SAMUDRA Monograph

A Participatory Study of the Traditional Knowledge of Fishing Communities in the Gulf of Mannar, India

The communities of Chinnapalam and Bharathi Nagar

Robert Panipilla

and

Marirajan T

International Collective in Support of Fishworkers
www.icsf.net

SAMUDRA Monograph

A Participatory Study of the Traditional Knowledge of Fishing Communities in the Gulf of Mannar, India

The communities of **Chinnapalam** and **Bharathi Nagar**,
Ramanathapuram district, Tamil Nadu, India

Robert Panipilla
Independent Researcher

and

Marirajan T
Executive Director
People's Action for Development (PAD)
Vembar

International Collective in Support of Fishworkers
www.icsf.net

SAMUDRA Monograph

A Participatory Study of the Traditional Knowledge of Fishing Communities in the Gulf of Mannar, India

Authors
The communities of **Chinnapalam** and **Bharathi Nagar**, Ramanathapuram district, Tamil Nadu, India

Robert Panipilla, Independent Researcher and
Marirajan T, Executive Director
People's Action for Development (PAD), Vembar

October 2014

Edited by
KG Kumar and Sumana Narayanan

Layout by
P Sivasakthivel

Front Cover
Seaweed collectors of Bharathi Nagar village in the Gulf of Mannar, Ramanathapuram district, Tamil Nadu, India

Photo by
Shilpi Sharma/ICSF

Printed at
L S Graphics, Chennai

Published by
International Collective in Support of Fishworkers
27 College Road, Chennai 600 006, India
Tel: +91 44 2827 5303 Fax: +91 44 2825 4457
Email: icsf@icsf.net
www.icsf.net

With support from
Bay of Bengal Large Marine Ecosystem (BOBLME) Project
Phuket, Thailand

ISBN 978 93 80802 31 2

Contents

ACRONYMS

BOBLME	Bay of Bengal Large Marine Ecosystem project
CBD	Convention on Biological Diversity
CMFRI	Central Marine Fisheries Research Institute
COP	Conference of Parties (to the CBD)
CSMCRI	Central Salt and Marine Chemicals Research Institute
EBSA	ecologically or biologically significant area
GEF	Global Environment Facility
GOMBRT	Gulf of Mannar Biosphere Reserve Trust
ICSF	International Collective in Support of Fishworkers
PAD	People's Action for Development
RFTU	Ramnad district Fishworker's Trade Union
SHG	self-help group
SSF Guidelines	Voluntary Guidelines on Securing Sustainable Small-scale Fisheries in the context of Food Security and Poverty Eradication
WLPA	Wildlife (Protection) Act, 1972

1 USD = 61.55 INR
(Exchange rate as on 1 October 2014. *Source*: www.xe.com)

GLOSSARY

baagham/paagam	depth measure that is almost 1 fathom or 1.86 m
cheru pakathi	muddy area
choodam	camphor
jati thailavan	the title given to the leader of the Paravas
kachaan	to one's right (when facing villangu)
kalankathudal/kalamkatti	a traditional method of fishing
kankar	calcium carbonate deposits
karai	the shore; also direction away from the sea
karnam	local revenue official in British times
koil	temple
kondal	to the left (when facing villangu)
manal pakuthi	sandy area
neithal	the coastal landscape (one of five landscapes described in Sangam literature)
panchayat	village council
patta	title deed to land
poromboke	one of the land classifications for revenue; wasteland
sambrani	a resin used as incense
taluk	an administrative division consisting of several villages
thallai pakuthi	seagrass area
thaali	an ornament that is a symbol of marriage in Hindu weddings
veesai	a measure; one veesai equals 1.25 kg
villangu	direction of the sea or where fishers go for fishing
zamindari/zamin	an estate/fiefdom controlled by a zamindar

Flora and fauna

aavoli	dugong
adappam kola	*Ipomea pes-caprae*
avili meen	*Arius subrostratus*

chappaathi kalli	*Opuntia* spp.
chappathi meen/ kada unni	sucker fish
chattapaar or tharapaar	dead corals
chaakku pasi	*Hypnea* sp.
chori	jellyfish
cigarette pasi	*Gracilaria folifera*
eekkithalai	*Halodule uninervis*
elichevi keerai	*Ziziphus jujuba*
eraal	prawn
erukkalam	*Calotropis gigantea*
kaalai	thread fins
kalavaa	reef cod
kalvettikadan	sole/flat fish
kathi meen	razor fish
kanava/kanavai	squid
kanda/kanna maram	mangrove
kanji pasi	*Gracilaria edulis*
karuvelai	*Prosopis juliflora*
katta	leather skins
kattaikkorai pasi	*Sargassum* sp.
kattikalai	tassel fish
keeli	tiger perches
kilaikan	sand whiting
kodakapuli	*Pithecolobium dulce*
kothaam palam	*Cuscuta* sp.
kuchithalai	*Syringodium isoetifolium*
kumula sira	mackerel
kuthippu	white fish
madanam	rock cod
manchal veru	turmeric root
marikkolundu pasi	*Gelidiella acerosa*
mural	half and full beaks
nandu	crab
nethili	anchovy

oalathalai	*Cymodocea* sp.
ola kanava	needle squid
oodakam	silver bellies/ *Gerres* sp.
oora	rabbit fish
oraa	spine foot
orande	surgeon fish
paarai	trevally
pakkoda pasi	*Turbinaria* sp.
pannaa	tiger toothed croaker
pasi	seaweed
pepsi pasi	*Kappaphycus alvarezii*
perandai	*Cissus quadrangularis*
poduvuthalai	*Syringodium* spp.
poochiral	mantis shrimp
poovali	shad
poovarasu maram	*Thespesia populnea*
puliyamaram	tamarind tree
pungai	*Pongamia* sp.
pura	carangid
salli	broken dead coral reef
savukku	*Casuarina* sp.
seela/oola	barracuda
semmpaarai crabs	reef crabs
shankhu	conch/chank
sheraya/keluthai	marine catfish
soodai	sardine
surameen/sura	shark
thillai maram	*Excoecaria agallocha*
thimili	electric ray
tirukaimeen/thirukai	rays
umari/ pulicha keerai	*Suaeda* sp.
vaagai	*Albizia lebbek*
valai	ribbon fish
vattalai	*Halodule* sp.
vaval	pomfret

vembu	neem/ *Azadirachta indica*
ver pasi	*Gracilaria crassa*
vilameen	bream

Boats/nets/gear

kai vathai	outrigger (single side) dug-out canoe
kanavai thoondi	hooks used for fishing squid
kara valai	beach-seine
madaiyan nets	gill nets
madi net	trawl net
nool valai	net made of cotton thread
othai valai	palm-leaf net
othai, vidu, koi valai	modified gill nets
singhi valai	modified bottom-set gill nets
soodai nets	sardine nets
thangoosi/narumbu valai	monofilament net
valai	net
vallam	large plank-built boat
vathai	dug-out canoe
veechu valai	cast net

FOREWORD

All over the world there is growing awareness that local, indigenous and traditional knowledge of natural resources can make an essential contribution towards meeting the challenges of securing sustainable development.

In the specific case of fisheries, especially small-scale fisheries, the local and indigenous knowledge, culture, traditions and practices of fishing communities have long been recognized under several international instruments and processes. These include the Convention on Biological Diversity (CBD), the 1995 FAO Code of Conduct for Responsible Fisheries, and the 2014 Voluntary Guidelines on Securing Sustainable Small-scale Fisheries in the context of Food Security and Poverty Eradication (SSF Guidelines).

The decisions of the Conference of Parties (COP) to the CBD on the programme on marine and coastal biological diversity, clearly recognize the importance of traditional knowledge and practices in the context of marine and coastal resources. Decisions IX/20, X/29 and XI/17 especially call upon Parties to recognize and integrate the traditional knowledge of indigenous peoples and local communities in the process of describing ecologically or biologically significant areas (EBSAs), and for further developing conservation and management measures.

Article 8(j) of the CBD calls for Parties to respect, preserve and maintain the knowledge, innovations and practices of indigenous and local communities that embody traditional lifestyles relevant for the conservation and sustainable use of biological diversity. It calls for promotion of their wider application with the approval and involvement of the holders of such knowledge, innovations and practices. It also encourages the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices, subject to national legislation. This article is also integrated into Target 18 of the Aichi Biodiversity Targets enumerated by CBD.

Using these COP decisions as a background, the International Collective in Support of Fishworkers (ICSF) has initiated a series of case studies to document the traditional knowledge of fishing communities dependent on marine and coastal resources in protected and conserved areas declared in marine and coastal ecosystems, in different parts of the world.

The first in the series relates to India, and documents the traditional knowledge of fishing communities in the Gulf of Mannar in Tamil Nadu. The study has been undertaken with the support of the Bay of Bengal Large Marine Ecosystem (BOBLME) project.

Within the Indian legal context, the traditional knowledge of communities is recognized under the Biological Diversity Act (2002) and Rules (2003). However, no serious effort has been made to document the traditional knowledge of fishing communities, until recently. The Kerala State Biodiversity Board initiated the first study to document the traditional knowledge of fishing communities in parts of Thiruvananthapuram district in Kerala, which was used to develop a marine biodiversity register.

This ICSF study documents the traditional knowledge and oral history of fishing communities who have, for generations, depended on the resources of the Gulf of Mannar. The authors, in collaboration with the fishing communities of the two villages of Chinnapalam and Bharathi Nagar, embarked on a detailed process to document their traditional knowledge in relation to resource exploitation, including by tracing their roots and the history of their villages as well. Traditional knowledge is collectively owned and often takes the form of stories, cultural values, beliefs, rituals, and community laws. The authors have tried to document these through this study.

The studies in these two villages clearly demonstrate the rich depth of the traditional knowledge of the local communities on the biological and geo-morphological aspects of the ecosystem. Further, they highlight the centrality of the participatory decision-making processes in these communities whereby this knowledge is developed and given effect. It is through these local processes that the technical aspects of the traditional knowledge of local communities can be accessed and used in the governance and management of marine and coastal resources, thereby contributing towards the sustainable use and conservation of marine and coastal biodiversity.

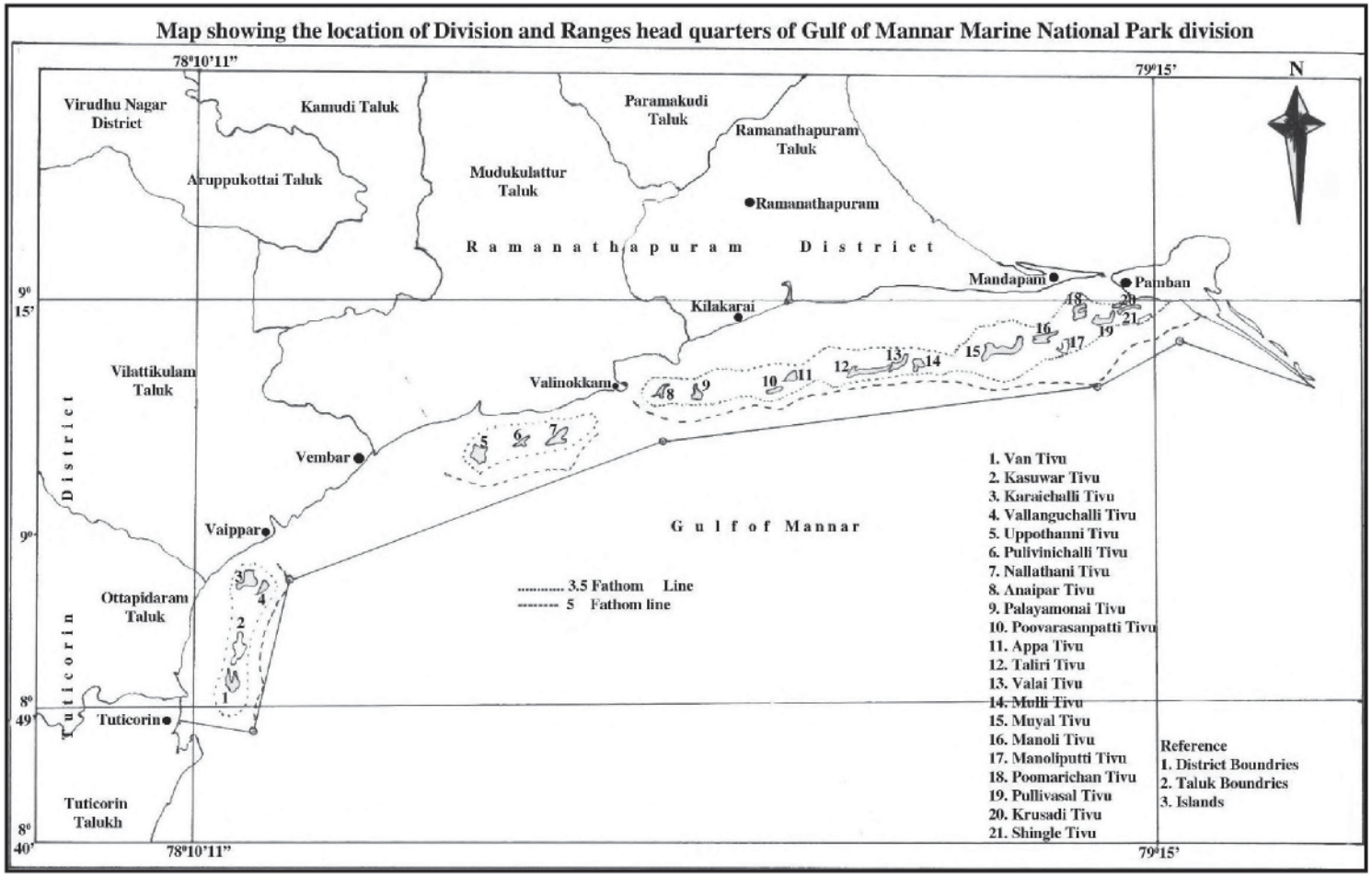
We hope these studies will help take forward, at the national and international levels, concerted initiatives to recognize the traditional knowledge of fishing communities.

ACKNOWLEDGEMENTS

There are many people without whom this study would not have been possible. First and foremost, our thanks to P Murugesan, S Arumugam, M Muniyammal and M Lakshmi from Chinnapalam, and A Palsamy, A Muthaiya, K Panchavarnam and K Ganesan from Bharathi Nagar who shared their knowledge and time with the researchers. We owe A Palsamy and G Joseph special thanks for being with us throughout the study, aiding us in contacting community members and helping organize resources.

We would like to acknowledge K Muniyandi, N Joseph Dev Ananth, N Muniyaraju, S Ramki, N Devi, M Guruveswari and J George from PAD who contributed to the field survey and provided logistical support. We cannot forget our divers, S Shrinivaasu and S Balamurugan. We also thank our GIS team of A Sumil Kumaran and R Arvindhkumar for their work on the thematic maps; and Aneesha Ani Benedict and Ammu Cicil who aided in the preparation of the marine and land biodiversity registers. We thank M Kasim, Ahana Lakshmi, Naveen Namboodiri and others who, in spite of the short notice and lack of specimens, pored over the photographs to identify many of the species.

Finally, our thanks to the Forest Department who made this study possible. We would especially like to express our gratitude to Mr Lakshmi Narayan, PCCF; Mr Venkatesh, CCF Virudhunagar Circle; and Mr Deepak Bilgi, Wildlife Warden, Gulf of Mannar Marine National Park.



Source: GOMNP Notification, 1986.

BACKGROUND

Gulf of Mannar

Off the coast of the southern Indian state of Tamil Nadu lies a shallow bay, the Gulf of Mannar, known for its marine biodiversity. The Gulf of Mannar is bound by Palk Bay and Rameswaram Island to the north; Ramanathapuram district in the northwest and west; Thoothukudi district to the south; and the Bay of Bengal in the east and lies between 78° 5' E - 79° 30' E and 8° 45' N - 9° 25' N. The Gulf of Mannar coastline extends up to 141 km in Ramanathapuram district alone, according to the Government of Tamil Nadu. The Gulf has a variety of habitats including coral reefs (especially fringing reefs), lagoons, sand dunes and salt flats.

The area is influenced by both the southwest and the northeast monsoons. The latter provides most of the rain for the region which receives 762 to 1270 mm of rain annually. The northeast monsoon is active between October and December. December is also the coldest month with a minimum temperature of 25°C.

High winds are seen in these coastal plains. North-northeasterly winds are seen from June to December while for the rest of the year the wind is westerly.

The currents are strong in the Gulf of Mannar. Rough seas are common between April and August. The tidal amplitude in the area is about half a metre (PAD 2009). At Pamban, the tides are irregular, owing to the wind force.

The Kottangui, Vembar, Gundar, Kappalar, Kallar, Vaigai and Vaippar are the non-perennial rivers that drain the region of which the last two are the important ones.

The Gulf of Mannar supports a rich biodiversity of 3,600 species, including 441 finfishes, 147 seaweed, 731 molluscs, 117 corals and 641 crustaceans. An endemic species found here is balanoglossus (*Ptychodera flava.* Eschscholtz 1825) which is a living fossil linking vertebrates and invertebrates. The Central Marine Fisheries Research Institute (CMFRI) notes that the region contributes 20 per cent of the marine catch in the state and that of the 2,200 fish species in Indian waters, 450 have been found in the Gulf. The region, therefore, has a multi-species, multi-gear fishery with a range of fishing practices (BOBLME 2011).

There are 178 fishing villages in Ramanathapuram district, with over 41,000 fisher families, of which over 37,000 are traditional fisher families. The number of active fishers in the Gulf of Mannar are 14,308 and the number of traditional fisher families is 12,981(CMFRI 2011).

According to reports from the Gulf of Mannar Biosphere Reserve Trust (GOMBRT), there are 125 fishing villages (31 villages in Thoothukudi district and 94 villages in Ramanathapuram district) and 35,000 active fishers in the Gulf of Mannar. However, local fishing communities have identified 54 villages (from the CMFRI 2011 Census in Ramanathapuram district) as being specifically dependent on the Gulf of Mannar resources for their livelihoods. In these 54 villages, there are over 12,000 traditional fishing families (with over 16,000 fishers) dependent on the resource for their livelihood, using over 800 small-scale fishing craft that are non-motorized, besides the women seaweed collectors. Apart from them, there are people from Thoothukudi district who are dependent on the 21 islands for their livelihoods, and fishers from villages bordering the Palk Bay who fish near these islands seasonally. Since the late 1970s, there has been an increase in the number of trawlers fishing in waters close to the shoreline.

Lying parallel to the coast, in the Gulf, are 21 islands between 8° 47' N - 9° 15' N and 78° 12' E - 79° 14' E. The islands are situated at an average distance of 8 km from the coast. The 21 islands are named Vaan, Kaasuvar, Kaaraichalli, Vilanguchalli, Upputhanni, Pulvinichalli, Nallathanni, Aanaipaar, Vaalimunai, Appa, Poovarasanpatti, Thalaiyaru, Valai, Mulli, Musal, Manoli, Manoliputti, Poomarichan, Pullivasal, Krusadai and Shingle. The islands range from 0.0025 sq km to 1.25 sq km in size. For administrative reasons, the islands are divided into groups—Thoothukudi (four islands), Vembar (three), Keelakarai (seven) and Mandapam (seven). The islands fall within the 560-sq km Gulf of Mannar National Park that was declared in 1986 under India's Wildlife (Protection) Act (WLPA) of 1972. The National Park, as per the original notification, covers waters around these islands up to a depth of 3.5 fathoms on the bay side, and five fathoms on the seaward side. The National Park forms a part of the 10,500-sq km Gulf of Mannar Biosphere Reserve created in 1989 under the United Nations Man and Biosphere programme.

Objectives

The study aims to document the traditional knowledge of two fishing villages, Chinnapalam and Bharathi Nagar, which have traditionally been dependent on the islands for their livelihood. Traditional knowledge relating to oceanographic, meteorological, biological, ecological and navigational aspects of fisheries in Krusadai and Appa Islands was documented.

The specific objectives of the study are to:

i. collect available archival and other information about usage of island areas (in all 21 islands) by local communities for the purposes of fishing and fish harvesting; and identify problems faced by the locals and their means of coping;

ii. document the customary use of fisheries resources and fishing practices, as well as customary and current fishing regulations, including through interviews with local communities; and

iii. document the traditional knowledge of local fishing communities about marine biodiversity and fisheries resources as well as their observations on significant changes over time, using mapping and other tools.

Study site

The communities of Chinnapalam and Bharathi Nagar were chosen as they are classified by GOMBRT as high-threat villages that are completely dependent on the islands for their livelihood. Out of 21 islands, Krusadai in the Mandapam group and Appa in the Keelakarai group were selected as these are the islands that the people of Chinnapalam and Bharathi Nagar depend on the most.

Methodology

The study used available archival and other published information on the usage of the 21 islands by local fishing communities. In addition, through focus-group discussions and interviews of key respondents, the traditional knowledge of the two villages relating to the customary use of fishery resources, fishing practices, fishing regulations, species identification, oceanographic, meteorological and navigational matters was documented, as well as the community members' perceptions/observations on changes in fishery resources over time.

The study, carried out between between November 2013 and August 2014, identified 20 fishers (men and women) from each village for primary data collection. The study team interacted with them through focus-group discussions between November 2013 and February 2014 to collect data on the islands and the resources in and around the islands on which they depend for their livelihood, as well as the traditional knowledge related to it. Through this, information on their knowledge of oceanographic, meteorological and navigational aspects of their working areas and the methods through which they exchanged this knowledge for generations, and also information on the evolving technologies over the period that influenced and changed the knowledge and skills of this community, was collected.

In April-May 2014 field visits to the islands were conducted with community representatives. During these field visits, the local names of the species seen were noted with the help of three persons (identified as knowledgeable people during the focus group discussions). Resource mapping and visual data collection of resources were done first in the land area of island and then, with the help of scuba divers, in the waters around the island.

The photographs taken of these species were later crosschecked with CMFRI, GOMBRT publications and online databases (such as fishbase) by the authors to identify the species. To clarify aspects of the community's ecological knowledge of the Gulf of Mannar and to gain a more comprehensive species list for the region, group discussions and interviews were conducted with selected people with the help of a marine resource catalogue specially prepared for the task. For this, five of the most knowledgeable and skilled persons from each community were identified. During the interactions with them, resource and species identification was done in relation to the above-mentioned islands. The catalogue consisted of photographs sourced from GOMBRT publications and from the Internet. The draft report and maps was shared with the community for their feedback in September 2014.

This report lists the species directly observed in and around the two islands by the study team. The scientific identification given has been done by the authors and is currently being confirmed with taxonomists. Therefore, this is a draft list. The report also does not list the species indirectly identified (through the marine resource catalogue) as this too is being checked with taxonomists. The species list will be developed into a marine biodiversity register.

(*Note*: The information provided here is based mostly on the community's collective memory. Communities are often not able to pinpoint the exact date of each event or chain of events. Typically well-known events, such as the December 2004 Indian Ocean tsunami or the 1964 cyclone which destroyed the settlements in Dhanushkodi, are used to approximate the timeframe.)

TRADITIONAL COASTAL COMMUNITIES

The literature of the Sangam period (300 BCE and 300 CE) in Tamil history speaks of *neithal* (coastal) communities, that is, fishers. Several castes of coastal fishers are mentioned—Parathavar/Bharathavar, Umanar, Nulaiyar, Thimmilar and Panar. Post-Sangam literature mentions only a few of these castes as coastal fishers, namely, Parathavar, Sempadavar, Meenavar, Valainar, Kadasar, Karaiyar, Pattinavar, Mukkuvar and Kuruppu (Rajesh 2004).

Today, the traditional fishing communities on the pearl fishery coast of Tamil Nadu are the Paravar, Karayar, Marakkayar and Valaiyar or Mutharayar. All of them are marine fishing castes, except the Mutharayars who are an agrarian caste who moved into fishing in the last century or so.

This study has focused on the Muthurayar villages, as they still use small boats for fishing, while the Paravas have moved towards trawling and fishing further from the coastline.

History of the pearl fishery

The documented fishing history of this coast has mostly been about the pearl and *chank* fisheries since these were of great economic importance. For centuries, travellers and traders have noted the fame of this coast for its pearls. With this history, one can also glean some information on the fishing communities of this area and the usage of the islands by these communities. Since the pearl and *chank* fisheries were seasonal, the main livelihood of these communities was fishing. However, details on fishing are non-existent as this was a subsistence occupation and not a commercial one (Mohamed 1997). It was only in independent India that fishing became commercial, though the British did contemplate how fish production could be increased in the early 20th century.

The Tamil Nadu coast has been known by various names over the centuries—Paraliya, Kolkhie Gulf, Malabar, Cholamandalam, Coromandel, Comorin, Tirunelveli and Madura coast. This coast, famous for its pearl fishery, was the home of Paravas or Parathavars who were fishers, pearl and conch-shell (*chank*) divers. References to the Paravas dates back to *The Periplus of the Erythrian Sea,* written by an unknown Alexandrian Greek in 1 CE. The Paravas also find mention in the works of Ptolemy, the 2 CE Roman-Egyptian geographer and the Arthasasthra by Kautilya in 4 CE. The Sangam texts, *Ettuthogai* and *Pathupattu*, also speak of the Paravas and the pearl fishery of this coast (Deckla 2004).

Over the years, various rulers (the Pandyas, Cholas, Vijayanagar kings, Nayaks, Delhi Sultans and the Nawab of Arcot) and, later, the Europeans (the Portuguese, Dutch, the East India Company and the British government) vied for, and gained control of, these lucrative fisheries (Coelho 1997). These powers invariably had changing relations and alliances with local petty rulers like the Sethupathi (also called Raja) of Ramnad, and the Parava fishers who were famed for their diving skills. In spite of these changing political scenarios, for the most part, the Paravas had control of the pearl fishery at the local level. It was they who dived for the pearls and *chank*s. This changed in 1516 when the Muslims took the lease of the fishery from the Nayak of Madurai. The Muslims, who first came as traders from Arabia, also had a long history of trade and settlement in this region. By this time, they had become politically powerful, thus making it difficult for the Paravas to regain the pearl fishery. This led to the Paravrs seeing an opportunity to turn the tide when the Portuguese arrived, leading to a large-scale conversion of Paravars to Christianity. The Portuguese used the Parava divers to access the pearl fishery.

Later, when the Dutch took control in 1658, the fishery was auctioned annually. The diving was done by Paravas, Muslims and other groups. The British East India Company took charge at the end of the 18th century and continued this system, giving Paravas privileges such as giving their leader, the *Jati Thailavan*, rights over a certain day's catch and appointing him manager of the fishery. In 1876, the fishery became a British Government-run fishery. By this time, the fishery had been overexploited and the returns were diminishing. As a result, many Muslims and Parava divers migrated to Sri Lanka and elsewhere (Mohamed 1997). With this, ports like Pamban, Rameswaram, Mandapam, Vedalai, Marakkayarpattinam, Ervadi, Valinokkam, Vaippar, Thoothukudi, Kulasekharapattinam and Kayalpattinam that had gained prominence due to the pearl fishery and concomitant trade went into decay. These places, over time, became large and important fishing villages. In 1909, the pearl and *chank* fishery came under the fisheries department of the Madras Presidency and a Superintendent was appointed for these fisheries. The pearl fishery was finally banned in the 1960s.

Customary rights and usage of the islands

The earliest reference to the use of the islands by traditional communities dates to 1604 when more than 10,000 Paravars from Thoothukudi, Vaippar and Vembar areas migrated temporarily to Pandiyan island in the Thoothukudi group of islands (Britto 2002). This island was owned by the Paravas' leader (the *Jathi Thalaivan*) and the move was aimed at avoiding payment of tax to the local kings. This settlement existed for more than six years. In 1606, a Roman Catholic

Church was built by the community on the island, which was later demolished by the Dutch.

In 1605, the Madurai Nayak appointed the first Sethupathi of Ramanathapuram to protect and guard pilgrims to Rameswaram. In return, the Sethupathi was given control of 69 coastal villages and seven islands (Raju 2010).

There are several inscriptions from the 17th century that mention the islands. A copper plate issued by King Koothan Sethupathi, who reigned during 1622-1635, declares that the sea up to Talaimannar belonged to him, including 22 islands (this included Katchatheevu, which was ceded to Sri Lanka by India in 1973).

In the Madras Fisheries Bulletin, James Hornell mentions that there is evidence of Parava fishing camps on Nallathanni Island dating back to the 1570s. He notes that in 1560, the Portuguese moved some Paravas from Punnakayal to the island of Mannar and that the Paravas controlled the pearl fisheries from the small islands along the coast (Hornell 1922).

As part of the *zamindari* system introduced during British rule (wherein local chieftans/landed gentry controlled the administration of these lands, including revenue collection), a plaque—Isthimerar Sannathu—issued for Ramanathapuram *zamin* (land or, in this case, estate) in 1803 clearly mentions the 22 islands under the control of Ramanathapuram *zamindar* (or the Sethupathi). The Sethupathi did, however, lease out some of the islands for various purposes at different times. For example, in June 1880, eight coastal villages and four islands were leased to the District Collector, Madurai, jointly with Abdul Kadar Marakkayar and Muthusamy Pillai (Registration No, 510/1880, Book 1, Volume 16) (Raju 2010).

Under this lease, Abdul Kadar Marakkayar had control of seven villages around Mandapam as well as Muyal (Hare) Island. The loading and unloading of cargo at Mandapam and Pamban ports was under his control. For this work, he had a fleet of 30 boats and employed some 1,000 people from local villages (Mohamed 1997).

