



Mangroves for the Future
INVESTING IN COASTAL ECOSYSTEMS

Small Grants, Large Gains

Lessons from MFF Small Grant Facility Projects in Sri Lanka (2011-2013)

Kumudini Ekaratne and Shamen P. Vidanage



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Sri Lanka (2011-2013)

IUCN, the International Union for Conservation of Nature, helps the world find pragmatic solutions to our most pressing environment and development challenges. It supports scientific research, manages field projects all over the world and brings governments, non-government organizations, United Nations agencies, companies and local communities together to develop and implement policy, laws and best practice.

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Sri Lanka (2011-2013)

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Preface

This booklet documents selected MFF Small Grants Facility Phase 2 projects, implemented in Sri Lanka, with emphasis on the sharing of good practices and lessons learnt. The projects are categorized into four thematic areas, namely Generating Knowledge, Education and Awareness, Ecosystem Restoration, and Livelihood Enhancement. The booklet is based on information gathered from project progress reports, mid-term reviews, notes made during field monitoring visits and lessons learnt workshops. Although the achievements of a few projects were not up to expectations, the outcome and impact of the successful ones are commendable.

IUCN Sri Lanka wishes to gratefully acknowledge the grantees' assistance in compiling this booklet. We also wish to record our appreciation to Dr Tilak Wettasinghe for editing this publication.

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1. Introduction

1.1 Mangroves for the Future initiative

Mangroves for the Future (MFF) is a partnership-based regional initiative promoting investments in coastal ecosystems that support sustainable development. MFF seeks to achieve demonstrable changes and results across four key areas of influence: regional cooperation, national programme support, private sector engagement, and community action. This is to be realized through concerted actions and projects to generate and share knowledge more effectively, empower institutions and communities, and enhance the governance of coastal ecosystems.

It is currently being implemented in Bangladesh, Cambodia, India, Indonesia, Maldives, Pakistan, Seychelles, Sri Lanka, Thailand and Viet Nam through National Secretariats. While mangroves are regarded as the flagship species, MFF addresses all coastal ecosystems.

MFF was initiated in 2006 by IUCN, the International Union for Conservation of Nature, and the United Nations Development Programme, UNDP. MFF's support base has now grown and includes other UN agencies, such as the UN Food and Agriculture Organization (FAO) and the United Nations Environment Programme (UNEP), as well as CARE International and Wetlands International (WI).

The programmes are implemented through/or in partnership with national governments, UN agencies, NGOs, CBOs etc. The Regional Steering Committee (RSC) and the National Coordinating Body (NCB) in the country concerned, oversee this work. These bodies ensure accountability and transparency to MFF's donors and stakeholders. The RSC provides overall direction and guidance to the programme and the NCB provides national level direction and coordination. In Sri Lanka, the National Steering Committee (NSC) is the NCB.

On the recommendation of the External MFF Midterm Review (2012) a Management Committee (MC) was established in 2013 to focus specifically on MFF management to carry out "business" between official Regional Steering Committee (RSC) meetings.

MFF presently has three categories of project funding, a Small Grant Facility, Medium Grant Facility and Regional Grant Facility.

1.2 MFF Small Grant Facility

The MFF Small Grant Facility (SGF) is a window for financing sustainable local level initiatives in the coastal areas, through small Grant. The objectives of the SGF are to

support activities that contribute towards conservation and restoration of coastal ecosystems as an essential part of the coastal development infrastructure. The SGF is administered by the MFF Secretariat as per MFF Regional Steering Committee decisions.

In Sri Lanka, SGF is managed by IUCN Sri Lanka Country Office (IUCN SL) under the guidance of the MFF National Steering Committee (NSC), which oversees the selection process and project implementation. SGF strives to achieve its objectives through community involvement.

1.3 Managing the programme

Phase 1 of the Small Grant Facility in Sri Lanka was in operation from December 2008 to December 2009. Phase 2, which became operational in January 2011, comprised of two overlapping cycles: Cycle 1 from 1 January 2011 to 30 June 2012 and Cycle 2 from 1 January 2012 to 30 June 2013. This booklet documents the results achieved in Cycle 1 and 2 of Phase 2.

1.3.1 Guidelines

Guidelines for the Small Grant Facility Phase 1, prepared by IUCN SL, were amended for Phase 2. However, the salient features of the Phase 1 guidelines were included. They were:

- Provide for quick disbursement of funds to NGOs, CBOs and other approved organizations in an effective and efficient manner.
- Operate transparently and accountably, in line with donor requirements, and with the governance structure and partnership arrangements specified for MFF.
- Provide technical support to project applicants and project grantees and facilitate exchange of information, field experiences and best practices.
- Implement efficient monitoring and evaluation procedures.
- Report regularly on progress of the small Grant project portfolio to RSC (via the MFF Secretariat).

Criteria to assess the eligibility of proponents also remained the same as in Phase 1: proponents to be national/local NGOs, CBOs, academic and scientific institutions or small scale businesses and enterprises. They should be registered with an appropriate institution, preferably for two years, and meet most of the following criteria:

- Capacity to implement community-based projects in the fields of coastal rehabilitation, conservation and/or sustainable use of natural resources
- Contributions towards community development

- Scientific or professional credibility (determined by peer review)
- Experience in project management and financial administration

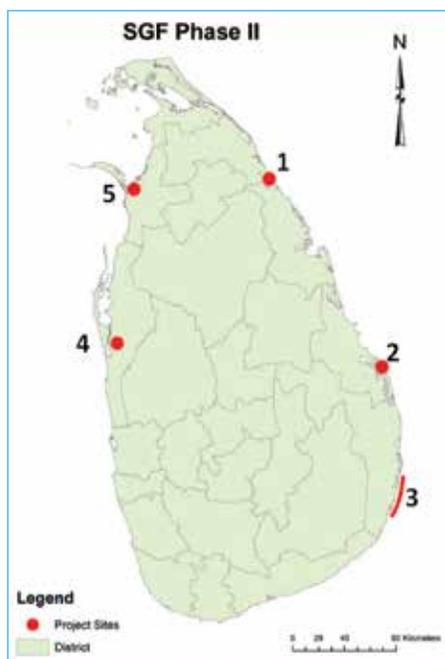
SGF mainly supports activities that:

- (a) Build local capacity
- (b) Create public awareness on environmental issues
- (c) Reduce disaster risks from floods, droughts, sea storms and tsunamis etc.
- (d) Demonstrate potential for replication or scaling-up, and co-financing
- (e) Replicate successful projects from Phase I or similar small projects funded by other donors
- (f) Create an impact on policy at the National/Provincial/District/Divisional level

Having considered the failure of mangrove replanting projects in Phase 1, the NSC decided not to grant financial support for mangrove planting, other than for applied scientific studies in restoring mangroves.

1.3.2 Geographic Areas selected for Implementation of the Small Grant Facility

As Phase 2 commenced operations after the 30-year civil unrest ended, the NSC decided to include some areas in the north of Sri Lanka, which were inaccessible during Phase 1. Thus the following geographic areas (not in order of priority) were selected for SGF Phase 2 interventions (see Figure 1):



1. Kokilai and Nayaru Lagoon system
2. Batticaloa Lagoon
3. Panama to Pottuvil coastal stretch
4. Puttalam Lagoon
5. Coastal areas of Mannar District

Figure 1 – Geographic areas selected for SGF Phase 2 interventions

1.3.3 Duration and Size of Grants

The duration of projects remained unchanged at 12 months.

In Phase 2 (Cycle 1), the upper limit for Grant was retained at LKR 500,000 based on Phase 1 experience, which showed that much work can be done with this amount. However, under special circumstances, grants up to LKR 750,000 were considered provided the proponent was able to justify the increased amount.

In Phase 2 (Cycle 2), the upper limit was increased to LKR 750,000 as costs of basic requirements such as fuel, materials and salaries had gone up. Under special circumstances, grants up to LKR 1,000,000 were considered if the increased amount could be justified by the proponent.

1.3.4 Call for project proposals

As stated under 1.3, Phase 2 had two overlapping cycles: Phase 2 (Cycle 1) from 1 January 2011 to 30 June 2012, and Phase 2 (Cycle 2) from 1 January 2012 to 30 June 2013. As in Phase 1, in order to ensure transparency in the selection of grantees, the following procedures were adopted:

- Advertisements calling for project proposals for Phase 2 (Cycle 1) were placed in the English, Sinhala and Tamil newspapers, from 24th to 26th January, 2011 with the deadline for receipt of proposals as 18 February, 2011
- Advertisements calling for project proposals for Phase 2 (Cycle 2) were placed in the English, Sinhala and Tamil newspapers on 16 February 2012 with 8 March, 2012 as the deadline
- The advertisements were displayed on public notice boards in the District and Divisional Secretariats and Provincial Council Offices in the selected geographic areas
- The availability of grants was publicized through the network of IUCN's previous small grantees, and also through the IUCN web site

The SGF Guidelines and a format for proposals were provided to the interested parties. These documents were also available on IUCN website for downloading.

1.3.5 Project Planning

The new procedures adopted at the 7th meeting of the MFF Regional Steering Committee (RSC 7) were followed. The proponents were required to submit a two-page pre-proposal on a country specific prescribed format. The budget was to be formulated using a standard format that identified the key expense items.

The eligible pre-proposals, on receipt, were carefully reviewed to ensure the inclusion of all essential information. The budget was reviewed along with the activities listed in the pre-proposal and also to standardize the provision for certain items across all projects (e.g. remuneration for project staff).

Seventy seven (77) eligible pre-proposals were received for both cycles.

1.3.6 Evaluation of pre-proposals

The eligibility criteria for organizations seeking grants were: registration with an appropriate authority for a specified period, contributions made to community development, scientific or professional credibility established by peer review and experience in project management and financial administration.

A preliminary screening by the MFF Small Grant Officer, using the SGF Guidelines, led to seven (7) of the 77 proposals being rejected. The main reasons for rejection were: project activities based outside the selected geographic areas, proponent's past performance with small grants was very poor, and nonconformity with the MFF objectives and grant application procedures.

The pre-proposals were submitted to the MFF Technical Sub-committee composed of ten NSC members. They recommended 28 and 14 pre-proposals for Cycle 1 and 2 respectively to be developed into full proposals; this was endorsed by the NSC. See Table 1.1 for a breakdown by geographic area.

Priority Geographic area	Number of pre-proposals received		Pre-proposals approved for development into full proposals		Number of proposals approved for each Cycle		Total number of grants awarded
	Cycle 1	Cycle 2	Cycle 1	Cycle 2	Cycle 1	Cycle 2	
Batticaloa	10	02	06	01	04*	01	04
Panama – Pottuvil	12	11	09	06	06	04	10
Puttalam	14	13	07	06	07	04	11
Mannar	05	03	05	-	05	-	05
Kokilai & Nayaru	02	01	01	01	01	01	02
Outside selected priority areas	04						
Total	47	30	28	14	23	10	32

Table 1.1 – Pre-proposals, proposals and grants awarded for SGF Phase 2 projects, by geographic area

*One proposal was withdrawn by the proponent

1.3.7 Development of full proposals

Proponents of the approved pre-proposals were trained in Project Cycle Management (PCM) with emphasis on a results-based approach and reporting. They were also trained in the preparation of full proposals and budgets using the templates provided by MFF Secretariat.

The PCM workshops for Cycle 1 and 2 proponents were held in Giritale and April 2012 in Colombo respectively. The Programme Manager of the MFF Regional Secretariat functioned as the Resource Person and was assisted by the National Coordinator MFF Sri Lanka and Acting Country Representative IUCN Sri Lanka.

These workshops not only enhanced the proponents knowledge of proposal development and PCM it also provided them the opportunity to form a network of organisations interested in coastal ecosystem management, and in IUCN's work.

Although 42 pre-proposals were approved for development only 37 full proposals were submitted; 32 projects were approved and awarded grants (Table 1.1).

1.4 Location and scope of approved projects

Most projects were implemented in the Puttalam and Panama-Pottuvil geographic areas, with eleven and ten projects respectively (Figure 2).

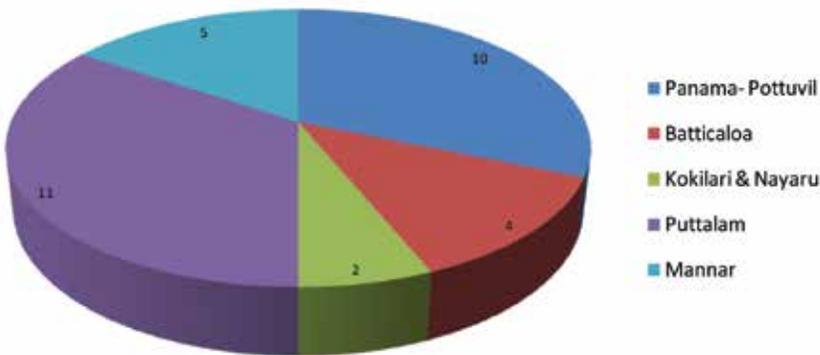


Figure 2 – Distribution of SGF Phase 2 projects over geographic areas

Based on their approach, the 32 projects fall into four thematic areas: Livelihood Enhancement (17 projects), Research (8 projects), Education and Awareness (6 projects) and Ecosystem restoration (1 project) (Figure 3).

Of the 32 grants, 23 were awarded to NGOs, five to Universities, three to Fisheries Cooperative Societies and one to a CBO.

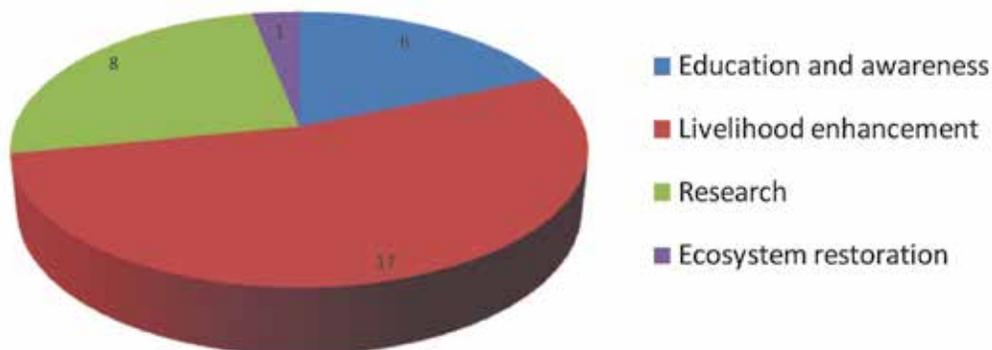


Figure 3 – Distribution of projects by thematic areas

Livelihoods enhancement projects covered beverage production from *Aloe vera*, introducing *Aloe vera* cultivation to the Panama geographic area, homestead vegetable cultivation, micro financing, handicraft production, to name a few.

Research projects included studies on sea grass species diversity and distribution from Puttalam Lagoon to Thalaimannar, coastal aquifers in Panama, mangrove distribution in lagoons in Panama and Pottuvil, water quality in the Panama lagoon, carbon sequestration in *Rhizophora apiculata* and Pb content in *Avicennia marina*.

1.5 Project Implementation

A project team was set up at IUCN SL to oversee project implementation. The MFF National Coordinator (NC) who also functioned as the Small Grant Officer, a Finance Officer and an Intern supported by the Acting Country Representative comprised the team. The first two members of the team were engaged in SGF Phase 1 as well. This was advantageous as they were familiar with all the procedures.

At the outset each grantee signed a contract with IUCN SL setting out the scope of work and the budget.

A programme brochure was produced in English, Sinhala and Tamil during the inception period. The brochure was very useful in creating awareness of the programme amongst the communities.

1.5.1 Reporting

The grantees were required to submit quarterly progress reports. Technical progress report template was provided by MFF Regional Secretariat and the financial reporting format was developed by the Finance Officer of IUCN SL. The formats were introduced to the grantees at the PCM workshops. A sample report was also shared with them.

The grantees were briefed on producing a results-based report rather than on the activities implemented. The need to see changes on the ground as a result of the project was emphasised.

1.5.2 Financial Management

The project budgets ranged from around LKR 340,000 to a maximum of LKR 1,000,000. IUCN released an advance of 30% on signing the contract and receiving the activity plan.

The procedure for reimbursing expenditure and the supporting documentation needed was explained to the grantees. A format for the reimbursement claims was also provided. This format was designed to enable grantees to keep track of the expenditure and the budget balance available.

Overall, the financial management aspects of the SGF were very satisfactory. The MFF Team supported the grantees continuously and was readily available to answer their queries.

Nevertheless, financial irregularities were detected in three projects due to submission of unauthentic documents. This resulted in the cancellation of one project and the deduction of unauthorised expenditure from the subsequent payments, in the other two projects.

1.5.3 Monitoring, learning and evaluation

The National Coordinator with IUCN staff and NSC members visited all the project sites at least thrice during the project life (Table 1.2). During these visits, the physical progress was verified against the activity plan and the relevant quarterly progress reports. Advice and suggestions received from the NSC members were highly appreciated by the grantees. Issues and clarifications related to financial reporting were also discussed during these visits.

Priority geographic area	Date of visit	Number of projects monitored
Kokilai, Batticaloa & Panama – Pottuvil	5-8 October, 2011	9
Puttalam & Mannar	23-25 Jan 2012	10
Batticaloa & Pottuvil	25-26 April 2012	5
Puttalam & Mannar	21-23 May 2012	4
Kokilai	18 October 2012	1
Batticaloa & Panama-Pottuvil	30 October-1 November 2012	5
Mannar & Puttalam	13-15 November 2012	4
Puttalam	12-13 December 2012	3
Kokilai	30-31 January 2013	1
Panama to Pottuvil	13-15 February, 2013	4
Puttalam	11 March 2013	2
Kokilai	13-14 June 2013	1
Panama to Pottuvil	24-25 June 2013	2

Table 1.2 – Details of monitoring visits to project sites

Towards the end of the programme, two workshops were held to share lessons from Cycle 1 and 2 projects. NSC members attended both workshops. An account of the lessons learned is presented in Chapter 6.



2. Generating Knowledge

Research projects that generate information and knowledge on coastal ecosystems constitute a new thematic area, unique to Phase 2 of SGF. Of the 32 small grants awarded, eight (25%) were for such research projects. However, the proposals for research projects were confined to only three geographic priority areas: Panama to Pottuvil coastal stretch, Puttalam Lagoon, and Batticaloa Lagoon. Some selected projects are described in this chapter.

2.1 Ecological study of mangroves in Panama, Helawa and Okanda Lagoons in the East Coast of Sri Lanka

Background:

Faunal and floral diversity in the northern and eastern part of Sri Lanka is yet to be fully assessed as these areas were inaccessible for 30 years due to civil unrest; available information is, no doubt, outdated. As these areas are presently undergoing rapid development, up-to-date information is essential to formulate conservation strategies for the remaining floral and faunal communities.



Fish catch © Kithsiri B. Ranawana



The Postgraduate Institute of Science (PGIS), University of Peradeniya (UoP), supported by a small grant, surveyed the mangrove vegetation in the Panama, Okanda and Helawa Lagoons to ascertain the species composition and density of key mangrove species. The fish and shell fish resources of these lagoons, the fishing methods practiced, and the threats to these lagoon systems were also studied.

Interventions:

The following surveys were carried out from May 2011 to April 2012:

- **Mangrove survey**
 - Mangrove vegetation, in all 3 lagoons, was surveyed using the belt transect method. Each transect was 5 m in width and extended from the mangrove's landward margin to the water's edge. A total of 268 transects were done (207 in Panama, 22 in Helawa, and 39 in Okanda)
 - Mangrove and associate species in each transect were recorded
 - Girth and height of selected trees were recorded
 - Relative density, relative frequency, relative dominance and Importance Value Index (IVI) were calculated
- **Fishery survey**
 - Only Panama Lagoon was surveyed as fishery in Okanda and Helawa Lagoons is not organized
 - Species harvested were recorded by visiting landing sites, interviewing fishermen and surveying fish catches
 - Fishing methods, fishing crafts and gear employed were surveyed
- Maps showing the distribution of mangroves were prepared

Findings & Outputs:

Mangrove survey

- The survey found nine (9) true mangrove species (Table 2.1) and 15 mangrove associates (Table 2.2). Highest species richness was recorded in Panama Lagoon and the lowest in Helawa Lagoon

Table 2.1 – True mangrove species recorded from the three sites

Family	Species	Sites		
		Panama	Helawa	Okanda
Acanthaceae	<i>Acanthus illicifolius</i>	+	-	-
Avicenniaceae	<i>Avicennia marina</i>	+	-	+
Combretaceae	<i>Lumnitzera racemosa</i>	+	+	+
Euphorbiaceae	<i>Excoecaria agallocha</i>	+	+	+
Rhizophoraceae	<i>Rhizophora mucronata</i>	+	+	+
	<i>Rhizophora apiculata</i>	+	-	-
	<i>Bruguiera gymnorhiza</i>	+	-	+
	<i>Bruguiera sexangula</i>	+	-	-
Pteridaceae	<i>Acrostichum aureum</i>	-	-	+

+ Available - Not available

Table 2.2 Mangrove associates recorded from the three sites

Family	Species	Sites		
		Panama	Helawa	Okanda
Apocynaceae	<i>Cerbera odollam</i>	+	-	-
Asclepiadaceae	<i>Calotropis gigantea</i>	+	+	+
Bignoniaceae	<i>Dolichandrone spathacea</i>	+	-	-
Clusiaceae	<i>Calophyllum inophyllum</i>	+	+	+
Combretaceae	<i>Terminalia arjuna</i>	+	-	-
	<i>Thespesia populnea</i>	+	+	+
Fabaceae	<i>Derris scandens</i>	+	+	-
Leguminosae	<i>Desmodium umbellatum</i>	+	-	-
	<i>Cassia auriculata</i>	-	+	-
Lythraceae	<i>Pemphis acidula</i>	+	-	-
Malvaceae	<i>Hibiscus tiliaceus</i>	+	+	+
Myrtaceae	<i>Syzygium cumini</i>	-	+	-
Palmae	<i>Phoenix zeylanica</i>	+	-	-
Verbenaceae	<i>Clerodendrum inerme</i>	+	-	-
	<i>Premna foetida</i>	+	-	+

+ Available - Not available



Recording girth measurements (Kumudini Ekaratne © IUCN)



Recording mangroves and associate species in a transect (Kumudini Ekaratne © IUCN)

- Four mangrove species namely *Avicennia marina*, *Lumnitzera racemosa*, *Excoecaria agallocha* and *Rhizophora mucronata* were the most common mangrove species in Panama and Okanda Lagoons (Figure 2.1). *Excoecaria agallocha* dominated the Helawa Lagoon mangrove community.

