

Socio Economic monitoring for Coastal Managers of South Asia: Field Trials and Baseline Surveys in Gulf of Mannar Region, South Tamilnadu, India

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Cover Photo: Fisher Activity on the sea shore

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Table of Contents

EXECUTIVE SUMMARY	6
ACKNOWLEDGEMENTS	8
ACRONYMS	9
1. INTRODUCTION	10
1.1. PEOPLES DEPENDENCE ON MARINE RESOURCES:	11
1.2. BACKGROUND OF SOCMON PROJECT	12
1.3. AIMS AND OBJECTIVES	12
1.4. REPORT CHAPTERS.....	13
2. METHODOLOGY OF PROJECT EXECUTION	14
2.1. UNDERSTANDING THE SOCIOECONOMIC BACKGROUND AND TO BUILD THE CAPACITY OF THE LOCAL COMMUNITY:.....	14
2.2. IMPLEMENTING THE RESEARCH PROCESS	14
3. COMMUNITY LEVEL DEMOGRAPHICS	17
3.1. SHORT HISTORY OF EACH SETTLEMENT - KEELAMUNTHAL:	17
3.2. SM VALASAI.....	17
3.3. PM VALASAI	18
3.4 DEMOGRAPHIC CHARACTERISTICS	18
4. HOUSEHOLD LEVEL DEMOGRAPHICS	21
4.1. INCOME SOURCES	21
4.2. COASTAL AND MARINE ACTIVITIES:	23
4.3. GOODS AND SERVICES PROVIDED BY THE COASTAL ECO SYSTEM	23
4.4. MARKET ORIENTATION:	24
4.4.1. FISHERR Cooperatives	24
4.4.2. Community based net shop	27
4.5. HOUSEHOLD USE.....	27
4.6. TRADITIONAL KNOWLEDGE:	27
4.7. PERCEPTIONS OF RESOURCE CONDITIONS.....	29
4.7.1. Activities Affecting the Ecosystem & Resource Use.....	29
4.7.2. Response to these changes	30
4.7.3. How Have These Changes Affected People?.....	31
4.8. MATERIAL STYLE OF LIFE	31
5. COMMUNITY INFRASTRUCTURE	32
5.1. Infrastructure in the region.....	32
5.2 Infrastructure in the Villages	32
5.3. Business Development and Ownership.....	32

6. EFFECTS OF COASTAL AND MARINE ACTIVITIES IN THE GOM	34
6.1. HOW HAS THE MACRO CHANGE AFFECTED ARTISANAL FISHERS?.....	35
6.2. PRESSURE ON MARINE GOODS AND SERVICES	36
7. TOURISM IN THE GULF OF MANNAR	41
7.1. BEACH RESORTS:	41
7.2. SNORKELLING AND SCUBA DIVING:	41
7.3. OTHERS (GLASS BOTTOM BOAT, FISHING, BOAT TRIPS):	41
8. KEY STAKEHOLDERS AND GOVERNANCE.....	42
8.1 Information sources that influence decision making	43
8.2. MANAGEMENT BODY: THE GULF OF MANNAR MARINE BIOSPHERE RESERVE TRUST (GOMBRT)	44
8.3. MANAGEMENT PLAN:	44
8.4. ENABLING LEGISLATIONS:	45
8.5. MANAGEMENT RESOURCES:	45
8.6. INFORMAL TENURE AND RULES CUSTOMARY LAWS	45
8.7. FORMAL TENURE AND RULES GOVERNMENT NOTIFICATIONS & LAWS:	45
8.8. COMMUNITY INCENTIVES	45
8.9. STAKEHOLDER PARTICIPATION AND SATISFACTION	46
8.10. COMMUNITY AND STAKEHOLDER ORGANISATIONS	46
8.11. POWER AND INFLUENCE:	46
9. COMMUNITY ATTITUDES AND PERCEPTIONS ON MPA MANAGEMENT AND CONSERVATION MEASURES IN GULF OF MANNAR	47
9.1 ABOUT THE RESPONDENTS.....	47
9.2 PERCEPTION SURVEY RESULTS.....	48
9.2.1 Perception of a protected area	48
9.2.2 Benefit of MPA	48
9.2.3. Non Market Non use Values of Gulf of Mannar.....	49
9.2.4. Can MPA'S be managed effectively	49
9.2.5 Perceived Barriers to effective Management	50
9.2.6 What can we do to Improve Management Effectiveness	50
10. CONCLUSION AND MANAGEMENT ADVICE	51
Appendices	55
Appendix 1. List of Corals of Gulf of Mannar	55
Appendix 2 List of Fishes of Gulf of Mannar.....	59
Appendix 3. Questionnaire on Perceptions of M P A Management	61

List of Figures	
Fig: 1. Map of Gulf of Mannar region.	10
Fig: 2. Sea cow (Dugong dugong)	11
Fig: 3. Application of PRA tools	16
Fig: 4. Twenty one Islands of Gulf of Mannar and study sites	17
Fig: 5. Marine resource map of S.M. Valsai	27
Fig 6: Marine Resource Map Keelamunthal	28
Fig: 7. Wind Direction applicable to study villages	28
Fig 8: Gender of Respondents	47
Fig 9: Age of Respondents	47
Fig 10 Occupation of Respondents	47
Fig 11: Level of Education	48
Fig 12: Income Level of Respondents	48
Fig 12. Agreement level with Value Statement	49
Fig 13. Can MPAs be managed effectively	49
Fig 14: Perceived Barriers to effective Management	50
Fig 15: How to improve management effectiveness	50
List of Tables	
Table: 1. Characteristic of 21 Islands in Gulf of Mannar	12
Table 2: Demographic Characteristics of the Villages	18
Table 3: Informed Differences between three communities	19
Table 4A: Simplified household diversity matrix - Unit Owners	21
Table 4 B: Simplified household diversity matrix –Labourers	22
Table: 5 Seasonal Diagram of sea based activities.	25
Table: 6 Types of Fishing Gear used by Artisanal Fishers	26
Table: 7. Characteristics of key stakeholders	42
Table 8: Source of Information that influences the decision making of the different Stakeholders in GOM	43
Table 9: Benefits of Conservation and MPA	48

EXECUTIVE SUMMARY

The Gulf of Mannar Marine Biosphere Reserve, as an ecosystem, has a sound and firm resources base, but, over the years, the coastal waters have been misused or overused so much that there are pressures already on the fragile ecosystem. The reefs and surrounding coastal ecosystems are in decline due both to natural causes (e.g. coral bleaching) and man-made impacts (e.g. coral mining, destructive fishing, over exploitation, land based pollution). In view of this fact, and concern for biodiversity conservation the entire Gulf of Mannar has been declared a 'National Marine Biosphere Reserve' since 1989, by introducing control and regulatory measures in order to prohibit exploitation of resources found on the islands and adjacent shallow habitats.

There are 133 villages distributed along the shores of the Gulf, where approximately 125,000 people live of whom 45% are estimated to be active fishers. They are Artisanal Fishers who use the traditional wooden crafts (known locally as *Vallams* and *Vathai*), which contribute to 46% of the overall marine fish production of the state (in 1998-1999). Conflicts between trawlers and artisanal fishers regarding equitable access to marine resources are increasing day by day. In the face of decreased catches and increasing competition from trawlers, the artisanal fishers were forced to fish in vain.

In this context, Socio Economic monitoring for Coastal Managers of South Asia: Field Trials and Baseline Surveys in Gulf of Mannar Region, South Tamilnadu, India was conducted by PAD in three selected villages in Gulf of Mannar region of Ramanathapuram district of Tamilnadu from October 2010 to December 2011.

The programme ensures the community based socio economic baseline assessment and monitoring of coastal resources for the benefit of the future generation in sustainable way and to involve the community from the beginning to end.

Apart from the baseline assessment of goods and services provided by the coastal eco system, the programme initiated the steps for building capacity of the local people and implemented the awareness generation activities for the sustainable utilization of the coastal bio resources.

The report is also documented the people's traditional knowledge on coastal resource, fishing seasons, wind directions and so on which is vital for the younger generation to learn and leading their life with sustainable utilization of the resources.

It also assess the perception / awareness level of the people on Marine Protected Area (MPA) policy of Gulf of Mannar and gave management advice to the policy maker and to find out the grievance re-addressable mechanism for future dialogue for the sake of conserving coastal resources which is under severe threat now.

The report has been prepared for the people of Gulf of Mannar (GoM) to facilitate them to continue with the dialogue for the need for Management of the ecosystem

goods and services of their coastal areas. It provides Management advice to the authorities concerned GoM area especially GOMBRT.

The key learning's of the study is that, the Fish catch per unit are going down in the years. But the fishers are optimistic and believe nature (especially Kadal Matha – Mother of Sea) will never let them down. In the mean time, they adjust to the changing conditions; the fishermen are always modifying their nets and try to adjust to the situations. The younger generation is seeking for alternative employment through the process of building their educational capacity.

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ACRONYMS

GoEF- Department of Environment and Forests,

IUCN - International Union for the Conservation of Nature

NGO - Non-Governmental Organization

GoM – Gulf of Mannar

SHG – Self Help Group

GOMBRT - Gulf of Mannar Marine Biosphere Reserve Trust

PAD – People’s Action for Development

FISHERR - Financial Initiative for Sustainable Human Resource Regeneration

GLOSSARY OF NATIVE TERMS

Coolies - Labourer

Challi - broken coral pieces

Dharna - Protest

Lakh - One hundred thousand

Shank/chank - All medium to big conch shells including sacred conch

Terms used for boats

Country boats - Mechanized and non-mechanized local wooden boats used in small-scale fishery

Vathai - Small wooden non-mechanized country boats with sail and oars for rowing. Used by 2–3 people

Vallam - Small wooden mechanized country boats with outboard diesel engine and often larger than Vathai

Vathai- Used by 6–10 people

Karavalai Thoni - Small wooden canoe, used for short distances and with shore net

Launches- Large commercial trawlers

1. INTRODUCTION

Gulf of Mannar (GoM) abounds in coral reef formations. It forms a part of the southeast coast of India. It is surrounded on the west by the parts of Ramanathapuram, Tuticorin, Thirunelveli and Kanyakumari districts of Tamilnadu State of India; on the north lies Adam's bridge and parts of Ramanathapuram district which include Rameswaram island, Pamban pass etc. of India; on the east lies the Srilankan coast and in the south, the Indian ocean.



Fig: 1. Map of Gulf of Mannar region.

The Gulf of Mannar covers an area of approximately 10,500 km² along 8°35′– 9°25′ north latitude and 78°08′– 79°30′ east longitude. Within the Gulf of Mannar 21 uninhabited islands covering a total area of 6.2 km² are scattered close to the coastline, stretching 140 km from Tuticorin in the South west to Rameswaram in the north east.

The Gulf of Mannar is home to three major ecosystem types, which are found around the 21 islands, namely coral reefs, sea grasses and mangroves. The extent and composition of these ecosystems has been the subject of much research in recent years and the area is recognized for its biodiversity. More than 3600 species of living marine organisms inhabit the Gulf of Mannar coast.

It is home to the globally endangered marine mammal the sea cow (*Dugong dugong*) and to an endemic living fossil that links vertebrates and invertebrates *Balanoglossus (Phychodera jluva)*. Other biologically important species of GoM sea are 5 varieties of sea turtles, dolphins, whales, whale sharks, 117 species of corals belonging to 7 genera like hard corals, gorgonids, sea whip etc., different types of Molluscan forms like sacred chank (*Xancus pyrum*), Finger chanks (*Lambis* spp.) etc. echinodemata like sea cucumber, sea urchins, star fishes etc., 147 species of sea weeds like *Gelidiella* spp., *Gracilaria* spp. *Sargassum* spp., *Turbinaria* spp., *Ulva* spp. *Caulerpa* spp. etc., sea grasses belonging to 6 genera with 50 species like *Cymodocea serrulata*, *Halodule univervis*, *Thalassia hemprichi*, *Syrincodium* spp.etc. Among the sea grasses *Enhalus acoroides* has become endemic and is available

only here. and around 450 species of edible fishes like perches, belones, groupers, tuna, sea bass, croakers, Scombroid fishes, flying fishes, sharks, rays, skates, prawns, crabs, cuttle fish etc.

1.1. PEOPLES DEPENDENCE ON MARINE RESOURCES:

A chain of 21 islands are present in the GoM sea starting from Shingle island in the north near Pamban of Rameswaaram island to Thoothukudi in the south. These islands are of coral origin. During the past millions of years, coral polyps have grown in the GoM sea in different locations. As years pass by, the coral areas became shallow by dead coral stones called corallites. Silt and sand accumulated in the elevated dead portions of coral stones. Vegetation might have colonized the accumulated sandy areas of the coral stones, thereby initiated the coral island formation. Live coral polyps can still be present in the fringes of all the coral islands indicating that these islands are still growing and extending their area in the GoM Sea. These coral islands, besides protecting the mainland seacoast from the fury of strong wind and wave's action, provide shelter and foraging ground for millions of marine organisms. An abundant coral habitat is always a highly productive ecosystem. Around five million people of the coast and inland are depend on the marine resources of GoM for their livelihood and to satisfy their protein requirements.

The coral reefs of the Gulf of Mannar form an integral part of the coastal ecosystem: creating the islands; sheltering the lagoons and sea grass habitats; and providing a nursery and feeding ground for ocean going fish. For the coastal communities the coral reefs and near-shore resources are the basis of their livelihood. They provide shelter to their homes and property, sources of income, food, medicines, and are the focus of an extensive knowledge system and diverse range of skills. Complex traditions and rituals are associated with the fishery, some of which relate to particular areas of reef or particular reef species. Thus the reef and near-shore resources are at the centre of the culture and way of life of the coastal people of the Gulf of Mannar and have been so for many centuries.



Fig:2. Sea cow (Dugong dugong)

Realizing the importance of GoM as a highly productive ecosystem, Govt. of India has declared it as a National Marine Park and a Bio reserve in the year 1972. This is the first marine national park in the whole of south and Southeast Asia. After the promulgation of the Act, few islands which were in the hands of private people have been taken control by the Government. They are now under the control of Wild Life Warden under Forest department of Tamilnadu state. Now Forest Department is taking all the steps to safeguard the endangered species of the GoM Sea from extinction and the GoM islands from its degradation.

