities for the area. Tourism related infrastructure must be developed by the DWC (for example. camp sites, nature trails and forest lodges), supported by and community members (for example guest houses, home stay and boat rides). However, these should be established integrating environmental safeguards (See Chapter 6.) Clear demarcation of the nature reserve boundary, according to gazetted boundaries is also urgently needed, with accompanying creation of awareness of what is permitted and what is not within a nature reserve.
Carrying capacity for tourism activities	No more than 75 -100 visitors per day.

Nanthi Kadal Lagoon

The data obtained for Nathhi Kadal lagoon were insufficient to provide meaningful recommendations. However, it should be noted that under the CCZRMP (2016) this lagoon has been declared a Special Management Area (SMA)

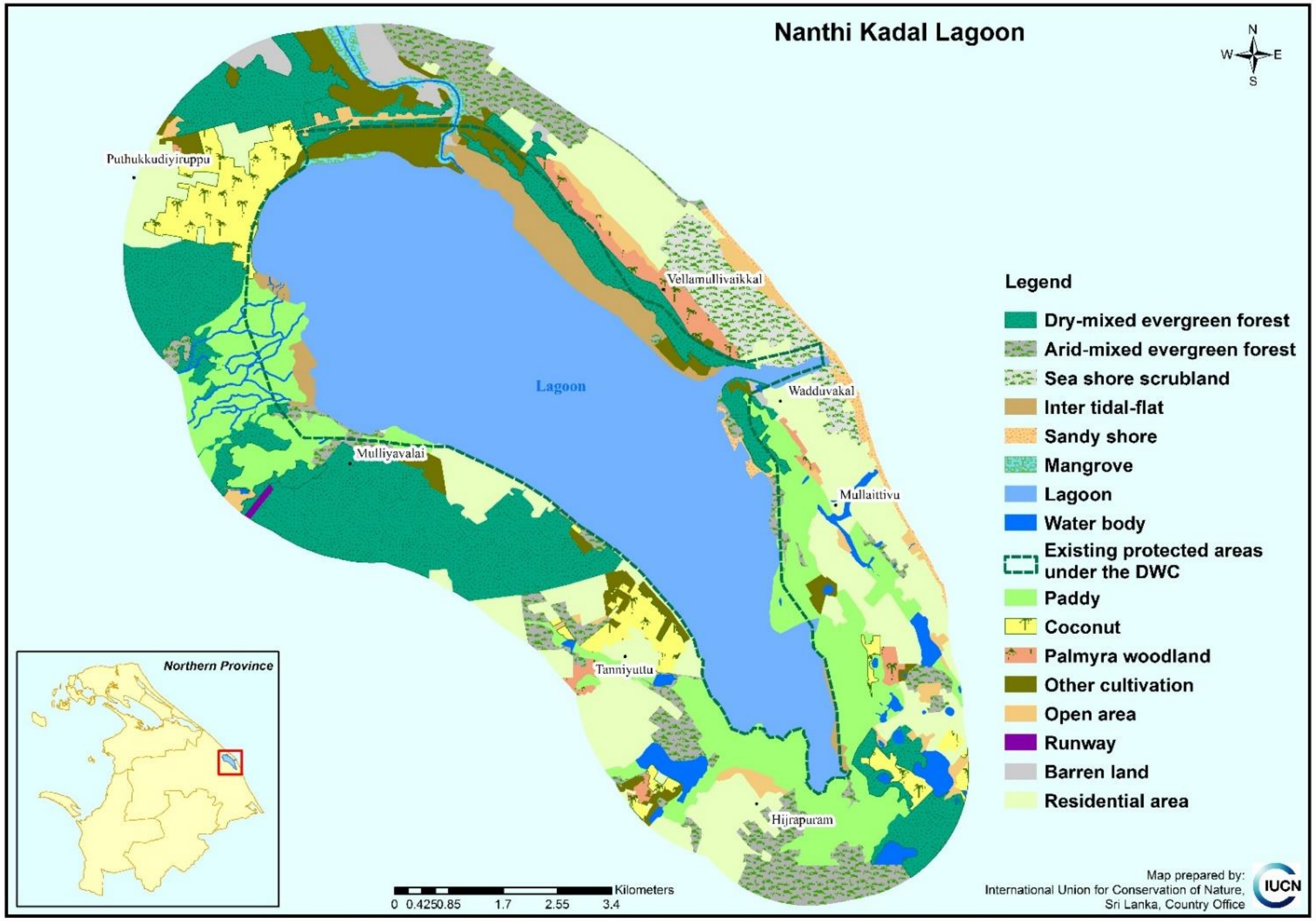

Figure 90. Map of Nanthi Kadal Lagoon its surrounds, showing ecosystems and land use

Nayaru Lagoon

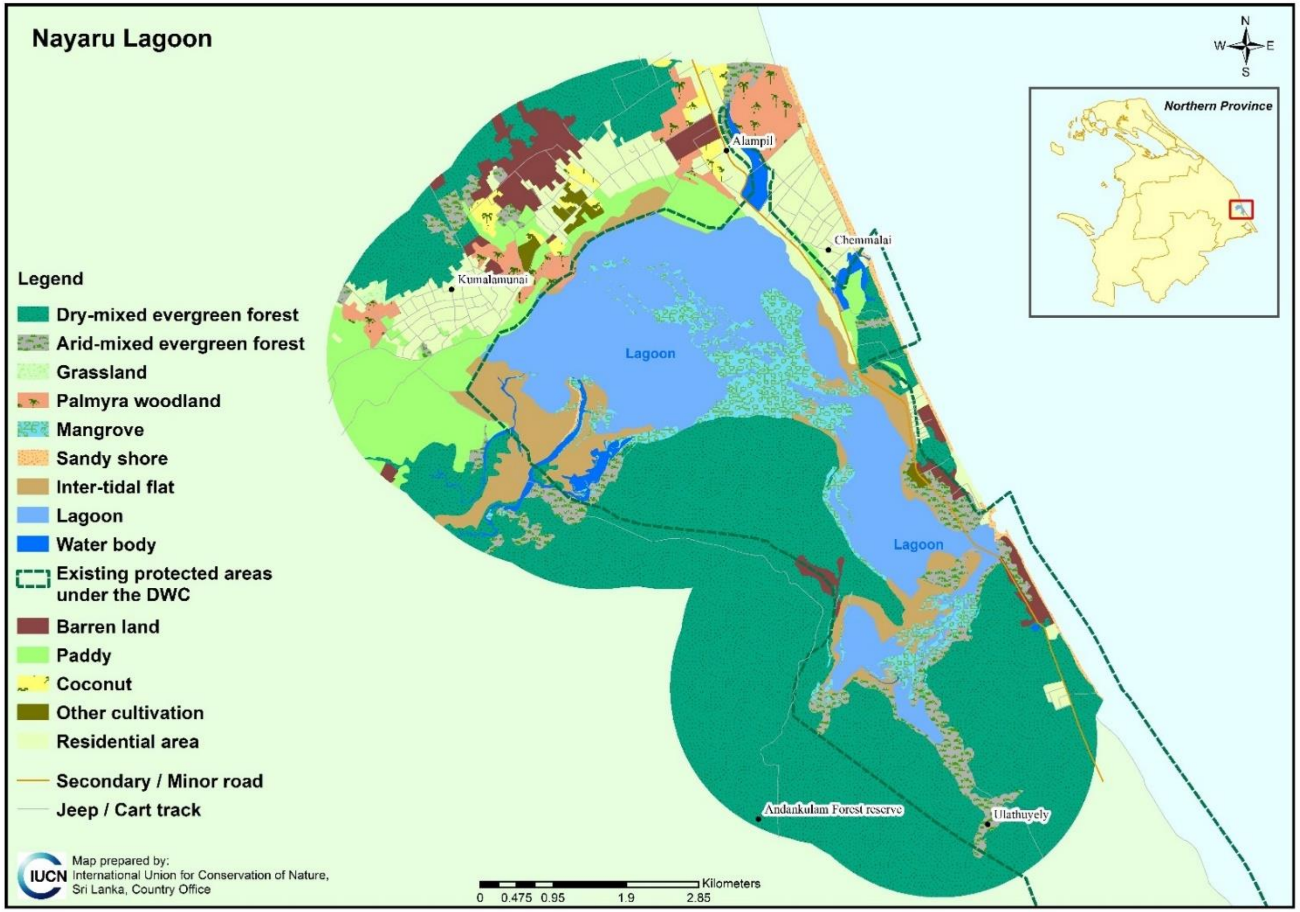

Figure 91. Map of Nayaru Lagoon its surrounds, showing ecosystems and other land use

The data for this lagoon are extracted from Ellepola and Ranawana (2016), Ranawana person. comm., Silva et al., 2013, Un-Habitat, undated.

Location	The Nayaru Lagoon is found in the Mullaitivu District and is approximately 17.60 km^2 in extent and is fed by Nay Aru and Palidai Aru. The lagoon is open to the sea on the east (Figure 91). The Mullativu-Kokilai road runs parallel to the eastern border of the lagoon.
Ecosystems	The southern and eastern shores have good mangrove cover.
Special attributes	*Avicennia marina, Exoecaria agallocha, Lumnitzera racemosa, Rhizophora mucronata, Aegiceras corniculatum, Avicennia officinalis and Heritiera littoralis* were found in the lagoon surrounds. The lagoon is important for fisheries. The mud crab (*Scylaa serrata*) and the Indian prawn (*Fenneropenaeus indicus*) are popular shellfish harvested from the lagoon. Fifty two percent of the lagoon harvest comprises flathead grey mullet (*Mugil cephalus*) and other species harvested are Milkfish (*Chanos chanos*), Barramundi (*Lates calcarifer*), bronze catfish (*Arius bilineatus*) and fourfinger threadfin (*Eleuthronema tetradactylum*). The estimated annual yield is 9.237 kg ha-1 year-1, which is lower than other similar coastal lagoons.
Proposed actions	After the civil war, there have been unplanned development activities that have destroyed mangroves around the mouth of the lagoon and constructed a narrow bridge over the lagoon month, changing the hydrology of the lagoon. This has led to the hydrological changes in the lagoon which may lead to the collapse of the lagoon fishery and decline of the mangrove vegetation cover around the lagoon Under the CCZRMP (2016) this lagoon has been declared a Special Management Area (SMA). The Mullaitivu Disaster Risk Reduction and Preparedness Plan (UN-Habitat undated) plans the application of an urban beautification approach, promoting nature parks and the DWC, the FD and CCCRM&D will jointly prepare an East Coast Master Plan to preserve for conservation purposes the chain of lagoons and bird sanctuaries south of Mullaitivu, and this will include Nayaru.
Proposed improvements	Camping, bird watching, establishment of nature trail, boat riding, establishment of a mangrove information centre.
Carrying capacity for tourism activities	Carrying capacity 50-100 per day.

Vidattaltivu Lagoon

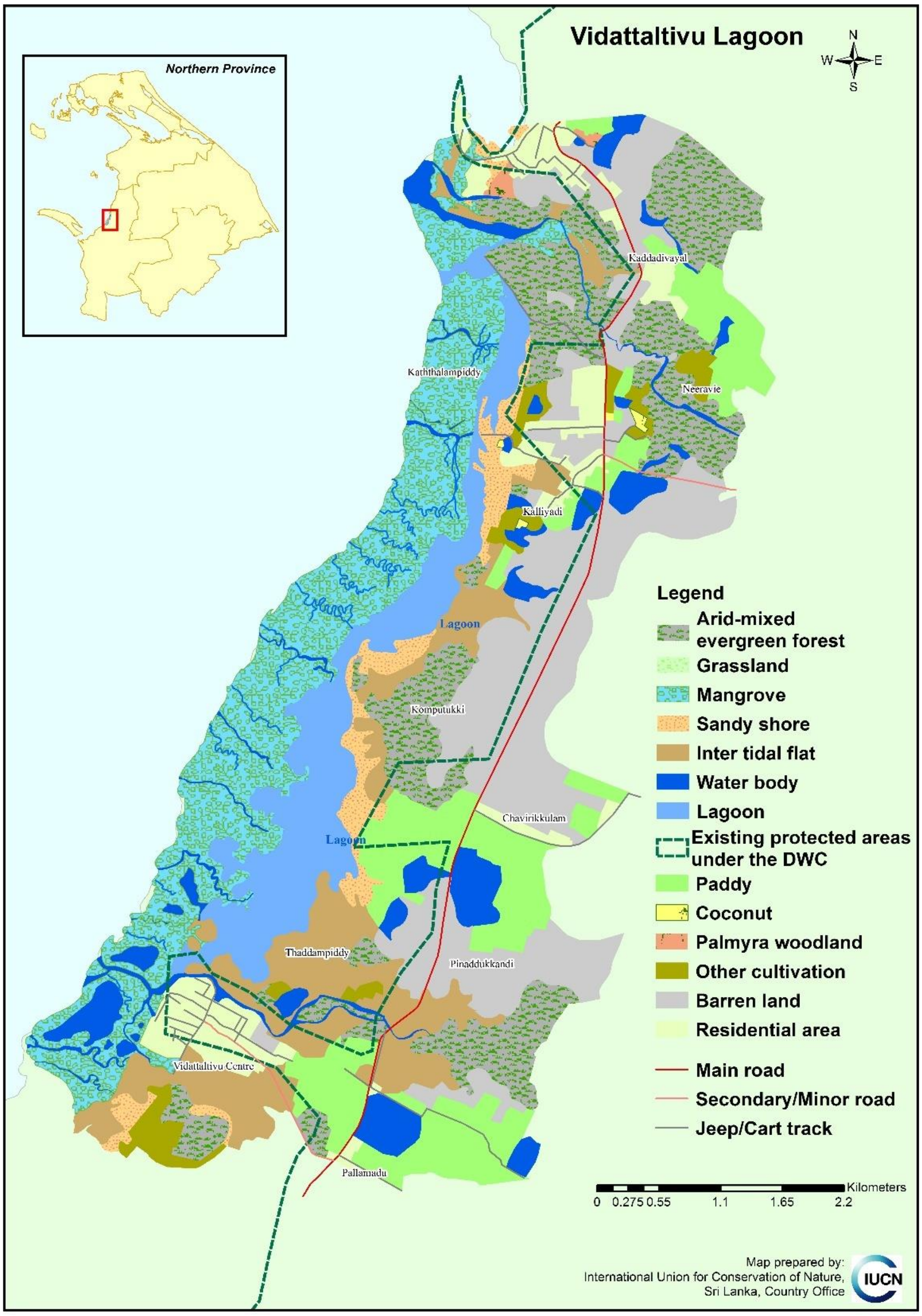

Figure 92. Map of Vidattaltivu Lagoon and its surrounds, showing ecosystems, land use and existing protected area.

(Note that the Vidattaltivu Nature Reserve extends beyond the limits of this map)

Location	The shallow, brackish water lagoon extends over 16 km^2 ha (Silva et al., 2013) and is located in the Mantai West divisional secretariat division of the Mannar District (Figure 92).
Ecosystems	Dense and luxuriant mangroves are found along the one edge of this lagoon and there are also arid mixed evergreen forests, paddy fields and water bodies. The extent of human settlement is low and only a few roads pass close to the lagoon edge. As can be seen in the map above, several freshwater streams join with the lagoon at various places.
Special attributes	In 2016, it was declared a Natural Reserve under the jurisdiction of the Department of Wildlife Conservation. A rare species of mangrove — small-leaved mangrove (*Pemphis acidula*) has been recorded in this area (Katupotha, 2016). One hundred and twenty-eight faunal species have been recorded from the area, of which 106 are bird species, but there is very little information about other species (IUCN, 2011b). This lagoon is a haven for migrating water birds. In its 2010 water bird census, the Ceylon Bird Club noted 1,100,000 to 1,200,000 birds in this lagoon (Sirivardana and Hettige, 2010). These identified birds included the Curlew sandpiper (*Calidris ferruginea*), Little stint (*Calidris minuta*), Lesser sand plover (*Charadrius mongolus*), Common redshank (*Tringa tetanus*), Marsh sandpiper (*Tringa stagnatilis*) and Grey plover (*Pluvialis squatarola*), all winter visitors.
Proposed actions	The lagoon and its surrounds are now under the jurisdiction of the DWC. However, the lagoon in under threat of being taken over for aquaculture activities.
Proposed improvements	Currently, the Lagoon and its surrounds are still being protected by the SL navy. The DWC needs to set up necessary infrastructure, ensuring the integration of environment safeguards as well as capacity building for tour guides and boat drivers, for example.
Carrying capacity for tourism activities	This will be set by the DWC.

Annex 4. List of Flora Found in the Study Area

Family	Scientific Name	Sinhala Name	Tamil Name	English Name	Habit	Species Status	Conservation Status	Island Names																																		
								Iranaitivu North	Iranaitivu South	Kalliaditivu	Kayts	Mandaitivu	Erumaitivu	Eluvaitivu	Parititivu	Analaitivu	Nainativu	Puliyantivu-Jaffna	Puliyantivu-Mannar	Kachchativu	Kurikadduwan	Pungudutivu	Delft/ Neduntivu	Karaitivu	Palaitivu	Kakkativu	Kakerativu	Adam's Bridge Islands	Point Pedro	Kavutharimunai	Dambakola Patuna	Akkarai Beach	Valvettithurai Beach	Manatkadu Beach	Thiliyadi Muruthankarni	Nayaru Beach	Pudumathalan	Chundikulam	Nanthi Kadal	Nayaru Lagoon	Kokkilai Lagoon	Total
Acanthaceae	*Acanthus ilicifolius*	Ililiya, Katu Ikiliya, Katu ikili / Ikiri	Attumulli/ Kaludaimulli/ Kolimulli	Sea holly/ Holly leaved Acanthus	Climber	N	LC																																1			1
	Andrographis alata				Climber	N	LC																								1							1				2
	Asystasia gangetica				Climber	N	LC	1							1					1		1	1			1				1	1											8
	Avicennia marina	Manda, Manda Gas, Ul Manda, Mada gas		Grey mangrove	Shrub	N	LC		1	1	1	1	1						1		1	1		1		1					1							1		1	1	14
	Barleria mysorensis	Katu Nelu	Ikkiri / Kikkiri		Herb	N	LC									1		1													1											3
	Barleria prionitis	Katu Karandu, Katu karanda	Shemmulli	Yellow hedge barleria, Common yellow nail dye	Herb	N	LC													1											1											2
	Dipteracanthus prostratus	Nil puruk	Pottakanchi		Herb	N	LC																1								1											2
	Ecbolium ligustrinum	Kawu thumba		Green Shrimp plant	Shrub	N	LC																								1							1				2
	Hygrophila schulli	Katu ikiriya, Neeramulliya, Ekiriya	Nirmulli	Marsh barble, Long leaved barleria	Herb	N	LC																								1								1	1		3
	Justicia procumbens	Mayani, Maha nai	Nerei-poottie		Herb	N	LC				1					1								1							1	1										5
Aizoaceae	*Sesuvium portulacastrum*	Maha sarana		Seaside purslane, Shore purselane	Herb	N	NT	1	1		1		1		1					1		1			1	1		1		1	1		1					1				14
Amaranthaceae	*Achyranthes aspera*	Karal haba, Gas-karalheba, Wel-Karal-sebo, Karalsebo, Wal Karal Heba	Nayururi	Pickly chaff flower	Herb	N	LC																1	1																		2
	Aerva lanata	Polkudu pala, Polpala	Cerupulai	Aerva	Herb	N	LC	1							1				1	1		1	1	1		1			1													9
	Atriplex repens				Herb	N	NT																		1													1				2
	Halosarcia indica				Herb	N	NT		1																													1				2
	Pupalia lappacea	Wel karal heba, Wal karal heba			Herb	N	LC	1												1			1		1																	4
	Salicornia brachiata				Herb	N	NT	1	1	1	1	1							1		1	1		1	1	1					1											12
	Suaeda maritima	Umiri			Herb	N	NT	1	1	1		1					1		1		1				1	1												1				10
	Suaeda monoica	Umiri			Shrub	N	NT	1	1										1																			1		1		5
Amaryllidaceae	*Crinum zeylanicum*				Herb	N	VU	1				1			1				1	1			1	1	1		1				1											10

