

# BAR REEF MARINE SANCTUARY MANAGEMENT PLAN 2019-2023



## Acknowledgement

Enhancing biodiversity conservation and sustenance of ecosystem services in environmentally sensitive areas is a GEF funded project, implemented by the Ministry of Mahaweli Development and Environment and supported by UNDP with the objective of operationalizing Environmentally Sensitive Areas (ESA) as a mechanism for mainstreaming biodiversity management into development in areas of high conservation significance. The project focuses on integrating biodiversity conservation into the mix of diverse land use patterns in environmentally sensitive areas. In this context, the project supports the Department of Wildlife Conservation to effectively mitigate threats emanating from outside the protected areas and create better linkages between wider landscape management and protected areas. Accordingly, this management plan was prepared for Bar Reef Sanctuary. Already strategic management frameworks are in place for Wilpattu protected area complex and a management plan for Kahalle-Pallekele Protected Area Complex. Hence, together, these key documents can bring in scientifically backed stakeholder approved management to these important protected areas in Kala Oya basin. Since Bar Reef is located right outside the mouth of River, Bar Reef is within the influential zone of the basin. Hence, preparation of a management plan for the sanctuary connects the landscape and sea scape calls for strategic management at basin level.

An ecologically sensitive area is tentatively defined as “Landscape/seascape with a mosaic of mixed land/marine uses that merit special management considerations on account of their high national and global significance based on biodiversity, natural and cultural features and/or ecological functions that warrants its special management in the best long-term interest of people and the environment, as it is particularly susceptible to irreversible negative impacts from mismanagement or overuse.

As a sanctuary, Bar Reef can be conserved only with participation of stakeholders as sea is still considered as an open source; hence presence of multi stakeholder interests both private and government. UNDP also acknowledges Dr. S. Jayakody, consultant to the production of this management plan, for the preparation of the document. Ministry of Mahaweli Development and Environment is acknowledged for providing the support throughout the process. All the officials of Department of Wildlife Conservation both at regional and national level are acknowledged for provision of information and arranging consultations. All the stakeholders representing political authority, other government ministries, district and divisional secretariats, departments, academia, national and international non-government conservation and civil organization that actively participated to consultations and validation of this document are acknowledged for their support. All fishing communities that actively participated to consultative meetings are acknowledged for their support and enthusiasm.

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## List of Abbreviations

B & B	Bread and Breakfast
BDS	Biodiversity Secretariat
BRMS	Bar Reef Marine Sanctuary
CBO	Community Based Organizations
CCD & CRM	Department of Coast Conservation & Coastal Resource Management
CEA	Central Environment Authority
CSD	Civil Security Department
DA	Department of Agriculture
DCC	District Coordinating Committee
DEd	Department of Education
DFAR	Department of Fisheries and Aquaculture Resources
DG	Director General
DoI	Department of Irrigation
DMC	Disaster Management Center
Dis.S	District Secretariat
DS	Divisional Secretariat
DoS	Department of Survey
DWC	Department of Wildlife Conservation
EAM	Ecosystem Approach to Management
EIA	Environmental Impact Assessment
ESA	Environment Sensitive Area
FD	Forest Department
FFPO	Fauna and Flora Protection Ordinance
FS	Fisheries Societies
IUCN	International Union for the Conservation Nature
LUPPD	Land Use and Policy Planing Department
M & E	Monitoring and Evaluation
MASL	Mahaweli Development Authority Sri Lanka
MEPA	Marine Environment Protection Authority
MER	Manage Elephant Reserve
MoF	Ministry of Finance
MoFAR	Ministry of Fisheries and Aquaculture Resource
MoMDE	Ministry of Mahaweli Development and Environment
MoSDW	Ministry of Sustainable Development and Environment
MoT	Ministry of Tourisum
MOU	Memorandum of Understanding
NAQDA	National Aquaculture Development Authority
NARA	National Aquatic Resources Researches and Development Authority
NCPCP	North Central Province Canal Project
NHDA	National Housing Development Authority
NLDB	National Livestock Development Board

NP	National Park
NWP	North Western Province
PAC	Protected Area Complex
PEA	Provincial Environment Authority
RPIC	Regional Project Implementation Committee
SLTDA	Sri Lanka Tourism Development Authority
SLTB	Sri Lanka Tourist Board
SLP	Sri Lanka Police
STC	Sri Lanka Timber Corporation
UNDP	United Nations Development Programme
WB	Water Board

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## Executive Summary

Bar Reef Marine Sanctuary was declared on 1992, and at the time of declaration, it was the largest marine protected area in the country with an extent of 30,670 ha (307 km<sup>2</sup>). The area is shallow coastal zone of the continental shelf to a depth of over 30m. The Bar Reef Marine Sanctuary (BRMS) is a complex of offshore continental shelf patch reefs constituting one of the largest coral reef systems in Sri Lanka with the nearest coral patches lying approximately 2 km from the shore. BRMS is subjected to strong winds and currents during the Southwest monsoon between May to October, which often results in decreased underwater visibility. Northerly surface currents during the southwest monsoon bring turbid water from the nearby Puttalam estuary and several small river outlets such as Aruvi Aru, Kal Aru, Modaragam Aru, and the one large river Kala Oya which open to sea directly from due east of one major coral reef. Geographically the area lies in the North-western dry zone of Sri Lanka with low rainfall, intense sunlight and seasonal strong winds. Annual rainfall ranges between 1,000-1,200 mm and average temperatures are around 28.2°C.

The submarine geography/bathymetry of the Kalpitiya seas is key to the high abundance and diversity of marine mammals in the area. On one side the carving in of the continental shelf in between the South Indian headland and North West Sri Lanka terminating below the Mannar land bridge brings in an effective deep oceanic water cove close to Kalpitiya and Mannar area. The predominant oceanic currents during the South west monsoon would drive against the walls of this bathymetric formation resulting in formation of an up-welling area in the sea that feeds a key food chain and may be the focus of many marine life aggregations observed in the area at that time including whales, sea birds and fishes.

Although declared a Marine Sanctuary in 1992, management of the reef is at basic level. Until the end of the civil war the area had limited access hence limited anthropogenic disturbance. Immediately after war, the area came globally known for kite surfing, dolphin and whale watching. The development of these two activities was mostly community based with very little involvement of the government. Gradually with the reputation of the area, new business ventures catering for accommodation and other touristic needs have been established. Some fishermen are now part-time safari boat operators, divers and tourist guides. Later with the influx of tourists DWC has established an office and a kiosk for issuing tickets.

BRMS consist of an offshore patch reef of two types; the shallow coral reef and the deeper sandstone reef. Prior to coral bleaching live coral cover was nearly 80% with *Acropora* spp. accounting for nearly 90% of all corals. The shallow coral reef habitats of Bar Reef were composed mainly of branching and tabulate *Acropora* and foliaceous *Echinopora*. However most of these corals died due to coral bleaching in 1998. Despite the recovery of corals after 1998 El-Nino, the reef was badly affected by 2016 El Nino and the live coral cover was again reduced to less than 1% in some sections of shallow water reefs. Two surveys conducted in 2017 as a part of surveys of ESA project confirmed the threat of elevated surface sea water temperature on coral hence the entire ecosystem. This resulted in a broad dialogue between policy makers to grass root level communities and with the support of all stakeholders, two identified areas of the reef were demarcated with buoys and was declared as “Left aside for restoration zone”.

This management plan was prepared using Ecosystem Approach to Management (EAM) model (Staples & Funge-Smith, 2009). Accordingly, a consultative process was used and all stakeholders from grass root level to policy makers were contacted and were invited to stakeholder meetings. Methodologies suggested by EAM approach namely Matrix analysis, Venn Diagrams and snowballing were used in identifying the key stakeholders. Stakeholder interactions, their intensity and the type of interaction (positive, negative, neutral) were analysed. The results were used in identifying the management structure of the proposed plan as well as key stakeholders that can assist DWC in implementing the management plan. Similarly, threats and issues of the protected area and the peripheral coastal areas were collected using published data, information from the DWC, divisional secretariats and stakeholder consultations. Threats and issues were analyzed using matrix analysis. The proposed plan was prepared considering the prioritized threats and issues.

The plan under the vision of ***“Bar Reef Marine Sanctuary serving the nation with a rich biodiversity and healthy ecosystems with optimal social wellbeing”*** was prepared for the period of 2019-2023.

The enabling policies, legislature and relevant conventions are presented. Regional Project Implementation Committee (RPIC) which is headed by the Assistant Director of the region and Ranger of BRMS and all regional key stakeholders will implement the projects at ground level. Regional Project Implementation Committee will report to Director General (DG) of the Department of Wildlife Conservation and District Coordinating Committees (DCC) of Puttalama. DG of DWC will be responsible for new gazette notifications, disbursement of funds, procurement of goods and services, monitoring and evaluating and obtaining national level clearance for activities.

In order to achieve the vision, four long term goals are set. An operational goal (to operationalize an enabling BRMS management environment to effectively serve ecological and human needs), an environment goal (to ensure a thriving ecosystem rich in biodiversity with long term integrity and resilience), a socioeconomic goal (to safeguard optimum living conditions to community and satisfaction from services derived by BRMS to all) and a governance goal (to warrant an enabling governance framework strengthened to manage BRMS and beyond with committed participation from stakeholders) are proposed. Expected outcomes are given for each goal. Goals are divided into objectives and strategic actions enabling the formulation of activities. Time frame indicates expected year of initiation and completion.

The objectives set for each goal intend to address identified key threats that have the highest likelihood of occurrence and the highest impact. Illegal fishing activities, bleaching of coral reefs, unregulated whale and dolphin watching resulting in disturbance to marine mammals, killing of *Dugong dugong*, solid waste and effluents from the basin as well as from the vicinity, accidental and purposeful killing of dolphins, coral trampling, removal of ornamental fish, in stable income, marginalised communities such as females that have little access to income generation, lack of inter-agency coordination, lack of continuously updated data, constructions and developments in the shoreline resulting in land encroachment and erosion of beach, undue political pressures, inadequate staff/skilled staff, inadequate infrastructure and insufficient communication between DWC and other stakeholders are the key threats addressed in this management plan.

The main strategic actions proposed are ensuring the management of newly demarcated zone and monitoring, collating already published data and conducting annual studies to establish the status of ecosystems, estimating the population status and distribution of key species such as dugongs, spinner dolphins and whales, coordinated boundary patrolling and systematic surveillance of the area with Sri Lanka Navy, restoration of degraded habitats, invasive management and afforestation of degraded mangroves, improvement of community based tourism, creation of alternative livelihoods and improvement of sustainable tourism models with options for marketing, are some of the proposed strategic actions.

For the socio-economic outcomes, communities should be engaged in activities that provide them with a sustainable income and elevated living conditions. For this purpose, several business models are proposed that can be carried out with minimal disturbance to ecosystems. Additionally, value addition of fishery products, value creation and post-harvest management of fisheries resources that are sustainably harvested and establishing home-stay facilities for visitors are proposed.

This management plan also proposes two visitor centers one at Kudawa and the other at Gange Vadiya and developing conservation tourism, species specific tourism such as for whales. Also, empowering visitors, villagers and hoteliers are planned. Empowering and engaging females of the area for proposed business models are also discussed.

Several infrastructure developments such as new visitor center, boats, new bungalows for visitors and establishment of new beat office in Uchchimunai is proposed. This management plan also contains communication, monitoring and evaluation and sustainability plans. A compilation of current information on community socio economics, species and ecosystems are given as annexes. Additionally, recommendations for broader landscape management of Wilpattu Protected Area Management are also annexed.

## 1 An Introduction to Bar Reef Marine Sanctuary

Bar Reef Marine Sanctuary is located 8° 32' 0 N and 79° 40' 0 E to 8° 8' 0 N and 79° 48' 0 E; 943513 N and 353252 E to 899234 N and 367795 E; northwest of the Kalpitiya Peninsula in the North-western Province (Figure 1). The sanctuary was declared in 1992 and the extent of the area is 30,670 ha (307 km<sup>2</sup>). The area is shallow coastal zone of the continental shelf to a depth of over 30m. The Bar Reef Marine Sanctuary (BRMS) is a complex of offshore continental shelf patch reefs constituting one of the largest coral reef systems in Sri Lanka with the nearest coral patches lying approximately 2km from the shore (Ohman et al., 1998, Ohman et al., 1997). The marine sanctuary includes shallow coral reefs and sandstone habitats located deeper than the true coral reefs. The sanctuary is located offshore of the Puttalam estuarine system which includes Dutch Bay and Portugal Bay.

BRMS is subjected to strong winds and currents during the southwest monsoon between May to October, which often results in decreased underwater visibility. Northerly surface currents during the southwest monsoon bring turbid water from the nearby Puttalam estuary and several small river outlets such as Aruvi Aru, Kal Aru, Modaragam Aru, and the one large river Kala Oya which open to sea directly from due east of one major coral reef. Geographically the area lies in the northwestern dry zone of Sri Lanka with low rainfall, intense sunlight and seasonal strong winds. Annual rainfall ranges between 1,000-1,200 mm and average temperatures are around 28.2°C. The continental shelf of the west coast of Sri Lanka makes a sharp turn close to Kalpitiya as it joins the Indian shelf forming a large bay like structure with forming a terminus to the Northward flow of currents in the deeper sea regions. This feature allows creation of conditions for the formation of up-welling currents from the deep sea which feeds a system that include migration of many species of animals including Marine Mammals and Sea Birds to visit this part of the shores. Seas around Kalpitiya include areas with narrow continental shelf as well as areas that have steep shelf slopes which also help to bring many species of marine mammals to areas closer to the shore.

The submarine geography/bathymetry of the Kalpitiya seas is key to the high abundance and diversity of marine mammals in the area. On one side the carving in of the continental shelf in between the South Indian headland and North West Sri Lanka terminating below the Mannar land bridge brings in an effective deep oceanic water cove close to Kalpitiya and Mannar area. The predominant oceanic currents during the south west monsoon would drive against the walls of this bathymetric formation resulting in formation of an up-welling area in the sea that feeds a key food chain and may be the focus of many marine life aggregations observed in the area at that time including whales, sea birds and fishes. The Continental shelf is very narrow around Talawila and Kandakuliya headland reaching in as close as 5 km from shore. The continental slope is also very steep in the area causing a sudden drop off allowing most Whales and Marine mammals to approach close to the coast while still staying in the safety of the deep oceans and make quick forays over the shelf to feed in shallower seas. The steep continental slope walls cause up welling of nutrient rich waters and food resource which may be an additional attraction for the marine mammal Oceanic sea birds and other animals to gather within the area (Weerakkody, 2017). Puttalam lagoon is quite shallow in most places and contains extensive sea grass habitats dominated by sea grass genera *Cymodoce*, *Halophila* and *Syringodium*. These extensive seagrass beds provide important habitats for endangered Dugong.

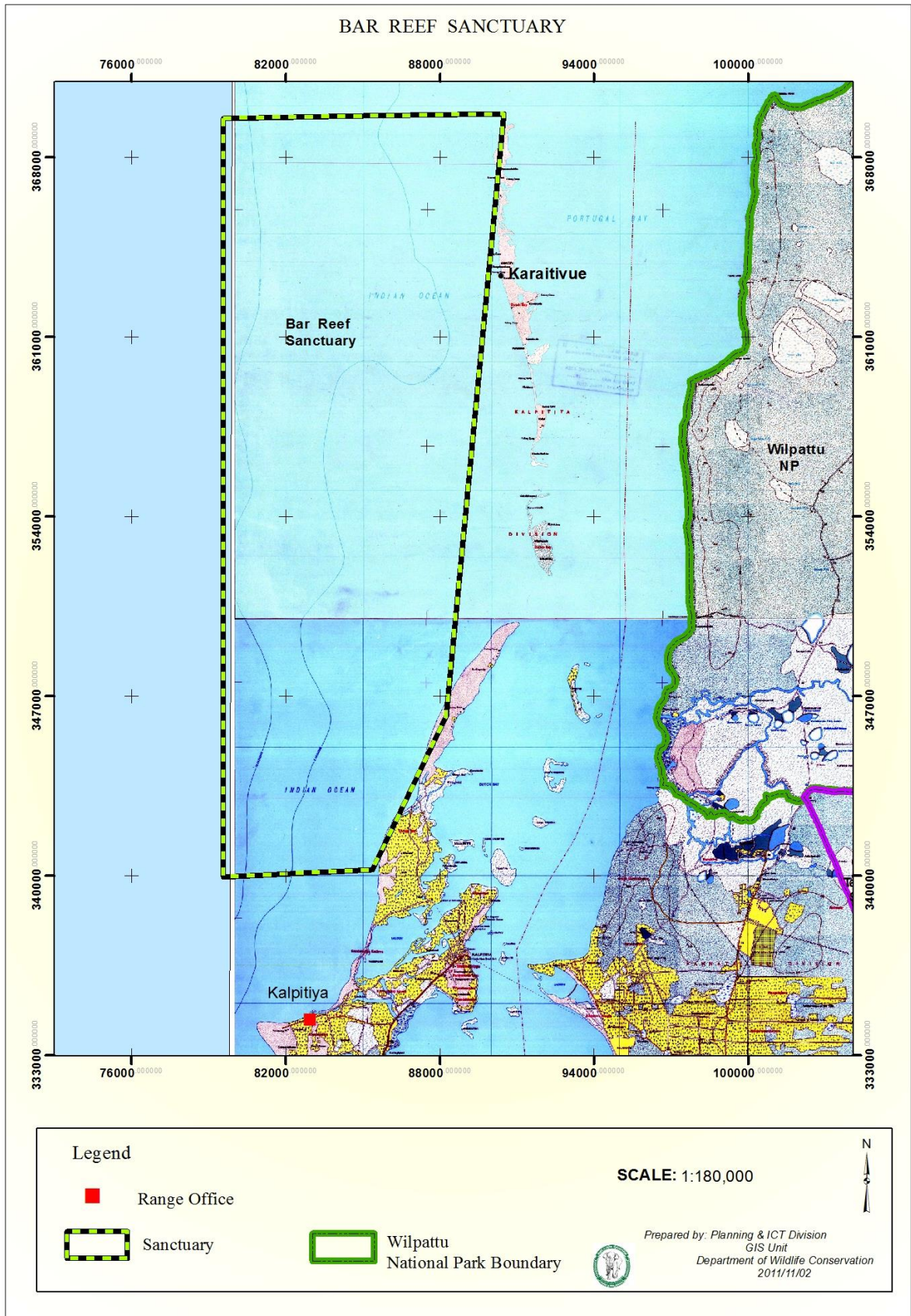


Figure 1: Bar Reef Marine Sanctuary

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Although declared a Marine Sanctuary in 1992, management of the reef is at primary level. Until the end of the civil war the area had limited access hence limited anthropogenic disturbance. Immediately after war, the area came globally known for kite surfing, dolphin and whale watching. The development of these two activities was mostly community based with very little involvement of the government. Gradually with the reputation of the area, new business ventures catering for accommodation and other touristic needs have been established. Some fishermen are now part-time safari boat operators, divers and tourist guides. Later with the influx of tourists DWC has established an office and a kiosk for issuing tickets.

Ecologically the area is an example for distinct marine and near coastal ecosystems that can form around a peninsula, river mouth and shallow continental shelf. Reefs in Sri Lanka can be categorized into three habitat types as true coral reefs, sandstone reefs and rocky habitats (Swan 1983; Rajasuriya & De Silva 1988; Rajasuriya et al., 1995; Rajasuriya & White 1995).

True coral reefs are composed of corals growing on a limestone and coralline substrate of dead and living coral and are characterized by a high live coral cover. In Sri Lanka, coral reefs occur either as fringing reefs or continental shelf patch reefs from shallow near shore waters to offshore areas. True coral reefs are found mainly in the Gulf of Mannar between Kalpitiya Peninsula and Mannar Island as fringing and offshore patch reefs, and as fringing reefs in the east coast around Trincomalee and Batticaloa Districts, the southern coast from Akurala to Tangalle, and around the Jaffna Peninsula in the north (Swan, 1983; Rajasuriya & De Silva 1988; Rajasuriya et al., 1995; Rajasuriya et al., 1998).

In addition, there are isolated patch reefs of coral on consolidated hard substrate along the seabed, mainly on the western and eastern sides of the island within a depth range of 15 to 25 m and vary in extent from about a hectare to several hectares. Sandstone reefs are common around the island and can be found within the continental shelf.

Many sandstone reefs occur as ridges running parallel to the shoreline, and according to Swan (1983) these may represent former coastlines that have been submerged due to sea

level changes in the past. Rocky shorelines and submarine structures based on geological formations are found along most coastal areas of the island (Cooray, 1984). Live coral cover is low in these habitats and is often less than 5% of total benthic cover.

BRMS consist of an offshore patch reef of two types; the shallow coral reef and the deeper sandstone reef. The coral reef is situated from the surface to a depth of around 10 m while the sandstone reef is located deeper than 18 m. The coral reef area is composed mainly of branching and tabulate corals although fairly large coral domes are found at around 10m depths. The deeper reefs are mainly sandstone substrate with corals growing on it. It is characterized by rocks, small hills and flat plateau like structures with holes and crevices (Ohman et al., 1997). Prior to coral bleaching live coral cover was nearly 80% (Ohman et al., 1993) with *Acropora* spp. accounting for nearly 90% of all corals. The shallow coral reef habitats of Bar Reef were composed mainly of branching and tabulate *Acropora* and *Foliaceous Echinopora*. However, most of these corals died due to coral bleaching in 1998. Despite the effects of coral bleaching, Bar Reef remains one of the most biologically diverse coral reefs in Sri Lanka. It has also shown strong signs of natural recovery from coral bleaching compared to many other reefs in the country.

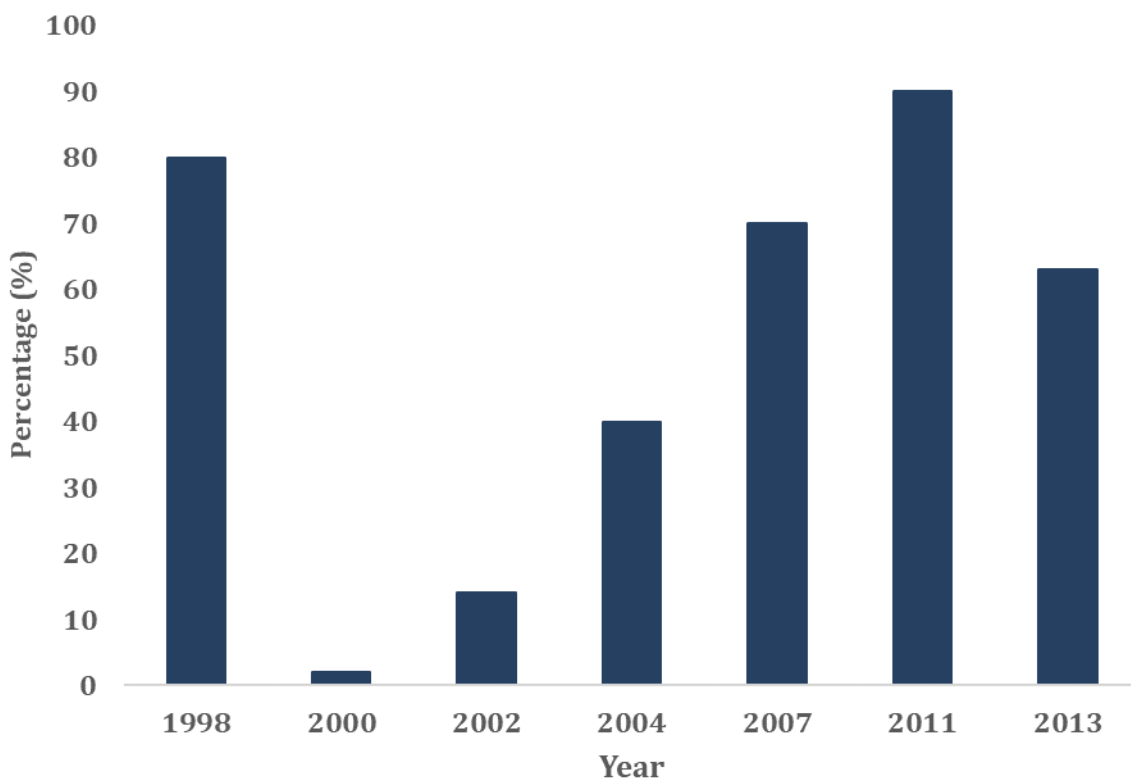


Figure 2: Variations in percentage of live coral cover in Bar Reef Marine Sanctuary after 1998 bleaching. Information obtained from BOBLME (2015) Education, capacity development and monitoring in support of Bar Reef Marine Sanctuary management, Sri Lanka. BOBLME (2015) Education, capacity development and monitoring in support of Bar Reef Marine Sanctuary management, Sri Lanka. BOBLME-2015-Ecology-47

Despite the recovery of corals after 1998 El-Nino, the reef was badly affected by 2016 El Nino and the live coral cover was again reduced to less than 1% in some sections of shallow water reefs. Two surveys conducted in 2017 as a part of survey of ESA project confirmed the threat of elevated surface sea water temperature on coral hence the entire ecosystem. The inshore



section of the reef was observed to be heavily overgrown with a diverse assemblage of algae dominated by algal genera *Padina* spp., *Stoechospermum* spp., *Caulerpa* spp., *Halimeda* spp., *Asperogopsis* spp. and *Dictyota* spp. with bleached coral turning into rubble stage.

