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EXECUTIVE SUMMERY

EX-SITU CONSERVATION, AN UNDERUTILIZED TOOL IN CONSERVATION OF BIODIVERSITY IN SRI LANKA

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For a small island of its size (65,610 km^2) Sri Lanka is remarkably rich in biodiversity. The last National Red List complied in 2012 reveals that we have a large number of unique plant and animal species including 3,154 flowering plants, 366 ferns, 237 birds, 124 mammals, 209 reptiles, 253 land snails, 111 amphibians, 205 ants, 130 bees, 245 butterflies, and 501 spiders. Many of those statistics are incomplete and the actual numbers may be higher.

As a considerable number of our flora and fauna are threatened due to various factors, conservation of those has become a priority. The traditional and the best method of conservation is conserving the natural ecosystems (in situ conservation) which houses the components of biodiversity.

Ex situ conservation is conserving components of biodiversity outside the natural ecosystems. The 2012 national red list shows that some species of plants are extinct in the wild. Those plant species are now found only within botanic gardens. Those endemic species are present on earth today due to ex situ conservation in botanic gardens.

The techniques of ex situ conservation include collection, handling and management (including research) of germplasm, and ensure its storage, regeneration, characterization/evaluation, documentation and dissemination of information to users, while at the same time emphasizing the need to ensure that such steps do not threaten ecosystems and in situ populations of species. In Sri Lanka, Ex-situ conservation activities are carried out using deferent methods at the several government organizations.

CRI (Coconut Research Institute), HORDI (Horticultural Research and Development Institute), FCDRI (Field Crops Development and Research Institute), DEA (Department of Export Agriculture), DNBG (Department of National Botanic Gardens), SRI (Sugar Research Institute), RARDC (Regional Agricultural Research and Development Centers) Makandura, Bandarawela, Aralaganwila, Bombuwella, TRI (Tea Research Institute) and PGRC (Plant Genetic Research Center) are having field gene banks. Seed banks are found in HORDI, RRDI (Rice Research and Development Institute), RARDC (Bandarawela and Bombuwela) and PGRC. PGRC has in vitro and cryo-preservation facilities. SRI and DNBG, NIFS (National Institute of Fundamental Studies) and FD (Forest Department) have arboreta.

There are over 14,000 accessions recorded in the ex-situ conservation centers (involved in Crop Genetic Resources) in Sri Lanka. These accessions are from 52 wild species, 108 traditional cultivars and landraces, 2 mutants, 2, breeder lines, 52 advanced/improved cultivars, 4 weedy species and 105 non-categorized species. Of the accessions only 1,618 are safety-duplicated. Almost all accessions in the SRI and TRI are duplicated.

The Plant Genetic Resources Centre was established in 1988 with a mandate to plan and conduct plant exploration, collecting, introduction, evaluation, documentation and conservation of genetic diversity of food crops and their wild relatives. Over 10,000 accessions of more than 125 plant species are presently conserved in the PGRC seed gene bank. The major collection conserved up to the end of 1997 include: rice and wild relatives (3,919), other cereals (1,054), grain legumes (1,772), vegetable legumes (1,064),

Solanaceous vegetables (1,121), cucurbit vegetables (662), leafy vegetables (135), other vegetables (327), spices and condiments (292), Brassica spp. (22) oilseeds (99), fruit crops (160), fiber crops (66), and miscellaneous plants (221).
There are several field gene banks in Matara (Cinnamon, and lemongrass), Kurunegala (betel) and Matale (Cardamom, Pepper, Cocoa, Coffee and Areca nut). In addition to these there are field gene banks for medicinal plant species in several places such as Haldummulla, Pattipola, Nawinna, Girandurukotte and Ganewatte (20 ha).

PGRC's interests are still limited to food crops, and about 99% of the accessions conserved in the gene bank are those of food crops. PGRC should widen the scope of its activities and should assume the role of a central or nodal agency for all PGR activities in Sri Lanka.

More than 300 accessions of different crops, namely, potato (152), sweet potato (70), cassava (65), dioscoria (7), aroid (6) and innala (1) are being maintained in vitro at the PGRC. A total of 4,749 accessions of crop germplasm (landraces and breeder's stocks) were received for conservation.

Sustained studies on cryopreservation have not been possible at PGRC owing to the lack of a steady liquid nitrogen source. Investigation of the possibility of cryopreservation of vegetatively propagated crop material and seeds and other material of crops where seed viability decreases rapidly under normal storage conditions should be considered a priority. The PGRC’s gene bank facilities are for only medium and short-term seed storage at +1° C and 35% relative humidity, and + 5 °C and 35% relative humidity respectively. This is far below international demands, and inadequate, making it necessary to monitor viability regularly at short intervals. It is recommended that PGRC should obtain the necessary equipment to conserve in original samples at least in one or two gene bank modules at -20°C.

Many obstacles remain in the quest to provide a secure source of germplasm. First is a lack of information. Secondly, the high cost of ex situ collections, particularly when seed is stored at very low temperatures can force some seed banks to cut back or shut down. The high storage costs mean that funds for describing the germplasm present in the banks, a necessity for making the germplasm useful to plant breeders, can be minimal. Thirdly a serious problem associated with ex situ collections involves gaps in coverage of important species, particularly those of threatened and endangered habitats. PGRC and other institutions dealing with field gene banks are conserving crop plants (including crop relatives) or economically important plants. The most worrisome gaps are in the coverage of species with recalcitrant seeds, wild species, and livestock.

Botanic gardens are uniquely suited to undertake research on the cultivation requirements, the reproductive biology and the propagation of individual plants. Such information is essential to be able to reintroduce the plants back into the wild and to provide material for restoring and rehabilitating natural habitats.

The botanic gardens in Sri Lanka today contain over 8,000 plant species. The Royal Botanic Gardens, Peradeniya alone contains an estimated 5,000 species of plants. The current geographical imbalance in the locations of botanic gardens could be remedied if more gardens were established in other parts of the island specially in the dry zone, low country wet zone, sub-montane and in the intermediate zone.

Until recently, botanic gardens have been underutilized in maintenance of threatened species and conservation of genetic resources. Although they contain a large proportion of the native flora, the gardens have traditionally not been integrated into overall biodiversity conservation programmes.

DETERMINING OCCUPANCY, ABUNDANCE AND POPULATION STRUCTURE OF AN ENDANGERED APEX PREDATOR, THE SRI LANKAN LEOPARD (*Panthera pardus kotiya*)

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Introduction

The endangered Sri Lankan leopard, the island's sole apex carnivore, plays a potentially vital role in maintaining ecosystem structure and function. Additionally, as a wide ranging species, its conservation may afford protection for other species in this region of high biodiversity and endemism. Effective leopard conservation requires improved island-wide distribution and abundance estimates. It is also necessary to determine leopard population genetic structure including possible sub-population occurrence and connections.

Objectives

We aim to improve on our current island-wide population size estimate (Stein et al 2016; Kittle & Watson 2008; 2015), a key component for species and eco-system conservation and management. Having comparable abundance estimates across habitats will allow for finer scale, habitat-specific management initiatives. By establishing the first overview of the island-wide connectivity of sub-populations, and possibly population genetic structure of the *P.p.kotiya* subspecies we hope to profoundly impact future conservation planning. Land use planning and targeted protection of areas and restoration of others will be identified accordingly.

Methods

To address these questions we are conducting occupancy and abundance surveys across varied habitats to detail regional - and further refine overall - population estimates. Having previously conducted surveys in other areas, we now focus on priority lowland dry zone (Wilpattu National Park) and a montane zone (Peak Wilderness Sanctuary vicinity) populations. Closed population remote camera surveys using a spatially explicit capture recapture framework will be used for this purpose.

We will undertake island-wide non-invasive faecal genetic analysis to assess population genetic structure and identify landscape-level connections.

Results

As the project is still ongoing results that can be presented here are limited. The Wilpattu National Park remote camera survey has however been completed successfully and what appears to be a robust population of a total of 49 identified study animals was established within a 500 km^2 study area of the park. Prey estimates and diet analysis are ongoing. The Peak Wilderness study is ongoing with 5 individual leopards being documented in the first section of the study area. Rusty spotted cat and fishing cat presence is confirmed in both locations and continued monitoring is ongoing. Leopard diet analysis as well as diet of these smaller cats is scheduled.

Discussion

This fundamentally valuable work will provide improved distribution estimates, habitat-specific abundance estimates and describe the hitherto unknown genetic population structure of this sub-species. With post-war development rapid, current, detailed information is vital to ensure that it is sustainable. Our results influence regional and national land use and conservation policy planning.

Site-specific abundance estimates form the basis for determining island-wide population trends. Current estimates used for *P.p. kotiya* IUCN Red List determination, provided by our project, require considerable refinement. Conducting more habitat-specific studies allows for increased appreciation of critical habitat-specific threats and provides quantitative data to support prioritization. During the course of the remote camera mark-recapture surveys we simultaneously address a number of other research targets, including fine-scale habitat selection analyses, prey abundance estimates and monitoring of other rare and elusive species of conservation concern (e.g. golden palm civet, fishing cat, rusty spotted cat and jungle cat).

Determining genetic relationships between sub-populations is vital as this can identify linkages impossible to understand otherwise, leading to the identification of presently unappreciated, highly threatened sub-populations or alternately exhibit that healthy island-wide connections exist. Either way, the implications for management are acute and can translate into landscape-level policy initiatives such as the conservation and/or creation of important corridors.

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BLEACHING PATTERNS AND CAPACITY BUILDING FOR MALDIVES CONSERVATIONISTS DURING REEFCHECK EXPEDITIONS

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Introduction

One of the particularly concerning attributes of coral reefs is the potential for 'phase shifts' from coral to non-coral dominated assemblages (e.g. Jamaica 25 years ago) (Dudgeon *et al.,* 2010). The reefs of the Maldives were variously regarded as 'pristine' or a 'wonderland' by initial visitors with SCUBA such as Cousteau in the 1950s, but profound ecological change has occurred since then. The 2016 bleaching event in the Maldives was induced by water temperatures of 32 degrees Celsius for two weeks in early May.

The Maldives is a nation built on atoll coral formation. Geological records show a relative stability in the environmental conditions of global reefs of the world up until the last 50 years, since when there have been an increasing number of warming events (e.g. 1998, 2002, 2016 for the Maldives). The Maldives has developed since the 1970s from a country of little tourism with a developing export market for tuna, to a country where global markets for tuna, live reef fish (e.g. grouper), and mass-tourism are starting to affect many of the local reefs and resources. The global bleaching event of 1998 led to 80% bleaching and mortality (90%) of hard corals to water depths of over 30m (Edwards *et al*, 2001). By 2005 many sites had recovered much of their hard coral (Morri *et al.,* 2015), with a mean percent cover from Biosphere Expeditions of 35% between 2005 and 2015 for central atoll reefs. But our expeditions have come across two some completely degraded reefs where *Discosoma* corallimorphs are almost completely dominant (Adhureys reef in southeast Rasdhoo atoll, Deh Giri in Northwest Male' atoll). There are concerns over the ability of the habitat to recover after bleaching (Schumacher *et al.,* 2005; Zahir, 2002), particularly where coral reefs may change state to reefs dominated by *Discosoma*. The main purpose of our expeditions is to assess recovery and coral health. Our expeditions have provided capacity building opportunities for local Maldivians including joint training and supporting the training of Maldivian survey dive teams.

Methodology

The method used by the Biosphere-Expeditions team is the internationally recognized method, Reef Check. Reef Check trains volunteers to record benthic lifeforms, recognize anthropogenic impacts, count invertebrates and fish populations (Hill and Wilkinson, 2004).

Sites were selected based on accessibility from Male' during a week-long liveaboard trip (Figure 1). They include sites in inner atoll locations (thillas) and outer reefs. Some of the thillas are house reefs that are adjacent to resorts, and some were selected to be further away from development – these can be smaller, submerged reefs such as giris. Many of the outer and channel reefs are both adjacent to deep water, in areas of greater wave action, and have increased currents. These were selected based on safety,

practicality and in areas that are known dive sites for liveaboard operators with whom the dive survey team have collaborated.

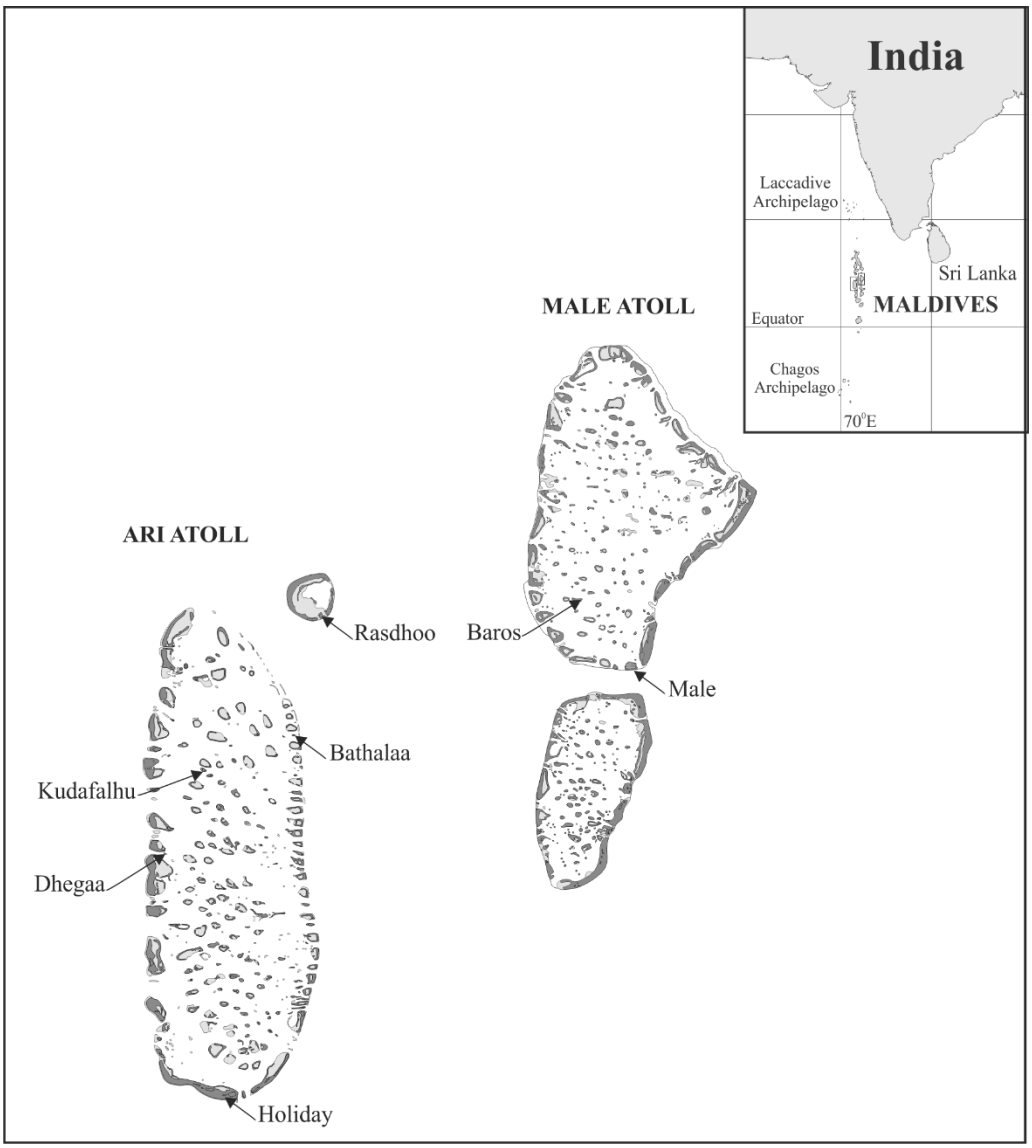

Figure 1. Location of 2016 surveys. Note the sheltered locations of the thilla sites – Baros, Kudhafalhu, Dega and Holiday. Rasdhoo is the most exposed, with Bathalaa slightly less exposed. A further site was surveyed on the outside of Dhigurah Island outside the large (Ari) atoll to the left.