Family	Scientific Name	Sinhala Name	Tamil Name	English Name	Habit	Species Status	Conservation Status	Island Names																																		Total
								Iranaitivu North	Iranaitivu South	Kalliaditivu	Kayts	Mandaitivu	Erumaitivu	Eluvaitivu	Parititivu	Analaitivu	Nainativu	Puliyantivu-Jaffna	Puliyantivu-Mannar	Kachchativu	Kurikadduwan	Pungudutivu	Delft/ Neduntivu	Karaitivu	Palaitivu	Kakkativu	Kakerativu	Adam's Bridge Islands	Point Pedro	Kavutharimunai	Dambakola Patuna	Akkarai Beach	Valvettithurai Beach	Manatkadu Beach	Thiliyadi Muruthankarni	Nayaru Beach	Pudumathalan	Chundikulam	Nanthi Kadal	Nayaru Lagoon	Kokkilai Lagoon	
Anacardiaceae	*Lannea coromandelica*	*Hik*	*Odi*	Wodier Jhingam	Tree	N	LC										1						1								1			1				1				5
	Mangifera indica	*Amba*	*Manga/ Ma*		Tree	Ex					1	1		1		1	1					1	1	1																		8
Annonaceae	*Polyalthia longifolia*	*Devadaru, Owila, I petta, O lila*	*Maraiillipa/ Assathi/ Asogu*		Tree	N	LC									1																										1
Apocynaceae	*Calotropis gigantea*	*Ela Wara, Hela Wara, Wara, Mudu Wara*	*Errukalai/ Erukku*	Giant milkweed, Crown flower, Bowstring hemp, Gigantic swallow-wort	Shrub	N	LC	1	1		1	1		1		1	1	1			1	1	1	1		1			1	1	1	1	1	1	1	1	1	1	1	1		25
	Carissa spinarum	*Heen-Karamba, Karamba*	*Chiru-kila*		Shrub	N	LC				1			1		1	1	1				1	1							1	1					1		1	1			12
	Catharanthus roseus	*Mini-Mal*	*Sudukattu mallikai*	Madagascar periwinlie	Herb	Ex		1				1											1						1		1		1	1			1					8
	Gymnema sylvestre	*Masbedde, Bim Nuga*	*Shirukurinja*	Sugar killer/ Periploca of the woods	Climber	N	VU																															1				1
	Hemidesmus indicus	*Heen-iramusu, Iramusu*	*Nannari*	Indian sarssaparilla	Herb	N	LC	1						1	1			1				1		1														1				7
	Heterostemma tanjorense				Climber	N	VU																															1				1
	Leptadenia reticulata	*Jeevanthi*			Climber	N	LC																1																			1
	Nerium oleander	*Kaneru*	*Alari*	Oleander/ Indian Oleander	Tree	Ex								1	1		1					1	1																			5
	Pentatropis capensis				Climber	N	LC	1			1					1						1	1								1									1		7
	Pergularia daemia	*Langali, Maha-medahangu, Wissani, Madahangu*	*Achanimuli*		Climber	N	LC	1			1	1			1		1					1	1	1							1											9
	Plumeria obusta	*Araliya, Sudu araliya*	*Perungalli*	Temple tree	Tree	Ex								1		1	1						1	1							1				1							7
	Tabernaemontana divaricata	*Nadawata, Thagara, Wathusudda*	*Nandi-battai*	Grape jasmine	Tree	Ex										1							1																			2
	Thevetia peruviana	*Kaha kaneru*	*Pachaiyalari*	Lucky-nut, Yellow oleander	Tree	Ex					1	1											1	1																		4
	Tylophora indica	*Mudu bin nuga, Bin nuga, Apa sith*	*Nayppalai*	Emetic swallow wory	Climber	N	LC																1																			1
	Wattakaka volubilis	*Anguna, Anukkola, Kiri-Anguna, Titta-Anguna*	*Kodi-palai kurincha*		Climber	N	LC	1								1							1	1							1											5

Family	Scientific Name	Sinhala Name	Tamil Name	English Name	Habit	Species Status	Conservation Status	Island Names																																	
								Iranaitivu North	Iranaitivu South	Kalliaditivu	Kayts	Mandaitivu	Erumaitivu	Eluvaitivu	Parititivu	Analaitivu	Nainativu	Puliyantivu-Jaffna	Puliyantivu-Mannar	Kachchativu	Kurikadduwan	Pungudutivu	Delft/ Neduntivu	Karaitivu	Palaitivu	Kakkativu	Kakerativu	Adam's Bridge Islands	Point Pedro	Kavutharimunai	Dambakola Patuna	Akkarai Beach	Valvettithurai Beach	Manatkadu Beach	Thilyadi Muruthankarni	Nayaru Beach	Pudumathalan	Chundikulam	Nanthi Kadal	Nayaru Lagoon	Kokkilai Lagoon	Total
Araceae	*Amorphophallus sylvaticus*	*Kidaran*			Herb	N	NT				1				1	1				1			1																			5
	Borassus flabellifer	*Thal*	*Panai*	Palmyrah/ Palm	Tree	Ex		1			1	1		1	1	1	1	1		1		1	1	1	1	1	1		1	1	1	1		1	1		1	1	1	1	1	26
	Calamus rotang	*We-wel, Polonnaru wewel, Heen we wel*	*Pirambu*	Common raffan/Rattan care palm		N	NT																																1			1
	Cocos nucifera	*Pol*	*Tennai*	Coconut, King coconut	Tree	Ex		1			1	1		1	1	1		1		1	1	1	1	1					1	1	1	1	1	1	1		1	1	1		1	23
	Phoenix dactylifera	*Rata indi*	*Perichchampalam*	Date palm/ Edible date	Tree	Ex																	1																			1
	Phoenix pusilla	*Indi , Wal indi*	*Inchu*	Small wild date palm	Tree	N	LC				1	1		1	1	1	1		1	1	1	1	1	1		1				1	1					1			1	1	1	19
Aristolochiaceae	*Aristolochia bracteolata*	*Sapsanda*	*Aduthinnappalai*	Ground birthwort	Climber	N	NT	1												1			1																			3
	Aristolochia indica	*Sapsanda, Sas sanda, Sananda*	*Isuru*	Indian birthwort/ Serpent root plant	Climber	N	LC																1																			1
Asparagaceae	*Asparagus racemosus*	*Hatawariya, Heen hathavariya*	*Chattavari*	Wild asparagus	Climber	N	LC				1			1	1	1		1					1	1	1	1	1			1									1			12
	Agave vera-cruz	*Kasete gaha*		American aloe, Century plant	Shrub	Ex								1		1							1																			3
	Sansevieria zeylanica	*Niyanda, Maha niyanda, Nagawalli, Muruwa*	*Maral*	Snake Plant, Bow-string hemp	Herb	N	NT													1					1														1			3
Asteraceae	*Blumea obliqua*	*Mudu mahana*			Herb	N	LC					1											1																			2
	Launaea sarmentosa				Herb	N	LC	1				1		1									1				1		1					1	1	1						9
	Mikania cordata	*Gam palu, Kehel palu, Lokapalu, Maha kihimbiya, Wathu palu, Demala Wel*	*Tuni-kodi*	Mile-a-minute	Climber	Ex																																	1			1
	Sphaeranthus indicus	*Aet-maha-mahana, Mudu-mahana*	*Kottakkarandai*	East indian globe thistle	Herb	N	LC																1																			1
	Tridax procumbens	*Wasu suda, Tridax*		Kurunagala daisy, Coat buttons	Herb	Ex						1			1	1											1						1			1					1	7
	Vernonia cinerea	*Maugul-Kumburu-venna, Monorakudumbiya, Watu-palu*	*Ehitiviyarchenkalainir*	Little iron weed, Ash fleabane, Ash-coloured fleabane	Herb	N	LC	1							1									1						1												4
	Vernonia zeylanica	*Hin-botiya, Papula, Wal-Pupula*	*Kappilay*		Climber	END	LC															1																1				2
	Wollastonia biflora	*Mudu-Gampalu*			Herb	N	LC													1																						1
	Xanthium indicum	*Wal-rambutang, Uru-kossa, Awadi*	*Marlumutta*	Rough cocklebur, Bur-weed		N	LC																																1			1

Family	Scientific Name	Sinhala Name	Tamil Name	English Name	Habit	Species Status	Conservation Status	Island Names																																		
								Iranaitivu North	Iranaitivu South	Kalliaditivu	Kayts	Mandaitivu	Erumaitivu	Eluvaitivu	Parititivu	Analaitivu	Nainativu	Puliyantivu-Jaffna	Puliyantivu-Mannar	Kachchativu	Kurikadduwan	Pungudutivu	Delft/ Neduntivu	Karaitivu	Palaitivu	Kakkativu	Kakerativu	Adam's Bridge Islands	Point Pedro	Kavutharimunai	Dambakola Patuna	Akkarai Beach	Valvettithurai Beach	Manatkadu Beach	Thilyadi Muruthankarni	Nayaru Beach	Pudumathalan	Chundikulam	Nanthi Kadal	Nayaru Lagoon	Kokkilai Lagoon	Total
Bignoniaceae	*Tecoma stans*	*Kelani tissa*		Yelloe elder, Yellow trumpet flower	Tree	Ex										1							1																			2
Boraginaceae	*Cordia dichotoma*	*Lolu*	*Naruvilli/ Vindi*	Sebesten plum	Tree	N	LC																1																			1
	Cordia monoica	*Lolu*	*Naruvili/ Ponnaruvili*		Tree	N	LC													1																						1
	Cordia subcordata				Tree	N	EN																		1		1															2
	Ehretia laevis				Shrub	N	LC								1					1																						2
	Ehretia microphylla	*Hin-Thambala*	*Pakkuvetti*	Ceylon boxwood	Shrub	N	LC				1			1		1							1																			4
	Heliotropium curassavicum				Herb	N	LC	1			1					1								1		1	1											1				7
	Heliotropium scabrum				Herb	N	LC																1																			1
	Tournefortia argentea	*Karan*			Tree	N	EN													1																						1
Burseraceae	*Commiphora berryi*				Tree	N	LC				1	1		1		1	1					1	1	1																		8
Cactaceae	*Opuntia dillenii*	*Katu-pathok*	*Kalli*	Prickly pear/ Snake hood fig	Herb	Ex		1	1	1	1		1	1		1	1						1		1	1					1		1			1		1	1	1		17
Capparaceae	*Crateva adansonii*	*Lunuwarana*	*Navala*	Three-leaved caper	Tree	N	LC												1																							1
	Cadaba fruticosa				Climber	N	EN															1	1								1											3
	Capparis brevispina	*Wal-dehi*			Climber	N	NT																1			1																2
	Capparis divaricata	*Wellangiriya*	*Torikei*		Climber	N	LC																1																			1
	Capparis rotundifolia	*Balal Katu*			Climber	N	LC						1																													1
	Capparis sepiaria	*Rila Katu*			Climber	N	LC													1			1																			2
	Capparis zeylanica	*Sudu-wellangiriya, Wellangiriya, Kalu welangiriya*	*Kattoddi / Vennachchi*	Ceylon caper, Caper plant	Shrub	N	LC				1		1							1					1	1	1															6
Caricaceae	*Carica papaya*	*Gas-Labu, Papol*	*Pappali*	Papaw, papaya, Pawpaw	Tree	Ex																	1																			1

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Casuarinaceae	*Casuarina equisetifolia*	*Kasa*	*Chavakka / Chavukku*	Beef wood, Bull wood, Whip tree, Whistling pine	Tree	Ex				1	1	1				1	1				1		1	1					1		1	1		1								12
Celastraceae	*Cassine balae*	*Nareloo, Neraloo*	*Perun / Piyaree*		Tree	END	LC									1		1				1	1	1																		5
	Cassine glauca				Tree	END	VU																							1	1								1			3
	Gymnosporia emarginata	*Katu pila*			Shrub	N	LC																1							1										1		3
	Pleurostylia opposita	*Panakka, Piyari*	*Chiru piyari*		Shrub	N	LC																		1																	1
	Salacia oblonga	*Himbutu, Gal Himbutu*			Shrub	N	EN																															1				1
Cleomaceae	*Cleome aspera*				Herb	N	LC																	1																		1
	Cleome viscosa	*Wal-aba, Ran-manissa*	*Nayikadugu*	Yellow spider flower, Wild mustard/ Dog mustard	Herb	N	LC												1																							1
Colchicaceae	*Gloriosa superba*	*Niyagala*	*Karti kai kilanku / Ventonti*	Glory lily, Flame lily, Vine lily, Malabar glory lily	Climber	N	LC				1					1				1			1	1	1																	6
Combretaceae	*Lumnitzera racemosa*	*Beraliya, Beriya*		Black Mangrove	Tree	N	LC																			1												1	1			3
	Terminalia arjuna	*Kumbuk, Kumbalu*	*Marutu*	Arjun	Tree	N	LC									1	1						1	1							1								1	1		7
	Terminalia bellirica	*Bulu*	*Ahdan-koddai/Tanti*	Myrabalans, Beleric myrobalan	Tree	N	LC																							1									1			2
	Terminalia catappa	*Kottamba/ Kottan*	*Amandi-maram*	Country almond, Indian Almond	Tree	Ex											1					1	1																			3
Commelinaceae	*Commelina ensifolia*				Herb	N	LC								1								1																			2
	Cyanotis cristata	*Bol-hinda*			Herb	N	LC																1																			1
	Murdannia spirata				Herb	N	LC																1																			1

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Convolvulaceae	*Argyreia populifolia*	*Girithilla*	*Sindu-kodi*		Climber	END	LC																1																			1
	Cressa cretica				Herb	N	LC	1														1	1								1								1	1		6
	Evolvulus alsinoides	*Visnu-kranthi, Nil Vishnukranthi*	*Vichna-kiranthi/ Vishnu kiranthi*	Little glory, Dwarf morning glory	Herb	N	LC	1									1						1								1											4
	Ipomoea sp.				Climber																						1															1
	Ipomoea coptica				Climber	N	EN																1																			1
	Ipomoea marginata	*Rasa-tel-kola*	*Tali*	Purple heart glory, Bankalmi	Climber	N	LC												1																							1
	Ipomoea pes-caprae	*Mudu-bin-thamburu, Ela-binthamburu*	*Adambu*	Goat's foot glory	Climber	N	LC		1		1	1		1	1	1	1			1			1	1	1		1	1	1	1	1	1		1		1	1		1		1	22
	Ipomoea violacea				Climber	N	LC																1																			1
Cucurbitaceae	*Citrullus colocynthis*	*Yak-komadu, Thiththa labu*	*Peykkomaddi/ Peykkomakki*	Coloeynth/ Bitter cucumber	Climber	N	VU				1												1																			2
	Coccinia grandis	*Kowakka*	*Kovvai*	Ivy gourd	Climber	N	LC	1				1	1			1				1			1		1		1															8
	Corallocarpus sp.				Climber																		1																			1
	Cucumis melo	*Gon kekiri/ Kekiri*	*Metukku/ Mulamparham*	Melon	Climber															1																						1
	Diplocyclos palmatus	*Pasengilla*		Red striped cucumber	Climber	N	LC																1																			1
	Momodica charantia	*Batu karavila, Karavila*	*Pakal/ Nuti-pakal*	Bitter gourd, Wild cucumber, Carilla fruit/ Balsam pear	Climber	N	LC																		1																	1
	Mukia maderaspatana	*Hin-Kekiri, Gon kekiri, Len kekiri, Kekiri*	*Mochumochukkai/ Mosumosukkai*	Rough bryony, Madras pea pumpkin	Climber	N	NT						1										1																			2
Cyperaceae	*Bulbostylis barbata*	*Uru hiri*			Herb	N	LC		1		1	1			1	1			1	1			1	1	1	1	1				1		1				1	1				16
	Cyperus arenarius	*Mudu-kalanduru*			Herb	N	LC			1									1				1															1				4
	Cyperus bulbosus				Herb	N	LC																1																			1
	Cyperus castaneus				Herb	N	LC																1																			1
	Cyperus compressus				Herb	N	LC																1																			1
	Cyperus conglomeratus				Herb	N	CR																1																			1
	Cyperus iria	*Wel-hiri, Thunessa*			Herb	N	LC																1																			1
	Cyperus pygmaeus				Herb	N	LC																1																			1
	Cyperus rotundus	*Kaladuru*	*Korai*	Nut grass	Herb	N	LC	1			1	1										1	1		1										1							7
	Cyperus stoloniferus				Herb	N	LC																1															1				2
	Fimbristylis argentea				Herb	N	LC																1																			1
	Fimbristylis cymosa				Herb	N	LC																				1	1		1								1				4
	Fimbristylis dipsacea				Herb	N	CR (PE)																1																			1
	Fimbristylis feruginea				Herb	N	LC																1																			1
	Rikliella squarrosa				Herb	N	LC																1																			1

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Dioscoreaceae	*Dioscorea pentaphylla*	*Katu-ala, Katuwala-ala*	*Allai*	Buck yam / Kawam yam	Climber	N	LC													1					1					1	1											4
Ebenaceae	*Diospyros ebenum*	*kaluwara*		Ebony	Tree	N	EN																															1				1
	Diospyros malabarica	*Thimbiri*	*Panichchai*	Gaub persimmon / Riber ebony	Tree	N	LC																							1									1			2
	Diospyros vera	*Thurana, Pila, Kaluhabaraliya, Jabara*			Tree	N	LC								1			1		1		1	1		1	1				1	1					1		1	1	1		13
Erythroxylaceae	*Erythroxylum monogynum*	*Devadaram, Agil, Lanka agil*	*Chemanatti*	Bastard sandal	Tree	N	NT						1			1							1			1												1				5
Euphorbiaceae	*Acalypha indica*	*Kuppamenia*	*Kuppameni / Punairananki*	Indian copper leaf, Indian Acalypha	Herb	N	LC	1												1			1		1																	4
	Codiaeum variegatum			Croton	Tree	Ex																	1																			1
	Croton bonplandianus			Bonpland's croton	Tree	Ex				1	1																											1				3
	Euphorbia antiquorum	*Daluk*	*Chatura kalli*	Spurge cactus, Fleshy spurge	Shrub	N	LC																1								1									1		3
	Euphorbia hirta	*Bu-dada-kiriya*	*Palavi*	Commen sprge, Snake weed	Herb	N	LC													1			1																			2
	Euphorbia rosea	*Mudu-dada-kiriya*			Herb	N	LC					1		1									1																			3
	Euphorbia thymifolia	*Bin-dada-kiriya*	*Chittirapalavi*	Thyme-leaf sprge	Herb	N	LC				1																															1
	Euphorbia tirucalli	*Navahandi, Weradi navahandi*	*Kalli*	Pencil bush, Pencil tree, Milk hedge	Tree	Ex										1			1				1		1																	4
	Excoecaria agallocha	*Talakiriya, Tela kiriya, Thela, Thela kihiriya,*	*Tilai*	Blind your eye tree, Blinding tree	Tree	N	LC	1					1						1			1				1												1	1	1		8
	Jatropha curcas	*Rata-Endaru, Weta endaru*	*Kaddamanakku*	Physic nut / Purging nut	Shrub	Ex																	1																			1
	Jatropha glandulifera	*Rath erandu*	*Atalai / Kattamanakku*		Shrub	N	NT				1	1		1	1	1	1						1																			7
	Ricinus communis	*Endaru*	*Chillamanakku / Chittamanakku*	Castor oil plant, Caster Bean	Shrub	Ex																																	1			1
	Tragia sp.				Herb																		1				1															2

