Socioeconomic Monitoring for Coastal Managers of South Asia: Field Trials and Baseline Surveys Agatti Island, UT of Lakshadweep

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Cover Photo: A reef fisherman selling his catch
Photo credit: Idrees Babu

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Executive Summary

This is a report of the Community based Socioeconomic Monitoring program carried out in Agatti Island from October 2010 to December 2011.

The program was initiated with the premise that long term sustainability for coral reef management and monitoring programs can be ensured, if the local community participate and feel a sense of ownership in the program.

An additional benefit of this program is that it serves as both a capacity building and an awareness building program for the local communities who are directly involved in using the ecosystem goods and services and those who are involved in monitoring them.

The project was carried out in partnership with a civil society group called the Lakshadweep Marine Research and Conservation Centre.

By monitoring the Islanders dependence on the ecosystem goods and services, and their perceptions on the current status of the ecosystem goods and services, we are able to arrive at a comprehensive mapping of reef related activities of the island of Agatti and derive several types of information:

a) Livelihood dependence on ecosystem goods and services

b) Poverty and dependence on ecosystem goods and services

c) Conflicts/ cooperation for using the same space and anthropogenic stress on the reef,

d) Perception of the stakeholders regarding resource status, conservation and MPA's.

Where possible the socioeconomic monitoring information has been supplemented with biophysical monitoring information, as available from the departmental project, LCRMN and other surveys conducted within this decade by NGO's.

The report has been prepared for the people of Agatti to enable them to continue with the dialogue for the need for Management of the ecosystem goods and services of their Island. It provides Management advice to the authorities concerned within the Lakshadweep Administration.

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Glossary of Native Terms

Aar Valli	6 oars
Aliv Aly	Main entrance for Lagoon
Bala	Net
Bala Adiyal	Shore seine
Bala Fadal,	Drag Net
Chal, Shal	Shallow entrance on the reef
Karanwar	The administrator of the Tharawad property generally the brother of the female property owner in the Marumkkathayam system.
Madrassa	School for islamic religious instruction
Makkatayam	Patriarchal System
Manju	Traditional Cargo vessel
Marumkkathayam	Matrilineal System
Oathapalli	School for islamic religious instruction
Pandaram	Common Land
Parai	Reef
Pitti	Sandbank
Tharawad	Traditional Joint Family
Thankis	fishing line
Doni/ Thoni/Odam	traditional wooden boats

List of Acronyms

ACRMN	Agatti Coral Reef Monitoring Network
AIBER	Agatti Island Beach Resort
BNHS	Bombay Natural History Society
CARESS	Centre for Action Research on Environment Science and Society
CMFRI	Central Marine Fisheries Research Institute
CMLRE	Centre for Marine Living Resources & Ecology,
CORDIO	Coastal Oceans Research and development in the Indian Ocean
DANICS	Delhi, Andaman Nicobar Island Civil Services
DoE	Department of Environment and Forests
DST	Department of Science and Technology
DoF	Department of Fisheries
DoT	Department of Tourism
GCRMN	Global Coral Reef Monitoring Network
GoI	Government of India
hp	horse power
IAS	Indian Administrative Sertvce
IUCN	International Union for Conservation of Nature and Natural Resources
LCRMN	Lakshadweep Coral Reef Monitoring Network
LCMF	Lakshadweep Cooperative Marketing Federation
LDCL	Lakshadweep Development Corporation Limited
LMFR	Lakshadweep Marine Fishing Regulation
LMRCC	Lakshadweep Marine Research and Conservation Centre
MPA	Marine Protected Area
NOAA	National Oceanic and Atmospheric Agency, USA
SPORTS	Society for Promotion of Recreation, Tourism and Water Sports

1. Introduction

Lakshadweep is an archipelago in the Arabian Sea (8^0 & $12^030'$ N, 71^0 & 74^0 E) off the west coast of India. It comprises of 15 atolls, and 5 submerged banks with a total land area of 32 km^2, and useable land area of 26 $km^{2)}$. It is considered the smallest Union Territory of India because of the limited land area (suresh Kumar and Idrees Babu, 2012. However when we take into account its lagoon area[1] of 4200 km^2, 20,000 km^2 of territorial waters and about 4,00,000 km^2 out of the 8,59, 992 km2 of Exclusive Economic Zone of the west coast of India, Lakshadweep is a large territory[2]. Lakshadweep constitutes the only atoll formation in India and forms the northern most segment of the Chagos – Maldive – Laccadive oceanic ridge. The islands are flat and scarcely rise more than two meters. The sea around Lakshadweep and reef lagoons are of great ecological significance as they influence the fauna and flora associated with the coral reef and the high sea resource to great extent. Eleven out of the thirty-six islands are inhabited. These are Agatti, Androtт, Amini, Bangaram, Bitra, Chetlat, Kadmat Kavaratti, Kalpeni, Kiltan and Minicoy. Kavaratti is the Administrative headquarters and Agatti is the only Island with an airport.

The land area of 32 km^2 accounts for less than 1% of the total area of the U.T of Lakshadweep and thus creates a huge dependency on the marine environment. Table 1 presents some facts about Lakshadweep.

1.1 Settlement History

> *"During King Solomon's reign, one of his friends accompanied traders to see the Malabar coast. The journey was an unforgettable experience. On their return, the crew begged the King's friend to immortalize their visit to the Malabar. He took his garland of rosary beads, cut the string and flung the beads into the sea. The Lakshadweep Islands appeared from the bottom of the sea" (Misbah,2009)*.

The history of these islands is obscure. The general belief is that the first settlements on these islands took place in the period of Cherman Perumal, the last Chera monarch of Kerala. According to tradition, the first islands to be settled were Amini, Kavaratti, Androth, and Kalpeni. People then moved on to the other islands, like Agatti, Kiltan, Chetlat and Kadmat. An old dialect of Malayalam is spoken on all the islands except Minicoy, where they speak Mahal and are culturally similar to the people of Maldives. The islanders are declared as Scheduled tribes by the Government of India. They have a matrilineal society and property is passed down the female line. The first settlers were probably Hindus. Signs of Buddhism being practiced in the Islands are also apparent, as some Buddha head excavated in Androth are on display at the Agatti Museum. The inhabitants of the islands embraced Islam following the advocation of the Islamic religion in the Islands by Hazarat Ubaidullah. Popular belief sets the date as in the 7th century A.D but the actual date is unknown.[3]

Records show that various rulers and dynasties have administered the islands of Lakshadweep since the 11th century. The Cheras ruled the islands followed by the Kolathris, Ali Rajas of Cannanore, Tipu Sultan and the Bibi of Arakal. The main interest in controlling these Islands was

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[1] the lagoon are in most publications is written as 4200 km2 but according to S. Sureshkumar and Idrees Babu 2012.Coral Reef Biodiversity and Conservation in India: Special reference to Lakshadweep. *Proceedings of National Seminar on Environment and Conservation,* SN College, Punalur , Kerala, the lagoon area is calculated as 604.91 km2.

[2] *Lakshadweep and its people: 1994-1995, Planning and Statistic department, Secretariat, Kavaratti.*

[3] Mannandiar, 1977, Gazatteer of India, Lakshadweep, Kavaratti

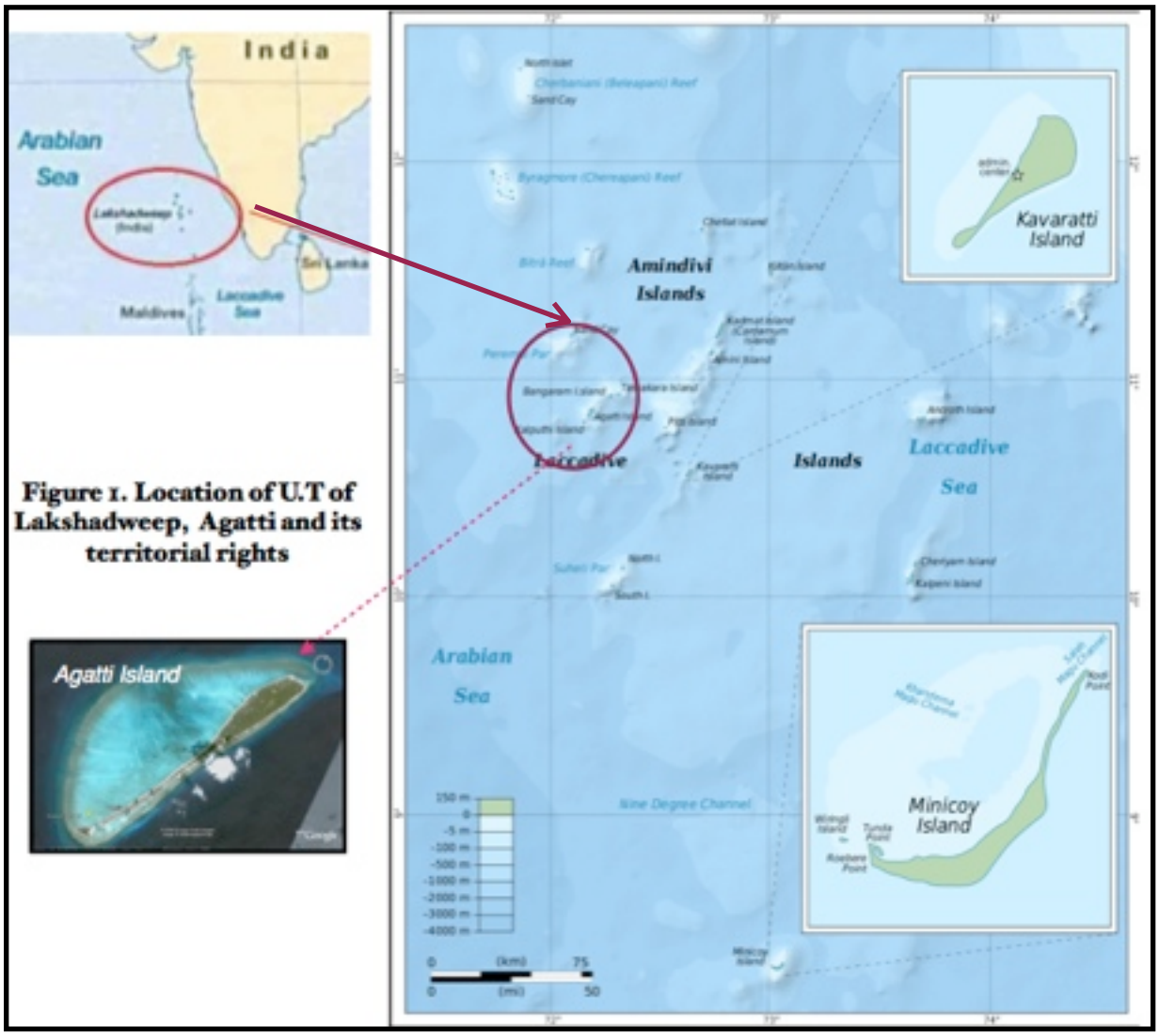


Figure 1. Location of U.T of Lakshadweep, Agatti and its territorial rights

Table 1 - Lakshadweep Facts			
Location	8°N to 12°N & 71°E to 74°E	Territorial waters (12 nautical miles surrounding every island.)	20,000 km²
Distance	Kavaratti-Calicut 340 km Kavaratti-Kochi 404 km Kavaratti-Mangalore 352 km	Economic zone	400,000 km²
Islands	10 inhabited 1 tourist resort	Population 2011 Males Females Pop density	64,429 33.106 31.323 2013/km2
Land area	32 km²	Temperature range	Max 35°C-38°C Min: 17°C-18°C
Landuse area	26.32 km²	Relative Humidity	70-75%
lagoon area	4200 km²/ 604.91km²	Average Annual Rainfall	1500 mm in Nrn isles 1640 mm in Srn isles

to control the coir trade. The Portuguese and British also showed interest in these islands for the same reason. The British managed to wrest control of the Islands in 1905.

Coconut cultivation became the main activity of interest for all the rulers. Significantly owning coconut trees became the main wealth marker and status differentiation among the islanders.

The Amin Cutcherry was an important administrative unit where people deposited their coir in return for rice. The Amin was normally the administrative head or Karanwar from the most important family or Tharawad on the Island. The early rulers from Kerala, as well as the British colonial government never paid any attention to fisheries or reef related activities of the islanders. Their attention was on maximizing coir production. The people were given land even in uninhabited Islands and encouraged to plant coconut trees.

There developed a two tier caste system of landlords called Koyas who owned the coconut trees and their servants known as Melacheries who tended the coconut trees. A caste called malmis, were sailors and had the knowledge of navigation by using the position of the stars in the sky.

1.2 Dependence on Marine Resources

Fishing was identified as an “industry” in the late 1950s. Once fishing became lucrative, the Koyas employed the malmis to navigate the fishing boats. Over time the people of Lakshadweep became experienced and skilled in navigating and fishing in the seas around them. They now have intimate understanding and knowledge about the currents, tides, stars, fish habits and characteristics. Today most of the households are involved in Tuna fishing both as boat owners

Box 1 *Goods and Services provided by Coral reefs*

Coral Reefs, also known as rain-forests of the sea, are productive shallow water marine ecosystems, that are based on rigid lime skeletons formed through successive growth, deposition and **c**onsolidation of the remains of reef building corals and coralline algae. The basic units of reef growth are the coral polyps and the associated symbiotic algae that live in the coral tissues. This symbiotic relationship is the key factor explaining both the productivity of reefs and the rather strict environmental requirement of corals. (Odum and Odum, 1955.) Coral reefs serve important ecosystem functions, which provide crucial goods and services to the Lakshadweep Islands. These include:

a. Coastal protection: Coral reefs serve as natural barriers to storm surges that can cause great destruction to coastline and communities.

b. Safety net for food. The lagoon between the reef and island is a safe fishing area during the monsoon period.

c. Fisheries: Coral reefs and their associated ecosystems including mangrove and seagrass beds. Provide important fish habitat.

d. Tourism: People the world over visit coral reefs to enjoy the recreational opportunities provided by these ecosystems, including SCUBA diving, snorkeling and glass bottom boat viewing, white sand beaches and clear water for swimming and other water sports.

e. Building construction material: dead coral shingle, washed up ashore is collected for house construction.

f. Biodiversity: The United Nation Atlas of Oceans describes coral reefs as among the most biologically rich ecosystems on earth, with about 4,000 species of fish and 800 species of reef building corals

g. Carbon sequestration: Coral reefs remove carbon dioxide from the atmosphere and are thus responsible for the mitigation of global warming.

and boat team members. Fishing effort is also being intensified and new technologies have been introduced since 2001.

Tourism is seen as a lucrative money earner and there is a clamor towards starting resorts and home-stay facilities on Agatti Island. This in turn has led to a construction boom with added stress on the land and fresh water resources. One can sense resentment between the local Administration, resorts owners, religious factions and the islanders. It is now necessary to devise management options to make conflict resolutions between stakeholders.

Rapid developments are taking place in the Islands of Lakshadweep. A delicate ecological base now sustains these islands. It is important to reflect on the ecosystem goods and services provided by the coral reef that has helped sustain the livelihood of the Island people. (Box 1)

Lakshadweep islands are composed entirely of coral reefs. These coral reefs not only form the very foundations of the island, but also support globally significant marine biodiversity. The reef bio composition is quite significant and includes 114 species of Corals, 42 species of seaweeds, 7 species of seagrasses, 108 species of sponges, 4 species of lobsters, 76 species of echinoderms, 600 species of fin fishes. Other groups of reef organisms are known to have comparable diversity, but have not yet been adequately studied. So even approximate estimates of species diversity are not available. Among groups which are known to be internationally threatened, Lakshadweep Islands are home to globally significant populations of green and hawksbill turtles; of whale sharks, reef sharks and manta rays; and of whales and dolphins. The Lakshadweep Islands are also significant as the only group of coral atolls in India. The atolls act as a stepping stone for transport of planktonic larvae of reef organisms from both the western and eastern Indian Ocean. Lakshadweep coral reefs are thus believed to play a significant role in the distribution and maintenance of coral reef biodiversity in India.

The goods and services form an important source of income to islanders living at subsistence levels. They are a potential tourist attraction, thereby contributing to local income generation and foreign exchange. Besides, they form a unique natural ecosystem with important biodiversity value as well as scientific and education value. When managed with care, they can provide a steady flow of income to the islanders through responsible fisheries and tourism. By one estimate, the total net benefit per year of the worlds coral reefs is $ 29.8 billion. Tourism and recreation account for $9.6 billion of this amount, coastal protection for $ 9.0 billion, *fisheries for 5.7 billion and biodiversity for 5.5 billion (Cesar, Burke and Per-Soede, 2003)*

Despite the high diversity of species on the reef, there are not large populations of any one kind. Hence species of fish, mollusks and crustaceans, favored by islanders, are vulnerable to over fishing and many species are now classified as endangered in government notifications, prohibiting their exploitation by local islanders.





However due to a lack of management and clear policies, coral reefs are being depleted due to human activities. People causing the threat benefit from unsustainable economic activities, but the costs are borne by others depending in some way or another on the coral reef resources.

Pollution caused by irresponsible waste disposal and over extraction of resources can destroy the very basis of the local economy. At the global level coral bleaching and ocean acidification have become an additional major threat.

1.3 Project Goals

Long term goal: To promote Environmental stewardship and help in the creation of a generation of Islanders who will become conscious of the possibilities and limitations of the Island environment and help in evolving a viable, sustainable, survival strategy for the islands.

Immediate goal

To monitor changes and establish a baseline for assessing socioeconomic status of the island population and their dependence on the environmental goods and services, which can be used for building stakeholder participation and appropriate awareness and livelihood programs.

Objectives

1. Building capacity among key local stakeholders for conducting socioeconomic assessment using the Socio-economic Monitoring or SocMon South Asia guidelines at Lakshadweep.
2. Conducting Socioeconomic monitoring and assessment at Agatti Island.
3. Collecting data on attitudes and perceptions of the Islanders towards site specific issues (tourism and MPAs).
4. Providing management and sustainable development advice by applying results of the assessments in management decision making process.

1.4 Report Chapters

This report is divided into 9 chapters.

Chapter 1 introduces the reader to the aims and objectives of this project

Chapter 2 explains how the project was carried out and the methods used for data collection.

Chapter 3 contains an ecological profile of Agatti Island and the infrastructure and business development on the Island.

Chapter 4: describes the social profile of the Agatti Islanders and their dependency on the goods and services provided by the coral reef ecosystem.

Chapter 5 describes the extractive reef related activities on the islands. It explains how the Agatti Islanders interact with the reef resources, fishing methods, gear used , etc., their perceptions on the state of the reef and the market attributes of extractive and non extractive reef resources.

Chapter 6. describes the tourism and Scuba Diving profile on the Island.

Chapter 7 describes the Islanders perception of MPA's based on a perception survey.

Chapter 8 introduces the reader to the Management body that governs how coastal resource management is undertaken in Lakshadweep. It lists all the community and government institutions that influence the way coastal goods and services are used and managed.

Chapter 9 is the concluding chapter and offers advice that can be used for adaptive management

2. Methodology of Project Execution

A socioeconomic assessment was carried out at Agatti Island, UT of Lakshadweep to study trends and provide baseline data to be monitored in the future. The CARESS and LMRCC, provided the training and supervision. The team of volunteers in Agatti carried out the work.

Supervisors from CARESS, LMRCC and the Agatti team met 6 times over the project period to discuss, validate and analyze the data collected and come up with key learnings and Management advice.

To achieve the objectives of the project, the work plan was structured as follows:

1. Conducting a SOCMON training workshop, December 2011.

2. Data gathering from December 2010 to August 2011

4. Validation of the data collected, took place in September 2011, January and February 2012

5. Management Advice, February 2012

2.1 SocMon Workshop

The Centre for Action Research on Environment Science and Society (CARESS) and Lakshadweep Marine research and conservation Centre (LMRCC) organized a SOCMON training workshop at Agatti from 18 to 27 December 2011. The workshop objectives were to:

1. Introduce the trainees to the principles of socioeconomic Assessment and Monitoring of coral reef users and reef health;
2. Familiarize the trainees and LMRCC members in using the Socioeconomic guidelines for Coastal managers in SA

Participants at the introductory function included officials from various Departments and stake-holders from the local community. Resource people, who interacted with the participants came from the department of Environment and Fisheries (Appendix 1).

The introductory function provided a platform to inform all the stake-holders and Government departments about SOCMON and its purpose. It was also explained that the Workshop trainees would be approaching the departments and stake-holder organisations for data collection and to help the trainees by providing relevant information.

The officials attended the Plenary and Valedictory sessions. Fourteen trainees, all residents of Agatti Island attended the workshop. They were selected by the Lakshadweep Marine Research and Conservation Centre, a local civil society organization. The workshop began by the participants introducing each other and writing down their expectations.

Workshop expectations

To learn more about ecosystem goods and services provided by coral reefs (12), What can we do to protect our coral reefs (8), How can we conserve our island resources (8), Nothing (3)

Workshop sessions

The Capacity building training workshop was conducted using the Socio-economic Monitoring (SOCMON) guidelines for South Asia and Socio-economic Manual for Coral Reef Management.

The classroom sessions at the workshop concentrated on preparing the participants for planning and carrying out fieldwork and data collection at Agatti and Bangaram Islands. The rest of the workshop followed the learning by doing approach in which the participants were given assignments to complete within time limits. They were free to approach the trainers to have their doubts clarified.

Visualization techniques were taught in-situ while conducting a group discussion with fishers on the beach and in the classroom.

The following tasks were completed during the workshop

1. Participants defined goals, Identified variables for data collection.
2. Prepared a list of Stakeholders and key informants to consult (Appendix)
3. They spent time assessing the secondary data available
4. Conducted interviews with cowry collectors, fishers of Agatti and Bangaram and practitioners of herbal medicine. They prepared charts, seasonal diagrams, and resource maps.

To fulfill the expectation of the participants we conducted a one day coral reef ecosystem education session, where they learnt about the coral reef food web by playing games such as the web of life, coral feeding and habitat linkages.

2.2 Data Collection

The Participants from Agatti formed a team to complete the data collection. A gender balance was maintained by equal number of male and female field volunteers.

The Agatti Monitoring team spent 12 weeks spread across several months, in carrying out the socio-economic assessments. They consulted with Island elders, Reef stakeholders, tourist resorts and the various government departments. Data was collected from both Secondary and Primary sources.

To ensure that data was collected from all over the island, the team divided themselves into pairs to collect data from the ten wards in the island. The field workers were given a short brief of activities to be carried out during the stipulated period. Once data was collected they were trained in feeding the data into the computer. The survey data was further analyzed and validated.

Secondary Sources

Secondary source of data include government records from the various departments. Demographic data was collected from the Basic Statistics Handbook published by the department of Planning and Statistics, Census operations for 2011, and the Health department from the Administrative headquarters at Kavaratti.

Fisheries landings and related information on fishing regulations was collected from the Department of fisheries, at Kavaratti.

Relevant legislations and Notifications for conserving coral reefs was collected from the Department of Science and Technology and Department of Environment.

The Land Survey and Records department was consulted to find out about the land ownership status in Agatti, Bangaram, Thinnakara and Pareli 1,2 & 3.

Tourism Statistics and development plans from the department of tourism and SPORTS that is in charge of developing tourism in the Islands and the basic Statistical handbook.

Information on Marketing produce, pricing and quantity marketed was collected from records of the Co-op Society

Primary Data Collection

The Project Team made a list of all the reef related activities at the workshop. Once the variables were selected, the team held focused group discussions and interviewed practitioners of various reef related activities. By doing this they were able to collect information on various variables simultaneously (Folk taxonomy, reef governance, traditional knowledge).

The field data collection methods included:

- Semi Structured interviews with approximately thirty key informants for the reef related activities.
- Interviews with the resort, home-stay and dive operators at the community level, with tourists and interviews with the officials in the department of Tourism.
- Tourist arrival and departure information was collected from the resorts from March 2010 to April 2011
- Data for scuba diving were collected from the dive instructors, this included number of divers (certified, discover scuba and dive courses) for the period April 2010 to May 2011.
- Observation by scuba diving and conducting informal interviews with guests
- To asses the levels of poverty we visited several different poor households and interviewed the house members.
- Oral histories were collected from elderly traditional fishers and reef gleaners.
- Focused Group discussions were carried out with the following focus two FGD were conducted one preliminary discussion to learn about the activity and the second one to Validate the findings.
- Data on material style of life was collected by observation and semi structured interviews to capture the livelihood strategy of different types of households and their ability to adapt to change.
- Household Surveys, were conducted to gather data on household income sources and occupation pattern and to learn about the attitudes and perceptions towards conservation and the state of the resources. We learnt that the total number of households were approximately 1200 and that Agatti Island has been divided into 10 wards for election enumeration. The Agatti team worked in pairs and conducted a 30 percent random sample survey of households from each of the 10 wards. Data was gathered to assess their life style, reef dependency,

perceptions, gender status, livelihood resilience and the main and supplementary sources of Income and Income distribution across the island population.

- A Perception of Marine protected areas was conducted over a period of three days. We used a questionnaire and interviewed 200 individuals randomly selected from all backgrounds. The respondents had to provide background information about themselves and answer questions about their perceptions of Marine Protected areas, non market and non use values, their awareness of the state of the environmental resources and laws to protect them and what they felt could be done to increase community compliance to environmental laws and effective management of endangered species.
- The team used a variety of visualization techniques during these interviews, and prepared resource use maps, seasonal calendars, and ranking.