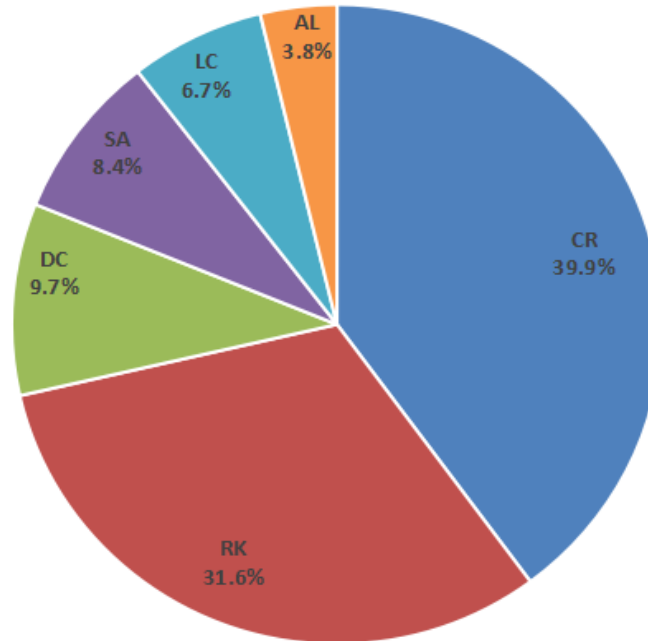


Figure 3: Average percentage substrate cover at Bar Reef (AL=Algae; CR=Coral Rubble; DC=Dead Coral; LC=Live Hard Coral; RK=Rock; SA=Sand). Information obtained from Arachchige and Perera (2017), Report on the systematic surveying of Bar Reef Marine Sanctuary, ESA project, UNDP, Sri Lanka

Two independent surveys that were carried out in 2017 to assess the status of the Bar-reef post to 2016 coral bleaching event. Both surveys indicated massive coral mortality with live coral cover of the two shallower reef’s crest sections of the bar reef to be less than 2% of substrates. These areas were the sections of the reef that survives and recovered post 1998 bleaching event and believed to have the highest chance of future recovery.

Both surveys made recommendations to establish a “No Go-set aside for restoration” zone at the reef for a period of 5-10 years preventing human use in the reef to allow natural re-colonization of corals and restoration of reef function.

*“Setting aside the key coral reefs to recover at least for five years with community and all other stakeholder participation, creating greater awareness among all public to obtain their support is required Sri Lanka Navy with its resources could be a potential partner in reef monitoring. Floating buoys can be erected with the support of SL Navy and Sri Lanka Coast Guards thus; DWC can effectively manage the sanctuary (Arachchige and Perera, 2017) “.*

*“Currently the reef is under heavy pressure from fisheries activities, Pollution and visitation by tourists. It is imperative that these stresses must be significantly reduced or stopped for a time period to allow the reef to naturally recover its bio-diversity and natural functions. Urgent consideration must be given to declare the reef a NO GO zone for all human activities preventing all fishing and tourist boats from approaching or traversing close to the reef. This*

*will require the visual demarcation of the park boundaries using suitable buoys and enforcement through regular patrolling by Navy crafts and also maintaining a more efficient look out watch point by the DWC with a rapid reaction capacity in the event of detection. Such a moratorium must be maintained for 5-10 years to gain sufficient level of reef recovery and resilience before human activities are permitted back on the reef. The fishery practices in the area need to be regulated at least within the BRMS boundary areas which include netting operations, collection of Marine organisms for the Food fish and Ornamental Export trades and illegal Spear fishing activities by divers (Weerakkody et al., 2017, p.151)".*

These recommendations were adopted in year 2018 and with a well-planned engagement strategy in which from policy makers to all grass root communities were made aware about the need of such a no-go zone, the identified core coral patches were demarcated. This demarcation is the first of such an intervention in the country where every stakeholder was involved in decision making and implementing. The Designated "Left aside for restoration" zones on the reef are defined as two separate reef sections encompassing the areas which survived the 1998 coral bleaching event and recovered. These include two shallow sections of the reef which previously formed reef crests over elevated ridges on the sea floor believed to be the most promising areas for coral recovery in a future scenario (Weerakody, 2018).

The two sections of the reef were identified as Zone "A" located North and further off shore and Zone "B" located Southward and more inshore of the two. Each section is now marked with 5 buoys including 4 regular red marker floats and one equipped with a solar powered flashing light buoy. These two buoys activate a flashing yellow beacon at night with an indicated range of 1 Nm. (Approximately 2 km). The details of buoy demarcation are given in Appendix.



Figure 4: Demarcated zones as “Left aside to restoration” in BRMS

## 1.1 Biodiversity of BRMS

Biodiversity of BRMS and the surrounding area as recorded by Weerakkody et al. (2017) is given in appendix. The Area is considered a Cetacean hot spot in Sri Lanka with 20 species of marine mammals' area recorded from the area including 19 species of Cetaceans and one species of Sirenian. There are also additional unconfirmed records of the possible presence of Irrawadi dolphins and fin less porpoise and the Hump-backed Whale in the area base on several recent kill records within the bay as well (Weerakkody et al., 2017, p.151). The Spinner Dolphins (*Stenella longirostris*) pods in area is estimated to be about 5000 in number which is usually divided in to several smaller pods which on occasion join together to form a super pod of Dolphins. The spinner dolphins usually inhabit the area of the continental shelf edge ranging a little inshore at times. There seem to be a general North South Diurnal movement travelling along the shelf edge ranging as far south as Norochhole and moving north up to Bar reef area. There is also another pod of Spinner Dolphins that are observed North of Bar reef which may be distinct from the Southern pods based on the observation of community tour boat operators. The pod size and direction of movement is often based on many environmental factors including sea conditions and pressure from tourist boats etc. The spinner dolphins are regularly observed in the presence of large schools of Yellow Fin Tuna (Kenda/Kelawalla) engaging in hunting together on the same fish aggregations. The local fishermen regularly use the Dolphin pods to locate the Yellow fin tuna which are caught using trolling lines, on occasion Bryde's whales (*Balaenoptera brydei*) are observed to feed among the dolphin pods as well. In addition to the spinner Dolphins; other small cetaceans recorded in the area include Bottle-nosed Dolphins (*Tursiops truncatus*), Risso's Dolphins (*Grampus griseus*), Rough tooth Dolphin (*Steno bredanensis*), Fraser's Dolphin (*Lagenodelphis hosei*), Pilot Whale, False Killer Whales, pigmy/Dwarf sperm whales, and the killer whales.

**Killer whales** (*Orcinus orca*) are recorded regularly during months of March-April and tend to come closer to the shore in the sea area closer to Talawila. They are also encountered further off shore beyond the shelf edge in deeper waters. Usually encountered in small pods of 2 to 10 animals on occasion records exist of large pods of up to 50 animals in the area. These include family groups of both males and females or all male groups. They have been observed to actively hunt and Kill Spinner Dolphins in the Kalpitiya area and the boatmen report that the arrival of Killer whales is often predicted by excited erratic movement of spinner dolphin pods which tend to leave the area when the Killer whales are around. On occasion, killer whales were reported by local tour boat operators to attack pods of sperm whales. The marine surveying team observed over 30 killer whales (on 10<sup>th</sup> March 2017) were to corral and repeatedly attack a pod of about 100 sperm whales about 20 km off the coast of Kandakuliya.

**Sperm whales** (*Physeter macrocephalus*) are regularly observed in the area; individually or as small groups. Super pods of Sperm whales aggregating off Kandakuliya area range from 50-200 animals gathering usually in the months of March-April before the onset of the South Western Monsoon conditions. The sperm whales are usually found further off shore and tend to stay in deeper waters beyond the shelf edge and further 5-7 km away from shore than the area frequented by spinner dolphins.

A small group of Bryde's whales (*Balaenoptera brydei*) are regularly seen in the outer area of the Bar-reef complex consisting of up to 6-7 animals. The Bryde's whales are encountered throughout the year which may indicate a resident group and unlike the other larger whales they are known to hunt in shallower waters ranging on to the continental shelf areas.

Though less common the Blue Whale (*Balaenoptera musculus*), Mink Whale (*Balaenoptera acutorostrata*) and Hump-back Whale, are also documented in the area.

A high diversity of Marine mammal species is recorded in the sea area off shore sea area beyond the shelf edge in deeper water including records of Risso's Dolphins, Rough-tooth Dolphins, Fraser's Dolphins, False Killer whales, Dwarf Sperm whale, Bottle nosed Dolphins, Pilot whales, Melon headed whales, Spotted Dolphins, Striped Dolphins, and the Common Dolphins

### **Indo-pacific Hump-backed Dolphin**

A pod of Indo-pacific Hump-backed Dolphins are regularly observed within the lagoon and is believed to be resident within the lagoon and adjacent sea area, though the original pod is dwindling in number with only about 8-10 individuals surviving. One juvenile dolphin was observed among the pod during the current surveys indicating that the population may be breeding. They venture deep inside the lagoon and can sometimes be observed feeding as close as 1km from the Kalpitiya town. The average depths in these lagoon areas can be as low as 2.0 m. In addition, the available anecdotal evidence indicates possible presence of Irrawaddy Dolphins based on 2 reported kills within the lagoon and reports of a small dolphin which is possibly be of Fin less porpoise.

### **Dugong**

Though a population of Dugong still survives in the sea areas between Battalangundu Island and Jaffna, the Dugong populations in Sri Lanka is considered to be highly threatened. The once significant population of Dugong in the Kalpitiya area have been decimated by hunting and by the increasing pressure from humans. Though many Records of Dugong entering the Puttalam Lagoon is found several decades ago, presently very few records of Dugongs are verifiable within the lagoon with many of the claimed records attributable to other species of marine mammals including the Indo-pacific humpback dolphin. There is still a surviving population of Dugongs recorded in the area of Sea North of Battalangundu Island and Kudiramalai point. The area contains vast sea grass beds which form the primary habitat for the Dugongs. The greatest threat to the Dugong is the use of Gill-nets set for Rays which contribute to the majority of Dugong kills in Sri Lanka.

A pod of Indo pacific Hump-backed Dolphins (*Sousa chinensis*) of about 8-10 animals are believed to be resident in the lagoon though they are seen sporadically; which may indicate that they may foray into the sea areas as well.

The Islands contain large roosts of sea birds and many of these birds use the area for resting, feeding and breeding. The islands and the subsequent land are the landing and take-off point of migratory birds. Heuglin's Gulls (*Larus heuglini*), Pallas's Gull, Brown headed gulls (*Larus ridibundus*), Caspian Terns (*Hydroprogne caspia*), Lesser Crested Terns (*Thalasseus bengalensis*), Greater crested terns (*Thalasseus bergii velox*), Common Terns (*Sterna hirundo*), Little Terns (*Sterna albifrons*), Gull-billed Terns (*Gelochelidon nilitica*), Spot-billed pelicans (*Pelecanus philippensis*) and Gray Herons (*Ardea cinerea*) are some of the common

birds seen in the area. Vagrants such as sooty terns (*Sterna fuscata*) and frigate birds have also been recorded.

BRMS and adjacent shallow sea area is known for muddy bottoms hence, extensive sea grass beds. Puttalam lagoon Portugal bay and Dutch Bay areas has sea grass beds of varying sizes specially around islands. The northern most area of the Lagoon in Portugal Bay between Battalangundu Island and Kudiramale point contains large tracts of thick sticky greenish muddy floors. There are significant sea grass beds lining the inner shores of most of the Islands from Kalpitiya to Battalangundu. The land ward shore closer to Gangewadiya contains few and much smaller sea grass areas sheltered within cove areas of the shore which may indicate the heavy action of the waves entering the bay from the Uchchimune entrance may restrict growth of sea grass on this part of the coast line. Sea grass habitats are also found between Uchichimune and Bar-reef and they provide a reference to the transition of habitat types and species composition of seagrass habitats from marine to lagoon habitats. This seagrass area is composed primarily of *Halophila ovalis* and *Halodule uninervis*. In recent years Weerakkody et al. (2017) recorded a high level of dead detached fronds of sea grass floating among the living sea grass patches. The die back was suspected to have resulted from the extreme cold-water event which lasted from December 2016 to February 2017. However, authors report good recovery. However, fish life at sea grass beds are reported to be lower compared to past with only Goat fishes *Mulloidichthys* sp. juvenile Parrot fish *Calotomus* sp. few juvenile Lethrinids and one clown fish observed in above mentioned study.

## 1.2 Habitats found in adjacent coastal areas of BRMS

### 1.2.1 Mangroves

True mangroves such as *Rhizophora mucronata*, *Avicenia marina*, *Ceriops tagal* as well as rare *Schyphiphora hydrophyllacea* are found in mangrove stands around Kala Oya estuary, Puttalam lagoon as well as along Wilpattu coastal belt. Mangroves recorded from Kala Oya river mouth in 2017 baseline survey are given below.

Table 1: True mangrove species recorded from the Kala Oya river mouth

Family	Scientific name	Common names	IUCN Status
Avicenniaceae	<i>Avicennia marina</i> (Forsk.) Vierh.	E: Grey mangrove/White mangrove S: Manda T: Kanna/Venkandal	LC
	<i>Avicennia officinalis</i> L.	E: Indian mangrove S: Manda T: Kanna/Upu attha	NT
Combretaceae	<i>Lumnitzera racemosa</i> Willd.	E: Teruntum bunga puteh S: Sudu beriya T: Thipparethai	NT
Euphorbiaceae	<i>Excoecaria agallocha</i> L.	E: Buta-buta/Blind-your-eyes S: Thelakeeriya T: Thillai	LC
Lythraceae	<i>Pemphis acidula</i> Forst.	S: Muhudu wara T: Kiri maram	NT
Meliaceae	<i>Xylocarpus granatum</i>	E: Mangrove cannonball S: Mutti kadol	EN

Family	Scientific name	Common names	IUCN Status
		T: Kadal manga/Somuntheri	
Myrsinaceae	<i>Aegiceras corniculatum</i> (L.) Blanco	E: Black mangrove/River mangrove S: Heen kadol/Awari kadol T: Vettilaikanna/Narikandal	LC
Rhizophoraceae	<i>Bruguiera cylindrica</i> (L.) Blume	E: Bakau Putih S: Mal kadol T: Sirukandal	EN
	<i>Bruguiera gymnorrhiza</i> (L.) Lamk.	E: Oriental mangrove S: Rath kadol	VU
	<i>Ceriops tagal</i> (Perr.) C.B. Robinson	E: Tengar S: Punkanda T: Chirukandal	NT
	<i>Rhizophora apiculata</i> BL.	S: Rana kadol T: Kandal	NT
	<i>Rhizophora mucronata</i> Lamk.	E: Asiatic Mangrove S: Murunga kadol T: Kandal	LC
Rubiaceae	<i>Scyphiphora hydrophyllacea</i> Gaertn.f.	S: Kalu kadol	VU
Sonneratiaceae	<i>Sonneratia alba</i> J. Smith	S: Sudu mal kirala/Gal kirala T: Vellai-kinnai	EN

### 1.2.2 Lagoon, tidal mudflats and associated sub-tidal habitats

The mouth of the Puttalam lagoon harbour patches of sub/inter-tidal mud flats and sea grass beds. Seagrass beds are extremely productive habitats that contribute to the sustenance of lagoon and near-shore fisheries, functioning as nurseries and habitat of many commercially important species of fish and prawns.

Mudflats are sedimentary inter tidal habitats created by mud deposition in low energy coastal environments, particularly in sheltered areas. Their sediment consists mostly of silts and clays with a high organic content with very little plant growth. The mudflats in this area are important habitat for wading birds, especially migrants. Mudflats, like other inter-tidal areas, dissipate wave energy and thereby contribute to minimize the impacts on salt marshes and flooding low-lying lands. Small mud flats are seen in Puttalam lagoon both towards the sea as well as further inland.

### 1.2.3 Salt marsh areas

Species like *Arthrocnemum indicum*, *Salicornia brachiata* and *Suaeda maritima* as the dominant ones that cover the bare ground, with prostrate and upright shoots and sedges such as *Cynodon dactylon* and *Cyperus* spp. occur intermixed in salt marshes. Extensive salt marshes are seen in Gange Vadiya area. Salt marshes also function as an important habitat of coastal aquatic birds.

#### 1.2.4 Seashore habitats (Sand bars, sandy beaches and dunes)

Vast extents of beach habitats, including sand bars and sand dunes are found from Kalpitiya to Mannar. Sand dunes in areas such as Uchchimunai have developed as a result of continuous sand accretion around certain creepers, shrubs or trees growing as clumps on the coast. The dunes usually occur as parallel rows with increasing size, height, stability and complexity from the sea shore to the inland. A series of plant assemblages representing different phases of dune succession can be observed. Young mobile dunes are frequented by herbaceous species such as *Cyperus bulbosus*, *Ipomoea pes-caprae*, *Hydrophylax maritima* and *Spinifex littoreus*. Young hummocks in Kandakuliya area are highly unstable owing to wind induced and wave induced erosion. Stabilized older dunes occurring away from the sea are characterized by a more complex woody vegetation such as *Scaevola taccada*, *Clerodendrum inerme*, *Erythroxylum monogynum*, *Pempis acidula*, *Thespesia populnea* and *Salvadora persica*.

#### 1.2.5 Seasonally inundated grasslands

Seasonally inundated maritime grasslands found along the coastline are influenced by salinity, sea spray and freshwater influx during rainy season. The dominant species of grasses are *Cynodon dactylon*, *Panicum repens*, and *Eragrostis* spp., while sledges such as *Cyperus rotundus* occur intermittently.

#### 1.2.6 Scrubland

Remnant patches of dry horny scrublands occur in the area. They are characterized by three distinct aerial strata. The upper most tree layer (5m-8m) is composed of scattered trees/tree lets such as *Limonia acidissima* (Divul), *Cassia auriculata* (Ranawara), *Bauhinia racemosa* (Maila), *Salvadora persica* (Maliththan) *Azadirachta indica* (Kohomba), and *Flueggea leucopyros* (Andara). Climbers like *Cissus quadrangularis* (Heeressa) and *Jasminum* spp. (Walpichcha) are commonly found associated with thorn scrubs. Below the scattered tree layer shrubby plants such as *Toddalia asiatica* (Kudumiris), *Dichrostachys cinerea* (Andara), *Carissa spinarum* (Karamba), *Catunaregam spinosa*, *Flueggea leucopyrus* (Katupila), *Randia* spp., *Ziziphus* spp. (Eraminiya) and *Capparis* spp. occur as dominants. Underneath the woody strata is a ground herbaceous layer (up to 75cm) consisting of plants like *Commelina* spp., *Barleria prionitis*, *Crinum latifolium*, *Heliotropium indicum*, *Cyanotis* sp., *Crotalaria* spp., *Sida acuta*, *Sida cordifolia*, *Urena lobata* and *Hemidesmus indicus*.

#### 1.2.7 Palmyrah woodlands

Additionally, the arid climatic affinities in the area have enabled successful spread of Palmyra (*Borassus flabellifer*) in some pockets mainly north of Kalpitiya.

#### 1.2.8 Coconut plantations

Coconut plantations are widespread in the area, but in recent years with the spread of hotels the extent of coconut plantations have reduced.

#### 1.2.9 Vegetable plots

Kalpitiya peninsula is one of the main vegetable and fruit producing areas of the country. Main fruits cultivated are guava, papaya and pomegranate. Cultivation of *Aloe vera* was once



very popular but in recent years the trend has declined. Kalpitiya now produces up country vegetables mainly beet root and potatoes in addition to other crops such as red onions. Extensive cultivation is found from Daluwa, Nawankaduwa, Mampuri, Ilanthadiya to Alankuda. The extensive use of inorganic and organic fertilizers, weedicides and pesticides is a major concern (Liyanage et al., 2000) resulting in ground and surface water pollution.

### 1.3 Social status

The main resource users of BRMS are from Kalpitiya Divisional Secretariat. A relatively small number of fishermen also enter to BRMS from Gange Vadiya fishing community residing in the river mouth. In recent years with the development of tourism, some visitors enter BRMS through Gange Vadiya. Fishermen also migrate to this area from Mannar on a daily basis. Additionally, fishers migrate from Chilaw, Negombo and North seasonally.

Reef and reef-associated fisheries are the main economic use of coral reefs in Sri Lanka. Major reef associated fisheries are demersal and semi-demersal fisheries, spiny lobster fishery and the marine ornamental fishery. In addition, sea cucumbers and chanks (*Turbinella pyrum*) are harvested in soft bottom areas around reefs. Ornamental fish, sea cucumber and chanks are harvested exclusively for export, while most of the spiny lobster catch is also exported. Reefs in the area support numerous fisheries livelihoods. This includes both permanent communities and migrant fishermen who operate from seasonal fishing camps located on remote islands off the tip of the Kalpitiya peninsula.

In addition to fishery, aquaculture practices such as mud crabs, shrimps provide permanent and seasonal employment to communities. Additionally, the recent development of tourism has opened new livelihoods hence, people are engaged as safari boat operators, recreational divers, small scale hoteliers, kite surfing venture operators and vehicle renters. At present a total population of 67352 lives only in Kalpitiya Divisional secretariat. Majority of the population is Muslims.

Table 2: Summary of the population (2016)

Total number of families	Total population	Female	Male	Average family members in a family
17293	67352	34676	32676	4

Table 3: Population distribution (According to the race)

Age Group	Race					Total
	Buddhist	Hindu	Islam	Catholic	Other	
0-5	2996	1654	3325	0	0	7975
6-10	2923	1659	3181	0	0	7763
11-16	2642	1716	2917	0	0	7275
17-19	1924	985	2292	0	0	5201
20-25	2953	1477	2857	0	0	7287
26-30	3443	1865	3144	1	0	8453
31-60	7955	3073	7327	1	0	18356
Above 60	1691	1217	2134	0	0	5042
<b>Total</b>	<b>26527</b>	<b>13646</b>	<b>27177</b>	<b>2</b>	<b>0</b>	<b>67352</b>

Table 4: Population distribution (According to the religion)

Age Group	Religion					Total
	Buddhist	Hindu	Islam	Catholic	Other	
0-5	732	653	3327	3248	30	7990
6-10	675	580	3227	3261	11	7754
11-16	694	546	2932	3066	10	7248
17-19	575	469	2260	1889	8	5201
20-25	727	536	2850	3157	21	7291
26-30	858	747	3135	3723	31	8494
31-60	2111	1216	7320	7658	24	18329
Above 60	440	457	2126	2013	9	5045
<b>Total</b>	<b>6812</b>	<b>5204</b>	<b>27177</b>	<b>28015</b>	<b>144</b>	<b>67352</b>

Table 5: Population distribution (According to the age groups)

Age Group (years)	Population	
	Female	Male
0-5	4121	3856
6-10	4001	3768
11-16	3783	3525
17-19	2745	2573
20-25	3730	3646
26-30	4152	4039
31-60	9445	8899
Above 60	2699	2370
<b>Total</b>	<b>34676</b>	<b>32676</b>

Table 6: Population density of the Divisional Secretariat (2012-2016)

Population density (km <sup>2</sup> )				
2012	2013	2014	2015	2016
414.7	428.9	413.7	421.3	437

As Bar Reef and the environments of Kalpitiya was identified for Special Area Management (SAM) planning in the Coastal zone management plan for Sri Lanka, a planning process was carried out from 2000 to 2005 resulting in an Environmental profile and a Special Area Management plan for the sanctuary and the environs of Kalpitiya. However, no proper implementation of this SAM is observed. One major concern in recent years around BRMS was the construction of Norochcholai coal power plant. The plant is in operation and the environmental concerns include release of warm water to coast, fly ash and coal.

All relevant socio economic data of the area are given in Annexure 4.

## 2 Current Legal Framework for Management

Table 7 summaries the main policies and legislations that would be relevant in implementing this management plan and international conventions to which Sri Lanka is signatory. The provisions of Fauna and Flora Protection Ordinance (Amended) Act No 32 of 2009 enable preparing management plans and executing them in protected areas.

