

**ECOLOGY, CONFLICT AND ADAPTATION OF THE  
JARAWA IN ANDAMAN ISLANDS**

**ABSTRACT**



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**THESIS**

**SUBMITTED IN FULFILMENT OF THE REQUIREMENT OF THE  
DEGREE OF DOCTOR OF PHILOSOPHY IN GEOGRAPHY**

**DEPARTMENT OF GEOGRAPHY  
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## ABSTRACT

### Introduction

Islands are unique ecosystems of the world owing to their location amidst the sea and a well-defined boundary. Thus, the islands have typical ecology, i.e., interrelationship between the organism and environment. The 'island ecology' is characterised by interface between land (terrestrial) and sea (aquatic) resources. The islands represent typical human habitats as well due to broad resource base (both terrestrial and aquatic). The land-sea interface in the island habitat represents a distinct boundary for most of its inhabitants, where readily defined area of the island and the functional niches of the inhabitants correspond in many respects. There are few essential features of island ecosystems viz., isolation/insularity and size of the islands, low diversity of the island biota, high endemism, poor representation of certain organisms like large predators and ecological release, i.e., expansion of the ecological niche by occupation of more area of the habitat and use of many types of resources. Of these, the insularity of the island ecosystem and typical and broad resource base make islands interesting for geographical and ecological studies. The islanders have the advantage of utilising resources of the islands as well as that of the adjoining sea. In order to harness the resources of the islands, human groups have to develop different means and ways to adapt to island environments, both terrestrial and aquatic. As a result, human adaptation to the island environment has peculiar form and process.

Today, most of the hunter-gatherers live in the environments like frozen Arctic tundra, desert, islands and inaccessible forests which typical human adaptation. It has been observed that the hunting and gathering way of life has been the most successful and persistent adaptation man has ever achieved in such environments. Study of

human adaptation of a foraging community to environment (like that of the island ecosystem) has been of special interest in ecology because the relationship between man and environment is organic and most direct.

The Jarawa, a hunting-gathering community of Andaman Islands, is one of the two simplest societies (primitive community) living in the western part of South and Middle Andaman Islands. Their adaptation to the island environment has distinct form and process. They derive resources from terrestrial and marine ecosystems through hunting, fishing and gathering by employing traditional technology and strategy. For long, they avoided friendly relations with the Non-Jarawa. However, since the late 1997, friendly contacts have been established with the Non-Jarawa and that has ushered changes in the resource base and the adaptation pattern of the Jarawa. Now, there is conflict between the Jarawa and the Non-Jarawa for sharing the resources of their area. These changes have negative influence on the survival of the Jarawa not only as a hunter-gatherer group but also as a human group. In fact, the Jarawa are finding it difficult to adapt to the changed situation. Therefore, in the present Ph. D. research an attempt has been made to study '**Ecology, Conflict and Adaptation of the Jarawa in Andaman Islands**'.

### **Objectives**

The main objectives of the study are as follows:

1. to prepare an inventory of natural resources (both terrestrial and aquatic) as perceived by the Jarawa and also by the Non-Jarawa,
2. to analyse human adaptation by finding out technology and strategy of resource utilisation by the Jarawa, and
3. to examine the impact of contact on the adaptation, environment and resource base of the Jarawa and the new challenges therein.

## **Research Questions**

The research issues dealt with in the present study include:

- i) As the Jarawa practice hunting and gathering means of subsistence it is interesting to answer the question that how far it is truly a hunting and gathering community.
- ii) The resource base of the Jarawa has eroded due to arrival of other human groups in their habitat; it is, therefore, essential to know impact of the increased taxation of the natural resources on the Jarawa and their environment.
- iii) Finally, what survival strategies have been adopted by the Jarawa to cope up with the new challenges in the conflict situation?

## **Database and Methodology**

### **Primary data**

Following types of primary data were collected and used for the present study:

- (i) During the field work data were on the Jarawa population and male-female ratio, because prior to 2001 only the estimated population of the Jarawa was available.
- (ii) To understand the natural endowment, the biophysical resources of the Andaman Island, particularly of the Jarawa Territory, were identified and recorded. It includes the preparation of a detailed resource inventory of both terrestrial and aquatic resources used by the Jarawa and Non-Jarawa.
- (iii) The detailed foraging data of the Jarawa were collected from three locations – Thidong, Boiab and Tanmad between 11-12-2001 to 09-01-2002, 11-04-2002 to 09-05-2002 and 11-08-2002 to 09-09-2002, respectively. It covered the three different seasons - rainy, cool dry, and summer dry seasons.



## **Secondary Data**

Secondary data used in the present studies are as follows:

- (i) Topographical information relevant to the study was obtained from the camp office of the Geological Survey of India.
- (ii) 1C LISS-III, Landsat-TM and IRS-1C -LISS-III-PAN geocoded merged data from 1997 and 2001 were sourced from Indian Institute of Remote Sensing, Dehradun for visual interpretation to identify types and density of forest resources in the Andaman Islands.
- (iii) In order to prepare a detailed inventory of resources and to know the scientific name of the resources used by the Jarawa, information were gathered from the reports of Zoological Survey of India, Botanical Survey of India, and Department of Environment and Forest,
- (iv) Information pertaining to food intake and its calorific value were gathered from the reports of All India Institute of Public Hygiene and Health, Kolkata and Directorate of Health Services, Port-Blair. Information on the occurrence of diseases due to contact in the pre and post hostility phases were collected from the Directorate of the Health Services and other published material.
- (v) Data on the history of contact and conflict were gathered from the Census records, published materials and Police Stations. In addition, records of the Adim Janjati Vikas Samiti (AAJVS), Port Blair were used to gather data on the gift articles given to the Jarawa and other related information.
- (vi) In addition, several published and unpublished records, reports, articles, and books were consulted in order to collect relevant data and information on the topic of the research.

## **Methodology**

Following methodology has been adopted for conducting the present study:

- (i) The spatio-temporal resource utilisation pattern in the Jarawa territory has been analysed with the help of the data collected from four physiographic zones. Since availability and seasonality of resources is distinct in each of these zones, the movement pattern of the Jarawa in these zones has been recorded and analysed.
- (ii) The input output analysis has been done to explain the ecological context of the subsistence economy of the Jarawa by finding-out the Index of Subsistence Effort. The analysis has helped in finding out work input of the economically active Jarawa in a week. It, in turn, has given information that how much of their subsistence efforts are oriented toward hunting, fishing and gathering. In addition, it also helps explain that after hunting-gathering activities, how much time the Jarawa are left with which they devote for leisure related activities
- (iii) To find out the optimality of foraging behaviour of the Jarawa, an encounter distribution for each individual hunter has been derived. The analysis has been accomplished by dividing each individual time spent searching for pray into equal units of one hour within which the number of the pray items is encountered. Thereafter, the observed distribution has been compared with an expected Poisson distribution. In order to generate further confidence in the results, chi-square goodness-of-fit test was carried out. The results have helped explain hunting behaviour of the Jarawa. Besides, maps charts and graphs have been used to give a cartographic representation of necessary information. Photographic coverage has also been done to show important features of the study.

## Summary

Entire study has been organised into Six Chapters. The introduction to the Ph.D. Dissertation is presented in the First Chapter in which the literature review, objectives of the study, research questions, study area, data base (both primary and secondary data) and methodology have been discussed. The Second Chapter deals with natural environment of the Andaman Islands, which is the habitat of the four Negrito people including the Jarawa. This Chapter highlights the biophysical richness of the Island ecosystem (both terrestrial and aquatic) from which the Jarawa derive various plant and animal resources for their sustenance; and now in the post-hostility phase, the same resource base is getting taxed by the Non-Jarawa in terms of illegal exploitation of certain resources from it.

The next three chapters are crux of the Dissertation. The Third Chapter gives a detailed inventory of the terrestrial and aquatic resources in terms of edible and non-edible resources. Further, it points out a pertinent fact that since many resources are common between the Jarawa and the Non-Jarawa, it was the cause of conflict in the past and it is a cause of concern at present. Adaptation of the Jarawa to the island environment and their response in terms of technology and strategy employed by them for the collection and utilisation of resources have been discussed in Fourth Chapter. The stress is on the foraging strategy of the Jarawa. The ecological context of the subsistence activity of the Jarawa has been worked out with the help of input-output analysis. It is followed by analysis of foraging behaviour of the Jarawa to understand that whether the hunting behaviour of the Jarawa conforms to that of a hunter-gatherer or not. Lastly, the work, resource and population relationship has been analysed. The Chapter Fifth gives a detailed account of the history of contact and conflict in pre and post-Independence period. Both the positive as well as negative

in relation to resources, health, material culture, food, addiction to intoxicants and barter trade. It is followed by adaptation of the Jarawa to the changing environment, and how they are coping up with the new situation. Summary and main findings of the study are given in the Sixth Chapter, which also include conclusions derived from it. It also includes limitation of the research and scope of further research on the topic.

The present Ph. D. Dissertation entitled 'Ecology, Conflict and Adaptation of the Jarawa in Andaman Islands' pertains to the study of form and process of human adaptation of the Jarawa to an island ecosystem, technology and strategy of resource utilisation, analysis of foraging behaviour, and impact of contact and conflict on the Jarawa and their resource base, and how the Jarawa are adapting themselves to the changing situation. Adaptation of the Jarawa to their environment is a process involving technology and strategy employed by them for harnessing the biophysical resources of the ecosystem.

The study shows how the hunting and gathering based immediate return economy of a hunter-gatherer group functions in an island environment, which has both terrestrial and aquatic resources. In addition, it reveals the pattern and process of adaptation of a hunting-gathering group like the Jarawa to the island environment. Since the Jarawa economy has a close approximation to the economy of classical forager, it helps in understanding the forging strategy and behaviour of a hunter-gatherer group. The study also illustrate that when human groups like the Jarawa are exposed to the technologically advanced group having production based economy, what are the impacts on their resources base, health, population, habits and material culture. Equally significant is how primitive groups like the Jarawa cope up with the changing situation in the aftermath of their exposure to the new people and changing

of their survival as hunter-gatherers, and as biological unit, is of great concern to the geographers, ecologist, anthropologists, planners, technocrats and the humanity as whole. Here lies the significance of present study on ecology of the Jarawa in an island ecosystem.

The study has also revealed that how in post hostility phase (after 1997) the Jarawa as a hunter-gatherer community may soon face survival threat in terms of erosion of their resource base, introduction of new diseases and their addiction to intoxicants. It also helps to look into the problems of post–hostility phase in which the Jarawa as a hunter-gatherer community are facing threat to their survival and may meet the fate of their counter part like Onges and Great Andamanese. The study, therefore, will help the planners in preparing and implementing plan for the betterment of the Jarawa. Thus, it can be said that the study is basically fundamental in nature but it has applied implications as well.

### **Major Findings**

Based on the present study, some findings have been derived. These are pertaining to the major theme of the Ph.D. research, i.e., adaptation of the Jarawa to the environment of the Andaman Island Ecosystem. The major findings have been mentioned below under certain relevant sub-headings for the sake of clarity.

#### **(1) Habitat and Resource Inventory**

1. The Jarawa are one of the four Negrito human groups inhabiting the Andaman group of Island. The ecological niche of the Jarawa is called as ‘Jarawa Reserve’ or ‘Jarawa territory’ spread over nearly 765 sq km of area.
2. There are three territorial groups among the Jarawa, who inhabit the *Boiab*, *Thidong* and *Tanmad* territories of the Middle and South Andaman Islands. Each

group has exclusive rights over its territory, and the other groups are forbidden to gather any resources from it. It means a strong sense of ownership and possession of resources exists at group level, which ensures sustainable subsistence and survival. The same is applicable to the Jarawa human group as a whole since they are traditionally used to defend their territory from being exploited by the Non-Jarawa. This, in fact, has governed their behaviour towards the outsiders, right through the known history.

3. As per the last count in 2002, the total population of the Jarawa is 265 persons, out of which 84 are in *Boiab*, 78 in *Thidong* and 103 in *Tanmad* territories.
4. The hunter-gatherer Jarawa eke out their livelihood through collection of roots, tubers and fruits, and hunting and fishing activities.
5. The Jarawa has a 'broad resource base', which is inclusive of both terrestrial and aquatic resources, ensures their subsistence in all seasons with adequate diet.
6. At cognitive level, the resource base is divided into five zones- *pilleh* (sea shore), *tagidh* (marshy area), *chanhanap* (plain land), *tinon* (thick forest area) and *wa* (fresh water bodies and streams), from which specific resources are gathered in different seasons of the year to maintain their survival.
7. Of the total resources used by the Jarawa, so far about 136 species of plants have been identified, of which 54 are edible and remaining non-edible. The major plant food includes tubers (*Dioscorea sp.*), *Cycus rumphii*, jackfruits, and *Nipa fruticans*.
8. The pig, monitor lizard and turtle are game animals of the Jarawa.
9. They have a dietary preference for meat, fish and molluscs, but pig is the most preferred one. Honey is another important food item.
10. The 'key stone resources' are the molluscs, fish and tuber (*Dioscorea sp.*).
11. In fact, the Jarawa rely upon a limited range of plants and animals to fulfil the

- bulk of their calorific requirements.
12. Hunting is an exclusively male activity while there is predominance of females in gathering activities. Interestingly, the Jarawa do not hunt the deer, as it is an exotic species.
  13. Both males and females do fishing using different means but the success rate is directly related with the number of the person fishing in an area, size of the area and size and density of fish in that area.
  14. The availability and collection of many of the edible resources are season specific. However, the seasonality is not applicable in case of pig though it is hunted most in rainy season when it has maximum fat due to availability of plenty of food.
  15. There are three broad resource seasons: (i) Dry summer in which wild jackfruit collection is at peak along with honey; (ii) Rainy season in which thrust is on pig hunting and collection of the seeds of *Cycus rumphii* and *Nipa fruticans*; and (iii) winter season which is meant for collection of honey and turtle eggs, followed by pig hunting.
  16. The Jarawa get iron tools and metal utensils from the AAJVS and at times, they procure these items from settlements. However, in the past they used to collect iron from jetsam, i.e., broken ships washed ashore.
  17. Sharing of flesh of the prey (game) animals at constituent families level and other foraged items at intra-family level is a strategy of better survival for all.
  18. Though cultivation is the primary activity of the settlers, they do extract timber and minor forest produces, hunt wild pigs and deer, and catch crab, sea cucumber, lobster and prawn from the 'Jarawa Reserve', means sharing the resource base of the Jarawa.

## **(2) Foraging Strategy**

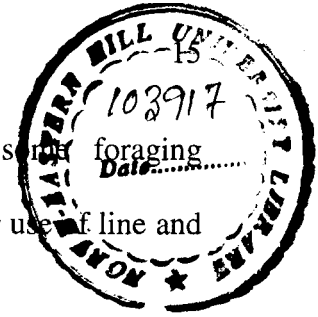
19. Selections of the site for location of the camps (*chadda*), the number of camps in an area and movement pattern of the Jarawa within their territory are part of the foraging strategy.
20. The permanent and semi-permanent camps are of large size and remain occupied for longer period than the temporary camps. Hence, the former two types of camps serve as 'base camps'.
21. Location of the base camps of the Jarawa is governed by combination of factors- ecological edges, proximity to drinking water, easy availability of one of the edible resources and season.
22. Now the camps are also located along the ATR to avail various benefits.
23. Surprisingly, despite living in an island environment the Jarawa do not have well built canoes like that of the Sentinelese, Onge, and the Great Andamanese.
24. Seasons play a decisive role in the location of the camp along the coast and inside the forests. The underlying strategy is to exploit both the terrestrial and aquatic resources.
25. The Jarawa make two type of movement i.e., residential and logistical.
26. The foraging expeditions are never more than 15 days at a stretch.
27. There is division of labour to carry out different activities related with food gathering. Hunting is exclusively a male activity; about 29 per cent of the total adult male population are involved in it, which account for 30 percent of the total man-days of work, while most of the fishing is done by the females.

28. The input-output analysis shows that the average value of Index of Subsistence Effort for the Jarawa is 0.295. The average work input varies between 3.7 to 3.9 days a week. About 3.1 to 3.3 days in a week are left for leisure, socializing, and other activities.
29. Testing of the Jarawa hunting behaviour conforms to the hunting behaviour of a true hunter-gatherer/forager as prey is encountered sequentially as a Poisson process. This answers the research question number one that how far the Jarawa are a true hunter-gatherer.
30. The net acquisition of resources in case of the Jarawa is satisfactory because on an average an adult Jarawa get approximately 2,500 KCal from the major resources alone. If the minor resources were also included then it would well be around 2,800 KCal.

### **(3) Impact of Contacts**

31. The later half of the year 1997 was the watershed in the Jarawa history as it marked the end of the hostility between the Jarawa and the Non-Jarawa.
32. In the post-hostility phase, the poaching by the Non-Jarawa people inside the Jarawa territory has increased. As a result, the Jarawa are competing with the poachers for those resources that are common to both.
33. Though the resource density in the interior of the forests is still adequate to support the foraging pursuit of the Jarawa, there is thinning and receding of the resources base in the area close to the settlements of the Non-Jarawa. It is more discernible in case of fish and pig density.

34. The Jarawa have fallen prey to some of the vices of the Non- Jarawa, e.g., addiction to *paan* and tobacco.
35. A barter trade is emerging between the Jarawa and the Non- Jarawa particularly tourists, where in the Jarawa exchange hunting implements, honey and resin for *paan* and tobacco. There is some sort of barter system existing between the Jarawa and the poachers also wherein the poachers offer *paan*, and tobacco and eatables to buy safe passage in the forest to exploit the resources of the Jarawa territory.
36. In recent times there have been out breaks of various communicable diseases like community-acquired pneumonia (1998) and measles (1999), which were absent before the friendly and free mixing of the Jarawa with the Non-Jarawa. Many cases of *P. falciparum* malaria (2000-2001) were also reported recently.
37. Skin diseases have spread after 1997, primarily due to wearing of used clothes given by the Non-Jarawa, and not washing of these clothes by the Jarawa.
38. Now the Jarawa make use of boat (motorized canoe operated by the Non-Jarawa) during the shifting of their huts along the coastal area and while camping at the roadside they make use of the vehicles plying on the road to cover longer distances in search of edible and no-edible resources.
39. Nowadays the Jarawa get a regular supply of iron from the AAJVS (Andaman Adim Janjati Vikas Samiti). The Jarawa can now be seen using hammer, chisel, sharpening file, and makeshift anvil for making hunting and fishing implements. In addition, they also get the cooking and storing utensils.
40. Now they use nylon threads along with traditional bark thread for making nets.



41. Though the Jarawa observe and gather information about some foraging techniques of the Non-Jarawa, like the use of snare to catch pig or use of line and hook for fishing, they are yet to adopt these methods.

42. Now the Jarawa have no hesitation in accepting any kind medicines either orally or externally (which have external application). There is a positive change in their hospital behaviour also as they are not wary of the other patients.

43. They have started eating non-traditional foods containing salts and spices, which have caused high blood pressure among few of them, particularly among those who frequently visit the hospital, jetty and the settlements.

44. Recently some of the Jarawas, particularly young boys, have picked-up Hindi. Even the broken knowledge of Hindi on the part of the Jarawa has proved very useful in case of medical treatment also as both the Jarawa and the medical attendant or Doctors are able to make each other understand.

## **Conclusions**

From the above findings following conclusions may be drawn.

1. The Jarawa of Andaman Islands are one of the few remaining hunter-gatherers in the world whose subsistence economy is still in the elementary form, which approximates the economy of the classical hunter-gatherers, for it is based on extraction and the consumption of most of the immediate resources available in their habitat.
2. The hunting, fishing and gathering activities are pursued with an in-depth indigenous knowledge of the ecosystem pertaining to edible and non-edible plant and animal species; different seasons and associated phenomena like rainfall, fruiting, flowering, regeneration of terrestrial and marine plants and animals,

availability of resources; nature and characteristics of the coastal and shallow seas; and others.

3. The subsistence activities are accomplished with intelligently designed strategy related to selection of sites for location of camps in different seasons and physiographic zones; timing, number and distance of foraging movements; selection of prey; image perception; division of labour; inter and intra-family sharing of gathered food items; and proper use of different tools and technology to ensure maximum returns from minimum efforts.
4. The collection of food is subject to availability and density of food resources in particular zone and season and the distance from the camp.
5. First of all, resources in the immediate vicinity of the camps are harvested then the distant ones, so that enough resources are available for longer time and regeneration of resources also go on in the already harvested area.
6. They try to eat a balanced diet comprising of both plant and animal food items that provide them with sufficient carbohydrate, fat, glucose, nutrients, minerals etc. Though flesh of game animals is preferred, the key stone resources consist of plant food items and small animals which are perennially available.
7. The Input-Output analysis reveals that there are still sufficient resources in the interior of the Jarawa habitat to support the hunting and gathering subsistence activities as exhibited by the less number of man-days in a week. It gives them sufficient time for leisure related activities which is one of the important preconditions for the happy survival of a foraging group.
8. The hunting behaviour of the Jarawa conforms to the basic premise of the Optimal Foraging Theory by following a Poisson distribution curve. It shows that the Jarawa do not manipulate the frequency encounter of the game animal and thus, their hunting behaviour exhibits the hunting behaviour of a classical hunter-gatherer.

9. In the post-hostility phase decline in the density of resources in the areas close to villages of the Non-Jarawa has been observed due to poaching and illegal extraction of resources. These are initial warning symptoms which need to be addressed immediately, because erosion of the resource base will force them to work for longer period per day/ week, which is undesired in any hunting-gathering society the world over.
10. If the thinning and decline in resources base continues unabated, it would soon force them to be dependent on the dole given by the Government/Local Administration as it happens in case of the Great Andamanese and the Onges- the Negrito neighbours of the Jarawa in the Andaman group of Islands.
11. The friendly contacts after 1997 have some negative impacts on the Jarawa, e.g., spread of many communicable diseases like skin infection, measles and community acquired pneumonia. In addition, they have become addicted to *paan* and tobacco.
12. The Jarawa are trying to adapt themselves to the changed situation as a part of their survival strategy like using the vehicles and boats plying on the roads and sea to reduce the distance, accepting the medical treatment and learning many of the material traits of the Non-Jarawa. But their failure to learn new techniques and use of new tools, which are used by the Non-Jarawa and which would make them survive in the situation when there is less density of resources in their habitat, is a matter of great concern.
13. There are three major concerns which need immediate attention. These are related with the health problems, eroding resource base and lack of interest among the Jarawa youth in learning new techniques of hunting and gathering used by the Non-Jarawa; all having direct bearing on their survival as a pure hunter-gatherer group and the survival of the Jarawa as a human group adapted to typical island environment.

**Limitation of Study**

Any scientific research, however detailed it may be, can not cover all the aspects with the problem. In fact, it is only a link in the long chain of research to find the truth. The present Ph. D. research work has been completed in respect to fulfilling of all the objectives and answering the research questions. However, there are limitations in terms of the points that could not be covered in the present. In view of the investigator following are the limitations of the present work.

The island ecology, conflict and adaptation of the Jarawa, who inhabit the western parts of the South and Middle Andaman, have been probed into with the help of both primary and secondary data. The primary data have been collected through field work between 1998 and 2004. The study gives the first hand information about resource inventory of the edible and non-edible resources of the Jarawa, seasonality of resources, major food items of the Jarawa, their foraging behaviour and adaptation of the Jarawa to the changing situation. However, the resource inventory is far from complete as there are many minor resources used by the Jarawa but could not be observed. Movement pattern and foraging behaviour are largely based on the detailed study of only three months. In the absence of other detailed studies on the Jarawa it was difficult to correlate many of the observations and findings on these aspects. All the more, collection of information on the above stated aspects, in fact, requires a team work, because there is all possibility that alone one may not collect all the information about all three territorial groups of the Jarawa at a time. In order to know many aspects related with present topic a detailed field work spread over twelve months is required. Moreover, data have to be gathered about all three groups at a time in the same year.

The ignorance about the Jarawa language was one of the major handicaps of the investigator in the initial phase in collection of authentic data. In fact, there was no one who knew the Jarawa language to act as interpreter. Later with great effort a broken Jarawa language could be learnt. The dense tropical rain forest with thick undergrowth particularly of canes coupled with presence of leaches had made the field work hazardous and this may be considered limitation imposed by the environment. Besides, there is no logistic support available in the forests to stay for a long field work. Nevertheless, it was interesting to conduct the present research within these constraints. Main limitations of the present study are listed below.

1. The Jarawa use many terrestrial and aquatic resources, but only a limited number of the resources could be observed and only that have been discussed in the present study. The study lack sufficient data on edible marine resources and minor resources as well. Similarly, the seasonality of major edible plant resources has been discussed but there is lack of data on seasonality of minor edible plant products as well as marine animal resources.
2. Though the factors influencing location of the camps have been studied but the present study lack detailed information on the minimum distance between two camps and pattern of setting up of camps in a particular season. Reoccupation of the same camp is also related with regeneration capacity of the resources, but the present study lacks information on the renewable characteristics of the plant and animal resources.
3. The Input-Output analysis has helped find out work week of a Jarawa i.e., how many days in a week an economically active Jarawa works, but how many hours a day is spent towards foraging could not be calculated due to lack of sufficient data.

4. Perception plays an important role in the human adaptation to environment. Though the Jarawa's perception of the four physiographic zones and its resources has been briefly discussed but a detailed information on the Jarawa perception of the environment related with potentiality and constraints on adaptation could not be gathered due many inevitable reasons.
5. Though sharing of food items has been discussed, the study lacks enough quantitative data on it, particularly sharing of flesh of game animal among constituent families of a band.

### **Scope for Further Research**

The present investigation on the human ecology of the Jarawa is a maiden study as no prior study has been conducted on the Jarawa's adaptation to the island environment, impact of contact and conflict and adaptation to the changing situation. Though the aim of the study was limited to prepare an inventory of resources as perceived by the Jarawa, analysis of Jarawa adaptation by finding out technology and strategy of resource utilisation, and to examine the impact of contact on the resource base and adaptation of the Jarawa, it has opened up several new vistas that require a detailed scientific investigation as listed below:

1. The entire resource potential of the Island ecosystem is yet to be identified and documented. In addition, a complete inventory of the resources used by the Jarawa is required to be prepared in order to find out the total resources available in Island ecosystem and how many of these are used by the Jarawa.

8. In the hunting-gathering society, the man-nature-spirit relationship needs to be investigated. A holistic study on such relationship is necessary to find out the organic relationship among the three factors. There is very little information on the spiritual world of the Jarawa too, and that needs to be probed.

Undoubtedly, detailed investigation on these points will help in understanding the intricacies of human adaptation of the Jarawa to Island environment, but keeping the present restrictions on visits to the Jarawa territory in mind it appears to be a difficult task if not impossible. However, there remains curiosity to understand the hunter-gatherer response to island environment, and present work is a sincere effort in that direction. If, by chance, unfortunately the Jarawa also meet the fate like that their neighbours have met, then the present dissertation may probably become an authentic and only source of information on the Jarawa human group and their hunting-gathering way of life in an island ecosystem.

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## DECLARATION

I, Umesh Kumar, hereby declare that the subject matter of this thesis is the record of work done by me, that the contents of this thesis did not form the basis of the award of any previous degree to me or to the best of my knowledge to anybody else, and that the thesis has not been submitted by me for any research degree in any University/Institute.

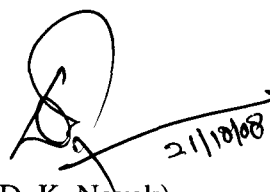
This is being submitted to the North-Eastern Hill University for the degree of Doctor of Philosophy in Geography.



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Shillong, 21 October, 2008

  
Umesh Kumar

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**CHAPTER I**  
**INTRODUCTION**

# CHAPTER I

## INTRODUCTION

Islands are unique ecosystems of the world owing to their location amidst the sea and a well-defined boundary. Thus, the islands have typical ecology, i.e., interrelationship between the organism and environment. The 'island ecology' is characterised by interface between land (terrestrial) and sea (aquatic) resources. The islands represent typical human habitats as well due to broad resource base (both terrestrial and aquatic). The land-sea interface in the island habitat represents a distinct boundary for most of its inhabitants, where readily defined area of the island and the functional niches of the inhabitants correspond in many respects. Mueller-Dombois and Bridge (1981) have identified few essential features of island ecosystems viz., isolation/insularity and size of the islands, low diversity of the island biota, high endemism, poor representation of certain organisms like large predators and ecological release, i.e., expansion of the ecological niche by occupation of more area of the habitat and use of many types of resources. Of these, the insularity of the island ecosystem and typical and broad resource base make islands interesting for geographical and ecological studies.

The human groups inhabiting the island ecosystems have the advantage of utilising resources of the islands as well as that of the adjoining sea. Human survival in the islands depends not only on what type and quantity of natural resources are available on the land but also in the water. Because of that, human groups have to develop different means and ways to adapt to island environments, both terrestrial and aquatic. As a result, human adaptation to the island environment has peculiar form and process, hence worth studying from geographical and ecological point of view.

Ecological perspective has been concomitantly present in geographical studies right from its inception as dynamic man-environment relationship is the central theme of the discipline. In ecological studies, the emphasis is more on process than on form to gain insight into the total man-environment interrelationship. In order to explain the man-environment relationship a number of fundamental aspects are taken cognisance of, *viz.*, (i) understanding the intricate and intimate relationship between organism (*man, plant and animal*) and environment; (ii) understanding the human behavioural pattern involved in the exploitation of natural resources of a particular area by means of a specific set of technology and strategy; and (iii) analysing the human interference in the ecological system in course of exploitation of natural resources.

Man has adapted to a wide range of environments of the earth. The form and process of adaptation varies with man, space and time. Human concentration is found in the most congenial environments of the world, whereas, there is sparse distribution in the uncongenial environments like the deserts (both hot and cold), tropical rain forests etc. Today, most of the hunter-gatherers live in the environments like frozen Arctic tundra, desert, islands and inaccessible forests. It has been observed that the hunting and gathering way of life has been the most successful and persistent adaptation man has ever achieved in such environments.

The Jarawa, a hunting-gathering community of Andaman Islands, is one of the four simplest Negrito human groups living in the Andaman Islands. They inhabit the western parts of South and Middle Andaman. They derive resources from terrestrial and marine ecosystems through hunting, fishing and gathering for their subsistence and survival. Their adaptation to the island environment has distinct form and process. The Jarawa have been living in the Andaman Islands since time immemorial in almost

isolated condition until the British landed in the Islands in 1789 and established First Penal Settlement, which continued only for a brief period of seven years. Then they came back in the year 1858 and established Second Penal Settlement. The Jarawa, along with other Negrito groups, considered establishment of settlements of the convicts and exploitation of the resources as intrusion in their habitat. It caused resentment among the indigenous groups. This led to the development of hostility and conflict between the Jarawa and Non-Jarawa (all Non-Negrito people). The causes of conflict have been related to sharing of the resources of the same habitat. The hostility continued until the end of Twentieth Century. Decades of efforts in post-Independence period to establish friendly contact with the Jarawa culminated at the end of 1997. It was a watershed in the history of relationship of the Jarawa with the Non-Jarawa as it saw the end of unfriendly relations between the two groups on one hand, and on the other gave the Non-Jarawa an unhindered fearless access to the resources base of the Jarawa. It has led to greater exploitation of the resources of the Jarawa habitat by the Non-Jarawa who have comparatively much better technology of resource exploitation, and that has detrimental impact on the Jarawa in the form of faster erosion of their resources base. The friendly contact has also brought changes in the material traits and food habits, and caused occurrence of new diseases in the Jarawa. In addition, many of the Jarawas have fallen prey to the intoxicants. These changes have negative influence on the survival of the Jarawa not only as a hunter-gatherer group but also as a human group. In fact, the Jarawa are finding it difficult to adapt to the changed situation. Therefore, in the present Ph. D. research an attempt has been made to study 'Ecology, Conflict and Adaptation of the Jarawa in the Andaman Islands'.

## **1.1 LITERATURE REVIEW**

To gain an insight into the theoretical aspects and empirical research related to the topic of Ph. D. research, review of the relevant literature has been made in the following lines. Various terms, concepts, hypotheses and theories used in the present Dissertation have been explained. There are many studies available on the human adaptation to a particular environment but only a few on the human adaptation to islands particularly that of classical foraging groups, which have also been mentioned here.

### **1.1.1 Ecology**

Ernst Haeckel (1866) made the first use of the term 'ecology' in its modern sense. He described meaning of ecology 'as the body of knowledge concerning the economy of nature- the investigation of the total relations of animal to its organic and inorganic environment....' In simple words, ecology is the study of interrelationship between organism and environment. However, during the last 150 years meaning and scope of the term ecology has broadened considerably. Today it is viewed as the study of ecosystem, flow of energy and matter and ecological balance in it. Castri (1981) opined that it is science of converging disciplines to form a common trunk of ecology.

The geographers have traditionally been closely concerned in many ways with the subject matter of ecology as geography is devoted to analyse the dynamic relationship between man and environment. The concept of ecology gave insight into the man-environment interaction and geography was redefined in ecological terms (Barrows, 1923). Chorley and Haggett (1971) considered geography and ecology as study of distribution, organisation and morphology of phenomena on the surface of the earth.

In fact, adaptation of an organism to its biophysical environment is the subject matter of ecology. The adaptation is response of an organism to its environment. Husain (2002:12-13) has considered human adaptation to environment as a process involving technology and strategy employed by man for harnessing biophysical resources of an ecosystem for his subsistence and future growth. Actually, human adaptation in its totality includes cultural, behavioural, biological and physical adaptation, whereas, in geography primarily the behavioural and to some extent technological responses are taken into account while dealing with human adaptation.

Many scholars have explored the role of '*ecological edges*' in human adaptation to a particular ecosystem. Odum (1971) describes the edges of the ecosystem as high in productivity and species richness or biodiversity. Berkes and Folk (1994) explain that the benefit of the ecological edge can be created across cultural edges through the development of institution that allow people from different ecological areas to share knowledge and goods. Similarly, the '*resilience*' concept originally developed for the study of ecosystem dynamics (Holling, 1973) has been applied to the study of social-ecological system by Gunderson *et al.*, (1995), Berkes and Folk (1998), Adger (2000), Davidson-Hunt and Berkes (2003) and others. McCay (2000) has described that how the integration of ecological edges and cultural knowledge system and practices of the human group living there enhances the resilience of local communities. The studies by Anderson (1996) and Peacock and Turner (2000) on the aboriginal people show that beneficial effect of the ecological edges is also created spatially and temporally through purposive human activity. Another example of intentional maintenance and development of ecological edges is provided by Deur (2000) in his research on tidal marsh garden of Kwakwaka'wakw and Nuu-Chah-Nulth people of the North-west Coast of North America.

### **1.1.2 Human Ecology and Island Ecosystem**

The term 'human ecology' like the term 'island' has tended to mean different things to different people. Human ecology in simple words is study of totality of dynamic interrelationship between man and environment, particularly focussing on means and ways of human adaptation to environment. The Chicago School of Urban Sociology brought it to prominence in the nineteen-twenties (Park and Burgess, 1921). While Barrows (1923) made an early attempt to define discipline of geography as the study of human ecology. By the early twentieth century, human ecology was taken by other social sciences to deal with man, society and their environment (Mckenzie, 1926; Park, 1936; Quinn, 1939 and others). For example, Mukerjee (1926) defined social or human ecology as 'synoptic study of the balance of plant, animal and human activities, which are systems of correlated working parts in the organisation of the regions (ecosystems)'. Mukerjee (1938) said that from Frederick La Play to Patric Geddes has come the valuable insight that the organism (man, folk), function (work, occupation) and environment (place, region and nature) can not be treated separately.

More recently, researchers approaching the man's ecology from two rather different standpoints have revived the term. A group of social scientists in geography, anthropology, physiology and nutrition have attempted to broaden their explanations of human function and variation by considering man as an organism in relation to his environment (Sargent, 1974). This approach of study is known as 'organism-ecology' approach. At the same time, the researchers in social sciences have also found it extremely useful to study the economic, social and geographical aspects of human populations in relation to their environment and this is known as 'population-ecology' approach. Out of both approaches- the 'organism-ecology' and the 'population-

ecology', the present researcher has adopted mostly the latter approach to deal with ecology of the Jarawa in the Andaman island ecosystem.

Two main trends within human ecology can be distinguished. The first is the adoption of an explicitly holistic viewpoint on man-environment interactions; the second is a move towards quantification. Both developments are to some extent general within the human sciences, but in studies of human ecology, they have resulted in part from the stimulus provided by biological concepts, particular the concept of 'ecosystem' (Ackerman, 1963; Stoddart, 1965; Watt, 1968; Binford and Binford, 1968; Buckley, 1969; Chorley, 1971; Chapman, 1970). Arthur Tansley (1935) coined the term 'ecosystem' for both biome and its habitat. Stoddart (1965) recommended adoption of ecosystem concept in geographical investigation because of its being monistic, structured, functional and as general open system.

Though the system analysis appears to offer much to the investigator of a human adaptation to environment, it can be criticised on two grounds. The first concerns the capacity of the investigator to cope with the daunting complexity of the natural world, and in particular of the interaction between man and his biophysical environment. It is usually not possible to define a system, to identify its components, and to specify its linkages within it, without first making subjective decisions about the critical processes in operation. When direct measurement and observation are not possible, as for example in an historical context, then the problem of defining system is even greater. Quantification of an incorrectly constructed or partially defined system merely suggests a spurious precision. A second and perhaps more important problem is the difficulty of analyzing change in a system which is inhabited by man, whereas, in a natural system this problem does not arise. Ecological succession, and

perhaps evolutionary changes, can be envisaged as being essential processes of self-organisation in which successive states that are more probable follow less probable ones (Margalef, 1968).