1.2. BACKGROUND OF SOCMON PROJECT

Socioeconomic Monitoring Guidelines for Coastal Managers of South Asia (SocMoN) Project is to support natural resource and biodiversity management and community development in South Asia by building capacity among stakeholders to conduct socioeconomic assessments using regionally agreed protocols; undertaking socioeconomic baseline surveys at target sites; and increasing the ability to apply such information in decision-making among a broad range of stakeholders.

The SocMon project field study was carried out by local NGOs at five sites South Asia namely - Havelock Island (Andaman and Nicobar Islands, India); Agatti Island

(Union Territory of Lakshadweep, India); Selected three villages of Gulf of Mannar in India; select villages around bar reef in Srilanka; and Nassimo and Banana reefs in North Male Atoll in the Maldives. PAD was responsible for coordinating the project activity in Gulf of Mannar site.

PAD has a close relationship with the local communities and has worked extensively with these communities in the past including the development of livelihood enhancement and diversification actions and training on SOCMON related activities from December 2006-June 2008 via the CORALI project. Apart from this intervention, PAD is also

involved in child centered community development in these villages from the year 2009 onwards.

1.3. AIMS AND OBJECTIVES

- To build capacity among stakeholders to conduct socioeconomic assessment's using regionally agreed protocols.

Table 1 : CHARACTERISTICS OF THE 21 ISLANDS OF THE GULF OF MANNAR				
Island group	Island	Area (km ²)	Nearest coastal town	Distance to nearest coastal town (km)
Tuticorin	Van Tivu	0.16	Tuticorin	6
	Kasuwar	0.20		7
	Karaichalli	0.16		15
	Vilanguchalli	0.01		15
Vembar	Upputhanni	0.30	Vembar	8
	Pulvinichalli	0.06		8
	Nallathanni	1.10		10
Keelakkarai	Anaipar	0.11	Keelakari	9
	Valimunai	0.07		9
	Appa	0.29		8
	Poovarasampatti	<0.01		8
	Thalairi	0.75		9
	Valai	0.10		9
	Mulli	0.10		10
Mandapam	Hare (Musal)	1.29	Mandapam camp	7
	Manoli	0.26		5
	Manoliputti	0.02		5
	Poomarichan	0.17		3
	Pullivasal	0.30	3	
	Krusadai	0.66	Pamban	3.5
	Shingle	0.13		4

- To conduct a socioeconomic base line assessments of the selected villages around the Gulf of Mannar.
- To assess the perceptions/awareness of the people on MPA's relating to Gulf of Mannar Biosphere Reserve. (management and rules)
- To develop Management and development advice based on the assessments

1.4. REPORT CHAPTERS

This report is divided into 10 chapters.

Chapter 1: introduction and aim and objective of the research

Chapter 2: Methodology and implementation of the research study.

Chapter 3: Community level demography of the research site

Chapter 4: Household level demography of Gulf of Mannar study site and their dependency on the goods and services provided by the coral reef ecosystem.

Chapter 5: Monitoring of development activity and infrastructure development

Chapter 6: Coastal and marine activities and macro level changes affecting local people and resource

Chapter 7: Monitoring of tourism activities – Scuba diving and water sports

Chapter 8: Role of Management body that governs how coastal resource management is undertaken in Gulf of Mannar. It lists all the community and government institutions that influence the way coastal goods and services are used and managed.

Chapter 9: Perceptions of MPAs

Chapter 10: It is the concluding chapter and offers advice to the Management committee

2. METHODOLOGY OF PROJECT EXECUTION

The socio economic assessment of Gulf of Mannar was carried out by the PAD to the changing trends and baseline data to be monitored in future by the community. The socioeconomic monitoring of research process undertook the following series of steps:

- (1) Understanding the socioeconomic background of the local community and to building the capacity
- (2) Developing socioeconomic assessment mechanism
- (3) Implementing the research process
 - Village selection
 - Community level capacity building
 - Identification of key stakeholder
 - Individual household and key informant level
 - Analysis & Validation.

2.1. UNDERSTANDING THE SOCIOECONOMIC BACKGROUND AND TO BUILD THE CAPACITY OF THE LOCAL COMMUNITY:

Developing an understanding of the socioeconomic background and to building the capacity of the local community helped focus the research towards the specific outputs required. This was principally undertaken by research team.

To build the stakeholders participation, community level awareness programs are planned and implemented regularly.

- Orientation workshop to the research team and village volunteers
- People's perception on Climate change with different livelihood group members
- Awareness on marine eco system, importance of sand dunes, mangrove and non-mangrove bio-shields were taught to youths.

2.2. IMPLEMENTING THE RESEARCH PROCESS

The research team consisting of social scientists, academicians, technical experts, practitioners of participatory methodologies and field coordinators were involved in the study process from the beginning to till end. The research team used the SOCMON South Asia guidelines and developed a check list for the application of the Participatory tools in both English and Tamil for the easy understanding of the field workers. The following steps were applied during the project period:

Step 1: Village selection

Time available for the study limits field research to only three small villages or communities in the study area. While this is too small a sample size to be representative of the full diversity of the study area, selection of the villages should take into account the major differences in the area and represent as far as possible a 'norm' or 'average' village or community (i.e. avoiding extremes). Thus, the first stage of the village selection process involves understanding the major differences in the study area in terms of:

- Livelihood options and diversity
- Access to the bio resources
- Seasonal variability of livelihoods
- Community organization

Step 2: Community level data collection

Once the villages have been selected, the following series of Rapid Livelihood Assessment tools are used at a community level:

Trend analysis: to understand changes in sea based livelihoods (including factors such as harvests, markets, physical access, perceptions, population, and status of reef area, conservation practices and beliefs) and to understand what factors have led to change, what impact these changes have had on the vulnerable groups, and what coping mechanisms have been employed.

Resource Mapping: to understand the biodiversity of coastal and reef areas, occupational access to and control of resource areas by vulnerable groups, resource conservation practices and social/ religious beliefs and activities associated with places and local knowledge of resources and resource use.

Seasonal diagrams: to understand seasonal diversities and fluctuations in terms of access to resources, availability, employment, income and expenditure patterns, and patterns of migration.

Venn diagrams: to understand local institutions, organizations and policies, their service level and their relationships, linkages, functions and relevance as perceived by locals. To understand how the institutional and policy context has changed and what impact this has had from the local perspective.

Occupational matrix: to understand risk, investment, return, women's involvement for different livelihood strategies or livelihood activity groups.

Semi-structured interviews were carried out in order to cross check and validate information from community and focus group levels, and develop an understanding of key issues, including:

- Trends, historical knowledge base and resource use patterns from oral histories
- Traditional knowledge, including; folk taxonomy and medicinal values
- Social values, beliefs, rituals, exchange networks and collaboration

Perception of Marine Protected Area survey was undertaken to assess the awareness of the village people of the Gulf of Mannar with regard to MPA and protection accorded to marine species

Step 3: The data collected was analysed shown in graphs and tables.

Step 4: Validation

Throughout the research process information was cross-checked, both within and between research tools and between participants. On-going cross-checking and triangulation of data is essential to ensure the information collected was valid. This was assisted by using of field tracking tables.

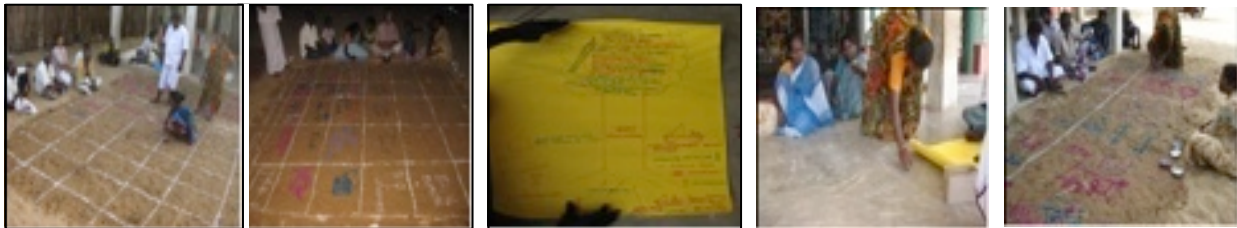


Figure 3: Application of PRA Tools

3. COMMUNITY LEVEL DEMOGRAPHICS

Three villages named Keelamunthal, S.M.Valasai, P.M.Valasai of Kadaladi block of Ramanathapuram district, Tamilnadu were selected for the study. All three villages are located in the Gulf of Mannar region and are dependent on the goods and services provided by the Gulf of Mannar for their sustenance. (Figure 4).



Figure 4. Twenty one Islands of Gulf of Mannar and study sites

3.1. SHORT HISTORY OF EACH SETTLEMENT - KEELAMUNTHAL:

The name Keelamunthal is associated with the great epic Ramayana. Valinokkam (Vali =Name of a King; Nokkam = seeing) to which Keelamunthal is a part. It is the place where the (monkey) King Vali saw Lord Rama for the first time. Vali and his brother Sukrivan had problems and Lord Rama felt that it was his duty to support Sukrivan and uphold justice. In the fight between the brothers, Sukrivans, soldiers overpowered Vali's soldiers and advanced further to defeat Vali. The place they advanced is called Munthal which means going forward. Since there is another settlement with the same name in the west, this settlement is called as Keelamunthal (Keela means east). Munthalians object to share their epic pride with newer settlements and continue to call their settlement as Munthal and not Keelamunthal. Munthalians retort "how can we allow a settlement of recent origin to share our epic pride." But when we discuss this in a focus group, one woman reacted "what is the use of epic pride? Our life has witnessed no advancement" Perhaps poverty of the people makes them disregard their historic past.

3.2. SM VALASAI.

SM Valasai is named after the first settler of this Village, Sadai Muniyan, which is shortened as SM Valasai (valasai means Village). Sadai Muniyan's descendants and relatives live here. Ten years ago a serious conflict during the celebration of the local

temple festival has brought a division in the community. A group of households have built a new temple and call their area as Mariamman Nagar. Though there is no overt conflict between these two areas, they still choose to maintain their separate identity as of Mariamman Nagar. One needs more probing to understand the impact of these new identities on the social capital of a small and poor village.

3.3. PM VALASAI

Like SM Valasai, PM Valasai is also named after the first settler Pitchai Mooppan. Unlike the term Sadai Muniyan, a secular term not associated with caste, Pitchai Mooppan is associated with the caste 'Mooppar'. Both Villages are settled by the Moopar caste people. However there is more cohesiveness in PM Valasai. This community cohesiveness has enabled the people to bring certain government program like schools to their village.

3.4 DEMOGRAPHIC CHARACTERISTICS

Table 2 shows the demographic characteristics of the villages. All three villages

	Keelamunthal:	S.M.Valasai	P.M.Valasai	Total
POPULATION	2418	320	695	3433
MALE	1161	161	273	1595
FEMALE	1257	159	222	1648
TOTAL FAMILIES	678	74	127	879
MIGRATION	27%	18%	21%	
SEX RATIO M:F	1161:1257 (1:1.08)	161:159 (1:0.98)	373:322 (1:0.86)	18:16.4
EDUCATION	near to 50%	near to 56%	near to 52%	
COMMUNITY CASTE	MBC (most backward caste)	MBC (most backward caste)	MBC (most backward caste)	MBC (most backward caste)
RELIGION	Hindu/Muslim	Hindu/Muslim	Hindu/Muslim	Hindu/Muslim
MOTHER TONGUE	Tamil	Tamil	Tamil	Tamil
OCCUPATION	Fishing, sun dried fish, seaweed collection and related activities			

share similar characteristics. Literacy levels are low and the dropout rate from schools are high for boys. Fishing is the main occupation. In every household, one son is expected to be a fisherman. The community has never looked at alternative employment options. Only one boy from a Keelamunthal fisher family has studied B.E (Marine Engineering) and five students are doing nursing and teacher training. Ten students from SM and PM Valasai go to college since the village is close to Keelakarai which has Engineering and Science colleges. The village wise informed differences given in Table 3.

Table 3: Informed Differences Between the three villages			
Characteristics	Keelamunthal	SM Valasai	PM Valasai
Location	Not near to any dynamic urban centre		
Opinion about the landing centre	Rough	Rough	Rough
Migration to other fishing grounds	Regular & Considerable	Insignificant	Insignificant
Village level organizations	Strong but not proactive	Weak	Weak but at times proactive
Ability to generate common fund	Considerable	Weak	Weak
Head load vending	Only widows		
Fish merchants	Dependent on fish merchants and their hold is significant		
Money lenders	Dependent on money lenders for consumption as well as gear purchase		
Food vendors	Significant	Less	Less
Market vending	Absent	Present	Present
Karavalai Thoni	Declining		
Craft modernization i.e. mechanization of vathais and vallams and use more nets	More	Less	Less
Road & Transport facilities	Regular transport only in recent years	No tarmac road & relying on secondary transport	
Communication facilities	Poor connectivity but desire to have more	Good connectivity but inability to have it	
Television sets	Considerable	Insignificant	
NGOs with development orientation	Present	Only recently started	
Fish processing activities	Drying of fish is not regular		
Presence of boat carpenter	Not available		
Services of engine mechanic	Accessible but delayed	Not that much needed	Not that much needed
Outcome of fish holiday (45 days ban)	Beneficial		
Seasonal Influence	Overcoming it by spending more on diesel	Since they operate with vathais It is felt more	
High value fishes i.e. Lobster, Prawn, Crabs, Squids	Significant	Not significant	Not significant
Interaction with Panchayat Raj	Since these three communities are part of bigger settlement they are unable to influence the course of action		
Role of local politicians	Their importance is limited to helping the individuals		
Role of Fishermen Unions	Isolated	Close to the union personnel	
Dynamism of Self Help Groups	Dynamic	Emerging	
Wealth ranking	Significant differences	No significant differences	
Opinion about GOMBRT	No opinion	Feels that GOMBRT is restraining them	
Interaction with MLA & MP	Not positive		
Alcoholism	problem	Expressed as a problem with elderly	
Intra community conflict	Significant	At times	Less
Inter community conflict	Significant	No	No

From Table 3 we can note that Keelamunthal which has a greater number of households has considerable differences in wealth, infrastructure and access to information. The village has a heterogeneous population with two religious groups and three caste groups. They are Mutharaiyar and Thevar, classified as (Most Backward Class), and Nadar classified as (Backward Class). This is why intra and inter community conflict is more significant in Keelamunthal in comparison to the two smaller villages.