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Fabaceae	*Abrus precatorius*	*Olinda, Hunida*	*Kundu-mani / Kuntu-mani*	Crab's eyes, Indian liquorice, Jequirity beans, Rosary pea	Climber	N	LC							1	1			1		1			1		1					1												7
	Acacia chundra	*Kihiri, Rat-kihiriya, Kaippu, Rath kiriya*	*Karangali / Kodalimurunkai*	Red cutch	Tree	N	LC						1																													1
	Acacia eburnea	*Gini andara*	*Kaludai / Udai-vel*	Cockspur thron	Shrub	N	LC							1	1				1							1																4
	Albizia lebbeck				Tree	N	NT	1															1																			2
	Albizia saman	*Pini mara / Mara, Para mara*		Rain tree	Tree	Ex																	1																			1
	Alysicarpus vaginalis	*Aswenna, Ratu aswenna*	*Pullardi*	Alice clover, One leaf clover	Herb	N	LC																1																			1
	Bauhinia racemosa	*Maila*	*Atti / Arai*		Tree	N	LC																			1	1										1	1	1			5
	Caesalpinia bonduc	*Kalu-Wavul-Atiya, Kumburu-Wel*	*Punai kkalaichchi*	Gray nicker	Climber	N	LC	1					1			1			1				1	1		1				1	1							1	1	1		12
	Caesalpinia pulcherrima	*Monara-mal*	*Mayuram / Mayirkonrai*	Barbados' pride, Peacock flower	Tree	Ex																	1																			1
	Canavalia rosea	*Mudu-awara*			Climber	N	LC																								1											1
	Cassia fistula	*Ehela, Erahandi, Erahendi*	*Kavani / Konnei / Tirukkontai*	Indian laburnum, Shower of gold, Purging fistula	Tree	Ex						1		1	1	1		1				1																				6
	Cassia roxburghii	*Ratu-Wa*	*Vakai*	Ceylon cassia, Red Cassia	Tree	N	LC				1																												1			2
	Clitoria ternatea	*Katarodu, Nil-katarolu, Nil katarodu*	*Chirupatarru / Karuttappu*	Butterfly pea	Climber	N	LC		1						1	1								1	1					1	1											7
	Crotalaria prostrata				Herb	N	EN																															1				1
	Crotalaria quinquefolia				Herb	N	LC												1																							1
	Crotalaria verrucosa	*Nil-andana-hiriya, Yak-bairiye*	*Kilukiluppai*	Blue rattlesnake	Herb	N	LC			1		1		1		1								1																	1	6
	Dalbergia candenatensis			Dalbergia	Climber	N	VU																															1				1
	Delonix regia	*Mal-Mara, Mei-Mara*	*Mayaram / Poo-vahai*	Flamboyant, Flame-tree, Gold mohur, Royal poincinna	Tree	Ex																	1																			1
	Derris parviflora	*Kala-wel, Sudu-kala-wel*			Climber	END	LC																															1	1			2
	Derris trifoliata	*Kala-wel*		Mangrove beanstalk	Climber	N	LC																															1				1
	Desmodium triflorum	*Heen-undupiyaliya*	*Sirupulladi*	Creeping tick threefoil, Tick clover	Herb	N	LC							1									1																			2
	Dichrostachys cinerea	*Andara, Katu andara*	*Vindattai / Anatter*	Sickle bush, Chinese Intern tree	Shrub	N	LC				1	1	1	1	1	1			1			1	1	1	1	1				1	1								1	1	1	17
	Erythrina variegata	*Erabadu, Eramudu, Katu-eramudu, Weta-*	*Mullu-murukku*	Coral tree, Indian Coral	Tree	N	LC																1																			1

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		erabodu, Yak-erabodu		tree, Thorny dadap																																						
	Gliricidia sepium	*Kona, Vetamara, Ginisooriya, Nanchi*	*Kona*	Mexican lilac	Tree	Ex										1	1					1	1	1																		5
	Indigofera oblongifolia	*Nari Mun*			Shrub	N	VU															1									1												2
	Indigofera linnaei				Herb	N	LC																								1												1
	Indigofera sp.				Herb																		1																				1
	Indigofera tinctoria	*Nil-Awariya*	*Kandarum*	Indigo, True indigo	Climber	N	LC																														1						1
	Lablab purpureus	*Ho-dambala, Kiri-dambala, Kos-ata-dambala, Ratu-peti-dambala, Sudu-peti-dambala*		Bonavist bean, Hyacinth bean, Lablab bean, Wild bean	Climber	N	LC																							1						1							2
	Leucaena leucocephala	*Ipil-Ipil*	*Nattucavundal*	Wild tamarind, Ipil ipil	Tree	Ex											1					1	1				1				1		1										6
	Mimosa pudica	*Nidi-kumba*	*Tottal-vadi*	Sensitive plant, Touch me not	Herb	Ex																																	1			1
	Parkinsonia aculeata			Jerusalem thorn, Mexican palo verde, Retama	Tree	Ex					1																																1
	Peltophorum pterocarpum			Copper-pod, Yellow flame, Yellow poinciana	Tree	Ex																	1																				1
	Pithecellobium dulce	*Pinikaral, Menila Siyambala*	*Kodai kaapulli*	Madras thorn, Manila tamarind	Tree	Ex																	1																				1
	Pongamia pinnata	*Magul-Karanda, Karanda, Gal karanda*	*Poona / Punka / Punku*	Indian beech, Mullikulam tree	Tree	N	LC				1			1									1						1													4
	Prosopis juliflora	*Katu-siyambala*		Mesqite	Tree	Ex					1																																1
	Senna auriculata	*Ranawara*	*Avarai*	Matara tea, Tanner's cassia	Shrub	N	LC				1		1	1	1	1	1					1	1	1		1						1								1	1	1	1	15
	Senna tora	*Peti-tora*	*Vaddutakarai*	Pot cassia, Sickle senna, Foetid cassia	Herb	N	LC	1			1	1		1		1		1	1					1	1					1		1											11
	Sesbania grandiflora	*Katuru-murunga*	*Akatti / Agati-keerai*	Swamp pea / Sesban / Agathi	Tree	Ex						1											1																				2
	Tamarindus indica	*Siyambala, Maha-siyambala*	*Puli / Indam / Egin palap / Amilam*	Indian date, Tamarind	Tree	Ex													1	1		1	1	1	1	1					1								1			9
	Tephrosia purpurea	*Pila, Katuru pila, Gam pila*	*Kavilai / Kawati / Kolinchi*	Common tephrosia, Fishpoison, Wild indigo, Purple tephrosia	Climber	N	LC																	1	1																	2
	Vigna marina	*Karal-li-me, Lee ma*	*Kodippayaru / Kodeppayam*	Beach pea, Dune bene, Field bean / Lima bean	Climber	N	EN																														1`				0
	Vigna trilobata	*Bin-me, Munwenna*			Herb	N	NT					1			1								1								1				1							1	6

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								Iranaitivu North	Iranaitivu South	Kalliaditivu	Kayts	Mandaitivu	Erumaitivu	Eluvaitivu	Parititivu	Analaitivu	Nainativu	Puliyantivu-Jaffna	Puliyantivu-Mannar	Kachchativu	Kurikadduwan	Pungudutivu	Delft/ Neduntivu	Karaitivu	Palaitivu	Kakkativu	Kakerativu	Adam's Bridge Islands	Point Pedro	Kavutharimunai	Dambakola Patuna	Akkarai Beach	Valvettithurai Beach	Manatkadu Beach	Thilyadi Muruthankarni	Nayaru Beach	Pudumathalan	Chundikulam	Nanthi Kadal	Nayaru Lagoon	Kokkilai Lagoon	Total
Gentianaceae	*Enicostema axillare*				Herb	N	LC	1	1							1			1												1							1				6
Gisekiaceae	*Gisekia pharnaceoides*	*Atthiripala*	*Manalikkirai / Manali*		Herb	N	LC																1																			1
	Gisekia sp.				Herb	N	LC																1																			1
Goodeniaceae	*Scaevola plumieri*	*Hin-Takkada*			Shrub	N	NT					1																														1
	Scaevola taccada	*Takkada*			Shrub	N	LC				1	1	1							1					1		1			1											1	8
Hernandiaceae	*Gyrocarpus americanus*	*Diya-labu-gas, Hima, Heiya*	*Tanakku*		Tree	N	LC						1						1	1			1				1															5
Lamiaceae	*Clerodendrum inerme*	*Boerende, Burenda, Gulinda, Wal-Gurenda, Gulinda*	*Dangamkuppi / Koika/ Pinari / Pinchil*	Common hedge bower	Tree	N	LC		1		1		1		1		1		1			1	1	1		1			1	1	1							1	1	1	1	17
	Clerodendrum phlomides	*Wadang, Gas-Pinna*			Shrub	N	NT																						1													1
	Gmelina asiatica	*Demata, Heen Demmata, Gatta demata*	*Kumil / Vikarini / Gumadi / Nela-kumi*	Asiatic beech berry / Small cash mere tree	Shrub	N	LC						1	1	1	1	1	1				1	1							1	1											10
	Leucas zeylanica	*Geta-Thumba*	*Mudi-tumpai*	Thumbe	Herb	N	LC	1	1		1	1			1		1							1													1					8
	Ocimum tenuiflorum	*Maduru-tala, Heen maduruthala*	*Karuttulaci*	Sacred basil, Holi basil	Herb	N	LC				1			1										1							1											4
	Premna obtusifolia	*Midhi,Wal-Midi, Maha-midi, Middee-gas, Sihin-midi, Heen midi*		Headache tree	Shrub	N	LC				1									1		1	1		1	1				1	1								1			9
	Vitex altissima	*Milla,Kaha-Milla, , Miyan-milla, Sapu-milla, Niyan-milla*			Tree	N	NT																													1						1
	Vitex negundo	*Nika, Helarika, Sudu-Nika, Nil nika*	*Nirnichchi / Vennochchi / Nochchi*	Chaste-tree, Indian privet / Five leaved chaste tree	Shrub	N	LC															1	1	1																		3
	Vitex trifolia	*Nika, Sudu-Nika*			Shrub	N	NT				1	1										1		1							1		1						1			7
Lauraceae	*Cassytha filiformis*			Love vine	Climber	N	LC				1	1			1	1		1					1			1				1	1											9

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Lecythidaceae	*Barringtonia acutangula*	*Era-Midella, Ela midella*	*Adampu / Kadambu*	Indian oak	Tree	N	LC																																1			1
Liliaceae	*Scilla hycinthiana*				Herb	Ex																	1																			1
Loranthaceae	*Taxillus courtallensis*				Epiphyte	N	VU																			1																1
Lythraceae	*Ammannia baccifera*				Herb	N	LC										1					1									1	1		1								5
	Lawsonia inermis	*Marathodi*	*Maruthondi / Marutonti*	Camphire, Henna, Tree-mignonette, Cypress shrub	Shrub	N	LC																								1											1
	Pemphis acidula	*Muhudu Wara*			Shrub	N	NT	1	1	1			1						1	1					1	1	1															9
	Sonneratia alba				Tree	N	EN		1																																	1
Malvaceae	*Abutolon indicum*	*Anoda, Beth anoda, Wak Anoda, Panagedi*	*Peruntulli / Peruntutti*	Indian mallow, Country mallow	Herb	N	LC			1																																1
	Adansonia digitata	*Baobab, Aliya gaha*	*Perukku / Papparappuli*	Judas' bag, Monkey bread tree,m Baobab		Ex																	1																			1
	Berrya cordifolia	*Halmilla*	*Chavandalali*	Trincomalee wood	Tree	N	LC									1	1						1																			3
	Grewia carpinifolia	*Wel-keliya, Wel-mediya*			Tree	N	LC																1				1															2
	Grewia orientalis	*Wel-keliya, Wel-mediya*			Climber	N	LC						1		1								1		1	1					1											6
	Grewia tenax				Shrub	N	NT												1																							1
	Fioria sp.				Shrub																		1																			1
	Hibiscus lobatus				Herb	N	LC													1																				1		2
	Hibiscus micranthus	*Bebila, Siriwedi babila*	*Perumaddi*		Herb	N	LC						1			1				1							1												1			5
	Hibiscus rosa-sinensis	*Sapaththu-Mal, Wada, Pokuru wada*	*Cemparutti*	Shoeflower, Chinease hibiscus, Chinest rose	Tree	Ex											1						1																			2
	Hibiscus tiliaceus	*Belipatta, Wal Beli*	*Artia / Nir-parathi*		Tree	N	LC				1	1																								1						3
	Muntingia calabura	*Jam*		Jamaican chrry, Jam-tree		Ex																																				0
	Sida acuta	*Gas-Bevila, Gas bebila*		Common wireweed	Herb	N	LC																1				1				1											3
	Sida cordata	*Bevila, Wel bebila*	*Palampasi*		Climber	N	LC	1							1																											2
	Thespesia populnea	*Suriya, Gansuriya*	*Kavarachu / Puvarachu*	Tulip tree, Pacific	Tree	N	LC	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1		1	1	1			1	1		1	28

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				rosewood, Portia tree, Indian tulip tree																																						
	Waltheria indica	*Punnikki*		Sleepy morning	Shrub	N	LC								1																											1
Melastomataceae	*Memecylon capitellatum*	*Dedi-Kaha, Dodan-Kaha, Wel-Kaha, Weli-Kaha, Idal gaha, Andun, Kayam*	*Katti kaya / Venkali-kaya*		Tree	END	LC																															1				1
	Memecylon umbellatum	*Kora-Kaha*	*Kaya / Kuree-kaya*	Blue mist	Tree	N	LC																															1	1	1		3
Meliaceae	*Azadirachta indica*	*Kohomba*	*Vembu*	Margosa, Neem	Tree	Ex		1			1	1		1	1	1	1	1		1		1	1	1					1	1	1		1		1				1			18
	Chukrasia tabularis	*Hulanhik, Hiri-kita*	*Aglai / Kaloti*	Chittagong wood	Tree	N	NT											1				1	1								1								1			5
	Khaya senegalensis	*Khaya*		African Mahogany	Tree	Ex					1													1							1											3
	Swietenia mahogani	*Mahogani*		Cuban mahogany, Mahogamy	Tree	Ex																	1																			1
Menispermaceae	*Cocculus hirsutus*	*Lunuketiya wel*	*Kattukkodi / Sirungattukodi*		Climber	N	EN																1																			1
	Pachygone ovata				Climber	N	VU																															1				1
	Tinospora cordifolia	*Rasa-Kinda*	*Chintil*	Tinospora, Gulancha, Guduchi, Gulancha Tinospora	Climber	N	VU																1																			1
Molluginaceae	*Glinus lotoides*			Lotus sweetjuice, Hairy carpet weed	Herb	N	LC																1																			1
Moraceae	*Ficus amplissima*	*Ela-Nuga*	*Kalati*		Tree	N	LC																1																			1
	Ficus benghalensis	*Maha-Nuga*	*Al / Arla*	Banyan	Tree	N	LC				1			1	1	1	1	1				1	1	1							1		1		1		1	1	1		1	16
	Ficus microcarpa	*Panu-nuga, Iti*	*Kallichi*		Tree	N	LC																															1				1
	Ficus religiosa	*Bo*	*Arachu / Arasu*	Peepul, Sacred bo	Tree	Ex										1	1					1	1	1							1											6
Moringaceae	*Moringa oleifera*	*Murunga*	*Murunga-maram*	Horse radish tree, Drumstic tree	Tree	Ex		1				1				1							1																			4

								Island Names																																		
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Muscaceae	*Musa x paradisaca*	*Kehel*	*Vaalai*	Banana, Plantain	Tree	Ex																	1	1																		2
Myrtaceae	*Eucalyptus sp.*				Tree	Ex								1		1	1																									3
	Psidium guajava	*Pera*	*Koyya / Sengoyya*	Guava	Tree	Ex					1					1								1																		3
	Syzygium cumini	*Ma-Dan, Dan*	*Naval / Perunaval*	Java plum, Jambol, Black plum	Tree	N	LC										1	1				1		1						1	1							1	1			8
Nyctaginaceae	*Boerhavia diffusa*	*Pita-sudu-pala*	*Karichcharanai / Mukkarichchi*	Red spiderling, Common hogweed, Pig weed / Hog weed	Herb	N	LC				1	1					1						1		1				1				1				1					8
	Bogainvillea sp.	*Boganvila*			Shrub	Ex																	1																			1
Nymphaeaceae	*Nymphaea pubescens*	*Et-olu, Olu*		Egyptian lotus, Water lily		N	LC																																1			1
Ochnaceae	*Ochna obtusata*	*Mal-Kera*			Shrub	N	LC																		1					1									1			3
Olacaceae	*Olax scandens*				Shrub	N	LC												1																							1
	Jasminum auriculatum	*Wal pichcha / Wekanda*	*Usimalligai*	Needle flower jasmine	Shrub	N	LC						1		1												1											1				4
Orchidaceae	*Cymbidium bicolor*	*Visa Duli*			Epiphyte	N	LC					1		1									1																			3

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Orobanchaceae	*Striga angustifolia*			White withchweed		N	NT																							1	1											2
Oxalidaceae	*Averrhoa bilimbi*	*Billing, Bilin*	*Kochittamarattai*	Bimlimbi cucumber	Tree	Ex																	1																			1
	Averrhoa carambola	*Kamaranga*	*Tamanta*	Carambola apple / Star fruit	Tree	Ex																	1																			1
Pandanaceae	*Pandanus odorifer*	*Mudu keyiya, Weta-Keiya*	*Talai / Kaidai*	Screw-pine / Umbrella tree		N	LC																							1												1
Passifloraceae	*Passiflora foetida*	*Pada Gedi, Pada wel, Udahalu, Wal Passion, Wel Delum*	*Siruppunaikkali*	Goat-scented passion flower, Common Passion Flower	Climber	Ex																	1																			1
Pedaliaceae	*Pedalium murex*	*Et-Nerenchi, Gokatu*	*Anai-nerechchi*	Common pedalium	Herb	N	LC	1					1							1			1																			4
	Sesamum prostratum				Herb	N	CR																															1				1
Phrymaceae	*Peplidium mariticum*				Herb	N	EN																1																			1

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Phyllanthaceae	*Breynia vitis-idaea*	*Gas-kayila*	*Manipulnati*	Coral berry tree	Shrub	N	LC				1												1								1											3
	Flueggea leucopyrus	*Heen Katu pila, Hen katu pila, Katupila*	*Mudpulanti / Pulanji*	Water caltrop / Spinous fluggea	Shrub	N	LC	1		1	1	1	1	1	1	1	1	1	1	1		1	1	1	1	1				1	1	1						1	1	1		23
	Phyllanthus acidus	*Rata nelli*		Goose berry tree	Tree	Ex																			1		1															2
	Phyllanthus amarus	*Pitawakka*	*Kilanelli*		Herb	N	LC	1							1	1				1			1	1	1						1											8
	Phyllanthus maderaspatensis				Herb	N	LC					1																														1
	Phyllanthus polyphyllus	*Kuratiya, Embitilla*			Shrub	N	LC																																1			1
Plantaginaceae	*Bacopa monnieri*	*Lunuwila*		Water hyssop, Thyme leaved gratiola	Herb	N	LC					1											1																			2
Poaceae	*Aeluropus lagopoides*				Herb	N	LC																			1					1							1				3
	Aristida adscensionis	*Boleela / Teli tana*			Herb	N	VU																															1				1
	Chloris barbata				Herb	Ex																	1																			1
	Cynodon dactylon				Herb	N	LC																1																			1
	Eragrostis ciliaris				Herb	N	LC																1															1				2
	Eragrostis riparia				Herb	N	LC																1															1				2
	Eragrostis viscosa				Herb	N	LC																1																			1
	Ischaemum ciliare				Herb	N	LC																1																			1
	Panicum repens	*Etora*	*Inji-pul*		Herb	N	LC																					1		1								1				3
	Saccharum officinarum				Herb	Ex																	1																			1
	Spinifex littoreus	*Maha-rawana-revula*	*Ravanan-meesai*		Herb	N	LC	1				1	1		1		1						1		1				1	1	1			1								11
	Sporobolus maderaspatanus				Herb	N	VU																1																			1
	Sporobolus tremulus				Herb	N	LC																1																			1
	Zoysia martella				Herb	N	LC																1																			1
Polygonaceae	*Antigonon leptopus*			Coral vine, Mexican creeper	Climber	Ex						1											1										1									3