Much socio-economic change, although having its ultimate origin in purposive behaviour, does not itself have adaptive value for any particular system (e.g., an island ecosystem) within which it occurs. This contrasts with change in natural systems, which operates in many ways to achieve greater stability for the ecosystem, as through greater species diversity (Odum, 1971). Ecosystems are dominated by negative feedback loops and homeostatic tendencies, whereas, all present-day systems involving man have, in contrast, much stronger inbuilt feedbacks (increasing populations, rising material expectations, the impact of innovation diffusion, etc.), and in addition the factor of active control (Chorley, 1973). The nature and effectiveness of control and the purpose of a particular system can perhaps be specified in terms of the aspirations of groups and individuals and the various constraints that make it unlikely that these goals will, in fact, be achieved. Nevertheless, there remains the problem of continual and essentially unpredictable change in the inputs to the system (Brookfield, 1975). Far from being equilibrium bound, most of the real world's systems that human ecologists study are increasingly dynamic, "lurching from one state of disequilibrium to another in response to changing impulses" (Brookfield, 1975). From this viewpoint, systems analysis appears far from panacea, but concomitantly the simplicity, manageable scale, and insularity of island ecosystems make it worth studying.

With respect to the small islands, insularity, whether actual or conceptual, has particular value for ecological studies. At the 1961 symposium on 'Man's Place in the

Island Ecosystem' Fosberg (1963:5) identified two essential features of real islands that made them attractive for study, i.e., isolation and limited size. With limited and well-defined size of the islands, it becomes easier to have an in-depth study and generalisation because of the greater ecological and cultural unity of small human groups of the islands. It also becomes easier to analyse in detail, because the studied sample inevitably represents a large percentage of the total population. Any isolation *of a society, even if relative, also presents practical advantage of boundedness or togetherness* that facilitates the operational definition of a population/group, and simplifies the measurement of flow of energy and matter. In addition to these methodological considerations, insularity also provides circumstances, particularly suitable for the study of human ecology, since in case of islands the spatial definition of man's ecosystem is relatively unambiguous. The land-sea interface represents a distinct boundary for most organisms so that a readily defined area of the island and the functional interactions of inhabitants within the ecosystem correspond in many respects.

### **1.1.3 Human Habitats in Island Ecosystem**

Many of the island ecosystems have become interesting and unique habitat of man (and of plants and animals too) where distinct cultures have flourished. Changes have been noticed in the human groups and the island ecosystems owing to interaction between the two. The importance of change is, of course, recognised by researchers into the human ecology of island populations, but within the explicit ecosystem framework. Among those who have used the ecosystem model more effectively is Rappaport, whose work is discussed by several authors (McArthur, 1977; Morren, 1977 and Bayliss-Smith, 1977). Rappaport's writings (1968, 1971a) about the Tsembaga Maring, a small and essentially insular community in the Bismarck

Mountains of New Guinea Island, illustrates well the conceptual problem that is posed by ecosystem change. Rappaport was concerned with two types of systems: firstly, the actual mountain forest ecosystem controlled and inhabited by the Maring, which he termed the 'operational model' of system; and secondly, knowledge and beliefs concerning the environment that the people themselves possess, which he termed the 'cognized model'. The Maring's cognized model is dominated by pig cycle, which is associated with religious and political rituals (Wagner, 1977), but which also has important environmental implications through changing land use pressure.

Inherent in the ecosystem approach is the study of the management of ecosystem. Chorley (1973: 160) views management of the ecosystem as "the manipulation of the equilibrating operations of the ecosystem so as to achieve the higher levels of production, generally within the existing structure of the system". Management of ecosystem appears to be difficult when the ecosystem is being transformed in irreversible way due to either government intervention or other reasons. In studying such changes, and in predicting the future of small insular groups, a steady-state ecosystem approach tends to offer limited insights. Even more the majority of the problems of island population today concern change and response to innovation, rather than to the dynamics of internal stability. Besides environmental alteration, this transformation involves an increase in the dependency of the community upon external inputs. It may pose ultimate threat to the once isolated populations of the interiors, such as the Jarawa. As elsewhere in the tropics, the traditional culture of foraging populations maintained an ecological balance through sustainable use of resources. The effects of interaction with external systems generally result in lowered subsistence diversity as new food items replace traditional ones and a reduced capacity to respond to signs of degradation within the ecosystem as

people's dependence upon external inputs increases. In the long run, such changes have negative impact as it leads to social and ecological instability, and ultimately threaten people's own welfare (Rappaport, 1971b; Howlett, 1973; Waddel, 1974; Lee, 1984; Ndagala, 1988)).

#### **1.1.4 Hunter-Gatherers or Foragers**

*The Cambridge Encyclopedia of Hunter-Gatherers* (Lee and Daly, 1999:3) defines 'foraging' as subsistence based on hunting of wild animals, gathering of wild plant foods, and fishing, with no domestication of plants, and no domesticated animals except the dog. The people who practice such subsistence activities are known as hunter-gatherers or foragers. In contemporary theory, this minimal definition is only the starting point in defining hunter-gatherers. Recent research has brought a more nuanced understanding of the issue. In defining foragers, it must be recognized that many of the contemporary foragers practice a mixed subsistence: gardening in tropical South America, reindeer herding in northern Asia, trading in South/Southeast Asia and parts of Africa. Given this diversity, Lee and Daly (1999:3) proposed that modern hunter-gatherers are typically characterized by a cluster of traits: 'subsistence is one part of a multi-faceted definition of hunter-gatherers, social organisation forms a second major area of convergence, and cosmology and world-view a third. All three sets of criteria have to be taken into account in defining and understanding hunting and gathering communities today.'

The basic unit of social organisation of most hunting and gathering communities is the 'band', a small-scale nomadic group of fifteen to fifty people related by kinship. Band societies are found throughout the Old and New Worlds and share a number of common features. First, they are relatively *egalitarian*. Leadership

is less formal. *Mobility* is another characteristic of band societies. People tend to move their settlements frequently, several times a year or more, in search of food. A third characteristic is that all band-organized peoples exhibit a pattern of *concentration and dispersion*. Rather than living in uniformly sized groupings throughout the year, band societies tend to spend part of the year dispersed into small foraging units and another part of the year aggregate into much larger units. A fourth characteristic common to almost all band societies is common access to resources of a particular territory. It is further characterized by rules of reciprocity. Another broad area of commonalities lies in the domains of the quality of interpersonal relations and forms of consciousness. *Sharing* is recognized as a common trait and the central rule of social interaction among hunters and gatherers (Kent, 1993). The most prized resources are shared among the constituent families of a band. However, the easily available resources are not shared normally; instead, these are shared within a family. The hunter-gatherers perception of the environment is as the '*giving environment*'. It is found among many hunter-gatherers who perceive the environment around them as their home and the source of all good things (Bird-David, 1990; Turnbull, 1968). Invariably, the terms hunter-gatherers and foragers have been interchangeably used but it has the same meaning.

The human groups who much later were to be called as 'hunters and gatherers' or 'foragers' have been central in the debates of European social and political thought from the sixteenth century onwards. Philosophers from Hobbes, Locke, and Rousseau onwards have drawn upon contemporary accounts of 'savages' as a starting point for speculations about life in the state of nature (Meek, 1976; Barnes, 1937; Barnes and Becker, 1938). These constructions became more detailed as more information accumulated from travelers' accounts, resulting in elaborate schemes for human

adaptation in the works of the eighteenth-century scholars like Smith, Millar, Ferguson etc. (Barnes, 1937; Harris, 1968).

With the rise of European imperialism and the conquest of new lands, some detailed studies were made on hunter-gatherers. William Sollas (1911) was one of the first to define hunting and gathering as a specific way of life. The study of the Central Eskimo by Boas (1888), a physical geographer, is one of the earliest seminal works on hunter-gatherer where the man-environment relationship has been seen from ecological point of view.

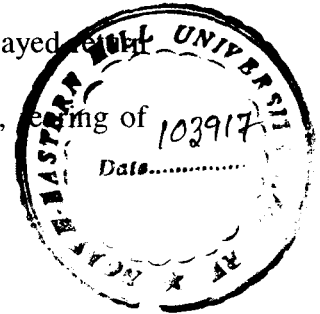
Modern studies of hunting and gathering people can be traced to two landmark works of the 1930s. First is an essay by Julian Steward (1936) on "the social and economic basis of primitive bands" in which he argued that resource exploitation determine to a significant extent the shape and dynamics of band organisation. It was followed by another seminal work by him on the Great Basin Shoshone, Ute and Paiute (Steward, 1938) where he analysed the functional relationship among the different aspects of their cultures, and of their cultures to the local environment as well. In doing so, he shed light on the patterns and processes of cultural change, especially among hunter-gatherers, that could be understood in terms of adaptation to specific environment and human ecology represents the pivotal bridge between culture and natural environment. In his later work, Steward (1955:32) shifted focus from 'human community' as a strictly biological construct to 'human community' as a cultural construct. In this study, he focussed on analysing the relationship between technology and the environment along with behaviour employed in exploitation of a particular environment by means of a particular technology. The second seminal work was the classic essay by Radcliffe-Brown (1930-31) on Australian aboriginal social

organisation. However, unlike Steward, for whom *ecological* factors were paramount, Radcliff-Brown saw structural factors of *kinship* as primary to man-environment relationship.

The publication of the edited book *Man the Hunter* by Lee and DeVore (1968) is considered the first detailed collection of works on hunting-gathering human groups. In yet another work on the Bushmen of Kalahari, Lee (1969) has examined the foraging pursuits of the Bushman through application of input-output analysis and came to the conclusion that ratio of labour expenditure to food collection in such society is generally low. The input-output analysis has been done while examining the foraging activities of the Jarawa in the present thesis.

A burst of research activities followed the publication of *Man the Hunter* (Lee and DeVore, 1968) resulting into coming out of a number of monographs and edited volumes. The worth mentioning among them are by Damas (1969), Balikci (1970), Bicchieri (1972) on the Netsilik Eskimo, Sahlins (1972) on Stone Age Economics of the !Kung, Watanbe (1973) on the Ainu ecosystem, Marshall (1976) on the !Kung of Nyae Nyae, Binford (1978) on the Nunamiut ethnoarchaeology, Lee (1979) on the !Kung San: Men, Women and Work in a foraging society, Suttle (1990) edited hand book on North American Indian, etc. While studying the adaptation of the !Kung to their habitat in Kalahari, Sahlins (1972:1-39) put called them '*original affluent society*'. He argued that except in times of scarcity, hunter-gatherer populations have to spend only a few hours per day in subsistence-related activities. He further articulated his theoretical position by stating that the work input in terms of time is an indicator of the state of the resources in the habitat. It means less the time spent, high is the state of the resources, and vice versa.

Based on his extensive work on the Hadza of Africa, Woodburn (1988) introduced the concept of the two types of economic system in foraging groups, i.e., 'immediate return' and 'delayed return'. He put the economies of the classical or full time foragers in the category of 'immediate return' because of absence of accumulation or surplus. In this type of economy, consumption and sharing of resources are immediate in time and space. Those based on a 'delayed return principle' allow for planning and investment of time in keeping of bees, horses or planting of some trees and making of traps.



Villoro (1982) and Deloria (1995) have studied the system of knowing and explaining the universe among the hunter-gatherer and concluded that it is the result of the collective wisdom and experience of generations in local or regional settings and history. The indigenous knowledge system put focus on many things: the nature and functioning of the physical world; the supernatural realm and human interaction therewith. Bird-David (1990) has described that most of the foraging groups consider the environment rich and kind to them that she termed as '*giving environment*'. Further, she explains that since the environment is considered the repository as well as provider of all resources, the interaction between man and environment in such society is organic.

A major development in hunter-gatherer research involves the study of foraging strategies. Winterhalder and Smith (1981) provided a detailed account of the application of the '*optimal foraging theory*' with respect to the hunter-gatherer subsistence behaviour. Based on the theoretical model they concluded that the hunter-gatherers seek to maximize their chances of finding food with the least effort. The hunter-gatherers exhibit a kind of economic 'rationality' in their subsistence

strategies, and that 'rationality' is product of their adaptation to a particular ecosystem. Bettinger (1991:106), while taking cognisance of the fact that rationality is culturally conditioned, put stress on the fact that analysis of the human foraging behaviour is grounded in concepts of objective rationality and it remains a desired objective in hunting-gathering studies. The versatility of '*optimal foraging theory*' is reflected in the way it has been adopted in wide range of studies. Analyses of hunter-gatherers occupying the South American rainforest (Kaplan and Hills, 1992), Central Australia (O'Connell and Hawkes, 1981; 1984), Arctic region (Smith, 1991) and numerous regions in between, have all relied heavily on the insight provided by '*optimal foraging theory*'. In an interesting application, some scholars have also employed foraging theory to illustrate the ways in which hunter-gatherers design their subsistence activities to minimise risk (Yellen, 1986; Winterhalder, 1986; 1990).

Human adaptation to the rain forest ecosystem, particularly of hunting-gathering groups, has always been of much interest to the researchers as the resources have typical diversification and dispersal. Hart and Hart (1986) have examined the ecological basis of subsistence in the African rainforest. Hoffman (1986) in his study on Punan and other Borneo foragers contends that the foragers cannot live on the forest resources alone. Similar views have been aired by the Headland (1986 and 1987) while discussing the adaptation and subsistence strategies employed by the Negrito hunter-gatherers in the Philippines. Bailey and Peacock (1988) analysed the foraging pattern of Efe Pygmies in the Ituri rain forest of northeast Zaire. Bailey et al., (1989) have studied possibility of independent foraging in the rain forest in the face of the ecological constraints in detail. They concluded that energy rich wild plant foods are too scarce in rain forest to allow independent subsistence by foraging peoples. But the study by Stearman (1991) on the Yuqui foragers in the Bolivian Amazon and by

Bahuchet (1988) on pygmy foraging peoples of Congo basin, like the Aka, suggest that there are significant variations in the tropical forest ecosystems on a worldwide as well as regional scale. Hence, the sustainability of the subsistence system of these foraging groups depends on a refined knowledge of their environment and the freedom of movement over a large territory to access the resources. In their study on the Batek of Peninsular Malaysia, Endicott and Bellwood (1991) have arrived at the conclusion that small nomadic groups of foragers can live of wild resources alone as their foraging strategy take into account the availability, seasonality and density of wild food resources in the rain forest ecosystem.

Like the human adaptation to rainforest ecology in continental situation, the island ecology and human adaptation therein has also been an area of major interest for researchers. Among the earlier works, the study by Fosberg (1963) discusses in detail the mechanics and behaviour of ecosystems in general and certain peculiarities of island ecosystem in particular with respect to the insularity and size of the island. Simmons (1966) explains the functionality of ecological approach when applied to land-use and the balance between man and environment. Rappaport (1968) discusses critical role of pigs in Melanesian ecosystem, and traces the evolution of pristine ecosystems and human alterations in it. He finds that the extent of human impact varies; the high islands are most susceptible to human alteration, the coral atolls less, and the reef-lagoon systems the least. Watanbe (1973) analysed in detail the changing man-environment relationship in an island ecosystem with respect to the Ainu, a hunting-gathering tribe of Japan; and how the changes brought about by the introduction of new technology have proved detrimental to the Ainu. While drawing a comparison between two human groups with regard to the utilisation of forest resources and its consequences in Malaysia, Dunn (1975) explains the sustainable

harvesting of forest resources by the Jahai, a foraging community of northern Malaysia during ancient time, and ecologically unsustainable commercial extraction of forest resources by the traders in modern times.

The impacts of contacts and resultant conflict of foraging groups with non-foraging groups have been studied by many scientists. Among the earlier works the study by Cooper (1946: 131, 138) describes the complete disappearance of Tehuelche and Puelche peoples by 1885 from the Pampas of Argentina because of war and diseases. The study by Bodley (1999) describes how the Europeans settlers and venture capitalists, during the 150 years of colonial period from approximately 1795 to 1945, took half of the globe from small-scale cultures to feed the market economy's suddenly expanded appetite for natural resources and in the process killed more than 50 million tribal people.

Lee (1984) has discussed about the survival challenges of the Bushman in the modern world after their being partly adopting the sedentary agriculture since the late 1970s due to thinning as well as receding of the resource base, introduction of new tools and techniques, and competition from the other human groups having superior technology. Ndagala (1988) has pointed out major threats to the Hadza due to land loss and breach of land rights because of granting of the hunting licences to commercial companies, and how these companies are jeopardising the very survival of the Hadza.

Apart from the aforementioned studies, there are some classical studies on hunter-gatherers in which attempts have been made to bring together much of the rich geographical, historical and ethnographic material that had accumulated since the

1940s. *The Handbook of North American Indians* (1978), under the general editorship of William Sturtevant, chronicled the 500 Nations of the continent in a series of landmark regional volumes. Six of these volumes deal largely, if not exclusively, with hunting and gathering peoples, e.g., *Northwest Coast*, edited by Wayne Suttles (1990); *Subarctic*, edited by June Helm (1981); *The Great Basin*, edited by Warren D' Azevedo (1986); *California*, edited by Robert Heizer (1978 ); *Arctic*, edited by David Damas (1984); and *Northeast*, edited by Bruce Trigger (1978). On other continents, Barnard (1992) and Edwards (1987) produced overview volumes on the Khoisan peoples and Aboriginal Australians, respectively.

### **1.1.5 Indian Perspective**

About 75 communities in India have been put in the category of Primitive Tribal Group. However, very few of them are full time hunter-gatherers. In the present literature review only those communities have been considered who derive much of their subsistence from the hunting-gathering pursuits.

The subsistence pattern of the Birhor has been analysed by Sinha (1958) from the cultural ecology point of view. Adhikari (1984) adopted structural approach in the study of Birhor. The hunting-gathering mode of subsistence of Nayaka of Karnataka has been discussed and analysed in detail by Bird-David (1992). She has also analysed the process of change in the Nayaka economy due to their contacts with outsiders. Gardner (1993) has discussed human adaptation of the Paliyan of Tamil Nadu to forest ecosystem.

Models drawn from ecology as well as from studies of modern and Pleistocene geographical and environmental changes have been applied in some of the studies of

Indian hunter-gatherers. Murty (1985), while examining the dynamics of hunter-gatherers cultures of Eastern Ghat, argues that the tremendous indigenous knowledge of plant species results from ecological adaptation and exploitation over a long period, and thus justifies the use of analogies drawn from the recent tribal subsistence pattern along the southeast coast to predict past subsistence strategies. Dutta (1974) and Cooper (1990; 1992; 1994) have tried to determine antiquity of the Andaman Islanders on the basis of the study of kitchen midden found on the old encampment sites.

Among the earliest studies on the foraging community of Andaman Islands the study by Man (1883) and Portman (1899) are important. Man (1883) has described the life and economy of the Great Andamanese. Portman (1899) has discussed the subsistence activities of the Negrito communities of the Andaman Islands, except the Sentinelese. More importantly, it records the process of contact and conflict between Negrito communities and others and their impacts on society and environment. Social organisations and economic activities of the Onge and the Great Andamanese have been described by Radcliff Brown (1922). Bose (1964), in his study on the Onge, has analysed the foraging pursuits of the Onge. Cipriani (1966) has discussed in detail the culture and economy of the Onges and the Great Andamanese. Among the recent studies on the Negrito communities of the Andaman Islands the studies on the Great Andamanese by Chakravarty (1990), on the Sentinelese by Pandit (1990), on the Onges by Basu (1990) and on the Jarawa by Sarkar (1990) are worth mentioning. These studies have been able to reveal human response to island ecosystem through the material culture and social organisations of the communities and the changes that are taking place due to contact with other Non-Negrito human groups. Pandya (1993) in his study on the Onge of Little Andaman has given a detailed account of

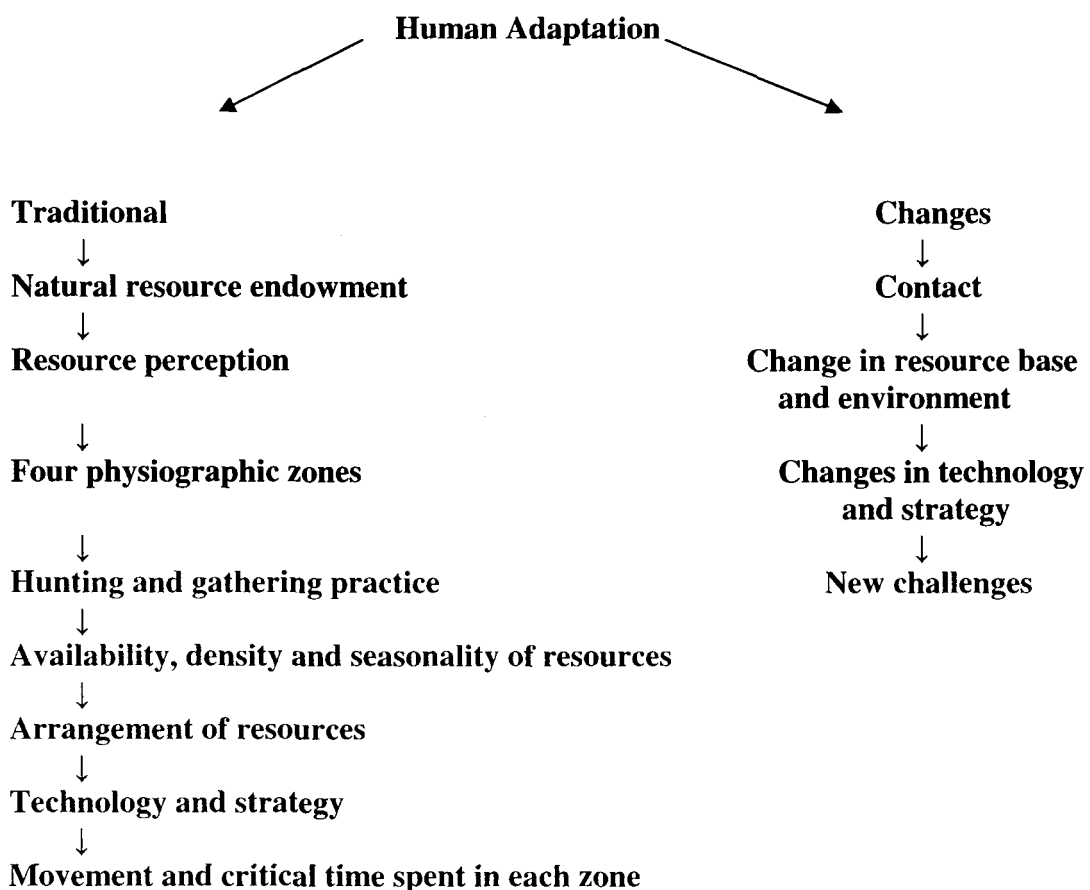
ethnography, cosmology and rite and rituals of the Onge. Mukhopadhyay (2002) has elucidated the history of contacts and conflicts of the Negrito population particularly of the Jarawa with Non-Negrito population. Kumar and Biswas (2002) have analysed man-environment relationship of the Jarawa. Although a number of studies have been done on the hunting-gathering communities, there are only few on the hunting-gathering communities of the Andaman and a very few on the Jarawa.

## **1.2 STATEMENT OF THE PROBLEM**

Study of human adaptation of a foraging community to environment (like that of the island ecosystem) has been of special interest in ecology because the relationship between man and environment is organic and most direct. The Andaman and Nicobar Islands, which abound in tropical rain forests and are surrounded by the warm tropical sea, are home of four Negrito foraging human groups including the Jarawa. They have been living in there for thousands of years and have adapted to the environment of the Andaman Islands. Besides the Sentinelese, the Jarawa are perhaps one of the best examples of full time hunter-gatherers anywhere in the world today. For long, they avoided friendly relations with the Non-Jarawa. However, since the late 1997, friendly contacts have been established with the Non-Jarawa and that has ushered changes in the resource base and the adaptation pattern of the Jarawa. Now, there is conflict between the Jarawa and the Non-Jarawa in sharing the resources of their area. In fact, it is competition between two sets of technology; simple one used by the Jarawa and developed one used by the Non-Jarawa. Like their counter parts in the Andaman Islands, namely the Great Andamanese and the Onges who have not only been reduced in number from about 5000 to 40 and 600 to 95, respectively, but also have almost abandoned hunting-gathering practice, the Jarawa may also give up the foraging activities someday under the changed situation. It means it is a race

against time for the geographers and ecologists to collect information on their adaptation pattern and process to island ecosystem.

The form and process of human adaptation of the Jarawa to island ecosystem has been studied taking into account the traditional technology and strategy employed by the Jarawa with respect to utilisation of resources for their sustenance. Emphasis has also been given on the changes in the technology and strategy under the influence of new challenges with regard to sharing of resources of their territory by the Non-Jarawa. The research problem to be investigated can easily be understood with the help of the flow diagram below.



An inventory of the natural resources, both terrestrial and aquatic as recognised by the Jarawa, has been prepared. It helps to know the number and types of resources used by them. Further, these resources have been arranged in order of significance as reflected through their dietary preferences. This also explains relative percentage of animal and plant resources in the total food items collected by the Jarawa. Since the resource distribution over space (four physiographic zones) and time (seasons) is not uniform the human perception of resources has also been studied highlighting the ways and means of recognising the resources in different physiographic zones, viz., coast (shallow sea area), wetlands (area between high and low tides), plains and mountains. The interplay between population and resources has been analysed in relation to foraging technology and strategy. While discussing foraging strategy, the stress has been out on seasonality of resources, location of camps, movement pattern and foraging methods. While the role of ecological edges have been discussed to find out the determining factors behind the location of camps, the movement of the Jarawa over time and space have been explained to understand whether there is any pattern in their movement or not, and if yes then what are the determining factors behind such movements. In addition, the foraging methods used in hunting, fishing and gathering have also been discussed in detail. Since the search image, role specialisation and sharing are also an aspect of foraging strategy, these factors have also been elucidated along with other factors. All these factors have been discussed in details to unravel the nuances of foraging pursuits of the Jarawa as they are directly related to the question as how the Jarawa derive their food or eke out their livelihood in the given island environment. Impact of contact with the Non-Jarawa on the resources base and adaptation of the Jarawa to the changing situation have also been examined.

### **1.3 OBJECTIVES**

The main objectives of the study are as follows:

1. to prepare an inventory of natural resources (both terrestrial and aquatic) as perceived by the Jarawa and also by the Non-Jarawa,
2. to analyse human adaptation by finding out technology and strategy of resource utilisation by the Jarawa, and
3. to examine the impact of contact on the adaptation, environment and resource base of the Jarawa and the new challenges therein.

### **1.4 RESEARCH QUESTIONS**

The research issues dealt with in the present study include:

- i) As the Jarawa practice hunting and gathering means of subsistence it is interesting to answer the question that how far it is truly a hunting and gathering community.
- ii) The resource base of the Jarawa has eroded due to arrival of other human groups in their habitat; it is, therefore, essential to know impact of the increased taxation of the natural resources on the Jarawa and their environment.
- iii) Finally, what survival strategies have been adopted by the Jarawa to cope up with the new challenges in the conflict situation?

### **1.5 STUDY AREA**

The Andaman and Nicobar group of Islands has 319 islands with an area of 8,923 sq km spread in north-south length for more than 700 km. Floating in splendid isolation, east of the Indian mainland, this archipelago is situated between 6° and 14° North Latitudes and between 93° and 94° East Longitudes in the Bay of Bengal with

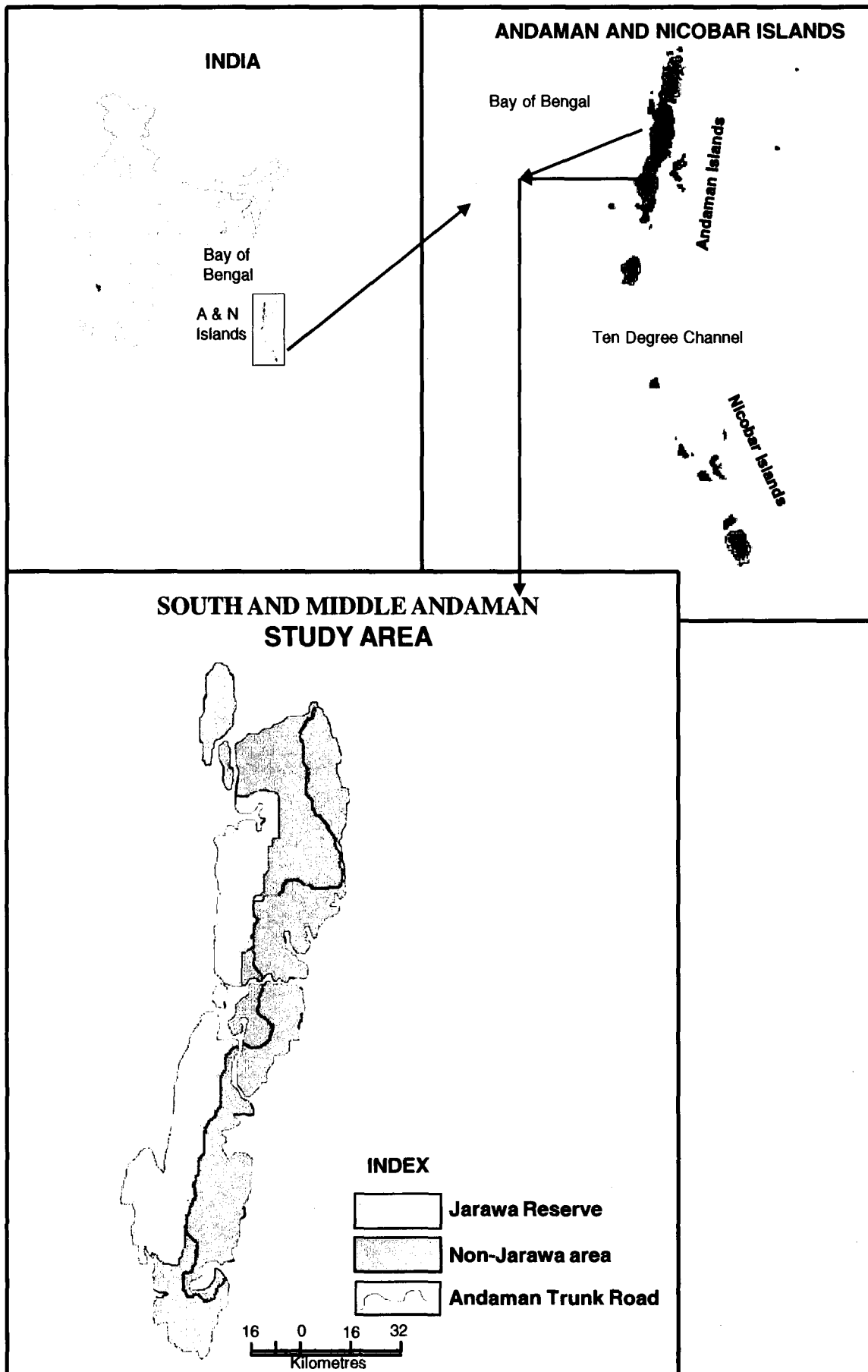


Fig. 1.1

Ten Degree Channel separating the Andaman group of islands from that of the Nicobar (Fig. 1.1). The Andaman group of islands can further be divided into two groups, viz., Great Andaman and Little Andaman. Geologically, the Andaman and Nicobar group of Islands is considered as a part of the continuous range of submarine mountains, stretching from Achin Head in Sumatra to Cape Negrais in Burma and further extending to the Arakan Hills (Oldham, 1885; Imperial Gazetteer, 1909). These arcuate islands are, in fact, peaks of a mountain range rising from the seabed to a maximum elevation of 732 metres above the mean sea level. The mountain range itself is part of a long chain of folded mountains, better known as Arakan-Yoma arc, starting from the Patkai range in Northeast India to Sumatra-Java mountain ranges in the Southeast Asia.

Climate of the Andaman Islands is of wet tropical regime with predominance of monsoon rainfall. High temperature and rainfall are two main characteristics, which are mainly responsible for luxuriant growth of tropical forests. The reserved and protected forests are spread over 80 per cent of the Island. Except for the areas cleared for settlements and small Islets which are devoid of natural vegetation, the entire land mass of the Islands is covered with lush green forests which are almost impenetrable due to luxurious growth of the tropical rain forests- a characteristic of the humid and warm tropics. The lack of gregariousness in Andaman forest is well known. An absolute preponderance of one species or even an assemblage of species rarely marks the floral landscape in these islands. There are several key features of the tropical rain forest ecology of the Andamans. Firstly, the tropical rain forests are one of the most productive terrestrial ecosystems with very high gross and net primary productivity; secondly, it is extremely efficient at rapidly recycling most of the nutrients; and thirdly, it has enormous biomass.

The Andaman group of Islands is home to four Asiatic Negrito hunter and gatherer communities *viz.*, the Great Andamanese, the Onges, the Jarawa and the Sentinelese. They have been living in the Andaman Islands from time immemorial. The Sentinelese inhabits the North Sentinel Island, Onges the Little Andaman, Great Andamanese the Strait Island and the Jarawa western part of the South and Middle Andaman Islands. The Sentinelese are still unfriendly with the outsiders. Like Sentinelese, the Jarawa were also hostile to outside population until October 1997. They have a total population of 265 persons (approximately). The Jarawa territory, which has been declared as 'Jarawa Reserve', covers an area of about 765 sq km. The resource base of the Jarawas is inclusive of both terrestrial as well as aquatic ecosystems.

Besides the Negrito groups, the Andaman Islands are inhabited by Non-Negrito population too. They include the Andaman Indians (local born), Mopillas, Bhandus, and Burmese settlers including Karens, refugees from the erstwhile East Bengal and the people from southern parts of India.

In the post-Independence period the Government of India initiated a programme to rehabilitate persons displaced from the then East Pakistan in the Andaman Islands immediately after Independence. Of all the refugee families, about 2328 families were settled in different parts of Middle and North Andaman. Interestingly, they were settled on eastern boundary of the Jarawa territory by clearing the forests. Agriculture has been their main economic activity. In addition, many people from mainland India who were or are in service have also settled here, mainly in and around Port-Blair- the capital of the Andaman and Nicobar Islands.

## **1.6 DATA BASE AND METHODOLOGY**

The present study is based on both primary and secondary data. Though the fieldwork in the Jarawa territory had begun from October 1998 and continued until February 2004, a detailed fieldwork could only be carried out from late 2001 onwards. It was so because prior to December 2001 Andaman Administration did not consider the situation safe enough to allow any persons to stay in the Jarawa territory.

### **1.6.1 Primary Data**

During the field work efforts were made to collect information on the Jarawa population and male-female ratio, because prior to 2001 only the estimated population of the Jarawa was available. To understand the natural endowment, the biophysical resources of the Andaman Island, particularly of the Jarawa territory, were identified and recorded. It includes the preparation of a detailed resource inventory of both terrestrial and aquatic resources used by the Jarawa and Non-Jarawa. The detailed foraging data of the Jarawa were collected from three locations – Thidong, Boiab and Tanmad between 11-12-2001 to 09-01-2002, 11-04-2002 to 09-05-2002 and 11-08-2002 to 09-09-2002, respectively. It covered the three different seasons - rainy, cool dry, and summer dry seasons. The data on the resources collected and consumed by them were gathered through focal family sampling, in which all the food collection activities of a few families were recorded for twenty-eight days in each season. The data thus collected gave quantitative information on the amount and type of the resources collected and the time spent on it. It also helped in finding the per capita availability of resources. This information also helped in explaining the state of health of resources in the Jarawa area. To ascertain the optimality of their foraging behaviour, data on the hunting behaviour of the Jarawa were collected over three different seasons. The data set include distinct hunting trips performed by individuals

to capture the games. In order to get information on the location of the Jarawa camp at particular site and availability of resources therein, altogether 69 Jarawa camp sites were visited and the location of the Jarawa camps were recorded with the help of Geographic Positioning System (GPS) instrument. The information on the movement pattern of the Jarawa, both logistical as well as residential, was obtained by visiting their locations and asking the remaining Jarawa of the group.

Data were also collected on the Jarawa perception of the resource, intra and inter-family sharing of the resources, division of labour and other socio-economic activities. The data set include information pertaining to impact of contact in the post hostility phase on dress, ornaments, foraging behaviour, addiction to tobacco, exchange of goods between the Jarawa and Non-Jarawa etc. For collection of data, the structured schedules and participant's observation and diary record methods were used. Population data on those individuals who were not present in the camps were collected through genealogical chart method.

### **1.6.2 Secondary Data**

Several published and unpublished records, reports, articles, and books were consulted in order to collect relevant data and information on the topic of the research. Topographical information relevant to the study was obtained from the camp office of the Geological Survey of India. As Andaman and Nicobar Islands has about 80 per cent of the area under forest cover, 1C LISS-III, Landsat-TM and IRS-1C -LISS-III-PAN geocoded merged data from 1997 and 2001 were sourced from Indian Institute of Remote Sensing, Dehradun for visual interpretation to identify types and density of forest resources in the Andaman Islands. In order to prepare a detailed inventory of resources and to know the scientific name of the resources used by the Jarawa, the

reports of Zoological Survey of India, Botanical Survey of India, and Department of Environment and Forest were consulted.

The subsistence activities of the Jarawa involve the hunting of animals and gathering of plants and fishing. In the health status of the Jarawa the total food intake and its calorific value play a vital role. Hence, information pertaining to food intake and its calorific value were gathered from the reports of All India Institute of Public Hygiene and Health, Kolkata and Directorate of Health Services, Port-Blair. Information on the occurrence of diseases due to contact in the pre and post hostility phases were collected from the Directorate of the Health Services and other published material. The Jarawa are in regular contacts with outsider since second establishment of the Penal Settlement in the Andaman Islands. Data on the history of contact and conflict were gathered from the Census records, published materials and Police Stations. In addition, records of the Adim Janjati Vikas Samiti (AAJVS), Port Blair were used to gather data on the gift articles given to the Jarawa and other related information.

### **1.6.3 Data Analysis**

Data on ecology of the Jarawa have been analysed using the spatio-temporal resource utilisation pattern, input-output method and optimal foraging model. These methods have been discussed below.

#### **1.6.3.1 Spatio-temporal resource utilisation pattern**

The spatio-temporal resource utilisation pattern in the Jarawa territory has been analysed with the help of the data collected from four physiographic zones.

Since availability and seasonality of resources is distinct in each of these zones, the movement pattern of the Jarawa in these zones has been recorded and analysed.

