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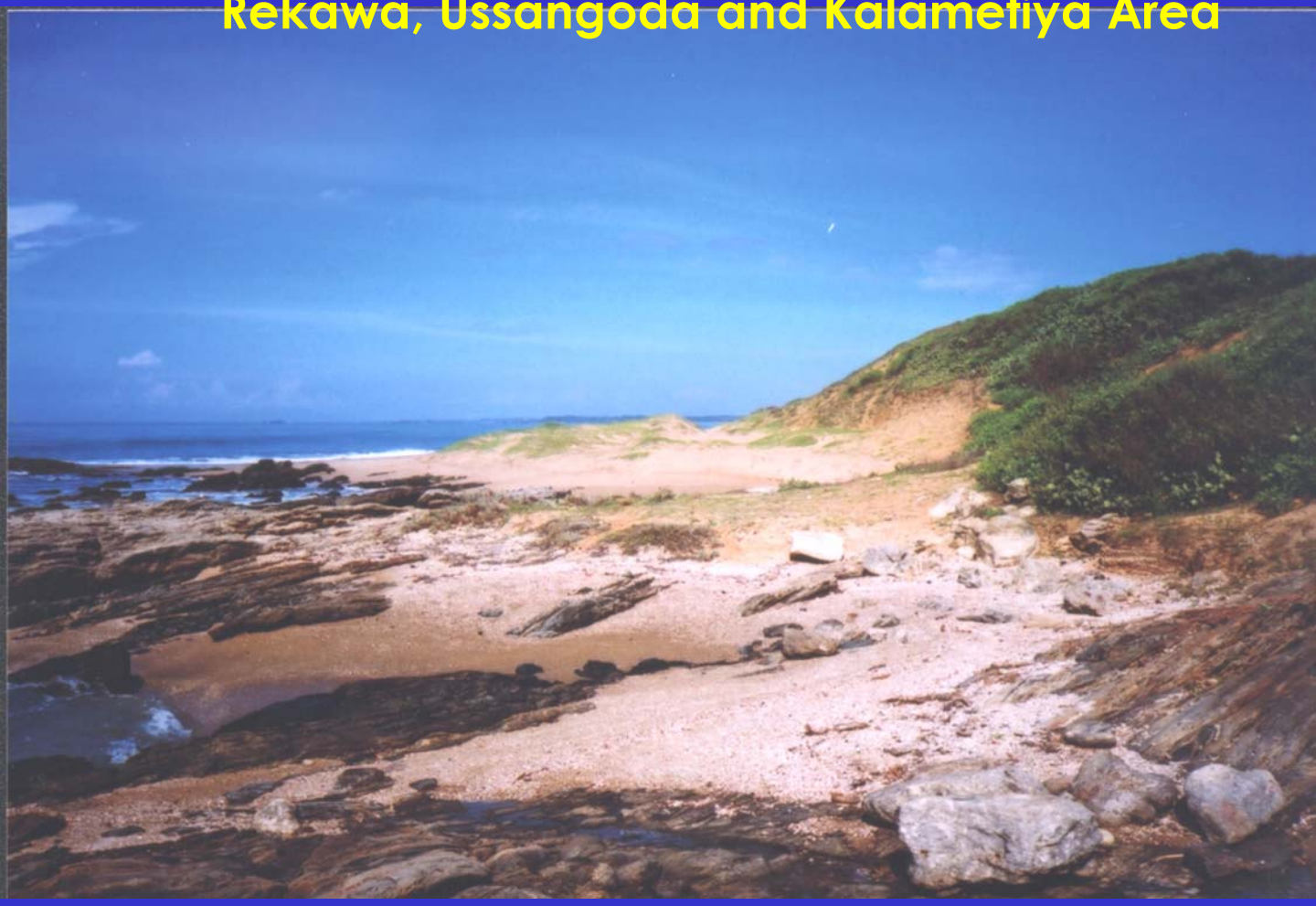

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IUCN

A Bio-Diversity Status Profile of Sub-tidal and Inter-tidal Habitats of the Rekawa, Ussangoda and Kalametiya Area

1. INTRODUCTION

Being an island, Sri Lanka is rich in coastal and marine habitats. Sub tidal habitats such as coral and rocky reefs are abundant, along with large soft bottom habitats. In addition, inter tidal and coastal habitats such as rocky shores, beaches, and coastal wetlands are an important part of the marine ecosystem and provide shelter for a large number of plant and animal species. Coral reefs are found along the entire coastline, with the three major coral reef areas being located in the East Coast, Southern Coast, and the Gulf of Mannar. Of these, the Gulf of Mannar contains the most extensive coral reefs in the country. The Northern coast is composed primarily of sand and mud banks, with a rich abundance of coastal lagoons and salt marshes. The Southeastern coast is composed mainly of rocky shores and barrier beaches capable of withstanding the constant high-energy conditions prevalent in the area.

The Rekawa, Ussangoda, Kalametiya (RUK) area is located along the Southeastern coast of Sri Lanka between Tangalle and Hambantota. The coastline consists of barrier beaches, rocky shores, lagoons, salt marshes and mangroves. Marine sub-tidal habitats include coral reefs, rocky and sandstone reefs and soft bottom communities. The area is extremely important as a habitat for birds and is an important fishery area. Several beaches are important turtle nesting sites for five species of globally threatened marine turtles.

Although the coastline between Tangalle and Hambantota is not one of the major coral reef areas in Sri Lanka, there are a number of small near-shore coral reefs of some significance. There are also extensive sandstone and rocky reefs along the coastline. These reefs are an important habitat for many fishery important species and play a vital role in the function of natural ecosystems in the area. In addition, due to its location along a high-energy coastline, the Southeastern coast features many geophysical characteristics that are unique to such environments.

However, apart from Rekawa (Rajasuriya 1994, in Ganewatte et al., 1995), there appears to be little information on the biodiversity of reef habitats in the area. The marine and coastal environments of Sri Lanka are a valuable natural heritage in terms of biodiversity, fisheries and other natural resources. Hence they warrant more extensive research to document the extent of biodiversity and resource potential. This is extremely important for a better understanding of our coastal environment and the sustainable use and management of our marine resources. There is also a need to accurately assess the status and extent of marine habitats in the country at a time when they are being subjected to continuous pressure and degradation due to human activity and natural causes.

The coastline along the Rekewa, Ussangoda, Kalametiyah area is rich in both animal and plant diversity, and is of both national and international importance. However, factors such as increasing population, poverty, over-fishing, shell mining, coral mining and overgrazing by livestock are creating serious threats to both aquatic, and terrestrial ecosystems. IUCN Sri Lanka conducted an assessment of the biodiversity of the inland and sub-tidal ecosystems within the RUK area as part of a project supported by the Global Environmental Facility (GEF) of the UNDP to conserve the biodiversity of this globally significant area.

2. METHODOLOGY

The sub-tidal biodiversity assessment of the RUK area consisted of the following key elements.