Table 7: Summary of policies, legislations and conventions related to management plan

Name	year	Major Area
<b>Policies</b>		
National Wildlife Policy	2000	Wildlife
National Forest Policy	1995	Forest resources
National Physical Planning Policy and Plan	2007	Land resources
National Environment Policy	2003	Environment
National Policy on Solid Waste Management	2003	Solid waste management
National Air Quality Management Policy	2000	Air pollution
National Watershed Management Policy	2004	Water pollution
National Policy on Wetlands	2006	Wetlands
National Fisheries Policy	2006	Fisheries resources
National Soil and Mineral Policy	2007	Minerals and sand
National Sand Policy	2005	Sand use
National Policy on Elephant Conservation	2006	Elephant management
Alien Invasive Species Policy	2017	Invasive species
<b>Legislations and regulations</b>		
National Environment Act No 47 of 1980	1980	Environment
Irrigation Ordinance No 32 of 1946 and Act No 1 of 1951	1951	Water resources
Fauna and Flora Protection Ordinance (Amended) Act No 32 of 2009	1937	Wildlife and protected areas
Plant Protection Act No 35 Of 1999	1999	Plant protection
National Aquatic and Development Agency Act No 54 of 1981	1981	Aquatic resources
Fisheries and Aquatic Resources Act No 2 of 1996	1996	Fisheries and aquatic resources
Control of Pesticide Act No 33 of 1980	1980	Environment protection
Felling of Trees Control Act No 9 of 1951	1951	Environment
Water Hyacinth Ordinance No 9 1909	1909	Aquatic resources
Mines and Minerals Act No. 33 of 1992	1992	Mineral extraction
Soil Conservation Act No. 25 of 1951 and No. 29 of 1953 and amended by Act No. 24 of 1996	1996	Soil
Irrigation Ordinance No. 32 of 1946, Act No.1 of 1951 and No. 48 of 1968, Law No. 37 of 1973	1973	Irrigation development
National Environment Act (NEA) No 47 of 1980 as amended by Act No 56 of 1988 and Act No 53 of 2000	2000	Environment
Land Acquisition Act No. 9 of 1950 and subsequent regulations (1596/12) in 2009	2009	Land acquisition

Name	year	Major Area
The Urban Development Authority Act No. 41 of 1978	1978	Urban area management
Urban Council (UC) Act No. 18 of 1987	1987	
The Antiquities Ordinance, No.9 of 1940 (now Act) and the subsequent amendments, particularly the Antiquities (Amendment) Act No. 24 of 1998	1998	Preservation of artefacts
Provincial Environmental Statue No 12 of 1990 of the North-western Province Forest Ordinance of 1907 and subsequent amendments	1907	Forest governance
<b>Conventions</b>		
Ramsar Convention	1971	Wetlands
Convention on Migratory Species	1979	Migratory species
International Plant Protection convention	1951	Plant protection
United Nations Framework Convention on Climate Change (UNFCCC 1992)	1993	Atmosphere
Kyoto Protocol (1997)	2002	Atmosphere
International Plant Protection Convention (1951)	1956	Biodiversity
Plant Protection Agreement for Asia and Pacific Region (1956)	1956	Biodiversity
Convention on the conservation of Migratory Species (CMS-1979)	1990	Biodiversity
Convention on Biological Diversity (CBD-1992)	1992	Biodiversity
United Nations Convention to Combat Desertification (UNCCD-1994)	1994	Land
<b>Management Plans/Strategies and other Documents</b>		
Wilpattu Protected Area Strategic Management Framework		Department of Wildlife Conservation (2017)
Education, capacity development and monitoring in support of Bar Reef Marine Sanctuary (BRMS) Management	2015	National Aquatic Resources, Research and Development Agency (2015)
Report on the Systematic Surveying of Bar Reef Sanctuary 2017	2017	Department of Wildlife Conservation (2017)
Enhancing Biodiversity Conservation and Sustenance of Ecosystem Services in Environmentally Sensitive Areas (ESA project)	2017	Department of Wildlife Conservation (2017)
<b>Gazette Notifications</b>		
Gazette Extraordinary No. 1533/16 dated 25 January 2008) Environmental Protection License (EPL) regulations gazetted under NEA (Government)	2008	Pollution control
Wastewater Discharge Standards-Gazette Notification No. 1534/18 dated 01/02/2008	2008	
EIA regulations gazetted under NEA (Government Gazette Extraordinary No.772/72 dated 24 June 1993 and in several subsequent amendments)	1993	Sustainable development

It is noted that Sri Lanka does not have a marine policy. However, DWC has drafted guidelines for whale watching

### 3 Stakeholder Analysis

Stakeholder analysis conducted using the matrix given below, and the Venn diagramming of the existing relationships, resulted in identifying the key stakeholders and their current level of communication. Data were gathered by conducting two regional level consultations and one national level expert consultation. Community meetings were organised with grass root level stakeholders with the assistance of Kalpitiya Divisional Secretariats and DWC, to address the coastal communities and their representatives to obtain their views. Stakeholders from grass root level to policy makers participated in all consultations. During the same period intensive community consultations and one to one communications with community leaders were conducted for the preparation of the management plan as well as for deploying of buoys in the selected areas of Bar Reef Sanctuary. Additionally, community was consulted and was interacting with us during a study conducted to identify the status of coral reef in 2017. Hence all these interactions provided us with opportunities to identify the stakeholders of the area. Stakeholders were categorized using following criteria by the participants to workshops.

**Importance:** how importance a stakeholder is for management process

**Influence :** how much influence (power) a stakeholder has over management process

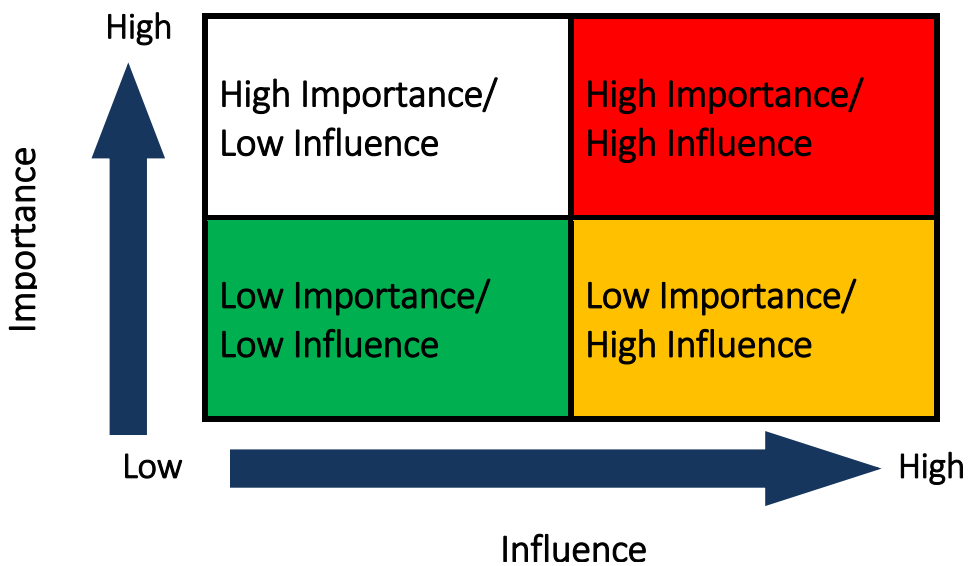


Figure 5: The 2x2 matrix schemes used in identifying the stakeholders

The results of the consultations are compiled below;

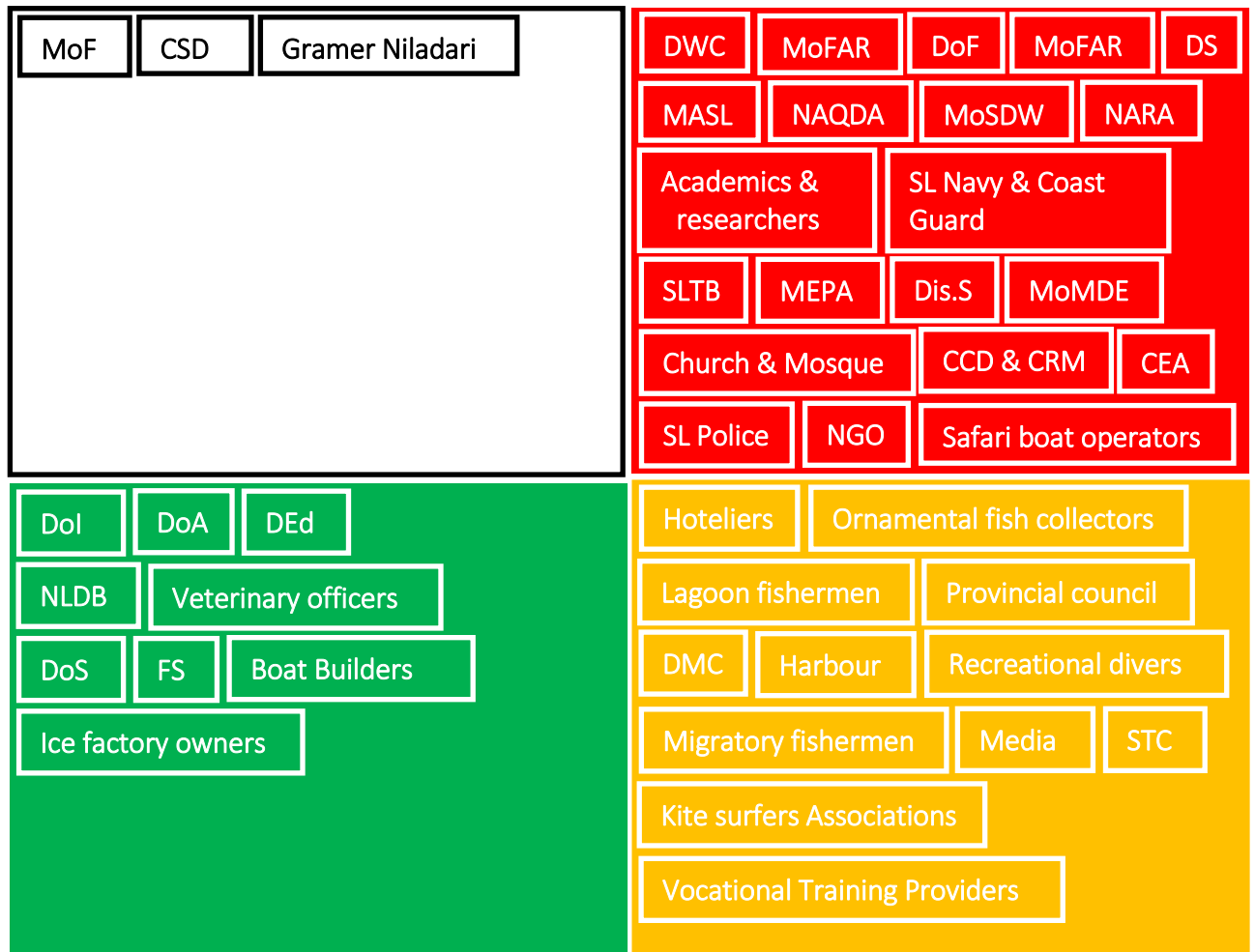


Figure 6: Outcomes of stakeholder analysis

“High Importance-High Influence” stakeholders should be included and consulted in preparation and implementation of this management plan. They are recommended to be selected to form the project implementation committee as their presence and support is mandatory to implement the actions of this plan.

The “High Importance-High Influence” stakeholders were;

- Department of Wildlife Conservation (DWC)
- District Secretariat (Dis. S) and Divisional Secretariat (DS)
- National Aquaculture Development Authority (NAQDA)
- Central Environmental Authority (CEA)
- Provincial Environment Authority (PEA)
- Sri Lanka Tourist Board (SLTB)
- Ministry of Mahaweli Development and Environment (MoMDE)
- Ministry of Sustainable Development and Wildlife (MoSDW)
- Academics and researchers
- Sri Lanka Navy and Coast guard
- Marine Environment Authority (MEPA)
- Safari boat operators
- Church & mosque

- National Aquatic Resources Research and Development Agency (NARA)
- Ministry of Fisheries and Aquatic Resources (MoFAR)
- Department of Coast Conservation and Coastal Resource Management (CCD & CRM)
- Department of Forest (DoF)
- Sri Lanka Police (SL Police)
- Provincial council
- Recreational divers
- Ornamental fish collectors
- National NGO's
- Small scale fishermen
- Trawl fishers
- Hoteliers
- Norochcholai Coal Power plant management
- Fishermen engaged in Dynamite fishing and other illegal gear operators
- Fishermen
- Mahaweli Authority Sri Lanka (MASL)

The other stakeholders are;

- Civil Security Department (CSD)
- Department of Survey (DoS)
- National Housing Developmental Authority (NHD)
- Department of Education (DEd)
- Media
- Srimp Farmers
- Sri Lanka Ports Authority
- Ministry of Finance (MoF)
- Migratory fishermen
- Disaster management Center (DMC)
- Ice Factory Owners
- Boat Builders
- Gramer Niladari
- Department of Irrigation (DoI)
- Department of Agriculture (DoA)
- Hoteliers
- Harbour
- Ornamental fish collectors
- Lagoon fishermen
- Provincial council
- Kite surfers' associations
- Sri Lanka Timber Cooperation (STC)
- Recreational divers
- Migratory fishermen
- Vocational service Providers
- Media
- Department of Irrigation (DoI)
- Boat Builder
- Department of Agriculture (DoA)
- Veterinary officers

### 3.1 Relationships between stakeholders

The current relationships of the stakeholders (Figure 7) were analysed by Venn diagramming. Typical to coastal zones of Sri Lanka, BRMS has a diverse set of stakeholders as mentioned above. However, the relationships of some of the stakeholders are strong such as the strong relationship seen between fishing community, safari boat operators, divers and church. Some relationships with regard resource use are volatile such as the issues pertaining between small scale fishers and trawl fishers of the area, Hoteliers, saltern owners, shrimp farmers and mangrove conservation organizations. Main reasons are;

1. Some fishermen are now part time safari boat operators targeting whale, dolphin and coral reef. However, some fishermen are still engaged in illegal fishing practices such as trawl fishery, Leila and Surukku net operation in coral reefs, that result in intentional and accidental spinner dolphin and dugong deaths and damage to coral reef, sea grass beds and the sea bed. There are conflicts between these two groups.
2. At present DWC has a limited number of staff at BRMS and lack of skilled manpower and resources have resulted in DWC not been able to conduct monitoring of activities in sea. Hence, the current entry system is confined to a mere issuance of a ticket and regular monitoring of the activities of seafarers is not present. This has created conflicts specially among safari boat operators and fishermen.
3. At present there is no mechanism to link the activities of key stakeholders that are important to manage and to monitor the activities happening within BRMS. These include Sri Lanka Navy, Coast Guard, Coast Conservation and Coastal Resources Department, Department of Fisheries and Department of Forest.
4. Visitor carrying capacities and demarcation of zones for different recreational activities and other income generating activities have not happened. Also, several plans have been prepared in the past for managing various interests such as fisheries, coastal resources and tourism etc. but none of the plans have been implemented fully, which has created a negative attitude among grass root level stakeholders.
5. Academia and researchers are not well connected to administrators and policy makers and as a result evidence-based decision making is not present. Since BRMS has gone through two major *El Nino* events both resulting in near destruction of live coral cover, there had been no prompt action in addressing the issues. Hence, there is a need for greater collaboration between these stakeholders.

Options for quick communication by all the stakeholders in relation to BRMS are currently absent. Therefore, prior to implementation of the management plan, development of a communication mechanism is required due to above mentioned reasons. Lack of communication has severely affected the progress of the sanctuary as well as the significance of this sanctuary for conservation of species and ecosystems. Also, a mechanism is not present to receive complains and concerns of stakeholders. Lack of communication has resulted in several agencies working in isolation. (Figure 7).



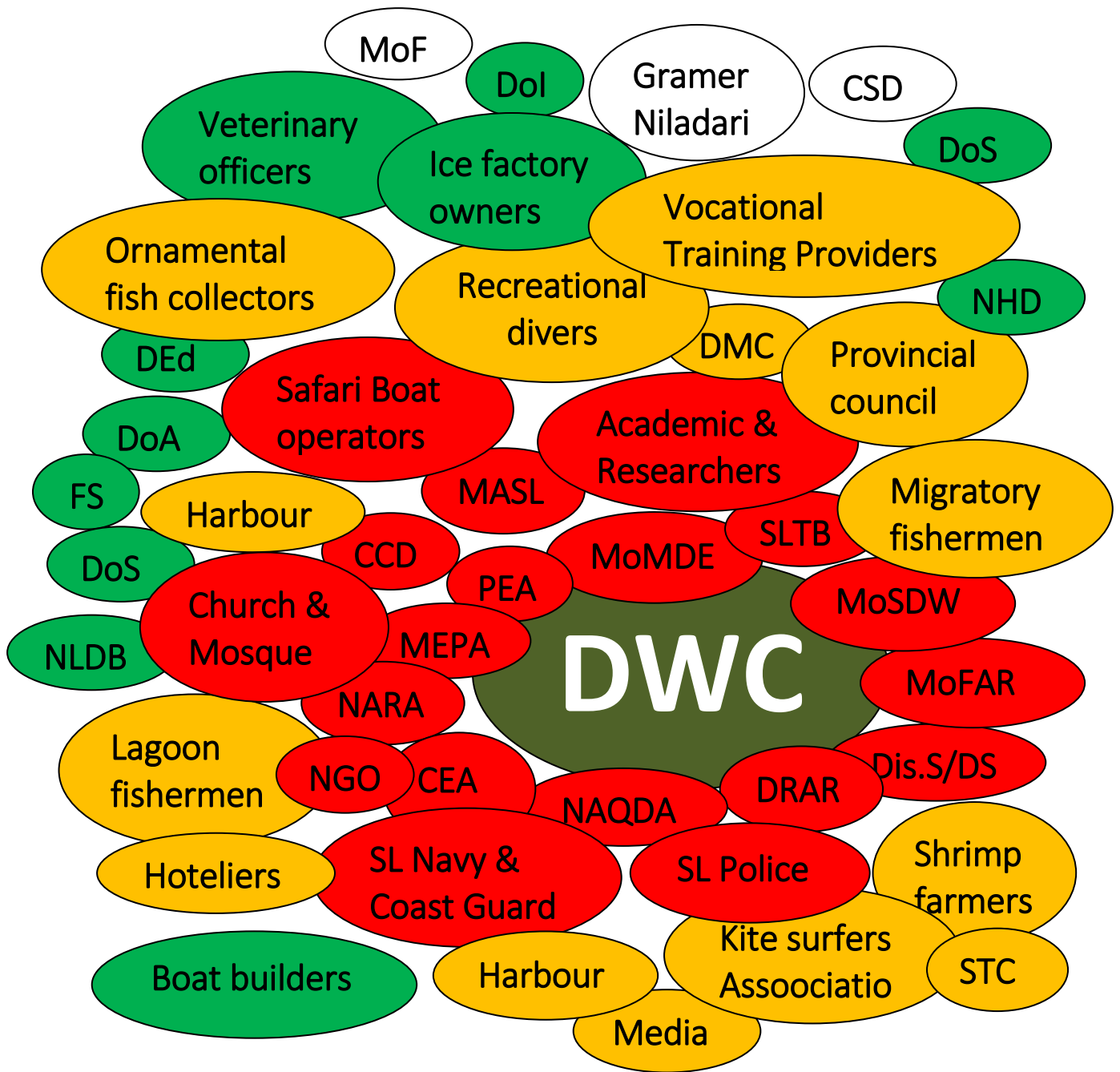


Figure 7: The current relationships of the stakeholders

Though there is a big potential for nature and adventure tourism, agencies such as Sri Lanka Tourism Board, hoteliers, tour operators, safari boat operators, kite surfing service providers, divers and conservationists have very little connection with DWC at present. Creating a greater awareness among national and regional level government officials and politicians on do's and don'ts in a sanctuary and the current regulations pertaining to a sanctuary, is vital for the future management of the sanctuary and its surrounding. BRMS and the surrounding evolved with community based and community led Most of the time, outcome was a result of lack of communication, miscommunication, untimely communication and/or lack of awareness regarding the regulations of FFPO. However, recent rallying of all stakeholders to demarcate selected coral reefs is an example to emphasize that with proper and committed communication, all stakeholders can be brought together for conservation with right trade offs.

#### 4 Current Participatory Frameworks and Their Mechanisms in Relation to Sanctuary Administration

Sanctuaries do not have appointed park wardens. As such, they are directly managed by the Assistant Director of the region with the support of range officers. As the regional zonation of DWC is different from the zonation adopted for public administration, many protected areas are administered independent to provincial, district and divisional administration. BRMS is managed by Assistant Director of North-western DWC administrative region.

One range office is currently operated in Kandakuliya. Additionally, a kiosk is operated by the department for the purpose of issuing tickets.

Assistant Director of North-western DWC administrative region is a member of Puttalama DCC. At the regional level, DWC officials participate to District Coordinating Committees (DCC) chaired by District Secretaries. DWC is also a member of environment committee of each divisional secretariat. Although no formal mechanism is present for collaboration with communities, civil societies and educational sector, depending on the situation and the need, loose temporary mechanisms are in operation. At the regional level, environmental impact assessments in relation to any developments in BRMS are coordinated by Central Environmental Authority of NWP as well as CEA. Staff of DWC works with Kalpitiya Divisional Secretariat.

At National level, DWC is a member of all national level committees that have been appointed by other ministries and departments in relation to coastal and marine environments, biodiversity, water and other natural resources use and conservation, land use, land reclamation, road development etc. Additionally, DWC is serving as a member of project approving agencies in relation to IEE and EIA. Hence, national level participatory framework for decision making is in place. DWC also has several committees established at both the ministerial and department level including Wildlife Advisory Committee and Marine Expert Group.

## 5 Current Threats and Issues of Bar Reef Marine Sanctuary

Threat and issue analyses were conducted using the following matrix (Figure 8). Both the likelihood of occurrence and significance of the impact were considered in identifying the threats that need to be addressed in this management plan. Data were gathered at two regional level stakeholder consultations, two national level consultations and 2 community meetings. Data were gathered by conducting two regional level consultations and one national level expert consultation. Community meetings were organised with grass root level stakeholders with the assistance of Kalpitiya Divisional Secretariats and DWC, to address the coastal communities and their representatives to obtain their views. Stakeholders from grass root level to policy makers participated in all consultations. During the same period intensive community consultations and one to one communications with community leaders were conducted for the preparation of the management plan as well as for deploying of buoys in the selected areas of Bar Reef Sanctuary. Additionally, community was consulted and were interacting with us during a study conducted to identify the status of coral reef in 2017. Data were also extracted from a study conducted to develop a management plan for spinner dolphins in Kalpitiya (Mattingly et al., 2015).

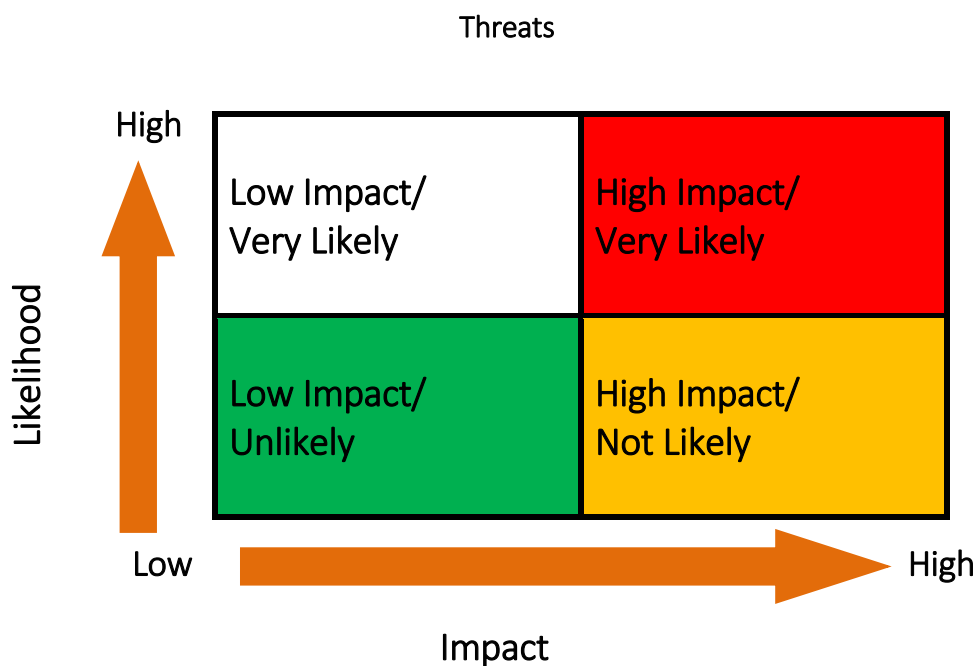
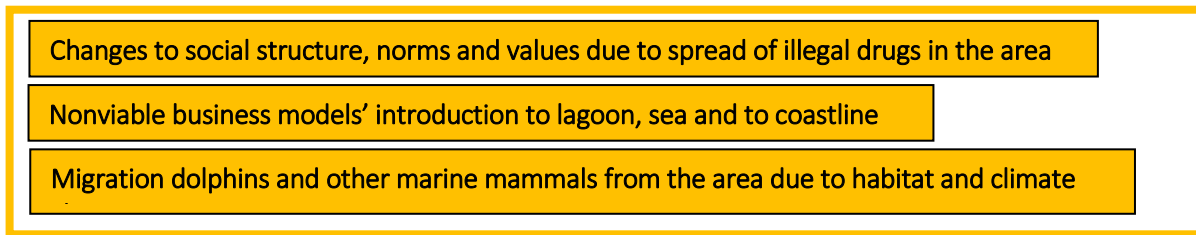


Figure 8: The 2x2 matrix scheme used in identifying significant

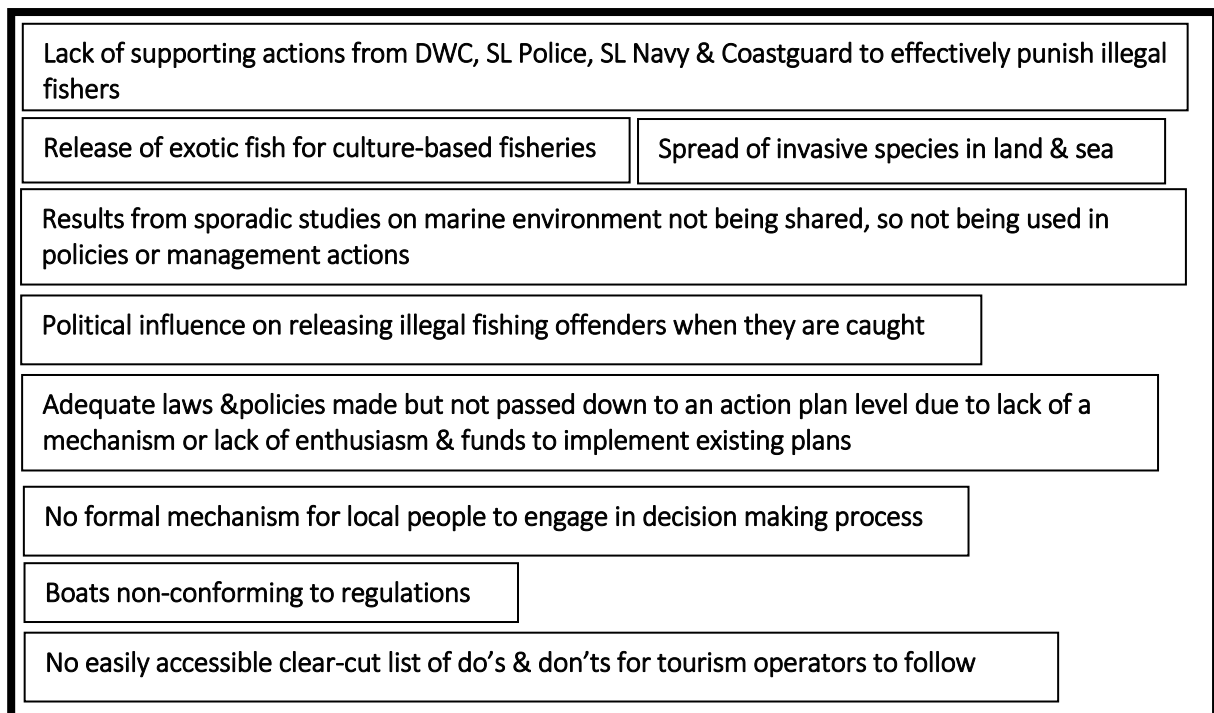
High impact-very likely



High impact not likely



Low impact very likely



Low impact unlikely



Figure 9: Outcomes of threat analysis

Within the high impact and very likely threats and issues, illegal fishing gear and fishing emerged as the most important threat to the system.