In 1880, the Sethupathi also outsourced toll collection on the Pamban canal. This was taken up by Aboobaker Marakkayar from Pamban (Mohamed 1997). His family also became pilots, ferrying people across the canal. His descendants were later appointed as pilots at the Pamban port and continue to pilot vessels across the canal even today.

Between 1913 and 1928, some of the islands were leased by the government of Madras Presidency from the Sethupathi, and sublet to fishers for 15 years.

Records show that fishers from Thondi and Nambuthazhai had taken up leases too. The records of the Sethupathi's office are quite detailed with regard to the islands and revenue obtained from them. In 1914, Krusadai Island was bought by the British from the Sethupathi and a marine biological station established on the island (Ramadhas et al 1999).

Utilization of islands by local people

The Ramanathapuram district gazetteer (1961–1968), published in 1972, indicates the presence of local people and their dependence on the islands (Government of Tamil Nadu 1972). Out of the 17 islands mentioned in the gazetteer, 15 islands are said to be uninhabited and two are noted as having habitations. The gazetteer notes that "the population of Kurusadai Island is 44". According to the community, this included both government employees as well as the watchmen of the coconut farms and labourers working in the farm. The uninhabited islands, however, the gazetteer notes, was used by people for various purposes, including camping to fish. Normally, camping on the islands involved a stay for two to three days for fishing and seaweed collection. Fishing was done by planting rectangular bamboo hedges in the sea, particularly in Manali Island, due to the presence of coral stones and irregular shoals. This method of fishing is called *kalamkatti* fishing.

Thalaiyari Island was used by fishers and saltpan workers as a place to stay temporarily (for a week at a time) to collect coral stones and *chanks* and to fish. Other visitors included Sinhalese fishers who camped for a month or more on Singalai (the name was corrupted to Shingle) Island.

Some of the islands had cultural importance. Valai Island was also called Kittoriamman Island as it had a Kittoriamman Church. The fishers of Periyapattinam came there to fish and to pray. Krusadai had a small church (St Xavier's) and it is said that the name of the island is a corruption of the word 'crusade'.

Kandasami (2000) mentions that government records show that people from the communities of Keelakarai and Vallinokkam were collecting oysters near Nallathanni Island in 1870, which led to a conflict between them and the Government of the Madras Presidency. One outcome was that the government passed rules under the Indian Fisheries Act of 1897 to curb this 'poaching'.

A paper presented in 2000 at a CMFRI national symposium on ecofriendly mariculture technology packages notes that Shingle Island is so named because Sinhalese fishers would base themselves there while fishing. Similarly, fishers would camp in Krusadai for a few days while fishing. Poormarichan Island was

used to collect shells as well by Mandapam fishers, while seaweed collection and fishing were done by people in Manoli Island. The paper also records that Muyal Island had dense coconut gardens and that people brought cattle, goats and monkeys there. Kariyashulli Island, the paper notes, was where fishers would operate bottom-set gill-nets and people from Ervadi would collect seaweed. Upputhanni Island was used by fishers from Narippaiyur to quarry for coral boulders and to collect the seaweed species, *Gelidiella* and *Gracilaria*. Nallathanni Island, with over 4,000 coconut, palmyra and other woody trees, had a temple to Muniswaran, which would attract people on Tuesdays and Fridays. This island was also used for fishing, and seaweed and shell collection. Puluvinchalli and Vallimunai Islands were used by Keelakarai fishers to fish for lobsters, for which they would spend up to a week on the island. In Poovarasanpatti Island (called Kilangan Paar by the fishers), seaweed was collected. Collection of seaweed was the only activity of the fishers here.

Trap fishing was common along the Keelakarai coast and nearby areas (Hornell 1950). Trap fishing, it has been recorded, was carried out from September to March, especially in Mandapam, Vedalai, Pullivasal, Pudumadhom, Muthupet and Keelakarai regions. Fishing was earlier carried out using shore-seines, boat-seines, drift-nets and gill-nets. It was only post-1965 that trawling was introduced in these areas. Even as late as the 1970s, there are reports of fishers using shore-seines in the islands, especially in Appa Island (Lalmohan 1971).

Post-Independence, in 1948-49, estates such as the Ramnad *zamin* were abolished under the Madras Estates (Abolition and Conversion into Ryotwari) Act (26 of 1948), and the lands vested with the State. With this, the leases for fishing *chank*s, etc., went to the government as well (Madras High Court 1953). The islands were transferred to the revenue department, except for Muyal and Nallathanni, which were privately owned (GOMBR 2012). For example, records indicate that out of the 1.012 sq km of Nallathanni Island, Syed Sara Uma, wife of Mohamed Meera Sahib, had the *patta* (title deed) for 0.3231 sq km. The remaining area was government land. In 1972, a further area of 0.5962 sq km was given to 48 people, though these assignments were later revoked. Then, in 1984, Sadai Muniyan, son of Muniyandi, of Keelamunthal, petitioned the District Collector for compensation for the Rs1,000 that he had spent annually on preparing the 0.012 sq km of government *poromboke* (wasteland under revenue classification) land in Nallathanni that he had leased in 1972. However, this lease was cancelled in 1979, although the lessee was unaware of this and had continued to use the land. In 1983, when he was made aware of the cancellation, he approached the Collector (Muniyan 1984). On Nallathanni, 0.0025 sq km were also marked as *koil poromboke* (temple wasteland).

The coconut and palm trees on Krusadai were leased from the fisheries department by individuals for tapping coconut and palm juice. For instance, such a lease was held, records show, by S Nagarajan from Chinnapalam from 1/12/1981 to 30/11/83. He paid Rs 50 as lease amount in the first year (M.T.C. Receipt No. 65296, dated 25/11/81). The amount was accepted and the lease renewed for the second year (Nagarajan 1981).

In 1989, Muyal Island was bought by the State from the family of Mohamed Kasim Marakkayar of Mandapam and, similarly, Nallathanni Island was bought from the family of Mohamed Meera Sahib. The Marakkayar was offered compensation at the rate of Rs 15 per acre. The total compensation was calculated as Rs 3,300,000 for Muyal Island. However, he refused the terms and approached the Ramanathapuram sub-court. In 1999, the court revised the compensation to Rs 53,318,628 but the order was not implemented. Hence, the Marakkayar's family moved the Madurai bench of the Madras High Court, which directed the revenue department to implement the order. This too was to no avail and, finally, the Marakkayar confiscated furniture from the revenue department office as recompense, as noted in an article in the newspaper *Dhinamalar,* dated 7 October 2010.

Utilization of islands by the state

Other than the communities, the state too accessed resources from the islands. Several coral mining leases were given in Manali, Valai, Mulli, Thalaiyiri and Appa Islands to private persons/industries (Government of Tamil Nadu 1972). Gazette records show that an entrepreneur from Rajapalayam (a town in Virudhunagar district) was given 20-year mining leases in 1959 for limestone and *kankar* (calcium carbonate deposits) extraction. Similarly, 20-year leases were given for 0.49 sq km in Manali island, 0.12 sq km in Mulli, 0.20 sq km in Valai, 0.40 sq km each in Thalaiyiri and Appa islands and so on. It has been estimated that the annual extraction of corals in the region was to the tune of 25,000 tonnes (Mahadevan and Nayar 1972). Coral mining was banned in 1989.

A 1977 field note by Satish Bhaskar, field officer of the Madras Snake Park, who was part of a survey team to prepare a Report on the Survey of the Islands of the Gulf of Mannar by CMFRI, speaks about the islands' ownership. The note says that Krusadai, Pullivasal, Puli and Shingle Islands were with the government (Fisheries Department of Tamil Nadu) while Muyal Island is owned by a private owner (Mandapam Marakkayar). The note also says that the survey team saw 50 or so people living on Muyal Island and off Pullivasal, they saw several women wading in the seaward reef, looking for seaweed (Bhaskar 1977). So, irrespective of ownership, the islands continued to be used by local people.

A 2003 study noted the high dependency (83 to 93 per cent) of the fishing community on the nearshore fisheries, especially on the resources around the islands. The study also noted that the islands are an important resource for the communities, providing a temporary resting place/campsite from where seaweed collection and fishing is carried out (Whittingham et al 2003).

Introduction of seaweed collection

Seaweed collection for commercial use started in the Gulf of Mannar in 1966. The species collected were *Gelidiella*, *Gracilaria* and *Sargassum*. *Turbinaria* was added to the list in 1975 and *Gracilaria crassa* in 1983 (Narayanakumar and Krishnan 2010).

National park

Based on the recommendation of the CMFRI Report on the Survey of the Islands of the Gulf of Mannar, it was proposed to set up a Marine National Park (Silas et al 1985). In 1986 the park was notified with a 560-sq km area. Later, in 1989, the Gulf of Mannar Biosphere Reserve was announced. It covers an area of 10,500 sq km and includes the Gulf of Mannar Marine National Park. Under the National Park notification, the ownership of 21 islands and the surrounding waters were ceded from various sources to the State and they are now notified as reserve lands, protected along with the surrounding waters.

When the National Park was declared, Krusadai Island was with the fisheries department. The State Fisheries Development Corporation had leased out a portion of the island for pearl oyster culture to a private firm in December 2001 for a period of five years. The lease covered the pearl culture project at Mandapam and Thoothukudi, a pearl oyster hatchery at Mandapam and the pearl farming areas at Krusadai. A report in *The Hindu* of 15 September 2002 indicates that this led to a dispute between the fisheries and forest departments when the forest department pulled down the pearl oyster farm on Krusadai as it fell within the national park.

Conflict

From 2002 onwards, a project for conservation and sustainable use was initiated with the support of the Global Environment Facility (GEF). Under this tri-partite arrangement (between the Governments of Tamil Nadu and India and UNDP), the Biosphere Reserve was managed by GOMBRT, which works with 252 villages in the area, which are directly or indirectly dependent on the resources

in the Gulf of Mannar. Approximately 125 fishing villages are directly dependent on the resource in the National Park, which is spread across two districts—Ramanathapuram and Thoothukudi. The designation of the National Park has affected 35,000 active fishers, including 5,000 women who collect seaweed, and 25,000 fishers who dive for sea cucumbers. The National Park declaration means these people are denied access to the fishing grounds surrounding the 21 islands as no extractive activity is allowed in this area (Rajagopalan 2008).

Despite the area being declared a National Park more than two decades ago, the settlement of the rights of the communities within the park area is yet to be completed, and the second legal notification as per the WLPA is yet to be issued.

These restrictions directly affect coastal communities, especially the weaker sections within the traditional communities. For example, the Mutharayar community, who harvest fish and seaweed around the islands by using traditional crafts and gear, are not allowed entry into the islands. In 2001, sea cucumbers, traditionally caught in large numbers by the Marakkayar community, were listed as Schedule 1[1] species under the WLPA. Under the Act, catching Schedule 1 species is banned.

These restrictions have had major impacts on the community; their access to resources that have traditionally been used for life and livelihood has been affected while viable alternatives are unavailable. The communities say that the alternative livelihood options offered by GOMBRT have not been economically viable. Many traditional fishers have had to switch to working as wage labour on trawlers, instead of running their own boats.

These communities have also not been involved in any part of the planning, management and decisionmaking regarding the Gulf of Mannar. These communities, who see themselves as the traditional custodians of the sea and its resources, have been alienated from their traditional milieu.

However, communities continue to follow certain self-imposed regulations. Local participation in the Ramnad district Fishworker's Trade Union (RFTU) has empowered small-scale fishers, and brought about a number of successful local management measures, such as restricting trawling activities in the sea between the mainland and the islands, banning dynamite fishing and coral mining (which has reinforced official bans), and banning the use of metal tools for

1 Under the WLPA are several Schedules providing various degrees of protection to the species listed under them.

harvesting seaweed. The ban on trawling in the area between the coast and the islands has safeguarded the resource for small-scale fishers and reduced conflicts between these two sub-sectors. The ban on the metal tools came about when the women seaweed collectors, recognizing that seaweed harvesting was reaching unsustainable levels, worked with the GOMBRT and scientists to move towards more sustainable methods of harvest (Whittingham et al 2003).

FISHING COMMUNITIES OF THE STUDY VILLAGES

The Bharathi Nagar and Chinnapalam communities are Valaiyars or Mutharayars who are classified by the Government of India as 'Most Backward Caste'. These communities fish in the shallows waters around the islands. They were originally an agrarian caste who mostly came from inland Pudukottai at the request of the *zamindar* of Ramanathapuram. They settled in the Sethukarai, Thoppuvalasai, Mukkaiyur and Munthal regions. Initially, say the community, they lived in the coconut groves of the Sethupathi and the Mandapam and Keelakarai Marakkayars. This community also took up fishing and over generations the occupation became the predominant one. Community members fished in the islands and adjoining reefs, where they deployed nets. This type of fishing does not need a great deal of traditional knowledge.

For their livelihood, apart from traditional island-dependent fishing, since the 1970s, the Mutharayars have been collecting seaweed for the agar industry and until it was banned, they were also diving for sea cucumbers for the international market.

Local institutions

The coastal villages from Thoothukudi to Dhanushkodi have traditionally had a *panchayat* (village council) for the past 40 years. The fishing community does not call it a traditional fisher *panchayat* but rather a meeting of all village residents. This is what researchers have classified as fisher *panchayat*s. This *panchayat* system varies depending on the ethnic groups living there. It differs with each district as well.

But for the 21 Parava villages, between Vembar in Thoothukudi district to Kootapuli in Tirunelveli district, there is also a *meenavar* (fisher) *panchayat*. This is at the district level were fishing-related matters are dealt with between villages, between the community and the government, and between the small-scale and large-scale fishers (on trawlers).

There is also a village council in Ramanathapuram (in villages from Rochemanagar to Dhanushkodi) that convenes on the first day of every month, a meeting that is mandatory to attend. Absentees are punished with a fine and a warning. Village-level issues are dealt with at the meeting. The council consists of seven members who are elected every year. If everyone is satisfied with the village head, his term can go up to a maximum of five years. There have also been village heads who have been in charge for a mere three months.

The village head presides over village functions. He hands over the *thaali* (an ornament that is a symbol of marriage in Hindu weddings) and is the first

person who must be invited to the ceremony. He solves family- and livelihood-related quarrels, conducts village festivals, and decides on taxes. He also tries to solve the problems with other villages. He cannot, however, impose the restrictions on mesh size or type of gear. In terms of consequences of harmful fishing methods, destructive fisheries, catching of juvenile fish, and so on, the village head only passes on information from the union, the RFTU; he does not take up these issues on his own. Before the fisheries co-operatives were formed, the village head also ensured that the welfare measures from the state government implemented during the seasonal bans were received. This is now done through the co-operatives.

One of the seven-member village council is deputed to the RFTU as a general body member. He pays the entire village's annual subscription fee to the union, which is managed by a 15-member executive committee. The union is active in both the Palk Bay and the Gulf of Mannar, that is, in the villages of Ramanathapuram district, from Dhanushkodi to Devipattinam.

There are also country boat societies/associations who work with RFTU when there is a problem. The union deals with issues relating to small-scale fishing centred around the islands, and on problems between country boats and trawlers, the forest department rules about the National Park, and women seaweed collectors' livelihood issues. There are several other institutions at the local level based on gear and craft. This study, however, does not discuss them as they do not have a direct relevance to the research.

The main focus of the two institutions of the village council and the union is small-scale fishers, fisheries resource conservation and sustainable livelihoods. They continue to emphasize community-based controls. Though the rules imposed by traditional institutions have been weakened by the livelihood changes brought on by the market-based economy, these institutions continue to function without any change in method.

CHINNAPALAM VILLAGE

The village is located in Pamban *panchayat* on the island of Rameswaram. It falls under Rameswaram *taluk* (an administrative division consisting of several villages) of Ramanathapuram district. From the Pamban railway station, the village is 1 km south of the railway tracks.

Today, Chinnapalam has a population of 1,138 (about 400 families of 612 men and 562 women). All of them are Muthurayars. There are 310 fishers and 200 seaweed collectors in the village. It has 250 dugout canoes and 120 plank-built boats fitted with motors. The community estimates that in 1964 there were 30 families, including one Muslim family. Over the next decade, the number rose to 100 families and, by 2004, there were 180 houses with about 240 families.

The village is bounded by the Madurai–Rameswaram railway track to the north, Thopppukadu to the west, and the Kunthukal Thevasthanam forest land and the sea to the south. Almost everyone in the village is involved in sea-based activities, including seaweed collection. Sixty of the women seaweed collectors also fish. The people of Chinnapalam have traditionally accessed Krusadai, Pulli, Poomarichan, Manali, Muyal, Manaliputti, Mulli, and Valai Islands for their livelihood needs.

History

The village existed in colonial times. It is located on what used to be coconut farms that extended up to Kunthukal. These were owned by the Mandapam Marakkayar's family. The people from Chinnapalam originally came from Pudukottai estate and settled in Sethukarai village and later moved to the Marakkayar's coconut farm.

The Kunthukal port, which was located near the village, was destroyed in the 1964 super-cyclone. This port was where ships plying to and from Sri Lanka used to unload cargo. Cargo was taken to Mandapam for customs via the bridge made of palm trees located between Kunthukal point and Marakkayar's coconut grove. This bridge was called *chinnapalam* (small bridge).

When the Dhanuskodi cyclone hit the shore of Kunthukal, two ships loaded with tiles were anchored close to Krusadai. These were upturned by the cyclone. Their shipwrecked remnants can be seen even today. In addition, 12 sail-type coal ships were wrecked. But the wrecks have sunk and these are used by *semmpaarai* crabs (reef crabs) as habitats. After the 1964 super-cyclone, the government gave the cyclone-affected 3 kg of thread each, in addition to

household goods like utensils. In 1974, the fishers had to contribute Rs 10 per month towards the contigency fund for the rough season. Later the amount was raised to Rs 180. In this region, the period September-November is when winds are strong and waves are rough, making it impossible to fish. For their basic needs at this time, fishers depend on the welfare scheme supported by the centre and state and distributed through the fisheries department. Locally, it is called the "rough season money".

Use of islands

Before settling in the current location, the people of Chinnapalam lived on Krusadai and Manoli Islands. In 1970, the forest department evicted them from the islands. Until then, 35 families lived on Krusadai and 15 on Manoli. Muyal Island was with the Marakkayar, and they did not live on it. However, they used to fish off Muyal Island using the *kalamkatti* method (a traditional fishing technique, explained later in the text) after taking verbal permission from the Marakkayar (in effect, from the two watchmen of the Marakkayar). Manoliputi and Manoli Islands were also used for *kalamkatti* fishing, with the fisheries department's permission. But fishing was not allowed on Krusadai. The villagers fished in Krusadai, Manoli, Muyal and Manoliputi Islands by casting nets. Today, those who fish and/ or collect seaweed are mostly those who were born and brought up in the islands.

From 1914, Krusadai was with the Sethupati of Ramnad. The fisheries department leased it from him for research. In 1937, a marine research station was set up. At that time, more than 20 Chinnapalam families lived and worked on the island for the fisheries department as watchmen, boatmen, watermen and cleaners. After 1964, the Marakkayar's men used to go to the islands for coral mining. The villagers of Chinnapalam stopped them.

After 1947, Krusadai, Manoli and Shingle came under the jurisdiction of the fisheries department and after that fishing in these islands was not allowed. However, the locals continued to fish there. If caught by the fisheries department, they were sent off with a warning and a notice. Such notices can be found among the fisheries department's documents. However, the fishers would ignore those notices and, within 10 days, would be back fishing in the same areas.

The Mandapam Marakkayar used to lease out Muyal Island for coconut harvesting. The lessee was able to harvest upto 20,000 coconuts per month. The coconut trees were in two areas on the island—*periya* and *chinna thoppu* (large and small groves). The large grove was in the Pallivasal area and had more than 500 palmyra trees, and over 200 coconut trees.

First Dairiyam of Akkalmadam had the lease to Muyal (from the Marakkayar). He kept goats there. When the goats became numerous, the Marakkayar felt it would impact the island and cancelled the lease. He appointed watchmen and gave the lease to the family of Lakshmiammal of Chinnapalam. From then until the forest department evicted them, this family held the lease. They protected the coconuts and harvested them; they also say that many monkeys and rabbits used to be seen on the island then.

Back then, the people of Chinnapalam would stay and fish for weeks and even months on Manoli and Manoliputti. The families living there celebrated functions and conducted rituals there; children have been born on the islands. They would take up to 10 kg of rice as provision. The daily catch would be landed at Vedalai. Once a week the women would go to Paisal Garden, 3 km from Vedalai, to bathe, fetch drinking water and shop for groceries and vegetables, leaving the houses in the village locked behind. When the chance arose, they would even take a goat belonging to the Marakkayar from Muyal Island.

In 1986, the Gulf of Mannar was declared a National Park under the WLPA and a pilot scheme launched in 1987, focusing on Krusadai. In 2001, 52 species were added to the Schedule 1 of the WLPA, affecting the fishers' livelihood. At this time, the people from Chinnapalam who stayed and fished in the islands faced great trouble. In Palli, Manoliputi and Poomarichan Islands, the forest department torched the huts, nets were cut, and boats' anchors were set adrift. Those arrested had to pay a fine; some were harassed and tortured. No longer were some of the arrested let off with a fine. Their crime was recorded as illegally cutting trees. Women were also questioned.

Island life

Ramalingam, 72, is a fisher and one of the few who knows the history of the village. He lived on Poomarichan Island from 1970 to 1995 with his wife, four sons and two daughters. Alongside them, three other families (of Marimuthu, Muniyandi and Seeni) also lived on the island. They joined Ramalingam's family in 1980. They would buy coconut fronds from Vedalai to build their shacks.

When Ramalingam lived on the island, he planted over 20 *poovarasu* trees (*Thespesia populnea*). In 1995, their huts on the island were burnt by the forest department. The other families left but Ramalingam continued to stay. He was finally forced to leave because he was arrested by the forest department and harassed. He says a false complaint was filed against him on the charge of cutting trees, even

though he had planted many trees himself. For six hours, he was illegally tortured, he says.

Ramalingam notes sadly that erosion has affected the island and two areas are now underwater. When he lived on the island, the seaweed and seagrass along the shore used to act as a barrier to erosion by acting as buffers against the waves, he says.

Seaweed collection

In 1964, collection of seaweed (*pasi*) as a livelihood measure began in this area. The important species harvested were *marikkolundu* (*Gelidiella acerosa*), *kattaikkorai* (*Sargassum* spp.), *pakkoda* (*Turbinaria* spp.), *kanji* (*Gracilaria edulis*) and cigarette *pasi* (*Gracilaria folifera*). Collection of *ver pasi* (*Gracilaria crassa*) began some 30 years later.

In 2004, the women seaweed collectors were questioned and harassed. They were pushed to give up their source of livelihood. But the women who collect seaweed—over 70 in number—got together to protect themselves and their livelihood by forming a unit within RFTU. They learnt to cope with the forest department's restrictions.

As the number of seaweed collectors increased on both islands, the resource base was getting depleted, making seaweed collection unsustainable. Hence, about five years ago, the women of Chinnapalam (other villages do not subscribe to these regulations), the union, and the fisheries and forest departments in the presence of the local Member of Parliament, Anwar Raj, held discussions and decided to limit harvesting to 12 days in a lunar month. They also decided to have a 45-day ban period from 1 April every year. They also prohibited the use of metal tools to collect seaweed. However, there is still disagreement over the 45-day ban as the women feel that certain species like *Gelidiella acerosa* grow throughout the year and must be harvested regularly.

About 20 years ago (after 1989) the Central Salt and Marine Chemicals Research Institute (CSMCRI), a government research institute in Gujarat, introduced the exotic *pepsi pasi* (*Kappaphycus alvarezii*) for cultivation. It introduced cultivation techniques and started a cultivation experiment in Krusadai. The species grew well but within four years, *Gracilaria edulis*, *kothai pasi* and *Gelidiella acerosa* decreased in quantity. The community believes that *Kappaphycus alvarezii* has halted the growth of the other seaweed. This caused the government to stop the experiment in Krusadai and the forest department has banned cultivation of *Kappaphycus alvarezii* in the Gulf of Mannar though it is done in Palk Bay where

it has affected the corals. *K. alvarezii* grown in the Palk Bay breaks up and during the northwest monsoon, the bits of seaweed drift down to Krusadai and grow on the live corals. For the last four years, on behalf of the forest department, this seaweed has been removed by Chinnapalam people in January by free-diving but it is difficult to remove all of it. The dead corals near the shore at office *munai* (an area of Krusadai) are testimony to this. This area is badly affected.

Boats and nets

Before 1964, dugout canoes made of local wood (*Prosopis* sp. but not *P. juliflora*) were used. In Chinnapalam, 23 people fished using the *kalamkatti* method (see section on fishing methods for details). Before 1964, there were 80 of these throw-nets. For each net, Rs 0.75 worth of cotton thread was required. The dug-out canoes had five nets each, which would get about 100 kg of catch totally. The fishers also used *othai* nets (modified gill-net), of which the village had ten. In addition, six persons had *vidu* nets (modified gill-nets).

Another net they used was the *kara valai* (beach-seine) which required 10-12 persons to operate. Back then, fish was plenty and could be easily caught from the shore. The small boats took only three people. Fish was sold not by the kilogram; handfuls or *veesai* were the measures used. One *veesai* was equal to 1.25 kg. On one catamaran, up to 20 to 30 *veesai* (25 to 37.5 kg) of fish could be caught. Before 1964, various varieties of fish were available—*paarai* (trevally), *seela* (barracuda), *vilameen* (bream), *sura* (sharks), *thirukai* (rays), *poovali* (shad), *kumula sira* (mackerel), *kuthippu* (white fish), *oodakam* (silver biddy), *panna* (tiger toothed croaker), *kattikalai* (tassel fish), *katta* (leather skin), *valai* (ribbon fish), *vaval* (pomfret), *kanavai* (squid), *kaalai* (thread fins), *kilaikan* (sand whiting), *oora* (rabbit fish), *soodai* (sardinella), *madanam* (rock cod), *pura* (carangid), *sheraya* (marine catfish), *kalvettikadan* (sole/ flat fish) and *mural* (half and full beaks). Turtles, dugongs, starfish, and sea cucumbers were plenty too. Then the seasonal winds were predictable and so fishing was good.

There have been records of dugongs washing up on the coast. Lal Mohan (2000) notes several dugong carcasses washed ashore after the 1954 cyclone.

In 1964, Chinnapalam had only six outrigger dugout canoes. Fishers used to wade out and use cotton nets (*nool valais*) near the shore. Per boat, seven *eraal* (prawn) nets were used, based on a belief that the nets must be taken out only in odd numbers, which were considered lucky. In 1964, catamarans and boats started using cotton nets made in Paruthi and they caught large quantities of fish but these had no value (the market price was low). Much later, fibre boats were introduced that could carry 15 to 20 *veesai* (18.75 to 25 kg) of fish.

During this time (1974-1984), boats made of *paai* wood were used for fishing. The catamaran numbers reduced, and more plank-built boats and row boats were used. In these boats, fishers could go further out to sea. In each boat, three men could go and catch fish farther away. This became common. Nylon nets were used. In 1984, catches were high – many *madangu* (one *madangu* is 34 kg) of fish were caught. By 1984, there were 45 boats sized 19 feet by 21 feet. In 1982, *madaiyan* nets (gill-nets) were used. These were made of local material. To this net, bells were attached. This modified net was called a 'disco' net. Until the mid-1980s, *nandu valais* (crab nets) were extensively used. Up to 90 crab nets would be taken in one dugout canoe.

After 1984, *thangoosi valai* (monofilament net) and *pachai valai* started to be used. In these nets, instead of *nattu nool* (cotton thread), nylon was used. Now for each boat, 10-15 nets were taken. Until 1984, *kalamkatti valai* (net used for *kalamkatti* fishing) was used. Dugout canoes and plank-built boats were used. Then, over the years, machinery began to be used in these boats, making it easier to go further out and catch fish with nylon nets to the tune of 7-15 kg. Many of the nets like the prawn and *othai* nets (modified gill-nets) began to be made of nylon.

Through the 1990s and until about 2004, more and more dugout canoes were fitted with engines. In 1990, the forest department assumed control of the area and many nets were banned such as the *othai* (modified gill-net), *veechu* (cast-net) and *kalamkatti*. A couple of the families then began to use buoys to fish. By 2004, there were 63 dugout canoes. The number of plank-built boats also went up; in 1992 there were six, today, there are 60. In 1994, a subsidy for diesel was introduced. Then more trawlers started coming in and many fishers began to work as wage labour on the trawlers that came into the harbour.

In 2004, 240 families were using dugout canoes and/or plank-built boats. After the 2004 tsunami, which destroyed many boats and nets, everyone began using monofilament nets (also called *narumbu* nets). Since the mid-1990s, this net has become popular. The barks of the tamarind tree, *udalai* tree, and *vembu* (neem or *Azadirachta indica*) were boiled in water and the nets were left to soak in it until they became soft, which strengthened them.

In 2007, compensation for the fishing ban period was given. Around this time, the numerous coastal development projects and related policies started making life very difficult for fishers. Also, several devastating cyclones—Aila, Nisha, and Thane—followed the 2004 tsunami.

Today, fish prices are high. The value of 20 kg of crab in 1974 is equal to the value of 4 kg of crab today. Due to rising fish exports, prices have also improved.