Results and Discussion

Figure 2 shows that the coral cover of Rasdhoo and Bathalaa maagaa (both outer reefs, with Rasdhoo an almost vertical slope) show the highest cover of bleached hard coral, relative to inner atoll sites such as Dega, Holiday and Kudafalhu thillas. Baros data was recorded during the bleaching event in May 2016. This is why the 'bleached coral cover' is so high, and the 'coral cover 2016' is so low relative to other sites. For the sites recorded in July 2016, 2 months after the bleaching event, the most sheltered inner thilla sites such as kudhafalu had already been infested with algae covering the dead and bleached coral. Also, this site had suffered from storm damage, as had some of the corals at Holiday thilla.

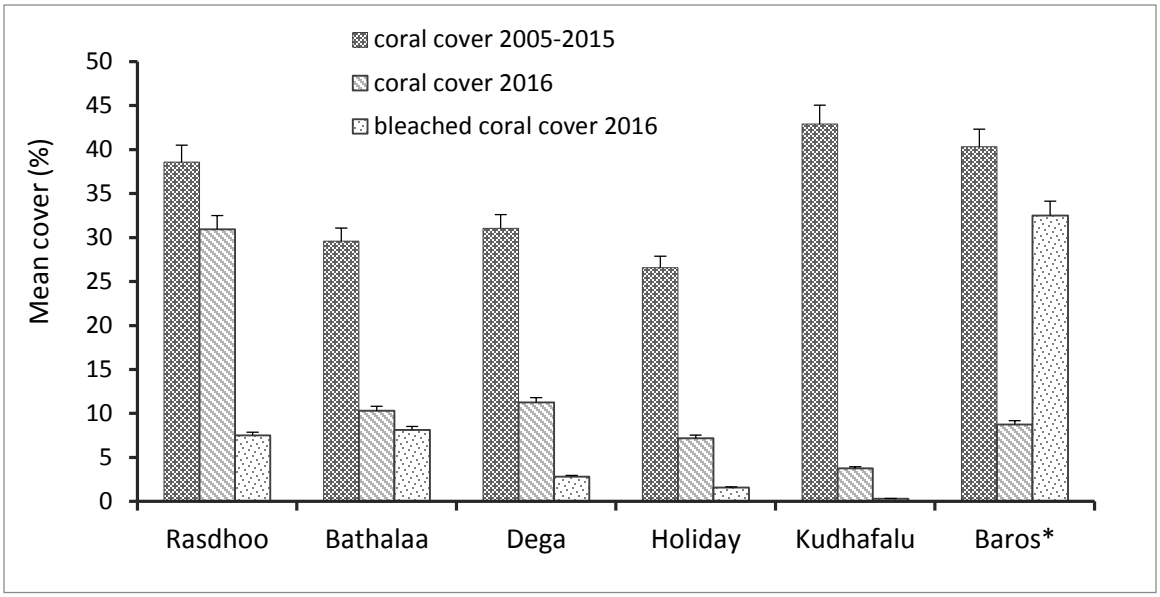

Figure 2. Mean live hard coral cover (±SE) before the bleaching event (data from all years pooled for each site) 2005-2015; live hard coral cover 2 months after the bleaching event, and the % bleached coral cover 2 months after the bleaching event. * Baros is exceptional in that the 2016 data was recorded during the bleaching event.

Some sites have shown extraordinary resilience to temperature-induced bleaching. Surveys in mid-July, 2 months after the bleaching event in May, showed corals in areas of deeper waters waters on the outside of atolls to be (a) either still bleached, some two months after the bleaching event, (b) recovered, or (c) not to have been bleached at all (e.g. Rasdhoo, Bathalaa). However, more sheltered reefs within the central lagoons showed mass colonisation by algal turfs, encroachment of vulnerable reefs by *Discosoma* corallimorphs, and Crown-of-Thorns invasions.

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SPECIES RICHNESS OF INSECTIVOROUS BATS IN SELECTED TEA PLANTATIONS IN SRI LANKA: A PRELIMINARY STUDY

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Introduction

Tea has been the country's principal and most famous export; for generations, it formed the backbone of the Sri Lankan economy, and plays a major part, even today, in the country's fortunes. The tea estates of Sri Lanka are exist in 14 Districts in Up-Country, Mid-Country and Low-Country in Sri Lanka (Sri Lanka Tea Board, 2011). Recent changes in cultural practices in tea plantations in Sri Lanka have increased yields but have intensified pest problems. Total of 46 species of insects and five species of mites have been identified as tea pests. These could be classified as key, seasonal, potential and occasional pests. To defend the tea crop against pests, a large number of chemical insecticides have been used in tea from time to time. However, the alarming rise in resistance to chemical pesticides, together with growing concern for their environmental impact, has led to renewed interest in biological control as often an inexpensive and safe component of integrated pest management (Vitarana, 2003).

Using natural enemies to suppress pest populations, known as biological control agents, include predators, parasitoids, and pathogens. At the turn of the last century large scale biological control programs have been initiated and now become a very effective and widely used method of controlling pests. Insectivorous bats are considered as the major predators of nocturnal areal insects. They consume a variety of insects, move in a large spatial area, and very high in numbers, that has the potential to act as very effective biological pest control agents in agricultural lands (Yapa, 2012). In our study we wish to firstly investigate community composition of bats in selected tea plantations. Secondly, we wish to establish baseline data on the diet of different bat species resident in the area, with a view to identify insect families, genera and species, which are consumed by these bats. Providing our findings will indicate that bats in fact play a major role in pest control inside tea estates. Then we wish to increase the presence of bats within selected tea plantations, providing suitable roosting sites (such as bat boxes), to augment the pest control capacity by bats in tea plantations.

Objectives

The objective of the present study was to ascertain the potential role played by bats in pest control in tea plantations. As a part of this study, we are focusing on the species richness in selected six tea estates representing all tea growing regions to assess their species diversity finally.

Methodology

Six tea estates corresponding to major tea growing regions in Sri Lanka were selected as follows. Small holder tea land at Thawalama (Wet zone low-country), tea estate at Idulgashenna (Intermediate zone up-country), tea estate at Udupussellawa (Intermediate zone up-country), tea estate at Radella (Wet zone up-country), tea estate at Yatideriya (Wet zone mid-country) and tea estate at Maskeliya (Wet zone up-country). All sites will be sampled once in three months for one year period (four phases) to cover all seasonal bat activities. Bat roosting sites vicinity to the selected tea estates also observed.

Capturing of bats within the tea plantations was done using Triple High Forest Filter Mist Net Set and G7 Forest Strainer Harp Trap. Mist net was opened in two times of each night (after sunset and before sunrise) and it is kept under continuous observation. Harp trap was placed on usual flyways of bats after prior observations and left open for all night and monitored at regular intervals. In addition to the above methods, bat roosting sites in tea plantations will also be studied. Capturing of bats was done under research permit (No: WL/3/2/02/2016) of Department of Wildlife Conservation of Sri Lanka (DWLC). All captured bats were immediately weighed and key morphometric measurements were taken using Pesola spring scale and digital vernier calipers respectively. Photographs of key morphological characters were taken using Canon EOS 70D digital SLR camera fitted with Canon EF100mm f/2.8L IS USM macro lens for confirm identification. GPS coordinates of all sampling sites were recorded using Garmin etrex 20x hand held GPS receiver. Species identification was confirmed using regional bat keys and handbooks.

Results & Discussion

Species Richness

First phase of the field works was conducted in September 2016 and the data gathered from that field works was used to prepare this publication. Six species of insectivorous bats from three families (Rhinolophidae, Hipposideridae and Vespertilionidae) were recorded from roosting sites in and closely located to the tea lands. Of the total recorded species, only two species of bats were caught by trapping gears while they were foraging inside tea lands (Table 1). According to the current results, *Rhinolophus rouxii* is the frequently recorded bat from sampling sites.

Table 1. Species of bats recorded from roosting sites and inside tea lands.

Region	Sampling site	Captured species inside tea land	Captured species from nearby roosting site
Wet zone low country	Thawalama	*Rhinolophus rouxii*	*Rhinolophus rouxii, Rhinolophus beddomei*
Intermediate zone up country	Idulgashenna	*Rhinolophus rouxii*	*Miniopterus fuliginosus*
Intermediate zone up country	Udupussellawa	-	*Rhinolophus rouxii*
Wet zone up country	Radella	*Pipistrellus ceylonicus*	*Pipistrellus ceylonicus*
Wet zone up country	Maskeliya	*Pipistrellus ceylonicus*	*Pipistrellus ceylonicus*
Wet zone mid country	Yatideriya	*Rhinolophus rouxii*	*Rhinolophus rouxii Hipposideros lankadiva Hipposideros speoris*

According to the Wordley *et al*., (2015) seven bat species from ten studied bats (*Hesperoptenus tickelli, Miniopterus fuliginosus, Miniopterus pusillus, Myotis horsfieldii, Pipistrellus ceylonicus, Megaderma spasma, Hipposideros pomona, Rhinolophus beddomei, Rhinolophus indorouxii* and *Rhinolophus lepidus*) in tea dominated landscape were recorded in tea plantations of Western Ghats of India. In their study *Megaderma spasma* and *Rhinolophus beddomei* were never recorded in tea plantations. According to their results, most bat species showed positive responses to Coffee plantations and forest fragments than tea plantations. However, we observed that, high bat activity and different kind of bat species were foraging

inside all sampling sites. By conducting more field works and changing the location of trapping gear establishment, we hope to obtain more results during next three phases.

In addition to the above species, two Mega-chiropteran bats were caught in to mist nets inside the tea estates. One *Pteropus giganteus* was caught in the Udupussellawa and one *Rousettus leschenaultii* was caught in the Radella site.

Roosting sites

Two roosting sites locating near to the tea land at Thawalama were observed. Both are abandoned plumbago mines and one is comparatively larger than the other one. *Rhinolophus rouxii* and *Rhinolophus beddomei* were observed in large and small mine respectively representing about 100 individuals at large mine while observing five in small mine.

An ancient tunnel was found below the Idulgashenna railway station and entrance of the tunnel is existing inside the tea estate. Near to the entrance of the tunnel, around 50 individuals of *Miniopterus fuliginosus* were observed.

At Udupussellawa one bat roosting site observed close to a tea estate and it was an ancient tunnel too. This tunnel is home to a big population of *Rhinolophus rouxii*.

Around 15 individuals of *Pipistrellus ceylonicus* colony was observed in hollows of two *Albizzia* sp. trees locating in the tea estate at Radella beside the Hatton-Nuwara Eliya main road.

A *Pipistrellus ceylonicus* colony around 30 individuals is roosting inside the ceiling of estate manager's office building in a tea estate at Maskeliya were observed.

Two rock cave located at the boarder of the tea estate at Yatideriya inhabits by colonies of *Rhinolophus rouxii, Hipposideros lankadiva* and *Hipposideros speoris*.

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PATHOGEN DRIVEN LOSS OF BIODIVERSITY: TREMATODE INDUCED MORTALITY AND MALFORMATIONS IN FROGS

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Aquatic communities and amphibians in particular stand at the forefront of the current biodiversity crisis with large number of declining populations and extinct species. Recent attention in disease ecology has focused on the pathogen driven loss of biodiversity which is well exemplified by many amphibian pathogens including digenetic trematodes. The digenetic trematodes have a complex life cycle involving sequential transmission from a freshwater snail as the first intermediate host and invertebrate or a vertebrate second intermediate host to a definitive vertebrate host. Trematode species, *Ribeiroia ondatrae* causes severe limb deformities in frogs and toads. This parasite uses rams horn snails, tadpoles and birds as its hosts and known to infect wide range of North American amphibian species with lethal and sub-lethal effects. The first report of malformed frogs of Sri Lanka came from two protected areas with missing limbs and short bones and digits in the hind limb in an endemic monotype genus *Lankanectes corrugatus* and *Rana temporalis* in the Dothalugala Man and Biosphere Reserve of the Knuckles Forest Range and Gannoruwa Forest Reserve. These malformations observed in the wild frogs prompted us to study the possible role of trematode infections under controlled laboratory conditions. We exposed two local anuran species: the common hourglass tree frog, *Polypedates cruciger* and the common Asian toad, *Duttaphrynus melanostictus* to the cercariae of a digenetic tremetode *Acanthostomum burminis* isolated from a freshwater snail *Thiara scabra*. We found that in addition to *R. ondatrae*, another trematode species, *A. burminis* induced malformations mainly axial and some limb malformations in the two frog species. The major types of axial malformations observed were scoliosis and kyphosis. Infections of *A. burminis* also increased mortality and time to metamorphosis and decreased the size at metamorphosis. Cercariae induced effects on the tadpoles were dose dependant, where the severity of the effects increased with a higher dose of cercaraie. The adult of *A. burminis* is found in the water snake and possibly using frogs and fish as the second intermediate host to reach the definitive host. Later, nine different types of cercariae released from *Melanoides* sp. were exposed to *P. cruciger* under laboratory conditions and found three of them induced malformations and increased mortality. In addition to the axial malformation, one cercariae type induced an open wound in the belly area of the tadpole which was also visible in the metamorphs. Of the nine types of cercariae, only three types induced malformations and increased mortality and lengthened the larval period while exposure to other six types had no effect on *P. cruciger*. Trematode infections induced direct mortality. In addition, they also lead to indirect mortality due to malformations as the malformed frogs become an easy prey for predators in their natural environment. Although infectious diseases are rarely been cited as the primary cause of global species extinctions, they however, can have a great impact on local populations by causing temporary or permanent declines in abundance. More importantly, pathogens can interact with other driving factors to contribute to local and global extinctions.