“High impact-very likely” threats and issues are the key threats that are addressed in this management plan. In order of importance, they are listed below;

- Removal of reef associated fish and other fauna for export
- Development of islands for tourism, wind energy and other commercial activities
- Illegal destructive fishing techniques-specifically dynamite, surruku and Lella nets
- New mega-scale entrepreneurs taking business from local tourist operators
- Spear fishing
- Absence of monitoring

- The temperature anomalies/bleaching events
- Disturbance from tourist guides and divers
- Non-natural materials being introduced to the system from land and the throwing of litter from tourist boats
- No regulation of trans boundary fisher catches or gear types
- Possible release of pesticide, weedicide and fertilizer residues from Kala Oya river and Puttalam lagoon to BRMS
- Lack of inter-agency coordination
- Lack of communication between the state sector & the informal sector
- Undue political pressure
- Absence of baseline data
- Excessive removal of mature fish from the populations
- Decline in live coral, sea grass cover and crumbling of coral structures
- Trampling of corals and anchoring of boats on corals
- Lack of knowledge and awareness about the importance of the area
- Elevated surface sea water temperatures
- Absence of a regular income from livelihoods and absence of opportunities to females
- Lack of compatible & strong policies between DWC, MEPA & CCD & CRM
- Lack of monitoring of solid and liquid effluents from Norochchoilai power plant
- Absence of land use plans resulting in haphazard development, clearance of vegetation and erosion
- No other life skills so local people are entirely dependent on fisheries or tourism
- Killing of dugong for meat and accidental killing from fishing nets

#### “Low impact-very likely” threats and issues

- Lack of supporting actions from DWC, police, navy and coastguard to effectively punish illegal fishers
- Release of exotic fish for culture-based fishery
- Results from sporadic studies on marine environment not being shared, so not being used in policies or management actions
- Political influence on releasing illegal fishing offenders when they are caught
- Spread of invasive species in land and sea
- Adequate laws and policies made but not passed down to action plan- level due to lack of a mechanism or lack of enthusiasm and funds to implement existing plans
- No formal mechanism for local people to engage in decision making process
- Boats non-conforming to regulations
- No easily accessible clear-cut list of do’s and don’ts for tourism operators to follow

#### “High impact-not likely” treats and issues;

- Changes to social structure, norms and values due to spread of illegal drugs in the area
- Nonviable business models’ introduction to lagoon, sea and to coastline
- Migration dolphins and other marine mammals from the area due to habitat and climate change

#### “Low impact unlikely” impact-not likely” treats and issues;

- Migration of fishers and population fit for work

## 5.1 Some notable threats and conservation issues

Biodiversity assessment conducted in 2017 has elaborated on some specific threats in BRMS (Weerakoddy et al 2017, p.151). Similarly, Mattingley et al (2015) has also highlighted governance, socio-economic and ecological threats in the area. Some of the key points are given below.

Table 8: Showing a preliminary list of governance, socioeconomic and ecological threats interlinked with the Kalpitiya spinner dolphin population for presentation at the EAFM workshop (Mattingly et al., 2015)

Governance Threats	Socio-economic Threats	Ecological Threats
Failures within trans-boundary communications	Local community has no other choice but to use fishing and tourism for income	Illegal, destructive fishing techniques. Specifically, dynamite, surruku and Leila nets
No regulation or records of transboundary fishers catches or gear types	Non-conformity to regulations by tourism operators as they can get more money from tourists for greater dolphin contact	Disturbance from tourist guides allowing people to dive and swim with the dolphins
Lack of supporting action from police, navy and coastguard to effectively punish illegal fishers	Lack of communication between the state sector and the informal sector	Flotsam disturbance, plastics and other non-natural materials are being introduced to the system from land and the throwing of litter from tourist boats
Many sectors in the area but no true ownership due to a lack of collaboration with existing stakeholders	Local people have no other life skills that would relieve some of the pressure from fishing and tourism	Fishermen barging into dolphin pods for tuna-dolphin association fishing
Adequate laws and policies made but not passed down to action-plan level		Pressure from high volumes of tourist boats operating in spinner dolphin habitat, disturbance includes increased noise levels and displacement of dolphins
No easily accessible clear-cut list of do's and don'ts for tourism operators to follow		Bycatch in gillnets, particularly industrial sized gillnets used by international vessels operating in the FMU
Results from sporadic studies on marine mammals and the ecosystem not being shared so not being used in policies or management actions		Starvation attributed to depletion of prey stocks from exhaustion of fisheries
Issuing of unlimited numbers of single-day boats for near shore fishing		Political influence on releasing illegal fishing offenders when they are caught

### 5.1.1 Bleaching events and recovery

BRMS very susceptible to coral bleaching events driven by global climatic events. The reef was critically damaged due to at least two of the major bleaching events recorded in recent times including 1998 and the 2016. The reef was also affected by several other coral bleaching events which were less severe in intensity or duration of the event and managed to survive and recover. The scale of these events prevents any human interventions that could reduce the impact.

The main shallow coral sections of the Bar-reef have been impacted heavily by the 2016 Coral bleaching/mortality event. The coral cover over most shallow areas have been reduced to 1-2 % with most of the remaining corals found in the deeper sections of the reef.

What is most worrying in terms of viability of the system is the percentage of coral rubble. When the coral turns into rubble the substrate for new recruitment is reduced. In addition to that, coral rubble further destroys the reef when it is moved by currents.

Recent studies have shown that inshore section of the reef is heavily overgrown with algae with low potential for new recruitment of coral from Platonic larvae as algae prevents optimal penetration of sunlight to reef and also substrate for settlement.

However, some marine biologists are of the opinion that the outer section of the reef is moving in to the secondary phase where the herbivorous fish numbers have increased significantly, and the grazing levels have reduced the algal cover, making it sufficiently open to allow settlement of new coral recruits. Observations indicate at least some recent recruitment have already taken place. The presence of significant populations of surviving coral in adjacent coral reefs at Silawathura-Arrippu reef complexes and in the deeper sandstone reef areas would ensure availability of larval coral for resettlement of reef surfaces.

The level of secondary non-algal invasive reef organisms on the reef is currently not significant and not expected to pose a significant threat to corals but requires continuous monitoring. It is believed that the main reason for the recovery of the Bar-reef from the previous coral bleaching event was due to the inaccessibility of the reef to most human activities due to the security restrictions enforced by the then prevailing security situation in the area. In the current situation the reef is impacted by fishing practices including use of Bottom-set nets, Purse-seine nets (Leila and Surukku), Blast fishing or combination of techniques used together.

Local tour boats also bring tourists in to the Bar-reef where they would swim and snorkel on the reef causing coral breakage due to trampling, souvenir collection and on occasion angling within the BRMS (Weerakkody et al., 2017, p.151)

### 5.1.2 Pollution solid/water

Solid debris on the reef primarily include discarded fishing nets and line and material of terrestrial origin from plastics and organic debris washed in through currents or discarded by fishermen/ tour boats visiting the reef. The off-shore sea area between Battalangundu Island and along the continental shelf edge and along the boundary with India contain high densities of floating debris which may originate in India. Some of these debris may be contributing to the solid waste over the reef as well as from local origins.



The reef is subject to pollution from solid waste as well as effluents including agricultural runoff which may be responsible for several events where algal blooms were observed on the reef post to heavy rains on land. the Kala-oya plume can periodically wash over the Bar-reef area bringing in Agricultural runoff and siltation through Kala-oya system and Puttalam lagoon during heavy flood conditions.

### 5.1.3 Fisheries

The use of destructive fishery practices pose a significant threat to the reefs, the use of "Leila" and "Surukku" Purse seine nets over reef areas. Use of explosives and SCUBA divers in conjunction with the nets causes excessive damage to reef and reef fauna both target and non-target species. The use of blast fishing is documented and the damage of the blasts on the reef surfaces is observed regularly. The illegal use of bottom set nets on reefs is significant and nets are often lost due to entanglement and abandoned on the reef as ghost nets are also observed. Fishermen also periodically carry sand bags as anchors and abandon them in reef.

The fishery for ornamental aquarium trade and the export trade including sea cucumber, chank and Spiny lobster is carried out mainly in the area adjacent to the Bar-reef proper and deeper sandstone reefs around the area. This is not sufficiently regulated and can deplete target species in the areas where the divers would fish one area till it is depleted of the target species and move on to other areas. At present there is no communication between DWC and Department of Fisheries on the number of permits issued and the area allocated. Spear fishing which is now an illegal activity is carried out regularly as there is no monitoring of boats out at sea. This activity is highly destructive on the reefs as the divers target the sensitive species and also selectively kills the largest and dominant members of a population on the site.

Trawl fishery and trans boundary fishing disputes also have an impact on BRMS. Although Naval bases are located in Kaipitiya, Uchchimunai, Gange Vadiya their involvement is current minimal as there is not formal agreement for obtaining the service of Sri Lanka Navy and Coast Guards.

### 5.1.4 Tourism

The whale and dolphin watching tour boats regularly provide an additional trip highlight to the tourist by bringing the tourists for snorkelling at Bar-reef. This activity is unregulated and involve tourist who have minimal skills in snorkelling. They depend on a life jacket to keep them afloat and through this process they trample the corals.

### 5.1.5 Invasive species

Many marine reef species can become invasive over reef areas when their natural densities on the reef is increased significantly. Reef organism invasive events can take two forms where they may be seasonal or activate as short term events triggered by an external cue. Sometimes it could be a long term takeover of reef substrates due to a more significant change in reef ecology. These include algae including *Halimeda* spp. *Ulva* spp. *Asperogopsis taxiformis*, *Stoichospemum polypodites*, *Padina* spp., *Dictyota* spp., *Caulerpa racemosa*, *Caulerpa verticilliata* etc. and reef invertebrates including encrusting black sponge (*Terpios* sp.) Corallimorphs, Green Ascidians (*Didemnum* sp.) and Crown of thorn sea stars etc. However, systematic studies are required to ascertain their invasiveness. Most of these

species are present on the Bar-reef complex and have on occasion shown to be locally invasive. The invasive events are believed to be linked to human activity including pollution/Eutrophication and selective removal of adult or larval predators of the species.

#### **5.1.6 Potential introduction of mass scale tourism without a proper plan and visitor capacity studies**

Several attempts to introduce large vessels to the area has been restricted due to community pressure. Although not implemented, plans were drawn in the past to use islands and to create mega scale tourism in Kalpitiya area. These plans were not viable and could cause substantial damages to ecological functions and to ground water.

Absence of a business models integrating biodiversity is the main threat to the area at present.

## 6 Proposed Management Plan

Bar Reef Sanctuary Management Plan is prepared for five years starting from 2019 to 2023. The plan includes BRMS, Kalpitiya divisional secretariat, Gange Vadiya area of Kala Oya estuary as these areas are the direct land bases with maximum impact to BRMS.

### *Vision*

***Bar Reef Marine Sanctuary serving the nation with a rich biodiversity and healthy ecosystems with optimal social wellbeing***

BRMS management plan requires support and collaboration from key stakeholders for implementation. This is due to the complexity in the types of social activities, key stakeholders and lack of scientific data. DWC needs to implement the management plan at the regional level with other key stakeholders by forming a project implementation committee. The proposed structure is as follows.

Headed by the Assistant Director of the region and Head Ranger of BRMS, DWC will formally appoint a regional implementation committee. This will include key stakeholders such as Department of Forest, Divisional Secretaries of the region, Department of Fisheries, Coast Conservation Department, Sri Lanka Navy, Police, Coast Guard, Central Environmental Authority, Provincial Environmental Authority, Department of Agriculture, Tourist Board, NAQDA, NARA and civil society representatives from fisheries, safari boat operators, tour operators and aquaculture.

This implementation committee will jointly implement the management plan with DWC and would report to District Environmental Committee and DCC of Puttalam in turn. Since regional environmental committees are already established and are attended by DWC and other committee members, information flow will be rapid. This committee will be responsible for ground level implementation, communication and progress monitoring. Budgetary allocations of management plan will be through DWC and other institutions. The committee will request and disburse funds. The chairman of this committee is Assistant Director of the region and he will be reporting to Deputy Director (Operations) of the head office and other divisional heads and DG of DWC. DG of DWC in turn will report and liaise with heads of key stakeholder institutions and Ministry of Sustainable Development and Wildlife and Ministry of Mahaweli Development and Environment (Figure 10).

An internal quality assurance mechanism responsible for implementation of independent monitoring and evaluations (M & E) at stipulated time periods to adjust the plan accordingly, is required. The evaluation of the plan for monitoring of progress, and for required modifications should be the responsibility of Deputy Director (Operations) of DWC. The schematic diagram given below indicates the proposed management structure.

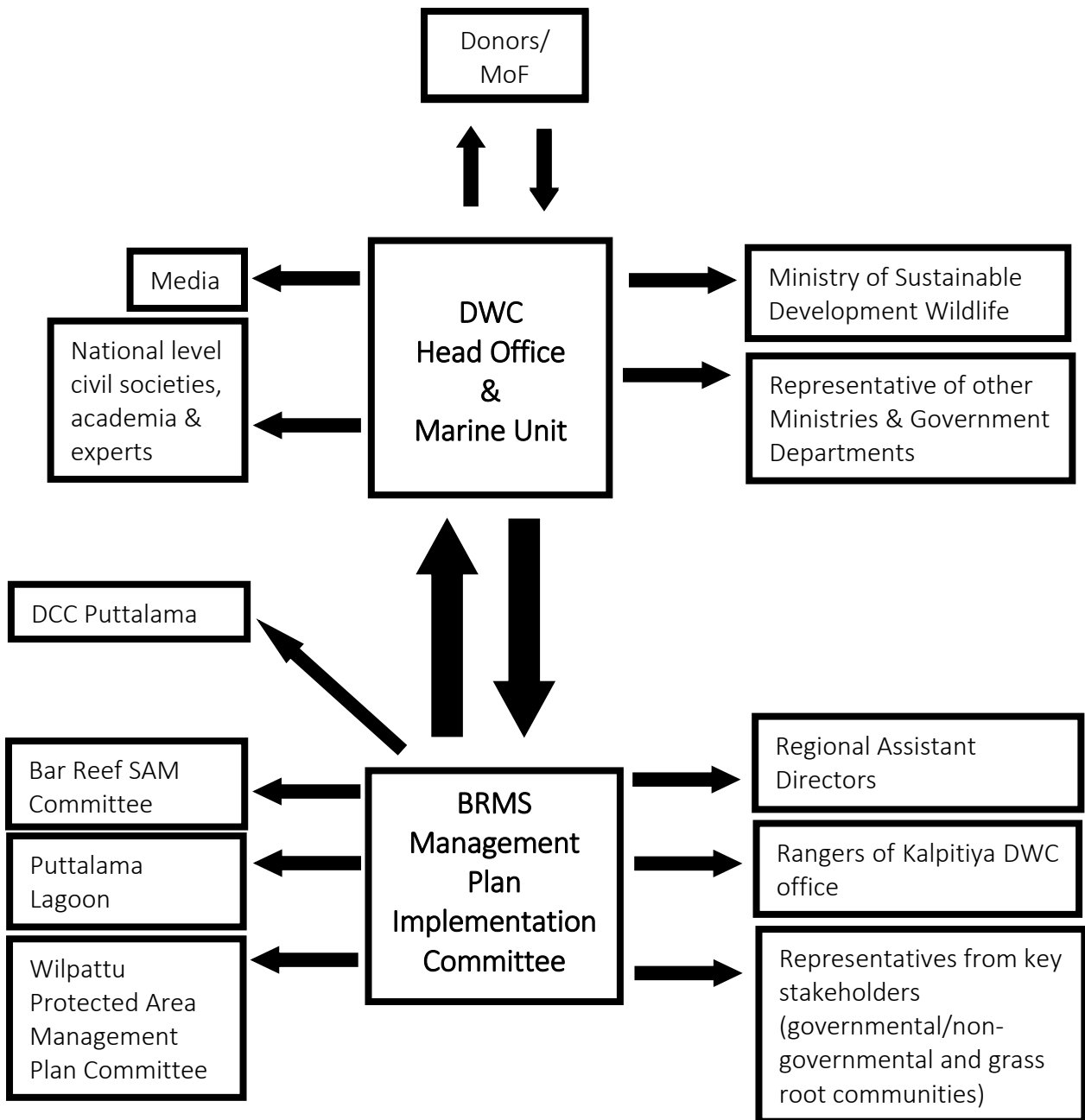


Figure 10: Schematic diagram of proposed project implementation structure

### ***Expected outcomes of the Plan***

- 1) *The good governance for BRMS is established*
- 2) *The fisheries and tourism associated with BRMS are sustained to ensure the security of local people's livelihoods*
- 3) *The Kalpitiya marine area is restored for the betterment of both ecosystems and the local communities*

Goals are divided into operational, environmental, socio economic and governance goals and achieving all four types of goals is a necessity to reach the vision set for this management plan. All the goals have been prepared to eliminate, reduce and control the threats and issues identified by stakeholders and also from published literature.

In order to achieve the goals, each goal is divided into objectives. Objectives specifically target identified threats hence, indicators have also been set for monitoring of progress and achieving of targets. Each goal is presented with strategic actions and a Gantt Chart depicting the expected time of start and completion of each activity.

<b>Vision</b>			
<b><i>Bar Reef Marine Sanctuary serving the nation with a rich biodiversity and healthy ecosystems with optimal social wellbeing</i></b>			
Governance goal	Socio economic Goal	Ecological goal	Operational goal
To warrant an enabling governance framework, strengthened to manage BRMS with committed participation from stakeholders, and to the maximum satisfaction of all	To safeguard optimum living conditions to community, and satisfaction from services derived by BRMS to all	To ensure a thriving ecosystem, rich in biodiversity, with long term integrity and resilience	To operationalize an enabling BRMS management environment to effectively serve ecological and human needs

## **7 Expected Outcomes from Goals**

### **7.1 Governance goal**

To warrant an enabling governance framework, strengthened to manage BRMS with committed participation from stakeholders, and to the maximum satisfaction of all.

#### **Expected outcomes from Governance Goal**

- 1.1. Enhanced inter-agency coordination with key stakeholders ensuring good governance.
- 1.2. Stakeholders operating within their limits in a protected area and fully committed to betterment of ecological and human wellbeing.

### **7.2 Socio economic goal**

To safeguard optimum living conditions to community, and satisfaction from services derived by BRMS to all.

#### **Expected outcomes from Socio Economic Goal**

- 2.1. Income and recognition for PA through sustainable and responsible ecosystem services trade.
- 2.2. Income, stability and better standards of life to communities within the PA and in periphery through sustainable and responsible ecosystem services and products trade.
- 2.3. Safe living conditions and new environmentally sustainable livelihood opportunities associated with BRMS.

### **7.3 Environmental goal**

To ensure a thriving ecosystem, rich in biodiversity, with long term integrity and resilience.

#### **Expected outcomes from Environmental Goal**

- 3.1. Updated status and distribution of marine and coastal habitats, fauna and flora, migratory species and water quality.
- 3.2. Ecosystems functioning optimally thus positively impacting the biodiversity, population sizes, species movements and interactions.
- 3.3. Ensured commitment to set aside areas for restoration within BRMS for minimal negative anthropogenic activities and long term ecological and social gains.

#### **7.4 Operational goal**

To operationalize an enabling BRMS management environment to effectively serve ecological and human needs.

##### **Expected outcomes from Operational Goal**

- 4.1. Well demarcated BRMS boundaries and core areas left aside for restoration.
- 4.2. Rights to resource use agreed and obeyed by all parties.
- 4.3. Knowledgeable, skilled, competent and resourceful DWC staff serving BRMS.

## 8 Governance Goal

To warrant an enabling governance framework, strengthened to manage BRMS with committed participation from stakeholder and to the maximum satisfaction of all

### 8.1 Expected outcomes from governance goal

- 1.1. Enhanced inter-agency coordination with key stakeholders ensuring good governance.
- 1.2. Stakeholders operating within their limits in a protected area and fully committed to betterment of ecological and human wellbeing.

Table 9: Outcomes from the governance goals 1.1 and 1.2 (Enhanced inter-agency coordination with key stakeholders ensuring good governance, Stakeholders operating within their limits in a protected area and fully committed to betterment of ecological and human wellbeing), objectives, strategic actions and intended time for the implementation

Strategic actions	2019	2020	2021	2022	2023
<b>Outcome: 1.1. Enhanced inter-agency coordination with key stakeholders, ensuring good governance</b>					
<b>Objective: 1.1.1. Improved inter agency coordination at regional and national level</b>					
1.1.1.1. Establish BRMS management plan Implementation committee with sufficient resources, finances and Infrastructure					
1.1.1.2. Conduct quarterly meetings during the phase of Implementation and prioritize actions					
1.1.1.3. Share annual plans if needed and updated maps with key stakeholders (including SL police)					
1.1.1.4. Secure an agenda item in DCC of Puttalama for updates and awareness creation regarding management measures					
1.1.1.5. Participate to Environment committees of the Region					
1.1.1.6. Conduct regular sessions with civil societies (quality meetings) and provide updates on PA matters and management					
1.1.1.7. Implement sensitization tours to key stakeholders on recently demarcated zone of "Left aside for restoration"					
1.1.1.8. Conduct external audits on BRMS management with stakeholder quality meetings will address					
1.1.1.9. Train staff on communication skills, conflict resolution and record keeping					
1.1.1.10. Develop a communication system to alert community on local job opportunities and sea condition and other important news related to BRMS					



Strategic actions	2019	2020	2021	2022	2023
<b>Objective: 1.1.2. Improved coordination with community living around BRMS</b>					
1.1.2.1. Clear disputes regarding resource partition and engage in Community discussions through civil societies to maintain identified resource use patterns, zones and seasons					
1.1.2.2. Conduct awareness sessions to communities, hoteliers, school children on current status of BRMS, global climate change, dos and don'ts and community activities that can involve local grass root communities					
1.1.2.3. Develop sustainable tourism plans and sectoral plans to be implemented with <ul style="list-style-type: none"> <li>a. Safari boat operators</li> <li>b. Kite surfing ventures</li> <li>c. Local tour operators and other service suppliers</li> </ul>					
1.1.2.4. Assist creating revolving funds with income related to BRMS specially with following tourism models <ul style="list-style-type: none"> <li>a. Community owned registered boat service with all safety gear, trained guides, information packs operated from identified locations. The number of boats operated per day to be decided considering the pressure for targeted species. DWC and NGO to support in training local youth. DWC FD and DS to support in Developing Communication material. DWC to develop a protocol for operation. Boat operators to agree in tourism packages that could be offered for various customer needs</li> <li>b. DWC, FD and communities to Develop specialised tour packages such as island hopping, migrant birds, sperm whale Aggregation watch, sand dune and mangrove watch on stilt bridges, Puttalam lagoon fishery and ecosystem and agree on prices, manpower etc. These special packages to be offered by the community assisted visitor centre. All personnel to be trained.</li> <li>c. Home stay with exposure to local fishing practices, net laying, cooking etc.</li> <li>d. Educational diving opportunities at a cost as volunteers during monitoring of "left aside to restore zone" Only experience divers with commitment to supply information to be selected</li> <li>e. Specialised packages to children on marine life, pond dipping and introduction to mangrove forests. To be offered to schools as a day tour with trained staff. Visitor centre to coordinate the tours and where possible local youth to get involved as an additional employment</li> <li>f. Land to sea packages from Gange Vadiya partly recreational partly educational with trained guides and safe community run</li> </ul>					

Strategic actions	2019	2020	2021	2022	2023
boats on mangroves, baobab tree, estuarine fauna, sea grass and coral  g. Fossils of Aruwakkaru and boat rides and kayaking in Kala Oya for a Prederimed number of tourists operated by proposed Gange Vadiya visitor centre					
<b>Objective: 1.1.3. Established and operational decision-making system that is transparent and consultation based</b>					
<b>1.1.3.1.</b> Invite civil societies to decision making processes and provide ample opportunities for commenting by Formally Appointing Community members to Implementation committee. Appoint the same committee to monitor “Left aside to restoration zone”					
<b>1.1.3.2.</b> Ensure all Management documents and action plans are public documents and are available for reading and commenting at DS Office					
<b>1.1.3.3.</b> Establish a local diver team and recruit them as coral watch team with a proper identity					
<b>1.1.3.4.</b> Engage safari boat operators in collecting data on the status of BRMS, species encountered and points to report such as death of species, aggregations, coral recovery and death zones etc. Develop social media link that can be used for uploading data					

## 9 Socio economic goals

To safeguard optimum living conditions to community, and satisfaction from services derived by BRMS to all

### Expected outcomes from socio economic goal

2.1. Income and recognition for PA through sustainable and responsible ecosystem services trade.

2.2. Income, stability and better standards of life to communities within the PA and in periphery through sustainable and responsible ecosystem services and products trade.