Nowadays shark and mackerel are hard to get. The number of plank-built boats has come down because of high diesel cost and labour shortage. By 2020, the number of boats is likely to decrease substantially since the cost of running small boats will be prohibitively high.

Traditional fishing methods

- Free-diving (for *chank* and sea cucumbers)
- Spear fishing
- Fishing while staying in islands
- *Sundu katti* fishing
- *Kalamkatti* fishing

Before the 1964 cyclone, there were about 100 families with some 60 catamarans in Dhanushkodi. The fish stocks were in good shape then and so catch was plenty. Fishers used traditional cotton nets made from *paruthi* thread. One day's catch for a catamaran was 15-20 *veesai* (22.5-30 kg).

Sea cucumbers were collected by free-diving in 3-ft deep waters. However, with the addition of the 52 species to the Schedule I of the WLPA, including all species of sea cucumbers, the traditional divers' livelihood was affected. The *chank* fishery was at its height during the colonial era and died out slowly. *Chank* fishery licences are still being issued by the state fisheries department in both Thoothukudi and Ramanathapuram districts.

Another traditional fishing method was to set traps among the corals. Fishers used to set the trap and go fishing. When they returned, many of the fish that had been milling around the trap would have got caught it. This method continues to be used though catches have dwindled. The decline in traditional trapping methods is also because the present generation does not know how to weave the trap. While earlier large quantities of fish were caught and prices were low, today the catch is low, but the price is high.

Sundu katti fishing is a traditional method where a stick is lit and held over the water to attract fish. This method was common before the 1980s. Some 10 people would go and thrust a lit stick over the water from the boat. One of the *madi* nets (trawl nets) would be used to haul in the fish. Nowadays, with more sophisticated nets, this method has died out, though a variation of it can be found in the Kanyakumari region where fishers use a petromax lamp that can be taken underwater.

Kalamkatti fishing is a traditional method that depends on locating shoals of fish in areas where the sea has receded (*vathi irrukum samayam*) near the islands.

At low tide the next day, the fishers would bury the *mada* net. A stake would be placed every 1.86 m (one *paagam*). At night, during the high tide, the top of the net would be hooked to the stakes. When the tide ebbed, the fish would get trapped in the net.

Village taboos

The village has long had traditional regulations to conserve marine resources, such as a ban on dynamite fishing and fishing with the traditional *olai* net, which is made of dried strips of palm leaves tied to the net before it is put in the water. The movement of the leaves in the water attracts fish. This is a method unique to this region. This net was banned since it uses a stick to stir up the water and rouse the fish, which can damage the corals. Also, fishing is banned on days when a death has occured in the village. However, in Bharathi Nagar *olai kayaru* or *olai* net fishing is not banned or considered a bad method.

Before 1964, the villagers had rules for fishing such as using *kanni valai* and *thoondikal* (hooks used for fishing), based on the species and the season. After 1964, the village introduced the no-fishing rule on Tuesdays. It is unclear why they picked this particular day or what the reason for a weekly ban is. There is also a rule that prohibits fishing on auspicious occasions or festival days. The community has other rules as well: no cutting of trees and breaking of corals, and no lighting of fires on the islands. About five years ago, the village introduced a ban on seaweed collection between March and May. Earlier, there were no restrictions on seaweed collection. Now collection is restricted to only 12 days in a month and often the women do not go out for all those 12 days because of social or personal constraints. No compensatory days are given to the women who miss collecting during the 12 days.

BHARATHI NAGAR VILLAGE

Bharathi Nagar in Mayakulam *panchayat*, is a coastal village, 6 km from Keelakarai in Ramanathapuram district. It lies off the Keelakarai-Erwadi road. To reach the village, one must turn off this road after Sathak Polytechnic College. The village occupies 0.02 sq km of land and has a population of 185 men and 189 women according to the traditional gram sabha records, all of whom belong to the Mutharayar fishing caste. Of these, 150 people go fishing and 104 collect seaweed (74 women and 30 men). The village has 20 dugout canoes, 40 plank-built boats fitted with motors and seven fibreglass reinforced boats. The houses in Bharathi Nagar occupy 0.008 sq km of the 0.02 sq km; the remaining land in the village consists of coconut groves and common public spaces. The village is bounded by Chinna Mayakulam and Muthurajnagar to the north, coconut farms to the west, Mangaleswarinagar, Vivekanandhapuram and coconut farms to the east, and the sea to the south.

Almost everyone in the village is involved in sea-based activities such as fishing and seaweed collection and post-harvest activities (40 women sell dry fish and fresh fish). Many people also work as hired labour. The people of Bharathi Nagar have traditionally accessed Nallathanni, Valai, Appa and Muyal Islands for their livelihood.

Before the ban, sea cucumbers were collected by Bharathi Nagar people by diving near the islands when the sea was calm. The price varied, depending on the size of the cucumber. More than 100 men were involved in this occupation. After the ban, they shifted to seaweed and *chank* collection. But sea cucumber collection was only possible for six months as the fishers could not go out during the three-month fishing ban and for the next three months when the weather was inclement. During the off season, they worked as wage labourers in the groves or in fishing activities further up the coast.

The important islands for Bharathi Nagar are Muyal, Valai, Appa and Nallathanni.

Muyal Island is the largest (about 0.29 sq km in area) among the Mandapam group of islands. Located about 7 km southwest of Mandapam, the island is 4 km long and 250 to 1,800 m wide. The elevation is 3.5-4 m. The island has a thick vegetation cover of *Acacia*, coconut and palmyra.

Valai Island is a small linear island about 9 km from Keelakarai, and is about 0.10 sq km in size. At high tide, Valai is split into two by a channel. This second section is known as Talairi, which is an elongated island of about 0.75 sq km.

The broadest portion of Talairi is on the western tip and is densely covered with trees.

Appa Island, located 8 km from Keelakarai, is about 0.28 sq km in size. The island's elevation is higher at the southern end, which stands on large fossilized coral stones. The northern part has an elevation of 6 m from the spring-tide level.

Nallathanni Island is the second-largest of the 21 islands. It is located about 10 km from Vembar and covers an area of about 1.10 sq km. The island, as its name suggests (*nallathanni* means good water), has potable water.

History

The people of Bharathi Nagar originally came from the inland areas of Pudukottai district. They came here three or four generations ago and settled in the Sethukarai, Thoppuvalasai, Mukkaiyur and Munthal areas and in the Sethupathi of Ramnad's coconut groves. They were from an agrarian background and served as part-time watchmen for the Muslims who had leased the groves, which were close to the seashore, making it convenient to go fishing. Over time, fishing became their predominant livelihood activity. Their main fishing areas were the islands and adjoining reefs where they deployed nets. This kind of fishing did not need a great deal of traditional knowledge. From the beginning, the fishers kept their boats in the area with a single *poovarasan* tree (*Thespesia populnea*) in what is now the Bharathi Nagar fish landing site. Other places were rocky, so this was the only suitable place. However, they would take the gear with them to the grove.

Later, they spread out to other settlements and established new ones. Once the community had spread out, involvement in community activities in the grove was not practical; thus began the tradition of a monthly meeting on the first day of the month. In the beginning, before the villages formed, the villagers used to put up a tent on the beach for the meeting. Those who continued to live in the groves also attended. A fee of Rs 1 was collected from each person for the community fund. Later, as the villages become more organized, they shifted to village meetings, and the *panchayat* developed.

The community was paid Rs 200 per month by the owners to guard the grove. Much of the productive land in the region—agricultural and horticultural—belonged to either the Sethupathi of Ramanathapuram or the Keelakarai Marakkayar. The coconut farms were large (around 0.12 sq km) so three to nine families were able to live in a grove.

The men would go fishing, and the women would collect palm and coconut fronds to make mats to pack dried fish or as roofing for the small water tank in the grove. They would also make brooms from coconut fronds. Even though they lived in coconut groves, the community used to gather monthly to discuss issues and problems and to reinforce their Mutharayar community identity. This sense of caste identity led to the need to create a separate village for themselves. As a result, in 1981, under the leadership of village elders, people migrated from Keelakarai, Erwadi, Valinokkam and other areas to what is now Bharathi Nagar village. The 0.02 sq km of land was bought for Rs 4,000 per acre from D S O Abdul Rahuman of Keelakarai. Each of the 30-40 families was allotted a plot of 202.34-404.69 sq m (5-10 cents; 1 cent =40.47 sq m). Of course, back then, there was no road to the village or to the seashore. That was built later after some struggle.

During the early days, there were only two boats in the village. Fishing was mostly through the *podu* net system (a system of catch shares, where people going on a boat would pitch in with contributions in the form of nets or the boats themselves or even physical labour). The catch share was based on the contributions, including labour. The fishers used hooks for crab (*nandu*), *soodai* nets (sardine nets) and *kanavai thoondi* (hooks for squid). The villagers fished only for these species. This practice continues even today. The Muthurayars did not go for deep-sea fishing, focusing instead on the shallow areas around the islands where they used nets like *singhi valai* (lobster net) and monofilament nets. Since 1990, because of the forest department's rules, they have not been allowed to stay over in the islands.

In the old days, they would go to the islands at 4 p.m., cook and by 5 p.m. they would lower the nets and haul them in at 7 p.m. Then the fish would be packed in ice boxes and they would sleep. The next day, they would get up at 4 a.m. to place the nets, which would be removed by 7a.m. The catch would be placed on ice. Then the fishers would have their meal. Thus they would spend two nights on the island before returning to the mainland. Nowadays, they go out at 2.30 a.m., set the sardine nets by 4 a.m., take them in by 7 a.m. and return by 11 a.m. Crab fishing is done between 4 a.m. and 6 a.m. The seaweed collectors too would spend days on the islands. Muyal, Mulli, Valai, Appa and Palliyarmunai Islands had *Gelidiella acerosa*. The collectors would stay at the Seeniappa *dargah* and collect seaweed.

Use of the islands

Mutharayar communities are traditional fishing communities who use traditional methods and boats. They are fully dependent on the marine resources

located in and around the islands, such as fish, seaweed, sea cucumbers and seashells.

They consider the islands to be their second home as they used the islands extensively, including to rest when winds were unfavourable or during fishing trips. Typically, they stayed on the islands for two to three days but some families lived there for longer periods. The short stays were usually to dry nets and to fish. The islands were also used to shelter from natural calamities like cyclones. Before 1980, some families lived on some of the islands.

Goat and cattle were reared by the Muthurayars on the mainland prior to their use of the islands. Livestock was a major part of their livelihood and they continued to rear them on the islands. While they needed the permission of the lessee/owner of the island(s), the fishers did not pay any rent for grazing or rearing livestock on the islands.

Kuuththa from Erwadi used to rear more than 50 goats on the southern side of Appa Island as did Karuppaiah from Bharathi Nagar. Thavasi from Bharathi Nagar had 200 goats and 20 cows on the island as well. However, after 20 years of using the islands, he had to move the animals to the mainland when the forest department banned the use of the islands. However, after being moved to the mainland, his livestock did not survive as the coastal area was much hotter than the islands due to less tree cover. Thavasi died within a month of losing his livestock. When the goats were young, he would take them by boat to Appa Island and once they grew older, he would leave them on Valai Island. He lived on the islands and would come once a month to the village for provisions. To source drinking water for the goats, he would dig for water in the southern part of Appa Island.

Muniyan's family lived on Appa and Valai Islands. Others who reared livestock on the islands included Thillai Muthu of Erwadi who had 200 goats, which were carried by traditional boats to the island. The islands were considered a good option for rearing livestock as the sea acted as a barrier to robbery attempts, and the vegetation on the islands was enough for the goats to graze on. The goats were taken out together to graze during the day but by 6 p.m. they were penned separately.

Over time, a well was dug on the southern side of Appa Island, which was used by the community. Except for Muyal, Appa and Nallathanni islands, the other islands lacked ample supply of potable water. The fishers found streams on these islands. One reason why families chose to settle on the islands was that fishers from other areas used to sometimes steal livestock from the islands. Over time, living on the island became a standard practice.

At that time, the Mandapam Marakkayar had the title deed to Muyal Island. Nallathanni was taken on lease by Mohamed Meera Sahib of Keelakarai. Both had employees living on the islands to protect their properties.

When Appa Island was under the control of Munsif of Keelakarai, the villagers would use it with his prior permission. He would also provide news about weather conditions. Munsif contested and lost the elections in the 1960s. One of his election promises was that he would get back the islands for the fishers.

Earlier, during the colonial period, fishers would inform the local revenue official (*karnam*) of when they were going to graze livestock on the islands, and when they were going to stay on the islands. This was when the islands were under the charge of the revenue department. After Independence, this practice continued with the village administrative officer.

Nallathanni Island

In the 1940s, the Narippaiyur Vellayathevar leased several islands from the Sethupathi of Ramnad. Veerabhadra Nadar of Keelamunthal subleased the island. In the 1960s, Sayeed Kasim (the head of Mariyur cooperative society) took the lease of Mariyur grove (0.40 sq km of palmyra and coconut) and Mohamed Meera Sahib got the lease of Nallathanni. Then there were upto 400 coconut trees in his area. He began to raise goats there.

Mohamed Meera Sahib got the title deed for that part of Nallathanni Island which had a sizeable coconut grove on it. The rest was government wasteland which was used by fishers. When out fishing, the fishers depended on the island for drinking water as well as for shelter and place to dry their nets. When Mohamed Meera Sahib had the island, it had numerous coconut trees that produced thousands of coconuts. The grove had watchmen. There were also palmyra trees. To get the unfermented toddy from the palmyra trees, Nadars from Vembar and Narippaiyur were brought to the island. They would stay in the island for the coconut and palmyra season and work for Mohamed Meera Sahib. Provisions and other needs were provided by Mohamed Meera Sahib. Bharathi Nagar people also worked during the coconut season, providing transport to the island. Nallathanni was divided by usage- people from Keelamunthal (locals) would camp in a particular area of about 0.01 sq km. Another part was Mohamed Meera Sahib's land (over 0.121sq km) with the groves protected by watchmen. The vast shore area was wasteland where people from Thoothukudi and Vembar would stay in seasonal fishing camps of some 500 huts for about three months to catch fish. The daily catch would be sold in Narippaiyur and Mookkaiyur. With that money, they would buy provisions for the house. The remaining area (not under coconut) was used by fishers for camping with the permission of the

watchmen. This space was needed to access drinking water as there was a stream there. There was a place where the mouth of a canal would get blocked, at low tide, due to sand accumulation. Here potable water would accumulate.

The fishers built a temple to Muniasamy where roosters, goats, cattle were left as offerings and they continue to worship here even today. Bharathi Nagar fishers used to spend up to four days at a time on the island.

Muyal island

The island's name, Muyal (meaning rabbit in Tamil) came from the many rabbits on this most fertile of islands. The Mandapam Marakkayar had rights to the island. The fishers could rarely stay on the island as it was difficult to get permission (taken from the watchmen rather than the Marakkayar directly). If they got permission, they could stay up to 2 days. If the Marakkayar was due to visit, the fishers would be told to leave immediately. A stream ran through the island where fish was so plentiful that they would catch fish with their bare hands. The island's owner, the Marakkayar was keen on guarding the biodiversity of the island and so two watchmen were hired. In later times, Chairman (name of a person) from Keelakarai leased the island to harvest coconuts that he sold in Vedalai.

Later, S.M (Che. Moo) from Keelakarai took Nallathanni and Muyal islands on a sub-lease for five years to harvest coconuts. He built some basic accommodation for the workers and would send provisions by boats. The fishers were hired for this transportation. Some of these fishers whose boats were hired in those days still live in Bharathi Nagar. A dargah was built on the island. During the months of October, November and December (Aipasi and Karthigai), many *ponni kuruvigal* (birds) and *ponnimuralgal* (half beaks) would come to the island. Near the stream (where the potable water accumulated), the fishers would use their beach seine to fish. They would also fish by a traditional method called *kalamkatti* or *kalankathudal*. For *kalankathudal*, 5 people settled on the island permanently. Besides which the Marakkayar had many goats there.

Appa Island

This was not leased to anyone so the fishers used it extensively. The island was a good source of wood, palmyra, and coconut. It also had some *kanna maram* (mangrove). Goats and cattle were raised here. Dargahs for the Muslim fishers who lived and died here were built. The island also had temples to Chattipaar Muniasamy, Sudalaimadasamy, and Kali.

In the last 10 years, the forest department, for the protection of the islands have cut the traditional trees and planted neem, *pungai* (*Pongamia* sp.), *vaagai* (*Albizia lebbek*), *kodakapuli* (*Pithecolobium dulce*), etc. They also cut a canal across the island to irrigate the trees. Because of this the natural environment has changed; trees have died, say the fishers. The island is barren now leading to erosion of up to 100m. Some of the *dargahs* and the Sudalaimadasamy and Kali temples have gone under the sea. Nowadays, the temple festival is not celebrated by the village but each family celebrates separately. The Muslims would offer rice cooked in milk at the dargahs. Fishers used to plant trees and irrigate them. *Gelidiella acerosa* was collected from here. Muslims also dived for chank.

Trees on the island were common property. Anyone who damaged a tree could be questioned by anyone else. Trees were much loved. For example before the advent of the forest department, in daytime over 10 boats would be at the island. So if a tree was cut, the culprit would be hauled up immediately. Nobody wanted to spoil the islands. The trees gave much needed shade which we appreciated as we lived on those islands. Trees also protected the people from the waves during the storms, and stopped erosion. Now a quarter of the island is lost to the sea on the north side. Digging doesn't get freshwater anymore. Freshwater is available only in the rainy season.

TRADITIONAL KNOWLEDGE

The World Intellectual Property Organization defines Traditional Knowledge as "knowledge, know-how, skills and practices that are developed, sustained and passed on from generation to generation within a community, often forming part of its cultural or spiritual identity".

Traditional fishing communities constantly track and understand the marine and coastal ecosystems, the weather and the interactions between abiotic and biotic factors as these are fundamental to success at fishing. Fishers also require exceptional navigational skills considering that there are few, if any, landmarks out on the water. Therefore, features such as elevated reefs that are just under water, become important for navigation and for fishing as well.

To understand the fishers' world and perspective, it is essential for the non-fisher to recognize that the fishers' vocabulary and understanding of the sea is different from that of the non-fisher. For example, when talking of *paaru*, fishers mean only rocks on the seabed. However non-fishers usually translate this to mean reef. But reef is commonly understood as coral reefs. But for fishers, coral reefs are not an important area for their livelihood. Similarly, when talking of locations, winds, currents etc, there is a difference in understanding. This has to be kept in mind.

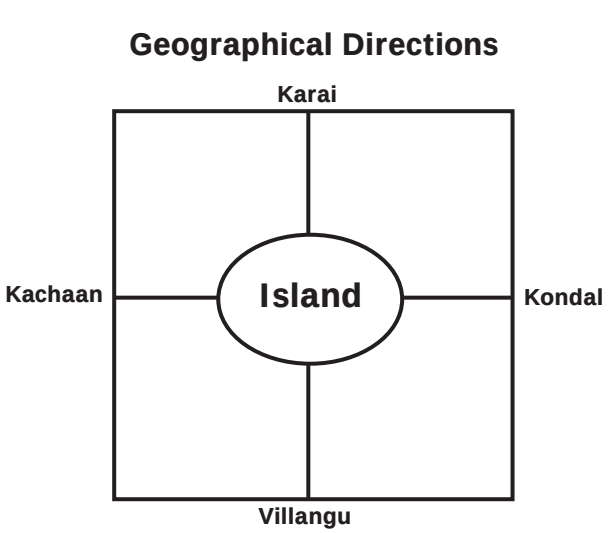
Oceanographic knowledge of both village communities

Different oceanographic factors have greatly influenced the diverse ecosystems in the sea and also those who depend on them for their livelihood. For traditional fishing communities who use non-mechanized boats, oceanographic factors are one set of reasons influencing fishers' decision to stay on the islands. Even today, the winds are relied on for navigation at sea while sea currents are viewed as an important element determining fish availability. The clear waters in the sea may suddenly become muddy when the currents change direction. Certain currents increase or decrease the water temperature. The fishers' experience teaches them which sea currents helps fish come near the islands. They continue to use the traditional names for these winds and the currents according to the direction that each of them take.

The directions

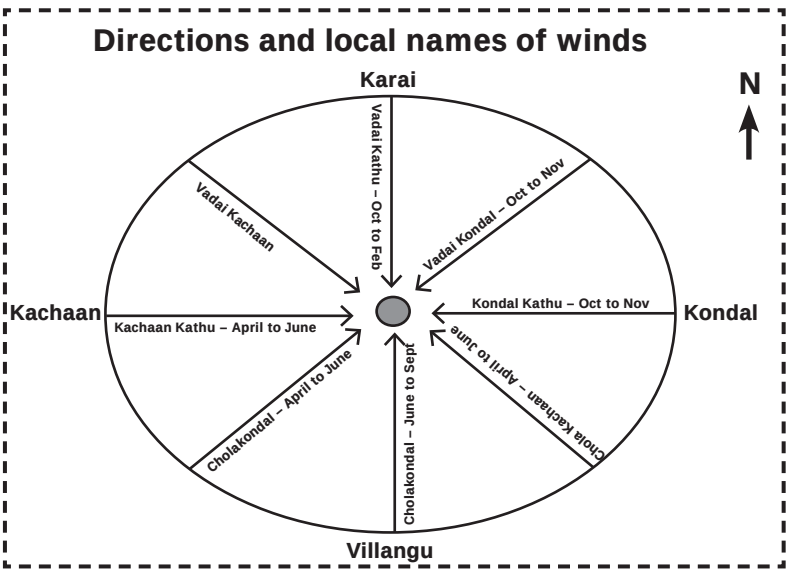
When on the beach, facing the sea, one is facing *villangu*, i.e. the direction of the sea. To one's right is *kachaan* and to the left is *kondal* and behind is *karai*.

So obviously this will change as the coastline changes and therefore does not match north/south/east/west.



At night the fishers rely on stars to navigate safely. For this, they paddle keeping the dug-out canoe's brow in the direction of the chosen star. In this way they can reach the canal accurately. The ghost star, *kuruchuvelli*, for example, is the star that helps fishers navigate through the canals (see Maps 1 and 2).

Sea winds



Cholava kaattu

This wind blows from *karai* to *villangu* and is strong from June to September.

Vaada kaattu

This wind blows from *villangu* to *karai* and is strong from October to February. During this wind, fishes from *villangu* travel to the island area.

Kachaan kaattu

This wind blows from *kachaan* to *kondal* and is strong from April to June. The wind's speed is about 60 km per hour and it is not easy to travel against this wind.

Kondal kaattu

This wind blows from *kondal* to *kachaan* and is strong in October and November. This is when fish come from villangu to the islands.

Cholava kondal kaattu

This wind blows from *villangu-kachaan* to *karai-kondal* and is strong from April to June.

Vaada kondal kaattu

The wind blows from *karai-kondal* to *villangu-kachaan* and is strong in October and November. This wind also bring fishes from *villangu* to the islands.

Cholava kachaan kaattu

This wind blows from *villangu-kondal* to *karai-kachaan* and is strong from April to June. Fishers cannot go for fishing because of the 60-70 kmph winds.

Vaada kachaan kaattu

This wind blows from *karai-kachaan* to *villangu-kondal*. This wind brings rain and sometime cyclones also can be expected.

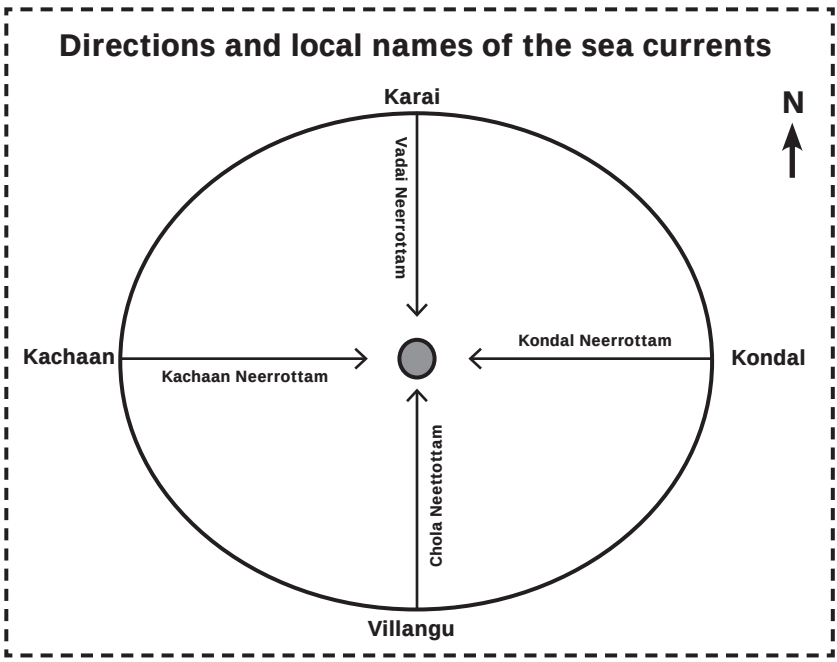
Sea currents

Chola Neerottam is seen from April to July, from *villangu* to *karai*. This is known as the lean session.

Vada Neerottam is seen from November to February, from *karai* to *villangu*. This time is known as *mural* season and people get good catches of half and full beaks.

Kondal Neerottam is seen from February to April, from *kondal* to *kachaan*. During this season, the current is not very strong and many fish species can be caught.

Kachaan Neerottam is seen from June and July, from *kachaan* to *kondal*. This is a powerful current and so normally fishing is not possible.



Geographical knowledge of sea floor between the coast and the islands

Between Chinnapalam and Krusadai Island

Krusadai Island, with an area of 0.71.80 sq km, is 2.44 km away from the Chinnapalam coast. The average depth of the sea between the coast and the island is 3 m. From the village, for about 400 m, the sea is very shallow at low tide, just under 0.61 m height. At high tide, the depth increases to more than 1.52 m. Fishers wade out to the boats or use small dug-out canoes to reach their boats that are anchored in this 400 m area. To go beyond this area, Chinnapalam fishers use a small canal (*attuvai*) which runs north-south for about 2 kms to reach *kunthukal atthuvai* which is a larger canal running east-west on the northern side of the island. This canal goes around Dhanushkodi and can be followed

to go to Sri Lanka. During the field visit, the study team, checked the depth of the canal at 3 points near the island and found it to vary from 6.4 to 9.6 m. The community notes that there was a small canal close to the south eastern side of Chinnapalam, but this filled with sand in the 2004 Tsunami. Canals are locally known as *aattuvai*, *thavu* or *kaavai*.

The community divides the sea floor between the village and Krusadai Island into four zones - sandy, muddy, seagrass and rocky. In some of these zones, sand and seagrass are interspersed. In the area between the village and island, there are many sea anemones, molluscs, sea cucumbers, sponges and small fish.

Between Bharathi Nagar and Appa Island

The island is 7.643 km from Keelakarai and has an area of 0.3 sq km. However, the distance from Bharathi Nagar is about 8.7 km. On the basis of traditional knowledge, the sea bottom from the land till the island is divided into four distinct areas - *manal pakuthi* (sandy area), *cheru pakuthi* (muddy area), *thallai pakuthi* (seagrass area), and *paaru pakuthi* (rocky area). Within 100 m of the Bharathi Nagar shore lie platform reefs that are oriented east-west.

To go to the island, the fishers launch their dug-out canoes through the few canals that lie between the platform reefs. This route, however, is not a direct one. The fishers have to go northeast along the coast towards Keelakarai and then turn south to Appa Island. This is true for all the fishers from Keelakarai, Mangaleshwari Nagar, Vivekanandapuram, and Eranthurai. Of these villages, trawlers are seen only in Keelakarai. The trawlers also use this route.

About 5 km into the sea towards the island from Bharathi Nagar, the depth increases to 13.7 m. During the field visits to the island, community members would indicate what the substrate below consisted of such as seagrass, rocks, and sea fans.

The specific features of the sea bottom and details on sea depth shared by fishers was verified with help of experienced divers who accompanied the study team. The underwater photographs taken by the divers showed exactly the same features at the same depth as described by the fishers.

Geographic and ecological details of both islands

According to people's knowledge and the study team's direct observations, there were different types of ecosystems in the waters around the islands (upto 3.5 fathoms to the shoreward side and 5 fathoms to the seaward side). These are mainly platform reef consisting of dead corals (*chattapaar* or *tharapaar*), live coral reef, sandy areas, broken dead coral reef (*salli*) and seagrass (*thallai*)

areas. The platform reefs are of great ecological importance and are sensitive areas. The fishers say that the lower parts of the reefs are breeding grounds of many species. The platforms reefs are also where the seaweed grow and the women collect seaweed here. The seagrass areas are also of importance as they act as breeding grounds and nursery for some species. This area is also frequented by fish from deeper waters which come through the canals. Hence the seagrass areas are good fishing grounds. The live coral areas are not used by the fishers. These areas have colourful fish which are not caught by the fishers. The broken dead coral reef area is rich in crabs and so crab nets/traps are deployed here. However it is not as important as the seagrass areas. The broken dead coral reef areas are usually a mix of broken dead coral reef and mud or broken dead coral reef and sand. Fishers differentiate between broken dead coral reef, mud and sandy areas in terms of which is predominant; sandy areas are mostly sand, muddy areas are mostly mud and so on.

Appa island, oriented east-west, appears to be two islands. The fishing community call the eastern part—*Kondal Pakuthi* and the western part as *Kachaan Pakuthi*. The area in between these two parts is only 1.52 m deep even at high tide.