SIGNIFICANCE OF DIFFERENT HABITATS IN UPPER HANTHANA MOUNTAIN AREA, CENTRAL SRI LANKA FOR CONSERVATION OF SPIDERS

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Spiders can be taken as biological indicators and model candidates for land based conservation studies. As no previous studies have been carried out to study the diversity of spider fauna in upper Hanthana mountain area (7^0 15' N, 80° 37' E), this study was carried out from January 2015 to September 2015 to identify the diversity, microhabitats and foraging guild structures of spiders at three different habitats; namely the natural forest, pine forest and grasslands in upper Hanthana mountain area.

Line transects (2m × 100m) method integrated with quadrat (2m × 2m) method was used in both day and night sampling. Standard sampling techniques such as sweep netting, active searching and hand picking were used to collect spiders up to 2.5 meters from ground level. Some spiders were identified in the field using field guides, photographed and released to their natural habitats. Other spiders were identified to the species or morpho species level using available taxonomic keys prepared for Sri Lankan and Indian spiders. Simpson's index of diversity (**1-D**) and Shannon index (**H')** analysis were used to compare the habitats.

A total of 1432 individual spiders and 84 species were recorded during this study period. Among them, 71 species in 18 families were identified to the species and morpho species level. It is interesting to note that 37.5% of the total spider families of Sri Lanka have been recorded during this study. Family Araneidae was the most abundant family (28.17%) in terms of number of species. Highest species abundance (69.06%) and species richness (74 species) were observed in natural forest. Lower/upper surface of a leaf or among leaves (55.95%) was the most abundant microhabitat type of spiders. Orb web spiders (49.3%) were the most abundant foraging guild type in terms of number of species. Simpson's index of diversity (**1-D**) and Shannon index (**H'**) gave highest values for the Natural forest (**H':** 3.057; **1-D:** 0.914) and lowest values for the grasslands (**H':** 1.997; **1-D:** 0.820). Results of this study highlight the high conservation importance of natural forests of upper Hanthana ecosystem for the survival of spiders.

STUDY ON BEE HONEY PRODUCTION FOR AGRICULTURAL AND FOOD SECURITY PURPOSE AND THE CONSERVATION OF ASIAN HONEY BEE (*APIS CERANA*) THROUGH A BASIC SURVEY ON CURRENT STATUS OF COMMERCIAL APICULTURE IN SRI LANKA.

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The practice of keeping bees in manmade units for the purpose of producing honey is called Apiculture. In Sri Lanka the Common Asian Honey Bee (*Apis cerana*) is kept in apiaries and their honey is considered valuable both as food and medicine.

Apiculture, commonly known Bee keeping is mostly considered as a household industry in Sri Lanka, which in developed countries grown in to a large scaled profit oriented industry with modern agricultural advancement.

With that in mind a basic survey was conducted to understand the current status of Apiculture in Sri Lanka. As up-to-date literature on the subject seems to be lacking, collecting information directly from the sources were preferred. Numbers of Bee farmers were directly met and collected information with a help of carefully prepared questioner. During the survey, several Bee farmers' collaborative and cooperative organizations emerged and participated in the research and provided data they have collected. However, during the interviews researchers learned that information collected from Bee farmers and collectives were incomplete as they have not kept records hence failing to provide all the data required. The survey has to be finished within six months because there was no funding for the continuation for a longer period or can cover the travel and logistics required to carry it out throughout the island.

It was unfortunate that irregularities and scarcity of expected data has prevented analyzing information at hand to achieve expected goals of the survey. But few less focused facts about Apicultural practices in Sri Lanka were come to attention.

Among the findings,

1. There is no government or non-government body to collect data that helps to understand past or current status of Commercial Apiculture.
2. There is quite less research and funds regarding to Apiculture, Social Bees, their Natural Habitats and Ecology.
3. In Sri Lankan food culture Honey is still not widely considered as a Food Item hence Commercial aspect of Apiculture isn't getting the attention it deserves.
4. There are more acceptances for Naturally Harvested Honey over Honey from Apiaries in the local market.
5. Most importantly there is a risk factor to the Gene-diversity of Asian Honey Bee (*Apis cerana*) due to both over-harvesting in Natural Habitats and some current practices in Commercial Apiculture.

At the end of this incomplete survey it is concluded that it is wise to establish an independent entity to collect data, conduct research and developments regarding to Honey Bees such as Commercial Apiculture, House hold Apiary management, Ecology of Bees in Natural habitats and Socio Economical Values etc; with the fulltime collaboration with government universities, Department of Agriculture, other related government institutes, bee farmers and other stakeholders.

RESEARCH, MANAGEMENT AND DECISION MAKING

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Discovering Biological resources and their conservation status, setting up conservation strategies, human animal conflict management, sustainable use of natural resources and assess threats on biological resources are some of managerial benefits that come out from research.

The Department of Wildlife Conservation has received 412 research proposals during past five year period seeking permission to conduct research on wildlife sector. Out of them 71% were for fulfilling the requirement of degree. Among them, 55% were for basic degree and 30% for the fulfillment of post graduate studies. 15% were on personal interest or for the personal carrier of the researchers. 16% of the applications were from universities but not undergraduate projects. 8% of the proposals came from other researchers with the collaboration of DWC or other state institutions. 5% of the researches were conducted by officers from DWC.

Among all, less than 20% of the proposals are focusing on management oriented objectives. More than 80% did their study with the objectives on basic concepts on faunal ecology and environment. Most Issues pertaining to natural resources management remains unresolved due to lack of scientific information which should be generated through research. Researchers and research institutions would be encouraged for management oriented research.

In almost all researches conducted in collaboration with foreign assistance it is intended to export samples for analysis. What the researchers claim on this is the high cost of analysis in local laboratory. Compare with the fact that the raw samples been gone out from the country, cost for local analysis would be negligible. Duplication of research is another issue that prevails in the research environment resulting conflict among researchers. Creating pleasant and collaborative environment among all researchers with self discipline is must for maintaining the recognition of the research and researchers.
Smuggling of biological resources for trade or commercial use in the past has resulted in imprisonment of personals including some foreigners too. Simply putting signatures of well known researchers for research proposals on which he/she was not specialized in is another managerial issue observed since recent past.

Taking all these into account together with other issues discipline among research should be created. Management oriented study should be encouraged. Confidence among researchers and with decision makers should be improved. Then the research will guide decision makers for better management.

COMMUNITY BASED SEA TURTLE MONITORING AND CONSERVATION PROJECT IN BANGLADESH

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INTRODUCTION

Five species of sea turtle are reported to occur in the territorial waters of Bangladesh: olive ridley (*Lepidochelys olivacea*), green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) (Groombridge et al. 1989, Rashid & Islam 2005). Illegal harvesting of turtle eggs, bycatch in offshore fisheries, alterations of sandy nesting/dunes have been recognized as the main threats to sea turtles in Bangladesh, and since 1980, nesting populations have declined due to severe exploitation of eggs and killing of adult turtles by fishing and other activities (Islam 1999). Sea turtles are facing dangers in our country from by-catch, eggs poaching, predation, nesting beach alteration and tourism/lighting. Indiscriminate tourism and infrastructure development along Teknaf peninsular beach and in St. Martin Island is the main inland threat. Community livelihood depends on fishing and resource based thus it is necessary to educate them to enhance breeding success and reduce by-catch in marine fisheries and urgent to initiate community based effective monitoring and conservation activity while scientific critical information are vital for the mitigation success. Besides overall environmental, climatic change and anthropogenic threats, Bangladesh Government also creating issues periodically through indiscriminate developmental threats viz., deep seaport, marine drive etc. (Islam, 2009, 2010).

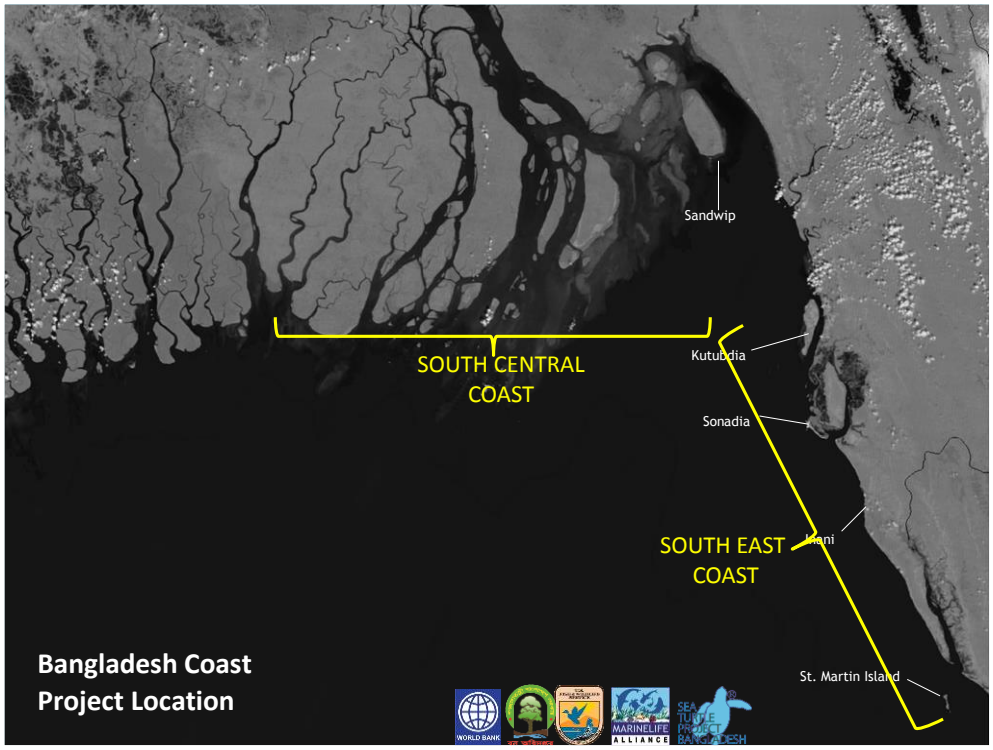
OBJECTIVES

- Determine nesting population, nesting and foraging habitat, migration routes.
- Establish sustainable community based sea turtle conservation & management.
- Establish sea turtle nesting reserve and safe foraging habitat.
- Develop community capacity to reduce threats and offshore fisheries bycatch.

METHODOLOGY

Project location is between N 22.089176° E 91.850071°to N 20.551328° E 92.349116° in Cox's Bazar and Chittagong district of Bangladesh covering Teknaf Peninsula (90 km sandy beach), Sonadia Island (12 kms sandy beach) and St. Martin Island (18 kms). Sea turtle program included nest and stranded turtle monitoring, flipper and satellite tagging, building capacity of community, offshore fisher's and Bangladesh Forest department, educate local students and establishing monitoring and research and conservation station. The major mission was conservation and restoration of sea turtle population. Nest Monitoring**:** monitoring conducted by local people and a total 1581 man/month with monthly 25-81 persons were engaged in monitoring and conservation depending on season along 250kms of sandy nesting beaches from St. Martin to Kuakata area during 2013-16. Community Based Conservation**:** During monitoring eggs conserved either by *semi in situ* or *in situ* process. 18-33 Beach relocation enclosure installed during 2013-16, over 3 seasons at deferent locations mentioned in Table-3. Eggs collected by locals from nesting beach within 1-1.5 kms and reburied within 5 -30 minutes. At some relatively secured place eggs in few cases at Sonadia Island eggs were left at natural state (*in situ*). CA covered the natural nest by bamboo and plastic durable nets to prevent predation by dogs. For *ex situ* & *in situ* conservation we followed the methods

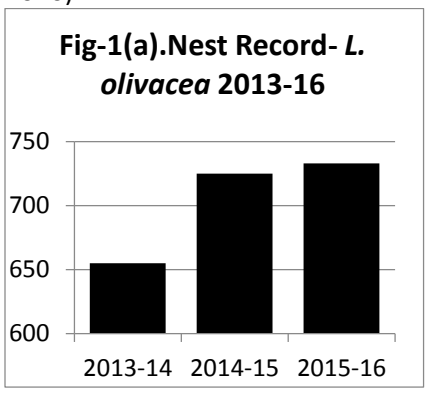
and guidelines described by Boulon, R.H.(1999) and Mortimer, J.A. (1999). Hatching success is often 1% or higher than emergence success. Flipper Tagging: We used INCONEL Tag, Model # 681s (NBT-USA) with serial BD0001-BD3000 are being used. So far we have attached 353 flipper tags along the coast and it is ongoing process. The Hawksbill and Green turtles were also tagged with PIT tags. We used BIOMARK scanner that is compatible for the region. Satellite Tracking: we used SPOT and SPLASH, Platform Terminal Transmitter (PTT) from Wildlife Computer, USA. We used Sika Anchorfix-3 and PowersPure Pro150 Epoxy Glue to attach the Satellite tags on turtle's carapace. These are ANGOS based tags and data retrieved from the Satellite Tracking and Analysis Tool (STAT) of seaturtle.org.

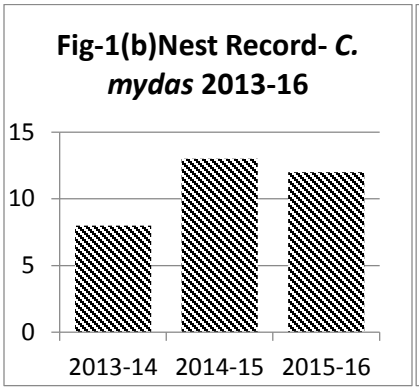


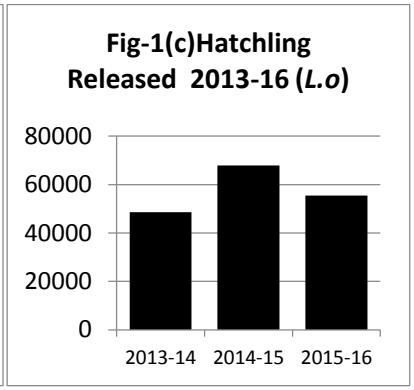
RESULT & DISCUSSION

In season 2013-16, we have recorded 2,113 olive ridley and 33 Green turtle nests along the entire Bangladesh coast except the Mangrove Sunderban. A total 171,972 hatchlings so far been recorded by the community people that revealed from their record estimated more than 76% hatching on average. In few cases highest 98 % hatching also recorded by the local people within the *semi in situ* relocated hatching ground. Few nests face inundation in late season and pre-monsoon period in May–June. The nest record and hatchlings release increased dramatically comparing the previous year efforts before 2013 due to large number of manpower where we recruited over 81 local people for nest monitoring and conservation. It seems that due to lack of survey efforts before, we could not get all nesting information. 100% *in situ* conservation is virtually ineffective in Bangladesh coast specially in Cox's Bazar area until now due to large number of settlements and disturbances. Although relocation is encouraged throughout the world in Bangladesh it is still our destiny and Marinelife Alliance found out innovative hatching technique just using natural parameters. Nesting, and hatching data summery has been depicted in following Figure-1a,b,c. The migration routes of olive ridley turtle nesting in Cox Bazar mostly along south west coast to edge of the Continental Self and through the Indian east coast towards south. One of our tracking turtle visited Indian Laksa Island travelling Arabian sea, hence we are awaiting for more exciting information and data. We have done a comprehensive work on education and awareness program around 2209 fishing

boats have so far been registered and fishermen's are periodically being trained and motivated on bycatch reduction, data collection and try to help safe release of marine megafauna affected in bycatch (Islam, 2016).