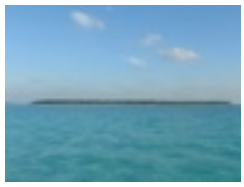
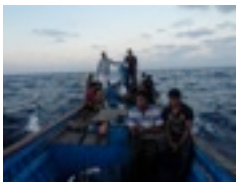
Since the team members are Agatti islanders themselves, they are familiar with the different reef related activities as they have participated in all of them at some time or the other of their lives. In some aspects they are also Key informants.

However by carrying out the Socioeconomic assessment themselves, they developed a pride in learning more about the islands and started questioning every activity with a monitoring perspective.

2.3 Data Validation

This was carried out throughout the project period. The team and supervisor met to discuss the summarized information on each variable to develop key learnings and note trends and emerging issues on the island. Further discussion with the stakeholders helped in developing management advice related to reef conservation, monitoring and management.




3. Site Description and Island Infrastructure

Agatti Island is an atoll and shares similar ecological characteristics to the other islands in Lakshadweep. A coral reef, surrounds and encloses the island with a big lagoon on the western side and a narrow one on the eastern side of the island. The traditional fishing and land rights of the people of Agatti, include Kalpitti Island at its southern end and extends as far as Perumal Par reef and Bangaram lagoon, which encompasses, Bangaram Tinnakara and Parelli Islands. These Islands were named by courtiers of king Perumal after they got wrecked on Perumal par (Hoon et al. 2002). They also have an exclusive fishing rights over 12 nautical miles[1] surrounding Agatti Island and its territories. Figure 3.1 and table 3.1 show the areal extent of traditional fishing and land rights of the people of Agatti.

The bathymetry of Agatti reveals an asymmetric cross-section of the atoll. The Western outer reef slope has a mild, gradual descent with relatively wide terraces at 4, 7, 13, 25 and 60 meters before it reaches 100-200 meters depths, then drops to 520-640 meters and eventually reaches the 1,300 meters sea bed. The Eastern slope is steep, creates almost a wall with very narrow terraces, and reaches 200-300 m within 100 meters from the reef flat.

The land area of Agatti is less than 1% of its total area. The existence of the Island has however has provided the people with a place to live and access to the goods and services provided by the marine area. The wide variety of habitats depends a lot on the morphology of the coral reef. The differences in temperatures, light, exposure to waves and tides, currents and the amount of food available result in different habitats and niches (Figure 3.1) Proper management and conservation strategies on the different geomorphological and biogeographic regions of the atolls have to considered of prime importance.

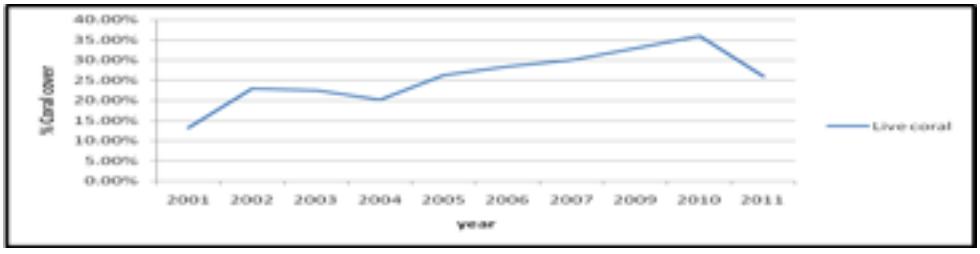
As with the rest of Lakshadweep the ecosystem goods and services provided to the people of Agatti include:

1. Lagoons and reef provide a large buffer for coastal protection. They also provide a safety net for food during bad weather,
2. A fresh water lens on the island provides drinking water to the people
3. Coral reefs provide building construction material.
4. The reef provides a great variety of fish and mollusks for the people to eat and sell. The extraction of goods includes 145 species of fish and mollusks.
5. Tourism, opportunities for scuba and beach tourism.
6. Carbon sequestration and mitigation of global warming
7. Potential for biomedical compounds and aquarium fish trade.

Status of the reefs

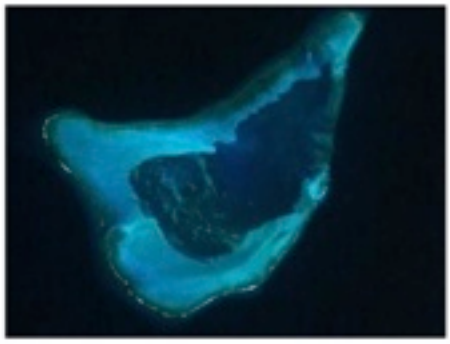
The coral reefs closest to the island on the eastern side, are easily accessed all year around and, show greater degradation than those reefs further away (Hoon et al. 2002, Hoon and Tamlander 2005). Coral bleaching in 1998, 2005 and 2010 have caused widespread coral mortality on the reefs. Surveys conducted by the LCRMN over the years team show that recovery is steady but slow. Figure 3.1 shows the recovery status after 1998 and unexpected 2010 bleaching outcome (Koya S.I and Idreesbabu, 2012).

Figure 3.1 Coral Reef Recovery Status

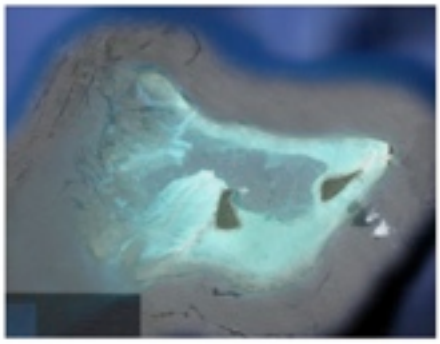


[1] The **nautical mile** (symbol **M**, **NM** or **nmi**) is a unit of length that is about one minute of arc of latitude along any meridian, or about one minute of arc of longitude at the equator. By international agreement it is exactly 1,852 metres (approximately 6,076 feet). source wikipedia

Figure 3.1 Traditional Resource Use Areas of Agattii Islanders



Perumal Par sunken reef



Bangaram Lagoon and Islands

land				
Area	**location**	**land km²**	**lagoon in km²**	**reef flat area in km²**
Agatti and Kalpitti	10°51' N 72°11' E.	3.84	17.5	14.4
Bangaram, Tinnakara, Parelli i, ii, iii	10°56' N 72°17' E	0.58	46.3	14.5
Perumal par	11°7" N 71°59 E	Nil	83.02	20.7
Total		4.42	146.82	49.6
Source: Land area. provisional census tables 2011, Reef area (Bahuguna and Nayak 1994) cf lagoon area BNHS 2006, Perumal par lagoon area, http://sagardweep.com/islands.html				

3.1 Site description

The Agatti islanders draw resources from four natural ecosystems. These are land, lagoon and reef, bar area or outer reef slope and the Ocean. The tides and ocean currents maintain the connectivity for goods and nutrient flow between all these ecosystems.

Land

Agatti is the western-most Island in the UT of Lakshadweep. The island is elongated and is 7. 5 km long. The width varies from north to south. It is 1000 meters at its widest point in the North and tapers of to as little as 100 m width in the South. The island is flat and rises around 2 meters above the sea level. The southern portion consists of a two kilometer long narrow stretch with an average breadth of 100 m. An airstrip has been built in this stretch in 1987. Kalpitti lies further south and it is separated from the airstrip by a shallow strait of about 200 m. A storm beach strewn with coral shingles can be seen in the South and western part of Kalpitti. The coral growth on the Southwest is strong and protects the islands from the Southwest monsoon.

Human settlement is concentrated in the northern portion of Agatti. The southern portion is uninhabited and houses the airstrip, airport and 5 small resorts, a solar plant, a packing unit, aquarium and hatchery.

Vegetation consists of coconut trees everywhere. There are a few neem, papaya and breadfruit trees as well. Storage place is limited and piles of construction materials, sand, bricks from the mainland, coral shingle, boulders and sand can be seen all over the island. A fresh water lens provides drinking water to the Islanders.

Reef and Lagoon

A coral reef forming an ellipse of 8 km encloses a wide lagoon on the western side. The surrounding reef has three natural main entrances, namely:

1. Aly (Main entrance) in the northern end. This serves as the main passage for boats plying between the passenger ships and Jetty.

2. Balliya Alivu (Centre of Western reef). This serves as a passage for cargo vessels (Manjus and Barges).

3. Thodu (southwest reef): used by small crafts and boats to enter. A narrow and shallow lagoon lies on the eastern shore of the Island it extends further south to surround Kalpitti and joins the Western reef. The eastern reef can easily be reached by walking from the shore. This is therefore the most trampled area by reef walkers and gleaners.

The eastern reef has 6 small natural and man made channels called shals or chals. The chals are important since these are points were the fish shoals enter and leave the lagoon with the tidal change and control the current within the lagoon. These chals are favored reef fishing spots for net operators. Each chal is named after a mosque or an important event that occurred at that spot for e.g. a boat capsized at the SE reef carrying people from the Balliya illam house. This chal is named Balliyaillatha Makkala chal (SE).

The lagoon encloses many rich habitats that provide services to marine life and fishers. These include, sea grass beds, coral boulders and pinnacles, anemone gardens, sandy areas and rubble beds. Each of this habitat provide services and is important to the fishers, since they support different kinds of marine life (goods). Removal of any small habitat translates to fishers being unable to catch a certain kind of fish.

Bangaram, Tinnakara, Parelli

Bangaram is located at 10°56' north latitude and 72°17' east longitude. Bangaram island lies 8 km N E of Agatti. The island has a very large and beautiful lagoon that encompasses Tinnakara and Parelli. There is a semicircular bay in the eastern point of the island which serves as an ideal place for swimming. The surrounding reef has three natural entrances:

1. Muli Aliv – the main entrance lies to the South.

2. Kuliyilia Bander – the main entrance in the West

3. Mand Aliv – lies in the West

There is a small brackish water lake called Fuller in the center of Bangaram. This lake serves as a refuge for several types of water Birds such as herons and storks. Rows of tetra pods and cement blocks can be seen around the Helipad, near the solar panel site and along the western shore. To the south of Bangaram and within the lagoon lies a small Pitti-sand bank. To its east about 2.5 km away is Tinnakara and further east is Parali 1 and 2. A sand bank connects these islands during the dry season. Parali III was washed away in 1976 during a big cyclonic storm.

Perumal Par

26 km northwest of Agatti Island lies Perumal Par. This is a reef enclosing a lagoon. It is a very important Tuna bait fishing ground. The fishers from Agatti go to this lagoon and reef only during the fair season from October to April. The reef is dangerous as it is barely visible during high tide and calm seas.

Tuna Fishing boats travel between Agatti and Perumal Par on a regular basis during the fair season. It takes roughly 2.5 hours to traverse the 26 km distance. The reef is very big and it takes around 2 hours by a Tuna fishing boat to circle Perumal par. There are two small natural entrances through which one can enter into the lagoon. There are four Pitti's or sandbanks within the lagoon. These are 1. Thekkila 2. Vadakila 3. Kadmathala and 4. Amin odam meena pitti. Each of these sand banks lie about 10-15 minutes by motor boat from each other. A Government of India Emblem is located on the North Western side of the Perumal Par reef.

Bar area

The Bar area includes the reef flat, reef front and outer reef slope. The reef flat is about 2.75 km and 2.10 km wide on the western side of Bangaram and Perumal par and varies between 0.1-0.3 km wide around Agatti and the eastern side of Bangaram and 0.5 km on the eastern side of perumal par. The bar area falls within the 12 nautical mile territorial limit around the islands. There is a great variety of species of fish and corals found in this area and it is favored by the reef fishers and harpooning experts.

During high tide water exchange takes place between the lagoon and the open sea over the reef. The lagoons have sand bottoms with scattered coral boulders and pinnacles followed by extensive sea grass beds at the landward side.

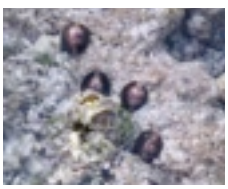
The ocean

The ocean contains substantial living and nonliving marine resources. Sharks, rays as well as a large number of food fishes such as tuna, seer and halfbeaks move about in shoals and frequent these waters. The fishers of Agatti conduct their deep sea fishing activities in these waters. They normally circle the deep sea area around each of these small islands and Perumal Par and prefer to stay within the 12 nautical mile limit.

Climate

The climatic conditions of the islands is similar to Kerala and the Southwest monsoon and northeast monsoons both contribute their shares of rainfall to these islands. The average annual rainfall is around 1,200 mm, most of which reaches the islands between June and September. The average temperature of the islands ranges between 25.31 0 C and 31.52 0 C. The temperature decreases one or two degrees with the onset of the SW monsoon in June. Throughout the year the air is humid, the relative humidity is from 81.33 to 83.08 %. south westerly to westerly winds are experienced during the monsoon period. The direction of wind changes to north easterly or northerly between December and February. Thereafter the wind slowly dies down to revive by the end of May. The islanders note two seasons: The fair season (Oct-May) and the monsoon season. May-October). The fair season is a hive of activity and everything slows down during the monsoon.




3.2. Community Infrastructure

Community Infrastructure is a general measure of the local community development and wealth. It includes information essential to determining sources of man made impacts on coastal resources.

3.2.1 Drinking Water Supply

Fresh water resource on the island are limited. They are contained in a freshwater lens 1.5 meters, below the surface. The water is periodically renewed by rainfall. This lens has shrunk due to building construction. It is polluted at places because of poor storage of diesel and leakage from septic tanks. There is no piped water supply. Until 1990 the people used to hand draw the water from a personal well. Now nearly every house has a 0.5 hp pump to draw water, which supplies piped water to the kitchen and toilet.

To meet the growing demand for water the Lakshadweep Administration has encouraged rain water harvesting. The Lakshadweep PWD provides plastic (Syntex) tanks to all the interested residents. So far 80 households, have availed this scheme.

Table 3.2 Rainwater Collection Tank Capacity

Rainwater tanks capacity (litres)	Total	Remarks
1,00,000	5	These are located at AIBER, High School. S.B School, Hospital, State guest house
90,000	1	Dak bungalow, guest house of Government official's
30,000	4	Hatchery
10,000	50	Located at the government staff quarters.
10,000	501	Built for various households by the government under a subsidy scheme

In 2011 a desalination plant with a capacity of 100,000 litres is under construction. This will help in meeting the fresh water demands of the Island population.

3.2.2. Ration cards

Ration cards are provided to families eligible for ration through the Public distribution system. Essential commodities such as rice, sugar and kerosene are supplied through the ration cards. In 2001 there were 1,430 ration cards in circulation. The number of ration cards in 2010 were 1533 and include 190, BPL cards and 138 AAY. these are people who are below the BPL and come under a special category. They also serve as identity cards.

3.2.3. Educational Services

There are altogether six educational institutions which include one High School, one Senior Basic school, three Junior Basic School and two Nursery school. All schools are co-educational.

3.2.4. Religious Services

There are 50 Mosques scattered all over the island that provide a place of worship at easy distance from their homes. The Juma (Friday) prayers are performed in two mosques called Juma masjid. On Fridays the fishers can go fishing only after the afternoon prayers have been completed. Two sects of Islam Sunni, Mujahideen are found in Agatti,

Religious education is provided by five Oathapalli (Madrassas) and one Markez (tution Centre). The Madrasas focus on providing religious education and teaching the children Arabic so that they can read and understand the Koran in its original text. The Markez and privately run tuition center also coach students from the Madrassas and regular schools.

3.2.5. Health Services

A community health center has been functioning since 1998 with the minimum required medical facilities. It was upgraded to a capacity of 30-bedded in 2002. The community health center provides health care facilities for persons suffering from ordinary diseases like diarrhea, jaundice,

respiratory infections, fever and colds. The serious cases are evacuated to either Kavaratti or mainland by helicopter. In September 2011, the hospital was handed over to Amrutha hospitals and is currently under private management.

3.2.6. Care for Elderly and Children

There are no formalized care institutions in the Island. The Joint Family system provides, the safety net for elderly, children and unemployed members. Traditionally women have always provided the care for their family members and it is not uncommon for them to take care of their elderly and children themselves. An orphanage provides a home to around 30 orphans. These orphans come from all the islands of Lakshadweep.

3.2.7. Sewage

Every house has a toilet in Agatti. These toilets are connected to a double and triple compartment septic tank. One compartment stores the fecal matter and the water passes into the other compartment and percolates into the soil. There is no direct sewage pipe to the lagoon or sea. The dry and decomposed fecal matter from the sewage pit is finally buried. There are 2000 septic tanks in Agatti. The Department of Science and Technology is introducing a bio toilet chamber to replace the septic tank and treat the fecal waste to reduce contamination of the ground water.

3.2.8. Electricity

Agatti was electrified in 1968-69 with a 29.6 Kw diesel generator. Now all the houses are electrified. Electricity is provided from diesel generation. Electricity charges are highly subsidized by the government and the Islanders only pay a nominal charge. 900 kW of electricity is consumed at the peak level of demand from 6 to10 pm. The Generator capacity has increased from 1140 kW in 2001 to 1700 kW. The HSD consumption to generate electricity is around 41,000 lt per day and 1.1.to 1.2 lakh lt per month[1]. The number of street lights have increased from 222 to 450 including 35 solar lights. The High Tension lines are underground and cover 10 km in 2010.

High energy usage area includes eastern jetty. Airport and the NIOT Desalination plant. Electricity rate is highly subsidized by the government.

The diesel is stored in barrels on the ground, they have 3 aluminum tanks of 15,000 lt/tank. This sometimes spills on the ground and enters the fresh water lens. Since diesel storage causes water pollution, the electricity department set up a Solar Power plant in the South. This will help minimize the heavy load being carried by diesel generators. The Solar energy plant was not working during the survey period.

3.2.9. Communications

Telephone

The mobile phone has created a revolution in communications in the island. There are 5200 mobile connections for a population of 9000 and 1200 households. This means an average of 4.3 connections per household. There are 662 landline connections. Most people opt for the Mobile connection and landline is no longer popular.

Internet and Fax

There are 56 internet connections. WIFI is not available. There are 12 Broadband connections with government offices, 44 private connections and one internet cafe. Fax connection is mainly used for official purposes for connecting all the government offices with Kavaratti.

Ship to shore Radio Communication

A police radio set and wireless communication is used for communication between Agatti and Bangaram. The Port office is in charge of the Mother-set and receive all communication and further pass it to the responsible person or department for further action.

The Port office has a multi channel facility and the Agatti Island beach resort and Bangaram resort have single channel base sets so that they can communicate directly with their own boats and personnel.

---

[1] Source, electricity department, Kavartti.

The new fishing boats that are being issued by the Fisheries Department are now fitted with these wireless handsets.

3.2.10. Transportation

Marine transportation

There are 7 passenger cum cargo ships that serve Agatti Island and connect it with mainland and the other islands. The ships MV Kavaratti, MV Arabian Sea, MV Lakshadweep Sea and MV Bharat Seema connect all the islands with the Kochi once a week throughout the year.

MV Dweep Setu, MV Amindivi and MV Minicoy connect the islands with mainland only in the fair season from September to April. The introduction of three new ships in 2010 has improved the frequency of travel between the islands and mainland.

There are seven speed vessels of varying capacity that serve as inter-island ferry. They connect all the islands with Kavaratti once a week.

Some private entrepreneurs ply their boats between the islands as taxies during the fair season. They charge the passengers around Rs.200/ each way. The Shipping Corporation of India also manages one oil barge and three cargo barges to bring cargo to the islands.

There are two motor sailing vessels called `manjus' owned by private operators, which carry cargo for the islanders. The manju's transport island produce such as mass-min, coir and copra. In return they bring essential food commodities and consumer goods. These manjus help in keeping up trade between islands and mainland.

Their are 4 cargo barges for transportation of Government Cargo which includes, provisions, stationery, furniture, construction materials such as bricks, sand and jally (granite chips) and fuel (diesel, kerosene and petrol).

There is a passenger jetty for embarkation in the western lagoon and currently a Jetty is being constructed on the eastern side to facilitate embarkation and disembarkation.

Air Service

An Airport started functioning at Agatti in 1988. Currently there two flight carriers operating to Agatti six days a week. Air passengers from Kavaratti can avail helicopter to fly to Agatti in time to catch their flights. The Lakshadweep administration run two helicopters to connect the Islands. These helicopters also serve as the inter-island and island-mainland ambulance.

Road Transport

There are three main roads that run north to south and 7 link roads that run east to west and connect with the northsouth roads. Besides this there are several walking and cycling tracks crisscrossing the island. The total length of concrete roads is 13.686 km.

At present in Agatti bicycling is a common method of road transport. Both girls and boys bicycle to schools. As the society became more affluent there came a demand for motorcycles. At present there are 694 two wheelers as against 396 in 2001. 96 three wheelers or auto rickshaws provide a taxi service and goods transport. There are18 tractors, that can be hired for transporting heavy loads, such as construction material.

Government offices own 9 jeeps, 3-ambulance 9 tempos and 2 fire engines and 4 cranes.

*3.2.11 Shore line protectio*n

At present around 11.7 km of shoreline has been protected by dumping, tertrapods (1350 m), hollow blocks (8275 m), sand filled coir bags (327 m) and a mix of tetrapods and granite boulders (1350 m) brought from the mainland.

3.2.12.Credit Facilities

The Syndicate bank is the lead bank in Agatti. It is functioning since 1976. There are 4255 account holders. The bank offer loans with an annual interest rate of 8.5 to 10% to start up business, house construction, buy vehicles. They give loans to WSHG at an annual interest rate of 9.5%. 275 people currently have loans from the bank for starting a business and 4 have home loans.

A post office is located close to the bank, people can use the post office for sending and receiving money orders. People can make deposits in the bank under various schemes and earn interest. Approximately 970 people have availed these schemes.

3.2.13. Marketing

Co-operative Societies

The Agatti Island Co-Operative Supply and Marketing Society LTD was first set up in 1962, to facilitate the islanders to buy provisions and rations and other essential commodities at a fair price. They have 6200 members, who own 9900 shares. It has been linked to the Lakshadweep Co-operative Marketing Federation (LCMF) which is its wholesale outlet unit. It is also the mediator between the islands and the NAFED, the later fixes the rates of copra. Presently the rates of copra, fixed by NAFED are Rs. 4,450 per quintal as opposed to 3250 in 2001. Earlier people could exchange copra for provisions (general as well as consumer electric appliances) on subsidized rates. Now the dealings are strictly in cash. They traded in 468.35 tons of copra and 1200 members sold their copra through the cooperative.

To cater for the increase in building construction they started supplying building materials viz river sand, metal jelly, cement and iron rods, imported from the mainland at cost price in 1999. During the study period, people complained that the society has not been supplying the construction material on a regular basis and that the supply came only once in May 2010. A housing board has been set up and private contractors now meet the demand for construction materials. At an average around 100 new houses have come up.

3.2.4. Government Subsidy

Owing to the remoteness of Lakshadweep and the high cost of transportation most things are provided to the islanders at a subsidized cost. Lakshadweep Union Territory is run as a Welfare State. The Lakshadweep Islanders are regarded as a scheduled Tribe population, which also entitles them to subsidies on electricity, transportation, rations (cereals, sugar and kerosene) and drinking water. Education and Health Care on the Island is free. Their are special welfare schemes for the poor that entitles the elderly to old age pensions and the people below poverty line.

To encourage more youth to take up Tuna fishing as a profession, the department of fisheries provides the following subsidies:

1. 40% for making the hull of the boat
2. 50% for acquiring new engine of tuna fishing boats
3. 75% for buying a Global Positioning System (GPS)
4. 50% of expenditure for boat renovation.
5. Rs. 20,000 subsidy for outboard engine. (full cost Rs. 89,000)
6. Rs. 30,000 for diesel OBM (full cost Rs. 55,530)
7. Shark fishing gear received 75% subsidy until 1980
8. The fisheries department also provides repair services at their workshop at very nominal rates to the fishers.
9. A cold store with 10 ton capacity at a time. (available at Agatti)
10. One small ice plant is in operation and a 10 ton block ice plant will be commissioned in 2012

The Department of Rural Development and Industries also have schemes to encourage entrepreneurship development.

4. Community Level Demographics

4.1 Socio cultural status

These islands are famous for their *Marumukkathayam* system adopted from Kerala where property was passed down the female line. Historically the islands had a matrilineal society. Women enjoy a special status being the owners of the house property. After marriage the men move to their wife's house. They sleep and have dinner and breakfast in their spouses house but take lunch at their mothers house. The employed men have an economic responsibility towards their mother and spouse. The Islanders practice Islam, but caste system still prevails based on occupation. The ruling powers, made use of the social hierarchy prevalent in these islands and tension often crept up between these groups. Agatti island witnessed a communal – inter-caste-strife in the early 20th century, between the *Koyas* and the *Melacheris*. Owing to the affirmative action schemes of the Government of India, people of the lower caste have also prospered. They have taken to higher education and secured government jobs. On the surface there is no longer a caste differentiation.

4.2 Land Ownership

Lakshadweep is a tribal territory. To protect tribal resources, the law does not allow non natives of Lakshadweep from owning land in the islands. Land can be bought and sold only by Islanders. People from the other Islands can buy and own land in Agatti. Land in Lakshadweep is owned by the Government or the Lakshadweep Islanders. Most of the government land is also acquired from the Islanders. Government land is known as pandaram lands and lands owned by the Islanders is called Jenom land. Accretion of land by the action of the sea comes under government ownership and landowners are not compensated for land that is lost because of the action of the sea.

Land is a very valuable asset in Agatti, especially now when people have understood the worth of tourism income. As can be seen from the table 4.1 more than four thousand people own tiny scattered plots of land in Agatti and likewise in Bangaram, Thinnakara, Kalpitti and Parelli. Any new venture that needs a block of land will have a difficult time acquiring land. A few resourceful Islanders are trying to acquire land as a large block by buying all the tiny plots of land in the uninhabited side of the island.