An interesting fact that fishers mentioned was that where currents are weak, seagrass is found and where currents are stronger, seaweed grow.

On reaching the island, it is seen that the shore of the island has eroded to the depth of about a man's height (1.5 m). People say that this happened in the Tsunami of 2004.

Platform reefs

Krusadai Island

Platform reefs are found on the southern side of Krusadai Island (along the length of the island) with four main canals cutting through them. These canals are useful to go out to sea. The canals are named *neettu kavai*, *othapparu kavai*, *oduchalli kavai* and *odapipu kavai*. Fishers note that fish from waters beyond the island used to come to the shallow waters around the island through these canals on the southern side of the island. These platform reefs play an important role in the Chinnapalam fishers; livelihood in relation to fishing around Krusadai Island. Platform reefs are areas having dead corals and isolated flat stones. The fishers name sections of the reefs based on their peculiarities. The range of names indicates the importance of these reefs to the fishers. Important platform reefs in this area are *odappu periyachalli, kuthukallu paaru, peevalichalli, kelaviye puthaicha munai paaru, thundi paaru,*

thalam paaru, otha paaru, office munai paaru, kalasachalli paaru, neettu paaru, tiruveilapallu paaru, akala paaru, kambi paaru, and *chinna paaru*.

It was observed that on the southwest side of the island there are sandy and broken dead coral reef areas because of the location of Pulli Island nearby, which blocks the current. Hence the waters here are not productive as few nutrients are brought by the sea. The sea floor in this area is not very biologically diverse as it is mostly sandy. Between the platform reefs further east of the island and the island itself are seagrass areas.

These platform reefs have distinct and rich biota. For example, the seaweed, *Gelidiella acerosa* grows in plenty on these particular platform reefs—*office munai paaru* and *akala paaru*. On *otha paaru*, *Sargassum* sp. grows well. These areas are also the breeding grounds of many species including fishes (see Maps 3 - 9).

According to the traditional knowledge of fishers, the breeding grounds of species near the islands are mainly the platform reefs and muddy areas. Platform reefs are highly sensitive and ecologically important for regeneration of millions of marine organisms which play a vital role in food systems of many other species. Because of this traditional knowledge, the island-dependent communities continue to safeguard these areas and do not indulge in destructive practices. This indicates their sustainable way of utilizing marine resources in and around the islands.

Appa Island

South and southwest of the *kachaan* part of the island are many platform reefs. A good part of these platform reefs are visible at low tide. They extend for about 500 m.

Beyond that, to the southwest, is a canal which is oriented north-south and is roughly 30 m wide and 23.77 m deep. For the people of Bharathi Nagar and nearby villages around Keelakarai, this canal is the only route to go out to *villangu* i.e. out to sea, a little further south into the Gulf of Mannar. Fishers say that this canal in between two platform reefs gets deeper as one proceeds to sea. The canal bottom is 'live mud' they say, as there are many organisms found here. Till about 30 years ago, a lot of fish, small and large, used to regularly migrate through the canal from waters beyond the islands to the waters around the islands. In this way this canal helped to replenish the sea around Appa Island with fish. Beyond the canal, the platforms reefs continue but are not visible at low tide.

Platform reefs are also found southwest of the *kondal* part and south/southeast of the *kachaan* part of the island. These are visible at low tide and are known

as *Urukkukallu*, *Thattukallu*, *Challimanal Paaru* and *Thale Kore Uruttu Paaru*. These reefs do not extend upto the island but are interrupted by seagrass, broken dead coral reef and sandy areas. The reefs begin around 500 m from the island. Fishers from Keelakarai who wish to access the seagrass areas have to go around the southwest tip of the *kachaan* island and come in from the southeast. The other route is to cut through the gap between the two parts of the island– *kondal* and *kachaan*. The reefs (beyond the seagrass area) have a few small canals crossing them. These canals can be traversed only by dug-out canoes.

Fishers say that 50 m from the platforms reefs (that are visible at low tide) the sea floor drops off rapidly to about 23.77 m depth and more.

Seagrass

The seagrass species in both islands are almost the same. The important ones are *Periya Vattalai* (*Halodule* sp.)*, Kodithalai, Elathalai, Oalathalai* (*Cymodocea* sp.)*, Kuchithalai* (*Syringodium isoetifolium*)*, Eekkithalai* (*Halodule uninervis*), and *Poduvuthalai* (*Syringodium* sp.). While *Syringodium*, *Cymodocea* and others grow mostly in shallow waters, *Halodule* species grow in comparatively deeper sea with mud and rubble and produce kernels. Seagrass grows on sandy and muddy substrates. In the shallow waters of the seagrass area there are little holes in the floor like a sand crab's burrow. At the entrance of these pits, a small fish (*kuravan meen*) is usually found guarding the entrance. Inside the hole, a blind burrowing shrimp lives which maintains the tunnel. The sand is brought out by the shrimp and deposited around it. Shells etc are deposited in a certain spot to protect the tunnel (see Maps 10 and 11).

In the shallow waters, along with smaller seagrass species, are small colonies of sponges where damsel fish live. The seagrass area is traditionally very important for small-scale fishers. The seagrass ecosystem is good for migratory species that come from beyond the island. Around the islands, one can observe the resident and migratory species that come from waters beyond the island in different seasons. Most of the fish here are those that come from waters beyond the island through the canals. Hence the sustenance of resources around the island also depends on the ecosystem outside the island.

Krusadai Island

While seagrass grows almost everywhere around Krusadai Island, vast areas of *Halodule* can be seen north-west and north-east of the island as the depth is greater here. These *Halodule* areas were traditionally used for *kalamkatti* fishing as this is where the fish would come through the canals.

The sea is shallow around Krusadai due to Pulli Island located south-west of Krusadai. The presence of this island reduces the strength of the current flowing to Krusadai. Hence less water flows near Krusadai, making the sea comparatively shallower and filled with sand, mud and rubble. It is on the shores of Krusadai Island close to these areas that mangroves grow in plenty (see Map 17).

Appa Island

Seagrass is mainly found close to the southern side of *Kondal* and *Kachaan* parts of the island. Beyond this are the platforms reefs. The main seagrass areas are on the northern side of the island as this where the waters are calmer, with weak currents.

Seaweed

During the enquiry on the two islands over 5 days, with the help of the women seaweed collectors, it was found that the seaweed species are common to both islands. Twenty nine seaweed species were identified of which the women harvest only a few. There may be more seaweed species on the islands but as the data collection was done on the basis of information provided by the women, only those identified by them were included. This is not due to any defect in the observational skills of the women. They do not use minute morphological variations like the shape of the leaf to distinguish between seaweed but focus more on the places where the seaweed grow, the different stages in their growth, the seasons in which they perish and the fish that feed on them (see Maps 12 and 13).

The seaweed are an important food for turtles and other species and act as breeding grounds for several species. Hence one finds many crabs in the seaweed areas. Seaweed mostly grow at a depth of 0.61 to 3.5 m. It is also found that some seaweed grow in large numbers in areas having platform reefs. In between the seaweed, crabs and fish can also be seen.

As mentioned earlier, it was in 1964 that people started collecting seaweed for livelihood in this region. From the beginning, *marikkolundu* (*Gelidiella acerosa*), *kattaikkorai* (*Sargassum* spp.), *pakkoda* (*Turbinaria* sp.), *kanji* (*Gracilaria edulis*) and *cigarette* (*Gracilaria folifera*) pasi were collected. Collection of *ver pasi* (*Gracilaria crassa*) began after 30 years.

Among the seaweed, only *chaakku pasi* (*Hypnea* sp.) grows where sand and mud are seen and where the seagrass also grows. All other varieties grow on dead corals/platform reefs. From the underwater photographs one can clearly see

that even in places where there are live corals, the seaweed grow only on dead corals found in between them. The main location of seaweed is the dead corals seen on the southern side of islands. The sea in this area has about 0.61 to 3.5 m depth that varies by season.

Krusadai Island

In Krusadai Island most of the seaweed are found on the platform reefs to the south and south-east of the island. Since Pulli Island prevents the natural sea current, sand is deposited over the platform reefs and it affects the natural growth of seaweed. On the north-eastern side of Krusadai Island, *Gelidiella acerosa* is found in large quantities and this is the main species that the women collect from Krusadai Island. After the Tsunami in 2004, as the beaches in Chinnapalam village were lost, they also lost the area for drying seaweed and hence they stopped collecting *Sargassum* and *Turbinaria* species.

The women say that the *Kappaphycus* experiment has meant that this exotic species has grown extensively and negatively affected the growth of other seaweed. Seaweed growth was also affected by a plankton bloom a year or two after the tsunami.

Appa Island

Most of the seaweed are found in the vast platform reefs lying on the southern and south-western side of the *kachaan* part of the island. *Sargassum* is extensively in the reefs on south-western side. *Sargassum*, *Turbinaria* and *Gelidiella acerosa* are the main seaweed species collected from Appa Island. South and southeast of the *kondal* part of the island, there are no platform reefs so seaweed cannot grow in this area.

Corals

The direct investigation on both islands identified several coral varieties—*Kolikkal Murukai* (*Sinularia* sp.)*, Poo murukai* (*Lemnalia* sp.)*, Paanachatti paaru, Naappal paaru, Thattu murukai* (*Heliopora coerulea*)*, Mundaan paaru, Kallu murukai, Murakkal, Sonai paru, Mooda paaru, Thundam paaru, Moola koodam, Katti moorai, Kinni vattai* (*Lobophytum* sp.)*, Thattu kinni vattai, Vellakoodam* (*Sarcophyton* sp.), and *Varikoodam*. But in the interview with the traditional communities, with the help of the species catalogue, more species were identified. In between the corals, in the shallow waters, colourful fish were seen. Among the corals in deeper waters, reef fish were seen (see Maps 14 and 15).

Krusadai Island

Areas east and south-east of Krusadai Island have more corals. But most of the corals here consist of the *Kallumurukai, Murakkal* and *Kattimurai* varieties (all these are considered as 'lime corals' or *chunnambu paar* by the community). To the north-east, close to the island, about half-a-km of *Kolikkal Murukai* and *Thattumurkai* corals are found. On enquiring about this, the communities said that this place is very close to where the experimental farming of *Kappaphycus alvarezii* was done, and that the sea currents and winds had brought *K. alvarezii* to the thickly growing corals, destroying them.

Appa Island

Here, the corals are concentrated to the south, west and north of the *kachaan* part of the island and also in the middle of sea between the *kachaan* and *kondal* parts. The island base is made of corals and after the tsunami, due to erosion, this has become visible to about 1.5 m (see Map 16 and 18). Isolated corals are also found to the south of the *kondal* and north of the *kachaan* part of the island. Since the sea floor gradient is steep on the south/south-western side of the platform reefs off the *kachaan* part, corals do not grow there.

The southern side of the *kachaan* part is getting badly eroded. The sand is making the water turbid and covering the corals with mud ultimately killing them. It is worth noting that the corals lying close to the *kachaan* part, inbetween the platform reefs where fishers used to wander often, remain stable and undamaged.

According to the community, one reason for the erosion could be because the forest department created canals to water the trees that the department planted in the island. As a consequence, the corals in the sea and the big trees inside the island died, say the fishers.

During the study, it was found that corals do not surround the island; in fact in some areas, the natural conditions are such that corals cannot grow.

Mangroves

On Krusadai, a fair amount of mangroves are found while on Appa, there are very little mangroves. On Krusadai itself, in the low lying areas, on the western half of the island are mangroves (*Avicennia* sp. etc). Sea water stagnates in these low lying areas, making it very saline in the dry season, and thus supporting some mangroves. This is a biologically rich, important area. As noted before, the presence of Pulli Island has resulted in shallow waters between the two islands. In these shallow areas, mangroves grow.

Traditional knowledge related to biodiversity

Documenting biodiversity on land is comparatively easier than in the sea. However a thorough documentation of terrestrial biodiversity is still lacking in many states of India.

Compared to land, biodiversity in the sea is greater. In addition, the size of the ocean and difficulties in accessing all regions of the ocean makes documenting the marine ecosystem extremely difficult. Hence, it is important that the ecological knowledge of the world's traditional marine fishing communities are acknowledged and tapped. In this study, we have been able to document to a limited extent this traditional knowledge. This information is being prepared as a marine and land biodiversity register.

Here we give some highlights in terms of ecological knowledge and belief systems of the community. This knowledge is limited to a few species not because the community has knowledge of only these but because with the limitations of time and resources we were able to discuss only some species. Also since documenting traditional ecological knowledge was linked to the marine biodiversity register, discussions revolved around species that had been seen by the study team around the islands and species that the community noted as present in the Gulf of Mannar.

Marine biodiversity related knowledge

General ecological observations from the community

- Juvenile shrimps are mostly found in mangroves but when they mature they can be seen in the canals.
- Fish forage between 6 and 8 in the evening and between 3 and 6 in the morning. This is called *masandai* and *velluppu* respectively. It is rare to find fish foraging at other times apart from those mentioned above. But, when there is bright moonlight, fish like barracuda, *para, chambu, motha* etc forage.
- During full and new moon nights, in the high tide, the fish from further away in the sea travel through the canals and reach the waters around the islands.
- During full moon, squid and cuttlefish lay eggs.
- The lower side of platform reefs, muddy and seagrass areas are the preferred breeding grounds of many fish species.
- Colourful fish are found mostly in coral areas; these are not caught by fishers as these do not have commercial value.

Suras (Sharks)

The male and females of the *udumbu* or *thaalan sura* can be distinguished by their body colours. The female sharks are mostly found between the limestone and seagrass around the islands and on the seabed. They stay on the seabed to lay eggs and to protect them. Therefore they are called *thaalan sura*. They lay 10-15 eggs at a time. On the other hand, the male sharks are found foraging above the reefs.

When cooked into a curry, the female sharks are tastier than the males. When new mothers are fed female shark curry cooked in a particular way, their lactation increases within a few days. The curry can also be given to 8-10 years old children who have not lost the habit of bed wetting at night. That's why the female sharks are also called *moothira* (urine) *sura*.

The male *paal sura* (*Scoliodon* sp.) are also called *meen* shark. In the season of *vaadai*, that is, October to March, when the *vaadai* winds blow hard from north to south and *vaada-kondal* winds blow from northeast to southwest, these sharks can be caught in great numbers. The water is relatively cold in this season. The sharks are mostly found west of the reefs and also in the reefs. A peculiarity of this shark is that the females give birth only when the babies are healthy and mature enough to forage on their own. Each will weigh about half a kilogramme. They are also called *pilar,* meaning "King of the Sea". A fully grown adult *paal* shark will be about 3.5 m long. Their tails and *peeli* (fins) used to fetch a good price on the export market. *Paal* sharks have medicinal value. *Paal sura, Pachatthai* and *othamullukara* (*Equuilites leuciscus*) can be made into a curry for new mothers to increase lactation.

Thirukkai (Rays)

There are different kinds of rays, each with its distinctive features and behaviour. The *manal thirukkai* (banded whip-tail sting-ray) lives close to the sands on the seabed. When the females are about to give birth, they shoot up 1 m below the surface. The flesh of this ray is edible. Lactating mothers are fed a particular recipe of this fish to control blood pressure.

On the backs of the *kallu thirukkai* (thorny ray) appear protuberances, as if white stones are glued onto them. These 'stones' decrease in size towards the tails of the fish. The outer skin of the *puli thirukkai*, have large spots, like a leopard. This ray is found mainly in the reefs.

The *adwani thirukkai* (*Gymnura micrura*) migrates in groups to the shallow waters in the season of *vaadai* when the water turns colder. They travel at a depth

of 6.4 to 9 m. They are considered migratory fish and have the tastiest flesh among all the rays. Most of the female rays that are caught in the *vaadai* season will have a fully grown embryo inside. On an average, there will be two embryos.

Yanai thirukkai or *yanai virali* (*Manta birostris*) is the largest among the rays. They travel in small shoals and reach the coast between October and March. Their distinctive feature is their shape. The long tusks, black backs and big eyes give them the name *yanai* (elephant) *virali*.

Kakka thirukkai are called so as they are similar in form and colour to the crow (*kakka*), though not in size. They live in deep waters. Their tails are longer than their bodies. The flesh is very delicious.

The significant feature of the *aada thirukkai*'s (cow-tail ray) body is its long tail. It has a black fin-like projection, with 3 sharp bones at the end. It goes into a defensive mode in the presence of what it perceives as its enemy, including man, thrashing its tail and poking with its sharp bones. It dives down to the sea bed, thrashes its tail and blankets itself with the swirling sand and dust and lies very still. When it does so, it is very difficult to locate it. As a result, the fishers who dive for *chanks* have faced sudden attacks from this ray.

Thimili (Electric ray)

It defends itself by giving an electric shock.

Ponnimural/koolamural fish (half and full beaks)

Ponnimural are caught in plenty in the season of thunderstorms (November) when the *ponni* birds migrate to this region. *Ponnimural* move along the sea surface with their mouths open, hence the name *ponnimural*. And when the birds leave, these fish are not to be found.

Vaalayamural, Kalinkka mural, Kolachi mural and *Kanda mural* (half and full beaks) have light green coloured bones. They are seen mostly among the mangroves (*kandal*), hence the name *kanda mural*.

Sheraya/ Keluthai (Plicofollis tenuispinis)

Plicofolis tenuispinis has an organ called *thamaranga* (*netti*) in Tamil and *vappu* in Malayalam. Most fish do not have this organ. The fishers observe that *P. tenuispinis* lives in the canals and muddy regions on the seabed. These regions are filled with sand and dust because of the undercurrents. Therefore, the *thamaranga* serves as a filtering organ. They also observe that the *thamaranga* is an air bladder that aids the fish to travel freely from the sea bottom to the

surface. It resembles the fruit, *thamaranga*, hence the name. It is white in colour and is edible.

Avili meen (Arius subrostratus)

Like the organ, *mankunni* in hens that act as a filter for straining sand and other particles, the *avili meen* too has a filtering organ. This fish eats mud and the microorganisms in it.

Kathi meen (razor fish)

It travels in a vertical position like the sea horse, with its head up.

Chappathi/ kada unni (sucker fish)

It travels by attaching itself to the backs of other fish.

Paarai (trevally)

They travel from deeper to coastal waters through the canals around full moon time.

Orande meen (surgeon fish)

Unlike other fish, *orande* have bones on either sides of the tail that point in opposite directions.

Koochimurai

The dried and pounded meat of *koochimurai* found within the shell is eaten as a cure for piles. Some roast the fish on burning coals, break open the shell and suck out the flesh.

Eraal (shrimp)

Shrimp spend the first phase of their lives in the seagrass areas and so their body colour will be green. The colour changes as they grow. Fully grown *vral* live in mud and prefer to stay covered in mud.

Shankhu (conches)

Conches like *skulichankku*, *kovanchi*, *verachin*, and *matti* live deep in the sand on the sea floor and are able to travel through the sand. The flesh of *chankku matti*, *yanamulli* and *iravalli* are edible.

The egg of *kuzhisankhu* is used to prevent babies from catching pneumonia. Incense and *kuminchaan* are burnt with the dried and powdered eggs of *kuzhisankhu*.

Squids

Squids lay eggs on the seabed and stand guard over them. They come up to the surface on moon-lit nights when they are caught in plenty. Though squids can travel backwards rapidly, they move forward very slowly. They have both front and rear vision. Squids lay eggs through their mouths. They lay eggs when the sea water is clear. The eggs of needle squids (*ola kanava*) look like bunches of grapes. They have the ability to change colour for camouflage.

Crabs

The fishers observe that it is generally difficult for crabs to forage during the full moon. They consume lean meat during this season. *Nondi muni* and *jeeppu* crabs, when eaten as a curry, gives one the feeling of intoxication. Several varieties of crabs are seen in the seagrass areas.

Sanyaasi crabs reproduce in places where sea and fresh water meet, and also where the leaves fallen from trees have decayed. In the initial growth phase they live within small pearl-like conches (*shankhu*); in the second phase, they live inside *chovis* (gastropod shells) and finally they live within bigger conches. They survive on the dead and decaying things found on the sea floor.

Jelly fish

Kaakka and *appa chori* come in from the deeper to the coastal waters at the time of the *cholava* current (April to July). *Thadikki* and *nonkku chori* are always present in the waters around the islands where the current is weak. *Alukku chori* come up to the surface, unable to bear the coldness of the water in the *vaada* season (October to March). *Chena* and *mooda chori* come from the deeper to the coastal waters in the *cholava* season.

Seela/ oola (barracuda)

There are two types of barracuda. If the tail is pale yellow, it is called *ooli*, and if it is black, it is *oola (koduva)*. *Ooli* travels in groups and stay put in the reefs for a long time. They prey mostly on squids.

Sea snakes

Sea snakes move to the coastal waters when the seabed becomes colder and the sea winds grow strong.

Poochiral (Mantis shrimp)

Normally, shrimps stay deep inside the mud. But mantis shrimps live in pits in rocks and sands.

Turtles

Among the turtles, the *perama* (green turtle) variety lays eggs in the canals in the sea. The eggs and blood of turtles possess medicinal value. Blood is effective in the treatment of asthma and piles while the meat is good for rheumatism and piles. Eggs are effective in controlling white discharge in women. However, this species is not caught now as it is listed in Schedule I of the WLPA.

Corals, sea fans

Black corals and sea fans grow on platform reefs, mud and broken dead coral reefs at more than 10 m depth. They are especially abundant on the continental shelf beyond the platform reefs to the south of the island. *Thattumurukai* (*Heliopora coerulea*) species live in important ecosystems in which colourful fish thrive. *Vellakudam* (*Sarcophyton* sp.) hosts certain fish species and sea turtles.

Traditional knowledge related to medicinal plants in the islands

Seaweed and seagrass

Sargassum wightii grows for 6 months during the *vaadai* season and then decays.

Gracilaria crassa grows only in the season of *cholava* current (April to July).

Potha pasi has a short life span. It is washed ashore when the currents and winds are strong.

Murukku pasi (*Acanthophora spicifera*) is eaten by turtles and many other fish.

Tholukku (*Caulerpa lentilifera*) and *chunnaambu pasi* (*Halimeda* sp.) are not eaten by fish.

Pachai pasi is eaten by turtles and some fish. Its peculiarity is that it sprouts in April and when the rains get over, it begins to decay.

Gelidiella acerosa, *olai* (*Padina* sp.), and *Acanthophora spicifera* are relished by turtles.

Vattalai fruit is edible.

Most of the seaweed sprout in the rainy season and die by April-May when the sea turns warm.

Umari or pulicha keerai (Suaeda sp.*)*

This plant is found all along the sandy shores of the islands and also in the pools of salt water within the islands. As they are deep-rooted, they help in preventing soil erosion. They can be cooked as a curry with *tharunasti* fishes like sharks and rays.

Eluthaani keerai

The leaves are used to make the traditional dish, *rasam*.

Thillai maram (Excoecaria agallocha)

The leaves can be boiled in water and the hot water poured over the body as a remedy for body ache.

Kannamaram/kandamaram (mangroves)

Mangroves prevent soil erosion and are also a source of marine wealth in the region.

Keeri maram

If the green branch of this tree is set on fire, it lights up and continues to burn vigorously. The scraping of its outer bark are used as a pain reliever for toothache. Its strong dry branch is used as the crossbar across the well from which a pulley is hung to draw water.

Vaagai (Albizia lebbek)

When pricked by poisonous fish like rays, *keluthe* (*Plicofolis tenuispinis*), spine foot, *samimeen* (*Thysanichthys* sp.), *imbi meen*, *vaagai* root is ground well, mixed with a little water and the juice poured over the wound. This relieves the numbing sensation.

Perandai (Cissus quadrangularis)

To ease earache, hot *Cissus* is dropped into the affected ear. The 'middle portion' of the plant, roasted and cooked as a curry with coconut, is effective in the treatment of '*sali*' (phlegm/cold). It is also good for dizziness, drowsiness and cough.

Pasali Keerai

Goats like to eat the leaves of *pasali*.

Vedathe Keerai

Those afflicted with chest pain are fed the traditional dish of cylindrical rice cake, called *puttu*, cooked with the flour made of the leaves and seeds of *vedathe*. The steaming hot *puttu* is covered with a cloth and placed over the chest.

Vembu (neem/Azadirachta indica)

A warm water bath with neem leaves relieves body ache.

Kathaalai

There are many places on both islands where this medicinal plant grows thickly. A paste of the plant can be applied on the head before bathing, which imparts a pleasant cool feeling. For eye infections, a jelly of the plant is wrapped in a cloth and placed over the affected eye for relief. When a new house is constructed, the plant is usually hung in front to ward off the evil eye. It is believed that the construction will progress well even as the plant decays.

Raali

If the leaves of *raali*, *nochi* (*Vitex negundo*) and *Eucalyptus* are boiled in water and the warm water used for a bath, it provides relief from body ache.

Kumalai

Earlier, when young children developed any swelling on their heads, the paste of *kumalai* leaves was applied for relief.

Perumpullu

Seen all along the coast of the island, this plant helps prevent soil erosion.

Neervali

Its root is of great medicinal value. In many places in the island, remnants of the plant was seen.

Paalamaram

Almost all the birds in the islands eat the fruit of the *paalamaram*.

Kothaam palam (Cuscuta sp.*)*

Though the fruit is very small in size, it brings instant relief from severe thirst.

Elichevi keerai (Ziziphus jujuba)

Its leaves are boiled and cooked with coconut.

Savukku (Casuarina **sp.***)*

Its wood was used in old days to build the *paaymaram* (mast) of the dugout canoe.

Puliyamaram (tamarind tree)

The tamarind trees seen in the islands grew out of the seeds of the tamarind fruits that the fishers had used for cooking long time ago. Later, these trees, in turn, bore fruit.

Koovaiyilankku valli

The *koovai* fruit is edible.

Kalachi

Flatulence is eased by eating the kernel of the *kalachi* fruit, mixed with egg white and fried in a little gingelly oil. Also, the paste of the kernel is effective for spider bites.

Chappaathi kalli (Opuntia **sp.***)*

Chappathi kalli is roasted over the fire, wrapped and placed on swollen knees to provide relief from arthritis. Its fruits are edible once the hook-like thorns have been removed.

Naattu pullu

This plant is good fodder for cattle.

Karuvelai (Prosopis juliflora)

Its branches are burnt and used as coal.

Peencha

It grows on the shores of the island and helps to prevent soil erosion.

Erukkalam (Calotropis gigantea)

Its leaves are fodder for cattle. The roasted leaves are applyed to the soles of the feet when they hurt. Earlier, its wood was used as a float for the fishing nets.

Veli paruthi

The juice of the leaves is effective in treating bites from poisonous creatures.

Vellai oovvu

This is fodder for cattle.

Nannaari

Its root, after being soaked in water, can be dried and used to make tea, coffee and sherbet. It imparts fragrance and sweetness.

Kelunchi

Keluchi has very deep roots, and hence help in preventing soil erosion. The leaves and branches are used as mulch and fertilizer for coconut trees.

Paithankkai

It is a sort of creeper that spreads out in the sands. Its leaves and fruit are fodder for goats.

Pongal poovu

During *Pongal* (harvest) festival in mid-January, the flowers of this plant are tied with the leaves of the mango tree and hung in front of houses. If the catch is lean for a prolonged time in a particular dugout canoe, as a remedial measure, sea water is sprinkled over the canoe with *pongal* flowers. The ritual is observed in silence.

Manchal veru (turmeric roots)

This plant prevents soil erosion.

Naattu odai

Goats eat the dried-up fruits of this plant.

Usilai

This is fodder for cattle. Traditionally, the outer bark was boiled in water and fishing nets immersed in it to dye them red. Also, the bark is mashed and placed over a wound, healing it quickly.

Adappam kola (Ipomea pes-caprae)

For the contraction of uterus after delivery, the following treatment is effective. Soak *adappam kola*, *veppin kola*, *usalampatta* and *aarespathi* (*Eucalyptus*) in 5 l of water

and boil until it reduces to 2 l. Tie a cloth around the waist of the new mother, covering the abdomen and steadily pour the hot water over the cloth.

Fishing methods

The experience of the fishing communities of the 2 villages is almost identical regarding fishing methods. Historical information reveals that until 1968, 5 types of fishing nets made of cotton country twine were being used. The country nets were mainly brought from Narippaiyur near Thoothukudi, well-known for traditional net making. The major fishing nets used are described below.

Kalamkatti valai

This net developed from the traditional knowledge of fishers on fish that come from beyond the islands to waters around the island. Mostly, these fish come in shoals during full moon. In the fishers' experience, such species remain in the waters around the islands but in areas where the current is not strong. During this season, fishers use the moonlight to observe the sea from the island shore, note the specific points where these fish come and settle and, as soon as the fish leave with the tide, they mark those spots by placing poles. Next morning, at low tide, they go with nets and submerge the lower parts of the net (called *madavalai*) around the poles by putting sand over it. Then the upper part of net (called *meevalai*) is placed, sand put over them, and more poles of about 1.83 m in height are placed in between to keep the net upright. In the experience of several generations of fishers in both villages, the fish would come and settle on the same spots in the moonlight of the next night.