The whole area is currently under threat from the indiscriminate tourism, alteration of sand dunes and beach habitat. Government declared the Sonadia Island to south eastern coast as Ecologically Critical Area in 1999 under Environmental Conservation Act but hence it has not been protected for conservation. But in contradictory government proposed Deep sea port at Sonadia Island, where due to lack of finance authority is so far away from the project. To strengthen and establish the sea turtle restoration program and saving habitat we need to continue the monitoring and conservation activity for long term.

Acknowledgement

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PRELIMINARY STUDY ON STRUCTURE AND COMPOSITION OF UDAKEERUWA DIPTEROCARP FOREST, BADULLA DISTRICT

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Introduction

Udakeeruwa natural forest managed by Forest Department (Lat.7.050902 & Lon.81.233480) is located in Lunugala Divisional Secretariat Division of Badulla district at an altitude of 513m. The area falls within the intermediate climatic zone of Sri Lanka. Its mean annual temperature is in the range of 22.5^0 C -25 ^{0}C and the annual rainfall varies from 2000mm-2500 mm (Survey Department, 1988). The forest study site is dominated by Dipterocapaceae trees confined to a narrow valley bottom land area flanked by hills. The forest being in a remote corner of the country is poorly known scientifically. Moreover, the abundance of rain forest plant species in this eastern intermediate zone of Sri Lanka is a matter of extraordinary scientific interest.

Objective

To document selected parameters of floristic structure and composition of woody flora of Udakeeruwa Dipterocarp forest as a part of establishing biodiversity baseline for the forest that can positively influence its future conservation actions.

Methodology

Enumeration was done for woody plants having stem girth of 10cm or above at breast height (1.3m) and 20 non-permanent plots of the size 10mx10m used for sampling. Plots were laid in random manner in a homogeneous patch of forest, best representative of Dipterocarp dominant forest as judged in the field. Girth at breast height (GBH) of woody plants was measured using a cloth measuring tape and taxonomic identification was done as per standard botanical practices. Abundance of woody plants was ranked according to Important Value Index (IVI) as proposed by Curtis & McIntosh (1950); IVI = Relative Frequency + Relative Density+ Relative Basal area.

Results and discussion

Altogether 627 woody plants belonging to 53 species (20 endemic species) having total basal area of 338938.49 cm^2 were encountered within the sample area and relevant quantitative characteristics have been summarized in Table 1. As regards density, *Mallotus fuscescens* is the most numerous species having 238 individuals; 38% of all individuals (627). The relatively small size of the tree has enabled establishing larger population per unit area. No Dipterocarpaceae species has shown the numerical density as *Mallotus fuscescens*. However, with regard to basal cover, the land cover is dominated by Dipterocarpacea tree *Dipterocarpus zeylanicus*, far exceeding the basal cover of *Mallotus fuscescens* though it has numerically dominated the forest. Once the basal area of other Dipterocarpaceae tree *Shorea dyeri*, which is next in rank, added to that of *Dipterocarpus zeylanicus*, the basal cover gets exceedingly dominated by Dipterocarpaceae; 78% basal area of the sum total of all species. Both trees are endemic to Sri Lanka and grows to massive sizes upto 70m as observed at the site. Frequency of occurrence of trees in different plots shows that *Mallotus fuscescens* as the most wide spread woody species in the forests. The plant was located in all 20 plots sampled. Although, domination of species varied with regard different components of IVI, *Dipterocarpus zeylanicus* has become the ecologically most important species in the forest as per

IVI value. In the same line the forest can be tentatively termed as *Dipterocarpus – Mallotus – Shorea* forest based on most important three species. Moreover, floristic analysis shows that in the sampled area of Udakeeruwa Dipterocarp forest, 65% woody plants (409 tree individuals out of 627 tree individuals) are endemic and threatened species and 94% of the basal coverage is occupied by endemic and threatened species. This high quality plant life in this remote forest stand calls for added conservation actions for its long term sustainability, and currently it is under anthropogenic pressures due to various reasons.

Table 1: Plant enumeration summery.

Key: ED- Endemics, EN,VU,CR are Redlist threatened categories of globally (G) or nationally(N).

(IUCN Sri Lanka and Ministry of Environment and Natural Resources, 2012)

	Species	**Status**	**%Density**	**%Basal area**	**% frequency**	**IVI**
1	*Dipterocarpus zeylanicus*	ED,EN(G)	11.00	56.86	9.79	77.65
2	*Mallotus fuscescens*	ED	37.96	7.79	10.31	56.06
3	*Shorea dyeri*	ED,VU(N)	4.31	21.09	6.70	32.10
4	*Timonius flavescens*		13.72	0.49	6.19	20.39
5	*Aporusa acuminata*		8.61	0.45	6.19	15.25
6	*Dimocarpus longan*		2.55	0.54	4.64	7.73
7	*Dalbergia pseudo-sissoo*		1.75	0.17	3.61	5.53
8	*Mangifere zeylanica*	ED,VU(G)	1.12	1.21	2.58	4.90
9	*Garcinia quaesita*	ED	1.12	0.56	3.09	4.77
10	*Bhesa ceylanica*		0.64	1.69	2.06	4.39
11	*Goniothalamus hookeri*	ED,VU(N)&CR(G)	1.12	0.57	2.58	4.27
12	*Syzygium makul*		1.12	0.04	2.58	3.74
13	*Flacourtia indica*		0.96	0.11	2.58	3.64
14	*Artocarpus nobilis*	ED	0.32	2.02	1.03	3.37
15	*Hydnocarpus venenata*	ED	0.64	1.05	1.55	3.23
16	*Rourea minor*		0.80	0.07	2.06	2.93
17	*Calophyllum tomentosum*	ED,EN(N)	0.64	0.23	2.06	2.93
18	*Palaquium hinmolpedda*	ED,VU(N)	0.80	0.03	2.06	2.89
19	*Strombosia ceylanica*	VU(N)	0.80	0.03	1.55	2.38
20	*Horsfieldia iryaghedhi*	ED,VU(N)&CR(G)	0.64	0.63	1.03	2.30
21	*Antidesma sp.*		0.48	0.15	1.55	2.18
22	*Acacia pennata*		0.48	0.02	1.55	2.05
23	*Euonymus walkeri*	ED,VU(G)	0.48	0.02	1.55	2.05
24	*Semecarpus nigro-viridis*	ED,VU(N)	0.48	0.02	1.55	2.05
25	*Myristica ceylanica*	VU(N)&CR(G)	0.32	0.61	1.03	1.96
26	*Litsea longifolia*	ED,VU(G)	0.48	0.19	1.03	1.70
27	*Nothopegia beddomei*		0.48	0.01	1.03	1.52

Table Ctd:

28	*Cinnamomum verum*	VU(N)	0.48	0.01	1.03	1.52
29	*Artocarpus heterophyllous*		0.16	0.80	0.52	1.48
30	*Olax zeylanica*		0.32	0.10	1.03	1.45
31	*Syzygium aqueum*		0.32	0.04	1.03	1.39
32	*Eugenia rufo-fulva*	ED,VU(N)	0.32	0.03	1.03	1.38
33	*Pandanus ceylanicus*	ED,VU(N)	0.32	0.02	1.03	1.37
34	*Uncaria elliptica*		0.32	0.02	1.03	1.37
35	*Macaranga peltata*		0.32	0.45	0.52	1.28
36	*Ficus drupacea*		0.16	0.60	0.52	1.28
37	*Entada pusaetha*	VU(N)	0.48	0.16	0.52	1.15
38	*Agrostistachys indica*		0.16	0.38	0.52	1.06
39	*Uvaria semecarpifolia*	ED	0.16	0.33	0.52	1.00
40	*Stemonurus apicalis*	ED	0.32	0.08	0.52	0.91
41	*Alstonia scholaris*		0.16	0.19	0.52	0.87
42	*Caryota urens*		0.32	0.02	0.52	0.86
43	*Calophyllum calaba*	ED	0.32	0.01	0.52	0.84
44	*Areca catechu*		0.16	0.04	0.52	0.71
45	*Connarus monocarpus*		0.16	0.01	0.52	0.69
46	*Mangifera indica*		0.16	0.01	0.52	0.69
47	*Gomphia serrata*		0.16	0.01	0.52	0.69
48	*Gomphandra coriacea*	VU(N)	0.16	0.01	0.52	0.68
49	*Salacia oblonga*	EN(N)	0.16	0.01	0.52	0.68
50	*Crptocarya wightiana*		0.16	0.00	0.52	0.68
51	*Diospyros ebenoides*	EN(N)	0.16	0.00	0.52	0.68
52	*Glochidion nemorale*	ED	0.16	0.00	0.52	0.68
53	*Pterospermum suberifolium*		0.16	0.00	0.52	0.68

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OVERVIEW OF REPTILES OF SRI LANKA: WITH SPECIAL REFERENCE TO CROCODILES

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Introduction

Presently Sri Lanka ranks as an extraordinary country in the world in terms of biodiversity and endemism of reptiles and amphibians. Currently 218 reptile species are known form this small continental island of which 134 are endemic. It is of interest to note that of the 218 reptile species; approximately 49 species (23%) were described since the year 2001, after the 4th World Congress of Herpetology, the most prestigious herpetological forum in the world was held in Sri Lanka. Presently, it is understood that extensive field surveys conducted in the island will increase this number in the course of the next few years. Phylogenetic data reveals taxa with Indian and Southeast Asian origins, with a varied timelines of colonization. Table 1 summarizes the diversity of currently known reptiles of the island.

Table 1. Diversity of reptiles of Sri Lanka

(As at September 2016)

Reptile group	No species	Endemic
Crocodiles	2	Nil
Chelonians	9	2 *
Tetrapod reptiles (Sauria)	103	83
Snakes	104	49
Total	218	134

*** one endemic subspecies**

CROCODILES

Two extant species of crocodiles inhabit most aquatic ecosystems in the country: the mugger or *Häla Kimbula* (*Crocodylus palustris*) is mainly confined to fresh water tanks (man made reservoirs), rivers, and agricultural streams. The mugger is not a solitary species; sometimes one may encounter about 10 to 60 muggers in one tank. The saltwater crocodile or the *Gāta Kimbula* (*Crocodylus porosus*) in reality lives in fresh water tidal rivers, man-made streams, estuaries, brackish water lagoons and marshes.

During past few years, following island wide surveys and investigations were carried out by us to study different aspects of crocodiles in Sri Lanka (de Silva, 2013), a few are:

1). To date, approximately 200 cases human crocodile conflict cases were investigated, of which around 60 were fatal.

2). About 150 mugger burrows were investigated and papers published.

3). Archaeological artifacts of crocodiles belonging to the 6th century ACE including work on the extinct crocodile: *Crocodylus sinhaleyus* were conducted and papers published. .

4). Studies on the reproductive biology were investigated and papers published.

5). Currently an island wide survey on the population status of both species and their natural habitats are on going.

CHELONIANS

Marine turtles:

Of the seven marine turtles known in the world, five species visit our beaches to nest. Late Paulus Edward Pieris Deraniyagala (1900-1973), worked on marine turtle embryology, distribution, natural history and status from 1927 until 1971. Since, 1971 several studies were conducted by other researchers. A land mark in chelonian conservation was; in 1994 Care for the Wild, a charity based in England, received a donation from the British Chelonia Group towards initiating a new project in Sri Lanka and Peter Richardson from UK started the well known Turtle Conservation Project (TCP) of Sri Lanka. Since then Lalith Ekanayake, Thushan Kapurusinghe, Suhashini Hewavisenthi, Anslem de Silva, Rupika Rajakaruna, late Dewapriya Amarasooriya and others have made many contributions towards our knowledge on marine turtles.

Fresh water terrapins:

Two extent native subspecies of hard-shell terrapins (*Melanochelys trijuga*) and one soft shell terrapin is known from Sri Lanka. They are: the Parkers hard-shell terrapin *Melanochelys t. parkeri* and the Black pond terrapin *Melanochelys t. thermalis,* and soft-shell terrapin: *Lissemys ceylonensis*. Currently detailed studies on the five extinct chelonian species of the country are investigated by Kelum Manamendara-Arachchi and the author.

Land tortoises:

There is substantial data available on the extant land tortoise: *Geochelone elegans* (de Silva, 2003). Though appreciable populations are distributed in the dry lowlands of the country, they face many threats, such as killed by road traffic, collection for pet trade, consumption of flesh and depleting natural habitats and making them vulnerable to predators.

TETRAPOD REPTILES (SAURIA)

Agamids, geckos, skinks and monitor lizards:

Since P.E.P. Deraniyagala's book on tetrapod reptiles in 1953, a comprehensive monograph with colour plates on the tetrapod reptiles is available (Somaweera and Somaweera, 2009). Since then many species of agamids or 'Dragons', geckos and skinks were described from the country by researchers (Kelum Manamendra-Arachchi, Mendis Winkramasinghe, Thasun Amarashinghe, Sameera Karunatrathna, the author and others).

SNAKES

As for the literature on snakes; Sri Lanka is fortunate to have nearly 1500 publications of which approximately 25 are books, few of these books are on medical aspects. A comprehensive Sinhala book by Somaweera, well illustrated with colour plates and three colour guides on snakes by the author is available. Extensive publications on sea snakes by Kanishka Ukuwela and others are also available, including the recent joint project on natricine snakes with Kyoto University, Sri Jayewardenepura University and the author.

DISCUSSION

Though Sri Lanka is blessed with many active herpetologists and a diversity of reptiles of which 134 are endemic and nine species are geographical relicts, many snakes, agamids, chelonians, monitor lizards and occasionally crocodiles are killed by road traffic. Studies indicate that several thousands of reptiles are annually killed due to this. Some species of freshwater terrapins and marine turtles are widely harvested illegally for consumption and to cater for the illegal pet trade, especially the star tortoise. There were several recent detections of attempts to smuggle chelonians abroad by customs. Thus, we recommend that well designed studies on breeding of some reptiles species that are widely collected by smugglers, be carried out by the responsible government departments and export the captively bread animals legally.