The fishers of these villages use two types of crafts, the plank built vathai in different sizes and vallam. Vallams are generally powered by an inboard diesel engine. But vathais are generally propelled by sail and by paddle.

Seasonal migration occurs to places in Rameswaram island from June to September, when the Gulf of Mannar sea becomes rough during south West monsoon season. The fishers leave behind their family members and migrate to a safer fishing area.

4. HOUSEHOLD LEVEL DEMOGRAPHICS

4.1. INCOME SOURCES

The villages show a high dependence on coastal and marine goods and services. Table 4A and 4B shows a simplified household diversity Matrix based on strategies of fishing unit owners and labourers. There are 12 different types of occupational households found in these villages. The following classification was made to understand the livelihood strategies of the villages for this study.

Table 4 A: Simplified Household Diversity Matrix (Fishing unit owners)			
Household / groups	Characteristics of the group	Livelihood Strategies	Strengths
Vathai Owners	Own vatahi, 3 – 4 different net types, some surplus, independent, mainly indifferent to common issues, lack adjustability with others	taking loan occasionally from money lenders, wife / women normally come to the shore during landing, children are taken to fishing,	Credit worthy,
Vallam Owners	Own vallams, 4-8 different nets, merchant dependent, forced to adjust with and take care of fishing labourers working with him	Many are indebted to merchants and money lenders, women /wife normally don't come to shore, along with men, women also like to take care of the labourers to retain them	Industrious, entrepreneur qualities, take interest in common issues, provide leadership
Karavalai Owners (Shore line Owners)	More investment, single type nets, forced to keep at least minimum 10 labourers with him by giving advance or by positive attachment, feels that he is the original fisher folk, women normally be in the shore when landing supervising & controlling	Has to cope up more or no catch, during off season has to go to sea in others boat taking his net as share fisher,	Has to support at least 30 -40 labourers, take more interest in community affairs, exhibit leadership qualities, lack entrepreneurial qualities, always surrounded by at least 3-4 men
Vathai & Vallam owners who are attached with merchants	Hard worked fishing labourers & vatahi owners attracted by merchants to advance money to purchase vatahi or vallam, dependent on merchants & money lenders	Generate small surplus after paying merchants & money lenders, likely to go far regular fishing, forced to think about supplementary activities	Like vathai & vallam owners these group is also industrious, exhibit entrepreneur qualities, take interest in common issues, provide leadership

Owners of fishing units engage themselves in fishing. They have to engage a minimum of 4 persons for his fishing operation. From the Income for a day's catch, diesel expense has to be deducted first; remaining money is divided into six shares. One share is for the boat and the other 5 shares are one share for each fisherman.

Table 4 B: Simplified Household Diversity Matrix (Non Boat owners)			
Household / groups	Characteristics of the group	Livelihood Strategies	Strengths
Fishing labourers – Those who go for fishing with their own nets	Not having vathai or vallam out of their own decision or merchants might have thought credit unworthy, attached with a boat owner, having 2-4 different nets in small numbers, Less investment little stakes in fishing	Take advance from boat owner, dependent on boat owner & moneylender,	Shortage of fishing labourer & possession of nets, if he exhibit skill in fishing any boat owner may try to retain him by giving interest free advances and fringe benefits
Patha coolie – Unattached fishing labourers	Fishing labourers who have not taken any advance from boat owners, likely to go with any skilful boat owner, independent, branded as skilful but calculative, liked & disliked	Non attachment makes him to be careful	Skilful in fishing
Those who sent nets only	Elderly and widows	Has to provide free labour in cleaning nets and piling it	Family relationship
Sea grass collectors	Mainly women, do this as supplementary option or forced to take up due to men's irresponsibility, hard working, like to show interest in fishery related problems,	Has to adjust with men and group of women,	Interested in SHG,
Fish vendors	Middle aged women, widows, men who are not interested in going to sea, spendthrift, exposure to the world	Trying to retain permanent customers Helping the customers to clean fish Adding value by sorting out	Skill in doing business, spendthrift, exposure to the world
Shore net labourers	Not a permanent group Mostly women & old Mandadi, Thodai	Getting advance Getting fringe benefits	
Migrant fishers families	Desire to improve Having crafts & gears	Take advance from merchants	Planning in advance about the type of nets to be used Knowledge about the fishing ground where he is migrating
Salt pan workers	Uneducated & poor young adult women Fixed working hrs		

Fishers who do not own any gear such as boat or net will go in other's boat as coolies. Such a fishing coolie will get a minimum of Rs.200/- per day even if there is no catch for the boat. His remuneration will increase depending on the catch up to Rs.1000/- as maximum per day. Income beyond such expenses will go to the owner of the boat. About 50% fishermen work as coolies in fishing boats or in shore-seine operations.

As elsewhere, small scale fishing techniques have different requirements of skill and capital investment and are preferred by different categories of people. New and relatively poor entrants to the fishery (table 4B) normally start as attached fishing labourers and then slowly focus on crab net and squid hooks, which require low levels of skill, risk taking and capital and fetch relatively secure returns. More experienced fishers focus on shank, lobster and other coral fishes. Others are gatherers, a generic term for those who collect marine plant and animal life using minimum of fishing gear. This category includes divers, who are specialized in chunks, sea cucumber and ornamental fish. Their attributes invariably includes a face mask and a pair of round metal disk that serves as flippers. The gatherers also include female harvesters of sea grass and those walk on the beaches and wade through the water in search of shell fish.

The fishing units and individual's take credit from moneylenders for purchasing their crafts and gear. The money lenders have faith in the ecosystem richness and advance the credit to the people. "It is not the people who are considered as credit worthy but the ecosystem richness". The strength, weakness aspirations of these communities is directly related to their ability to exploit and market the harvest from the coral ecosystem.

4.2. COASTAL AND MARINE ACTIVITIES:

Fisheries are the predominant industry in the coastal belt of the Gulf of Mannar. Traditional or small-scale fishing is carried out predominantly in the 'trapped sea' between the islands and the mainland coast and in the shallow waters and reef areas surrounding the islands. Fishing takes place throughout the year, but changes in nature according to local availabilities of different species. Wind patterns generally restrict the use of small-scale crafts between the months of August and October, and during this period many fishermen simply switch to being paid labour on larger mechanized boats.

In addition to fisheries-related occupations along the coast, there are opportunities for employment in salt extraction near Tuticorin, and also in Palmyrah (toddy) tapping and agricultural labour. Table 5, explains the nature, seasonality and income of the sea based activities of the research sites.

Fishing is the main and predominant activity. After completion of the fishing activity, then they start in drying and repairing of nets. Fisher's recreation consist of drinking liquor, playing cards and watching T.V.

4.3. GOODS AND SERVICES PROVIDED BY THE COASTAL ECO SYSTEM

Fishing is the main livelihood option provided by the coastal ecosystem throughout the year. The diversity of near-shore marine resources enables households to exploit

the fishery throughout the year, with the peak in harvest of different species complementing one another throughout the year and providing overall livelihood stability. Thus, seaweed and shell resources provide income when other fisheries resources are low, while crabs and lobsters provide a source of income more or less constantly throughout the year. Even during the windy months of August–October when non mechanized country boats cannot access the sea, there are opportunities as labour on mechanized boats.

The fishing activity is done based on the seasons and the availability of the particular net. Table 6 shows the nature of fishing gears used for the best utilization of the goods and services provided by the coastal ecosystem.

4.4. MARKET ORIENTATION:

Fish catch is sold to fish vendors or exporters. House requirement is taken from the catch depending on the quantity. During 1980's, the left over fish after sales and the fish caught in voyage fishing were converted to dry fishes. The dried fish was sold in weekly fairs which assembled in different cities in and around Ramanathapuram district on different days of a week. It is still a custom for the citizen's of the cities and the nearby agricultural villages to go to the weekly fairs mainly for the purchase of dried fish through which their protein needs are supplemented.

Since 2000, the fishermen have carrying insulated boxes with ice, to store the fish catch which is sold on arrival to the shore. The remaining fish after sales are also stored in insulated box with ice to be sold in subsequent days. Thanks to the use of insulated ice boxes, the fisher-women's workload of post harvest operations of the unsold catch is saved. This included cutting, cleaning, salting and drying and then bringing them to different cities to sell in weekly fairs.

Coral fish like Clathi (*Triacanthus* spp.), Puffer fish (*Petrodon* spp.) and few varieties of eels are caught in fishermen's nets when they fish near to the GoM islands. People have less preference for these fish due to less taste. Now the trend has changed and these fish are included in trash fish to be used in poultry feed.

The growing trade of ornamental marine fish are also picking up. A few firms from Chennai have established field farms around Erwadi (one village in GoM coast) to store the marine ornamental fish and pack them for sales to the buyers mostly in foreign countries. These two phenomena lead to the fisher folk to look for alternative employment options through non marketable fishes.

4.4.1. FISHERR Cooperatives

Most of the fishers in GoM region are indebted to the money lenders and fish merchants to meet their family needs. To relieve the indebted poor fishermen from the clutches of money lenders and merchants, PAD has initiated a scheme called

FISHERR cooperatives (Financial Initiative for Sustainable Human Resource Regeneration) in Keelamunthal village based on the community request. Livelihood groups were formed in the fishing villages. Fishermen's lists indebted to merchants were taken. The debt money for a group to the merchants was initially paid by PAD through the debtors. Then the group of fishermen relieved from debt can sell their catches to any merchant who pay good price. From that money, the fishermen have to save 5% for future unexpected expenses and 20% is used for settling the loan taken from PAD. The loan repayment money will be kept in a bank and the money accumulated later is used to relieve subsequent indebted fishermen from the clutches of money lenders or merchants. In this manner, 439 indebted fishermen from 3 fishing villages (Keelamunthal, Roachmanagar and Mookaiyur) have so far been relieved from bondage.

In Keelamunthal forty nine people have joined FISHERR. The fish catch of the FISHERR group is brought to Sayalkudi (20km away) for getting better price from the export merchants.

Catch from other fishermen are purchased by fish vendors at the landing centres and are transported by two wheelers and sold in nearby places. When the catch is heavy the export merchants send lorries for transporting the fish catch from the landing centers. The fish catches is sent to cities like Madurai, Bangalore, Kochi and Trivandrum etc. for sale. From bigger landing centres like Tuticorin, Vembar, Keezhakarai etc. the catch especially prawns, cuttlefish, crabs are procured by bigger merchants for export to foreign countries.

Table 5 Seasonal Diagram of sea based activities												
Sea Based Activities	Months											
	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr
Important fish sp.												
Chala	•					•	••	•••	•••	••••	••••	••••
Sudai	•	•	••	••	••							
Mawla	••					•	••	••	••	••	••	••
Velameen												
Praws								•	••	•••		
Dry Fish	••	•	•	•	•	•	•	•	•	••	•••	•••
Income				•	•••	•••	••	••	••••	••••	••••	••••
Fiber Boats	•					•	•	••	••	•••	•••	•••
Commercial Trawlers								••	••	••		

Table 6: Types of Fishing Gear Used by Artisanal Fishers			
Fishing Gears	Months	Target Species	Gears Characteristics
Chalavalai and Sudavalai (Gillnet)	All	Chalameen, Sudameen, Kolameen, Karameen.	Net is made of Nylon twine. (Length – 17 bagam, breadth–6 bagam). Net size-27mm–34mm. Net position–It is laid 1 ½ to 2 bagam from the water's brim in the sea. Net is laid for 1 ½ to 2 hours.
No. 2 valai (Gillnet)	All	Maawlameen, Seelameen, Paaraimeen, Vaalaimeen, Velameen, Kuluvameen.	Net is made of Nylon twine. (Length – 35 bagam, breadth–6 to 7 bagam). Net size-58mm–60mm. Net position–It is laid 2 ½ to 3 bagam from the water's brim in the sea. Net is laid for 4 to 5 hours.
Iraal valai (Gillnet)	Nov- Dec	Iraal, Nandu, Pannameen	Net is made of Nylon twine. (Length– 15 to 20 bagam, breadth–1 ½ bagam). Net size-36mm–38mm. Net position–It is laid 1 ½ bagam from the sea floor. Net is laid for every ¼ to ½ hours randomly.
Keerimeenchala valai (Gillnet)	Sep - Jan	Keerimeen, Karaooli	Net is made of Nylon twine. (Length – 18 bagam, breadth–7 bagam). Net size-32mm–34mm. Net position–It is laid 1 ½ to 2 bagam from the water's brim in the sea. Net is laid for 1 ½ to 2 hours.
Narambu valai (Gillnet)	Sep - Jan	Colourmeen, Paaraimeen, Kumulameen, Kattameen, Pannameen	Net is made of plastic. (Length– 40 bagam, breadth–3 bagam). Net size-58mm–60mm. Net position–It is laid 1 ½ to 2 bagam from the water's brim in the sea. Net is laid for ½ to ¾ hours.
5 No. Thundil (Hook)	Sep - Apr	Seelameen, Paaraimeen, Kattameen, Kadavuraa, Thirukkai, Kalava	Nylon twine is used for the hook. (Length – 80 bagam). An iron string is tied along with the nylon twine from the hook to about one feet length. Gap 20 mm.
7 No. Thundil (Hook)	Jan - Apr	Velameen, Kalavameen, Seppilimeen, Guruvalaimeen,	Nylon twine is used for the hook. (Length – 20 to 25 bagam). An iron string is tied along with the nylon twine from the hook to about one feet length. Two hooks are tied to the string. Gap 16 mm.
Kanavakattai (Hook)	Oct - Dec	Kanavaai	Nylon twine is used for the hook. (Length – 20 to 30 bagam). The hook resembles a fish with attractive colours on it.
Sanku	Aug-Dec	Sanku-visiri, Thoodhu kanavaai	Wearing a mask and having steel plates tied on the foots, they jump in to the water having iron rod or a heavy stone just to gain speed.They stay in the water for upto 1-2 minutes.
Karavalai (Shore seine net)	Aug-Dec	Kumula, Kalar, Salai, Kara, Panna, Parai	Nylon twine is used for the karavalai (Length-half kilometer, width-6 bagam), about 20 people pull this karavalai. On one side 10 people and on the other side 10 people join together and pull in one accord. It takes about 3 hrs to pull this karavalai.