### 1.6.3.2 Input-output analysis

The input output analysis has been done to explain the ecological context of the subsistence economy of the Jarawa by finding-out the Index of Subsistence Effort. The analysis has helped in finding out work input of the economically active Jarawa in a week. It, in turn, has given information that how much of their subsistence efforts are oriented toward hunting, fishing and gathering. In addition, it also helps explain that after hunting-gathering activities, how much time the Jarawa are left with which they devote for leisure related activities

The formula used in the here is taken from the Lee (1969), which is as follows:

$$S = W/C$$

where S = the index of subsistence effort,

where W = the number of man-days of work, and

where C = number of man-days of consumption.

Mean group size = total man-days of consumption divided by 7

Man-days of hunting = total man-days of hunting divided by total man-days  
of consumption.

Work week = the number of work days per adult per week.

Hunting week = the number of hunting per adult per week.

Index of Subsistence = man-days of work divide by man-days of  
consumption.

### **1.6.3.3 Optimal foraging model**

To find out the optimality of foraging behaviour of the Jarawa, an encounter distribution for each individual hunter has been derived. The analysis has been accomplished by dividing each individual time spent searching for pray into equal units of one hour within which the number of the pray items is encountered. Thereafter, the observed distribution has been compared with an expected Poisson distribution. In order to generate further confidence in the results, Chi-square goodness-of-fit test was carried out. The results have helped explain hunting behaviour of the Jarawa. Besides, maps charts and graphs have been used to give a cartographic representation of necessary information. Photographic coverage has also been done to show important features of the study.

## **1.7 ORGANISATION OF THE STUDY**

The present study has been organised into the six chapters. The First Chapter provides details pertaining to the basic research design including the statement of the problem, definitions, relevance of the study, a brief note on the selection of the study area, broad objectives of the research, important research questions, research methodology, survey of literature and the organisation of the study.

The Second Chapter elucidates the natural endowment of the Andaman Islands. It gives detailed geographic information about the Andaman Islands in general and the Jarawa Reserve in particular. It begins with locational attributes of the Andaman and Nicobar islands and is followed by geological and physiographic account of the islands. It also describes about the islands' climate and vegetation cover. In addition, information on the antiquity of the Andaman Islanders, and

demographic information about the Jarawa and their different territorial groups have been given.

The ecological niche of the Jarawa has been discussed in Third Chapter. The ecological niche of the Jarawa has been discussed in terms of their perception of the resources in different physiographic zones. A detailed inventory of the resources both edible and non-edible has been prepared. It also discusses how the broad based ecology of the Jarawa functions. The order of importance of resources have been analysed along with identification of the most preferred as well as the 'key-stone' resources of the Jarawa. In addition, a resource inventory of resources of resources utilised by the Non-Jarawa has also been attempted.

The adaptation of the Jarawa to the Island ecology has been discussed in the Fourth Chapter. The discussion centres on technology and strategy employed by the Jarawa for the collection and utilisation of resources have been discussed. The stress is on the foraging strategy of the Jarawa, which is a collective response to the island ecosystem for harnessing resources spread over different space and time. The foraging strategy of the Jarawa has been discussed in detail with reference to seasonality of resources, location of camps, movement pattern, selection resources, foraging methods, search image, role specialisation and pattern of sharing of resources within a group. The importance of the ecological edges in the location of camps in the process of food collection has been described. The ecological context of the subsistence activity of the Jarawa has been worked with the help of input-output analysis. It is followed by analysis of foraging behaviour of the Jarawa in relation to optimal foraging theory. It is followed by analysis of the work, resource and population relationship.

The impacts of contact have been discussed in Fifth Chapter. It gives a detailed account of the history of contacts and conflicts. It describes the history of contacts and conflict in pre-Independence and post-Independence periods. Further, it analyses the causal factors responsible for the change in attitude of the Jarawa towards Non-Jarawa in different phases. Both the positive as well as negative aspects of the contact in the post-hostility phase have been dealt with in relation to resources and how the Jarawa have adapted them in the changed situation. The impact of contacts on the resource base, health, acceptance of the material traits and innovation in technology has also been discussed.

Finally, the Sixth Chapter provides the summary and conclusions of major findings derived from the study. It also provides the recommendation based on the understanding of the present research problem. Difficulties faced in carrying out the present study and scope of further research on the related topic have also been incorporated. An exhaustive list of references follows the last chapter.

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## **CHAPTER II**

# **PHYSICAL ENVIRONMENT OF THE ANDAMAN ISLAND ECOSYSTEM**

## **CHAPTER II**

### **PHYSICAL ENVIRONMENT OF THE ANDAMAN ISLAND ECOSYSTEM**

As ecology is the interrelationship between the organism and environment of an ecosystem, and within it particularly of the ecological niche, it is relevant to understand the physical environment so that ecological interrelationship could be revealed in its all-possible details. Moreover, it is from the biophysical environment a human group identifies, perceives and derives resources for the subsistence and survival. Therefore, in the following lines physical environment of the Andaman Island (that is the habitat of the Jarawa) has been discussed. The discussion not only highlights the natural endowment of the Andaman Islands but also points out its peculiarities to which the Jarawa have adapted and made their niche.

#### **2.1 LOCATION AND EXTENT**

The Andaman and Nicobar archipelago comprises as many as 319 islands, spread in the form of more or less an arch for a length of 700 km. The Andaman and Nicobar group of islands cover an area of about 8,293 sq km, and it extends between 6<sup>0</sup> to 14<sup>0</sup> North latitudes and 92<sup>0</sup> to 94<sup>0</sup> East longitudes in the Bay of Bengal with the Ten Degree Channel separating the Andaman group of islands from the Nicobar group of islands (Fig. 2.1). The Andaman and Nicobar Islands are located in the eastern side of the Bay of Bengal. These Islands are comparatively at more distance from the mainland India than the Myanmar and Malaya Peninsula (Fig. 2.2). The Andaman Islands lie 944 km from the Hooghly mouth, while merely 192 km from Cape Negrais of Myanmar. The land area of the Andaman Islands is 6,340 sq km and that of the Nicobar is 1,953 sq km. Interestingly, only 38 islands are inhabited, of which 26 are in the Andaman group and 12 are in the Nicobar group. In addition,

these islands are habitat of six tribal groups, four of them (including the Jarawa) belong to the Negrito stock, while remaining two belong to the Mongoloid stock.

The Andaman group of Islands lie north of the Nicobar group of Islands (Fig.2.1). It extends between 10<sup>0</sup>30' and 13<sup>0</sup>30' North latitudes and 92<sup>0</sup>15' and 95<sup>0</sup>10' East longitudes. The Andaman Islands consist of 204 islands. At the extreme north of the Andaman group of Islands is the Landfall Island followed by the three main islands known as the North Andaman, Middle Andaman and South Andaman, all of them separated by shallow seas. At a distance of 64 km from the South Andaman stands the Little Andaman Island. Besides, there are innumerable small islands, e.g., Ritchie's Archipelago, Tarmughli, North and South the Sentinel Islands etc. (Table 2.1). The Middle Andaman is the largest of all islands in terms of area (561 sq km).

**Table 2.1 Areas of Different Islands of the Andaman**

Sl. No.	Name of Islands	Area (sq km)
1.	North Andaman	490.20
2.	Middle Andaman	561.00
3.	South Andaman	359.51
4.	Landfall and 7 other islands in the North Andaman Group	27.92
5.	Interview and 4 other islands in the Middle Andaman Group	59.00
6.	Baratang and 4 other islands in the Baratang Group	11.34
7.	Havelock and 6 other islands in the Ritchie's Archipelago Group	94.20
8.	Rutland and 3 other islands in the South Andaman group of islands	73.86
9.	Tarmughli and 4 other islands in the Labyrnth island	12.20
10.	Little Andaman	289.90
	Other islands numbering 166	430.97
	<b>Total</b>	

Source: Sen, 1962.

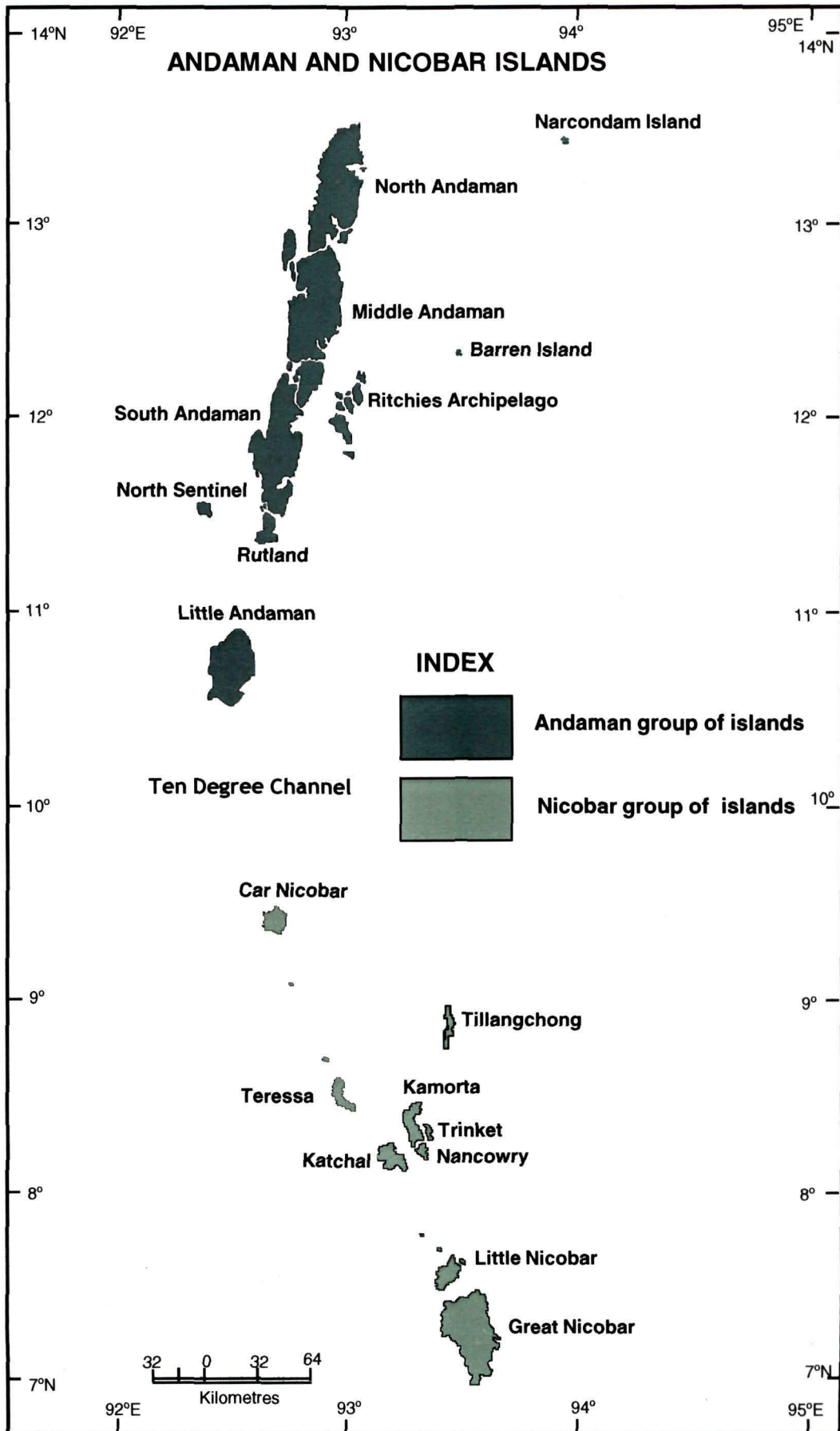


Fig. 2.1

### LOCATION OF ANDAMAN AND NICOBAR ISLANDS

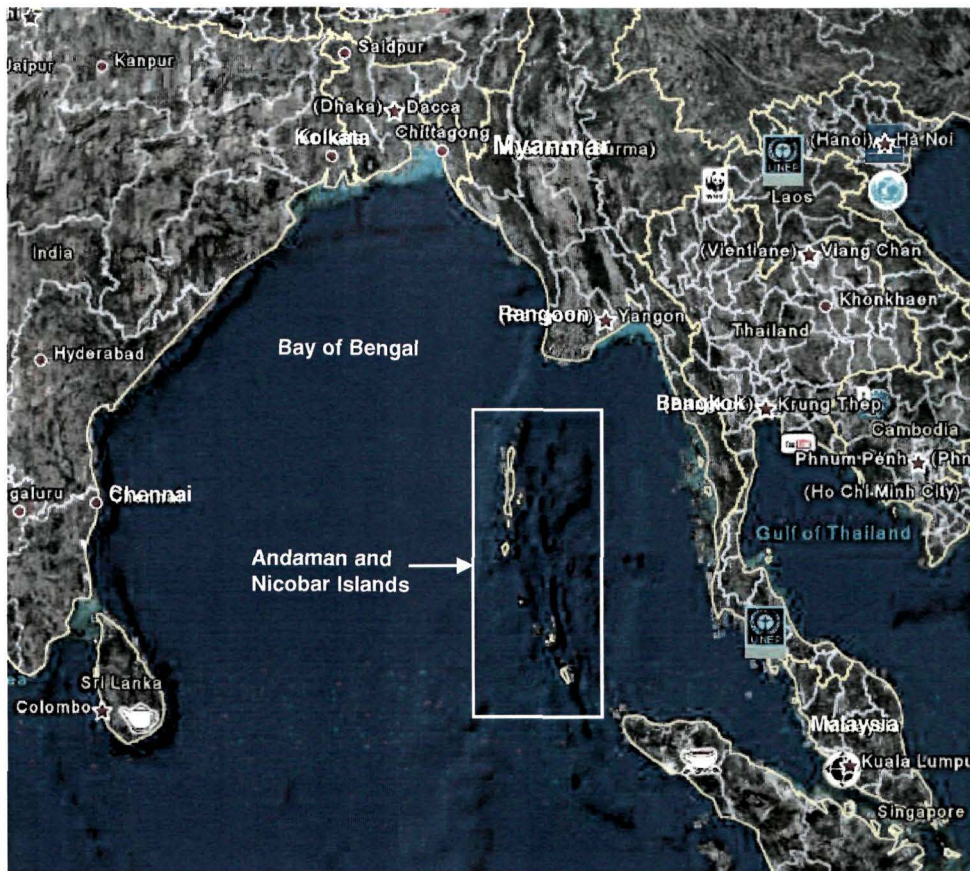


Fig. 2.2

## 2.2 PHYSIOGRAPHY

The first attempt to study geology of these islands was made by Helfer and Millheil in 1840 which was published in 1859 . However, a systematic geological study could begin only from 1870 and thereafter a number of geological notes were published in the '*Records and Memoirs of the Geological Survey of India*' and '*London Geological Magazine*' (cf. Lal, 1976). Since 1958, the Geological Survey of India has been doing detailed study with a view to investigate geology and mineral resources of the Islands. Most of the physiographic information on Andaman Islands, which have mentioned below, have been sourced from Sen (1962) and Lal (1976).

Oldham (1885) has distinguished two sedimentary formations besides serpentine series- Port Blair Series, and Archipelago Series. In the Port Blair series, the rock types are grey sandstones with interbedded shales, frequently consisting nests of coaly matter and occasionally beds of conglomerate and pale grey limestone as subsidiary members. The Archipelago series, as the name implies, is dominant in the islands of the Archipelago group. It consists of soft limestone formed of coral and shell and soft calcareous sandstones and soft white clays with occasional bands of conglomerates. Tipper (1904-05) put these series to Eocene (Lower Lutetian) and Miocene formations, respectively. Altogether five formations have been distinguished in the Andaman Islands. These are Pre-tertiary, Cretaceous, Eocene (Lower Lutetian), Miocene Burdigalian, Miocene and recent and sub-recent formations. Of all the formations, the Eocene rocks are most widely prevalent. They occupy the three main islands i.e., North, Middle and South Andaman Islands. Conglomerate is common in the North Andaman and in some parts of the Middle Andaman, while sandstone is common in the South Andaman.

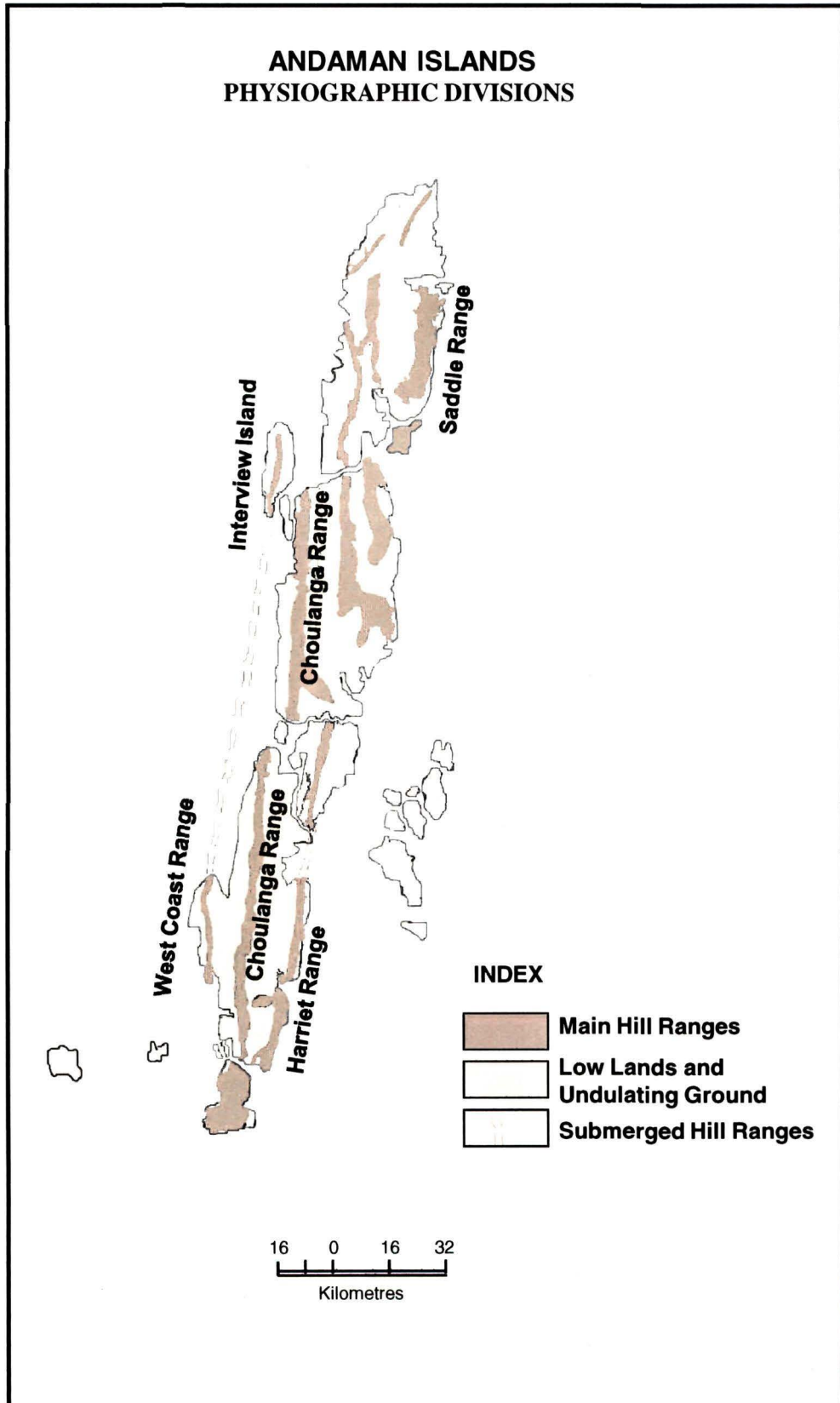


Fig. 2.3

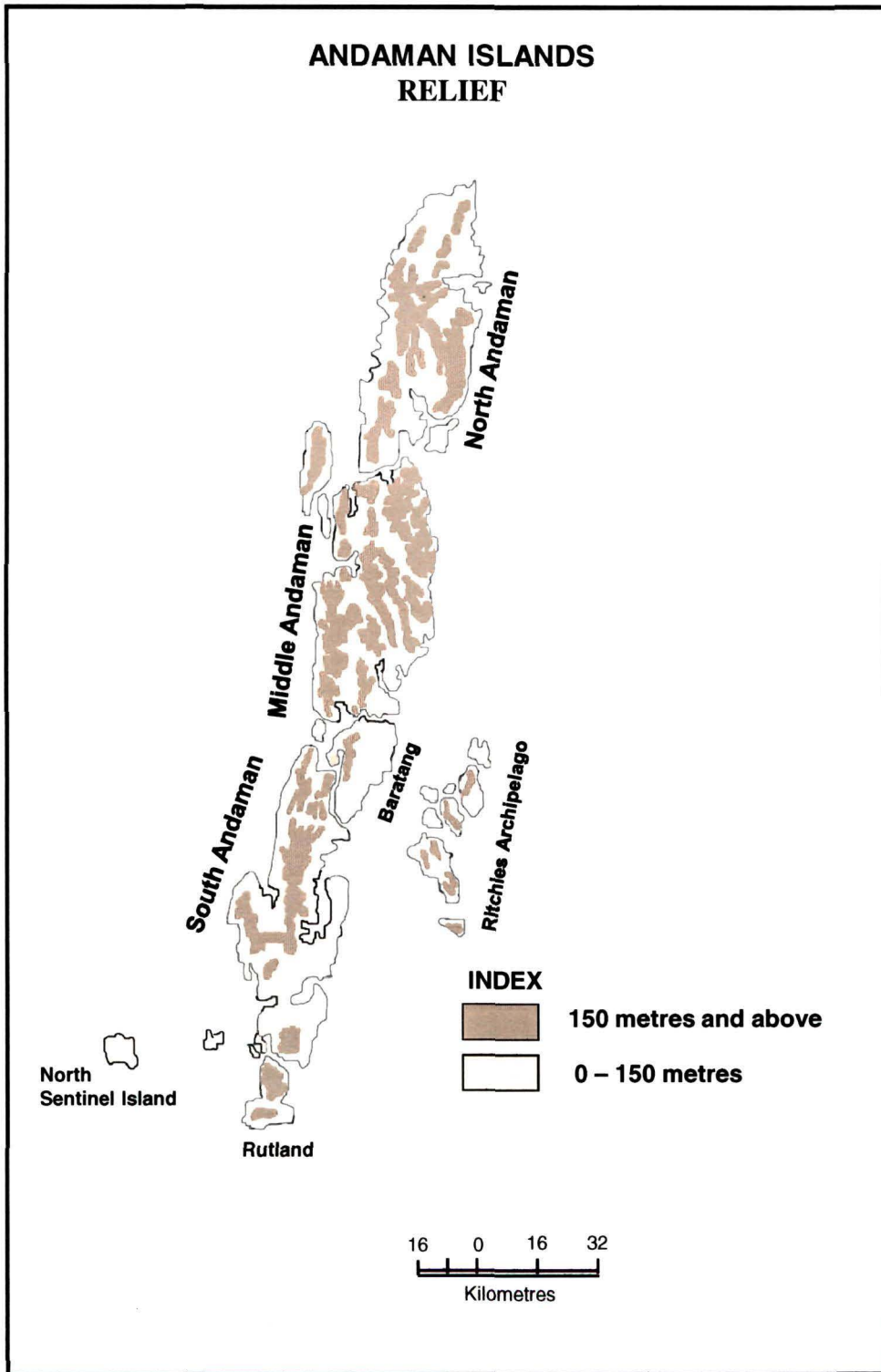


Fig. 2.4

Physiography of the Andaman and Nicobar Islands is dominated by the mountain ranges. Andaman Islands consist of three parallel ranges, which are, in fact, continuation of the Arakan Yoma arc- running from the Pataki range in the Northeast India to Sumatra Island in Southeast Asia. These ranges run through the islands from north and northeast to south and south-west in an arcuate shape. Along the east coast, the Saddle range of the North Andaman continues in the Middle Andaman and passes through Baratang Island to form the Harriet Range of the South Andaman (Fig. 2.3). The western range passes through the west coast of Andaman Islands. In the west coast of North Andaman, it forms a series of detached islets as West Islet, Paget Islet, Interview Island, Flat Islet and finally forms the west coast range of South Andaman which continues in the south to form Tarmugli and other small islets. In between the two parallel ranges is Cholunga Range. Cholunga Range and its continuation up to the Rangers Island are one of the highest ranges of the Andaman Islands, attaining maximum height of 434.64 m at Mt. Ford peak in Rutland. It runs through the middle of South Andaman, where on its both sides are longitudinal bays. Further, the range runs along the west coast of the Middle Andaman and merges into the Ranger Island. The series of parallel ranges have given rise to ridge and valley topography in the Islands. In between the mountain ranges lie the longitudinal bays into which a number of very short distances torrential streams flow from both sides.

In general, the hill ranges are low in height never exceeding 762 m and they send out spurs in all directions. The highest peak in the whole of the archipelago is Saddle Peak (732.12 m) in North Andaman. On an average, the east coast ranges are steeper than the west coast ranges. All these ranges are under the deep mantle of forest cover. In between the East West Range of North and Middle Andaman Islands and Harriet Range continuation in the North, lie the Blair Bay, Kalpong Bay, Kalara

Bay, Congo Bay etc., in the North Andaman and Betapur river valley and Bomlungta river valley in the Middle Andaman.

A profile across north Andaman from west to east gives an idea of the nature of terrain of the Andaman Islands. In the west coast up to Kalara Sea Creek, the relief is undulating. Here the topography is dominated by parallel hills of moderate elevations and narrow valleys. To the east of Kalara Creek, the land for some distance rises gently and then steeply to the highest point at the Saddle Peak (732.12 m). To the east of the Saddle Peak, the slope is very steep and the steepness continues even under the sea after a narrow continental shelf.

The relief of Andaman Islands is striking because, nowhere, the elevation is more than 732.12 m, which is the culminating point in the entire Andaman and Nicobar group of islands. This height is attained by Saddle Peak along the east coast of the North Andaman. The general elevations of the hills ranges in the Andaman Islands vary from 76.2 m to 381 m (Fig. 2.4). A number of ridges and spurs project out from these hill ranges that enclose narrow and flat valleys and at places have been cut up by streams and their tributaries. The valleys are usually below 15.24 m in their lower part while in the upper part the valleys pass through areas of difficult terrain. Narrow stretches plain land is available at few places. The hills in most places descend steeply to the water.

A continental shelf that dips steeply seaward bound the seaward edge of the Andaman and Nicobar Islands. The continental shelf is wider on the western side than on the eastern side. The western side has a number of coral banks in the Andaman Islands. The rate of growth of and extent of corals formation are richer on the western

considered as barrier reefs. On the eastern side, the coral reefs are fringing type. The coastline is highly indented and at many places penetrates into the island to make inland bays and deep creeks. Protected harbours are mostly along the east coast of the island. Thus, one observes that a wider continental shelf, indented coast and barrier reef provide a ideal breeding and nesting place for many marine resources which are harvested by the different population groups particularly Jarawa.

### 2.3 SOIL

The soils of the Andaman Islands have either developed *in situ* on the hill ranges or in the valleys by the materials derived from the hills by erosion and deposited in the valleys or along the seacoast. Following are the three major soil types:

1. *Sandy soils*: This soil type consists chiefly of sand and shingle, mostly calcareous, lumps of old coral and broken shells uplifted by the action of wind and waves just above the reach of high tides. It is extremely porous and the streams coming down the hills disappear here to emerge again at sea level or in the sea. This formation is limited to the seacoast and usually occurs as narrow strips.
2. *Clay and loamy soils*: This soil type occurs in the valleys and in the lower slopes of the ridges up to a height of about 76.2 m from the sea level. It is rarely found beyond 91.44 m. This soil is formed by the disintegration of indurated clays and shales, limestones and conglomerates. The soil varies from clayey loam to a coarse rubbly sandy loam and is very shallow in some places. There is no trace of visible humus. It is rich when it is dry and water is less in the dry season.

3. *Hilly soils*: This consists of stiff clayey soil of dark red loam overlying micaceous sandstones. It is moist throughout the year and numerous perennial springs issue from it.

In general, it can be said that the soils of different parts of Andaman Islands contain high amount of clay, and are of silty clay to loamy in texture. The refugee population has been settled in the valleys where clay and loamy soil are found and thus conducive for agriculture.

## **2.4 CLIMATE**

The location of the Andaman Islands between 10°30' and 13°30' North latitudes makes the climate of the islands as of the tropical type which closely approximates to the equatorial one in the south. The insular position of the Islands in the Bay of Bengal in between two landmasses in the east and west, location in the tropical zone along the path of travelling tropical storms and cyclones in specific months, considerable north south extension, broken coastline and peculiar arcuate shape, and the dominant functional control of the southwest and northeast monsoons in the specific months of the year, all together have combined influence on the climate of the Andaman Islands to give it a distinct feature. With the help of the temperature, rainfall and humidity the peculiarity of the climate of the Andaman has been tried to explain in the following lines.

### **2.4.1 Temperature**

The mean annual temperature is 26°C. The islands have very little annual variation in temperature. The annual mean maximum temperature varies from 29° to 30.5°C and mean minimum from 23.5°C to 25°C and mean annual temperature from 26°C to 27.5°C. The relative humidity is also very high and the average is 80 per cent

(Basu, 1993). The high temperature coupled with the high relative humidity gives rise to a high sensible temperature. The weather is always warm and very sultry but is ameliorated to some extent by the pleasant sea breezes.

#### **2.4.2 Rainfall**

The relative humidity varies from 63 per cent to 90 per cent. The highest humidity occurs from May to November i.e., during the southwest monsoon and the beginning of the northeast monsoon. The lowest humidity occurs during December to February when it varies from 72 per cent to 75 per cent. The annual variation is about 15 per cent. (India Meteorology Department, 2003). Comparatively, the humidity in the south is more than in the north.

The Islands experience good rainfall from both the southwest and northeast monsoons. The average annual rainfall is 3400 mm. The highest annual rainfall recorded during the last 60 years is 3810mm and the lowest is 2130mm (India Meteorology Department, 2003). The southwest monsoon brings the maximum amount of rainfall. It begins from third week of May and ends in October. The southwest region experiences the maximum amount of rainfall because it comes first under the direct impact of the southwest monsoon. This greater amount of rainfall helps in the development of dense tropical vegetation in the western coast. The southwest monsoon burst over the South Andaman by about 20<sup>th</sup> May accompanied by thunder and rain. The two periods of maximum precipitation are from May to June, and from August to, which correspond to the beginning and the termination of the southwest monsoon. Rainfall from the northeast monsoon begins in the month of October, whereas, the months of January and February are almost rainless in the northern stations.

### 2.4.3 Seasons

As mentioned earlier that there is not much monthly variation in temperature of the Andaman Islands but there are seasonal variability in rainfall. In spite of the equable nature of the climate round the year, four seasons are experienced in the Islands mainly due to the mechanism of the southwest and northeast monsoons. Moreover, the seasons do govern the availability and distribution of certain prey animal species including their nesting and hatching periods, for example the turtle nest and hatch from November to February, particularly along the western coast. In accordance with seasons, the Jarawa regulate their movement over space to avail the seasonal resources. The four seasons are as follows:

(1) Cool season	...	From December to February
(2) Hot season	...	From March to Mid-May
(3) Southwest monsoon season	...	From Mid-May to Mid-October
(4) Post southwest monsoon season...		From Mid-October to November

### 2.5 STREAMS

The Andaman Islands is traversed by innumerable streams. The drainage is influenced by the nature and amount of rainfall, the extent of the catchment area and the character of rocks through which they flow. The copious rainfall in these Islands, hilly terrain and surrounding of sea from all sides, results in short and swift streams capable of vigorous erosion. These streams form a close network of drainage over the whole Islands. The water divide of the Andaman Islands runs in north-south direction separating the drainage systems of the east coast from that of the west coast. From the main water divide, minor divides shoot off and thus dividing the whole region into a number of drainage basins. Because of the seasonal rainfall fall, the water level of the

streams declines in the dry season, hence most of the rivers either do not have any water or have only a trickle of water. Little water in the rivers may also be partly due to the porous nature of the soils and rocks, whereas, perennial streams are mostly confined to the eastern part of the Andaman Islands, thus favouring establishment of more number of human settlements along the eastern coast.

The Middle Andaman Island has only a few small rivers and important among them are the Betapur and Bamlangta rivers. Both of them originate from the hill ranges that are continuation of Mt. Harriet Range and flow through the longitudinal valleys. The Betapur River and its tributaries drain almost the whole of the northeastern part of the Middle Andaman. A noteworthy feature of the drainage system of these islands is that the perennial rivers are very few. For the aboriginal populations, including the Jarawa, both perennial and non-perennial are very important as the water points are one of the deciding factors for the setting of their camps. It means their camps are *wet point* camps.

## **2.6 FORESTS**

Forests are in abundance in the Andaman Islands except in the areas that have been cleared for settlement and agricultural needs of the settlers. About 77.80 per cent (6682.17 sq km) of the total area of the Andaman Islands is still covered under thick forests. The original forest cover in many areas has been modified in many areas. The growing settlements around Port-Blair, Rangat, Mayabander and Diglipur areas in South, Middle and North Andaman have encroached upon the forest reserve. Of the total area under forest (6353.24 sq km) in the Andaman Islands, 86 per cent is reserved, 1 per cent is protected, 5 per cent is unclassified and 8 per cent is under Jarawa Reserve (Basu, 1993). The following are the administrative divisions of the forest:

1. *Reserved Forests*: These forest cover an area of 5410.74 sq km or 86 per cent of the total area of Andaman Islands.
2. *Protected Forests*: These forests cover 53.35 sq km. The forests of south Andaman have been declared as 'protected forests' by the government.
3. *Unclassified Forests*: These forests cover 355.35 sq km.
4. *Jarawa Tribal Reserve*: About 765 sq km of forests have been reserved for Jarawa in south and middle Andaman Islands along the western coast.

The forests of the Andaman Islands can broadly be divided into two categories based on edaphic and climatic factors. On the basis of edaphic factors, three broad forest divisions are: (i) Tidal Forests (Mangrove Forest), (ii) Beach Forests, and (iii) Riverine Forests (Low Level Evergreen Forests). On the basis of climatic factors two major types of forests are: (i) Moist Deciduous Forests, and (ii) Wet Evergreen Forests. Except for the areas cleared for settlements and small Islets which are devoid of natural vegetation, the entire land mass of the Islands is covered with lush green forests - a characteristic of the humid and warm tropics.

### **2.6.1 Forest Types**

The standard and most detailed classification of Andaman forests is that of H.G. Champion (1936). Later, Champion and Seth (1968) gave a revised classification of forest types. They distinguished altogether 14 types of natural vegetation. Some of the forests types merge into each other imperceptibly hence difficult to identify, whereas others offer a distinct contrast, and can be discern without any easily. Major forest types as identified by the Department of Forest have been shown in the Figure 2.5, 2.6 and 2.7. Distribution and types of forests are discussed below.