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AWARENESS RAISING, SURVEYING AND CONSERVATION OF ELASMOBRANCHS (SHARKS AND RAYS) IN THE SOUTH EAST COAST OF INDIA

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Introduction

Sharks and Rays are the major capture fishery resources of Indian EEZ and are being continuously exploited. In India, the production of elasmobranchs in 2014 was estimated at 47242 tons. According to Wildlife Protection Act, 1972, the Government of India has protected the shark species such as *Carcharihnus hemiodon, Glyphis gangeticus, Gluphis glyphis* and*, Rhincodon typus,* and Ray species *Himantura fluviatilis* and *Urogymus asperrimus.* Recently, Under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), India has listed five shark species and two species of manta rays for protection from international trade. However, landings of the protected species have still been recorded from the Indian coastal region. Despite the commercial importance, no serious attempts were made towards the conservation of elasmobranchs in Southeast coast of India, particularly in Tamil Nadu. Due to lack of policy awareness among fishermen, exploitation of these resources are continuously in progress. Lack of knowledge on species identification amongst fishermen, particularly endangered/banned species, also forms a major barrier to elasmobranch conservation. There is an urgent need for evaluating the status and conservation of these vulnerable resources.

Objectives

1. To determine species specific status of elasmobranchs and gears used for collection along Tamil Nadu coast

2. To collect biological data on elasmobranchs by frequently visiting the major fish landing centres

3. To compare the species landing data with IUCN and CITES listed species and recommend species specific conservation action plans.

4. To generate an awareness programme among the fishing community for reducing the fishing pressure on elasmobranchs.

Methodology

1. Landing status of shark and rays were collected from the four major fishing harbors and fish landing centres such as Chennai, Nagapattinam, Tuticorin and Kanyakumari located in the Southeast coast of India at weekly intervals during March 2015 to March 2016. Catches by different craft and gears, and bycatch by mechanized trawlers were individually recorded according to Akilesh et al. (2011). Biological data of elasmobranchs such as species composition, disc width, sex and maturity status, as well as male clasper length was also analyzed. The clasper length was measured as a straight-line distance from the posterior point of the cloaca to the end of the clasper as described by Devadoss (1978). The species identification was analyzed by following the standard manuals and literatures (Stevens, 1994; Daley et al. 2002; FAO, 2005; Bernard Seret, 2006; Last and NSW DPI 2007-2008)

2. Attention was paid to the IUCN red-listed shark and rays which are not included in Schedule I of Wildlife (Protection) Act, 1972 of India. The final list of species were compared with the IUCN and CITES listings for establishing species specific action plans for sustainable harvesting and conservation

3. Awareness training programme was conducted in the major fish landing areas with stakeholders including traditional fishermen, trawl owners, and other stakeholders such as suppliers, traders and exporters.

Results and Discussion

The present study was undertaken to explore the landing and by catch status of sharks and rays from the major fishing harbors and landing centres of Southeast coast of India (Chennai; lat: 13.0844° N and long 80.2899° E, Nagapattinam; lat: 10.7906°N and long 79.8428°E, Tuticorin; lat: 8.76417 and long: 78.13484 and Kanyakumari; Lat: 8°10'19.88" and Long: 77°14'54.75"). The maximum landing of sharks was recorded in Tuticorin landing centre. During the study period, 23 species of sharks were recorded (Table.1). The species in the landing consisted of many endangered and critically endangered/banned sharks listed by the IUCN, CTES and Wild life Protection Act 1972. Among the sharks, species milk shark and grey sharp nose shark were recorded in large numbers throughout the year. Most of the deep sea sharks such as the Goblin shark, Long nose velvet dogfish, Bramble shark and Prickly shark, and species belonging to the family Alopiidae were recorded in Kanyakumari. A maximum species diversity of 52.2% was observed in the Carcharhinidae, with maximum landings recorded in the vicinity of Tuticorin landing centre. The IUCN status comparison revealed that 40.9% of the sharks landed were near threatened, 27.3% were vulnerable, 18.18% were least concern, and 4.54% of sharks were either data deficient, endangered or critically endangered status (Table. 1). Studies on the status, survey and identification of rays is ongoing.

To create awareness among fisherman, the posters about the protected shark species, including identification characteristics, were produced and distributed among the fishermen and boat owners. Interactions were made with the fishermen through informal interviews and awareness programs to the fishermen, boat owners, NGO volunteers, fisheries extension officials, policy makers etc. It is hoped this will contribute to reducing fishing pressure on protected sharks and rays species, support species specific conservation management plans.

Table1. Shark species recorded in the present study along the Tamil Nadu coast

Family	Common Name	Scientific Name	IUCN Status	Landing data (Numbers) from March 2015-March 2016
Alopiidae	Pelagic thresher	*Alopias pelagicus*	Vulnerable	808
	Bigeye thresher	*Alopias superciliosus*	Vulnerable	834
	Blacktip shark	*Carcharhinus limbatus*	Near Threatened	452
Carcharhinidae	Carcharhinus leucas	*Carcharhinus leucas*	Near Threatened	17
	Whitecheek shark	*Carcharhinus dussumieri*	Near Threatened	11
	Grey Reef shark	*Carcharhinus amblyrhynchus*	Near Threatened	18
	Pondicherry shark	*Carcharhinus hemiodon*	Critically Endangered	9
	Blacktip reef shark	*Carcharhinus melanopterus*	Near Threatened	179
	Silky shark	*Carcharhinus falciformis*	Near Threatened	22
	Sandbar shark	*Carcharhinus plumbeus*	Vulnerable	16
	Grey sharp shark	*Rhizoprionodon oligolinx*	Least Concern	1457
	Milk shark	*Rhizoprionodon acutus*	Least Concern	4525
	Whitetip reef shark	*Triaenodon obesus*	Near Threatened	24
	Tiger shark	*Galeocerdo cuvier*	Near Threatened	37
Hemiscyllidae	Brownbanded bamboo shark	*Chiloscyllium punctatum*	Vulnerable	134
Mitsukurinidae	Goblin shark	*Mitsukurina owstoni*	Least Concern	908
Somniosidae	Long nose velvet dogfish	*Centroselachus crepidater*	Least Concern	2385
Squalidae	Piked dogfish	*Squalus acanthias*	Vulnerable	4850
Echinorhinidae	Bramble shark	*Echinorhinus brucus*	Data Deficient	304
	Prickly shark	*Echinorhinus cookie*	Near Threatened	155
Sphyridae	Scalloped hammer head shark	*Sphyrna lewini*	Endangered	106
	Smooth hammer head shark	*Sphyrna zygaena*	Vulnerable	103
Rhinidae	Shark Ray- Bow mouth guitarfish	*Rhina ancylostoma*	Vulnerable	54

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SMALL CATS AS URBAN CONSERVATION FLAGSHIPS: THE ECOLOGY AND BEHAVIOUR OF FISHING CATS IN SRI LANKA'S CITIES

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As urban sprawl takes a toll on natural habitat there is a greater realisation of the need for urban 'green areas' for aesthetic and practical considerations such as flood control, recreation, and biodiversity conservation. If conservation plans can be infused into city plans, the green refuges can be more effective for biodiversity conservation, including for conserving ecological functions. Resembling a small leopard, the fishing cat (*Prionailurus viverrinus*) has flagship status for raising conservation awareness in urban Sri Lanka. As a habitat specialist the fishing cat requires riparian habitats, swamps, and wetlands; critical ecosystems for preserving watershed and drainage functions, but among the first to be reclaimed or converted during urbanisation. We determined the presence and distribution of fishing cats in urban habitats of Sri Lanka using camera-traps, and later tracked certain individuals after fitting them with GPS collars. We found that fishing cats are active during the day and night in areas adjacent to dense human habitation. Based on the distribution and movement patterns of fishing cats in urban habitats, we proposed the creation of 'urban bioparks' for biodiversity conservation, and green areas for urban wildlife. The integration of these green areas and urban bioparks are especially important now, more than ever, with the proposed megapolis development plans which are said to spread across the Western Province.

Keywords: Urban Ecology, Fishing Cat, *Prionailurus viverrinus*, GPS telemetry

SEA TURTLES & COASTAL BIODIVERSITY CONSERVATION IN THE KALPITIYA PENINSULAR OF SRI LANKA

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Introduction

Kalpitiya Peninsular was selected as the project site, of which one side is open sea and other side is Puttlam lagoon. This area is habitat for many sea creatures, including sea turtles, dolphins, whales, dugong & sea birds. CThe coral within this habitat (Bar Reef) is home to 156 species of corals and 283 species of fish. The Bar Reef was declared a Marine Sanctuary in 1992, the area of the reserve being 306.7 km² (http://en.wikipedia.org). The core zone of 70 km2 supports reef-building coral and true coral reefs, with about 300 species of reef-associated fish (Ranasinghe, 2010). Puttalam lagoon has largest mangrove coverage in Sri Lanka, with ~327 km^2 water surface and 25 small islands. Five species of sea turtles (green turtle, loggerhead, hawksbill, olive ridley & leatherback) feed and migrate around the Gulf of Mannar near Kalpitiya. Sea turtles play a very important role in maintaining biodiversity in the near shore area. Green turtles graze on seagrass beds, and help create habitat for breeding fish and other sea creatures. Leatherbacks feed on jellyfish and hence allow fish population increases. So conservation of sea turtles will leads to improve the species, population, habitat and also the ecosystem.

By-catch of turtles in fishing gear is an acknowledged threat to marine turtles around the world, with by-catch in inshore, artisanal gill net fisheries thought to catch more turtles than other fishing gear. Marine turtle conservationists around the world concede that tackling gill net fishery by-catch is a priority issue. One of the least understood and possibly most serious threats that face marine turtles in Sri Lanka is by-catch in fishing gear (Ekanayake et al., 2015). The fishing communities in the northwest coast of Sri Lanka depend on seasonal, artisanal gillnet fisheries targeting pelagic shoaling fish. Olive ridley turtles actively seek and target gillnets containing captured fish while feeding, although other marine fauna just swim through. But in the process of feeding, sea turtles often get entangled and injured and damage the fishing gear. In response, fishers either beat the turtles' heads until they are rendered unconscious, or hack off the turtles' body parts to make disentanglement easier. Despite possession of turtle meat being an offense under national law, some fishermen will keep the carcass to consume the meat. Harming and killing the turtles, or possessing their body parts, has been prohibited since 1972 by Fauna and Flora Protection Ordinance. Through these unwanted turtle interactions, fishing families are therefore compromised through significant costs incurred in repairing damaged gear, as well as risk of illegal activity under the national legislation. Further, it was observed that the many dolphins and other creatures were killed due to the illegal fishing activities such as use of nylon nets and dynamiting. Many fishermen in the sea and lagoon use illegal fishing gears & techniques to catch a big harvest within a short time and hence, the practice badly damages marine biodiversity in the area (Ekanayake, 2015).

For the conservation and management of sea turtles and coastal biodiversity, public awareness has been identified as the major solution by many global, regional and national action plans. As a result, many conservation organizations throughout the world conduct public awareness programmes as the key conservation activity.

Objectives

The overall objective of the project was to reduce turtle by-catch & loss of other coastal biodiversity by fishing practices, and promote marine & coastal ecosystem conservation with fishing communities in the Kalpitiya Peninsular of Sri Lanka. The objectives are as follows.

Increase the education and awareness on sea turtle biology & conservation, legislation and law enforcement to protect sea turtles among the target group.

Increase community knowledge on sustainable use of surrounding natural coastal resources.

Reduce the rate of by-catch which is the major threat to sea turtles in the area.

Encourage more active participation of coastal community members in sea turtle conservation activities.

Receive more information about sea turtles from coastal community members, such as tag recoveries.

Increase the availability of educational materials and news paper articles on sea turtles and coastal ecosystem in Sri Lanka.

Activities & Methodology

1. Organize and conduct awareness programmes for the fishermen and school kids in fishing villages of Kalpitiya peninsular

2. Conduct conservation field activities (eg. beach cleaning, mangrove re-plantation)

3. Media promotion in newspapers

4. Designing and producing an awareness poster

The field assistant organized the awareness programmes at schools and also in the fisheries societies. Support from the teachers and principal of the school was taken to organize the programmes and volunteer teachers from the schools translated the presentations into Tamil. The chairman and other officials of the fisheries societies helped to organize the awareness programmes during their monthly meetings. The field activities such as beach cleaning and mangrove re-plantation was organized with the help from the "Environmental Pioneer Brigades" at the schools and also members of the fisheries societies and women's welfare societies.

Results & Discussion

Awareness programmes were conducted in the schools and fisheries societies. Members of the coastal community, including fishermen & school children attended the programmes. As they are among the people who both depend on coastal resources and use them in a destructive manner, it was important to improved education and awareness about sea turtles & coastal biodiversity so as to understand the importance of conservation their surrounding. Most of the community members were very interested about the programme and welcomed information on coastal biodiversity conservation. They understood how they benefit from conservation of coastal biodiversity including sea turtles. The fishermen learned about the importance of turtles & how to release entangled turtles from their fishing gear. The kids will

hopefully encourage their parents to conserve sea turtles & also practice it themselves when they become adults.

The active participation of coastal community members (both adult and children) increased during field activities about coastal biodiversity conservation. The school children did many beach clean-ups and school environmental cleaning programmes. Both children and adults participated in the mangrove re-plantation programmes. We believe this is the major project outcome and must continue more field work with the community to encourage more active contribution and participation.

Many newspaper articles were published in three local news papers, and approximately 400,000 copies of these newspapers were distributed throughout the island. So, the conservation message was spread to a large number of people. Further, the community members were very happy to see published stories and pictures about their field activities. In addition, about 800 cashew nut and pomegranate plants were distributed among two hundred families at Kandakkuliya village as a pilot project to motivate the community. It was very successful and now the plants are growing well.

There are many fishermen active in the area. Conserving sea turtles will be a long term benefit for the local fishing community due to an increase of the fish stocks. Further, some fishermen in Kalpitliya area engaged in whales and dolphin watching programme for local and foreign tourists. Moreover, the fishermen show the basking sea turtles to the tourist. So, the maintaining the biodiversity of the area in a sustainable manner will be very useful to continue these tourism programmes. All the above activities and by-catch reduction and conservation of sea turtles will improve the day to day income of local fishing communities in the area. In conclusion, conservation of sea turtles, coral reefs, reef fishes & marine mammals will lead to overall coastal biodiversity benefits as well as advantaged for the local fisheries community.