The person who spots the arrival of fish would give the signal to others by lighting a matchbox or with a particular unique howl. Immediately, others would come in from all sides to lift only the *meevalai* and put it over the poles placed around. Once this operation is completed, the fish within the encircled net cannot escape. This method was used to catch *kilaikan* (sand whiting), *keeli* (tiger perches), *avili meen* (*Arius* spp.), *parathuwa meen*, *oodakam* (*Gerres* spp.), juvenile rays, juvenile sharks, and *kalluvettikadan* (sole/flat fish). It often takes hours to pull out the fish caught in the net. Also, much time would be required to put the fish in the dugout canoes and row back to the villages. Each unit of *kalamkatti valai* required about 15 crew members. When country nets were used, there were more than 20 such units each in the 2 villages. According to the traditional management system formulated by the *kalamkatti valai* owners (called *Shammattees*), each owner would get a 10-day long work opportunity (following the *padu* system). This was decided collectively. Until outside interventions came in, a strong local management system regarding fishing

rights and regulations prevailed among this community. Till the 1980s, *kalamkatti valai* was the main fishing gear of both these villages. Because of the peculiar nature of this method, it could only be done if fishers stayed on the islands.

Koi valai (modified gill-net)

Certain large fish species that migrate to waters around the islands do not come to shallow waters near the shore but remain in comparatively deeper waters where *Halodule* sp. grows. *Koi valai* (modified gill-net), with a mesh size of about 7.62 cm, was used to catch these species. The net is placed with stones tied in the *mada valai* and blocks made of *Erukkalam* wood tied in the *mel valai*. After casting the net around sunset, it would usually be pulled in early morning. Species such as carangid, catfish, *manala*, *kuruthala*, bream, *mathanam*, *tholan* and *kalava* were caught in this net. Fishing with this net would take place mostly from the full moon to four-five days before the new moon.

Vidu valai (modified gill-net)

This net has two variations in terms of mesh size—2.54 cm and 1.27 cm. The smaller one is also called *kurukettu valai*. This net is mainly used in areas with no reefs around the island. Many small species can be caught with this net.

Elu/Olai valai

Starting from one end of the beach, the net is cast along the shore for a kilometre. The thick rope connecting this net has palm leaves tied to it, giving it the name *olai valai* (palm leaf net). From both ends, about 10 to 20 people will pull the net towards the beach and fish that live in the seagrass beds get caught. Nowadays this net is also cast with two canoes pulling the net at sea.

Crab nets

Crab nets are used to catch reef crabs and those found in the seagrass areas. Reef crabs are caught by keeping the net close to platform reefs on the southern side of the islands. The reef crabs that remain on the continental slope south of the platform reefs come to the shallow waters around the island through the platform reefs after sunset and at night. This is when these nets are deployed and the crabs caught. Crabs in the seagrass areas are also caught with this net. The fishers are able to identify the spots where the crabs usually come.

Nylon nets

Around 1968, nylon nets to catch certain fish were introduced. Once the nylon nets arrived, all the country cotton twine nets were abandoned as all the nets to

catch lobsters and half and full beaks began to be made of nylon. The major change was the discovery of the export market for lobsters; until then, people considered lobsters inedible. With the introduction of nylon nets, issues such as the weight of wet nets used at sea, the possibile rapid deterioration of the nets, and the long period required to dry nets were resolved to a great extent. Alongside these changes, large canoes with sails started replacing small dugout canoes in the 1970s. With this, fishing areas also expanded.

Even though nets changed from locally made cotton to nylon twine, there was no change in ownership or labour relations. But the number of fishing gear owners started increasing over the period.

Plastic nets

It was in 1985 that plastic nets were introduced. With this, *shingi raal*, various types of crabs and reef fish were caught in large numbers. It was the emerging market for these species that encouraged fishers to catch them in greater quantities with the help of plastic nets. Various crabs that were considered inedible earlier were now targeted with these nets. Thus the lightweight plastic nets began to be used in an uncontrolled manner resulting in overfishing. As fishing around the islands was strictly regulated, fishing pressure in other areas increased. In the 1990s, outboard engines were introduced in country crafts. Though it helped in sea voyages, investments and daily operating costs also increased. The system of sharing the entire sales proceeds between the owner and crew got affected. A good portion of it had to be kept apart for fuel and loan repayment, thus affecting the net income of fishers.

Monofilament nets

In 1995 monofilament nets were introduced. For each species, different nets evolved. Though fishing was mostly done during the night earlier, with monofilament nets, day fishing increased.

In short, a community that used to cast their nets with a good understanding of the sea, weather and the ecosystem were more and more influenced by external forces. In addition, there are now several bans on fishing that they find unacceptable.

Myths and taboos associated with fishing

- The women in fishing households do not touch the nets or dugout canoes when they are menstruating. However, if they do so inadvertently,

a ritual of penance is performed. Two vessels full of sea water are poured over the dugout canoe, which is then fumigated by burning incense, *choodam* (camphor), *sambrani,* etc. The remains of the burnt offerings are deposited in the sea. The dugout canoe is upturned and rolled over twice, and then, it is ready for use.

- Incense is lit near the dugout canoe, and the ritual of *aayudha pooja* (in honour of the tools of one's trade) is performed before it is first launched to sea.

The fishing community here have a saying that indicates their deep link with the sea:

"Thaayvayathile 10 maasam vattavayathile vaazhvu muzhuvan" meaning "Ten months in the mother's womb but a lifetime on the boat."

RECOMMENDATIONS

For the sake of sustainable use, conservation and management of fisheries resources, we must :

- *Recognize traditional knowledge*: The study clearly shows the importance of the islands and surrounding ecosystems for the traditional fishing communities. It is important to recognize the traditional knowledge of fishing communities in planning, management, sustainable use and conservation of marine resources, especially in the Gulf of Mannar.
- *Conserve essential habitats*: The traditional fishers' knowledge of the habitat around the islands clearly shows that the most important habitats for fishing are seagrass areas, flat-rock beds and platform reefs. Fishing communities should be allowed access to these fishing grounds that have been traditionally important for them for sustainable use. Their conservation practices must be implemented as well. The *thallai* habitat as they call the seagrass beds, are critical habitats.
- *Community-led protection of platform reefs*: Platform reefs are highly sensitive and ecologically important for regeneration of millions of marine organisms. These organisms play vital roles in the food systems of many other species. Because of their traditional knowledge, the island-dependent communities continue to safeguard these areas and avoid destructive practices. This indicates their sustainable utilization of marine resources in and around the islands. These areas must, therefore. be continuously protected under the direct control of the community under Conservation Reserve (Section 36A (I) of the WLPA.
- *Develop marine biodiversity registers:* Using the traditional knowledge of fishing communities, marine biodiversity registers must be developed as per the Biological Diversity Act (2002). Efforts must also be taken to form district-level biodiversity management committees where fishing communities can directly participate in community-initiated, legally-recognized sustainable use and conservation measures.
- *Implement existing regulations*: Implementation of existing regulations, especially those related to the Tamil Nadu Marine Fishing Regulation Act and Rules, on trawling is important. The area between the coastline and the islands needs to be reserved for small-scale fishing communities using traditional gear. Trawling should be allowed only on the seaward side of the islands.

- *Mesh size regulation*: The communities have clearly identified that it is essential to have mesh size regulations, including for monofilament nets. A mesh size below 30 mm should not be used in waters around the islands.
- *Allocate space for seaweed drying*: Due to the December 2004 Indian Ocean Tsunami, most of the shore area in Chinnapalam was washed away. This shore area was used by the women seaweed collectors to dry species of *Sargassum* and *Turbinaria*. Since the Tsunami, the women have stopped collecting these seaweed species for want of a drying space. Hence, the study team suggests that the forest department could set aside an open space within Krusadai Island for this purpose, thus boosting the women's income. The extent of the drying area(s) could be decided in consultation with the fishing community of Chinnapalam, and the women self-help groups can be given the responsibility of monitoring and managing these areas.
- *Widen livelihood options*: Seaweed collection is one of major livelihoods of island-dependent communities in the Gulf of Mannar. More than 2,000 women from 24 villages of both Rameswaram and Keelakarai areas depend on this source of livelihood. Due to natural reasons and restricted access to the islands, the life and livelihood of seaweed collectors have been negatively impacted for the past 15 years. Efforts must be taken, in consultation with the island-dependent communities, to widen livelihood options for the women.
- *Combat erosion of Appa Island*: Erosion of the shore in the *kondal* area of Appa Island is a very crucial issue. At this rate, a part of the island will soon be washed away. Immediate steps need to be taken to arrest the erosion by the relevant state and central government agencies. The study team suggests it would be useful to commission a hydrography study to understand the magnitude of the problem and to find a scientific and feasible solution. In addition to the loss of land mass in Appa Island, the rapid erosion is causing dust and debris to accumulate on the corals, killing them.

REFERENCES

A.M.S.S.V.M. & Co. vs The State Of Madras, Madras High Court, 24 February, 1953.

Anand, M., and J. Anandan. "Islands around Gulf of Mannar," in *Souvenir 2000: National Symposium on Eco-friendly Mariculture Technology Packages*. CMFRI, 2000.

Bhaskar, Satish. *Field note on the Survey of the Islands of the Gulf of Mannar*. CMFRI, 1977.

BOBLME. First *bi-lateral consultation meeting on Gulf of Mannar ecosystem, 05 - 06 Sep 2011*. Rameshwaram, India: BOBLME, 2011.

Britto, Vincent, S J. *Thuya saveriyaar kadithangal*. 2002.

CMFRI. Tamil Nadu Marine Fishing Census. Part IV. 2011.

Coelho, J C. "Indian Luxuries and Europeans 1600-1800: A Study of International Trade of India with Special Reference to the Dutch." PhD diss., Pondicherry University, 1997.

Deckla, S. "Maritime history of the pearl fishery coast with special reference to Thoothukudi." PhD diss., Manonmaniam Sundaranar University, 2004.

GOMBRT. *On-site Periodic Review 2011*. GoMBRT, 2012.

Government of India. *Report of the Task Force on Islands, Coral Reefs, Mangroves & Wetlands in Environment & Forests for the Eleventh Five Year Plan 2007-2012*. New Delhi: Planning Commission, Government of India, 2007.

Hornell, James. *Fishing in many waters*. Cambridge: Cambridge University Press, 1950.

Hornell, James. "The Indian Pearl Fisheries of the Gulf of Mannar and Palk Bay," in *Madras Fisheries Bulletin, Vol. XVI*, 6-49. Government Press Madras, 1922.

Johnson, B., Shyam, S. Salim., and R. Narayanakumar. "Market structure analysis of fish markets in Ramanathapuram district." *Marine Fisheries Information Service T&E Ser* CMFRI: 217 (2013): 35-37. http://eprints.cmfri.org.in/9628/1/29.pdf

Kandasami, D. "Marine Pearl Culture," in Souvenir 2000: National Symposium on Eco-friendly Mariculture Technology Packages. CMFRI (2000): 28-35.

Lal Mohan, R.S. "The Sea Cow, *Dugong dugon* of India," in *Souvenir 2000: National Symposium on Eco-friendly Mariculture Technology Packages*. CMFRI(2000): 23.

Lal Mohan, R.S. "Note on a case of death due to jelly fish sting in Gulf of Mannar." *Current Science*, December 5, 1971.

Mahadevan, S., and K Nagappan Nayar. "Distribution of coral reefs in the Gulf of Mannar and Palk Bay and their exploitation and utilization." *Proc. Symp. Corals and Coral Reefs. Mar. Biol. Assoc. India* (1972):181–190.

Mohamad, J Raja. "Maritime Activities, Economy and Social Customs of the Muslims of Coromandel Coast 1750 – 1900." PhD diss., Pondicherry University, 1997.

Muniyan, Sadai. Sadai Muniyan s/o Muniyandi, of Keelamunthal to District Collector, 1984.

Nagarajan, S. S Nagarajan to State Fisheries Department, 1981.

Narayana Kumar, R., and M Krishnan. *Socio-economic dimensions of Seaweed Farming in India*. CMFRI, 2010.

PAD. *Participatory plan for disaster management of Bharathi Nagar village*. Unpublished study. 2009.

Prabhu, M.S. "The perch-fishery by special traps in the area around Mandapam in the Gulf of Mannar and Palk Bay." *Indian Journal of Fisheries*. http://eprints.cmfri.org.in/1606/1/Article_07.pdf

Rajagopalan, R. *Marine protected areas in India*. Samudra Monograph. Chennai: ICSF, 2008.

Rajesh, Vinoth Vincent. *Ethnographic history of Parathava community*. Department of History, Manonmaniyam Sundaranar University, Tirunelveli, 2004.

Raju, S. "Katcha Theevu is Ours." *Pudumalar*, 2010.

Ramadhas, V., Santhanam, R., Venkataramani, V. K., and V. Sundararaj. *Gulf of Mannar – A profile released on the Occasion of Coastal Pollution Awareness Meet*. Thoothukudi: Fisheries College and Research Institute, Tamil Nadu Veterinary and Animal Sciences University, 1999.

Ramanathapuram district Gazetteer (1961 – 1968). Madras: Government of Tamilnadu, 1972.

Silas, E G., Mahadevan, S., and K Nagappan Nayar. "Existing and Proposed Marine Parks and Reserves in India—A Review." *Proc, Symp. Endangered Marine Animals and Marine Parks*, CMFRI (1985): 414-428.

Suresh Kumar, P S. "Forest, Fisheries departments fight over Krusadai island," *The Hindu*, September 16, 2002.

Whittingham, E., Campbell, J. and P. Townsley. *Poverty and Reefs*. DFID–IMM–IOC/UNESCO, 2003.

ANNEXURE I:
SPECIES DIRECTLY OBSERVED IN APPA ISLAND

SPONGES		
NOTE: 8 directly-observed specimens were identified only by local name, kadal panchi and 50 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
CORALS (Phylum Cnidaria)		
Family	**Scientific Name**	**Local Name**
ACROPORIDAE	*Acropora* sp.	
ACROPORIDAE	*Montipora* sp.	
AGARICIDAE	*Pavona venosa*	
FAVIIDAE	*Favia danae*	
FAVIIDAE	*Favia vavus*	
FAVIIDAE	*Favites* sp.	
FAVIIDAE	*Favites* sp.	
FAVIIDAE	*Leptastrea purpurea*	
PORITIDAE	*Porites astreoides*	
PORITIDAE	*Porites evermanni*	
NOTE: In addition to this list, 12 directly-observed specimens are unidentified and 50 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
JELLYFISH		
NOTE: 2 directly-observed specimens were identified only by local name, chori and 12 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
SEA ANEMONES (Phylum Cnidaria)		
Family	**Scientific Name**	**Local Name**
ACTINODISCIDAE	*Zoanthus* sp.	Poomurgai
STYCHODACTYLIDAE	*Stichodactyla haddoni*	Nachathiram kinnivetai
STYCHODACTYLIDAE	*Stichodactyla mertensii*	Nachathiram

STYCHODACTYLIDAE	*Stichodactyla* sp.	Kadal thaamarai
STYCHODACTYLIDAE	*Stichodactyla* sp.	Kadal thaamarai
STYCHODACTYLIDAE	*Stichodactyla* sp.	Kadal thaamarai
STYCHODACTYLIDAE	*Stichodactyla* sp.	Kadal thaamarai
STYCHODACTYLIDAE	*Stichodactyla* sp.	Kadal thaamarai
STYCHODACTYLIDAE	*Stichodactyla* sp.	Kadal thaamarai
STYCHODACTYLIDAE	*Stichodactyla* sp.	Kadal thaamarai
THALASSIANTHIDAE	*Cryptodendrum adhaesivum*	Kadal thaamarai
NOTE: In addition to this list, 14 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
SEA FANS (Phylum Cnidaria)		
Family	**Scientific Name**	**Local Name**
SUBERGORGIIDAE	*Subergorgia* sp.	Kadal vishari
NOTE: In addition to this list, 12 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
WORMS		
NOTE: 1 directly-observed specimen is unidentified and 12 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
BIVALVES (Phylum Mollusca)		
Family	**Scientific Name**	**Local Name**
PHARIDAE	*Siliqua radiata*	Chippi
PLACUNIDAE	*Placuna placenta*	Kulichanku/Paalvaayan
NOTE: In addition to this list, 5 directly-observed specimens are unidentified and 8 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
GASTROPODS (Phylum Mollusca)		
Family	**Scientific Name**	**Local Name**
BURSIDAE	*Marsupina bufo*	

CASSIDAE	*Semicassis* sp.	Kovanchi
FASCIOLARIIDAE	*Fusinus nicobaricus*	
MURICIDAE	*Chicoreus* sp.	
MURICIDAE	*Chicoreus* sp.	
MURICIDAE	*Murex shells*	Kottaachi
NERITIDAE	*Nerita* sp.	
OLIVIDAE	*Oliva* sp.	Peechovi
STROMBIDAE	*Laevistrombus canarium*	
STROMBIDAE	*Lambis lambis*	Airavalli
STROMBIDAE	*Margistrombus marginatus*	
TURBINELLIDAE	*Turbinella pyrum*	Kulichanku/Paalvaayan
VOLUTIDAE	*Harpulina lapponica*	
NOTE: In addition to this list, 6 directly-observed specimens are unidentified and 35 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
CEPHALOPODS (Phylum Mollusca)		
Family	**Scientific Name**	**Local Name**
LOLIGINIDAE	*Sepioteuthis lessoniana*	Oosikkanava
SEPIIDAE	*Euprymna berryi*	
SEPIIDAE	*Sepia pharaonis*	Oattu kanava
SEPIIDAE	*Sepioteuthis lessoniana*	Oattu kanava
NOTE: In addition to this list, 9 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
CRABS (Phylum Arthropoda)		
Family	**Scientific Name**	**Local Name**
CALAPPIDAE	*Calappa lophos*	Kolakkattanjandu
CALAPPIDAE	*Calappa* sp.	Kolakkattanjandu
DORIPPIDAE	*Dorippoides facchino*	Nattuvaakkali
VARUNIDAE	*Varuna litterata*	Paaruodinjandu
NOTE: In addition to this list, 18 directly-observed specimens are unidentified and 22 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		

HERMIT CRABS (Phylum Arthropoda)		
Family	**Scientific Name**	**Local Name**
DIOGENIDAE	*Calcinus* sp.	Natthai poochi
DIOGENIDAE	*Calcinus* sp.	Natthai poochi
NOTE: In addition to this list, 2 directly-observed specimens are unidentified and 5 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
PRAWN (Phylum Arthropoda)		
NOTE: 4 specimens were identified to the Family level - 1 in Alphiedae and 3 in Penaeidae. In addition, 11 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
SEA CUCUMBER (Phylum Echinodermata)		
Family	**Scientific Name**	**Local Name**
HOLOTHURIIDAE	*Holothuria leucospilota*	Kadalattai
STAR FISH (Phylum Echinodermata)		
Family	**Scientific Name**	**Local Name**
ASTRICLYPEIDAE	*Echinodiscus auritus*	Nachatthiram/star
ASTROPECTINIDAE	*Astropecten granulatus*	Nachatthiram/star
ASTROPECTINIDAE	*Astropecten* sp.	Nachatthiram/star
OPHIOCOMIDAE	*Ophiocoma erinaceus*	Nachatthiram/star
OPHIOTRICHIDAE	*Macrophiothrix nereidina*	Nachatthiram/star
OREASTERIDAE	*Pentaceraster regulus*	Nachatthiram/star
OREASTERIDAE	*Pentaceraster* sp.	Nachatthiram/star
OREASTERIDAE	*Pentaceraster* sp.	Nachatthiram/star
OREASTERIDAE	*Pentaceraster* sp.	Nachatthiram/star
		Nachatthiram/star
NOTE: In addition to this list, 6 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		

BIRDS (Phylum Chordata)		
Family	**Scientific Name**	**Local Name**
ACCIPITRIDAE	*Haliastur indus*	Kalla pranthu
CHARADRIIDAE	*Charadrius mongolus*	Kottang
LARIDAE	*Sterna* sp.	Kaava
LARIDAE	*Sterna* sp.	Kadal pakshi
PHALACROCORACIDAE	*Phalacrocorax carbo*	
FISH (Phylum Chordata)		
Family	**Scientific Name**	**Local Name**
ACANTHURIDAE	*Acanthurus nigrifascus*	Orande
ACANTHURIDAE	*Acanthurus* sp.	Orande
ACANTHURIDAE	*Acanthurus* sp.	Orande
ACANTHURIDAE	*Acanthurus* sp.	Orande
ACANTHURIDAE	*Acanthurus* sp.	Orande
ACANTHURIDAE	*Acanthurus xanthopterus*	Orande
ACANTHURIDAE		Therakom
ANTENNARIIDAE	*Antennarius nummifer*	Saami meen
APOGONIDAE	*Cheilodipterus* sp.	
APOGONIDAE	*Pempheris vanicolensis*	Aattu thalai
BALISTIDAE	*Abalistes stallatus*	Klatthi
BELONIDAE	*Strongylura leiura*	Vaalai mural
BOTHIDAE	*Pseudorhombus* sp.	Adal
CAESIONIDAE	*Caesio* sp.	
CARANGIDAE	*Alectis indica*	Thennam koduva
CARANGIDAE	*Atule mate*	Thira paarai
CARANGIDAE	*Caranx heberi*	kadukkam paarai
CARANGIDAE	*Scomberoides commersonnianus*	Ola katta
CARANGIDAE		Kumila paarai
CARANGIDAE		Manja paarai

CARANGIDAE		Pottu paarai
CARANGIDAE		
CARANGIDAE		
CHAETODONTIDAE	*Chaetodon decussatus*	Vannatthi meen
CHAETODONTIDAE		Vannatthi meen
CHAETODONTIDAE		Vannatthi meen
CHAETODONTIDAE		Vannatthi meen
CLUPEIDAE	*Sardinella melanura*	
CLUPEIDAE		
CLUPEIDAE		
CYNOGLOSSIDAE	*Cynoglossus lida*	Adal
DIODONTIDAE	*Arothron stellatus*	Petthai
DIODONTIDAE	*Canthigaster solandri*	Petthai
ELOPIDAE	*Elops machnata*	Kulachaan
ENGRAULIDAE	*Satolephorus waitei*	Netthali
EPHIPPIDAE	*Drapane* sp.	Painthi
EPHIPPIDAE	*Drapane* sp.	Painthi
EPHIPPIDAE	*Drapane* sp.	Painthi
EXOCOETIDAE		Parava mural
GERREIDAE	*Gerres filamentosis*	Oodakam
GOBIIDAE	*Ctenogobiops* sp.	
HEMIRAMPHIDAE	*Hemiramphus far*	Shelva mural
HEMISCYLLIDAE	*Scolidon* sp.	Paal sura
HEMISCYLLIDAE		Sura
HOLOCENTRIDAE	*Sargocentron* sp.	Silanthi meen
HOLOCENTRIDAE	*Sargocentron rubrum*	Silanthi meen
LABRIDAE	*Bolbometopon muricatum*	Kininchaan
LABRIDAE	*Cetoscarus* sp.	Kininchaan
LABRIDAE	*Halichoeres hortulanus*	Kinichaan
LABRIDAE	*Halichoeres* sp.	Kinichaan

LABRIDAE	*Scarus ghobban*	Kininchaan
LABRIDAE	*Scarus* sp.	Kininchaan
LABRIDAE		Kinichaan
LATIDAE	*Psammoperca waigiensis*	
LEIOGNATHIDAE	*Gazza minuta*	Kuthippu kaara
LEIOGNATHIDAE	*Leiognathus lineolatus*	Kaara
LEIOGNATHIDAE	*Leiognathus lineolatus*	Kaara
LUTJANIDAE	*Lutjanus ehrenbergii*	Parutthi velai
LUTJANIDAE	*Lutjanus* sp.	Kuruvalai
LUTJANIDAE	*Lutjanus* sp.	Kuruvalai
LUTJANIDAE	*Lutjanus* sp.	Kuruvalai
LUTJANIDAE	*Lutjanus* sp.	Parutthi velai
LUTJANIDAE	*Lutjanus* sp.	Parutthi velai
LUTJANIDAE	*Lutjanus* sp.	Parutthi velai
LUTJANIDAE	*Paracaesio sordida*	Manja parutthi valai
MONACANTHIDAE	*Aluterus scriptus*	Klatthi
MONACANTHIDAE	*Lalmohania velutina*	Klatthi
MONACANTHIDAE	*Paramonacanthus frenatus*	Klatthi
MONACANTHIDAE	*Paramonacanthus* sp.	Klatthi
MONACANTHIDAE	*Paramonacanthus* sp.	Klatthi
MUGILIDAE	*Liza* sp.	Paratta
NARCINIDAE		Amanam
OSTRACIIDAE	*Trosomus* sp.	Kuttulu
OSTRACIIDAE	*Trosomus* sp.	Kuttulu
PLOTOSIDAE	*Plotosus* sp.	Aakkanam kiluthu
POMACENTRIDAE	*Abudefduf vaigiensis*	Paal satthai
POMACENTRIDAE	*Amphiprion* sp.	Varna meen
POMACENTRIDAE	*Dascyllus trimaculatus*	Varna meen
POMACENTRIDAE	*Stegastes partitus*	Varna meen
SCARIDAE	*Halichoeres cosmetus*	Kinichaan

SCARIDAE	*Halichoeres margaritaceus*	Kinichaan
SCARIDAE	*Halichoeres* sp.	Kinichaan
SCARIDAE	*Halichoeres* sp.	Kinichaan
SCOMBRIDAE	*Scomberomorus commerson*	
SCOMBRIDAE	*Scomberomorus* sp.	
SERRANIDAE	*Cephalopholis formosa*	Varikalava
SERRANIDAE	*Epiniphelus fuscoguttatus*	Thaalan kalava
SERRANIDAE	*Epiniphelus merra*	kalava
SERRANIDAE	*Epiniphelus undulosus*	Panchi kalava
SERRANIDAE		Kalava
SERRANIDAE		Kalava
SERRANIDAE		Kalava
SERRANIDAE		Kalava
SERRANIDAE		Kalava
SERRANIDAE		Kalava
SERRANIDAE		Kalava
SIGANIDAE	*Siganus* sp.	Oara
SIGANIDAE	*Siganus* sp.	Vella oara
SIGANIDAE	*Siganus sutor*	Vella oara
SILLAGINIDAE	*Sillago vincenti*	Kelakkaan
SPHYRAENIDAE	*Sphyraena jello*	
SPHYRAENIDAE	*Sphyraena chrysotaenia*	
SYGNANTHIDAE		Kadal palli
SYNODONTIDAE		thanni panna
TETRODONTIDAE	*Arthron hippides*	Petthai
THRYSSIADE	*Thryssa* sp.	Kuttha
THRYSSIADE	*Thryssa* sp.	Matta chooda
TRIACANTHIDAE	*Pseudotriacanthus strigilifer*	Klatthi
TRIACANTHIDAE	*Triacanthus biaculeatus*	Klatthi
		Chemmeen

		Chemmeen
		Chempalli
		Keeli
		Keeli
		Keeli
		Keeli
		Mural
		Mural
		Nagara
		Nagara
		Nagara
		Nagara
		Othadan
		Paaru moottan
		Tholan
		Tholan
		Vari tholan
		Velameen
		Velameen
		Velameen
		Velameen
		Velameen
NOTE: In addition to this list, 15 directly-observed specimens are unidentified and 250 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
SEAWEED (Phylum Chlorophyta)		
Family	**Scientific Name**	**Local Name**
CAULERPACEAE	*Caulerpa lentillifera*	Tholukku pasi
CAULERPACEAE	*Caulerpa peltata*	Podi kannumuli pasi

CAULERPACEAE	*Caulerpa racemosa*	Kannumuli pasi
CAULERPACEAE	*Caulerpa racemosa*	Mukkuthi pasi
CAULERPACEAE	*Caulerpa sertularioides*	Ila pasi
HALIMEDACEAE	*Halimeda* sp.	Chunnambu pasi
HALIMEDACEAE	*Halimeda* sp.	Mookkucheli pasi
SIPHONOCLADACEAE	*Boergesenia forbesii*	Thracha/ Thrachkotthu pasi
ULVACEAE	*Ulva lactuca*	Pattu pasi
VALONIACEAE	*Valoniopsis pachynema*	Kambi pasi
Phylum Ochrophyta		
DICTYOTACEAE	*Padina* sp.	Paper pasi/Ola pasi
SARGASSACEAE	*Cystoseira trinodis*	Mani pasi
SARGASSACEAE	*Sargassum wightii*	Kattaikkorai pasi
SARGASSACEAE	*Turbinaria ornata*	Pakkoda pasi
SCYTOSIPHONACEAE	*Hydroclathrus clathratus*	Idiyappa pasi
Phylum Rhodophyta		
GELIDIELLACEAE	*Gelidiella acerosa*	Marikkolundu pasi (initial/ growing stage)
GRACILARIACEAE	*Gracilaria crassa*	Kavattu pasi
GRACILARIACEAE	*Gracilaria crassa*	Veru pasi
GRACILARIACEAE	*Gracilaria edulis*	Kanji pasi
RHODOMELACEAE	*Acanthophora spicifera*	Murukku pasi
SOLIERIACEAE	*Kappaphycus alvarezii*	Pepsi pasi
		Kunchu pasi
		Moora pasi
SEAGRASS (Phylum Tracheophyta)		
Family	**Scientific Name**	**Local Name**
CYMODOCEACEAE	*Cymodocea* sp.	Ola thaalai
CYMODOCEACEAE	*Halodule uninervis*	Eekki thaalai