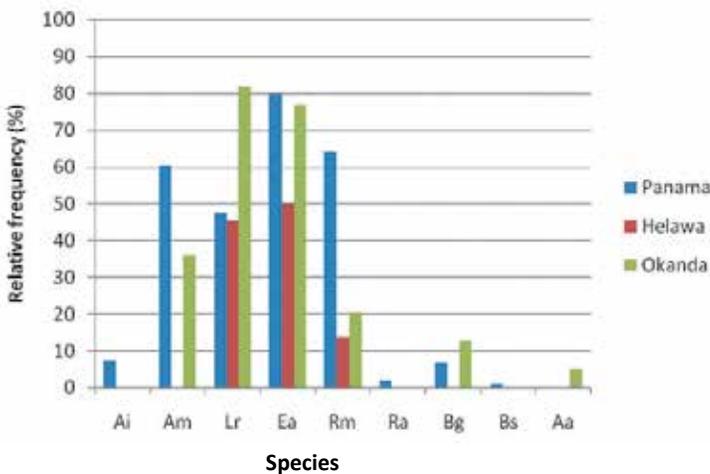


Figure 2.1 – Relative frequency of the true mangrove species in the three sites

- Relative density of *Lumnitzera racemosa* was highest in both Helawa and Okanda mangroves (Figure 2.2). In these two sites *Lumnitzera racemosa* had colonized the opened up areas (disturbed sites) forming dense thickets.

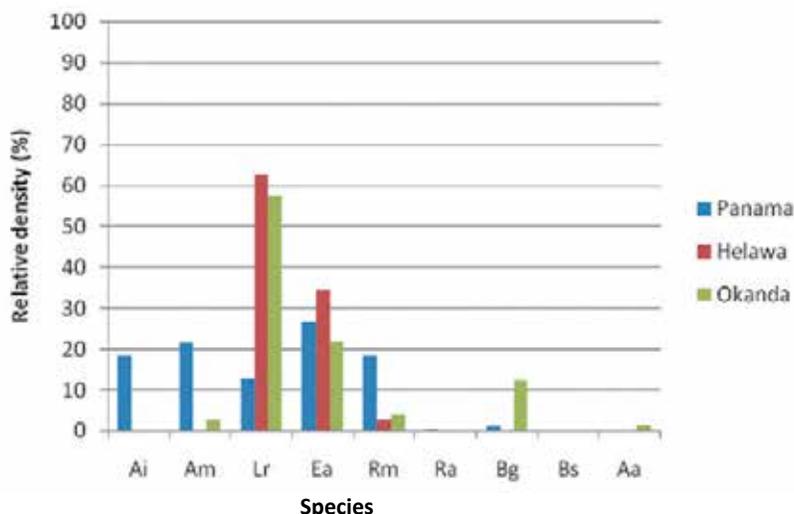


Figure 2.2 – Relative density of true mangrove species in the three sites

- Luxuriant growth of mangroves was observed along the fringe of the Panama Lagoon. Mangroves occupied 83 ha of land bordering the lagoon
- Mangroves in Helawa and Okanda were relatively small in extent (2.1 ha and 3.3 ha respectively). Helawa mangroves, severely damaged during 2004 tsunami, has shown no signs of regeneration ever since
- Three maps depicting the distribution of mangroves in each lagoon were prepared and shared with the relevant government agencies

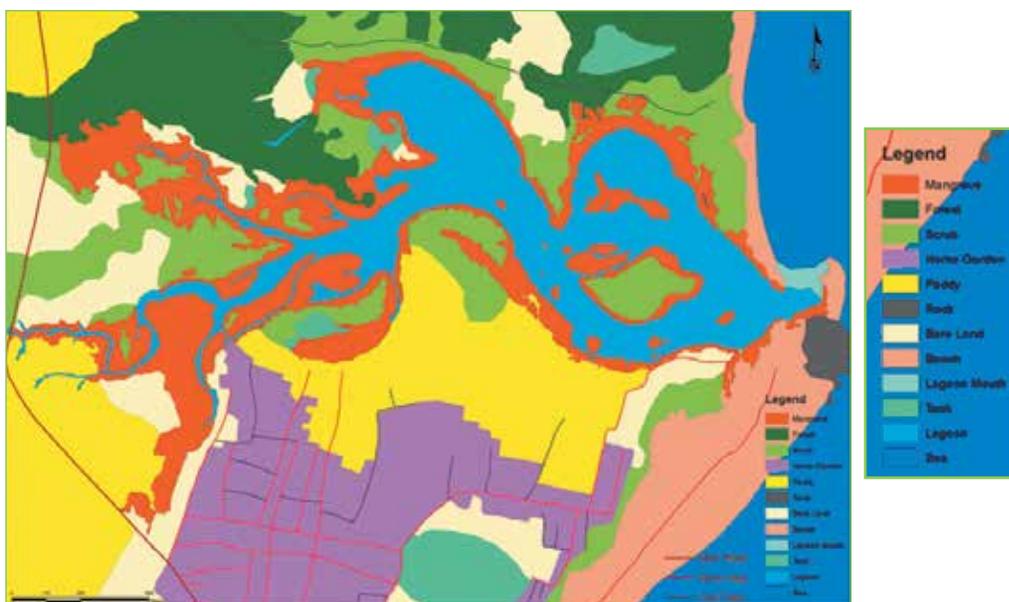


Figure 2.3 – Distribution of mangrove vegetation in Panama Lagoon (Source: PGIS, UoP)



Figure 2.4 – Distribution of mangrove vegetation in Helawa Lagoon (Source: PGIS, UoP)

Fishery survey

Fishing crafts and methods:

- The main fishing craft used in the Panama Lagoon was the fiber glass canoe with an outrigger (operated by one or two fishermen). Use of motor boats for fishing is prohibited in this lagoon
- The main fishing gear were gill nets and cast nets (stretched mesh size varying from 3.5-9.0 cm)
- Crab cages were used seasonally to capture mud crabs (*Scylla serrata*)

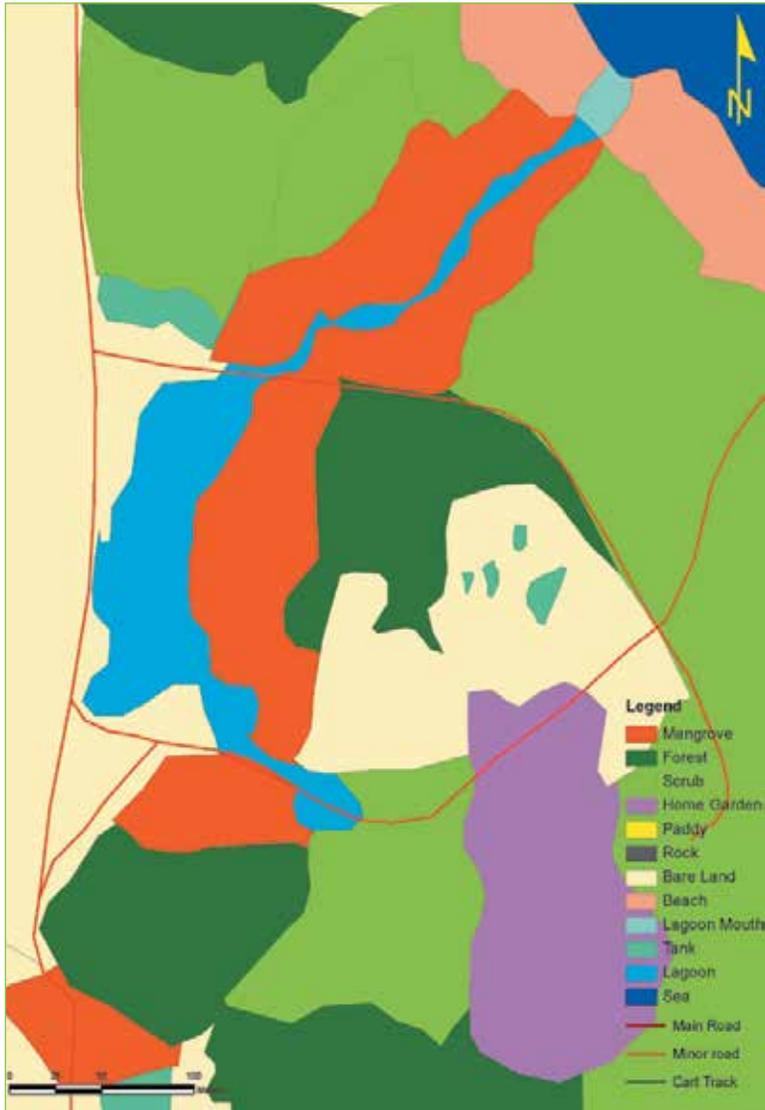


Figure 2.5 – Distribution of mangrove vegetation in Okanda Lagoon (Source: PGIS, UoP)

- Small hand nets were used to capture shrimps hiding among roots of mangroves during the shrimp season in April
- Panama Lagoon Management Society has 106 members, but only 27 members were involved in lagoon fishery on a regular basis

Fish catch:

- About 45 species of fish (belonging to 31 families) are harvested from the lagoon. However, just five species, namely *Siganus virmiculatus*, *Oreochromis niloticus*, *Mugil cephalus*, *Gerres argyreus* and *Mystus guilio* form the bulk of the catch (Figure 2.6) and occur regularly in the fish catch

- *Siganus virmiculatus* and *Mugil cephalus* are the most preferred food fish among the Panama village community and thus comparatively high priced
- A complete list of food fish harvested from Panama Lagoon was compiled
- Mud crabs (*Scylla cerrata*) are caught seasonally
- During the shrimp season four species of shrimps are harvested, namely *Penaeus indicus*, *Penaeus monodon*, *Penaeus merguensis* and *Macrobrachium sp.*

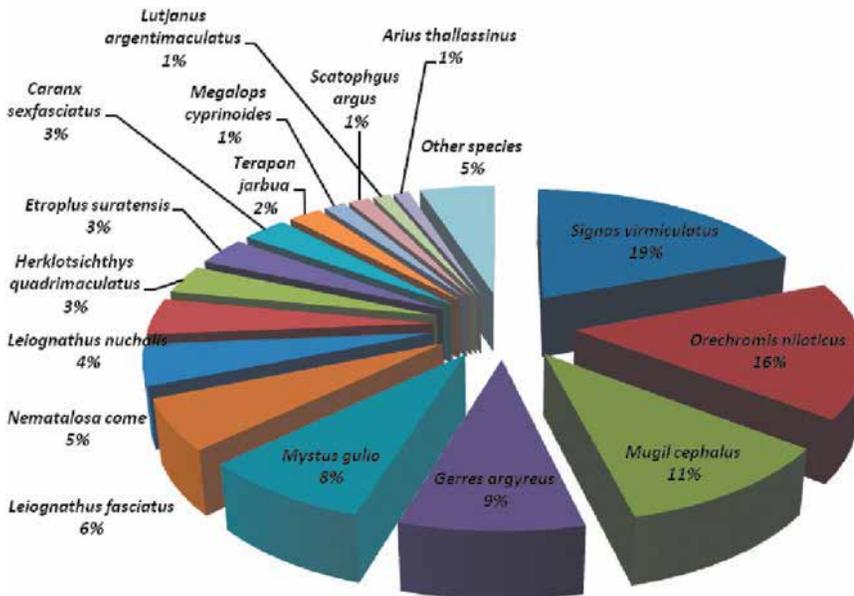


Figure 2.6 – Composition of the fish catch in Panama Lagoon (Source: PGIS, UoP)

Achievement:

The project has enhanced the knowledge on the ecology of mangrove communities associated with three lagoons in the east coast.

Lessons Learnt:

- With the on-going development activities there is a grave danger of mangrove areas also being cleared. Therefore, the boundaries of mangrove areas in this region must be demarcated clearly
- Improving the knowledge base always helps in improving management

What has changed or is likely to change:

The community had the opportunity to participate in data collection along with the Field Officer, a graduate in Biological Science. The unemployed youth showed an especial

interest. Not only did they receive a small allowance for their services, the enhanced knowledge gained through participation was much appreciated. Having become aware of the diversity of the mangroves they vowed to protect them in future.

Recommendations:

Clearly demarcate the mangrove boundaries. These areas are now undergoing rapid development, especially for the tourism industry. Hence there is a great demand for land and the mangrove ecosystem is in imminent danger. Clearly demarcate the natural boundaries of these important ecosystems to avert disastrous consequences.

2.2 Assessment of groundwater quality and vulnerability in the Panama coastal aquifer system



Collecting well water samples (Kumudini Ekaratne © IUCN)

Background:

Coastal sandy aquifers in Sri Lanka are mainly confined to a narrow strip of the island and are mostly overlain by beaches and low sand dunes. Generally highly productive, they are often found in densely populated and intensively cultivated areas. Hence, they are vulnerable due to excessive extraction and anthropogenic pollution. However, these aquifers are very important sources of fresh water for communities' domestic and agricultural activities.



On-site analysis of water samples (Kumudini Ekaratne © IUCN)

Salt water intrusion is one of the commonest problems associated with coastal sandy aquifers in Sri Lanka resulting from over extraction and unregulated water abstraction and high pumping rates that often cause seawater movement toward the freshwater zone.

Panama typifies a coastal aquifer system undergoing drastic changes mainly due to recent rapid development activities, ongoing urbanization and intensive agriculture after the 30-year civil unrest ended in 2009. The area is characterized by flat topography extending to the Indian Ocean in the east. Groundwater wells in this region are often within 10-100 meters of the sea and brackish water lagoons. An increasing number of people in Panama area obtain domestic water from shallow boreholes that penetrate into the sandy aquifers.

In the study area, aquifer-based water supply accounts for over 80% of local water use. The availability of groundwater and the reliability of aquifers even during droughts have brought significant social and economic benefits to the region. However, due to increased water demand, the impact of cultivation practices on groundwater quality is significant. Nitrates and phosphates are potential major water pollutants in groundwater coastal aquifers resulting from extensive fertilizer usage and improper management of waste and sewage.

The Post Graduate Institute of Science, University of Peradeniya, secured a small grant to assess the groundwater vulnerability in the Panama coastal aquifer system.

Interventions:

- The following studies were conducted to evaluate water quality in Panama area:

Seasonal water quality changes

Water samples from 33 selected ground water extracting wells were analysed four times during the project period — in June 2011, August 2011, January 2012 and April 2012.

Analyses of the following hydrogeochemical parameters were carried out using portable field devices, UV-visible spectrophotometer and atomic absorption spectrophotometer: electrical conductivity (EC); pH; hardness; nutrients (nitrate, nitrite, ammonia, phosphate); cations [sodium (Na), magnesium (Mg), calcium (Ca), potassium (K), iron (Fe), manganese (Mn)]; anions (sulfate, fluoride, chloride) and toxic metals [arsenic (As) and mercury (Hg)].

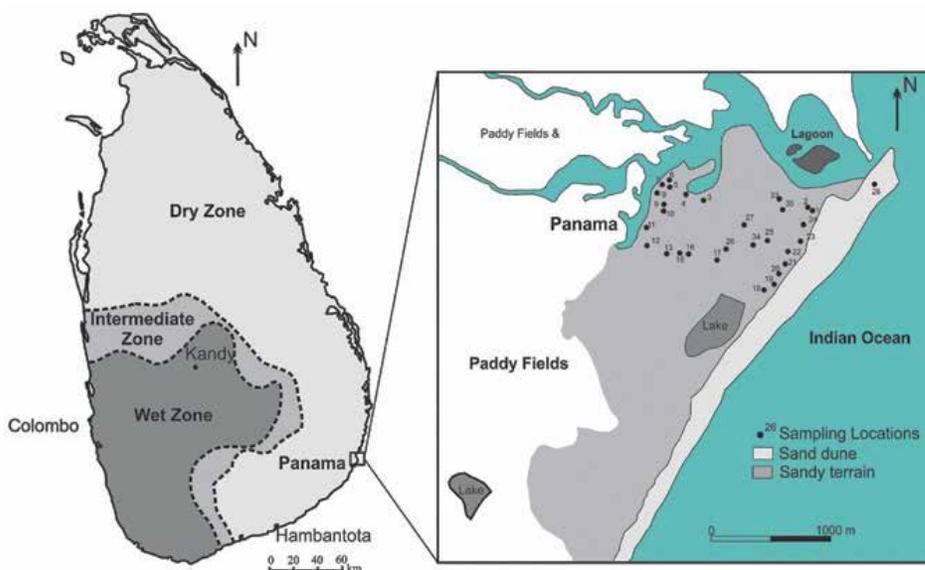


Figure 2.7 – Sampling locations

Study of sea water intrusions using stable isotopes

Oxygen and hydrogen isotope ratios in water samples were measured by wavelength-scanned cavity ring-down infrared spectroscopy with a Picarro L1102-i instrument that was coupled with a vaporization module. Results were reported in delta (δ) notation versus the V-SMOW standard and expressed in per-mille (‰). The analysis was carried out by the GeoZentrum-Erlangen, Germany.

Salinity variation in the Panama Lagoon

Salinity was measured at two locations in the lagoon during each sampling event.

Bacteriological quality of drinking water

Bacteriological analysis was carried out once at five selected locations.

- A database, including GIS based element distribution maps, was established to facilitate management activities

Findings & Outputs:

- Water in the study area is mainly Na-Cl type and mixed Ca-Mg-Cl type indicating that its primary origin is from precipitation and a small degree of mineralization and mixing in groundwater. This is typical of groundwater with a short residence time in sandy aquifers
- Electrical conductivity (EC) and some chemical components of groundwater in the shallow aquifer, mainly chloride and sodium, varied significantly
- Nitrate-nitrogen in most samples was within the permissible limits for drinking water set by the World Health Organization (10 mg/l); however, high levels were recorded in a few wells. High nitrate-nitrogen levels were mainly related to leakage from septic tanks that had been constructed in loose sandy soil. Relatively high nitrate-nitrogen concentrations (up to 4.0 mg/l) were also found in intensively cultivated areas
- Na, K, Ca and Mg concentrations in groundwater was high. High Na is an indication of salt water intrusion. Isotope ratios indicated that precipitation is the main source of groundwater recharge
- The high ratio of Na/Cl in groundwater indicates a significant intrusion of saline water into the aquifer. Saturation Indices (SI) of calcite, dolomite and magnesite was generally greater than zero. According to the salinity classification of the US Salinity Laboratory and the Wilcox diagram shallow groundwater in the region was suitable for irrigation
- Groundwater retention was estimated through tritium (^3H) analysis. Stable isotopic compositions of $\delta^{18}\text{O}$ and δD in the groundwater indicated that precipitation is the main source of aquifer recharge. In the Panama area, rain water rapidly recharges groundwater
- Hydrogeology, hydro geochemistry and isotope data suggests that the Panama area is characterized by a two-aquifer system: sandy unconfined aquifer overlying a weathered and fractured semi-confined aquifer. In general, groundwater is fresh in unconfined aquifers and brackish in semi-confined aquifers

- GIS-based water quality distribution maps identifying highly vulnerable areas were prepared to facilitate the planning and control of groundwater use in the area, and for spatial and statistical analyses of existing groundwater contamination

Data from the chemical analyses of ground water were used to identify geochemical processes and mechanisms in the aquifer region. Saline water intrusion and anthropogenic activities are the major processes responsible for the high concentration of major cations such as Na, K, Ca and Mg. If the evaporation process is dominant, and no mineral species are precipitated, the Na/Cl ratio remains unchanged

Achievements:

- Maps providing information needed to plan appropriate land use and associated human activities, as an integral part of an overall policy of groundwater protection and development, were produced
- A research paper on the study findings has been accepted for publication in the *Journal of Environmental Earth Sciences* (Springer Berlin Heidelberg). The findings will now reach a wider scientific community.

Lessons learnt:

- Reliable and regular data is invaluable for the relevant agencies
- Raised awareness and prioritization of water quality management across the region is important

What has changed or is likely to change:

The study findings, including the water quality distribution maps identifying highly vulnerable areas, have been shared with the National Water Supply and Drainage Board of Sri Lanka.

Owners, whose drinking water wells were sampled, received a brief report on the water quality of their wells. Based on this information some owners were reluctantly compelled to stop using their well water for drinking and cooking purposes.

A leading private bank in Sri Lanka undertook a project to build drinking water wells for community use. They made use of the water quality distribution maps, prepared by this project, to avoid the highly vulnerable areas and selected safe locations to construct the new wells.

Recommendations:

The following actions are vitally important to safeguard ground water in the region and prevent its degradation:

- Improve the sanitary and drainage systems and adopt safe domestic waste disposal systems
- Develop a groundwater budget for the region. To ensure sustainability groundwater use should be properly planned in keeping with the needs of development. Economic development plans should be geared to the water resources available
- Conduct continual follow up assessments of water quality, and control the extraction of groundwater to ensure its sustainability. Local authorities and government institutions should play a key role in this regard
- Implement and enforce existing policies and regulations. Introduce new legal instruments such as a Groundwater Protection Law
- Enhance the technical capacity of various organizations dealing with groundwater
- Establish a groundwater quality monitoring network, particularly for the coastal regions of Sri Lanka where groundwater is highly vulnerable

2.3 Assessing the diversity and distribution of seagrass species in the Puttalam Lagoon

Department of Oceanography and Marine Geology of the Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna.

Background:

Seagrasses are flowering plants that thrive in shallow coastal seas, estuarine and lagoon habitats. Believed to be descendants of terrestrial plants that re-entered the ocean between 100 and 65 million years ago, seagrasses have leaves, stems, rhizomes (horizontal underground runners) and roots. They form meadows on the beds of their habitats and provide feeding, breeding and nursery grounds for many finfish, shellfish, micro-organisms, algae and other



*Specimen prepared for the National Herbarium
(Kumudini Ekaratne © IUCN)*

invertebrates. Seagrasses cycle nutrients in coastal waters and are carbon sinks. Seagrasses are called 'biological sentinels' because they respond quickly to changes in water quality, indicating deterioration of the surrounding environment by degrading and declining, before dying.

There are about 60 seagrass species in 5 families and 12 genera. About half the species are tropical and half are temperate. In Sri Lanka, 15 species in 9 genera have been recorded; one species, *Enhalus acoroides*, is considered to be endemic to the Gulf of Mannar.

Seagrass survey in the Puttalam Lagoon (Kumudini Ekaratne © IUCN)

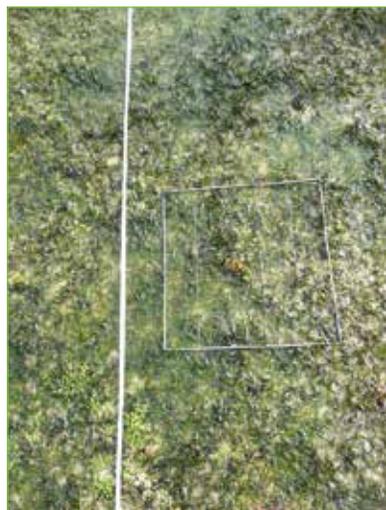


Information on the existing seagrass communities in Sri Lanka is scarce, partly due to security concerns over the past 30 years in the northwest, where sea grasses are abundant. Another issue is the lack of scientists with specialized snorkeling and diving skills to explore these underwater habitats. Clearly, studies on the diversity and distribution of seagrasses in Sri Lanka are important.