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THREATS AND CONSERVATION OF BRYOPHYTES

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Bryophytes occupy an important position in land plant evolution as the first plant group that colonized on land. Three morphological groups of bryophytes are included in three phyla; Marchantiophyta (liverworts), Bryophyta (mosses) and Anthocerotophyta (hornworts). Bryophytes perform pivotal ecological services in forests and other natural ecosystems like retention of humid forest microclimates and the regulation of water flow, forming large biomasses, soil stabilization, accumulation of humus and providing nesting material for birds and protective habitats for amphibians. According to the recent checklists of bryophytes, Sri Lanka consists of 327 species of liverworts, 560 species of mosses and 5 species of hornworts. These plants have been recorded mainly from the central highlands and lowland areas in Sri Lanka according to the limited literature on past collections of bryophytes. Most of the natural forests are distributed in these areas in Sri Lanka and deforestation for constructions and cultivations pose bad impacts on these minute plants. Heavy logging for timber industry causes severe loses of epiphytic and epiphyllous bryophytes. Due to the rapid industrialization and escalating population density there is significant environmental pollution in Sri Lanka. Physical disturbances to the soil by machinery used for agricultural purposes excessive use of fertilizers and herbicides also make fatal conditions for the bryophytes in Sri Lanka. Due to the lack of proper cuticle bryophytes are highly sensitive to the changes in microclimatic conditions caused by deforestation and environmental pollution. There are no conservation measures carried out in Sri Lanka to protect this important plant group mainly due to the lack of knowledge on the ecological value of these plants. People are not aware of how deforestation, industrialization and pollution can affect the survival of these plants and a whole ecosystem. Currently only a few number of studies are being carried out regarding Sri Lankan bryophytes. Therefore it is high time to discuss the existing bryophytes in Sri Lanka, their potential habitats, prevailing threats and suitable conservation steps to avoid huge loses and extinctions of bryophytes.

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MANGROVES OF MADAMPA LAKE SANCTUARY IN SOUTHERN SRI LANKA

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Introduction

Wetlands are important and unique ecosystems which provides many ecological, economical as well as cultural benefits for the country. Wetlands are rich in biodiversity, provide a variety of macro and micro habitats for many faunal and floral groups and give livelihood support to the communities living around wetlands. But people, who are not aware of the benefits of the wetlands, see them as waste lands (Bambaradeniya, 2004).

Madampe Lake sanctuary is located at Ambalangoda Divisional Secretariat Division in Southern province of Sri Lanka. This wetland area comprises of mangroves, open water bodies, marshlands, degraded forests, home gardens and some cinnamon (*Cinnamomaum verum*) plantations.

According to a recent biodiversity survey, 264 plant species belonging to 87 families have been recorded from the sanctuary. The plant species encountered included 11 endemic species as well as two critically endangered, one endangered and 11 vulnerable species (Ekanayake, *et al.,* 2013). Further, 16 invasive species also have been recorded. Altogether 246 vertebrate species belong to 113 families have been recorded from the Madampe Lake ecosystem including 16 endemic species. Among those species one was critically endangered, seven were endangered and seven were vulnerable (Ekanayake, *et al.,* 2013). Therefore, this wetland ecosystem could be considered as an important and highly diverse but least known wetland in the country.

Mangroves

Mangroves are an endangered forest formation in the world consisting of a small group of 73 tree species. Globally mangroves cover about 15.2 million hectares which is 0.4 % of all forest and less than 1 % of tropical forests in 123 countries and territories (FAO 2007). They are most extensive in Asia (39 %) followed by Africa (21 %), North and Central America (15 %), South America (12.6 %) and Oceania (Australia, Papua New Guinea, New Zealand, south Pacific islands). Mangroves are largely restricted to the tropics and few warm temperate regions where they have greater abundance and diversity along sheltered coastlines, in deltas and estuarine areas (FAO, 2007).

Mangrove forests contribute significantly to the global carbon stocks, although they are distributed along only 0.7 % of global coastal zone. The mangroves are known to remove CO_2 from the atmosphere through photosynthesis. This perhaps reduces the problems that go with the 'green house gases' and global warming which is timely important in the sense of climate change and global worming issue. They fix greater amounts of CO_2 per unit area, than what the phytoplankton do in the tropical oceans (Kathiresan and Bingham 2001). The mangroves contribute to 10 % of total net primary production and 25 % of carbon burial in the global coastal zone (Alongi, 2007).

In Sri Lanka mangroves are distributed discontinuously along the shore line. The extent of mangroves in Sri Lanka is about 15,670 ha which is around 0.23% of the total land area (Edirisinghe, 2012). Though this is a small ecosystem in extent, it always provides immense benefits to the adjoining systems and mankind.

Twenty one true mangrove species have been recorded from in Sri Lanka. Among them two species namely *Lumnitzera littorea* and *Ceriops decandra* were identified as critically endangered. *Lumnitzera littorea* is located only in Maduganga estuary at Balapitiya Divisional Secretariat Division in Galle District while *Ceriops decandra* was recorded only in few places in Trincomalee District. Another three species; *Bruguiera cylindrica, Sonneratia alba* and *Xylocarpus granatum* were listed under endangered category and another five species were identified as vulnerable (MOE, 2012)). The mangrove ecosystems are threatened due to high anthropogenic pressure.

Objectives

Main objective of this study was to identify the true mangrove species richness in Madampa Lake Sanctuary.

Materials and Methods

The study was carried out from January 2016 to May 2016 in Madampa Lake. Ten sits were selected for this study. Distribution and abundance of the true mangrove species in the study sites were estimated using 20 m x 20 m plots. All true mangrove species were identified in the field and number of individuals of each species was recorded. All these numerical data of each species was used to calculate the relative frequency and the relative densities of the rue mangrove species in the Madampa Lake.

Results and Discussion

Madampa Lake spared over large area supporting various types of ecosystems. Previous researchers have identified about 18 types of habitats (Ekanayake, *et al.,* 2013). Three true mangrove species *Bruguiera sexangula*, *Nypa fruiticans* and *Sonneratia caceolaris* were recorded in study site. Of the three species *Nypa fruticans* occur as a pure stand at the water's edge. All three species were recorded in nine study plots.

Another two species namely *Rhizophora apiculata* and *Bruguiera gymnorhiza* were recorded outside of the study plots. All the species were naturally occurring in the lake fringe. A few individuals of *R. mucronata* encountered outside the study plots have been recently planted.

Highest Relative Density value was shown by *Nypa fruiticans* (49.5%) while highest Relative Frequency was shown *Bruguiera sexangula* (34.48%) and *Sonneratia caceolaris* (34.48%) in the Madampa Lake Sanctuary (Table 1).

Table 1. Relative density and Relative frequency of the true mangrove species

Species	Relative Density (%)	Relative Frequency (%)
Bruguiera sexangula	26.50	34.48
Sonneratia caceolaris	27.60	34.48
Nypa fruiticans	45.90	31.03

When species richness is compared with two closest mangroves which are located north (Maduganga Estuary) and south (Akurala) of the study site . that only low salinity tolerant species are found in the Madampa Lake (Table 2).

Table 2. Species composition two Mangroves close to Madampa Lake

Species.	Maduganga Estuary	Madampa Lake	Akurala Wetland
Bruguiera gymnorhiza	+	+	+
Bruguiera sexangula	+	+	+
Rhizophora mucronata	+	-	-
Rhizophora apiculata	+	+	+
Sonneratia caseolaris	+	+	+
Excecaria agallocha	+	-	+
Lumnitzera racemosa	+	-	+
Lumnitzera littoria	+		-
Heritiera littoralis	+	-	-
Nypa fruticans	+	+	-

'+' present, '-' absent

Discussion

All three mangroves are in close proximity to each other and are connected to sea separately. But in Madampa Lake there is a large sluice gate which was constructed to control sea water intrusion to the upsteram by the Irrigation Department in order to facilitate paddy cultivations around the Madampa Lake. Due to this construction, the natural processes were stopped and no tidal water enters the estuary and silts coming from the upstream areas are not flushed to the sea. Therefore, all the sediments are deposited in the river. Due to the artificial construction across the Madampa Lake, natural flow regime has changed. Therefore, it harbors mangrove species which perform well under low saline conditions. However, it provides a unique habitat and the much protection to two threatened true mangrove species namely *Bruguiera sexangula* and *Nypa fruticans* in high density.

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CONSERVATION OF LOCALLY ENDANGERED DUGONG (*Dugong dugon*) THROUGH COMMUNITY BASED SEAGRASS RESTORATION PROJECT IN THE BAY OF MANNAR, SRI LANKA

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Existing seagrass beds in Sri Lanka need to be conserved and expanded in order to rehabilitate the Dugong (*Dugong dugon*) that were common along the Northern coastal waters in the past but now listed in the National Redlist of Sri Lanka as threatened mainly due to seagrass habitat destruction. We conducted seagrass restoration program in Mannar (Northern coast), Sri Lanka to reestablish this valuable habitat. Our focus was to use short-term data to predict long-term outcomes of transplanting four species of seagrasses consumed by Dugong; *Halodule uninervis*, *Halophila ovalis*, *Enhalus acoroides* and *Thalassia hemperichii*. This restoration effort was initiated in January, 2016 and involved transplanting 1000 seagrass plugs at 1.0 m intervals by the end of April 2016, covering an area of 1000 m^2. The planting method used was the peat pot method. Donor plugs were extracted at no less than 25 cm between plugs to minimize any effects on the donor beds. Most of the (93.26%) transplanted plugs survived at the end of first three months of the project. Measured average temperature, pH and salinity of the restoration site were 29.2 °C, 7.10 ppm and 34 ppt respectively. Several anthropogenic activities such as harmful fishing gears, destructive fishing methods and pollution were observed influencing sea grass habitats in this area. Thus, awareness on seagrass habitats enhances the knowledge on seagrasses and their importance reducing the pressure on seagrass habitats ensuring the long-term survival of donor habitat and the restored habitats through local community support. Seventy six percent of the local fishermen participated in the awareness programme held in April, 2016 showed positive feedback towards seagrass restoration. Creation of new healthy sea grass habitats with special emphasis on seagrasses fed by dugongs will eventually help to restore the dugong populations lived in these areas years ago.

Keywords: Restoration, Mannar, *Dugong dugon*, *Halodule uninervis*, *Halophila ovalis*, *Enhalus acoroides*, *Thalassia hemperichii*

ENIGMATIC CROP RAIDERS OF UDAWALAWE

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Introduction

The population of the Asian elephant is estimated to be between 35,000 to 50,000. The elephant population in Sri Lanka is around 6000, and the Department of Wildlife Conservation assumes that 70% of these elephants living outside the protected area network (Santiapillai1 et al. 2010). The Sri Lankan elephant (*Elephas maximus maximus*) is categorized as an Endangered species in the IUCN 2014 Red list and is one of the priority species for conservation nationally and globally. Each year around 250 elephants die in Sri Lanka due to Human Elephant Conflict (HEC) which has been identified as the primary threat to survival of the Asian elephant (Fernando et al. 2012). Crop raiding is the main cause for the conflict between humans and elephants. However, all males in a population do not raid crops. Elephants raid crops primarily at night making it difficult to observe them. The aim of this study is to record the number of individuals, age, sex, time of visit and other activities of crop raiding elephants using infra-red night vision camera traps in the villages bordering the UdaWalawe National Park (UWNP), Sri Lanka.

Study site and methodology:

The study area consisted of the villages of Pokunuthanna, Neraluwa and Dahaiyagala at the northern border of the UWNP (6.583838, 80.894299). The vegetation consists of open grassland and shrubs. The major crops cultivated in the villages are Paddy, Banana, Coconut, Mango, Manioc, Papaya and Vegetables. Villagers guard their crops using tree huts, by shouting, lighting fire crackers, hanging electric torches, setting up fires and by erecting locally made electric fences. A total of 38 days were spent in the field to collect data from March 2014 to January 2015. Four night vision camera traps were used to capture elephants. The cameras were stationed at fence openings and elephant trails. Camera traps were set only during the night. A series of three consecutive still photos and a 15 second video clip were captured at each trigger. The cameras were in operation from 1730h to 0630h at a particular location. The elephants were identified using morphological features. Capture history was constructed from camera trap data and observations. Elephants captured within 10 min of each other and moving in the same direction were considered a group. Three age classes were defined as mature-adult, young-adult and sub-adult based on assessed height and secondary sexual characteristics.

Results

Elephants were observed on 33 out of the 38 field days. A total of 192 elephant crossings were recorded and all were by male elephants. The number of crossings ranged from 0 to 22 with an average of 5 per day. A total of 35 individuals were identified, of which 21 were mature-adults, five young-adults and nine sub-adults. Majority (69%) of fence crossings were by solitary individuals. Group crossing consisted of 2-9 associating individuals with an average of 3.16 ± 1.46 (Fig.4). The earliest time of leaving the park was 1755 h and the latest time of entering the park was 0606 h. The peak duration of leaving the park was 1800 - 2129 h (86%). The peak duration of returning to the park was 0400 - 0630 h (86%). Elephant crossings were minimum between 2330 - 0230 h

Discussion

We found that only males crossed the fence to enter the study villages, which is consistent with previous studies on African elephants and Asian elephants that found only males raid crops (Ekanayake et al. 2011). Since crops have higher nutrient value than wild fodder, males raid crops to increase their body size hence enhancing reproductive success. The study identified 35 crop raiding males in the three study villages. This is 15% of the total number of males previously identified by de Silva et al. (2011) in the UWNP. Given the limited locations the camera traps were set in, the proportion of crop raiding elephants in our study area could be much higher than detected. Majs.pority of the elephants crossed the fence alone but groups of up to nine males were recorded with a mean group size of three. A similar pattern was observed in Hasanur in southern India (Sukumar 1989), and at a study done in South-east Sri Lanka (Makay 1973). Thirty percent of the identified males in our study associated in bull groups. The group of 9 observed by us is the largest bull group recorded in Sri Lanka. We found that the elephants left the park at dusk and returned at dawn. Similar results were found in southern India (Sukumar 1989). Elephants enter human areas and raid crops during the night to minimize detection risk.

Conservation importance

This study reveals that night vision camera traps can be used to identify problem elephants and to gain information on the patterns and timing of the movements of elephants during night. Such data can be used in managing problem elephants without disturbing the other members of the population.

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DIVERSITY OF STINGLESS BEES (HYMENOPTERA: MELIPONINI) IN SRI LANKA

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Introduction

Stingless bees are known as magnificent pollinators and general foragers who enhance habitat biodiversity (Karikari & Kwapong, 2007). In addition, their beehive artifacts (honey, bee pollen and propolis) are containing medicinal, antibacterial and immuno stimulatory properties. According to the Engel &Michener (2013), most of Asian and African stingless bees belong to the genus *Trigona*. Taxonomic identification of stingless bees was at unclear early stages and diversity studies are very rare in the Indian subcontinent. But in 2013, Rasmussen summarized eight named species of known stingless bees in the Indian subcontinent. Their natural history information is focused on their nest ecology, pollination biology, natural enemies and worker communication. According to Karunaratne et al, (2005) only one identified species of stingless bees, *Trigona iridipennis* and another unidentified species have been recorded from Sri Lanka. However, detailed studies on stingless bees in Sri Lanka are completely lacking.

Objectives

To investigate the diversity, distribution, nest entrance characteristics and floral resources of stingless bees in Sri Lanka.