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Portulacaceae	*Portulaca sp.*				Herb																																					0
Primulaceae	*Aegiceras corniculata*	*Hin-Kadol, Avari Kadol, Kehelken gas*	*Vitlikanna*	River mangrove	Tree																																	1				1
Punicaceae	*Punica granatum*	*Delum*	*Madalai / Madulan kai*	Pomergranate	Tree	Ex										1							1																			2
Putranjivaceae	*Drypetes sepiaria*	*Wira*	*Virai*		Tree	N	LC																															1				1
Rhamnaceae	*Colubrina asiatica*	*Mauirmanikkam / Tel hiriya*	*Mayirmanikkam*		Climber	N	VU						1										1		1	1	1															5
	Scutia myrtina				Climber	N	LC				1							1				1	1		1		1			1												7
	Ziziphus mauritiana	*Maha-Debara, Eraminia, Masan, Dabara*	*Ilantai / Illantai*	Indian Jujube, Chinese apple, Chinese date / Indian cherry	Tree	N	LC	1	1		1						1			1		1	1	1		1	1			1			1						1			13
	Ziziphus oenopila	*Hin-Eraminia*	*Churai/Perilantai*	Jacka / Jujube	Shrub	N	LC				1			1									1							1								1	1			6
Rhizophoraceae	*Bruguiera cylindrica*	*Heen Mal Kadol*			Tree	N	EN		1																																	1
	Ceriops tagal	*Punkanda, Ratugas*			Tree	N	NT		1																																	1
	Rhizophora mucronata	*Kadol, Ela Kadol, Maha Kadol*	*Kandal*	Asiastic mangrove	Tree	N	LC			1													1																	1		3

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Rubiaceae	*Benkara malabarica*	*Pudan, Maha-geta-kulu*			Tree	N	LC							1																												1
	Canthium coromandelicum	*Kara*	*Karai*		Shrub	N	LC				1					1						1	1	1							1							1	1			8
	Catunaregam spinosa	*Kukuruman, Kukurummuwan, Pupuru Maha*	*Karai*	Spiny randia, Enetic-nut, False guava	Shrub	N	LC							1		1		1				1	1			1					1											7
	Guettarda speciosa	*Nil-Pitcha*	*Panir*		Shrub	N	VU													1					1		1															3
	Hydrophylax maritima	*Mudu getakola*			Herb	N	LC																						1													1
	Ixora pavetta	*Maha-Rathambala*	*Kanmuttankirai*	Toarch tree	Tree	N	LC								1								1		1					1									1			5
	Morinda coreia	*Ahu*	*Manchavanna*	Morinda tree	Tree	N	LC				1	1		1	1	1		1				1	1	1						1	1	1	1									13
	Oldenlandia corymbosa	*Wal-pathpadagam*	*Parpatagam*	Old world diamond flower, Flat top mille graines	Herb	N	LC	1	1		1	1		1		1				1				1	1		1		1		1											12
	Pavetta indica	*Parvatta*	*Pavaddai*	White pavetta	Shrub	N	LC						1						1						1	1																4
	Psilanthus wightianus				Shrub	N	VU				1			1																												2
	Spermacoce hispida	*Hin-geta-kola*	*Yar / Nattaichchuri*		Herb	N	LC																	1	1				1									1	1			5
	Tarenna asiatica	*Tarana, Maha Tarana*	*Karanai*		Shrub	N	LC						1												1	1					1											4
Rutaceae	*Atalantia ceylanica*	*Yakinaran, Wal-dehi, Yati-naran, Yak dehi*	*Pey-kuruntu*		Shrub	N	LC						1							1					1		1											1				5
	Chloroxyclon swietenia	*Burutha*	*Moodudad-marum / Muritai*		Tree	N	VU																															1	1			2
	Citrus aurantifolia	*Dehi, Hin-dehi,Udu dehi*	*Ambu / Arunam / Thesikkai*	True lime, Lime / Bitter lime / Soar lime	Tree	Ex																	1																			1
	Clausena dentata	*Etkara-Bemiya, Gandapana, Weda-pana*	*Narangam / Thodam*		Tree	N	LC						1			1										1												1				4
	Glycosmis mauritiana				Shrub	N	LC								1																							1				2
	Limonia acidissima	*Divul*	*Mayaladikkuruntu / Vila / Vilatti*	Elephant-apple, Wood-apple	Tree	N	LC				1					1						1	1								1									1		6
	Paramignya monophylla	*Wellangiriya, Yaka bendi wel*			Climber	N	LC				1					1				1																						3
	Pleiospermium alatum	*Tunpath-Kurundu*			Tree	N	LC						1		1											1																3
	Toddalia asiatica	*Kudu-Miris*	*Kandai*	Forest pepper / Lopez tree / Wild orange tree	Climber	N	LC	1			1	1	1	1	1	1	1					1	1								1											11
Salicaceae	*Casearia zeylanica*	*Wal-Waraka, Wal Moonamal*	*Kakapelar / Kakkaipalai / Kakkapalai*			N	LC																							1												1
	Flacourtia indica	*Katukutundu, Ugurессa, Ukkuressa, Katulovi, Dik Patana, Wal Divul,*	*Katukali / Karumurukki / Mulanninchil*	Governor's plum / Madagascar plum / Sapida / Ramon	Tree	N	LC																1																			1

Family	Scientific Name	Sinhala Name	Tamil Name	English Name	Habit	Species Status	Conservation Status	Island Names																																			
								Iranaitivu North	Iranaitivu South	Kalliaditivu	Kayts	Mandaitivu	Erumaitivu	Eluvaitivu	Parititivu	Analaitivu	Nainativu	Puliyantivu-Jaffna	Puliyantivu-Mannar	Kachchativu	Kurikadduwan	Pungudutivu	Delft/ Neduntivu	Karaitivu	Palaitivu	Kakkativu	Kakerativu	Adam's Bridge Islands	Point Pedro	Kavutharimunai	Dambakola Patuna	Akkarai Beach	Valvettithurai Beach	Manatkadu Beach	Thilyadi Muruthankarni	Nayaru Beach	Pudumathalan	Chundikulam	Nanthi Kadal	Nayaru Lagoon	Kokkilai Lagoon	Total
Salvadoraceae	*Azima tetracantha*	*Wel dehi, Katu Niyanda*	*Ichanku / Iyanku*	Needle bush, Bee sting bush	Shrub	N	LC					1					1		1				1	1		1													1	1		8
	Salvadora persica	*Malittan, Peelu*	*Perungoli*	Salt bush / Tooth brush tree	Tree	N	NT	1	1	1			1		1	1			1	1			1		1	1	1												1	1		14
Sapindaceae	*Allophylus cobbe*	*Bu-Kobbe, Kobbe, Mudu-kobbe, Koba, Wal Kobbe*	*Amarai*		Shrub	N	LC								1			1		1			1			1																5
	Cardiospermum halicacabum	*Penela-wel, Wel penela*		Ballon vine	Climber	N	LC				1																															1
	Dodonaea viscosa	*Et-Werella*	*Virali*		Shrub	N	LC							1		1		1					1		1	1				1								1	1			9
	Gleniea unijuga	*Wal-Mora*			Tree	END	LC																																			0
	Lepisanthes tetraphylla				Tree	N	LC								1								1																1			3
	Schleichera oleosa	*Kon*	*Kula / Puvu / Kolama*	Ceylon oak / Lac tree	Tree	N	LC									1																										1
Sapotaceae	*Madhuca longifolia*	*Mi, Gam-mi, Galu-pushpa, Tel-mi, Illipi*	*Illupai / Kuligam*	Mousey mi / Butter tree / South Indian Mahua	Tree	N	NT				1					1	1	1					1	1																		6
	Manilkara hexandra	*Palu*	*Palai / Sivandi*	Obtuse leaved mimusops	Tree	N	VU	1											1	1			1		1	1				1						1		1	1			10
Solanaceae	*Solanum melongena*	*Ela-Batu*	*Kattiri -kai*	Aubergine, Brinjal, Egg plant	Herb	Ex		1			1					1								1																		4
	Solanum trilobatum	*Wal-tibbatu*	*Tuttuvalai*	Climbing brinjal	Climber	N	LC												1				1								1											3
	Solanum virginianum	*Kara-Batu, Katu-wel-Batu, Karabatu*	*Kandan-kattari*	Yellow berried night shade	Herb	N	LC																1								1		1									3
Surianaceae	*Suriana maritima*				Shrub	N	CR(PE)																		1					1												2
Tamaricaceae	*Tamarix indica*	*Kiri*			Tree	N	LC												1																				1			2
Typhaceae	*Typha agustifolia*	*Hambu-pan*		Bullrush, Cat-tail, Lessar bulsrush, Narrowleaf cat-tail	Herb	N	LC																																1			1
Turneraceae	*Turnera ulmifolia*			Twelve o'clock flower	Shrub	Ex																																				0

Family	Scientific Name	Sinhala Name	Tamil Name	English Name	Habit	Species Status	Conservation Status	Island Names																																	
								Iranaitivu North	Iranaitivu South	Kalliaditivu	Kayts	Mandaitivu	Erumaitivu	Eluvaitivu	Parititivu	Analaitivu	Nainativu	Puliyantivu-Jaffna	Puliyantivu-Mannar	Kachchativu	Kurikadduwan	Pungudutivu	Delft/ Neduntivu	Karaitivu	Palaitivu	Kakkativu	Kakerativu	Adam's Bridge Islands	Point Pedro	Kavutharimunai	Dambakola Patuna	Akkarai Beach	Valvettithurai Beach	Manatkadu Beach	Thilyadi Muruthankarni	Nayaru Beach	Pudumathalan	Chundikulam	Nanthi Kadal	Nayaru Lagoon	Kokkilai Lagoon	Total
Verbenaceae	*Lantana camera*	*Ganda-pana, Garda-pana, Katu-hinguru, Rata-hinguru, Ton-kinna*	*Arisimalar*	Common lantana, Pickly lantana, Wild sage	Shrub	Ex					1	1											1	1						1	1	1	1						1			9
	Phyla nodiflora	*Herimana-detta*	*Podutalai*	Cape weed, Cidron, Fogweed, Godet's weed, Link weed, Lippia grass, Sprain brush, Mat grass, Turkey tangle, Purple lippia	Herb	N	LC	1			1	1				1							1			1			1		1			1					1			10
	Stachytarpheta jamaicensis	*Balu-nakuta, Rata-nil-nakuta*		Berbena, Blue porterweed, Blue snakeweed, Commom anakeweed		Ex-N																									1											1
	Tectona grandis	*Thekka / Takku*	*Tekku*	Indian oak, Tek, Teak tree	Tree	Ex								1																												1
Violaceae	*Hybanthus enneaspermus*	*Maha yotu wenna*	*Oritad-tamarai*	Spade flower	Herb	N	LC					1		1	1																											3
Vitaceae	*Cayratia sp.*				Climber																		1	1																		2
	Cayratia trifolia	*Wal-Rat-diyalabu*		Threeleaf cayratia	Climber	N	LC																1																			1
	Cissus quadrangularis	*Heeressa, Sirassa, Heeressa palu*	*Arugani / Kiritti / Pirandai / Indiravalli*	Veld grape, Edible-stemmed vine	Climber	N	LC				1		1	1		1	1	1		1		1	1	1	1	1	1				1							1	1	1		17
	Cissus vitiginea	*Wal Nivithi*			Climber	N	LC													1										1												2
	Cyphostemma setosum				Climber	N	NT																1								1											2
Xanthorrhoeaceae	*Aloe vera*	*Komarica*	*Kattalai*	Indian Aloe	Herb	Ex							1	1		1	1					1	1	1							1							1				9
Zygophyllaceae	*Tribulus terrestris*	*Gokatu, Sembu nerenchi, Heen nerenchi*	*Shivanarbembu*	Puncture plant, Land caltrops	Herb	N	LC	1															1																			2

Legend

Species Status

N	Native
Ex	Exotic
Ex-N	Exotic, naturalised
END	Endemic

Conservation Status

VU	Vulnerable
CR (PE)	Critically Endangered, Possibly Extinct
CR	Critically Endangered
EN	Endangered
VU	Vulnerable
NT	Near Threatened
LC	Least concern
NE	Not evaluated

Annex 5. List of Fauna Found in the Study Area

Crimson rose (*Pachliopta hector*), Karainagar © IUCN/Sampath de A. Goonatilake

(Sources: This study; Abhirami & Shivashanthini, 2008; Asela et al., 2014; Balasubramaniam et al., 2003; IUCN, 2011b; Karunarathna et al., 2009; Packiyanathan & Wijesundara, 2014; and Veronika et al., 2013)

a) Snails

Family	Scientific Name	Species Status	Conservation Status	Islands																																			
				Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Puliyantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Puliyantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bay Road	Nagadeepa	Kurikadduwan (Causeway)	Pungudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thiyaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Nayaru Lagoon	Nayaru Beach	Kokkilai Lagoon	Total
Ariophantidae	*Cryptozona semirugata*	IN	VU	1	1	0	1	0	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
Camaenidae	*Trachia vittata*	IN	CR	0	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4

* No common or vernacular names known

b) Scorpions

Family	Scientific Name	English Name	Sinhala Name	Tamil Name	Species Status	Conservation Status	Islands																																								
							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Puliyantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Puliyantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bay Road	Nagadeepa	Kurikadduwan (Causeway)	Pungudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thiyaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Nayaru Lagoon	Nayaru Beach	Kokkilai Lagoon	Total
Buthidae	*Isometrus maculatus*	Lesser Brown Scorpion	*Gatussa*	*Therl*	IN	NE	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Hottentotta tamulus	Indian Red Scorpion	No name known	*Vellai pooran*	IN	NE	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Scorpionidae	*Heterometrus (Gigantometrus) swammerdami*	No name known	*Gonusa*	*Karupu therl/ Kodukan*	IN	NE	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

c) Dragonflies

Family	Scientific Name	English Name*	Species Status	Conservation Status	Islands																																			
					Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Puliyantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Puliyantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bay Road	Nagadeepa	Kurikadduwan (Causeway)	Pungudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thiyaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Nayaru Lagoon	Nayaru Beach	Kokkilai Lagoon	Total
Coenagrionidae	*Pseudagrion microcephalum*	Blue Sprite	IN	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Libellulidae	*Lathrecista asiatica*	Pruinosed Bloodtail	IN	NT	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Orthetrum luzonicum	Marsh Skimmer	IN	NT	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Orthetrum sabina	Green Skimmer	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Potamarcha congener	Blue Pursuer	IN	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Brachythemis contaminata	Asian Groundling	IN	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3
	Crocothemis servilia	Oriental Scarlet	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Diplacodes trivialis	Blue Percher	IN	LC	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	7

Family	Scientific Name	English Name*	Species Status	Conservation Status	Islands																																				
					Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Puliyantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Puliyantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bay Road	Nagadeepa	Kurikadduwan (Causeway)	Pungudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thiyaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Nayaru Lagoon	Nayaru Beach	Kokkilai Lagoon	Total
	Indothemis carnatica	Light tipped Demon	IN	NT	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Neurothemis intermedia	Paddyfield Parasol	IN	NT	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Trithemis aurora	Crimson Dropwing	IN	LC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Rhyothemis variegata	Variegated Flutter	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Pantala flavescens	Wandering Glider	IN	LC	1	1	0	1	0	1	1	0	1	1	1	1	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	16
	Tramea basilaris	Burmeister's Glider	IN	VU	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Tramea limbata	Sociable Glider	IN	LC	1	1	1	1	0	1	1	1	1	0	1	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	13

*No vernacular names known

d) Butterflies

Family	Scientific Name	English Name	Sinhala Name*	Species Status	Conservation Status	Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Puliyantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Puliyantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bay Road	Nagadeepa	Kurikadduwan (Causeway)	Pungudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thiyaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Nayaru Lagoon	Nayaru Beach	Kokkilai Lagoon	Total
						Islands																																				
Papilionidae	*Graphium agamemnon*	Green jay / Tailed jay	*Kola papilia*	IN	LC	1	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
	Pachliopta aristolochiae	Common rose	*Podu rosa papilia*	IN	LC	0	1	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5
	Pachliopta hector	Crimson rose	*Maha rosa papilia*	IN	LC	0	1	1	1	1	1	0	1	1	1	1	1	0	0	0	1	1	1	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	16
	Papilio demoleus	Lime butterfly	*Kaha papilia*	IN	LC	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5
	Papilio polymnestor	Blue mormon	*Maha nilaya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Papilio polytes	Common mormon	*Kalu papilia*	IN	LC	1	0	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	7
Pieridae	*Appias galane*	Lesser albatross	*Kuda sudana*	EN	LC	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	3
	Appias libythea	Striped albatross	*Iri sudana*	IN	LC	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	Belenois aurota	Pioneer	*Thambiliwan sudana*	IN	LC	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Catopsilia pomona	Lemon emigrant	*Kaha piyasariya*	IN	LC	1	0	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
	Catopsilia pyranthe	Mottled emigrant / African emigrant	*Thith-piya piyasariya*	IN	LC	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	14
	Cepora nerissa	Common gull	*Podu Punduru-sudana*	IN	LC	0	1	0	1	0	0	0	1	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	8
	Colotis amata	Small salmon arab	*Punchi rosa sudana*	IN	LC	0	1	1	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	13
	Colotis danae	Crimson tip	*Rathu-thudu sudda*	IN	VU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Colotis etrida	Little orange tip	*Heen sudana*	IN	NT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	Colotis aurora	Plain orange tip	*Podu tembiliwan sudana*	IN	VU	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	6
	Colotis fausta	Large salmon arab	*Maha rosa sudana*	IN	VU	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	4
	Delias eucharis	Jezebel	*Podu Maha-sudda*	IN	LC	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0		1	1	1	0	0	1	0	0	0	0	1	0	1	1	11
	Eurema blanda	Three-spot grass yellow	*Thun-thith kahakolaya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Eurema hecabe	Common grass yellow	*Maha kahakolaya*	IN	LC	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	6
	Hebomoia glaucippe	Great orange tip / Giant orange tip	*Yoda sudana*	IN	LC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Ixias marianne	White orange tip	*Sudu maha sudana*	IN	LC	0	1	0	0	0	0	0	1	1	0	1	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
	Ixias pyrene	Yellow orange tip	*Kaha maha sudana*	IN	LC	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Leptosia nina	Psyche	*Kalu-thith sudda*	IN	LC	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	6
	Pareronia ceylanica	Blue wanderer / Dark wanderer	*Anduru nil piyasariya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	3
Nymphalidae	*Acraea violae*	Tawny costor	*Thambily panduru-boraluwa*	IN	LC	1	1	1	1	0	1	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	1	0	0	0	1	1	1	0	0	15
	Ariadne ariadne	Angled castor	*Ruthu pathan-sariya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
	Ariadne merione	Common castor	*Podu pathan-sariya*	IN	VU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
	Byblia ilithyia	Joker	*Kawataya*	IN	VU	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Danaus chrysippus	Plain tiger	*Podu koti-thambiliya*	IN	LC	0	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	1	0	1	1	18
	Danaus genutia	Common tiger	*Iri Koti-thambiliya*	IN	LC	0	0	0	1	0	0	0	0	1	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
	Elymnias hypermnestra	Common palmfly	*Podu thal-dumburuwa*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Euploea core	Common crow	*Podu kaka-kotithiyaya*	IN	LC	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Hypolimnas bolina	Great eggfly	*Maha alankarikya*	IN	LC	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Hypolimnas misippus	Danaid Eggfly	*Kela Alankarikya*	IN	LC	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Junonia almana	Peacock pansy	*Monera alankarikya*	IN	LC	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3
	Junonia iphita	Chocolate soldier	*Podu alankarikya*	IN	LC	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Junonia lemonias	Lemon pansy	*Dumburuwan alankarikya*	IN	LC	0	0	1	0	0	0	1	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	6
	Junonia orithya	Blue pansy	*Nil alankarikya*	IN	NT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Neptis hylas	Common sailor	*Gomara selaruwa*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Neptis jumbah	Chestnut-streaked sailor	*Thambala-iri selaruwa*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1