4.4.2. Community based net shop

Repairing of fishing nets is one of the daily activities of fishing community. Normally nets are purchased from faraway places like Nagarkoil, Ramanathapuram and Madurai etc. PAD, **community based Net shop** were set up in Keelamunthal in the year 2007. Ten self help groups have contributed their share in these initiatives. These are now worth Rs 15 lakhs and they are the owners of the shops now. The total net and other fishing accessories requirement of the fishermen are now met in their village itself.

4.5. HOUSEHOLD USE

Edible fishes are eaten after cooking. Salted dry fishes, dried chunk meat are eaten by fisher people along with their traditional food of cooked rice. Occasionally crabs, cuttlefishes and prawns are also taken from the catches for household use especially when the fisherman's family has guests. Gowry, chanks are sold to shell merchants for making ornamental items.

4.6. TRADITIONAL KNOWLEDGE:

Fisher folk have an integrated and holistic perception of the ocean. Coral Reefs are perceived as part and parcel of the ocean. So when they say that they depend on the sea, they include all the different resources associated with the sea.

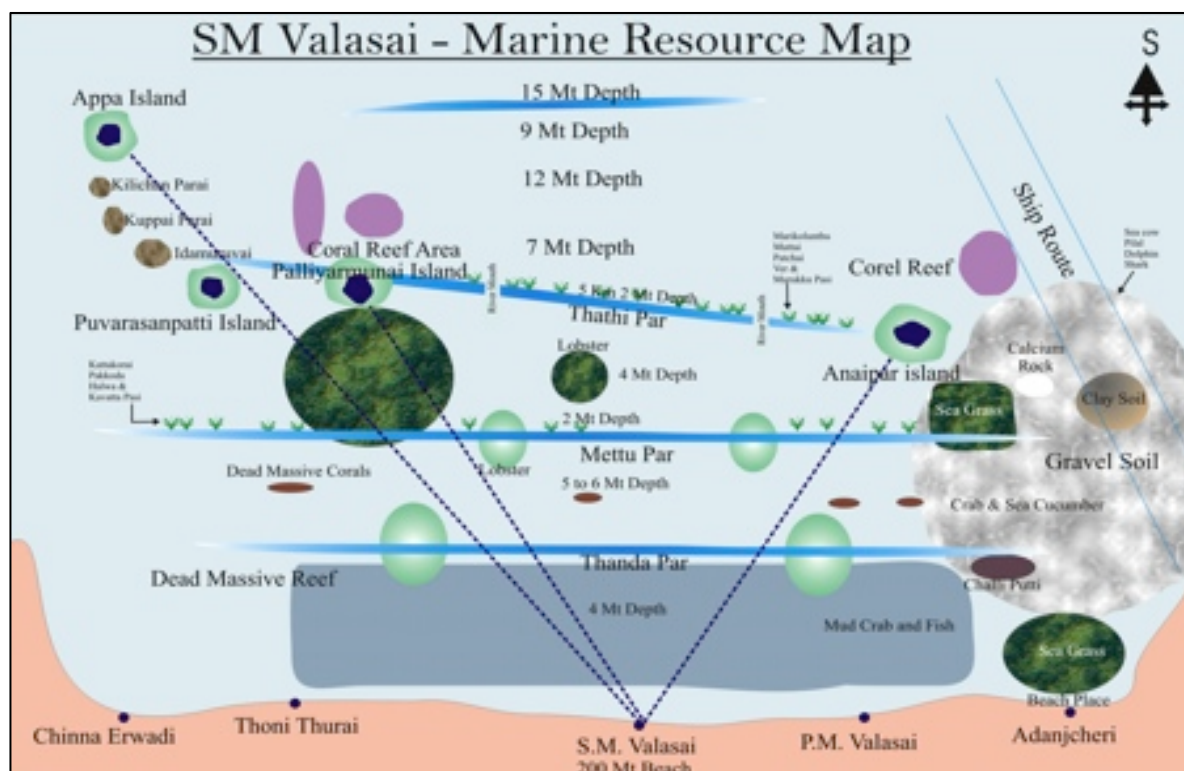


Figure 5. Marine resource map of S.M. Valsai

The marine resource maps shown in figure 5 and 6 were developed by the team and are based on indigenous knowledge of the local community.

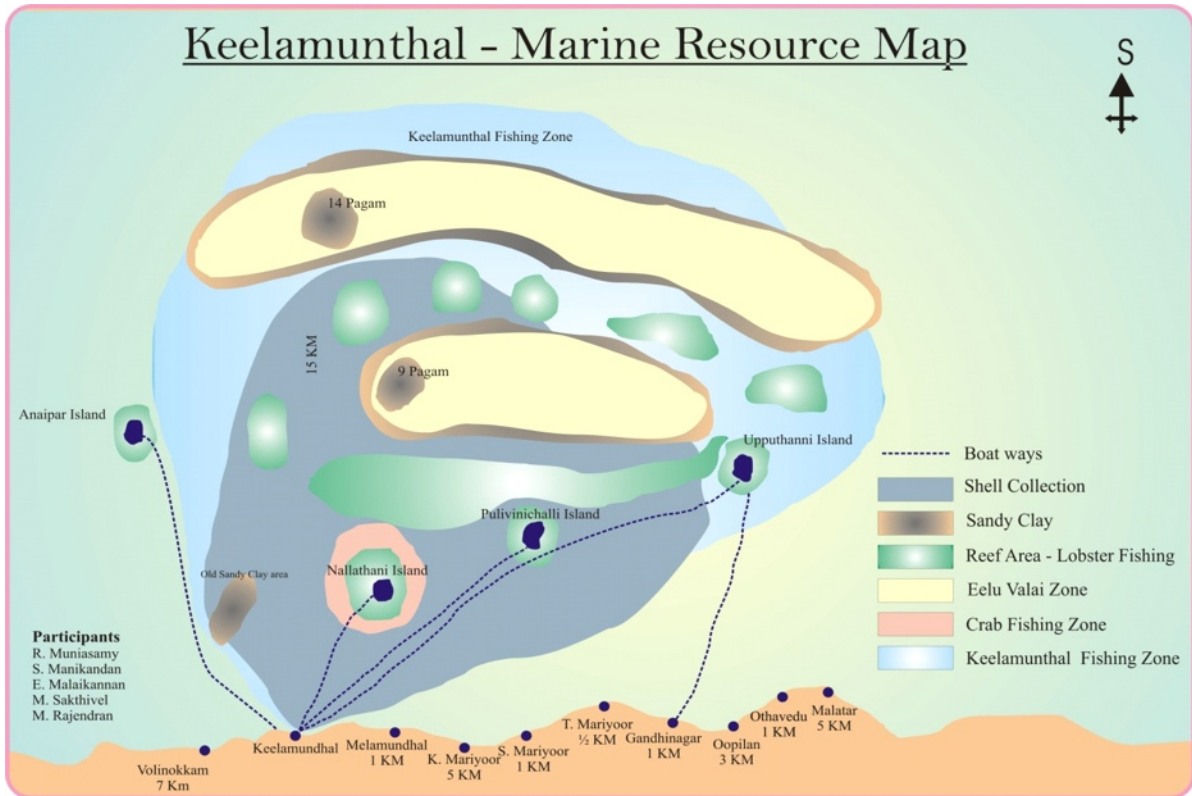


Figure 6 Keelamunthal Marine Resource Map

The use of marine species for medicinal purposes was found to be extensive in all three villages, with the extent of use varying depending on availability of different species. Common species, such as *Mural (Hemiramphus spp.)* and *Soodai (Sardinella spp.)* fish are available throughout the year and taken regularly as a preventative medicine against anaemia.

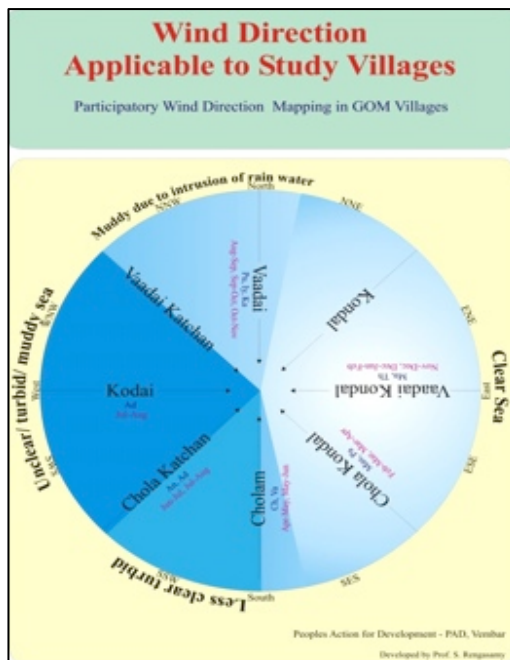


Figure 7. Wind Direction applicable to study villages

The knowledge and skills associated with exploiting the reef and reef-associated resources were found to be extensive, including practical skills for working in water and with boats and fishing gear, and knowledge relating to fish species and the physical characteristics and properties of the sea and resources.

Men and women from all the three villages were able to identify over 100 different species associated with the near-shore ecosystem and demonstrated an understanding of behavior and potential dangers of certain species. Such skills and knowledge help to ensure success in harvest and to avoid danger. They enable the local communities to exploit the diverse resource despite inadequate financial capital

for sophisticated equipment or years of formal education. Thus, the human resource of skills and knowledge provide an important insurance for poorer households against the uncertainties of sea based livelihoods.

The team was able to understand the myth and realities of several academically debated concepts like Traditional Ecological Knowledge (TEK). Individuals in the community are not uniformly endowed with TEK. TEK also does not guarantee for a good fish catch. Hence youngsters tend to ignore TEK as it has failed to guarantee any income to their elders.

4.7. PERCEPTIONS OF RESOURCE CONDITIONS

Most of the fishermen feel that the fish catch has decreased during the recent years. But they are optimistic that the “Sea Mother will never let them down. When we asked about alternate livelihood with the fishermen, their answer is that, their use of different nets during different seasons is their alternate livelihood. About 50% of the fishers, especially women residing in the coast of GoM from Rameswaram to Keezhamunthal depend on the seaweed resources around the islands. They are well aware of the areas where the commercially valuable seaweeds, are found and the times of low tides for the collection.

A group of seaweed collectors will usually carry an iron spear to pierce fish or rays stranded between coral boulders during the low tide. This kind of occasional fish catch provides protein nutrition to these families. Bigger fishes which can be cut into many pieces are shared by the group. The seaweed collectors catch fish for the household use throughout the year except during the monsoon season of October to December.

But after the introduction of 45 days ban period on fishing by Tamilnadu government from 15th April to 30th May every year, the seaweed collectors also observe the ban period to allow the seaweed to grow. Since they note that the seaweed harvest is diminishing.

4.7.1. Activities Affecting the Ecosystem & Resource Use

The following activities are affecting the ecosystem services negatively:

- From **Industries**, effluent water is released in the sea. The effluent water poisons the sea, and changes the distribution / movement of fish sometimes even killing them.
- **Dumping plastic and other waste in the sea:** it keep the fish away from the sea shore
- **Hazardous fishing practices:** Trawler and banned nets fishing destroys other fish resources and disturbs the equanimity of the sea.

In all the three areas, when fishers start getting more catch, they stay in the same area by anchoring their boats. The anchors get caught in the reef and damage them when lifted with the help of ‘pallumutton’ coir (this is additional coir tied to one of the five fingers of the anchor to facilitate easy lifting of the anchor).

There are divers in Keelamunthal who assist the fishers in catching lobsters. When the lobsters which hide in the corals are caught in the net, the divers help to remove the lobsters and the net safely without any damage to the corals. The divers are paid twice for their services. Their services help in protecting the corals from getting damaged due to forceful pulling of nets when they are caught in the corals while catching lobsters.

On the other hand, there is also an opinion that only because divers are available fishers go into the coral reefs for fishing. Otherwise, they may not do so for fear of their nets getting damaged.

Collecting from the reef (reef gleaning boulders, etc.): Earlier fishers used to collect coral pieces ('challi' corals – Acropora and Mondipora sp.) for tying into the fishnets as a weight. As the corals break into pieces they collect challi corals often from the reefs.

4.7.2. Response to these changes

By government agencies: Tamil Nadu Marine Fishing Regulation Act 1983 was enacted by Tamil Nadu government to safeguard the fishing interests of traditional and artisanal fishers. As per the Act, mechanized fishing boats could fish only beyond 3 nautical miles from the coast (1 Nautical mile = approximately 1.85 kilometers). But, even then the mechanized boats often wantonly stray into traditional fishermen's territory for better catch and conflict arose occasionally between the two groups which will be resolved by Fisheries and Police department officials and leaders of both the groups. Because of the law breaking activities of the wealthy mechanized boat fishermen, the poor traditional boat fishermen have to suffer with loss of resources and fishing implements.

Token system was introduced by Tamil Nadu Fisheries Department to mechanized fishing boats to regulate their operations only during night times. Some instances have occurred where boats have gone without getting token and were warned and fined by Fisheries Dept.

GOMBRT has become the watch dog in the area and they have tried to change the fishermen sea based livelihood into non-sea based livelihood, the fishermen have shown no interest to take up the alternative livelihoods suggested by GOMBRT. The fishermen however are utilizing the group loan facilities given by GOMBRT and the alternate livelihood trainings to their wards. The college fees of some fisherman wards are even paid by GOMBRT.

By reef users: People are restricting themselves due to fear of action by police and forest department. But they also feel that they cannot prevent the prohibited fish being caught accidentally in their nets. In such cases, they bring it to the shore instead of throwing them back into the sea.

4.7.3. How Have These Changes Affected People?

People who depended upon collection of seaweeds are economically affected. They can no longer collect seaweeds as it is banned. When they collect the seaweeds they are forced to sell at a very low price as buyers say that there is lot of risk involved in selling them.

Agar jelly production is affected as there is lot of restrictions on collecting seaweeds. Poor fishermen are affected by these restrictions, whereas rich fishermen are able to diversify into deep-sea fishing and also into illegal fishing using roller net etc. in trawlers.

There are women divers who involve in seaweed collection in SM Valasai and PM Valasi. They do involve in seaweed collection but are advised in using plucking method with their hand. This reduces the quantity of collection. It is also informed that still women do use "Sorandi", for collecting seaweed.