Methodology

Filed visits were made from January to September 2016 to several locations (Knuckles, Peradeniya, Polgolla and Kegalle) determined based on previous field visits made to collect bees of the country. At each location, availability of bee nests, if present, their entrance characteristics and floral hosts were identified. More than 50 individuals (worker bees) from each different nest type were collected and preserved to identify the species (using external morphology and morpho metric characters obtained with the help of micro view USB digital microscope x 650) with the available keys and descriptions (Rasmussen, 2013). The morphometric data were subjected to statistical analysis, Sample t - test and PCA to study the extent of variations among the species.

Results & Discussion

Present study yielded three species of stingless bees. *Listotrigona cassia* was found only once from Knuckles region and were collected while flying around our faces in the field under hot sun. It was the very first record of tear drinking bees in Sri Lanka. The identity was confirmed by Prof. M. S. Engel, University of Kansas. No floral hosts were identified so far. Further studies are being carried out to investigate their biology, diversity and distribution within the country.

Two other species of the collected bees belonged to the genus *Tetragonula* (earlier known as *Trigona*). Individuals of this genus were seemed quite similar, but closer observations of their nest entrance characteristics (round entrance lined by brown-black sticky substance and long tubular nest made of either sand or wood particles, with a laterally flatted nest entrance) identified two species belong to the "*iridipennis"* species group. The species identification of this group strongly depends on the worker bee morphology. Accordingly, two species, *Tetragonula iridipennis* (Smith, 1854) and *Tetragonula praeterita* (Walker 1860) were recorded from the study sites. *Tetragonula iridipennis* was reported from Sri Lanka since 1850s and is widely distributed throughout the island. Its nest entrance is round in shape and the

nests were found in tree trunks, logs, cracks and crevices of walls and other man-made structures. They were commonly found collecting nectar and pollen from a wide range of flower types.

Tetragonula praeterita (Walker 1860) was found from three study sites except from Knuckles region. Nest entrance is tubular in shape and nests were found in cracks and crevices of wooden structures, walls and rocks. This species was also common visiting a wide range of different types of flowers in the vicinity. *Tetragonula praeterita* was described from a single specimen collected from Sri Lanka in 1863 and deposited in the Natural History Museum, London.

As the two identified species were seen morphologically very similar, data of five morphometric characteristics of the two *Tetragonula* species were subjected to statistical analysis (Sample t - test and PCA) to study the extent of variation between the two species. Analysis revealed that there is a significant difference in Inter ocellar distance (t= 17.77; p = 0.000), Upper inter ocellar distance (t= 19.01; p= 0.000), Head width (t= 15.23; p= 0.000), Inter antennal distance (t= 5.23; p= 0.000) and Eye length (t= 9.83; p= 0.000). According to PCA, there is a clear separation of the two *Tetragonula* species (Figure 1). The morphometric character, Head width gave the highest contribution to the separation of the two species. Studies are being continued to describe male genitalia, hive characteristics and molecular analysis for further confirmation of identity.

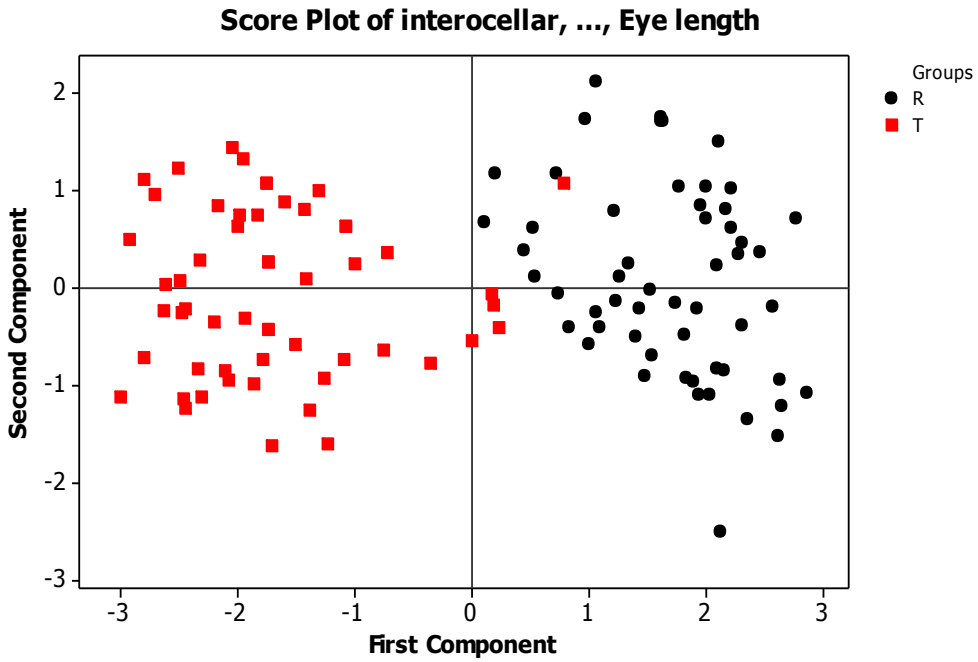

Figure1: Score plot taken from PCA analysis of morphometric characteristics of two *Trigona* species (R- round nest, T- tube nest).

So far only three species of stingless bees are recorded from Sri Lanka, although there are eight species in the Indian subcontinent. Therefore, studies to be conducted in the future to cover all agro-ecological regions of the country may encounter more species of stingless bees from Sri Lanka.

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CORAL REEF CONSERVATION PLANNING IN PASSIKUDAH: IDENTIFYING KEY AREAS, RESEARCH PRIORITIES AND CONSERVATION INTERVENTIONS

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Introduction

The coral reefs are declining globally at a rapid rate. This has urged the conservation community to accelerate efforts towards a deeper understanding of species distributions, population trends, threats and conservation status of coral reefs. This growing concern of the species extinction crisis, and the recognition that there are limited conservation funds to address it, should have a profound influence on conservation planning. With a focus on regions, including areas allocated to both economic exploitation and protection for conservation purposes, there is a need to identify priorities and implement conservation actions within a practical yet science based planning framework (Groves *et al*., 2002). A structured framework for conservation planning is necessary to enhance the effectiveness of a conservation project and to address the social and economic issues that arise. The effectiveness of political processes also plays an important role in achieving stated biodiversity goals.

A systematic, science based conservation planning frame work is especially important in Passikudah since it is a major tourist attraction in the east coast of Sri Lanka. North East Coastal Community Development Programme (NECCDP), based on a rapid survey identified some major issues and made recommendations for the management and conservation of the Passikudah coral reef in 2008 (Green Tech Consultants, 2009). Yet, relevant authorities still have not been able to meet any recommendations of the NECCDP which has caused the Passikudah reef to degrade significantly. If the current rate of reef degradation continues and management actions are not imposed, once a luxuriant coral reef would be lost to the country.

Objectives

This paper summarizes the current status of the Passikudah coral reef, threats and management implications for conservation of the Passikudah coral reef. The recommendations of the study are aimed at providing information to enable the sustainable utilization of the coral reef in the lights of rapid development in the east coast.

Methodology

Passikudah bay is situated about 28 km north of Batticaloa in the Eastern Province of Sri Lanka. The bay is renowned for its wide, shallow, calm sandy beach extending to about 200 m from the beach and the coral reef inhabiting it. Passikudah reef is a part of a series of discontinuous fringing reef systems along the east coast from Kalmunai to Trincomalee. This reef provides habitats for a variety of species of corals, fish, and other invertebrates and also aids in sustaining the life of local people by providing many livelihood methods. An extensive survey was carried out over a period of two years in Passikudah. Priority areas in the coral reef was identified using line transect and manta tow surveys. Fish surveys were carried out using underwater video transects and physical and chemical parameters were measured. Background

information was gathered by interviewing local fishermen, glass bottom boat operators and hoteliers in the area.

Results and Discussion

Passikudah coral reef is a near shore fringing reef with scattered coral communities within the bay. The reef is composed of corals growing from near the shore and extending seaward in a gentle gradient following the contour of the sea floor. A narrow, shallow lagoon and a reef crest is visible. Many of the branching corals are found inside the sheltered lagoon with the exposed reef slope being composed of coral rock and more robust coral types such as encrusting and massive corals. The recorded coral species include 47 species of hermatypic corals which belonged to 23 genera and 11 reef building coral families. This was fairly a low amount in comparison to the 2009 survey reports (Green Tech Consultants, 2009).
The core area of corals remained towards the edge of the north eastern side of the bay. This area was dominated by *Acropora formosa* and few other *Acropora* spp. Though most colonies resembled branching clumps some massive tabular types were also observed. This area contained branching and thicket forming *Acropora* spp, large areas of sub-massive colonies of *Porites rus* and *Psammocora contigua*, *Foliaceous Montipora aequituberculata* and *Pocillopora* spp. Although previous surveys have identified four main coral reef sections (Green Tech Consultants, 2009), currently only above mentioned area of the reef remains live. All other areas where corals existed previously have died due to the shallowness, high amount of sedimentation and extreme sea surface temperatures. Past research have identified several bleaching events in the reef whereas El-nino in 1998 and Tsunami in 2004 which has caused a significant damage to the reef. However, Ellepola *et al.*, (2016) identified that the coral reef of Passikudah is subjected to massive coral bleaching due to freshwater dilution caused by heavy monsoon rains each year. They further stated that freshwater dilution is a consequence of unplanned water drainage system operated on land. Further, land filling has caused the natural marsh lands to deplete, multiplying its effects. However, today there remains only about 12.5% of live coral cover on the reef. Although, a natural recovering process remains in the reef, it is not sufficient to overcome the depletion caused by freshwater added to the reef each year through monsoon rains.

The fish life was moderate on the reef with a total of 88 species of fish belonging to 27 families. Majority of the species represented families Acanthuridae, Chaetodontidae, Labridae, Lutjanidae, Serranidae, Pomacentridae, Scaridae and Siganidae. However, absence of certain species of colour fish is a notable feature which suggests that the reef has been subjected to heavy fish collection in the past. The invertebrate fauna was fairly low in the reef.

Local people are heavily dependent on the reef since majority is fishermen. Others benefitted from the reef are tour boat operators and Hoteliers. Reef degradation has caused serious impacts on the livelihoods of people since numbers of tourists visiting the reef are declining. Further, fishermen reports that their yields have declined in comparison to the past.

The coral reef of Passikudah seems to be degrading each year and ultimately the reef will be lost. It is timely that proper management action plans are imposed for the better management of the reef. Immediate action to prevent freshwater from diluting the bay should be taken to stop the reef from degrading. For this a canal system interconnecting the pre-existed water channels and diverting it in to Valachchenai river further north of Passikudah is suggested. The reef requires more targeted conservation research and better integration of research findings in conservation decisions and interventions. Maintaining connectivity between individual isolated colonies through artificial transplanting will support the natural recovery of the reef. Alternative methods should be used to replace lost substrate of the reef. Further, existing wildlife protection laws and ordinances should be enforced by having onsite wildlife

officers, NAVY and police officers. This can be achieved only through increased political commitment to effective wildlife conservation and strengthened community support. Increased awareness among local people, tourists and hoteliers is an essential part in conserving the coral reef. More partnerships should be built upon various stake holders. Using business for conservation is a good strategy to build awareness through publicity. Joining the private sector for conservation through cooperate social responsibility will ensure continuous flow of money to any conservation project carried out. A community based conservation project is recommended at Passikudah. If these recommendations are met, the Passikudah reef could be restored and will enable the sustainable utilization of the coral reef.

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MALFORMATIONS IN A SRI LANKAN PADDY FIELD AMPHIBIAN COMMUNITY

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Recent reports of high prevalence of amphibian malformations have prompted concerns over the causes and possible implications on amphibian populations. Incidences of malformations that exceed background levels (0–5%) are usually associated with serious habitat degradations. In this context, agricultural lands often receive much attention because they support a significant diversity of amphibians, while being influenced by human-induced changes. However, there is a paucity of published information on prevalence of amphibian malformations in agro-ecosystems in Sri Lanka. Here we report the results of an ongoing study being conducted in a paddy field (~ ¼ acre) located in Doluwa, Kandy district, Sri Lanka (7.1808° N 80.6026 E, 492 m a.s.l). Starting from June 2016 field surveys were conducted once every 12–14 days; during each sampling session 3–4 person-hours were spent between 7.00 pm and 11.00 pm searching for frogs. Frogs were sampled using visual encounter survey method. Individuals were thoroughly examined for malformations, and ones having malformations were brought to laboratory while others were released back to their habitat. After six field visits we recorded 218 individuals belonging to five species: *Fejervarya limnocharis* (86.6%), *Euphlyctis cyanophlyctis* (9.6%), *Indosylvirana temporalis* (2.3%), *Lankanectes corrugatus* (~1.0%) and *Duttaphrynus melanostictus* (~0.5%), of which 20 (9.2%) were malformed. Malformations were recorded in only two species; *F. limnocharis* (9%) and *E. cyanophlyctis* (14%). The malformation types observed were: skin malformations (10.0%), eye malformations (10.0%) including anophthalmia (missing eyes), and limb malformations (80.0%). Hind limbs were affected more than fore limbs, with brachydactyly (shortened digit) being the most frequent type of malformation (65.0% of total malformations) in both fore- and hind-limbs. Other limb malformations included ectrodactyly (missing digit), ectromelia (missing limb elements) and apody (missing feet) which were less common (5.0% each). Our results are consistent with several surveys conducted elsewhere in that limb malformations, particularly those involving hind-limbs were the predominant type. In our study, so far the average incidence of malformations (9.2%) exceeded the background incidence of malformations (0–5%), suggesting observed high frequency may be the result of the exposure of amphibians to some environmental stressor/s. Contamination by agrochemicals, which according to laboratory studies is a confirmed cause of amphibian malformations, can be proposed as a probable cause for observed malformations in this paddy field, but verification of this claim needs further studies. Financial assistance by the National Science Foundation Sri Lanka (RG/2014/EB/02) is greatly acknowledged."