Family	Scientific Name	English Name	Sinhala Name*	Species Status	Conservation Status	Islands																																			
						Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Puliyantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Puliyantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bay Road	Nagadeepa	Kurikadduwan (Causeway)	Pungudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thiyaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Nayaru Lagoon	Nayaru Beach	Kokkilai Lagoon	Total
	Parantica aglea	Glassy tiger	*Suduwan nil-kotithiya*	IN	LC	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	Phalantha phantha	Leopard	*Podu thith-thambiliya*	IN	LC	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	4
	Tirumala limniace	Blue tiger	*Podu nil-kotithiya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Tirumala septentrionis	Dark blue tiger	*Anduruwan nil-kotithiya*	IN	NT	0	0	1	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	Ypthima ceylonica	White four-ring	*Podu heen-dumburuwa*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lycaenidae	*Azanus jesous*	African Babul Blue	*Apricanu neelaya*	IN	LC	0	1	1	1	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	7
	Azanus ubaldus	Bright Babul Blue	*Punchi neelaya*	IN	CR	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Castalius rosimon	Common Pierrot	*Podu Mal-nilaya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Chilades lajus	Lime Blue	*Podu Panu-nilaya*	IN	LC	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Chilades parrhasius	Small Cupid	*Punchi Panu-nilaya*	IN	LC	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Euchrysops cnejus	Gram Blue	*Maha Panu-nilaya*	IN	LC	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Leptotes plinius	Zebra Blue	*Raja Iri-Neelaya*	IN	LC	0	0	0	1	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Prosotas nora	Common Lineblue	*Podu Nil-iriya*	IN	LC	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Rathinda amor	Monkey-puzzle	*Visituru vanduru nilaya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Spindasis vulcanus	Common Silverline	*Podu Ridee-nilaya*	IN	LC	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Tajuria cippus	Peacock Royal	*Monara Raja-nilaya*	IN	LC	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Tarucus nara	Striped Pierrot	*Thith-iri Mal-nilaya*	IN	LC	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Zizeeria karsandra	Dark Grass Blue	*Anduruwan Thruna-nilaya*	IN	LC	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Zizina otis	Lesser Grass Blue	*Podu Thruna-nilaya*	IN	LC	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0	0	0	0	0	0	0	7
Hesperiidae	*Zizula hylax*	Tiny Grass Blue	*Punchi Thruna-nilaya*	IN	LC	0	0	0	0	0	0	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Pelopidas agna	Little Branded Swift	*Podi-irisariya*	IN	NT	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

*No specific Tamil names known

e) Amphibians

Family	Scientific Name	English Name	Sinhala Name*	Species Status	Conservation Status	Islands																																				Total
						Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Puliyantivu	Parititivu	Analaitivu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Puliyantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bay Road	Nagadeepa	Kurikadduwan (Causeway)	Pungudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thiyaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Nayaru Lagoon	Nayaru Beach	Kokkilai Lagoon	
Bufonidae	*Duttaphrynus scaber*	Ferguson's Toad	*Fergusonge gemba*	IN	VU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Duttaphrynus melanostictus	Common house toad	*Sulaba geai gemba*	IN	LC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Microhylidae	*Kaloula taprobanica*	Common bull frog	*Visituru ratu madiya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Microhyla ornata	Ornate narrow mouth frog	*Visituru muwapatu madiya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Microhyla rubra	Red narrow mouth frog	*Ratu muwapatu madiya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Uperodon systoma	Balloon frog	*Balun madiya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Euphlyctis cyanophlyctis	Skipper frog	*Utpatana madiya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dicroglossidae	*Euphlyctis hexadactylus*	Six-toed green frog	*Sa Eangili pala madiya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Zakerana shyadrensis	Common paddy field frog	*Sulaba vel madiya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hoplobatrachus crassus	Jerdon's bull frog	*Jerdonge hala madiya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Sphaerotheca breviceps	Banded sand frog	*Tunhiri vali madiya*	IN	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Sphaerotheca rolandae	Marbled sand frog	*Lapavan vali madiya*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhacophoridae	*Polypedates maculatus*	Spotted tree frog	*Pulli gas madiya*	IN	LC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

*No specific Tamil names known.

f) Reptiles

Family	Scientific Names	English Name	Sinhala Name	Tamil Name	Species Status	Conservation Status	Islands																																		
							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Pulivantivu	Parititivu	Analativu	Erumaitivu	Kavts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Pulivantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bay Road	Nagadeepa	Kurikadduwan (Causeway)	Punguduтivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thivaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Navaru Lagoon	Navaru Beach	Kokkilai Lagoon	Total
Testudinidae	*Geochelone elegans*	Indian star tortoise	*Mevara ibba/ Taraka ibba*	*Kal amai/Kattu amai/Kattupota amai*	IN	NT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Agamidae	*Calotes calotes*	Green garden lizard	*Pala katussa*	*Pachchai onnan*	IN	LC	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Calotes versicolor	Common garden lizard	*Gara katussa*	No name known	IN	LC	0	0	1	1	0	0	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	10
	Sitana devakai	Devaka's Fanthroat lizard	*Devakage talikatussa / Vali katussa*	No name known	EN	VU	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	4
Chameleonidae	*Chamaeleo zeylanicus*	Sri Lankan chameleon	*Bodilima / Bodiliya*	*Kombi/Onthi/Pachchai onthi*	IN	EN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Gekkonidae	*Hemidactylus frenatus*	Common house-gecko	*Sulaba gehuna*	*Veetu palli*	IN	LC	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Hemidactylus leschenaultii	Bark gecko / Sycamore gecko	*Kimbul huna / Gas huna / Kumbuk huna*	*Maram palli*	IN	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Hemidactylus parvimaculatus	Spotted housegecko	*Pulli gehuna*	No name known	IN	LC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Scincidae	*Eutropis bibronii*	Bibron's sand skink	*Vali hikanala*	No name known	IN	EN	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Eutropis carinata	Common skink	*Sulaba hikanala*	*Arannai/Pambarannai*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Eutropis macularia	Bronzegreen little skink	*Pingu hikanala*	No name known	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Lankascincus fallax	Common lankaskink	*Sulaba lakhiraluva*	No name known	EN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Lygosoma punctatus	Dotted skink	*Tit hiraluhikanala*	No name known	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Varanidae	*Varanus bengalensis*	Land monitor	*Talagoya*	*Udumbu*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Acrochordidae	*Acrochordus granulatus*	Wart snake	*Diya goya/Redi naya*	No name known	IN	VU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Family	Scientific Names	English Name	Sinhala Name	Tamil Name	Species Status	Conservation Status	Islands																																				
							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Pulivantivu	Parititivu	Analativu	Erumaitivu	Kavts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Pulivantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bay Road	Nagadeepa	Kurikadduwan (Causeway)	Punudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thivaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Navaru Lagoon	Navaru Beach	Kokkilai Lagoon	Total
Pythonidae	*Python molurus*	Indian python	*Pimbura*	*Periya pambu*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Colubridae	*Ahaetulla nasuta*	Green vine snake	*Ahaetulla*	*Kankuththi pambu/pachchai pambu*	IN	LC	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
	Boiga ceylonensis	Sri Lanka cat snake	*Nidi mapila*		IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Boiga trigonatus	Gamma cat snake	*Ran mapila*	*Nedunchuvai/Poonai pambu/Wollai pambu*	IN	LC	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Coeloganthus helena	Trinket snake	*Katakaluwa*	*Kattu pambu/Kattu viriyan/Vakkannaththi*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Dendrelaphis tristis	front Spot bronze back	*Handa haldanda*	*Komberi moorkhan/ Panaiyeri pambu*	IN	LC	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Dryocalamus nympha	Bridal snake	*Geta Radanakaya / Geta karawala*	*Kattallai viriyan/Kattu viriyan*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Lycodon aulicus	Wolf snake, house snake	*Alu radanakaya*	*Kuwar pambu/Nai pambu*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Lycodon osmanhilli	Flowery wolf snake	*Mal radanakaya*	No name known	EN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Oligodon arnensis	Common kukri snake/ Banded Kukri	*Arani dath ketiya*	*Olai pambu/Pul viriyan*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Oligodon taeniolata	The variegated kukri snake / Russell's kukri snake	*Wairi dattketiya*	No name known	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Ptyas mucosa	Rat snake	*Gerandiya.*	*Sarai pambu*	IN	LC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Natricidae	*Amphiesma stolatum*	Buff striped keelback	*Aharukuka*	*Kaliyan kutti/nikitan kutti/wellala pambu*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Atretium schistosum	The Olive keelback watersnake	*Diyawarna.*	*Pachchai thanni pambu*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Xenochrophis asperrimus	The checkered keelback	*Diya polonga / Diya bariya*	*Thanni pambu*	EN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Xenochrophis cf. piscator	Checkered Keelback	*Diya bariya*	*Thanni pambu/Thanni saradi*	EN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Homalopsidae	*Cerberus rynchops*	Dog-faced water snake	*Kuna diya kaluwa.*	*Bokadam/Naithalayan/Uprana r pambu*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					0
	Enhydris enhydris	Rainbow Mud Snake	*Dedunu diyabariya*	No name known	IN	DD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Elapidae	*Bungarus caeruleus*	The common krait	*Thel karawala*	*Ennai viriyan/Karuvula pambu/Panai viriyan*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Naja naja	Indian cobra	*Naya*	*Naga pambu*	IN	LC	1	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	Astrotia stokesii	Stoke's sea snake	*Maha valakkadiya*	No name known	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Enhydrina schistosa	Hook nose sea snake	*Valakkadiya*	*Pottai pambu/Valaikadiyan*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Hydrophis cyanocinctus	The chitul	*Wairan muhudunaya*	*Kadal sarai*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

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							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Pulivantivu	Parititivu	Analativu	Erumaitivu	Kavts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Pulivantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bay Road	Nagadeepa	Kurikadduwan (Causeway)	Pungudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thivaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Navaru Lagoon	Navaru Beach	Kokkilai Lagoon	Total
	Hydrophis gracilis	John's sea snake	*Kudahis muhudu naya*	No name known	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Hydrophis lapemoides	Persian gulf seasnake	*Persiyanu bokke muhudu naya*	No name known	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Hydrophis mammilaris	Bombay gulf sea sanke	*Bombay Muhudu naya*	No name known	IN	DD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Hydrophis spiralis	Narrow banded sea snake	*Sihin mudhu naya*	No name known	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Hydrophis stricticollis	Guenther's sea snake	*Guntherge muhudunaya*	No name known	IN	DD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Kerilia jerdonii	Jerdon's sea snake	*Jerdonge muhudu naya*	No name known	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Praescutata viperina	Viperine sea snake	*Polon muhudunaya*	No name known	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Typhlopidae	*Ramphotyphlops braminus*	Common blind snake	*Dumuta kanaulla*	*Sevittu pambu/Sevi pambu*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Viperidae	*Daboia russelii*	Russell's viper	*Tith polonga.*	*Kannadi viriyan*	IN	LC	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Echis carinatus	Saw scale viper	*Vali polonga*	*Churuttai/Korattai/Surattai pambu*	IN	VU	1	0	0	0	0	0	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
	Hypnale hypnale	The Merrem's hump nose viper	*Polon thelissa*	*Kopi viriyan*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

g) Birds

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							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Pulivantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Pulivantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bav Road	Nagadeepa	Kurikadduwan (Causewav)	Punqudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thivaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Navaru Lagoon	Navaru Beach	Kokkilai Lagoon	
Phasianidae	*Francolinus pondicerianus*	Grey Francolin	*Alu Ussawatuva*	*Kowthaari*	BrR	NT	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	5
	Gallus lafayetii	Sri Lanka Junglefowl	*Sri Lanka Wali-kukula*	*Kattu koli*	END	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Pavo cristatus	Indian Peafowl	*Monora*	*Neela mayil*	BrR	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Anatidae	*Dendrocygna javanica*	Lesser Whistling-duck	*Heen Thamba-seruwa*	*Seeriya seezhkkai siravi*	BrR	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	4
	Anas strepera	Gadwall	*Alu tharava*	*Karuvaal vaaththu*	Va	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Anas penelope	Eurasian Wigeon	*Rankiralu tharava*	*Naamaththalai vaaththu*	VRWV	NE	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Anas poecilorhyncha	Spot-billed Duck	*Thith-hota tharava*	*Pullimookku vaaththu*	WV/ BrR	NE	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Anas clypeata	Northern Shoveler	*Path-thudu tharava*	*Thattaivaayan*	UCWV	NE	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Anas acuta	Northern Pintail	*Ulpenda tharava*	*Oosivaal thaara*	VCWV	NE	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Anas querquedula	Garganey	*Bemmasudu tharava*	*Neelachirahu vaaththu*	VCWV	NE	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Turnicidae	*Turnix suscitator*	Barred Button-quail	*Bola Watuuruwa*	*Kadai*	BrR	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ramphastidae	*Megalaima zeylanica*	Brown-headed Barbet	*Polos Kottoruwa*	*Paluputalai kukkuravan*	BrR	LC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	3
	Megalaima haemacephala	Coppersmith Barbet	*Rathlaye Kottoruwa*	*Semmarbu kukkuravan*	BrR	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Upupidae	*Upupa epops*	Common Hoopoe	*Podu Poroluwa*	*Kondalaaththi*	BrR	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	3

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							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Pulivantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Pulivantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bav Road	Nagadeepa	Kurikadduwan (Causewav)	Punqudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thivaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Navaru Lagoon	Navaru Beach	Kokkilai Lagoon	
Coraciidae	*Coracias benghalensis*	Indian Roller	*Dumbonna*	*Panangkaadai*	BrR	LC	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	5
Alcedinidae	*Alcedo atthis*	Common Kingfisher	*Mal Pilihuduwa*	*Siriya neela meen koththi*	BrR	LC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
	Halcyon smyrnensis	White-throated Kingfisher	*Layasudu Madi-pilihuduwa*	*Vanmarbu meen koththi*	BrR	LC	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	1	0	0	0	0	6
	Ceryle rudis	Pied Kingfisher	*Gomara-pilihuduwa*	*Siriya karuppu vellai meen koththi*	BrR	LC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2
Meropidae	*Merops orientalis*	Green Bee-eater	*Punchi Binguharaya*	*Siriya pachchai panchuruttan*	BrR	LC	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	1	7
	Merops philippinus	Blue-tailed Bee-eater	*Nilpenda Binguharaya*	*Neela vaal panchuruttan*	BrRWV	NE	1	1	1	1	1	0	1	1	1	0	1	1	1	1	1	1	1	1	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	18
Cuculidae	*Clamator jacobinus*	Pied Cuckoo	*Gomara Kondakoha*	*Kadalaik kuyil*	BrR	LC	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Cuculus micropterus	Indian Cuckoo	*Indu Kookilaya*	*Varikkuyil*	SU	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Cacomantis passerinus	Grey-bellied Cuckoo	*Kusalu Gurukoha*	*Saambal vayitru kuyil*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Surniculus lugubris	Drongo Cuckoo	*Kawudukoha*	*Karichchan kuyil*	BrR	NT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Eudynamys scolopacea	Asian Koel	*Kowula*	*Aasiaa kuyil*	BrR	LC	1	0	1	0	1	0	1	1	0	0	0	1	1	0	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	14
	Centropus sinensis	Greater Coucal	*Ati-kukula*	*Periya sembahan*	BrR	LC	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	4
Psittacidae	*Psittacula krameri*	Rose-ringed Parakeet	*Rana Girawa*	*Pachchaikili*	BrR	LC	1	0	1	0	1	1	1	1	1	0	0	0	0	0	1	1	0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	1	15
Apodidae	*Cypsiurus balasiensis*	Asian Palm Swift	*Asiaa Thal-thurithaya*	*Panai ulavaran*	BrR	LC	1	0	1	0	1	0	0	1	1	0	1	1	1	0	1	1	0	1	1	1	1	0	0	0	1	0	0	1	0	0	1	0	1	0	0	1	19
Hemiprocnidae	*Hemiprocne coronata*	Crested Treeswift	*Silu Ruk-thurithaya*	*Kondai ulavaran*	BrR	LC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	3
C	*Columba livia*	Feral Pigeon	*Podu Paraviya*	*Madu pura*	BrR	LC	1	0	0	1	0	0	1	1	1	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	10

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							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Pulivantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Pulivantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bav Road	Nagadeepa	Kurikadduwan (Causeway)	Punqudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thivaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Navaru Lagoon	Navaru Beach	Kokkilai Lagoon	
	Streptopelia chinensis	Spotted Dove	*Alu Kobeiyya*	*Pullipura*	BrR	LC	1	0	0	0	1	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	1	0	0	0	9
	Streptopelia decaocto	Eurasian Collard Dove	*Mala Kobeiyya*	*Pattaikazhuththupura*	BrR	NT	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	1	0	0	0	7
	Treron pompadora	Pompadour Green-pigeon	*Pompadoru Batagoya*	*Samba netri pachchai pura*	END	LC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Rallidae	*Amaurornis phoenicurus*	White-breasted Waterhen	*Laya-sudu Korawakka*	*Venmarbu karankoli*	BrR	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Fulica atra	Common Coot	*Podu Kithala*	*Naama kozhi*	BrR	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1
Scolopacidae	*Gallinago nemoricola*	Wood Snipe	*Wana Kaswatuwa*	*Kaattu korai ullaan*	WVa	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Gallinago gallinago	Common Snipe	*Podu Kaswatuwa*	*Visirivaal korai ullaan*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2
	Limosa limosa	Black-tailed Godwit	*Kalu-penda Gohuduwiththa*	*Karuvaal mookkan*	WV	NE	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Limosa lapponica	Bar-tailed Godwit	*Waira-penda Gohuduwiththa*	*Pattaivaal mookkan*	WV	NE	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Numenius phaeopus	Whimbrel	*Wimburali Kalikaya*	*Arivaal mookku ullaan*	WV	NE	0	0	0	0	0	0	0	1	0	1	0	1	1	1	1	0	0	1	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	9
	Numenius tenuirostris	Slender-billed Curlew	*Heen-thudu Kalikaya*	*Odungiya alaku vallaimookan*	WVa	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Numenius arquata	Eurasian Curlew	*Eurasiya Kalikaya*	*Eurasiya arivaal mookku ullaan*	WV	NE	0	0	1	0	0	0	0	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	7
	Tringa totanus	Common Redshank	*Podu Rathpa Silibilla*	*Senghaal ullaan*	WV	NE	0	0	0	1	0	0	0	0	1	1	0	0	1	1	1	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	11
	Tringa stagnatilis	Marsh Sandpiper	*Waguru Silibilla*	*Sathuppu munkoththi*	WV	NE	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	7
	Tringa nebularia	Common Greenshank	*Podu Palapa Silibilla*	*Pachchai kaal ullaan*	WV	NE	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Tringa ochropus	Green Sandpiper	*Kola Silibilla*	*Pachai munkoththi*	WV	NE	0	0	0	0	0	0	0	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Tringa glareola	Wood Sandpiper	*Wana Silibilla*	*Pori munkoththi*	WV	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Xenus cinereus	Terek Sandpiper	*Terek Silinna*	*Terek munkoththi*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Actitis hypoleucos	Common Sandpiper	*Podu Siliththa*	*Munkoththi*	WV	NE	1	0	1	0	1	0	0	1	1	1	1	1	1	1	1	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	15
	Arenaria interpres	Ruddy Turnstone	*Rath Galperaliya*	*Kulthiruppi ullaan*	WV	NE	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Calidris tenuirostris	Great Knot	*Mahanot Hinna*	*Periya Kosuullaan*	WVa	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Calidris canutus	Red Knot	*Rathu Not Hinna*	*Sirappu Kosuullaan*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Calidris alba	Sanderling	*Wali Hinna*	*Kosu Ullaan*	WV	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Eurynorhynchus pygmeus	Spoon-billed Sandpiper	*Handi Hinna*	*Karandivaayi munkoththi*	WV	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Calidris minuta	Little Stint	*Punchi Hinna*	*Sru kosu ullaan*	WV	NE	0	0	0	0	0	0	0	1	1	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
	Calidris temminckii	Temminck's Stint	*Temminck Hinna*	*Temminck kosu ullaan*	WV	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Calidris ferruginea	Curlew Sandpiper	*Kalika Hinna*	*Valaimookku munkoththi*	WV	NE	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Limicola falcinellus	Broad-billed Sandpiper	*Mathudu-hinna*	*Paruththu alaku munkoththi*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Philomachus pugnax	Ruff	*Lowichchiya*	*Pathai ullaan*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Phalaropus lobatus	Red-necked Phalarope	*Rathgela Diyawatuwa*	*Sengkazhuththu ullaan*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