Department of Oceanography and Marine Geology of the University of Ruhuna received funding to explore the species diversity, relative abundance and distribution of seagrasses in the Puttalam Lagoon.

Interventions:

- Survey of seagrasses in the Puttalam Lagoon
 - Selected 14 sites to be surveyed in the Puttalam Lagoon
 - The exact position (latitude and longitude) of each site was determined with a hand-held Global Positioning System (GPS) receiver
 - At each site a 50 m transect was laid perpendicular to the shoreline. Each transect was marked at 5 m intervals and samples drawn from each 5m segment using 50 x 50 cm quadrates laid on either side of the 5 m points



Quadrat sampling (© Terney Pradeep Kumara)

- A map showing the distribution of seagrasses was prepared (as per instructions of the Seagrass Watch Manual)

Findings & Outputs:

- Eight sea grass species, belonging to six genera were recorded. *Enhalus acoroides* (11 sites), *Thalassia hemprichii* (6 sites) and *Cymodocea serrulata* (4 sites) were the three most common species. Other species were *Halophila decipiens* (3 sites), *H. ovalis* (2 sites), *Cymodocea rotunda* (3 sites), *Halodule uninervis* (2 sites) and *Syringodium isoetifolium* (2 sites)
- A map of the distribution of seagrasses in the Puttalam Lagoon was prepared (Figure 2.4)
- Herbarium sheets of these species were prepared and submitted to the National Herbarium

Table 2.3 – Species diversity at each sampling site. Sites – 1-Kalpitiya, 2-Nedithiu, 3-Kilithiu, 4-Panathiu, 5-Eramathiu, 6-Kannampitiya, 7-Kandakuda, 8-Thalavila, 9-Ettalai, 10-Palaviya, 11-Puttalam, 12-Ellipuram, 13-Karathiu, 14-Gangewadiya. Species - a-*Cymodocea rotundata*, b-*Enhalus acoroides*, c-*Thalassia hemprichii*, d-*Halodule uninervis*, e-*Syringodium isoetifolium*, f-*Cymodocea serrulata*, g-*Halophila ovalis*, h-*Halophila decipiens* (Present-1; Absent-0)

Site	Species							
	a	b	c	d	e	f	g	h
Kalpitiya	0	1	0	0	0	0	0	0
Nedithivu	0	1	0	0	0	0	0	0
Kilithiu	0	1	1	0	0	0	0	0
Panathiu	0	1	1	0	0	0	0	0
Eramathiu	0	1	0	0	0	1	0	0
Kannampitiya	1	1	1	1	1	1	0	0
Kandakuda	1	1	1	1	1	1	1	0
Thalawila	0	1	0	0	0	0	0	0
Ettalai	0	1	1	0	0	1	0	0
Palaviya	0	0	0	0	0	0	0	1
Puttalam	0	0	0	0	0	0	1	1
Ellipuram	0	0	0	0	0	0	0	1
Karathiu	1	1	1	0	0	0	0	0
Gangewadiya	0	1	0	0	0	0	0	0

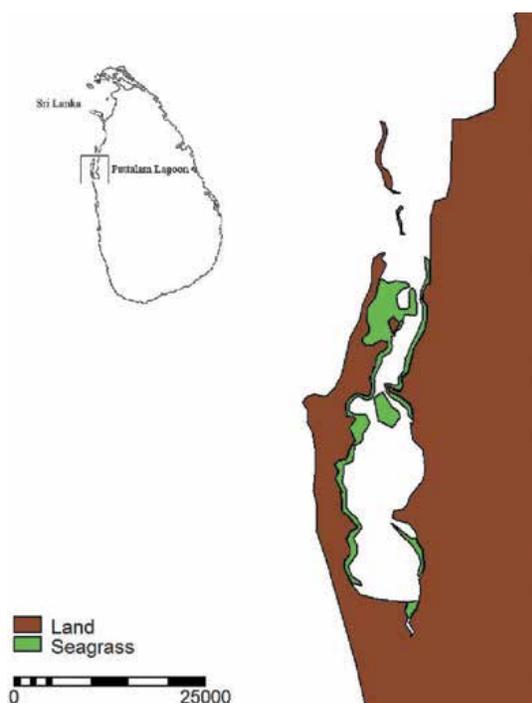


Figure 2.8 – Distribution pattern of seagrasses in the Puttalam Lagoon (Source: UoR)

- Anthropogenic activities mainly responsible for damaging seagrass communities were:
 - Use of propeller driven fishing boats in the lagoon
 - Excessive use of fertilizers by farmers. Chemicals such as nitrogen and phosphorous in the fertilizers become toxic pollutants at higher concentrations. These and other pollutants derived from anthropogenic activities are carried into the lagoon by rainwater seepage and runoff. Seagrasses being located near the shore are exposed directly to these pollutants
 - Laying of fishing nets on or near seagrass meadows,
 - Discharging untreated aquaculture effluents and solid waste of domestic origin into the lagoon

- Research findings were presented at scientific meetings
 - Mapping of seagrass beds in Puttalam Lagoon as a tool for future management. *Proceedings of the 19th Session of the Sri Lanka Association of Fisheries and Aquatic Resources. 15-16 May 2013, Colombo*
 - Seagrass habitat degradation and marine snakes in the Puttalam Lagoon. *Proceedings of the Conference on Herpetological Conservation and Biology, 28-29 Nov, 2012, Peradeniya, Sri Lanka*

- Contributions were made to the ongoing process of National Red Listing
- Published an article, in Sinhala, on 'Present status of seagrass beds in the Puttalam Lagoon' in the 2013 Edition of *Sath Samudura* published by Marine Environment Protection

Lessons Learnt:

- Lack of an appropriate common forum in Sri Lanka for marine scientists is a major deficiency
- The importance of seagrass beds in terms of economic and ecological values is poorly recognized
- Lack of herbarium sheets of seagrass species in the National Herbarium is a major shortcoming. It is hoped that herbarium sheets prepared by the project would fill this void

What has changed or is likely to change:

Findings of this comprehensive study on the distribution pattern of seagrass species, with supporting maps, are now available to coastal development planners, and also provide a baseline for future research studies. The herbarium sheets submitted to the National Herbarium will be available for future generations.

Recommendations:

- a) Systematic research should be promoted to fully document the current distribution patterns and habitat status as the baseline
- b) Targeted programmes with a local community focus should be held on the importance of seagrasses for their livelihoods and why seagrasses should be conserved
- c) Undisturbed seagrass meadows should be demarcated and given some degree of legal protection
- d) A forum of marine scientists in Sri Lanka should be formed

2.4 Assessment of lead (Pb) contamination in mangrove sediments and *Avicennia marina* plants in Batticaloa Lagoon

Background:

Total mangrove area in Sri Lanka is about 12,000 ha; 0.1-0.2% of the total land area. Mangrove ecosystems provide many extractive and non-extractive uses. Trapping sediments and acting as a sink for suspended sediments is an important function of mangroves.



Mangroves in Batticaloa lagoon (Kumudini Ekaratne © IUCN)

Batticaloa Lagoon is Sri Lanka's third largest brackish water body. Rich mangrove stands border this lagoon and the original mangrove cover amounted to 1,490 ha. However, it has been reduced 80% of the original cover within a 20-year period, due to

- poorly planned infrastructure development
- construction of aquaculture ponds
- clearing for security purposes

After the conclusion of the civil unrest in May 2009 increased clearing for unplanned development activities is to be expected.

EML Consultants (Private) Ltd. sought funding to inventorize the species in Palameenmadu-Mattakali and Santhurukondan areas bordering the Batticaloa Lagoon, and to assess the lead (Pb) levels in *Avicennia marina* (believed to phytoremediate metals effectively), sediments and water associated with mangroves.



Project monitoring by NSC members © IUCN

Interventions:

- Mangroves in Palameenmadu-Mattakali and Sathurukondan areas were surveyed, in November 2012, through plot sampling (20 m x 20 m) and opportunistic observations

Area	No. of locations sampled	How opportunistic observations were made
Palameenmadu-Mattakali	7	Walking along paths and boating
Sathurukondan	3	Walking along paths

- Pb content was measured in 2 samples of sediment (upper 5 cm profile) and *Avicennia marina* plant tissue (leaves, shoots and roots from trees $\leq 1\text{m}$ tall) from a few cleared areas and pristine areas
- Pb content and salinity of the water were measured in 2 grab samples, and pH, turbidity and electrical conductivity were measured *in situ*
- Socioeconomic status of the study area was assessed, with emphasis on levels of income and livelihood, through key informant interviews, focus group interviews and perusal of secondary data/information. This was carried out in Palameenmadu, Amirthakali, Ponacholai and Mattakali Grama Niladhari Divisions
- The impact of tourism on the mangroves in the Batticaloa Lagoon (Batticaloa Municipality area) was studied

Findings & Outputs:

Mangrove surveys:

- Of the 22 true mangrove species recorded in Sri Lanka, seven were found in Palameenmadu-Mattakali area and eight in Sathurukondan. True mangrove diversity in the two sites is similar except that only very few *Avicennia officinalis* trees are found in the Sathurukondan area
- The species recorded from both areas were: *Avicennia marina*, *Avicennia officinalis*, *Lumnitzera racemosa*, *Aegiceras corniculata*, *Rhizophora mucronata*, *Excoecaria agallocha*, *Acanthus ilicifolius* and *Sonneratia caseolaris*
- *Rhizophora mucronata* (Kadol) was dominant in both Palameenmadu-Mattakali and Sathurukondan areas. The other dominant species were *Lumnitzera racemosa* (Sudu Beriya) in Palameenmadu-Mattakali, and *Excoecaria agallocha* (Thela Kiriya), *Avicennia marina* (Manda), and *Sonneratia caseolaris* (Kirala) in Sathurukondan area
- Of the eight species recorded in Sathurukondan area, *Avicennia officinalis* and *Aegiceras corniculata* were found only in one and two locations respectively); the other six species were found in all three sampling sites. None of the seven sampling locations in Palameenmadu-Mattakali had all seven species recorded in that area
- The number of mangrove associates observed in the Palameenmadu-

Mattakali area was about twice that in Sathurukondan area

Pb accumulation study:

In both mangrove areas and mangrove cleared areas, the Pb levels in the sediment and plants were negligible (<0.01 ppm) but were high in the water (0.17-0.29 mg/L and 0.26-0.34 mg/L respectively).

Pb in water may become available to fish and other marine fauna. Higher Pb levels in the water in mangrove cleared areas suggests that mangroves may, at least to some extent, play a vital role in the removal of Pb from this ecosystem. But *Avicennia marina*, judging by the low accumulation levels, was not effective in removing Pb.

Socioeconomic assessments:

- The present mangrove cover is about 80% of the original cover (1490 ha) having been depleted due to natural and human-induced hazards and unplanned development work
- The communities surveyed were not heavily dependent on mangroves (extractive and non-extractive uses); they made limited use of mangroves for fuel wood, poles and brush piles
- Majority of families were engaged in unskilled work and offshore fishing for their livelihood
- There was a lack of community awareness on the importance of mangroves and their socioeconomic and environmental value
- Institutional support and cooperation was inadequate for community social capital formation and empowerment

Tourism study:

- In the past, Batticaloa City had not experienced mass movements of tourist traffic; it was especially sparse over the last three decades. However, both international and domestic tourist traffic has increased over the last two years
- Current room capacity in the accommodation sector in Batticaloa City is around 250 rooms. However, quality wise these rooms are not suitable for international tourists and have been mostly utilized by traveling salesmen, locals visiting friends and relatives, and domestic tourists
- At an average occupancy of 60% and room density of 1.8, Batticaloa City's accommodation sector provides for around 235 guest nights a day or around 85,000 persons per annum. International tourists who spend one night in the city amount to around 4,000 persons per annum. They are mostly low budget travelers. No marketing effort has been made to attract the more affluent tourists to the city
- The Batticaloa Lagoon and the mangroves have been subject to adverse

environmental impacts. The situation worsened over the last three to four decades. Since tourist activities were limited the adverse impacts on the lagoon and mangroves cannot be attributed to tourism

- As per current records, Batticaloa City receives around 20,000 day visitors and 85,000 overnight visitors per annum. Over the next 5 years a considerable increase in tourist traffic to the city, both international and domestic, is to be expected. This has the potential to inflict considerable damage to the natural resources of Batticaloa

Lessons Learnt:

- Pb removal by mangrove plants is negligible, resulting in water with a high Pb content, which could become bioavailable
- A planned approach to develop tourism should be adopted. Haphazard development is likely to damage natural assets and threaten the sustainability of the industry, which is heavily dependent on the natural environment to attract tourists
- Officials handling a specialized subject such as tourism need training to build their capacity. Skill levels and management capabilities of those engaged in providing tourism services and facilities need to be enhanced with an overall understanding of the subject

Recommendations:

- a) Prepare an appropriate tourism development plan for Batticaloa City, based on extensive study and research. Such a plan should be incorporated into the Batticaloa City Development Plan, prepared by the UDA, for the Batticaloa Municipal Council.
- b) Action should be taken to curtail all possible sources of Pb emission to the lagoon. For example, using petrol powered boats for fishing and recreational activities should be restricted. Central oil collection systems should be in place at boat anchoring points to systematically collect waste oil and reduce oil discharge into the lagoon. The waste oil can be recycled or traded to relevant stakeholders.
- c) Community awareness on the importance of mangroves and their socioeconomic and environmental value should be enhanced.

2.5 Seasonal and spatial variation of physicochemical parameters of water in Panama Lagoon

Background:

The physicochemical parameters of water can be effectively used to assess the

ecological health of a lagoon such as their productivity and sustainability. The changes in temperature, salinity and other chemical parameters such as dissolved oxygen, nitrate and phosphate provide valuable information on the quality of water and their impact on the functions and biodiversity of lagoons. Proper study of these ecosystems therefore will improve the knowledge about ecological interactions within the lagoon, as well as factors external to the ecosystem, such as changes in seasonal patterns of stream flow, physicochemical characteristics of source streams, and the type and amounts of pollutants that enter water courses from surface runoff.



Measuring water parameters (Kumudini Ekaratne © IUCN)

Panama Lagoon, believed to be presently unpolluted, is vulnerable to pollution due to the rapid development ongoing in the region. Salt water intrusion from the ocean by subsurface flow through the barrier beach, and leaching of ions from lagoon bottom sediments could also be expected in this ecosystem. Therefore, studying the spatial and temporal variation of lagoon water quality, including salinity, will provide baseline information for future studies in the region. The differences in water quality will also be reflected in the composition of the fish assemblages in a lagoon ecosystem.

The Ecological Association of Sri Lanka secured a grant to study the temporal and spatial variation of water quality and to identify the potential risks to the Panama Lagoon.

The information obtained from this study will provide a baseline to assess future changes due to global climatic changes and its impact on the coastal ecosystem. The data generated can be correlated with fish diversity and productivity of the lagoon ecosystem.

Interventions:

- Samples collected from June 2012 to May 2013 were analyzed to determine water quality. Surface water samples from 22 locations and bottom samples from 5 selected locations were collected and analyzed for their



Measuring water parameters (Kumudini Ekaratne © IUCN)

major chemical parameters such as pH, salinity, turbidity, dissolved oxygen, alkalinity, hardness, chlorides, sulphates, fluorides and major cations

- *In situ* measurements of pH, dissolved oxygen, turbidity, salinity and electrical conductivity were carried out using Hach SensION portable probes while alkalinity was tested using a Hach Field titration kit
- Water samples that were filtered through 0.45 μm syringe filters were collected into HDPE vials and acidified with ultrapure nitric acid for analysis of major cations (Na, K, Ca, Mg, Fe, Mn) using a Varian-240FS Atomic Absorption Spectrophotometer
- Anions (nitrate, ortho phosphate, sulphides, chloride, fluoride) were measured within 48 hours of sampling, using methods described in APHA (1998) and using a portable visible spectrophotometer (Hach DR 2700)
- Bathymetry data of the lagoon were obtained using a Gamin Echo 150 Sonar unit connected with a Magellan GPS device, and a digital bathymetric map of the lagoon was prepared
- Hydrological information (tidal levels, rainfall, etc.) was collected
- Information on fish harvests was collected to determine the seasonal variation of fish diversity
- Sources of pollution in and around the lagoon were identified
- Sediment core samples were collected from selected locations in the lagoon

to study nutrient dynamics — an analysis of sediment for its nutrient loads (nutrient dynamics of the lagoon)

Findings & Outputs:

- Water quality of the Panama Lagoon showed significant spatial variation
- Water quality of the lagoon was highly dependent on the current weather conditions
- Salinity of the lagoon was very low, indicating that the effect of sea water was minimal
- Physical water quality parameters such as salinity, EC, TDS, turbidity, nitrate and chloride showed strong seasonal variation
- All the variables examined showed significant temporal differences and partial spatial variability
- Most water quality parameters showed significant temporal trends (Figures 2.5 and 2.6); the exceptions were i) Total Phosphorus (TP) - an increasing trend in the inflow segment, and ii) Total Suspended Solids (TSS) - a decreasing trend in the mouth segment
- The primary factors that influence lagoon water quality were untreated domestic sewage discharge and/or agricultural runoff from cultivated lands
- Anthropogenic activities and storm water runoff, diverted directly into the lagoon, have negatively affected the water quality
- Substantial amounts of water from surrounding creeks, heavily loaded with nutrients, flow into the lagoon. This input is likely to have aided eutrophication in shallow areas of the lagoon
- Generally, the highest finfish harvest in the lagoon is in January when the fresh water inflow is high and salinity is lowered (max: 0.6‰)
- Four species of shrimps were found in the lagoon; *Penaeus monodon* was the most common and harvests were highest in April-May when the salinity increases up to 25‰. Abundance of some fish species also showed a clear correlation with water chemistry
- Bathymetry maps of Panama Lagoon were prepared and shared with relevant agencies

Lessons Learnt:

- Hydrochemically, the lagoon consists of three main segments, namely the salt water segment, fresh:salt water interface and the fresh water inflow segment
- Water quality of the lagoon is highly dependent on the existing weather conditions and salinity of the lagoon is very low in most parts of the year, indicating that the effect of sea water on the lagoon was minimal
- Effects of season and runoff are the major factors that control the variation in water quality; however human activities are interfering with this cycle
- The main lesson learnt is that it is possible to progress from successfully completing a small project (the first MFF /05) to secure another SGF (MFF/67) and then to leverage funds from other sources to expand further

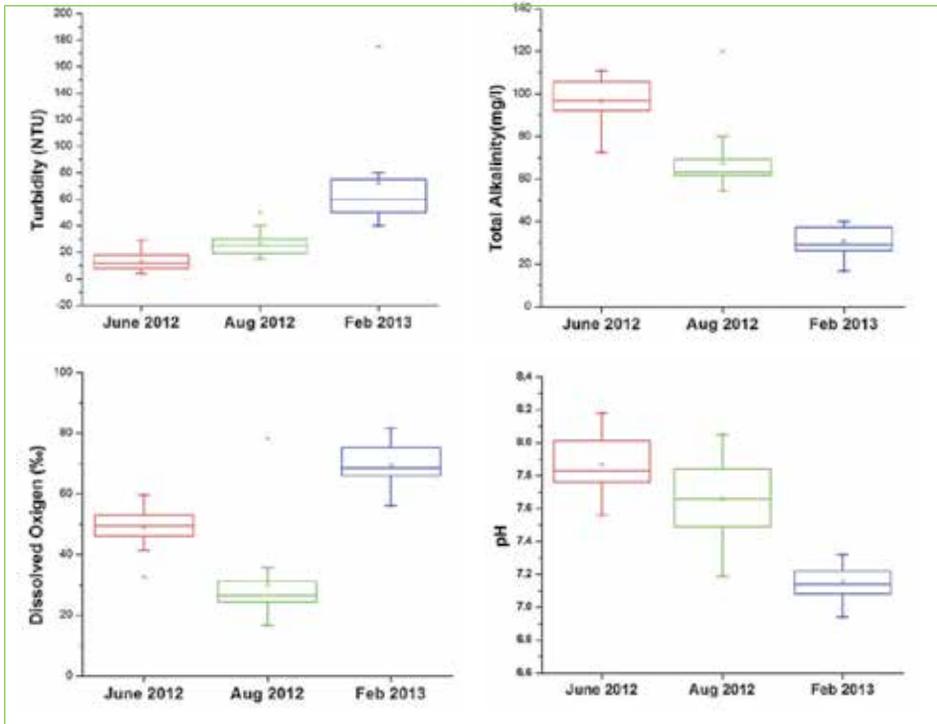


Figure 2.9 – Temporal variation of some physical parameters in the Panama Lagoon

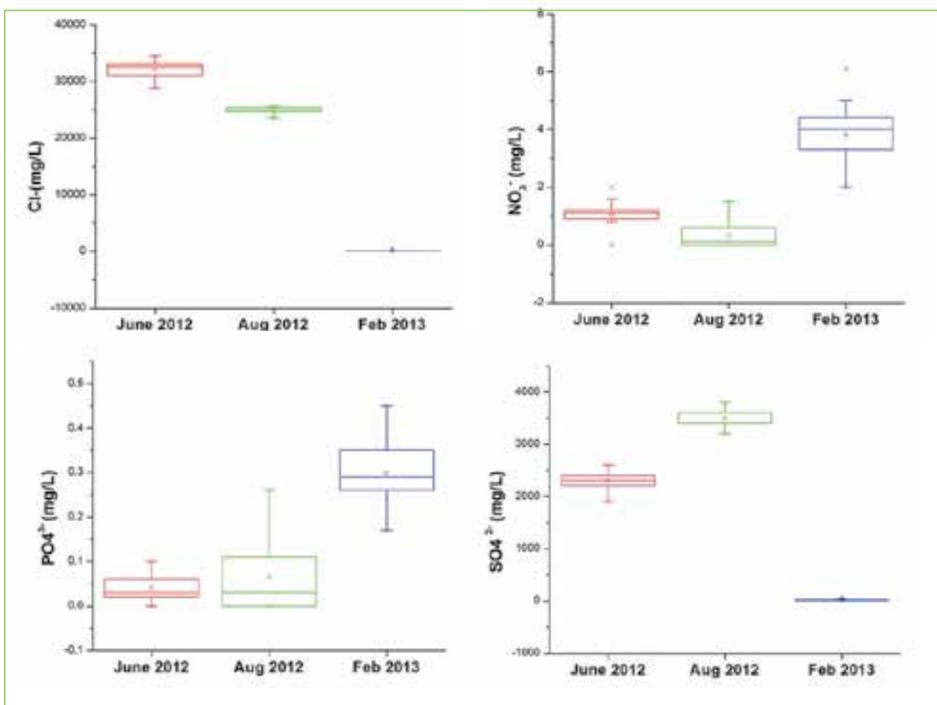


Figure 2.10 – Temporal variation of some chemical parameters in the Panama Lagoon (Source: EASL)

What has changed or is likely to change:

Study findings provide baseline information on trends in water quality variation in the Panama Lagoon, and help to assess the effectiveness of ongoing and future management actions. The study also provided information on major and trace elements that will assist in understanding spatial distribution, sources and associated potential ecological impacts in the Panama Lagoon.