CYMODOCEACEAE	*Syringodium isoetifolium*	Kuchi thaalai
CYMODOCEACEAE	*Syringodium isoetifolium*	Poduvu thaalai
PLANTS (Phylum Magnoliophyta)		
Family	**Scientific Name**	**Local Name**
XANTHORRHOEACEAE	*Aloe vera*	Katthaalai
MELIACEAE	*Azadirachta indica*	Vembu
ARECACEAE	*Borassus flabellifer*	Panai maram
ASCLEPIADACEAE	*Calotropis gigantea*	Erukkalam
RHIZOPHORACEAE	*Ceriops tagal*	Kandal
VITACEAE	*Cissus quadrangularis*	Perandai
FABACEAE	*Crotalaria* sp.	Kilukilupai
CONVOLVULACEAE	*Ipomea pes-caprae*	Adappan kodi
MORINGACEAE	*Moringa* sp.	Murungai tree
CACTACEAE	*Opuntia* sp.	Chappaatthi kalli
ARECACEAE	*Phoenix sylvestris*	Eechai palm
FABACEAE	*Prosopis juliflora*	Karwai
POACEAE	*Spinifex littoreus*	Raavana meesai (male)
POACEAE	*Spinifex littoreus*	Raavana meesai/Mulli
MALVACEAE	*Thespesia populnea*	Poovarasu
RHAMNACEAE	*Ziziphus jujuba*	Elichevi keerai
		Arisi pullu
		Kallu oavu
		Kanna
		Kattu arugam pullu
		Keeri
		Kolunji
		Kovai kodi
		Manjal ver
		Naattu odai

		Naattu pullu
		Nannari
		Nerinji mullu
		Oavu pullu
		Paitthankaai chedi
		Peencha
		Pongai maram
		Pongal poovu
		Poo mulli
		Pothankaai chedi
		Pulicha keerai/ Umari keerai
		Usalai maram
		Velipparutthi
		Vellai adappai
		Vellai oovu

ANNEXURE II:
SPECIES DIRECTLY OBSERVED IN KRUSADAI ISLAND

SPONGES (Phylum Porifera)		
Family	**Scientific Name**	**Local Name**
CLIONAIDAE	*Spheciospongia* sp.	Kadalpanchi
CLIONAIDAE	*Spheciospongia vagabunda*	Kadalpanchi
TETILLIDAE	*Cinachyra* sp.	Kadalpanchi
NOTE: In addition to this list, 15 directly-observed specimens were identified only by local name, kadal panchi.		
CORALS (Phylum Cnidaria)		
Family	**Scientific Name**	**Local Name**
ACROPORIDAE	*Acropora nasuta*	
AGARICIIDAE	*Leptoseris hawaiiensis*	
AGARICIIDAE	*Pavona cactus*	
DENDROPHYLLIDAE	*Turbinaria mesenterina*	
DENDROPHYLLIDAE	*Turbinaria* sp.	
FAVIIDAE	*Platygyra* sp.	
FAVIIDAE	*Favia danae*	
FAVIIDAE	*Favia fragum*	
OCULINIDAE	*Galaxea fascicularis*	
POCILLOPORIDAE	*Stylophora* sp.	
NOTE: In addition to this list, 5 directly-observed specimens are unidentified.		
JELLYFISH (Phylum Cnidaria)		
Family	**Scientific Name**	**Local Name**
CASSIOPEIDAE	*Cassiopea* sp.	Pavila chori
PELAGIIDAE	*Chrysaora hysoscella*	chori
		Pavila chori

SEA ANEMONES (Phylum Cnidaria)		
Family	**Scientific Name**	**Local Name**
ACTINODISCIDAE	*Zoanthus* sp.	Poomurgai
ACTINODISCIDAE	*Zoanthus* sp.	Poomurgai
STYCHODACTYLIDAE	*Stichodactyla haddoni*	Nachathiram kinnivetai
STYCHODACTYLIDAE	*Stichodactyla mertensii*	Nachathiram
STYCHODACTYLIDAE	*Stichodactyla* sp.	Kadal thaamarai
THALASSIANTHIDAE	*Cryptodendrum adhaesivum*	Kadal thaamarai
FLAT WORMS (Phylum Platyhelminthes)		
Family	**Scientific Name**	**Local Name**
PSEUDOCEROTIDAE		Kadal pulu
PSEUDOCEROTIDAE		Kadal pulu
WORMS (Phylum Annelida)		
Family	**Scientific Name**	**Local Name**
SABELLIDAE	*Myxicola* sp.	Valukkapaasi
SABELLIDAE	*Sabellastarte indica*	Chembaasi
NOTE: In addition to this list,10 directly-observed specimens are unidentified and 2 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
BIVALVES (Phylum Mollusca)		
Family	**Scientific Name**	**Local Name**
ARCIDAE	*Anadara* sp.	
PINNIDAE	*Pinna* sp.	Naakku aakku
CHAMIDAE	*Chama* sp.	
ARCIDAE	*Anadara* sp.	
ARCIDAE	*Arca* sp.	
CARDIIDAE	*Cardium* sp.	

CARDIIDAE	*Cardium* sp.	
CUCULLAEIDAE	*Cucullaea labiata*	
CONIDAE	*Conus* sp.	
VACCINIEAE	*Paphia* sp.	
SPONDYLIDAE	*Spondylus* sp.	
ARCIDAE	*Trisidos tortuosa*	
NOTE: In addition to this list, 1 directly-observed specimen is unidentified.		
CEPHALOPODS (Phylum Mollusca)		
Family	**Scientific Name**	**Local Name**
SEPIIDAE	*Euprymna berryi*	
SEPIIDAE	*Sepia pharaonis*	Oattu kanava
SEPIIDAE	*Sepioteuthis lessoniana*	
NOTE: In addition to this list, 2 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
CRABS (Phylum Arthropoda)		
Family	**Scientific Name**	**Local Name**
CALAPPIDAE	*Calappa lophos*	Kolakkattanjandu
PORTUNIDAE	*Charybdis natator*	Penjandu/Paarunjandu/ Nondimuni
PORTUNIDAE	*Portunus sanguinolentus*	Moonnupullinjandu
PORTUNIDAE		Paarunjandu
PORTUNIDAE		
		JCBNjandu
		Karanjandu
		Karanjandu
		Karanjandu
		Karanjandu
NOTE: In addition to this list, 15 directly-observed specimens are unidentified and 6 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		

HERMIT CRAB (Phylum Arthropoda)		
Family	**Scientific Name**	**Local Name**
DIOGENIDAE	*Calcinus* sp.	Natthai poochi
DIOGENIDAE	*Calcinus* sp.	Natthai poochi
INSECTS (Phylum Arthropoda)		
Family	**Scientific Name**	**Local Name**
		Arattaalai poochi
		Poochi
NOTE: In addition to this list, 1 directly-observed specimen is unidentified.		
PRAWN (Phylum Arthropoda)		
NOTE: 5 specimens were identified to Family Penaeidae.		
SEA CUCUMBER (Phylum Echinodermata)		
Family	**Scientific Name**	**Local Name**
HOLOTHURIIDAE	*Holothuria imitans*	Kadalattai
HOLOTHURIIDAE	*Holothuria leucospilota*	Kadalattai
HOLOTHURIIDAE	*Holothuria* sp.	Kadalattai
SEA URCHIN (Phylum Echinodermata)		
Family	**Scientific Name**	**Local Name**
ECHINOMETRIDAE	*Echinometra mathaei*	
STOMOPNEUSTIDAE	*Stomopneustes variolaris*	
NOTE: In addition to this list, 1 specimen is unidentified.		
STAR FISH (Phylum Echinodermata)		
Family	**Scientific Name**	**Local Name**
ASTRICLYPEIDAE	*Echinodiscus auritus*	Nachatthiram/star

BIRDS (Phylum Chordata)		
Family	**Scientific Name**	**Local Name**
ACCIPITRIDAE	*Haliastur indus*	Kalla pranthu
ARDEIDAE	*Ardea alba*	vella kokku
CHARADRIIDAE	*Charadrius dubius*	Kottang
CORVIDAE	*Corvus splendens*	Kaakka
PHALACROCORACIDAE	*Phalacrocorax niger*	Kadal kaakka
PHASIANIDAE	*Pavo cristatus*	Mayil
		Egg of Kathavaali koli
		Njaara kokku
FISH (Phylum Chordata)		
Family	**Scientific Name**	**Local Name**
ACANTHURIDAE	*Acanthurus lineatus*	Vari orande
ACANTHURIDAE		Orande
ACANTHURIDAE		Orande
ACANTHURIDAE		Orande
ACANTHURIDAE		Orande
APOGONIDAE		Aattu thalai
APOGONIDAE		Aattu thalai
ARIIDAE	*Plicofolis* sp.	Sheraya
BALISTIDAE	*Abalistes stellatus*	Manja klatthi
CARANGIDAE	*Caranx* sp.	Paarai
CARANGIDAE	*Caranx* sp.	Paarai
CARANGIDAE	*Caranx* sp.	Paarai
CARANGIDAE	*Caranx* sp.	Paarai
CARANGIDAE	*Caranx* sp.	Paarai
CARANGIDAE	*Caranx* sp.	Paarai
CARANGIDAE	*Caranx* sp.	Paarai
CARANGIDAE	*Caranx* sp.	Paarai

CARANGIDAE	*Trachinotus blochii*	Shekani paara
CARANGIDAE		Kadukkam parai
CHAETODONTIDAE	*Heniochus acuminatus*	Vannatthi meen
CHAETODONTIDAE		Vannatthi meen
CHAETODONTIDAE		Vannatthi meen
CHAETODONTIDAE		Vannatthi meen
CHIROCENTRIDAE	*Chirocentrus dorab*	Vaala meen
CLUPEIDAE		
CLUPEIDAE		
CLUPEIDAE		
ENGRAULIDAE	*Satolephorus waitei*	Netthali
EPHIPPIDAE	*Drapane* sp.	Karuva painthi
EPHIPPIDAE	*Drapane* sp.	Karuva painthi
HAEMULIDAE		Tholan
HAEMULIDAE		Tholan
HAEMULIDAE		Tholan
HAEMULIDAE		Tholan
HAEMULIDAE		Tholan
HEMISCYLLIDAE	*Scolidon laticaudus*	Sura
HEMISCYLLIDAE	*Scolidon* sp.	Sura
HOLOCENTRIDAE	*Sargocentron melanospilos*	Silanthi meen
LABRIDAE		Kinichaan
LABRIDAE		Kinichaan
LABRIDAE		Kinichaan
LABRIDAE		Kinichaan
LABRIDAE		Kinichaan
LABRIDAE		Kinichaan
LABRIDAE		Kininchaan
LABRIDAE		Kininchaan
LABRIDAE		Paal kininchaan

LABRIDAE		Paal kininchaan
LEIOGNATHIDAE	*Leiognathus* sp.	Kodunkaaran
LEIOGNATHIDAE	*Leiognathus* sp.	Kodunkaaran
LEIOGNATHIDAE	*Leiognathus* sp.	Kodunkaaran
LETHRINIDAE	*Lethrinus* sp.	Salli velameen
LETHRINIDAE	*Lethrinus* sp.	Salli velameen
LETHRINIDAE	*Lethrinus* sp.	Salli velameen
LETHRINIDAE	*Lethrinus* sp.	Salli velameen
LETHRINIDAE		Velameen
LUTJANIDAE	*Lutjanus fulviflamma*	Manja kunju
LUTJANIDAE	*Lutjanus* sp.	Chenkalava / Chempalli
LUTJANIDAE	*Lutjanus* sp.	Parutthi velai
LUTJANIDAE	*Lutjanus* sp.	Parutthi velai
LUTJANIDAE	*Lutjanus* sp.	Parutthi velai
MUGILIDAE	*Liza parsia*	Cheraya
MUGILIDAE	*Liza tade*	Avali meen
NEMIPTERIDAE		Nagara
NEMIPTERIDAE		Nagara
NEMIPTERIDAE		Nagara
NEMIPTERIDAE		Nagara
OSTRACIIDAE	*Lactoria cornuta*	Kuttulu
OSTRACIIDAE	*Lactoria* sp.	Kuttulu
PLOTOSIDAE	*Plotosus limbatus*	Aakkanam kiluthu
PLOTOSIDAE		kiluthu
POMACENTRIDAE	*Abudefduf vaigiensis*	Paal satthai
POMACENTRIDAE		Varna meen
SCOMBRIDAE		
SCOMBRIDAE		
SERRANIDAE	*Epinephelus* sp.	Kalava
SERRANIDAE	*Epinephelus* sp.	Kalava

SERRANIDAE	*Epinephelus* sp.	Kalava
SERRANIDAE	*Epinephelus* sp.	Kalava
SERRANIDAE	*Epinephelus* sp.	Kalava
SERRANIDAE	*Epinephelus* sp.	Kalava
SERRANIDAE	*Epinephelus* sp.	Kalava
SERRANIDAE	*Epinephelus* sp.	Kalava
SERRANIDAE	*Epinephelus* sp.	Kalava
SERRANIDAE	*Epinephelus* sp.	Kalava
SERRANIDAE		Keeripillai kalava
SIGANIDAE	*Siganus* sp.	Oara
SIGANIDAE	*Siganus* sp.	Oara
SILLAGINIDAE	*Sillago vincenti*	Kelakkaan
SOLEIDAE		
SOLEIDAE		
SPHYRAENIDAE	*Sphyraena* sp.	
SYGNANTHIDAE		Kadakkuthira
SYGNANTHIDAE		Kadakkuthira
SYNODONTIDAE		thanni panna
SYNODONTIDAE		thanni panna
SYNODONTIDAE		thanni panna
TETRODONTIDAE	*Arthron* sp.	Petthai
TETRODONTIDAE	*Arthron* sp.	Petthai
TETRODONTIDAE	*Arthron* sp.	Petthai
TRIACANTHIDAE	*Triacanthus* sp.	Klatthi
TRIACANTHIDAE	*Triacanthus* sp.	Klatthi
		Keeli
		Keeli
		Keeli
		Klatthi
		Klatthi

		Klatthi
		Klatthi
		Klatthi
		Kuruvalai
		Paarumoottan
		Pannaa meen
		Thola katthaalai
NOTE: In addition to this list, 18 directly-observed specimens are unidentified and 154 specimens were indirectly identified using visual aids (i.e. marine resource catalogue).		
MAMMALS (Phylum Chordata)		
Family	**Scientific Name**	**Local Name**
CERCOPITHECIDAE	*Macaca mulatta*	Kurangu
NOTE: In addition to this list, 1 specimen is unidentified.		
TURTLES (Phylum Chordata)		
Family	**Scientific Name**	**Local Name**
CHELONIIDAE	*Lepidochelys olivacea*	Kadal aamai
SEAWEED (Phylum Chlorophyta)		
Family	**Scientific Name**	**Local Name**
CAULERPACEAE	*Caulerpa lentillifera*	Podi kannumuli pasi
CAULERPACEAE	*Caulerpa racemosa*	Kannumuli pasi
CAULERPACEAE	*Caulerpa sertularioides*	Ila pasi
CODIACEAE	*Codium tomentosum*	Kodikathalai pasi
HALIMEDACEAE	*Halimeda macroloba*	Kallu pasi
HALIMEDACEAE	*Halimeda macroloba*	Kallu pasi (growing stage)
HALIMEDACEAE	*Halimeda opuntia*	Thattu pasi
HALIMEDACEAE	*Halimeda opuntia*	Thracha/ Thrachkotthu pasi

HALIMEDACEAE	*Halimeda* sp.	Mukkuthi pasi
SIPHONOCLADACEAE	*Boergesenia forbesii*	Thanni pasi
Phylum Ochrophyta		
DICTYOTACEAE	*Dictyota* sp.	Cigarette pasi
DICTYOTACEAE	*Padina* sp.	Paper pasi/Ola pasi
SARGASSACEAE	*Sargassum wightii*	Kattaikkorai pasi (initial/ growing stage)
SARGASSACEAE	*Turbinaria ornata*	Pakkoda pasi
SARGASSACEAE	*Turbinaria ornata*	Pakkoda pasi (initial/ growing stage)
SCYTOSIPHONACEAE	*Hydroclathrus clathratus*	Idiyappa pasi
Phylum Rhodophyta		
CYSTOCLONIACEAE	*Hypnea* sp.	Chaaku pasi
GELIDIELLACEAE	*Gelidiella acerosa*	Marikkolundu pasi
SCINAIACEAE	*Scinaia huismanii*	Chuvappu pasi
RHODOMELACEAE	*Acanthophora spicifera*	Murukku pasi
		Kunchu pasi
		Moora pasi
		Thaila pasi
NOTE: In addition to this list,1 specimen was indirectly identified using visual aids (i.e. marine resource catalogue).		
SEAGRASS (Phylum Tracheophyta)		
Family	**Scientific Name**	**Local Name**
CYMODOCEACEAE	*Cymodocea cerulata*	Ola thaalai
CYMODOCEACEAE	*Halodule uninervis*	Poduvu koraai
CYMODOCEACEAE	*Halodule uninervis*	Vaattalai
CYMODOCEACEAE	*Syringodium* sp.	Kuchi thaalai
CYMODOCEACEAE	*Syringodium* sp.	Poduvu thaalai
HYDROCHARITACEAE	*Halophila ovalis*	Ela thaalai

PLANTS (Phylum Magnoliophyta)		
Family	**Scientific Name**	**Local Name**
ACANTHACEAE	*Adhatoda vasica*	Aadathodai
ARECACEAE	*Phoenix sylvestris*	Eechai palm
FABACEAE	*Acacia auriculiformis*	Acacia
FABACEAE	*Tamarindus indica*	Puliya maram
FABACEAE	*Prosopis juliflora*	Karuvai
MORACEAE	*Ficus religiosa*	Arasa maram
MALVACEAE	*Thespesia populnea*	Poovarasu
MELIACEAE	*Azadirachta indica*	Vellai arukku
MORACEAE	*Ficus benghalensis*	Alamaram
POACEAE		Arisi pullu
FABACEAE	*Acacia planifrons*	Naattu odai
XANTHORRHOEACEAE	*Aloe vera*	Katthaalai
ACANTHACEAE	*Avicennia marina*	Kanda maram
ASCLEPIADACEAE	*Calotropis gigantea*	Erukkalam
CASUARINACEAE	*Casuarina* sp.	Savukku
VITACEAE	*Cissus quadrangularis*	Perandai
CONVOLVULACEAE	*Cuscuta* sp.	Cuscuta fruit
CONVOLVULACEAE	*Cuscuta* sp.	Kottham paalam chedi
CONVOLVULACEAE	*Cuscuta* sp.	Kottham paalam/ Cuscuta
EUPHORBIACEAE	*Excoecaria agallocha*	Thillai maram
CONVOLVULACEAE	*Ipomea pes-caprae*	Adappan chedi
LAMIACEAE	*Ocimum* sp.	Thulasi
PANDANACEAE	*Pandanus* sp.	Thaalai
FABACEAE	*Pongamia pinnata*	Pungai
RHIZOPHORACEAE	*Rhizophora mucronata*	Kanna maram
CHENOPODIACEAE	*Suaeda* sp.	Umari keerai
FABACEAE	*Thespesia populnea*	Kodi poovarasu
RHAMNACEAE	*Ziziphus jujuba*	Eli chevi keerai

RHAMNACEAE	*Ziziphus* sp.	Ilanthai tree
		Adappan kodi
		Asai thadam kodi / Sakkalatthi of Vavai
		Balvakka kilanku
		Chada keerai
		Elamatthai
		Elanthai
		Eliutthaani keerai
		Kaattu movhai
		Kalachi
		Kandal kai
		Karna chedi
		Karna maram
		Karuma palam
		Karuppuvalam maram/ Kakka
		Keeva nelli
		Kilukiluppan chedi
		Kovai kilanku valli
		Kumulai
		Kuppameni
		Mani chedi
		Mookkutthi poovu
		Mulli
		Mulli (male)
		Naattu keeri
		Naavi kandal/ Ciriopas
		Nachathra poovu
		Nandhi keerai
		Nawwa

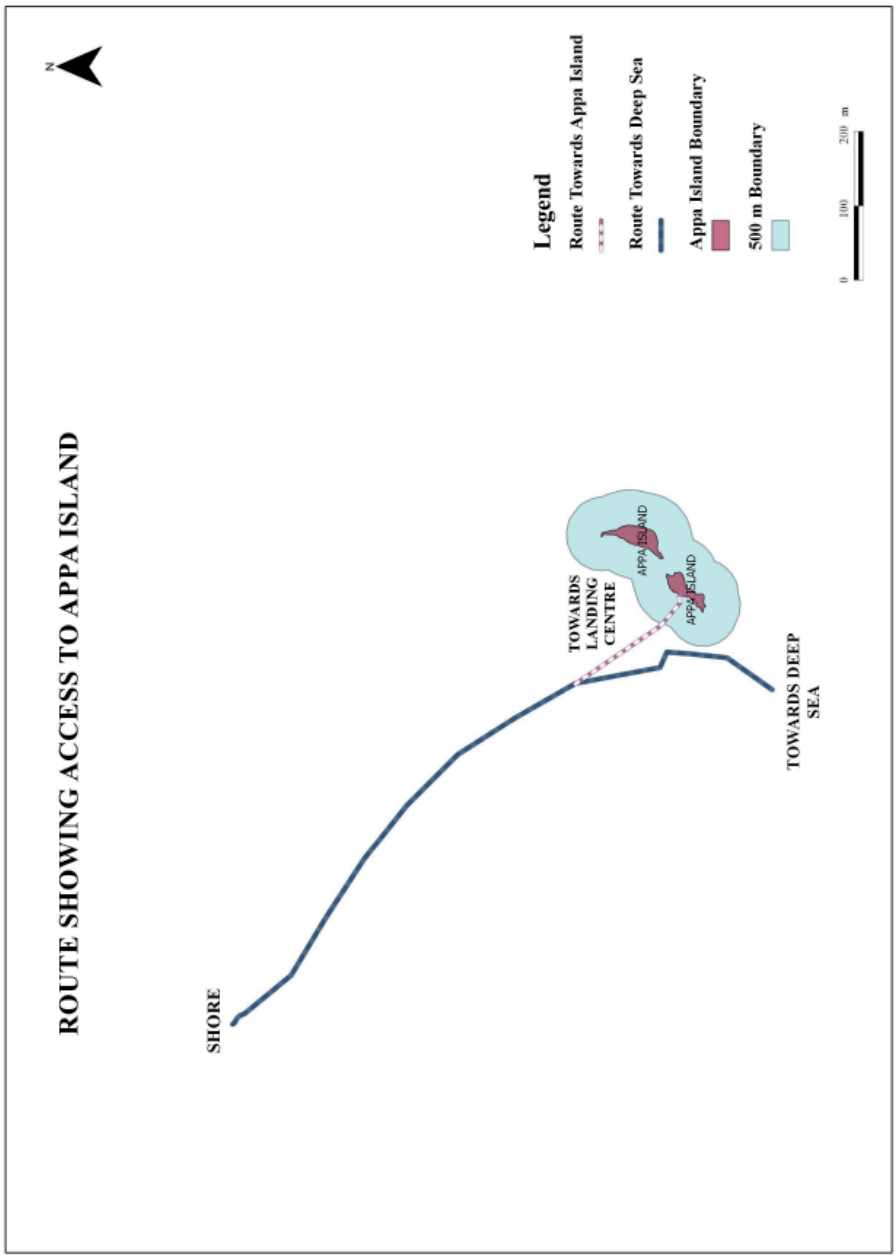
		Neervali chedi
		Ottu mutthi
		Paala maram
		Panakai maram
		Pasali
		Peenjan kulai
		Perum pullu
		Pongal poovu
		Ponni maram
		Pottu ilai / Nachathira ppovu
		Raali
		Sakkalatthi of Pongal poovu
		Sorandai
		Uppu tharavai
		Uthala maram
		Vakai palm
		Vattu odai
		Vedathai
		Vellai arukku
		Veppal poovu (lichen)
		Yaanai thattai
NOTE: In addition to this list, 2 specimens are unidentified.		

NOTE: In addition, on Krusadai Island, 1 barnacle, 40 gastropods and 4 mantis shrimp were indirectly identified using visual aids (i.e. marine resource catalogue).

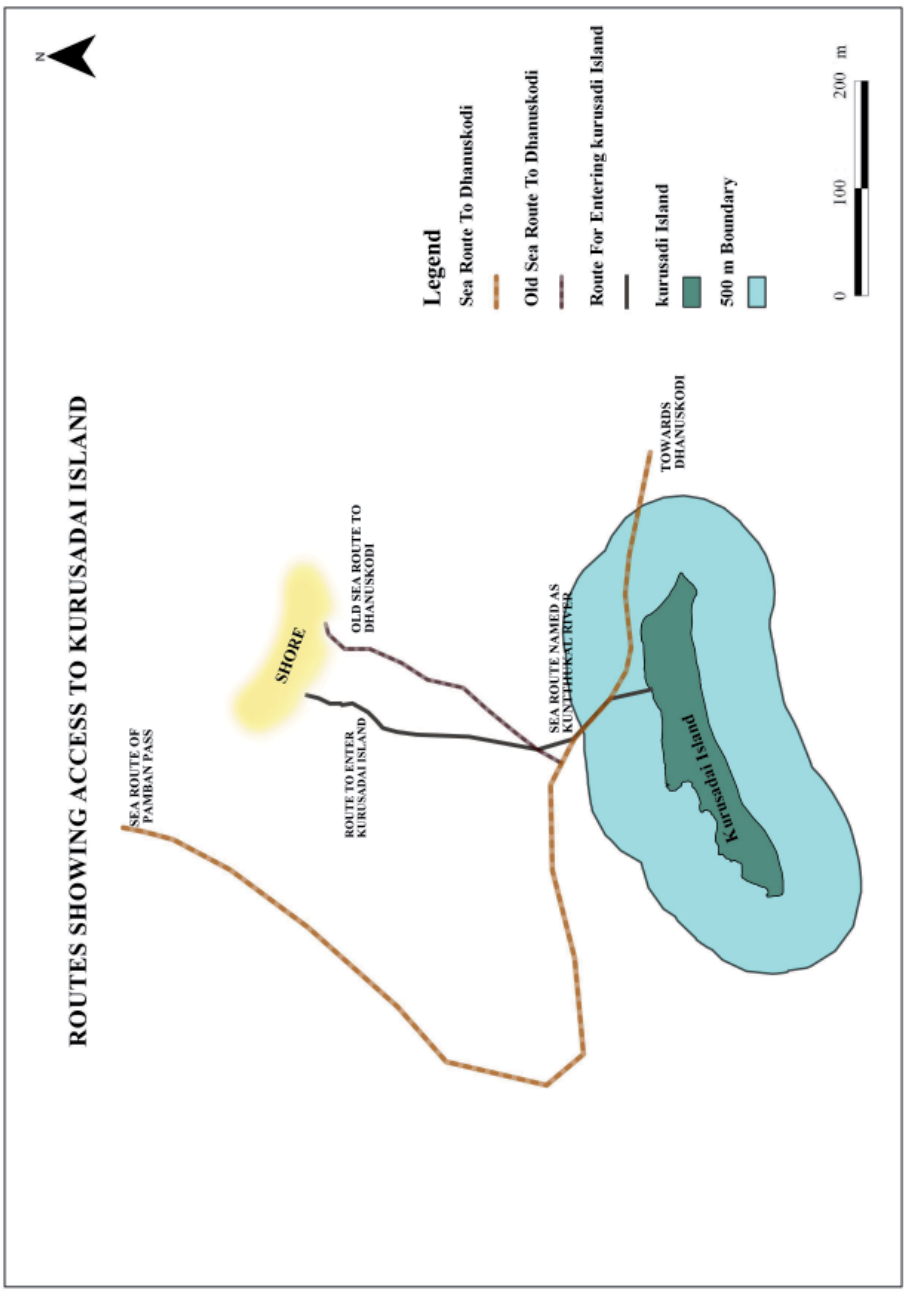
Disclaimer

This report lists the species directly observed in and around the two islands by the study team. The scientific identification given has been done by the authors and is currently being confirmed with taxonomists. Therefore this is a draft list. The report also does not list the species indirectly identified (through the marine resource catalogue) as this too is being checked with taxonomists. Here we list the number of specimens identified indirectly in each island.