1. Review existing literature for information and gathering of background information.
2. Initial investigations of the area to identify habitats, sea conditions, select representative sites and plan out a sampling schedule and practical sampling methods.
3. Collecting field data and creating an inventory of fauna and flora using standardized scientific techniques.
4. Assessment of site-specific threats to biodiversity and natural ecosystems.

Study Area

The site area is located between Madilla (lat: 06 02' 11.8217", Long: 80 48' 19.9743") and Godawaya (Lat: 06 06' 35.3134", Long: 81 03' 10.0986'') along the Southeastern coastline of Sri Lanka, spanning a coastline of about 30km. The areas surveyed were near-shore marine habitats located less than one Kilometer from the shore and less than 10m in depth.

The area is composed of a predominantly sandy coastline lying approximately in a South West - North Easterly direction. The sandy beaches are interspersed by several rocky headlands, river and lagoon estuaries, and sandstone beach reefs.

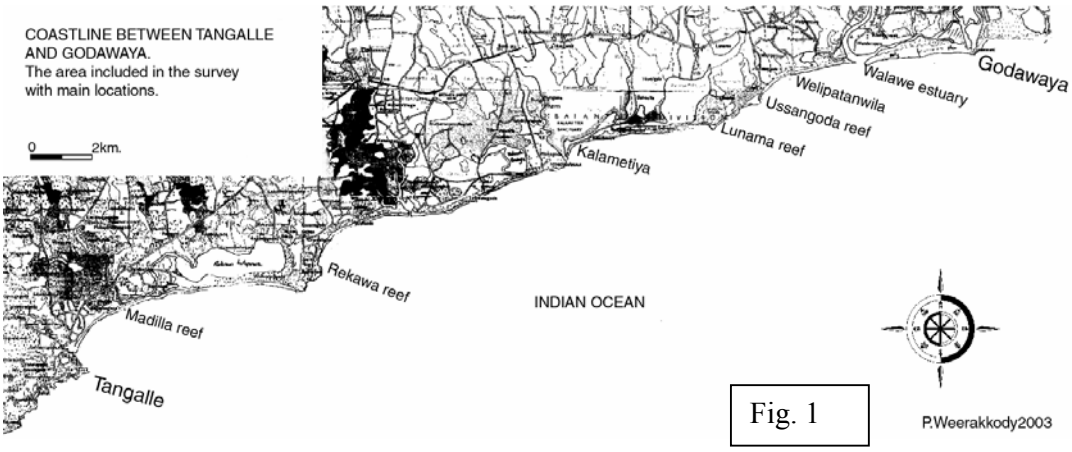


Fig. 1

The seas are among the highest energy shorelines in Sri Lanka with recorded average velocity currents of 0.25m/sec. and higher velocity currents of 0.5 –0.9 m/sec. (Swan 1983). The approximate tidal range is Mean high-water spring tides of 58cm and Mean high-water neap tides of 40cm (Swan 1983). The beach seems to be fluctuating between erosive and accreting processes depending on season. However, over a long period the coast may be slowly eroding in places.

The inshore waters harbor many commercially important fish species such as Jacks (Carangidae), Snappers (Lutjanidae), Mackerels (Scombridae), Groupers (Serranidae) and Sardines (Clupeidae). Beach-seines are common throughout the area and form an

extremely productive and lucrative fishery. The coral and rock reefs of the area also support a large lobster population. Lobster fishing is practiced using circular traps (Dati) or Bottom Set Nets. The presence of structurally diverse reef formations and the generally turbid water provide ideal conditions for lobsters. As a result, the Southeastern coast is one of the major lobster areas of Sri Lanka.

Period of Field Survey, Sampling Frequency and Sampling Times

After an initial reconnaissance survey in December 2002, field sampling was carried out from January 2003 to the end of April 2003 (four months duration). A minimum gap time of two weeks was kept for repetitive sampling of the same site to avoid duplication. Underwater observations were conducted between 0900 hrs. and 1300 hrs. to facilitate standardization and make use of the best sea conditions.

Selection of Sampling Sites

Survey sites were selected based on accessibility, coastal morphology, representative habitats and distribution patterns. Sampling was not done in soft bottoms (Sand/Silt/Shingle) as the extent and spatial distribution of these systems need to be sampled at too large a scale than can be done by divers. Five sampling sites were chosen, which included three sub-tidal coral areas (Rekawa, Lunama and Ussangoda) and two inter-tidal sandstone beach reefs (Madilla and Welipatanwila).

Sampling Techniques:

Sampling techniques were designed to identify and quantify reef fishes, corals and major invertebrate groups. Qualitative sampling to record species richness of other invertebrates and marine algae was also done.

In designing a practical field methodology it was necessary to take into account the small size of local reefs, limitations in underwater visibility and the prevalence of rough seas. Sampling at each site included field observations to document the morphology of the reef and general diversity of marine life.

The sampling strategy was based on the GCRMN/AIMS methodology (English et al, 1997), but was adapted to suite the physical conditions of the site. For substrate, 20m Point Transects were carried out and sampled at 0.5m intervals (40 points per transect). 20mx3m Belt Transects were used to document the fish and sessile invertebrate abundance. All transect were surveyed by the same observer to facilitate standardization of identification and abundance estimates.

Several fishing communities and landing sites were visited to collect information on fisheries, both through direct observation and through discussions with fishermen.

Identification and Nomenclature of Fauna and Flora

Whenever possible, species were identified visually in the field, with specimens of difficult species collected for further analysis. Fauna and flora were identified and classified using published literature listed below.

Guides used for the identification of fauna and flora

Group	Source
Fish	Allen & 1994, Bianchi 1984, De Bruin et al., 1995, Lieske & Myers 1994, Munro1955, Randall 1986
Crustaceans	Burukovskii 1974, Chaapgar 1957, De Bruin 1962, Richmond 1997, Vanini & Valmori 1981(a), Vanini & Valmori 1981(b)
Echinoderms	Clark 1971, Richmond 1997
Mollusks	Keerthisinghe 1978, Oliver 1984, Wye 1991
Corals	Randall & Myers 1983, Veron, 1986, Veron 2000
Other Invertebrates	Colin & Arneson 1995, Young & Ekarathne 1996, Fauchald 1977, Richmond 1997
Flora	Richmond 1997

Species inventories were compiled using species observed directly on the reef, and those observed in fisheries conducted in near-shore areas.

Constraints

The underwater surveys were often carried out under difficult conditions. Poor underwater visibility, heavy surf and strong currents restricted the number of sites surveyed, and the number of transects that could be carried out. Such conditions would also reduce the opportunity of observing fast moving and cryptic species. Due to rough sea conditions, no sampling was carried out at night, resulting in poor documentation of nocturnal species.

3. Marine Habitat Types and Habitat Structure in the RUK Area

The coastline is composed primarily of large barrier beaches. The beaches are steep, in some places rising 4-7m from the mean waterline, and are exposed to strong waves. There are significant dune formations. The beach line is cut in places by rocky headlands and accompanying shallow bays. Beachrock and inter-tidal sandstone reefs occur at Welipatanwila and Madilla, and within sections of the Rekawa reef.