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							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Pulivantivu	Parititivu	Analativu	Erumaitivu	Kavts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliadititvu	Pulivantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bav Road	Nagadeepa	Kurikadduwan (Causewav)	Punqudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thivaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Navaru Lagoon	Navaru Beach	Kokkilai Lagoon	
Rostratulidae	*Rostratula benghalensis*	Greater Painted-snipe	*Raja Ulu-kaswatuwa*	*Mayil ullaan*	BrR	VU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Burhinidae	*Burhinus oedicnemus*	Eurasian Thick-knee	*Golu-kiraluwa*	*Perungkanni*	BrR	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Esacus recurvirostris	Great Thick-knee	*Gal-kiraluwa*	*Valaimookku perungkanni*	BrR	LC	0	0	0	0	1	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Haematopodida	*Haematopus ostralegus*	Eurasian Oystercatcher	*Eurasia Bolugulla*	*Killinjal koththi*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt	*Kalupiya Ipalpawa*	*Nedungkaal ullaan*	BrR	LC	0	0	1	1	0	0	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	1	0	0	1	13
	Recurvirostra avosetta	Pied Avocet	*Gomara Avasatha*	*Valaimookku ullaan*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Charadriidae	*Pluvialis fulva*	Pacific Golden Plover	*Sethkara Ran Maha-oleviya*	*Ponnira uppu koththi*	WV	NE	0	0	0	0	0	0	0	1	0	1	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
	Pluvialis squatarola	Grey Plover	*Alu Maha-oleviya*	*Saambal uppu koththi*	WV	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Charadrius hiaticula	Common Ringed Plover	*Loku Mala Oleviya*	*Pattaani uppu koththi*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Charadrius dubius	Little Ringed Plover	*Punchi Mala Oleviya*	*Sinna Pattaani uppu koththi*	BrR & WV	VU	0	0	1	0	0	0	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	10
	Charadrius alexandrinus	Kentish Plover	*Kenti Oleviya*	*Kentish pattaani uppu koththi*	BrR & WV	VU	0	0	1	0	0	1	1	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
	Charadrius mongolus	Lesser Sand Plover	*Heen Wali Oleviya*	*Mongoliya pattaani uppu koththi*	WV	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	7
	Charadrius leschenaultii	Greater Sand Plover	*Raja Wali Oleviya*	*Periya pattaani uppu koththi*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Charadrius asiaticus	Caspian Plover	*Caspia Oleviya*	*Caspian uppu koththi*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Vanellus malabaricus	Yellow-wattled Lapwing	*Kaha-yatimal Kirella*	*Manjal mookku aathaatti*	BrR	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

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							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Pulivantivu	Parititivu	Analativu	Erumaitivu	Kavts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Pulivantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bav Road	Nagadeepa	Kurikadduwan (Causewav)	Punqudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thivaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Navaru Lagoon	Navaru Beach	Kokkilai Lagoon	
	Vanellus indicus	Red-wattled Lapwing	*Rath-yatimal Kirella*	*Sihappu mookku artkaati/aathaatti*	BrR	LC	0	0	1	0	0	0	1	1	1	0	0	1	0	1	1	1	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	1	0	0	1	14
Dromadidae	*Dromas ardeola*	Crab-plover	*Kakulu-oleviya*	*Nanduththinni*	SU	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Glareolidae	*Cursorius coromandelicus*	Indian Courser	*Indu Javalihiniya*	*Kal porukki*	BrR	CR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Glareola pratincola	Collared Pratincole	*Karapati Javasariya*	*Airoppiya thotkuruvi*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Glareola maldivarum	Oriental Pratincole	*Peradigu Javasariya*	*Thotkuruvi*	BrR	EN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Glareola lactea	Small Pratincole	*Small Pratincole*	*Sinnathth thotkuruvi*	BrR	VU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Laridae	*Larus argentatus*	Herring Gull	*Herring Galuviya*	*Kadatkaakai*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Larus cachinnans	Heuglin's Gull	*Heuglin Galuviya*	*Kadatkaakai*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Larus brunnicephalus	Brown-headed Gull	*Bora-hisa Galuviya*	*Pazhuppu thalai kadat kaakai*	WV	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	5
	Larus ridibundus	Black-headed Gull	*Kalu-his Galuviya*	*Karuppu thalai kadat kaakkai*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Larus genei	Slender-billed Gull	*Heen-thudu Galuviya*	*Melliya alaku kadat kaakkai*	SU	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Sterna nilotica	Gull-billed Tern	*Galuthudu Sayurulihiniya*	*Paruththu alaku aala*	SU	NE	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Sterna caspia	Caspian Tern	*Caspia Muhudulihiniya*	*Caspian aala*	WV	NE	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	7
	Sterna bengalensis	Lesser Crested Tern	*Heen Konda Muhudulihiniya*	*Siriya kondai aala*	WV	NE	1	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
	Sterna bergii	Great Crested Tern	*Maha Konda Muhudulihiniya*	*Periya kondai aala*	BrR	NT	1	1	0	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	0	1	11
	Sterna sandvicensis	Sandwich Tern	*Sandwich Muhudulihiniya*	*Manjal pulli alaku aala*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Sterna dougallii	Roseate Tern	*Arunu Muhudulihiniya*	*Ilanjsivappu aala*	SV/BrR	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Sterna hirundo	Common Tern	*Podu Muhudulihiniya*	*Aala*	WV/UBr	NE	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Sterna albifrons	Little Tern	*Punchi Muhudulihiniya*	*Sirita aala*	BrR	VU	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	3
	Sterna saundersi	Saunders's Tern	*Saunders Muhudulihiniya*	*Saunders aala*	BrR	CR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Sterna anaethetus	Bridled Tern	*Kadiyalam Muhudulihiniya*	*Pazhuppu irakkai aala*	PM/WV/R?	NE	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Chlidonias hybrida	Whiskered Tern	*Alupiya Kangul-lihiniya*	*Meesai aala*	WV	NE	1	1	0	0	0	1	1	1	0	1	0	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0	15
	Chlidonias leucopterus	White-winged Tern	*Sudupiya Kangul-lihiniya*	*Venirakkai aala*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Anous stolidus	Brown Noddy	*Bora Nidilihiniya*	*Pazhuppu aala*	BrR/WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Anous tenuirostris	Lesser Noddy	*Heen Nidilihiniya*	*Saambal thalai aala*	BrR/WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

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							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Pulivantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Pulivantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bav Road	Nagadeepa	Kurikadduwan (Causeway)	Punguduthivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thivaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Navaru Lagoon	Navaru Beach	Kokkilai Lagoon	
Accipitridae	*Milvus migrans*	Black Kite	*Bora Parakussa*	*Karum-parunthu*	BrR	LC	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Haliastur indus	Brahminy Kite	*Bamunu Piyakussa*	*Sem-parunthu*	BrR	LC	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	1	0	1	1	1	1			1	1			1	1	1	1	0	1	0	0	1	25
	Haliaeetus leucogaster	White-bellied Sea-eagle	*Kusa-ali Muhudukussa*	*Ven vaitru kadakkalahu/kadatkazh uku*	BrR	LC	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	3
	Spilornis cheela	Crested Serpent Eagle	*Silu Sarapakussa*	*Kondai pambu kalahu/kazhuku*	BrR	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Circus aeruginosus	Western Marsh Harrier	*Waguru Harikussa*	*Metku pponai parunthu*	WV	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Accipiter badius	Shikra	*Kurulugoya*	*Valaru*	BrR	LC	0	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Falconidae	*Falco tinnunculus*	Common Kestrel	*Podu Ukusugoya*	*Sivappu vallooru*	BrR/UWV	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Phethontidae	*Tachybaptus ruficollis*	Little Grebe	*Punchi Gembithuruwa*	*Sinna mukkulippaan*	BrR	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
Anhingidae	*Anhinga melanogaster*	Oriental Darter	*Abikava*	*Pambu thara*	BrR	LC	0	0	0	0	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Phalacrocoracidae	*Phalacrocorax niger*	Little Cormorant	*Punchi Diyakava*	*Siriya neerkaham/neerkaaham*	BrR	LC	0	0	1	1	0	1	1	1	1	1	1	1	1	0	1	1	0		0	0	0	0	0	0	0	0	0	1	1	0	1	0	1	1	0	1	18
	Phalacrocorax fuscicollis	Indian Cormorant	*Indu Diyakava*	*Naduthara neerkaaham*	BrR	LC	0	0	1	0	0	1	0	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	1	0	0	0	12
	Phalacrocorax carbo	Great Cormorant	*Maha Diyakava*	*Periya neerkaaham*	BrR	NT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ardeidae	*Egretta garzetta*	Little Egret	*Punchi Anu-koka*	*Sinnakokku*	BrR	LC	1	0	1	0	0	1	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	1	1	0	0	0	0	1	1	0	1	0	1	1	0	0	18
	Egretta gularis	Western Reef Egret	*Para Anu-koka*	*Kaarai kokku*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Ardea cinerea	Grey Heron	*Alu Koka*	*Saambal kokku*	BrR	LC	1	0	1	1	0	1	1	0	1	1	1	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	12
	Ardea purpurea	Purple Heron	*Karawal Koka*	*Senneela kokku*	BrR	LC	1	0	0	0	0	0	0	1	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	6
	Casmerodius albus	Great Egret	*Sudu maha-koka*	*Periya kokku*	BrR	LC	0	0	1	0	1	1	1	1	1	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	12
	Mesophoyx intermedia	Intermediate Egret	*Sudu Madi-koka*	*Naduththara kokku*	BrR	LC	0	0	0	0	1	1	1	1	1	1	0	1	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	13
	Bubulcus ibis	Cattle Egret	*Geri-koka*	*Unni kokku*	BrR	LC	1	1	1	0	1	1	1	1	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	0	0	1	14

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	Ardeola grayii	Indian Pond Heron	*Kana-koka*	*Mudayan*	BrR	LC	1	1	1	0	0	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0	1	1	1	0	0	0	0	1	1	0	1	0	1	1	0	0	19
	Butorides striatus	Straited Heron	*Pala-koka*	*Siriya pachchai kokku*	BrR	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	7
	Nycticorax nycticorax	Black-crowned Night Heron	*Ra kana-koka*	*Iraakkokku*	BrR	NT	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3
Phoenicopteridae	*Phoenicopterus roseus*	Greater Flamingo	*Raja Siyakkaraya*	*Periya poonaarai*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Threskiornithidae	*Plegadis falcinellus*	Glossy Ibis	*Silutu Dathuduwa*	*Jolikkum arivaal mookkan*	WV	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Threskiornis melanocephalus	Black-headed Ibis	*Hisakalu Dakaththa*	*Valai arivaal mookkan*	BrR	LC	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	8
	Platalea leucorodia	Eurasian Spoonbill	*Handialawa*	*Karandi vaayan*	BrR	LC	0	0	0	1	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	5
Pelecanidae	*Pelecanus philippensis*	Spot-billed Pelican	*Thithhota Pasthuduwa*	*Pulli alaku koozhaikkadaa*	BrR	LC	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Ciconiidae	*Mycteria leucocephala*	Painted Stork	*Lathuwakiya*	*Manjalmookku naarai*	BrR	LC	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	5
	Anastomus oscitans	Asian Openbill	*Vivarathuduwa*	*Nattakuththi narai*	BrR	LC	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Pittidae	*Pitta brachyura*	Indian Pitta	*Avichchiya*	*Thotta kallan*	WV	NE	0	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Laniidae	*Lanius cristatus*	Brown Shrike	*Bora Sabariththa*	*Paluppukeechchan*	WV	NE	1	1	1	0	0	1	0	1	0	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
	Lanius schach	Long-tailed Shrike	*Dikpenda Sabariththa*	*Neelavaal keechchaan*	BrR	VU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1

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Artamidae	*Artamus fuscus*	Ashy Woodswallow	*Alu Wanalihiniya*	*Saambal kaattu thakaivilaan*	BrR	LC	0	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5
Oriolidae	*Oriolus xanthornus*	Black-hooded Oriole	*Kahakurulla*	*Karanthalai mankuil*	BrR	LC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	3
Dicruridae	*Dicrurus macrocercus*	Black Drongo	*Kalu Kawuda*	*Karungkarichaan*	BrR	LC	0	0	1	0	0	0	0	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	6
	Dicrurus leucophaeus	Ashy Drongo	*Alu Kawuda*	*Saambal karichaan*	WV	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Monarchidae	*Terpsiphone paradisi*	Asian Paradise-flycathcher	*Asia Rahanmara*	*Arasuvaal eepidippaan*	BrR/WV	LC	1	1	0	0	1	1	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	9
Corvidae	*Corvus splendens*	House Crow	*Kolamba Kaputa*	*Kaakkai*	BrR	LC	1	1	1	1	1	1	1	1	1	1	0	1	0	0	1	1	0	1	0	0	1	1	1	1	1	0	1	1	1	1	1	0	1	0	0	1	26
	Corvus levaillantii	Large-billed Crow	*Kalu Kaputa*	*Andanakakkai*	BrR	LC	1	1	1	0	0	0	1	1	1	1	1	1	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	1	15
Aegithinidae	*Aegithina tiphia*	Common Iora	*Podu Iorawa*	*Manjal chuttu*	BrR	LC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Muscicapidae	*Muscicapa daurica*	Asian Brown Flycatcher	*Asia Bora Masimara*	*Pazhuppu eeppidippaan*	WV	NE	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Copsychus saularis	Oriental Magpie Robin	*Polkichcha*	*Karuppuvalni solaipali*	BrR	LC	1	0	1	1	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
	Saxicoloides fulicata	Indian Robin	*Indu Kalukichcha*	*Karungchuttu*	BrR	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	3
	Saxicola maurus	Siberian Stonechat			WVa	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

Family	Scientific Name	English Name	Sinhala Name	Tamil Name	Species Status	Conservation Status	Islands																																		Total
							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Pulivantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Pulivantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bav Road	Nagadeepa	Kurikadduwan (Causewav)	Punqudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thivaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Navaru Lagoon	Navaru Beach	Kokkilai Lagoon	
Sturnidae	*Sturnus pagodarum*	Brahminy Starling	*Bamunu Sharikawa*	*Karungkondai nadhanavaai*	WVa	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Acridotheres tristis	Common Myna	*Mayna*	*Nahanavai/ naahanavaai*	BrR	LC	1	1	1	1	1	0	1	1	1	0	0	1	1	0	1	1	0	0	0	0	1	0	1	1	0	0	0	1	0	1	1	1	1	0	0	1	21
Hirundinidae	*Hirundo rustica*	Barn Swallow	*Atu Wahilihiniya*	*Thahaivilan*	WV	NE	0	0	0	1	0	0	0	0	1	1	1	1	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	9
Pycnonotidae	*Pycnonotus cafer*	Red-vented Bulbul	*Kondaya*	*Chinnaan*	BrR	LC	0	0	1	1	0	0	0	1	1	1	0	0	0	0	1	1	0	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	0	1	1	13
	Pycnonotus luteolus	White-browed Bulbul	*Bamasudu Kondaya*	*Ven puruwa chinnaan*	BrR	LC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	5
Cisticolidae	*Cisticola juncidis*	Zitting Cisticola	*Iri Pawansariya*	*Naattu visirivaal kathirkuruvi*	BrR	LC	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Prinia socialis	Ashy Prinia	*Alu Priniya*	*Saambal kathir kuruvi*	BrR	LC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
	Prinia inornata	Plain Prinia	*Sarala Priniya*	*Kathirkuruvi*	BrR	LC	0	0	0	1	0	0	0	1	0	0	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
Sylviidae	*Acrocephalus dumetorum*	Blyth's Reed Warbler	*Blyths Panraviya*	*Blyth naanal kathitkuruvi*	WV	NE	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Orthotomus sutorius	Common Tailorbird	*Battichcha*	*Thaiyatkarakadirkuruvi*	BrR	LC	0	0	1	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	5
Timalidae	*Turdoides affinis*	Yellow-billed Babbler	*Demalichcha*	*Manjal alahu chillamban*	BrR	LC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Pycnonotidae	*Eremopterix grisea*	Ashy-crowned Sparrow Lark	*Kirulalu Gekurulu-thulikawa*	*Saambal thalai vaanampaadi*	BrR	LC	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2
	Alauda gulgula	Oriental Skylark	*Peradigu Ahas Thulikawa*	*Vaanampaadi*	BrR	LC	0	0	1	0	0	0	0	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	12

Family	Scientific Name	English Name	Sinhala Name	Tamil Name	Species Status	Conservation Status	Islands																																		Total
							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Pulivantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Pulivantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bav Road	Nagadeepa	Kurikadduwan (Causewav)	Pungudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thivaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Navaru Lagoon	Navaru Beach	Kokkilai Lagoon	
Dicaeidae	*Dicaeum erythrorhynchos*	Pale-billed Flowerpecker	*Lathudu Pililichcha*	*Tickel malarkoththi*	BrR	LC	0	0	1	0	0	0	0	1	1	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	7
Nectariniidae	*Nectarina zeylonica*	Purple-rumped Sunbird	*Nithamba Dam Sutikka*	*Uudapitta thenchuttu*	BrR	LC	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5
	Nectarina asiatica	Purple Sunbird	*Dam Sutikka*	*Uuda thenchuttu*	BrR	LC	1	0	0	1	1	1	1	1	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9
	Nectarina lotenia	Loten's Sunbird	*Lotenge Sutikka*	*Loten thenchuttu*	BrR	LC	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		1	0	0	0	0	0	2
Passeridae	*Passer domesticus*	House Sparrow	*Gekurulla*	*Chittukkuruvi*	BrR	LC	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Motacillidae	*Anthus richardi*	Richard's Pipit	*Richard Varatichcha*	*Richard nettaikkaali*	WV	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Anthus rufulus	Paddyfield Pipit	*Keth Varatichcha*	*Vayal nettaikkaali*	BrR	LC	0	1	1	1	0	0	0	0	1	1	0	0	1	1	1	1	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	11
	Anthus godlewskii	Blyth's Pipit	*Blyth Varatichcha*	*Blyth nettaikkaali*	WV	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ploceidae	*Ploceus philippinus*	Baya Weaver	*Ruk Wadukurulla*	*Thookanaangkuruvi*	BrR	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Estrididae	*Lonchura malabarica*	Silverbill	*Sarala Weekurulla*	*Venthondairchillai*	BrR	VU	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Lonchura punctulata	Scaly-breasted Munia	*Laya Kayuru Weekurulla*	*Pullichillai*	BrR	LC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
	Lonchura malacca	Black-headed Munia	*Hisakalu Weekurulla*	*Karunthalaichillai*	BrR	LC	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3

h) Mammals

Family	Scientific Name	English Name	Sinhala Name	Tamil Name	Species Status	Conservation Status	Islands																																				
							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Pulivantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Pulivantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bay Road	Nagadeepa	Kurikadduwan (Causeway)	Punguditivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thivaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Nayaru Lagoon	Nayaru Beach	Kokkilai Lagoon	Total
Soricidae	*Suncus murinus*	Common musk shrew	*Podhu Hik-miya*	*Pothu muunjuru*	IN	LC	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0												3
Pteropodidae	*Pteropus giganteus*	Flying fox	*Ma-vavula*	*Periya nari vauval*	IN	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												1
Vespertilioninae	*Pipistrellus coromandra*	Indian pipistrel	*Indu Koseta-vavula*	*Inthian kutti-vauval*	IN	VU	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0												2
Cercopithecidae	*Macaca sinica*	Sri Lanka toque monkey	*Sri Lanka Rilawa*	*Ilangai thoppi thalai kurangu/Siru kurangu*	EN	LC	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												1
	Semnopithecus priam	Grey langur	*Eli-wdura*	*Thoppi thalai kurangu/Siru kurangu*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0												2
Canidae	*Canis familiaris*	Domestic dog	*Balla*	*Nai*	Domestic	NE	0	0	1	1	0	0	0	0	1	0	0	1	1	1	0	0	1	0	0	0	1	0	0	0	0												8
Felidae	*Felis cattus*	Domestic cat	*Balala/ Pusa*	*Poonai*	Domestic	NE	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0												2