Table 4.1 Land tenure in Agatti island

Island	size (ha)	Land survey fields	Govt land (ha.aire.mt^2)	No of Landowners
Agatti	270.726	1326	8.75.7	4352
Kalpitti	7.192	14		180
Bangaram	56.621	49	1.84.7	1285
Tinnakara	41.935	37		728
Parelli 1	3.505	-		32
Parelli 2	2.430	-		26
Parelli 3*	0.00	-		0
Total	382.509			

*washed away in 1976 owned by Taloda house. Source: land records office

4.3 Demographic characteristics

Figure 4.1 Population growth in Agatti

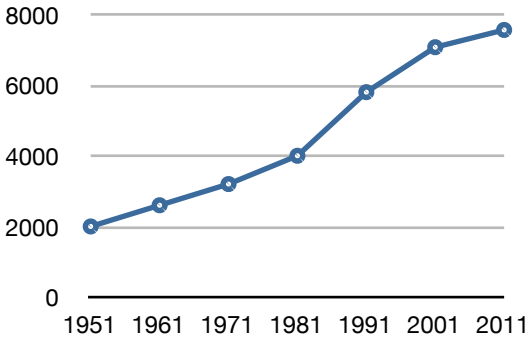
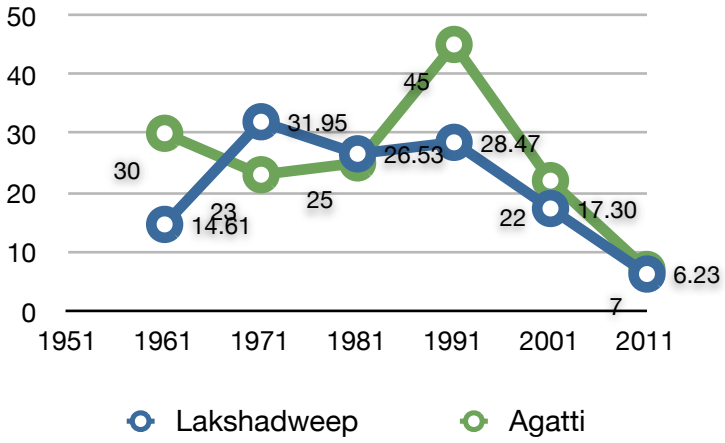


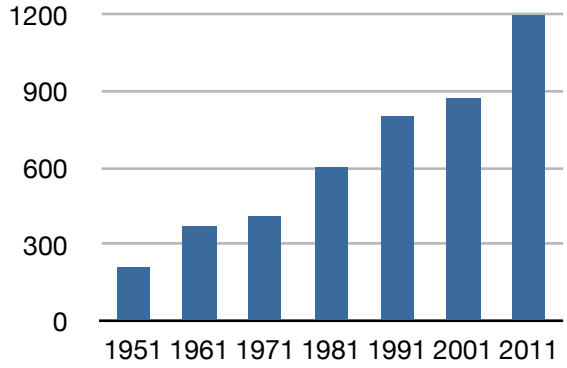
Figure 4.1 shows that Agatti has a steadily growing population. Agatti showed a decade growth rate of 6.23% for 2001-2011. The 2011 census reports that the population of Agatti is 7560, with 3889 males and 3671 females. The sex ratio of 944 has improved from 918 in 2001, but, continues to be unfavorable for females. Agatti has a birth rate of 6.52 and death rate of 4.44[1]. Literacy rate here is 92.8%. and Agatti ranks 5 in literacy rate in Lakshadweep. Out of the total literate population of 6186, males are 95.8% and females (89.7%). All these demography rates are slightly higher than that the Union Territory average. The MMR is 0 and no maternal deaths were reported at Agatti during child birth during 2010-2011. IMR for Lakshadweep is 14.5% being significantly lower than in 2001 (source: Directorate of Medical Services, Kavaratti).

Figure 4.2 Decadel growth rate in %



The population density in 2011 has increased to 1969/km^2 from 1842/km^2 in 2001. The rise is population has led to an increase in the number of households in Agatti. The increase in the number of households also reflects in the breakdown of the tharawad system that favored extended families living under one roof. Now we find that the tendency to live in nuclear families. The total number of houses have increased from 870 in 2001 to 1200 in 2011.

Figure 4.3 Agatti Households



4.4 Household size

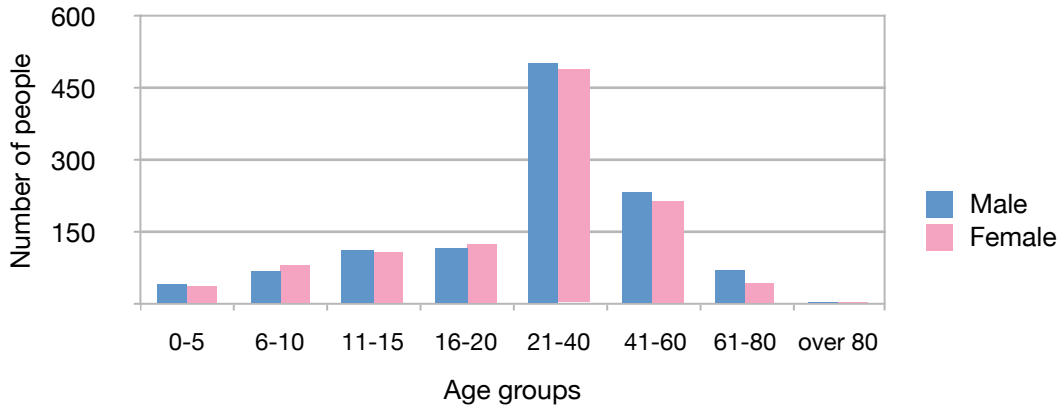
The total number of households in Agatti are said to be 1200. We conducted a household survey of 390 households or a 30% household survey to assess gender values, reef dependency; main and supplementary sources of Income; and Income distribution across the island population. The household survey, shows the trend that Joint families are breaking down to form nuclear families. The average household size is 6.6 against 9.36 in 2001. The largest household had 14 members, against 23 in 2001, and the smallest household had 1 member, as against 3, in 2001.

4.5. Age

The average age of the head of the household is 50.1 years old, with a maximum age of 90 and a minimum of 21. It can be noted from figure 4.4 that Agatti has a fairly young population. The population below 20 years of age is 32% and the population over 60 is 5%. This implies that there will be enough care givers to the aged. It also implies that the younger population who aspire for a higher standard of living will pose more pressure on the island resources. The active working population in the age group of 21-40 is 44% and in the age group 41-60 is 20%.
The sex ratio favors males after the age of 21.

[1] data collected from hospital at Agatti.

Figure 4.4 Age wise distribution of population



4.5 Head of the Household

The head of the household is considered is generally the oldest member of the family. In keeping with the matrilineal system the majority of the house owners are female. 68% of the house owners were female as against 72% in 2001. 81% of the households surveyed have reported the head as male and 19% as female. This is also an indicator that the matrilineal system is breaking down as boys also demand and get a share in the property. It also indicates the growing influence of mainland patriarchal culture, where the males are accorded greater importance.

Figure 4.5 Gender of the House owner

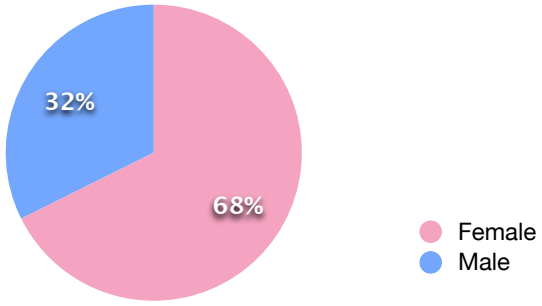


Figure 4.6 Gender of Head of Household

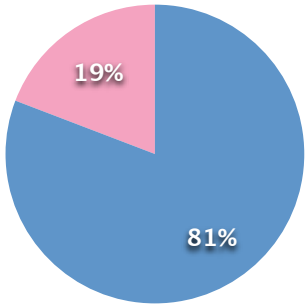


Figure 4.7 Occupation of Household Head

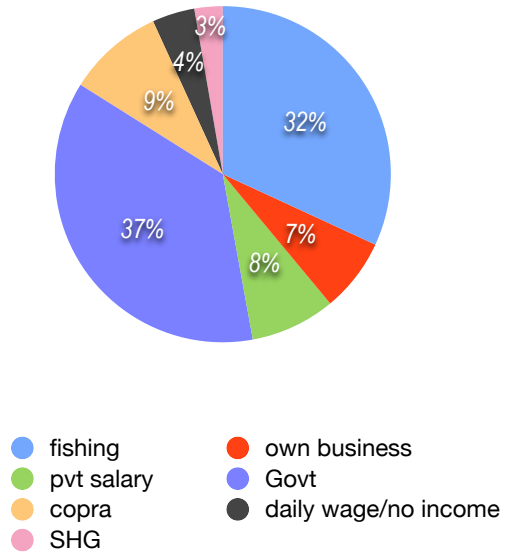


Figure 4.8 Educational level of Household Head

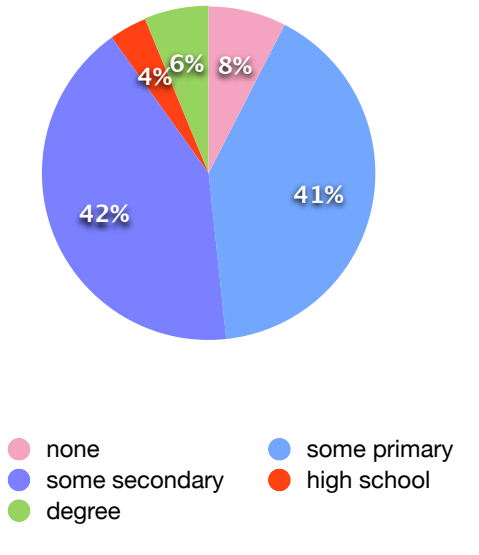


Figure 4.7 and 4.8 shows the occupation and education level of the household head. The average age of the household head is 50. Only 6% of the household heads has some university education and hold a degree. The Islanders have fairly good business sense since they used be traders and so those who cannot get government jobs, have started small businesses to cater to the needs of the island inhabitants. In most cases the head of the household is not the only one who brings in an income and the strategy is to have multiple sources of income. Those who are self employed often rely on family labour to help out and cut overhead costs of salaries. A few women have joined self help groups under direction of the Women and child welfare department and the Syndicate bank. They make and sell products to supplement the household income or have a personal income.

4.6 Sources of Income and pattern of employment

Figure 4.9 and 4.10 show the pattern of employment and its equivalent share as the source of income. Historically the traditional income source came from coconut plantations and the products derived from the coconut tree – copra and coir. This is a reason why owning coconut trees continue to have a prestige value. Every islander strives to own a few coconut trees. The income derived from the coconut plantations is now marginal. The pattern of employment takes into consideration the number of people involved in a certain occupation, to derive the household source of income. The traditional sources of income continue to be fishing and coconut cultivation and allied industries. Fish caught from recreation fishing is also taken into account while calculating annual household income, since it accounts for goods and services received from the marine ecosystem.

Figure 4.9 Pattern of employment

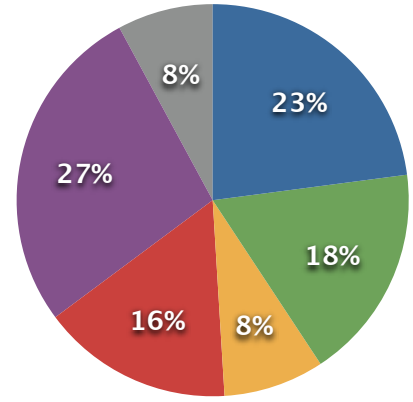
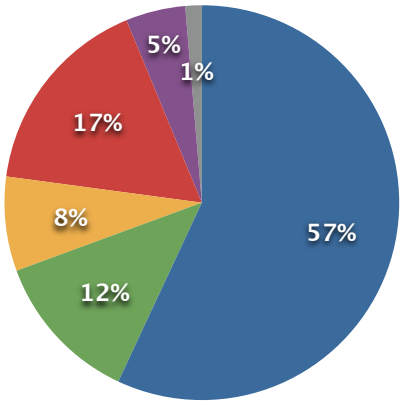


Figure 4.10 Sources of Income



Salary Govt Salary Pvt Own deep sea copra Lagoon/reef

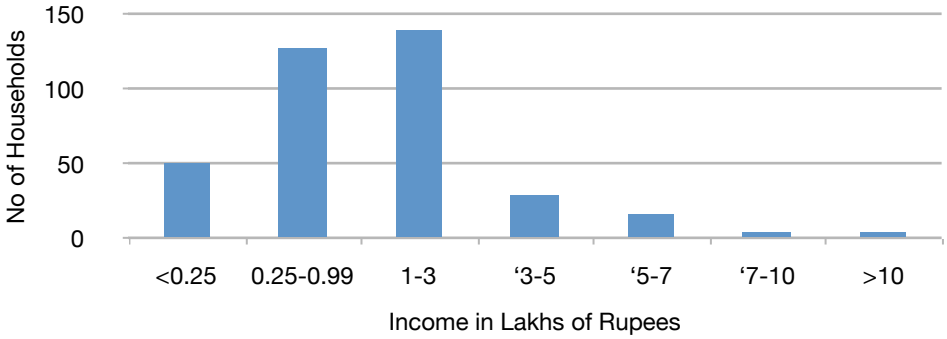
The sources of Income are from the deep sea fishing, lagoon and reef fishing, coconut trees, government jobs, own businesses and private employment in grocery shops, motor cycle repair, teashops, tourist resorts, Madrassa and contract labour. Every household tends to supplement the main source of income with reef related activities such as cast-netting, line fishing, cowry and shingle collection. 80% of the households rear 2-3 goats and chickens as a dietary supplement. 87% of the households get some income from selling copra and fulfill their household needs for coconut oil and coconut for food.

As can be seen from figure 4.9 and 4.10, government jobs are the most lucrative income earners. 54% of the households have at least one person employed in government. They form 23% of the income providers and generate 57% of the annual Income of the Island. In contrast 87% of the households had at least one person who received income from selling copra. They formed 27% of the income providers and generate 5% of the annual Income. 16% of the households have at least one person employed in tuna and deep sea fishing and generate 17% of the total Island Income. 8% are self employed in own businesses which range from fish trade agents, cargo, construction contractors to shop owners. They generate 8% of the annual income. They have the distinction of providing jobs to 12% of the households who generate 18% of the annual income. 8% of the households report lagoon fishing, shingle, mollusks, Octopus and cowry collection as their main occupation and depend on the reef and lagoon for their annual income and generate 1% of the total income.

4.7. Distribution of Income

Figure 4.11 shows the Income distribution across households in Agatti. Every family in Agatti has multiple sources of income. A typical mix is one person has a salaried job, does a business on the side, some fishing and income from coconuts. By dividing the total income earned by the households by the total number of household population, we get a Per capita income of Rs. 26,882/- and an average household income of Rs.1,67,235/-. Per capita and per household income has doubled since the socioeconomic assessment conducted in 2002, (Hoon et al. 2002).

Figure 4.11 Distribution of Income



It would imply that the people in Agatti are well to do and have surplus income. However the income earned is not evenly distributed. Two percent of the households reported an annual household income of more than Rs10,00,000. At the other end of the spectrum 14% of the total households had an annual income of less than Rs. 25,000 of which more than half had an annual household income of less than 10,000. This household income is less than the Per capita income of Agatti. These households are the poorest of the poor. They live in run down conditions and do not have an economically active adult male to support them.

4.8 Standard of living: Poverty and Wealth

Poverty on the island is not immediately discernible since all the people appear to lead simple lifestyles and dress and eat similarly. It must be noted, however, that situation in these islands is very different from that in the mainland, and the nature of 'poverty' here must be seen in a different context, for the expenses, the nature of spending, the question of shelter, etc., are unique and cannot be compared with that of an average low-income group representative from other parts of the country. Nevertheless, it is important to also note that the society here is far from equalitarian.

There are no special caste differences for a poor or rich families and that the poor families followed both the *Marimakkatayam* and *Makkatayam* system and could be both nuclear and joint families. The most vulnerable groups are those who were forced into nuclear families due to disintegration of the *Tharawad* style joint family and those families who did not have an able-bodied man contributing to the household sustenance.

The *Tharawad* system provided a safety net for all its members. Every member contributed to the best of their ability and were in return assured a minimum meal and roof irrespective of whether they were earning members or not. The earning members pooled their earnings to a common kitty and the matriarch assured that no one went hungry. Now with the growth in population and break down of the *Tharawad* one can see **poor relations.** Table 4.1 describes the wealth characteristics of different income groups in Agatti. The local definition of poverty in Agatti is:

a) Households dependent on large landowners for livelihood;

b) Households without a source of regular cash income;

c) Households with inadequate buying power; and

d) Households with no able bodied male.

Table 4.2 Wealth characteristics in Agatti					
	Wealthy	**Upper Middle Class**	**Lower Middle class**	**Poor**	**Impoverished**
Annual Income	> Rs. 10,00,000	5-10 lakhs	50,000-5 lakhs	15,000-50,000	>15,000
House type	Concrete double story modern house with compound wall attached toilets.	Double or single story concrete house attached toilets	Single story concrete house, with verandah	Traditional old house built with coral shingle, sit out. Toilet and kitchen in the backyard	Traditional house with tile roof, small rooms and verandha used as living area.
Education	Graduate or post graduate	Graduate or high school	High School - some secondary education	Some secondary or primary education	Primary or no education
Occupation Characteristics	High ranking government jobs More than 2-3 members on government pay roll Manju owners Tuna boat owners, resort partners	Lower level government jobs Tuna fishers Several earning members	Fishing boat crew Shark fishers Lagoon fishers Casual employment in government jobs Ship to shore boat transport Salaried employment Petty shops/catering	Coconut climbers Casual labour supplemented with lagoon fishing and gleaning	Depend on Wealthy households for livelihood Live by taking alms Devoid of regular income No able bodied male Elderly destitute or widows
Source of Income	Multiple	Multiple	Single/multiple sources of income	No steady source Government welfare	No steady source Government welfare
Bank balance	Yes	Yes	Nil	Nil	Nil
Physical resources	- Own land & coconut trees - Manju/outboard engine - Car/motorcyle - Labour saving gadgets washing machine, TV, grinders, microwave etc	- Own land/ coconut trees -/motorcyle - labour saving gadgets TV grinders, microwave etc - Boat outboard engine/auto rickshaw	- Own land/coconut trees -/Motorcyle - Labour saving gadgets TV grinders, microwave etc - Boat outboard engine/ auto rickshaw	- No land - Survival skill - Castnet, handline	- No land/trees - Survival skills - Firewood for cooking
Reef Use	Can pay to have others collect building materials and fish. Use for recreation fishing	Main use for fishing and recreation and construction material	Main use for supplementary income, construction material and monsoon fishing	Use for subsistence and survival	Use for subsistence and survival when able
Resilence	High	Medium-high	Medium	Low resilience	Low resilience
Source: Survey, SSI and FGD held at Agatti in 2011					

The poor are those who are equipped with very few survival skills. They are illiterate or have primary education, hence cannot get gainful employment. They can also be educated unemployed who have no fishing skills. Elderly men and women, divorced women, widows with small children and the unemployed fall into the most vulnerable group. The following case studies give examples of the varying living conditions on Agatti.

Box 4.1 Case study The family belongs to one of the 40 coconut climber families who were brought from Kiltan Island to Agatti in the 1940's.[2] The family head is 58 years old. He is married and has six daughters. None of the family members completed school. They have no skills other than that related to the coconut tending. He is the only earning member in his family. He had an accident recently and fell down from the coconut tree. He will no longer be able to keep up his vocation. His cash income came from climbing 15 coconut trees to harvest and harvesting 30-40 bunches every other month. For which he was paid 2 coconuts per bunch cut. He was allowed to collect coconut leaves to thatch their roof.
Earlier the women collected cowries and the men also did some subsistence fishing for subsistence and this way managed to survive. The spouse and daughters sometimes get an opportunity for daily wage labour. With no grown up son to help support the family, his accident has dried up the only source of income.

They continue to live in the small house that was built when their grandparents came to Agatti. In time the Koyas took back all the land around the house and the only have the roof over their head and no other resource. They have been unable to prosper or change their vocation. The households without an active male member suffers the most as they cannot even get fish from the lagoon. One sees low resilience to change and even an inability to carry on with traditional livelihoods of fish. They manage to survive because of Government welfare schemes, free medical and schools and midday meals at school ensures that the

Case study 2 is a coconut climber, native of Agatti. 50 years old. He never attended school and learnt his vocation from his father and uncles from when he was 15 years old. He is married and has five children, one son and four daughters. Three of the daughters are married and have small children. They all live together. The household owns their house and compound. They have 6 coconut trees and manage 70 coconut trees for two families. He collects Meera (coconut nectar) and the family helps process it into vinegar and jaggery. They produce enough coconut oil for their household needs. He has the skill to weave thatch from the coconut leaves and earns Rs. 12 per leaf. He owns a bala idal and fishes in the western lagoon and provides fish for his home. He proudly took us around his home that he had built himself using building material made from coral shingle and sand. The family also own 1 goat with two kids and a hen that lays eggs. They are able to make a cash income of around Rs. 30,000 annually. They fulfill the dietary protein needs from fishing, rearing goats and hens. They still use firewood for cooking and keep their energy bills down. The women also bring in cash income from doing wage work for the Panchayat. This household is a good example of survival from the land with their own labour and judicious management.

Case study 3 is a shark fisher aged 52 has studied till the fifth standard. He says life has given him all the education he needs. He used be a pole and line fisher and a boat owner. He had seen other fisher doing beypidal (fixed longline) 9 years ago and noted that the beypidal team consisted of 4 fishers rather than the 9 needed for Tuna fishing. He switched to beypidal. In 2009 CMFRI introduced longline as a research project for catching yellow fin tuna. He joined their project and learnt how to use longline. The main difference between the two operations is that longline is a drifting line and beypidal is a fixed line. The project stopped in 2011 but the 4 fishers who were trained, continue with longline fishing as the main occupation as they find it profitable. They have invested in the gear. The main fish caught are shark, yellowfin tuna and olemeen (halfbeaks).
They fish at the bar area close to the reef front and catch groupers and wrasse. The biggest shark he has caught is 120 kg tiger shark. They pull the detached line with shark and use a chatooli (harpoon) to pierce the shark and haul it into the boat.

The women of the house assist in post harvesting, and salt the fish. Shark fishing brings they around an income of between Rs. 1-2 lakh. The women also glean the reef and earn around Rs. 2000 a year. They also do all the sewing and tailoring for the household.

Case study 4 is a big landowner who has an annual income of over Rs. 1,000,000. He owns several small businesses in Agatti. He comes from a large family of six half brothers and three sisters. He is the only son who completed university education and has degree. After completing education in 1999 he started own business and has a cafe and a computer repair and supply business. He does not like to borrow money to invest in his ventures and so far has managed to start his new ventures with his own savings and some family support. His family owns land in Bangaram and Agatti. When tourism started in Bangaram, lease rent became a source of Income. The family leased their land to SPORTS and through them to Casino. The litigation between Casino and SPORTS has lead to the closure of the resort and hit their family income. They are now waiting and watching as there is a clamor to start tourist resorts in Agatti and the islands in Bangaram lagoon, he knows that they are in a good bargaining position. Personally he would prefer to deal directly with the resort owner and maximize his income. He feels hindered by the lack of a transparent tourism policy and permit rules. When asked about whether his income is dependent on the coral reef resources. He was quick to answer that his dependency was 100% since the rent from the resort was tied to the tourists desire to visit coral islands.

The case studies (Box 1 and 2) provide examples of the living conditions of the poor on Agatti Island. They represent two different kinds of situations for people of the same vocation and skills. In the first case (Box 1) the household is a representative of the poorest economic class, the case study is of a coconut climber families who was brought and settled from Kiltan to Agatti in the 1940s. Here the only male in the family is elderly with no access (or limited access) to the resources of both the land and the sea. The second case (Box 2), is that of a coconut climber, who is a native of Agatti. He has the same skill as his counterpart from Kiltan, but in addition has access to land and coconut trees. They are able to take care of the minimum needs of food, clothing and shelter even though they lack buying power. They own land and were able to build a home with their own labour and gathering construction material from the reef.

Two other case studies provide an example of middle class and wealthy families with more access to resources, land, knowledge, political and business connections. They do not have government jobs, yet manage to make a decent living, because they are resourceful and can adapt to change.

4.9 Business Development and Ownership

Table 4.3. Provides the types of self employment options that the Islanders have taken up as they explore other opportunities. It also shows the residency of the business owner and credit availability. The Agatti Islanders have opted for the following business to cater for the needs of the residents of Agatti.

Passenger and goods transport: This is a very popular self-employment option with the youth. The auto serves for home use as well as can be hired out. Their are 70 passenger and pickup three wheelers to transport goods in the island. The driver is generally the owner or a relative from the same household. An auto stand and union also exists in Agatti to cater for the rights of the Auto drivers and owners.

General Stores: There are 50 privately owned stores in Agatti, these are multi purpose shops and carry good such as provisions, milk powder, soft drinks, candy, snacks and stationary. There are two photo studios and three shops with photocopying facilities. There is no medical shop and medicines are supplied at the health centre or bought from the mainland.

Workshops: There are several workshops catering for the maintenance and repair of bicycles, motorbikes, autos and home appliances live television, fridge and airconditioners

Teashops and cafes: There are around 14 teashops, where one can have tea and snacks. They close from 1 to 3 pm. Three of them also serve lunch and dinner on demand basis.