2.3. Safe living conditions and new environmentally sustainable livelihood opportunities associated with BRMS.

Table 10: Outcomes from the socio-economic goal 2.1 (Income for PA and adjacent communities through sustainable and responsible ecosystem services and products trade), objectives, strategic actions and intended time for the implementation

Strategic actions	2019	2020	2021	2022	2023
<b>Outcome: 2.1. Income and recognition for PA through sustainable and responsible ecosystem services trade</b>					
<b>Objective: 2.1.1. Increased sustainable income from BRMS</b>					
2.1.1.1. Construct a new visitor's centre with all amenities in Kudawa and Gange Vadiya					
2.1.1.2. Construct and maintain sanitary facilities and community operated dressing rooms near proposed visitor centres					
2.1.1.3. Design and build accommodation for day visitors and overnight visitors in selected locations targeting ecotourism with expertise assistance					
2.1.1.4. Procure minimal carbon/zero carbon emission boats and other water gear for lagoon and river-based tourism					
2.1.1.5. Develop an eco-tourism plan focusing wildlife and with opportunities for local communities to sell their products specially fishery products to both national and foreign tourists					
2.1.1.6. Develop, print and sell pamphlets, books and other educational material on wildlife and marine ecosystems at community centre					
2.1.1.7. Develop and regularly maintain a dedicated social media site					
2.1.1.8. Introduce customized tourism packages, species specific tourism (winter migrant avifauna) etc.					
2.1.1.9. Develop nature trails in Gange Vadiya and Kandakuliya area targeting both fauna and flora					

Strategic actions	2019	2020	2021	2022	2023
2.1.1.10. Operate on-site waste management system and up cycle visitor generated waste onto marketable products with community					
2.1.1.11. Design and develop BRMS mascots and develop mascots for sale with females as a home-based industry					

Table 11: Outcomes from the socio-economic goal 2.2 (Income, stability and better standards of life to adjacent communities through sustainable and responsible ecosystem services and products trade), objectives, strategic actions and intended time for the implementation

Strategic actions	2019	2020	2021	2022	2023
<b>Outcome: 2.2 Income, stability and better standards of life to communities within the PA and in periphery through sustainable and responsible ecosystem services and products trade</b>					
<b>Objective: 2.2.1 Increased Sustainable income for Communities within and in Periphery</b>					
2.2.1.1. Procure a specialist on alternative livelihood and Community development to develop a plan for Introducing alternative income sources and products for communities that can also be marketed in visitor centres and other Franchises					
2.2.1.2. Train communities with Tourist Board on how to maintain amenities for B & B and "Home stay"					
2.2.1.3. Empower communities for eco-tourism with the collaboration of Tourist Board, and civil societies and DS (basic cooking skills, housekeeping, hygiene, finance management etc.)					
2.2.1.4. Introduce water conservation and up cycling skills to communities					
2.2.1.5. Introduce organic farming and create a market for products near the proposed visitor centres in Hela Bojun style					
2.2.1.6. Train and recruit seasonal staff for visitor management during dolphin and whale watching season					
2.2.1.7. Train and recruit youths of the area as tour guides and use their service for diving, nature trail management, species identification, kayaking and school programmes					
2.2.1.8. Conduct feasibility studies for value addition of products from the communities (e.g. dried fish, Jadi etc.)					
2.2.1.9. Introduce post Harvesting techniques for fishery products with DF and provide outlets for their sale					
2.2.1.10. Create opportunities to sell organic vegetables and fruits as salad bars and juice bars with coffee and tea café					
<b>Objective: 2.2.2. Contingency plans for disaster management are established and all relevant stakeholders are trained and made aware of actions</b>					
2.2.2.1. With DMC, plan and prepare contingency plans for major disaster to BRMS such as coral bleaching, tsunami, storm surges and Droughts					
2.2.2.2. Train park officials and other stakeholders in using the plans					
2.2.2.3. Procure essential equipment to manage disasters and conduct regular Maintenance					

Strategic actions	2019	2020	2021	2022	2023
2.2.2.4. Identify and draw necessary restoration plans for areas affected by any type of disaster to mitigate the impacts					
2.2.2.5. Ensure alternative livelihood options and train communities accordingly in the event of disasters					

Table 12: Outcomes from the socio-economic goal 2.3 (Safe living conditions, access to water and new environmentally sustainable livelihood opportunities associated with BRMS in existing and proposed protected areas), objectives, strategic actions and intended time for the implementation

Strategic actions	2019	2020	2021	2022	2023
<b>Outcome: 2.3. Safe living conditions and new environmentally sustainable livelihood opportunities associated with BRMS</b>					
<b>Objective: 2.3.1. Well planned and established livelihood options and business models for communities</b>					
2.3.1.1. With community, DS, social services, and financial organisations plan and identify viable business models that can be adopted by community as start up businesses					
2.3.1.2. Create mini business groups and coach the selected enterprises with adequate training on sustainability					
2.3.1.3. With the help of DS create a data base of manpower and skills of local youth and use the data base for all employment opportunities creating in implementing the plan					
2.3.1.4. Conduct assessments on water partitioning for locals and tourists and agree on water conservation initiatives					
2.3.1.5. Create clusters of community managed forestation schemes for mangroves and other forest types and incentivize the community engagement					
2.3.1.6. With the assistance of an expert, introduce environment friendly product development and post-harvest techniques					
2.3.1.7. Promote village-based tourism in BRMS with trained local youth and obtain PADI licence for selected youth					
2.3.1.8. Ensure waste disposal mechanisms, up cycling and composting in the area and community-imposed restrictions on use of waste and ensure DWC policy on waste is implemented in BRMS					

## 10 Environmental Goal

To ensure a thriving ecosystem, rich in biodiversity, with long term integrity and resilience

### Expected outcomes from Environmental Goal

- 3.1. Updated status and distribution of marine and coastal habitats, fauna and flora, migratory species and water quality
- 3.2. Ecosystems functioning optimally thus positively impacting the biodiversity, population sizes, species movements and interactions
- 3.3. Ensured commitment to set aside areas for restoration within BRMS for minimal negative anthropogenic activities and long term ecological and social gains

Table 13: Outcomes from the environmental goal 3.1 (Updated status and distribution of marine and coastal habitats, fauna and flora, migratory species and water quality.), objectives, strategic actions and intended time for the implementation

Strategic actions	2019	2020	2021	2022	2023
<b>Outcome: 3.1. Updated status and distribution of marine and coastal habitats, fauna and flora, migratory species and water quality</b>					
<b>Objective: 3.1.1. Baseline data of bio-physical environment is established for management, monitoring and scientific purposes</b>					
<b>3.1.1.1.</b> Collate data on BRMS and conduct a gap analysis of information and update the status of coral reefs, sea grass beds as an annual survey concurrent to monitoring of “Left aside to restoration zones					
<b>3.1.1.2.</b> Prepare land cover, vegetation type and land use maps for the Coastal zone					
<b>3.1.1.3.</b> Establish an auto pilot sea surface water temperature and other water quality monitoring devise for regular monitoring					
<b>3.1.1.4.</b> Commission a research for determining the impact of selected chemicals and chemical residues on coral growth z`and survival					
<b>3.1.1.5.</b> Conduct studies to determine effective approaches for coral and sea grass restoration					
<b>3.1.1.6.</b> Conduct a systematic survey on types and current distribution of invasives and prepare a strategic plan for management of invasives within and around BRMS, jointly with FD and BDS					
<b>3.1.1.7.</b> Conduct studies on breeding techniques for selected marine fish					
<b>3.1.1.8.</b> Commission studies on daily and seasonal migration pattern of dolphins, turtles, dugongs and whales with academia and other experts					
<b>3.1.1.9.</b> Develop a MOU with reputed environmental research organizations for annual bird, whale and dugong counts and conduct census periodically					

Strategic actions	2019	2020	2021	2022	2023
3.1.1.10. Plan and conserve sand dunes, mud flats and mangroves in the area and develop land use plans mainstreaming biodiversity					
3.1.1.11. With NAQDA, determine a protocol for fish, shrimp and other aquatic organism culture with minimal impact to assessments prior to extraction and Blasting native fauna and habitats					
3.1.1.12. Assess the impact of removal of sand and other minerals from PA and surrounding and adhere to environment					
3.1.1.13. Conduct Bathymetric studies in BRMS, Puttalam lagoon and Kala Oya Estuary					

Table 14: Outcomes from the environmental goal 3.2 (Ecosystems functioning optimally thus positively impacting the biodiversity, population sizes, species movements and interactions), objectives, strategic actions and intended time for the implementation

Strategic actions	2019	2020	2021	2022	2023
<b>Outcome: 3.2. Ecosystems functioning optimally thus positively impacting the biodiversity, population sizes, species movements and interactions</b>					
<b>Objective: 3.2.1. Core areas for conservation are identified and are given the maximum protection whilst other areas are suitably zoned and managed for the intended purpose/s</b>					
3.2.1.1. Monitor and manage “Left aside to restoration zone” of BRMS and value to the impact of management					
3.2.1.2. Develop data Reporting mechanism for status of buoy by selected divers and volunteers					
3.2.1.3. Ensure no fishing and other anthropogenic activities in demarcated area for the specified time period					
3.2.1.4. Develop reporting system and a rewarding system					
3.2.1.5. Systematically conduct raids to eliminate illegal fishing activities with the support of Navy					
3.2.1.6. Systematically conduct raids to eliminate tree felling in Kala Oya estuary with FD and Police					
3.2.1.7. Systematically conduct raids to eliminate illegal sand extraction with the joint assistance from, CCD & CRM, FD and Police					
3.2.1.8. Demarcate the boundaries of BRMS					
<b>Objective: 3.2.2. Identified habitats formally affected by anthropogenic pressures are restored</b>					
3.2.2.1. Conduct studies for artificial propagation of corals and breeding of coral reef associated					
3.2.2.2. Conduct studies for artificial propagation of corals and breeding of coral reef associated					
3.2.2.3. Establish CBO assisted nurseries for selected plant species					
3.2.2.4. Conduct awareness programmes to public and visitors on their role and responsibilities in minimizing impacts to BRMs associated habitats and species					

Strategic actions	2019	2020	2021	2022	2023
3.2.2.5. Establish garbage sorting facilities in proposed visitor centres, dressing areas, fish landing sites and harbour					
3.2.2.6. With CBO, plan and produce environmentally friendly products and alternatives to polythene and plastic use and up cycle waste					
3.2.2.7. Phase out use of agro chemicals among communities engaged in vegetable cultivation with assisted market facilities for organic food and “champion farmer assistance” schemes					
3.2.2.8. With DS and DA, fund and facilitate ecological farming					
3.2.2.9. Conduct systematic raids on unauthorized constructions and land grabs					
3.2.2.10. With the assistance of Dol restore canals and other water ways in Puttalama lagoon					

Table 15: Outcomes from the environmental goal 3.3 (Ensured health and safety of wild animals as well as adjacent communities through improved co-existence and minimal negative anthropogenic activities), objectives, strategic actions and intended time for the implementation

Strategic actions	2019	2020	2021	2022	2023
<b>Outcome: 3.3. Ensured commitment to set aside areas for restoration within BRMS for minimal negative anthropogenic activities and long term ecological and social gains</b>					
<b>Objective: 3.3.1. Establishing optimal habitats with ecological gains</b>					
3.3.1.1. Collate data on current status of sea grass beds, their distribution and diversity and develop plans for management of sea grass beds					
3.3.1.2. Train DWC staff and other relevant officials on importance of sea grass beds for dugong and other species					
3.3.1.3. Phase out dugong unfriendly fishing gear from BRMS in consultation of SAM plan					
3.3.1.4. Establish a communication mechanism and options for regular monitoring and reporting of waste and water from Norochcholai Power Plant					
3.3.1.5. Establish protocols for environmentally sensitive kite surfing in the area					
3.1.6. Ensure obtaining of dumping permits and environmental licences for establish industries					
3.3.1.7. Establish do’s and don’ts for recreational activities within Kala Oya estuary					
3.3.1.8. Set speeds for boats in Kala Oya estuary and restore the habitats affected due to tourism (Boabab tree area, bathing points of Kala Oya)					
3.3.1.9. Introduce gears and train fishermen on how to avoid by-catch					
3.3.1.10. Conduct EIA and IEE for developments					



## 11 Operational Goal

To operationalize an enabling BRMS management environment to effectively serve ecological and human needs

### 11.1 Expected outcomes from Operational Goal

- 4.1. Well demarcated BRMS boundaries and core areas left aside for restoration.
- 4.2. Rights to resource use agreed and obeyed by all parties.
- 4.3. Knowledgeable, skilled, competent and resourceful DWC staff serving BRMS.

Table 16: Outcomes from the operational goal 4.1 (Properly, well demarcated and gazetted national park boundaries, with one-mile radius of development restricted area and Managed Elephant Reserve), objectives, strategic actions and intended time for the implementation

Strategic actions	2019	2020	2021	2022	2023
<b>Outcome: 4.1 Well demarcated BRMS boundaries and core areas left aside for restoration</b>					
<b>Objective: 4.1.1 Established boundaries left aside to restoration zone functioning optimally</b>					
4.1.1.1. Identify all legal boundaries with the use of gazette notifications for the existing sanctuary and demarcate accordingly					
4.1.1.2. Establish DWC, Navy, Coast Guard, academia, NGO and community based resource pools for buoy monitoring, repairing and collation of data					
4.1.1.3. Establish land use maps of the area					
4.1.1.4. Create awareness on boundary demarcation to all key stakeholders through DCC					
4.1.1.5. Distribute maps with newly demarcated boundary details to all key stakeholders					
4.1.1.6. Develop and install sign boards of appropriate size, decide on text, Intervals, locations etc. within BRMS					
<b>4.1.2 Established routine boundary patrolling scheme</b>					
4.1.2.1. Develop compulsory boundary patrolling scheme along with regular patrolling conducted by range/beat officers, Navy, Police and community leaders for demarcated zone, whale and dolphin watching areas					
4.1.2.2. Procure vehicles including a boat with facilities, and allocate cadre for regular patrolling (refer Goods list)					
4.1.2.3. Develop a boundary patrolling log book					
<b>4.1.3. Established joint boundary management actions with Sri Lanka Navy and Coast Guards</b>					
4.1.3.1. Prepare and implement a joint boundary protection action plan with quarterly progress reviews					
4.1.3.2. Conduct training including diving to staff as and when necessary					
4.1.3.3. Develop a "community alert system" for information sharing					

Table 17: Outcomes from the operational goal 4.2. (Rights to land ownership agreed and obeyed by all parties.), objectives, strategic actions and intended time for the implementation

Strategic actions	2019	2020	2021	2022	2023
<b>Outcome: 4.2. Rights to resource use agreed and obeyed by all parties</b>					
<b>Objective: 4.2.1. Agreed set of management interventions introduced and executed for fishery thereby, disputes are resolved for ecologically unsustainable occupations within and around the BRMS</b>					
4.2.1.1. Develop a mechanism for DWC, DS, DoF and community representatives to agree on possible relocation of unsuitable fishing gear with compensation					
4.2.1.2. Work with communities to phase out illegal fishing practices					
4.2.1.3. Design and distribute awareness material on importance of maintaining ecological integrity of BRMS to resource users					
4.2.1.4. With the assistance of DS, clear the land ownership and work with community on acceptable relocation packages for illegal occupancy and land grab					

Table 18: Outcomes from the operational goal 4.5 (Knowledgeable, skilled, competent and resourceful DWC staff serving BRMS), objectives, strategic actions and intended time for the implementation

Strategic actions	2019	2020	2021	2022	2023
<b>Outcome: 4.3. Knowledgeable, skilled, competent and resourceful DWC staff serving BRMS</b>					
<b>Objective: 4.3.1. Skilled and knowledgeable staff serving PAC</b>					
4.3.1.1. Plan and execute a training schedule for park management on following local training (where possible invite official of DS, FD, CCD & CR, CEA, Navy, Coast Guards, DI, tour operators, conservationist and community leaders)					
1. Water quality monitoring and coral reef management					
2. Tools for wildlife habitat analysis, evaluation and management					
3. Use of sonar, drone technology, remote sensing and basic GIS use for marine ecosystem management					
4. Basic veterinary care for marine mammals and marine mammal rescue					
5. Conducting raids, ambushes and skills of combat					
6. National and International policies and legislature for wildlife officials including efficient handling of judicial system					
7. Identification of whales					
8. Use of fire arms					
9. Snorkelling and diving					
10. Conducting animal senses and population estimations in sea					

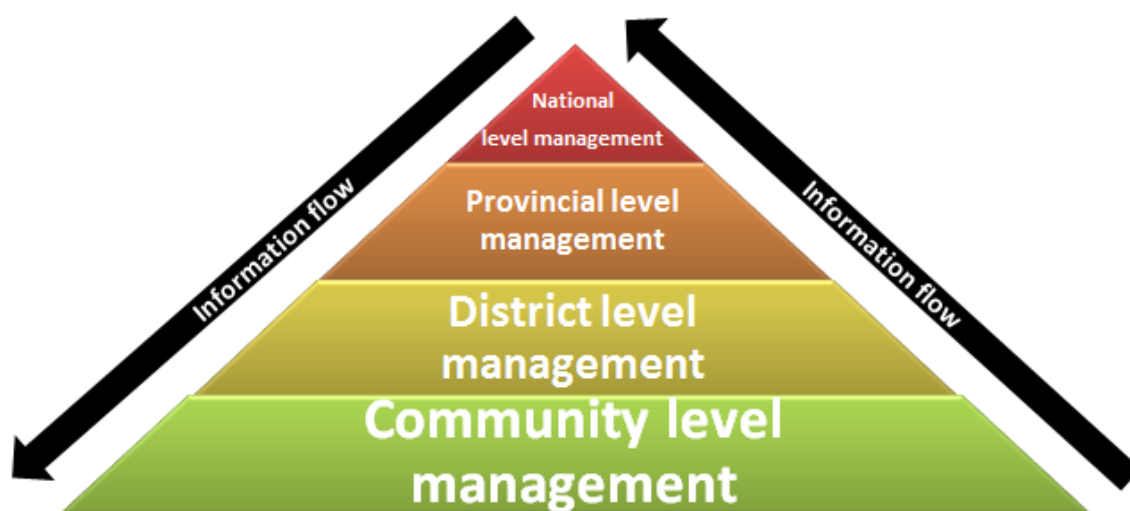
Strategic actions	2019	2020	2021	2022	2023
11. Remote sensing					
12. Record keeping and Information Systems Management					
13. Conflict resolution and participatory management					
14. Gender equality and empowering PA buffer zone communities					
15. Science communication techniques					
16. Sustainable tourism, ethical tourism and eco - tourism					
17. Survival skills in sea					
18. Identification of mangrove, mudflat and sand dune fauna and flora					
19. Identification, monitoring, eradication, containment and record keeping for invasives					
20. Wildlife photography					
21. Peace building and maintenance of ethnic identity of people					
<b>4.3.2.2.</b> Plan, identify appropriate locations and execute following foreign training programmes and study tours for park officials					
1.Fundamentals of habitat restoration and evaluation					
2. In situ and ex situ breeding of turtles					
3. Upcycling of waste					
4. Plant propagation techniques and restoration of endangered flora					
5. Community forestry					
6. Invasive species management from introductions to public awareness					
7. Community linked park management in marine protected areas (study tours)					
8. Tools for rainwater harvesting and water management in coastal areas					
9. Collection and use of DNA samples for identification of marine mammals and reptiles					
10. Designing of effective visitor resources and nature trails					
<b>4.3.1.2.</b> Strengthen the cadre for BRMS (Annexure 3)					
<b>4.3.1.3.</b> Train and recruit seasonal staff as and when needed from periphery					
<b>4.3.2. Park officials sufficiently provided with infra structure for daily operations, research, awareness and visitor management</b>					
<b>4.3.2.1.</b> Supply BRMS with following essential items required for park management (operational needs)					
<b>4.3.2.2.</b> All items are listed under goods category I in Annexure 1					

Strategic actions	2019	2020	2021	2022	2023
4.3.2.3. Supply BRMS with following essential items required for park management (research needs)					
4.3.2.4. All items are listed under goods category II in Annexure 1					
4.3.2.5. Supply BRMS with following essential items required for park management (visitor management needs)					
4.3.2.6. Alternative items are listed under goods category 111 in Annexure 1					

## 12 Monitoring and evaluation

In order to ensure transparency, following steps should be followed during monitoring and evaluation when implementing this plan. Also, it is of utmost importance that baseline data are available, indicators have been agreed upon, indicators are capable of showing initial, mid and final achievements of goals, agencies are aware about the type of data they are expected to generate, agencies have agreed to share data and a system is in place with a competent person to collate, analyse and report.

1. Monitoring should be conducted during the whole of the plan's implementation. The frequency of monitoring activities will be indicator dependent i.e. some indicators will need to be monitored monthly, some seasonally and some annually.
2. At the simplest level, because specific objectives and indicators have been chosen to cover the important ecological, social, economic and governance issues, assessing the status of each indicator against its benchmark should provide a snapshot of how well management is performing at the ecosystem level.
3. Different evaluation results will be required by different stakeholders and there should be upward and downward information flows between different levels, ranging from the national level to the community level, as well as across sectors.



4. In addition to internal audits, three independent audits should be conducted at 1.5, 3.5 and 5 years of the project by either a donor nominated team, or a team selected by the ministry.
5. Progress review meetings should be held every month during the implementation and PIP should be regularly updated, accordingly. Both technical and financial progress should be evaluated with accurate formats. An initial training on record maintenance to all involved staff is important.
6. The minutes of meetings should be maintained and distributed timely, after every meeting.
7. An online calendar should be maintained and shared with all stakeholders.
8. Outcomes of reviews should be made available for stakeholders.

## 13 Sustainability plan

The sustainability of the proposed management plan and its outcomes depends on several factors.

- a. Incentives stakeholders receive during the implementation of the strategic actions
- b. Efficiency of the proposed implementation committees in communicating the outcomes to stakeholders at all levels
- c. Perceived benefits encouraging the stakeholders to continue even in the absence of visible external funding
- d. Compatibility of the proposed operational mechanisms with the existing management structures
- e. Retaining staff trained for specific tasks within PAC

The strategic actions proposed here, if implemented diligently, will result in positive attitudinal changes as well as better living conditions for communities, who in turn need to be made aware that to enjoy these positive changes, PAC needs to be protected.

Hence, setting aside a part of the revenue in a liberal trust fund that can be accessed can benefit continued functioning of the systems. Also, the proposed actions have been spanned out in such a way; the first five years take care of provisioning of resources. Hence, latter stages are for monitoring and upgrading without the need of large amounts of expenditure for procurement.