Family	Scientific Name	English Name	Sinhala Name	Tamil Name	Species Status	Conservation Status	Islands																																	Total
							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Puliyantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Pulivantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bay Road	Nagadeepa	Kurikadduwan (Causeway)	Pungudutivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thivaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Navaru Lagoon	Navaru Beach	Kokkilai Lagoon	
Herpestidae	*Herpestes fuscus*	Brown mongoose	*Bora Mugatiya*	*Kapila keerie-pulle*	IN	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												1
	Herpestes edwardsii	Grey mongoose	*Alu Mugatiya*	*Naraiththa keerie-pulle*	IN	LC	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												2
Elephantidae	*Elephas maximus*	Elephant	*Etha / Aliya*	*Yanei*	IN	EN	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												1
Bovidae	*Bubalus bubalis*	Domestic water buffalo	*Mee Haraka*	*Erumai*	Feral/ domestic	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0												2
	Bos indicus	Domestic hump-backed cattle	*Sinhala Elaharaka/ Batu Haraka*		Feral/ domestic	NE	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	1	0	0	1	0	1	0	0												9
	Capra hircus	Domestic goat	*Eluva*	*Aadu*	Domestic	NE	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0												3
Cervidae	*Axis axis*	Spotted deer	*Tith Muwa*	*Pulli mann*	IN	LC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												1
	Muntiacus muntjak	Barking deer	*Olu Muwa / Weli Muwa*	*Sembli-mann*	IN	NT	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												1
Suidae	*Sus scrofa*	Wild boar	*Wal Ura*	*Kattu pantri*	IN	LC	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0												2
Equidae	*Equus asinus*	Donkey	*Buruwa / Puttalam Buruwa*	*Kaluthai*	Feral/ domestic	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0												1
	Equus caballus	Delft ponies	*Diweldiwa Poniya*	*Delft kudirai*	Feral/ domestic	NE	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												1
Hystricidae	*Hystrix indica*	Porcupine	*Ittewa*	*Mullam pantri*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0												2

Family	Scientific Name	English Name	Sinhala Name	Tamil Name	Species Status	Conservation Status	Islands																																			Total
							Eluvaitivu	Kachchativu	Karaitivu	Mandaitivu	Puliyantivu	Parititivu	Analativu	Erumaitivu	Kayts	Delft	Palaitivu	Iranaitivu South	Iranaitivu North	Kakerativu	Kalliaditivu	Puliyantivu	Sandbar 4	Kakkativu	Palikhudah	Palk Bay Road	Nagadeepa	Kurikadduwan (Causeway)	Punguduitivu	Punnali Khadu	Dambakola Patuna	Valvettithurai	Akkarai Beach (Thondaimanaru Estuary)	Point Pedro	Manatkadu Beach	Thiyaldi Muruthankarni	Chundikulum	Pudumathalan	Nanthi Kadal	Nayaru Lagoon	Nayaru Beach	Kokkilai Lagoon	
Muridae	*Rattus rattus*	Common rat	*Podu Ge Miya*	*Veedtu eli*	IN	LC	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0												2
	Tatera indica	Antelope rat	*Weli-miya*	*Inthian vel'-eli*	IN	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0												2
Sciuridae	*Funambulus palmarum*	Palm squirrel	*Leena*	*Sinna anil/Mara anil*	IN	LC	0	0	1	0	0	0	1	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0												6
Leporidae	*Lepus nigricollis*	Black-naped hare	*Wal Hawa*	*Kattu muyal*	IN	LC	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0												3
Balaenopteridae	*Balaenoptera acutorostrata*	Mink Whale	*Minki thalmaha*	*Minke thimingilam*	Marine	LC	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0												4
	Balaenoptera brydei	Bryde's Whale	*Brydige thalmaha*	*Broodes thimingilam*	Marine	NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0												1
	Balaenoptera physalus	Fin Whale	*Waral thalmaha*	*Fin thimingilam*	Marine	EN	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0												2
	Megaptera novaeangliae	Hump-backed Whale	*Molli thalmaha*	*Koon muthuku thimingilam*	Marine	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0												1
Delphinidae	*Peponocephala electra*	Melon-headed Dolphin	*Puhulolu thalmaha*	*Mulaam palath thalai-thiminkalam*	Marine	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0												1
	Pseudorca crassidens	False killer Whale	*Boru minimaru thalmaha*	*Poli kolaith-thiminkalam*	Marine	DD	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0												2
	Sousa chinensis	Indo-pPacific hump-backed Dolphin	*Kabara mulla*	*Koonmuthuhu tholpin*	Marine	NT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0												1
	Stenella longirostris	Spinner Dolphin	*Sannali mulla*	*Neel munchi sulal ongil*	Marine	DD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0												1
	Tursiops truncatus	Bottle nosed Dolphin	*Digasubu mulla*	*Kuppi mukkinai oonjia*	Marine	LC	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0												1
Physeteridae	*Physter macrocephalus*	Sperm Whale	*Manda thalmaha*	*Vinthu Thimingilam*	Marine	VU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0												1
Dugongidae	*Dugong dugon*	Common Dugong/ Sea cow	*Muhudu ura*	*Kaddu-pandri*	Marine	VU	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0												1

Legend

SpS	Species status		CR/PE	Critically Endangered/Possibly Extinct
CoS	Conservation status		CR	Critically Endangered
IN	Indigenous		EN	Endangered
EN	Endemic		VU	Vulnerable
EX	Exotic		NT	Near Threatened
BrR	Breeding Resident		DD	Data Deficient
WV	Winter Visitor		LC	Least Conscern
WVa	Winter Vagrant		NE	Not Evaluated
Va	Vagrant			
SU	Status Unknown			
SV	Summer Visitor			
PM	Passege Migrent			
R	Resident			
UWV	Uncertain Winter Visitor			
UBr	Uncertain Breeding Resident			

Annex 6. List of Coral Species Found in the Study Area

Acropora formosa **(Erumaitivu) © IUCN/Arjan Rajasuriya**

Family	Species
Acroporidae	*Acropora aculeus*
	Acropora anthocercis
	Acropora acuminata
	Acropora aspera
	Acropora cytherea
	Acropora divaricata
	Acropora digitifera
	Acropora hyacinthus
	Acropora millepora
	Acropora microphthalma
	Acropora muricata
	Acropora samoensis
	Acropora secale
	Montipora aequituberculata
	Montipora digitata
	Montipora foliosa
	Montipora verrucosa
Agariciidae	*Pavona maldivensis*
	Pavona venosa
Dendrophyllidae	*Turbinaria mesenterina*
	Turbinaria peltata
Faviidae	*Favia favus*
	Favia pallida
	Favia speciosa
	Favites abdita
	Favites complanata
	Favites halicora
	Montastrea curta
	Diploastrea heliopora
	Goniastrea edwardsi
	Goniastrea pectinata
	Goniastrea retiformis
	Goniastrea aspera
	Platygyra lamellina
	Platygyra sinensis
	Platygyra daedalea
	Leptoria phrygia
	Leptastrea purpurea
	Cyphastrea chalcidicum
	Echinopora lamellosa
	Podabacia crustacea
Merulinidae	*Merulina ampliata*
	Hydnophora microconos
Mussidae	*Symphyllia agaricia*
	Symphyllia radians

Family	Species
Oculinidae	*Galaxea astreata*
Pocilloporidae	*Pocillopora damicornis*
	Pocillopora elegans
	Pocillopra verrucosa
	Pocillopora eydouxi
Poritidae	*Porites rus*
	Porites lutea
	Porites lobata
	Goniopora sp
	Goniopora stokesi
Siderastreidae	*Pseudosiderastrea tayamai*

Annex 7. List of Reef Fish Species Found in the Study Area

Coral reef at Point Pedro showing two species of butterfly fish (*Chaetodon decussatus and C. andamanensis*), a damselfish (*Abudefduf vaigiensis*) and a snapper (*Lutjanus rivulatus*) © IUCN/Arjan Rajasuriya

The following list draws upon University of Ruhuna (2010).

Family	Species	Common name (English)	Common name (Sinhala)	Common name (Tamil)
Acanthuridae	*Acanthurus bariene*	Black-spot surgeonfish		
	Acanthurus dussumieri	Eyestripe surgeonfish		
	Acanthurus leucosternon	Powderblue surgeonfish	*Nil detha*	*Nila orandeya*
	Acanthurus lineatus	Lined surgeonfish	*Sevaya*	
	Acanthurus mata	Elongate surgeonfish		
	Acanthurus nigricauda	Epaulette surgeonfish	*Kalu orava*	
	Acanthurus xanthopterus	Yellowfin surgeonfish	*Orava, Peela*	
	Ctenochaetus striatus	Striated surgeonfish		
	Naso brachycentron	Humpback unicornfish		
	Naso brevirostris	Spotted unicornfish		
Apogonidae	*Ostorhinchus aureus*	Ring-tailed cardinalfish		
	Ostorhinchus angustatus	Broadstriped cardinalfish		
	Apogon sp.	-		
	Taeniamia fucata	Orangelined cardinalfish		
	Cheilodipterus macrodon	Large toothed cardinalfish		
	Rhabdamia gracilis	Luminous cardinalfish		
Blenniidae	*Cirripectes* sp	-		
	Salarias sp	-		
Caesionidae	*Caesio caerulaurea*	Blue and gold fusilier		
	Caesio cuning	Redbelly yellowtail fusilier	*Battalaya*	*Vaipara*
	Caesio xanthonota	Yellowback fusilier		
	Pterocaesio chrysozona	Goldband fusilier	*Hemala, Ilitta, Illitta*	*Peroomkilche*
	Pterocaesio tile	Dark-banded fusilier		
Carangidae	*Caranx heberi*	Blacktip trevally	*Atanagul parava, Guru parawa, Pareh*	
	Caranx sp	-		
	Gnathanodon speciosus	Golden trevally	*Kabara parava*	*Pathi-parah, Pilli-parah*

Family	Species	Common name (English)	Common name (Sinhala)	Common name (Tamil)
	Scomberoides lysan	Doublespotted queenfish	*Gona kattava, Katta, Katu bollu kattava, Nil kattava*	*Katta*
Chaetodontidae	*Chaetodon auriga*	Threadfin butterflyfish		
	Chaetodon andamanensis	Andaman butterflyfish		
	Chaetodon collare	Redtail butterflyfish		
	Chaetodon decussatus	Indian vagabond butterflyfish		
	Chaetodon lineolatus	Lined butterflyfish		
	Chaetodon lunula	Raccoon butterflyfish		
	Chaetodon octofasciatus	Eightband butterflyfish		
	Chaetodon trifascialis	Chevron butterflyfish		
	Chaetodon trifasciatus	Melon butterflyfish		
	Chaetodon vagabundus	Vagabond butterflyfish		
Chanidae	*Chanos chanos*	Milkfish	*Vaikkaya*	*Pal-kendai, Palmeen, Tulucandul*
Cirrhitidae	*Paracirrhites forsteri*	Blackside hawkfish		
Clupeidae	Unidentified sp	-		
Echeneidae	*Echeneis naucrates*	Live sharksucker		
Ephippidae	*Platax teira*	Longfin batfish		
Gerridae	*Gerres* sp	-		
Gobiidae	*Amblygobius* sp	-		
	Amblygobius sphynx	Sphinx goby		
	Salarias sp	-		
	Valenciennea sexguttata	Sixspot goby		
Kyphosidae	*Kyphosus vaigiensis*	Brassy chub		
Haemulidae	*Plectorhinchus ceylonensis*	Sri Lanka sweetlips	*Boraluwa*	
	Plectorhinchus gibbosus	Harry hotlips		
	Plectorhinchus schotaf	Minstrel sweetlips	*Boraluva, Gal modha, Gobeya*	*Kallu kallewa, Tholen*
	Pomadasys guoraca	Grunter		
Hemiramphidae	*Hemiramphus* sp	-		
Holocentridae	*Myripristis* sp	-		
	Sargocentron diadema	Crown squirrelfish		

Family	Species	Common name (English)	Common name (Sinhala)	Common name (Tamil)
	Sargocentron sp	-		
Labridae	*Cheilinus chlorourus*	Floral wrasse	*Muthu gireva, Pothy gireva*	*Kili meen*
	Halichoeres sp.	-		
	Halichoeres margaritaceous	Pink-belly wrasse		
	Stethojulis sp	-		
	Thalassoma janseni	Jansen's wrasse		
Latidae	*Psammoperca waigiensis*	Waigieu seaperch		*Chenganni*
	Lates sp.	-		
Leiognathidae	*Leiognathus* sp.	-		
	Karalla daura	Goldstripe ponyfish		*Veri-kare*
Lethrinidae	*Lethrinus harak*	Thumbprint emperor		
	Lethrinus lentjan	Pink ear emperor		
	Lethrinus sp	-		
Lutjanidae	*Lutjanus argentimaculatus*	Mangrove red snapper	*Thambalaya, Thabalaya, Adallu, Dhala, Guru thambuwa*	*Adallu, Antaleyan*
	Lutjanus fulvus	Blacktail snapper	*Pen dhalla, Padalla*	
	Lutjanus gibbus	Humpback red snapper		
	Lutjanus johnii	John's snapper		*Parithi*
	Lutjanus rivulatus	Blubberlip snapper	*Badawa, Badava, Kuruviliya, Rumasse*	*Kuruvilla, Baddau cuttu-pirium*
	Lutjanus russelli	Russell's snapper		
Microdesmidae	*Ptereleotris evides*	Blackfin dartfish		
Monodactylidae	*Monodactylus argenteus*	Silver moony	*Kapu handha, Kapuwa*	*Moolen, Purrandee*
Mugilidae	*Sicamugil cascasia*	Yellowtail mullet		
	Mugil cephalus	Flathead grey mullet	*Is barri godeya, Kitheya, Thel godeya*	*Kasmeen, Manalei, Manla*
	Mugil sp	-		
Mullidae	*Parupeneus barberinus*	Dash-and-dot goatfish		
	Parupeneus indicus	Indian goatfish	*Gal nagareya*	*Kal-nakharai, Kulnaveri, Mussara*
	Upeneus tragula	Freckled goatfish		

Family	Species	Common name (English)	Common name (Sinhala)	Common name (Tamil)
Nemipteridae	*Scolopsis bimaculatus*	Thumbprint monocle bream	*Pol ranna*	*Kundul*
	Scolopsis vosmeri	Whitecheek monocle bream	*Andiya, Andiya Kiri vavoula, Kiri vavoula*	*Andiyan, Kundul, Pal muta, Pompton*
Ostraciidae (Boxfish)	*Ostracion cubicus*	Yellow boxfish		
	Ostracion meleagris	Whitespotted boxfish		
Pempheridae	*Pempheris oualensis*	Silver sweeper		
	Pempheris vanicolensis	Vanikoro sweeper		
Pinguipedidae	*Parapercis clathrata*	Latticed sandperch		
Plotosidae	*Plotosus lineatus*	Striped eel catfish	*Mudhu hunga*	*Irung-keleru, Kanjakalutti, Kedal-changuan*
Pomacanthidae	*Pomacanthus semicirculatus*	Semicircle angelfish		
Pomacentridae	*Abudefduf bengalensis*	Bengal sergeant		
	Abudefduf sordidus	Blackspot sergeant		
	Amblyglyphidodon leucogaster	Yellowbelly damselfish		
	Amphiprion clarkii	Yellowtail clownfish		
	Amphiprion sebae	Sebae anemonefish		
	Chrysiptera unimaculata	Onespot demoiselle		
	Neoglyphidodon bonang	Ocellated damsel		
	Neopomacentrus azysron	Yellowtail demoiselle		
	Neopomacentrus cyanomos	Regal demoiselle		
	Pomacentrus indicus	Indian damsel		
	Stegastes nigricans	Dusky farmerfish		
Pseudochromidae	*Pseudochromis fuscus*	Brown dottyback		
	Pseudochromis dilectus	Dilectis Dottyback		
Scaridae	*Chlorurus rhakoura*	Raggedfin parrotfish	*Muli gireva*	
	Scarus ghobban	Blue-barred parrotfish		
Scatophagidae	*Scatophagus argus*	Spotted scat	*Ilattiya*	

Family	Species	Common name (English)	Common name (Sinhala)	Common name (Tamil)
Serranidae	*Cephalopholis boenack*	Chocolate hind		*Verri-cullawah*
	Cephalopholis formosa	Bluelined hind	*Kangan kossa*	*Verri kaleva*
	Epinephelus caeruleopunctatus	Whitespotted grouper		
	Epinephelus longispinis	Longspine grouper		
	Epinephelus malabaricus	Malabar grouper	*Gal bola, Gal kossa, Gas bola*	*Kalava, Punni-calawah*
Siganidae	*Siganus argenteus*	Streamlined spinefoot		
	Siganus canaliculatus	White-spotted spinefoot		
	Siganus javus	Streaked spinefoot	*Nava*	*Ottah*
	Siganus stellatus	Brown-spotted spinefoot		
	Siganus virgatus	Barhead spinefoot		
Syngnathidae	*Corythoichthys* sp	-		
Sparidae	*Acanthopagrus berda*			
Sphyraenidae	*Sphyraena obtusata*	Obtuse barracuda	*Theliya, Ulava*	
Synodontidae	*Synodus jaculum*	Lighthouse lizardfish		
Tetraodontidae	*Arothron nigropunctatus*	Blackspotted puffer	*Paiththaya*	
	Canthigaster solandri	Spotted sharpnose		
Zanclidae	*Zanclus cornutus*	Moorish idol		

Annex 8. List of Invertebrates Recorded during the Survey and Beach Collection from Kachchaitivu

Skin diver with spiny lobster (*Panulirus versicolor*), Vankalai Lagoon
© IUCN/Arjan Rajasuriya

Species were identified by Dr. Malik Fernando

Group	Family	Common name	Species
Molluscs	Cardiidae	Cockles	Unidentified
	Fissurellidae	Limpets	Unidentified
	Muricidae	Venus comb murex	*Murex* sp
		Ramose murex	*Chicoreus ramosus*
	Mytilidae	Sea mussels	Unidentified
	Olividae	Olive shells	Unidentified
	Pectinidae	Scallops	Unidentified
	Pteridae	Winged oysters	Unidentified
	Strombidae	Common spider conch	*Lambis lambis*
		Chiragra spider conch	*Lambis chiragra*
	Tridacnidae	Fluted giant clam	*Tridacna squamosa*
	Loligonidae	Pharaoh cuttlefish	*Sepia pharaonis*
Crustaceans		Painted spiny lobster	*Panulirus versicolor*
		Mantis shrimp	*Squilla* sp
		Western king prawn	*Penaeus latisulcatus*
		Blue swimming crab	*Portunus pelagicus*
		Giant mud crab	*Scylla serrata*
		Mangrove swimming crab	*Thalamita crenata*
		Barnacles	Unidentified
Echinoderms	Holothuroidea (Sea cucumbers)	Brown sandfish	*Bohadschia marmorata*
		Lollyfish	*Holothuria atra*
		Pinkfish	*Holothuria edulis*
		Golden Sandfish	*Holothuria scabra*

Annex 9. Legislation Related to Biodiversity

Bar-tailed godwits (*Limosa lapponica*) winter visitors to Vankalai Nature Reserve © Sriyanie Miththapala

(Extracted directly from MoMD&E, 2016 and recent amendments)

Act	Last amendment	Implementing Agency	Relevance to biodiversity conservation
Fauna and Flora Protection Ordinance, No. 02 of 1937	**Act No. 22 of 2009**	**DWC; has empowered the SLPD and FD also to implement.**	**Directly protects habitats and species.**
Provisions			
This enactment plays the major role in affording protection to indigenous species of animals and plants. It has been amended several times and the latest amendments are by Act No. 22 of 2009. The intention of this enactment are ‘to provide for the protection of and conservation of the fauna and flora of Sri Lanka and their habitats, for the prevention of commercial and other misuse of the fauna and flora and their habitats and for the conservation of biodiversity of Sri Lanka’. The provisions of this ordinance are broad and wide, cover the protection of both habitats and species, and also have provisions to regulate the import and export of animals. The protection of habitats is effected by making them parts of a protected area or declaring the habitat as a protected area. Three types of protected areas, namely National Reserves, Sanctuaries and Managed Elephant Reserves can be declared under this ordinance. The type known as National Reserves can be declared only on state (government) land and the entry in to these areas are restricted according to the category, and there are seven categories under which a National Reserve can be made. These are the Strict Nature Reserves, National Parks, Nature Reserves, Jungle Corridors, Marine National Parks, Refuges and Buffer Zones. The Sanctuaries and Managed Elephant Reserves can have both state and private land within their areas, and there are certain controls and restrictions on activities that are permitted in private lands that fall within these areas. The concept of declaring Managed Elephant Reserves covering both state and private lands is to ensure that both human beings and elephants can live in harmony and not in conflict with each other and is intended to strike a balance between different needs, rather than acquiring such lands to resettle people and declare National Reserves. The protection of species under this enactment saw a major new development through the latest amendment which brought in a new category of protected species known as Strictly Protected Species for mammals, reptiles and birds. Elephants are provided with a special degree of protection because of their ecological, cultural, social and economic importance and because they are under severe pressure and threat. A special feature in the protection afforded to elephants is the provisions that allow people to keep tame elephants and to keep the tusks of dead elephants in their possession, both being old and traditional practices that are allowed under the law by regulating through a process of registration and permits. There are 20 species of mammals, 16 species of reptiles and 63 species of birds that are listed as Strictly Protected Species. These are given a higher degree of protection by increasing the punishments provided for offences against these species. The protection of birds covers all the migrants (including vagrants and stragglers) that come within the area belonging to Sri Lanka and has been afforded in a manner that any new species that is seen within Sri Lanka will automatically be protected by law. It is noteworthy that all other migrant species belonging to different categories in addition to birds — such as reptiles, mammals and even dragonflies — are enjoying protected status in Sri Lanka.			