Lodges: There are 4 lodges that charges between Rs. 100-200 per day. These lodges have a total capacity of 15 rooms. They cater for the demand of inter Island local traffic

All the teashops and lodge are run on personal initiative and are privately owned by islanders.

Table 4.3. Business development, credit and ownership									
Type	Avg age	Lease	Self owned	Owner residency			CREDIT		
				Agatti	Other island	Main land	Own/family	Friends	Bank
Passenger and goods transport	37	2	68	70	0	0	70	0	0
Snacks and tea shops	38	1	9	10	0	0	10	0	0
Contractor	42.25	0	8	7	2	0	8	0	0
Manju owner	50	0	1	1	0	0	1	0	0
Dry Fish traders	40.5	0	4	4	0	0	4	0	0
Workshop Repairs	47	1	8	9	0	0	8	1	0
Mill/flour/oil/saw	51.2	0	9	9	0	0	9	0	0
Lodge	48.6	0	3	3	0	0	3	0	0
Barber shop	33.2	0	5	5	0	0	5	0	0
General Stores	41	5	28	33	0	0	32	0	1
Stores: Hardware/mobile TV	42	7	9	15	1	0	14	0	2
Travel Ticketing	40.5	0	2	2	0	0	2	0	0
Dive Centre	41.5	1	1	1	1	0	1	1	0
Resort	46.75	3	2	2	2	1	2	0	0
Total		17	89	101	5	1	99	2	3

Home-stay tourism: In 2009, the administration promoted home-stays. Around 7 people built a separate house for this purpose. These are not successful. They cannot operate independently of the entry permit rules. They have made a tie up with SPORTS for marketing and getting tourists.

Dive Centre: Two Islanders who are qualified Dive Instructors have started Dive Centres. to cater for the demand to learn Scuba diving and do recreational open water dives. They have made a tie up with the guesthouses and opportunistically take people diving.

Women's Self Help Groups: There are around 15 Women's self help groups in Agatti. These have been promoted by the Women and Child welfare departments and the banks on the Island. Each of these WSHG have between 10-20 members who work together to produce a product for sale. The usual products that are marketed by these WSHG's are short eats, pickles, catering, snacks and coconut oil. The self help groups have helped the women to become independent, self reliant and have provided them with some freedom and occupation. One member of a women's self help group is the elected chairperson of the Island Panchayath.

4.10 Discussion

a. Social resilience:

While the literacy level at Agatti is 94% we find that literacy automatically does not translate into job opportunities. From the household survey we have noted that 94% of the population has dropped out of school and have very few vocational skills. The perception survey respondents in chapter 10 also presented a similar picture.

The case studies of the occupational status of different groups within the community, show that the poor with limited or no access to resource natural, technical and financial cannot prosper. The

deep sea fisher owns a boat and was employed by the Longline project of CMFRI. He represents a medium income family, who is quick to learn and seize opportunities. The last family represent the higher income families who are well educated and well connected and represent the interests of the business community.

Government welfare, subsidies in providing free education and medical assistance for all has helped the islanders achieve a high level of literacy. However, one notices that the Fisheries and other government departments have hardly made any significant interventions in distinguishing the economically lesser-off sections and providing them scope for earning a decent livelihood. The blanket category of Scheduled Tribe for the whole island has undoubtedly helped the higher castes and more resourceful sections access support and subsidies compared to the more vulnerable sections of society. Perhaps the tenets of Islam have helped with communal sharing and the ideas of charity, which makes case study1's economic survival in Agatti far better than his counterparts in other states. Also there is very little scope for spending that may also be seen as an important 'relief' factor in such cases.

b. Changing Status of women

These islands are famous for their *Marumukkathayam* system adopted from Kerala where property was passed down the female line. Women therefore enjoyed a special status being the owners of the house property. The household survey revealed that the joint family or *Tharawad* system is breaking down. The shariat law is gaining popularity for property division. This favors male interests over female interests. Nuclear families and housing are growing and there is a boom in house construction. The *marumukkathayam* systemhas s on the decline. 68% of the households surveyed reported that the house they lived in belonged to their mother. It was 74% during the 2001 survey. The others report that they live in the house built by their father *(Makkatayam*). The head of the household is always cited as male. Outside influences are evident in the changing dress styles of women. Now most of them wear pardha and the head scarf. At the time of marriage, the brides father shows his status by offering some gifts such as a computer or motorcycle to the bridegroom.

Women tend not to be self-employed and play a small role in the economic sphere of the Island life. The economic activities of fishing and post harvest and harvesting coconuts are work assigned to males. Women confine themselves to domestic work and only go for employment if they get government office jobs. The women and child welfare departments and banks have been encouraging women to form Self Help Groups. This also provides an avenue for women to come together and do income generation activities.

c. Credit and business development

As seen in Table 4.3 the Agatti self employed non fisher people are comfortable running small businesses which are self owned and started with own or family finances. These are all low risk and need low to medium investment.

The banks are willing to give credit but the people are a little averse to taking credit. Part of the reason is that Credit involves a payment of Interest and the tenets of Islam say that it is wrong to give or take interest.

Businesses that require more investment like starting a tourist resort have attracted people from other Islanders, who seem to have better connections with investors in the mainland.

5. Coastal and Marine Activities (Extractive)

The people of Lakshadweep Islands have been dependent on fishing and coconut cultivation for centuries. All the households show varying degrees of dependency on marine goods and services for their livelihood, subsistence and recreation. The fisher families and the coconut climber families show direct dependency on marine goods and services. They fish, collect coral boulders, sand and rubble for building construction and glean the reef for valuable mollusks and shells. The business men also note the connection of their livelihood and dependency on marine goods and services. Businessmen looking towards tourism to augment their income realize the importance of the non extractive market attributes of the coral islands. The government servants enjoy the beaches and lagoons in their leisure time. All the islanders understand that the reef protect them and their material assets from storm surges.

The coastal and marine activities can be classified as the following:

- Reef gleaning
- Collecting coral building materials
- Fisheries: subsistence and commercial

5.1 Goods Targetted from the Reef and lagoon

Figure 5.1 Goods collected during Reef Gleaning and perception of Status

Local Name	common	Relative abundance	Value	Perception	Tide	habitat
Kathi kavadi	snakehead	*****	Cash	Declining	Low	Reef flat
Valliya kavadi	tiger	****	Cash	Always low	Low	Live coral area/lagoon
Valla kavadi	money	*****	Cash	Declining	Low	Sea grass /reef flat
Pullikavadi	tiger	***	Cash	Always low	Low	Reef flat
Chirimarinnakavadi	N.A	**	Cash	Declining	Low	Reef flat
Chirimalannakavadi	N.A	**	Cash	Declining	Low	Reef flat
Chakara kavadi	N.A	**	Cash/Food	Declining	Low	Reef flat
Steem box kavadi	N.A	**	Cash	Declining	Low	Reef flat
Kompukavadi	N.A	**	Cash	Always low	Low	Reef flat
Karutha pulli kavadi	N.A	**	Cash	Declining	Low	Reef flat
Kakka	clam shell	*****	Cash/Food	Declining	Low	Reef flat/lagoon
Kallichi	mollusc	*****	Cash/Food	Abundant	Low	Reef flat
Komb	N.A	*****	Bait	Abundant	Low	Reef flat/lagoon
Phykala	spider conch	***	Cash/ornamental/ Food	Declining	Low	Reef flat/lagoon
Shang	Conch	**	Cash/ornamental	Declining	Low	Reef flat/lagoon
Utthly	N.A	*****	Cash/ornamental	Abundant	Low & med	Sandy area/near shore
Karaviyaood	N.A	***	Cash/ornamental	Always low	Low	Reef flat/lagoon
Star fish	N.A	***	Cash/ornamental	Declining	Low	Reef flat/lagoon
Koumb Kallichi	mollusc	**	Cash/ornamental	Declining	Low	Reef flat
Appal	Octopus	*****	Cash/Food	Declining	Low/Med/ high	Reef flat/coral bolder in lagoon

Reef Gleaning

Reef gleaning is both an important pastime and subsistence activity for the Agatti Islanders. Reef gleaning is at its peak for six days a month around the new moon period. Figure 5.1 lists the goods collected during reef gleaning. It shows their habitat, time of collection along with their relative abundance and perceptions of the collectors. Reefs are gleaned by both genders and all age groups. Figure 5.1 shows the intensity of reef gleaning in the reef flats around Agatti from June 2003 to may 2009. The island was divided into 4 parts Uninhabited and habited east and west zones (UW, UE IE, IW).

The intensity of reef gleaning is greater on the eastern reef, as they are easy to reach by walking across the shallow lagoon from the shore. At an average around 100-200 people can be seen gleaning the reef looking for octopus, cowries and shells and carrying out *kalmoodsal*. A

maximum of about 400 people have been recorded on the eastern reef flat on a single day. The gleaners wear rubber footwear to protect their feet and carry an iron rod for turning over corals while looking for cowries and clams, and poking octopus out of their dens. Gleaning continues to be a recreation activity for some. While for the women from the poorer households reef gleaning

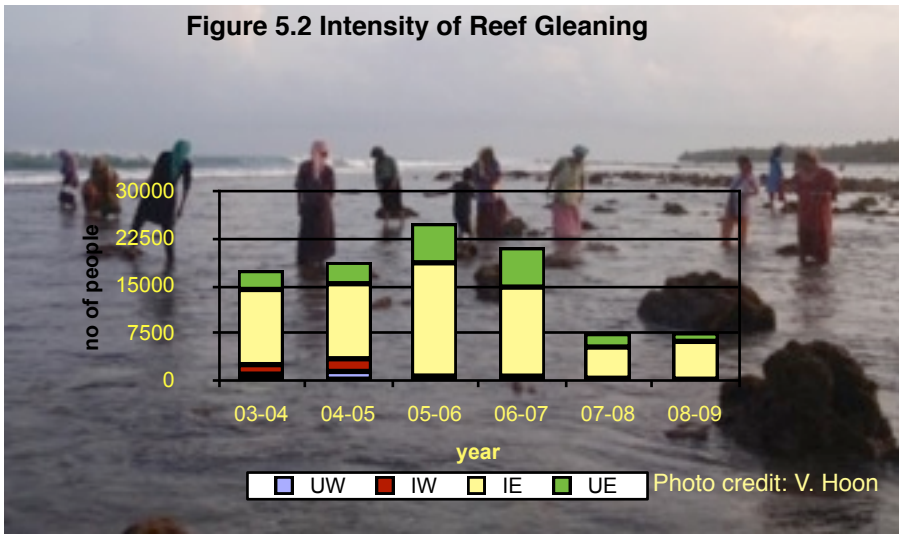


Figure 5.2 Intensity of Reef Gleaning

continues to provide an important source of protein and cash income to the family.

Octopus hunting/Appal kuthal

At present octopus is caught on a very small scale from the lagoon of all islands forming only 0.25 % of the total marine creatures landing in Lakshadweep. The octopus is highly relished by the local people. Octopus usually lies hidden in crevices of coral reef. They are caught by reef walking on the eastern reef and snorkeling on the western reef. When an octopus is spotted it is pierced with a pointed iron rod, as the octopus writhes out of its hiding place the iron rod is taken out of water with the octopus. This is usually practiced during low tide since it is difficult and dangerous to catch octopus during high tide. This method of fishery is popular in all the islands.

Plate 5.1 Octopus hunting (1&2) and Octopus drying (3)
Photo credit:Idrees babu

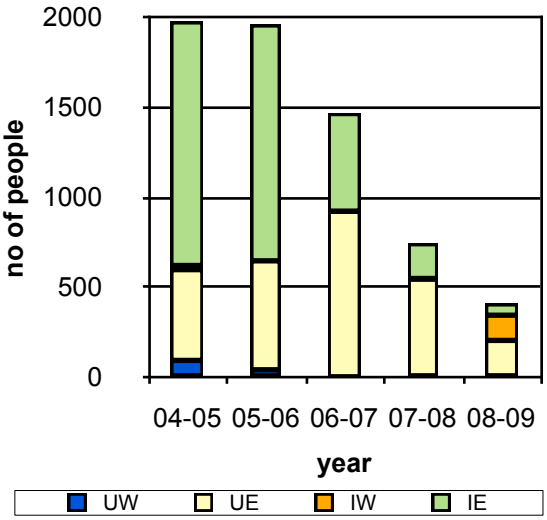
There are around 20 people involved in this activity. Women catch octopus while gleaning the reef. Octopus is eaten fresh and are dried and sold to other islands. Octopus hunting is a popular sport and a lucrative activity. Fresh octopus sells for Rs. 300/kg and dried octopus sells for Rs. 700/kg. The inter island trade is thriving and most of the dried catch goes to Androth. Octopus are caught all year round, though the intensity is greater in the fair season June-October.

5.2 Boulder, Shingle and Sand Collection

Coral boulders, shingle and sand are collected for building construction purposes. Shingles are the broken pieces of branching coral that get washed ashore. Boulders are big and small massive coral. Boulder coral, is collected from the entire reef area and even the patch reefs found within the lagoon.

Boulders can be distinguished as two types:

Figure 5.3 boulder collection



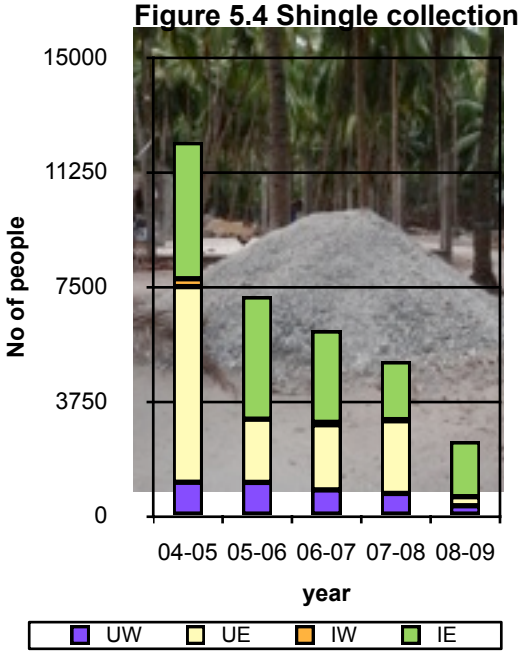
1. *Kummayatha kall* can be 1-4 feet in length and breadth. They are used for construction and making lime. This type of boulders are collected by men since it is hard work and one goes into the lagoon. They use boats and crowbars to heave the boulders into the boat. Typically this activity is carried out during low tide period. 2-3 craft loads are collected in one days work. One boat load is equal to 400-500 Kg.

2. *Uralam Kal:* This is collected from the eastern sea-shore area. It is used for laying the foundation during the building construction. Collection is carried on by women, children and men. They are placed as heaps on the seashore area.

Boulders are normally collected for own use and not sold. There is no class distinction for collecting coral boulders and people from all income groups can collect corals for their own use. Figure 5.3 represents the trends in boulder collection. Boulder collection intensity is greater on the eastern reef and lagoon due to proximity. It goes on throughout the year on a need base. Also one notes that boulder collection is showing a downward trend. The supply of alternate building materials and the ban on live coral boulder collection corals is showing some desired result. Boulders cost around Rs. 1200/tiller.

Shingle

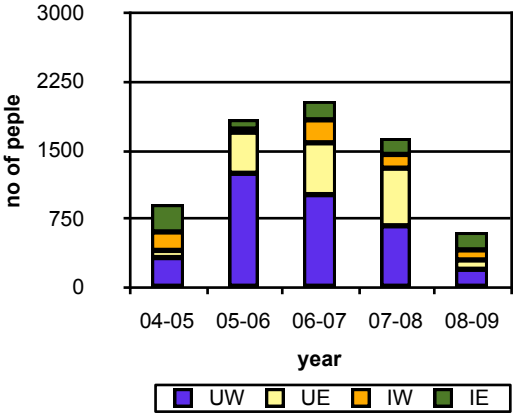
Figure 5.4 Shingle collection



Shingle is the coral debris that accumulates on the shore especially along storm beaches. Shingle is used for filling the foundation and to make compressed blocks for building construction. One bag of shingles sells for Rs. 60. One notes from figure 5.4 that shingle collection is greatest on the Inhabited and uninhabited eastern side of the island. Shingle is also collected from the Kalpitti storm beach, in the uninhabited western side of the Island. Women and children in the island routinely collect coral shingle for household construction and repairs. Shingle collection is a regulated activity and one has to apply to the dept of environment to get permission for gathering shingle. All income groups participate in this activity, there is no class distinction. The amount of shingle being collected is coming down and collection is seen on the inhabited eastern side. With one bag of shingle being sold of Rs. 60/-it is an important source of supplementing the income of poor households and unemployed youth.

Sand

Figure 5.5 Sand collection



Sand is collected from beaches and dug out from the sand dunes along the shore, fairly evenly throughout the year (hoon et al.2004). The heaviest collection is from the uninhabited western side of the island, which has in the souh. Sand is collected by tiller and tractor. A tractor load is 1.5 tons and a tiller load is equal to 0.5 tons. The sand dunes on this part of the island are no longer in existance. In the northern inhabited part sand is collected by the sack load. It is calculated that at an average a person will fill up a minimum of 5 bags of 20 kg in one operation. Sand is sold at Rs. 50 per bag.

5.3 Fishing Activities and gears used

The planned development of fisheries in Lakshadweep started with the inception of the department of fisheries in 1959. The department systematically trains fishers towards commercial deep sea fishing, in order to enhance the fishing potential of the islands. Tuna catching was popularized in the 1970s, by bringing, Minicoy[1] fishermen, to train fishermen in other islands. The department provides training and a 30% subsidy for purchasing diesel, hand held radio sets, GPS and mechanized fishing craft. After an organized effort of several decades the total fish landings has increased from 500 tonnes (for the entire Lakshadweep) in the 1960's to to a total catch of 2344 tons in 2000 and 1869 tons in the year 2010 in Agatti Island alone.[2]

The traditional fishing crafts are constructed of wood and were carvel built. The wooden planks are fastened together and fixed to ribs with coir yarn. The rudder made of wood is detachable and removed when the craft is hauled up on to the shore. The commonly used craft are named according to the number of oars used. They are known as *ettuvalikkunna odam* (8 oars), *Aruvalikkuna Odam* (6 oars) and *Naluvalikkuna odam* (4 oars). All these crafts are used within the lagoon and in the outer reef area. They also used a raft made up of 4-5 logs tied together called tharappam for octopus hunting and hand line fishing within the lagoon.

Folk tales and songs reveal that the islanders fished in the lagoon and outside the reef. The earlier fishing activities were subsistence-based and commerce was limited to selling turtle shells, cowries etc. The traditional craft and gears used, took long hours, required teamwork and skill for an operation. Every able-bodied male was involved in fishing. The fish caught was shared equally amongst all the team members who rowed the boats and hauled the nets. An extra share was given to the owners of the boats, nets and other gear. Earlier when fish were plentiful and inhabitants few, the fishermen would distribute fish to any one who required fish (Hoon et al), 2002, 2004). The catch was never sold since there was no cold storage and people did not have purchasing power. Now the surplus catch is sold, as demand exceeds supply. The price of lagoon fish has shot up from Rs 20 in the year 2000 to Rs 80 in 2011. Many households have purchasing power and own refrigerators to store surplus fish.

Plate 5.2 Commonly used fishing crafts
L-R Odam, Tuna boat Photo credit: O.G Moosa, Dhoni Photo credit Sikander Hussain

5.4 Subsistence fishing

The Agatti Islanders use several methods for catching fish in the lagoon throughout the year. The methods range from a single persons effort, such as, fishing with rods, lines and castnet, to 30-40 people involved in a bala fadal drag net operation. The fish catch depends on the effort and luck. A cast netter averages 0.5 kg a day two while three hundred kilograms of fish may be caught in a single bala fadal drag net operation, which literally can sweep an area clean of fish.

Some fishing methods are named after the location of the fishing operation or on the variety of fish caught. For example set net fishing at the shallow entrances is called shal kakal, but within the lagoon it is called bala attal. Handling fishing from the shore or jetty is called shammam fokkal (going for shammam (grouper). Shammam fokkal not only specifies the variety of fish to be caught but also specifies that the fisher is going to the chals on the eastern reef. Table 5.1 describes the

[1] Minicoy fishermen are masters of the pole and line tuna fishery.

[2] Department of fisheries, Kavaratti

fishing activities and gears used in the lagoon and reef area. The new activities noted are the Balafadal in the eastern lagoon since 2004 and speargun introduced in 2007

Table 5.2. Fishing activities/gears used in Agatti lagoon and reef Area

Local Name	avg catch in 2009 (kg)	no of sp caught	unit size no of people	Description
bala adiyal	2.26	21	4	Shore seine, used mainly in the western lagoon
bala attal	3.25	18	4	Purse seine, used inside the lagoons around the island
bala fadal W	280	28	30-40	Large drag net involving 15-30 people, two boats and an olavala (scaring net made of coconut leaves tied to a rope) operated in western lagoons near thodu.
bala fadal E	18.5	10	6-8	Dragnet used in the eastern lagooon involving 6-8 people, boat is not needed since the lagoon is shallow.Specially near the hatchery
bala idal	1.5	15	2-4	Gillnet set in the lagoon on the east and west and around kapitti.
cast net	0.5	21	1	Small mesh cast net used mainly from the shore and frequently opportunistically, around the island
hand line	0.3	17	1	Baited hook and line, used opportunistically around the island,
handline with boat	3.74	7		eastern jetty, frequently from boats during transport or in association with other fishing activities
rod and line	0.56	17	1	Baited hook and line, used opportunistically around the island and mainly from the shore. sometimes used with rod.
kalmoodal	0.25	6	4	“Boulder trap” – a net set around a coral boulder which is then agitated using rods to drive out fish.
kurakkal*	0.2	5	2	Light and spear or sword. Not commonly used, only practised in shallow water
shal kakal*	1	2	2	Gillnet set in reef channels, used mainly during the monsoon and at spring tide. Not commonly used
spear gun*	1	6	1	A new gear introduced in 2007 by people returning from Haj. The young boys like this gear and enjoy the chase and hunt. Skills needed are swimming, skin diving and aiming and shooting the fish. To ensure catching the fish of their choice, the speargun user, searches out the hiding places of the fish and spear it.

Price of lagoon fish has gone up from Rs 20 per kg in 2002 to Rs 80 per kg in 2012.
source: gears, hoon et al 2002, 2005, catch data collected from 2005-2009 by the ACRMN and *interview in april 2011

Box 5.1 Interview with a speargun fisherman

Photo credit: Idrees babu

Aman age 25 enjoys spear gun fishing as a sport. As a teenager he used to do traditional spear fishing. He saw a few young men doing spear gun fishing at Kavaratti in 2006 and wished to get a spear gun. On learning that they had got theirs from Dubai he requested a friend going to Haj to bring one for him along with a mask and snorkel. He says he likes the spear gun, since he can target his fish. The biggest fish he caught is a yellow fin tuna weighing 35 kg. He says that was by chance while standing on the jetty. He spotted the yellowfin and shot at it and to his amazement got the fish. Then he and his friend jumped into the water and hauled it up. Fishermen say that sometimes yellow fin enter the lagoon through the channels and get disoriented and swim towards the shore. Spear gun fishermen target rudder fish (funji) goatfish, (fulariam) red snapper, carrangids, madathala, shamam, (Grouper). The spear gun costs Rs 2,500/-. Their are 25 boys in the age of 20-35 who like spear fishing. The best days for spear fishing are for 3 days before and after the new moon when he tides are low and the nights are dark. When they want to target a big fish such as napolean wrasse or grouper, then 2 or 3 spear gun fishers will aim together at the same fish and strike it. It is difficult for a lone fisher to spear a big fish since he cannot hold it stable.

Goods targeted by reef fishers

During southwest monsoon the fishing activities are concentrated in the inshore waters which include the lagoons, reef flats, reef fronts and reef slopes. Almost all of the fishable areas are found in inshore water with the exception of a few pelagic areas. Fish found in inshore waters include bait fishes, aquarium fish, reef food fishes and other species like lobsters, sea cumbers, octopus etc. All varieties of reef fishes and octopus are targeted this time. Table 5.2 gives a list of the commonly occurring and targeted fish from the lagoon and outer reef.