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## 15 Appendices

### 15.1 Annexure 1: Table of goods required for PAC management

Place of Requirement	Description	Number required	Remarks
<b>Goods for Operational Needs</b>			
Proposed BRMS office and visitor center	Four-wheel drive cabs	02	For boundary patrolling, tourism and park administration related travelling
	Telephone line (with an operator)	02	For new visitor centres
	GPS	02 Units per each range & beat Office	Training to be provided on use and data entry
	Drones	02	
	Truck		
	Crew cab	01	
	Mechanized outrigger Boats	02	For patrolling
	Utility boat with motors	01	
	Large tractors	02	
	ATV bikes	01	To be placed at strategic posts
	Diesel generators	02 units	
	Solar light systems	Complete unit for each building	All beat and range offices should be supplied with solar power
	Swiss Army knives and tool Pack	05	
	Gum boots	10	
	Compost bins ad bins for plastic/ polythene and glass	03 sets each	For every building where waste is generated including ticketing office
	Spades, weeders, rakes, trowels, Dutch hoe, wheel Barrows	01 set each	For every bungalow, range and beat office
	Rain coats	3 per office	
	Gaiters	01 each for all park officials	
	Night vision binoculars	02	
	Tents (single/3 person & 10 person)	02 sets each	
	Camping chairs (2 nos.) & folding tables	02 sets	
	VHF/W.T./R.S	A system to connect entire PAC	
	Digital SLR underwater Camera	01	
Stainless steel flasks (500 ml)	02 for each office		
Headlamps	01 each for every officer		
Camping cookware	02 sets		

Place of Requirement	Description	Number required	Remarks
	Sleeping bags	01 each for every officer	
	Solar LED Lanterns	02 each for every office	
	Personal Locator beacons	03 sets	
	Lap top computer	02	Park office and range offices
	Printer cum scanner	05	Park office and range offices
	Laminating machine	05	Park office and range offices
	Stainless steel cupboards	10	Park office and range offices
	Office chairs and tables	10 sets	Park office and range offices
	Establish a meteorological station with instruments	01	To be established with Department of meteorology
Range office cum officers Accommodation	Sleeping bags	03 per beat Office	
	Basic furniture and items for office (office table, chairs, stainless steel lockable cupboard, lockable cupboard for arms, 1:5000 maps of the area, communicating systems, GPS)	Each office	
	Basic furniture for bed rooms (single beds, table, chair, cloth rack and dressing cupboard cum wardrobe, mosquito nets)	Each office	
	Basic furniture for living room (arm chairs, dining table and coffee table, first aid box)	Each office	
	Basic furniture and equipment for kitchen (storage cupboards, cooking pots, coconut scraper, gas cooker crockery and cutlery)	Each office	
	Binoculars	01 unit per Office	
Proposed ticketing points	Tables and chairs		New Kala Wewa entrance ticketing office
	Cash machines		
	Safety lockers		
	Display cupboard for Leaflets		
	Large screen		
	DVD player		
	Visitor chairs		
	Lockable cupboards		
Large notice board			

Place of Requirement	Description	Number required	Remarks
	Customer satisfaction survey box		
<b>Goods for research and animal Health management</b>			
Research wing of visitor centre	Refractometer	02	
	Digital multipara meter for water quality	01	
	Soil pH meters	02	
	Stainless steel quadrats (1×1m)	04	
	Stainless steel quadrats (0.5×0.5 m)	04	
	Under water writing pads	02	
	Oxygen cylinders	04	
	Sampling jars	10	
	Field microscope	02	
	Regulators	04	
	Diver's suites	04	
	Snake handling tool	04	
	"L- tool"		
	Hand nets of various mesh sizes for fish	10	
	Snake tongs for capture Snakes	04	
	Hand nets for butterflies & other insects	10	
	Light traps for insects	03	
	Hand held GPS	05	
	Dingy boat	02	
	Refrigerator	01	
Stainless steel cupboards	02		
Projector	01		
Screen	01		
Wooden Chairs for meetings and awareness Sessions	50		

## 15.2 Annexure 2: Proposed buildings

Type	Description	Number
Range Office	Park office, accommodation quarters and store rooms	One (01) in Kudawa
Visitor centre cum research Hut		One (01) in Kandakuliya/Kudawa
Staff accommodation		New staff accommodation in Gange Vadiya
Sanitary facilities and community run canteen		Proposed visitor centre
Nature trail with watch huts and hide outs		Two (02) nature trails in Kandakuliya

## 15.3 Annexure 3: Current status of staff and additional staff required for implementation of PAC strategic action plan

Location	Category	Existing cadre	Additional cadre required
Range office of Kudawa	Ranger	01	01
	Range Assistant		02
	Wildlife Guards	02	04
	Volunteer Guide		03
	Field Assistant		01
	Drivers	01	01
	Visitor centre managers		01
	Visitor centre assistants		05
	Divers		01
Proposed Beat office of Gange wadiya	Range Assistant		01
	Wildlife Guards		02
	Field Assistant		01

## 15.4 Annexure 4: Socio-economic data of Divisional Secretariat Kalpitiya

Divisional Secretariat Kalpitiya

- 154.2 Km<sup>2</sup>

Climate: Annual Precipitation, Flooding incidents, Annual Average temperatures (2006-2016)

year	Annual Precipitation (ml)	Flooding incidents (Months)	Annual average temperatures	Dry periods (Months)
2006	1035.10	October, November	28.69	
2007	662.60		29.20	
2008	280.38		28.71	
2009	688.32		28.59	
2010	714.90	December	29.14	April, May
2011	942.80	November	28.68	February
2012	680.20		28.33	March, April
2013	228.60		31.00	April, May
2014	1012.60	December	32.87	June
2015	1624.70	November	28.80	May, June
2016	853.00	November	30.15	June

### Population, employment & education

Summary of the population (2016)

Total number of Families	Total population	Female	Male	Average family members in a family
17293	67352	34676	32676	4

Population distribution (According to the race)

Age Group	Race					Total
	Sinhala	Tamil	Muslims	Burger	Other	
0-5	2996	1654	3325	0	0	7975
6-10	2923	1659	3181	0	0	7763
11-16	2642	1716	2917	0	0	7275
17-19	1924	985	2292	0	0	5201
20-25	2953	1477	2857	0	0	7287
26-30	3443	1865	3144	1	0	8453
31-60	7955	3073	7327	1	0	18356
Above 60	1691	1217	2134	0	0	5042
<b>Total</b>	<b>26527</b>	<b>13646</b>	<b>27177</b>	<b>2</b>	<b>0</b>	<b>67352</b>

Population distribution (According to the religion)

Age Group	Religion					Total
	Buddhist	Hindu	Islam	Catholic	Other	
0-5	732	653	3327	3248	30	7990
6-10	675	580	3227	3261	11	7754
11-16	694	546	2932	3066	10	7248
17-19	575	469	2260	1889	8	5201
20-25	727	536	2850	3157	21	7291
26-30	858	747	3135	3723	31	8494
31-60	2111	1216	7320	7658	24	18329
Above 60	440	457	2126	2013	9	5045
<b>Total</b>	<b>6812</b>	<b>5204</b>	<b>27177</b>	<b>28015</b>	<b>144</b>	<b>67352</b>

Population distribution (According to the age groups)

Age Group (years)	Population	
	Female	Male
0-5	4121	3856
6-10	4001	3768
11-16	3783	3525
17-19	2745	2573
20-25	3730	3646
26-30	4152	4039
31-60	9445	8899
Above 60	2699	2370
<b>Total</b>	<b>34676</b>	<b>32676</b>

Population density of the Divisional Secretariat (2012-2016)

Population density (km <sup>2</sup> )				
2012	2013	2014	2015	2016
414.7	428.9	413.7	421.3	437

Summary of the manpower

Age groups (Years)	Total population	Population not contribute to man power	Man power	Unemployment	Employment	Employment %
15-18	6838	3681	3157	1305	1852	59%
19-60	37323	6648	30675	7803	22872	75%
Above 60	5039	2386	2653	1103	1550	58%
<b>Total</b>	<b>49200</b>	<b>12715</b>	<b>36485</b>	<b>10211</b>	<b>26274</b>	<b>72%</b>

Employment according to the age group

Age group (years)	Local occupations						Foreign occupations						Total
	Full time			Part time			Full time			Part time			
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	
15-18	495	312	807	667	353	1020	9	7	16	5	4	9	1852
19-60	5225	1799	7024	10037	4036	14073	77	52	129	782	864	4166	22872
Above 60	369	118	487	612	451	1063	0	0	0	0	0	0	1550
<b>Total</b>	<b>6089</b>	<b>2229</b>	<b>8318</b>	<b>11316</b>	<b>4840</b>	<b>16156</b>	<b>86</b>	<b>145</b>	<b>145</b>	<b>787</b>	<b>868</b>	<b>4175</b>	<b>26274</b>

Foreign and local employment according to the age group

Age group (years)	Local employment	Foreign employment	Total
15-18	1827	25	1852
19-60	21097	1775	22872
Above 60	1550	0	1550
<b>Total</b>	<b>24474</b>	<b>1800</b>	<b>26274</b>

Population which does not belongs to manpower

Full time house wives	Full time students	Retired or elderly people	Disables	Other
3686	13239	2205	393	5635

Unemployment according to the age group

Age Group (Year)	Sex		Total
	Female	Male	
15-18	729	504	1233
19-30	1819	931	2750
31-40	1847	973	2820
41-60	1490	815	2305
Above 60	605	498	1103

Unemployment according to the education level

Academic level	Female	Male	Total
Without school education	385	214	599
Primary education	1579	819	2398
Grade 6-11	2500	1628	4128
Grade 12-13	993	516	1509
O/L	386	222	608
A/L	539	236	775
Graduates	62	35	97
Post graduate	1	0	1
Professional courses/Diplomas	37	47	84
Other	8	4	12
<b>Total</b>	<b>6490</b>	<b>3721</b>	<b>10211</b>



Employment according to the education level

Academic Level	Female	Male	Total
Without school education	631	770	1401
Primary education	2090	5256	7346
Grade 6-11	3092	7989	11081
Grade 12-13	1037	1885	2922
O/L	501	1092	1593
A/L	560	886	1446
Graduates	115	120	235
Post graduate	6	12	18
Professional courses/Diploma	122	86	208
Other	10	14	24
<b>Total</b>	<b>8164</b>	<b>18110</b>	<b>26274</b>

Population according to the academic level

Academic level	Female	Male	Total	Percentage % (Total)
Less than 5 years	4384	4114	8498	12.57%
At present (school/university/technical college)	7323	6574	13897	20.56%
Not attending to school	997	994	1991	2.95%
Primary (Grade 1-5)	8039	7956	15995	23.67%
Secondary (Grade 6-11)	8955	8761	17716	26.21%
O/L	2782	2422	5204	7.70%
A/L	1860	1558	3418	5.06%
Professional courses/Diploma	177	149	326	0.48%
Graduates	126	109	235	0.35%
• Arts	138	115	253	0.37%
• Engineers	0	5	5	0.01%
• Doctors	9	5	14	0.02%
• Other Science	3	2	5	0.01%
• Commerce	18	16	34	0.05%
• Other	5	6	11	0.02%
Post graduate	5	6	11	0.02%
<b>Total</b>	<b>34802</b>	<b>32785</b>	<b>67587</b>	<b>100%</b>

Education at present (Number of students in each educational level)

Educational Level	Female	Male	Total	Percentage (%) (Total)
Grade 1-5	2838	2570	5408	257%
Grade 6-9	2120	1907	4027	345%
Grade 10-11	1197	999	2196	633%
O/L	763	628	1391	999%
A/L	376	287	658	2112%
Graduates	82	60	142	9787%
Technical/professional training	36	39	75	18529%
<b>Total</b>	<b>7412</b>	<b>6490</b>	<b>13897</b>	<b>100%</b>

## Female oriented families

Year	No. of Family Members	Total Families
2013	1026	6
2014	1966	11.3
2015	1343	7.7
2016	1353	7.8

## Employment

Distribution of occupations according to jobs

Gender	Government sector	Private sector	Self-Employment		Foreign employment		Tunnel/ garden/ daily work	Other	Total
			Agriculture	Other than agriculture	Full-time	Short term			
Female	332	426	419	1528	54	814	3683	455	7711
Male	424	612	3594	6765	94	914	4883	1277	18563
<b>Total</b>	<b>756</b>	<b>1038</b>	<b>4013</b>	<b>8293</b>	<b>148</b>	<b>1728</b>	<b>8566</b>	<b>1732</b>	<b>26274</b>

Employment according to the job title

Occupation	Number	occupation	Number
Executive/Management	122	Business	1332
Teachers	390	Self-employment	5934
Clerks	294	labors	7213
Mechanics	323	Farmers	4233
Security sector	75	Land owners	207
Foreign employment	1800	other	4351
<b>Total</b>			<b>26274</b>

Number of families according to the self-employment

Type of self-employment	No. of families
Textile/clothes	64
Shops	710
Agriculture	230
Livestock	512
Fisheries	3729
Mason/Carpentry/ Technical	460
Other	187
<b>Total</b>	<b>5934</b>

Production according to the industries (annual)

Type of production	Amount
Eggs	12000
Sweets	3500 kg
Concrete towers	7200
Flower pots	5400
Bricks made by cement	3500

## Income

Average income of a family

Monthly income of a family (Rs.)	Number of families	Percentage (%)
0-3999	1130	7%
4000-7999	1917	11%
8000-11999	2502	14%
12000-15999	2508	15%
16000-19999	2186	13%
20000-23999	2317	13%
24000-27999	1746	10%
28000-31999	1520	9%
Above 32000	1467	8%
<b>Total</b>	<b>17293</b>	<b>100%</b>

Number of families according to individual monthly income

Monthly income of a family (Rs.)	Number of families	Percentage (%)
0-3999	1306	8%
4000-7999	2075	12%
8000-11999	2456	14%
12000-15999	2573	15%
16000-19999	2419	14%
20000-23999	2109	12%
24000-27999	1687	10%
28000-31999	1315	8%
Above 32000	1353	8%
<b>Total</b>	<b>17293</b>	<b>100%</b>

Income distribution

Average income of a family	Average income of a person
582463.23	767227.77

## Poverty

Total number of families	Income per person less than 4125.00		Income per person less than 8550.00		Number of families reworded by Divinaguma	
	Number	Percentage	Number	Percentage	Number	Percentage
17293	1397	8%	2329	13%	4619	27%

Number of families obtained bursaries

Amount	250 LKR	300 LKR	350 LKR	500 LKR	750 LKR	Total
Number of families	713	299	129	158	129	1487

Number of families awarded the Divinaguma bursaries

Amount	3500 LKR	2500 LKR	1500 LKR	420 LKR	Total
Number of families	1963	867	1356	433	4619

Welfare of elderly people

Number of elderly families	23
Total number	675
Population above 60	5069
Number of elderly families without any help	0
Percentage of elderly people without any help	0

## Houses

Physical condition about houses

Permanent houses (Bricks/cements/tiles/sheets)			Half completed permanent houses (clay/timber walls or coconut leaves)	Temporary houses	Other	Total number of families
Total	Completed	Half completed				
12252	8902	3350	1174	2188	76	13216
Percentage	67%	25%	9%	17%	1%	100%

Ownership about houses

Total number of families	No. of families having their own house	No. of families living in rental houses	No. of families without any houses
17293	15116	568	1609
Percentage	87%	3%	10%

Number of families with and without basic facilities

Total number of families	Number of Families		Percentage	
	with	without	With	without
Toilet	14338	1352	91%	9%
Electricity	14787	903	94%	6%
Water supply	11357	4341	72%	28%
Telephone (landlines)	6166	8623	39%	55%
Internet	6153	8836	39%	56%

## Presence of additional facilities

Facility	Number of families		Percentage	
	with	without	With	without
Motor cycles	8536	8757	49%	51%
Three wheelers & vehicles	3540	13727	20%	79%
Television	13005	4562	75%	26%
Computers	3656	13611	21%	79%
Refrigerators	5540	11727	32%	68%

## Waste management

Year	Amount of waste (MT)	Amount of waste recycled (MT)	Amount of fertilizers produced (MT)
2013	1600	0	0
2014	2880	0	0
2015	3440	200	3.5
2016	3600	500	5.64

## Agriculture

### Main permanent crop & annual production

Crop	Cultivated acres	Annual Production
Coconut	8003.8	27677750 (number)
Cashew	2	25Kg

### Main problems regarding those crops

- Red beetle and mite attack
- Adverse effect of power stations, increase the price of fertilizers
- Black beetle attack, construction of new houses in coconut lands, destruction of coconut trees due to high temperature

### Alternative methods

- Introduction of new varieties
- Proposals for improvement
- Distribution of coconut palms
- Fertilizers with discounts
- Educating people
- Introduction of new varieties

### Other cultivation/annual production

Crop	Cultivated land (Acres)	Annual production
<b>Fruits</b>		
Banana	136.5	569400
Pineapple	5	624
Mango	3.5	52000
Passion Fruit	1.53	5490

Crop	Cultivated land (Acres)	Annual production
Guawa	152.25	1907700
Rambutan	0	0
Papaya	221.254	1304760
Orange	0	0
Delum	52.5	143614
Orange (sweet)	5	80800
Lime	0.002	100
Sweet water melon	20	409200
<b>Total</b>	<b>597.536</b>	<b>4473688</b>
<b>Vegetables</b>		
Pea	524.5	970500
Snake gourd	41	151969.2
Ridge gourd	41.3	94300
Brinjols	149.5	653100
Chilies	924.25	4616974
Bitter guard	54.75	315370
Bandakka	301.5	1249102.8
Onions	954.5	3896802.5
Capsicum	336	1269259.8
Other	411.5	2069500
<b>Total</b>	<b>3923.8</b>	<b>16189261.3</b>
<b>Grains</b>		
Green gain	0	0
Peanut	1	600
Kaupi	0	0
Bada irigu	0	0
Thala	0	0
<b>Total</b>	<b>1</b>	<b>600</b>
<b>Small scale export products</b>		
Pepper	0	0
Coffee	0	0
Coco	0	0
Cloves	0	0
Cardamom	0	0
Cinnamon	0	0
Betel	0	0
Tobacco	10	8000
<b>Total</b>	<b>10</b>	<b>8000</b>

### Issues

- Destruction of the cultivation by sudden disasters
- Increase of the prices of fertilizers
- Animal/insect attacks
- Less prices

### Positive points for the cultivation

Presence of preferable conditions (land), ability to cultivate throughout the year

### Suggestions for improvements

- Requirement of registering as agricultural area
- Establishment of a proper draining system
- Introduction of organic fertilizers
- Awarding the fertilizer allowances
- Maintaining a stable price for harvest

Number of people cultivates the main crop

Coconut

Amount of land (Acres)	Number of owners	Total area (Acres)
0.25-0.50 (15-30 trees)	1077	518.95
0.50-1 (31-65 trees)	846	718.5
1-5	743	1997.5
More than 5	351	4768.85
<b>Total</b>	<b>3017</b>	<b>8003.8</b>

Cashew

Amount of land (Acres)	Number of owners	Total area (Acres)
0.25-0.50 (10-20 trees)	0	
0.50-1 (21-40 trees)	0	
1-5	1	2
More than 5	0	
<b>Total</b>	<b>1</b>	<b>2</b>

Vegetables and fruits

Amount of land (Acres)	Number of owners	Total area (Acres)
0.25-0.50	533	245.236
0.50-1	1008	680.8
1-5	1500	3039.25
More than 5	202	897
<b>Total</b>	<b>3243</b>	<b>4862.286</b>

Livestock statistics

Type	Government	Private	Total	Improved varieties	Local varieties	Total
Hens (Eggs)	0	3843	3843	4838	25291	30129
Chicken (Meat)	0	162	162	5712	13376	19088
Pigs	0	2537	2537	1038	11089	12127
Goats	0	1633	1633	860	8048	8908
Sheeps	0	0	0	0	0	0
Cows (milk)	0	240	240	15	1835	1850
Buffalos (milk)	0	0	0	0	0	0
Quils	0	2	2	0	20	20
Other	0	0	0	0	0	0

Milk collection centers : NO  
Centers for dairy products : NO

Milk production and productivity

Milk-farmer projects/number of families	Number of cows	Daily production (L)	Annual production (L)	Average milk production of a cow (daily) (L)
11	33	80	19300	17

Daily Egg production

Number of families or farms	Number of hens	Daily production	Annual production
3246	22046	29496	5722920

### Issues

- Highest prices of food
- Lack of grasslands
- Possibilities for livestock
- Barren lands

### Suggestions for improvement of livestock

- Coconut land are suitable for livestock
- Rearing goats and cows can also help in vegetable production

### Land usage

Description	Land usage (Ha)
Main crops (Coconut)	4562.16
Other permanent crops	1045.28
Rice	0
Home cultivation (home/business)	1900.67
Protected forest areas	434.04
Cultivated lands in protected forest	0
Government lands	1202.12
Uncultivated areas	
Land	445.79
Wet	5.96
Other protective areas	587
Barren lands	192.8
Other	5044.18
<b>Total</b>	<b>15420</b>

Information about land ownership

Category (Acers)	Number of families		Amount of land	
	Land	Paddy	Land	Paddy
1/4-1/2	6835	0	3352.12	0
1/2-1	4466	0	3175.05	0
1-5	2569	0	2761.17	0



Category (Acers)	Number of families		Amount of land	
	Land	Paddy	Land	Paddy
5-10	1414	0	4361	0
More than 10	619	0	4242.1	0
Without any land	303	0	3870	0
<b>Total</b>	<b>17293</b>	<b>0</b>	<b>21761.44</b>	<b>0</b>

## Industries

### Large scale industries (servants more than 100)

Name & the place	Type of production	Annual Production (unit)	Number of servants	Market	
				Local	Foreign
Coal Power plant	Electricity	900Mw	500	Local	

### Middle & minor scale industries (servants 1-99)

Name & the place	Type of production	Annual Production (unit)	Number of servants	Market	
				Local	Foreign
Lanka Isuru Daluwa Mampuriya	Salt	10000	10		
Thal industry Aanawasala	Hand bag	200Kg	8	Local	
Thara Garment Factory Karamba	Textile		50		Foreign
Shantha Anna Industry	Coconut oil & desiccated	3000 T	40	Local	

### Home based industries

Industry	Number	Production	Annual production value (LKR)	No. of employments	Market	
					Local	Foreign
Cloth weaving (Hand loom)	36	2156	1200000	31		0
Ready make clothes	162		6101000	154		0
Batiks	4	120	43000	12	0	0
Food processing (Fruits)	20	186	562000	12		0
Agricultural products	0	0	0	0	0	0
Salt	25	1007500	7750000	59		0
Sweets	259		4963000	275		0
Gold productions	0	0	0	0	0	0
Furniture	37	669	3637000	66		0
Clay products	2	3	1225000	6	0	0
Cement production	64		32254307	100		0
Coconut fiber products	2	0	0	1	0	0
Leather products	0	0	0	0	0	0
Ornamental	27	75	35500	23		0
<b>Total</b>	<b>638</b>		<b>57770807</b>	<b>739</b>		<b>0</b>

### Industries with least attention

- Palm leave production Palmyra leaves
- Beach seine industry

### Issues

- Lack of basic knowledge
- Lack of raw materials
- Lack of capital investment

### Suggestins for improvement

- Create a good market for existing industries
- Proper price for products
- Training programs

Information about new creations

Name	Address	Production	Whether working as industrial level
MF Hafla	Palliwasalathure	Products using coconut shells	Yes

Government and private agencies which obtained SLS & productivity certificate

Year	Number of agencies obtained SLS Certificate	Number of agencies obtained ISO certificate	Number of agencies obtained SLS
2013	0	0	0%
2014	0	0	0%
2015	0	0	0%
2016	1	0	1%

### Fisheries industry

Marine fisheries

Length of the sea (Km)	Number of families	Number of fishing harbors/fish landing sites	Beach seine stations	No. of boats	No. of fishery societies	No of fish selling centers under the permission of Pradeshiya saba
71.83	4912	62	65	2426	48	17

Productions in relations to fishery industries

Industry	Number of families	Annual production (Kg)
Dried fish industry	327	170270

Shrimp industries government lands/private/with permits/without permits

No.	Land Area	No. of jobs	Annual production (kg)	Closed Farms	
				No.	Land area (Ha)
21	200	71	478000	10	31

#### Barriers to reopen those farms

- Financial problems
- Freshwater fisheries-No
- Potential reservoirs and pond for in land fishers
- Thethapola Nillan Kuliya Wewa

#### Issues

- Inability to purchase fishing gears
- Lack of sun protectors
- Lack of better market and storing facilities
- Lack of inbuilt motivation for the industry
- Lack of fish landing sites
- Decrease the fish population due to the Lakvijaya Coal power plant (Release of hot water to the sea)
- Use of prohibited fishing gears
- Lack of proper landing facilities
- Tourist industry

#### Proposals for the improvements of fishery industries

- Replanting mangroves
- Distribution of fishing gears
- Distribution of latest equipment
- Conducting training programs
- Bursary programs
- Development of fishery harbors/fish landing sites

#### Places important for tourist industries

(Environment, religious, cultural, sports, entertainment, historic)

	Place	Important	Annual participation		Proposals for improvements
			Local	Foreign	
1	Nirmalapura Beach	Tourist	775	25	Create tourist attraction
2	Beach	Dolphin watching	900	1050	Conservation of beach, making the beach nicer, road development
3	Erumbukkudal Beach	Diving place	0	120	
4	Kappaldaya Kele Church	Catholic	7 million	2000	

	Place	Important	Annual participation		Proposals for improvements
			Local	Foreign	
5	Kappaldiya Oda	Beach	5000	4000	
6	Kakka Doopatha	Church	250	120	
7	Nachchi amman Genge	Environment	100	50	Construction of protective fences
8	Beach	Tourist	80000	25000	
9	Olanda Church	Historic place	1300	750	
10	Fort	Historic place	4000	1000	Conservation
11	Dutch Muhathuwarala	Historic place	300	1500	Road development

### Tourist and accommodation facilities

Type	Name of the institute	Telephone No.	No. of servants	No. of rooms		Status (Star)
				AC	Non-AC	
Rest Houses	Breeze-Resort	0323322620	4	2	2	
	Dolpin Village	724810727	2	0	6	
	Canrak Cathari	718415331	7	2	4	
	Kalpitiya Rest House		9	1	4	
	Kapadiya	0774486037	6	5	8	
Guest Houses	Arya Nikethanaya	777668668	10	5	2	
	Rentam Villa	771543958	1	2	6	
	Chaleesa	3222614160	1	2	4	
	Dolpin Beach Resort	0326388050	18		9	
	Rosaanne Beach Resort	771825455	10		9	
	Omesha Beach Hotel	727878782	10		10	
	Makara Resort	729205961	19	9		
	Bed Rock	715553666	5	4	0	
	Kite keeda	770037740	7	0	6	
	Nilanki	770037740	4	0	4	
	Villa	783832099	5	0	4	
	Kite Gurn	723787999	10	4	12	
	Nenu villas	773686235				
	Kitesurfing	719463474	6	3	4	
	Cocodance	718372639	5	2	4	
	Hassanakite	712572690	5		6	
	Cocodance	719468474	5		4	
	Wellewadiya	114322288	8	4	4	
	Horizon	767474713	6		5	
	Saltbay	773062030	3		5	
Sandy Edge	710574295	2		4		

### Problems on tourist industries

- Dumping waste/garbage to the lagoon
- Soil erosion
- Undeveloped road system
- Highest charge taken by DWC for the tourist, who is coming for dolphin watching
- Sounds coming from wind power stations
- Ashes released by Lakvijaya coal power station

### Potential sources for the tourist industries

- Situation of the lagoon (Closeness)
- Traffic close to the main road

### Proposals for the developments of tourisms

- Development of road system
- Proper disposal of garbage/waste
- Coast conservation

### Auto mobiles

Description	Bicycle	Motor-bicycle	Three-wheeler	Tractors (Hand)	Tractors	Van	Tractor	Buses	Cars	Other	Cart	Bullock carts
Government	15	88	7	2	9	13	2	2	2	15	3	0
Private	9751	7336	1908	43	169	345	41	31	167	77	4	0
Total	9766	7424	1915	45	178	358	43	33	169	92	7	0

### Education

Number of preschools	81
Higher education institutions	00
Training institutions	00
Tuition classes	08 (students-996; instructors - 41)
Piriven	00
Dhaham schools	49 (Buddhist-07; Hindu-03; Catholic-17; Muslim-22)
Schools	40 (Students-17963; teachers-826)

### Types of schools

Type of School	Number	Number of students	Number of teachers		
			Science	Math	English
1 AB	3	2806	9	6	8
1C	9	7296	21	16	17
2	13	4721	10	9	13
3	15	3140	3	1	10
<b>Total</b>	<b>40</b>	<b>17963</b>	<b>43</b>	<b>32</b>	<b>48</b>

Requirement of teachers

Description	Sinhala	Tamil
Total number of students	28	12
Required number of teachers	737	299
Number of teachers (at present)	537	202
Number of vacancies for teachers	200	97

Percentage of students, got through A/L exam during the past few years

Year	Number of students	Number of students, got thorough the exam	Percentage % (got thorough the exam)	Number of students, selected to the University
2012	274	213	77.737226	28
2013	275	192	69.818182	33
2014	238	187	78.571429	35
2015	267	201	75.280899	67
2016	288	206	71.527778	65

Percentage of students, got through O/L exam during the past few years

Year	Number of students	Number of students, got thorough the exam	Percentage % (got thorough the exam)
2012	972	504	51.851852
2013	1035	538	51.980676
2014	928	378	40.732759
2015	1025	349	34.04878
2016	1088	442	40.625

15.5 Annexure 5: Locations of buoys demarcating “Left aside to restoration zone”.  
Information obtained from Weerakkody, 2018)

<b>Northern reef Zone (A)</b>				
<b>Locations identified with stakeholder team</b>			<b>Final positions with modifications</b>	
<b>Fix</b>	<b>Position</b>		<b>Position</b>	<b>Depth</b>
A1	N8 23.312 E79 44.709	→	N8 23.315 E79 44.717	6m.
A2/AC1	N8 23.156 E79 44.183	→	N8 23.159 E79 44.177	8m.
A3/AC2	N8 22.938 E79 44.276	→	N8 22.946 E79 44.307	4m.
A4	N8 23.054 E79 44.793	→	N8 23.054 E79 44.810	6m.
A5– Light Buoy	not marked	→	N8 23.280 E79 44.441	5m.
<b>Original identified area *</b>			<b>Modified Final area *</b>	
Perimeter	2.68 Kilometers	→	2.97 Kilometers	
Area	0.40 Square Kilometers	→	0.51 Square Kilometers	
<b>Boundary leg distances *</b>				
<b>Buoy marker</b>	<b>Distance (aprx.) *</b>			
A1 –A5	510 m.			
A5 –A2	536 m.			
A2 –A3	407 m.			
A3 –A4	945 m.			
A4–A1	512m.			