Sharing study findings with the community and stakeholders, enabled both parties to appreciate the value of the ecosystem.

This small grant project entered into a partnership with Linköping University of Sweden and secured additional funding from the Swedish Research Council under the Swedish Research Link Programme. This new study will focus on reconstructing the monsoon variability in Sri Lanka during the Holocene epoch. Based on the MFF SGF project, Panama Lagoon was selected as one of the three sampling locations for the new study.

Recommendations:

- a) As a continuation of this study, a program to monitor lakes and their inlets should be instituted, covering all lagoons in Sri Lanka, especially those located in the east and northeast coast. This could be extended to identify point sources of pollution that contaminate lagoon ecosystems.
- b) A public awareness program was successfully conducted during this project; such programs should be continued.
- c) Turbidity of the lagoon water increased drastically during rainy periods. As this adversely affects aquatic animals in the lagoon consider action to minimize soil erosion from areas presently developed and from future developments. Furthermore, to protect this important ecosystem, develop appropriate criteria and standards to assess land use applications for lagoon shoreline construction and landscaping activities.
- d) Review the current system of land use in the watershed as an important step towards improving the future management of the lagoon ecosystem. Limiting the inflow of nutrients is also necessary to keep the lagoon ecosystem healthy for generations to come.

2.6 Mangrove species composition, diversity and related fishery in lagoon and estuarine systems in the Pottuvil-Panama coastal stretch



Mangroves in Shastrawela (Kumudini Ekaratne © IUCN)

Background:

Mangroves in the Pottuvil to Panama coastal stretch had hardly been studied. A record of the species diversity and the threats to these mangrove systems is an important prerequisite for the development of a long-term conservation strategy. Hence, this project, implemented by the Ecological Association of Sri Lanka (EASL), aimed to gather baseline information on the mangroves associated with lagoons in the Panama to Pottuvil stretch.

Interventions:

- Mangrove communities were surveyed in the Pottuvil Lagoon, Goda Oya Estuary in Kudakalli and Heda Oya Estuary in Shastrawela, using belt transects; and in Ragamwela Creek (at Peanut Farm) using belt/line transects
- Threat factors to mangroves were recorded
- Food-fish species caught in the Pottuvil Lagoon was surveyed in detail.
- Mangrove distribution was mapped
- Maps showing the distribution of mangroves in these sites were prepared and the mangrove extents were calculated

Findings & Outputs:

Mangrove survey

The survey found nine true mangrove species (Table 2.4) and 16 mangrove associates in the study sites. Distribution of the true mangrove species over the sites was varied; only two species were found in all four sites and no site contained all nine species.

Table 2.4 – True mangrove species recorded from the surveyed sites

Family	Species	Pottuvil Lagoon	Kudakalli	Heda Oya Estuary	Ragamwela Creek
Acanthaceae	<i>Acanthus ilicifolius</i>	+	-	-	-
Pteridaceae	<i>Acrostichum aureum</i>	+	+	+	-
Myrsinaceae	<i>Aegiceras corniculatum</i>	+	-	-	-
Avicenniaceae	<i>Avicennia marina</i>	-	-	-	+
Rhizophoraceae	<i>Bruguiera gymnorhiza</i>	+	-	+	-
Euphorbiaceae	<i>Excoecaria agallocha</i>	+	+	+	+
Combretaceae	<i>Lumnitzera racemosa</i>	+	+	+	+
Rhizophoraceae	<i>Rhizophora apiculata</i>	-	-	+	-
Rhizophoraceae	<i>Rhizophora mucronata</i>	+	-	-	-

+ Available

- Not available

The biggest trees (in terms of tree height and girth) in the surveyed sites, were *Bruguiera gymnorhiza* and *Rhizophora apiculata* found in the Heda Oya Estuary at Sahastrawela. On average, *B. gymnorhiza* was 20 m tall with a girth of 55 cm, and *R.apiculata* was 15 m tall with the girth ranging from 20-25 cm. This is unusually tall for dry zone mangroves. Tree heights of this magnitude are not achieved by mangrove species even in the wet zone of the country. This project, through the MFF National Steering Committee of Sri Lanka, drew the attention of the Forest Department to this unique patch of mangroves, about 6.5 ha in extent. This patch of mangroves is being declared as a Forest Reserve under the Fauna and Flora Protection Ordinance.

Regrettably people living in the area fell mangroves for use as fuel in brick kilns, fence posts and in construction work. Steps should be taken immediately to stop the cutting of mangroves in these sites.



Mangroves in Ragamwela Creek (near Peanut Farm) (Kumudini Ekaratne © IUCN)

Fishery survey

Fish catch

Generally, the fish catch in Pottuvil Lagoon consists of six species of fin fish, two species of Penaeid shrimps and one species of crab (Table 2.5.)

Table 2.5 – Fin fish and shell fish species harvested from Pottuvil Lagoon

Family	Species	Common name (English)
Bagridae	<i>Mystus gulio</i>	Long Brown Whiskers Cat Fish
Carangidae	<i>Caranx sexfasciatus</i>	Bigeye Trevally
Cichlidae	<i>Etroplus maculatus</i>	Spotted Etroplus
	<i>Oreochromis niloticus</i>	Tilapia
Mugilidae	<i>Mugil cephalus</i>	Flathead Mullet
Siganidae	<i>Siganus lineatus</i>	Double-barred Spinefoot
Penaedae	<i>Penaeus monodon</i>	Giant Tiger Prawn
	<i>Penaeus indicus</i>	Indian Prawn
Portunidae	<i>Scylla serrata</i>	Mangrove Crab

Two fin fish species namely *Oreochromis niloticus* and *Mugil cephalus* forms the bulk of the catch (Figure 2.10).

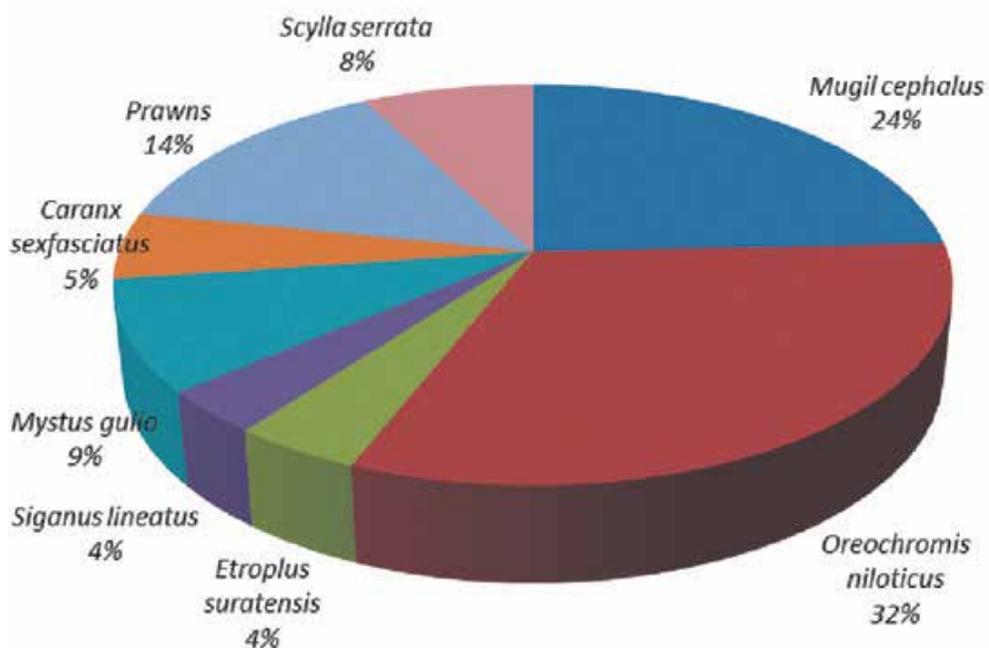


Figure 2.11 – Composition of the fish catch in the Pottuvil Lagoon (Source: EASL)

Catch per unit effort (CPUE) estimates showed that the fish harvest per boat is about 5 Kg (4.86 Kg) during the peak fishing season (ie. between March-August).

Fisheries societies

- There are two fisheries societies operating in the Pottuvil Lagoon:

Society 1: Muslim community – 266 members of which 233 are engaged exclusively in lagoon fishing. They operate from two fish landing sites: Tambatte and Kottukallu.

Society 2: Tamil community – 65 members — all engaged in lagoon fishing, and operating from a single fish landing site: Uraniya.

- There are three main fishing sessions:
 - Overnight (from 6.00 pm to 6.00 am on the following day)
 - Morning (between 2.00 am and 12.00 noon)
 - Evening (from 2.00 pm to 6.00 pm)

Spatial distribution of mangroves

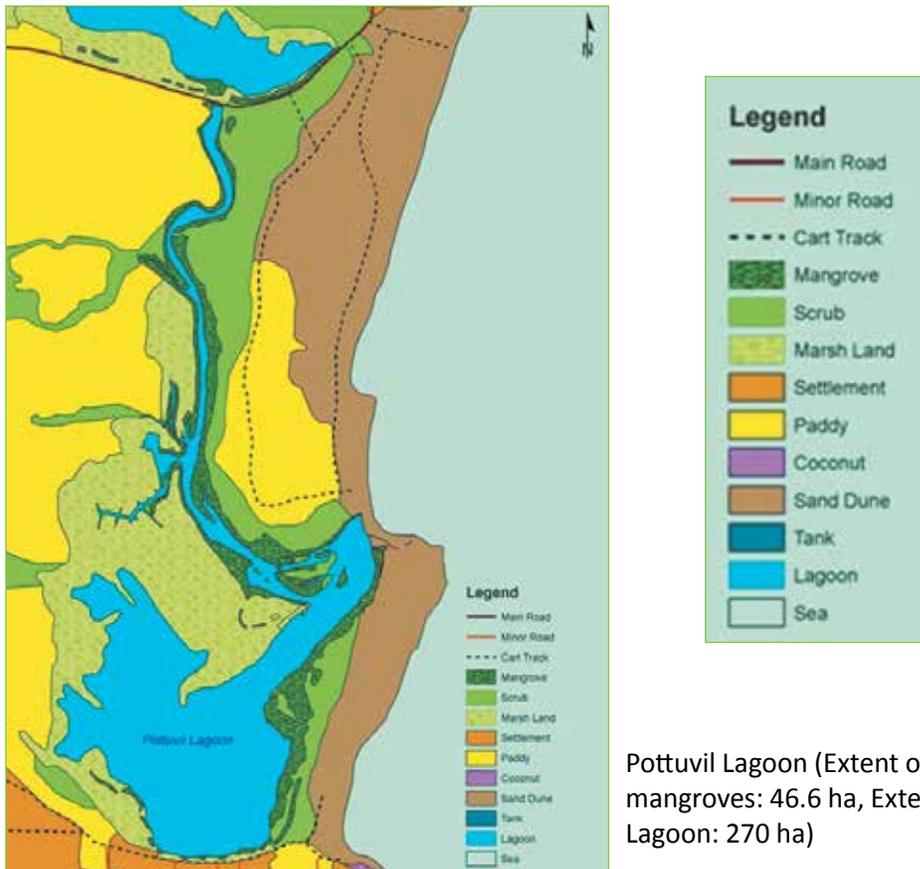
The distribution of mangrove vegetation in the study sites was mapped and their extents estimated (Table 2.6).

Table 2.6 – Extent of mangroves in the study sites

Mangrove site	Extent (ha)
Pottuvil Lagoon	46.6
Heda Oya Estuary (at Sahastrawela	18.5
Ragamwela Creek (near Peanut Farm)	0.9

Kudakalli is a seriously disturbed site and only a few *Lumnitzera racemosa* bushes and *Excoecaria aggalocha* were found scattered in the area. Therefore, the extent of the Kudakalli mangrove was not estimated.

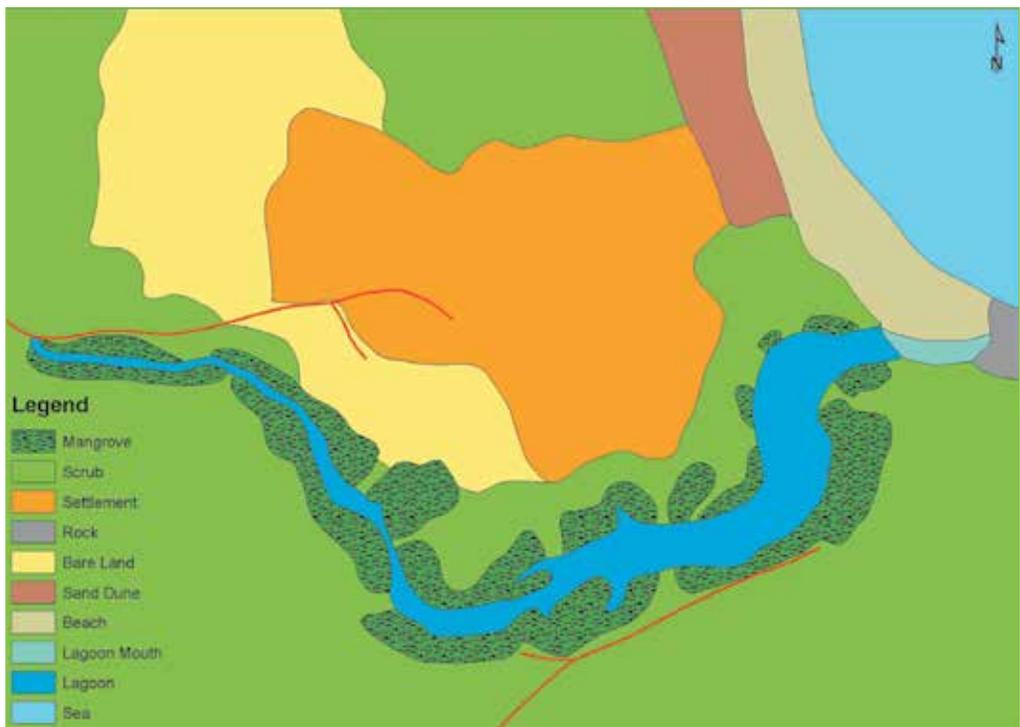
Figure – 2.12 Distribution of mangrove vegetation in Pottuvil Lagoon, Heda Oya Estuary and Ragamwela Creek (Source: EASL)



Pottuvil Lagoon (Extent of mangroves: 46.6 ha, Extent of Lagoon: 270 ha)



Heda Oya Estuary (at Shastrawela)



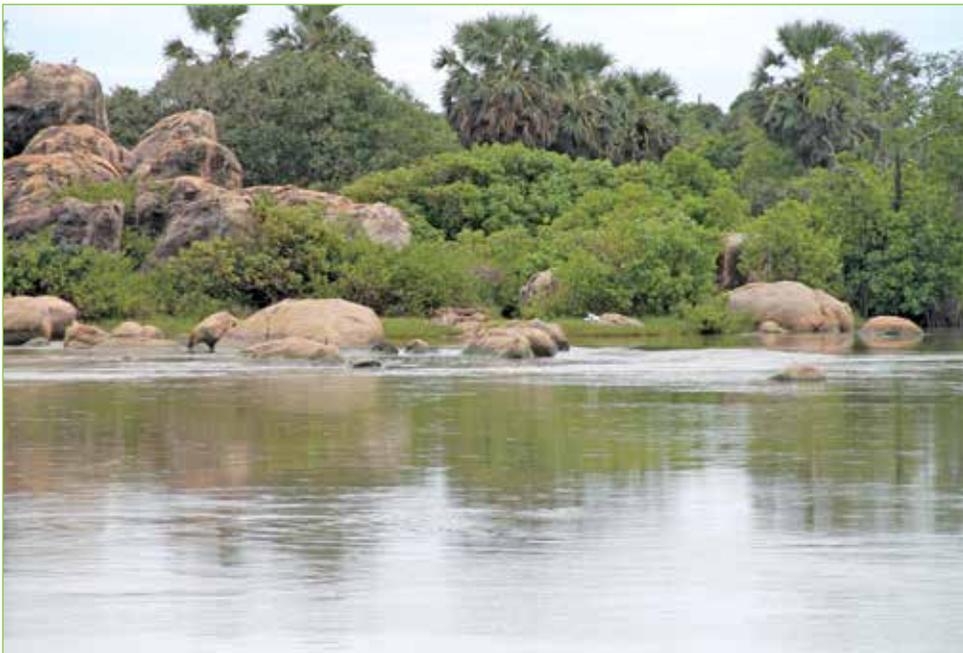
Ragamwela Creek (near Peanut Farm)

Threats to mangroves

Cutting large mangroves (for construction, poles and fuel wood) and land filling were the main threats.

Lessons Learnt:

- Communities living around Pottuvil Lagoon are highly dependent on commercial fishery
- Most communities living around lagoons and estuaries in the study area do not have a clear understanding of the importance of mangroves
- Fishermen understand the importance of mangrove ecosystems to fisheries, but others do not care
- There is no village level or state level protection for the mangrove ecosystems in the sites studied
- A support system for mangrove conservation is needed. This is critical as much development has been planned in the area
- The knowledge generated by this study has enhanced our understanding of the ecology of mangrove communities associated with lagoon/estuarine systems in the Pottuvil-Panama coastal stretch. This knowledge must be utilized in decision making



Mangroves in Pottuvil Lagoon (Kumudini Ekaratne © IUCN)

What has changed or is likely to change

Up-to-date information on the species composition, species distribution, abundance, density and extent of mangroves in the four sites studied are now available.

The unique mangrove patch discovered in Sahastrawela was brought to the attention of the Forest Department (FD) and Coast Conservation & Coastal Resources Management Department, through the NSC. FD is in the process of declaring this mangrove patch as a Forest Reserve.

The knowledge generated from this study was shared with the community to raise their awareness of the importance of these ecosystems. This has enhanced the community's knowledge of the mangroves of the four lagoons and they are now likely to make a conscious effort to protect mangroves.



Fishing in Pottuvil Lagoon (Kumudini Ekaratne © IUCN)

Recommendation:

The prompt action taken by the Forest Department (FD) to declare the 6.5 ha patch of giant mangroves in Sahastrawela as Forest Reserve, under the Forest Ordinance, is much appreciated. A unique partnership has been forged between FD and the Coast Conservation and Coastal Resources Management Department, where the latter is financing the survey and demarcation costs related to the declaration.

2.7 Species diversity and distribution of marine angiosperms from Kalpitiya to Thalaimannar in Sri Lanka (continued from Phase 1 (Cycle 1))



Seagrass survey in progress (Kumudini Ekaratne © IUCN)

Background:

On completion of the study on seagrass distribution in the Puttalam Lagoon in Cycle 1, Phase 2 (see section 2.3), the Department of Oceanography and Marine Geology of the University of Ruhuna secured funding in Cycle 2, Phase 2, to extend their studies further north from Kalpitiya to Thalaimannar along the coastal areas of the Gulf of Mannar.

The Gulf of Mannar is an ecosystem with high biodiversity and is rich in fishery resources. The fishing-dependent population in the Mannar basin exceeds 42,000; an active fishermen engaged in fishing operations is around 10,000. A large number of fishermen from adjacent Puttalam District too operate in this area. Moreover, a large number of people are linked in the fish marketing and processing chains.

Interventions:

Survey of seagrasses

- Selected 14 sampling sites from Kalpitiya to Thalaimannar, representing almost all the coastal habitats in the area
- Seagrass density and species composition were determined from June 2012 to May 2013, using the methodology described in section 2.3 above
- At each site, sea grass distribution, species composition, benthic characteristics and substrate composition were recorded

- At each site, the nature of surrounding habitats (eg: near fishing grounds, near hotel), substrate, anthropogenic impacts and wave action were recorded
- A map showing the distribution of seagrasses was prepared as per instructions in the Seagrass Watch Manual using Geographic Position System (GPS)



Discussion with NSC members during a monitoring visit (Kumudini Ekaratne © IUCN)

Findings & Outputs:

- Six seagrass species (out of the 15 species recorded from Sri Lanka), belonging to five genera were recorded from the 14 sampling sites studied. The two most common seagrass species recorded were: *Enhalus acoroides* (12 sites) and *Thalassia hemprichii* (12 sites). The other species were: *Halophila decipiens* (10 sites), *Halophila ovalis* (9 sites), *Cymodocea serrulata* (6 sites) and *Syringodium isoetifolium* (4 sites)
- Certain anthropogenic activities along the coastline had huge negative impacts on seagrass communities. Disposal of solid waste (mainly plastic, polythene and glass), operating propeller driven fishing boats (damaging seagrass shoots), laying of fishing nets and push net operations on or in the vicinity of seagrass beds, were the main threats that directly and severely impacted on seagrasses
- As seagrass meadows are located close to the shore, they were directly exposed to pollution and sedimentation caused by rainwater runoff
- Over exploitation of fish resources using harmful fishing methods and gear was observed. Extensive sea cucumber collection using divers was also

observed in Mullikulam village. Action should be taken to control this through a proper management program, including the provision of acceptable alternative livelihood options to the fishers engaged in such harmful fishing activities

- A presentation was made at a side event of CBD COP 11 (16 Oct 2012) on *Joint strategy for Conservation of Seagrass in the Gulf of Mannar: Why bother?*
- An article in Sinhala titled: *Present status of seagrass beds in Sri Lanka* was published in the Marine Environmental Protection Authority's annual publication 'SATH SAMUDURA – 2013'.

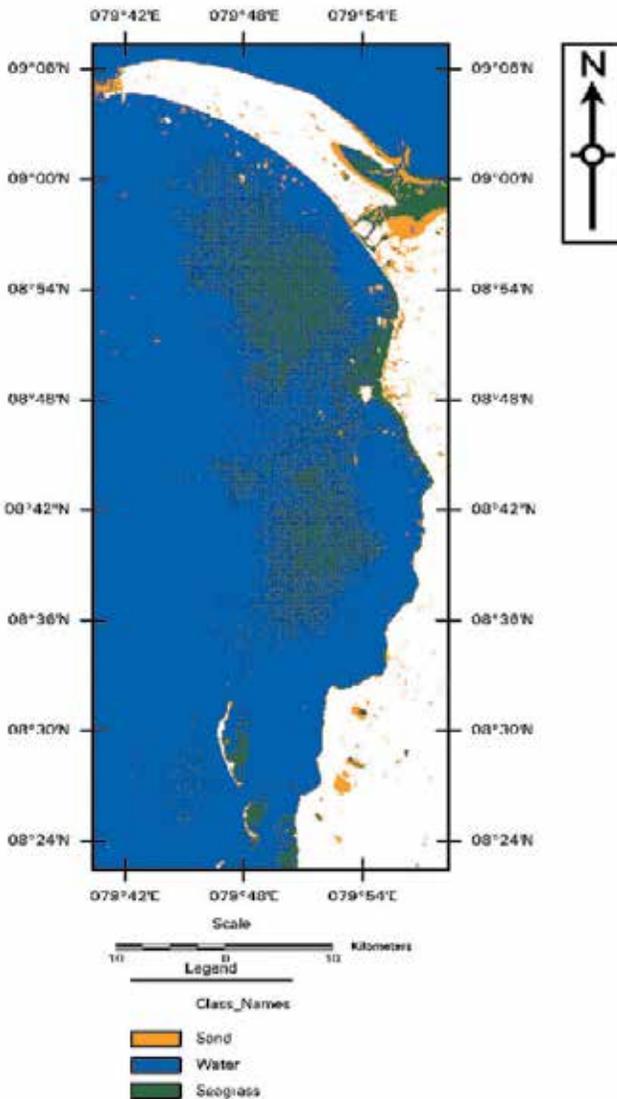


Figure 2.13 – Seagrass distribution pattern in the study area (Source: UoR)

Table 2.7 – Species composition of seagrass recorded by each sampling sites.