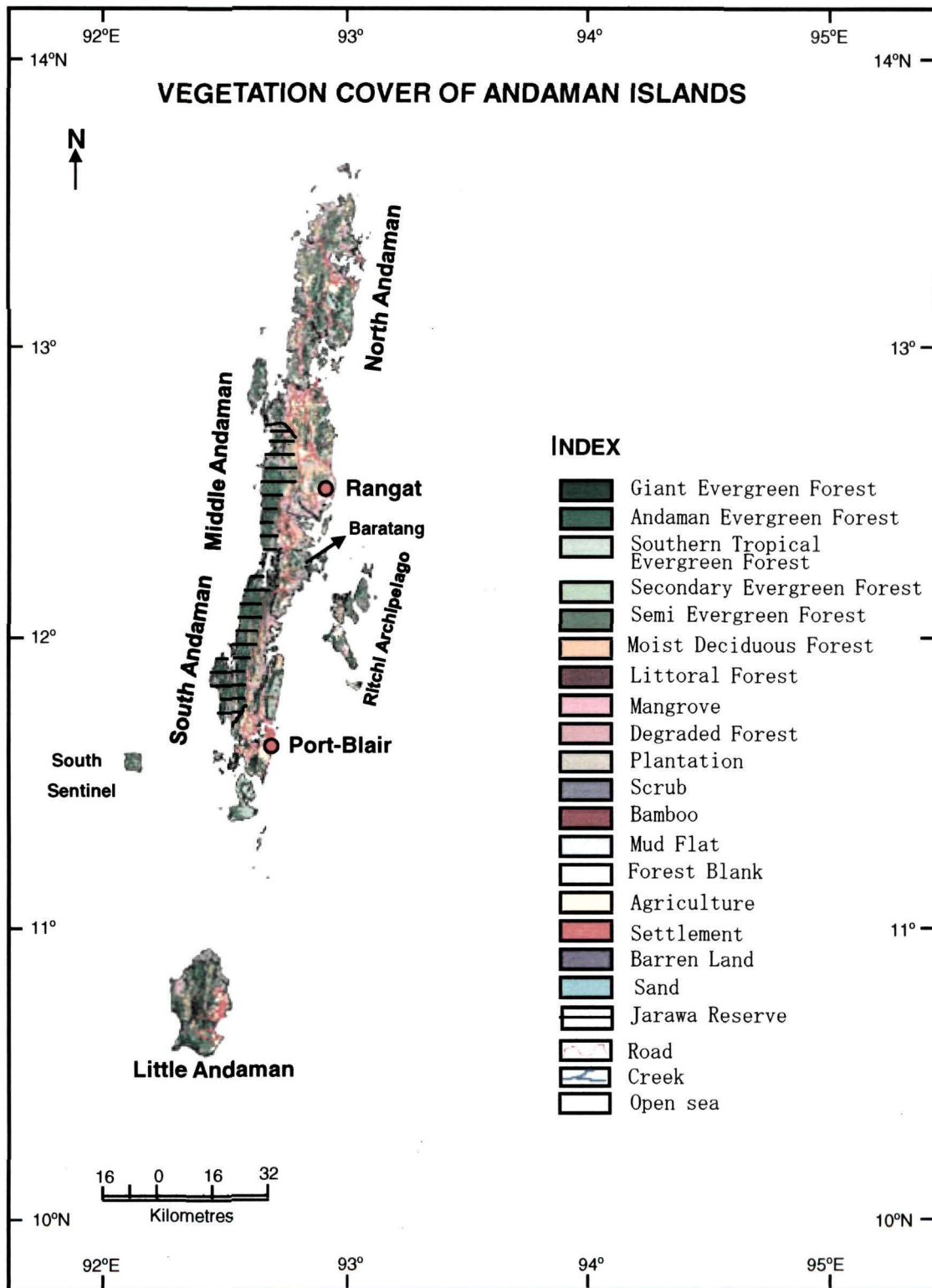


Fig. 2.5

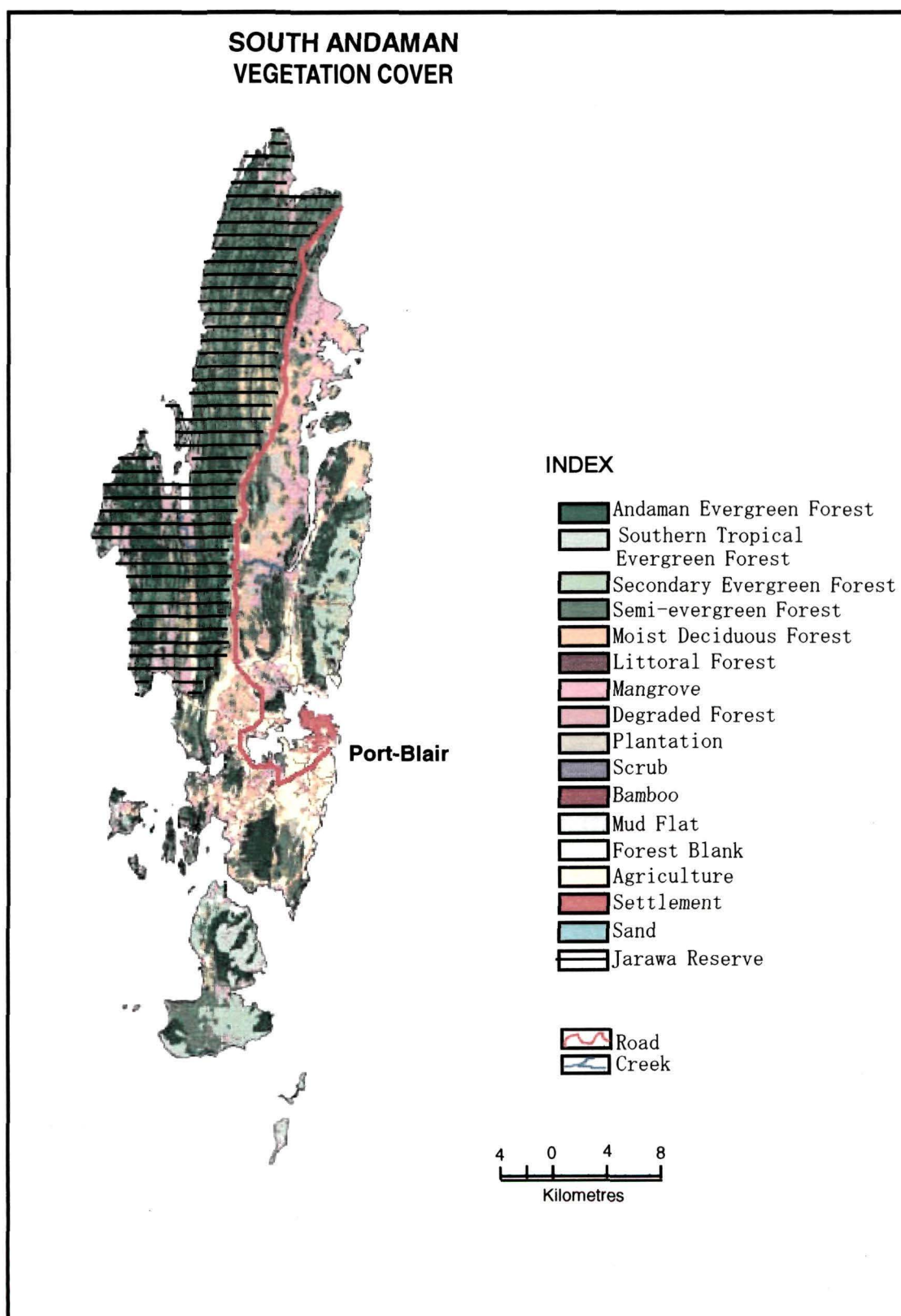


Fig. 2.6

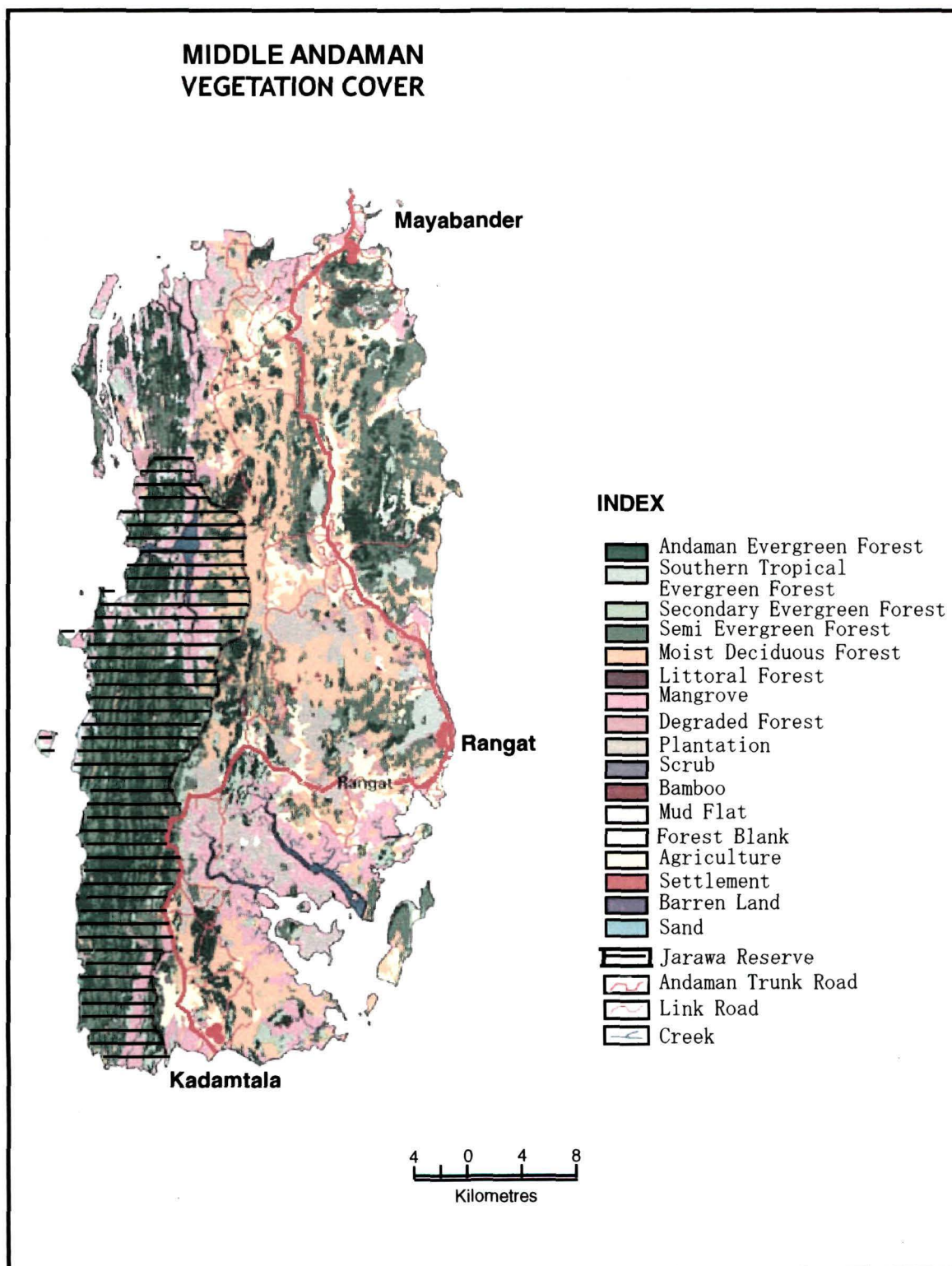


Fig. 2.7

### **2.6.1.1 Low mangrove forest and High mangrove forest**

These two types of tidal forests occupy marshy alluvium and stiff clays inundated by salt water. They extend as far as the highest reach of the tide along sheltered seacoast and up the creeks as far as the influence of the salt water is felt. The low mangrove forests, which form more or less dense evergreen belts, are characterised by *Rhizophora mucronota* and *Rhizophora congugata* species that extend farthest into the sea and take the full blast of the tidal currents. These forests do not grow more than 7 m of height. Next to the low-level mangrove belt is found belt of high mangrove forests which are spread in the higher reaches of the tidal creeks where influence of the fresh water is also felt. The predominant species of the high-level mangrove forests are *Brugviera gymnorhiza* and *Brugviera paruiiflora*. They grow gregariously and attain height of 13 m to 21.33 m.

### **2.6.1.2 Beach forest**

Beach forests form a narrow belt just above the high tide level in the Andaman Islands. The soil of this belt consists of sands, shingles, shells fragments, etc., and is poorest in mineral contents except lime. This soil is coarse porous and more or less dry at the surface. Beach forests are locally known as *Mohwakhari* and have a fairly high girth and a long clear bole. Main species of beach forests are *Colophyllum inophyllum*, *Terminalia catapa*, etc.

### **2.6.1.3 Southern tropical moist deciduous riverine forest**

This type forms a very small percentage of the forests of these islands being confined to the well-drained alluvium near the banks of the big streams. It grows in the areas characterized by gravelly, sandy and very loose textured soils. The predominant species are *Pyinma* and *Thitkando*, etc.

#### 2.6.1.4 Southern tropical semi-evergreen riverine forest

In the Andaman Islands these forests are found typically on alluvial soils along the banks of large fresh water streams which are sufficiently raised above the flood level and are, therefore, fairly well drained having a good subsoil water supply. The soil is clayey and sufficiently old to let vegetation progress to a climatic climax. The principal species in these forests is *Dipterocarpus alatus*, which grows to the largest size amongst Gurjans (*Dipterocarpus spp.*), often reaching a girth of 9.14 m at breast height and a clear bole of about 304.8 m. Other tree species of importance in these forests are *Sterculia companulata*, *S. alata*, *Terminalia procera*, *T. biolata*, etc. The trees are found scattered and the ground floor is densely covered by shrubs, bamboos, climbers and cane breakers forming a thick tangle of vegetations.

#### 2.6.1.5 Secondary moist bamboo brakes

This type of forests occurs usually in the upper parts of steep hill slopes particularly on their hotter (sunny) aspects. It is found characteristically in parts of the north Andaman along the higher ridges of Saddle Range. This type of forests consists of a gregarious growth of bamboo brakes with a few scattered trees of *Dipterocarpus turbinatus*, *Terminalia procera*, *Sterculia companulata*, etc.

#### 2.6.1.6 Andaman moist deciduous forest

This is the subsidiary edaphic type of moist tropical forests, locally known as the *Padauk* (*Pterocarpus dalbergioides*), which is found on the undulating surface and gentle slopes up to about 91.44 m in height and covers about 45 per cent of the total area of the Andaman. *Padauk* is the most important timber species of these forests and is associated with many other valuable deciduous species such as *Terminalia biolata*, *T. procera*, *Canarium euphyllum*, etc., and a number of species valuable to the match, plywood and packing case industries.

### **2.6.1.7 Cane brakes**

They occur in dense shadow and wet hollows where the soil is permanently wet, consisting of fine clay rich in humus. This type is mostly in association with evergreen and semi-evergreen climaxes than the deciduous ones. It forms an impenetrable thicket of long trailing stems with a few erect species also. Some of the important species of cane present in these brakes are *Calamus andamanicus*, *Calamus pheuborivalsis*, *Calamus palustris*, etc. The creeping bamboo is also invariably present.

### **2.6.1.8 Southern wet bamboo brakes**

This type is also connected with the evergreen and semi-evergreen climaxes along sheltered valleys. Dense clumps of *Oxylenanthera nigso-ciliata* occur with scattered trees of *Dipterocarpus incanus*, *Planchonia andamanica*, *Pisonia excelsa*, etc.

### **2.6.1.9 Southern moist bamboo brakes**

This type occurs on the moist shady and gentle slopes. The species forming such brakes are *Oxylenanthera nigso-ciliata* occurs with scattered trees of *Dipterocarpus incanus*, *andamanica*, *Pisonia excelsa*, *Hopea odonata*, etc.

### **2.6.1.10 Southern tropical semi-evergreen forest**

This type is more or less in transitional pre-climax form, between the tropical evergreen and the moist deciduous forms. It is not as dense as the southern tropical semi-evergreen riverine type, though it resembles very much in its floristic composition. It has a mixture of both the evergreen and deciduous trees, the former predominating.

#### **2.6.1.11 Southern low tropical evergreen forest**

This type occurs in steep hill slopes exposed to strong winds and having hard, reddish brown, infertile thin layer of soil. In the region of its occurrence, there is usually heavy rainfall of over 2540 mm and very often, the atmosphere is cloudy and misty. It occurs typically on the steep slopes of Saddle Hill and surrounding peaks in north Andaman, Mt. Ferrington in Middle Andaman, etc. The characteristic feature of this type is the presence of stunted trees which rarely exceed 9.14 m in height and 0.9 m in girth. The floristic composition in the overhead canopy is of *Dipterocarpus costatus*, *Mesua ferras*, *Canarium manni*, etc.

#### **2.6.1.12 Eastern tropical evergreen forest**

This type forms the climax vegetation in areas of heavy rainfall having more or less shallow soil overlying serpentine intrusions. It is found on the steeper slopes of the higher ridges, the tree growth being less luxuriant than in the evergreen *Dipterocarpus* type.

#### **2.6.1.13 Evergreen *Dipterocarpus* forest**

Andaman forests reach their climax in this type of forests and it constitutes the most luxuriant evergreen forests of the Islands. These forests are found in the high hill slopes and ridges in which outcrops of igneous rocks predominate. The rainfall here is the heaviest being well over 3040.8mm per annum. The soil consists of a deep clayey loam which is always wet, having a thick humus layer. The principal tree species is *Dipterocarpus grandiflorus* which attains maximum height and growth among the trees in the Andaman Island Ecosystem.

### **2.6.2 Characteristics of Andaman Forests**

The dense forests consist of a tangled mass of climbers, lianas, canes, bamboos etc. Mangrove forests are confined to low lying banks of creeks and sheltered portions of the coastline subject to tidal action. On the upper most part of the higher hills and sometimes on steep slopes with poor soils, which are usually exposed to speedy winds, the vegetation is comparatively stunted in growth. Such areas contain mainly bushes, shrubs and stunted trees, which are not presently of commercial importance. In various types of forests excluding mangroves, the trees grow in an intimate mixture of different species, many of which are of commercial importance.

In virgin deciduous forests, fresh regeneration and the younger age classes are practically absent except to a small extent in giant evergreen and Andaman tropical evergreen forests. The reason for this is that in deciduous forests, the top storey trees are deciduous whereas vegetation below the top storey is often evergreen. Without human assistance, the deciduous species would find it difficult to regenerate themselves through this evergreen under storey. In fact, the climax vegetation of the Andaman Islands belongs to the giant evergreen forests.

The lack of gregariousness in Andaman forest is well known. An absolute preponderance of one species or even an assemblage of species rarely marks the floral landscape in these islands. There are several key features of tropical rain forest ecology of the Andaman Islands, some of which are as follows:

1. the tropical rain forests of the Andaman Islands are having one of the most productive terrestrial ecosystems with very high gross and net primary productivity;

2. it is extremely efficient in rapidly cycling most of the nutrients; and
3. it is having a very great biomass.

A notable feature of the resource availability in the tropical rain forest is that the species with edible parts are widely dispersed. It is, therefore, implied that the tropical rain forest environment of the Islands is extremely diverse floristically. The members of a particular species tend to be widely dispersed than clumped together. In addition, there are limited numbers of edible plant species. It, in turn, is reflected in the dietary composition of the Jarawa. The Jarawa, despite inhabiting an ecosystem with diverse biotic environment, rely upon a limited range of edible plants. However, there are enough non-edible plant resources to meet their various requirements.

## **2.7 FAUNA**

In spite of abundance of forests in the Andaman Islands, wild life is peculiarly deficient throughout these islands. The deficiency is more pronounced concerning mammals. There are only 20 identified species of mammals, of which again about 12 are peculiar to these islands. The Andaman species of mammals and birds differ significantly from those of the adjacent islands like Nicobar, Sumatra and Java, etc.

### **2.7.1 Mammals**

The Andaman Islands are endowed with rich floristic composition but they are poor in fauna. The large mammals and monkeys are entirely absent from the Andaman Islands. The largest indigenous wild mammal is only the Andaman Pig (*Sus andamanensis*) which is much smaller than the mainland pig. The other indigenous mammal found in the Islands is Civet Cat (*Paguma larvata tytlery*). Bats and rats constitute nearly three-fourth of the known mammals. A number of deer species were introduced in these islands in the early 1920s. Of these, the spotted deer (*Axis axis*)

has acclimatized well and has spread in almost all the islands. Barking deer (*Muntiacus muntjak*) has also survived in these Islands, and have been breeding successfully but they are comparatively rare. Hog deer (*Axis porcinus*) has also been reported in the Islands but they are also rare. Of the introduced mammals, another interesting species is the wild goat in Barren Island. Queerly enough, they have adapted to saline water. Two marine mammals, viz., sea cow (*Dugong dugong*) and Dolphins (*Dolphinus dolphis*) are found in the surrounding seawaters. While dolphins could be seen very frequently, but the *dugong* is very rare. All mammals, except deer, are an invaluable source of food for the aborigines.

### **2.7.2 Reptiles and Amphibians**

There are a number of lizards and snakes including viper and cobra inhabited in the Island ecosystem. However, cobras are very rare. Salt-water crocodiles (*Crocodiles palustris*) are widely distributed in almost all the creeks and back waters. Among the reptiles, only monitor lizards are the game animal for the aborigine of Andaman Islands.

### **2.7.3 Birds**

The bird fauna though not very rich but consists of a few indigenous species which are rare and quiet interesting. There are few species indigenous to these islands which are rare and quite interesting. Amongst birds, the Andaman green pigeon, hawk, eagle, scarlet minivet, black head bulbul, white head mynah and Indian cuckoo are common. Based on his survey as well as on the basis of the recorded evidences available, Abdulali (1962) has listed 112 species and sub-species of birds. The list also includes several introduced species that have adapted to the environmental setup of the Islands. Birds are occasionally eaten by the aborigines including the Jarawa and therefore are not the part of major edible food items.

## 2.8 COASTAL ENVIRONMENT

In terms of assemblage of animal species, the Andaman and Nicobar Islands occupy a unique position. They are close to the “Indo-Malayan Region” which is considered to be a ‘faunastic centre’ from which other sub-divisions of the Indo-West Pacific region recruited their fauna ((Tikader *et al.*, 1986). Therefore, some of the typical Indo-West Pacific groups of animals are found in these Islands. Some of the animals are giant calms (*Tridacnidae*) among molluscs and sea moths (*Pegasidae*), whittings (*Silligindae*), rabbit fishes (*Siganidae*) and plesiopdae (*Plesiopidae*) among fishes. There are many more such marine animals. Although the Islands have a great diversity of marine fauna, many groups are yet to be identified in detail. The Andaman Sea in the tropical belt, with an area of  $0.602 \times 10^6$  km<sup>2</sup> (average depth of 106 m) and enclosing water of the volume of  $0.660 \times 10^3$  km<sup>3</sup> (Tikader *et al.*, 1986:14), provides a vast ecosystem for the existence of rich marine life that can be converted into resources for various uses. The intertidal and neritic zones of the Andaman islands, together called as coastal sea, are the happy abodes of almost four-fifth of all the plants and animals. They are abode to a variety of pisces, molluscs, crustacean and reptiles. Around the islands, the littoral and sub-littoral zones are occupied by underwater coral populations, which display the flamboyancy of tropical life. Sea shore of Andaman Islands can be divided into rocky, sandy and muddy shores. It is often interspersed with mangrove vegetation.

### 2.8.1 Rocky Shore

In several of the Islands, the coasts are rocky. The life forms on the rocky shore are mainly governed by the tides. The sea animal found in the rocky shore zone are limpets, chitons, neritides, top shells, turban shells and certain species of crabs, molluscs and shrimps.

### **2.8.2 Sandy Shore**

The flourishing of life in the sandy shores is not so marked as on rock shore. The fauna of sandy beaches are *polychaetes*, molluscs, amphipods, *sea-anemones*, etc. *Polychaetes* of the phylum *Annelida* are the most characteristic and abundant of the sandy intertidal animals. Among crustaceans, dominance of copepods has been seen. Other important crustaceans are snapping shrimps, fiddler crabs, bivalve shells, cockles, and calms. The turtles prefer to visit the sandy shores during the winter season for laying eggs.

### **2.8.3 Muddy Shore**

The muddy shores have developed where sea currents are slow and weak allowing settling of fine particles on the relatively calm beaches. Such conditions are found in sheltered bays and in mouths of coastal streams. The fauna of muddy shore consists predominantly of pelecypod molluscs, worms, few crustaceans and some fish that spend at least part of their lives in the habitats below the ground.

### **2.8.4 Mangroves**

Two types of forest, namely mangroves or tidal swamps and littoral forests or beach forests influence seashore topography of the Islands. The mangrove ecosystem supports many brackish water and fresh water fishes. Many of the animals of mangroves are common to mud flats. These include different types of crustaceans like fiddler crabs and hermit crabs. Among molluscs gastropods, bivalves and edible oyster are common. It can be said that the paucity of terrestrial fauna is compensated by the abundance and diversity of marine animals. In fact, the coastal zones are the major food gathering zones for the aboriginal people of the Andaman and Nicobar Islands. Interestingly, the Jarawa do not relish the sea cucumbers which are available in abundance near the shore.

## 2.9 THE PEOPLE

Discussion on the physical environment of the Andaman ecosystem would remain irrelevant if the people whose habitat it has become are not mentioned. Ecological study of the people of the Andaman Islands is rendered extremely interesting by virtue of the great diversity of the people inhabiting the island ecosystem. Andaman Islands have found place in the accounts of sailors, travellers and traders from long past like that of Ptolemy in the Second Century, of Chinese in the Seventh Century, of the Arabs in Ninth Century, and of the Europeans in the Thirteenth Century (Mathur, 1968:7). However, a systematic and detailed account about the Islands and its people has been found since 1858 when the British occupied the Islands second time for penal settlement. In post-Independence period, some detailed studies were carried out on the environment and people of the Andaman Islands (Majumdar, 1975; Pandit, 1974, 1976, and 1989; Sarkar, 1985 and 1987; Sarkar, 1987, 1990, 1993 and 1996). In the post 1998 phase, the major works are by Sreenathan (2001) and Mukhopadhaya *et al.*, (2002).

The Andaman and Nicobar Islands are home to six tribal groups namely the the Sentinelese, the Jarawa, the Onge, the Great Andamanese, the Shompen and the Nicobarese. Of the six tribal groups, the first four tribal groups belong to Negrito stock (Plate 1, 2, 3, and 4) while the latter two to Mongoloid stock. Interestingly, the Andman Islands are home to Negrito people while the Nicobar islands to Mongoloid people.

Prior to the colonisation of these Islands by the British, particularly after 1857, The Andman Islands were the exclusive abode of the Negrito aborigines. However, it was only at the end of the 18<sup>th</sup> Century, with the attempt of the formation of the settlements and latter on, of the penal settlement, that there could began an influx of

the foreign people, mainly from different parts of main land India. Since these people were from different parts of India, their diverse social and cultural traits gave a character of heterogeneity to the human fabric of the Islands. In the post-Independence period, the settlement of the refugees from the erstwhile East Bengal and some of the people from South India took place in the Islands. It was mostly at the displeasure of the aboriginal people. Hence, people of the Andaman Islands could now be divided into two groups, viz., the aboriginal (generally referred to as tribal) and the non-tribal people.

### **2.9.1 The Aboriginal People**

Nothing more deserves a special note in the Islands than the aboriginal population. Because of the insular nature of the Islands, the aboriginal population is considered as one of the purest types. Their way of life may be considered as the living forms of the most ancient and primitive style of life. They are short in stature; their skin is black and their hair frizzy. There are some biological and cultural affinity of these tribes with the Negrito groups of South-East Asia like, Semang of Malaysia Peninsula and the Aeta of Philippines. Thus, it is believed that Andaman Negrito groups migrated to their present habitat from South-East Asia in remote past either by sea or by land route. Nevertheless, evidences to establish this hypothesis are not yet sufficient. Regarding distribution of the four Negrito tribes (aborigines) in three different islands of the Andaman and Nicobar, there are a number of assumptions, but all these have a common proposition that for their nomadic nature either these tribes moved to different islands or some of them were drifted to present habitat by the sea waves, while moving from one place to other in canoes. Their movement further south below Little Andaman was most probably hindered because of the presence of fast flowing turbulent ocean currents at 10° North latitude which is also known as 10° Channel.

**Table 2.2 Tribal population in Andaman and Nicobar Islands**

Tribes	Location	Population	Remarks
Great Andamanese	Strait Island	41	On the verge of extinction
Onge	Little Andaman	97	78 settled in Dugong Creek and 19 in the South Bay
Sentinelese	North Sentinel Islands	100 *	No major breakthrough until today in establishing friendly relationship with them, but efforts are on.
Jarawa	Western Coast of South and Middle Andaman Island	265	Till 1997, a hostile tribe. Efforts to befriend them have been successful.
Nicobarese	Car Nicobar, Chowra, Teresa, Nancowry, Katchal, Trikant and Great Nicobar	36000	Relatively well advanced.
Shompen	Great Nicobar	274	A shy tribe living in the interior.

Source: Directorate of Economics and Statistics (2007).

\* Approximate population

The intrusion and decades of contacts with the non-aboriginal population have brought about a rapid impoverishment and decline of two of the aboriginal people of the Islands, i.e., the Onges and Great Andamanese. The other aboriginal population i.e., the Jarawa have been experiencing a gradual shrinkage in their total command area because of the gradual expansion of the area of influence of the new settlers. The Jarawa are today confined to the western part of the Middle and South Andaman Islands with a total population of about 265 and the Onges in the Dugong Creek and West Bay areas of the Little Andaman having a population of 96. While the Great Andamanese have been resettled at the Strait Island having a total population of about

41 and the Sentinelese are in the North Sentinel Island with an estimated population of 100 souls only (Table 2.2). The relationship of the aborigines with the outsiders have had one of deep distrust and hostility, which has rightly been explained by Portman (1899) as an outcome of unfriendly attitude of the outsiders. While the Great Andamanese and the Onges were coerced to be friendly with the use of force during the colonial period, the relation with other two Negrito groups continued to be sour even in the post-Independence period. Decades of friendly gesture by the Andaman Administration ultimately succeeded in befriending the Jarawa in 1997, but this is not the case with the Sentinelese. They are still outside the ambit of friendly relations. However, the acceptance of friendliness on the part of the aborigines has proved to be a bane for them as their numbers have drastically decreased after the friendly contacts due to various reasons.

### **2.9.2 Antiquity of the Negrito People**

The antiquity of the Jarawa or for that matter of the Negrito people of the Andaman Islands is still shrouded in the mystery. In this regard, one has to depend on the materials obtained from the excavation of the kitchen midden sites (shell mounds), which are an assemblage of shells, pottery, implements, equipments etc. buried in successive layers at Beehive Island and Chouldhary, and considered to be the earliest sites of human occupance of the Islands (Man, 1883; Portman, 1899; Holland, 1904; Cipriani, 1966; and Dutta, 1974). Chatterjee excavated one kitchen midden site at Beehive Island of Middle Andaman in 1952, and Cipriani also carried out study of the shell mounds (*cf.* Dutta 1974: 13-15). In comparison to the Beehive, *lithic* industry at this site was richer. Here the flakes were predominant (65%) than core (2.03%) and finished tools (32.93%). On the basis of faunal evidences, flakes etc. and comparing them with the blade industry found at different Toalean sites of South-East Asia, Dutta (1974: 35-38) opined that the Andaman Islanders would not have arrived prior

than 300-100 years B. C. The radio carbon dating of these materials put them to be 2,280 years old (Cooper, 1990). The Mesolithic culture of the Andaman Islands was associated with the pottery. When the Andaman findings are compared with those of the South-East Asian ones, it seems improbable that the bearers of this culture existed in Andaman Islands earlier than 300 B.C. It must be noted that pottery could be found in the Upper Toalean layer in Indonesia, allowing some time for the spread and drift of the culture, the Mesolithic culture “possibly arrived in the Andaman Islands sometimes around the beginning of the Christian era” (Dutta, 1974:35). Thus, the archaeological evidences suggest establishment of a cultural link between the Andaman Islands and South-East Asia around that period. Interestingly, the Great Andamanese oral tradition bears memory of a period when they were inhabitants of a large landmass where there were many other people speaking the same language, and large animals used to roam in that land. Then there was a great cataclysm that submerged the large mass of land with man and animals (Portman 1899:8).

### **2.9.3 The Jarawa**

The Jarawa are one of the four Negrito groups of the Andaman Islands. They inhabit the western part of the South and Middle Andaman Islands. The Jarawa territory, also known as ‘*Jarawa Reserve*’ measuring approximately about 765 sq km (see Fig. 3.1 in Chapter III). The total population of the Jarawa is 265 as per the last survey in 2002. They derive their livelihood through hunting, fishing and gathering. The tools used for the collection of resources are simple, which include bow and arrow, fishing hand net, digging rod, metal knife, iron dao (a kind of chopper), wooden bucket and baskets. The resources are collected from both terrestrial and aquatic ecosystem. There are three territorial groups of the Jarawa viz., Tanmand group, Thidong group and Boiab group (see Fig. 3.1 in Chapter III). The Tanmad group inhabits the southern part of Middle Andaman Island, while Thidong and Boiab

groups inhabit the northern and southern part of the South Andaman Island, respectively. The immediate neighbours of the Jarawa are the non-tribal population, which have also been referred as 'Non-Jarawa' in the present discussion .

#### **2.9.4 Non-Tribal Population**

Leaving aside the aboriginal people, the Islands are being inhabited by the those who came or were brought to Andaman Islands after the arrival of the British. The convicts of the penal settlements have settled in these areas by bringing their family members from the mainland or by getting married with the convict women. They are now called as 'local born'. The settlements of these people have grown exclusively in the South Andaman, particularly in Port-Blair and the neighbouring villages. Though having hailed from different parts of India and speaking different languages, they have become an integrated community and the Hindi is their spoken language- a binding force. Such formation of a homogenous community is verily an example of fusion under a given set of geographical setting- isolation of the Islands. Apart from them, a few groups of Bhandus and Mopillas, and a few Burmese and Karens have also settled in these Islands. Except the Karens, who have settled through free enterprise in the northern part of Middle Andaman, all other groups were brought to the Islands to serve the terms of their conviction. After termination of colonial rule, very few of them opted to go back to their native place. However, all these groups have settled quite peacefully in these islands. Initially the agriculture was the basis of economy. Now many of them are engaged in other enterprises also like service, business, transport etc. With a view to attain all-round development of the Andaman Islands, the Government of India initiated a programme to rehabilitate persons displaced from the then East Bengal in the Andaman Islands immediately after Independence. At that time, it was very difficult to get any large patch of suitable land for settling the refugees as the Andaman Islands were covered with dense forests.

However, some lands were identified, acquired and cleared of forest in different parts of the South, Middle and North Andaman Islands for locating settlements of the refugees. Out of approximately 5,000 refugee families, 1,328 families were settled in South and Middle Andaman Islands (Census of India, 1961). Each of the family was given 10 acres of land for agriculture and horticulture.

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**CHAPTER III**  
**RESOURCE INVENTORY OF THE JARAWA**

## **CHAPTER III**

### **RESOURCE INVENTORY OF THE JARAWA**

The human beings have varying needs and wants. Various efforts are made by human beings to meet these needs. Resources are the means of satisfying those needs and wants. However, a natural thing or a substance does not become a resource unless man recognises its utility. In fact, it is the function played by a thing or a substance in relation to human wants that make it a resource. Zimmerman (1951) in his 'functional or operational theory of resources' has described that resources do not mean a thing or substance, but the function which a thing or substance may perform or operation in which it may take part. While the nature provides the necessary physical base for man's efforts in the creation of resources, the culture influences the environmental perception, preferences and decision making of a human group. Therefore, unless perceived as 'resource' a matter or substance remains part of the nature. It is the human perception that turns a thing or substance into resource. In addition, the availability and seasonality of resources also determine the pattern of resource utilization.

The Jarawa are a hunter-gatherer community with a distinct culture inhabiting the western part of the South and Middle Andaman Islands. In order to meet their needs, they utilise different types of resources of the Island ecosystem. In the present Chapter an attempt has been made discuss how a hunting-gathering community like the Jarawa have perceived resources in the island ecosystem. Before elucidating in detail the inventory of resources of the Jarawa, it is worth mentioning about the Jarawa and their territorial groups, as these are directly or indirectly related with distribution and availability of resources.

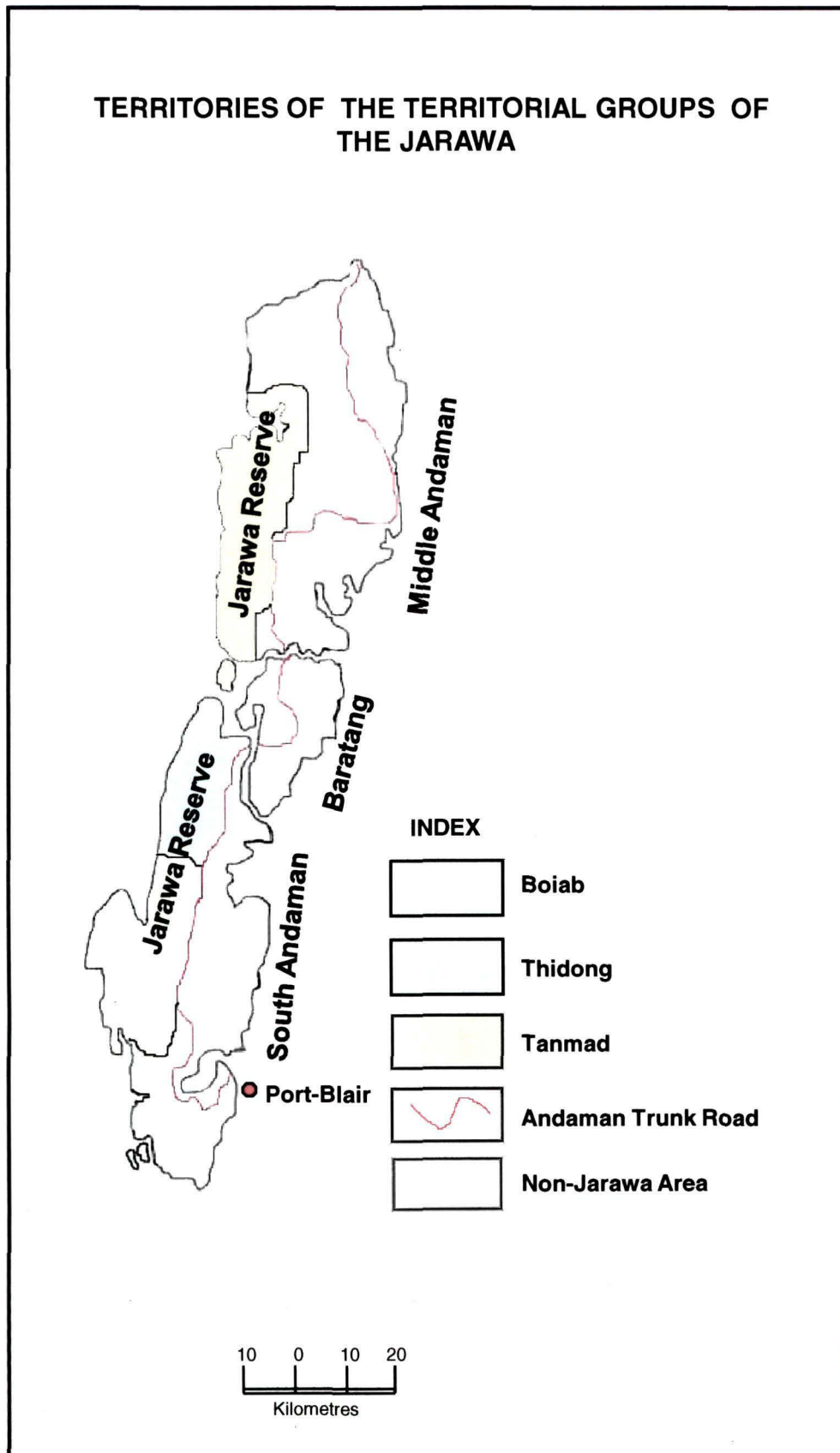


Fig. 3.1

### 3.1 TERRITORIAL GROUPS OF THE JARAWA

The Jarawa are one of the four Negrito tribes living in the western side of the South and Middle Andaman Islands. Their movement within the habitat is confined to a Reserved Forest having approximately an area of 765 sq km. The hunting, fishing and gathering activities are carried out with the help of bow and arrow, small fishing nets, digging stick and knife. Like other hunters and gatherers, they are also semi-nomadic people.

There are three territorial groups among the Jarawa who inhabit *Boiab* (Tirur area), *Thidong* (Middle Strait area), and *Tanmad* (Kadamtala area) territories of South and Middle Andaman Islands (Fig. 3.1). Territories of the *Boiab* (Tirur area) and *Thidong* (Middle Strait area) are contiguous to each other, only punctured by the inland creeks. While the third territory, i.e., *Tanmad*, is on a separate island but in the same continuation. Besides, there are some buffer zones also like Baratang Island, which is in between *Thidong* and *Tanmad* areas. Resource acquisition in a particular territory by a particular group of the Jarawa is the basis for grouping the Jarawa into three territorial groups and demarcating their respective territories. Since the *Boiab* and *Thidong* territories are contiguous, it is difficult to draw a boundary between the both. However, in order to solve this problem the huts of the Jarawa of both territories were plotted on the map and it was found that the 12° North latitude roughly divide them. The line dividing the *Boiab* and *Thidong* territories runs from Putatang on the eastern side to Petchhleg on the western side of the Jarawa territory.