There are a number of discontinuous sub-tidal reef systems. These are composed mainly of rock and sandstone, but coral reefs are also found in a few locations. Corals, sponges, tunicates and other marine organisms encrust the large rocks and sandstone reefs. Many of the rock and coral structures provide high vertical relief for reef dwelling animals. Apart from hard substrate, bottom composition consists mostly of sand and rubble.

Sandy Beaches

Large expanses of wide sandy barrier beaches are a dominant feature of the coastline. The sand grains are fine to course, and well sorted. The beaches near the Walawe River outfall consist of significant Garnet sand deposits. The beaches support populations of Ghost crabs (*Ocypode* spp.*),* Land Hermit crabs (*Coenobita* spp.) and Mole crabs (*Emerita* sp.) Shells washed ashore on the beaches indicate rich populations of sand dwelling shell fauna in offshore habitats. The dune and beach associated vegetation consists mainly of *Spinifex* sp.*, Euphorbia pescaprae*, *Pandanus* sp. *Cocos nucifera*, *Opuntia dillenii, Terminalia catappa,* and *Thespesia populnea*.

Fig. 2. Profile of Beach in RUK Area.

Beachrock / Sandstone Beach Reefs

Beachrock and sandstone reefs are composed of compacted sand and shell material cemented by marine organisms such as algae, bacteria and annelid worms. Deposited on ancient coastlines, these structures are found encircling the shoreline along most parts of the country at different depth regimes from above the high-tide line to depths of over 30m.

At Medilla and Welipatanwila, an inter-tidal sandstone reef runs along the coastline with exposed crests and rock pools. In some areas the reef lies buried under sand and is exposed seasonally. These reefs are rather low in structural diversity compared to the sub-tidal reefs. The bio-diversity on these reefs is low due to the fact that these reefs are subject to periodic smothering by regular accreting / eroding beachlines preventing continuous colonization by any faunal or floral group. The reef crests are covered by algal communities consisting mainly of *Ulva* spp.

Fig. 3. Profile of Beach Reef.

Rocky Shores

Several rocky headlands create significant areas of shoreline composed of exposed rock boulders, often enclosing extensive rock pool systems. These rock pools are mostly inter-tidal and the higher sections are prone to periodic drying. There is a marked stratigraphy of life along these shorelines, dictated mainly by the frequency of drying and level of exposure to wave action.

The rocky shores support diverse algal assemblages, colonies of Mussels, Oysters, Tubeworms, Urchins (*Diadema setosum*), Shore crabs (*Grapsus* spp., *Geograpsus* sp., *Percnon* sp., *Plagusia* sp.) Reef crabs (*Charybdis* spp. *Thalamita* spp.) Hermit crabs (*Calcinus* spp., *Clibenarius* spp.) and shore fishes including Rock Skippers (*Istiblennius* spp.) Blennies (*Salarius* spp. *Entomacrodus* sp.) Gobies (Gobiidae), Damselfish (Pomacentridae), Surgeons (Acanthuridae) and Flag tails (Kuhliidae).

Some of the larger and more constant pools are inhabited by several species of corals. These environments act as nursery grounds for some reef fish species, and juvenile fishes including some Butterflyfishes (*Chaetodon* spp.) and Angelfishes (*Pomacanthus* spp.) can be frequently observed.

Fig. 4. Profile of Rocky Shore.

Coral Reefs

The high structural diversity of coral reefs support a greater diversity and abundance of life compared to sandstone beach reefs. Reefs consist mainly of boulder, encrusting or other robust coral types capable of withstanding high-energy waves. A few foliaceous types occur in sheltered sections of reefs where direct wave action is lower. The reef structures are varied, ranging from open assemblage of large submerged rock boulders covered by corals (e.g. Lunama) to more mature reef formations with a distinct reef crest and enclosed reef lagoon (e.g. Ussangoda and Rekawa). Vertical relief in the near-

shore coral reefs range from less than 1m to nearly 3m where large rocks and coral boulders are present.

All the coral reef sites contain large areas of dead coral. These appear to be of similar age, and possibly date back to the 1998 coral mortality event when many corals around the world including Sri Lanka died due to an increase in Sea Surface Temperature (SST) caused by an El Niño episode. The average dead coral cover at reef sites in the area is presently around 23% of the substrate.

Fig. 5. Profile of Coral Reef

4. FAUNA & FLORA

Marine Reptiles

The area is an important nesting site for five species of endangered marine turtles. These are the Green turtle (*Chelonia mydas*), Olive-Ridley turtle (*Lepidochelys olivacea*), Hawksbill turtle (*Eretmochelys imbricata*), Loggerhead turtle (*Caretta caretta*) and Leatherback turtle (*Dermochelys coriacea*), which is also the largest marine turtle in the world. Rekawa beach has been identified as one of the most important turtle rookeries in the country (IUCN 1999). Two more rookeries are located at Lunama and the beach between Godawaya and Ussangoda. The latter is an important nesting site for the Leatherback turtle. Four species of sea snakes (. *Hydrophis spirulis, H. cyanoscinctus, Microcephalus gracilis,* and *Pelamis platurus*) have been recorded from the area

Fish

A total of 185 reef associated fish species in 119 genera, belonging to 62 families were recorded within the area. The number of species observed directly on the reef was 132, with another 53 reef associated species being recorded through fishery catches.

The families Labridae (19 species), Pomacentridae (14 species), and Acanthuridae (12 species) supported the highest diversity. Sardines (Clupeidae), Shads (Pristigasteridae), Barracudas (Sphyraenidae) and Anchovies (Engraulidae) are found in abundance in beach seine catches.

Nine species of Butterflyfishes (*Chaetodon* spp.) were recorded. Of this, 3 species, (*C. meyeri*, *C. trifascialis* and *C. trifasciatus*) are corallivores, feeding exclusively on live coral polyps. The Honeycomb Grouper (*Epinephelus merra*) is common although the abundance of other grouper species is low. However, many large groupers are caught regularly from offshore reefs. The most common reef predators are Snappers (Lutjanidae), Emperors (Lethrinidae) and Jacks (Carangidae). Lionfish (*Pterois miles*) appear to be less common than in other areas, although the Painted Scorpionfish (*Parascorpaena picta*) is commonly observed in bottom net by-catch at Welipatanwila. The genera *Halichoerus, Thalassoma* and *Labroides* are the most common Wrasses. Several large Parrotfishes (Scaridae), including the Sri Lankan Hump-headed Parrotfish

(*Chlorurus rhakoura*) are seen occasionally. The Black Damselfish *Neoglyphidodon bonang,* Regal Damsel (*Neopomacentrus azysron*) and Common Sergeant-Major (*Abudefduf vaigiensis*) are common in shallow reef habitats. The Powder-blue surgeonfish (*Acanthurus leucosternon*) is abundant, possibly due to the very low collection pressure from the ornamental fish industry in the area.