	<i>Halophila decipiens</i>	<i>Halophila ovalis</i>	<i>Cymodocea serrulata</i>	<i>Syringodium isoetifolium</i>	<i>Enhalus acoroides</i>	<i>Thalassia hemprichii</i>
1	A	A	A	A	A	A
2	A	A	A	P	A	A
3	A	P	A	P	A	P
4	P	P	A	P	A	A
5	A	P	A	A	A	A
6	P	A	P	P	A	A
7	A	A	P	P	A	P
8	A	A	P	P	A	A
9	A	A	P	P	A	A
10	P	P	A	A	A	A
11	A	A	P	P	A	A
12	A	A	P	P	P	A
13	P	P	P	P	P	A
14	A	A	P	P	A	A

1-Kollankanatta, 2-Kudiramalai point, 3-Mullikulam, 4-Karadikkuli, 5-Kala oddi, 6-Silavathurai, 7-Arippu, 8-Arachchankulam, 9-Vankalai, 10-Thalladi, 11-Thalvupadu, 12-Nadukudah, 13-Kuthirahkuthi, 14-Kaddularan;
(P-Present, A-Absent)



Seagrass survey in Kalpitiya (Kumudini Ekaratne © IUCN)

Flora of Seagrass

Herbarium , Department of Oceanography and Marine Geology,
Faculty of Fisheries & Marine Sciences and technology,
University of Ruhuna, Sri Lanka

Collectors : 1 U. S. C Udagedara

2 J.T De Silva

Locality: Ettalai, Puttalam, South west coast of Sri Lanka

Discription : Ettalai site was located closed to the old jetty at ettali, Puttalam. Both side of jetty was covered with dense seagrass beads. Water turbidity of the site was minimum; well exposed to the direct sun light. Anthropogenic activates were recorded. GPS measurements of this island were N 8 050 30' 5''/ E 79 430 54' 8. During the sampling period, water temperature was ranged from 31.0⁰C- 33.0⁰C; salinity was ranged from 40 ppt to 41 ppt.

Habitat: Ettalai site was located at closed to the old jetty at ettali, Puttalam. Both side of jetty was coved with dense seagrass beads

SEA: Indian Ocean

Country: Sri Lanka

Date: 20.04.2012

Family: A relatively less common species with a cluster of 2-3 dark green leaves attached by a well develop long leaf sheath. Leaf sheath scars form continuous ring around the shoot-annular appearance. The leaf tip is bluntly rounded and sometimes appears slightly heart-shaped to the naked eye. The rhizomes are smooth and clean, devoid of leaf scars between successive shoots.

Name: *Cymodocea rotundata* (Ehrenberg & Hemprich ex Ascherson)

Identify by: U. S. C Udagedara

Identification Date: 25.04.2012

Herbarium Number: OUR/OMG/SE/04



Herbarium sheets

Lessons Learnt:

- Majority of the fishing-dependent population in the Mannar basin are unaware of the economic and ecological value of seagrass and the importance of seagrass to their livelihoods
- Seagrass coverage is in great danger of being diminished due to pollution, fishing and climate change induced factors
- Sri Lanka lacks a common forum for scientists working on seagrasses

What has changed or is likely to change:

The National Herbarium of Sri Lanka has a poor collection of seagrass; the last update was in 1890. This project presented a set of herbarium sheets to the National Herbarium.

A collection of published literature built-up during the course of two projects on seagrasses implemented by the Department of Oceanography and Marine Geology, University of Ruhuna is now available in its library.

The seagrass checklist prepared by the project has been submitted to the Ministry of Environment and Renewable Energy, which is mandated to prepare the National Red List.

The data collected and maps prepared will be made available to the Marine Environment Protection Authority, Central Environmental Authority and Coast Conservation & Coastal Resources Management Department for their reference and information. It is planned to further update these sensitivity maps using the latest information available.

Recommendations

- a) Negative impacts on the diversity and ecology of seagrass ecosystems will ultimately adversely affect the livelihoods of the fishing and coastal communities in the western coast. Hence, to safeguard the health of seagrass meadows in the Kapitiya to Thalaimannar coastal system the following measures should be implemented:
 - o Enhance the communities' knowledge on seagrass through awareness programs
 - o Compile a set of baseline data on seagrass distribution
 - o Introduce a zoning system to facilitate managing the western coast
- b) Conduct research to investigate the impacts of river runoff and its nutrient content on sea grass ecosystems.

3. Education and Awareness

Six of the 32 projects implemented aimed at raising awareness among school children, youth and the fisher community, on environmental issues, with emphasis on the coastal environment. Activities ranged from printing a Mangrove Identification Guide in Tamil, awareness programmes for members of the fisheries cooperative societies, and education programmes targeting school children and youth. Some activities are discussed below.

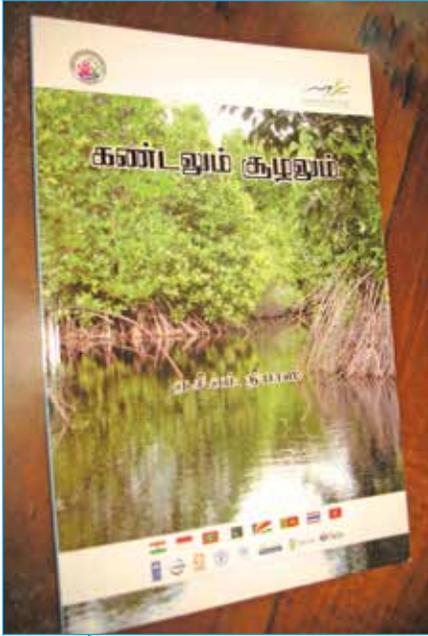
3.1 *Kandalam soolalum* — a Tamil language book on mangroves



Author presenting a copy to the Director General, Department of Fisheries and Aquatic Resources Development at the book launch © IUCN

Background:

Puttalam Lagoon, located on the northwestern coast of Sri Lanka, is the island's second largest lagoon with a mangrove coverage of 338.6 hectares. Of the 24 mangrove species recorded from Sri Lanka, 14 are found in Puttalam Lagoon, including the very rare *Scyphiphora hydrothylacea* (Kalu Kadol) reportedly found only in Puttalam Lagoon. Also found in this region are two other rare species, *Xylocarpus rumphi* (Konthalan) and *Xylocarpus granatum* (Mutti Kadol). The mangroves are threatened by anthropogenic activities such as clearing to construct shrimp farms and felling for fuel wood. Famed for sandy beaches, kite surfing, whales and dolphin sighting, tourism is flourishing in the region and mangroves are being felled to construct hotels. The communities' lack of knowledge on the significance and value of mangroves aggravates the situation.



Kandalam soolalum

Regulations to protect mangroves were in force, but the best way to provide protection is through awareness raising on the importance of mangroves among the very communities that harm this valuable ecosystem. Several publications and identification guides on the mangroves of Sri Lanka are available in English and Sinhala, but hardly any in Tamil. Realising this, the Marine and Coastal Resources Conservation Foundation (MCRCF) moved quickly to rectify the deficiency. Already, a Tamil manuscript written by a nature loving member of MCRCF, a farmer by profession, was available. MCRCF sought funding from MFF SGF to publish it.

Interventions:

- The manuscript was reviewed by a renowned Botanist to validate and endorse the contents
- Printed and distributed 500 copies of *Kandalam soolalum* among relevant organizations and personnel
- Five capable, enthusiastic volunteers/key agents from the area were selected, equipped with mangrove guide materials and trained to identify mangroves. They included the *Grama Niladhari* (Village Headman) of Puthukkuderuppu GN Division of Kalpitiya Divisional Secretariat Division; a senior teacher of Nirmala Matha Sinhala Maha Vidyalaya, Kalpitiya; Presidents of Semuthu and St. Mary's Fisheries Cooperative Societies (FCSs); and a student of Zahira National College, Puttalam, the *Kandalam soolalum* author's son.
- Training programme for the volunteers included field excursions to:
 - mangrove areas from Kalpitiya to Palavi on 3 February 2012
 - Wanathavillu and Gangewadiya on 11 March 2012
 - Kala Oya estuary and Dutch Bay Islands on 29 March 2012
 - Anawilundawa on 7 April 2012
- Trainees were groomed as Field Guides familiar with mangrove and associated vegetation, enabling an alternative livelihood in the tourism industry
- A database was established by organizing and computerizing the collected data; information was shared with other relevant parties
- The database was continuously updated and used as a monitoring tool

Achievements:

- Printing 500 copies of *Kandalam soolalum* and launching the book on 30 December 2011 in the presence of the Programme Manager of MFF Secretariat, Bangkok, Government officials, including directors-general of the departments of Coast Conservation & Coastal Resources Management, and Fisheries & Aquatic Resources Development, IUCN Sri Lanka, principals and teachers of schools in the area, NGOs, CBO leaders and selected community members
- The trained volunteers are using their knowledge in day-to-day activities:
 - *Grama Niladhari* is able to identify mangroves when dealing with land disputes/land development projects and in investigating complaints regarding illegal felling of mangroves
 - The teacher shares his knowledge with his students. Also, being a professional translator the training has enabled him to use correct terminology and species names in his translations. A skilled simultaneous translator, from English to Tamil and vice versa, he now performs with enhanced confidence at mangrove related workshops
 - President, Semuthu FCS who lives in Kudawa, a popular tourist destination, was a mangrove tour boat operator during his spare time. With his newly acquired ability to correctly identify mangrove plants he provides a better service to his clients
 - President, St Mary's FCS lives in Kurakkanhena surrounded by lush mangrove stands that are threatened by anthropogenic activities. His enhanced knowledge has now strengthened his resolve to protect them
 - The student has carried the message on mangroves to his school mates
- The well-established project data base, linked to the MCRCF website, is being accessed by students and undergraduates

Lessons learnt:

- A book on mangroves of Sri Lanka, containing validated information, published in the language of the community, is an indispensable tool to educate communities on the importance and value of mangroves and encourage them to protect mangroves
- Training carefully selected volunteers drawn from the community pays rich dividends

What has changed or is likely to change

With *Kandalam soolalum* and five well trained community members being close at hand, the Tamil community in Kalpitiya has now been enabled to enhance their knowledge on mangroves. Hopefully, thus empowered they will be motivated to protect this unique ecosystem.

3.2 Building capacity of school children as a forerunner to conserving the coastal environment



Awareness programme (Darshani Wijesinghe © IUCN)

Background:

Batticaloa District on the eastern coast of Sri Lanka has been severely affected by a three-decade long civil unrest, as well as recurring natural disasters. Many children live under impoverished conditions and their opportunities for gaining knowledge outside the classroom are very limited.

Heavy dependence on coastal resources, rapid development in the area and a lack of basic knowledge on the environment have already impacted negatively on the coastal ecosystems in the area.

Visura Development Foundation (VDF) realized the need for an intensive awareness programme, as a pre-requisite for other activities, to arrest the degradation of the coastal ecosystems. VDF felt that school children are the best target, as they will, no doubt, transmit the message to the adults.

Interventions:

- A comprehensive awareness programme on the importance of conserving and sustainably managing coastal resources was conducted for 25 junior and 25 senior students of Sri Maman Geswarwar Vidyalaya, Batticaloa
- On field visits to popular tourist beaches in Nilaweli and Pasikudah the students gained first-hand knowledge on well-and poorly-managed areas, and the impact of pollution on coastal ecosystems
- Students were trained in developing project proposals to conserve coastal ecosystems
- An environmental unit, comprising 20 students, was formed in the school to motivate other students in environment-related activities. A small collection of environmental books were presented to this unit
- Art and essay competitions were conducted on the importance of the coastal environment
- Two display boards on coast conservation were erected at the school
- An awareness programme on vegetable gardening was conducted for mothers of the 50 trained students
- Agricultural equipment, vegetable seeds, fertilizers, water pump and water tank were provided and three vegetable plots were established in the school
- An exhibition on the importance of the coastal environment was held in January 2012; children of nearby schools were keen viewers



Agriculture equipment donated to the school © IUCN

Achievements:

- Fifty students enhanced their awareness on coastal ecosystems in the east coast of Sri Lanka and acquired the skills to write and implement project proposals
- Students' knowledge on important tourism areas, close to Batticaloa, was enhanced

- Knowledge gained from project activities was shared with nearby schools by holding exhibitions
- Despite different ethnic backgrounds, the grantees and school children worked in harmony to achieve project objectives

Lessons Learnt:

- A local partner fluent in the language of the local community is vital for successful project implementation
- Children who have a good knowledge on coastal ecosystems excel at conveying conservation messages to parents and elders of the community with a view to changing their attitudes and behaviour

What has changed or is likely to change

The importance of, and need for, conservation of coastal ecosystems have been clearly understood and accepted by the school children in the community — the future custodians of this valuable coastal ecosystem. And they have effectively taken the message to their elders at home.

3.3 Protection of Baobab trees in Mannar Island to promote eco-tourism



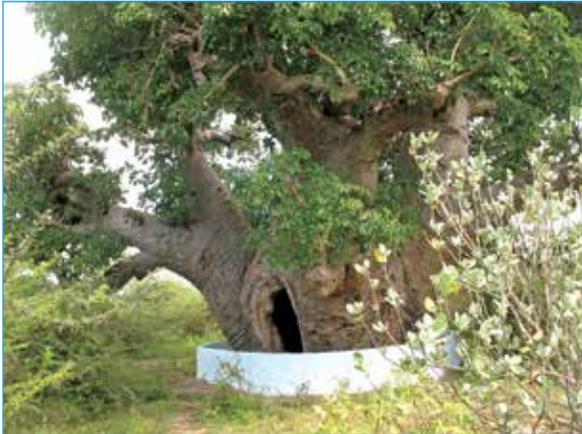
Awareness board © IUCN

Background:

Baobab (*Adansonia digitata*), native to the African continent, is a deciduous tree generally found in arid areas. These trees reach heights of up to 30 m and have swollen trunks, in which they store up to 120,000 litres of water to endure the harsh drought conditions (Wikipedia). Baobab trees are believed to have been brought to Sri Lanka by Arab traders, around 700 AD. The oldest and the largest individual Baobab tree in Sri Lanka, reportedly over 700 years old, is found at Pallimunai in Mannar.

In Sri Lanka, Baobab is now found mainly on Mannar Island; about 30 trees in all and they attract both local and foreign tourists. Baobab trees, owing to their historical value are protected by law, but, the ongoing rapid development, since civil unrest ended in 2009, poses a threat.

Duly concerned, Al-Azhar Fisheries Cooperative Society in Uppukkulam, felt the best solution to overcome this growing threat is to wall off at least a few trees and sought funding for this endeavour.



Walled off tree © IUCN

Interventions

- Ten Baobab trees, to be walled off individually, were selected, and the District Secretariat's approval obtained to undertake construction
- An awareness programme on historical value of Baobab trees in Sri Lanka and the benefits of conserving them was conducted for 30 residents in the vicinity of the Baobab trees
- An officer of the Coast Conservation & Coastal Resources Management Department served as a resource person for this programme
- Brick walls (0.75 m high) were built around ten Baobab trees in Mannar Island
- An awareness board setting out the historical value of Baobab trees, the need to conserve them and the benefits thereof, was installed near each walled off tree

Impacts

- Communities are now aware of the history and importance of Baobab trees
- The protective walls have markedly reduced tree damage, both from humans and foraging animals
- The white painted protective walls and sign boards are attracting some tourists to these trees

Lesson learnt:

Official recognition of the importance of Baobab trees in a tangible and visible manner (protective walls and awareness boards) was a prerequisite to generate community support and promote eco-tourism; legislation *per se* appears to be inadequate. And becoming a tourist attraction has facilitated their conservation.

What has changed or is likely to change

The Baobab tree has earned due recognition from both locals and visitors to Mannar. The need to conserve this historical tree is hopefully etched in the minds of the community and officials responsible for infrastructure development in the area.

3.4 Conservation and sustainable use of coastal and marine resources in the Gulf of Mannar area through raising awareness of the fisher community



Awareness programme for fishermen © Pallimunai Fisheries Cooperative Society

Background:

The Gulf of Mannar lies between the southeastern tip of India and the northwestern coast of Sri Lanka. With a coastline of 222 km (including lagoons) the Mannar District is equally famous for marine fresh fish and dry fish. Fishing is a major contributor to the economy of Mannar District; 38% of the population is involved in the fishery industry, the second major source of livelihoods. The marine fishing area in the district stretches from Thavenpidy to the north, to Mullikulam in the east and Talaimannar to the south. Although the majority of anchorage facilities are damaged or destroyed, there are 29 separate, small fishing harbours spread around the coastline (Wikipedia).

The long-drawn-out civil unrest in the country had a major impact on the fishery in Mannar, but with the dawn of peace in May 2009 fishery is picking up at a remarkable speed.

However, fishermen are engaged in many destructive fishing practices, which impact on the long term sustainable utilization of resources in the Gulf of Mannar. Among them are the use of explosives (dynamite) for fishing (although banned), monofilament (thangus) nets, brush piles for catching cuttlefish, Surukku nets (encircling nets), moxy nets, and SCUBA diving to collect sea cucumber and conch (use of SCUBA gear is not permitted in Mannar). Another serious issue is poaching by Indian trawlers in Sri Lankan waters.

Apart from harmful fishing practices, other environmental issues prevailing in the area are sea erosion compounded by sand harvesting for construction purposes, cutting of mangroves to make brush piles, damage to coral reefs by moxy nets and bottom trawling, damage to sea grasses by trawlers and drift/bottom set nets, and polluting coastal areas (in and around landing sites) by discarding by-catch and fish refuse.

In order to address these issues the Pallimunai Fisheries Cooperative Society initiated action to raise awareness of fishermen.

Interventions:

- Conducted eight awareness programmes specially designed for fishermen
- Conducted eight awareness programmes for students from eight schools in the district
- Officers from the Coast Conservation & Coastal Resources Management Department (CC&CRMD) and Fisheries Department served as resource persons at these programmes
- Printed and distributed 3,000 brochures, targeting fishermen, students and boatmen, on the importance of conserving coastal and marine resources
- Installed five awareness boards depicting the importance of coastal ecosystems

Achievements:

- Enhanced coastal ecosystems awareness among 332 fishermen from eight FCSs. They understood and appreciated how protecting coral reefs, sea grass beds and mangroves will result in enhanced fish catches
- Enhanced coastal ecosystems awareness among 343 school children from 8 different schools — Arippu R.C.T.M. School, Adampan School, Vidaltivu Central School (R.C.T.M.), Nanattan R.C.T.M. School, Talaimannar West School, Thottaweli R.C.T.M. School, Vaddakkandel T.M. School and Musali Muslim School

- 3,000 brochures on the marine resources in the Gulf of Mannar, and the threats they face, printed in the Tamil language were distributed at the awareness programmes
- Five awareness boards with information on coastal ecosystems were erected at strategic locations

Table 3.1 – Schedule of awareness programmes

Programme for schools			Programme for Fisheries Cooperative Societies		
Date	School	Number attended	Date	Fisheries Cooperative Society	Number attended
23.01.2012	Arippu R.C.T.M. School	52	13.02.2012	Thalaimannar	43
06.02.2012	Adampan School	41	25.09.2012	Periyakadai	41
27.02.2012	Vidaltivu Central School (R.C.T.M.)	42	06.10.2012	Achchankulam	41
02.03.2012	Nanattan R.C.T.M. School	42	09.10.2012	Vankalai	42
09.03.2012	Talaimannar West School	42	23.10.2012	Illuppakkadavai	40
16.03.2012	Thottaweli R.C.T.M. School	41	30.10.2012	Erukkalampidy	41
20.03.2012	Vaddakkandel T.M. School	41	13.11.2012	Kondachi	42
26.03.2012	Musali Muslim School	42	27.11.2012	Thevanpidy	42
Total		343			332

Lessons learnt:

Awareness programmes should be followed with field visits to place what was taught in the context of the real world.

What has changed or is likely to change

The mindset of fishermen has been changed; they gave a commitment not to cut mangroves for brush piles. They also pleaded with the resource personnel from the Fisheries Department and CC&CRMD to ensure proper enforcement of the legislation available.

3.5 Raising Awareness about Conservation of Bar Reef Marine Sanctuary

Background:

The Bar Reef, in the Gulf of Mannar, was declared a Marine Sanctuary under the jurisdiction of the Department of Wildlife Conservation in 1992. The Bar Reef Marine Sanctuary (306.7 km²) is the largest of the four Marine Protected Areas in Sri Lanka. Being home to 156 species of coral and 283 species of reef fish, Bar Reef is threatened by many anthropogenic activities such as overexploiting fish resources, utilizing illegal fishing methods (e.g. dynamiting, purse-seining), and pollution from activities such as shrimp farming and agriculture.



Awareness programme © Semuthu FCS

In order to control the threats to this habitat, St Sebastian Fisheries Coop Society, Kandakuliya sought funding from MFF to educate communities living around the Bar Reef Marine Sanctuary (BRMS) highlighting its value and the threats to its habitats.

Interventions:

- Conducted eight awareness programmes for members of Fisheries Cooperative Societies, government officials and tourism service providers
- Printed 4,000 brochures on marine resources in the area
- Erected five awareness boards with environmental messages

Achievements:

- Enhanced awareness among 235 members of FCSs (St Sebastian FCS, Kandakuliya, St Benedict FCS, Kandakuliya, St. Sebastian FCS, Annawasala, St Anthony's FCS, Kandakuliya) through six programmes on the importance of the BRMS and the benefits they stand to gain by protecting it
- Government officials such as the Divisional Secretary and officials of the Kalpitiya Pradeshiya Sabha, the Police, Navy officers, staff of the Department of Coast Conservation & Coastal Resources Management, Urban Development Authority and Sri Lanka Tourism Authority, and school principals enhanced their awareness on the importance of, and the need to conserve, the Bar Reef Marine Sanctuary
- Enhanced the knowledge of 38 hotel owners in the area on the importance of the BRMS and the benefits they stand to gain by protecting it
- Four thousand brochures (2,000 each in Sinhala and Tamil languages) were printed and distributed among school children and fishing communities
- Five awareness boards carrying messages about the value of dolphins, the importance of keeping the coast pollution free, the conservation of mangroves, and the value of coral reefs, have been installed in Kandakuliya, Kudawa and Eichchakaduwa

Lessons learnt:

- Awareness programmes specially designed for fishermen can change their mindsets and divert them from harmful fishing practices
- FCSs are able to successfully implement small grants on initiatives that fall well within their areas of competence

What has changed or is likely to change

The fisher community, government officials and tourism service providers have enhanced their knowledge on the value of the BRMS. Their thorough knowledge of this unique ecosystem and its importance will motivate and enthuse them to protect and conserve their heritage.