Movement of different groups of the Jarawa is territory specific in relation to hunting and gathering activities, but this rule is not applicable when they move for

social purposes, for example in case of marriage alliances as inter-territorial marriage alliances do exist among them. It clearly shows that each group has access only to its own territory, and inter-territorial sharing of resources is strictly prohibited for each of the three territorial groups. It means there is a very clear and strong sense of possession of resources of a territory at the territorial group level. The Jarawa as a whole display the same sense of possession of resources of their territory when question of sharing of resources of their territory by the Non-Jarawa arises (details are discussed in Chapter V). Thus, it can be said that the concept of territoriality at subsistence level is very strong in the Jarawa and it flows from the topophilia (sense of attachment). It is quite natural in a society that is primarily hunter and gatherer.

**Table 3.1 Jarawa Population in Different Territories**

Sl. No.	Territory	Male	Female	Total
1.	Boiab	39	45	84
2.	Thidong	45	33	78
3.	Tanmad	51	52	103
	Total	135	130	265

Source: An.S.I., 2002.

As per the last count in 2002, the total number of the Jarawa is 265. Out of which 135 are males and 130 are females (Table 3.1). The Table reveals that the largest concentration of the Jarawa (103 persons) is found in Tanmad territory followed by Boiab (84 persons) and Thidong (78 persons). Though within the same territory there are sub groups also, there appears to be no restriction on the movement of these sub-groups within the territory for the purpose of the food acquisition.

### **3.1.1 The Jarawa Reserve**

The Government of India declared the Jarawa Territory as a 'Reserved Area' in the year 1956. In the subsequent notification, there was some change in the total area of the 'Jarawa Reserve' (Mukhopadhyay, 2002). Prior to the Gazette Notification of 2004, it measured about 765 sq km. After the 2004 notification, it has been expanded to approximately 950 sq km (Gazette, 2004). Earlier, 200 m on both sides of the Andaman Trunk Road (ATR) in the 'Jarawa Reserve' were not reserved. Now it extends to 30 m only on both sides of the ATR in the 'Jarawa Reserve'. In Thidong and Boiab areas, which lie in the South Andaman Island, some patches of the land on the eastern side of the Andaman Trunk Road have also been included in the 'Jarawa Reserve'. Prohibition on coastal fishing of the Non-Jarawa has now been extended from two km to five km in water in the coastal areas contiguous to the 'Jarawa Reserve'. Besides, provision of special wards for the Jarawa at the Primary Health Centre at Kadamtala and Tirur has also been included in the 'Jarawa Reserve'. However, the newly added territories in the 'Jarawa Reserve' are yet to be delimited and demarcated on the ground. As such, in the present study the former area of the 'Jarawa Reserve', which extends over 765 sq km of area, has been considered. A scrutiny of the notification reveals that this increase in the territory has not much of significance for the Jarawa as they have had been using that territory prior to the notification. Firstly, from the viewpoint of the resource extraction there is no increase in the area of the Jarawa as they have had been using the newly added areas prior to the promulgation of the Gazette notification. Secondly, the inclusion of the special wards of Primary Health Centres into 'Jarawa Reserve' does not increase their resource base, for these wards are simply related to medical facilities in the Primary Health Centres. The increase in the area of Jarawa territory did not make any significant change in terms of increase in resource availability. However, the

beneficial aspect of this notification is that now there is prohibition on the extraction of timber and other forest produce from the newly added territories by other people or Non-Jarawa. This, in turn, would provide protection to the main Jarawa territory by functioning as shock absorbing zone in the event of extraction of resources by Non-Jarawa from the eastern side in South Andaman. Interestingly, unlike many hunter-gatherers of the world, the immediate neighbours of the Jarawa are people engaged in business, trade, service and commercial agriculture. In case of most of the hunter-gatherers of the world, their immediate neighbours happen to be people who have next higher level of socio-cultural and economic development, such as cattle herders or cultivators engaged in subsistence agriculture.

### 3.2 RESOURCE BASE OF THE JARAWA

The resource base of the Jarawa is inclusive of both the terrestrial and aquatic resources. At cognitive level the Jarawa classify the space into four categories. These are *pilleh* (coastal area), *tagidh* (marshy area), *chanhannap* (plain forest land), and *tinon* (hilly dense forest). Of course, *wa* (streams, inlets) are considered an important resource by them. A schematic diagram exhibits the spread of different physiographic zones and types resources available in each zone (Fig. 3.2). The four physiographic zones are, in fact, the five broad ecological zones providing different suits of resources.

Terrestrial resources are exploited from the *Chanhanap* and *Tinon* areas, while *Pilleh* and *Tagidh* areas are used for the exploitation of aquatic resources. The fresh water need is met from *wa* (streams). However, the availability of many of these resources is season specific. So far the Jarawa has been observed to use about 136

species of plants as resource of which 54 are used as edible resources and remaining as non-edible resources. The collection of aquatic resources is mostly for food purpose. Aquatic resources mostly consist of different varieties of fish, crabs, shells, molluscs, turtle and turtle eggs. The resources gathered by the Jarawa can be put under two broad categories namely edible resources, water and non-edible resources. The edible resources can further be sub-grouped into two categories namely (i) plant resources, and (ii) animal resources.

#### SCHEMATIC PRESENTATION OF COGNITIVE SPACE OF THE JARAWA

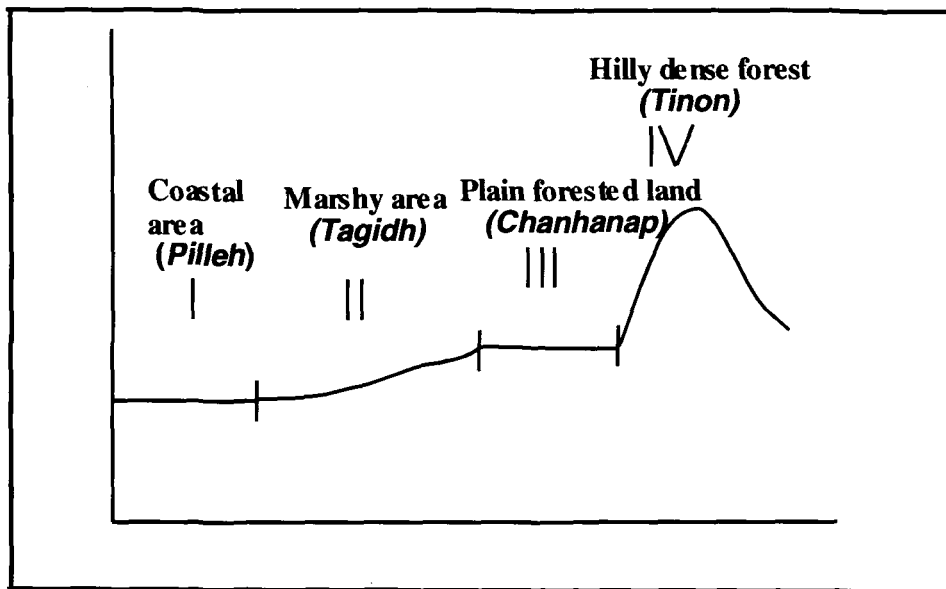


Fig. 3.2

### 3.2.1 Edible Resources

The edible resources of the Jarawa consist of both animal and plant resources. The plant resources are gathered from the terrestrial ecosystem only, while animal resources are procured from both terrestrial and aquatic ecosystems. Thus, both terrestrial and aquatic ecosystems provide food resources to the Jarawa. The edible resources (both plants and animals), which are perceived and collected by the Jarawa, have been discussed in the following lines.

#### 3.2.1.1 Edible plant resources

There are numerous plant species available in the 'Jarawa Reserve', which are yet to be fully documented. Of the total edible plant species used by the Jarawa, so far only 54 plant species have been documented (Table 3.2). The edible plant resources of the Jarawa can be put under three broad groups. These are (a) tubers, (b) fruits, pulp and tender leaves, and (c) seeds. Further, the edible plants and their products are classified into three categories as per their utility.

1. *Major foods*: There are only five plant species which provide for major part of Jarawa diet in a certain season. Among them are honey (produced by large bee), two species of *Dioscorea*, jackfruits (*Artocarpus chaplasha*), *Nipa fruticans* and seeds of *Cycus rumphii* (Plate 5, 6 and 7).
2. *Minor foods*: Under this category comes those plants which are eaten in less quantity compared to the above mentioned five species, and their period of consumption is also short. There are about fourteen minor food resources/items. These are *Artabotrys speciosus*, *A. lakoocha*, *Baccaurea*

*ramiflora*, *Alamus andamanicus*, *Diospyros andamanica*, *Ficus racemosa*, *Garcinia cowa*, *Mangifera andamanica*, *Pinanga manii*, *Donax canaeformis*, *Pometia pinnata*, *Terminalia catappa*, *Sterculia rubiginosa* and *Entada redeedei*.

3. *Supplementary foods*: Under this category come those plant resources that are not eaten regularly in any season, but these are consumed on the spot as and when found in course of their foraging activities. Seasonal fruits and the shoots of the tender plants come under this category (Plate 8 and 9).

**Table 3.2 Edible Plants Used by the Jarawa**

Sl. No.	Type of edible plants	No. of species	Availability of edible plant resources		
			Plenty	Adequate	Occasional
1.	Tubers ( <i>Dioscorea sp.</i> )	3	3	0	0
2.	Fruits, pulp and tender shoots	41	16	18	4
3.	Seeds	5			
	(a) <i>Artocarpus chaplasha</i> (Jackfruit's seeds)	1	1	0	0
	(b) <i>Cycus rumphii</i>	1	1	0	0
	(c) <i>Nipa fruticans</i>	1	1	0	0
	(d) <i>Sterculia Rubiginosa</i>	1			
	(e) <i>Entada redeedei</i>	1			

Source: Field Investigation, 1998-2004; and Department of Environment and Forests, 2002.

Both minor and supplementary foods are consumed in less quantity and generally at the place of gathering itself. These edible plants are the source of

carbohydrate, vitamins and other nutrients for the Jarawa. Most of the fruits are eaten fresh and raw. A major portion of them is consumed on the spot of gathering without cooking. However, there are two plant resources which are processed before eating. These are the seeds of the wild jackfruit (*Artocarpus chaplasi*) and the *Cycas rumphii*. The seeds of the jackfruits, both ripe and unripe, are processed. They put the seeds in a net bag and bury it under mud in a creek for about three weeks. Thereafter, it is taken out and sun dried. Thereafter, it is eaten. The seeds of the *Cycas rumphii* are also put under the seawater for about a week before consuming them. According to Jarawa, this process helps remove the toxic elements present in the seeds. However, it is yet to be scientifically established. Besides the seeds, the pulp of the wild jackfruit is also eaten (Plate 6). Pulp of the ripe jackfruit is eaten immediately, while unripe jackfruits are broiled in fire. For broiling, they make shallow elliptical depression in the ground. It measure about 100 to 150 cm in diameter and about 50 cm in depth. Thereafter, burning firewood is placed inside it. Then it is covered with an interrupted layer of stone - chips above which the food material is placed in heaps. After three to four hours of baking, the fruits are taken out and the pulp is relished.

### **3.2.1.2 Edible animal resources**

The edible animal food items are collected from both terrestrial and aquatic ecosystems of the Island. The animal resources from terrestrial ecosystem consist of wild pigs (*ovu*), monitor lizards (*orrugu*), grub larvae, honey and a few species of birds, while the resources of the aquatic ecosystem comprise of turtle (*ukkele*), turtle eggs, fish (*naappo*), molluscs, crustaceans etc. (Table 3.3). So far the Jarawa have been found to use 82 edible animal resources.

**Table 3.3 Edible Animal Resources of the Jarawa**

Sl. No.	Type of animal resource	No. of species	Availability of animal resources		
			Plenty	Adequate	Occasional
1.	Wild pigs ( <i>Sus scrofa andamanensis</i> )	1	-	1	-
2.	Monitor (lizards <i>Varanus salvator andamanensis</i> )	1	-	1	-
3.	Sea cow ( <i>Dugong dugon</i> )	1			1
4.	Birds	9	-	-	-
5.	Turtle	3			
6.	Fish	29	15	-	-
7.	Crustaceans	15	-	-	-
8.	Insects	3	-	-	-
9.	Molluscs	17	4	-	-
10.	Grub larvae	1	-	1	-
11.	Honey	2	1	0	1

Source: Field Investigation, 1998-2004; Z.S.I., 2002, Port Blair.

Although numerous edible items are collected through hunting, fishing and gathering, the Jarawa have a dietary preference for meat of wild pig, monitor lizard, turtle, fish and molluscs (Plate 10, 11, 12 and 13). This means that when these items are available in plenty, other items are eaten less. The flesh of the Andaman feral pig is the most relished of all items. Culturally also the wild pig is very significant and hold a special importance for the foraging communities of the Islands including the Jarawa. Flesh of the wild pig has importance in almost all the rites and rituals. Oliver (1984) and Whitaker (1988) have drawn an analogy between the density of wild pig and the general health of other resources in the forest. Their analysis suggests that by taking one variable, i.e., wild pig population, the status of other resources (mostly the forest-based resources) of the area can be inferred. High density of wild pigs means

healthy status of other resources, whereas low density indicates thinning and dwindling of other resources, meaning poor status. Since the foraging communities of Andaman Islands are dependent on natural resources for their sustenance, the status of resources directly affects them.

It is interesting to note that the Jarawa do not hunt the deer that are in abundance in the Jarawa territory (Plate 14). The apparent reason may be that it is an introduced species in the Andaman Islands ecosystem. When the Islands were occupied for the second penal settlement, the British introduced the deer. Since it was an alien species, it was not in the list of prey animals of the Jarawa; hence, they desisted from hunting the deer. Because of being an introduced species, the deer did not find any mention in their traditional worldview and knowledge system. As such, the deer was not included in the category of food items. Besides, the Jarawa have the notion that eating of deer's meat would make them sick. Moreover, they do not find the meat of the deer delicious as that of wild pig and monitor lizard for it contains comparatively less fat.

Honey is collected mostly during the dry season between December and early May. The entire contents of the bee-hive are relished by the Jarawa which consist of honey, eggs, larvae and pollen. At times, when honey is collected in plenty, it is stored up also. For this purpose a small trench is dug and wooden bucket of honey is put into it. Thereafter, it is covered with soil and leaves. However, such storing up of honey is occasional. Generally most of the honey is consumed within two to three days of its procurement.

Aquatic resources mostly consist of different varieties of fish, crabs, shells, molluscs, turtle and turtle eggs (Table 3.3). In the aquatic resources, fishes and molluscs are important food items for the Jarawa, and both are found in abundance in the coastal region of their habitat, hence easy to catch. Of particular importance are bivalve shells and fishes found in the creek and shallow water near the shoreline. Male members do the fishing by bow and arrow while female members do it with hand nets. However, the females do most of the fishing. In the case of such simple tools, the success rate is directly related with abundance of fish. The fish are not only source of protein but of fat too for the Jarawa. The edible marine resources, particularly the fish and molluscs, are the key stone resources for the Jarawa. The key stone resources (Terborgh, 1986) are those resources, which are available round the year and enable the population to survive through the lean period. In case of the Jarawa, the above-mentioned marine resources are available throughout the year, and regularly consumed by them. The aquatic animals can be classified into following three categories according to their importance as food items.

1. *Major foods*: The major foods of the Jarawa consist of meat of wild pig and monitor lizard, bivalve shells, turtle eggs, and different species of fish. The availability of turtle eggs and many of the fish species are seasonal. Significantly, the honey is also included in the *major foods*.
2. *Minor foods*: Under this category come those animals that are eaten in less quantity compared to the *major foods*. Numerous sea animals come under this category. Important ones are turtle, grub larvae, prawn and certain species of fish and crab.

3. *Supplementary foods*: Animals, which are not eaten regularly in any season, are included in this category. In fact, the occasionally eaten animal food items are sea cow, lobster, birds and certain species of shell and fish.

### 3.2.2 Fresh Water Sources

Apart from the edible plant and animal resource mentioned above, water is a basic resource for the Jarawa, like any other life forms. The Andaman Islands have a wet tropical climate with an average rainfall of 2900 mm per annum. Due to high rainfall and mountain ranges, there are a number of streams (a major source of fresh water) in the Jarawa Territory. During the course of study, few fresh water sources have been identified. Three of these sources are in Middle Andaman Island, one each near Panighat, Lekera Lunta and Dhaninala, while two are in South Andaman Island, one each near Middle Strait and R.K. Nallah area. Besides, there are fresh water streams near Constance Bay area, Dalrymple Beach area, Port Campbell and Blair Beach. The Foul Bay, Rocky Points, Bay Flat Island and Robert also have a number of seasonal streams. Robert Bay is also a camping site of the Jarawa, mainly for turtle hunting, as this area happens to be turtle nesting ground. Two types of turtle- green turtle (*Chelonica mydas*) and hawks bill (*Eretmochelys imbricate*) come here for laying eggs. Other places of fresh water streams have been in found in Cape Bluff, Spike Islands, Port Anson, Foul Bay area, Louis Inlet, the coastal belt along Palmer Point, Cape Barwell and south of Montgomery Island, Melagar Boilya and Wologa Boilya system. The Melagar Boilya and Wologa Boilya system have an extensive wetland area that is also fed by a fresh water streams. Yeratiljig is only wetland and creek system in the Andaman Islands with the most extensive *nypa* palm (*Nypa fruticans*) habitat. Fresh water streams have also been found near Hiran Tikri, and Badabalu.

There are probably some more fresh water sources inside the Jarawa territory because water is one of the few important factors taken into consideration by the Jarawa while setting up a camp at any place and all camp sites have not yet been studied due to various reasons. Observations made during field investigation suggest that there is no scarcity of drinking water in the Jarawa territory. However, it may be noted that the perenniality of the water sources in this area is a function of high density of forest cover. Water sources will remain perennial only so long as the forests are undisturbed.

### **3.2.3 Non-Edible Resources**

In addition to edible resources, there are many non-edible resources used by the Jarawa to meet their other requirements. It mostly consists of plant and non-plant resources. The non-edible usage of plant resources are mainly for shelter, medicines, ornamentation, repellent for honeybee and implements. It has been so far found that the Jarawa make use of 85 plant species (Table 3.4) for non-edible purposes. The actual number could be much more than the observed figures. In addition to the plant resources, there are a few things which are also important for the Jarawa. Important among those are ochre, iron and metal utensils. While the ochre is used to paint the body, the iron is used to make various implants. In addition, metal utensils is also used by them for storing and cooking purpose. It is interesting to note that except the iron and other metal utensils, all other resources are naturally available in the Jarawa area. The iron and metal utensils are supplied presently by the AAJVS. All these resources have been discussed below in detail.

**Table 3.4 Non-Edible Plant Resources of the Jarawa**

Sl. No.	Type of non-edible plant resources	No. of Species
1.	Medicinal plants	15
2.	Plants used in hut making	19
3.	Plants used in ornamentation	41
4.	Plants used in implements making	7
5.	Plants used as repellent	3

Source: Field Investigation, 1998- 2004.

### 3.2.3.1 Plants for shelter

Shelter is one of the basic requirements of the human beings. For shelter, the Jarawa construct huts made of parts of plant. Based on the size, the huts of the Jarawa can be put under two categories namely the large *bee-hive* type huts and *lean-to* type huts. While the former is a community hut, bigger in size and stronger, the latter is individual family hut, small in size. In the construction of huts, the plant products are used as poles, strips and for thatching purpose.

The Jarawa use parts of many plant species. Some of the common uses have been discussed here. For poles, the Jarawa generally use stems of plants like *Baccaurea ramiflora*, *Knema andamanica*, *Leea angulata*, *Lagerstroemia*, *Areca triandra*, *Antidesma velutinum*, *Sterculia alata*, *Mussaenda macrophylla*, bamboo etc. The selection of the plants generally depends on its availability in a particular area. For thatching purpose, the leaves of *Licuala peltata*, *Caryota mitis*,

*Daemonorops*, *Calamus grandis*, *Calamus pseudorivalis*, *Daemonorops kurzianus* and *Musa sapientum* plant species are used. Interestingly, the Jarawa were never seen using the leaves of the *Nypa fruticans* for thatching purpose while the other tribes of the Andaman Islands use it.

For making bark strips *Anodendron manubrium* (Apocynaceae), *Antidesma velutinum* (Euphorbiaceae), *Calamus longisetus* (Arecaceae), and *Dendrobium* spp. (Orchidaceae), *Desmos dasymaschalus* (Annonaceae), *Hibiscus tiliaceus* (Malvaceae), *Planchonia valida* (Lecythidaceae), *Pterocymbium tinctorium* (Sterculiaceae), *Sterculia villosa*, *Combretum latifolium* and (Combretaceae) *Calamus* plant species are used. For twigs they generally use *Combretum* plant species. The floor of the huts, especially the place earmarked for sleeping is usually covered with leaves of *Licuala peltata* or *Pterospermum acerifolium*.

### 3.2.3.2 Plants for medicines

From ages, the Jarawa have been depending upon ethno-medicines to cure different ailments. By continuous practice, elders of the Jarawa community have developed expertise in identifying and applying different plant products for curing various health disorders like cough, cold, headache, body ache, abdominal pain etc. Further, the Jarawa also use leaves and barks of some of the plants (*Dracaena angustifolia* and *Enpatorium odoratum*) during menstruation period to stop excess bleeding. So far, about 15 species of medicinal plants have been identified, whose different parts are used by the Jarawa for medicinal purpose (Table 3.5). Significant to mention that all plant products are applied externally either as intact material or in the form of crushed paste. Interestingly, there is no oral ingestion of any medicinal plant product.

Table 3.5 Medicinal Plants Used by the Jarawa

Sl. No.	Name of the Plant	Family	Jarawa Name	Part Used	Purpose
1.	<i>Amomum aculeatum</i>	<i>Zingiberaceae</i>	Uiyaw	Leaf, stem	Tied around chest for cough and fever, leaf is applied on scars
2.	<i>Angiopteris lygodifolia</i>	<i>Angiopteridaceae</i>	Tikal	Fronde	Fronde are worn around chest for cough & cold.
3.	<i>Caryota mitis</i>	<i>Arecaceae</i>	Endau	Stem, pith	Stem pith is eaten to stop vomiting & for stomach pain.
4.	<i>Chromolaena odorata</i>	<i>Asteraceae</i>	Auth	Leaves	Leaves used as coagulant particularly on leech bite, cold & cough.
5.	<i>Curcuma zedoaria</i>	<i>Zingiberaceae</i>	Ooyekuchin	Leaves	Used in cold and cough.
	<i>Cucurbita sp.</i>	<i>Cucurbitaceae</i>	Uru	Leaves	Used in neck pain and fever
6.	<i>Dracaena angustifolia</i>	<i>Agavaceae</i>	Tidba	Young twigs	Used to clean genitals during menstruation period.
7.	<i>Enpatorium odoratum</i>	<i>Zingiberaceae</i>	Aath	Leaves	Used during menstruation.
8.	<i>Gnetum scandens</i>	<i>Gnetaceae</i>	Ehole	Stem, sap	Stem sap is used externally to get relief from stomach pain.
9.	<i>Knema andamanica</i>	<i>Myristicaceae</i>	Aure	Stem, leaves	Used as coagulant
10.	<i>Kunstleria keralensis</i>	<i>fabaceae</i>	Quato	Bark	Used in headache
11.	<i>Myristica andamanica</i>	<i>Myristicaceae</i>	Oro	Leaves, twigs	Leaves and twigs are used as garland when sick.
12.	<i>Piper betle</i>	<i>Piperaceae</i>	Tole	Leaves	Used in cold and cough.
13.	<i>Pseuduvaria prainii</i>	<i>Annonaceae</i>	Hoomal	Leaves	Leaves are wrapped around body in cough and fever.
14.	<i>Thottea tomentosa</i>	<i>Aristolochiaceae</i>	Udupet	Whole plant	Used in cough and fever
15.	<i>Trichosanthes tricuspidata</i>	<i>Cucurbitaceae</i>	Urubethe	Whole plant	Used in throat pain

### 3.2.3.3 Plants for ornamentation

The Jarawa have high aesthetic value. They are fond of flowers and they adorn themselves with several wild flowers, floral buds, leaves and fruits. They adore real colour and apply white ochre on face. They wear girdle made from finely dissected tender leaves of plants. Besides, they also wear ornaments made of flowers seasonally available in the forests. These are put on as headband, necklace, garland and armlet.

### 3.2.3.4 Plants as repellent for honeybee

At the time of honey collection the Jarawa use the sap of leaves of *Orophea katschallica* called 'tangopa jath', *Pseudouvaria prainii* called 'hoomal' and leaves and stem of *Amomum aculeatum* called 'uiyaw' as bee-repellents. External application of these plant products ensures safety from the bees while collecting honey from the hives. Otherwise, collection of honey may become hazardous to their health.

### 3.2.3.5 Plants for making implements

The foraging pursuits of the Jarawa involve hunting, fishing and gathering. In their foraging pursuits, both the hunting and gathering implements are used. While the hunting implements consist of bow and arrow, and pointed wooden stick and iron rods, the fishing and gathering implements comprise of fishing net, bucket and basket. The process of making some of these implements is gender specific. For instance, hunting objects like bow and arrow are always made by the adult male folk while adult female folk make basket and fishing net. Both males and females make wooden bucket. The bow and arrows are exclusively used by the male Jarawa, while the fishing net is used by the female folk only. The other implements used by the Jarawa are knives and 'dao', which are obtained from the AAJVS or settlers.

### 3.2.3.5.a Bows and arrow

Bows and arrows are of cardinal importance to the Jarawa. For making bow, good quality wood with high elasticity is required (Plate 15). To meet this requirement, the Jarawa use the stems of *Calamus andamanicus*, *Dinochloa scandens* and *Sageraea elliptica* plants. The strings of the bows are made from the bark of *Ficus scandens*, *Desmos dasymaschalus*, *Anodendron manubrium* and *Polyalthia parkinsonii* plants. Jarawa make arrows of different type and size for different purposes (Plate 15 and 16). Stem of *Murraya paniculata* is chosen for preparing wooden arrow, while stem of *Areca triandra*, *Dinochloa*, and *Ancistrocladus* are used for making hunting arrows. Iron is used for the arrowhead. This arrow head is tied to the stick with a string made of plant fibre from *Dendrobium*.

### 3.2.3.5.b Chest guard

While going out for hunting, the Jarawa wear chest guard called 'kekad' made from the bark of *Planchonia valida*, *Polyalthia parkinsonii* and *Sterculia villosa* (Plate 17). It protects them from injury during hunting. It is also used for keeping knives during hunting. There are two layers of bark strip in a guard and it is 20-30 cm in diameter. The ends of the bark strip are neatly stitched together with bark string. The surface of the 'kekad' is decorated with a dye obtained from the stem juice of *Myristica andamanica* plant.

### 3.2.3.5.c Basket

The Jarawa also use baskets called 'taaiku' for collection of food, leaves, shells etc (Plate 18 and 19). These baskets are of various sizes and more or less conical in shape with wide mouth and narrow bottom. These are made from the strips of cane and *Korthalsia laciniosa*. The leaves of *Licuala palm* are spread inside the basket.

#### 3.2.3.5.d *Wooden bucket*

For collection and storage of honey and for keeping and carrying other articles, they use dug-out wooden buckets which they call 'uhu' (Plate 19 and 20). For making the bucket, wood of the *Pajanelia longifolia*, *Oroxylum indicum* and *Sterculia villosa* plant species is used. Making of wooden bucket is an exclusively adult male activity. While making the wooden bucket, the wooden block is scooped out and given the shape. Thereafter, wax is plastered both inside and outside of the bucket to avoid any leakage from it, which guarantees safe storage of valuable food items, particularly honey, derived through strenuous labour, sharp skill and tactful strategy.

#### 3.2.3.5.e *Bark strips*

The Jarawa use bark strips of plants for various purposes like for cordage, lifting of baskets, carrying babies, transporting the hunted pigs etc. For preparing strips they often use bark of *Anodendron manubrium* (*Apocynaceae*), *Antidesma velutinum* (*Euphorbiaceae*), *Calamus longisetus* (*Arecaceae*), *Combretum latifolium* (*Combretaceae*), *Dendrobium* *sps.* (*Orchidaceae*), *Desmos dasymaschalus* (*Annonaceae*), *Hibiscus tiliaceus* (*Malvaceae*), *Planchonia valida* (*Lecythidaceae*), *Pterocymbium tinctorium* (*Sterculiaceae*) and *Sterculia villosa* plants.

#### 3.2.3.5.f *Torch*

The Jarawa use torches, called 'pone', for movements during night. To prepare the torch the powdered resin of *Canarium euphyllum* (*Burseraceae*) plant is put into the leaves of *Licuala peltata*. Thereafter, the leaves are rolled and tightened with a string obtained from the bark of any plant. Thereafter a thin coating clay is applied on the outer side of the torch to prevent the leaves from burning quickly. To lit the torch

nowadays they use match sticks, otherwise in the past they produced fire by rubbing two stones.

### **3.2.3.6 Ochre**

The Jarawa use two types of ochre – red and white – that are naturally available in their territory. They mix pig fat in the ochre and prepare the paste. Thereafter, it is applied on the body. The ochre is applied either for medicinal purpose or in relation to any ritual or for decorating the body (Plate 21).

### **3.2.3.7 Iron pieces and metal vessel**

For the Jarawa, acquisition of iron, a material that is the basis of their entire food gathering process by hunting is of cardinal importance. It is not naturally available in their habitat. They do not know of any other easy source for this material but the settlements of the Non-Jarawa. In the past, they used to collect iron from jetsam, and parts of broken ships washed ashore. The iron is used for making arrowheads, knife and digging rod. These implements are of vital importance to the Jarawa. The tools of central importance for them are arrows of different types, knives and digging rods. Besides, they also use machete for clearing the vegetation. For hunting pigs, arrows with elongated leaf like iron head are used, while arrows with pointed iron head are used for fishing. In addition, they also procure metal utensils. These utensils are used for storing and cooking. Of course, these articles have lately found their way in the material culture of the Jarawa. Now these items have become a necessity. For procuring the metal, earlier (i.e., before 1997) they used to visit the settlement areas, sea coasts and the motorable roads. Such activities had led to development of a kind of relationship between the Jarawa and the settlers, arisen

historically out of a one-sided necessity, i.e., acquisition of iron implements and aluminium pots from the villages of the Non-Jarawa. The relationship that continued in the ambience of hostility was one of necessity and not of choice. In the post hostility phase, i.e., after 1997, the Jarawa are getting regular supply of iron and utensils of aluminium from Andaman Adim Janjati Vikas Samiti (AAJVS), an organisation functioning under the Andaman and Nicobar Administration.

### **3.3 SEASONALITY OF FOOD RESOURCES**

The harvesting of terrestrial and aquatic resources is mostly for food purpose. However, the availability and in some cases density of many of these resources is season specific, it means availability of these resources vary from one season to another. The collection of resources by the Jarawa is, therefore, subject to abundance of specific resource in a particular season. Availability of few of the edible resources is inter-seasonal also. There are three broad resource seasons as given below:

1. *Mid-March to mid-May (dry summer season):* It is the season of collection of wild jackfruit. The fruits of wild jackfruits are collected in large quantity during dry summer season. The pulp of ripen fruit is eaten instantly. The unripe fruit is cooked in the fire and there after its seeds are taken out. Some of the seeds are eaten immediately, while the rest are stored. The stored seeds last until August. Coincidentally, this period happens to be the lean season of pig hunting due to some reasons discussed elsewhere. There is occasional collection of honey also in this season.

2. *Mid-May to November (rainy season)*: The rainy seasons include both the south-west and the north-east monsoons. During this season, the thrust is on pig hunting and collection of the seeds of *Cycus rumphii* and *Nipa fruticans*. During this period roots and tubers, the food of the feral pigs, are available in abundance. As a result, the pigs grow heavier during this period. The collection of the seeds of *Cycus rumphii* continues until end of November.
3. *December to mid-March (cool winter season)*: This is the main season of collection of honey and turtle eggs, followed by pig hunting. The turtle starts coming ashore for laying the eggs from November onwards. Thus, the turtle hunting together with collection of eggs begins from November and continue until end of February, though egg collection diminishes gradually. There are a few species of turtles that lay eggs in other seasons also. The honey collection begins when the rain stops, i.e., from December and last until May.

In case of wild pig, the seasonality, in fact, does not hold true except that pigs are hunted less during March to May. There appears to be two reasons for it. Firstly, there are other edible resources available in abundance during this period. During this period the roots and tubers eaten by the wild pigs are available in less quantity and as such pigs become thinner and have less fat on their bodies. According to the Jarawa version, during this period, wild pigs turn black and their meat does not taste good as it has less of fat. In other words, the Jarawa relish flesh of the pigs when it is rich in fat contents. The less of hunting efforts in this period is related with lesser fat in the pigs. In addition, no seasonality is observed in case of the fish, molluscs and crabs as these are available throughout the year. Thus fishing goes on round the year and the supply of the aquatic edible resources is in plenty. Same is the case with availability

of edible tubers (*Dioscorea sp.*) also. Plants of a single species can be found at all stages of growth at the same time. At least two species of tubers (*woh*) sometimes have mature and immature tubers on the same plant at a particular time. The data from 1999 to 2004 show that wild tubers were available round the year, though the rate of return varied to some extent. Interestingly similar kind of observation was made for edible tubers available in the Malay Peninsula by many persons. Those tubers are also of *Dioscorea sp.*

### **3.4 RESOURCES OF THE NON-JARAWA PEOPLE**

Agriculture is their primary occupation of the Non-Jarawa rural population while the urban population is engaged in secondary and tertiary occupations. To meet their needs for timber and minor forest produce, concessions have been granted to them under Government Notification No. 13/87-F(T)/27/25, dated 24-4-1987, but they are supposed to procure these items from the forests on the periphery of the Jarawa territory. Owing to degradation of the forests in non-reserved area, they have to depend on the forest resources of the 'Jarawa Reserve'. Over the years, their population has increased and so has increased their needs. Consequently, many of them are inadvertently using the terrestrial and aquatic resources of the 'Jarawa Reserve'. Though entry in the 'Jarawa Reserve' is restricted and the extraction of the resources prohibited, many of the Non-Jarawa population stealthily and illegally indulge in poaching and extraction of forest resources. Until 1996, the Department of Forests was the chief agency involved in extraction of timber and minor forest produce from the Jarawa territory. The rural as well as urban population also meet their requirements by purchasing sawn timber from the sawmills of the Department of Forests at Chatham or the privately owned small sawmills operating in and around

Port Blair. Besides forest resources (plant and plant products), animal resources are also extracted by the Non-Jarawa people, which consist of terrestrial as well as animal resources. In this brief background, the resources collected by the Non-Jarawa from the Jarawa territory have been discussed in the following lines. The ensuing discussion is worth from the point of discussion of the conflict between the Jarawa and Non-Jarawa, elaborated in the Fifth Chapter, as many of the points mentioned below have been referred there.

### **3.4.1 Forest Resources**

A large variety of forest products are extracted by the Non-Jarawa from the forests of the Jarawa territory to meet domestic as well as commercial needs. This very act has caused ripples in the relations between the Jarawa and the Non-Jarawa. The forest resources extracted by the Non-Jarawa consist of both minor forest produce and commercially important woods.

#### **3.4.1.1 Firewood**

Firewood is one of important minor forest produce procured by the Non-Jarawa people to meet the basic requirement of fuel for domestic or cooking purpose. The Forest Department issues licenses for firewood to the local people as well as to the contractors for the extraction of fuel wood on payment of royalty. Besides, firewood is also obtained from both private as well as government owned sawmills. Earlier the left over lops and tops from the areas of timber extraction by the government provided a good source of fuel to them.

### 3.4.1.2 Cane

Eight species of canes are available in the Forests. Cane is used for making rafts to transport the logs by the Forest Department, and as the coupe holder. The Non-Jarawa also use cane for manufacturing furniture and construction of houses. They procure cane on payment of royalty. The demand for cane is increasing day by day. The sports goods industry at Meerut and Jalandhar are interested in getting *Calamus andamanicus* (mota beth) cane species to manufacture of cricket bats, hockey sticks and other sport materials. Annually about 200 tons of canes are harvested from this area by various agencies, viz. government, businessmen, free grantees and right holders (Basu, 1993). In the South and Middle Andaman Islands, the cane is extracted in most of the cases from the Jarawa Reserve. Besides cane, the seeds of canes are collected by the Non-Jarawa on behalf of the businessmen. These seeds find various uses in mainland market at Kolkata and Chennai. At times, the collection of these cane seeds is so much so that it hinders the natural regeneration of cane.

### 3.4.1.3 Dhup and gum

White Dhup and Red Dhup yield a very useful resin called rock dammar. It is collected by both the Forest Department and the Non-Jarawa. Nabbe (*Lannea coromandelica*) yields a mucilaginous gum from wounds or cracks in the bark. Gum is used as adhesive.

### 3.4.1.4 Tans and dyes

In order to make tans and dyke the bark of the mangrove trees (*Bruguiera spp.* and *Rhizophora*) are used by the Non-Jarawa. The bark of mangrove is rich in tannin but it contains an excessive quantity of colouring matter. Forest Department issues

Licences to the local people for collection of raw material for tans and dykes. So far, no systematic attempt has been made to extract mangrove bark for tannin.

#### **3.4.1.5 Honey and wax**

The Non-Jarawa people collect these materials. It is mainly collected for personal consumption. So far, no effort has been made to collect honey on commercial basis because the availability of honey is too small for any commercial exploitation.