The documented diversity of nocturnal and cryptic groups such as Cardinalfishes (Apogonidae), Squirrelfishes (Holocentridae), Sweepers (Pempheridae), Morays (Muraenidae), Gobies (Gobiidae), Blennies (Blenniidae), Dottybacks (Pseudochromidae) and Scorpionfish (Scorpaenidae) is currently inadequate due to difficulties in sampling.

Damselfishes were the most abundant fish group recorded, accounting for 64% of all recorded fishes. Other important groups were Wrasses (21%), and Surgeonfishes (9%).

Corals

Reefs are dominated by sub-massive, massive and encrusting forms of coral. Significant stands of foliaceous *Montipora* spp. occupy sheltered sections of reefs, and *Montipora aequituberculata* is a visually dominant species within reef lagoons. The families Favidae, Acroporidae (mainly *Montipora* spp.) and Poritidae (primarily *Porites rus*) dominate the reefs. *Galaxia, Siderastrea*, *Pocillopora, Agaricia, Platygyra* and *Symphyllia* constitute the other common genera. At Ussangoda, *Platygyra verweyi* is one of the dominant coral species, forming massive dome like structures with colonies covering large rock boulders. All the reefs have large areas of dead coral consisting mainly of *Acropora hyacinthus*, *A. formosa, Pocillopora eydouxi,* and *Porites* spp.

Thirty six species of coral belonging to 17 genera were recorded within the area with the highest number of species being recorded from Ussangoda and Lunama.

Other Invertebrates

Evidence of a highly diverse shell fauna can be observed throughout the area from beach debris to net cast-off. Many shell species can be found on the reefs although they are often cryptic and difficult to see. A large number of species inhabit sand or rubble habitats. Mussels (*Mytilus* and *Perna* spp.) are found along rocky shores, beach rock and inter-tidal sandstone reefs. Gastropods such as *Chicoreus adusta, Cymatium perryi, Pleuroploca* spp*., Purpura persica, Oliva reticulata, O. oliva, Conus ebraeus,* and Cowries such as *Cypraea moneta, C. caputserpentis,* and *C. assellus* are common throughout the area. The rocky shores contain Limpets (*Acmaea* and *Patella* spp*.)*, Periwinkles (*Littoraria* spp.), Chitons and Topshells (*Trochus* spp.), Sundials (*Architectonica* sp.) and Oysters (*Crassostrea* sp*.)*. Conchs, (*Strombus* and *Lambis* spp*.),* Venus comb Murex (*Murex* spp*.),* Helmet shells (*Cassis* sp.), Chanks (*Turbinella pyrum*) and *Melo melo* shells are found on offshore reefs. The beaches are generally littered with an assortment of dead bivalve shells. This includes 37species of Bivalves, 70 species of Gastropods and 4 species of Ophisthobranchs and Polyplacophorans.

An abundance of corrallimorpharians can be seen at most sites, with species of *Palythoa* and *Protopalythoa* forming extensive banks at Ussangoda and Lunama.

Many species of crabs are found in the area, dominated by Xanthid crabs, Box crabs and Spider crabs. The rocky shorelines are populated by two species of Swift foot crabs

(*Grapsus* spp.). Crab species such as *Percnon plannisimum, Plagusia depressa* and *Geograpsus stormi* occupy the rock pools and shallow reef zones. Several species of Ghost crabs (*Ocypode* spp.) populate beach areas along with Shore Hermit crabs (*Coenobita* spp.). Several other species of Hermit crabs (*Aniculus, Calcinus* and *Dardanus* species) can be observed on the reefs and in reef based fisheries by-catch. Five species of Spiny Lobsters (*Panulirus* spp.) and one Slipper Lobster (*Parribacus* sp.) are found in the area. Cuttlefish (*Sepia* sp.) and Squids (*Loligo* spp.) are caught by fishermen in the area.

The Black Sea Urchin (*Diadema setosum*) is abundant in most shallow hard-bottomed areas of the coastline. 6 species of Sea stars were recorded, mainly from the fish net by-catch. 5 species of Brittle stars were observed on the reefs along with 3 species of Sea cucumbers. Feather stars are found although they are rarely seen due to their nocturnal and cryptic nature.

A total of 238 species of marine invertebrates belonging to 113 families were recorded.

Marine Algae

Inter-tidal habitats in the area contain a high density of algal cover. 18 species of marine algae were identified from specimens collected in inter-tidal habitats. A more detailed investigation into the algae of both inter-tidal and sub-tidal habitats is needed to provide a more comprehensive assessment of the species diversity and abundance of marine algae in the area. The sandstone beach reefs and rocky shores are dominated by *Ulva* spp. and *Gracilaria* spp.

7. DESCRIPTION OF SELECTED COASTAL SITES

Madilla

Madilla is located in close proximity to the Tangalle town and is presently the most popular tourist beach within the area. A discontinuous sandstone ridge approximately 1km in length is located parallel to the shoreline (between *Long: 80° 48'19. 9743" Lat:06° 02' 11.8217"* and *Long: 80° 48' 55.5661" Lat: 80° 48' 55.56*61"). This reef shows signs of significant weathering. The reef is located mostly inter-tidally and awash, with several large rock-pools. Heavy surf often breaks on the outer edge of the reef. This reef is structurally more diverse than the sandstone reef at Welipatanwila.

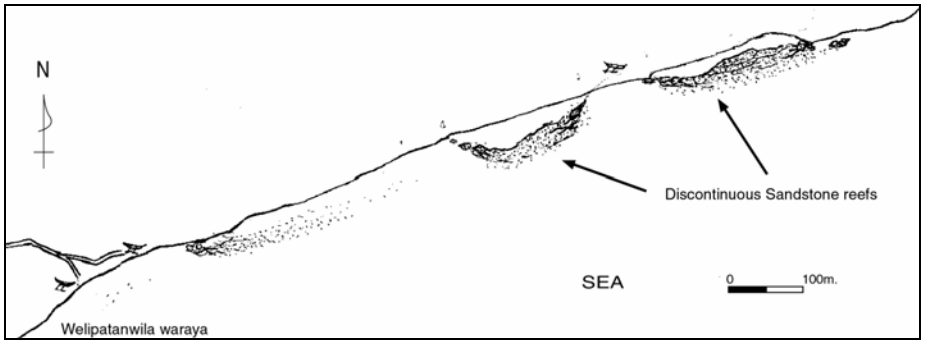
The reef surface is covered in algae and colonies of tubeworms, while white coralline algae line the shoreward areas. The tubeworm colonies are inhabited by juvenile Portunid crabs. Large numbers of small rock anemones (c.f. *Anthopleura sp*.) are common along with colonies of Corallimorphs. Black Sea Urchins (*Diadema setosum*) are common over most of the Eastern end of the reef.

The shoreline is in a state of flux and active filling of the beach can be seen in sections. The populations of sea urchins is composed mainly of small-sized juveniles indicating a

population that is re-colonizing the reef after a local extinction event; possibly caused by the covering and re-exposing of the reef.