4. Ecosystem Restoration

The Small Grant Facility (Phase 1) supported several mangrove planting and 'restoration' initiatives in different parts of Sri Lanka. The highly inconsistent results produced by these initiatives compelled IUCN Sri Lanka to reappraise the mangrove planting initiatives. The reappraisal was based on field observations and deliberations among informed stakeholders in two colloquia. Many of the participants were familiar with the situation in the field.



NSC members reviewing the progress (Kumudini Ekaratne © IUCN)

IUCN Sri Lanka organized the main colloquium in Colombo and a satellite colloquium in Batticaloa. Stakeholder state agencies, academia, researchers, practitioners and policy makers discussed and debated a number of themes relating to mangrove replanting (and 'restoration') procedures, their successes and failures, and possible effects on ecosystem health and productivity. The consensus amongst the participants was that mangrove planting and restoration measures should be scientifically based and take into consideration the inherent resilience of ecosystems to regenerate themselves, with minimal intervention, after natural disasters. The proceedings of the colloquia were published and widely shared.

Accordingly, the NSC decided not to fund mangrove restoration projects, and in SGF Phase 2, financial support was available only for applied research on mangrove

restoration. Hence, there was only one proposal to be considered under the thematic area, ecosystem restoration. This project, which aimed at protecting beaches from wind erosion, is dealt with below.

Planting *Pandanus* trees to arrest wind erosion in the coastal belt of Kandakuliya

Background:

Kandakuliya is a coastal village in the Kalpitiya Peninsula in Puttalam District. This village is bordered by the Indian Ocean on the west and Puttalam Lagoon on the east. This area is often subject to wind and sea erosion that reduces the width of the coastal belt. The situation is compounded by anthropological activities such as sand mining, vegetation clearing and land reclamation. Consequently, the fishing community living in this coastal belt undergo immense hardship. Concerned about their plight, Kandakuliya North Semuthu Fisheries Cooperative Society (SFCS-North) through MFF SGF, implemented a project to plant *Pandanus* trees in the coastal belt of Kandakuliya that will, in time, protect beaches from wind erosion whilst beautifying the coastal belt. They also conducted awareness programmes on the importance of protecting coastal ecosystems.



5 months after planting
(Kumudini Ekaratne © IUCN)



12 months after planting
(Kumudini Ekaratne © IUCN)

Interventions:

- Selected three beach areas (total of 0.37 ha in extent) in Kandakuliya for restoration, in consultation with the members of SFCS-North:
 - Kandakuliya-Kudawa beach
 - near Civil Defense Force Training College, Kandakuliya
 - near Naval Detachment, Kandakuliya
- The land was cleared and prepared for planting from mid-August to September 2012
- Planted 600 *Pandanus* saplings, from October 2012 to March 2013, as follows:
 - Kudawa beach – 225 saplings
 - near Civil Defense Force Training College – 325 saplings
 - near Naval Detachment – 50 saplings
- Erected 600 protective cages to protect the plants from harsh, salt-laden winds. The protective cages were constructed using discarded timber from timber yards and fallen coconut fronds from nearby plantations
- Plants were nurtured and watered regularly by members of the SCFC-North. Water drawn from inland wells had to be transported to the beach by bullock cart; expenses incurred were shared equally by the project and the grantee
- Conducted two awareness programmes: for the fisher community on 15 November, 2012, and government officials and hoteliers on 23 December, 2012. The project outline, importance of coastal ecosystems and threats such as sand mining, effects of wind erosion and the importance of having vegetation in the coastal belt, were explained. Head, Coast Conservation and Coastal Resources Management Department (CC&CRMD) in Kudawa, and Deputy Director of the Ministry of Resettlement were resource persons for both programmes
- Erected display boards depicting the importance of protecting ecosystems at the *Pandanus* plantings at Kudawa beach and Civil Defense Force Training College beach area

Achievements:

- At the end of the project, in September 2013, 83% of the *Pandanus* plants were well established and growing — details are tabulated below:
- Thirty-eight fishermen, from five Fisheries Co-operative Societies (FCS), enhanced their awareness on coastal ecosystems and on the need to minimize anthropogenic threats. The fishermen were from Kandakuliya North Semuthu FCS, St Anthony's FCS, St Anne's FCS, Uchchamune FCS and Kandakuliya FCS

- Twenty-five government officers and hoteliers enhanced their awareness of the project objectives and on the need to conserve coastal ecosystems. The participants included the *Grama Niladhari* (Village Headman), officials from Department of Wildlife Conservation, CC&CRMD, Sri Lanka Navy, Civil Security Training College, Disaster Management Centre, Small Fisher Federation and a few hoteliers from the area
- The display boards at Kudawa and Mune serve as ready sources of information for visitors to the area and passers-by

Lessons learnt:

At the end of the project, 83% of the *Pandanus* plants were well established. The high rate of survival was achieved at a high cost; water for the plants had to be transported to the site from an inland source 3 km away. Why? Because planting was done during the dry season when the wells were running dry. Planting in the wet season is less risky and cheaper.

What has changed or is likely to change

Now, the government officials and fisher community in the project areas understand the value of coastal ecosystems, especially the sand dunes. Communities have refrained from mining sand for domestic purposes.

The attractive display boards are drawing the attention of passers-by and convey important environment messages to a wide audience.

The *Pandanus* plants will need to be cared for and nurtured at least for another year. The plants in Kudawa will be looked after by members of the SCFC-North, while the plants near the Civil Security Training College and Kandakuliya Navy Point will be taken care of by officers of the respective establishments. Hopefully, the green belt will, in time to come, minimize wind erosion.



Display board depicting the importance of protecting ecosystems (Kumudini Ekaratne © IUCN)

5. Livelihood Enhancement

Seventeen of the 32 projects in SGF Phase 2 aimed at enhancing the livelihoods of coastal communities. The projects covered all five prioritized geographical areas and introduced activities such as home gardening, handicraft production, microfinance, traditional mud crab fishery, fish preservation etc. A few selected projects are described in this chapter.

5.1 Home gardening

Fisher families, especially the women, were introduced to home gardening through four small grants projects in Batticaloa and Pottuvil areas. The beneficiaries were trained and provided with seeds/plants and gardening tools to commence cultivating their homesteads with vegetables and fruits. The produce was mainly utilized by the family; any surplus was sold to earn an additional income. A few of these projects are described below.

5.1.1 *Enhancing alternative incomes for fisher families living near Pottuvil Lagoon*

Background:

Pottuvil, on the east coast of Sri Lanka, a biodiversity rich area, is now threatened due to increasing population (resettlement after civil unrest ended), overfishing, mangroves being cut for fire wood and cleared for agriculture and tourism.

People living near Pottuvil Lagoon were victims of the 30-year civil unrest and the 2004 Tsunami. Poverty, lack of proper facilities for education and skill development and poor resource management has made them highly dependent on the lagoon ecosystem.

Considering these facts, Al-Aksha Sarvodaya Shramadana Society realized the need to develop alternative livelihoods that are appropriate for the environment, but are not



Home garden in Hidayapuram (Kumudini Ekaratne © IUCN)

capital-intensive. In pursuance of this objective they established 30 organic home gardens in two villages: Hidayapuram and Thamaraikulam. Increasing the coastal communities' awareness on sustainable utilization of coastal resources in the Pottuvil Lagoon was another aim of the project.



Agricultural tools received by a beneficiary
(Kumudini Ekaratne © IUCN)



Compost bin (Kumudini Ekaratne © IUCN)

Interventions:

- In order to mobilize the project, its activities were discussed with government officials, CBO leaders, religious leaders and other stakeholders in the area in July 2011. This had a positive impact on project implementation
- Thirty fisher families, 15 each from Hidayapuram and Thamaraikulam were selected with the assistance of the *Grama Niladhari* (Village Headman)
- Thirty-eight, including the 30 selected beneficiaries, were trained in home garden techniques in September 2011. The trainer was the Deputy Director, Department of Agriculture. Trainees received a handout titled *Home Gardening Techniques* written in Tamil by the trainer
- Forty-one, including the 30 beneficiaries, were trained in organic farming in November 2011. The trainees received a handbook on *Organic Farming Techniques* written by the trainer

- Beneficiaries were provided with agricultural tools: mammoties, water saving buckets (25 liters), watering cans, rakes, shovels and compost bins in September 2011 and February 2012
- Each beneficiary received 35 brinjal plants, 50 g each of lima bean, tomatoes and green chillies seeds, 100 g each of lady's finger and snake gourd seeds in October 2011
- Beneficiaries were given fruit varieties such as papaya (3 plants), ambarella, guava and orange (2 each) and 1 mango plant were given November 2011
- Beneficiaries were trained in business management, marketing opportunities and financial management in February 2012
- Beneficiaries' progress was monitored with the assistance of the Agricultural Extension Officer



Home garden in Thamaraiikulam (Kumudini Ekaratne © IUCN)

Achievements:

- The 30 organic home gardens are flourishing and producing vegetables and fruits for the beneficiary families' daily needs
- Surplus produce is sold to hotels and vegetable shops in Pottuvil town
- Additional income earned by a beneficiary family averages around LKR 2,600/= per month

What has changed or is likely to change:

- Rural folk, engaged in conventional fishing in Pottuvil Lagoon, have enhanced their awareness and knowledge of home gardening techniques and organic farming

- Beneficiaries' families now enjoy a regular supply of homegrown, pesticide free fruits and vegetables
- Sale of surplus produce brings an additional income to the beneficiaries

Lessons learnt:

- Establishing an organic product sales centre would further promote and facilitate marketing the organic vegetables and fruits produced by the beneficiaries
- Sustainable utilization of natural resources could be further advanced by extending the organic farming system not only to fishermen depending on the lagoon ecosystem but also to farmers engaged in conventional farming
- Tourist hotels in Arugam Bay are potential markets for organic produce. Efforts should be made to develop it by meeting with the tourist hotel owners, along with printed leaflets and posters

5.1.2 Women undertake homestead cultivation in Pottuvil

Background:

Located on the east coast of Sri Lanka, Pottuvil receives only the northeast monsoon rains, from October to January. Consequently, water is scarce and generally, vegetables and fruits are not cultivated in home gardens. The men engage in small-scale paddy cultivation or lagoon fisheries and the monthly household income is very low. Wanasarana Thurulatha Swechcha Society (WTSS) initiated a project, funded by SGF, to develop 50 homesteads using 'bag culture' which requires much less water.



Mobile vegetable stall
(Kumudini Ekaratne ©
IUCN)

The beneficiaries were trained in this novel method of cultivation and also to prepare compost utilizing their kitchen refuse. Each beneficiary was provided with vegetable seeds (brinjal, okra, green chillies and lima bean) and planting material of local yams, papaw and lime to make a start. Home grown vegetables and fruits will provide food security and an additional income from the surplus sold through mobile sales outlets to be established by the project.



Home garden (Kumudini Ekaratne © IUCN)

Interventions:

- The programme was discussed with the chief priest of the mosque, and the project was initiated with his blessings
- The beneficiaries, 50 Muslim women from Pottuvil 5 & 6 areas, were selected following a community survey in May 2011. Selections were made from the low income families earning LKR 2,500-4,500 per month. Main selection criteria were: source of family income, family leader's role, monthly expenditure and savings, nutritional level of children and mother
- Mr. Rahim Abdul was appointed as the Group Leader to coordinate the beneficiaries' work
- The beneficiaries were provided with mammoties, watering cans, polythene sacks (30 each), soil, plants and packeted seed on 24 May 2011
- The beneficiaries were trained in appropriate agricultural practices by the Agricultural Extension Officer in Pottuvil. Four training workshops were held for this purpose

- The first two workshops on home gardening skills held on 4 June and 18 June 2011 dealt with:
 - Home gardening techniques and water conservation (bag culture)
 - Pest control methods
 - Practical training on nurseries and bud grafting
 - Group work on planting, fertilizing and aftercare of grow bag plants
 - Improving the productivity of home gardens
 - Post-harvest technology
 - Practical work on planting
- The third work shop on composting was held on 2 July 2011 and covered:
 - Compost making techniques
 - Practical training on home garden level composting
- The fourth work shop on pest control methods was held on 18 September 2011 and was attended by 30 beneficiaries
- Short-term vegetable varieties such as brinjal, lady's finger (okra), cucumber, radish, green chillies and tomatoes were planted in July 2011
- Beneficiaries were provided with two mobile vegetable stalls. They were accepted by the Group Leader who entered into an agreement with WTSS. Repairs and maintenance of the stalls will be the beneficiaries' responsibility
- The women were encouraged to deposit a percentage of their income in savings accounts in the rural bank

Achievements:

- Fifty women, with no previous experience in tending plants, have been trained as successful gardeners
- Fifty home gardens, using minimal amounts of water, were established
- The family consumes about 25% of the vegetables and fruits produced in the home garden
- Before the project, a family had spent about LKR 3,200 a month on vegetables at the public market. According to a survey by WTSS it is now down to LKR 2,240
- Household income has increased by 30-40% through the sales of surplus produce
- Beneficiaries have opened bank accounts; each woman has deposited at least LKR 500
- Consumption of homegrown, pesticide-free vegetables has reduced malnutrition among the children
- Pottuvil Home Garden Association has been established; it operates a separate bank account at the SANASA Bank

What has changed or is likely to change:

Muslim women who were not used to group work are now enjoying the experience. The project has made an economic impact. Profits from vegetable sales are banked. For the first time in their lives, 50 women have opened accounts in the rural bank. The additional income enables them to pay for their children's extra-curricular activities (violin classes).

Lessons learnt:

- Developing the women's gardening skills paid dividends
- 'Bag culture' method is highly appropriate for the dry zone where water is scarce
- Effective monitoring and guidance from competent agricultural officers ensured project success
- Small grants can achieve a great deal at the community level if the funds are used wisely and carefully

5.1.3 Crop cultivation to improve livelihoods of families in Kirankulam, a village bordering Batticaloa Lagoon

Background:

Kirankulam, a coastal village in the Manmunai Pattu Divisional Secretariat Division, is located 20 km from Batticaloa town. Kirankulam is bordered by the sea on the east, Batticaloa Lagoon on the west, Puthukkudierruppu Village on the north and Ethalai Kulam and Kurkalmadam on the south, and is subject to frequent floods. It was also badly affected by the 30 year civil unrest and the 2004 Tsunami. Sixty percent of the villagers are poor farmers



Homestead vegetable cultivation (Kumudini Ekaratne © IUCN)

who cultivate paddy and highland crops. Well known for cucumber cultivation during the summer, vegetables and coconuts also have a good market in the area. However, they were reluctantly compelled to stop cultivation due to frequent damage by cattle. These lands are not fenced and protected against free ranging grazers; nor do the land owners have the means to erect proper fencing. Social Economic Development Organization

(SEDO), an NGO from the area, stepped in to assist 20 widows to undertake crop cultivation; they were trained and equipped, and most importantly helped to protect their lands from stray cattle.



Homestead vegetable cultivation (Kumudini Ekaratne © IUCN)



Interventions:

- The project was discussed with Manmunai Pattu Divisional Secretary in July 2011 and with his assistance 20 widows were selected as beneficiaries
- The selected beneficiaries' lands, 0.1-0.2 ha each in extent, were cleared and ploughed
- Three training programmes on crop cultivation were conducted, including field demonstrations, by the local Agricultural Extension Officer on 16, 17 and 23 July 2011. The topics discussed were:
 - o importance of vegetable cultivation, vegetable cultivation near lagoons, and food and nutrition
 - o Land preparation, integrated vegetable cultivation, organic fertilizer, and nursery maintenance
 - o Compost preparation, pest control, preparation of natural pesticides, and post-harvest techniques
- Each beneficiary was provided with a set of farm equipment: mamoty, garden rake, watering can and watering vessel in August 2011.
- Each beneficiary was provided with 18 fence posts and a roll of barbed wire in August 2011. The fences were erected by the beneficiaries
- Each beneficiary was provided with 200 chilli, brinjal and tomato plants, and 10 each of coconut, banana and papaya (Red lady) plants in October 2011.
- The home gardens were monitored and evaluated periodically by the Agricultural Extension Officer

Achievements:

- Twenty beneficiaries enhanced their knowledge on crop cultivation through training and field application
- The plots belonging to the 20 widows, totaling 2.6 ha, were cultivated and 3,422 kg of vegetables were harvested from October 2011 to March 2012
- Sales, over the same period, amounted to LKR 417,280 bringing a profit of LKR 308,000. Profit per beneficiary varied from LKR 10,500 to 24,000
- In April 2012, after the project ended, 14 widows opted to cultivate cucumber. Over the 3-month season their income amounted to LKR 330,200; profit per beneficiary ranged from LKR 10,000-38,000.

What has changed or is likely to change:

- Fencing the plots protected the crops from cattle damage and consequently increased yields and profits
- The higher incomes earned have enabled the beneficiaries to have three nutritious meals (with home grown produce) per day, open savings accounts for their children and conduct social ceremonies (weddings) on a grander scale than before

- All family members participated in field operations and nurturing the home garden. This has improved interaction and harmony among family members

Lessons learnt:

Completing the training activities before implementing field operations was crucial for project success. The Agricultural Extension Officer's training and guidance generated greater self-confidence and motivation, which helped beneficiaries to realize their expectation of higher incomes.

5.2 Handicraft production

5.2.1 Empowering women through handicraft production

Background:

Iranawila and Samindugama are two villages in East Iranawila and West Iranawila Grama Niladhari (GN) Divisions in the Mahawewa Divisional Secretariat Division of Puttalam District. Iranawila and Samindugama have a total population of 3,941 in 132 families of which 60% are reported to be illiterate.



*Ekel-based handicrafts produced by a beneficiary
(Kumudini Ekaratne © IUCN)*

There are dense mangroves in the area. These are cut and sold for the construction of dwellings, for firewood and making broom sticks, to bring an additional income for the families. Being illiterate, livelihood options available, especially for women of fisher families, are limited. Although cutting mangroves is illegal, generally the law is not enforced in these areas.

In this context, the NGO Mihikatha Environmental Organization (MEO), which had considerable experience in the area, realized that alternative income generation activities for these families would help in conserving the mangroves.



Blouses sewn by a beneficiary (Kumudini Ekaratne © IUCN)

Interventions:

- Forty beneficiaries (all women) were selected with the assistance of the *Grama Niladharis* (village headmen)
- The project was introduced to the beneficiaries at a meeting held on 15 June, 2011
- Twenty beneficiaries were trained in handicraft production using coconut ekles. Four training programmes were conducted on making waste paper baskets (6 October, 2011), marketing bags (17 January, 2012), office bags (2 February, 2012) and flower vases (11 February, 2012). Coconut estates nearby provided the raw material, free of charge, to the beneficiaries
- Trainees were provided with tools and other material required: knives, scissors, hammers, planks, synthetic cane, thinner, varnish, sealer and nails
- Twenty beneficiaries were trained in dress making. Two training programmes on dress making were conducted on 17 and 25 November, 2011. Basic equipment and material needed for dress making such as measuring tapes, tracing wheels, scissors, tracing paper, etc. were distributed among beneficiaries at the first training session. Training covered sewing a baby shirt, shirt blouse and an A-line frock using blocks
- Beneficiaries were taken on a tour to Odel (designer store), Lakpahana (private handicraft shop) and Laksala (the government handicraft emporium) in March 2012 to expose them to the quality standards required by the market

Achievements:

Additional income earned by a beneficiary from the sale of ekel products and clothing averages LKR 2,500 and 4,000 per month respectively, which increases the family income by about 30-50%. The buyers are both locals and foreign tourists to the area.

- The women trained in tailoring and sewing now sew all the clothes needed by the family thus saving about LKR 2,000 per month. They also take orders from their neighbours to sew clothes
- The awareness raising programmes on the value of mangroves, conducted with MEO funds, have motivated the fisher folk to conserve the mangroves
- Touring the handicraft shops in Colombo enabled the beneficiaries to realize the importance of producing items of high quality to have a ready market. This has motivated the women to improve and maintain the quality of the final product
- Self-employment skills together with awareness programmes motivated the people to avoid extraction of materials from mangrove sites, thereby helping to conserve the mangroves

Lessons learnt:

- Enlisting the support of the GNs in selecting the beneficiaries was a plus factor; if possible, The beneficiaries' collaborative and friendly manner ensured success; healthy competition among them led to high quality products
- Keeping records in the way recommended by IUCN helped to implement the project successfully

What has changed or is likely to change:

The self employment skills acquired by the beneficiaries generated additional incomes. In this context, the awareness programmes motivated the people to conserve the mangroves. The additional income will motivate these empowered women to continue with their newfound livelihoods.

5.2.2 Conservation of rushes and reeds and reviving traditional handicraft production in Pottuvil

Background:

Handicraft production in Sri Lanka is basically a cottage industry where the know-how is handed down from generation to generation. Generally, producers ensure that the raw materials are sustainably extracted from the wild.



Beneficiary using a handloom weaving machine (Kumudini Ekaratne © IUCN)



Beneficiary using a flattening machine (Kumudini Ekaratne © IUCN)



Handicrafts turned out by the beneficiaries (Kumudini Ekaratne © IUCN)

The rushes and reeds (R & R) industry that once flourished in the Pottuvil area declined with the onset of civil unrest. Committee for the People's Rights (CPR) is an NGO from Horana with extensive experience in conserving traditional handicraft production. They sought funding from SGF to revive and conserve the traditional knowledge in Hijra Nagar, a coastal village in Pottuvil, which was hit by the 2004 Tsunami. The project was appropriate as the villagers had some experience and an abundant supply of the raw material, *Cyperus corymbosus* (Peri-peri, Gal-eha) in the area.