<b>Southern reef Zone (B)</b>				
<b>Locations identified with stakeholder team</b>			<b>Final positions with modifications</b>	
<b>Fix</b>	<b>Position</b>		<b>Position</b>	<b>Depth</b>
B1	N8 22.402 E79 44.920	→	N8 22.400 E79 44.920	7.0 m.
B2	N8 22.482 E79 44.859	→	N8 22.483 E79 44.856	8.5 m.
B3	N8 22.102 E79 44.800	→	N8 22.102 E79 44.801	4.5 m.
B4	N8 22.120 E79 44.667	→	N8 22.123 E79 44.670	3.0 m.
B5– Light Buoy	not marked	→	N8 22.297 E79 44.707	4.0 m.
<b>Identified area *</b>				
Perimeter	1.80 Kilometers			
Area	0.17 Square Kilometers			
<b>Boundary leg distances *</b>				
<b>Buoy marker</b>	<b>Distance (aprx.)</b>			
B1 -B2	190 m.			
B2 –B5	430 m.			
B5-B4	350 m.			
B4 –B3	250 m.			
B3 –B1	600 m.			

## 15.6 Annexure 6 Marine Species recorded from Kalpitiya area.

### 15.6.1 Mammal Species recorded from Kalpitiya area

(RL Categories: VU – Vulnerable; EN – Endangered; En: Endemic; Ex: Exotic; CR – Critically Endangered; NE: Not Evaluated NT – Near Threaten; LC – Least Concerned; DD – Data Deficient) (Source: IUCN, 2012) S – Sinhala Name; E – English name; TR – Threatened

Scientific name	Common Name	RL Categories
<b>Family: Balaenopteridae</b>		
<i>Balaenoptera musculus</i> Linnaeus, 1758	E: Blue whale S: Nil thalmasa	EN
<i>Balaenoptera acutorostrata</i> Lacepede, 1804	E: Mink Whale S: Minki thalmasa	LC
<i>Balaenoptera edeni</i> Anderson, 1879	E: Bride's whale S: Bridege thalmasa	DD
<i>Megaptera novaeangliae</i> (Borowski, 1781)	E: Hump-backed Whale S: Molli thalmasa	LC
<b>Family: Physeteridae</b>		
<i>Physeter macrocephalus</i> Linnaeus, 1758	E: Sperm Whale S: Manda thalmasa	VU
<b>Family: Kogiidae</b>		
<i>Kogia sima</i> (Owen, 1866)	E: Dwarf Sperm Whale S: Mitimanda thalmasa	DD
<b>Family: Delphinidae</b>		
<i>Orcinus orca</i> (Linnaeus, 1758)	E: Killer whale S: Minimaru thalmasa	DD
<i>Lagenodelphis hosei</i> Fraser, 1957	E: Fraser's Dolphin S: Keti hota mulla	LC
<i>Pseudorca crassidens</i> (Owen, 1846)	E: False Killer Whale S: Wyaja minimaru thalmasa	DD
<i>Peponocephala electra</i> (Gray, 1846)	E: Melon headed Whale S: Puhu lolu mulla	LC
<i>Steno bredanensis</i> (Lesson, 1828)	E: Rough-toothed Dolphin S: Ralu dath mulla	LC
<i>Stenella longirostris</i> (Gray, 1828)	E: Spinner Dolphin S: Sannali mulla	DD
<i>Stenella attenuata</i> (Gray, 1846)	E: Spotted Dolphin S: Thith mulla	LC
<i>Stenella coeruleoalba</i> (Meyen, 1833)	E: Striped Dolphin S: Wyiram mulla	LC
<i>Grampus griseus</i> (Cuvier, 1812)	E: Rissos Dolphin/Grey Dolphin S: Malina mulla	LC
<i>Tursiops truncatus</i> (Monotagu, 1821)	E: Bottle nosed Dolphin S: Digasumbu mulla	LC
<i>Sousa chinensis</i> (Osbeck, 1765)	E: Indo-pacific hump-back Dolphin S: Kabara mulla	NT
<i>Delphinus delphis</i> Linnaeus, 1758	E: Common Dolphin S: Podu mulla	LC



<i>Globicephala macrorhynchus</i> Gray, 1846	E: Short-finned Pilot Whale S: Keti waral niyamu thalmasa	DD
<b>Family: Dugongidae</b>		
<i>Dugong dugong</i> (Muller, 1776)	E: Dugong S: Muhudu Ura	VU*
<i>Unconfirmed records from documented kills within the lagoon.</i>		
<b>Family: Phocoenidae</b>		
<i>Neophocaena phocaenoides</i> (Cuvier, 1829)	E: Finless Porpoise S: Awaral mulla	VU
<i>Orcaella brevirostris</i>	E: Irrawadi Dolphin	VU

(Sources: Prasanna Weerakkody, 2017 unpublished data)

### 15.6.2 Sea Birds Recorded in the sea area off Kalpitiya

Scientific Name	Common Name/s	RL Categories
<b>Family: Laridae</b>		
<i>Sterna fuscata</i> Linnaeus, 1766*	E: Sooty Tern S: Dumbutu muhudulihiniya	CR
<i>Sterna albifrons</i> Pallas, 1764*	E: Little Tern S: Punchi muhudulihiniya	VU
<i>Sterna nilotica</i> Brehm, 1830*	E: Gull-billed Tern S: Galuthudu muhudulihiniya	CR
<i>Sterna bergii</i> Lichtenstein, 1823	E: Great Crested Tern S: Maha konda muhudulihiniya	NT
<i>Sterna caspia</i> Pallas, 1770*	E: Caspian Tern S: Kaspiya muhudulihiniya	CR
<i>Sterna hirundo</i> Linnaeus, 1758*	E: Common Tern S: Podu muhudulihiniya	CR
<i>Thalasseus bengalensis</i> (Lesson, 1831)	E: Lesser Crested Tern	
<i>Anous stolidus</i> (Linnaeus, 1758)	E: Brown noddy	
<i>Anous tenuirostris</i> (Temminck, 1823)	E: Lesser noddy	
<i>Larus fuscus heuglini</i> Bree, 1876	E: Heuglins Gull	
<i>Ichthyaetus ichthyaetus</i> (Pallas, 1773)	E: Palla's Gull	
<i>Chroicocephalus brunnicephalus</i> (Jerdon, 1840)	E: Brown Headed Gull	
<b>Family: Procellariidae</b>		
<i>Puffinus persicus</i> (Hume, 1872)	E: Persian Shearwater	
<i>Ardenna carneipes</i> (Gould, 1844)	E: Flesh-footed Shearwater	
<i>Ardenna pacifica</i> (Gmelin, 1789)	E: wedge-tailed Shearwater	

Scientific Name	Common Name/s	RL Categories
<b>Family: Stercorariidae</b>		
<i>Stercorarius longicaudus</i> Vieillot, 1819	E: Long tailed Skua	
<i>Stercorarius pomarinus</i> Temminck, 1815	E: Pomarine skua	

(Sources: Prasanna Weerakkody, 2017 unpublished data; Report on the systematic surveying of Bar Reef Marine Sanctuary, ESA project, UNDP, Sri Lanka)

### 15.6.3 Reptile species recorded in Kalpitiya

Scientific Name	Common Name/s	RL Categories
<b>Family: Cheloniidae</b>		
<i>Chelonia mydas</i> (Linnaeus, 1758)	E: Green turtle S: Gal kasbaeva/Mas kasbaeva/Vali kasbaeva T: Pal Amai	EN
<i>Lepidochelys olivacea</i> (Eschscholtz, 1829)	E: Olive ridley sea turtle S: Batu kasbaeva/Mada kasbaeva T: Pul Amai	EN
<i>Eretmochelys imbricata</i> (Linnaeus, 1766)	E: Hawksbill sea turtle S: Pothu kasbaeva/Leli kas baeva T: Nanja Amai	EN

(Sources: Prasanna Weerakkody, 2017 unpublished data)

#### 15.6.4 Marine fish species recorded from the Bar-reef and surrounding area

Family	Species	Family	Species	
Acanthuridae	<i>Zebrasoma scopas</i>	Antennaridae	<i>Antennarius striatus</i>	
	<i>Zebrasoma desjardini</i>	Apogonidae	<i>Apogon kalopterus</i>	
	<i>Acanthurus lineatus</i>		<i>Apogon novemfasciatus</i>	
	<i>Acanthurus leucosternon</i>		<i>Apogon frenatus</i>	
	<i>Acanthurus triostegus</i>		<i>Apogon aureus</i>	
	<i>Acanthurus pyroferus</i>		<i>Cheilodipterus macrodon</i>	
	<i>Acanthurus tristis</i>		<i>Cheilodipterus quinquelineatus</i>	
	<i>Acanthurus mata</i>		<i>Cheilodipterus sp.</i>	
	<i>Acanthurus dussumieri</i>		<i>Archamia fucata</i>	
	<i>Acanthurus blochii</i>		<i>Archamia biguttata</i>	
	<i>Acanthurus nigricauda</i>		Arridae	<i>Arius sp.</i>
	<i>Aanthurus guttatus</i>	Aulostomidae	<i>Aulostostoma chinensis</i>	
	<i>Acanthurus xanthopterus</i>	Balistidae	<i>Balistapus undulates</i>	
	<i>Ctenochaetus striatus</i>		<i>Balistoides viridescens</i>	
	<i>Ctenochaetus strigosus</i>		<i>Balistoides conspicillum</i>	
	<i>Naso litturatus</i>		<i>Pseudobalistes fuscus</i>	
	<i>Naso uniconis</i>		<i>Rhinecanthus aculeatus</i>	
	<i>Naso annulatus</i>		<i>Rhinecanthus rectangulatus</i>	
	<i>Naso brachicentron</i>		<i>Odonus niger</i>	
	<i>Paracanthurus hepatus</i>		<i>Melichthys vidua</i>	
	<i>Melichthys indicus</i>			
	<i>Suffleman albicaudatus</i>			
Belonidae	<i>Tylosus sp.</i>	Bothidae	<i>Bothus sp.</i>	
	<i>Strongylura strongylura</i>		Caesionidae	<i>Pterecaesio chrysozona</i>
	<i>Plagiotremus rhinorhynchos</i>	<i>Casio cunningg</i>		
	<i>Plagiotremus tapeinosoma</i>	<i>Caesio caeruleaurea</i>		
	<i>Aspidonotus taeniatus</i>	<i>Caesio lunaris</i>		
	<i>Petroscritus sp.</i>	<i>Caesia teres</i>		
	<i>Meiacanthus</i>	<i>Caesio varilineata</i>		
	<i>Cirripectus</i>	<i>Dipterygonotus balteatus</i>		
	<i>Escanias nalolo</i>	<i>Gymnocaesio gymnoptera</i>		
	<i>Ecsenias sp.</i>	Callionymidae		<i>Synchiropus sp.</i>
	<i>Escanias bicolor</i>			Carcharinidae
	<i>Exalias brevis</i>	<i>Carcharhinus amblyrhynchoides</i>		
	<i>Entomacrodus sp.</i>	<i>Galeocerdo cuvieri</i>		
	<i>Istiblennius</i>	<i>Carcharhinus melanopterus</i>		
Carangidae	<i>Carangoides fulvoguttatus</i>	Centropomidae	<i>Lates calcarifer</i>	
	<i>Carangoides gymnostethus</i>		<i>Psammoperca waigensis</i>	
	<i>Carangoides hedlandensis</i>	Chanidae	<i>Chanos chanos</i>	
	<i>Carangoides malbaricus</i>		Congridae	<i>Gorgosia maculate</i>
	<i>Caranx heberi</i>	<i>Gorgosia preclara</i>		
	<i>Caranx ignobilis</i>	<i>Conger cinerascens</i>		
	<i>Caranx sem</i>	Chaetodontidae		<i>Chaetodon decussatus</i>
	<i>Caranx melampygus</i>		<i>Chaetodon vagabundus</i>	
Carangidae	<i>Carangoides fulvovittatus</i>		<i>Chaetodon collaris</i>	
	<i>Sexfasciatus</i>		<i>Chaetodon Auriga</i>	
	<i>Alectis indicus</i>		<i>Chaetodon citrinellus</i>	
	<i>Alectis ciliaris</i>	<i>Chaetodon melanotus</i>		
	<i>Gnathanodon speciosus</i>			
<i>Trachinotus blochii</i>				

Family	Species	Family	Species
	<i>Alepes vari</i>		<i>Chaetodon trifasciatus</i>
	<i>Atule mate</i>		<i>Chaetodon trifascialis</i>
	<i>Decapterus russelli</i>		<i>Chaetodon plebeius</i>
	<i>Selar crumenophthalmus</i>		<i>Chaetodon xanthocephalus</i>
	<i>Scomberoides commersonianus</i>		<i>Chaetodon klinii</i>
	<i>Scomberoides lysan</i>		<i>Chaetodon falcula</i>
	<i>Parastromateus niger</i>		<i>Chaetodon lineolatus</i>
<b>Chirocentridae</b>	<i>Chirocentrus</i>		<i>Chaetodon meyeri</i>
<b>Cirrhitidae</b>	<i>Paracirrhitis forsteri</i>		<i>Chaetodon unimaculatus</i>
	<i>Paracirrhitis arcatus</i>		<i>Chaetodon rafflesi</i>
	<i>Cirrhitis pinnulatus</i>		<i>Chaetodon lunula</i>
	<i>Cirrhitichthys oxycephala</i>		<i>Chaetodon traingulum</i>
	<i>Oxycirrhitis typus</i>		<i>Chaetodon octofasciatus</i>
<b>Clupeidae</b>	<i>Amblygaster sirm</i>		<i>Gardineri</i>
	<i>Amygaster clupeoides</i>		<i>Chaetodon guttassimus</i>
	<i>Sardinella</i>		<i>Forcipiger longirostris</i>
	<i>Nematalosa nasus</i>		<i>Chelmon rostratus</i>
	<i>Hilsa kelee kelee</i>		<i>Hemitaurichthys zoster</i>
	<i>Sardinella gibbosa</i>		<i>Heniochus acuminatus</i>
	<i>Sardinella longiceps</i>		<i>Heniochus monoceros</i>
	<i>Sardinella albella</i>		<i>Heniochus singularis</i>
<b>Coryphaenidae</b>	<i>Coryphaena hippurus</i>		<i>Heniochus pleurotaenia</i>
<b>Cynoglossidae</b>	<i>Cynoglossus sp.</i>	<b>Dactyloptertidae</b>	<i>Dactyloptera sp.</i>
	<i>Symphurus sp.</i>	<b>Diodontidae</b>	<i>Diodon hystrix</i>
<b>Dasitidae</b>	<i>Dasyatis kuhlii</i>		<i>Diodon liturosus</i>
	<i>Taeniura lymma</i>	<b>Drepanidae</b>	<i>Drepane punctate</i>
	<i>Tyniura melanospilos</i>	<b>Echeneidae</b>	<i>Echeneis naucrates</i>
	<i>Urogymnus sp.</i>	<b>Engraulidae</b>	<i>Stolephorus indicus</i>
	<i>Himantura uarnak</i>		<i>Encrasicholoina heteroloba</i>
<b>Ephippidae</b>	<i>Ephippus orbis</i>		<i>Thryssa hamiltoni</i>
<b>Exocoetidae</b>	<i>Hirundichthys oxycephalus</i>	<b>Fistularidae</b>	<i>Fistularia commersoni</i>
	<i>Hirundichthys coromandalensis</i>	<b>Gerridae</b>	<i>Gerres abbreviates</i>
	<i>Cheilopogon nigricans</i>	<b>Gobiidae</b>	<i>Cryptocentrus/Amblyeleotris sp.</i>
	<i>Cheilopogon suttoni</i>		<i>Amblyeleotris diagonalis</i>
	<i>Cheilopogon cynopterus</i>		<i>Amblygobius phalaena</i>
	<i>Cheilopogon furcatus</i>		<i>Valencienna strigata</i>
	<i>Cypselurus poecilopterus</i>		<i>Valencienna puellaris</i>
<b>Haemulidae</b>	<i>Plectorhynchus vittatus</i>	<b>Gobiidae</b>	<i>Valencienna sp.</i>
	<i>Plectorhynchus schotaf</i>		<i>Gobiodon citrinus</i>
	<i>Plectorhynchus ceylonensis</i>		<i>Gnatholepis sp.</i>
	<i>Plectorhynchus lineatus</i>		<i>Istigobius decorates</i>
	<i>Diagramma pictum</i>	<b>Hemiramphidae</b>	<i>Hemiramphus sp.</i>
	<i>Pomadasys sp.</i>		<i>Oxyramphus sp.</i>
	<i>Pomadasys guoraka</i>		<i>Hyporhamphus limbatus</i>
<b>Hemiscyllidae</b>	<i>Chiloscyllium griseum</i>	<b>Holocentridae</b>	<i>Myripristis murdjan</i>
	<i>Chiloscyllium indicum</i>		<i>Myripristis adusta</i>
	<i>Chiloscyllium plagiosum</i>		<i>Myripristis vittata</i>
<b>Kuhliidae</b>	<i>Kuhlia mugil</i>		<i>Myripristic melanosticta</i>
<b>Kyphosidae</b>	<i>Kyphosus sp.</i>		<i>Neoniphon samarra</i>
	<i>Kyphosus cinerascens</i>		<i>Neoniphon opercularis</i>
<b>Labridae</b>	<i>Chelinus undulates</i>		<i>Neoniphon argentius</i>

Family	Species	Family	Species
	<i>Chelinus chlorurus</i>		<i>Sargocentron spiniferum</i>
	<i>Chelinus trilobatus</i>		<i>Sargocentron caudimaculatum</i>
	<i>Anampses melanurus</i>		<i>Sargocentron diadema</i>
	<i>Anampses lineatus</i>		<i>Sargocentron rubrum</i>
	<i>Anampses sp.</i>	<b>Leiognathidae</b>	<i>Leiognathus daura</i>
	<i>Halichoerus hortulanus</i>		<i>Leiognathus berbis</i>
	<i>Halichoerus marginatus</i>		<i>Leiognathus equulus</i>
	<i>Halichoerus nebulosus</i>		<i>Gaza minuta</i>
	<i>Halichoerus margaritaceus</i>		<i>Leiognathus sp</i>
	<i>Halichoerus timorensis</i>	<b>Lethrinidae</b>	<i>Lethrinus ornatus</i>
	<i>Halichoerus leucoxanthus</i>		<i>Gymnocranium elongatus</i>
	<i>Hemigymnus fasciatus</i>		<i>Lethrinus olivaceus</i>
	<i>Hemigymnus melapterus</i>		<i>Lethrinus microdon</i>
	<i>Gomphosus caeruleus</i>		<i>Lethrinus mahsena</i>
	<i>Macropharyngodon ornatus</i>		<i>Lethrinus lentjan</i>
	<i>Macropharyngodon meleagris</i>		<i>Lethrinus harak</i>
	<i>Stethojulis trilineata</i>		<i>Lethrinus nebulosus</i>
	<i>Stethojulis sp.</i>	<b>Lutjanidae</b>	<i>Lutjanus decussatus</i>
	<i>Parachelinus mccoskeri</i>		<i>Lutjanus quinquelineatus</i>
	<i>Parachelinus carpenter</i>		<i>Lutjanus madras</i>
	<i>Xyrichthys pavo</i>		<i>Lutjanus lunulatus</i>
	<i>Novaculichthys taeniours</i>		<i>Lutjanus bohar</i>
	<i>Choerodon fasciatus</i>		<i>Lutjanus argentimaculatus</i>
	<i>Bodianus diana</i>		<i>Lutjanus lutjanus</i>
	<i>Bodianus neilli</i>		<i>Lutjanus biguttatus</i>
	<i>Coris frerei</i>		<i>Lutjanus vittata</i>
	<i>Epibulus insidiator</i>		<i>Lutjanus kasmira</i>
	<i>Diproctacanthus xanthurus</i>		<i>Lutjanus monostigma</i>
	<i>Labroides dimidiata</i>	<b>Lutjanidae</b>	<i>Lutjanus fulviflamma</i>
<b>Labridae</b>	<i>Thalassoma amblycephalum</i>		<i>Lutjanus fulvus</i>
	<i>Thalassoma quinquevittatum</i>		<i>Lutjanus rivulatus</i>
	<i>Thalassoma purpureum</i>		<i>Lutjanus johnii</i>
	<i>Thalassoma lunare</i>	<b>Lutjanidae</b>	<i>Lutjanus gibbus</i>
	<i>Thalassoma janseni</i>		<i>Lutjanus ehrenbergii</i>
	<i>Thalassoma hardwickii</i>		<i>Macolor niger</i>
<b>Microdesmidae</b>	<i>Nematoleotris decora</i>	<b>Mobulidae</b>	<i>Mobula sp.</i>
	<i>Nematoleotris magnifica</i>	<b>Monacanthidae</b>	<i>Amanses scopas</i>
<b>Mugilidae</b>	<i>Valamugil sp.</i>		<i>Alutera scripta</i>
	<i>Oedalechelus sp.</i>		<i>Monodactylus argenteus</i>
	<i>Mulloidichthys flavolineatus</i>	<b>Mullidae</b>	<i>Parupaneus barbarinus</i>
	<i>Mulloidichthys vanicolensis</i>		<i>Parupaneus indicus</i>
	<i>Mulloidichthys mimicus</i>		
<b>Muraenidae</b>	<i>Permistes</i>		<i>Parupaneus forskali</i>
	<i>Enigmaticus</i>		<i>Parupaneus macronema</i>
	<i>Enchelycore sp.</i>		<i>Parupaneus bifasciatus</i>
	<i>Gymnothorax chlamydatius</i>		<i>Upaneus sp.</i>
	<i>Gymnomuraena zebra</i>		<i>Gymnothorax javanicus</i>
	<i>Sideria thyrsoides</i>		<i>Gymnothorax flavimarginatus</i>
	<i>Echidna nebulosi</i>		<i>Gymnothorax favagineus</i>
	<i>Echidna sp.</i>		<i>Gymnothorax meleagris</i>
	<i>Uropterigius marmoratus</i>		<i>Gymnothorax undulatus</i>