Welipatanwila

The extensive barrier beach at Welipatanwila contains a shoreline sandstone reef extending over a kilometer in length and about 20-30m in width located between Lat: 06 05' 57.5393", Long: 80 59' 43.0171" to Lat: 06 06' 06.1331", Long: 81 00' 13.8389". The reef does not have mch structural diversity, with few erosion gullies. The reef surface is covered with inter-tidal populations of algae. A large pool of water exists between the reef and the shore, with seawater constantly washing over the reef and flowing outwards from breaks in the reef. The water within this area could be stagnate or fast flowing depending on wave strength, tidal status and beach topography.



As at Medilla, the coastline is constantly changing and the beaches continuously change shape. Large lagoons are created while sections of the reef are filled up seasonally. Local residents report that the reef is sometimes covered over by an accreting beach line. The Walawe River enters the sea about 1.5km away from the reef and the silt plume washes over the area, severely reducing underwater visibility at times.

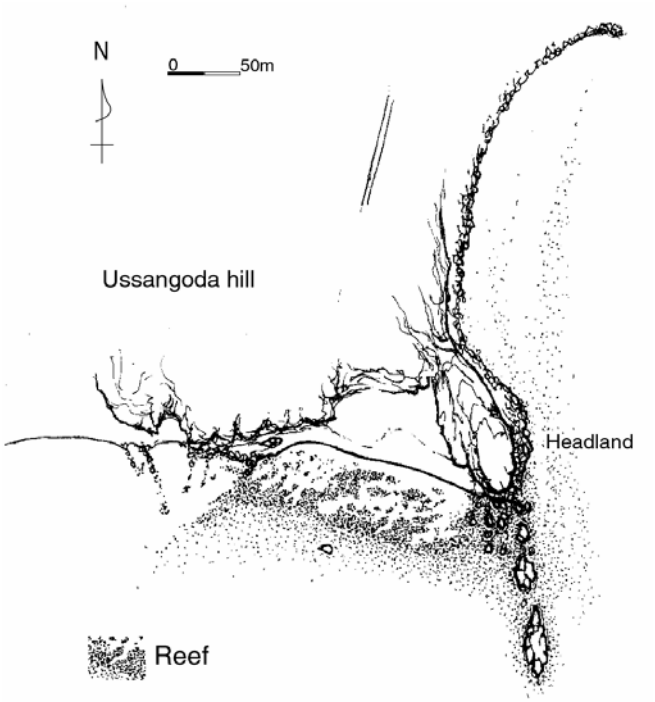
The beach debris indicates a rich sand bottom fauna, consisting mainly of seashells in the surrounding area. Sea turtles are regularly seen off the seaward edge of the reef, and the beach is an important turtle nesting site.

Several beach-seine nets are operated from the open beach area in Welipatanwila. It appears that these nets are sometimes dragged over a hard substrate as the catch often contains many reef dwelling fish species including Cardinalfish (Apogonidae). A secondary beach landing located in the middle of the reef is seasonal and operates canoes using Gill Nets, Bottom Set Nets, Lobster traps, and Lines.

Ussangoda

The Ussangoda reef runs along approximately 200m of coastline West of the Ussangoda headland, covering an area of approximately 1 hectare in extent. The seaward section of the reef forms a shallow crest extending from the tip of the headland and ending at a point close to the tip of the Ussangoda hill towards Lunama, and encloses a sheltered reef lagoon.

The reef system is composed mainly of an extensive system of Granite rock boulders 1-3 meters across with a substantial overgrowth of coral. There are substantial areas of dead coral possibly caused by the 1998 coral mortality event. The dead coral is composed primarily of branching and tabulate *Acropora* spp., *Pocillopora* spp., and *Montipora* spp.



Platygyra verweyi is one of the common corals at the reef, and dense colonies grow over large rock boulders giving the impression of massive coral domes.

Beneath the Ussangoda headland the eastern end of the reef forms a very shallow section with small to medium sized rock boulders covered by *Montipora* and other coral species. The outer section contains dead coral and an area of densely packed boulders with deep interim crevices of 2- 3m depth. The inner section of the lagoon is shallower with the boulders being more spaced. There are also significant amounts of corrallimorphs and zoontharians that dominate some sections of the reef. Soft Corals and the Brown Rock Sponge are also common. The section towards Lunama contains dense stands of foliaceous *Montipora*. A few small colonies of branching *Acropora* are present within the western end of the lagoon.

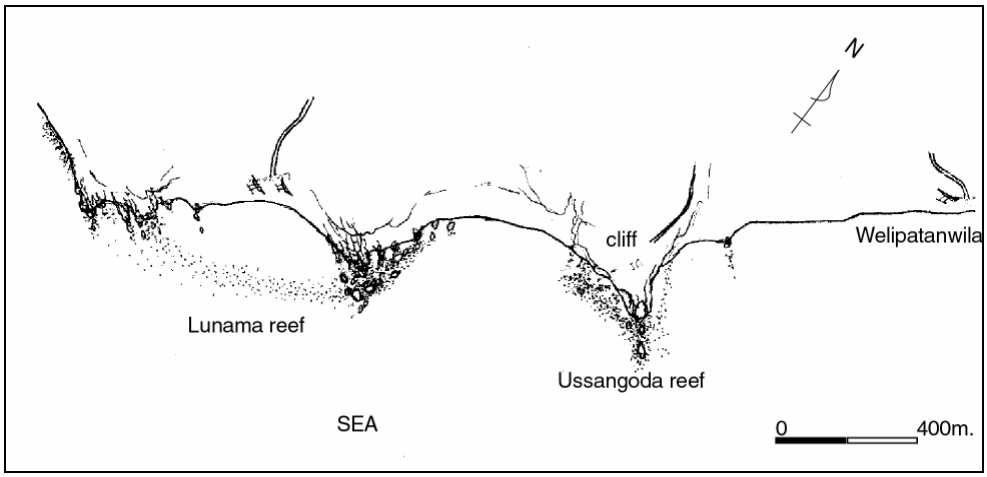
Ussangoda appears to be the most diverse reef site within the RUK area. 89 species of reef fish and 134 species of invertebrates including 31 species of coral were recorded. Live coral cover is around 26%.

Located approximately 3 km from the Walawe estuary, the reef undergoes extended periods of heavy sedimentation that reduces horizontal underwater visibility to less than ½ meter.