#### **3.4.1.5 Charcoal**

A small quantity of charcoal is made by the Forest Department, and sold to the Non-Jarawa people, and mainly the owner of the black smithy shops buy it. The wood for preparing the charcoal is derived from the forest. The Non-Jarawa are also issued Licenses on payment of royalty for the extraction of firewood and its conversion into charcoal.

#### **3.4.1.6 Commercial woods**

The dense tropical rain forests of the Andaman Islands have high species diversity. Various species are commercially important and find ready market. The commercially important woods are extracted by the Forest Department, though after 1997 it has been stopped. However, there is illegal extraction of timber woods also. The commercially important woods can be put into to five categories according to end uses i.e., ornamental timber, plywood, match wood, general utility timber and packing case wood (Table 3.6). The above-mentioned categories of timbers are in much demand in the markets of both the mainland and Andaman and Nicobar Islands

**Table 3.6 Timber Types**

Category	Species
a) Ornamental timber	Padauk ( <i>Pterocarpus dalbergioides</i> )
	Silvergrey ( <i>Terminalia bialata</i> )
	Chooi ( <i>Sageraea elliptica</i> )
	Marble Wood ( <i>Diospyros marmorata</i> )
	Satin Wood ( <i>Murraya paniculata</i> )
b) Ply wood	Gurjan ( <i>Dipterocarpus Spp.</i> )
	Badam ( <i>Terminalia procera</i> )
	White Chuglam ( <i>Terminalia bialata</i> )
	Lalchini ( <i>Amoora wallichii</i> )
	Red Dhup ( <i>Parishia insignis</i> )
c) Match wood	Papita ( <i>Pterocymbium tinctorium</i> )
	Didu ( <i>Bombax insigne</i> )
	White Dhup ( <i>Canarium euphyllum</i> )
	Lambapathi ( <i>Sideroxylon longepetiolatum</i> )
d) General utility timber	Pyinma ( <i>Lagerstroemia hypoleuca</i> )
	Koko ( <i>Albizia lebbek</i> )
	Black Chuglam ( <i>Terminalia manii</i> )
	Hill Mohwa ( <i>Madhuca butyracea</i> )
	Red Bombwe ( <i>Planchonia andamanica</i> )
	Jhingam ( <i>Panjanelia longifolia</i> )
	Thingam ( <i>Hopea odorata</i> )
	Yewgi ( <i>Adenanthera pavonina</i> )
	Nabbe ( <i>Lannea coromandelica</i> )
	Thinkla ( <i>Nauclea gageana</i> )
	Gangaw ( <i>Mesua ferrea</i> )
Mau ( <i>Duabanga sonneratioides</i> )	
e) Packing case wood	Softwood logs of the match woods, except <i>Pterocymbium tinctorium</i> .

Source: Field Investigation, 1998-2004.

### **3.4.2 Animal Resources**

The animal resources procured by the Non-Jarawa people comprise both terrestrial and aquatic animal resources. In the animal resources, the pig, deer, monitor lizards and birds are the important food resources. Though the hunting of these animals is prohibited under the forest law, the rural people are found to be involved in hunting of these animals. These resources are mainly procured from the Jarawa Reserve. Among the aquatic resources fish, molluscs, shells, crabs, lobsters, prawn, sea cucumbers, turtle and turtle eggs are the important resources collected by the Non-Jarawa. These are vital food resources for the Jarawa as well. The people settled on the periphery of the Jarawa Reserve procure these resources mainly from the Jarawa Territory.

### **3.5 CONFLICT FOR RESOURCES**

The above discussion shows that many of the resources used by the Jarawa and Non-Jarawa are common to both of them. During the pre 1997 period, the extraction of the resources by the Non-Jarawa from the Jarawa territory was one of the reasons of hostility between the Jarawa and the Non-Jarawa. However, it was very much restricted. But in the post 1997 phase (i.e., in the post hostility phase) when the Jarawa has become friendly to the Non-Jarawa, now the Jarawa have to share in a big way their resource base with the Non-Jarawa. Now, it has created a situation where the two groups of people are using same set of resources and that too from the same ecosystem. Worth mentioning is the point that both the groups have different technology and purpose of resource extraction. The technology used by the Non-Jarawa is better in comparison to simple technology used by the Jarawa. The Jarawa use bow and arrow, hand nets and digging rods during hunting, fishing and gathering,

while the Non-Jarawa use more efficient hunting techniques like firearms and traps. Definitely, the Non-Jarawa have an advantage. In case of the Jarawa, the purpose of resource extraction is to satisfy their bare minimum needs, while for the Non-Jarawa it is for personal as commercial purposes. The opinion is that soon it may put the resources of the Jarawa Reserve under stress. It was one of the reasons of development hostility (in terms of competition for resource extraction) between Jarawa and Non-Jarawa in the post contact phase (i.e., after 1997).

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## **CHAPTER IV**

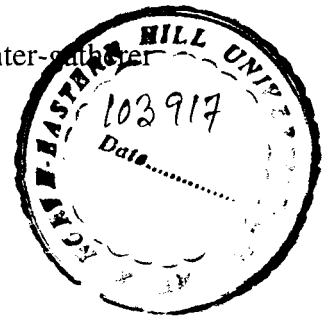
# **ADAPTATION OF THE JARAWA TO ANDAMAN ENVIRONMENT**

## **CHAPTER IV**

### **ADAPTATION OF THE JARAWA TO ANDAMAN ENVIRONMENT**

Human adaptation to the environment is a process involving technology and strategy employed by man for harnessing the biophysical resources of an ecosystem not only for his sustenance and survival but also for his future growth. Instead of being static, human adaptation is dynamic which includes the adjustment of activities of man to changing environment. The growth of the human adaptation is spiral in form (Husain, 2002). Hunting and gathering is considered as the most primitive means of human adaptation to its environment. The term 'primitive' has been used in relation to time as well as technology. In relation to time, the term 'primitive' refers to the initial human response to its environment, while in terms of technology it refers to simple technology employed for harnessing of resources. It is surprising to find that there are still some human groups in the world who practise hunting and gathering means of subsistence. Therefore, it is interesting to know how the hunting and gathering means of subsistence is still being practised in the modern times. In order to answer this question, in-depth studies have been conducted by many social scientists about the subsistence mode of economy of the hunter-gatherers. In these studies, attention has been given to the availability and seasonality of resources that influence the items hunted and gathered, the technology and strategy used in the procurement of resources and the movement pattern of the hunting and gathering bands (Lee, 1968; Yellen, 1971; Sahlins, 1972; Harris, 1985; Farb and Armelagos, 1980; Keene, 1981; Winterhalder and Smith, 1981 and others). These studies have tried to develop predictive models of the subsistence economy of hunter-gatherers based on rigorous analysis of ecological context in which they live and survive today, like 'input-output

analysis' and 'optimum foraging behaviour'. The 'input-output analysis' is done to find out as how much efforts in terms of time a hunter-gatherer group spends towards satisfactory collection of resources in foraging activity, and how far the human adaptation itself is successful, where as, through the 'optimum foraging analysis', it is tried to find out how far hunting behaviour of the Jarawa conform to a hunter-gatherer human group.



#### 4.1 FORAGING TECHNOLOGY AND STRATEGY

The Jarawa practice hunting, fishing and gathering with the simple implements, technology and strategy. The implements used by the Jarawa are few and simple like bows, arrows, knife, *dao* and small fishing nets. The average length of the bows used by the Jarawa is about one metre. There is only one type of bow used by them. As per earlier reports they had bows of more than one metres in length (*cf.* Sreenathan, 2001:41). But now such long bows are not used by them. The Jarawa have different types of arrows for different purposes. Arrow making is a long process. Iron for arrow head is either supplied by the Local Administration or the Jarawa collect it from the neighbouring settlements of the Non-Jarawa. Tempering of iron is unknown to them. Shaping of iron into arrowhead is done with the help of hammer and chisel (Plate 22). There are five types of arrows (Plate 15 and 16) used by the Jarawa depending on the nature of use:

- (i) *Thoochalotuvopaattoov* – used in pig hunting
- (ii) *Toomeedituvopattoov* – used for hunting monitor lizard
- (iii) *Thaahoodintaavpaattoov* – used for killing humans
- (iv) *Thaahoodintaavpaattoov* – used in fishing, and
- (v) *Taaheteyaalpaattoov* – arrow with detachable head, used for hunting wild pig as well as turtle.

Apart from the bow and arrow, there are other items also which are made and used by the Jarawa. Knife (*tuwoodu*) is made from aluminium which they either procure from the settlement of the Non-Jarawa or get from the AAJVS. The knife is used for polishing the shaft of the bows and arrows, making spark for fire and for making design on the bow and bucket.

Fishing net (*pootho*) is conical in shape and is made from plant fibre, but nowadays nylon string is also used for this purpose. The fishing net is used in both individual and group fishing. (Plate 23)

Wooden bucket (*uuhu*) is dug out of a block of a wood and is used mainly for honey collection (Plate 20). Wooden basket (*taaiku*) is made of cane and is used for gathering purpose (Plate 18). Besides, they also use machetes (*tottichale*) which are supplied by the local Administration. These are of three types viz., sickle tipped, straight tipped and flat tipped. It is generally used for cutting vegetation.

The foraging pursuit of the Jarawa is a collective response to the environment of the Andaman Islands to harness the resources spread over space and time. The Jarawa set-up their camps at locations, which give them access to wider resource-base. In order to harness the resources of their territory, they move from one place to another which involves a meticulous planning and execution. The resources are harnessed by employing simple technology and strategy. The foraging strategy of the Jarawa can be explained in relation to (i) location of the camps, (ii) movement pattern and, (iii) foraging methods, (iv) search image, (v) role specialisation, and (vi) sharing.

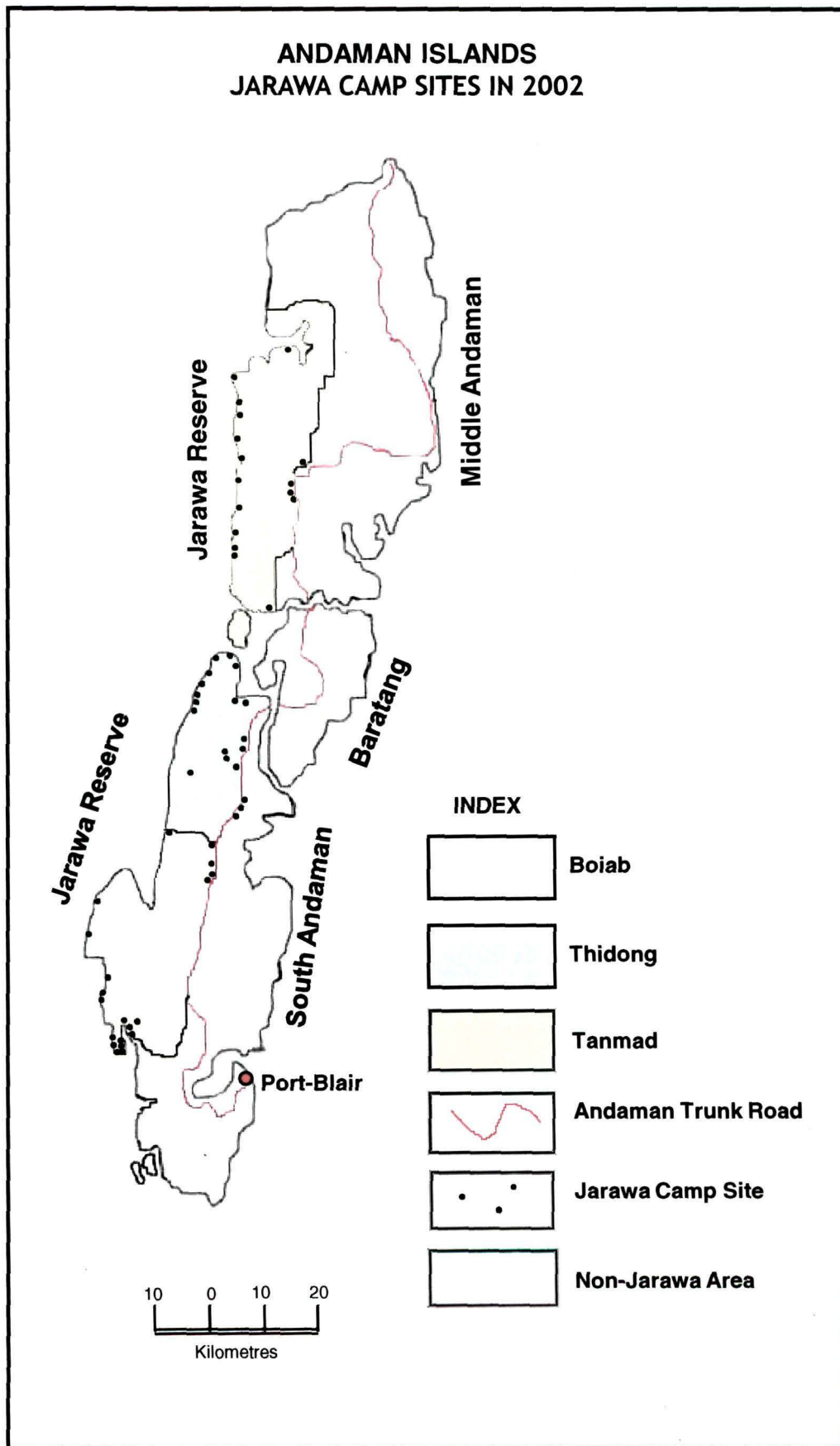


Fig. 4.1

#### 4.1.1. Location of Camps

The Jarawa like other hunter-gatherers of the world construct huts (camps) made of forest produce. The huts are known called *chadda* by the Jarawa. In the process of food collection, the camps play an important role as the foraging area begins from outside the camp. During the course of the study, about 69 camps of different types and at different locations were visited. Out of 69 camps as mentioned above, 40 were located along or near the coast while 29 in the forest (Appendix I). Few of them have been shown in Fig. 4.1. The huts can be put into three categories – permanent, semi-permanent and temporary camps (Sarkar, 1990:12-15) which are in descending order as per size of the camps. The functions of the first two camps, i.e., permanent and semi-permanent are almost similar, hence they serve as the *base camp* (Plate 24). They are large and remain occupied for longer period of one to three months. Third type is a *lean-to* type hut where they spend a day or two in the course of their foraging movement (Plate 25). The base camps of the Jarawa are not randomly distributed over space. Instead, the location of a camp at a place is governed by combination of three factors viz., (i) ecological edges, (ii) proximity to drinking water along with easy availability of one of the edible resources, and (iii) seasons.

##### 4.1.1.1 Ecological edges

A well-known facet of ecosystems is that the edges – the boundaries or transitions from one ecosystem to another – which often exhibit high level of species richness or biodiversity. Ecological edges facilitate exploitation of a wide variety of micro-sites and habitat interfaces situated within a major ecosystem. Human societies situated ‘on the edge’, ecological and geographical, are likely to benefit from the

increased biodiversity in terms of their access to the resources of two or more ecosystems (Odum, 1971; Turner *et al.*, 2003).

The cognisance of territory into five broad zones by the Jarawa is in fact the division of space into five broad physiographic zones (Fig. 3.2, Chapter III.). Each of these zones has different assemblage of resources. Spatially most species, even those that are wide spread in terms of their overall range, are restricted in their living requirements to particular ecological habitats or niches (Winterhalder, 1983). It is these characteristics of ecological edges, which make them suitable places for location of camps (Brothers, 1993; Meiners and Steward, 1999). By locating their camps on the ecological edges, the Jarawa get access to the resources of two or more than two ecological zones having high resource diversity.

The location of the camp along the waterways and the roads is very common among the Jarawa. But the use of waterways for transportation is not a deciding factor for the location of the camps by Jarawa because they do not have well developed water transportation system like that of their counter parts (Sentinelese, Onges, Great Andamanese) who make out-rigger canoes. The Jarawa do not make canoe. Instead, the Jarawa make very rudimentary raft (Plate 26 and Plate 27), the use of which is to cross the small creek. Camping sites of the Jarawa are found at points along streams, inlets, creeks and shorelines. It gives them access to resources of two or more than two ecological zones. For example, the location near a creek or coast provides them easy accessibility to inter-tidal zone (renowned for the richness and productivity of its food resources) towards the seaward side, and to the wetlands, creeks marshes, as well as forest of various types on landward side. Thus, they get access to diverse range

resources available in different physiographic zones, which, in turn, widen their resource base. In the post hostility phase (after 1997), the proximity to road has emerged as another important factor for location of the camp. It provides them easy access to the vehicular traffic plying on the Andaman Trunk Road. By using the vehicular traffic, they are reducing the travel cost in terms of time and are able to exploit the resources of larger area along the road. This phenomenon is more pronounced in the Thidong and Tanmad areas compared to Boiab area.

#### **4.1.1.2 Availability of water and resources**

The setting-up of the camps at ecological edges is governed by the proximity to drinking water, and availability of one of the edible resources in plenty, particularly one or more than one of the aquatic resources. When the camp has inland location, the edible resources available in plenty are the bivalve shell followed by fish. These resources are found in the nearby creek or stream; and in case of coastal location, the edible resources available in abundance are different species of molluscs and fish.

#### **4.1.1.3 Seasons**

Seasons play a decisive role with respect to location of the camp along the coast and in the forest. At any given point of time, the Jarawa have between two to three permanent campsites in any territory. During the rainy season (south-west monsoon) from May to September, the permanent campsites along the western coast are avoided as the southwest monsoon winds thrashes the western coast harshly. Consequently, the sea remains turbulent and rough on the western side of the Islands. On the seaward side, the sheltered bay and creeks are ideal sites for location of the camps. Inside the forest, raised grounds are selected as campsites.

With onset of cool winter season from November to February, both seaward and landward locations are preferred for setting up the camps. The underlying strategy is to harness the abundantly available seasonal resources particularly honey followed by turtle eggs. While the former is available in the forest, the latter is found along the coast on sandy beaches. During the dry summer period, the camps are usually located a bit away from the coast well inside the forest with the purpose of gathering honey and jackfruits. As such the ideal location for setting-up the camp is generally inside the forest so that both the resources could be exploited.

#### **4.1.2 Movement Pattern**

There are a numbers of factors that condition the way hunter-gatherers position themselves over space and make movements. Movement strategies are organisational responses to the structural properties of the natural and social environment (Binford, 1980). The logistical component of a settlement system, in which task-specific groups range out from residential locations for purpose of obtaining food, raw materials or information, is related to the organisation of production of a society as well as to the distribution of critical resources in the environment (Kelly, 1995). There are two types of movement- residential and logistical (Binford, 1980; Kelly, 1995). In case of residential movement, the entire group, producers and dependents, move from one place to another in their territory (Plate 28). It involves the change from one base camp to another base camp. Logistical movement, on the other hand, is the movement to and from a base camp by an individual or task oriented group for obtaining matter, energy, or information. Logistical movement also includes the movement between base camp and temporary camp.

The logistical trips of the Jarawa consist of either daily forays or expeditions of several days or weeks. During all the three phases of primary data collection for the present study, it was observed the Jarawa were always on move from one place to another in search for food resources. Merging and diffusion or fusion and fission of families in a group were constant features. Based on the frequency of the movement and distance covered, the Jarawa may be divided in to three groups. The most mobile group is that of unmarried boys who have been initiated into the hunter-hood through the *lepa* ceremony. Even within their territory, they move frequently from one camp to another. In fact, they help spread information from one group to another. The least mobile group comprises of unmarried girls and widows. They never venture out of their territory alone and generally move along with the family units. The family groups, widowers and boys of adolescent age stand in between the above two groups.

The fieldwork of three months in three different seasons has given a glimpse of the movement pattern of the Jarawa. It revealed that the movements of the Jarawa oscillate between the coasts and forests. The underlying strategy behind the movements is to exploit the resources of both the areas, and have access to a broad resource base. The study in three different seasons revealed that the one-day trip of the Jarawa is within a radius of 10 km. Initially, the resources that are at lesser distance from the camp are exploited. With the thinning of resources in the vicinity, they travel longer distances to exploit the distant resources. However, in case of pig hunting the strategy of exploitation of an area in a sequential manner (i.e., first the nearest resources) is not applicable. Further, when the movement requires covering of more than 10 km, then they either stay overnight in the forest or organise foraging expeditions ranging from a few days to two weeks.

At any given point of time, the Jarawa have between two to three permanent campsites in an area. All the logistic movements are made from any of these campsites. Movement pattern of the Jarawa is governed by the seasons also. During the summer season when the wild jackfruits and seeds of *Cucur biternata* are available in plenty, the movement of the Jarawa is oriented towards the collection of these resources. Since the former is available in the forest while latter is found in the creek, the movement of the Jarawa oscillate between creek and forest. During dry season, less number of logistical movements is made compared to other seasons. The reason for this is attributed to the fact that the gathering and processing of jackfruits require them to stay at a place for about 4 to 5 days at a stretch when they are away from the base camp.

During the rainy season, when the sea is rough due to southwest monsoon, it is virtually impossible to exploit the sea resources on the western coast. That's why permanent campsites are not located along the western coast. Instead, they are located inside the forests away from the western coast, where they do most of the pig hunting. As pig is a mobile prey, the Jarawa have to undertake a great number of logistical movements for hunting it. As a result, the numbers of foraging expeditions of more than five days at a stretch are more in the rainy season. In the fieldwork, it was observed that during the rainy season eight foraging expeditions were performed in one month (August-September, 2002) from Uli base camp.

During the cool dry season, the movements of the Jarawa oscillate between the sea coast and forests. It is because the sea usually remains calm during this season. Interestingly, it is also the season in which turtles lay eggs on sandy beaches and honey is available in the forests. Hence, the movements of the Jarawa are oriented

base camp is comparatively longer, ranging from a minimum of four days to maximum of fifteen days.

The role of information in this system of aggregation and dispersal is important. Every one knows which group is where and which group is to move where within a territory. This kind of information system serves as a means of ensuring subsistence security and reduces the chance of many groups converging at the same place for the resources, without knowing about other groups. Monitoring and information among groups and individuals are crucial in decision making about movement and resource use strategies.

#### **4.1.3 Foraging Methods**

Foraging methods, besides tools and technology, is an important aspect of human adaptation. It usually maximises returns by spending minimum efforts and time. In course of deriving resources, particularly the animal resources, the Jarawa employ particular set or sets of foraging methods. It involves interplay of three variables (i) selection of food resources; particularly prey animals, (ii) methods employed in collection of plant and animal resources, and (iii) search image.

##### **4.1.3.1 Selection of food resources**

By now, 221 species of plant and animal have come to be known that the Jarawa eat. Out of which 136 are of plant species and 85 of animal species. Despite the wide edible resource base, the Jarawa are found to be highly selective in food. They tend to eat only the most palatable and abundantly available food items, and bypass the less desirable foods. However, exception is flesh of the game animals (wild pig, monitor lizard, turtle) which is the most desired and sought after food item

though not available in abundance. For harvesting of resources, both plants and animals, various factors are taken into considerations, which are discussed below.

#### **4.1.3.2 Methods employed in collection of animal and plant resources**

Hunting, fishing and gathering are three means of getting animal resources. These require application of specific method for the satisfactory gains in terms of resources. The meticulous execution of method undoubtedly enhances the chances of getting targeted prey. During the fieldwork, it was observed that the Jarawa were using following methods in relation to hunting, fishing and gathering.

##### **4.1.3.2.a Hunting**

The game animals of the Jarawa include wild pig, monitor lizard and turtle. During course of hunting the Jarawa use any of these three methods get the prey.

1. *Ambushing*: In this case the hunter is stationary. He does not pursue the prey. Rather he waits for the prey to approach a pre-selected site and as soon as the prey is within the shooting range, he shoots the arrow. It is applied in case of all the game animals.
2. *Besetting*: It is opposite to the ambushing. Here the hunter roams in search of a stationary prey at their resting or nesting places. This method is also applicable in case of all the game animals.
3. *Following the moving prey*: In this case, both hunter and prey are mobile. Here the hunter actively seeks, tracks, stalks and pursues the prey. This method is applicable only in case of hunting of pig and monitor lizard.

Further to mention that the first two methods of hunting are used when the hunter is individually pursuing the prey, while the third method is used in both

individual and group hunting. The kind of the game animal determines whether it will be individual hunting or group hunting. In case of turtle and monitor lizard, it is individual hunting, whereas, pig is hunted both individually and in groups. It is to be noted that the Jarawa engage in group hunting only in case of wild pigs. Both individual and group hunting begins in the morning and ends by the early evening. Generally, hunting is not practised in the night.

#### **4.1.3.2.b Fishing**

Fishing provides an excellent opportunity for the examination of foraging methods and techniques employed by the Jarawa. This is precisely because the prey is small, quick, and has capacity of escaping away in the water from the predator. Traditionally, the fishing sites are the coastal areas, creeks, swamps and dammed-off channels where a creek or stream has parted around an island. In fact, fishing is carried out generally during low tide. The male folk do fishing with bow and arrows while the female folk with hand net and pointed wooden stick and iron rod. Fishing by putting poison in the water is unknown to the Jarawa. Fishing is done both individually and in group (Plate 29 and 30). The group fishing has obvious advantage over individual fishing. In case of individual fishing, the success rate is less compared to the group fishing. It is so because if a fish escapes an individual's arrow or spear jab or hand-net, it returns only after a time lag of few minutes it returns.

Group fishing is generally carried out in dammed off channels, creeks and marshy areas during the low tide. Though both man and woman take part in fishing, there is preponderance of women in this activity. In the group fishing, the females form a semi circle and drive the fish in a corner by moving forward. Once the fish have been cornered, they put the hand net at the escape routes. It is followed by jabbing the fish with pointed wooden stick or iron rod. Thus, some of the fish are

jabbed while others, which try to escape, are trapped in the net. The success rate in terms of catch is certainly very high in group fishing. However, in case of both individual and group fishing, the probability that an individual fish will be encountered is directly related to the number of persons fishing in the area, the size of the area and size and density of fish.

#### **4.1.3.2.c** *Collection of grub larvae*

The grub larvae are collected from the rotting trunk of trees. In fact, it has been observed that some trees are felled when camps are being set-up at a new site. This serves some purpose. Firstly, it allows the sunlight to reach the ground. Secondly, the felled trees soon begin to rot under the hot and humid condition and in these rotting tree trunks, the grub larvae flourish. Thirdly, the clear space help accelerate the rate of the natural regeneration of species particularly moist deciduous species. Thus, the distribution and abundance of the grub larvae to some extent is influenced by human intervention also.

#### **4.1.3.2.d** *Harvesting of tuber*

Tubers (*Dioscorea sp.*) are one of the plant resources harvested by the Jarawa. It is one of the food items, which meets their carbohydrate needs. In order to ensure the long-term adequacy of the tubers, the plants are not killed when harvested. When tubers are dug up, the roots at base of the tuber is normally left. From the left roots grow new vines and tubers.

#### **4.1.4 Search Image**

Many of the species sought as prey by the Jarawa are located in or obtained from particular physiographic zones or in some cases from particular places. For example, wild pigs are most often sought in the forested piedmont zone and extensive

back swamps. Bivalve shells are available in high quantity in streams that drain the back swamps. The larvae of some species of beetle are collected from the rotting trunks of trees. In addition, many of the strategies used are best suited to particular species or sets of ecologically similar species as in case of fish. Some tactics used for hunting pigs, monitor lizards, and turtle are, in fact, incompatible with other prey animals. Thus, it is apparent that strategies employed in search image are not only location specific but in some case prey specific as well.

As a consequence of these facts the search image, during single episode of hunting, is usually narrow. People seek a particular species or set of species within a particular environment using a particular strategy. While searching for one category of prey, the Jarawa seldom divert their attention to another prey. It means one kind of prey at a time. Again, this behaviour presumably enhances the effectiveness with which the targeted category of prey is pursued.

#### **4.1.5 Role Specialisation**

Role specialisation in hunting may be quantitative, with some individuals or groups of individuals taking more game than others do. It is mainly due to difference in the strategy they follow or the categories of prey animals, they pursue. It has been found that there is division of labour in the Jarawa society for every type of work or activity. Though the females do not hunt wild pigs, they do hunt small animals like snails, molluscs and monitor lizards. Most of the fishing and collection of bivalve shell are done by the women. In fact, most of the gathering is done by the women folk. Though men also take part in gathering, it is comparatively much less. It is interesting to note that the female gatherers bring in bulk of the edible resources from their area i.e., honey, roots, tubers, grub larvae etc. Thus, a combination of food from both animal and plant sources provide the necessary balanced diet comprising of

protein and carbohydrate. Much of the qualitative difference in terms of food collection between males and females is because the females do not use bow and arrow while collecting animal food. Several reasons are responsible for this difference, some of which seem to be rooted in biological differences in the male and female.

1. Most of the Jarawa women in their prime age are apt to be either pregnant or nursing mother. In either case, their ability to travel long distances on foot, something that is unavoidable in search of prey for hunting it, is significantly restricted.
2. There is higher risk involved in hunting than other tasks of food gathering usually performed by the Jarawa women. To place women at such a high risk would mean to place children also in an actual or potential risk.

Among males, the amount of meat collected individually in hunting varies greatly. The performance of male was not examined in terms of either age or marital status. Some men got a lot of meat and some got very little. The variations in individual performance in hunting appear to be related with differences in hunting skill and chance of getting prey.

#### **4.1.6 Sharing**

Sharing of the resources of the habitat and collection from it are a norm in the hunting-gathering human groups and the Jarawa are no exception to it. The first application of this norm is seen in distribution of territorial groups of the Jarawa at the territorial level wherein the natural resources of a particular territory can be accessed only by that group which is inhabited there. It means all the members or sub-groups of a territory have right of access to the natural resources of the territory they are

inhabiting. As discussed earlier (Chapter III), there are three territorial groups among the Jarawa and each one of them has their own well defined territory from where they gather their resources. Secondly, the edible resources collected by an individual or a family or a group are brought to the campsite. The campsite is the place that acts as the centre of daily activities. It is the place where the sharing of the collected resources actually occurs. The edible resources gathered and brought to the camps are shared systematically among the constituent members or families. While the meat of the game animals is shared among the constituent families of a camp, sharing of other resources is at intra-family level. In the Jarawa society, relatively regular supply of protein to all the members is ensured through sharing of meat of the wild pig, monitor lizard and turtle. Though sharing of meat is the norm, there is lack of sufficient quantitative information about this practice for attempting further analysis. The meats of the game animals are routinely distributed from a communal hearth; each household is given a portion of the meat; while family units generally consume small animals and plant foods separately. Usually the hunter's family gets the larger share while other constituent families get comparatively small but equal share of the meat.

One can easily understand why sharing is considered necessary if game is hunted collectively, and how the survival of every member of the group is related with it. The individual hunters find it in their interest to share what they cannot entirely consume. For the individual hunter, food sharing is really a way of storing food for future; his generosity gives him a claim in future on surplus of other hunters. As flesh of pig is the most preferred of all food items, the Jarawa always share this item as a survival strategy. The visitors (i.e., Jarawa from other territory) to the Jarawa are common and they are offered meat available with the host. The Jarawa never consider the visitors as a burden as the latter also participate in food collection and share their collection with other members of the group, when they are staying

with the host. Meat of the hunted game animals is distributed across the group of families, however the amount of meat individual hunter contributes in the common pool varies greatly. Given the type of hunting system, this is inevitable because hunting skill varies from person to person. There is little likelihood that they would achieve similar returns. To sustain sharing in the face of unequal contributions calls for mechanisms that would level the effects of varying individual performance, so that the group can benefit from overall performance. In the Jarawa community, there are no sanctions associated with performance, particular poor performance in hunting. Consequently, the varying individual is not associated with any reward or penalty.

## **4.2 FORAGING STATUS**

The Jarawa are a group that lives solely by hunting and gathering in the western part of South and Middle Andaman Islands. To illustrate their hunting-gathering (*foraging*) status, firstly, it is important to know that how much time is expended towards satisfactory collection of resources. Secondly, it is equally important to find-out that how far the hunting behaviour of the Jarawa conforms to the hunting behaviour of a hunter-gatherer group. Lastly, based on the above-mentioned two conditions an attempt has been made to explain the dynamics of interrelationship among three factors i.e., people, resource and work.

### **4.2.1 Input-Output Analysis**

The Jarawa have a simple, self-contained economy that exhibits the aforementioned properties. The hunting and gathering subsistence pursuits of the Jarawa are entirely based on extraction of resources in which accumulation of food is negligible. Domestication of plants and animals is absent. The relation between collection and consumption of food is immediate in terms of space and time. In the Jarawa society, every able bodied person above the age of 14 is an economically

active member of the society supporting himself and the dependent members as well. In the Jarawa society, there is no dependent population except the children. Surprisingly, no handicapped person is found in the adult age group, who is unable to support him/her or is dependent on the other members of the band. In other words, the person with crippling disability is not supported by the Jarawa. Consequently, he dies very soon. There is generalised reciprocity in terms of sharing of resources. Flesh of the game animals is shared routinely among the constituent families of a group, while the other foraged items are shared only within a family. It, therefore, presents a suitable case for the application of the input-output analysis.

Having taken cognisance of the above-mentioned points, the 'input-output analysis' has been applied to the data collected on the subsistence effort of the Jarawa. The subsistence effort is a compilation of all days of work carried out by a member of a group within a specified period. It has been described in terms of number of days per week per hunter.

The formula used for input-output analysis is taken from Lee (1969), which is as follows:

$$S = W/C$$

where S = the Index of Subsistence Effort,

where W = the number of man-days of work, and

where C = number of man days of consumption.

In a self-sufficient human group the magnitude of 'S' (Index of Subsistence Effort), refers to the efforts made for collection of resources to feed the group.

**Table 4.1. Summary of Subsistence Efforts at Alaoethala Base Camp (from 12-12-2001 to 08-01-2002)**

<b>Week</b>	<b>Mean group size</b>	<b>Adult</b>	<b>Children</b>	<b>Man-days of consumption</b>	<b>Man-days of work</b>	<b>Man-days of hunting</b>	<b>Meat out-put (kg)</b>	<b>Male involved in hunting (%)</b>	<b>Work week</b>	<b>Index of Subsistence</b>
I week (12-18)	40.4 (31-42)	128	155	283	074	27	83	33	4.0	0.26
II week (19-25)	51.8 (42-57)	193	170	363	108	29	69	25	3.9	0.30
III week (26-01)	23.7 (10-26)	089	077	166	050	13	23	25	3.9	0.30
IV week (02-08)	15.1 (10-16)	065	041	106	035	11	34	24	3.8	0.33
4 weeks total	131.0	475	443	918	267	80	209	107	15.67	1.19
4 weeks average	32.75	118.75	110.75	229.5	66.75	20	52.25	26.75	3.9	0.30

Source: Field Investigation, December 2001- January 2002.

Summary of the dairy at Alaoethala base camp in Thidong area for the period from 12-12-2001 to 08-01-2002 is presented in Table 4.1. It is the season of honey gathering, turtle eggs collection and hunting. The average group size varies from 15.1 to 40.4 persons. Of the total population at the campsite, 52 per cent (475 persons) are active population while the remaining 48 per cent (443) are dependent population. The workweek varies between 3.8 and 4.0 days a week with average being 3.9 days a week. It means they have 3 to 3.2 days per week for leisure, socialising and other activities.

The Index of Subsistence Effort 'S' for four week is 0.30. The value of 'S' indicates 30 days of work per hundred days of man-days consumption; or each day's work provided food for the worker and 2.3 dependent persons. The week wise analysis of the Table 4.1 reveals that the Index of Subsistence Effort was 0.26 in the first week, which increased to 0.30 in the second and third weeks. In the fourth week, it further increased to 0.33. This increase in the value of 'S' was due to the onset of season of collection of honey and turtle eggs, which began from the second week of December 2001. Then the subsistence effort of the group was directed towards the collection of honey and turtle eggs. Interestingly, it was observed that decline in the success rate of wild pig hunting on account of their long stay at the same place was off-set by success in the monitor lizard hunting. Of the total adult male population, subsistence effort of only 27 per cent was directed towards hunting, while rest of the males were involved in gathering activities. The hunting accounted for 30 per cent of the total man-days of work while 70 per cent of the man-days of work was oriented towards fishing and gathering activities.

**Table 4.2 Procurement of Food Articles  
(Period from 12-12-01 to 08-01-02)**

S.N.	Food Article	Quantity (kg)
1	Meat	209
2	Honey	185
3	Tubers	185
4	Molluscs	65
5	Fish	25
6	Turtle eggs	10
	Total	679

The Table 4.2 shows the collection of total food items at Alaoethala base camp is during the corroborated from 12-12-2001 to 08-01-2002. The analysis shows that about 679 kg of different food articles were collected by 475 Jarawa in 28 days. The flesh of wild pig and monitor lizards constituted about 30.78 percent (209 kg) of the total resources collected. It was followed by honey and tuber. Each one of these constituted about 27.25 per cent (185 kg) of the total resources collected. These were followed by the fish and turtle eggs. It may be noted that this season for collection of turtle eggs and honey and only major resources have taken into account.

Table 4.3 is the summary of the work diary at Ulia base camp in Tanmad area for the period from 12-08-02 to 08-09-02. It is the period of rainy when pig hunting along with collection of seeds of *Cycus rumphii* is major subsistence activities. The group size varied from 23.3 to 47.6 persons. The work week varied between 3.4 to 3.9 days a week with average being 3.7 days a week. It implies that they had 3.1 to 3.6 days for leisure, socialising and other activities.

**Table 4.3 Summary of Subsistence Efforts at Ulia Base Camp (from 12-08-2002 to 08-09-2002)**

<b>Week</b>	<b>Mean group size</b>	<b>Adult</b>	<b>Children</b>	<b>Man-day of consumption</b>	<b>Man-days of work</b>	<b>Man-days of hunting</b>	<b>Meat out-put (kg)</b>	<b>Male involved in hunting (%)</b>	<b>Work week</b>	<b>Index of Subsistence</b>
I week (12-18)	47.6 (16-73)	190	143	333	107	48	150	54	3.9	0.32
II week (19-25)	23.3 (16-33)	082	081	163	044	05	014	13	3.7	0.27
III week (26-01)	24.6 (16-33)	089	083	172	048	15	032	36	3.8	0.29
IV week (02-08)	27.0 (23-30)	105	084	189	051	12	027	23	3.4	0.27
4 weeks total =	122.5	466	391	857	250	80	223	126	14.8	1.15
4 week average =	30.6	116.5	97.75	214.25	62.5	20	55.75	31.5	03.7	0.29

Source: Field Investigation, August and September 2002.