Family	Species	Family	Species	
	<i>Rhinomuraena quaesata</i>		<i>Breedeni</i>	
Myliobatidae	<i>Aetobatus narinari</i>		<i>Favagieneus</i>	
	<i>Aetomylaeus sp.</i>	Myliobatidae	<i>Rhinoptera javanica</i>	
Nemipteridae	<i>Scolopsis vosmeri</i>	Ophichthyidae	<i>Myrichthys maculatus</i>	
	<i>Scolopsis bilineatus</i>		<i>Myrichthys collubrinus</i>	
	<i>Scolopsis ghanam</i>		<i>Brachysomorphus crocodilianus</i>	
	<i>Scolopsis xenochrous</i>	Ostraciidae	<i>Ostracion cubicus</i>	
	<i>Monotaxis grandoculis</i>		<i>Ostracion meleagris</i>	
Pempheridae	<i>Pempheris oualensis</i>		<i>Parapriacanthus sp.</i>	
	<i>Pempheris schwenkii</i>	Pinguipididae	<i>Parapercis sp.</i>	
Platacidae	<i>Platax teira</i>	Pomacanthidae	<i>Plectroglyphidodon dickii</i>	
Plotocidae	<i>Plotosus lineatus</i>		<i>Plectroglyphidodon lacrymatus</i>	
	<i>Paraplotosus sp.</i>		<i>Chromis viridis</i>	
	<i>Pomacanthus semicirculatus</i>		<i>Chromis ternatensis</i>	
	<i>Pomacanthus imperator</i>		<i>Chromis weberi</i>	
	<i>Pomacanthus annularis</i>		<i>Chromis dimidiatus</i>	
	<i>Centropyge multispinis</i>		<i>Chrysiptera leucopoma</i>	
	<i>Centropyge eiblii</i>		<i>Chrysiptera glauca</i>	
	<i>Centropyge flavipectoralis</i>		<i>Pomacentrus similis</i>	
	<i>Aplomichthys xanthurus</i>		<i>Pomacentrus philippinus</i>	
	<i>Abudefduf sordidus</i>		<i>Pomacentrus indicus</i>	
	<i>Abudefduf septemfasciatus</i>		<i>Pomacentrus chrysurus</i>	
	<i>Abudefduf notatus</i>		<i>Dascyllus trimaculatus</i>	
	<i>Amphiprion clarkia</i>		<i>Dascyllus aruanus</i>	
	<i>Amphiprion nigripes</i>		<i>Dacyllus carneus</i>	
	<i>Amphiprion sebae</i>		<i>Neopomacentrus azysron</i>	
Pomacanthidae	<i>Stegastes nigricans</i>			<i>Neoglyphidodon bonang</i>
	<i>Abudefduf vaigiensis</i>		Priacanthidae	<i>Priacanthus humrur</i>
Rhincodontide	<i>Rhincodon typus</i>		Scaridae	<i>Calotomus carolinus</i>
Scatophagidae	<i>Scatophagus argus</i>			<i>Leptoscarus vaigiensis</i>
	<i>Euthynnus affinis</i>	<i>Chlorurus rhacoura</i>		
	<i>Auxis rochei</i>	<i>Scarus sp.</i>		
	<i>Auxis thazard</i>	<i>Scarus scaber</i>		
	<i>Sarda orientalis</i>	<i>Scarus sordidus</i>		
Scatophagidae	<i>Katsuwonus pelamis</i>	Scaridae	<i>Scarus niger</i>	
	<i>Rastrelliger kanagurta</i>		<i>Scarus ghobban</i>	
Scombridae	<i>Thunnus albacores</i>		<i>Scarus frenatus</i>	
	<i>Pterois antennata</i>		<i>Scarus prasiognathos</i>	
	<i>Pterois milesi</i>		<i>Sarus caudofasciatus</i>	
	<i>Rastrelliger kanagurta</i>		<i>Scarus rubroviolaceus</i>	
	<i>Scomberomorus guttatus</i>	Scorpaenidae	<i>Dendrochirus zebra</i>	
	<i>Scomberomorus lineolatus</i>		<i>Scorpaenopsis diabolus</i>	
	<i>Scomberomorus commerson</i>		<i>Scorpaenopsis oxycephala</i>	
	<i>Acanthocybium solandri</i>		<i>Rhinopias frondosa</i>	
	<i>Thunnus obesus</i>		<i>Inimicus didactylus</i>	
Serranidae	<i>Anthias dispar</i>	Siganidae	<i>Siganus javus</i>	
	<i>Anthias hutchie</i>		<i>Siganus argenteus</i>	
	<i>Cephalopholis argus</i>		<i>Siganus stellatus</i>	
	<i>Diploprion bifasciatum</i>		<i>Siganus virgatus</i>	
	<i>Grammisted sexlineatus</i>		<i>Siganus canaliculatus</i>	

Family	Species	Family	Species
	<i>Pogonoperca punctate</i>		<i>Siganus lineatus</i>
	<i>Plectropomus laevis</i>	<b>Sillaginidae</b>	<i>Sillago sihama</i>
	<i>Variola louti</i>	<b>Soleidae</b>	<i>Solea elongata</i>
	<i>Epinephelus flavocaeruleus</i>		<i>Zebrias sp.</i>
	<i>Aniperodon leucogramicus</i>	<b>Solenostomidae</b>	<i>Solenostomus cyanopterus</i>
	<i>Aethaloperca rogae</i>		<i>Sphyrna barracuda</i>
	<i>Variola louti</i>	<b>Squalidae</b>	<i>Eusphyrna blochii</i>
	<i>Epinephelus malabaricus</i>		<i>Centrophorus granulosus</i>
	<i>Epinephelus longispinnis</i>		<i>Centrophorus uyata</i>
	<i>Epinephelus caeruleopunctatus</i>	<b>Stromateidae</b>	<i>Pampus chinensis</i>
	<i>Epinephelus merra</i>	<b>Syngnathidae</b>	<i>Hippocampus sp.</i>
	<i>Epinephelus sexmaculata</i>		<i>Synodus variegatus</i>
	<i>Epinephelus faciatus</i>	<b>Terapontidae</b>	<i>Terapon jarbua</i>
	<i>Epinephelus tauvina</i>		<i>Terapon puta</i>
	<i>Cephalopholis miniata</i>	<b>Tetaodontidae</b>	<i>Arothron nigropunctatus</i>
	<i>Cephalopholis sonarati</i>		<i>Arothron stellatus</i>
	<i>Cephalopholis Formosa</i>		<i>Arothron immaculatus</i>
<b>Torpidinidae</b>	<i>Torpedo fuscomaculata</i>		<i>Arothron meleagris</i>
	<i>Triacanthus sp.</i>		<i>Arothron hispidus</i>
	<i>Helcogramma striata</i>		<i>Canthigaster valentini</i>
<b>Tripterigiidae</b>	<i>Helcogramma sp.</i>		<i>Canthigaster solandri</i>
	<i>Tripterigion sp.</i>	<b>Zanclidae</b>	<i>Zanclus cornutus</i>
	<i>Enneapterigius sp.</i>		

(Sources: Prasanna Weerakkody, 2017 unpublished data; Report on the systematic surveying of Bar Reef Marine Sanctuary, ESA project, UNDP, Sri Lanka)

#### 15.6.5 Stony Coral species recorded from the Bar-reef and surrounding area with species recorded for sample sites included.

Family	Species	Family	Species
<b>Acroporidae</b>	<i>Acropora aculeus</i>	<b>Astrocoeniidae</b>	<i>Astreopora gracillis</i>
	<i>Montipora verrucosa</i>		<i>Stylocoeniella guentheri</i>
	<i>Montipora undata</i>		<i>Astreopora forbesi</i>
	<i>Montipora monasteriata</i>	<b>Agariciidae</b>	<i>Pavona decussata</i>
	<i>Montipora foliosa</i>		<i>Gardineroseris planulata</i>
	<i>Montipora danai</i>		<i>Pavona venosa</i>
	<i>Montipora aequituberculata</i>		<i>Pavona varians</i>
	<i>Acropora yongei</i>		<i>Pavona minuta</i>
	<i>Acropora valenciennesi</i>	<b>Caryophyllidae</b>	<i>Leptoseris explanata</i>
	<i>Acropora solitariensis</i>		<i>Plerogyra sinuosa</i>
	<i>Acropora secale</i>		<i>Catalaphyllia jardinei</i>
	<i>Acropora robusta</i>		<i>Euphyllia ancora</i>
	<i>Acropora nobilis</i>		<i>Paracyathus sp.</i>
	<i>Acropora microphthalma</i>		<i>Pachyseris speciosa</i>
	<i>Acropora hyacinthus</i>		<i>Pachyseris rugosa</i>
	<i>Acropora formosa</i>		<i>Leptoseris papyracea</i>
	<i>Acropora danai</i>		<i>Leptoseris mycetoroides</i>
	<i>Acropora cytheria</i>	<b>Dendrophyllidae</b>	<i>Heteropsammia cochlea</i>
	<i>Acropora anthoceros</i>		<i>Turbinaria peltata</i>
<b>Faviidae</b>	<i>Favia fava</i>		<i>Dendrophyllia sp.</i>
	<i>Leptoria transversa</i>		<i>Tubastrea micracantha</i>

Family	Species	Family	Species	
	<i>Leptoria purpurea</i>	<b>Fungidae</b>	<i>cyphastrea chalcidicum</i>	
	<i>Leptoria Phrygia</i>		<i>Cycloseris cyclolites</i>	
	<i>Platygyra sinensis</i>		<i>Cycloseris costulata</i>	
	<i>Platygyra pini</i>		<i>Oulaphylla Crispa</i>	
	<i>Platygyra lamelliana</i>		<i>Echinopora lamellosa</i>	
	<i>Platygyra daedalea</i>		<i>cyphastrea serailla</i>	
	<i>Goniastrea retiformis</i>		<i>Cycloseris patelliformis</i>	
	<i>Goniastrea pectinata</i>		<i>Diaseris fragilis</i>	
	<i>Goniastrea aspera</i>		<i>Polyphyllia talpina</i>	
	<i>Pleisiastrea versipora</i>		<i>Podabacea crustacea</i>	
	<i>Diploastrea heliopora</i>		<i>Fungia fungites</i>	
	<i>Montastrea valenciennesi</i>		<i>Fungia scutaria</i>	
	<i>Montastrea curta</i>		<i>Fungia repanda</i>	
	<i>Favites pentagona</i>		<i>Fungia echinata</i>	
	<i>Favites flexuosa</i>		<i>Fungia dan</i>	
	<i>Favites chinensis</i>		<i>Diaseris distorta</i>	
	<i>Favites abdita</i>		<b>Fungidae</b>	<i>Sandalolitha robusta</i>
	<i>Favia maxima</i>		<b>Mussida</b>	<i>Acanthastrea echinata</i>
	<i>Favia rotundata</i>			<i>Lobophylla sp.</i>
	<i>Favia veroni</i>			<i>Cynarina lacrymalis</i>
<i>Favia pallida</i>	<i>Symphilla valenciennesi</i>			
<i>Favia speciose</i>	<i>Symphilla recta</i>			
<b>Merulinidae</b>	<i>Hydnopora exesa</i>	<i>Symphilla radians</i>		
	<i>Hydnopora microconus</i>	<i>Symphilla agaricia</i>		
<b>Oculinidae</b>	<i>Galaxia astreata</i>	<b>Pectinidae</b>	<i>Australomussa rowleyensis</i>	
	<i>Galaxia fascicularis</i>		<i>Mycedium elephantosus</i>	
<b>Poritidae</b>	<i>Porites rus</i>	<b>Pocilloporidae</b>	<i>Echinophyllia aspera</i>	
	<i>Alveopora verrilliana</i>		<i>Pocillopora damicornis</i>	
	<i>Goniopora stokesi</i>		<i>Pocillopora eydouxi</i>	
<b>Pocilloporidae</b>	<i>Stylopora pistillata</i>	<b>Thamnasteridae</b>	<i>Pocillopora verrucosa</i>	
	<i>Coscinaria collumna</i>		<i>Pseudosiderastrea tayamai</i>	
<b>Milleporidae</b>	<i>Millepora exesa</i>	<b>Stylasteridae</b>	<i>Psammocora contigua</i>	
	<i>Millepora platyphyllia</i>		<i>Distichopora violacea</i>	

(Sources: Prasanna Weerakkody, 2017 unpublished data)

### 15.6.6 Marine Algae and Seagrass species recorded during the surveys

Type	Species
Green Algae	<i>Ulva lactuca</i>
	<i>Ulva prolifera</i>
	<i>Caulerpa racemose</i>
	<i>Caulerpa taxifolia</i>
	<i>Caulerpa verticillata</i>
	<i>Avrainvillea erecta</i>
	<i>Halimeda opuntia</i>
	<i>Halimeda discoidea</i>
	<i>Halimeda macroloba</i>
	<i>Velonia sp.</i>
<i>Codium geppiorum</i>	



Type	Species
Brown Algae	<i>Padina spp.</i>
	<i>Stoechospermum</i>
	<i>Polypodioides</i>
	<i>Turbinaria ornate</i>
	<i>Turbinaria sp.</i>
	<i>Sargassum sp.</i>
	<i>Dictyota friabilis</i>
	<i>Dictyota sp.</i>
	<i>Canistrocarpus sp.</i>
Red Algae	<i>Asperagopsis taxiformis</i>
	<i>Halymenia durvillaei</i>
	<i>Hypnea pannosa</i>
	<i>Jania adherens</i>
	<i>Gracillaria sp.</i>
	<i>Amphiroa fragillissima</i>
	Turf Algae
Sea Grass	<i>Halodule uninervis</i>
	<i>Cymodoce serrulate</i>
	<i>Halophila ovalis</i>
	<i>Enhalus acroides</i>
	<i>Syringodium isoetifolium</i>
	<i>Thalassia hemprichii</i>

(Sources: Prasanna Weerakkody, 2017 unpublished data)

### 15.6.7 Marine Invertebrate species (non-coral) recorded during the surveys

Phylum	Common category	Species/Genus/Common names
Porifera	Sponges	<i>Terpios sp.</i>
Cnidaria	Jellyfish	<i>Rhizostmeae sp.</i>
	Hydroids	Hydroids
	Soft Coral	<i>Sarcophyton sp.</i>
		<i>Sinularia</i>
	Sea Whips	<i>Juncella</i>
	Anemones	<i>Heteractis magnifica</i>
		<i>Stichodactyla martensii</i>
Gorgonians	Gorgonians	
Zooanthids	<i>Palithoa sp.</i>	
Annelida	Tube Worms	<i>Spirobranchus sp.</i>
		Feather duster
		Christmas tree
		<i>Sabella sp.</i>
Crustacea	Barnacles	<i>Chthamalus sp.</i>
	Shrimps	<i>Alpheus sp.</i>
		<i>Stenopus hispidus</i>
		<i>Rhinchochinet sp.</i>
		<i>Periclimenes sp.</i>

Phylum	Common category	Species/Genus/Common names
	Spiny	Painted Spiny
	Lobster	<i>Panulirus versicolor</i>
	Hermit crab	<i>Dardanus logopodes</i>
	Crabs	<i>Percnon planissimum</i>
		<i>Charybdis miles</i>
		<i>Charybdis Cruciate</i>
		<i>Thalmita sp.</i>
		<i>Etisus splendidus</i>
	<i>Carpilius sp.</i>	
Mollusca	Shells	<i>Heliotis sp.</i>
		<i>Trochus sp.</i>
		<i>Oliva sp.</i>
		<i>Strombus sp.</i>
		Arthritic Spider
		<i>Lambis Chiragra</i>
		Common Spider
		<i>Lambis Lambis</i>
		<i>Cypraea Tigris</i>
		<i>Cypraea sp.</i>
		<i>Ovula Ovum</i>
		<i>Conuss sp.</i>
		<i>Terebra sp.</i>
		<i>Chicoreus Ramose</i>
		<i>Chicoreus sp.</i>
	<i>Turbinella pyrum</i>	
	<i>Pleuroperca filamentosa</i>	
	Sea Hares	<i>Aplysia sp.</i>
	Nudibranch	<i>Phyllidia sp.</i>
	Shells	<i>Tridachna sp.</i>
		<i>Lopha cristigali</i>
		<i>Tellina sp.</i>
		<i>Hyotissa hyotis</i>
	<i>Pinna sp.</i>	
Cephalopod	<i>Sepiothiuthis lessoniana</i>	
	<i>Octopus cyaneus</i>	
Echinodermata	Sea-urchins	<i>Echinothrix calamaris</i>
		<i>Echinostrephu</i>
		<i>Stomopneuste</i>
		<i>Echinodiscus auritus</i>
	Sea cucumber	<i>Holothuria atra</i>
		<i>Holothuria edulis</i>
		<i>Stichopus hermanii</i>
		<i>Pearsonothuri</i>
	Sea-stars	<i>Calcita sp.</i>
		<i>Pentaceraster affinis</i>

Phylum	Common category	Species/Genus/Common names
		<i>Pentaceraster alveolatus</i>
		<i>Protoreaster linki</i>
		<i>Nardoa sp.</i>
		<i>Fromia indica</i>
		<i>Linkia laevigata</i>
		<i>Linkia guildingi</i>
		<i>Linkia multifora</i>
		<i>Macrophiothri</i>
	Brittle-star	<i>Ophiocoma sp.</i>
		<i>Ophiplepis sp.</i>
	Feather star	<i>Stephanometra sp.</i>
		<i>Comanthina sp.</i>
		<i>Himerometra sp.</i>
<b>Ascidacea</b>	<b>Ascidian</b>	<i>Didemnum sp.</i>

(Sources: Prasanna Weerakkody, 2017 unpublished data)

**15.7 Annexure 7: Recommendations for Strategic Management Framework of Wilpattu Protected Area Complex addressing conservation concerns at a wider landscape level to minimize threats from outside the PA**

Kala Oya basin has several protected areas scattered around the basin including one of the largest and the oldest, Wilpattu National Park. In addition to this PA, several other PA's have been established by both DWC and FD. Current PA network is a typical example of scattered non-connected PAs in a basin, with most of the upper course of the river remaining unprotected. Since landscapes and seascapes are connected to each other by riverscapes, here Kala Oya River connects the wider landscape of the basin to BRMS. Hence, understanding integrated management of a mosaic of landscapes for ecological and social well-being of the basin requires evaluating the factors that can affect PAs both from within and outside.

<b>Threat</b>	<b>Disrupted flow due to hindrances to river order and flow</b>		
Issues	1. Altered biological, chemical and physical fluxes of the river affecting continuum of processes 2. Localized extinctions of aquatic species 3. Siltation 4. Drying of wetlands 5. Loss of biodiversity in splash and riparian zone 6. Discontinuation of migration of aquatic species		
<b>Options for management</b>		<b>Responsibility</b>	<b>When to start</b>
1. Measuring and mapping, identifying conservation related threats to river flow, reviewing existing disturbances, selecting alternatives, implementing conservation actions and management and monitoring		Dol	Immediate
2. Restore impacted riverine and riparian zones of the river		DWC, FD, Private Sector	After site selection
3. Conduct environmental assessments for river-based development and assess cumulative impacts		CEA	At all times
4. Create adequate passes for aquatic species movement		CEA, SEA, RDA	Immediate

<b>Threat</b>	<b>Organic and inorganic pollution of water</b>		
Issues	1. Altered chemical and physical characteristics of water and sediments affecting species survival, density and distribution 2. Decline in potable water availability for humans and wildlife 3. Mortality of corals 4. Higher COD and BOD resulting in algal blooms and eutrophication of aquatic systems		
<b>Options for management</b>		<b>Responsibility</b>	<b>When to start</b>
1. Implementation of integrated water management for the entire basin focusing on water rights, access regimes, and polluter pays schemes and overall water use mapping		Dol, CEA	Immediate
2. Restore impacted riverine and riparian zones of the river		DWC, FD, Private Sector	After site selection
3. Strategic management of waste water from agricultural,		CEA	Immediate

industrial and urban landscapes		
4. Focused group awareness and creation of water groups	CEA	Immediate
5. Monitoring and restoring of water quality in selected strategic locations for informed decision making	CEA, WB	After site selection
6. Restoration of aquatic flora that can absorb and adsorb pollutants	DWC, FD, volunteers, NGO	After studies

Threat		Solid waste accumulation in the basin and in near coastal zone	
Issues	1. Loss of biodiversity due to consumption of waste 2. Loss of habitats 3. Changes to soil micro and macro fauna 4. Decline in habitable space 5. Micro and Nano particles of non-degradable waste such as plastics entering into food chains		
Options for management		Responsibility	When to start
1. Implementation of integrated solid water management for the entire basin focusing on managed dumps, voluntary reduction of generated waste, polluter pays schemes.		DoI	Immediate
2. Focused group awareness		DWC, FD, Private Sector	Immediate
3. Strategic management of non-degradable waste by introduction of environmental friendly degradable products		CEA	Immediate
4. Implementation of non-degradable waste free zones like Pas		CEA	Immediate

Threat		Intensified extreme weather conditions	
Issues	1. Loss of biodiversity due to floods, droughts and elevated sea water levels and temperatures 2. Decline in micro habitats 3. Deterioration of ecosystems 4. Changes to population dynamics of species compositions		
Options for management		Responsibility	When to start
1. Restoration of natural barriers against weather mediated destructions such as mangroves, wetlands and upland flora		DoI, FD, CCD & CRM, DWC, NGO, CBO	Immediate
2. Preparation and implementation of disaster risk reduction strategies for urban and protected areas		DMC, DS, DWC, FD, Private Sector	Immediate
5. Establishment of early warning systems and training for risk mitigation		CEA, CCS	Immediate
6. Establishment of seed and gene banks of fauna and flora		Academia, MoMDE	

Threat	Land grab and land clearance		
Issues	<ol style="list-style-type: none"> <li>1. Fragmentation of ecosystems</li> <li>2. Deterioration and decline of services</li> <li>3. Disrupted species movements</li> <li>4. Loss of biodiversity</li> <li>5. Human animal conflict</li> </ol>		
Options for management		Responsibility	When to start
1. Systematic clearing of land rights and ownership and implementation of land use plans and prevailing law		DS	Immediate
2. Systematic boundary patrols and community engagement for boundary demarcation		DWC, FD, Private Sector	Immediate
3. Development of biodiversity mainstreamed land use plans and their implementation		LUPPD	Within 1-2 years
4. Restoration and reforestation of degraded land		DWC, CCD & CRM, FD	Immediate

Threat	Destructive fishing practices and gear use		
Issues	<ol style="list-style-type: none"> <li>1. Loss of biodiversity due to by-catch</li> <li>2. Deterioration of habitats</li> <li>3. Loss of livelihood and income</li> <li>4. Social instability and migration</li> <li>5. Movement of dependent species elsewhere</li> </ol>		
Options for management		Responsibility	When to start
1. Co-management of fishing grounds and community agreed fishing quotas		DoF, DWC, CCD & CRM	Immediate
2. Establishment of fisheries refugia		DWC, DoF, CCD & CRM	Mid term
3. Buy back of fishing gear and empowerment of fisher communities including women for alternative livelihood, better post-harvest techniques and marketing		DWC, DoF, CCD & CRM	Immediate
4. Habitat restoration		DWC, CCD & CRM, NARA	Mid term
5. Adaptive collaborative management of target species with evidence-based decision making		DoF, CCD & CRM, Community	Immediate

Threat	Mismanaged tourism		
Issues	<ol style="list-style-type: none"> <li>1. Disturbance and stress to species due to improper tourism practices</li> <li>2. Habitat deterioration</li> <li>3. Migration of species from their feeding and breeding grounds</li> <li>4. Vulnerable communities specially females and younger generation losing quality lifestyle</li> <li>5. Pollution</li> </ol>		
Options for management		Responsibility	When to start
1. Agreed standards and ethics for tourism and monitoring of		DWC, MoT,	Immediate

adoption	FD	
2. Community based, carrying capacity established tourism with revolving funds facilitating overall social wellbeing of communities	DWC, MoT, FD	Mid term
3. Environmental assessment of existing and proposed operations	DWC, DoF, CCD & CRM	Immediate

### 15.8 Annexure 8: Feasibility report based on a mixed approach for sustainable tourism in Bar Reef and associated ecosystems to create a long term self-supporting marine PA

BRMS is already under tourism pressure as the area is world renowned for whale and dolphin watching, diving and snorkeling, island hopping, illegal spear fishing and kite surfing. At present tourism operates without any plan and community imposed restrictions and a ticketing system operated only at Kudawa by DWC. However, a substantial number of people also enter to BRMS through Gange Wadiya now and the tourism in that area are confined to boat excursions, kayaking, river picnics, visiting to baobab tree, coral reef associated diving and snorkeling etc.

Tourism developed in this area after war and at present there is rapid development of many forms of tourism in the area. Kite surfing is the main reason for visitor centered facility development which includes home stay and various other small and medium scale accommodations, local travel and other tourist related franchises.

Previous plans to convert the area into a mega tourism zone has not materialized yet and also the concerns of experts if this area can handle such tourism persists. Specially conversion of islands to resorts, creating golf courses and other adventure related amenities in sensitive coastal zones may require careful attention and assessment.

The main issues with existing tourism are as follows

1. Lack of basic visitor facilities such as a visitor centre, sanitary facilities and options for dining etc.
2. Lack of skilled workforce
3. Primitive health and safety measures
4. Absence of resource inventories and information on biodiversity, ecosystems and socio economics of the area
5. Unsustainable tourism practices
6. Unstable income
7. Income not trickling to all levels of communities
8. Females with skills not being integrated to income generated activities, hence remain marginalised
9. Lack of an assessment of expectations of visitors
10. Constructions leading to erosion, pollution and loss of aesthetic beauty of the area

In order to address these issues following models are proposed. Creating revolving funds with income related to BRMS specially with following tourism models can support a stable income and sustainable tourism in the area

- a. Community owned registered boat service with all safety gear, trained guides, information packs operated from identified locations. The number of boats operated per day to be decided considering the pressure for targeted species. DWC and NGO to support in training local youth. DWC FD and DS to support in Developing Communication material. DWC to develop a protocol for operation. Boat operators to agree in tourism packages that could be offered for various customer needs.
- b. DWC, FD and communities to Develop specialised tour packages such as island hopping, migrant birds, sperm whale Aggregation watch, sand dune and mangrove watch on stilt bridges, Puttalam lagoon fishery and ecosystem and agree on prices, manpower etc. These special packages to be offered by the community assisted visitor centre. All personnel to be trained.
- c. Home stay with exposure to local fishing practices, net laying, cooking etc.
- d. Educational diving opportunities at a cost as volunteers during monitoring of “left aside to restore zone” Only experience divers with a commitment to supply information to be selected.
- e. Specialised packages to children on marine life, pond dipping and introduction to mangrove forests. To be offered to schools as a day tour with trained staff. Visitor centre to coordinate the tours and where possible local youth to get involved as an additional employment.
- f. Land to sea packages from Gange Vadiya partly recreational partly educational with trained guides and safe community run boats on mangroves, baobab tree, estuarine fauna, sea grass and coral.
- g. Fossils tours: Fossils of Aruwakkaru and boat rides and kayaking in Kala Oya for a predetermined number of tourists operated by proposed Gange Vadiya visitor centre.