Lunama

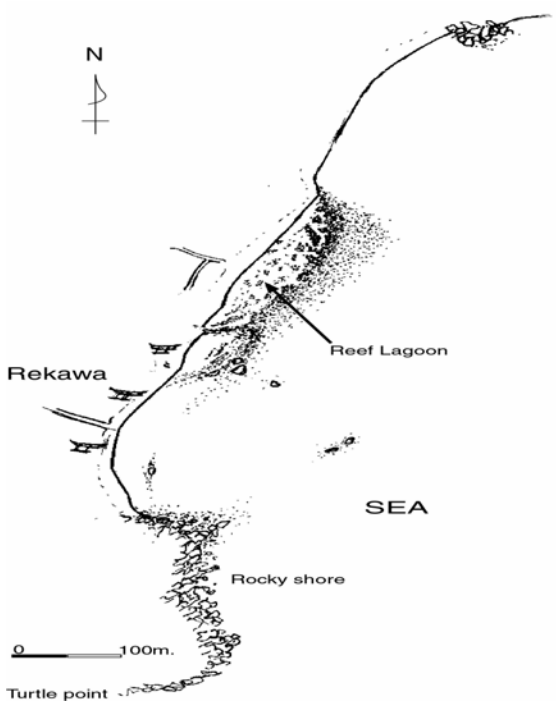
Separated from Ussangoda reef by a sandy cove approximately 170m in length, Lunama reef covers nearly 1.4 km of coastline (Between Lat: 06 05' 12.6198", Long: 80 58' 37.7042", and Lat: 06 05' 27.7024", Long: 80 59' 02.2689"). The reef is divided into two sections of coastal rocky shoreline at either end connected by a submerged ridge located about 200m offshore. The shoreline contains many rocky habitats and extensive coralline algae cemented beachrock at the far Southwestern end of the reef.

The most accessible and best coral area is the eastern end of the reef, along an area of nearly 300m of rocky shoreline. This section is composed of an aggregation of rocks forming a shallow open pool system with some drain channels. There is good live coral among the rocks along with significant amounts of dead coral. Apart from colonies of *Montipora aequituberculata*, most of the corals are robust forms. Encrusting, sub-massive, massive and digitate coral forms predominate as the area is subject to heavy wave action and currents. Several medium sized *Porites* domes are also present. Green *Didemnid* ascidians are common. There is a high abundance of corallimorphs.



The reef contains approximately 34% live coral dominated by *Montipora aequituberculata, Porites rus*, *Porites* spp. and favid species. 71 species of reef fish and 107 species of invertebrates were recorded from the site.

Although located approximately 4km away from the Walawe estuary, Lunama also suffers periodic heavy siltation when the river plume is carried westward.



Rekawa
The 1.5km long coastline between Turtle point and Oruwella is composed of extensive rock formations with large rock-pools that are exposed to constant high-energy waves.

The Northern section of the rocky shore continuing into the Rekawa Bay contains a few rocky habitats with ephemeral coral cover. The section between the rocks and the reef lagoon is composed mainly of scattered rubble and sand areas.

The main reef extends to the Northeast of the Rekawa Waraya and extends over 300m of coastline between Lat: 06 03' 04.7943", Long: 80 51' 57.6774" and Lat: 06 03' 14.6627", Long: 80 52' 02.6792". A shallow reef crest runs parallel to the shore enclosing a reef lagoon about 1.5 hectares in extent. The bottom of the lagoon is composed of coral and rocky rubble substrates interspersed with large to massive boulders of old limestone rock. These boulders contain a few encrusting and sub-massive corals growing on them. Towards the outer end of the reef and to the North there are several sections of reef containing a high abundance of foliaceous *Montipora aequituberculata* colonies. Most of the other corals on the reef are low growing sub-massive or encrusting types.

The reef currently contains 26 % live coral and 23 % dead coral. Most of the substrate rocks are composed of old limestone and dead coral that would possibly indicate higher coral cover before it was degraded to current extent.

The reef is highly degraded due to extensive coral mining. Large quantities of coral are removed when sea conditions are favorable for mining activities. Only a few coral areas at the outer edge and on the Eastern end of the reef remain intact.

The fish and invertebrate populations are low, with herbivores and detritivores being more abundant. 72 species of fish and 108 species of invertebrates were recorded from the site. Only two species of Butterflyfishes were recorded from this site. Aggregations of Sweetlips (Haemulidae) can be observed on outer areas of the reef. One of the major turtle rookeries in Sri Lanka is also located along Rekawa beach West of the rocky area of Turtle Point.

Kalametiya
The beach-seine site at Kalametiya is one of the most productive fishing grounds in the area. The near-shore waters are constantly enriched by nutrients from the Kalametiya lagoon attracting fishery important species to the area. The water in the area is often turbid and the substrate is mostly rich mud supporting a thriving soft bottom community. Due to the high turbidity the area does not provide favorable conditions for good coral growth.

8. THREATS

There are several human activities and biological and climate related factors that are threatening the marine ecosystem and biodiversity in the area. These threats vary from mild to heavy depending on the level of impact at each site.

Coral Mining
At Rekawa, coral mining activities have caused extensive damage to the reef, and in some sections destroyed the reef down to the coral rock base. When sea conditions are favorable, especially between the months of December and April, divers remove large amounts of coral on a daily basis. The mined coral is transported to lime kilns located inland or along other areas of the coast. Apart from a loss of biodiversity, the destruction of the reef structure has led to severe coastal erosion in Rekawa. There may also be a decline in fish stocks in the area in the future as many commercially important species are dependant on coral reef for at least part of their life cycle.

Destructive Fishing Practices and Overfishing
Bottom set nets bring up a varied by-catch of organisms ranging from hard coral and gorgonians to sea stars, crabs and shells. Larger and more colorful shells are retained for sale while the rest are often discarded. Occasional blast fishing using dynamite is reportedly carried out within the Rekawa reef lagoon and in offshore areas. Blast fishing is extremely destructive due to indiscriminate killing of all species and damage caused to reef habitats.

The increase in population and the consequent increase in fishing pressure may lead to overexploitation of fishery resources of the area in the future. Although there are regulations and some management efforts for the lobster fishery, laws are poorly enforced and management is inadequate. Undersized animals and egg-bearing females are taken regularly. Lobsters are also sometimes collected during closed seasons when lobster collection is prohibited.

Shell collection
Limited collection of high priced seashells is carried out mostly on offshore reefs, targeting species such as *Melo melo*, *Lambis* spp., and *Cassis coronata*. Though no specific fishery seems to exist for Chanks (*Turbinella pyrum*) shells taken as Bottom Net by-catch are regularly sold.

Pollution
With the initiatives being taken to develop the Southern region of the country, there is potential for large-scale pollution of marine and coastal habitats in the area. It is therefore important that proper studies are done to understand the effects of such a large-scale industrial complex in an ecologically sensitive area. The new industrial complex being built at Bata-atha could be cause for concern if it would discharge significant quantities of heavy metals and marine toxins into the coastal waters. This could impact the highly lucrative fishing grounds of Kalametiya located nearby. The pumping of approximately 25,000 cu/ft. of water per day from the Kalametiya lagoon could also have an impact on the nutrient cycle and food web of the lagoon.

Climate Change and Coral bleaching
The increase in Sea Surface Temperature (SST) during the El Nino event of 1998 led to the death of many corals in Sri Lanka. The abundance of large areas of dead coral of similar age together with observations of bleached corals in 1998 indicates that reefs in this area were also severely affected by this event. With the current predictions of global warming and possible increases in SST, coral reefs may be subjected to similar events in the future.

Invasive Organisms
There appears to be an unusually high abundance of zooantharians and corrallimorphs on the sub-tidal reefs in the area. Instances where these organisms compete with corals and even smother live corals have been recorded elsewhere in Sri Lanka. However, it is difficult to make assumptions on the impact of these organisms due to the lack of detailed information on the status of the reefs in the area prior to this survey.