Table 5.3 Commonly occuring and targetted fish from lagoon and outer reef

Fish group	local taxa	Fish group	local taxa
angelfish	shabadu kallam	milkfish	ilimeen, kuruthola, manambalkody
baitfish	bella chala, bodhi, chala manja chala, pacha chala rahiya	mojarra morays mullets	furachi malanji thidira
barracudas	kolas	parrotfish	chandi, feesom
billfish	kudirameen, Olameen	pufferfish	chemaniyam
box fish	thomp	rabbitfish	oram
butterfly fish	fakikadiya	rays	kottar, thirandi
damselfish	kally, kurichil, lattom, mamban, thukiyam	sea chubs	funji, kalkuratty, poonchi
dorado	habnoose, Shameen	seerfish	ayakura
emperor	auran metty, fallam metty, fonthom metty, kannam metty, kilukom, kulakathi, manjam, metty, pulli metty	shark	atta churav, balam churav, bella churav, firuthaliam, kalla churav, komban churav, mana churav, maram churav, meen churav, nayam churav, poocha churav
flying fish	farava	snapper	chemmali, fulariyam, karim karavalli
fusiliers	baichala	sole	Lammam
garfish	keram, oola	squirrel and soldier fish	kallaalam, kankaduvam, pherunganny
goatfish	kalmanakkam, manakkam	stone fish	Pehchan
gobies	mandiyam	sweetlips	Kotha
grouper	chammam, arkoli chammmam, pulli chammam	surgeonfish	Barifad, fala, karukkam, naithala, nilalam, varipad
halfbeak	mural	threadfin	Mookam
Jacks and trevallies	cheemkanni, fankuluval, faradam kuluval, fiyada, keri machan, madathala	triggerfish	Falli, Karatty
lizardfish	balaka	tuna	choora, yellow fin
mackerel	bangada	wrasse	balala, njaala, thokka

5.5 Traditional knowledge

The major fishing season in Lakshadweep is the period between November to May; during the rest of the year i.e. southwest monsoon period, fishing activities are restricted to the lagoons and the leeward side of the islands. The fishing methods use both traditional and modern gear and the combination of the two at times. Over centuries the fisher folk have developed a deep knowledge of the general wind system and currents prevailing around the island and their territorial areas.

a) Currents that influence fishing

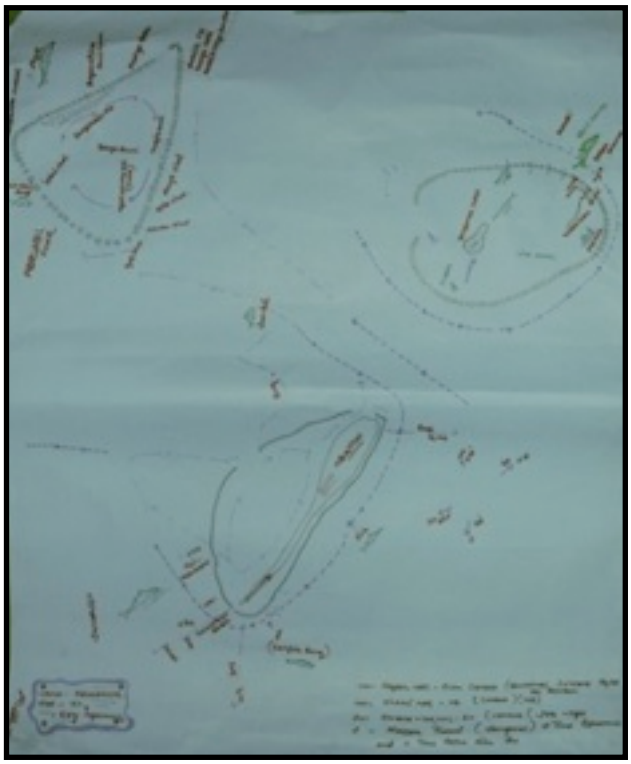
The Fishermen have a deep knowledge of the currents and weather patterns around the fishing area of Agatti, Bangaram and Perumal par. Figure 5.6 was made during a visualization exercise with expert elderly fishermen. They explained that their are mainly 4 currents that influence fishing these are:

1. Hajaneer; a slow current from the NW which happens occasionally , Fishermen like this current since their is a chance of good fish landing when this current occurs.
2. Thekkantani: a current coming from the south. This - is very dangerous and occurs randomly. Aboobacker, the key informant experienced this current only twice in his life.
3. Aharajankat - coming from SW during monsoon time june to september
4. Ehathaneer - a current moving from NW to NE oct-May.

One current comes from the northeastern side, near the east jetty and bifurcates into 2 and one moves north and the other south.

The south current circles Kalpitti and moves towards SW of Perumalpar. Fishermen note that if one species of fish particularly seer fish is found near Kalpitti the same is also found at west of perumal par and in between both islands at the same time.

Figure 5.6 Map of Currents around Agatti, Bangaram & Perumal par



The north current moves along the channel between Bangaram and Agatti. it reaches Perumalpar. The Bangaram current forms a semicircle and moves from south to north towards Perumalpar. So if a seer fish is being caught north of Parelli the same fish is caught NW of Perumalpar.

b. Seasonal Calander

Figure 5.7 presents the seasonal calendar and the gender involved for various reef related

Figure 5.7 Seasonal Calendar for reef related Activities

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cowry collection	♂♀♀	♂♀♀	♂♀♀						♂♀♀	♂♀♀	♂♀♀	♂♀♀
Octopus hunting	♂♂♂	♂♂♂	♂♂♂	♂♂♂	♂♂♂	♂♂	♂♂	♂♂	♂♂	♂♂♂	♂♂♂	♂♂♂
Cast Netting	♂	♂	♂	♂	♂♂	♂♂	♂♂	♂♂	♂	♂	♂	♂
Drag netting	♂♂	♂♂	♂♂	♂♂	♂♂♂	♂♂♂	♂♂♂	♂♂♂	♂♂	♂♂	♂♂	♂♂
Harpooning	♂	♂	♂							♂	♂	♂
Shore Hand Line	♂♂	♂♂	♂♂	♂♂	♂♂♂	♂♂♂	♂♂♂	♂♂♂	♂♂	♂♂	♂♂	♂♂
Boat hand line	♂♂	♂♂	♂♂	♂♂	♂	♂	♂	♂	♂♂	♂♂	♂♂	♂♂
Light and sword	♂	♂	♂							♂	♂	♂
Trap over boulder	♂	♂	♂							♂	♂	♂
Pole&line tuna	♂♂♂♂	♂♂♂♂	♂♂♂♂	♂♂				♂♂	♂♂♂	♂♂♂♂	♂♂♂♂	♂♂♂♂
Scuba diving	♂♂ ♀	♂♂ ♀	♂♂ ♀	♂♂ ♀						♂♂ ♀	♂♂ ♀	♂♂ ♀
Snorkeling	♂♂ ♀	♂♂ ♀	♂♂ ♀	♂♂ ♀	♂	♂	♂	♂	♂	♂♂ ♀	♂♂ ♀	♂♂ ♀
Spear gun	♂	♂	♂	♂	♂♂	♂♂	♂♂	♂♂	♂	♂	♂	♂

activities. These activities take place all year round. However the intensity and type of usage changes with the seasons.

- Cowry (kavadi) collection – Collecting cowries is at its peak from October to March. The activity slows down in April, and stops during the monsoon period.

- Octopus Hunting (Appal kuttal) – carried out throughout the year. It is at its peak between October and April.
- Castnet (bala beeshall) - Cast net is operated though out the year but the frequency of netting increases during the monsoon and decreases during the fair season, when tuna is easily available.
- Dragnet (bala adiyal) – Operated through out the year. The frequency of netting is greater during the monsoon and slows down during the fair season.

The Agatti team helped the fishers and reef users of Agatti to visualize the seasonal calendar of species availability (Figure 5.8) . The fishers continue to be keen observers of fish habitats and

Figure 5.8 Seasonality of Fish Availability

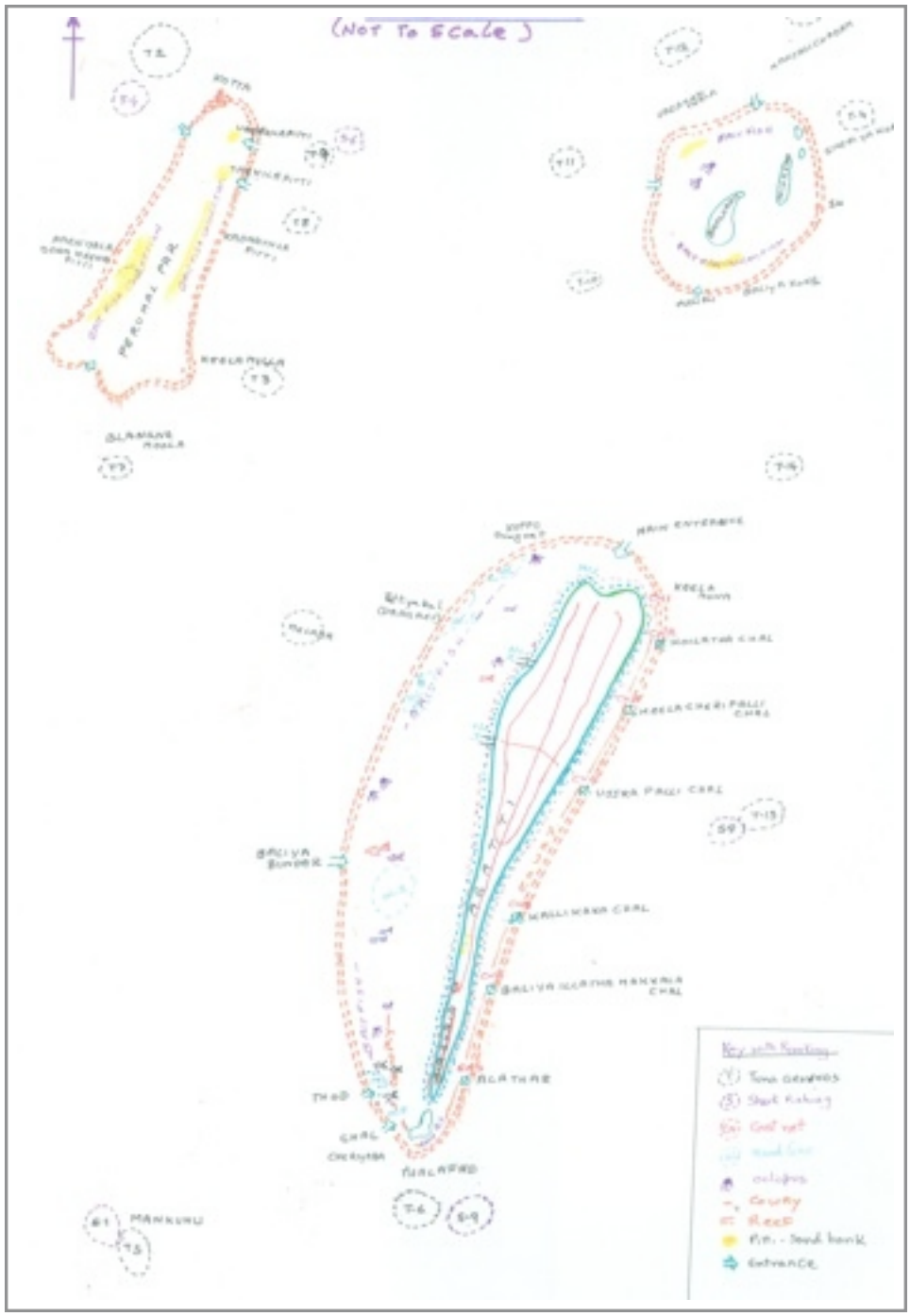
Fish Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kulluval												
Matty/Metty												
OOLA												
Manakkam												
Mannjam												
Chemmally												
Njola												
Balala												
Khoda												
Shammam												
Nayithala												
Karrukkam												
Furrachi												
Faarun kanny												
Faruthaliyam												
Kulakkaathi												
Nilalam												
Mockam												
Thidra												
Funjee												
Karatty												
Bangada												
Baichala												
Thirandi												
Fally												
Beesam												
Shandi												
Mullam												
Orram												
Mural												

are well acquainted with fish behavior, habitat preference and seasonality of occurrence. Certain fish like oola, kuluval, shammam, furachi, karatty, baichala, Mural and thirandi are caught all year round and others are more abundant during certain months.

d. Resource activity use map

Figure 5.8 presents a resource activity map showing the various activities that take place within the site area. Note that these activities and the are used has nor changed since 2002. But the intensity of Activity has changed and a few new activities are also taking place in this region, which have been marked on the map.

Figure 5.9 Resource Activity map



From Figure 5.9 we can note that each activity has well defined areas of operation within the lagoon. These activity zones relate to the topography within the lagoon. Generally speaking baitfish are caught in sandy areas and sea grass beds. *Bala fadal* operation needs deep water and so is concentrated in the southwest and North-west of Agatti lagoon. Fairly well defined activity zones are found within the Bangaram lagoon. Sometimes different activities occur at the same site. However no apparent conflicts were reported between the different reef users, probably due to the difference of timings of each activity during the day. For instance the same areas are often used for bait fishing and snorkeling. Bait fishing takes place at dawn and tourists go snorkeling after 9:00 a.m. Some conflicts have been noted between Agatti Islanders and other Islanders on usage of certain areas within the Agatti lagoon for Bait collection.

5.6 Commercial Fishing

Fishing for commerce is carried out in the outer reef and ocean within the territorial waters of Lakshadweep. Agatti fishermen besides their own territories of Perumal par, Banagram and Agatti, chase tuna shoals all over Lakshadweep and frequent waters around Pitti, Bitra, Suheli , cheriyapani and Belliapani.

1. Pole and line tuna fishing

Tuna is not a coral reef associated fish but is included here since the tuna fisheries is dependent on bait availability and the bait used for skip jack tuna are found in coral reef habitats.

This technique originated in Minicoy, and later the fisheries department, popularized this technique in other islands through a systematic effort. Tuna fishing is done with a bamboo pole (3, 4 and 5 meter in length) attached to a line (3-4cm in diameter), two-thirds of which is synthetic rope and the rest is 1mm monofilament. At the end of the line is a hook. The important concept in this method is the use of live baitfish. The baitfish is stored in a floating tank anchored within the lagoon, in the traditional form at Minicoy. In Agatti fishermen however skip the overnight storing process and directly place the live bait in the bait tank within the boat.

In Agatti at present there are 75 boats engaged in tuna fishing. 8-10 people form a team in one boat. Until recently the team composed of a boat driver, bait thrower, two people to chum the water to simulate rain, two people to keep the water tank filled with sea water and four men who do the pole and line fishing. A water-spraying machine has now been included in the Tuna fishing boat and thereby the 4 people involved in water chumming activities are no longer needed. The new fishing boats are also fitted with GPS sets and a C B radio for communicating with the island.

Tuna fishing takes place only during the fair season October-May.

Operation: The first step is to collect bait and keep them live in a bait tank inside the boat. The boat then moves to the deep sea scouting for tuna shoals. Once the shoal is sighted the tuna is chummed by throwing the bait into the water and the fishermen start fishing with the pole and line and land the fish in the boat.

Catch composition. Skip jack 70% and yellow fin tuna 30%. Average landings 200 numbers/ operation when landing is good and >100 when landing is poor.

Share 50% of the total catch goes to the boat owner and 50% are shared amongst the team members. The team members not only share the catch but also continue the partnership in post harvest activities of preparing Mas and even marketing the Mas. As soon as the Tuna catch is landed on the shore. The fishermen start cutting and cleaning the Tuna. The heads are chopped off and the body is neatly filleted and the skeleton also removed. All this waste is buried in a pit dug at the seashore itself. Unlike in Minicoy, women do not take part in the post harvesting and marketing operations.

Table 5.3 Reef Fish targeted for export

Target fish	Price/kg
Red snapper (chemmaly)	80
Grouper (chammam)	80
Snapper (Metty)	80
Snapper(Fularium)	80
Jacks (Kuluval)	80
Trigger fish (Karratty)	80
Baracuda (Farmas)	80
Seer (Ayakura)	100

The Tuna Fillets are boiled in a huge pot filled with seawater. After boiling the fillets are smoked on a fire using coconut leaves and husk. Thereafter they are dried in the sun to remove residual moisture. They are then packed in Gunny bags and exported to the mainland markets either through the Co-operative society or directly.

2. Halaka bala/ Drift Net

The name Halak bala translates to destroyer net. This fishing operation involves catching fish from boats using a net which drifts with the currents. The operation takes place in the outer reef area. A

Team of 4-5 people, engaged in this gear operation, It is operated with outboard or mechanised boat. All kinds of fishes are caught especially yellow fin tuna (kindala) hence this method is also known as Kindala fokkal. The net catches any marine animal that is swimming with the current and turtles and dolphins often get entangled in these destroyer nets.

Gears needed:

1. Traditional odams or mechanized boats.
2. Nets - Olukkuvam bala / halakku bala, mesh size 120 mm
   – 100 fakan length - 50 fakkam wide 1 Fakkan = 1.5 meters
3. Float and sinks (5kg concrete blocks) are placed at a 20 fathoms interval
4. kani (a hook with a wooden handle is used for detaching fish from the net.)

Gear consists of nylon net, headrope with floats and footrope with sinkers and drifts with the current and the boat follows the net. In some occasions they will anchor the net or attach it a line to the boat so that the boat drifts with the net. This netting is being done by two parties during the SW monsoon.

The fishing is carried out at night especially during the new moon days. The operation starts around 5. p.m and boats go to the bar area beyond the reef and identify the direction of the current. The nets are set accordingly by sunset. At every 20 fathoms a float is tied on the upper side of the net and 5 kg weights on the underside of the nets. The net is examined after an interval of 2 hrs. Fishes removed and the boat and net slowly floats toward the island till dawn breaks. The fishers also use handline while they wait to examine the nets.

A boat can procure a minimum of 5-10 and max of 15-30 fish in a single operation. A yellowfin on an average weighs between 8-20 kg. is 2-3' long and 1' wide.

The catch is sold at the seashore itself. The boat owner determines the price of the catch. Price is determined according to the size or weight of the tuna. The price is directly related to supply and availability of other fish in the market. It ranges between Rs 200-500 per Kg

3. Oola fish catching activity

A team of 5 fishers carry out this operation. The fishers use a special type of net which is 100 m long and 10 m deep with a mesh size of 30 mm. They go outside the eastern reef in traditional 4 to 6 oar boats called odams, with outboard engine in search of oola since they are rarely found within the lagoon.

During the morning high tide time the boats reach the outer reef. Ropes tied with coconut fronds (olavala) are spread on the water. The fishermen wait for the Oola fish to aggregate around the olavala. When they see the Oola (halfbeaks) the net is spread and the operation continues till the second high tide in the afternoon. The average catch size varies between 10-50 in the lean days and 300-500 in the good days. The fish are 2' long and 2 " wide.

The fish is sold and distributed on the sea shore itself. The fish catch is shared equally amongst the fishermen after the boat gets a 50% share. Everyone who has helped in hauling up the boat will get one fish in payment. The remained are sold for Rs 80-100/kg, but even in this priority is given to family and friends.

Mechanised boats carry out this operation in zones 3,4 and 5 and in zones 6,7 and 8 traditional odams are used. These days 10 teams are engaged in this activity.

5. Commercial Reef Fising

Commercial reef fishing started in December 2003. These fisheries remained under exploited due to the lack of infrastructure on the island for both storage and transportation. In 2003 the fisheries department established an ice plant and cold storage on the island and the Lakshadweep

Development Corporation Ltd. (LDCL) introduced two new ships with freezer facilities. This has opened the doors for the Agatti Fishers to export their catch to the mainland at least once a week during the fair season.

The main fishing grounds are at Perumal par, Bangaram and the outer Agatti reef. When fishing is conducted in the far grounds the fishing program constitutes 2-3 days, otherwise the boat leaves the shore with 4-5 fishermen in the evening and returns the next morning. Each boat carries around 100 kg of ice and 50 L of diesel.

Table 5.5 Fish Landings in Agatti year 2010			
species	**Catch (KG)**	**species**	**Catch (KG)**
Barracuda	2020	Coral fish	22025
tuna	1563555	Carrangids	15360
sail fish	6270	Garfish	80505
flying fish	16810	goat fish	11620
seer fish	9210	Octopus	7055
Shark	5565	Perches	59740
R. runner	31895	Rays	1250
others	35180	Trigger fish	1435
Total	1869495		
Source: Fisheries Department, Kavaratti			

The operational cost of running a reef fishing boat is less than for tuna fishing, because the boat does not have to scout for fish shoals. The reef fish are always found around the reef. The fishermen only need to know the whether the fish is nocturnal or not. The average landing per boat is about 60 kg and the quantity landed is directly in proportion to the amount of ice the boat has available. Table 5.3 shows the fish Targeted.

The fish landed by each boat is taken by the agents and stored in the departmental cold storage until a ship is available to transport the fish to the mainland. The agents are fishermen on the island with connections in Kochi.

Depending on the availability of ships the fish are transported in insulated boxes to Kochi where the Island fisheries agent disposes of the fish to yet another agent.

Baepiddal (shark and Tuna)

The gear consist of a cotton line or monofilament line of about 50 m length fastened to a hook in some case about one meter steel wire also as the leader. The lead weight of about 200 gm is used as sinker. The free end of the line is attached to a buoy . Both mechanized boat and country craft are used for the operation, about 2-4 persons participate in this fishing. The bait normally used is tuna head or turtle flesh. The letting and hauling of the line is done manually. Operation of this gear is commonlly done in the bar area consisting of reef slope and dropoff. This gear target, yellow fin tuna and shark.

Long Line

The longline operated in the island water is a variation of japanese model tuna longline. A longline set consists of the following items such as; floatline, mainline, branchline, steel wire and hook

The length of the line is approximately 5 km. The hooks are spaced at a distance of 50 meters. The longline is operated from the mechanized boat with a minimum of 4 persons. As soon as the boat reaches the fishing ground the line is shot, marker buoys are attached at the intervals. so that the gear can be identified from a longer distance. Three fishers are needed for the shooting operation from the slowly moving boat. One person handles the main line while the mainline is being shot. The second person hooks the bait[1](goatfish and baichala) and throw the branch line

[1] When there is a scarcity of bait the fishers even import sardines and mackeral from kerala to use for bait. A common practice in Kerala is to dip the fish in ammonia so that it looks shiny and fresh, some people who ate it fell sick.

into the sea slightly away from the mainline to avoid entanglement. The third person is engaged in attaching float line.

The engine of the boat is stopped after shooting the line and the boat is allowed to drift. The line is hauled up after 3-4 hours. The targeted fish is yellowfin, the operation is done during the day time. In Agatti Island longline is promoted by CMFRI under National Agriculture Program.

Plate 5.3 Longline by-catch victims, Posing with Yellow fin Photo credit O.G Moosa, Hauling in the by-catch of shark Photo credit Idreesbabu, Shark killed by longline, Photo credit Sumer Verma,

Due to the introduction of this gear, by-catch landings have increased. By catch is several varieties of shark (tiger, thresher, white tip reef) rays, manta ray and grouper, giant grouper, napolean wrasse of very large size - some of these are schedule 1 protected species.

Spear fishing (for seer, sail fish & rays)

Harpooning, operated from country craft in the outer reef area and the open sea area within the 12 nautical mile radius.. 2 people engaged in this fishing operation. Gear consists of harpoon and 200 m rope. They use dummy wooden fish to attract the seer and sailfish. When the sear fish come near the boat they harpoon it.

The Rays are harpooned opportunistically whenever they are seen. The 500m long rope helps in hauling the ray when it swims down to deeper depths.

5.7 Market Attributes (Extractive)

The market for extractive reef resources lies in the mainland and Srilanka. The local market for fresh fish and other reef resources consists of the government employees who have the purchasing power, fish pickle making units, fish processing units and resorts.

Deep sea Fishing

Tuna fish comprises 84%, other deep sea fish and reef associated fish comprise 8% each of the total fish catch for the year 2010. Modern post harvest facilities were not available in Agatti and therefore post harvest processing is limited to the pickle making units and producing tuna *mass* by parboiling and sun drying tuna fillets, salting and drying octopus and shark fins. The other fish catch is sold fresh. The market for fresh fish is also growing in the islands as many households have diversified their livelihood away from fisheries and have purchasing power. **T**una and deep sea fishing is dependent on bait collected from the reef area. It is the most energy intensive and capital intensive of the entire reef related activities. The returns are also high according to the income survey a boat owner typically makes around Rs 100,000 (a conservative estimate) annually after paying all the running costs. The crew earns approximately, Rs. 40,000 annually from Tuna fishing. This is more than twice as much as they made in 2001.

According to the fish landings data a total of 1563 tons of Tuna fish were landed for a total value of Rupees. 54.80 million.[1] and a total amount of 1870 tons of fish were landed for a total value of Rs 57 million in the year 2010. The market for commercial fisheries is the mainland and shark fins, dried fish is exported to Srilanka and the far east.

Artisanal fisheries

Fish landing from artisinal and subsistence fisheries are not taken into account for the fisheries landing data. Artisanal fisheries accounts for around 56 mt harvested from the lagoon, using various nets and hand line as single or two to four man operations (Tamlander and Hoon 2008). The market for artisanal fisheries is fresh catch on the island. Its mostly for home consumption and the surplus is given to friends and neighbors and sometimes sold.

Octopus: are valued at Rs 300/kg fresh and Rs 600/kg for dried octopus. The main market is inter Island trade and the main consumer are the Androth Islanders. Around 3 kg of fresh octopus is needed to make one kg of dried octopus. The total value of Octopus caught in 2010 is around Rs 14 lakhs.

Sharks: Shark fishing has seen a boost with the introduction of the longline fishing project at Agatti in 2009 Shark fins are dried and exported. fins of 40 cm size are valued at Rs 6000/kg and fins below 40cm are valued between Rs. 1000-5000. Shark meat is eaten on the island and sells for Rs 80/kg. Surplus is salted and sold to merchants at Calicut at Rs 80/kg.

Cowrie collection: cowries and shells have a market in the mainland as curios and large cowries can fetch a price of Rs25/30 each, while the small snakehead and money cowries are sold for between Rs 1.00 and Rs 2.00. However, as all cowries are now listed as endangered species (see Section 1.2), collection is now illegal, but people continue to collect cowries both as a pastime and for sale.

Coral sand, shingle and boulder: Coral sand, shingle and boulder are required for building construction. Most people collect it for personal use. At a conservative estimate 500 tons of these materials are collected per annum building construction. The market price for a 20 kg bag of any of these materials is around Rs 60.

Aquarium trade: Aquarium trade is at an nascent stage in Agatti, with two hatcheries having tried to breed ornamental fish and failed in 2007. Currently there is one hatchery that functions and has trained 16 people in growing aquarium fish. The target species is clown fish, anemone fish, one trial sales of 1000 pieces was conducted at the rate of Rs 60 per piece. market rate is between 1000/ Rs 60/- to 100/- per piece.