The average value of 'Index of Subsistence Effort' for four weeks was 0.29 (29 work days per 100 consumption days). The value  $S = 0.29$  indicates 29 man-days of work per hundred man-days of consumption; or each day's work provided food for the worker and two and half (2.4) other people. A week wise analysis of subsistence index shows, it was high in the first week i.e., 0.32, while in the following three weeks it remained between 0.27 and 0.29. The reason for high value of 'Index of Subsistence Effort' in the first week was due to greater effort made for hunting. In the subsequent weeks less effort was made for hunting owing to less availability of pig on account of intensive hunting operation in the first week. It is evident from the column man-days of hunting which shows that only 32 man-days (40 per cent) of work was expended for hunting in three weeks compared to 48 man-days (60 per cent) of work in the first week. Of the total adult male, the about 31.5 per cent adult male were involved in hunting. The hunting accounted for nearly one third (32%) of the total man-days of work while approximately two-third of efforts in terms of man-days were oriented towards fishing and gathering.

**Table 4.4 Procurement of Food Articles  
(Period from 12-08-02 to 08-09-02)**

S.N.	Food Article	Quantity
1	Meat	223
2	Honey	005
3	Tubers	173
4	Molluscs	052
5	Fish	055
6	<i>Cycus rumphii</i>	177
	Total	685

At Ulia base camp, there were about 466 Jarawa who collected 685 kg of food in 28 days (Table 4.4.). Among the collected food items, the flesh of wild pig (223 kg) was main item, followed by *Cycus rumphii* (177 kg), tubers 173 kg), fish (55 kg), molluscs (52 kg) and honey (5 kg). It may be noted, that it was the rainy season when

pig hunting and collection of seeds of *Cycus rumphii* are major activities. Of the total collected food items, the pig accounted for 32.56 per cent followed by *Cycus rumphii* 25.84 per cent, tubers 25.26 per cent and fish and molluscs approximately 8 percent each.

When both the Tables (4.1 and 4.3) are taken together, the input-output analysis shows that the average value of 'Index of Subsistence Effort' for the Jarawa varied between 0.29 and 0.30, average being 0.295. It meant 29.5 days of work per hundred man-days of consumption; or each day's work provided food for the worker and 2.38 other members of the band. The average work input varied between 3.7 to 3.9 days a week. It meant they still had between 3.1 to 3.3 days in a week left for socializing and other leisure activities. Of the total adult male population, approximately 29 per cent were involved in hunting. It accounted for 30 per cent of the total man-days of work. It may be generalised that nearly one third of their subsistence effort is meant for hunting and the remaining two third for fishing and gathering. This result, in turn, support the earlier statement that despite their preference for the meat of game animals, the fish, molluscs and tubers are the key stone resources for the Jarawa.

From the above analysis it can be deducted that the Jarawa work for only limited period of time, the average being between 3.7 and 3.9 days in a week and the rest of the time is spent in socialising and other leisure related activities. Secondly, in the subsistence efforts of the Jarawa, fishing and gathering account for nearly two third of their total subsistence effort while hunting accounts for nearly one third of it.

#### 4.2.2 Foraging Behaviour of the Jarawa

Foraging behaviour of many human groups of the world has raised important questions, which have been investigated by number of social scientists (e.g., Lee, 1968, 1979; Sahlins, 1972, 1976; Harris, 1985; Farb and Armelagos, 1980). Models derived from optimal foraging theory are being used increasingly to evaluate human foraging behaviour (Winterhalder, 1981; Hawkes, *et al.*, 1982; Smith, 1983; Hill and Hurtado, 1989). These models have provided useful insights into human subsistence patterns, particularly of the hunter-gatherers with respect to their hunting behaviour.

The conventional optimal foraging models make three constraint assumptions (Stephens and Krebs, 1986: 10-11), viz., (i) the exclusivity of the acts of search and of exploitation of resources, (ii) complete information – the forager behaves as if he or she is aware of the rules of the model, and (iii) prey items are encountered sequentially and as a Poisson process. Of these three central assumptions, the final one – sequential Poisson encounters – is unique in that it can be quantitatively verified. The validity of this assumption has been examined utilising the data collected on the hunting behaviour of the Jarawa. Because of the importance of the assumption and the relative ease with which it can be verified, it is viewed an important – even necessary – first step in any optimal foraging analysis. If the hunting encounters do not conform to a Poisson process, then any results generated by an optimal foraging model needs to be questioned.

The first necessary analytical step is to derive an encounter distribution for each individual hunter. This step is accomplished by dividing each hunter's time, spent searching for prey, into equal units of one hour within which the number of prey encountered is counted. The choice of a particular time unit, such as the one hour unit used here, is an arbitrary matter within certain constraints keeping in mind that the

time unit must be neither so short that the distribution decomposes into its component Bernoulli (binary) distributions, nor so long that there are too few units of observations in the sample. The one-hour time unit is convenient, readily interpretable, and meets the constraints.

The next step is to compare the observed distribution with an expected Poisson distribution characterized by the same mean. The Poisson distribution itself is a distribution of discrete, independent, and rare events. It is represented by the following equation:

$$f(x) = \frac{\mu^x (e^{-\mu})}{x!}$$

where  $\mu$  = mean of the distribution,

$x$  = number of events per unit time, and

$e$  = base of natural log.

Along with the more familiar normal distribution, the Poisson distribution is a type of probability distribution. It is utilized in optimal foraging models because it describes discrete events (such as encounters with prey items in a given time period) that do not occur frequently. Further, in order to generate confidence in the results, a chi-square goodness-of-fit test has been done to compare observed distributions with expected Poisson distributions having the same mean. Though the value in some of the categories is less than 5, yet in order to generate further confidence in the results Chi-square goodness-of-fit test has been used following Zelenznik and Bennet (1991). The distributions has also been compared graphically.

**Table 4.5 Observed and Expected Frequency Distribution**

Encounter per Hour	Observed Frequency	Probability	Expected Frequency	Chi-square
0	9	0.126162	6.923015	0.62312
1	14	0.261499	14.34952	0.008513
2	12	0.271008	14.87132	0.554387
3	10	0.187242	10.27473	0.007346
4	6	0.097025	5.324177	0.085786
5	2	0.040221	2.207113	0.019435
6	2	0.013895	0.762457	2.008654
7	0	0.004114	0.225766	0.225766
Sum	55	1.001168	54.9381	3.533008
p value = 0.832				
Mean = 2.0727				
Variance = 2.4761				

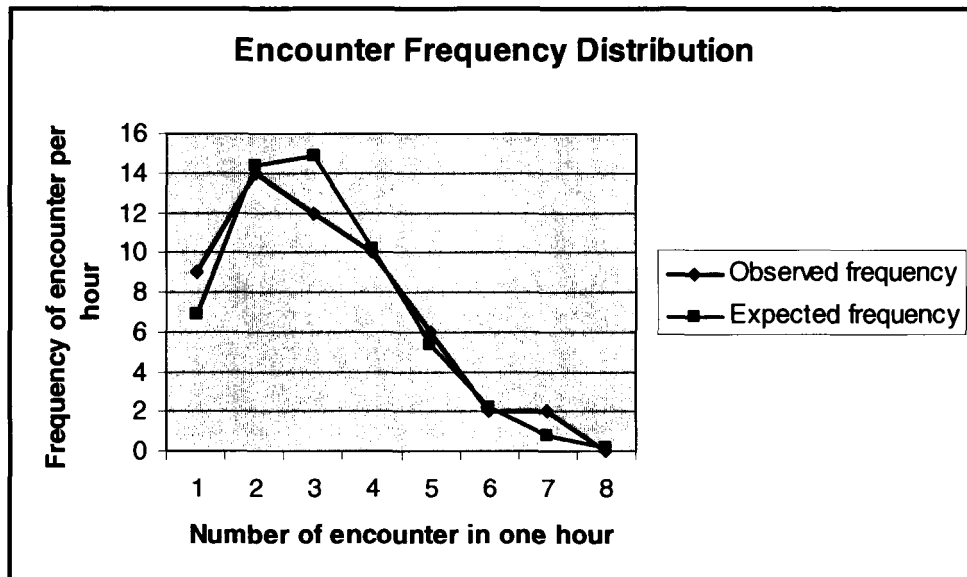
**Fig. 4.2**

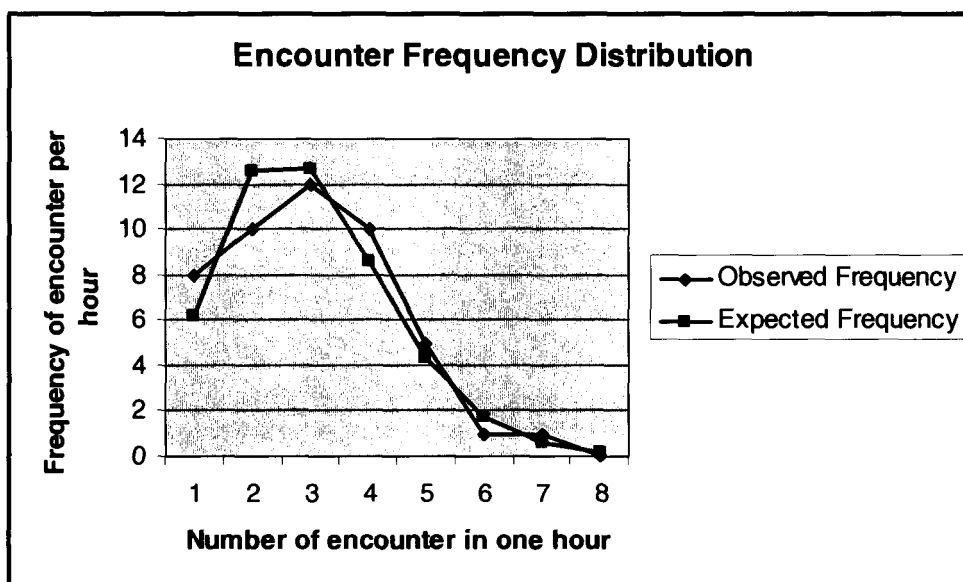
Table 4.5 shows 55 observations. It demonstrates that the mean (2.0727) and variance (2.4761) of this distribution approximate each other though not equivalent. There is greater similarity between the observed and expected distributions. However, there is period with no encounters and an under representation of the two categories. Despite these discrepancies, the Chi-square value of 3.533 is associated with a 'p' value of approximately 0.8317 for 7 degrees of freedom, which is well above the standard alpha value of 0.05. It means the  $p > 0.05$ . Therefore, it can be concluded that these distributions are insignificant. Graphically also these distribution appear similar (Fig. 4.2).

The Table 4.6 has 47 observations. Here also one finds that the mean (2.021) and the variance (2.108) approximate each other. The observed and expected distributions are quite similar as well with a total chi-square value of 2.199418 and an associated 'p' value of approximately 0.948 for 7 degrees of freedom. The 'p' value is greater and well above the standard alpha value of 0.05. It means the  $p > 0.05$ . These distributions, therefore, are also insignificant. Graphically these distributions appear similar as well (Fig. 4.3). Once again, here also there is a period with no encounters and an under representation of the two categories.

Finally, in the Table 4.7 the data of the Table 4.7 and 4.8 i.e., the data of two seasons are combined into a single distribution. The similarity between the observed and expected distributions has further increased. The mean (2.049) and variance (2.285) approximate each other, and the total chi-square value is 4.810616 with an associated 'p' value of 0.683 for 7 degrees of freedom. Here also the p value is greater and well above the standard alpha value of 0.05. It means the  $p > 0.05$ . These distributions, therefore, are insignificant. Graphically also the similar distribution has been achieved (Fig. 4.4).

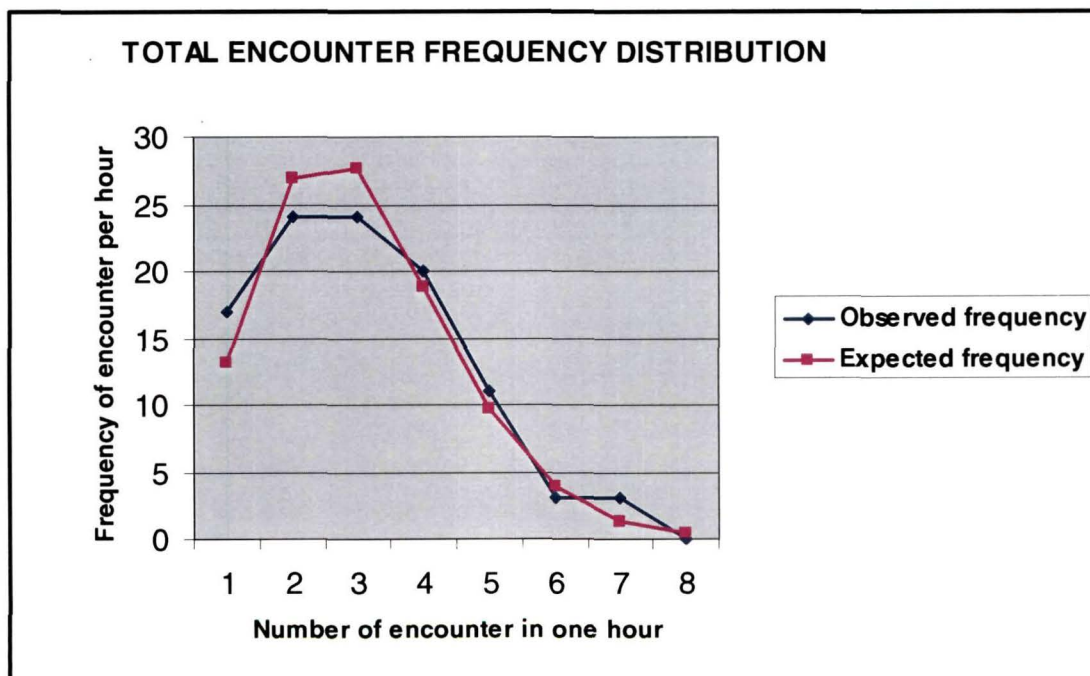
**Table 4.6 Observed and Expected Frequency Distribution**

Encounter per Hour	Observed Frequency	Probability	Expected Frequency	Chi <sup>2</sup>
0	8	0.132327	6.219363	0.509806
1	10	0.267469	12.57105	0.525837
2	12	0.270315	12.70479	0.039098
3	10	0.182127	8.559968	0.242255
4	5	0.092032	4.325517	0.105173
5	1	0.037205	1.748613	0.320495
6	1	0.012533	0.589072	0.286657
7	0	0.003619	0.170097	0.170097
Sum	47	0.997627	46.88848	2.199418
p value = 0.948				
Mean = 2.021				
Variance = 2.108				

**Fig. 4.3**

**Table 4.7 Total Observed and Expected Frequency Distribution**

Encounter per Hour	Observed Frequency	Probability	Expected Frequency	Chi <sup>2</sup>
0	17	0.129	13.158	1.121824
1	24	0.264321	26.960742	0.325139
2	24	0.270797	27.62128018	0.474767
3	20	0.184954	18.86533436	0.068246
4	11	0.094743	9.663767527	0.184764
5	3	0.038826	3.960211933	0.232818
6	3	0.013259	1.352412375	2.007189
7	0	0.003881	0.395870422	0.39587
Sum	102	0.999781	101.9776188	4.810616
p value = 0.683				
Mean = 2.049				
Variance = 2.285				

**Fig. 4.4**

From the above analysis, it can be concluded that all the three distributions are remarkably similar and closely resemble a Poisson distribution. It means the prey items are encountered sequentially as a Poisson process. The results also have a very important implication in a sense that it shows that the Jarawa are still a hunting-gathering community as their foraging behaviour conforms to it. Further, as noted above, the Poisson distribution is a probability distribution of discrete, independent and rare events. Its occurrence here suggests that, in terms of encountering animals, the Jarawa do not consciously manipulate their environment in order to make prey encounters uniform, or if they attempt to, they are not successful at it. This distribution of encounters reflects the interaction between moving foragers and the distribution of prey animals in an environment. If prey animals were highly aggregated or the Jarawa hunters were able to manipulate their encounters, one would expect a bimodal or unimodal non-Poisson distribution, respectively. This simple analysis is a critical step in analysis of hunting behaviour of the Jarawa based on optimal foraging theory.

#### **4.2.3 People, Resource and Work**

In foraging activities, the foraging efficiency is related with satisfactory collection of resources. The satisfactory collection of resources, in turn, ensures adequate consumption of required calories. These calories provide them maintenance energy required for the survival of an individual and replacement of oneself with one's offspring (Winterhalder, 1993). If the net acquisition rate of edible resources is greater than maintenance rate then the forager produces extra energy that is available for individual reproduction above replacement resulting in population growth; if it is less, then individuals do not meet their maintenance need and eventually the population begins declining due to malnutrition. It is, therefore, important to find out whether the resources collected by the Jarawa meet their calorific requirement or not.

As discussed earlier the edible items of the Jarawa consist of both terrestrial and aquatic resources. The major edible resources of the Jarawa are pig meat, pig fat, honey, mollusc, fish, turtle eggs, tubers, jackfruits and seeds of *Cycus rumphii* and *Nipa fruticans*, though availability of many of these resources varies seasonally. Apart from these, there are numerous other seasonal fruits, which form part of the Jarawa diet. Among the game animals, pig is the most preferred animal. However, of all the major edible resources, the molluscs, fish and tuber (*Dioscorea sp.*) are the key stone resources as these are found round the year and consumed regularly. The key stone resources allow the population to survive through the lean period (Terborgh, 1986).

The nutritional study conducted by the Department of Health, Port-Blair and Indian Institute of Public Hygiene and Health (2002) has put major edible items of the Jarawa diet under two categories i.e., (i) Pig dominant diet, and (ii) Other diet (Table 4.8 and Table 4.9).

The pig dominant diet of the Jarawa comprises pig meat, pig fat, honey, tubers, fruit and fruit-seeds (Table 4.8). On average, an individual consumes about 925 gm of food (2432 KCal), of which animal food comprises 54.05 per cent (500 gm) and plant food 44.95 per cent (425 gm). However, in terms of calorific value of the edible items, the Jarawa derives 71.96 per cent (1750 KCal) from the animal food items and 28.04 per cent (682 KCal) from the plant foods. It means animal foods are the major source of energy for the Jarawa.

Other diet of Jarawa consists of pig fat, honey, fish, molluscs, turtle eggs, tubers, fruits and seeds (Table 4.9). In this case, percentage contribution of the plant foods is more than animal food. Of the total diet, the plant food constitutes about 54.5 per cent (625 gm) and animal resources 45.4 per cent (529 gm) in terms of weight.

However, in terms of the total calorific value of the resources, the 58.87 per cent of the calorie (1489.7 KCal) is derived from the animal food and 41.13 per cent calorie (1041 KCal) from plant food. Thus, the above analysis suggests that in case of other diet also, the animal food constitutes the major part of the Jarawa diet in terms of calorific value.

**Table 4.8 Pig Dominant Diet**

S. N.	Food Articles	Amount (gm)	KCal
1.	Wild pig	350	400
2.	Wild pig fat	150	1350
3.	Honey	150	478
4.	Tubers	150	105
5.	Fruits & seeds	125	99
6.	Total	925	2432

**Table 4.9 Other Diet**

S.N.	Food Articles	Amount (gm)	KCal.
1	Wild pig fat	120	1080
2	Fish	250	252.5
3	Mollusc	100	97
4	Turtle eggs	50	60.2
5	Honey	250	767
6	Tubers	250	175
7	Fruits & seeds	125	99
8	Total	1145	2530.7

Source: Department of Health, and Indian Institute of Public Hygiene and Health, 2002

Note: Time period of data from 12-12-2001 to 08-01-2002, 12-04-2002 to 09-05-2002 and 12-08-2002 to 08-09-2002.

The above analyses of Table 4.8 and Table 4.9 also support the fact that the net acquisition of resources in case of the Jarawa is satisfactory because on an average an adult Jarawa get approximately 2,500 KCal from the major resources alone. If the minor resources are also included then it would well be around 2,800 KCal. It means the net acquisition rate of resources in case of the Jarawa is above maintenance requirement and thus theirs is a growing population. The ratio of surviving children per couple is more than two or around three, which is a sign of a growing population (Sarkar and Sahani, 2002).

If the total Jarawa population (about 265) and the entire area of the Jarawa Reserve (about 765 sq km) is considered it could be easily said that there exist an approximate population density of 1 person/ 2.87 sq km. The study by Kumar and Biswas (2002) says, during the first four to five days of their camping at a certain place, the Jarawas do not put in more than three to four hours per day for hunting and gathering activities. Thereafter, the required time starts increasing due to harvesting of available resources. After about ten to twelve days of their stay at one place, the time spent in collection of resources goes up to about five hours per day. In such a situation, they desert the place and move to other area. So the movement of the Jarawas is basically related to the resource density of the area. Once they realise that the resources a place have been exploited to the extent where returns are not enough, they leave the place allowing a fallow period for replenishment of the resources, which ranges from two to three months in case of the inland/forest locations depending on the regeneration rate of resources. The fallow period is much less i.e., about a month in case of the coastal sites. The analysis, thus, shows that after a few days of hunting and gathering the law of diminishing return is applicable on availability of natural resources.

The results of the input-output analysis show that on an average the work input of an adult Jarawa varies between 3.7 to 3.9 days a week. It is considered a healthy condition for a hunter-gatherer group devotes a great deal of time on leisure related activities and socializing (Winterhalder, 1993). There are certain reasons, why the Jarawa and some other groups of people in similar situation work only for limited period of time or days. The reasons are as follows:

1. There is a non-accumulative extracting economy.
2. Sharing is an effective means of reducing the uncertainty of food quest, particularly during the lean period. Thus sharing is a powerful disincentive for individuals who might be inclined towards extra work. Winterhalder (1990:1-40), in his studies on hunters-gatherers, says sharing of collected resources reduces the demands on individuals to increase foraging hours.
3. Foraging time/days are related to satisfactory collection of resources and to opportunity costs. The foraging days in case of the Jarawa is between 3.7 to 3.9 days a week and rest of the time is spent in leisure and for socializing. It means, foraging days are kept within a limit so that time becomes available for alternative activities. Riches (1982:214-16) has argued that time allocation decision of hunter-gatherers is affected by cultural factors because they place a high value on leisure and other non-subsistence pursuits.

Thus, the foregoing analysis reveals that Jarawa of Andaman Islands are one of the few remaining hunter-gatherers of the world whose subsistence economy approximates the classical hunting-gathering economy of the foragers and they have successfully adapted themselves to the island environment.

**CHAPTER V**  
**CONTACT, CONFLICT AND ADAPTATION**

## **CHAPTER V**

### **CONTACT, CONFLICT AND ADAPTATION**

For unknown centuries, many of the human groups living in the environment of the dense/deep forests, mountain interiors, deserts and isolated islands remained unknown, fully or partially, to rest of the world. With the passage of time, contacts could be established with many of them, but some exceptions are still left. Probably, the Jarawa are the most recent group of hunter-gatherers with whom the friendly contact has been established. Whether it is isolation or contact of a human group with other, it has its own advantages and disadvantages. The disadvantages are more if a human group happens to be small in numbers and practise hunting-gathering mode of subsistence activities with simple tools and technology. This is also true for most of the indigenous human groups of the world, including the Jarawa.

The indigenous human groups in most parts of the world have been subjected to various types of threats, sometimes even endangering their very existence. They are being constantly pushed out of their resources as well as livelihood. The risk appears particularly intense when such a population is small in numerical strength. Therefore, indigenous small populations appear extremely vulnerable in the event of direct or indirect threat from various forces, particularly encroachment of their territory by others, invasion of modern culture etc., as an aftermath of the contacts. In such conditions, smaller the size of the population, larger is the threat to their existence and survival. Such examples are not rare where vibrant human populations due to intervention of forces of modern culture, including spread of communication network and market mechanism, were altogether obliterated or eliminated or assimilated. For example, the Tasmanian aborigines, who once dwelt the island with mighty strides, could not withstand the pressure let loose by the expansion of European empires on

their land (Danda, 1993). Several among the tribes of Australia, America and Canada failed to adjust to the new situation grown owing to the arrival of waves of the white immigrants to their territories and in the process were ultimately eliminated. The examples of the Great Andamanese and the Onge of the Andaman Islands make almost close parallels in this respect. Though they have not been eliminated, their population has decreased alarmingly.

It is important to note that in the present context, even apparently conducive programmes of welfare states or those introduced through activities of the other agencies do not appear to be wholly beneficial to the indigenous populations. In fact, there appears something rather paradoxical in this context. While intentions of welfare states or governments need not be doubted, in spite of serious endeavours on their part, the net results of welfare programmes largely have not been very rewarding. In fact, the outcomes have often been quite baffling to the governments or the welfare agencies. The overall impact of such a situation has mostly been frightening. Owing to exposure to such a situation, the small groups often face cultural disintegration, if not biological extinction. Thus, small populations have almost everywhere become pathetically vulnerable. As a result, they have been subjected to the process of cultural disintegration and are declining in number all over the world. Of late, the Jarawa, one of the four Negrito tribes of the Andaman Islands has been undergoing through the similar situation and experiences as witnessed by the Great Andamanese and the Onges. An effort has been made in this Chapter to describe and analyse the history of contacts, causative factors behind it, its impact on the Jarawa, and adaptation of the Jarawa to the changed situation. Both friendly and unfriendly contacts have been mentioned in the following lines, and the unfriendly contacts are termed as 'conflict'.

## 5.1 CONTACTS AND CONFLICTS

Contacts of Jarawa with the other people have not been at one go and in one fashion or manner. In fact, contacts between the Jarawa and Non-Jarawa have a chequered history. There have been definite phases of contact characterised by specific nature, extent, characteristics, forces and impacts. Therefore, the contacts between the Jarawa and Non-Jarawa have been discussed and analysed according to some periods, marked by important historic events/accidents/decisions etc.

### 5.1.1 The Pre-Colonial Period

The Andaman Islands have found place in the accounts of sailors, travellers and traders since long, much before the colonial control over these Islands. For example, the Island of Buzacat, as described by Claudius Ptolemy in the Second Century A.D., was probably the Andaman Islands. While the Chinese mentioned about it in their accounts of the Seventh Century, the Arabs in the Ninth Century and the Europeans in the Thirteen-Century (Mathur, 1968:7). The central theme in almost all these references was the cruel nature and the demonic appearance of the cannibal inhabitants of the Islands. The Arabs wrote that “..... the people on this coast eat human flesh quite raw... their countenance and eyes frightful, their feet are very large...”(cf. Portman, 1899:51). Marco Polo’s account was no less interesting: “The people are ... no better than wild beasts and I assure you all the men of this Island of Angamanian have heads like dogs, and teeth and eyes likewise; in fact, in the face they are just like big mastiff dogs ...they are a most cruel generation, and eat everybody that they can catch, if not of their own race” (cf. Portman, 1899: 52). Traders and travellers from distant places might have been misinformed about the physical appearance and nature of the inhabitants of the Andaman Islands, but there was no such confusion in the neighbouring countries of South-East Asia. In reality, the Andaman Islands were not as isolated as the travellers have described about it.

Pirates from the neighbouring South-East Asian countries often used the shores and creeks of these Islands as harbours. They plundered ships sailing through the sea, and sometimes they even ventured into the surrounding and interior of these Islands to collect edible birds' nest, shark fin and tortoise shell. The most prized catch for them were the Andaman Islanders who were sold as slaves in different parts of South-East Asia (Portman, 1899:11-19).

### **5.1.2 The Colonial Period (1789 to 1947)**

During the colonial period, a number of events took place that shaped the history of the Islands and brought a great variety of changes in the human population, cultural fabric and environment of the Andaman and Nicobar Islands. Of course, this definitely looks a very long period spanning for about 160 years, but there were some lulls and gaps, for example between 1796 and 1858 there was a gap of approximately half a century i.e., time gap between the first and second penal settlement, when there were no contacts. Contacts during the colonial period can be divided into two distinct phases i.e., first penal settlement and second penal settlement, each representing its own period, nature of contacts and different happenings.

**The First Penal Settlement** was established by the British in September 1789 in Andaman islands. A documented account of contact with Negrito populations of Andaman and Nicobar Islands is available only since first penal settlement (Majumdar, 1975:52). When the British set their foot on the Andaman Islands in 1789, the behaviour of the Andaman Islanders was baffling for them during the brief phase of colonisation. While the tribesmen on the northern side of the Port Cornwallis (Port-Blair of present day) were very hostile, those inhabiting the southern side were quite friendly. To the British, both the groups were same while in reality they were confronting two different tribes, the hostile Aka-Bea, a group of the Great

Andamanese in the north, and the friendly Jarawa in the south. Lt. Colebrook and Archibald Blair were the first to encounter the Jarawa and described them to be indifferent (Portman, 1889:76). There was practically no major confrontation even with the different groups of the Great Andamanese. Nevertheless, it was the first major contact of the Negrito tribes with the alien people or Non-Islanders. However, the British vacated the Islands in May 1796 on many counts; most important was that they were prone to tropical diseases, particularly malaria.

**The Second Penal Settlement** in Andaman Islands was established in March 1858 after the acceptance of 'the Report of a Committee' formed to give its suggestion, regarding reoccupying the Andaman and Nicobar Islands and establish penal settlement, by the British Government. It was done immediately after the First Indian war for independence in 1857. Interestingly, there were penal settlements already existing in this part of the world, which had been established by the British. The first in the order was Benkulen in Sumatra followed by Singapore, Penang and some places in Myanmar (erstwhile Burma) (Majumdar, 1975: 48-49). By establishing a penal settlement in the Andaman Islands, the British government were faced with two urgent problems that required immediate attention. The first was the general policy to be adopted towards the aborigines, and second was the creation of a suitable machinery of administration for the Islands. Considering the aborigines as primitive and cruel, the Court of Directors formulated a policy of behaviour towards the aborigines. The British officials were told "all possible precautions may be taken to protect the aboriginal inhabitants of the Andaman Islands from the collision with convicts, which, it is not too probable will be provoked on both sides and which once commenced are so likely to end in the extermination of the weaker race" (*cf.* Mathur, 1968:69). Now, contacts of different Islanders of the Andaman with other people can be seen separately for a clear picture of contacts of each human group with the others

and to have a comparative scenario of contacts. It is better to see this tribe wise so that contact, conflict and its impact on each human group can be understood separately.

### **5.1.2.1 The Great Andamanese**

The Great Andamanese, one of the four Negrito tribes of the Islands, originally had ten subgroups and were distributed from south to north in the Andaman Islands. The present day Great Andamanese include members of three groups namely the Aka-Chari, Aka-Jeru and the Aka-Bea-da. Besides these three, they had other seven groups, viz., the Aka-Kora, Aka-Bo, Aka-Kede, Aka-Kol, Okka-Juwai, Aka-Puikwar and the Aka-Bele. Each group had occupied a certain area of the island. Leaving aside the Aka-Bea, the average extent of territory occupied by a tribe was about 264 sq km (Fig. 5.1). Of the ten tribes, the largest in terms of area was probably the Aka-Kede, having over 300 sq km of territory, while the smallest was probably the Aka-Chari having less than 160 sq km territory (Radcliffe-Brown 1922:25). Within their own territory, these small subgroups were nomadic in order to make the best use of natural resources available there. The relationships among these groups were not friendly. On the contrary, there existed tribal warfare among these different groups.

As expected, skirmishes of different types started taking place immediately after the establishment of the penal settlement. Hitherto the aborigines were in a sullen mood of anger and discontent at the intrusion of the outsiders into their habitat, and this feeling found vent in occasional clashes and skirmishes. As punitive measures, several expeditions were sent to teach a lesson to the autochthones. The Government communication admitted that the settlement officials preferred to ignore the path of conciliation and selected to play the role of assailants (Portman, 1899:271-73). It was evident from the suggestion of the Superintendent of Port-Blair, Mr. P.

Walker, who had sent a proposal to the Secretary for State to the British Government in India that the Great Andamanese should be driven out by the military guards from the southernmost part of the Great Andaman Island and the area should be cordoned off by a military in order to prevent entry of the aborigines. But the Government did not accept the proposal of Mr. Walker.

However, the cruel and vindictive policy of the British officials posted in the area generated among the aborigines a definite spirit of hostility against the British and a grim determination to drive them out from their habitat. It found expression in a series of attacks by them in quick succession during the months of April and May 1859. But the bow and arrows were no answer to the fire arms of the British. The first organised attack by the Great Andamanese was made on 6<sup>th</sup> April, 1859. It was followed by another attack on 14<sup>th</sup> April 1859, in which about 1500 aborigines participated (Majumdar, 1975: 82-83). It was a revelation to the whole spectrum of contacts of the aborigines with the British, and the latter's relation with and attitude towards the aborigines. In the said attack, the Great Andamanese vented their wrath on gang men but were quite friendly with convicts who had iron ring round the ankle as distinctive marks. According to Portman, the Great Andamanese told him that they objected to the clearing of the forests. Important among them was conflict of 17<sup>th</sup> May 1859, also known as the 'Battle of Aberdeen'. In this skirmish, many Great Andamanese were killed (*cf.* Majumdar, 1975: 82-83). Portman (1899:279, 288) said "Far from being a ludicrous skirmish, it was the most desperate and determined attack by the aborigines ever made on the settlement. The policy of Mr. Walker must be held responsible for these unfortunate episodes." After the retirement of Mr. Walker in 1859, his successor adopted a friendlier attitude towards the aborigines and consequently a gradual change in the attitude of the aborigine towards the settlers was noticeable.

**Table 5.1 Decadal Population of Negrito Groups in Andaman Islands  
(Up to 1950s)**

Sl. No.	Tribe	Estimated Population					
		1858	1901	1911	1921	1931	1951
1	Aka-Chari	100	39	36	17	9	23*
2	Aka-Kora	500	96	71	48	24	
3	Aka-Jeru	200	48	62	18	6	
4	Aka-Bo	700	218	180	101	46	
5	Aka-Kede	500	59	34	6	2	
6	Okka-Juwai	300	48	9	5	...	
7	Aka-Kol	100	11	2	...	...	
8	Aka-Puikwar	300	50	36	9	1	
9	Aka-Bea-da	500	37	10	1	...	
10	Aka-Bele	300	19	15	4	2	
11	Onges	700	672	631	346	250	150
12	Jarawa	600	585	231	231	120	50

Source: Mathur, 1968:128-29.

\*It is the combined population of the Great Andamanese group from Sl. No. 1 to 10.

**Table 5.2 Decadal Population of Negrito Groups in Andaman Islands  
(After 1960)**

Sl. No.	Tribe	Population					
		1961	1971	1981	1991	2001	2002
1.	Great Andamanese	19	24	27	45	43	43
2.	Onges	129	112	93	95	96	97
3.	Jarawa*	500	275	200	280	240	265
4.	Sentinelese**	50	82	100	100	39	39

Sources: Census of India, 1961; 81; 91; 2001; AAJVS, 2002 and Directorate of Economics and Statistics, 2007.

\* Population of the Jarawa were estimated till 2001. First time in 2002 a head count of the Jarawa population was done.

\*\* Population of the Sentinelese are estimated.

In 1863, E. H. Man at Port-Blair established “Andaman Home”. Rev. Corbyn, a priest, was entrusted with task of civilising the Great Andamanese. “Here they were provided free rations, lodgings and medical attendance” (Radcliffe-Brown, 1922:10). The Great Andamanese were free to come and stay as long as they wanted and then could go back with gifts from the British administration. Nevertheless, the Portman report (1899) reveals the yearning of the Great Andamanese to go back and to live the traditional way of life in the forests always remained strong among them. In the latter years, the situation gradually improved and by the end of 1860s almost all the subgroups of the Great Andamanese had been slowly and gradually tamed following the policy of carrot and stick. The Aka-Bea-da was the first to be completely befriended followed by other groups of the Great Andamanese. But an obvious fallout of the contact situation was the sudden decline in their population from a strong 3,500 in 1858 to 50 in 1951 and 19 in 1961 (Table 5.1 and Table 5.2). In the post-Independence period, they were living in dilapidated condition in and around Port-Blair. Finally, the Andaman and Nicobar Administration settled them at Strait Island in 1974 (Chakraborty, 1990). Presently their population is 41 (AAJVS, 2007). Now they are no longer full time hunter-gatherers. Presently, few of them are working in different departments of Andaman and Nicobar Administration also.

#### **5.1.2.2 The Onges**

The Onges are another Negrito tribe inhabited in the Little Andaman. Like other Negritos, they also resented any intrusion in their territory. They put up resistance within the limitation of their weaponry based on simple tools, technology and their physical strength, which lasted for several years. References are found of many unsuccessful attempts between 1867 and 1874 by the British to bring the Onges in the fold of friendship. The goodwill efforts of the M.V. Portman, Officer-in-Charge of relations with the aborigines from 1879 to 1900, bore fruits in 1886 when he

succeeded in establishing friendly contacts with the Onges. Within a span of twenty years since their friendly contact with outsiders in 1886, the Onges had completely been befriended (Sarkar, 1993:171). This change in their outlook from hostility to friendliness towards outsiders proved a turning point because thereafter they never picked bows and arrows to defend them and their territory. The British did not colonise the island of Little Andaman as they had done in South, Middle and North Andaman Islands, nor were the Onges put in any kind of “Homes” for civilising them. In the post-Independence period, Little Andaman was opened for the rehabilitation of the refugees in 1967 (Pandit and Chattopadhyay, 1993:171). It dealt a major blow to the Onges as it not only reduced the size of their territory but also curtailed their resource base. To compensate the loss of space (niche) and resources, they were settled in 1974 at two places in the Little Andaman- namely South Bay and Dugong Creek. Today they are no longer solely dependent on hunting, fishing and gathering. At the new place of settlements, the Andman Administration regularly provides them the articles of daily use including food items. Like the Great Andamanese group, the Onge population has also declined from 700 in 1858 to 150 in 1951 and 97 in 2002 (Table 5.1 and Table 5.2). In the Year 2005, the total population of the Onges was only 97 (Kumar and Haider, 2007: 128).