Interventions:

- The project was discussed with interested people on 5 May 2011, and 20 women were selected as craft developers/rush and reed weavers. Criteria considered for selection were: permanent residency in the project area, land ownership, family back ground (experience in R & R industry), income below poverty line and interest in R & R cultivation
- A CBO named *Rush and Reed Conservation and Producers Forum (R&RCPF)*, Hijra Nagar was established on 7 May 2011, and registered
- The 20 craft developers were trained on 26 June and 6 July 2011 at the CPR's Training Centre in Horana. Harvesting methods, processing rushes and reeds, introducing new designs appropriate for traditional weaving methods and machine weaving techniques were the main topics covered
- Three handloom weaving machines and one flattening roller were provided to R&RCPF at the end of the training programme
- 25 cultivators (20 women and 5 men) were selected and lands for cultivation were identified on 10 September 2011. Five groups were formed and trained in planting
- Lands were ploughed, live fences built around the plots, compost added and 25,000 reed plants (1000 per plot x 25 plots) planted from 20-25 October 2011. Cultivated plants were; Gal-eha (*Cyperus corymbosus*), wetakeyya (*Pandanus thwaitesii*) and Pathegi (*Caesalpinia sappan*) on 25 October 2011. The live fences comprised of Pathegi or Sappanwood (*Caesalpinia sappan*). Pathegi stems yield a natural dye
- 500 Pandanus plants (20 plants per plot x 25 plots) were also planted

Achievements:

- The craft developers are now earning LKR 4,000-5,000 per month as additional income; they are producing handbags, hats, mats and baskets in various designs
- A total of 1.16 ha of land has been cultivated by 25 cultivators in five groups. The craft products have a ready market in the village. The beneficiary group is planning to construct a shop near the main road to expand their business

What has changed or is likely to change:

Beneficiaries no longer extract rushes and reeds from the wetlands. They grow these raw materials and conserve the habitat. By using weaving machines their production targets are achieved in double quick time. For the first time in their lives, the beneficiaries are members of a Forum and earn additional incomes for their families. This has empowered the beneficiaries and earned them recognition in their villages.

Lessons learnt:

Traditional weavers can be upgraded by introducing new designs (to achieve product diversity) and machines (to save time and increase production).

5.3 Helping Ammathottam fishing villagers

Background:

Ammathottam, is a fishing village located on the western coast of Puttalam Lagoon. Poverty is a common factor among these villagers and malnutrition among the children is rising. Felling of mangroves for firewood and timber, destruction of natural resources due to usage of unauthorized fishing gear and development of prawn farms are threats to this lagoon. Malnourished children can be attributed to the parents' low incomes and ignorance.

Improving the well-being of these fisher families while reducing the pressure on lagoon resources is a formidable task. To meet this challenge, PEARLS (Peaceful Environment Assured Right Lasting Solutions), an NGO in the area, obtained a small grant to develop alternative livelihoods for the community.



*Onion cultivator
(Kumudini Ekaratne ©
IUCN)*



Grocery shop of a beneficiary (Kumudini Ekaratne © IUCN)



Poultry farmer (Kumudini Ekaratne © IUCN)

Interventions:

- Two awareness programmes on coastal management were conducted on 29 May and 24 July, 2011. The Divisional Secretary, Kalpitiya, an officer from National Aquatic Resources, Research and Development Agency, Officer-in-Charge of Kalpitiya Police Station, *Grama Niladhari* (village headman), and an officer from the Forest Department functioned as resource persons. Topics discussed were: importance of protecting mangroves, role of the police in protecting mangroves, harm caused by illegal fishing methods, and community's role in protecting natural resources of the lagoon

- A village Pressure Group to protect the coastal resources was established. Comprised of two men and 11 women, the group met once a month. The members were social activists, school principals and the *Grama Niladhari*
- Training programmes were conducted, on 25 June, 2011, for 100 women on self-employment activities such as home gardening, poultry and goat farming, dry fish making and bee keeping
- A training on preparation of nutritious food was conducted on 31 October, 2011. The importance of nutritious food and a balanced diet was explained
- A micro finance loan scheme for women in self-employment (generating a sustainable income) was established in July 2011. For this purpose a revolving fund of LKR 250,000/= was managed by PEARLS. Loans were given to members of two well established women's organizations in the area namely, Al Haida and Jana Handa Women's Societies, and disbursed in three rounds during the 12-month project period:
 - First round: loans for eight women, amounting to LKR 50,000
 - Second round: loans for 12 women, amounting to LKR 95,000
 - Third round: loans for 13 women, amounting to LKR 105,000
 - On receiving some loan repayments, the grantee provided loans to another nine women
 - Individual loans ranged from LKR 5,000 and 20,000
 - Marketing facilities needed for the beneficiaries' produce/products were identified. Regional and country level markets were found for their produce such as fruits and vegetables



Vegetable stall of a beneficiary (Kumudini Ekaratne © IUCN)

Achievements:

- Women are engaged in self-employment activities — an outcome of the training programmes
- Forty-two loans were given for self-employment activities as follows:

Activity	Number of loans
Dry fish production	5
Poultry farming	9
Goat rearing	11
Vegetable cultivation	5
Yam cultivation	2
Papaw/banana cultivation	2
Weaving palm fronds	5
Vegetable shop	1
Grocery shop	2

- Average profit per activity:

Activity	Average loan size (LKR)	Average profit per activity (LKR)
Dry fish production	5,000	4,000 per month
Poultry farming (meat)	10,000	6,000 per month
Poultry farming (eggs)	10,000	5,000 per month
Goat rearing	10,000 (for 2 goats)	2,500 per goat
Yam cultivation (manioc/cassava)	20,000	20,000 per 5-month cultivation season
Weaving palm fronds	5,000	3,000 per month
Grocery shop	10,000	9,000 per month
Vegetable shop	5,000	6,000 per month

- Generally, the additional incomes range from 40-80% of a fisherman's income; the grocery shop income exceeds it. Income generated is being saved or used for additional needs of children, structural improvements to houses (fixing ceilings) and purchasing furniture
- All beneficiaries have started paying back their loans; some small loans have been fully repaid
- PEARLS use the capital as a revolving fund; gives new loans as the repayments come in
- The micro finance scheme is well established and PEARLS continues to operate it after project closure
- Generally, these communities were not aware of the need for balanced meals, especially for children. After the awareness programme, mothers make herbal porridge and other nutritious food for their children
- The pressure group is vigilant and keeps a look out for those who damage mangroves; culprits are reported to the local police, through the GN

What has changed or is likely to change:

Living standard of loan recipients has been uplifted and the beneficiaries are empowered. A well-managed microfinance scheme is in operation. Except for one failure, loan repayments are in order. In view of the multiple benefits the women will in all probability continue with their newfound vocations.

The Pressure Group is active and vigilant about activities harmful to nature.

Lessons learnt:

To succeed a microfinance scheme needs a committed manager. The operation should be monitored closely and funds disbursed in installments taking into consideration the progress made by the beneficiary and her repayment capacity.

5.4 Aloe vera value-added products

Aloe vera is a multipurpose succulent plant valued as a medicinal herb. The succulence helps it to thrive under low moisture conditions. Two products are extracted from *Aloe vera* leaves: gel and latex. The gel is the base for many modern cosmetics. In recent times, the demand for *Aloe vera* products has increased both locally and internationally.



Aloe vera plantation (Kumudini Ekaratne © IUCN)

In SGF Phase 1, Marine and Coastal Resources Conservation Foundation (MCRCF), through a small grant, introduced *Aloe vera* cultivation as means of livelihood in selected areas in Kalpitiya, near the Puttalam Lagoon. Thirty women of fisher families benefitted from this initiative, and their homestead cultivations are now thriving. Janet Group, a leading cosmetics production company in Sri Lanka continues to purchase their entire harvest.

5.4.1 Community-based production of *Aloe vera* beverage

Background:

MCRCF formulated and successfully tested an *Aloe vera*-based beverage during its SGF Phase 1 cultivation project. In the current Phase 2, MCRCF secured a grant to introduce *Aloe vera* cultivation to another 20 women, with a view to supplying the increasing requirements of Janet Group, and using the excess leaves for beverage production.



Stages of production - from Aloe vera sheath to drink
(© Hasantha Amerasekera, MCRCF)



Interventions:

- *Aloe vera* cultivation was expanded with 20 new beneficiaries:
 - Semuthu Fisheries Cooperative Society, Kudawa – 3 women
 - St. Sebastian Fisheries Cooperative Society, Kudawa – 2 women
 - St. Sebastian Fisheries Cooperative Society, Anawasala – 8 women
 - Eachchankaduwa Rural Development Society, Kandakuliya – 7 women

Selection criteria were the same as in Phase 1:

- o Willingness to participate in the project
 - o Availability of arable homestead land, at least 125 m² each
 - o Availability of water for irrigation
- *In situ* training on land preparation and cultivation was conducted for beneficiaries from Echchankaduwa and Kudawa on 25 July 2011, and Anawasala on 26 July 2011. Basic inputs for cultivation (cow dung and 400 plantlets per family) were provided during the training programme
 - Training programmes on financial management were conducted on 27 and 28 September, 2011. The system utilized in Phase 1 to record day to day expenses and *Aloe vera* planting activities, was introduced to the new beneficiaries
 - MCRCF implemented a buy-back system for the *Aloe vera* harvest and facilitated collecting and transporting *Aloe vera* to the cosmetics factory in Colombo. The sales proceeds, less costs incurred by MCRCF, were remitted to the beneficiaries
 - An *Aloe vera* beverage processing unit, manned by a trained processing assistant, was established at the MCRCF office. Hygienic conditions were maintained in the processing unit, which was regularly monitored by the Public Health Inspector of Kalpitiya
 - Beverage sales were made from a specially turned out tricycle with a chilling facility. It was operated by a previously unemployed person from Kalpitiya
 - The beverage was promoted through leaflets and posters



Tricycle with chilling facility (© MCRCF)



Achievements:

- Fifty women are engaged in homestead cultivation of *Aloe vera*. Each woman sells about 20-35 kg every month to Janet Group for cosmetics production. Beneficiaries received LKR 35-40 per kg from MCRCF (after deducting a 10% coordination fee, transport and incidental expenses). Monthly income ranged from LKR 800-1,400
- The surplus is sold to MCRCF at LKR 33 per kg for beverage production
- *Aloe vera* production details in Phase 1 and Phase 2 (Cycle 1) are as follows:

Period	Number of growers	Number of harvests	Total sold to Janet Group t (kg)	Total Income (LKR)
August 2010 to May 2011 (Phase 1)	30	7	7,560	307,725.74
August 2011 to May 2012 (Phase 2, Cycle 1)	50	10	10,150	393,539.60

The additional 20 beneficiaries have increased the total income by 28%

- Beverage production costs and sales data from 12 February to 24 September, 2012:

Month	Cost of raw materials (LKR) (<i>Aloe vera</i> , sugar)	Transport costs etc. (LKR)	Sales person's income (LKR)	Beverage produced (Litre)	Beverage sold (Litre)	Total income (LKR)	Total Profit (LKR)
February	9,950	1,200	7,800	219	189	24,790	5,840
March	16,500	2,250	14,050	306.5	263	35,350	2,550
April	15,150	2,100	12,950	281	238.5	34,690	4,490
May	18,250	2,422	16,200	342	302	42,250	5,378
June	8,850	1,200	7,800	171	144.5	20,100	2,250
July	Fasting month – no beverage production						
August	2,700	450	2,800	54	45	6,650	700
September	8,150	1,070	7,400	156	128	18,110	1,490
Total	79,550	10,692	69,000	1,530	1,310	181,940	22,698

- The salesperson (tricycle operator) from Kalpitiya), previously unemployed, now earns a monthly income of about LKR 10,000
- MCRCF continues to operate the successful buy-back arrangement after project closure
- MCRCF won the most prestigious environmental conservation/women empowerment SEED International Award for 2011 for its *Aloe vera*-based initiatives
- In view of the positive outcomes, print and electronic media have given wide publicity to these initiatives. A country-wide interest in the *Aloe vera* beverage is now apparent

What has changed or is likely to change:

- The monthly incomes of the beneficiary fisher families have increased by 10-15%
- Five percent of the beneficiaries who were engaged in fishing in the lagoon have completely given up fishing thus reducing the fishing pressure on the Puttalam Lagoon
- The cosmetics production company no longer engages in wild collection of *Aloe vera*. Their requirements are purchased from homestead cultivations, thereby providing livelihoods and also conserving the habitat

Lessons learnt:

- Hygienically prepared, fresh and tasty natural herbal beverages, such as the *Aloe vera* beverage, have a sizeable local market and can be popularized within a short period
- During the dry season when the *Aloe-vera* yields are low, the demand for the beverage is high. This suggests the need for a storable bottled product

5.4.2 Market expansion of *Aloe vera* beverage to enhance the incomes of fisher women

Background:

In the MFF SGF project, described in 5.4.1 above, MCRCF successfully introduced an *Aloe vera* beverage to Kalpitiya Town using a tricycle to make retail sales. In this project, MCRCF expanded the marketing area beyond Kalpitiya Town by using an improved, motorized, mobile selling unit.

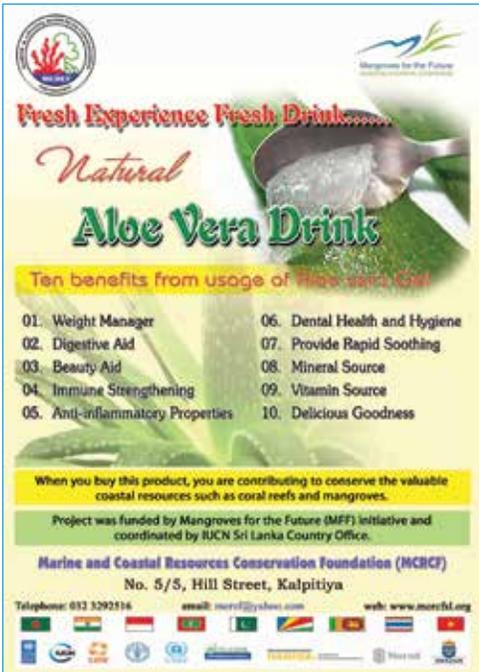


Motorized selling unit (© MCRCF)

Interventions:

- MCRCF purchased a small motorized truck (with own funds) in September, 2012
- A driver and an assistant were recruited from the community and commenced work on 31 January, 2013

- The truck was modified as a long-distance mobile selling unit fitted with cool boxes, dispensers, large containers etc., by end February, 2013
- The existing processing unit at MCRCF office was improved with the addition of a refrigerator, processing table, blender and plastic containers
- Recruited and trained a backup Processing Assistant to cope with the increased production
- Produced 6,000 awareness brochures and 1,000 posters to popularize the beverage



Poster



Leaflet in local language

Achievements:

- The upgraded and refurbished beverage processing unit is now capable of large-scale production
- The beverage truck now travels beyond Kalpitiya Town (more than 30 km)
- Beverage sales increased considerably with the introduction of the truck
- Growers receive a guaranteed price of LKR 33 per kg of leaves sold to MCRCF for beverage production
- Profits from this venture are steadily increasing
- Print and electronic media have given much publicity to this project This has generated a great deal of interest on the cultivation and processing methods

Aloe vera Beverage Sales Record: February-June 2013

Month	Leaf purchased (kg)	Beverage produced (Litre)	Beverage sold (Litre)	Income from sales (LKR)	Production and transport costs (LKR)	Profit (LKR)
February	not available	541	497	91,810	66,994	24,817
March	not available	492.5	448	77,700	60,027	19,540
April	116.5	355	283	50,250	36,765	13,485
May	270.5	375	320	55,985	39,996	15,989
June	226	357	279	49,270	36,420	12,850

What has changed or is likely to change:

Each month, the cosmetics company buys up to 1,500 kg leaf from MCRCF, according their needs. Therefore, before this project was introduced, MCRCF could not buy the entire harvest; only a certain quota from each grower to supply the company requirement. MCRCF still buys leaf for the cosmetics company on a quota basis. However, they buy the entire surplus for beverage production, though at a lesser price. Now, the growers are assured of a reasonable monthly income.

Growers now treat their visitors with the *Aloe vera* beverage, instead of other soft drinks

Lessons learnt:

- During the dry season when the *Aloe-vera* yields are low, the demand for the beverage is high. This suggests the need for a storable bottled product
- There is a great demand for natural herbal beverages. The *Aloe vera* beverage is very popular among educated locals and foreign tourists

5.5 Reintroduction of traditional fishing gear for Mud Crab Fishery in Kokkilai Lagoon

Background:

The Kokkilai Lagoon, located on the northeast coastline of Sri Lanka, is an estuarine lagoon well-known for mud crab (*Scylla serrata*) and shrimp fisheries, as well as other fisheries. About 300 families in the area depend on mud crab fishery. At present, most of them use nylon nets (sometimes even monofilament nets) to catch mud crabs. This invariably damages their claws, especially the most valuable chelipeds, and makes by-catches of small crabs (less than 350 g) and untargeted aquatic fauna. The export market is for live undamaged crabs weighing at least 350 g; there is no market for dead crabs and damaged crabs sell at around half price. Moreover, crabs damage the nylon nets and fishermen need to spend considerable time mending these nets whose durability has also been greatly reduced.



Monitoring the progress by NSC and IUCN staff members (Kumudini Ekaratne © IUCN)

Crabs are purchased from the fishermen and exported to Hong Kong and Singapore by the single exporter P N Fernando, whose collection centre is located near the lagoon. The price depends on two factors: weight of the crab and the state of the pincer. Crabs below 350 g have little or no commercial value. The price plummets by 20-25% if the pincers are not intact or damaged; in fact a 500 g crab with a single pincer fetches the same price as a 350 g crab with both pincers.

Traditional baited crab traps are used in this lagoon by about 15 fishermen. Traditional crab traps are capable of selectively catching mud crabs and avoiding unwanted by-catches. The bait, discarded meat of rays, lures crabs into the trap. As the meat is very hard and consuming it takes a long time, the crabs invariably stay in the trap for a long time. Fishermen lay these floating traps (about 100 each) every morning and return about 5-6 hours later and collect the crabs feeding on the bait. This traditional trap allows the crab to enter and exit without being damaged. The gravid crabs and underweight crabs are released to the lagoon. Others are tied up and taken to the buyer. This method, which is not a wasteful process, is sustainable.

Sevalanka Foundation, realizing the importance of sustainably harvesting mud crabs, provided 32 mud crab fishermen around Kokkilai Lagoon with traditional crab traps to encourage selective crab fishing.



Beneficiary with his crab traps (Kumudini Ekaratne © IUCN)

Crab caught by a trap (Kumudini Ekaratne © IUCN)



Interventions:

- First of all, in June 2012, clearance for the project was obtained from the Ministry of Fisheries and Aquatic Resources Development
- Selection of beneficiaries was completed by 10 July 2012; 17 from Kokillai and 15 from Karnaterkerney and Allampil villages. Kokkillai fishermen use mechanized boats while the others are traditional canoe fishermen

Kokkillai village is situated close to the lagoon mouth where the rapid movement of water prevents the use of canoes. Karnaterkerney and Allampil villages are situated away from the lagoon mouth where traditional canoes can be used for fishing

- An awareness programme on coastal ecosystems services in Kokkilai Lagoon area and sustainable utilization of resources was conducted for the selected beneficiaries on 22 July, 2012. A few others from the Kokkilai Lagoon fishing community also attended the programme
- Another awareness programme for the 32 beneficiaries, on 23 July, 2012, focused on the basic biology of mud crabs, and the importance of sustainable harvesting of mud crabs, and target fishery
- Distribution of materials required to assemble 3,200 crab traps (galvanized rods, cotton netting, nylon rope and buoys) commenced on 30 August 2012. The fishermen's request for galvanized rods instead of iron rods for the trap frame was accepted. However, insufficient stocks of galvanized rods in the area and high prices led to some delay. Fourteen fishermen constructed their traps by November 2012. The other beneficiaries, who were trained in the meantime, fabricated the traps on their own, supervised by the Field Officer of Sevalanka Foundation, by end February 2013
- Beneficiaries were trained in record keeping on 12 September, 2012, using the grantee's own funds



Crab caught by a trap (Kumudini Ekaratne © IUCN)

Achievements:

- Beneficiaries are now using the traditional traps. The average monthly income per fisherman, before and after using traps, is LKR 6,000 and LKR 10,000 respectively

- Average monthly income of the fishermen from Karnaterkerney and Allampil, who use canoes, increased by 30-40% while the increase for Kokkilai village fishermen was 10-15%. The lower increase in income for the Kokkilai fishermen is due to the fuel cost for their motorized boats
- Use of traditional traps has reduced wastage of fishery resources-no more by-catches. Selective harvesting facilitated by the traps enable the fishermen to throw the underweight or gravid crabs back into the lagoon
- Daily sales records are maintained by the beneficiaries

What has changed or is likely to change:

The fishermen are now aware of the importance of coastal ecosystems. They no longer cut mangroves for fuel wood; dried branches and twigs are used instead. They have understood the biology of mud crabs and release the gravid crabs found in the traps thus reducing threats to mud crab stocks.

The beneficiaries enter daily sales records in the record books provided by the project. This helps them to keep track of sales and manage their income.

Most importantly, the crabs are caught without any damage to pincers. This enables fishermen to get higher prices from the exporter — LKR 900 for a 500 g crab with both pincers intact.

The additional income has uplifted the beneficiaries' living standards as reflected by the purchase of basic household furniture, gas stoves, tuition classes for children, improvements to dwellings and paying back loans taken from the village money lender.

Lessons learnt:

- Reintroduction of crab traps can enhance incomes and living standards of the fishing communities around Kokkilai Lagoon
- Experience and practical judgement of the fishermen helped in improving project activities
- It is best not to depend entirely on the beneficiaries for record keeping, if reliable and comprehensive data is needed. Hire a person to keep records

Fishermen's experience and practical judgement — guiding the Project Manager ...

When the fishermen learnt that iron rods will be used to fabricate crab traps, they informed the Project Manager that galvanized rods are more durable and worth the additional investment.

Similarly, when cotton netting with thick thread was to be used for making the traps, as it is more durable, the fishermen cautioned the Project Manager — nets with thick thread will hold up and support big crabs and enable them to walk quickly and escape from the trap.

5.6 Improving the living standards of 20 fisher families in Naguleliya Village

Background:

Naguleliya is a remote coastal village in Arachchikattuwa DS Division in the Puttalam District. The village occupies a strip of land 1 km long and 200 m wide on the Muthupanthiya land projection between Chilaw Lagoon and the Indian Ocean.

There are 20 fisher families, with a total population of 86, living in extreme poverty in Naguleliya, a village devoid of any infrastructure facilities. Most of the fisher people engage in lagoon fishing as they cannot afford the fishing gear needed for fishing in the sea. Fisher families receive a fair income during the fishing season but due to their illiteracy and lack of household management skills, most resources are wasted.



NSC members in discussion with the beneficiaries (© WWSE)

Wilpotha Women's Savings Effort (WWSE) secured a small grant to focus on building people's economic power by promoting income generation activities, self-help development programmes, and formation of a community-based organization for sustainability and collective action to overcome their burning issues.