It must be noted that the market value of all the extracted resources (goods and services provided by nature) only takes into account the cost of labor and gear involved in the extraction process and does not take into account the services nature provides into growing the resources. Their is no capital investment as in aquarium or culture fisheries. Also no management costs are incurred since the capture fisheries remain open access.

[1] To calculate the tuna value we have used lakshadweep canning factory rate that pays Rs. 35/kg of tuna. The price is much higher if we calculate based on Market price of Rs. 150 payed by islanders for fresh tuna and the rate for 1 kg of maldive fish sundried tuna is Rs. 350 or Rs. 70/kg. Market value of most fish is around Rs. 80 and Seer fish fetches Rs. 180/kg

6. Coastal and Marine Activities: Tourism

The goods and services provided by coral atolls include natural scenic beauty, white sandy beaches, coconut palms, a safe lagoon to swim and snorkel, coral reefs with the multitude of colorful corals and fish which attract scuba divers and nature lovers from all over the world. Coral reefs therefore have a great non extractive market value as well.

In this chapter we will look at the growth of tourism in Agatti Island and the changing perceptions and attitudes towards tourism.

Agatti islanders were the first to experience International tourism in Lakshadweep. The first international resort, with scuba diving facilities was set up at Bangaram in 1988 and an airstrip was built at Agatti Island, for easier access and to help promote tourism.

In 1988, the mindset in the administration was low volume, high value eco-tourism. They felt that for scuba and beach tourism to be sustainable, it should only be in encouraged in uninhabited islands, so as not to hurt the sensibilities of the conservative Muslim population and not to overburden the limited fresh water and electricity resources on the inhabited islands. This was strictly followed until 2009.

The land in Bangaram, Thinnakara, Parellii, Kalpitti and Agatti is owned by Agatti Islanders. This land cannot be bought by non Islanders. Therefore to start a resort the land has to be leased from the land owners with intervention from the lakshadweep administration. The procedure is that the Lakshadweep Administration, leases the land from the islanders and then calls a global tender and re-leases the land to the highest bidder. Currently the resorts pay a 4% royalty and 22% of the gross turnover to the Lakshadweep administration/SPORTS.

There is currently no clear policy for tourism promotion and hence no one knows where they are headed.

6.1 Profile of the Resorts

CGH earth, Bangaram Island Resort (1988-2009)

The first International tourist resort with a scuba diving centre was set up at the uninhabited Island Bangaram in Lakshadweep in 1988. The dive centre was operated by a German national and the resort was operated by the Casino group of hotels. The CGH earth group did their marketing well and Bangaram Lakshadweep became an international tourist destination.

The resort had 30 guest rooms, 60 bed capacity and followed a high value, low volume, Responsible eco-tourism philosophy. They tried to minimize the carbon footprint by offering no air conditioning or tele communication facilities. Rain water was collected for cooking and drinking. Tourists were constantly reminded to conserve water resources and they also set up a waste water treatment plant. This resort catered for international and national tourists looking for an island experience relaxation and adventure. It offered yoga and Ayurvedic treatment for relaxation and Scuba diving, snorkel and fishing trips for the more adventurous.

The resort had a turn over of Rs. 69 million, with an average occupancy of 90% during the high season and 50% during the monsoon season.

The resort had a staff of 60 people of which 54 were Islanders and 6 from the mainland.

The resort was very popular amongst the international and national tourists, who were very satisfied by its service and several guests returned to stay at the resort more than 5 times during

its operation. This resort had to stop operating in September 2009 when administration would not renew their lease when it came up for renewal. The case is now in litigation since 2009, causing difficulty to tourists, and the livelihood of the islanders who were directly employed and indirectly dependent on the income earned from the resort by providing goods and services.

Bangaram Island, is owned by the people of Agatti, who leased their land to the Lakshadweep administration. The administration in turn leased out the land to Casino group of hotels (CGH) Earth and the AIBER resort. The lease comes for renewal every five years. The lease amount at the time closure was a minimum amount of Rs. 75,00,000 or 22% of the turnover, which ever is higher. The resort owners paid SPORTS Rs. 15.3 million, during its last year of operation.

Agatti Island Beach Resort

Times changed slowly and in 1996, a second resort came up at Agatti close to the airport. This resort area is leased from the lakshadweep Administration by a Amini Islander and has financial backing from the mainland. Lease is renewed every five years. They had to pay a lease rent of Rs 8,00,000 per year or 22% of the profit, which ever is higher.

The AIBER dive centre was run by foreign nationals until 2008. This resort has 30 rooms and small conference facility. This resort offers both air-conditioned and non air conditioned rooms. Since fresh water is short in supply they have constructed a 200,000lt capacity rainwater harvesting tank. This water is used for cooking and drinking. This was the only resort that was fully operational during the SOCMON and hence the tourist arrival only reflects this resort. Tariff offered is around Rs. 12.000/ room.

The Resorts lease expired in October 2011, they also went into litigation with the administration and had to stop operating in March 2012.

Other Resorts, lodges and Home stays

By 2010 the Lakshadweep Islanders, have begun to see tourism as a lucrative income earner. To maximize their earnings, they have started buying land and locating a marketing partner on their own. There are currently five resorts in the pipeline awaiting clearance from the administration.

Coral Paradise

This resort is owned by an Agatti Islander. They have built six rooms, with plans to extend once they get clearance from the administration. The guests at the resort get the entry permission as private friends of the owner.

Sea Shells

This resort started operation in December 2010. The resort owner is a person from Androth. 10 rooms have been built with a plan to extend it to 40 rooms and a 80 bed capacity. All the rooms have big glass windows, ensuring the need for air conditioning.

For fresh water they have also set up an RO plant with a capacity to desalinate 10,000 lt per day. The water being treated is from a well on their premises. They also arranged for an Agatti well owner to supply them with 3000 lt at the rate of Rs. 25,000/month from the northern side of the island on a daily basis. This was stopped in August 2011 as the residents filed a complaint to the administration.

The Lakshadweep administration has not yet authorized these resorts, but they continue to function. The manager mentioned that it was running to 70% capacity between December and

April 2011. The guests at both the resort get the entry permission as private friends and relatives of the owner on a declaration from the Dweep Panchayath.

Home stays

There are three families offering home stay. They have built a seperate home for tourists for this purpose and charge between Rs. 2000 to 3000/-per night, per room. They get their tourists as both private guests and through SPORTS.

Lodges

Their are three lodges in Agatti, with a total of 8 rooms, that cater for the people who come to Agatti for short stays on work. They charge around Rs. 200/-per day.

6.2 Tourist Profile

The tourist profile is based on an analysis of tourists arrival and departure at the Agatti Island beach resort from the period 13th February 2010 to April 30th, 2011.

From Figure 6.1 we can note that a total number of 5402 tourists arrived during the period from March 2010 to April 2011. Of this 86 percent were from India and 14% from other parts of the world. The Indians stayed for an average of 2 days and the foreign tourists stay an average of 4 days. The keen scuba divers tend to stay one to two weeks.

Figure 6.1 proportion of Indian & foreign tourists

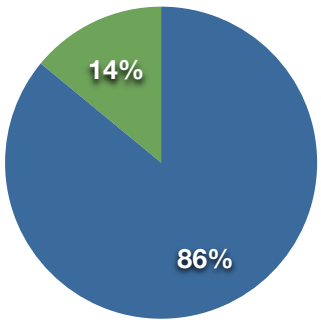


Figure 6. 2 length of Stay at Agatti

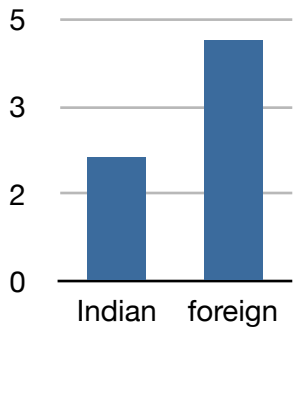


Figure 6.3 we can note that the International tourists came from 29 countries. The largest percentage is from European countries: Germany, Italy, France and U.K, followed by Switzerland and Sweden. The International tourists include expats living in India. The expats stay for 2 to 5 days and explore Scuba diving opportunities.

Figure 6.4 , depicts the tourist arrivals from within India. Tourists have arrived from 20 States and three Union Territories. They have come from as far of Assam and Jammu to spend two nights in Lakshadweep. The highest number come from Kolkatta and New Delhi.

Figure 6.5 shows the monthly arrival of tourists. We note that their is a steady flow of visitors through out the year. The main season is from October to April, when the weather is good and boating and scuba diving is possible. The resorts offer a discount in the off-peak season from May to September.

Figure 6.3 Origin of International Tourist

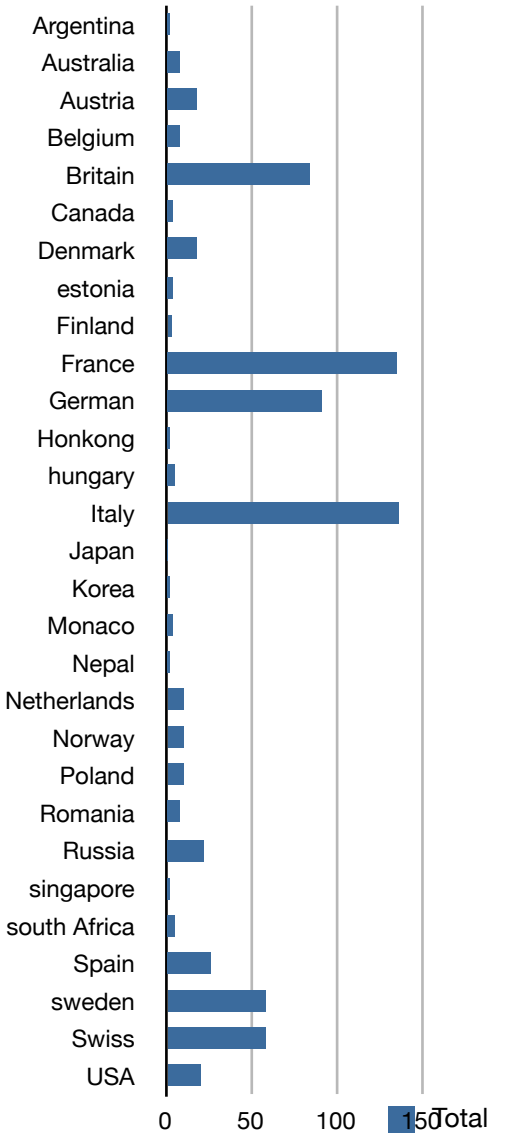


Figure 6.4 Origin of Indian Tourists

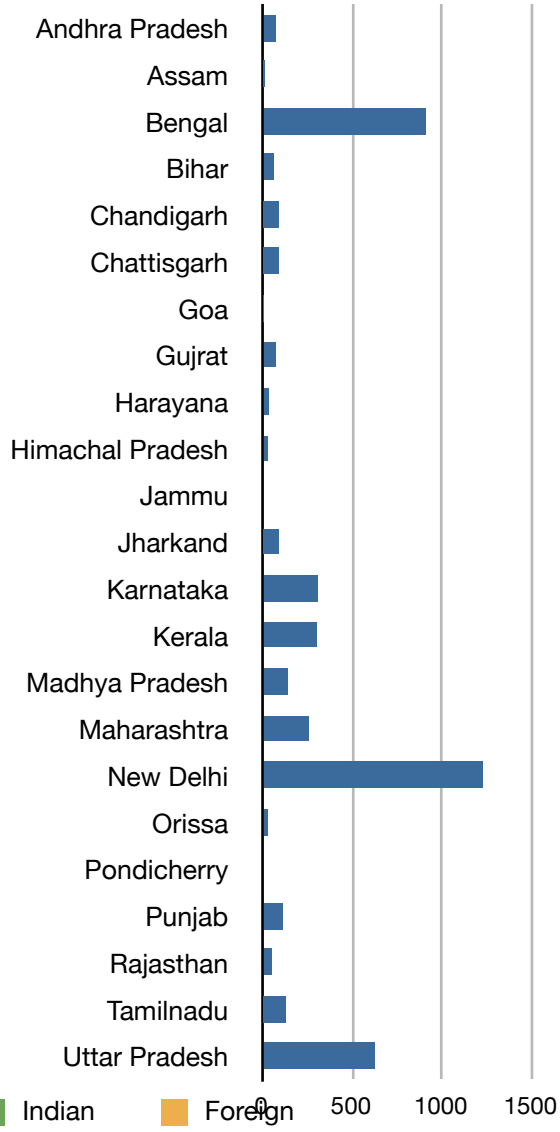
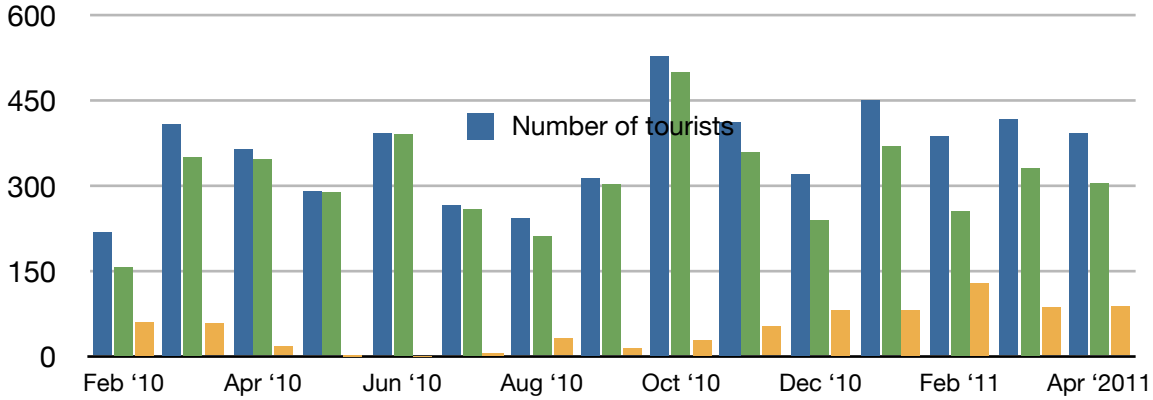


Figure 6.5 monthly arrival of tourists from feb 2010 to April 2011



A discussion with the tourists and Resort Managers revealed that most of the Indian tourists who visited Lakshadweep, were government employees availing LTC (leave Travel Concessions) scheme. Under this scheme the Government covers the holiday travel any where in India, once in 4 years for the government servants' family. They stay for one or two nights only. The prime

reason for traveling to Lakshadweep is to avail a high LTC, these tourists have ensured keeping the resort occupied throughout the year. They are not aware of scuba facilities.

6.3 Scuba Diving and water sports

The first Scuba diving centre in Lakshadweep opened in 1989, as part of the Bangaram Bangaram Island resort. At this time there where no Indian Dive Instructors and scuba Diving was

Table 6.3 Scuba diving facilities in Lakshadweep		
Year Started	**Dive Centres in Lakshadweep**	**Instructors Nationality**
1988	Bangaram Island resort dive centre (1988-2002)	German
	Bangaram Island resort dive centre (2003-2009)	Indian (Laccadives)
1997	Kadmath Dive Centre	Indian (Laccadives)
1997	Agatti Island Beach resort (1997-2005)	U.K/Indian (Goa Diving)
	Agatti Island Beach resort (2006-2009)	German (Dive Line)
	Agatti Island Beach resort	Islander (Dive Lakshadweep)
2010	Sea Shells	Islander (Lak Lagoona)
	Kavartti (2001) Minicoy (2006)	Islanders (SPORTS)

relatively unknown in India. The dive centre was run by a German national. When he quit in 2002, an Indian company called Laccadives took over the dive centre in Bangaram. Laccadives also ran a dive centre at Kadmath Island from 1997 to 2012.

Figure 6.6: Dive Sites around Agatti Island

Figure 6.7 Dive Sites frequented april 2010-May 2011

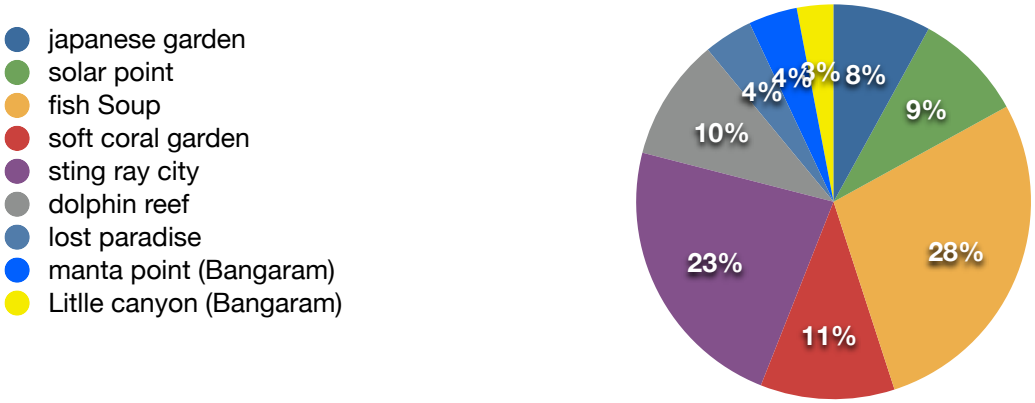
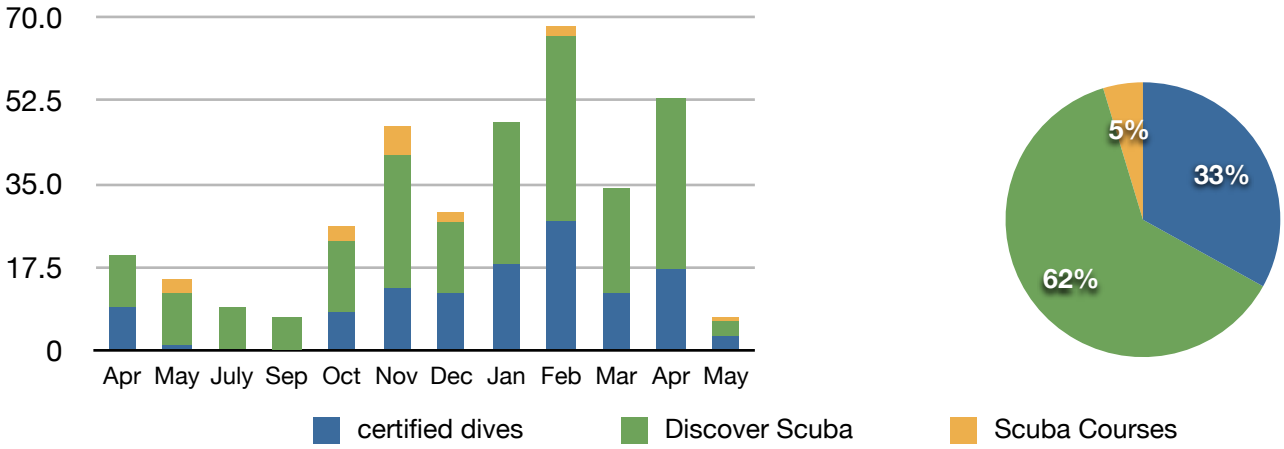


Figure 6.6 depicts the dive sites around the Island and figure 6.7 intensity of diving at these sites from Mar 2010-May 2011. Fish soup on the eastern side and Sting Ray City on the western reef are the sites most frequented. All the scuba divers are first taken to these two sites. If they opt for more than two dives they are taken to the other dive sites around Agatti. Scuba divers who opt for six or more dives are taken to dive sites near Bangaram.

Figure 6.8: Certified, discovery and Dive courses dives april 2010-May 2011



The dive center provides training in open water scuba diving, open water scuba opportunities for certified divers and discover scuba for non divers. From figure 6.8 we can note that, 62% of the clients do take up the discover scuba, 33% do scuba dives and 5% take up scuba courses.

Figure 6.9: Foreign and Indian nationals who did Discover Scuba

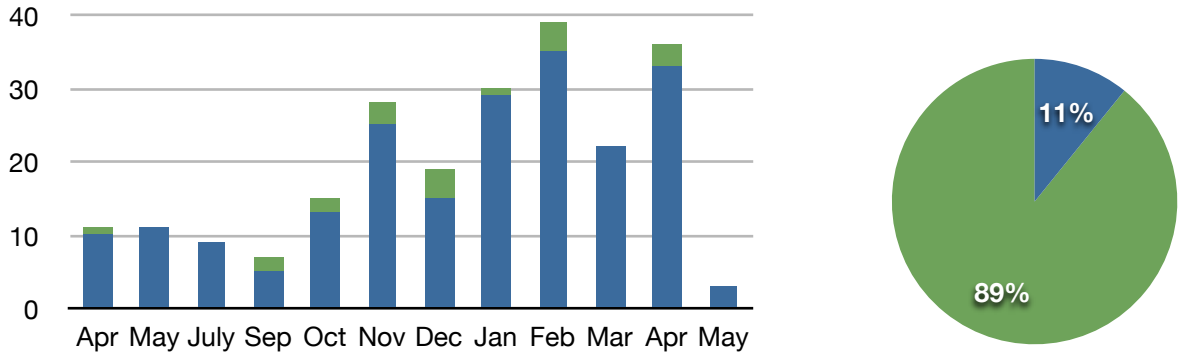
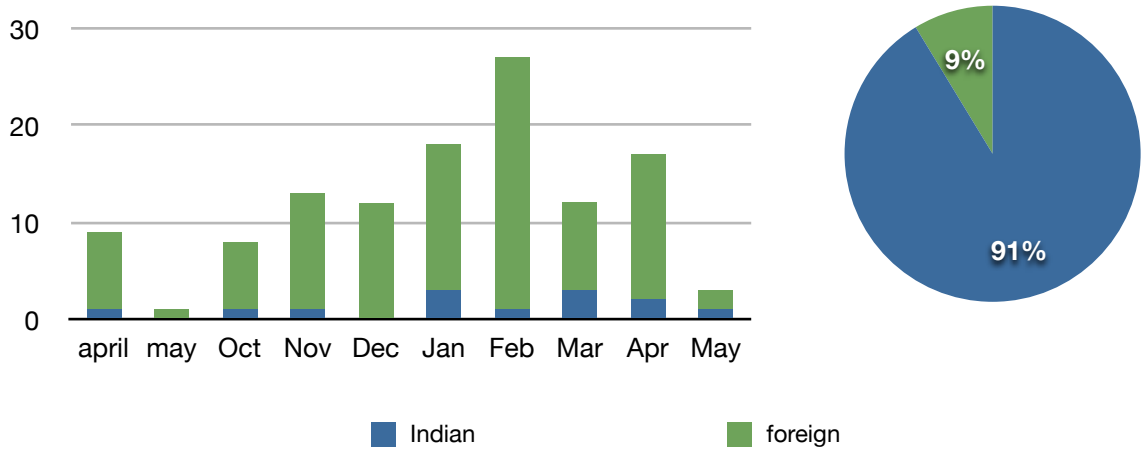


Figure 6. 10: Number of Certified divers



Figures 6.9 and 6.10 show that the main clients for scuba diving are certified divers from foreign countries. We can note that 89% of the certified divers come from foreign countries. This may change in the future as we note that most of the courses are taken by Indians and 91% of the clients who take the discover scuba dive are Indians. This shows that there is an interest amongst Indians, in taking up scuba and discovering the underwater world.

6.4 Conclusion and discussion

Lakshadweep is administered by the Central Government as a welfare state and the rights of Islanders are protected through the entry rules. Non Islanders have to get an entry permit to visit the Islands. Outsiders cannot buy land in the Islands. All activities are heavily subsidized by the government, education and health services are given free of cost to the islanders.

Box 6.1 Stakeholders in Tourism

- **Lakshadweep Administration**
- **SPORTS (Government owned)**
- **Resort Operators**
- **Home Stay Owners**
- **Lakshadweep Islanders**
- **Agatti Land owners**

Tourist operations are controlled by the administration through SPORTS (A government controlled Marketing Society). They directly run the operation or lease the resort out to private entrepreneurs. The land owned by the islanders is leased out to the Department of tourism, who is responsible for providing infrastructure and re-leases it to interested parties through a global tender. Tourism which was thriving (Hoon et al. 2002, 2005) is in a state of limbo in 2012.

The Lakshadweep Islanders are no longer isolated as twenty years ago. Twenty years of exposure to outside influences and greater contact to both national and international markets. As livelihood opportunities are limited and employment in Government jobs has reached a saturation point. The people are looking for increasing their income. In the case of tourism, profit is the main motivation to start resorts and lodges at Agatti. The Islanders are now capable of finding their own marketing partners. They no longer want to follow the pattern of leasing the land to the Lakshadweep administration and have them as middle men. They now wish to do direct marketing and maximize their own profit. In 2010 the local administration had also encouraged local entrepreneurs to set up home-stay tourism and dive centers. All the initiatives are still waiting to obtain various clearances to make a clean start.

The Bangaram Island operations, which was the success model in Lakshadweep tourism is not operational since 2010 and the Agatti resort started in 1996 had to stop operation in January

2012. Both are in a legal battle with the administration. A privately owned resort started in 2011 with 10 rooms is functioning with a legal stay order. This resort received no clearances from the local administration. One issue is that the land owned by islanders is at a premium and a few better informed and connected Islanders are speculating in land, by either buying or leasing the many small plots owned by several poor islanders. The land owners want to work Independently with the resort leasers and not have SPORTS as the go-between. They are however hampered by the entry permit rules. All tourism activities are being put at a standstill until the administration can figure out a way forward which will ensure equity to all the stakeholders and not just a few.

The problem with money being the main denominator is that, the enterprise is not sustainable in the long run. For example one of the resorts bought 3000 liters of water per day from a well owner in the North to meet the fresh water needs of the resort. He was paid Rs. 25,000/-per month. It shows that money rules and the resort owner and the water supplier are totally insensitive to the limitations of the Island environment. While the people who cause this threat benefit from the unsustainable practice, the costs are borne by the others who depend on these natural resources for their survival.