PREDICTED DISTRIBUTION AND CONSERVATION PRIORITIES OF FISHING CAT *PRIONAILURUS VIVERRINUS* IN SRI LANKA

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The Fishing cat *Prionailurus viverrinus* (Carnivora: Felidae) is the second largest, endangered wild cat inhabiting the wet zone of hill country and dry zone forests in Sri Lanka. They can also be found in the Himalayan foothills, East coast of India, Java and Pakistan. The fishing cat is considered as medium sized cat categorized along with some other cat species under the umbrella term *Prionailurus*, and the members of this family are characterized by noticeable stripes and spot patterns on the head, face and body. The local populations are highly threatened due to a range of threats such as road kills, poisoning, hunting, and habitat destruction. Road kills are often the result of high degree of fragmentation of the species' habitat due to rapid expansion of the national road network. The species is often victimized by local communities due to misconceptions. Fishing cats are also highly sensitive to degradation of wetlands, which is one of their key habitats. But still no one has studied their island wide distribution of this elusive wild cat. This study was designed to predict the distribution of fishing cats in Sri Lanka primarily through threat records and as outcome the study, conservation actions were and will be implementing to protect the species. In the study, data was collected mainly by indirect methods such as road kills, accidents, poaching, and poisonings, random camera trapping and also from interviews with local communities. Then the data were used in maximum entropy modeling software Maxent version 3.3.3k and edited using ArcGIS (10.1) software. The 81 occurrence records were observed in 21 districts throughout the 36 month time period starting from July in 2013 to July in 2016 and 90% of the data were associated with threats. Special filtering buffer was used in the occurrence records to minimize the bias of the data. Bioclimatic variables were derived from freely available Bioclim database. Three environmental variables and 10 bioclimatic variables were selectively used. The wet zone area in Sri Lanka consisted of 46 records out of 67. Twenty one occurrence records were spread among the dry zone areas, costal mangrove and marsh areas. The distribution model represent fishing cats in Sri Lanka are mainly concentrated from middle of the country to south, west and south west areas. The model predicts that more than one third of the island is suitable for fishing cat inhabitance including the highly urbanized capital cities to mountain habitats. Results so far indicate 69 total confirmed fishing cat road kills throughout the country in past months. Poisoning, electric fencing, use in indigenous medicine also increase the threats to fishing cats. To overcome those problems Awareness programs and youth camps were organized targeting school children and local villagers in the target sites. Specially design signs and information boards were placed at most vulnerable road kill points and they will be monitoring up to 12 months. Although fishing cats are distributed is vast range in the country, their population is rapidly declining. In order to protect this magnificent species conservation actions should be implemented and regular observation is indispensable.

ENVIRONMENTAL JOURNALISM AND BIODIVERSITY CONSERVATION IN SRI LANKA

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Environmental journalism is the collection, verification, production, distribution and exhibition of information regarding current events, trends, issues and people that are associated with the non-human world with which humans necessarily interact. To be an environmental journalist, one must have an understanding of scientific language and practice, knowledge of historical environmental events, the ability to keep abreast of environmental policy decisions and the work of environmental organizations, a general understanding of current environmental concerns, and the ability to communicate all of that information to the public in such a way that it can be easily understood, despite its complexity (https://en.wikipedia.org/wiki/Environmental_journalism).

Green Media Network is a non-governmental organization which consists of journalist working on environmental & biodiversity conservation in Sri Lanka for about 10 years. The main objective of the Green Network is education and raising awareness among the media organizations, media heads, editors and local journalists to develop media practices that properly report on environment and biodiversity conservation measures to the public. We provide new concepts regarding the above conservation measures through national newspapers, children newspapers, women newspapers as well as television & radio channels.

We conduct several activities to raise awareness among the media, including seminars, workshops, press conferences, field tours. Appropriate experts from different field and also politicians give their support for these programmes. Further, we facilitate meetings among journalists and resource persons. We inform journalists about various environmental conservation activities conducted by NGO's , government & private sector. We also explain environmentally destructive activities to the journalists to publish and raise community awareness about them. We provide basic resources necessary to maintain an environmental library and coordinate use of books, videos etc from other organizations. So our main aim & objective is to link environmental journalists with the NGO'S and researchers working on biodiversity conservation in Sri Lanka.

Website : www.greenmedia.lk

REPORT ON SCHOOLS' AWARENESS PROGRAM

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The Biodiversity and Elephant Conservation Trust (BECT) is a non-governmental and non-profit organization. It has carried out many Schools Awareness Programs on the conservation Sri Lanka's Biodiversity in the last sixteen years at the rate of 150 schools in each year.

Awareness creation among school children is a programme to educate our future generation on Biodiversity and its conservation, especially elephant conservation.

The Schools Awareness Program has been very successful thought all these years. The feedback on the program has been very positive in that the children not only become aware of the realities of the critical situation in which our biodiversity is but also are made aware to the conservation measures that need to be taken.

Objectives

The objectives of the Schools' Awareness Program is to create an awareness amongst the children living in the areas where there are human-elephant conflicts on: value of elephants; their ecology, biology and physiology; their role in the religion and culture of the country; that only a few elephants cause damage to crops and houses, and cause human fatalities and of the need to conserve elephants for the future as part of their and the world's heritage.

We have added a lecture on Sri Lanka's Biodiversity and Natural Environment to the program. We have the continued to receive the approval of the Ministry of Education and have also the assistance of the Department of Wildlife Conservation. A local staff member of the Department of Wildlife is invited to talk to the students at these sessions. We also obtain the assistance of a local environmental organization to join in these sessions.

Introduction to Human-Elephant Conflicts

An increasing human population in the country has also increased the demand for jungle lands for development purposes such as settlement, agriculture and infrastructure development. Uncoordinated land clearing for these purposes, by different government agencies, has resulted in the destruction and fragmentation of the jungle habitats of the elephants.

With the limited population of wild elephants in this country – guesstimates of the wild elephant population varies from 4,500 to 5.500 - the deaths of wild elephants due to these conflicts, is a matter of grave concern to conservationists. The Department of Wildlife Conservation has tried various methods to mitigate and reduce the intensity of these conflicts which, however, seem to be escalating. People living with wildlife are important players in any strategy of conserve wildlife. This becomes more important where there are many conflicts between man and wildlife. The importance of the involvement of the local people in wildlife conservation is because these people share resources with wildlife and the interaction of people and wildlife affect each other both positively and negatively. Therefore, one cannot isolate local people from the conservation of wildlife. It is also equally important to look at conservation issues from both the point of view of conserving wildlife per se and its socio economic aspects.

Human-elephant conflicts (HEC) are one such issue that requires a greater consideration in its socio economic aspects, if any mitigation measures are to be successful. These conflicts impact on the livelihoods of people. The declaration of protected areas takes away land that could be used by increasing human populations for cultivation. Agriculture in elephant habitats disrupts elephant home ranges, and reduces the resources available to the elephants. The loss of human lives and damage to houses and cultivations affects the livelihood of families. It creates animosity with the elephants. Therefore, if one does not tackle these issues directly, it would be difficult to find long term solutions to the ever increasing HEC.

HEC is now a major socio-economic and political issue in Sri Lanka. The mitigation of HEC has all this time, been largely the function and responsibility of the Department of Wildlife Conservation. However even though HEC mitigation has become one of the main functions of the department, HEC has increased in severity and become more widespread over the past few decades.

Work plan of Schools Awareness Program
The schools are chosen from the districts where human-elephant conflicts are most intense. These conflicts occur in sixteen districts of Sri Lanka's 24 districts.

<u>The Programme that we carry out in each school is as follows;</u>

a. Short introduction by the Principal of the school or a teacher (5 minutes)
b. Lecture on the biodiversity of Sri Lanka with slides (45 minutes)
c. Lecture on the elephant and its conservation with slides (45 minutes)
d. Address by the local Wildlife Department official
e. Video presentation on the elephant (10 minutes)
f. Question and Answers session (60 minutes)
g. General discussion, focused on showing how these could lead to some positive action in the future (30 minutes)
h. Presentation of books to the School Library and Vote of Thanks

NB: These sessions last for over 3 hours.

After each session children who are interested in follow up action, are given details of whom to contact etc. The main contacts are the Department of Wildlife Conservation and the Biodiversity & Elephant Conservation Trust. The average attendance at each session is about (125) children and 5 teachers.
During the seminars we advise the children on the following;

1. What precautions they should take against elephant attacks
2. If any unfortunate incident occurs where they should go for assistance
3. How they could obtain compensation (we provide the address and telephone numbers etc.)

The Biodiversity & Elephant Conservation Trust has a Project Coordinator, Mr. Sudath Abeysinghe, who has 16 years' experience in this work. The Project will continue to be supervised by Mr. Jayantha Jayewardene, Managing Trustee of the Biodiversity & Elephant Conservation Trust. BECT hires lectures who are competent and who can give lectures in the two local languages Sinhala and Tamil. These lecturers are used depending on the language spoken in the area where the schools are located.

The program was conducted in 16 districts in Sri Lanka where there are Human-elephant Conflicts. Most of these schools are in the interior of the poor rural parts of the country. Some of these schools do not have electricity. Since we have a generator and all the multimedia, laptop and other necessary equipment, there is no problem delivering these lectures anywhere in the island.

Evaluation

The evaluation of the school's program carried out in a representative set of schools, reveals that the program has been successful in terms of delivering a complete knowledge of elephants to the children. It also has successfully created some long term impacts that can be further strengthened through proper assistance. The quality of this program has evolved through the years and is now of a very high standard both in terms of the lectures and the multimedia presentations. The multimedia presentation is on a program titled Flash.

There will be a greater value if the programme is continued next year as well, considering the comments of the evaluation. The continuation of the program will enable the Biodiversity & Elephant Conservation Trust to conduct a better programme, monitor the success of the previous programmes and also upgrade its services in terms of addressing the human elephant conflict issue. At the end of the sessions the principals, who have participated in our program, are requested to write their comments in the Log Book. This is another way in which we get feedback on their impression of our program.

SAVING ELEPHANTS BY HELPING PEOPLE: FIELD SCOUTS PROGRAM, WASGAMUWA, SRI LANKA

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Introduction

The Sri Lanka Wildlife Conservation Society (SLWCS) has been developing community-based initiatives for the past seven years to address the issues of human- elephant conflicts (HEC) for the long-term conservation of the Sri Lankan elephant. The SLWCS firmly believes that community development and sustainable economic development must be ultimate goals that coincide with our conservation and scientific research efforts. The Field Scouts Program (FSP) was developed with such an aim in mind. The FSP is a community integrated field research program that involves recruiting and training village youth to work as field assistants helping to gather information on, human-elephant conflicts, collect data on elephants to understand their ecology and to help monitor and maintain measures implemented to mitigate human-elephant conflicts.

Lack of empirical data on the local elephant population is a deficiency that hinders the efforts to resolve HEC as well as address other elephant conservation issues successfully. While mostly anecdotal evidence exists, a focused effort to collect empirical biological and ecological data on the elephant populations at our project sites is needed. Such data will be necessary and important for the following reasons:

1. To develop conservation management strategies that includes the resolution of HEC.
2. To provide ecological data when village expansion is planned at the local level, and at the national level when government authorities enact rural development programs.
3. To develop alternative economic incentives to reduce dependency on agriculture.

If we know the population biology and the ecology of the local elephants our efforts can be more effective. The FSP is a pioneering attempt initiated by the SLWCS to build the capacity of local people to participate in wildlife research and conservation in an effort to promote a new paradigm for sustainable conservation.

The human threat to elephants also occurs when the elephants enter the villages to raid crops and break houses. The SLWCS has been working since 1998 to try and resolve human elephant conflict (HEC) in this region. Scientific research on the nature of these raids is required to continue with these efforts.

The Field Scouts Program is part of the capacity building component of the Saving Elephants by Helping People (SEHP) Project that initially began by recruiting and training a cadre of seven rural youth to observe, monitor and record elephant behavior in the neighboring forests as well as to develop a data base on the temporal and spatial distribution of the local elephant population. The youth were selected on the basis of having completed 10-12 years of secondary schooling. Such direct involvement in a field research and wildlife conservation project has instilled in these village youth increased self-esteem, and a greater knowledge and appreciation of the elephant and its habitat. Such an approach will also help garner support of the villagers in the area for the conservation of the elephant. The increased stakeholder participation in a wildlife conservation and research project will give these rural youths a sense of how important their efforts are to saving the endangered Sri Lankan elephant and its habitat. It also makes

them stakeholders of these efforts. Developing the capacity of local villagers to assist with field research makes it economically feasible to continue such a program over the long-term.

Objectives

1. The conservation and protection of the Sri Lankan elephant (*Elephas maximus maximus*) and its habitat (especially outside the protected areas).
2. Establishment of a sustainable community integrated field research program to gather data about the temporal and spatial distribution of the local elephant population and their habitat, and a database on the plant and animal species of the region to help ascertain their conservation status.
3. Mitigation of human-elephant conflict.
4. Creating support for wildlife conservation and protection through capacity building, community and sustainable development.
5. Development of economic incentives to support the long-term conservation of the Sri Lankan elephant and its habitat.
6. To obtain the ecological and biological information necessary to develop a baseline data base on the local elephant populations in Wasgamuwa and to ascertain their population, composition, feeding including patterns in crop raiding, annual ranging behaviors and seasonality.
7. Use this information to successfully resolve HEC as well as develop a management plan for elephant conservation and protection.
8. Establish a new paradigm for sustainable conservation.
9. Develop a sustainable tourism program to support conservation research efforts.

Methodology

The Field Scouts Program initially started with seven locally recruited Field Scouts who had studied up to grades 10 and/or 12. The first group was trained by a field scientist to conduct direct and non-direct observations of elephants, operate GPS units, use binoculars, spotting scopes, night vision scopes and how to observe, read and record elephant signs.

Result

Today the FSP has achieved its goals and has proved that local youth can be trained to work as field assistants and become better stewards for the environment. Today the FSP is extremely popular among the villagers, and due to its popularity, it keeps attracting many rural youths who are keen to join. Unfortunately, due to fiscal limitations it has not been possible to offer opportunities to all of these hopeful youth.

Discussion

At the time the project was initiated in 2003 the assumed advantages of training villagers as research assistants were:

- Facilitation of long-term monitoring and surveying of wildlife by providing resident research assistants.
- Capacity building increases the ability of villagers to gain revenue through conservation.
- Increased environmental awareness and appreciation of nature by locals who are otherwise likely to have adverse impacts on the environment.
- To obtain local support for the entire project and avoid conflict that often arises between local habitants and non-local scientists as a result of their differing interests.
- Reduced costs in conducting long term field research

Through innovative community development, wildlife conservation and sustainable development programs the umbrella project, which is called “Saving Elephants by Helping People,” is helping rural communities to support wildlife conservation while reaping economic and environmental benefits for doing so.

BCSL ACTIVITIES

Distribution of home garden plants 2016

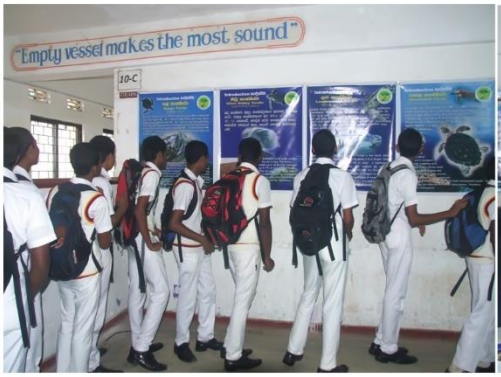
School awareness programme

Mangrove Replating at Kandakuliya, Kalpitiya

BCSL ACTIVITIES


Rural medical clinic


Environmental Cleaning Programme



School Exhibitions



Sea turtle by-catch survey & fishermen attitudinal survey