Coral Diseases
The *Porites* pink-band disease was observed in Lunama and Rekawa reefs, with most of the sub-massive and massive *Porites* colonies being affected in the Western area of the Rekawa reef.

Siltation
The many river outflows including the Walawe discharge large amounts of silt into the coastal waters. This impacts coral reefs several kilometers down current from the outflows for several months of the year. The high wave energy of the coastline keeps the sediments in suspension reducing water clarity. It appears that the reefs have adapted to this natural phenomenon, with most of the corals being sediment tolerant species such as *Porites* and *Montipora*. However, there may be increased sedimentation and nutrient levels caused by deforestation and poor agricultural practices in upriver regions, and this may have potential long term implications for coral reefs of the area.

9. CONSERVATION RECOMMENDATIONS

The RUK area is home to a number of important inter-tidal and sub-tidal marine habitats. The high-energy conditions in the area have given rise to unique geological and morphological characteristics that are not commonly encountered in other areas of Sri Lanka. These habitats also support a major lobster and beach-seine fishery that form an important economic resource for the people of the area. It is therefore important that measures are taken to protect this important resource and avoid possible over-exploitation and use of destructive fishing methods that may lead to severe habitat degradation and loss of bio-diversity in the area.

1. Action to Stop Coral Mining Activities
Coral mining has led to severe degradation of the Rekawa coral reef. This has also led to extensive coastal erosion along the immediate shoreline. Poverty, easy access to the resource, and the lack of an effective deterrent are the main reasons for coral mining in Rekawa. Immediate action is required to stop this activity and prevent further destruction. Currently, the level of enforcement is poor, and mining activities are openly carried out.

Proposed activities
- Effective enforcement of the law to deter such activity.
- Provide alternate income opportunities for those involved in coral mining. Such alternatives should also be attractive enough and sustainable in the long term to encourage the community to move away from coral mining as an income generating activity.

2. Initiate Measures to Effectively Manage Fishery Resources

Although the use of illegal and destructive fishing methods is low in the area, blast fishing does take place occasionally. In addition, some fishermen continue to harvest resources in an unsustainable manner. Illegal fishing in Sri Lankan waters by foreign fishing vessels is also reported and could be a serious threat to fish stocks in the area. Currently, the capacity of the law enforcement agencies to prevent such actions is minimal.

Proposed activities

- Strengthen the existing coast guard system and effectively patrol territorial waters with the assistance of the navy to discourage the use of illegal and destructive fishing methods and poaching by foreign fishing vessels.
- Enforce strict legal action against offenders.
- Initiate measures to stop the trade of selected species during certain seasons to discourage fisherman from catching such animals.
- Educate fisherman on sustainable fishery practices and management of fishery resources.
- Provide financial and technical assistance as necessary to encourage fishermen to use more productive, non-destructive and sustainable fishing methods.

Action to Conserve Turtles and their Nesting Beaches

Poaching of turtle eggs is still a serious problem in the area despite several initiatives to address the issue.

Proposed activities

- Efforts to promote in-situ conservation of nests.
- Declaration of important nesting beaches as protected areas.
- Effectively patrol major nesting sites.
- Enforce strict legal action against poachers

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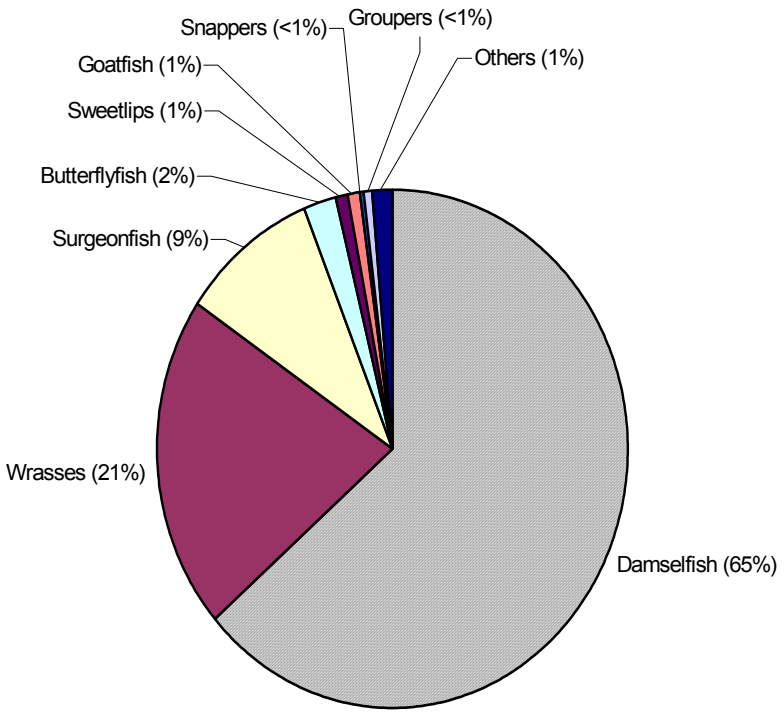
Annex 1:Composition of Bottom Substrate

		Percentage of cover					Mean	
Benthos categories		Welipatanwila	Madilla	Rekawa	Lunama	Ussangda	**SANDSTONE REEFS**	**CORAL REEFS**
	Live coral	**0**	**0**	**26.3**	**33.75**	**25.63**	0	28.54
	Dead coral	0	0	23.75	15.00	30	0	22.92
	Coral rubble	0	0	13.75	4.38	5	0	7.71
	Rock or very old dead coral	0	3.33	16.67	23.13	11.25	1.67	17.01
	Sandstone	13.33	4.58	0	0	0	8.96	0
	Sand	8.33	11.67	8.33	7.50	14.38	10.00	10.07
	Ascidians	0	0	7.08	0.63	6.88	0	4.86
	Corallimorphs & Zooanthids	0	0	0	15.63	3.75	0	6.46
	Tube worms	0	3.33	0	0	0	1.67	0
	Algae	65.83	67.92	0.42	0	0.63	66.88	0.35
	Corraline algae	3.33	7.08	0	0	0	5.21	0
	Sponges	0	0	3.33	0	1.88	0	1.74
	Bacterial mats	9.17	2.08	0	0	0	5.63	0
	Soft coral	0	0	0.42	0	0.625	0	0.35