The livelihood of the dive centre's is also at risk since they depend on tourist arrival at the resorts. They have to turn down clients who wish to do a dive course since the dive centers are not entitled to apply for permits to visit Lakshadweep for their clients.

The dilemma seems to be one on how to ensure equity. Equity between the Islanders and for the visitors to Lakshadweep.

With adventure sports picking up in the country and many youngsters have taken to scuba diving, the demand for scuba diving courses and access to dive sites in Lakshadweep, is growing. There is a need to develop both expensive resorts and less expensive facilities for the visitors. The things to be ensured is that neither facility impinges on the ecological services provided by the natural environment. The resorts should be small and visitors should be made to understand the limitations of living in Lakshadweep.

Here is an opportunity for Lakshadweep to develop community based responsible tourism in association with recognized and established operators. The Lakshadweep administration should put its energy into Governance: management and monitoring that, policy rules are met by the resort and dive operators. It is preferable that they do not conduct the business themselves but provide an enabling and structured environment for private enterprise to come up.

7. Community Attitudes and Perceptions on Marine Protected Area Management and Conservation measures In Lakshadweep

There are no Marine Protected areas in Lakshadweep. However Agatti Island has been a focal point for several conservation efforts and research studies for Turtles, Corals, and Giant Clams since the year 2000. The NGO's CARESS and NCF had floated the idea of establishing No take zones with the fishers and Agatti Islanders in 2004. Subsequently BNHS tried to established the first Community Conservation Reserve for Lakshadweep in Agatti. Understanding the attitudes and perceptions of people towards the goods and services provided by the coral reef ecosystem is useful to understand what action can be taken to increase management effectiveness and peoples compliance. A survey of 200 random individuals was conducted to understand their attitudes and perceptions towards conservation and MPAS

7.1 About the survey respondents

A total of 200 randomly selected individuals between the ages of 15 to 60 were surveyed. 70% were males and 30% were females (Figure 7.1). The respondents were from all backgrounds as shown in Figure 10.2.

Figure 7.1 Percentage of Males and Females

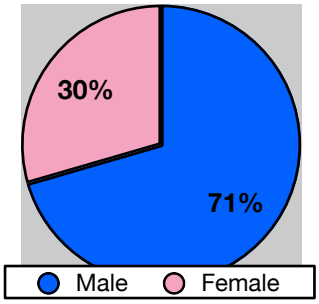


Figure 7.2 Occupation of Respondents

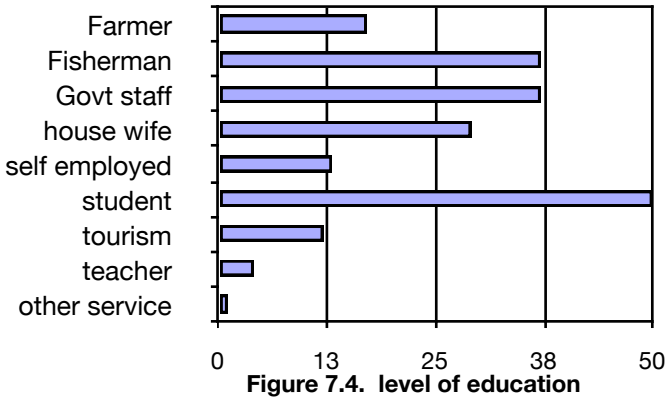


Figure 7.3 Respondents Income

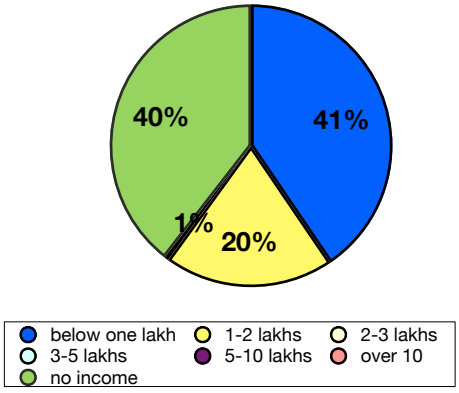


Figure 7.4. level of education

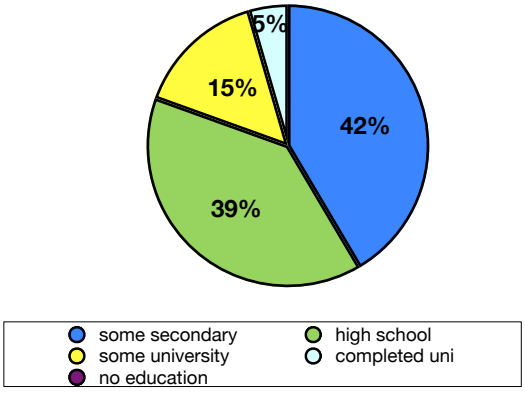


Figure 7.3 shows that 40% of the people have reported no income as they are homemakers and students. Forty-one percent have reported an income of below Rs. One lakh. Twenty percent had an annual income in the range between Rs. 1-2 lakhs, one percent had an income in the range of Rs. 2-3 lakhs. One person had an annual income in the range of 5-10 lakhs and one person had an annual income over ten lakhs. Figure 7.4 shows that the respondents had some secondary and high school education. 15% had dropped out of University and 5% had completed their degree courses.

7.2 Survey Results and Discussion

The results of the local perceptions of an MPA showed that all the people interviewed understood the Marine Protected Area concept. They said that an MPA was a marine area that was set aside to allow coral reefs and their associated species to regenerate and Islanders should not use this area for fishing or any other extractive use. 100% were aware that corals, turtles and giant clams were protected under the law and that collection was a punishable 90%.

Benefits of MPA

The respondents were asked what they saw as a benefit of an MPA for themselves as an individual and for the community as a whole. 90% of the respondents perceived the benefits shown in table 7.1 from establishing a Marine Protected area. 43% of the respondents felt that MPA's would help in protecting their island home. 41% wanted protection so that some areas would remain pristine (23%), for the future generations to enjoy (18%).10% perceived that it would help in improving their personal livelihood and 30% of the respondents felt it would help improve livelihoods of artisanal fishers.

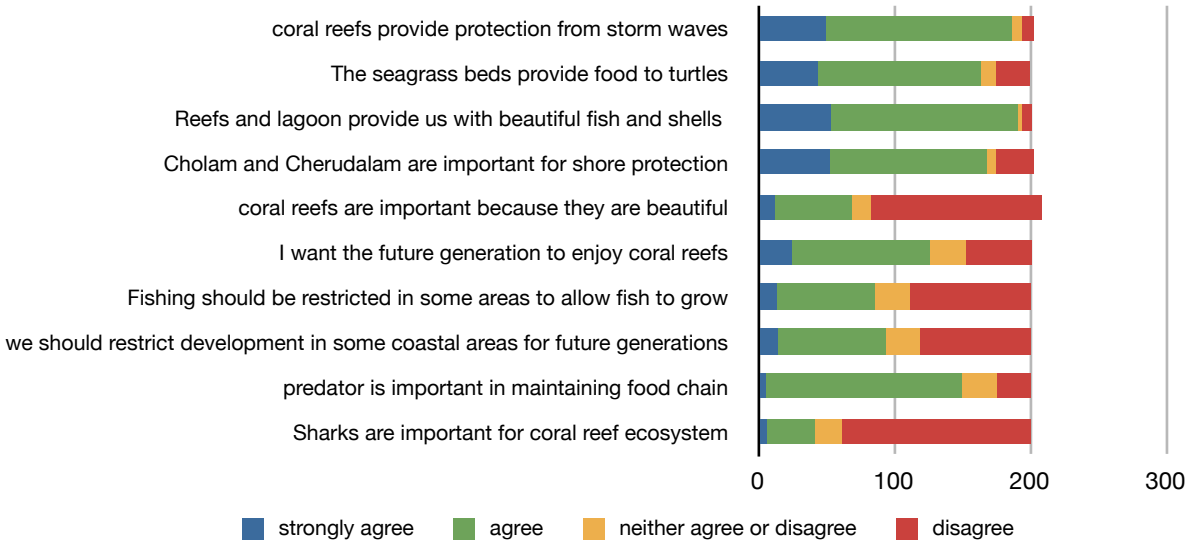
Table 7.1 Benefits of Conservation and MPA

	Individual	Community
1	it will protect my home (43%)	it will protect the homes of all the islanders
2	Our future generations will be able to enjoy pristine coral reefs	the livelihood of future generations will be protected
3	Personal satisfaction that an area is protected	Improve livelihood for artisanal fishers, tuna fishing and tourism

Non Market and Non use values of Agatti Islanders

The respondents were given a number of ecological statements and were asked to on a scale of 1-10 agree strongly, 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 responses to the statements show the importance of the environment and biodiversity to the islanders.

Figure 7.6 Agreement level with Value Statements

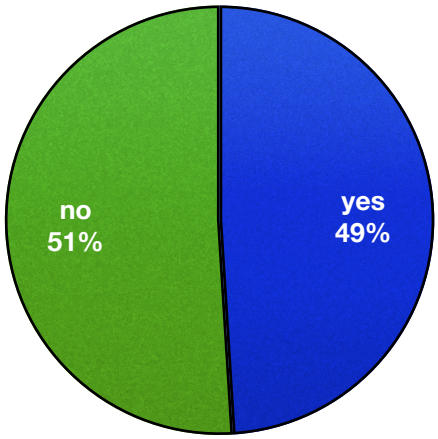


However it should be noted that conservation at the expense of development was not favourable

to the local people. The aesthetic beauty of coral reefs do not seem to be appreciated by the islanders most probably due to low level of interaction with the reef for recreation purposes. There was strong agreement that coral reefs provide protection from storm waves. They also agree on the importance of the predator in maintaining the food chain. However the respondents tended to disagree towards statements that introduce restriction or hint at conservation especially with regard to sharks. The highest percentage of disagreement was with the statements that coral reefs are important due to aesthetic reasons, that fishing should be restricted in some areas and that coastal development should be restricted for future generations respectively and that sharks are important for maintaining the coral reef ecosystem

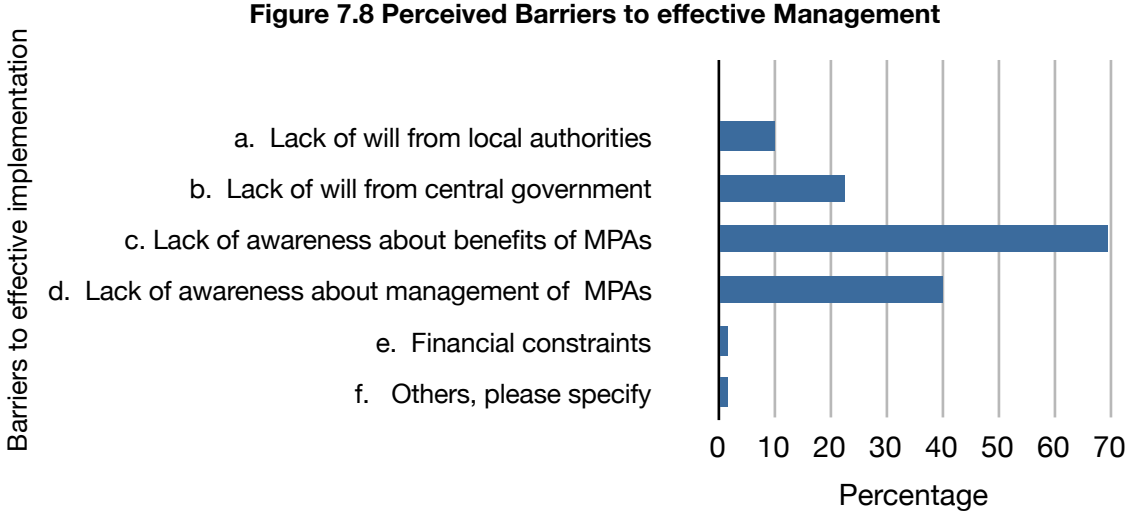
While the respondents felt that it would be good to establish MPA's they were doubtful about the management process and effectiveness. Figure 7.7 shows that 49% said that it could be managed effectively and 51% felt that management would not be effective.

Figure 7.7 Can MPA's be managed effectively



The Respondents felt that the Management and conservation measures were not effective for various reasons as shown in Figure 7.8. Most of the people felt that lack of awareness about the benefits and management of MPA's was the main barrier towards effective management. Lack of will from the authorities

Figure 7.8 Perceived Barriers to effective Management

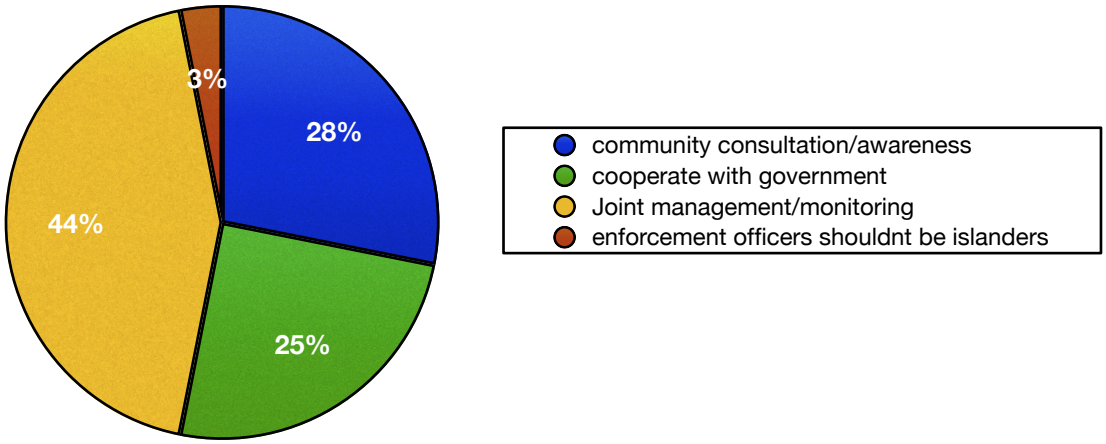


was perceived as a reason. Financial constrained was not perceived as a barrier and In others a few people specified that the enforcement officers being islanders themselves they cannot be effective especially when their relatives and friends are involved in collecting construction materials.

When asked about what could be done to improve management effectiveness forty percent had no idea on what to suggest for improving management. Percentages in Figure 7.9 represent the responses given by the other 60%. They have put forth a strong case for community involvement, consultation and awareness.

One of the hindrances to effective management was the lack of a management plan of coral reef

Figure 7.9 How can we Increase Management Effectiveness



resources. While some people instinctively understood the value of a no take zone, they felt that their should be targeted awareness building towards all stake-holders that operate in the marine area. Including officials, fishers, coast guard and Navy. They felt that their was a greater need for the people to support and co-operate with government action and that such support would increase if the islander stake-holders had greater participation in management.

8. Governance

8.1 Management body

Lakshadweep is a Union Territory and it is under the direct administration of the Union Government. At the Union Territory level, Lakshadweep Administration - is the over arching authority with powers vested from the Central Government. The Administrative head is the Administrator of Lakshadweep. Below him is the Collector cum District Commissioner, who is also the secretary for several key departments of the administration. He is assisted by 36 department heads and their staff. The same bureaucratic model as the rest of India is also followed in the UT of Lakshadweep. Until 1990 most of the staff employed came from the mainland; today Islanders fill several of the department posts. The top Administration staff comes on a posting to the Islands with a tenure for 3 years. The top administration comprises:

a. Island Administrator (IAS)

b. The District collector cum Development Commissioner

c. The Secretary Environment

d. Officers (Danics)

e. The Superintendent of Police

The other posts are filled by native Islanders. Key posts such as the director of fisheries, tourism, science and technology often remain vacant. They are managed by a deputy director or acting director, who is usually an Islander. Frequently one department head holds an extra charge of another department.

The Lakshadweep has the authority to issue permits to visitors to visit Restricted Area of Lakshadweep) Permits holders are allowed to visit the island for the time specified on the permit. This restriction controls all market forces and presence of people from outside.

8.2 Management Plan

All the departments in Lakshadweep administration have to make a 5 year plan and budget allocation for their activities. These however deal with departmental functioning and there is yet no Management plan to manage ecosystem goods and services. There is also no marine protected area set aside in Lakshadweep. The Coastal Zone management Plan (appendix 8.1) is the overarching management plan that applies to all activities that take place on the island.

An Integrated Island Management Plan (IIMP) for Lakshadweep is being prepared. This will supersede the CRZM

Environment Impact Assessment (EIA) is carried out before carrying out any development activity. An environment clearance certificate has to be obtained from the Department of Environment

8.3 Enabling Legislations

Several acts provide for regulation of activities potentially influencing the management of ecosystem goods and services in UT of Lakshadweep. These acts are presented in Table 8.1.

The 1972 Wild life Protection Act was first to include corals as a protected species. This act has been amended in 1974, 1986 and 2001 to include more species from coral reefs under schedule A, for protection.

In 1991 a coastal zone regulation Act of 1991 that declared coastal stretches as Coastal Regulation Zone (CRZ) and regulated activities in the CRZ was passed for all India coverage. The Lakshadweep Administration modified the CRZ in 1996 because if the CRZ was to be strictly followed no one could inhabit or carryout any activity in Lakshadweep. The 1996 CRZ notification states that:

“coral stones, shingles / boulders and sand from the beaches and coastal waters are not allowed to be removed or disturbed. (The collection of corals is allowed for scientific studies/ for museum specimens with specific permission from the competent authority)”.

A note was attached which said

“ Note: Till such time an alternate building material is available collection of shingles from the beach in regulated manner is allowed with specific permission from the competent authority of Lakshadweep Administration.”

Table 8.1 Enabling Legislations
Wild Life Protection Act, 1972
1. Wild (Life Transactions& Taxidency) Lakshadweep rules 2. Lakshadweep Wild Life (Stock declaration) Rules. By Ministry of Agriculture, GOI, New Delhi – Nov, 1973.
Coastal Zone Regulation by Ministry of Environment and Forests, GOI, New Delhi 19 Feb,1991 This regulation financed under section – 3 (1) and section – 3 (2) of the Environment (protection) act 1986 and Rule – 5 (3) of DoE (Protection) rules, 1(CRZ) and regulating activities in the CRZ.
Coastal Zone Management Plan for UT of Lakshadweep by DSTE, Kavaratti 20th Nov, 1996.
Lakshadweep Protection of Corals By-laws. Published by the UT of Lakshadweep Administrtaion (DST&E), Kavaratti 4 Aug, 1998. For protection of the coral to preserve the environment of Lakshadweep Island. This law framed on basis of the regulation 82 (1) (g) of Lakshadweep Panchayat Regulations, 1994) Lakshadweep Protection of Corals(Amendments) to By-laws. Regarding collection of coral shingle, boulder and sands etc. and declaring coastal stretches as coastal regulation zone (CRZ) and regulation of activities within the CRZ. Lakshadweep Sanitation Conservancy By-law. Prohibiting the use of Non biodegradable wastes hazardous to the Islands.
The Lakshadweep Marine Fishing Regulation no 3 of 2000 published by the Ministry of law Justice and Company Affairs (Department of Legislatives) New Delhi: 21st September, 2000. This regulation provides for the regulation of fishing and fishing vessels in the lagoon and sea around the UT of Lakshadweep. The LMF Regulation has clear instructions as to the extent of territorial waters in the ocean surrounding the reefs and lagoon of Lakshadweep islands and the kinds of gear that can be used. (appendix 8.2) The Kinds of fishing gear may be regulated, restricted or prohibited: in any specified area under clause (d) of sub section (1) of section 4 namely a. Purse - Seine b. Ring Seine of 2mm mesh size and below c. Pelagic Trawl d. Mid water Trawl e. Bottom Trawl f. Drift Gillnet of 50 mm or below g. Shore Seine of 20 mm mesh size and below in the specified area
The Lakshadweep Marine Fishing Regulation & Rules by Lakshadweep Administration (Department of fisheries) Kavaratti – 24th February, 2001. According to this fishing by a ship or boat fitted with mechanical means of propulsion may be regulated, restricted or prohibited in any specified area under clause (b) of the sub- section (1) of section - 4. Notification by the Ministry of Environment, Friday December 21, 2001
Ministry of Environment and Forests Notification dated January 2011 on the management of costal zones and Islands

The Lakshadweep Administration modified the 1996 ruling that banned the use of coral for building material. The notification number 17/2/98 says that while boulder collection is banned, people can collect shingles by obtaining a permit from the environment wardens. Non-permit holders would be regarded as offenders. The environment wardens have the duty of issuing permits and punishing offenders.

In 1998 another notification was issued, stating that people desirous of collecting shingle need to apply for a permit and remit Rupees 5/- per 20 kg bag of that they wished to collect.

In 2011 the CRZ notification has been modified for islands and Island authority have to prepare and Integrated Island Management Plan.

8.4 Management Resources

The department of Environment is responsible for management. The Chief Conservator of forests is the head of the department. He is assisted by environment wardens, There is one environment warden posted in every inhabited island.

8.5 Informal Tenures (customary Traditions)

Traditional customary laws in Lakshadweep deal only with harvest sharing and there appear to be no customary practices towards reef protection. Customary traditions are listed in Hoon et al 2002, Agatti's marine resources are considered as open access common pool resources. All islanders have equal rights to withdraw resources. People from other islands do not pay heed to local customary laws as breaking them is not a punishable offense. This sometimes leads to disputes.

Fishing grounds are still referred to by local names. Fishers use the lagoon's resources on the principle of 'first comes first served'. When the lagoon's fishing grounds are all taken, late-comers go to other lagoons at the expense of increased transportation cost or retreat from harvest that time.

Two nets are not placed in the same area at the same time. The number of boats fishing from a shoal is determined by the size of the shoal. There is a silent assessment, understanding and space sharing among boat operators. Disputes are avoided.

The catch gets divided between the team members and boat owner. The boat owner gets 50% of the catch, the crew shares the other 50% equally divided.

In olden days elders dictated a set of unwritten codes. The 'Karanavars' of the 'Tharawads' determined property rights. The unwritten codes regulated freshwater use, cleanliness and sanitation, law and order, collection of construction materials and fishing and lagoon use rights. Later on the 'Amin' decided on the fishing grounds and made allocation to the fishers who approached him for permission. In return, the Amin was then presented with one or two of the best fishes in the catch.

There are no seasonal or gear restriction in Agatti unlike in Minicoy where bait fish harvesting is regulated by voluntary restraints. 'Bodhi' is a resident baitfish in the Minicoy's lagoon. Fishermen observe a voluntary seasonal restriction of collecting bodhi or live bait from May-November 15th. Even if the tuna fishing season starts early, the 'bodhi' gets collected only after Nov 15th. This practice makes sure sustainable live bait harvest. Although tuna fishing was introduced by Minicoy fishermen to Agatti, this and other similar customary laws on sustainable resource management did not get transferred or got ignored.

8.6 Community incentives

The fisheries department offers subsidies to the registered fishermen and in return they have to fill in their log books and provide data.
To reduce the pressure on coral based building materials, the administration provides alternative building materials from the mainland at a subsidized rate.

8.7 Stakeholder Participation and Satisfaction

Public hearings are held before starting any major development activity such as extending the airport or building the eastern jetty. The Right to Information Act also allows the public to get any information they so desire by applying for it from the administration.

The incentives listed in 8.6 are not strictly followed and the fishers continue to get their subsidies whether or not they supply data. Since enforcement is not strict the people continue to collect building material. Sometimes conflicts arise for the use of the same resource as shown in box 8.1.

8.8 Community and Stakeholder Organizations

A *Dweep Panchayat* was formed with democratically elected leaders in 1997. There are 3 blocks and 8 wards in Agatti, and the Chairperson is a woman (Umukulas). The Dweep Panchayat represents the political party in power and assists the administration. Welfare, employment schemes and Science and Technology projects are routed through the *Dweep Panchayat*.

Box 8.1 conflicts on resource use

Under LMFR fishing boats have to be registered in a particular Island and the boat is permitted to fish in the specified area of the island. For example boats registered in Kavaratti can fish around Kavaratti, Pitti and Suheli and Agatti registered boats can fish around Agatti, Bangaram and Perumal par. If a boat is desirous of fishing in another area then they have to change their base of operation to that island. This can be done through the authorized officer empowered under LMFR. Their earlier fishing license will be revoked. Every registered boat owner is required to submit his monthly statement, logbook, catch, operation cost including ice, diesel, engine oil, provisions, maintenance of the boat and areas fished.

Earlier fishing was confined to close to the island of residence. Now with the introduction of bigger boats, engines and better communication, navigation, ice and freezing facilities the fishing effort has increased as the fishermen have to explore further and catch more fish to make it economical to run the bigger boats and protect their investment.

This increased effort sometimes creates conflicts as fishermen move around in search of tuna bait. Recently a conflict arose between Agatti and Kavaratti fishers, when the Kavaratti fishers came to collect blue chromis (a tuna bait) within the Agatti Lagoon. They disregarded to customary traditions of Agatti and collected the bait from the northern part of the lagoon where accropora are thriving. Incidentally this is also the area that the Agatti Islanders had earmarked for conservation reserve under the BNHS project. The Agatti islanders were annoyed that the careless netting of the bait fish destroyed the habitat and also that other Island fishermen were catching commercially important reef fish such as snapper and grouper close to their reef. They are worried that indiscriminate fishing will lead to over-exploitation and reduce fish populations around their reefs. At the same time there was not much the Agatti Islanders cold do since Agatti fishermen are referred to as gypsies who follow tuna and will go and fish wherever the tuna shoals are seen. They fish in Bitra, Elikalpeni, Cheriyabani, Belliapani, pitti, suheli and androth - basically anywhere that fishing effort is comparatively less. Conflict with other islanders will result in them being unwelcome to other islands for fishing. As it is fishers in Androth say that whenever Agatti Fishers come to Androth they drive the price of fish down. (Jafer Hisham:2012)

other institutions that learn, store knowledge & experience are:

- Fishing teams (men)
- Cowry collection teams (women, men, children)
- Women Self-Help Groups
- Clubs: sport, arts (traditional dances and songs), nature (young men)
- Khadi Board' (part of Ministry Culture, promotes rural art, culture, cuisine, dances, crafts and related livelihood)
- Madrasas
- Schools (primary, secondary, tertiary)
- Political parties

8.9 Power and Influence

The power is in the hands of the government administration and this can be influenced by the political party in power.