Act	Last amendment	Implementing Agency	Relevance to biodiversity conservation
However, domestic animals are not protected under this ordinance and have been excluded from being provided protection. This enactment also excludes providing protection to exotic or alien species of animals, although the entry of such species is regulated by making it mandatory to import them only under a permit issued by the DWC.			
Forest Conservation Ordinance, No. 16 of 1907	**Act No. 65 of 2009. This amendment changed the hitherto used short title of the enactment (Forest Ordinance) to the Forest Conservation Ordinance.**	**The Conservator-General of Forests is responsible for the enforcement of the provisions of the FCO.**	**Directly protects forests and species within these forests.**
Provisions			
This amendment changed the hitherto used short title of the enactment (Forest Ordinance) to the Forest Conservation Ordinance. The intention of the FCO is to 'Consolidate and amend the law relating to the conservation, protection and the sustainable management of the forest resources and the utilization of forest produce'. It can be made use of both to provide protection to habitats and regulate and maintain the sustainable use of plant species through a system of permits. This enactment provides for the declaration of three types of protected areas, namely, Conservation Forests, Reserved Forests (Forest Reserves) and Village Forests. All these can be declared on state land only. The Conservation Forests have the highest degree of protection under this enactment and entry is restricted for non-extractive practices only. The type known as Village Forests is declared to cover an area that is used for different purposes by a community or several communities and certain kinds of extractive practices are permitted inside such areas. A very important feature in this enactment is that it provides protection to all state lands within Sri Lanka that are not declared as protected areas by this or by another enactment. Hence, this provision allows these areas to enjoy a certain degree of protection by regulating some of the activities that can be carried out in such lands. The other important feature in the Forest Conservation Ordinance is that it allows the extractive use of flora under a regulatory system. This is effected through the issue of permits to collect different parts of plants which are grouped under the broad category known as 'Forest Produce'. This category is divided into two, namely Major Forest Products and Minor Forest Products and the former includes timber, while the latter includes parts of plants, as well as medicinal herbs. This system, which has been in place and has been in practice for more than a century, ensures the sustainable use of forest resources. The permit system is geared to ensure the sustainable use of biological material that falls within the category of Forest Products. According to the Forest Ordinance (Amendment Act, No. 65 of 2009), the Conservator-General of Forests is required to prepare and implement a Management Plan for Reserved Forests, in such manner as may be prescribed, for the purposes of conservation of bio-diversity, soil and water and for the preservation of its unique ecosystem, genetic resources and as a habitat of rare and endemic species of flora and fauna. The Minister shall make			

Act	Last amendment	Implementing Agency	Relevance to biodiversity conservation
regulations applicable either to the whole or any specified area of the Reserved Forests in respect of the administration and management of the Reserved Forests. In several areas, mangrove forests areas have been brought under the purview of the Forest Department and declared as forest reserves. However, as yet, management plans, as required under the Forest Ordinance, have not yet been prepared.			
The National Heritage Wilderness Areas Act, No. 03 of 1988	**None**	**The Conservator-General of Forests is the competent authority**	**Directly protects habitats.**
Provisions			
The intention is to provide protection to habitats that are important in terms of biodiversity, as well as for other aspects such as aesthetic values, and geological and hydrological importance of such areas. It does not have provisions to provide any direct protection to species. This enactment is unique in having provisions to afford protected status to an area for reasons other than the value of biodiversity. Therefore, this enactment enables the declaration of areas with special biodiversity values — such as habitats of rare and endangered species — as well as for the protection of wilderness areas for their importance as watersheds and areas that have special aesthetic value. The protection provided to an area declared under this act permits the entry into such areas and allows only non-extractive uses such as tourism and recreational purposes. This act has been made use of to declare only one area as a National Heritage Wilderness Area and that is the Sinharaja National Heritage Wilderness Area. However, it has the potential to afford much needed protection to places that have high biodiversity value.			
The National Environmental Act, No. 47 of 1980	**Act. No. 56 of 1988**	**The Central Environmental Authority (CEA) is responsible for the enforcement of the provisions of this Act.**	**Supports biodiversity conservation by controlling pollution and requiring mitigatory measures for development projects through mandatory EIAs.**
Provisions			
The intention of this enactment is to provide for the protection, management and enhancement of the environment and for the prevention, abatement and control of pollution of the environment. The main activities under this enactment are the protection of the physical environment by regulating the discharge of substances that may cause pollution to the environment, through a process of licensing. It also has provisions for environmental approval for certain types of new ventures and projects and this approval has to be preceded by an Initial Environmental Examination (IEE) or an Environmental Impact Assessment (EIA) report. The subject matter that is evaluated under these reports includes the biodiversity of the areas that will be affected by the proposed activities and suitable mitigatory measures for the proposed activities. Thus, both the licensing process and the environmental approval have indirect roles in protecting biodiversity. In addition, there are provisions in this act to designate areas as Environmental Protection Areas where the			

Act	Last amendment	Implementing Agency	Relevance to biodiversity conservation
biodiversity value of a particular area merits it to be designated as an Environmental Protection Area. An important feature of this act is that there can be regulations to prohibit, restrict, regulate and approve certain types of activities within such areas and these are effected through regulations.			
Coast Conservation Act No. 57 of 1981	**Act No. 64 of 1988**	**The Director of the CC&CRMD**	**Protects biodiversity in coastal areas.**
Provisions			
The Coastal Zone is defined under this act. This enactment details regulations related to activities permitted within this zone, as well as those prohibited. The Director of the CC&CRMD can request an EIA for development activities in the coastal zone. The Coast Conservation Amendment Act No. 49 of 2011 provides for the establishment of Special Management Areas (SMAs) and for which regulations can be made with regard to activities, access arrangements and administrative matters. This is an improvement on the earlier Special Area management (SAM) concept which had no legal status. The Coastal Zone and Coastal Resources Management Plan of 2016 has identified a total of 40 SMA sites. SMAs provide a collaborative approach for coastal communities and stakeholders to plan and implement resource management within a defined geographic area of land within the Coastal Zone. A total of 12 SMA sites from Mannar, Jaffna and Mullaitivu have been proposed in the Coastal Zone and Coastal Resources Management Plan of 2016. SMAs proposed under the Coastal Zone and Coastal Resources Management Plan of 2016 in the study area are: Manatkadu dunes, Jaffna estuary (town area), Thondaimanaru Lagoon, Kankesanthurai and Keeramalai coastal areas, Mandaitivu, Delft, Nainativu, Karainagar (including Casuarina beach) coastal area, Navali coastal area in the Jaffna District; Gulf of Mannar, Thalaimannar coastal area, Silavatturai, Arippu and Aruvi Aru coastal area in the Mannar District and Nanthi Kadal Lagoon and Nayaru Estuary in Mullaitivu (CCZRMP, 2016). The amended Act No. 49 of 2011 has also extended CC&CRMD mandate to 100m of the riparian land of the water bodies (rivers/lagoons) within the coastal zone and has also extended CC&CRMD mandate to implement coastal resources management programs including coordination, information dissemination, research, etc. Therefore, the CC&CRMD can now be directly and actively involved in natural resources conservation and management, including conservation and management of mangroves and sea grass beds, for example, in the coastal zone.			

Act	Last amendment	Implementing Agency	Relevance to biodiversity conservation
Fisheries and Aquatic Resources Act, No. 02 of 1996	**Act No. 22 of 2006**	**The Director-General of the Department of Fisheries and Aquatic Resources is responsible for the enforcement of this enactment.**	**Supports biodiversity conservation by declaring areas protected for regulation of fisheries, which supports other species and habitats in the area. It also protects some marine species.**

Provisions

The objectives of this enactment are to provide for the management, regulation, development and the conservation of the fisheries and aquatic resources of Sri Lanka. This enactment has defined the term 'fish' in a very broad manner and covers not only fish but every species of aquatic fauna from invertebrates to marine and aquatic mammals. The definition of aquatic resources covers every type of aquatic plants including seaweeds and thus, has a broad range of applications. This enactment has provisions to declare protected areas and to declare protected areas and to prohibit the import of any species that can have an adverse impact on aquatic organisms.

There are two types of special areas that can be declared under this enactment, namely the Fisheries Management Areas and Fisheries Reserves. The former are declared for the sustainable management of a particular area and is done through regulations that ensure the sustainable use of fisheries resources and through a process of public participation in decision-making in relation to the area. The type known as Fisheries Reserves is intended to protect a particular resource or the resources that are found in a particular area by restricting and controlling the activities that are allowed in such an area. This provision can be made use of to protect the spawning areas of aquatic animals and to ensure the sustainable use of fisheries resources.

This enactment provides for the declaration of any species from being overexploited and to protect species by restricting or preventing the catching and landing of such species and also through the regulation of exports. Marine mammals and marine turtles and thrasher sharks are protected by prohibition of the catching of these species, while the export trade has been regulated by prohibition of the export of certain species of freshwater and marine species, the mandatory need for permits for the export of yet other species. Another important aspect in this enactment is the powers to prevent the import of any species of aquatic organisms by formulation of regulations. This will help protect biodiversity by preventing the introduction of predators and invasive alien species. The regulations made during the past have prohibited the import of 24 species of fish, which can become either predators or invasive species if released to the water bodies.

Since 2006, the Fisheries Act has been amended in 2013, 2016 and 2017. The Fisheries and Aquatic Resources (Amendment) Act No. 35 of 2013 provides for ecosystem- based collaborative management of designated fisheries/areas through Fisheries Management Coordinating Committees composed of representatives from fishing communities, local administration, local political authority, fisheries agencies (DFAR, NARA, NAQDA), other development (SLTDA, FD, DWC) and regulatory agencies (CC&CRMD, MEPA, UDA), enforcement authorities, women's groups, etc. These committees

Act	Last amendment	Implementing Agency	Relevance to biodiversity conservation
are required to develop and implement fisheries management plans in their designated areas, incorporating elements of environment/ecosystem conservation. The Fisheries and Aquatic Resources (Amendment) Act No. 11 of 2017 prohibits fishing using bottom trawls.			
Marine Pollution Prevention Act No. 59 of 1981	**Act No. 35 of 2008**	**The Marine Environment Protection Agency is responsible for the enforcement of this enactment.**	**Supports biodiversity conservation by preventing one of the drivers of its loss, in the marine sector.**
Provisions			
This enactment mandates the Marine Environment Protection Agency (MEPA) to prevent, control and reduce pollution in the territorial waters of Sri Lanka or any other maritime zone, its fore-shore and the coastal zone of the country.			
Antiquities Ordinance No. 9 of 1940	**Act No. 24 of 1998**	**The Director-General of Archaeology is responsible for the enforcement of this enactment.**	**Indirectly supports biodiversity conservation through the declaration of archaeological reserves which serve as habitats for species.**
Provisions			
This ordinance and its amendments provides for the Director General of Archaeology to declare certain areas as Archaeological Reserves, where encroachment of any kind is prohibited. It also empowers the Director General of Archaeology to conduct an Archaeological Impact Assessment of areas that may be affected by development, industrial or other projects proposed by anyone and implement any mitigatory measures that may be required.			
Agrarian Development Act No. 46 of 2000	**Act No. 46 of 2011**	**Commissioner General of Agriculture Agrarian Development is responsible for the enforcement of this enactment.**	**Paddy areas are known to be areas of high species richness, so this act indirectly supports biodiversity conservation.**
Provisions			
This act prohibits the conversion of paddy land for a purpose other than agricultural cultivation without the written permission of the Commissioner General.			
Plant Protection Act No. 35 of 1999		**The Director of Agriculture is responsible for the enforcement of this enactment.**	**This has direct bearing on the spread of invasive alien species**
Provisions			
This act provides for the prevention of wild plants, seeds and plant diseases and controls the introduction of new plant species.			

Act	Last amendment	Implementing Agency	Relevance to biodiversity conservation
Soil Conservation Act No. 25 of 1959	**Act No. 24 of 1996**	**Director of Agriculture, Ministry of Agricultural Development is responsible for enforcement of this enactment**	**Soil erosion damages water ways that become sedimented, thus degrading aquatic habitats. This act, therefore, indirectly supports biodiversity by preventing habitat degradation.**
Provisions			
This act and its amendments provides for the conservation of soil resources, mitigation of soil erosion, and protection against floods and drought.			
Felling of Trees (Control) Act No. 9 of 1951	**Act No. 1 of 2000**	**The Conservator-General of Forests is the competent authority**	**This has a direct bearing on threatened species**
Provisions			
This act provides for the prohibition and control of the felling of selected tree species.			
State Lands Ordinance No. 8 of 1947	**Act No.13 of 1949**	**State lands vested in Village councils and Local Authorities– District Secretary Other lands - President**	**This act has a direct bearing on habitat loss and degradation.**
Provisions			
This ordinance provides for how state lands and their resources – rivers, streams and reservoirs – should be allocated and managed.			
Mahaweli Authority of Sri Lanka Act No. 23 of 1979	**Act No. 59 of 1993**	**The Minister of MoMDE with the approval of the President**	**This has a very large bearing on biodiversity conservation the Mahaweli Basin covers 16% of the land area of Sri Lanka.**
Provisions			
This act established the Mahaweli Authority of Sri Lanka and provides for the protection watershed areas and protection of the physical environment of the Mahaweli area.			
Urban Development Authority Law 1978	**Act No. 41 of 1988**	**Urban Development Authority**	**This act has a direct bearing on habitat loss and degradation.**
Provisions			
This law and its amendments promote integrated planning and implementation of economic, social and physical development in areas declared as urban development areas, all development activity within the said areas fall within the purview of the Urban Development Authority			

Act	Last amendment	Implementing Agency	Relevance to biodiversity conservation
Water hyacinth Ordinance No. 9 of 1909	**No amendment**	**Department of Agriculture**	**This act has a direct bearing on the spread of IAS.**
Provisions			
This controls the introduction and proliferation of water hyacinth and other weeds and invasive plants in the country.			
The National Zoological Gardens Act No.14 of 1982	**No amendment**	**Department of National Zoological Gardens**	**This act has a direct bearing on biodiversity conservation as it sets up an *ex-situ* conservation site.**
Provisions			
This Act set governs the management and administration of the National Zoological Gardens.			
The Botanic Gardens Ordinance No. 31 of 1928.	**Law No. 32 of 1973**	**Department of National Botanic Gardens**	**This act has a direct bearing on biodiversity conservation as it sets up an *ex-situ* conservation site.**
Provisions			
This deals with *ex-situ* conservation of plants and concerns the management and administration of the National Botanic Gardens.			
Mines and Minerals Act No. 33 of 1992	**Act No. 66 of 2009**	**Board of Management of the Geological Surveys and Mines Bureau**	**This act has a direct bearing on habitat loss and degradation.**
Provisions			
Regulates mining, exploitation, processing, trading and export of minerals.			
Irrigation Ordinance No. 32 of 1946 (as amended) – Part VI.	**Act No. 13 of 1994**	**Commissioner of Irrigation**	**This has a bearing on e-flows.**
Provisions			
Deals with environmental aspects of water, irrigation and land use in irrigated agricultural activities.			
Control of Pesticides Act No. 33 of 1980 (as amended).	**Act No. 31 of 2011**	**Registrar of Pesticides**	**This has a direct bearing on pollution of soil and water.**
Provisions			
Provides for the licensing and regulation of the import, packing, labelling, storage, formulation, transportation, sale and use of pesticides.			

Act	Last amendment	Implementing Agency	Relevance to biodiversity conservation
Municipal Councils Ordinance No. 29 of 1947 (as amended).	**Act No. 34 of 2014**	**Municipal Councils**	**This has a direct bearing on solid waste and water pollution.**
Provisions			
Provides for the establishment of Municipal Councils and outlines their powers, duties and responsibilities in relation to the built environment and areas such as waste disposal and sanitation.			
Urban Councils Ordinance No. 61 of 1939 (as amended).	**Act No. 35 of 2014**	**Urban Councils**	**Same as above.**
Provisions			
Provides for the establishment of Urban Councils and outlines their powers, duties and responsibilities in relation to the built environment and matters such as waste disposal and sanitation.			
***Pradeshiya Sabha* Act No. 15 of 1987 (as amended).**	**Act No. 36 of 2014**	***Pradeshiya Sabhas***	**Same as above.**
Provisions			
Provides for the establishment of *pradeshiya sabhas* and outlines their powers, duties and responsibilities in relation to the built environment and matters such as waste disposal and sanitation.			
Water Resources Board Act No. 29 of 1964 (as amended).	**Act No. 42 of 1999**	**Water Resources Board**	**This has a direct bearing on the prevention of water pollution and attempting to reverse habitat loss.**
Provisions			
Establishes the Water Resources Board and sets out its duties, which include promotion of afforestation, preventing the pollution of rivers, streams and other water courses, and formulation of national policies relating to the control and use of water resources of the country.			

Act	Last amendment	Implementing Agency	Relevance to biodiversity conservation
Sri Lanka Land Reclamation and Development Corporation Act No. 15 of 1968 (as amended).	**Act No. 49 of 2011**	**Sri Lanka Land Reclamation and Development Corporation**	**This has direct bearing on the loss of wetlands.**
Provisions			
Empowers the Sri Lanka Land Reclamation and Development Corporation (SLLR&DC) to reclaim low-lying lands and wetlands			

Mangroves for the Future
INVESTING IN COASTAL ECOSYSTEMS
www.mangrovesforthefuture.org

Mangroves for the Future

Mangroves for the Future (MFF) is a unique partner-led initiative to promote investment in coastal ecosystem conservation for sustainable development. Co-chaired by IUCN and UNDP, MFF provides a platform for collaboration among the many different agencies, sectors and countries which are addressing challenges to coastal ecosystem and livelihood issues. The goal is to promote an integrated ocean-wide approach to coastal management and to building the resilience of ecosystem-dependent coastal communities.

MFF builds on a history of coastal management interventions before and after the 2004 Indian Ocean tsunami. It initially focused on the countries that were worst affected by the tsunami -- India, Indonesia, Maldives, Seychelles, Sri Lanka and Thailand. More recently it has expanded to include Bangladesh, Cambodia, Myanmar, Pakistan and Viet Nam.

Mangroves are the flagship of the initiative, but MFF is inclusive of all types of coastal ecosystem, such as coral reefs, estuaries, lagoons, sandy beaches, sea grasses and wetlands.

The MFF grants facility offers small, medium and regional grants to support initiatives that provide practical, hands-on demonstrations of effective coastal management in action. Each country manages its own MFF programme through a National Coordinating Body which includes representation from government, NGOs and the private sector.

MFF addresses priorities for long-term sustainable coastal ecosystem management which include, among others: climate change adaptation and mitigation, disaster risk reduction, promotion of ecosystem health, development of sustainable livelihoods, and active engagement of the private sector in developing sustainable business practices. The emphasis is on generating knowledge, empowering local communities and advocating for policy solutions that will support best practice in integrated coastal management.

Moving forward, MFF will increasingly focus on building resilience of ecosystem dependent coastal communities by promoting nature based solutions and by showcasing the climate change adaptation and mitigation benefits that can be achieved with healthy mangrove forests and other types of coastal vegetation.

MFF is funded by Sida, Norad, Danida and the Royal Norwegian Embassy in Thailand.

Learn more at: www.mangrovesforthefuture.org