Annex 2: Non-Sessile Organisms: Sandstone Beach Reef Sites

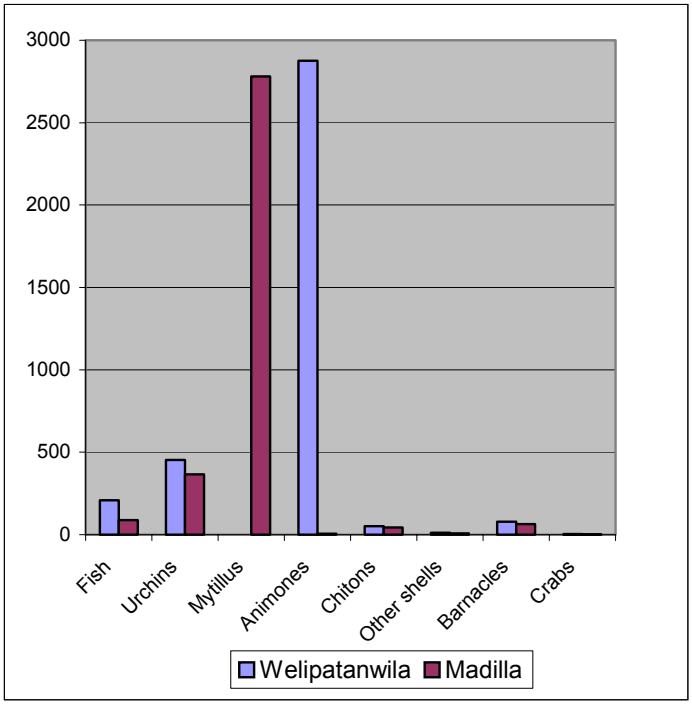
	Madilla		Welipatanwila	
Category	**Average**	**SD**	**Average**	**SD**
Fish				
Damselfishes	11.17	12.81	27.5	60.54
Wrasses	0.5	0.84	4.33	10.61
Gobies	3	3.22	2	4.43
Surgeonfish	0	0	0.83	1.6
Angelfish	0	0	0.17	0.41
Others	0	0	0	0
Invertebrates				
Urchins	61	69.72	75.67	107.3
Mytilus spp.	463.33	694.02	0	0
Anemones	1	1.26	479.17	486.93
Chitons	7.33	8.41	8.67	3.5
Other Shells	1.33	1.97	1.83	2.32
Barnacles	10.67	11.41	13.17	11.87
Crabs	0.33	0.52	0.5	0.84

Annex 3. Composition of Fish by Families at Coral Reef Sites in RUK Area.



Fish Species Composition by Family on Transects at Coral Reef Sites

Annex 4. Faunal Composition on Beach Reefs in RUK Area.



Annex 5. List of Invertebrate Species in the RUK Area.

Phyllum		Family	Common Name	*Genus*	*Species*
Porifera					
		?	Gray finger sponge	*c.f. Dysidea*	*sp.*
		?	Brown stone sponge		
		?	Black encrusting sponge		
Hydrozoa					
		Bougainvillidae	Hydroids	*c.f.Bourganvillia*	*spp*
		Agalophaenidae		*c.f. Aglaophaenia*	*sp.*
Ctenophora					
		Beroidae	Comb jelly-fish	*Beroe?*	*sp.*
Cnidaria (Coelenterata)					
	ACTINARIA	**Actiniidae**	Sand anemone	*Actinia/Anthopleura*	*sp.*
	ALCYONACEA	**Alcyoniidae**	Leather coral	*Lobophytum*	*sp.*
			Flower Soft coral	*Sinularia*	*sp.*
	ZOANTHIDEA	**Zoanthidae**	Zooanthid	*Palythoa*	*sp.1*
		Zoanthidae	Zooanthid	*Palythoa*	*sp.2*
		Zoanthidae	Zooanthid	*c.f. Protopalythoa*	*sp.*
	CORALLIMORPHARIA	**Ricordeidae**	Corrallimorph	*c.f. Ricordia*	*sp.*
	SCLERACTINIA	**Acroporidae**	Rose coral	*Montipora*	*aequituberculata*
				Montipora	*monasteriata?*
				Montipora	*informis*
				Montipora	*sp.*
				Acropora	*yongei*
			Staghorn coral	*Acropora*	*aculeus?*
			Table coral	*Acropora*	*hyacinthus*

			Staghorn coral	*Acropora*	*sp.*
		Pocilloporidae	Antler coral	*Pocillopora*	*eydouxi*
			Cauliflower coral	*Pocillopora*	*damicornis*
				Pocillopora	*sp.*
		Oculinidae	Galaxy coral	*Galaxia*	*fascicularis*
		Siderastreidae		*Coscinaria*	*collumna ?*
		Agaricidae		*Pavona*	*variance*
				Pavona	*venosa*
				Pavona	*minuta*
				Agaricia	*humilis?*
		Mussidae		*Acanthastrea*	*echinata*
				Symphyllia	*radians*
		Faviidae	Pineapple coral	*Favites*	*pentagona*
				Favites	*helicora*
				Favites	*chinensis*
				Favites	*spinosa*
				Favia	*favus*
				Favia	*spp.*
				Goniastre	*retiformis*
				Montastrea	*curta?*
			Maze coral	*Leptoria*	*phrygia*
				Platygyra	*verweyi*
			Brain coral	*Platygyra*	*daedalea*
				Platygyra	*sp.*
				Diploastrea	*heliopora?*
		Poritidae	Pore coral	*Porites*	*rus*
			Pore coral	*Porites*	*solida?*
			Pore coral	*Porites*	*sp.*
			Ball coral	*Goniopora*	*sp.*
Annelida					
	POLYCHAETA	**Sabellidae**	Tubeworm	Sebellastarte	*sp.*
		Terebellidae	Tubeworm	*?*	*sp.*
		Sabellaridae	Colonial Tubeworm	*?*	*sp.*
		Serpulidae	Christmas tree worm	*Spirobranchus*	*sp.*

			Calcareous Tubeworm	*Serpula*	*sp.*
		Glyceridae ?	Polychaete worm	*?*	*sp.*
		Eunicidae	Palolo worm	*?*	*sp.*
Crustacea					
	MALACOSTRACA		Amphipods	*?*	*spp.*
			Isopods	*?*	*spp.*
	CIRRIPEDIA	**Chthamalidae**	Acorn Barnacle	*Chthamalus*	*sp.*
		Balanidae	Acorn Barnacle	*Balanus*	*sp.*
		Tetraclitidae	Acorn Barnacle	*Tetraclita*	*sp.*
	STROMATOPODA	**Gonodactylidae**	Mantis shrimp	*Gonodactylus*	*sp.*
	ANOMURA	**Diogenidae**	Streaked Red Hermit-crab	*Aniculus*	*maximus*
			White-claw Hermit-crab	*Calcinus*	*laevimanus*
			Reef Hermit-crab	*Calcinus*	*latens*
			White-finger Hermit crab	*Clibanarius*	*bimaculatus*
			Reef Hermit-crab	*Dardanus*	*gemmatus*
		Coenobitidae	Land Hermit crab	*Coenobita*	*rugosa*
			Red Land Hermit crab	*Coenobita*	*sp.*
		Hippidae	Mole crab	*c.f.Emerita*	*sp.*
	PALINURA	**Palinuridae**	Painted spiny lobster	*Panulirus*	*versicolor*
			Ornate spiny lobster	*Panulirus*	*ornatus*
			Scalloped spiny lobster	*Panulirus*	*homarus*
			Prong-horn spiny lobster	*Panulirus*	*penicilliatus*

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