9. Conclusion and Management Advice

The Socioeconomic monitoring SA has provided comprehensive guidelines to carry out socioeconomic monitoring in the south Asia context. The study has shown that the marine and coral reef ecosystems are vulnerable environmental resources that provide significant economic goods and services. The health of these ecosystems is critical to human well-being; they contribute to the livelihoods, food security and health of the Islanders. By accounting for marine ecosystem values in management decisions, we can sustain their flow of goods and services in the interest of current and future generations. The study has highlighted the challenges faced at Agatti Island, Lakshadweep which include:

- Rich biodiversity.
- Fragile ecosystem.
- Livelihood based on natural resources.
- Highly vulnerable to Climate change.
- Unique society and Values
- Remoteness

It is clear that the economy and social wellbeing of the people of lakshdaweep is closely entwined with the ecosystem goods and services provided by the marine environment. A healthy reef means better livelihood prospects in fishing and tourism. From the social profile of the Agatti Island it is evident that the people rely on the marine environment and related industries such as tourism and fisheries for their livelihoods and sustenance. Thus the importance of appropriately managing the natural resources and at the same time building the people's resilience, with the capacity to take up other livelihoods is the crucial for the management of the ecosystem goods and services.

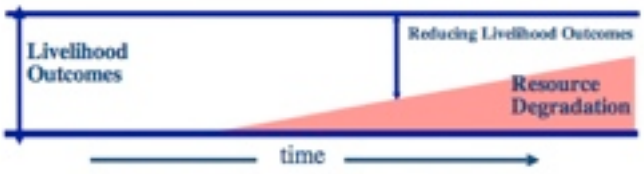


Figure 9.1: Reduced livelihood outcomes caused by long-term resource degradation.

Figure 9.1. 9.2 and 9.3 (IMM:2008) show the need for addressing livelihood issues in step with managing and conserving ecosystem goods and services. Figure 9.1 shows the commonly seen scenario of reduced livelihoods because of degraded resources. As time passes and no management measures are put to place both the ecology and economy of the area will collapse.

Figure 9.2: Where people are unable to adapt to changes in resource access they are likely to find their livelihood outcomes are reduced as a result.

Figure 9.2 shows that when environmental protection and management measures are put in place, there is a reduced livelihood outcome in the short term but longterm benefits are derived from conservation for the society as a whole. However from the point of view of the subsistence users and the poor the short term loss will be even greater that gradual decline of resource access from environment degradation. This is because they have limited capacity and skills to adapt to other livelihoods.

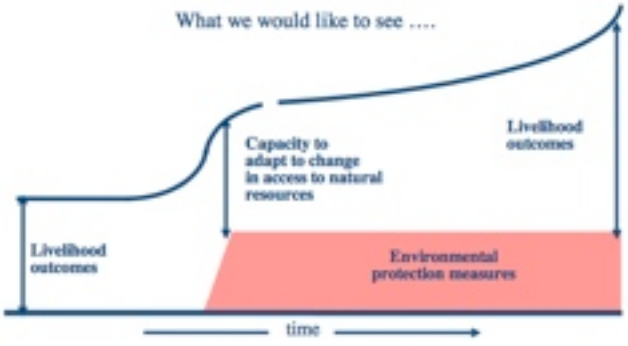


Figure 9.3: People who have the capacity to respond to change can cope with and even capitalise on the introduction of environmental protection measures.

However, when the peoples capacity to adapt to change is increased, in step with environmental protection measures it can result in a win win situation and increased livelihood outcomes in the future.

What is clear from the study is that a continuous dialogue is needed with the

islanders and targeted awareness building is necessary to change perceptions especially about threatened animals such as turtles and sharks.Table 9.1 provides a framework for communication

Table 9.1 Framework for Communication and Adaptive Management				
Who needs to be informed of SOCMON findings and their Implication for planning, management, policy?	**What needs to Change?**	**What is the best Media to use?**	**Does this Media already exist?**	**Resources required?**
Government Departments relating to environment, fisheries, Welfare, Science and technology,	The way laws are made and enforced	printed reports power point presentation	YES	Knowledgeable people
Harbour wand PWD	Integration of activities in discussion with the department of environment and LCRMN of DST	printed reports power point presentation, discussion	some	Knowledgeable people on mitigation methods for coral propagation and shoreline protection.
Navy, Coast Guard, outsiders on the island other Islanders	Knowledge of local ecological conditions and local customary traditions.	Printed reports power point presentation	No	Manpower to document and preparation of the Media and to communicate with the target groups
Tourists	Do's and Donts while on the Island. reduce carbon footprint,	A talk on arrival Posters, Pamphlets, documentaries	some	
Islanders	attitudes and perceptions towards MPA, turtles, sharks and tourism	Posters, cable TV public meetings	NO	
Fishermen	attitudes and perceptions to wards MPA and fisheries	Posters, cable TV public meetings welfare schemes	No	

As protected areas are used as a tool for managing the natural resources, it is applicable both in the tourism and fisheries sectors. There is as yet no designated protected area in Lakshadweep. A community based conservation reserve at Agatti was suggested in 2009 under the giant clam BNHS project, which has not been implemented.

From the perceptions study it is evident that the Agatti Islanders have mixed feelings about Marine Protected Areas and their implementation. They can grasp the context and see the inherent good sense in keeping aside a MPA. However they are divided over wether MPA's can be effectively managed in Lakshadweep. Due to the geographical spread of the islands it is a huge challenge to implement management of ecosystem goods and services without the participation of the island community. Customary traditions of resource sharing and management are dying out with the introduction of new laws and notifications. It is the general opinion of the islanders that management can only be effective if the local community is involved and a partnership is developed between the administration and the local Islanders. The recommendations include:

1. Developing a Management Plan for managing ecosystem goods and services and implementing it
2. Including an MPA where possible so that a biodiversity stock can be maintained.

3. Educating the public to the benefit of MPA's, protecting sharks and other schedule 1 species and developing a consensus for their protection.
4. Including community partnership in Protected area management and monitoring.
5. Continuous dissemination of the results of the biological monitoring
6. Improve Enforcement and environmental management by providing more efficient manpower, equipment and financial resources to the managing authority.
7. Strengthen political will through education of decision makers of the tangible benefits of management.
8. Raise Awareness of customary traditions of each Island specifically traditions that aim to protect reef resources and fisheries.
9. Mitigation measures are needed to reduce the destructive effects of harbor activities such as channel deepening and building jetties. The current practice is to dispose the dredged material into other places within the lagoon thereby smothering corals. Instead of this the dredged material can be used of strengthening the shoreline and building the beaches.
10. When there is no choice but to destroy live corals for development activities, care should be taken to collect the live coral and use them for coral propagation in another area within the lagoon or outer reef slope.

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Appendices

Appendix 1 List of SOCMON workshop participants and trainees (held 17 to 27 December 2011)

Government / Panchayath officers

1. Ms Ummukulus (chairperson)
2. Mr. MP.Cheriya koya (Asst Director of Fisheries)
3. Mr. Abdul Rahman (Wild life Warden Dept of Environment &Forest)
4. Dr Praveen (Scientist Central Institute of Fisheries Technology Cochin)
5. Mr. Sulfiker (Asst Manager LDCL Mass making Unit Agatti)
6. Mr. OG Moosa (Curator Archaeological Museum)
7. Mr. FG Mohammed (IAP Agatti)
8. Valedictory function Mr Jalaludeen Island councillor
9. Cooperative Society secretary

List of Trainees

1. Noorul Ameen .TK
2. Koyamon.K.G
3. Rihana Beegam.K
4. Kadheeshoma.CP
5. Shahnas beegam.k
6. Hajarabeebi.MC
7. Bushra.MI
8. Amina.K
9. Abida.FM
10. Shahnas.K.P
11. Namsir Babu.MS
12. Zakeer Husain.CK
13. Naseer.KM
14. Mohammed noushad.K

Appendix 2. Key Sources and Information Sources of Agatti iIsland

	Variables	Information Source/ Key Informant/ Stakeholder	Method of Data collection
1	Study Area	ACRMN	Observation, secondary sources
2	Reef related activities Indigenous knowledge	Expert fishermen for tuna, shark artisanal and recreation.	Observation, SSI, FGD, Seasonal Calender, Location Map, Resource Map, Time line
3	Tourism	Sikandar Hussain, Kamaruddin, AIBER, SeaShells, CGH earth, Pykala, Indian Airlines, Tourists Officials from Department of Tourism and SPORTS	Interview, tourist arrival and dive records kept by the resort
4	Fisheries	Assistant Director of Fisheries and fisheries officer Tuna and Shark Fishers	Interview, reviewing regulations and fish catch data.
5	Island Stakeholders Island demography, literacy, occupation, percapita Income	Published statistics, DC office, Panchayath, Helath department Islanders	Secondary sources Survey and interviews
	Stakeholder Survey of MPA's reef condition, threats to reef	Islanders	Survey of randomly selected Individuals
6	Organisation & resource governance. Govt Laws and Acts, Customary Laws and traditions	Dept Science and Technology, 2002 Agatti report, Island Administration Island elders, Shamsuddin Maulvi, V.M. Shamsuddin, P.	Secondary and FGD Interviews
7	Traditional Knowledge	Expert fishermen for tuna, shark artisanal and recreation.	FGD, Resource Map
8	Community Services & facilities	Relevant govt departments	Publish information SSI Observations survey of shops
9	Business development	Business owners, Banks	SSI
10	Market attributes	Island records, LDCL, Resorts, Fishermen, public	discussion

Appendix 4.1 Household Questionnaire for calculating Income, dependency and attitudes to natures goods and services

Name of data collector

person interviewed

House name ward number

House owner's name _____ Male/female

Head of the household_____ Male/female

	Name	Age	education	work	income
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					

for source of income please differentiate between tuna, open sea and lagoon/fishermen

	Income calculation	daily/ monthly	yearly
	Government salary		
	private salary		
	Business		
	coconut trees		
	open sea Fishing (tuna/shark etc)		
	cowry/shells		
	fish received as gift/ recreation fishing		
	Total		

how do you use the lagoon, and reef resources

1	swimming.snorkeling/scuba		
2	relaxing on beach		
3	fishing recreation/subsistence		
4	collect cowries and shells		
5	octopus		
6	collect building material/ coral rubble/sand		
7			

what are the important threats to the reef?

How can we protect the reef?

What are the threats to your livelihood?

Do you agree to put aside a marine area for protection? yes/ No

What media should be used for awareness programs - 1.Audio/Visual 3. Written

Appendix 4.2 Occupational Livelihood groups within the community

Appendix 4.2 Occupational Livelihood groups within the community					
Occupational livelihood groups	**Typical combinations of household livelihood activities of these groups**	**No of peopleH. hold**	Characteristics of these occupational/ livelihood groups (gender, age/ houshold size/ethnic group etc	level of dependence on coral reef	poverty levels of these
coconut climbers	coconut climbing/wage labour	200	large families/ came from kiltan in 1946 / dont own land or coconut trees/dependence of others goodwill, caste dominated	90% for construction and food	Very poor low resilience
	coconut climbing/jaggery/ wage labour/fishing/cowry collection/	300	large families, Native to Agatti/ own some coconut trees/own house and land	90% for construction & food	Poor low resilience
	mainland	3	single men	low	high resilience
Subsistence fishers	Net/handline/coconut	200	large families, Native to Agatti/ own some coconut trees/own house and land	90% for construction & food	low resiliance
Artisinal fishers	barkas/country craft/net and other traditional gear	80	medium sized families, Native to Agatti/ own coconut trees/own house and land	90% for construction & food	medium
Tuna fishermen/ boat owner	Tuna and open sea fishing / coconut trees land house/ contractors	60	medium sized families, Native to Agatti/ own some coconut trees/own house and land	70%	wealthy
	boat team member/reef fishing	600	5-9 members in the family, native to agatti	100%	Medium/ poor
longline/ shark/	All types of open sea and lagoon fishing/ freezer sales of lagoon fish/ some land coconut trees copra/ pvt business/auto owner run cool bar, barber shop	4 boats 20 people	started as a research project by CMFRI to teach fishermen to use new standardised gear. now accepted by fishers hardworking, forward thinking, open mind	100%	medium
boat transport for goods and people tourist	boat transport/coconut landowners/pvt business auto rickshaw	8 boats and 16 people	medium sized families, Native to Agatti/ own some coconut trees/own house and land	70%	medium
Tourist Resorts	Business/ govt job/	5	speculation/belong to other islands/depend on a partner from mainland to finance and marketing	non extractive	wealthy
Dive operators	dive centre/salaried job	2	both belong to Lakshadweep and one of them is a native of Agatti.	non extractive	medium
Government Jobs	Government employment/ own coconut trees/ recreation fishing		Men and women working in government departments with salary and pension plans	low	Medium/ wealthy
private jobs	employed by private shops and businesses/ recreation/ spear gun fishing		young Male, few women, age groups 21-35, mostly school dropouts	medium	medium wealthy resilient
Contractors	construction/manju owners/ tillers. collect sand and shingle and import building materials from mainland		Male in the age of 35-50, 2-3 children, have money to invest, belong to Agatti	90% for construction & food indirectly	medium/ wealthy

Appendix 4.3 Current Market Price of Marine goods

	Price in Rs 2001	price in Rs 2011		Price in Rs 2001	price in Rs 2011
Baracuda	20	80	cowrie tiger	15	
tuna	25	130-150	snakehead		
sail fish	20	120	moneta		
flying fish	20	50	aquarium	nil	
seer fish	20	180-300	Shingle bag 20kg	15-20	60
Shark	20	80 - 100	Sand bag 20kg	15	50
shark fin >40 cm <40 cm		6000 1500-5000	boulders/trip tiller 2 cm		1200
Rays dry ray	50-80 500		homestay	nil	3000/pp
Perches (Metty)		80	resort	7000/ double	12,000/ double
Octopus Fresh Dry		 250- 300 900- 700	bangaram	9000/pp	nil
Rainbow runner	20	50	lodge	nil	200
Coral fish	20	80	scuba	1500	3000
Carrangids	20	80	granite stones		
Garfish	20	80	tertrapod		
goat fish	20	80	land value/ cent	nil	1-2 lakhs
Trigger fish	10	20			
others	20	50			

Appendix 7. Questionnaire on Protected Area Management - SOCMON

1. What in your opinion is a protected area ?

2. What are the benefits of protecting a natural area?
   a. For you as an individual?
   b. For the community?

3. Indicate degree of agreement with the following statements using the scale of agree strongly (4), agree (3), neither agree nor disagree (2), disagree (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) Sholam and Cherudalam are important for shore protection
   ____ (e) Coral reefs are important because they are beautiful
   ____ (f) I want the future generations to enjoy the mangroves
   ____ (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
   ____ (i) We should restrict development in some coastal areas so that future generations will be able to have natural environments
   ____(j) Predator is important in maintaining the food chain in an ecosystem
   ____(k) Sharks are important for coral reef ecosystem

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

5. Are you aware that coral reefs are protected under the law? Yes/ No

6. Are you aware that Giant clams and Turtles are protected under the law? Yes/ No

7. 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 _____

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

BACKGROUND QUESTIONS

9. Sex: (please tick) Male Female

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

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

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

   No formal education
   Primary education
   Some Secondary education
   Completed Secondary education
   Some University or College/Technical School
   Completed University

12. What is your profession? _____

13. We would like to know your approximate annual income ? (please tick)

   Below Rs 100,000
   Rs 101,000 – 200,000
   Rs 200,000 – 300,000
   Rs 301,000 – 500,000
   Above 1,000,000

Appendix 8. Government Notifications

THE LAKSHADWEEP GAZETTE
Extra Ordinary

Vol. XXXIII. No. 40. FRIl)AY, 22nd AUGUST, 1997/Ist BHADRA, 1919 (SAKA)

ADMINISTRATION OF THE

UNION TERRITORY OF Lakshadweep

(Department of Science, Technology & Environment)

Kavaratti Island,

dated 20-11-96.

NOTIFICATION

COASTAL ZONE MANAGEMENT PLAN FOR

UNION TERRITORY OF Lakshadweep

F.No. 10/3/90-ST&E Whereas the Lakshadweep Administration prepared and submitted the Coastal Zone Management Plan (CZMP) identifying and classifying the Coastal Regulation Zone (CRZ) areas for Lakshadweep in accordance with the guidelines given in Annexure - I & II of the CRZ, Notification 1991 as amended in 1994 and notified under Section 3(1) and Section 3(2) ~ of the Environment Protection Act, 1986 and rules 5(3Xd) of Environment Protection Rules 1986, Declaring Coastal Stretches as Coastal Regulation Zone and Regulating Activities in the CRZ. The submitted CZMP for Lakshadweep has been approved with certain modification by the Central Government vide their letter No. 5-1901 1/16191- IA-III dated 27th September, 1996 in accordance with the powers vested under section 3(3) (i) of CRZ Notification, dated 1 9-2-9 1 .

In exercise of the powers conferred under section 3(3)(i) and 3(3Xii) of CRZ Notification dated 1 9-2- 1 99 1 the following Coastal Area Classification and Development Regulations is notified in respect of the Union Territory of Lakshadweep:

(a) Categorization of Coastal Areas

(b) CRZ I,

No new construction shall be permitted within the CRZ- I However in those uninhabited islands which are classified as area. **CRZ- I, continuation of existing traditional rights, special rights and customary uses are allowed.**

The following areas are categorized as CRZ-I

1. Pitti, the Bird Sanctuary.
2. Mangrove area of Minicoy Island at its South Western end.
3. Perumal par reef and lagoon.
4. Cheriyapani reef and lagoon.
5. Valiyapani reef and lagoon.
6. All coral reef that may emerge in future.
7. Kodithala islet (of Kalpeni Island).
8. Thilakkam isletI (of Kalpeni Island).
9. Thilakkam isletII (of Kalpeni Island).
10. Thilakkam islet III (ofKalpeni Island).
11. pitti islet I(of Kalpeni Island).
12. Parali I(of Rangaram Group).

13. Parali II (of Bangaram Group).

14. Kalpitti islet (of Agatti Island),

15. Viringili(o fMinicoy Island).

16. SuhaliValiyakara

17. The coral reefs surrounding all the Islands comprised in the UnionTerritory of Lakshadweep.

18, All sand dunes.

(ii) CRZ- IV

Coastal stretches in the Andaman & Nicobar, Lakshadweep and small islands except those designated as CRZ-I,CRZ-II or CRZ-III.

The following islands are categorised as CRZ-IV. The width of the 'No Development Zone' (NDZ) in these islands shall be as specified below:

1. Androtl Island :

Uniformly 50 metres from High Tide Line (HTL).

2. Amini Island:

Uniformly 50 metres from HTL.

3. Kavaratti Island :

Uniformly 50 metres fiom HTL.

4. Kalpeni Island:

Uniformly 50 metres from HTL.

5 Agatti Island:

Uniformly 50 metres from HTL.

6. Minicov Island:

(i) 20 metres from HTL, on the non-lagoon side or smaller lagoon side.

(ii) 50 metres fiom High Tide Line (HTL) for rest of the area.

7. Kadmat Island :

(i) 20 metres from HTL on the non-lagoon side or smaller lagoon side.

(ii) 50 metres from the HTL for rest of the area.

8. Kiltan Island :

(i) 20 metres from the HTL on the non-lagoon side or smaller lagoon side.

(ii) 50 metres from the HTL for rest of the area

9. Chetlat Island :

(i) 20 metres from the HTL on the non-lagoon side or smaller lagoon side.

(ii) 50 metres from the HTL for rest of the area.

10. Bitra Island:

(i) 20 metres from the HTL on the non-lagoon side or

smaller lagoon side.

(ii) 20 metres from the HTL for rest of the area.

11. Cherivam Island:

Uniformly 50 metres ·from HTL.

12. Thinnakara Island :

Uniformly 50 metres from HTL.

13. Suhali Cherivakara Island:

Uniformly 50 metres from HTL.

14. Bangaram Island:

Uniformly 50 metres from HTL.

b) Prohibited Activities:

The following activities are declared as prohibited within the Coastal Regulation Zone namely:

(i) Setting up of new industries and expansion of existing industries, except those directly related to water front or directly needing foreshore facilities;

(ii) Manufacture or handling or storage or disposal of hazardous substances as specified in the Notifications of the Government of India in the Ministry of Environment & Forest, No. S.O. 594 (E) dated 28th July, 1989, S.O. 966(E) dated 27th November, 1989 and GSR 1037 (E) dated 5th December, 1989;

(iii) Setting up and expansion of fish processing on units including warehousing (excluding hatchery and natural fish drying in permitted areas);

(iv) Setting up and expansion of units mechanisms for disposal of waste and effluents, except facilities required for discharging treated effluents into the water course with approval under the Water (Prevention and Control of Pollution) Act, 1974; and except for storm water drains;

(v) Discharge of untreated wastes and effluents from industries, cities or towns and other human settlements;

(vi) Dumping of city or town waste for the purposes of land filling or otherwise;

(vii) Dumping of ash or any wastes from thermal power stations;

(viii) land reclamation, bunding or disturbing the natural course of sea water with similar obstructions, except those required for control of coastal erosion and maintenance or clearing of water ways, channels and ports ' and for prevention of sandbars and also except for tidal regulators, storm water drains and structures for prevention of salinity ingress and for sweet water recharge;

(ix) mining of sands, rocks and other substrata materials, except those rare minerals not available out side the CRZ areas;

(x) harvesting of ground water and construction of mechanisms therefore within 200 m of HTL; in the 200 m to 500 m zone it shall be permitted only when done manually through ordinary wells for drinking, horticulture, agriculture and fisheries;

(xi) construction activities in ecologically sensitive areas as specified in Annexure-I of the Notification dated 1 9-02- 1 99 1 ;

(xii) any construction activity between Low Tide Line and High Tide Line except facilities for carrying treated effluents and waste water discharges into the sea, facilities for carrying sea water for cooling purposes, oil, gas and similar pipelines and facilities essential for activities permitted under the Notification dated 19-02-1991;

xiii) dressing or altering of sand dunes, hills, natural features including landscape changes for beautification, recreational and other such purpose, except as permissible under Notification 19-02-1991 ;

c) Restricted activities within the CRZIV

The following activities shall be regulated in accordance with the manner laid down below:

1. New buildings or extension of the existing buildings shall not be permitted; within the No Development Zone.

2. No new jetties shall be built in the lagoon with out the approval of the Ministry of Environment and Forest. Should exceptional circumstances make it necessary to widen or lengthen any jetty in the lagoon, prior approval of Ministry of Environment & Forests shall be taken through the Department of Environment of Lakshadweep Administration.

3. The design and construction of buildings shall be consistant with the surrounding landscape and local architectural style and in conson8nce with the building Bye Laws being formulated by the Union Territory of Lakshadweep Administration.

4. Coral stones, shingles/boulders and sand from the beaches and coastal waters are not allowed to be removed or disturbed. (The collection of corals is allowed for scientific studies/for museum specimens with specific permission from the competent authority).

Note: Till such time an alternate building material is available, collection of shingles from the beach in regulated manner is allowed with specific permission from the competent authority of Lakshadweep Administration.

5. No new ship repair facilities shall be allowed in the lagoons.

6. No blasting would be permitted in and around the lagoon except dredging of those existing navigation channels which have already been approved by the Ministry of Environment & Forest.

7. Capital dredging will not be permitted in and around the lagoons and coral *formations*.

8. Under-water blasting in and around the lagoons and coral formations shall not be permitted.

9. In the CRZ areas where the NDZ has been reduced from *50* metres to 20 metres construction for non - residential use in this zone is not permitted.

10. Dredged material will not be disposed within the CRZ area.

d) This notification is extended to the whole of the Union Territory of Lakshadweep.

This will come into force with immediate effect.

Sd/-

Rajeev Talwar
Administrator

Appendix 9. Notification on LMFR

The Lakshadweep Gazette
Published by authority

Extraordinary

Vol. XXXVI. No 68, Thursday, Ist March, 2001/100th Phalguna. 1922 (SAKA)
Administration of Lakshadweep
(Department of Fisheries)

Kavaratti Island
Dated 24-02-2001

NOTIFICATION

Kinds of fishing gear may be regulated, restricted or prohibited: in any specified area under clause (d) of sub section (1) of section 4 namely

a. Purse - Seine
b. Ring Seine of 2mm mesh size and below
c. Pelagic Trawl
d. Mid water Trawl
e. Bottom Trawl
f. Drift Gill net
g. Shore Seine of 20 mm mesh size and below in the specified area

F.No 45/2/2001- fy dated 22/1/2002
In exercise of the powers conferred by clause (j) of section - 2 of the lakshadweep Marine Fishing Regulation 2000 (No 3 of 2000), the administrator, UTL hereby specifies the lagoons and the area in the sea around the inhabited, uninhabited islands and submerged reef and islts of the UTL, not beyond the territorial waters starting from the coral reefs around the island and lagoon as specified area" for the purpose of sub section (1) of section-4 of the regulation