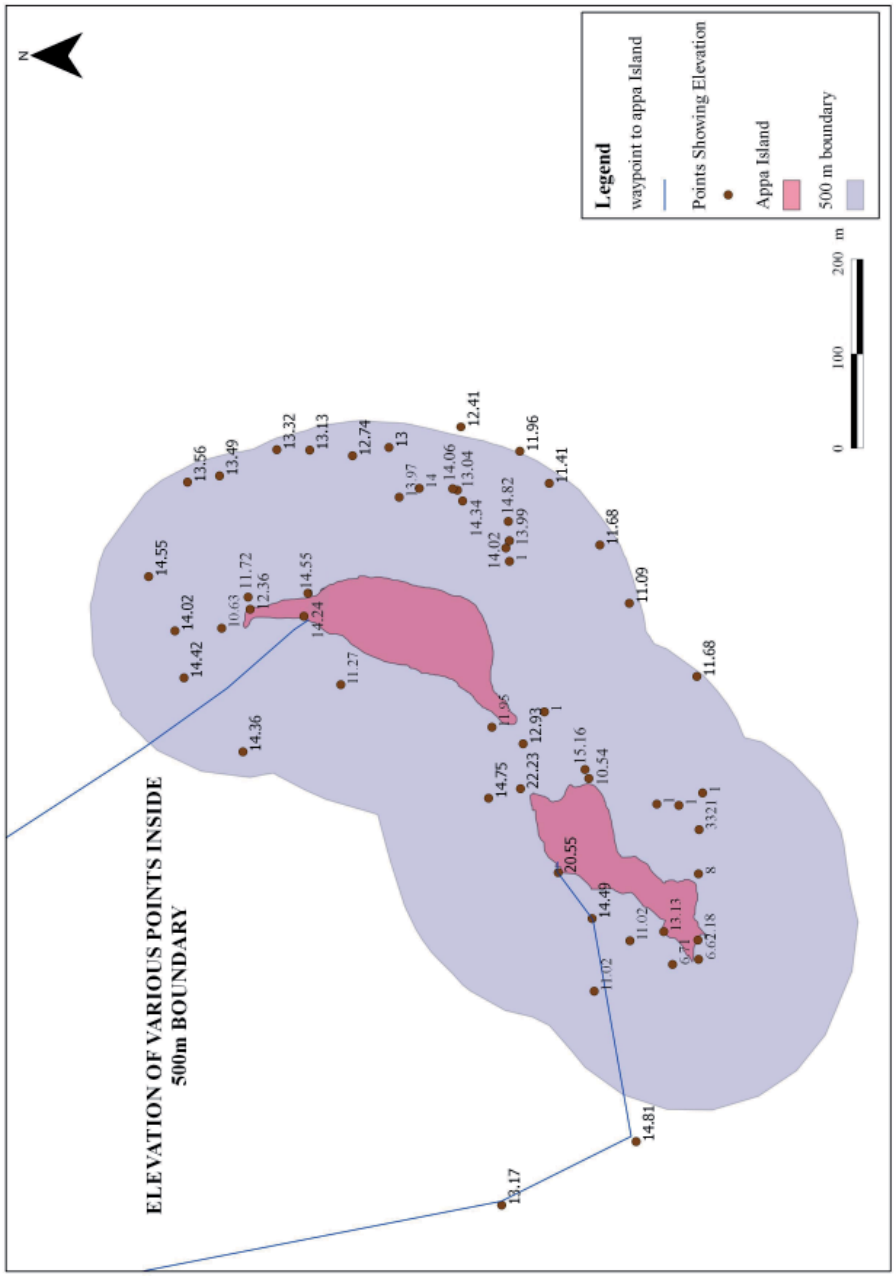
MAP 1


ROUTE SHOWING ACCESS TO APPA ISLAND
N
Legend
Route Towards Appa Island
Route Towards Deep Sea
Appa Island Boundary
500 m Boundary
0
100
200 m
SHORE
TOWARDS LANDING CENTRE
APPA ISLAND
APPA ISLAND
TOWARDS DEEP SEA

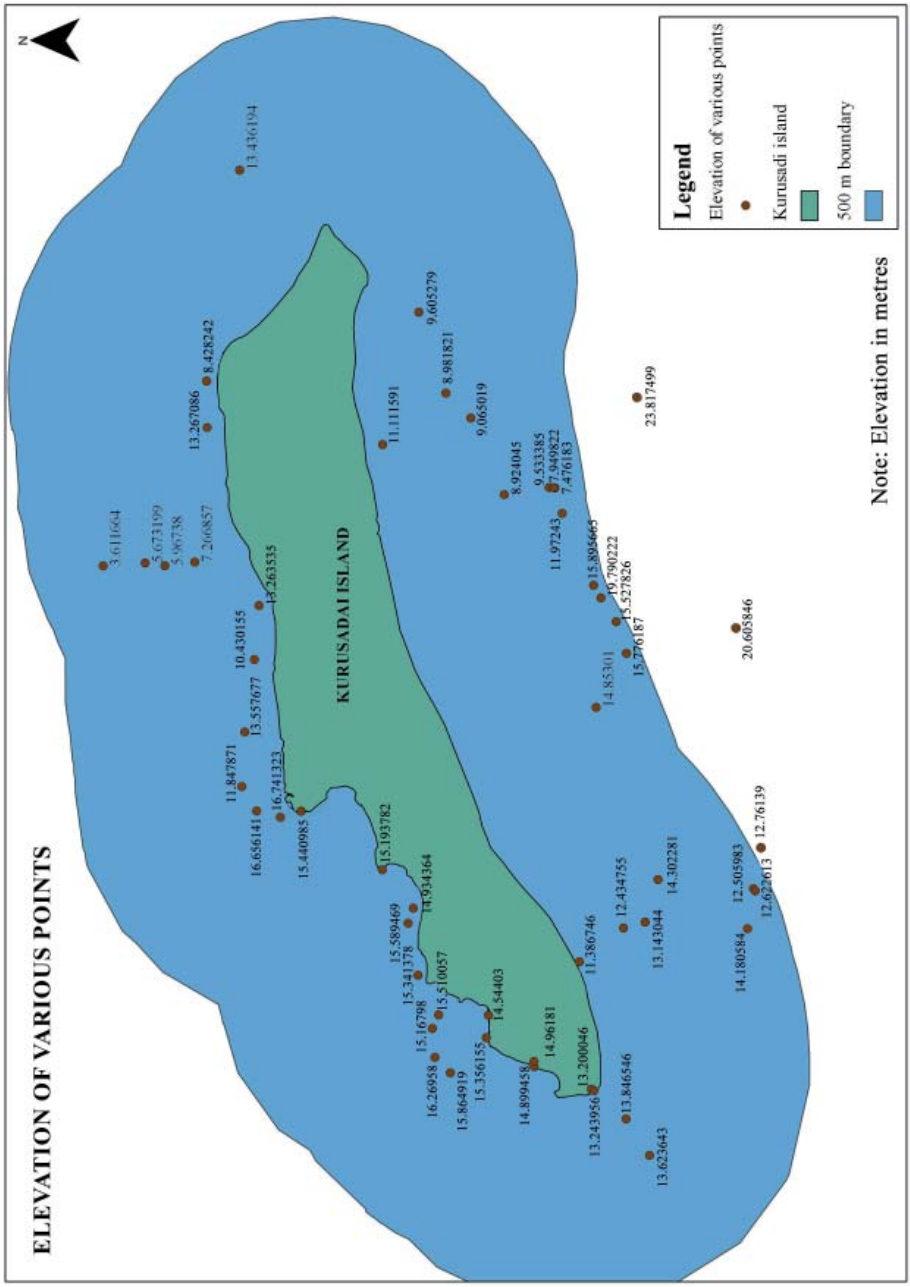
MAP 2


ROUTES SHOWING ACCESS TO KURUSADAI ISLAND
N
Legend
Sea Route To Dhanuskodi
Old Sea Route To Dhanuskodi
Route For Entering kurusadi Island
kurusadi Island
500 m Boundary
0
100
200 m
SEA ROUTE OF PAMBAN PASS
SHORE
OLD SEA ROUTE TO DHANUSKODI
ROUTE TO ENTER KURUSADAI ISLAND
SEA ROUTE NAMED AS KUNTHUKAL RIVER
TOWARDS DHANUSKODI
Kurusadai Island

MAP 3


N
Legend
waypoint to appa Island
Points Showing Elevation
Appa Island
500 m boundary
0
100
200
m
ELEVATION OF VARIOUS POINTS INSIDE
500m BOUNDARY
14.55
13.56
13.49
13.32
13.13
12.74
13
12.41
11.96
11.41
14.02
14.42
10.63
11.72
12.36
14.55
14.24
11.27
13.97
14
14.06
13.04
14.34
14.82
14.02
13.99
11.68
11.09
11.68
14.36
11.95
12.93
1
15.16
10.54
14.75
22.23
20.55
14.49
11.02
13.13
6.21
6.62
18
8
3321
1
11.02
14.81
13.17

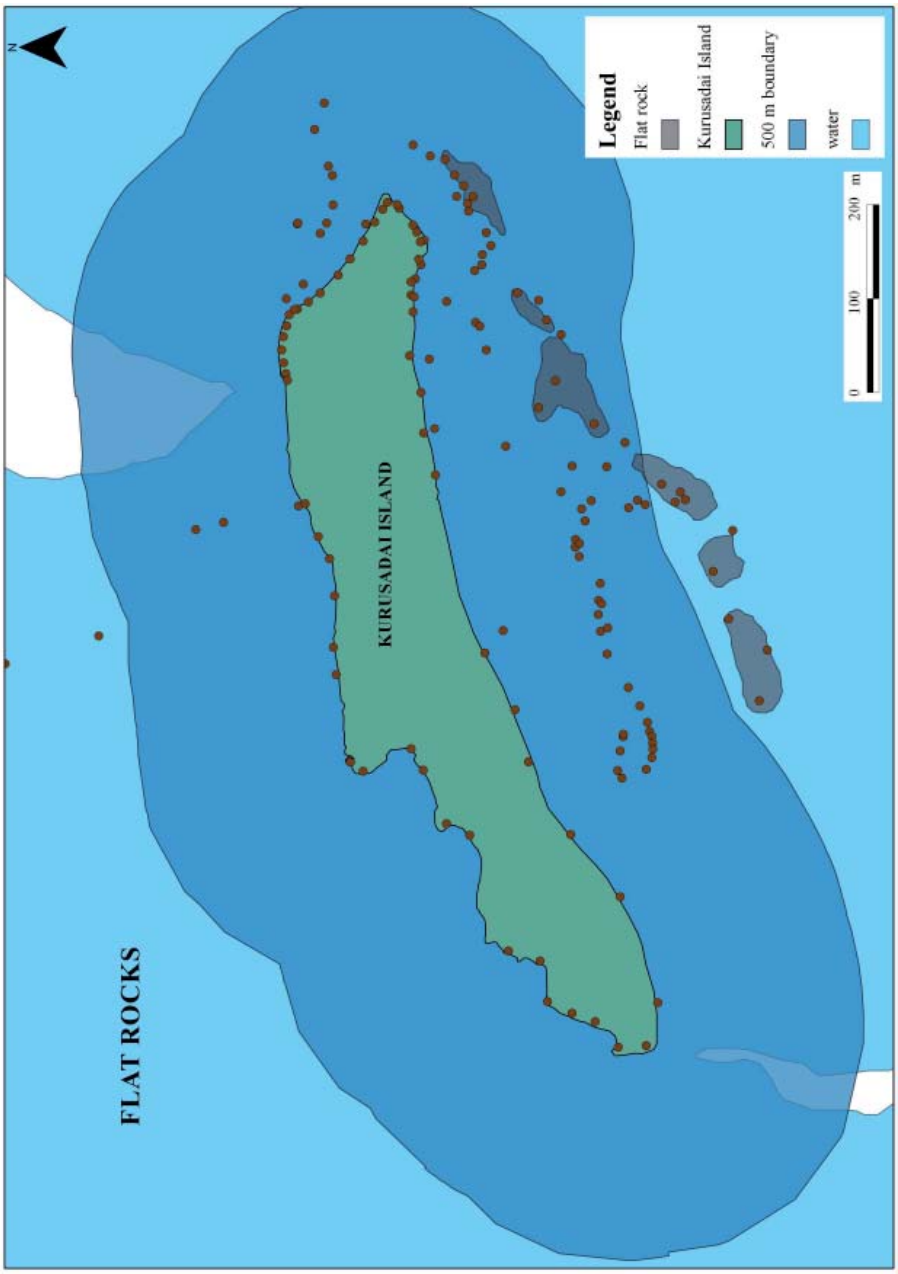
MAP 4


ELEVATION OF VARIOUS POINTS
N
KURUSADAI ISLAND
Legend
Elevation of various points
Kurusadi island
500 m boundary
Note: Elevation in metres
3.611664
5.673199
5.967738
7.266857
8.428242
13.436194
13.267086
9.605279
8.981821
9.065019
11.111591
8.924045
9.533385
7.949822
7.476183
11.97243
15.895665
19.790222
15.527826
23.817499
15.776187
20.605846
14.85301
10.430155
13.557677
13.263535
11.847871
16.741323
16.656141
15.440985
15.193782
15.589469
14.934364
15.34378
15.510057
15.16798
14.54403
16.26958
14.96181
15.864919
15.356155
14.899458
13.200046
13.846546
13.243956
13.623643
11.386746
12.434755
13.143044
14.302281
14.180584
12.505983
12.672613
12.76139

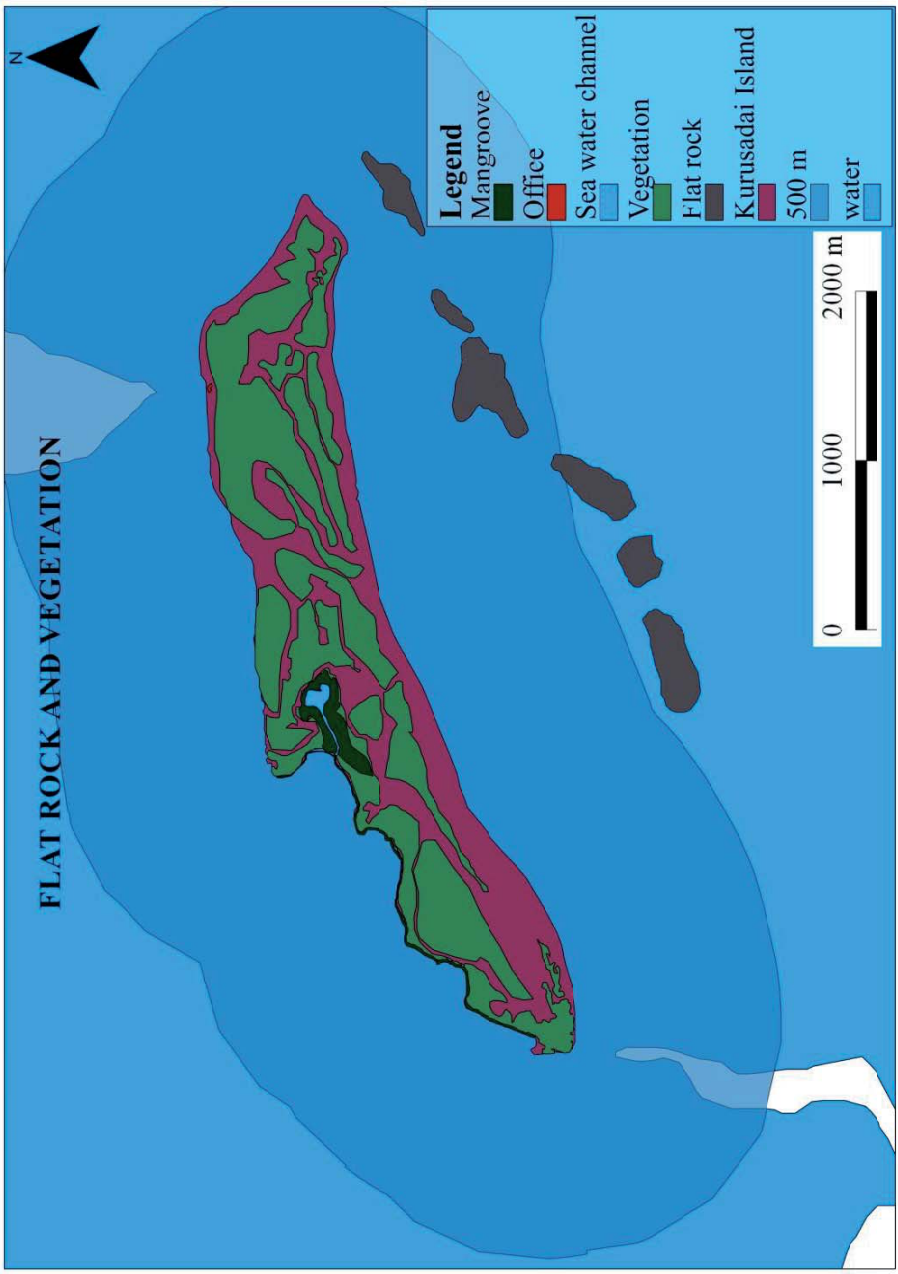
MAP 5


MAP SHOWING ALL FEATURES
N
Legend
Flat Rock
sea grass
Mangroove Area
Coral
Live Dense Coral
Live/Dead Patchy Coral
Rubble/Dead Coral
Sea Weed
Exploited Area
Patchy Distribution
sand
Rubble+Sand
Sand
Sand+Clay
kurusadi Island
500 m boundary
0
100
200 m
9 14'53.04"N
79 13'19.44"E
Navaneeth Island
9 14'29.86"N
79 12'05.03"E

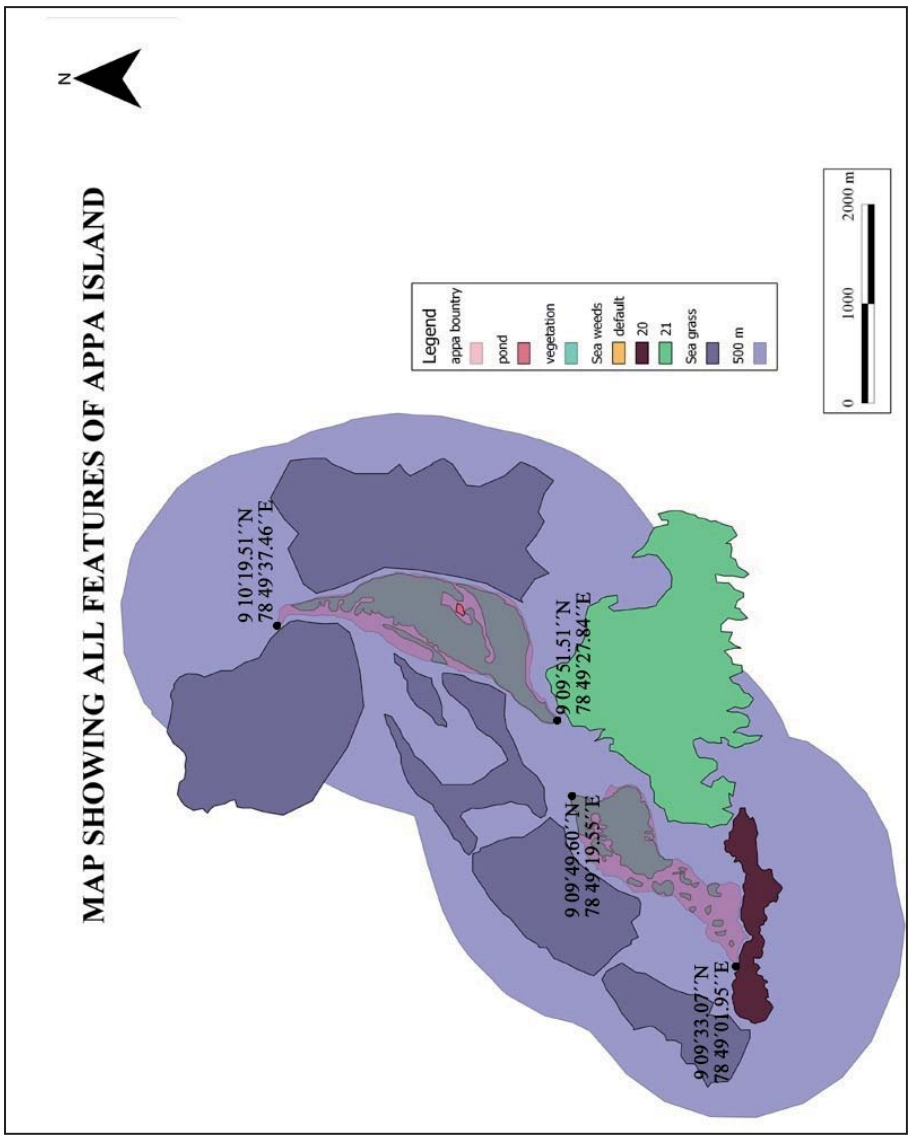
MAP 6


N
Legend
Flat rock
Kurusadai Island
500 m boundary
water
0
100
200 m
KURUSADAI ISLAND
FLAT ROCKS

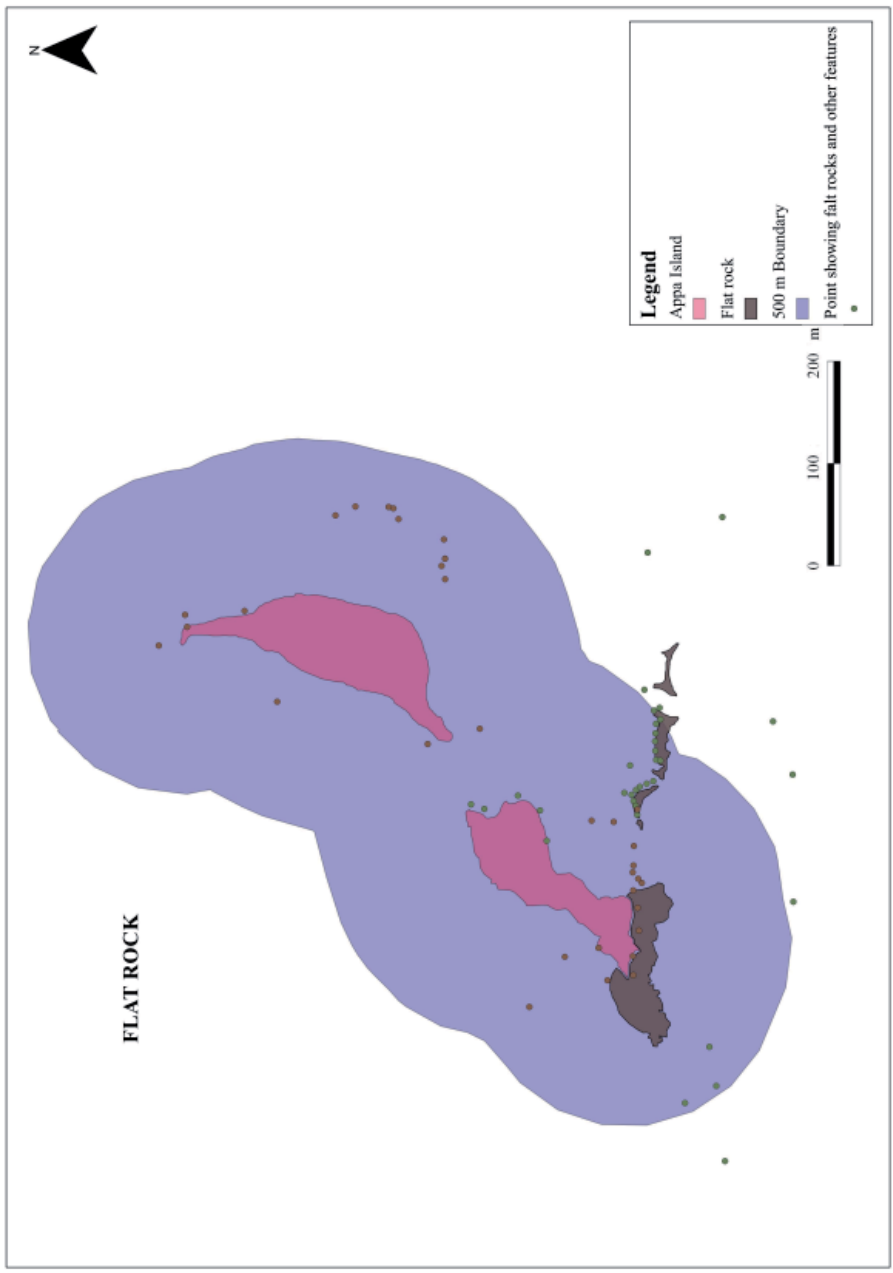
MAP 7


FLAT ROCK AND VEGETATION
N
Legend
Mangroove
Office
Sea water channel
Vegetation
Flat rock
Kurusadai Island
500 m
water
0
1000
2000 m

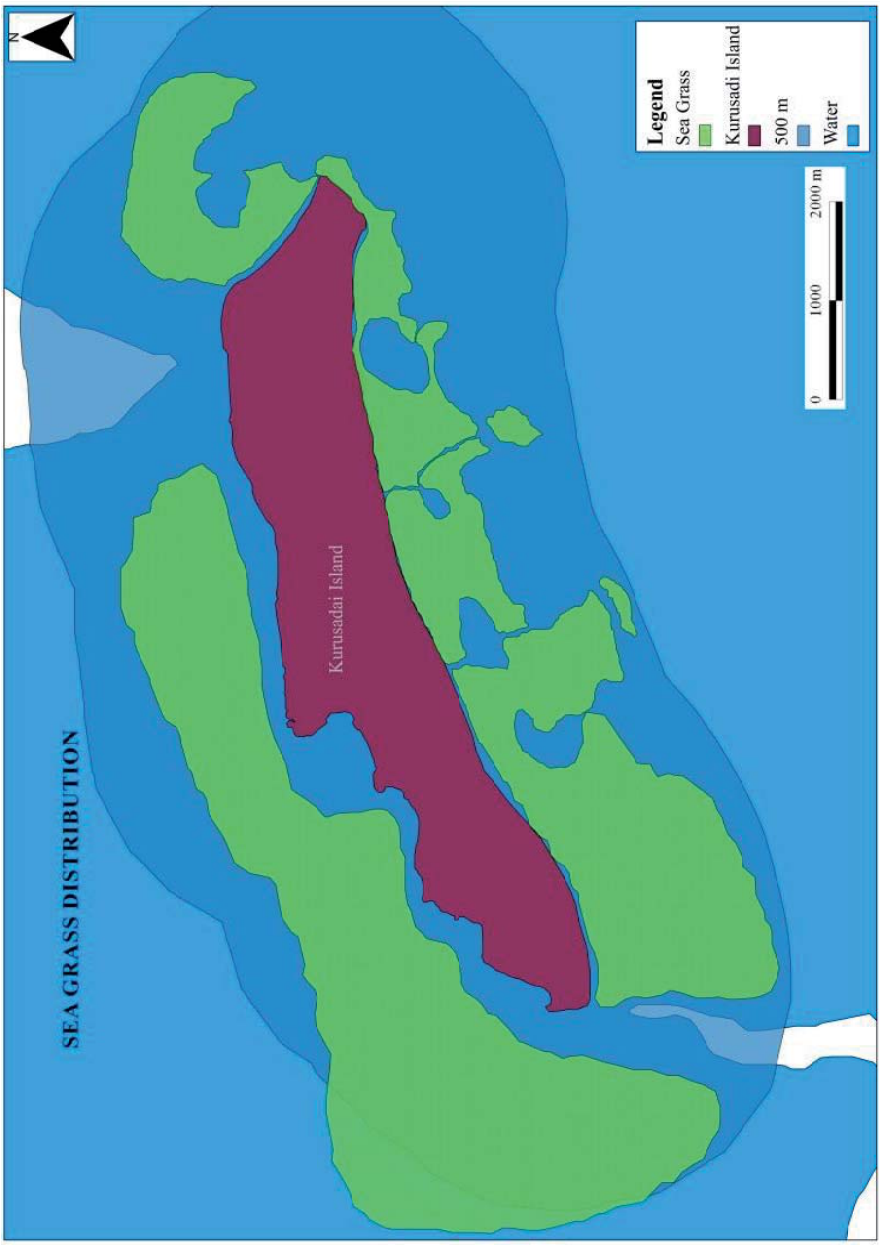
MAP 8


MAP SHOWING ALL FEATURES OF APPA ISLAND
N
Legend
appa bountry
pond
vegetation
Sea weeds
default
20
21
Sea grass
500 m
0
1000
2000 m
9 10'19.51''N
78 49'37.46''E
9 09'51.51''N
78 49'27.84''E
9 09'49.60''N
78 49'19.55''E
9 09'33.07''N
78 49'01.95''E

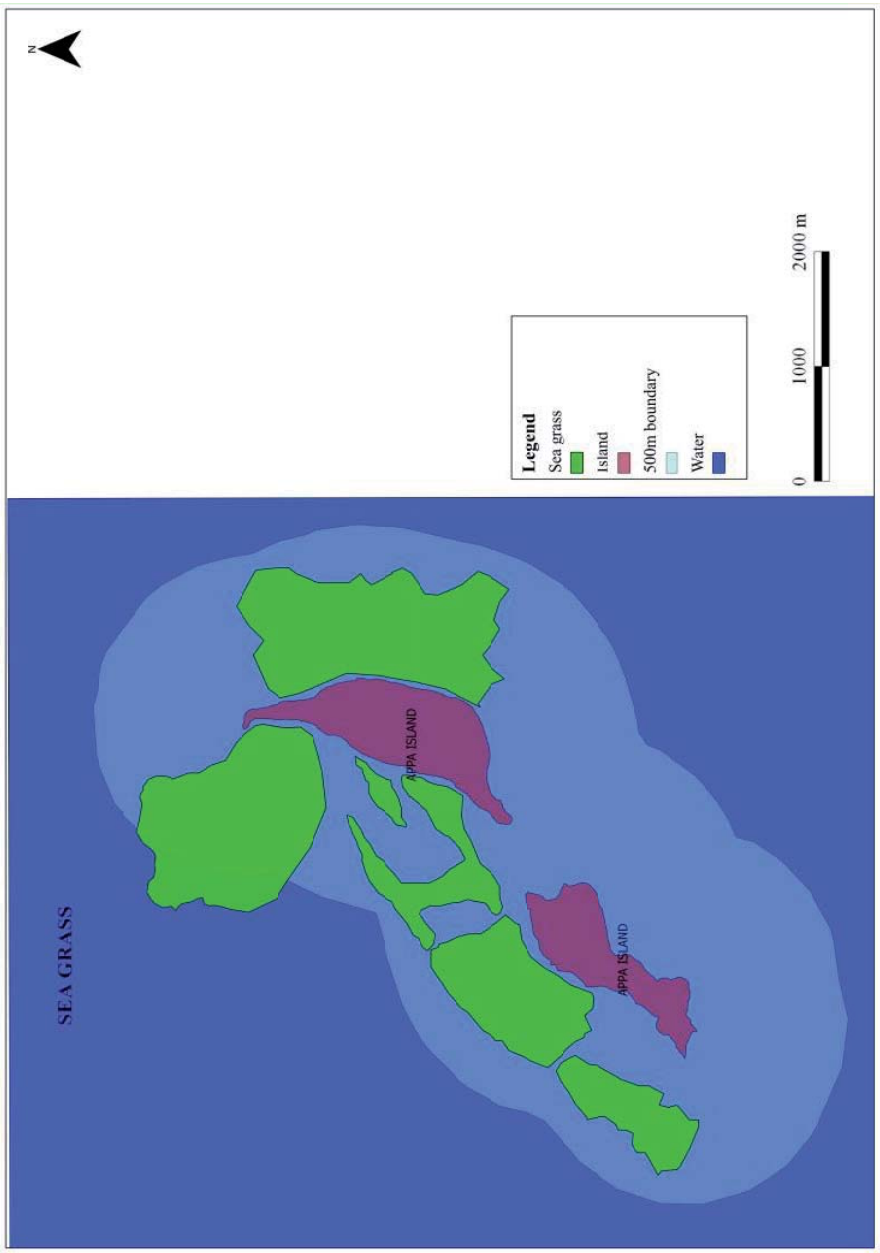
MAP 9


N
Legend
Appa Island
Flat rock
500 m Boundary
Point showing falt rocks and other features
0
100
200
m
FLAT ROCK