4.8. MATERIAL STYLE OF LIFE

The wealthy live in concrete houses and thanks to government welfare schemes T.V, household gadgets such as Mixie, grinder, liquid petroleum gas (LPG) connection is given by Tamilnadu government for families below poverty line. 20 Kg of free rice per month is provided. Electricity for huts using a single bulb is free. Concrete houses are provided under 'Tsunami' rehabilitation scheme or subsidies are given under fisher housing schemes.

5. COMMUNITY INFRASTRUCTURE

5.1. Infrastructure in the region

The ECR (East Coast Road) from Chennai to Kanyakumari near GoM coast has given a boost for the development activities of this area. Mostly heavy vehicles use this road for their easy journey to Chennai, Thoothukudi, Kanyakumari, Pondicherry, Cuddalore, Kerala state etc. Colleges and Polytechnics have sprung up in the nearby villages like Vembar and Kannirajapuram and hence the land cost increased.

5.2 Infrastructure in the Villages

There are no proper health and drinking water facilities available in these three villages. Potable drinking water is brought from Uchipuli (60 Km. away) by tanker lorries to SM Valasai and PM Valsai and from Kannirajapuram to Keezhamundel (35 Km. away). There are Primary schools at SM Valasai and PM Valasai. In Keelamunthal, Middle school is run by state government. These three villages are remote even from the nearby town Sayalkudi and Erwadi.

Public transport to these villages is rare. It can take a whole day for a person to visit the district headquarter at Ramanathapuram which is 65km away. Fishermen have to go to Ramanathapuram for moderate disease diagnosis and treatment or to Madurai, which is around 150km away, for better treatment.

All the three villages have electricity supply. Both SM Valasai and PM Valasai have bank and post office facilities at Erwadi which is 5 km away. Keezhamundel has these two facilities at Mariyoor which is 5 km away.

Fishing related information such as distance and availability of fish shoals from the shore, wind speed and wave height which are provided by INCOIS (Indian National Centre for Ocean Information Service) .are transmitted to the mobile phones of selected fishermen along Gulf of Mannar coast by VKCs of PAD and MSSRF

5.3. Business Development and Ownership

Repairing of fishing nets is one of the day to day activities of fishing community. Normally nets are purchased from faraway places like Nagarkoil, Ramanathapuram and Madurai etc. With the support of PAD, **community based Net shops** were set up in villages like Natarajapuram, Keezhamundal and Roachmanagar in the year 2007 and are functioning with the running capital of 15 lakhs.

10 self help groups have contributed their share in these initiative and they are the owners of the shops now. The total net and other fishing accessories requirement of the fishermen are now met in their village itself. The fishermen's expenses towards their journey to cities for purchase of fishing accessories are saved and they can use this time for their livelihood activities.

The **FISHERR programme** initiated by PAD had relieved the fishing community from bondage to the middle man. So far 344 families are relieved from bondages.

Few petty tea shops, cool drink shops and grocery shops are owned by the village people themselves. They are the owners of the shops. In Keezhamundel especially, no outsider is allowed to settle in their village. As the banks are in a faraway place from their villages, they are not getting business development loan facilities from the banks.

On the other hand, a Livelihood Group (LG) group has purchased an auto rickshaw from the loan got from PAD and running the Auto profitably. The LG group members are the owners of the auto.

6. EFFECTS OF COASTAL AND MARINE ACTIVITIES IN THE GOM

Gulf of Mannar is a marine biodiversity 'hot spot' in the state and nearly 3600 marine species living in this area which many of them are endemic to the area. The Gulf of Mannar area is prone to severe anthropogenic pressures from the coastal fisher population. The major threats prevailing in the area are

- Over exploitation of Marine Resources
- Habitat destruction
- Localized marine pollution.
- Nearly 0.3 million fishermen are dependent on Gulf of Mannar for their day to day livelihood.
- Nearly 5,000 mechanized trawler boats and nearly 25,000 traditional boats (Vallam / Vathai) are operating in the Exclusive Economic Zone (EEZ) of Gulf of Mannar.
- Nearly 30 industries are located along the coast of Gulf of Mannar.
- Sewage and other waste disposal locations along the coast are draining into Gulf of Mannar.
- Trade in highly endangered marine organisms such as Sea Cucumber, Sea turtle, Sea horse, Sea Cow, Sponges and Scheduled shells is prevalent in illegal market.
- Dynamite fishing
- Use of prohibited fishing gears

Due to this anthropogenic pressures and unethical development of the industries caused the livelihood of the fisher folk in three villages.

Use of killer nets (Trawl nets, bull trawl nets and roller trawl nets) by mechanized trawlers who are migrant as well as non fishing communities caused heavy damage to eco system which was controlled previously by traditional fisherman panchyat at village level. These nets literally sweep the mid water and sea floor in that; all fishes including fish-fingerlings are caught. Killer nets destroy coral reefs; seaweeds and bottom fauna in the sea. Fish eggs and fingerlings normally grow and develop in coral reef environments, eats sea moss and other weeds on the reefs. Destructive process of Killer nets on the coral reefs, sea moss and other bottom fauna in the sea are going on unabated. Traditional fisherman panchyat is active at certain level in Keelamunthal and it was totally dysfunction in other villages namely SMValasai and PM Valasai.

Seaweed collection using scrap instruments: It was the practice by the seaweed collectors of Keelamunthal to use a metal made scrap instrument for the easy removal of seaweeds with their holdfast attachment in the substratum. This kind of practice will not give way for the regeneration of seaweeds from their holdfasts.

After the intervention of the GOMBRT, the seaweed collectors have disbanded the use of scrap instruments and use their hands in seaweed collection works.

Fishing activity using 'Koodu' (Fish trap) around coral reefs. Dropping boat anchors while laying 'koodus' near the coral reefs damages the corals.

6.1. HOW HAS THE MACRO CHANGE AFFECTED ARTISANAL FISHERS?

As per the PRA study on traditional fisheries management practices in Gulf of Mannar conducted by PAD, before Dhanushkodi cyclone (December, 1964), there was no destructive fishing practices and no release of effluent water in the sea. Therefore, the people had healthy fish, healthy coastal ecosystem. In the name of cyclone rehabilitation, trawlers were introduced through Norwegian technology and financial aid.

Subsidies for boat engines and bigger boats encouraged even the non-fishing communities to invest in fishing. Most of the trawler owners are rich people from inland who have money to invest. They do not have any ethics in fishing and they do not respect the local customs and values.

Since 1991 the international market also opened for export. This globalization policy has encouraged everyone to exploit more resources from the sea and fishing became a commercial venture.

The traditional and artisanal fishers have been affected since they are forced to fish further and go to deeper waters every day in order to reduce the competition and conflicts. Almost all the traditional and artisanal fishers are indebted to the merchants or moneylenders. The merchants and the moneylenders fix the price for indebted fisher's catch. The price fixed by them is much lower than the market price.

Now due to the release of effluent water and other plastic wastes into the marine ecosystem the living resources of the ocean are affected, thereby the health of the people and food and nutrition security is not ensured.

Numbers of mechanized fishing units using trawl nets are increasing. The powers of the recently constructed boats have increased beyond 200 H.P. About 80% of traditional and mechanized boats are propelled by engine power. The rotation of propellers' is detrimental to the coral larval establishments and damages the coral polyps.

Granite sand mining is at an alarming rate from Kanayakumari to to the mouth of river Vaipar. Port expansion works at Thoothukudi port is progressing. There is a proposal to construct a fishing harbour at Mookaiyur (6 km away from the ECR) and the works of constructing broad road and bridge is in progress. All these activities will result in more silt loaded water in the coral reef area, poor coral larval establishment and poor photosynthesis of the coral symbiotic partner zooxanthellae.

There is already a thermal plant at Thoothukudi discharging large heaps of fly ashes into GoM sea water and one more is about to start its function near Tharuvaikulam 15km. north of Thoothukudi. Another bigger coal based thermal power station is speedily in the process of establishment by Tamilnadu government near Udankudi near the GoM coast to meet the deficit power crisis of the state.

6.2. PRESSURE ON MARINE GOODS AND SERVICES

Millions of people around the coast are dependent on the sea resources of GoM for their livelihood. Fishermen catch different fishery resources using different types of nets by going into the sea either by wind propelled or engine propelled boats. Another group of fishers catch the shore living fishes using shore seines (Shore nets). Very poor fishers using pith floats as their floating means, fish cuttle fishes using special types of hooks. Mechanized boats are in the hands of wealthy fishers who engage poor fishers as labourers in their boats.

As mechanized boat mostly use the trawl net, the nets cast by traditional boats are torn, damaged and some time taken by the mechanized boat fishers. Hence conflicts arose often between mechanized and traditional fishers. Sometime fight between these two group of fishers arise in the mid sea and results in the loss of life or vital parts like hand, leg etc. Some time the mechanized boats are seized by traditional boats crew and driven to their villages and anchored near their village. Then tension arose between these two group fishers. When the matter comes to the knowledge of fisheries department officials, they try for a compromise between these two groups which may prolong for some days to weeks. Until a compromise is reached and compensation got from the mechanized boat owner for the loss of nets etc, the traditional boat will not go for fishing fearing aggressive action from mechanized fishers. The socio-economic lives of the fishers of GOM continue to be a greater struggle.

Around five million people living around the coast of GoM and interior are getting their protein rich sea-food from GoM sea. Fishes ranging from tiny silver bellies (*Leiognathus* spp.) to large whales are living in GoM sea. During the last two decades, traditional fishers ancient fishing crafts like catamarans were replaced by modern fiber glass boats or wooden valloms. Still poorer fishers buy thermocol sheet, make a polythene or gunny bag cover for it, strengthen its underside by tying tightly two or three bamboo reapers and use it as a tiny craft to move near the coastal waters using wooden plank oars. The fisher people call this tiny thermocol craft as 'buoya'. The cost of a craft is around Rs.800/-. Such crafts are used for catching cuttle fishes in the coastal waters using special types of hooks in the shapes of fishes. Such type of fishing is called 'Squid jigging'. Cuttle fishes such as *Sepia* spp., *Loligo* spp. are caught in such fishing. On certain days these buoyas of about 5 to 7 are loaded in fibreglass boats or valloms to move into deeper waters if the catches are poor in coastal waters.

Some fishers, especially the Srilankan refugee fishermen living in the refugee camp at Mandapam camp use the air filled lorry wheel tube as their fishing craft. The central gap of the air filled tube is knitted with rope or twine to load nets in that area. This kind of craft is carried by using bicycle or other two wheelers to the fisherman's seashore place. The two wheeler is kept locked in the shore in a safe place. The air filled tube is floated in the sea and oared by wooden plank to his desired location in the sea. The fishers use this type of craft to cast nets in the coral reef areas around GoM islands.

Torchlight fishing is another recent innovation by fishermen of this area. Fishers involved in such fishing carry two high powered batteries and lights in their boats in addition to hooks and line with baits. They move to deeper areas of the sea by out-board or in-board motor powered boats. During the nights, battery powered light is switched on. Fishes like barracuda (*Sphyraena* spp.), tuna (*Thunnus* spp.), seer fish (*Scomberomorus commerson*), dolphin fish (*Coryphaena hippurus*), needle fish (*Tylosurus* spp.) etc. are attracted by the powerful light. During that time, the fishermen put the hooks with baits and easily catch the fishes attracted by the light. The fishermen venture into such fishing bring insulated boxes with ice bars, stay in the sea for two nights and came to the shore with the iced catches at the end of the second night.

'Surukkumadi' and 'bull trawl' are two types of destructive fishing nets used in the GoM sea. Surukkumadi is used by traditional fishermen. Two traditional boats are used for the operation of this net. On sighting a shoal, it is encircled by the two boats using this net. The bottoms as well as the surface ends are closed by the ropes meant for such purpose. At the end, the encircled fishes in the shoal are entangled as if within a bag. The bull trawl is a large trawl net with wide mouth. Two mechanized boats trawl the sea, each one holding one end rope. Large areas of the sea from sea bottom to surface are trawled by such operation. The two nets mentioned before will catch all organisms on their course and hence are banned as destructive nets. But the fishermen are commonly using these nets in GoM sea.

GoM sea is famous for pearl oysters and sacred chanks. Thoothukudi is famous for pearl oyster harvest and auction. Beyond the early 1960s, pearl fishery ceased to exist in this coast probably due to the introduction of mechanized boats. But sacred chank (*Xancus pyrum*) fishing is existent in this coast and to certain areas of Palk bay. Talented divers are living in this coast especially in villages like Periapattinam and Thoothukudi.

These divers can dive up to 11 fathoms to collect sacred chanks living in the bottom of the sea. November to March is the season for chank fishery in GoM sea during which time the sea water is clear with less turbidity. In the year 2011, certain fishermen near Thoothukudi have used SCUBA diving equipments to dive into deeper waters and to harvest chanks in greater quantity. The artisanal skin divers have objected to this type of fishing and gave a petition to the Thoothukudi

collector to bring an end to such activity. If such activity is allowed to continue, it may also bring an end to chank fishery in this coast.

Apart from such recent innovations, fishing by mechanized trawlers and traditional valloms and fibreglass boats using different types of gill-nets, boat-seines, hooks and line etc. are in operation along GoM coast.

6.3. VALUE OF GOODS AND SERVICES:

Beyond providing mankind with varieties of protein rich fishes, GoM sea harbour varieties of agar (*Gracilaria edulis*, *Gelidiella acerosa*) and algin (*Sargassum* spp., *Turbinaria* spp.) yielding seaweeds. The seaweeds grow attached with dead coral reefs and nearby shallow areas of the sea. The chain of 21 GoM islands protects the main land coast from the fury of strong wind and waves of the sea. The sea grasses and seaweeds growing underneath decrease the wave actions of the sea and minimize sea erosion. Such sea grass and seaweed beds are safe habitats for the juveniles of prawns, sea-horses, sea cucumbers etc. All the live and dead coral reef is habitat for many of the marine fin and shell fishes. The live coral polyps and the countless number of phytoplankton live on the surface of the world oceans fixes the atmospheric CO₂ for the manufacture of their food and give out O₂. The Scientist considered the phytoplankton and the coral polyps as the prime agents in the world minimizing global warming.