Interventions:

- A socio-economic survey was carried out in the village in August 2012 by WWSE and the results were presented to the villagers. They had identified the problems and issues facing the community

- WWSE mobilized the community to form a women's organization, and 19 fisher families set up an independent Women's Organization named Rosa Kusum Fisher Women's Society (RKFWS) to address their issues. They wrote down the issues and posted the list on the church wall. They also identified the issues that could be tackled by themselves, and those needing outside assistance and support
- On 18 August, 2012, 15 members and 20 children of RKFWS visited the WWSE office in Wilpotha to meet, discuss and learn from the experience of WWSE members which, no doubt, sharpened their knowledge. The visitors observed the income generation activities promoted by WWSE and learnt how most of these activities are conducted



*Training in using a sewing machine
(© WWSE)*

- Training in dress making
 - The first 10-day training programme, attended by 10 women, was conducted in September 2012. The younger trainees had not used a sewing machine before and were thrilled with the opportunity to operate one. As it takes time to acquire this skill, they did most of the sewing by hand. Basics of dress making, needle work and peddling the sewing machine were some of the topics covered
 - The second 10-day training programme, attended by 12 women, took place in October 2012. Meanwhile they had developed the skill to operate a machine. Needle work, cutting cloth to make children's dresses, sewing pillow cases, table cloths etc. were the topics covered in this programme



Trainees in fabric painting with their Trainer (© WWSE)

■ Training in fabric painting

- o The first 2-day training programme was conducted on 08 September, 2012 (attended by 12 beneficiaries) and on 15 September, 2012 (attended by 10 beneficiaries). Fabric painting was a completely a new experience and they appreciated it very much
- o The second 2-day training programme was conducted on 04 and 23 October, 2012, attended by 12 beneficiaries. The trainees, especially the young girls, showed a keen interest in learning the new techniques in fabric painting. In addition to fabric painting, they were trained in painting earthen pots and flower vases



Coconut seedlings being distributed (© WWSE)



Pillow cases produced (Kumudini Ekaratne © IUCN)

- Training in dry fish and Jadi production (local method of fish preservation) — 17 women were trained on 26 November, 2012. In addition to Jadi production, they were trained in Maldive fish and fish chutney preparation enabling them to commence operations in the next fishing season starting in January. Jadi, Maldive fish and fish chutney has a niche market with a high demand, especially for Maldive fish and Jadi
- Training in basic bookkeeping — Five RKFWS members were trained on 20 and 21 September, 2012. Training covered accounts keeping, maintaining books/records, record keeping on membership collection, preparation of signature lists, passbooks maintenance, ledger, expenditure statements and maintenance of the minutes book
- Training in home gardening — 20 women were trained on 10 October, 2012. Soil preparation techniques and preparation of organic manures were among the topics covered. On 08 November, 2012, the 20 beneficiaries were provided with basic garden tools and with seeds/seedlings of lima beans, luffa, lady's fingers, pumpkin and Indian spinach to be cultivated in their home gardens
- Training in coconut planting — 20 families were trained on 15 November, 2012. After being trained each family received five coconut seedlings from a highly reliable and approved nursery, along with coconut husks and fiber needed to prepare the pits to plant the seedlings
- Two workshops on protecting the environment and mangroves were conducted for the villagers on 14 and 28 August, 2012. Although, Naguleliya villagers do not damage mangroves, they discussed the importance of mangroves, and how the ecosystem and the natural breeding of fish will be affected in case mangroves are damaged
- The 20 families in Naguleliya were provided with energy saving hearths and trained on how to use them

Achievements:

- With the knowledge gathered from their discussions at Wilpotha, the beneficiaries identified the income generation activities they could initiate with the existing facilities at Naguleliya
- Items such as baby shirts, children and ladies garments, pillow cases and curtains stitched by them are used at household level. One woman bought a secondhand sewing machine and takes sewing orders and earns about LKR 2,000 per month
- The young beneficiaries are quickly developing their skills and now paint pillow cases, skirts, children's dresses etc. for use at household level. The finished products, though much improved, are yet not up to a marketable standard. A table cloth and other decorative items produced by these women have been donated to the village Church
- Dry fish and Jadi prepared by the trained women is of good quality and are presently consumed at household level. Their product is to be marketed soon at village fairs. Part of the income will be used to buy more fresh fish when the price is low and increase Jadi production
- Energy saving hearths have reduced fuel wood usage considerably
- Divisional Secretary of Arachchikattuwa, has arranged for Naguleliya women to attend a dressmaking class (funded by his office) at Muthupantiya, the adjoining village. Eight ladies are already following these classes

What has changed or is likely to change:

The project facilitated the formation of a women's society, named Rosa Kusum Fisher Women's Society. This society is very active and looks after the interests of the 20 families in Naguleliya.

The women are now empowered and are engaged in decision making. They act in a transparent manner and follow accepted rules and regulations.

Large-scale fishing operators, from other villages, were using tractors to haul beach seines causing serious beach erosion. The empowered women of Rosa Kusum Fisher Women's Society made representations to the Arachchikattu Divisional Secretary and succeeded in stopping this activity completely.

The women are now recognized and respected in the community.

Lessons learnt:

- In future, distance to a project site from grantee's office and accessibility must be assessed before commencement
- With a proper approach and attitude, it is possible to influence the thinking of the villagers and bring about some upliftment to their living standards

5.7 Fish preservation by dehydration as a livelihood option for fisher women in Panama

Background:

The Panama communities are among the most marginalized tsunami and conflict-affected coastal communities. Fisheries and agriculture, both seasonal activities, are their main sources of income. During the high season when fish is plentiful it fetches a low price, and at times it even goes waste.



Fish ready to be dehydrated (Kumudini Ekaratne © IUCN)

The womenfolk are engaged in sun drying the excess fish. Sun drying fish is a labour intensive process, subject to losses due to fickle weather conditions. As the process is difficult to control the end product is of variable quality and subject to microbial contamination. All in all, sun drying is an expensive process.

In this project, the Green Movement of Sri Lanka (GMSL) introduced a fish preservation method, using dehydrators, to 30 women beneficiaries from Abeyesinghapura and Shastrawela villages. Dehydrators are fuelled with saw dust; electricity is used only to kick-start the process. Less salt is used in this process and the end product is free of grit or sand that usually contaminates sun dried fish. The dehydrators create a stable drying environment that is not dependent on human and natural factors, and the production cost over time is reported to be 20% lower than sun drying. Dehydrated fish could be stored for home consumption or sold at a high price in the lean fishing season.

Interventions:

- Selected 30 women beneficiaries; 15 each from Abeysinghapura and Shastrawela villages
- Training on fish preservation using dehydrators was conducted by the Program Manager, Food Sovereignty and Sustainable Agriculture Programme of GMSL on 1 November, 2012 for the Shastrawela beneficiaries, and on the following day for the Abeysinghapura beneficiaries. The training focused on preparing the fish for dehydration and on how to operate a dehydrator to produce a high quality end product
- One stainless steel dehydrator was installed for the Sahastrawela beneficiaries on 1 November, 2012. On 20th January, 2013, two dehydrators were installed in Abayasinghapura as their fish harvests are much larger, and the beneficiaries were divided into 2 groups to receive the dehydrators. MoUs on the acceptance of dehydrators were signed between GMSL and the leaders of the three groups
- On 21 January, 2013, each group was provided with a set of processing equipment comprised of a chopping knife, sieves/net spoons, 2 storing baskets and saucepans, and a polythene sealer. All items have been inventoried
- All beneficiaries were trained in operating and maintaining the equipment on 21st January, 2013
- During the project period three dehydrated samples were sent to the Chemical & Microbiological Laboratory of Industrial Technology Institute (ITI) in Colombo for testing in March, June and July 2013. Parameters tested were: sulphide test, aerobic plate count per g, coliform count (MPN) per g, salmonella per 25 g, histamine mg/kg, and sodium chloride percent by mass. As advised by IUCN, the third sample was sent along with a sample of dry fish bought from the market
- The products were introduced to the market after testing for microbial contamination, nutritional value, and determining expiry dates



Dehydrated fish (Kumudini Ekaratne © IUCN)



Cooked product (Kumudini Ekaratne © IUCN)

Achievements:

- 30 women continue to process dehydrated fish under hygienic conditions; their product has a high demand
- Monthly income of a beneficiary ranges from LKR 1,300-2,600 and household income has been increased by 25-30%
- Some items the beneficiaries purchased with the additional income were: a porcelain dinner set, six plastic chairs, a mattress (on hire purchase), ladies bicycle, and utensils for a string hopper business. One beneficiary used the income to admit her son to a computer training course
- The grantee (GMSL) sells the dehydrated product, on Thursdays, at Diyatha Uyana “Good Market” in Colombo
- ITI tests showed that the dehydrated fish was not contaminated with salmonella or coliform bacteria and suitable for consumption. NaCl content of the dehydrated fish was only 5% of that in a dry fish sample from the market. The tests also revealed that the histamine content of dehydrated fish was 13 mg/kg while that of the sample from the market was 15 mg/kg



Dehydrator in Shastrawela (Kumudini Ekaratne © IUCN)

Sealing the packets (Kumudini Ekaratne © IUCN)



Finished product (Kumudini Ekaratne © IUCN)



Dehydrating process:

Clean and cut fish in to 4x1cm pieces. Put them into a stainless steel sieve and dip the sieve into boiling salted water. Then drain and spread the fish evenly on the trays in the drier.

The drier can take 15-25 kg of raw fish. Optimum load is 15 kg, which will take 4 hours to dry; 25 kg will take 6 hours.

What has changed or is likely to change:

The women are now able to process fish under hygienic conditions. 15 kg of raw fish can be dried and readied for marketing in just 4 hours. Sun drying the same quantity would have taken 3 days. The dehydrated fish products contain less salt than the sun dried fish available in the market.

Lessons learnt:

- Paddy husk was not suitable as a fuel for the burners of fish dehydrators; it produced a bad odour and affected the quality of the dehydrated fish. On the other hand, sawdust proved to be an excellent fuel and improved the quality of the product
- At the time the project commenced it was the lobster season — the community was engaged in harvesting lobsters and were not fishing. Beneficiaries used the small fish found in lobster pots to become familiar with the use of the new machines and thereby saved project time
- As tests to determine food quality are expensive indiscriminate testing is not affordable. Master the technique of using the dehydrator and producing a quality end product before sending samples for testing

6. Lessons Learnt in the MFF Small Grants Facility

Lessons learnt from Phase 2, Cycle 1 and 2 projects are many. The National Secretariat is richer for its experience in dealing with 32 grantees over a period of nearly 30 months. Likewise the grantees also enhanced their knowledge during the course of the programme. This chapter presents the lessons learnt both at the managerial and operational levels. The latter were captured at the two lessons learned workshops held on 9-10 July, 2012 and 7 May, 2013, from technical progress reports and during field visits.



Lessons learnt workshop on 9 July 2012 (Kumudini Ekaratne © IUCN)

6.1 General considerations including managerial issues

- a) In the current phase, the shortlisted project proponents were provided with training in Project Cycle Management (PCM). The PCM workshops, conducted by the Regional Secretariat of the Mangroves for the Future, enabled them to develop well focused full proposals that targeted the actual issues/problems they had identified in the pre-proposals. The importance of a results-based approach and reporting was also emphasized during the training.

The proponents valued the PCM training which provided them with the foundation to develop and effectively implement results oriented activities. Also, the grantees being well-trained, no doubt, eased the Secretariat's task of results based monitoring of small grants.

- b) The PCM workshops not only enhanced the proponents knowledge of proposal development and PCM it also provided them the opportunity to form a network of organisations interested in coastal ecosystem management, and in IUCN's work.



Lessons learnt workshop on 9 July 2012 (Kumudini Ekaratne © IUCN)

- c) Regular field visits were made by the National Secretariat staff along with NSC members. These interactions helped a great deal to maintain the tempo of the programme and to develop a close rapport with the grantees.
- d) Grantees presented their progress, against the agreed timelines, at mid-term review meetings. These progress reviews were found to be useful, and the grantees took pride in presenting the progress to the very committee that approved their projects. During these meetings they also had the opportunity to interact with the NSC members and discuss problems related to their projects and seek guidance.
- e) Often, the grantees' perception of timelines for projects was unrealistic. This led to delayed delivery of outputs and impacted on fund disbursement.
- f) Generally, LKR 500,000-750,000 was adequate to successfully complete community level tasks, but not for research activities.

- g) A twelve-month project period was not adequate for the ecosystem restoration project. The plants require at least another year's attention before the sustainability of project outputs could be assessed. It is hoped that the grantee (Semuthu Fisheries Cooperative Society) will maintain the plants and fill gaps, as necessary.
- h) As in Phase 1, most of the grants (more than half) were awarded for projects aiming to enhance environmentally sustainable livelihoods. These projects achieved commendable results; the percentage increase in incomes ranged as follows:
- o Home gardening: 30-40%
 - o Crab fishing: 10-40%
 - o Handicraft production: 30-50%
 - o *Aloe vera* cultivation: 10-15%
 - o Dehydrated fish production: 25-30%
- i) Unlike in Phase 1, project proposals were received for research activities (Knowledge generation). Five proposals were from universities and three from NGOs. Of the latter group, the principal investigators of two projects were academics. The outcomes were very rewarding: the findings of two studies (*Panama aquifer system study* and *Survey of seagrasses in Puttalam Lagoon*) were published in scientific journals; water quality distribution maps prepared by the *Panama aquifer system study* were used by a private bank to identify suitable locations to construct drinking water wells for the community; the discovery of a unique 6.5 hectare patch of mangroves in Shastrawela during the *Survey of mangroves in the Pottuvil-Panama stretch* - Forest Department is taking action to declare it as a Forest Reserve; and the *Panama Lagoon water quality study* led to leveraging funds from a foreign university to further expand the research.
- j) Fisheries Cooperative Societies (FCS) secured grants for awareness raising among their communities. Of the six projects on Education and Awareness, three were implemented by FCSs. It was pleasing to note the high level of keenness displayed by them to enhance the knowledge of their fellow members; two FCSs were from Mannar area which had undergone immense hardship due to civil unrest, which ended in 2009.
- k) Projects implemented with adequate planning and proper coordination achieved good results. Project success was directly related to the commitment of the leadership. Weak leadership brought about problems that ranged from poor implementation of the agreed work plan to financial irregularities.

- l) Projects should aim to bring substantial tangible benefits to local stakeholders.
- m) Sustainability of results and outputs were evident in projects implemented with community participation. In such instances, the community accepted the ownership even during the project implementing period as they realized the benefits were for their community. Therefore, they made an extra effort and diligently helped to implement project activities. In doing so, they gained experience and by the end of the project period they were able to continue with project activities without the presence of the donor.
- n) Collaboration with Local Authorities (LA) and relevant institutions is indispensable for the success of the programme. Introducing the project to LAs at the outset and moving forward with their blessings enabled grantees to overcome many obstacles. For example, the beneficiaries in home gardening projects were selected in close consultation with the *Grama Niladhari* who was aware of the social status of the families in the area. This enabled a fair selection and also prevented possible allegations of favouritism being leveled at the grantee.

The Zonal Education Department's permission is required for projects involving school children. In such instances, local officials extended their fullest cooperation to obtain the necessary clearance promptly, so that the activities could be implemented according to project timelines.

Collaboration with LAs was also extremely valuable for research projects as the principal investigators were outsiders. It is important for principal investigators to introduce themselves, the project and the team members to the relevant local officials. If not, the sight of strangers collecting water samples or carrying out mangrove and sea grass line transects is likely to arouse unfounded suspicions.

- o) It is best not to depend entirely on the beneficiaries for record keeping. When reliable and comprehensive data is needed, hire a person to keep records.
- p) All projects should have an effective exit mechanism to ensure sustainability of the project outputs. The grantee should ensure a smooth transition from a donor funded to self-sustaining operation.
- q) Small grants can achieve a great deal at the community level if the funds are used wisely and carefully.
- r) It is even possible to progress from successfully completing a small project (See section 2.5) to leverage funds from other sources to expand further.

6.2 Specific lessons learnt

The important lessons learnt during project implementation are listed below. They are grouped under the four thematic areas covered.

6.2.1. *Generating Knowledge*

Mangroves

- a) Improving the knowledge base on mangroves through research will certainly help in improving management.
- b) With the on-going development activities in the east coast, there is a grave danger of mangrove areas also being cleared. Therefore, the boundaries of mangrove areas in this region must be demarcated clearly.
- c) There is no village level protection for the mangrove ecosystems in the sites studied. A support system for mangrove conservation is needed. This is critical as much development has been planned in the region.
- d) Most communities living around lagoons and estuaries in the study area do not have a clear understanding of the importance of mangroves.
- e) Fishermen understand the importance of mangrove ecosystems to fisheries, but others do not care.
- f) The knowledge generated by the two studies on mangroves has enhanced the understanding of the ecology of mangrove communities associated with lagoon/estuarine systems in the Pottuvil-Panama coastal stretch. This knowledge must be utilized in decision making.

Water quality

- g) Water quality of the Panama Lagoon is highly dependent on the existing weather conditions.
- h) Salinity of Panama Lagoon is very low in most parts of the year, indicating that the effect of sea water on the lagoon was minimal.
- i) Effects of season and runoff are the major factors that control the variation in water quality of Panama Lagoon; however human activities are interfering with this cycle.
- j) Reliable and regular data on groundwater quality is invaluable for the relevant agencies.

- k) Raised awareness and prioritization of water quality management across the region is important.

Seagrasses

- l) Seagrass coverage is in great danger of being diminished due to pollution, fishing and climate change induced factors.
- m) The importance of seagrass beds in terms of economic and ecological values is poorly recognized. Fishermen were not aware of the services provided by seagrass beds to fishery by way of feeding, breeding and nursery grounds for many commercially important fin-fish and shellfish. Seagrasses also act as a filter — clearing and cleaning coastal waters. Educating the community on these matters will motivate them to effectively conserve seagrasses.
- n) Lack of herbarium sheets of seagrass species in the National Herbarium is a major shortcoming. It is hoped that herbarium sheets prepared by the project would fill this void.
- o) Sri Lanka lacks a common forum for scientists working on seagrasses. Seagrasses are under threat due to various reasons. A forum to address these issues and alert the relevant authorities will be more effective than the efforts of individual scientists.

Tourism industry

- p) Due to the high demand for land, generated by the rapidly developing tourism industry, the mangrove ecosystem is in imminent danger. Disastrous consequences could be averted if the natural boundaries of these important ecosystems are clearly demarcated.
- q) A planned approach to develop tourism should be adopted. Haphazard development is likely to damage natural assets and threaten the sustainability of the industry, as well, which is heavily dependent on the natural environment to attract tourists.
- r) Officials handling a specialized subject such as tourism need training to build their capacity. Skill levels and management capabilities of those engaged in providing tourism services and facilities need to be enhanced with an overall understanding of the subject.

6.2.2. *Education and Awareness*

- a) Having a local partner fluent in the local language in the project area is vital for successful implementation of education and awareness projects.
- b) Children are an important resource to convey the message of conservation to their parents and other elders of the community to effect changes in attitudes and behavior of adults.
- c) Awareness programmes should be followed with field visits to drive home the message.
- d) Awareness programmes specially designed for fishermen can change their mindsets and divert them from harmful fishing practices.

6.2.3. *Ecosystem Restoration*

- a) Planting should coincide with the rainy season to have a better chance of success. It is less risky and cheaper — fresh water for irrigation is generally not available within easy reach.
- b) Using a protective cover made out of coconut leaves to reduce the effect of salt-laden winds increased the survival rate of seedlings.

6.2.4. *Livelihoods Enhancement*

Crop cultivation in homesteads

- a) Sustainable utilization of natural resources could be further advanced by extending the organic farming system not only to fishermen depending on the lagoon ecosystem but also to farmers engaged in conventional farming.
- b) Developing the women's gardening skills paid dividends.
- c) 'Bag culture' method is highly appropriate for the dry zone where water is scarce .
- d) Effective monitoring and guidance from competent agricultural officers ensured project success.
- e) Completing the training activities before implementing field operations was crucial for project success. The Agricultural Extension Officer's training and guidance generated greater self-confidence and motivation, which helped beneficiaries to realize their expectation of higher incomes.

Handicraft production

- a) Traditional weavers can be upgraded by introducing new designs (to achieve product diversity) and machines (to save time and increase production).
- b) The beneficiaries' collaborative and friendly manner ensured success; healthy competition among them led to high quality products.
- c) Touring the handicraft shops in Colombo enabled the beneficiaries to realize the importance of producing items of high quality to have a ready market. This has motivated the women to improve and maintain the quality of the final product.
- d) Self-employment skills together with awareness programmes motivated the beneficiaries to avoid extraction of materials from mangrove sites for handicraft production.

Microfinancing

- a) To succeed a microfinance scheme needs a committed manager.
- b) The operation should be monitored closely and funds disbursed in installments taking into consideration the progress made by the beneficiary and her repayment capacity.

Aloe vera beverage production

- a) Hygienically prepared, fresh and tasty natural herbal beverages, such as the *Aloe vera* beverage, have a sizeable local market and can be popularized within a short period.
- b) During the dry season when the *Aloe vera* yields are low, the demand for the beverage is high. This suggests the need for a storable bottled product.

Reintroduction of crab traps

- a) Reintroduction of traditional mud crab traps can enhance incomes and living standards of the fishing communities around Kokkilai Lagoon.
- b) The experience and practical judgement of the fishermen helped in improving project activities.

Dehydration of fish

- a) Fish preservation using dehydrators helped fishers to produce high quality dried fish in comparison to traditional methods of sun drying, and fetched better prices.
- b) Paddy husk was not suitable as a fuel for the burners of fish dehydrators; it produced a bad odour and affected the quality of the dehydrated fish. On the other hand, sawdust proved to be an excellent fuel and improved the quality of the product.



About Mangroves for the Future

Mangroves for the Future (MFF) is a unique partner-led initiative to promote investment in coastal ecosystem conservation for sustainable development. It provides a collaborative platform among the many different agencies, sectors and countries who are addressing challenges to coastal ecosystem and livelihood issues, to work towards a common goal.

MFF builds on a history of coastal management interventions before and after the 2004 Indian Ocean tsunami, especially the call to continue the momentum and partnerships generated by the immediate post-tsunami response. It initially focused on the countries worstaffected by the tsunami; India, Indonesia, Maldives, Seychelles, Sri Lanka, and Thailand. MFF has expanded to include Bangladesh, Cambodia, Pakistan and Viet Nam. MFF will continue to reach out other countries of the region that face similar issues, with an overall aim to promote an integrated ocean wide approach to coastal zone management.

The initiative uses mangroves as a flagship ecosystem, but MFF is inclusive of all coastal ecosystems, including coral reefs, estuaries, lagoons, sandy beaches, sea grasses and wetlands. Its long-term management strategy is based on identified needs and priorities for long-term sustainable coastal ecosystem management. These priorities emerged from extensive consultations with over 200 individuals and 160 institutions involved in coastal management.

MFF seeks to achieve demonstrable results in influencing regional cooperation, national programme support, private sector engagement and community action. This will be achieved using a strategy of generating knowledge, empowering institutions and individuals to promote good governance in coastal ecosystem management.

Learn more at: www.mangrovesforthefuture.org