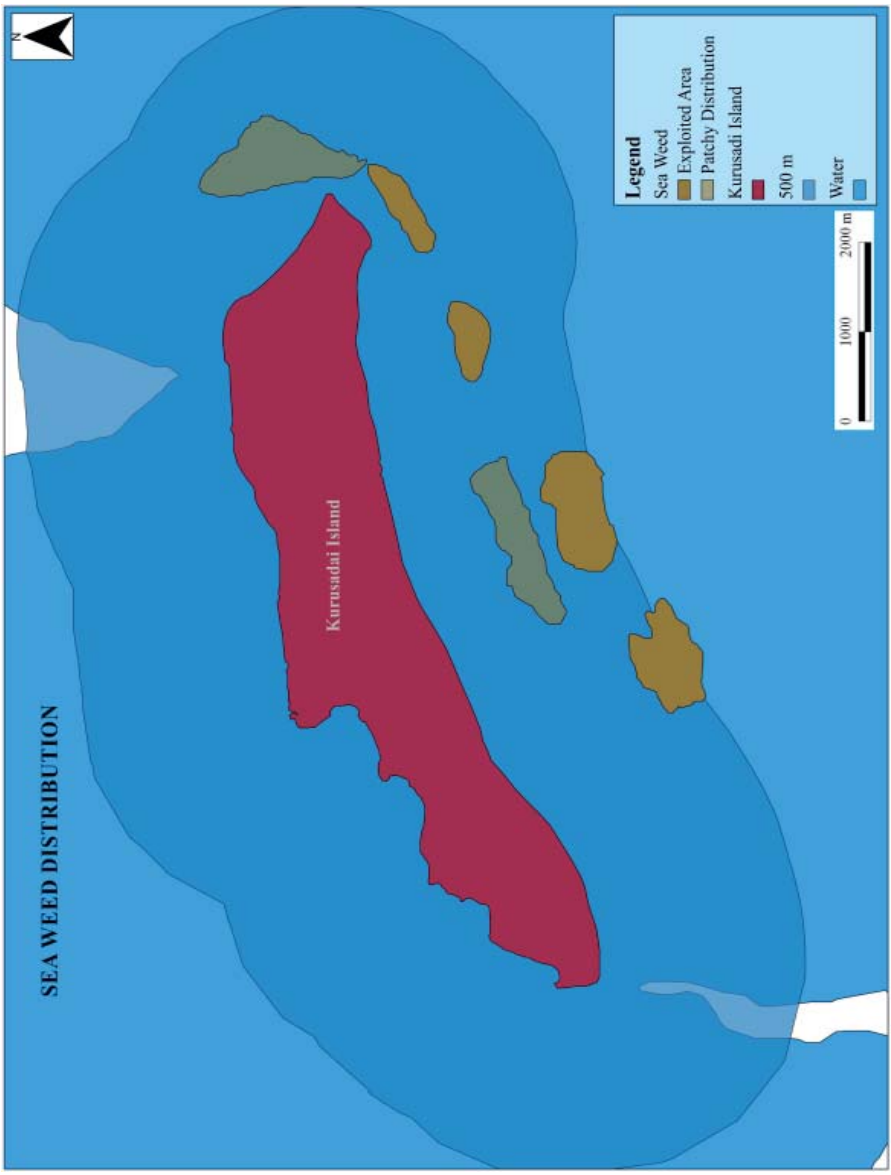
MAP 10


SEA GRASS DISTRIBUTION
Kurusadai Island
N
Legend
Sea Grass
Kurusadi Island
500 m
Water
0
1000
2000 m

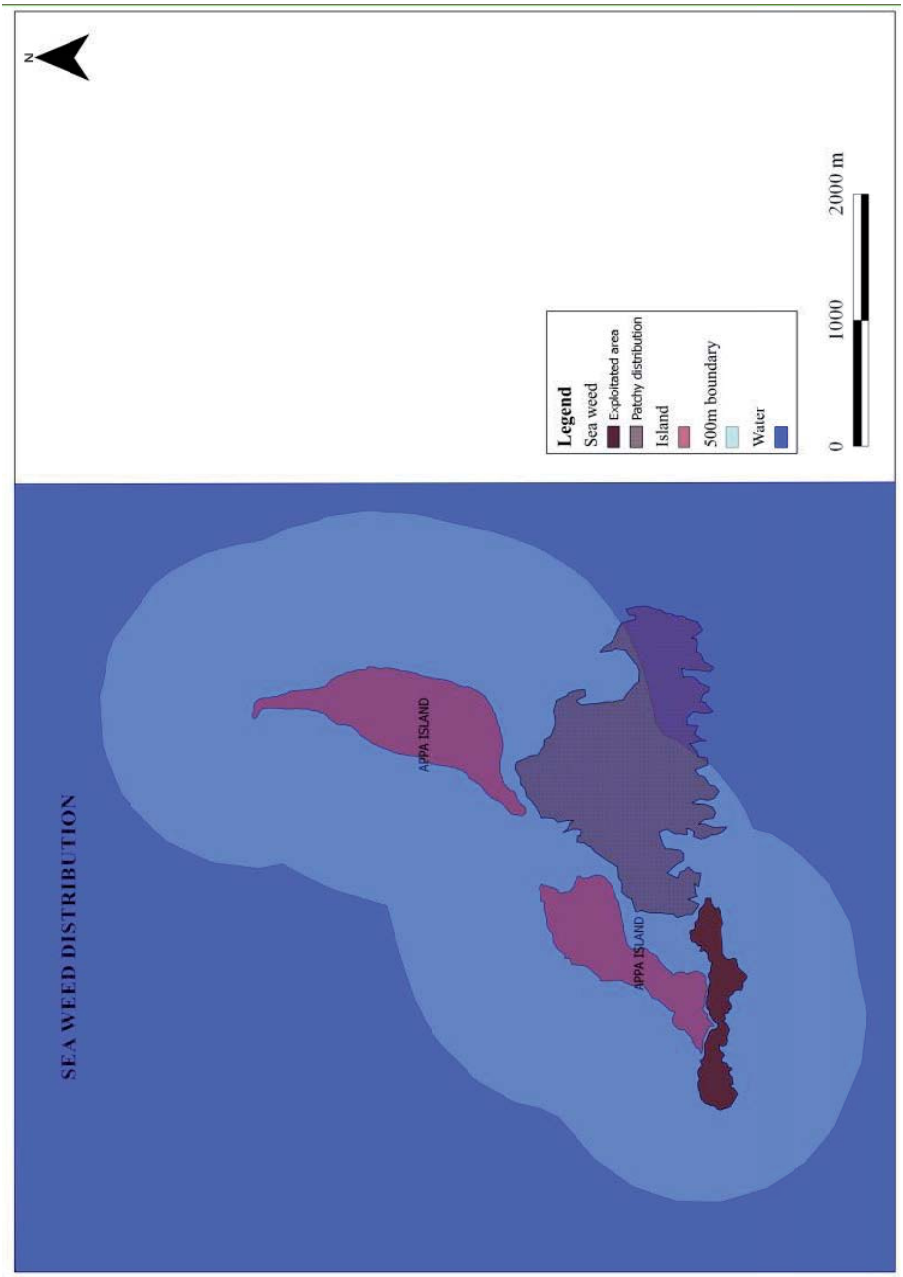
MAP 11


N
Legend
Sea grass
Island
500m boundary
Water
0
1000
2000 m
SEA GRASS
APPA ISLAND
APPA ISLAND

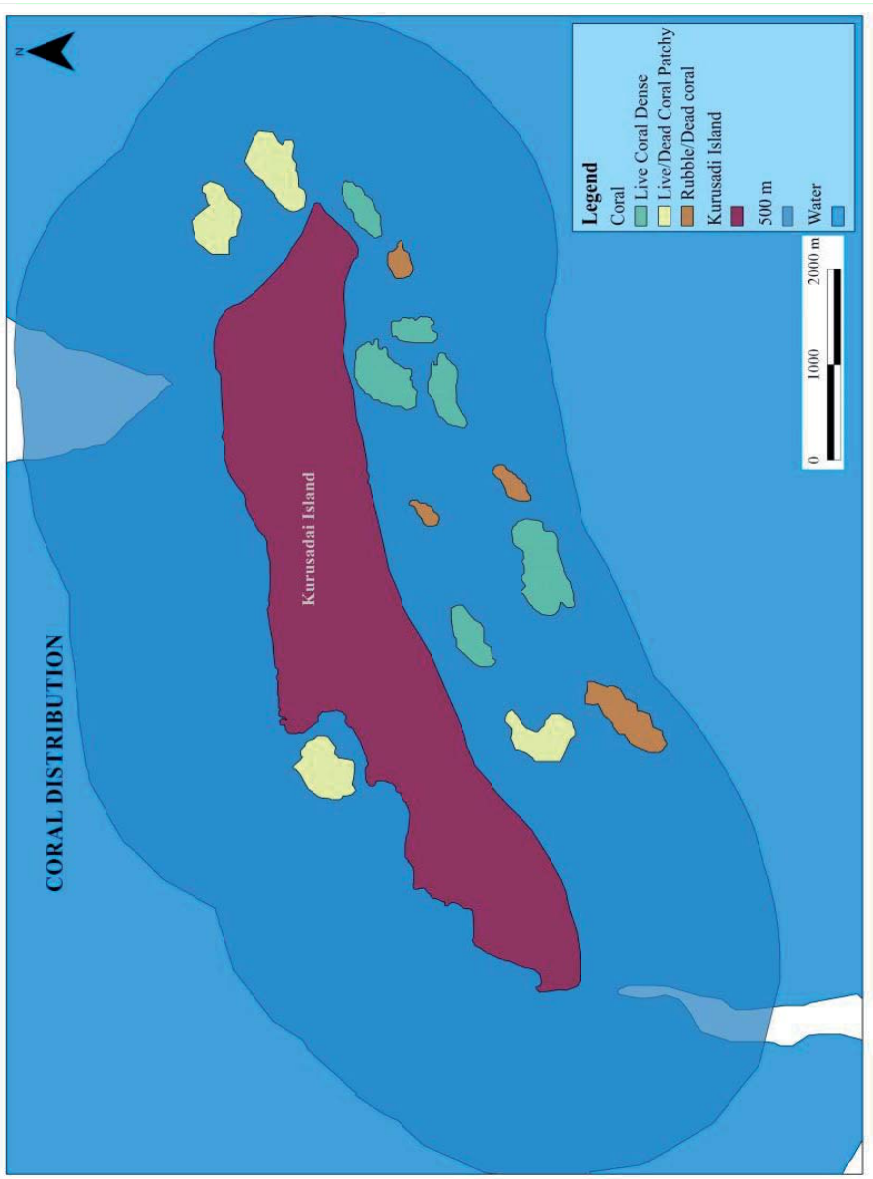
MAP 12


SEA WEED DISTRIBUTION
Kurusadai Island
N
Legend
Sea Weed
Exploited Area
Patchy Distribution
Kurusadi Island
500 m
Water
0
1000
2000 m

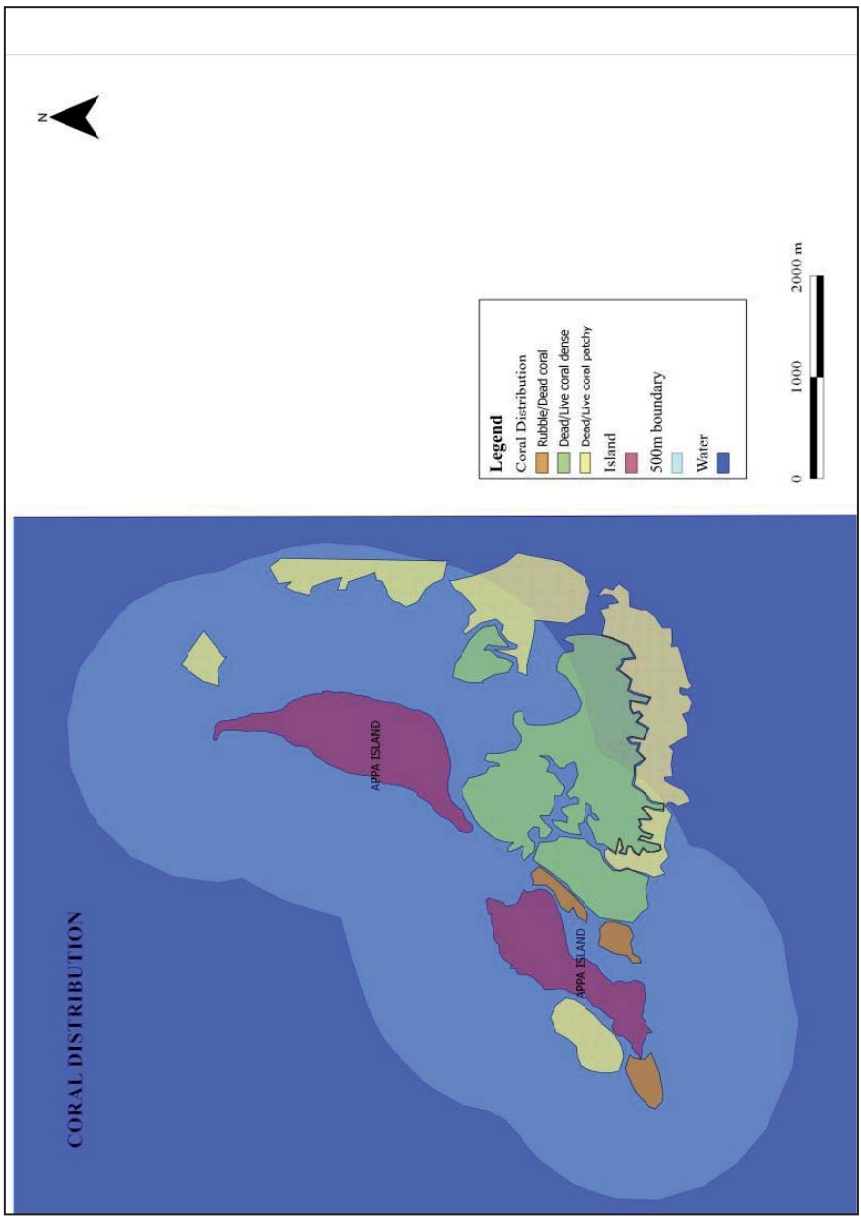
MAP 13


SEA WEED DISTRIBUTION
APPA ISLAND
APPA ISLAND
N
Legend
Sea weed
Exploitated area
Patchy distribution
Island
500m boundary
Water
0
1000
2000 m

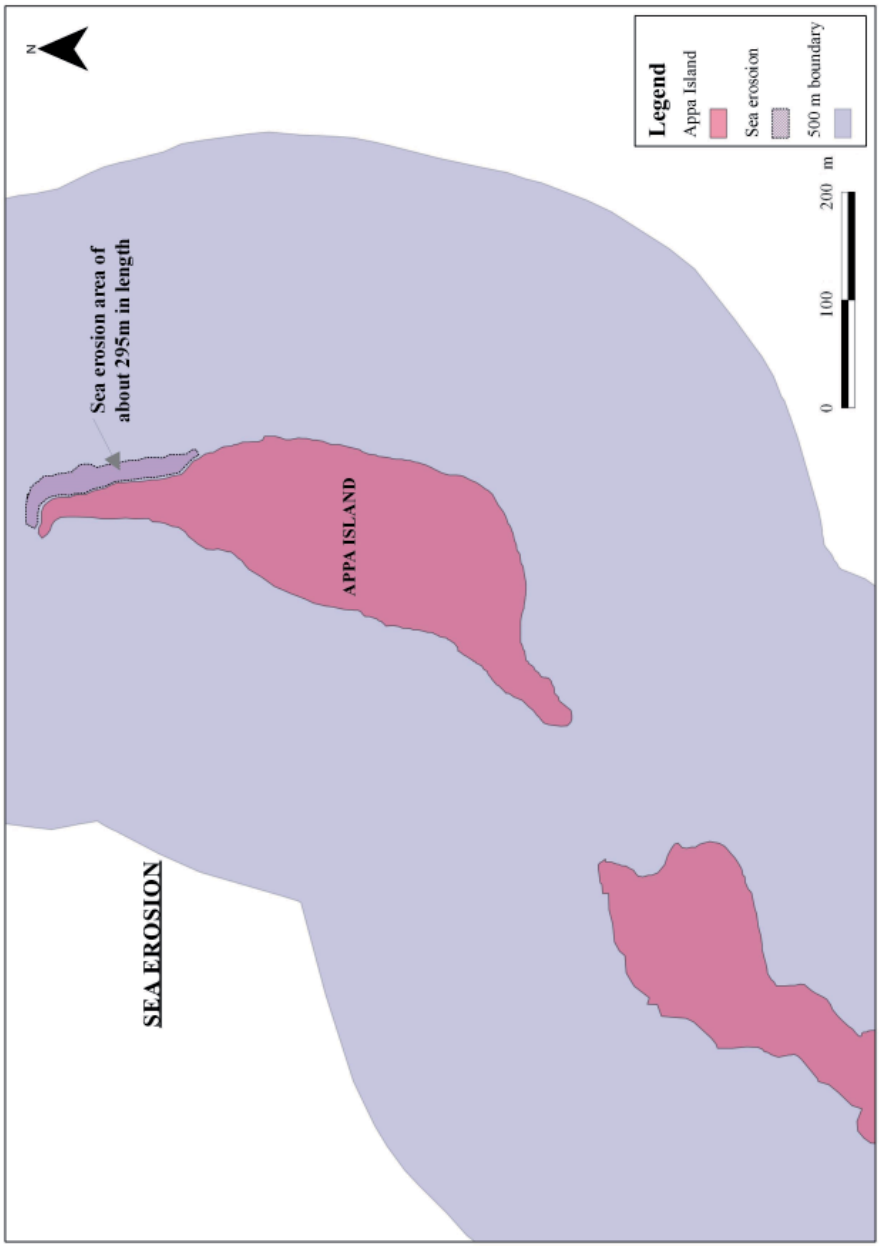
MAP 14


CORAL DISTRIBUTION
Kurusadai Island
N
Legend
Coral
Live Coral Dense
Live/Dead Coral Patchy
Rubble/Dead coral
Kurusadi Island
500 m
Water
0
1000
2000 m

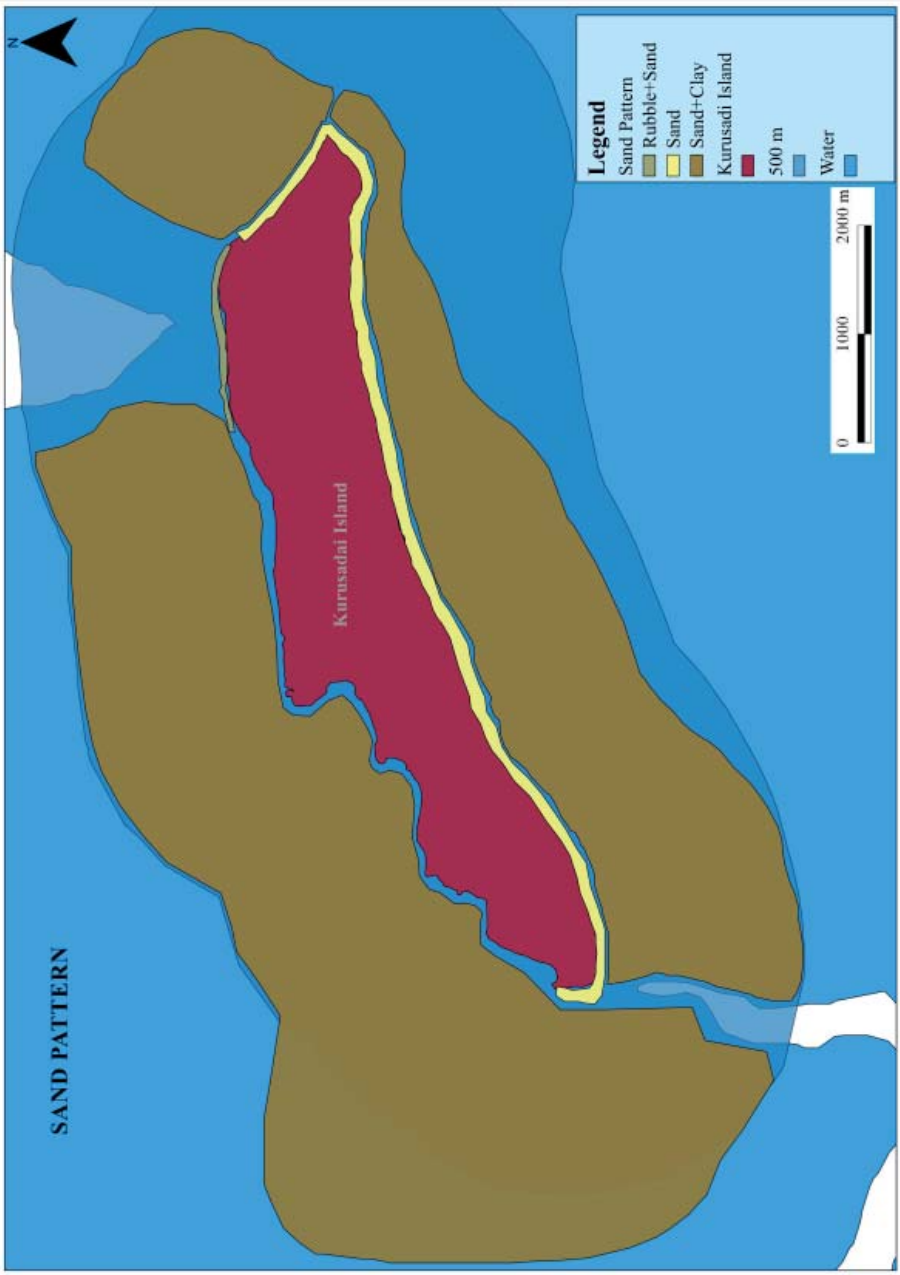
MAP 15


CORAL DISTRIBUTION
APPA ISLAND
APPA ISLAND
N
Legend
Coral Distribution
Rubble/Dead coral
Dead/Live coral dense
Dead/Live coral patchy
Island
500m boundary
Water
0
1000
2000 m

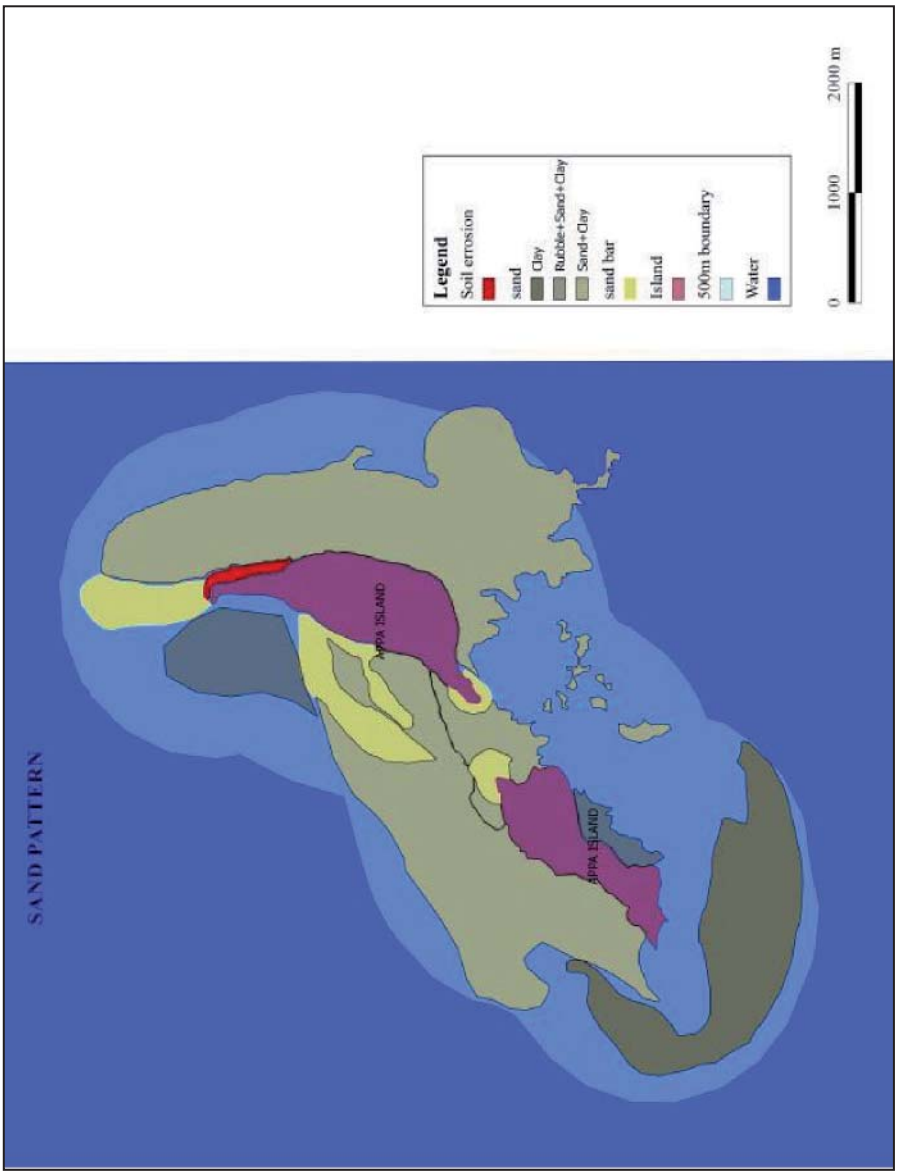
MAP 16


N
Legend
Appa Island
Sea erosoion
500 m boundary
0
100
200 m
Sea erosion area of about 295m in length
APPA ISLAND
SEA EROSION

MAP 17


N
Legend
Sand Pattern
Rubble+Sand
Sand
Sand+Clay
Kurusadi Island
500 m
Water
0
1000
2000 m
Kurusadai Island
SAND PATTERN

MAP 18


SAND PATTERN
APPA ISLAND
APPA ISLAND
Legend
Soil errosion
sand
Clay
Rubble+Sand+Clay
Sand+Clay
sand bar
Island
500m boundary
Water
0
1000
2000 m

With support from

Bay of Bengal Large Marine Ecosystem (BOBLME) Project
Phuket, Thailand
www.boblme.org

Bangladesh, India, Indonesia, Malaysia, Maldives, Myanmar, Sri Lanka, and Thailand are collaborating through the Bay of Bengal Large Marine Ecosystem (BOBLME) Project to better the lives of their coastal populations by improving regional management of the Bay of Bengal environment and its fisheries.

SAMUDRA Monograph

A Participatory Study of the Traditional Knowledge of Fishing Communities in the Gulf of Mannar, India

This is the first in a series of case studies undertaken by the International Collective in Support of Fishworkers (ICSF) to document the traditional knowledge of fishing communities dependent on marine and coastal resources in protected and conserved areas in different parts of the world.

The study, done with the support of the Bay of Bengal Large Marine Ecosystem (BOBLME) project, documents the traditional knowledge of fishing communities in the Gulf of Mannar in the state of Tamil Nadu.

It focuses on two fishing villages, Chinnapalam and Bharathi Nagar, whose communities have traditionally depended on Krusadai and Appa Islands for their livelihood. Traditional knowledge relating to oceanographic, meteorological, biological, ecological and navigational aspects of fisheries was documented.

The study will be useful for researchers, students, scientists, policymakers, fishworker organizations, NGOs and anyone interested in the traditional knowledge of local fishing communities related to marine biodiversity and the customary use of fisheries resources and fishing practices.

ICSF

ICSF is an international NGO working on issues that concern fishworkers the world over. It is in status with the Economic and Social Council of the UN and is on ILO's Special List of Non-Governmental International Organizations. It also has Liaison Status with FAO. As a global network of community organizers, teachers, technicians, researchers and scientists, ICSF's activities encompass monitoring and research, exchange and training, campaigns and action, as well as communications.

ISBN 978 93 80802 31 2