6.4. TARGET MARKETS FOR GOODS AND SERVICES

Shell fishes like prawns, lobsters, crabs, cuttle fishes are exported to foreign countries like Japan, Singapore and America etc. in frozen form. Fin fishes like seer fishes, barracuda, pomfrets, perches etc. are sent to interior markets like Madurai, Bangalore, Chennai, Coimbatore, Kochi, Thiruvananthapuram etc. The sacred chank fished in GoM sea are sent to markets in W.Bengal for better price. The fins of sharks are exported to countries like Singapore, China, and Japan etc.

Recreational activity in the GoM sea is minimum. Some foreign tourists visiting places like Rameswaram, Thiruchendur, occasionally use the sea for bathing. Devotees visiting temples like Rameswaram, Thiruchendur, Vembar and Thoothukudi etc. use the sea for bathing. Apart from such activity, there is no organized recreational activity in GoM sea.

Coral construction material: (sand, shingle Boulders) Coral stones were used for construction purposes during the first half of 19th century. Few of the dilapidated buildings at the Dhanuskodi Railway station (Remnants of 1964 cyclone) are still bearing the coral stones in their walls. Coral stones were also removed from GOM islands and sent to cement factories as source of calcium carbonate during the same period. But, however after knowing its importance, such practice were banned by the Government.

Cowry: Shells of different varieties got from GoM area are used in shell industries as ornamental materials. Rameswaram Island where the flows of Hindu pilgrims are heavy is an important place for shell industries and business.

Ornamental Fish: Ornamental coral reef fishes are caught in live condition by using a trap called 'koodu' in villages like Erwadi and SM valasai. The fishermen venture into such fishery practice by placing the 'koodus' near the coral reefs. While anchoring their boats near reef areas, coral reefs are damaged due to throwing the anchors on the reefs. The ornamental fish fetch good price to the exporters. Few exporters have also opened their establishments in Erwadi. Training on the laboratory culture of marine ornamental fishes was conducted by Forest department in collaboration with Annamalai University. Central Marine Fisheries Research Institute (CMFRI) at Mandapam camp also has conducted such ornamental fish culture training to local people and entrepreneurs with the aim of relieving pressure on the coral reefs.

Reef fish: Groupers/ Rock (Reef) cods/ Coral trouts are some of the varieties of reef fishes of GOM sea. Species of Groupers (*Epinephelus* spp.) have great export potential. A project is underway for the artificial breeding of groupers at CMFRI, Mandapam camp.

Tuna: *Thunus obesus*, a tuna species is occurring in GOM coast. As the fish is not liked by the people living along this coast, there is no demand for this fish. The fish also will not fetch good price. However, the fishermen will sell the tuna fish got in their nets for whatever price it fetches.

Shark: As per the fishermen of the GOM coast, the catch of sharks has decreased during the recent past. Small sharks like *Chilocelium indicum* are also occurring rarely in the trawl fish catches at Vembar.

Octopus: Octopus (*Octopus dollfusi*) is a trash fish in the commercial fish catch. It is not commercially important. However, cuttle fish which is similar to octopus in body construction forms a good fishery along GOM coast.

Other ocean fish: *Copia (Rachycentron* spp.) which is an oceanic fish is fast growing found in GOM sea. Captive breeding of this fish was achieved in Central Marine Fisheries Research Institute (CMFRI) centre at Mandapam camp. Its young ones were are also successfully reared to adult size.

6.5. KEY LEARNING'S

- Fish catch per unit are going down in the years. But the fishers are optimistic and believe nature (especially Kadal Matha – Mother of Sea) will never let them down. This is their faith towards fishing.
- There are already signs of reduction in the mean sizes of a many species in the exploited stock. Juveniles of *Sillago sihama*, *Nemipterus japonicus*, and *Lethrinus* spp. form the major portion of the exploited catches.

- Silver bellies which though ranked first in the percentage of the total catch (upto 74% in September 2012), the total quantity has decreased over the years.
- To adjust to the changing conditions, the fishers are always modifying their nets and try to adjust to the situations.
- The younger generation is seeking for alternative employment through the process of building their educational capacity.

7. TOURISM IN THE GULF OF MANNAR

Beach Tourism is almost nonexistent in the Gulf of Mannar region. Rameshwaram on the Southern end of the Gulf of Mannar is considered a very holy place for the Hindus and has been a pilgrimage site since times immemorial. The whole region is steeped in legends connected with Lord Rama. The visitors to this region are Pilgrims and they have created a market for pearls, sea shells and the sacred chank. This market has seriously impacted the chank fishery in the region. The pilgrim visitor pressure is concentrated at Rameshwaram.

7.1. BEACH RESORTS:

Resorts as such are not in existence at GOM coast. A small park as tourist attraction is established near the entrance of Pamban Road Bridge to Pamban at GOM coast. Twenty percent of the tourists visiting Rameswaram Island for pilgrimage also visit Dhanuskodi and Mukudarayar chatram. They spend some time on the GOM coast.

Traditional fishermen who were using the sea resources for their subsistence are banned to enter the GOM islands. But, a proposal is in the offing of the Tamilnadu government to allow tourist in few of the GOM islands. The fishermen of GOM coast and their trade unions are opposing this proposal.

7.2. SNORKELLING AND SCUBA DIVING:

This activity is nonexistent except by research Institutes and students for their studies.

7.3. OTHERS (GLASS BOTTOM BOAT, FISHING, BOAT TRIPS):

Glass bottom boats were in existence at the entrance to Pamban Road Bridge quite some time back. But it is not existence at GOM side. They are now only found at Palk Bay side of Rameswaram.

8. KEY STAKEHOLDERS AND GOVERNANCE

Fishers are the instruments for the exploitation of the marine resources. It is essential to safeguard the welfare of the fishers and to resolve the conflicts between different groups of fishers and between fishers and other groups and the Fisheries department. The Fisheries department is also a body to transmit the welfare schemes of the government. Cooperative Societies act as liaison agencies between fishermen and Fisheries department. Panchayat Raj institutions, village/ community panchayats all work for the family welfare of the fishermen. Balwadies, village school teachers, NGOs, CBOs will all play their role to bring the fishermen society to cope up with the advancing societies. Religious institutions in some parts of our country control the fishers and their welfare in a better way. Service providers, money lenders and health practitioners are all essential parts of modern society to make it a dynamic system.

Key stakeholder	Characteristics
Fisherman	Responsible for utilization of marine resources for their own consumption as well as commercial exploitation.
Fisheries Department	Responsible for the fishermen welfare
GOMBRT	Responsible to safeguard the biodiversity & sustainable development, accountable both to the government and donors
Panchayat Raj Institutions	Representative bodies, constitutionally responsible to meet the basic needs
Village/ community Panchayats	Close to the people, they represent the social capital of the community
Cooperative societies	Part of fisheries dept with peoples participation, credit and input support
Village school teachers	With appropriate motivation they can influence & shape the attitude of the upcoming generation
Balwadis	Play a positive role in improving the child health
NGOs & NGO promoted CBOs	Roles are not fixed, can be creative in sphere of activity
Religious Institutions	Church & Jamat are the formal institutions can play a positive role
Service providers – ranging from merchants health practitioners, shopkeepers, money lenders to transport operators	It is they who run the local economy – though motivated by profit they introduce appropriate changes to enhance livelihoods

The traditional fishers who use the GOM are dependent on the coastal and marine resources for their survival. They are dependent on the goods and services originating from the coral reefs. The subsistence of fisher women lies on the macro algae existing around the islands. There is an attempt by the governing Tamilnadu Forest Department to lay buoys at a distance of 500 m. around each island just like fence and the fisher people and their activity will not be allowed within the fenced area. The Forest department has also procured the required buoys at a huge cost. But it is kept in abeyance due to the stiff opposition of the fishers of this coast.

8.1 Information sources that influence decision making

Table 8: Source Information that influences the decisions of the different stakeholders in GoM region					
subject of information	Information Source	Information form	Groups targeted	Actual effect of information	Other comments
What is to be harvested - Value of the fishes	Market through merchants	Mainly oral	Fishermen, traders	Fishermen respond immediately	Information is likely to spread immediately
What is not to be harvested	Fisheries department, forest dept, GOMBRT	Mainly in written formats, posters	Fishermen to avoid unnecessary harassment	Encourages illegality, hide actual practices	If the restricted varieties are of high value it encourages secrecy & spying among the fishermen
Weather conditions	Meteorological dept, TV, Radio, news paper,	Written as well as verbal, visual	Fishermen	Unreliability breeds indifference	Become insensitive and ignore it except on certain occasions
Knowledge about fishing grounds	Informal gatherings, friends, relatives, GPS, Experience, apprenticeship i.e. actual involvement in fishing	Local, oral, demonstration	Fishermen	Improves the productivity	Always considered valuable, Interested to acquire this type of information at times by paying money & liquor
Knowledge about nets & its efficiency	Experience apprenticeship i.e. actual involvement in fishing	Local, oral, demonstration	Fishermen	Improves the productivity	Always considered valuable, Interested to acquire this type of information
Availability of fish	Experience as well as using GPS	Verbal	Fishermen	More productivity / catches	Directly related to livelihood
Knowledge about net restriction	Govt- fisheries dept, GOMBRT	Source is written down, disseminated orally	Fishermen		Encourages illegality, harassment by officials & bribery
Govt schemes & programmes	News paper, TV, Local politicians PRI representatives & pro-social behaviourists	Multi-various forms	Entire community, depending on the nature of the programmes sometimes SHGs, aged, handicapped, homeless are targeted	Enhances livelihood	One may be knowledgeable but actualization may bit frustrating, it demand special skills to get it
Health & Nutrition related information	Primary Health centres, Health educators, Balwadis	Written, verbal as well as individual contact	Entire community especially pregnant & lactating mothers	Enhances livelihood	Poor people normally respond
Awareness about rights	Fisheries union. Mainly NGOs, mass media	Written, verbal, training	Entire community and those who were affected	Protect existing sources of livelihood	Can claim compensation
Aquaculture activities like crab, lobster fattening	Training by NGOs, research institutions & fisheries dept	Training form – written, oral as well as demonstration	Fishermen and interested persons in coastal communities	Livelihood enhancement	Actualization of knowledge demand support as well as enabling environment
Migration to other fishing grounds	Experience, relatives, friends, demonstration	Oral	Fishermen	Livelihood enhancement	Ensures sustainability
Overseas migration	Agents	Oral as well as written	Young adults	Livelihood diversification & promotion	Ensures livelihood betterment

Table 8.1 lists the sources of information that enable decision making by stakeholders for various activities. One can note that the communities living along the coast of Gulf of Mannar are well informed and take risks and prioritized

decisions based on their needs and situation at a state of time. Traders and cash incentives provide the main influence in decision making by the stakeholders.

8.2. MANAGEMENT BODY: THE GULF OF MANNAR MARINE BIOSPHERE RESERVE TRUST (GOMBRT)

GOMBRT was declared the first marine biosphere reserve not only in India but also in South and Southeast Asia. The IUCN Commission on National Parks and WWF identified the reserve as being an area of 'particular concern' given its diversity and special multiple use management status. As the first marine biosphere reserve declared in India, this area has long been a national priority.

The GOMBRT was declared on 18 February 1989 by the Government of India and the State of Tamil Nadu. The intention of declaring the 21 islands and surrounding sea, including 6.4 m depth on the bay-side to 9.1 m depth on the seaward side, as a marine biosphere reserve is to protect marine wild life and its environment. The main objectives of the GOMBRT are:

- Conservation and management of representative marine ecosystems
- Protection of endangered and important marine living resources
- Provision of long-term conservation of genetic diversity
- Promotion of basic and applied research work and its monitoring
- Dissemination of information through education and training.

The following persons were part of the management committee of GOMBRT

- | | |
|--|------------|
| 1. Secretary, Ministry of Environment & Forests | - Chairman |
| 2. Joint Secretary (WL), /Ministry of Environment & Forests | - Member |
| 3. Joint Secretary (FA) Ministry of Environment & Forests | - Member |
| 4. Representative of State Government of Tamilnadu | - Member |
| 5. Director of Gulf of Mannar Biosphere Reserve | - Member |
| 6. Representative of Botanical Survey of India | - Member |
| 7. Representative of Zoological Survey of India | - Member |
| 8. Director-in-charge of Biosphere Reserve programme in
The Ministry of Environment and Forests | - Member |

8.3. MANAGEMENT PLAN:

The Action and Management plan to be prepared by the Government of Tamil Nadu as per the decision of Management Committee. The Management plan may be under the following heads: Survey, Conservation, Protection, Eco restoration, Education and awareness. The Government of Tamil Nadu will set up a local committee for coordination of the activities of various departments in the area covered by the Biosphere Reserve. The Government of India will provide financial assistance for approved items of expenditure included in the action and Management plan.

8.4. ENABLING LEGISLATIONS:

At present, except forest department officials, others are not allowed in the islands. Catching banned animals like sea cucumber and other item are monitored. Violations are fined or cases booked on the violators and remanded in prison.

8.5. MANAGEMENT RESOURCES:

Three range offices have 3 mechanized boats at their disposal for surveillance of the island area and the rangers and watchers

8.6. INFORMAL TENURE AND RULES CUSTOMARY LAWS

Informal tenure and rules of the customary laws are not recognized by existing formal laws. There is clear cut delegation of area for fishing is practiced by local fisherman in GOM area which is over ruled by trawlers who are migrated from other districts. It was happened due to the introduction of mechanized boats and the practice of Thangal (Staying in the sea for one or two days) fishing.

8.7. FORMAL TENURE AND RULES GOVERNMENT NOTIFICATIONS & LAWS:

In the telex message No.75612/FRV/88-3, dated the 24th January 1989, the Government of Tamil Nadu have conveyed to Ministry of Environment & Forests, their acceptance of the proposal for setting up of Biosphere Reserve in Gulf of Mannar area. It has, therefore, been decided that the Gulf of Mannar Biosphere should formally be deemed to have come into being with effect from 18th February, 1989.

8.8. COMMUNITY INCENTIVES

To decrease the fishing pressure on the coral reef resources, GOMBRT (Gulf of Mannar Marine Biosphere Reserve Trust) has its head office at Ramanathapuram and branch offices at Thoothukudi, Keelakarai and Mandapam. The GOMBRT has village level workers. It has formed EDC (Eco Development Committee) in the coastal villages up to 5 km from the sea coast. LG (Livelihood Group) groups were formed in the villages. The strength of a LG group is up to 20 members. Account in bank was opened in the name of each group. There will be a Secretary and treasurer for each group. Each group was initially given a loan of Rs.60, 000/- which can be divided between the members. The loan amount bears an interest of 2% per month. Out of the 2% interest money, 1% will go to the expenses of EDC. The loan money with interest will be collected from the members at intervals and deposited in the bank. The accumulated money will be recycled among the members for developing their alternative livelihood like charcoal making, goat and cow rearing, tailoring etc. In addition, the wards of fisher people were given short term trainings like JCB operator, motor driver, two wheeler and marine engine mechanism, computer training, tailoring, short term course of nursing, mid-wife etc. All the trainings were given with the collaboration of nearby academic institutions like

Mohamed Sathak Polytechnic, Keelakarai, Pioneer Hospital, Ramanathapuram etc. Some of the wards of fisher people were secured admissions in the nearby colleges and their fees to the colleges were paid by GOMBRT.

8.9. STAKEHOLDER PARTICIPATION AND SATISFACTION

The marine conservation efforts made by the GOMBRT and forest department never seek any stakeholder's participation actively. The fishers act like passive participants for conservation activities.

The fishers and other stakeholders make decision of what to catch, based on the information available to them through various sources. The decision taken mainly based on the interest of the market and traders influence. For example, the schedule 1 is prohibiting fishers to catch some of the marine species but since enforcent is weak and the market price is high the fishers continue to take the risk of extracting it.

8.10. COMMUNITY AND STAKEHOLDER ORGANISATIONS

All the three villages have a community lead organization for ensuring village unity through traditional fisherman panchayat.

There is a trade union called RFTU (Ramanathapuram Fish worker Trade Union) at Ramanathapuram which is a fisher community organization which is fighting for the traditional rights of fisher folk over the MPA at GOM.

8.11. POWER AND INFLUENCE:

RFTU has organized dharnas in Ramanathapuram against the proposal of laying buoys around the GOM islands. They have also represented to central and state ministers against the move of the forest department. The move of the forest department is so far kept in abeyance.

9. COMMUNITY ATTITUDES AND PERCEPTIONS ON MPA MANAGEMENT AND CONSERVATION MEASURES IN GULF OF MANNAR

Gulf of Mannar was declared as Marine National Park and Biosphere Reserve on 18th February 1989 by Government of India. After the constitution of the national park, two of the islands which were in the custody of private ownership were taken over by Government of India after paying compensation. Responsibilities and surveillance of the marine national park were entrusted with the Tamilnadu Forest Department. Tamilnadu Forest department has established 3 range offices at Mandapam, Keelakkarai and Tuticorin for effective surveillance of the area. Mechanized boats, ranger and watchers were provided to each range office.

Gulf of Mannar Marine Biosphere Reserve Trust was formed with its head quarters at Ramanathapuram mainly to give alternate livelihood options to the people depending on the resources of Gulf of Mannar and to make researches on the living marine resources and environments of Gulf of Mannar.

Understanding the attitudes of the people along the coast of Gulf of Mannar regarding the services provided by the coral reef ecosystem is essential while deciding what action can be taken to increase the management's effectiveness and people's compliance. A survey of 150 individuals randomly selected was conducted to understand their attitudes and perceptions towards conservation activities of Gulf of Mannar.

9.1 ABOUT THE RESPONDENTS

A total of 150 randomly selected individuals were surveyed of which 53% were males and 47% were females (figure 8). The respondents were from age groups as shown in figure 9 and different walks of life as shown in figure 10

Figure 8 Gender of respondents

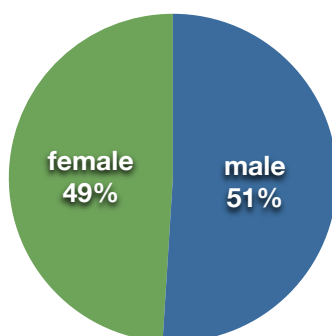


Figure 9. Age of the respondents

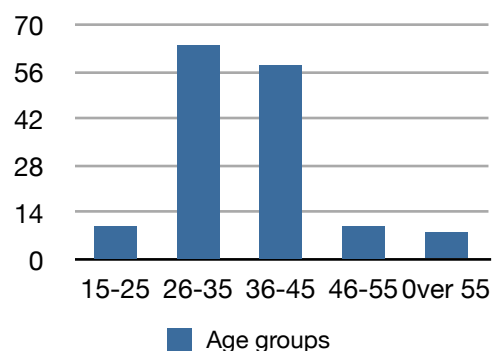


Figure 10 Occupation of respondents

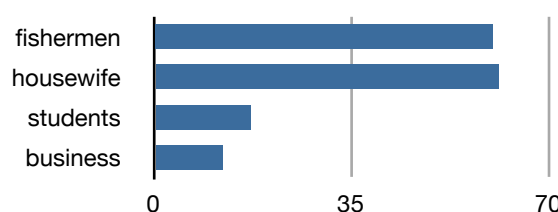


Figure 11. Respondants Income

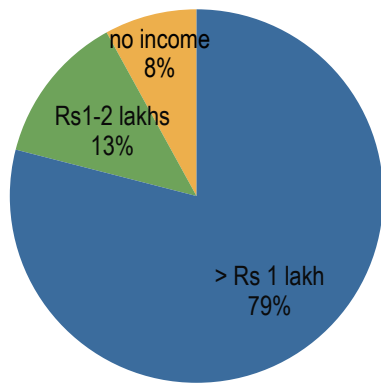
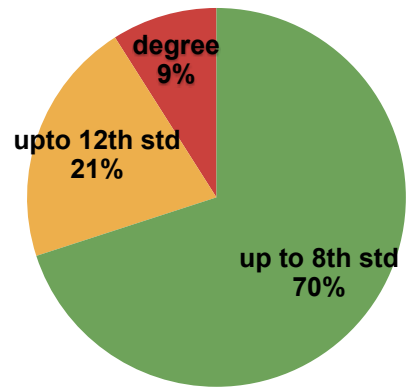


Figure 12. Level of education



As can be seen from figure 11, seventy nine percent of the respondents have reported an income of below Rupees one lakh. Thirteen percent had an annual income in the range between Rs 1 to 2 lakhs, and eight percent of Respondents were students. They have reported no personal income.

Figure 12 shows that 70 percent of the respondents had studied upto the 8th standard, while 21% had studied until the 12th standard and 9 percent had a degree.

9.2 PERCEPTION SURVEY RESULTS

9.2.1 Perception of a protected area

All 150 people interviewed understood the concept of a Marine Protected Area. 50% of the people had the opinion that MPA was a marine area that should be protected to allow coral reefs, Mangroves and their associated flora and fauna to regenerate. But 50% of the people felt that fishing should be allowed in the protected area after a certain period. 100% are aware that corals, turtles, sea cows and sea cucumbers are all protected under the law and their collection is punishable offense.

9.2.2 Benefit of MPA

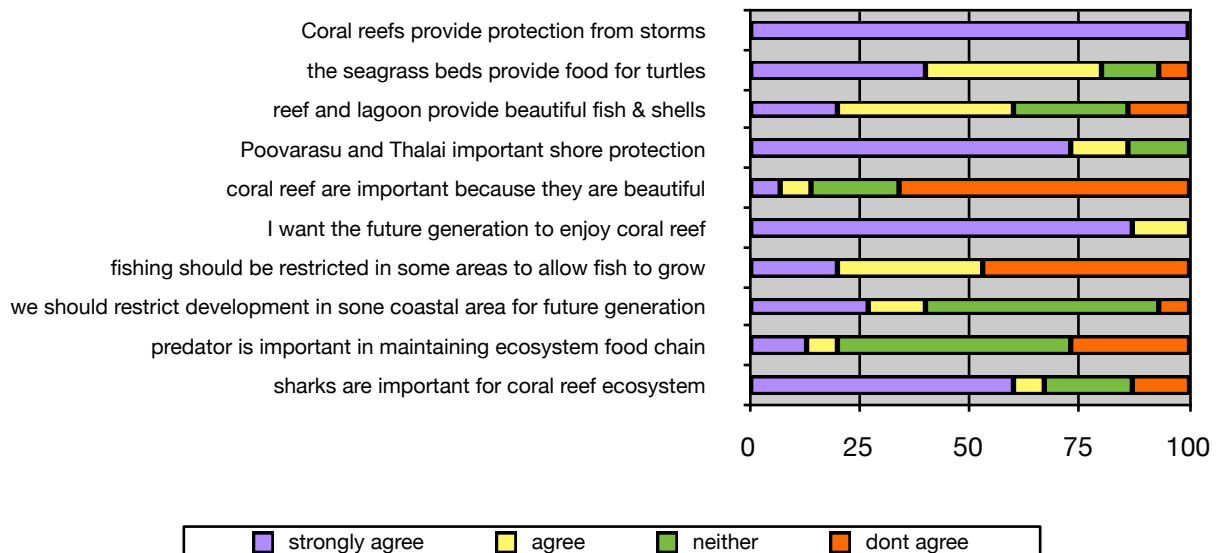
Table 8 lists the communities perception of benefit from conservation and implementing MPA's.

Table 9: Benefits of Conservation and MPA	
Individual	Community
Marine resources will increase, Fishery will be good	Safeguard the community as a whole
Family needs will be met	Safeguard people from natural calamities
Income will increase	Export will increase, consequently economic and social development will increase
Children's education status will increase	Industrial development and marketing of products will increase

The respondents have linked prosperity of the area with the implementation of MPA's

9.2.3. Non Market Non use Values of Gulf of Mannar

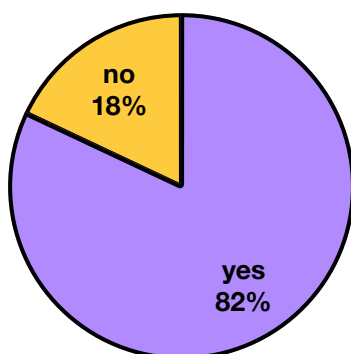
Figure 12. Agreement Level with Value Statement



The respondents were given a number of ecological statements and were asked to score on a scale of 1-10 agree, strongly agree, agree, neither agree or disagree and disagree. Overall they have agreed with all the statements relating to the goods and services provided by the ecosystem. The respondents strongly agreed that coral reefs provide protection to the coast from storm waves. There was strong agreement that Poovarasu (Thespesia) and Thalaki (pandanus) trees are important for shore protection. Most of them want the future generation to enjoy the coral reefs. There was agreement that sharks are important for coral reef ecosystem as tertiary carnivore. There was maximum disagreement that coral reefs are important only because they are beautiful.

9.2.4. Can MPA'S be managed effectively

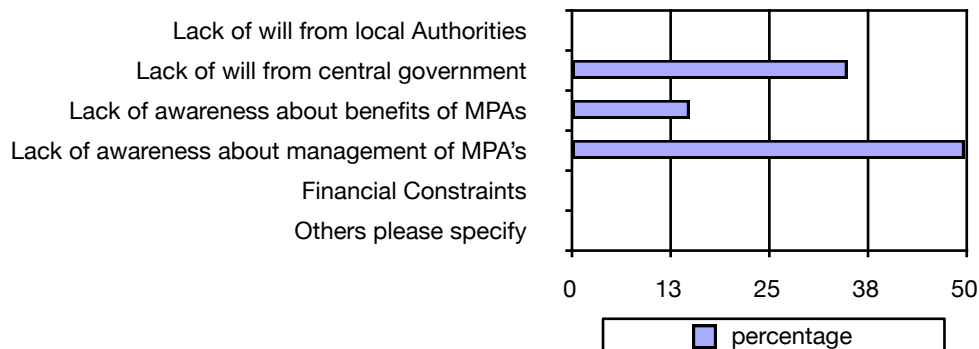
Figure 13 Can MPA's Be effectively Managed



When the respondents were asked about the effectiveness of the management of the Gulf of Mannar Biosphere Reserve, 82% felt that the MPA is managed effectively. Only 18% hold opposite view (figure 13)

9.2.5 Perceived Barriers to effective Management

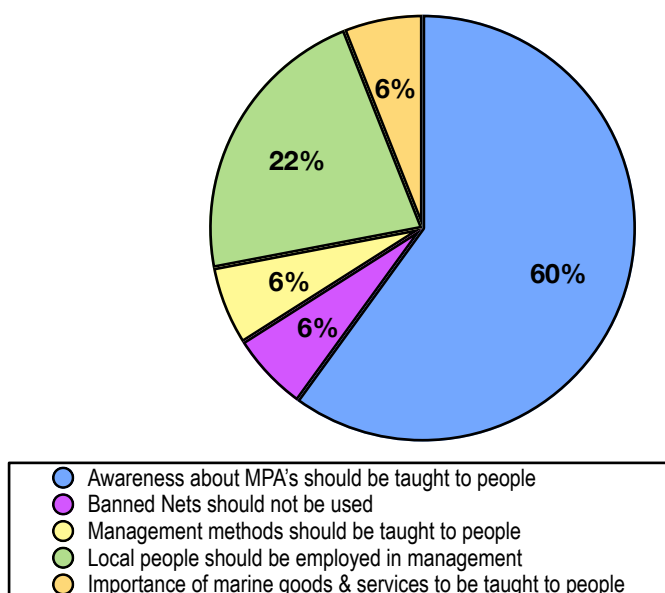
Figure 14. Perceived Barriers to Effective Management



As can be seen from figure 14 the respondents felt that the Management and conservation measures were not effective for various reasons. The main barriers perceived were lack of awareness about management of MPA's was the main barrier towards effective management. Lack of will from Central government was perceived as the next reason. Lack of awareness about the benefits of MPA's was the other reason. Financial constraints and lack of will of local authorities were not considered as constraints.

9.2.6 What can we do to Improve Management Effectiveness

Figure 14 What can we do to Improve Management Effectiveness



As can be seen from figure 15 sixty percent of the respondents said that the people do not have enough awareness about the usefulness of MPA's and the people should be taught the usefulness. Twenty-two percent felt that the local people's should be selected as management staff (government staff) as far as possible. Other ideas given by the respondents are lack of marine management methods with the authorities and the management methods to be taught to them. Enforcement should

be more effective and banned nets should not be used. People should be taught about the importance of marine organisms to the ecosystem. Basically they have stressed on targeted awareness programmes and greater involvement of local community particularly fishers in management decision making.

10. CONCLUSION AND MANAGEMENT ADVICE

SOCMON South Asia provides a comprehensive guideline to carrying out socioeconomic monitoring in the Asian context. The conditions in this region are very different from the developed world with poverty and livelihoods issues are deeply intertwined with natural resources. Thus, it is very important that these resources are well managed to reap the benefits by the community, at the same time providing environmental conservation values.

The economy of the coastal communities that live along the Gulf of Mannar is based on the well being of its marine and coastal resources. From the livelihood studies of the three villages we can note that the livelihoods rely heavily on the extraction of marine goods through fishing. Tourism which was absent in the Gulf of Mannar reef area is now being thought of as the new economic driver by the government and management authorities. Thus the importance of appropriately managing the natural resources is crucial to the development of the local community.

As protected areas are used as a tool for managing natural resources it is applicable in the tourism and fisheries sector of the Gulf of Mannar. If properly implemented they can aid in conflict resolution between stake holders who are using the same resources. The life and livelihoods of the fisher community who live along the gulf of mannar is connected with the marine resources provided by the GOM. They have indigenous knowledge about the area which can prove useful for management of the goods and services provided by the GOM.

The community context has shown that livelihood resilience is low. The drop out level for boys from the school is high. The male population has a preference for fishing which they have learnt from their elders as a livelihood. One son from every family is expected to join their fishing team and creditors also provide credit to the fishers since they have more faith in the goods and services provided by the GOM rather than the skill of the fishers.

The perceptions survey has shown that the management authority GOMBRT and the Department of Environment and Forests have been effective in declaring GOM as a Biosphere reserve and that the coastal community is aware that GOM is an MPA with strict rules and regulations that have to be adhered to. They are well aware of the fines and repercussions involved in carrying out illegal activities and extracting schedule 1¹ species.

At the same time they are a well informed lot and are well aware of the market price of all the individual marine goods and services in the national and international market. Prioritization of an extractive good is done first on the market value of the

¹ marine species that have been given the highest protection under the law. These include, seahorse, dugong, turtles, corals, gorgonions and some sharks that are found in the gulf of mannar.

product and second taking into consideration enforcement and penalties. Immediate cash seems to override the risk of being caught.

At present the coastal community is in need of more livelihood diversification and awareness. Clearly the efforts have helped in raising the awareness levels on issues of conservation and sustainable use in these villages. These efforts should be replicated in the other villages depending on the marine resources of the GOM. Furthermore, development pressure is at a level that has to be managed and controlled in these areas.

The following suggestions were given by the people of the study villages to the management authorities of GoM and other relevant stakeholders for sustainable management of the fishery resources.

1. Recognizing the traditional and customary rights of Fisherman: Like Adivasis people who have traditional rights over forest and forest products, the fishermen also have traditional rights over the sea and the sea resources. Hence, preventing the fishermen near the GoM islands by putting buoy fencing is similar to denying their traditional rights over the sea resources. CPF (Coastal People's Federation), RFTU (Ramanathapuram district Fish worker Trade Union) are some people's organization fighting for the welfare of fishermen of Gulf of Mannar to secure their traditional rights over the island resources. Administrative and scientific community is advocating the installation of buoys around the islands. But the people's agitation made the politician's to have second thought.

2. People said that, there is a proposal by the Tamil Nadu Government to allow tourist in some of the GoM islands. The fishermen around GoM coast feel that their traditional rights to enter the islands are denied. But at the same time how the Government can allow others inside the islands? This question logically appears to be correct. If tourism is allowed in these islands it will definitely hamper the serene eco system of GoM in to a polythene laden hell adversely affecting all the marine living resources.

3. Wards of fishermen living along GoM coast may be involved in the works of Wildlife Warden's Office, GOMBRT office and other office works of forest department. This activity will pacify the minds of the fishing community towards a reasonable thinking about the coral reefs and the dependent marine resources.

4. Higher education assistance may be given through interest free loans to the wards of fishermen of GoM coast. GOMBRT has paid the college fees of some fishermen students to win over their hearts.

5. Importance of coral reefs for sustainable fishery and other uses and the ways of protecting the reefs may be taught to fisher people and their children through other

agencies by screening films, street play etc. PAD is working on this line. Awareness programs to school teachers and students of the coastal villages are taught by PAD's staff through video films and power point presentation highlighting the importance of coral reefs and their role in global dynamism.

6. Study revealed that, the useful and viable alternative employment training may be provided to the wards of fisher people. GOMBRT has given many trainings like computer training, two wheeler and four wheeler mechanism, driver, pogyline driver, nurse training, tailoring etc. to the wards of fishermen. It may give fruit in its long run.

7. Loan assistance with low interest can be given to the trained wards of fisher people to start viable income generating alternatives. If such schemes are implemented, it may after some duration may change the hearts of fishermen to alternate livelihood options.

8. Recognize and respect the bond between traditional fisherman and sea. Unlike the mechanized boat fishermen who are daily plowing the sea floor with otter boards of their boats using trawl nets, traditional fishermen are the real saviors of sea resources using gill nets. By using gill nets, they are not damaging the juveniles and other sea bottom fauna. But catching the grown resources suits to the mesh size of their nets.

9. Strictly prohibit fishing with killer nets, double nets, purse nets and by dynamite (bomb) fishing, These practices are commonly practiced in most of the Gulf of Mannar fishing grounds, In Rameswarm island, huge quantities of sardines and other quality fishes are got by these nets. Sometime, some caught fishes are let in the sea in killed state as the fishermen could not bring it to the shore due to excess quantity.

10. Prevent industries across the coasts that pollute air, water, sea and earth. Sterelite, SPIC, TAC, Heavy water plant, DCW, Thermal plant are some of the marine polluting industries along Gulf of Mannar coast. In addition, Koodunkulam atomic power station in the offing is also alarming the marine resources of Gulf of Mannar.

11. The excavation of marine coastal land for the extraction of granite like minerals along the coast of Tuticorin, Thirunelveli and Kanyakumari districts of Gulf of Mannar is harming the marine life to a greater extent.

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Appendices

Appendix 1. List of Corals of Gulf of Mannar

Family: Pocilloporidae

Pocillopora damicornis
P. verrucosa
P. eydouxi
P. madracis

Family: Acroporidae

Acropora: This genus prefers clear water with better circulation. This genus is very sensitive to sedimentation. This genus is found in many growth forms like arborescent, ramose, tufted, corymbose, digitiform and flabellate. Encrusting species also occur. Around 14 species are found in GOM sea. The common forms are

A. hyacinthus
A. cervicornis
A. cytheria
A. variabilis- Rare form
A. diversa- Rare form

Montipora: This genus is found in many growth forms like encrusting, ramose, submassive and foliaceous. At least 17 species of this genus is recorded from GOM sea. The common forms are,

Montipora divaricata
M. digitata
M. folios
M. subtilis
M. granulosa
M. exerta
M. turgescens
M. manauliensis
M. manasteriata
M. venosa
M. spumosa
M. tuberculosa
M. jonesi
M. verrucosa
M. verrilli
M. hispida
M. foliosa

Family: Agarciidae

Pavona: The agaricid, colonial genus is represented by 4 species in GOM sea. The common forms are

- Pavona varians
- P. duerdeni
- P. divaricata- Rare form
- P. decussate- Rare form
- Pachyseris rugosa

Family: Siderastreidae

Pseudosiderastrea tayami: *Small* encrusting colonies of this coral with polygonal corallites are found along with other massive corals

- Siderastrea savignyana
- Psammocora contigua

Family: Fungiidae

Cycloseris cyclolites: It is a deep water form and found in several locations in GOM sea

Family: Poritidae

Goniopora: This genus is very conspicuous in the field due to its fully expanded polyps. 3 species are known from GOM sea. They are

- G. stokes
- G. planulata
- G. nigra

Porites: The growth form of this genus is massive, sub-massive, encrusting and ramose. It is the most important reef builder, a raw material for calcium based industries and as a building block material. 5 species are reported from GOM sea. They are,

- Porites lutea
- P. solida
- P. mannarensis
- P. lichen
- P. exserta

Family: Faviidae

Favia: An economically important, sub-massive form found mixed with Porites and other massive corals. Species reported from GOM sea are,

- Favia pallida
- F.favus
- F.stelligera
- F. speciosa
- F. valenciennesi

Favites: It was once a common colonial form found in all the islands of GOM. Now it is rare and the species represented are,

Favites abdita

F. halicora

F. pentagona

F. melicerum

Goniastrea: A massive and chief reef builder is represented by 2 species, which are,

Goniastrea retiformis

G. pectinata

Platygyra: Commonly called as the brain coral is fairly common in GOM. The species represented are,

P. daedalea

P. sinensis

P. lamellinea

Leptoria: This also a brain coral which is monotypic and very rare.

L. phrygia

Hydnophora exesa

Leptastrea transversa

L. purpurea

Cyphastrea microphthalma

C. serailia

Echinopora lamellose

Family: Rhizangiidae

Culicia rubeola

Family: Oculinidae

Galaxea fascicularis

G. astreata

Family: Merulinidae

Merulina ampliata

Family: Mussidae

Symphyllia nobilis

S. radians

Family: Pectinidae

Mycedium elephantotus

Family: Caryophylliidae

Paracyathus profundus

Polycyathus verrilli

Heterocyathus aequicostatus

Family: Dendrophyllidae

Balanophyllia affinis

Endopsammia philippinensis

Heterpsammia michelini

Tubastrea aurea

Dendrophyllia coarctata

D. indica

Turbinaria crater

T. undata

T. peltata

Appendix 2 List of Fishes of Gulf of Mannar

Serial No.	Name of fish	Family
1	Dussumieria acuta	Clupeidae
2	Sardinella albella	"
3	S.fimbriata	"
4	S.gibbosa	"
5	Ilisha spp.	Pristigasterinae
6	Pellona ditcela	"
7	Opisthopterus tardoer	"
8	Stolephorus commersoni	Engraulidae
9	S. devisi	"
10	Thryssa malabarica	"
11	Chirocentrus dorab	Chirocentridae
12	Chanos chanos	Chanidae
13	Arius caelatus	Aridae
14	A.dussumierii	"
15	Plotossus limbatus	Plotosidae
16	Saurida tumbil	synodidae
17	Exocoetus volitans	Exocoetidae
18	Hemiramphus far	Hemiramphidae
19	H.archipelagicus	"
20	Strongylura crocodile	Belonidae
21	Platycephalus indicus	Platycephalidae
22	Lates calcarifer	Centropomidae
23	Psammoperca waigensis	"
24	Epinephelus bleekeri	Serranidae
25	E.tauvina	"
26	E.latifasciatus	"
27	Terapon jarbua	Teraponidae
28	T.puta	"
29	Sillago sihama	Sillaginidae
30	S.maculata	"
31	Rachycentron canadum	Rachycentridae
32	Alectis indicus	Carangidae
33	carangoides malabaricus	"
34	selaroids leptolepis	"
35	Megalaspis cordyla	"
36	Scomberoides lysan	"
37	Gaza minuta	Leiognathidae
38	Leiognathus blochi	"
39	L. dussumieri	"
40	Lutjanus johni	Lutjanidae
41	Nemipterus japonicas	Nemipteridae
42	Gerres abbreviates	Gerridae
43	Lethrinus nebulosus	Lethrinidae
44	L.ornatus	"

45	<i>Johnius elongates</i>	Sciaenidae
46	<i>Upeneus tragula</i>	Mullidae
47	<i>U.sulphureus</i>	"
48	<i>U.vittatus</i>	:
49	<i>Drepane punctata</i>	Ephippidae
50	<i>Scatophagus argus</i>	Scatophagidae
51	<i>Mugil cephalus</i>	Mugilidae
52	<i>Liza macrolepis</i>	"
53	<i>Sphyraena barracuda</i>	Sphyraenidae
54	<i>S.bleekeri</i>	"
55	<i>Siganus javus</i>	Siganidae
56	<i>S.canaliculatus</i>	"
57	<i>Scomberomorus guttatus</i>	Scombridae
58	<i>S. commerson</i>	"
59	<i>Rastrelliger kanagurta</i>	"
60	<i>Thunnus albacores</i>	"
61	<i>Pampus argenteus</i>	Stromatidae
62	<i>S. niger</i>	"
63	<i>cynoglossus lingua</i>	Cynoglossidae

Appendix 3. Questionnaire on Perceptions of M P A Management

What in your opinion is a Marine protected area is? Explain.

What are the benefits of protecting a natural area?

For you as an individual?

For the community?

Indicate degree of agreement with the following statements using the scale of agree strongly (5), agree (4), neither agree nor disagree (3), disagree (2) and disagree strongly (1).

- ___ (a) Coral reefs are important for protecting land from storm waves
- ___ (b) The seagrass beds provide food to turtles
- ___ (c) Reefs and lagoon provide us with beautiful fish and shells
- ___ (d) Poovarsu and Tilakam (Pandanus) trees are important for beach protection
- ___ (e) Coral reefs are important because they are beautiful
- ___ (g) I want the future generations to enjoy the coral reefs
- ___ (h) Fishing should be restricted in certain areas even if no one ever fishes in those areas just to allow the fish and corals to grow
- ___ (l) We should restrict development in some coastal areas so that future generations will be able to have natural environments
- (j) In the ecosystem food chain/web the the top predator plays an important role in balancing the animal populations.
- (k)Sharks are important because they are on top of the coral ecosystem food web.

Are you aware that corals are protected under the law?

Are you aware that turtles are protected under the law?

Do you think protected areas can be effectively implemented in Lakshadweep ? Yes/ No

What in your opinion are the barriers to effective implementation of management?

- a. Lack of will from local authorities
- b. Lack of will from central government
- c. Lack of awareness about benefits of MPAs
- d. Lack of awareness about management of MPAs
- e. Financial constraints
- f. Other. Please specify _____

What do you think can be done to facilitate management of these protected areas?

BACKGROUND QUESTIONS

1. Sex: (please tick) Male Female

2. In which of the following age group do you fall? (please tick)

Below 15 15–25 26–35 36–45 46–55 Over 55

26. What is your level of Education? (please tick)

Some Secondary education/High School

Completed Secondary education/High School

Some University or College/Technical School

Completed University

What is your profession? _____

27. We would like to know your approximate annual income (after taxes)? (please tick)

Below Rs 100,000

Rs 100,000 – 299,999

Rs 200,000 – 299,999

Rs 300,000 – 499,999

Over Rs 500,000