### **5.1.2.3 The Sentinelese**

The Negrito hunter-gatherers of the North Sentinel Island are known as the Sentinelese. They have been described as the world’s most isolated population and hence the least known. As such, there has been a mystique about their life style, culture and society. The British in the absence of any urgent need for land and forest resources of this small island (area 50 sq km) off the west coast of the South Andaman did not make any efforts to befriend them. Only few visits were made from 1867 onwards by the British but no close contact was made. In the post-Independence

period from 1967 onwards, occasional expeditions were sent to the North Sentinel Island, but the Sentinelese did not like it. At few occasions, they even shot arrows at the visiting party, though nobody was hurt. The situation improved with time and a breakthrough was achieved in February 1991 when the Sentinelese accepted the gifts from the hands of the members of the contact team who were awaiting ashore (Pandit and Chattopadhyay, 1993: 176). Thereafter, a few of them even boarded the lifeboat and then disembarked on their own. Despite the initial success, there still exists an ambience of hostility between the Sentinelese and the outsiders. The occasional expeditions are still being sent by the local Administration into their area for establishing friendly contacts with them, but of no avail. Presently, the Andaman and Nicobar Administration is following the policy of non-interference with respect to the Sentinelese.

#### **5.1.2.4 The Jarawa**

While all ten groups of the Great Andamanese and the Onge tribe had come under the influence of the British within the few years of the establishment of the second Penal Settlement at Port-Blair in 1858, the Jarawa, however, did not accept the friendly overture of the British. The Jarawa suffered violence because of the punitive expeditions sent by the British Administration against them for their disinclination to be friendly with the new settlers and their unwillingness to submit to new arrangements. The Jarawa continued with their defensive posture until the latter half of 1997, and then they became friendly with the Non-Jarawa. The history of the contacts of the Jarawa with Non-Jarawa has been discussed in three broad time-periods: (i) contacts during 1858 to 1900, (ii) contacts 1901 to 1939 and, (iii) contacts during the Japanese occupation between 1942 and 1945. The details of the contacts during the afore-mentioned time-periods have been discussed below.

#### 5.1.2.4.a *Contacts during 1858 to 1900*

As mentioned earlier that during the first phase of the penal settlement the Jarawa behaved in a nonchalant manner with the colonizers in contrast to the Aka-Bea-da tribe. During the initial years of the second penal settlement, the Jarawa remained inoffensive. The British learnt about the hostility of the Jarawa around 1863 when Topsy, the Great Andamanese girl staying at the “Andaman Home” told the Reverend H. Corbyn, in-charge of the “Home” that there were tribes in the south like the Jarawa who were hostile not only to the Andamanese but also to the British and warned him not to proceed to their settlement (Majumdr, 1975: 87). However, he failed to understand the reasons behind their hostility. In the annual report for the year 1872-1873, General Steward wrote that the Jarawa “seem to be peacefully disposed, whereas the Little Andaman Islanders habitually kill or attempt to kill, everyone that lands on their shores” (*cf.* Portman, 1899:716). The Jarawa attacked the settlement for the first time in the year 1872. However, the situation took a turn for worse in the following years and hostility with Jarawa scaled up and hardly a year passed without violent skirmishes between the Jarawa and the Non- Jarawa (Census of India, 1931:14). There appeared to be following reasons for Jarawa turning hostile against the Non-Negrito population:

1. The Jarawa resented the partiality shown by the settlers to them in treatment compared to the other tribes of the Great Andamanese group.
2. The clearing of the forests near the Port-Blair made them angry, which they regarded as a part of their homeland.
3. In the latter years, several expeditions were sent against them. It resulted in the killing of many Jarawas that further worsen the situation.
4. To add fuel to the fire, the Great Andamanese were used to catch and befriend

the Jarawa ignoring the fact that the Great Andamanese, particularly the Aka-Bea-da, were traditionally at enmity with the Jarawa. The objective was to catch the Jarawa, bring them to Port-Blair, keep them in “Home” as had been done in case of the Great Andamanese, give them gifts and then send them back. The underlying idea was that it would help establish friendly relations with the Jarawa as this method had contributed partially in the overall efforts of establishing friendly contact with the Great Andamanese and the Onges. Even this method did not bear fruit. For example, the British Administration succeeded in capturing one Jarawa man with the help of the Great Andamanese in March 1885 and he was kept in Mr. Portman’s house. However, the Jarawa kept begging the Great Andamanese to kill him by throttling or cutting his throat, and rejected all overtures of friendship (Portman, 1899:60).

By sending armed personnel into their territories, a people with friendly disposition were pushed to abject hatred, and the British Government refused to learn any lessons from it. By the end of the Nineteenth Century, the situation had further worsened. The British Administration was thinking of invading the Jarawa territory and catching them alive with the help of armed police and convicts. Astonishingly, some British officials even wanted complete extermination of the Jarawa people.

#### **5.1.2.4.b** *Contacts during 1901 to 1939*

After the retirement of Mr. Portman in 1900, the conciliatory policy that was followed till 1900 for the Jarawa was abandoned. As a result, the hostility on both sides aggravated. Now the Jarawa were even resisting with all their might establishment of any settlements in their territory. In turn, the settlers and British authority were attacking the Jarawa frequently. The turnaround from a policy of

protecting the tribes from collision with the settlers and thus saving the indigenous people from extermination was complete when in 1905 a 'Bush Police Force' was formed with friendly Great Andamanese as members and Burmese Jamadar in-charge of it. The job of the Bush Police Force was to hunt the Jarawa and the runaway convicts too (Mathur, 1968:114-15). In one such expedition by Captain West in 1925, as many as 37 Jarawa were claimed to have been shot dead (Census of India, 1931: 16). With each passing year, the number of the punitive expeditions sent inside the Jarawa territory increased. Consequently, the feeling of hostility in the Jarawa against the outsiders was further fuelled. Later at some point of time, it was felt that the most effective way to conciliate the Jarawa was to 'capture them in large numbers, tame them and then sent them back as messenger of peace'. One such expedition, organised in 1939 by McCarthy Commandant, Civil and Military Police, was considered to be successful as they could capture one young Jarawa woman with three of her children (Census of India, 1961: 104). However, in the following years such expeditions could not be carried out because of the Japanese occupation of these islands during Second World War.

#### **5.1.2.4.c** *Contacts during the Japanese occupation (1942 -1945)*

Andaman and Nicobar Islands were under Japanese occupation from March 1942 to October 1945. The Japanese were interested to fortify the entire coast but the Jarawa made their work difficult on the west coast of the Andaman. Consequently, the Jarawa areas were reported to have been machine gunned from air because two Japanese soldiers had allegedly been killed at the hands of the Jarawa (Sarkar, 1993:104). Though nothing is known about the casualties the Jarawa suffered in that attack, it did enhance their hatred towards the outsiders.

### **5.1.3. The Post-Independence Period**

In the initial two years after the Independence of India, the situation remained more or less same. Soon the events that followed the Independence made substantial impact on the Jarawa people and their territory. Important among these events was opening of the Islands for the rehabilitation of the refugees from the erstwhile East Bengal (now Bangladesh). Development of the events was in the following manner.

#### **5.1.3.1 Refugee rehabilitation**

Between 1949 and 1959, altogether 68 villages of the refugees consisting of 2328 families having a total population of 10,018 persons were established in the South and Middle Andaman Islands (Table 5.3 and Table 5.4). It was an open case of invasion of the Jarawa territory. During that time the forest cover in the Andaman Islands was wider and thicker and it was very difficult to get any large patch of cleared land, hence the forests were cut from a large area for settling the refugees. However, in different parts of the South, Middle and North Andaman Islands some lands were identified and a programme for acquiring the land was made. It was also estimated that approximately 5,000 refugee families could be settled in those areas (Sen, 1962:92).

In course of the rehabilitation programme, the refugees were taken in batches to the Andaman Islands. Initially some parts of the South Andaman Island were selected for rehabilitation because of the readily available cleared land, nearness to the administrative Headquarters at Port-Blair and communication facilities. Initially, the first batch of 202 families was rehabilitated in March 1949 (Table. 5.3). Each of the rehabilitated families was provided with certain facilities. They were given an ex-gratia grant of Rs. 1,050, a recoverable loan of Rs. 1,730 and a total of 10 acres of land, of which five acres each for paddy land and hilly land (Sen, 1962:103-104). In

addition to this land, each family was given five acres of land as homestead and for other uses. During a span of seven year from 1949 to 1955, altogether 931 families were rehabilitated in various villages of South Andaman like Homfregunj, Herbertabad, Guptapara, Wimberlygunj and Shoal Bay.

Similar process of encroachment on the Jarawa territory was repeated in the Middle Andaman during the second phase of rehabilitation. In the Middle Andaman alone, between 1953 and 1956 as many as 1300 families were rehabilitated (Table. 5.4). The peak years of the rehabilitation activities were 1954 and 1956. Within a period of seven years, about 1397 families were rehabilitated in six batches in different parts of the Rangat Valley, stretching from Betapur to Uttara. Here, each family was provided with Rs. 2000/- as loan in addition to the usual allotment of 10 acres of land. This area has certain special features like good soil, abundant rain, and perennial sources of fresh water, which attracted more settlers. As a result, population in this part of the Island registered phenomenal growth.

**Table 5.3 Year-wise Achievement of the Rehabilitation Programme in South Andaman**

Years	Number of villages established	Number of families rehabilitated	Population settled (in persons)	Area allotted for paddy cultivation (in acres)
1949	6	202	830	1,530
1950	10	265	1,165	1,765
1951	4	114	554	0,625
1952	8	123	595	0,789
1953	NA	NA	NA	NA
1954	3	97	400	0,575
1955	5	130	620	0,735
Total	36	931	4,164	6,019

NA= Data Not Available.

Source: Chakraborty and Dinda, 2002: 46.

**Table 5.4 Year wise Achievement of the Rehabilitation Programme in Middle Andaman**

Years	Number of villages established	Number of families rehabilitated	Population settled (in persons)	Area allotted for paddy cultivation (in acres)
1953	3	198	812	1,439
1954	12	438	1,810	1,905
1955	7	264	1,157	0,725
1956	8	400	1,729	1,884
1957	NA	NA	NA	NA
1958	1	88	807	400
1959	1	09	039	45
Total	32	1,397	5,854	7,398

NA= Data not available.

Source: Chakraborty and Dinda, 2002 : 47.

The unfortunate part of the rehabilitation plan was that the refugees were settled near sources of fresh water, which effectively barred access of the Jarawa to this vital resource. The intrusion in their habitat and resultant loss of territory and life sustaining resources because of establishment of refugee settlements must have made the Jarawa more and more hostile towards the Non-Jarawa. Therefore, the Jarawa resisted rehabilitation, as there were 76 encounters with them between 1946 and 1961 in which 15 settlers and a number of Jarawa were killed (Census of India, 1961).

Administratively elaborate arrangements were made to protect the villages, forest camps and persons working in the Reserve or in the adjoining areas. The Bush Police Force was no more a group of game trackers and hunters. By 1961, it was manned by 35 Jamadars, 311 Constables and 1 Inspector from 44 camps along the periphery of the Reserve. In addition, the Forest Department also maintained 150 constables. Both the forces were armed (Census of India, 1961:104). Besides giving protection to the Non-Jarawa, one of the aims of the Bush Polish was to keep a watch on the movement of the Jarawa.

### 5.1.3.2 The Andaman trunk road

The induction of new settlements brought with it the need of development of road for transportation and communication between Port-Blair and the settlements. The easiest method would have been communication by the ships and boats, as in the first decade of settlement the sea transport was the main means of transport between Port-Blair and the settlements. However, the settlers themselves had a continental mind-set, distinctly different from that of a true islander. They were gripped by the natural fear and mistrust of the sea transport. To them the road was a preferred means of transportation. Even more, the administration and decision makers in the Independent era were also mainlanders with continental mindset and preferences.

A grandiose project was conceptualized and soon the survey work for the proposed 343 km long Andaman Trunk Road started in 1970s. The road became fully operational in 1989, which now connects the four major Islands of South Andaman, Baratang, Middle Andaman and North Andaman, from Chiriyatapu in South Andaman to Diglipur in North Andaman. When the road construction started, the Jarawas actively opposed it as it was passing through their territory and disturbing their way of life (Acharya, 2002:170). Besides, the Jarawa were also traumatised by the large-scale tree felling and use of noisy heavy machinery for construction of the road, which probably drove their game species away and scared them. The Jarawa regularly raided the labourers' camps, drove wedges in the water pipes to obstruct the flow of water and made log barriers. On the other hand, the armed police protected the construction crews. According to a report in the local press, the construction agency used to surround the camps with live electric wire, a sort of improvised electric fence, which claimed many lives (*cf.* Acharya, 2002: 167-69). Many incidents of conflicts had taken place on the road since the 1970s and continued until 1997 when the situation changed. The number of Jarawa killed during the road construction

will never be known, be it by electrocution, bullets or other means. Attacks on labourers, Bush Police, trucks and buses by the Jarawa were merely a form of resistance towards the intrusion into their lives and territory, which today is seemingly complete.

### **5.1.3.3 Deforestation and commercial forestry operations**

The development of the Andaman Trunk Road through the South Andaman and Middle Andaman Islands also caused large-scale deforestation in the area that led to further deterioration of the environment of the Jarawa in the form of erosion of their forest and other resources. A notification issued by the Chief Commissioner of the Islands in 1957 had virtually declared the whole of the northern part of the South Andaman Islands as a 'Tribal Reserve'. Later the same authority amended the notification in 1979 and excluded the areas east of the Andaman Trunk Road from the 'Tribal Reserve' and opened the area to logging and for the construction of the road (Mukhopadhyay, 2002: 41).

The eastern portion of the forest along the trunk road beyond Jirkatang was felled in suitable areas and regenerated with teak commercial species of timber including *padauk*, teak, *didu* and other timber wood species. This had definitely caused great distress to the Jarawa as it has ruined their hunting grounds and reduced the diversity of food species due to raising of timber plantations, extraction and hunting by the Non-Jarawa, and other forestry operations including setting up of temporary camps at Pochang, Poona Nallah and Puttatang. Forestry operations were finally stalled after March 1996 when about 60 to 70 Jarawas ambushed workers of the Forest Department from three sides, killing two and injuring three of them (Department of Police, 1997). Until date, the Putatang camp has not been abandoned, skeletal staff has been kept there to maintain a token presence in the area.

#### **5.1.3.4 Contact missions and the Jarawa**

After the Independence, under the new policy of the Indian Government, the legacy of large scale and organised state violence and policy of punitive expedition towards the Jarawa was entirely given up. The Jarawa were declared a 'Scheduled Tribe' along with other five tribes of the Andaman and Nicobar Islands. Their territory was declared a Reserved Territory under the Government of India Forest Act and the Tribal Regulation of the Andaman and Nicobar Islands. Further, in order to befriend the Jarawa, intermittent gift giving operations were started.

In mid 1968, three Jarawa were caught by the villagers of the Kadamtala in Middle Andaman when they had come to pick up some metal implements from the village. They were taken to the Port-Blair and kept for a month, then sent back to Kadamtala for release. After this incidence, the activity of gift dropping operation in the Jarawa area was increased and systematised. On the 18th February 1974, a gift dropping party, under the supervision of Shiv Prasad Singh, Head Constable, Bush Police, was accosted by a group of Jarawa without their weapons and with friendly gesture. This was followed by vigorous efforts to renew contact with the Jarawa in the area. On 5<sup>th</sup> and 10<sup>th</sup> April 1974, Mr. Bakhtawar Singh, Officer-in-Charge, Bush Police, and other members of the contact team were able to meet the Jarawa at Lakra Lungta on the west coast of the Middle Andaman (Pandit and Chattopadhyay, 1993:173). This was followed by frequent contact missions organised by the Andaman Administration. Between 1974 and 1996 scores of visits were paid to the Jarawa area. The contact parties used to visit the western coast of the Middle Andaman in small vessels and make contact with the Jarawa on the shore. Such visits were conducted on every full moon day and the visitors used to be officials of the local government, doctors and anthropologists. The underlying idea was that the Jarawa would be able to understand the regularity of such visits if they were visited

on each full moon day, keeping in mind that natural cyclic phenomenon would presumably be intelligible enough to the Jarawa. It was also recommended that the visitors should be medically screened to prevent any possible spread of communicable diseases among the Jarawa (Awaradi, 1990: 132). During the contact missions the Jarawa were gifted with huge quantity of banana, coconut, and pieces of red cloth.

The contact missions did succeed in creating some positive impact on the Jarawa. After sometime, the Jarawa started coming forward on their own to greet the members of the contact team. However, the nascent friendship and amity were interrupted time and again by continuing conflicts with the settlers (Mukhopadhyay, 2002: 24-29). In this way, one comes across ambiguous behaviour of the Jarawa, i.e., both friendliness and hostility towards the Non-Jarawa after 1974. While on one side the Jarawa were hostile to the settlers, forest labourers working in and around the Jarawa Reserve and vehicles passing through the Jarawa Reserve, on the other they displayed friendly gesture to the members of the contact team. It clearly explains the fact that the Jarawa did not like encroachment in their territory and sharing of natural resources by others as it was the question of life and death for them. Nevertheless, the Jarawa were friendly with members of the contact teams as the Jarawa found them to be not encroaching on their ecological niche and destroying it. However, after 1990 the Jarawa have also demonstrated more friendly behaviour towards their Non-Jarawa neighbours.

#### **5.1.3.5 Enmei episode and friendliness of the Jarawa**

In April 1996, a Jarawa named Enmei with broken leg was captured and admitted to the Primary Health Centre at Kadamtala and then referred to G.B. Pant Hospital, Port-Blair, where he received treatment for about six months. Following this incident, the contact situation took a decisive turn. After being released from the

hospital, Enmei was sent back to the Kadamtala from where he was released in the Jarawa territory. The underlying approach of the administration behind this act was that he would carry back to his Jarawa people the message of goodwill and friendship. Unexpectedly, few months later, one day in October 1997, a group of unarmed Jarawa appeared at Uttara Jetty, Middle Andaman. This event was a watershed in the history of relationship of the Jarawa with the Non-Jarawa as it marked the end to the phase of hostility and beginning of friendly relations between the Jarawa and the Non-Jarawa. After that eventful day, the Jarawa started visiting the settlement areas frequently. On the subsequent visits, they started plucking banana from the plantation of the settlers and it soon became a regular phenomenon. The Primary Health Centre was the other place, which they were visiting quite often. It was a welcome change as hardly any incident of conflict between the Jarawa and the villagers was reported thereafter.

## **5.2 IMPACT OF CONTACTS AND CONFLICTS**

Every contact, whether friendly or hostile, between two human groups has its own impact on both the groups, and the contacts have their own origin, nature and development. In the background of the above-mentioned contacts, it would be worthwhile to see the impact of contact and conflict on the Jarawa people and their habitat. Impact of contact has been seen through two time periods- determined by important historical events.

### **5.2.1 Impact During the British Period (1858-1947)**

Major impact of contact during the British period was in the form of territorial displacement and redefining of boundaries. Both the social and geographical boundaries amongst the Andaman Islanders have evolved through many factors such as language, customary law, spatial organisation and access to resources. Such variables are applicable to most societies in the world. The tribes of the Andaman

Islands largely distinguished themselves by their own territory and dialect. Maintenance of exclusive territories by these groups gave them the benefits of extraction of resources from specific areas and social cohesiveness of small groups, and at the same time created a situation of diversity of cultures. Previous studies on Andamanese culture and social organisation described the Andamanese tribes based on their spatial organisation as people were divided in groups. The area used and occupied by a particular Andamanese group was delineated by specific names pertaining to and corroborative of both natural features and accounts that were associated with the area (Man, 1883: 30-40).

For long in the past, different Negrito groups of the Andaman Islands were hostile to each other and their territories were well demarcated and protected. During the year 1889, the North Andaman was inhabited predominantly by four major tribes, i.e., the Aka-Chari occupying the coastal areas of the North Andaman, and the Aka-Kora living mostly in the interior of the North Andaman, while the Aka-Bo and Aka-Jeru inhabited the central and southern part of the island respectively (Fig. 5.1). By 1901, there was remarkable shrinkage of the Aka-Jeru territory and conspicuous spread of the territory of the coastal Aka-Chari (Fig.5.2). It means the coastal tribe dominated their counterpart in the tribal warfare. By 1961 there was a complete disappearance of the Aka-Kora and Aka-Bo from the North Andaman (Fig. 5.3).

In the Middle Andaman, during the year 1889, there were four main tribal groups (Fig.5.1). These were the Aka-Kede occupying more than half of Middle Andaman. While the Aka-Kol were settled along the south-east coast, the Okka-Juwai occupied the south-western interior, and the Aka-Puikwar the southern coastal area of the Middle Andaman. By 1901, the Aka-Kede had pushed their territory southward by dominating over the other tribes (Fig. 5.2). Consequently, the Aka-Kol were pushed

further south and south-west dominating over the other two tribes i.e., the Aka-Puikwar and the Okka-Juwai. Later on, all suffered the same fate as those of the North Andaman groups and in the process completely vanished and sometime around 1930 the area came under the control of the Jarawa (Fig. 5.3 and Table 5.1).

Further south, the Baratang Island and a part of the South Andaman were inhabited by the Aka-Puikwar tribe during the year 1889 (Fig.5.1). In 1901, the Jarawa from south invaded their territory and pushed them out of south Andaman and occupied a part of Baratang Island also (Fig. 5.2). In the following decades the whole of the Aka-Puikwar had vanished. Later, the British pushed the Jarawa out of the Baratang Island.

The South Andaman Island and Rutland Island were inhabited by three major tribes in 1889 (Fig. 5.1). The Aka-Bea-da had occupied the major areas of South Andaman; the Jarawa were in the interior and the Aka-Puikwar in small territory along the north-eastern coast. The Aka-Bele tribe inhabited the Richie archipelago. Table 5.1 shows a progressive decline of all these tribes except the Jarawa in 1901 that had moved themselves from south to north. By 1930s, the Jarawa had established themselves over major parts of the South and Middle Andaman Islands.

By 1951, most of the tribal groups of the Great Andamanese had vanished. Of the ten groups of the Great Andamanese only three were surviving and had a total population of 19 only in 1961 (Table. 5.4). They were namely the Aka-Chari, Aka-Jeru and the Aka-Bea-da. They had no control over their formal territory (Fig. 5.3). Having been reduced in number and without any territory of their own they were living in miserable condition in and around Port-Blair. Finally, they were settled at Strait Island in 1970 (Sarkar, 1993:7).

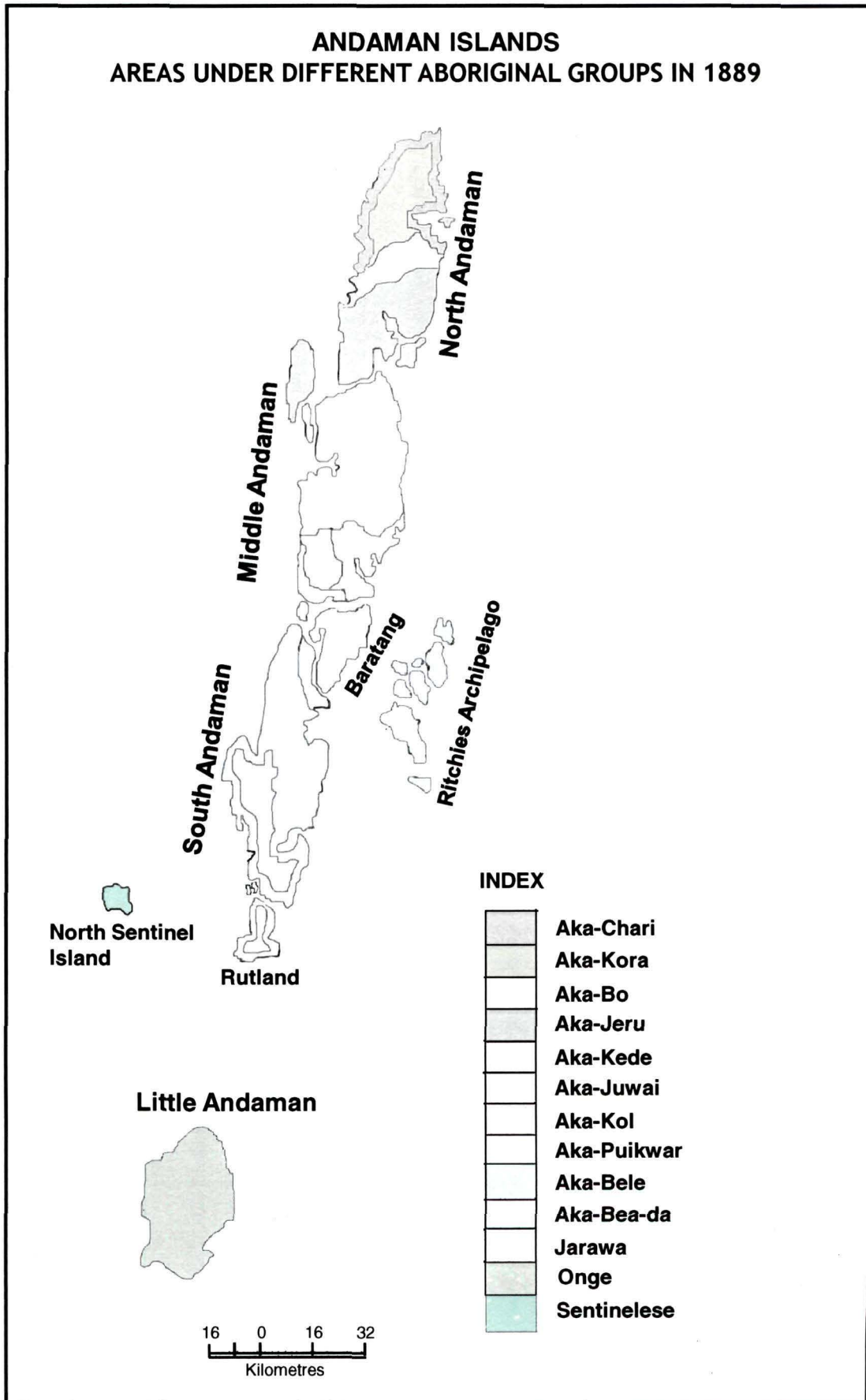


Fig. 5.1

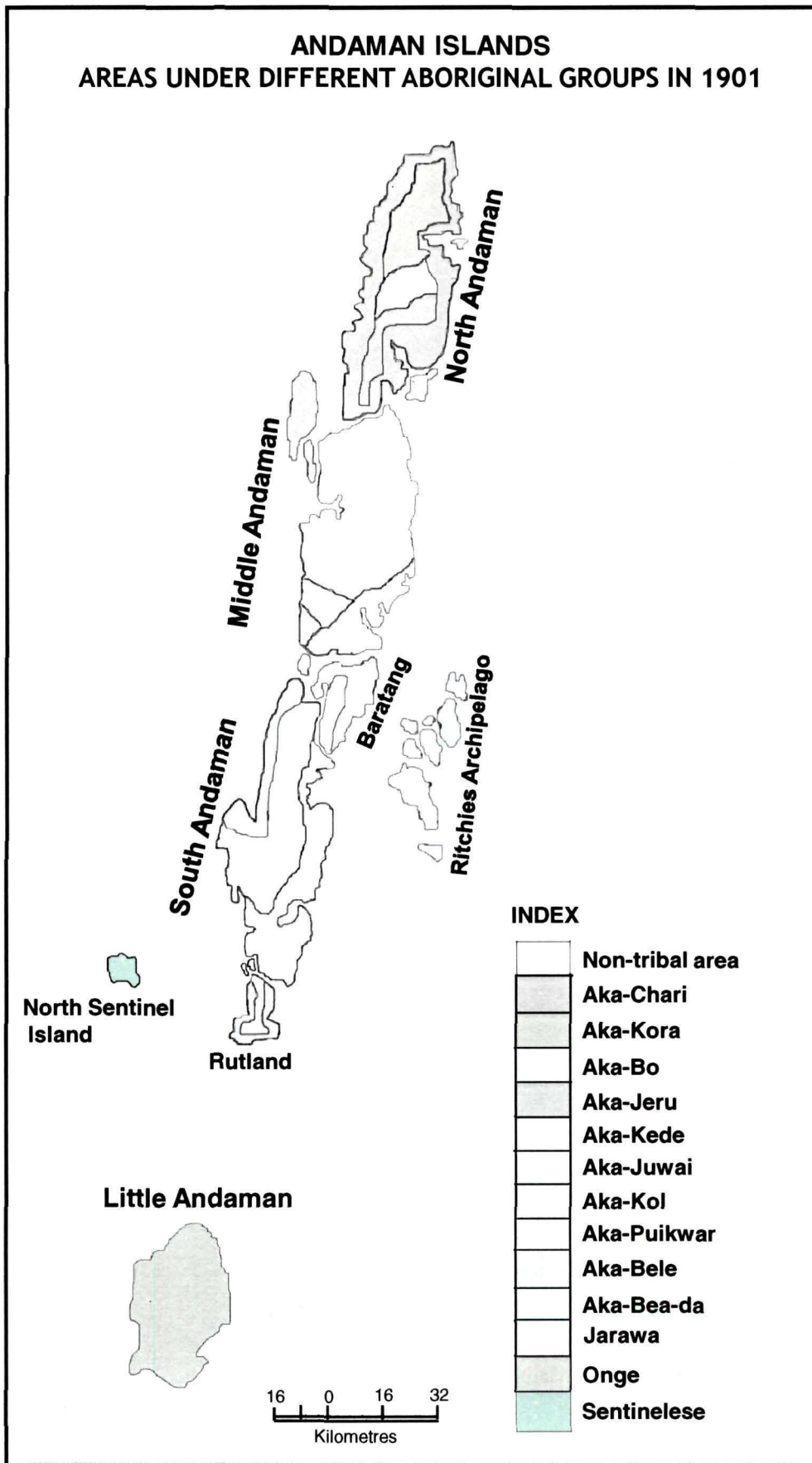


Fig. 5.2

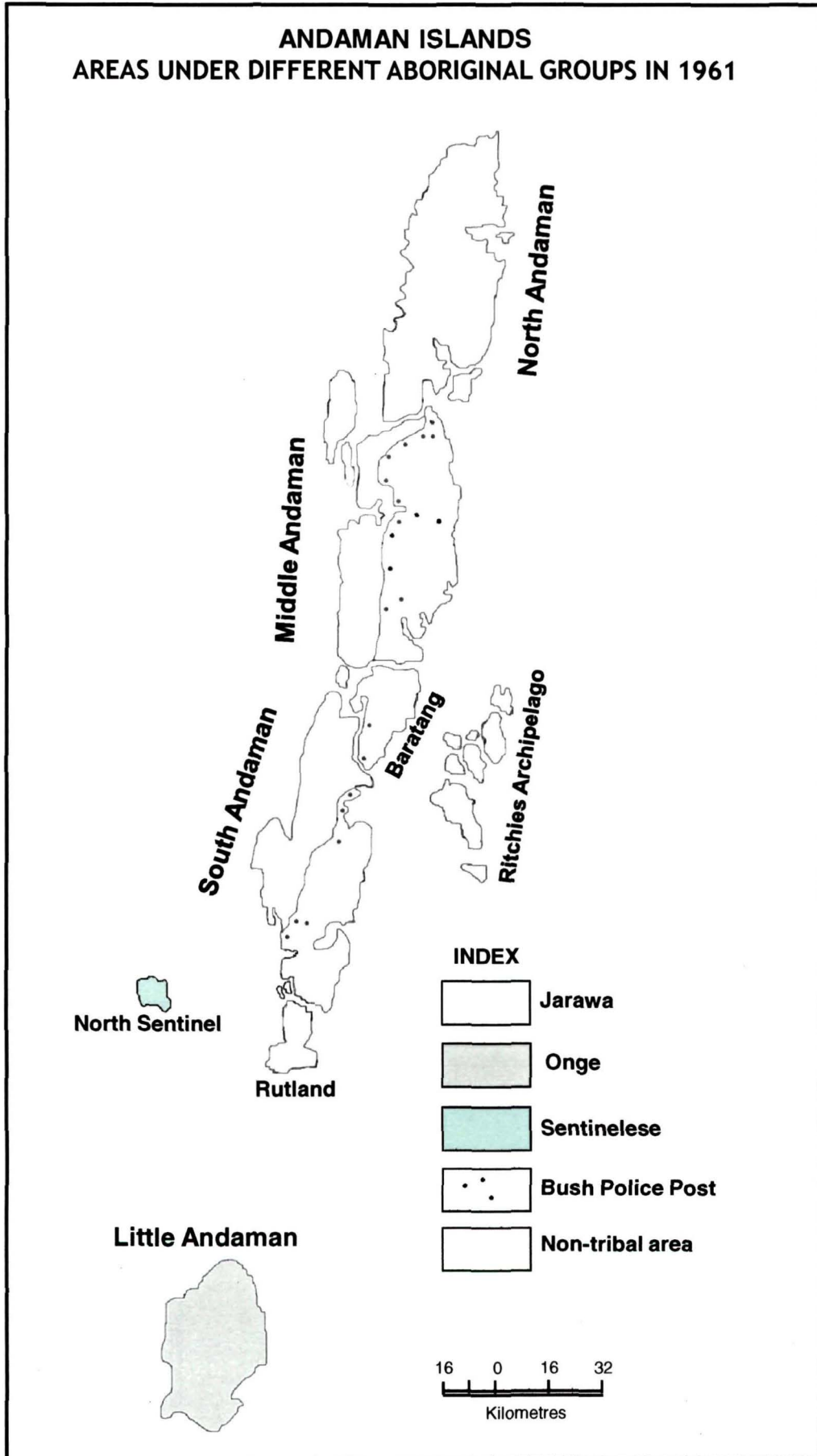


Fig. 5.3

### ANDAMAN ISLANDS AREAS UNDER DIFFERENT ABORIGINAL GROUPS IN 2007

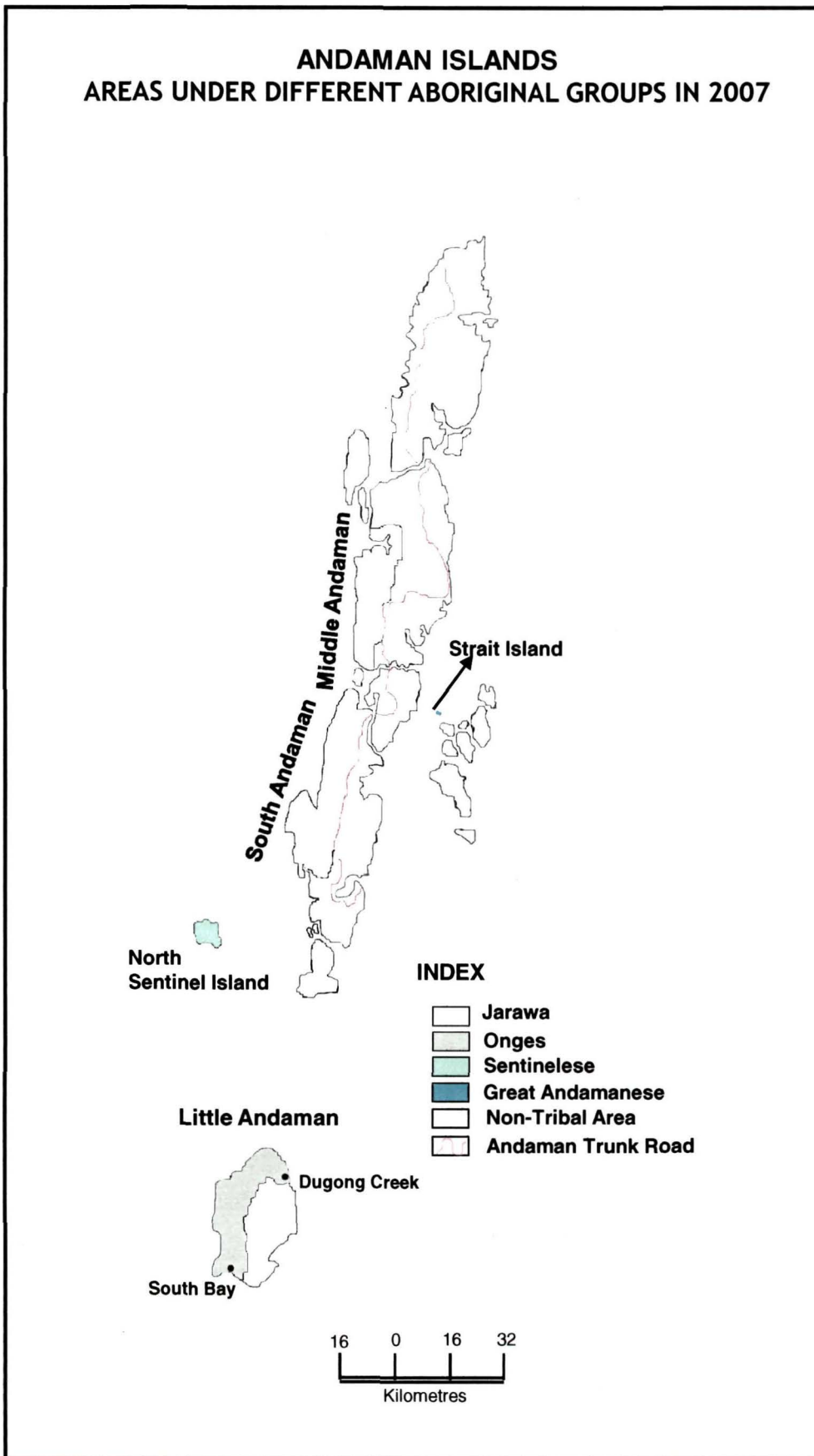


Fig. 5.4

By 1951, the Jarawa had completely vacated Richie Island and were occupying the western part of the South and Middle Andaman as these islands were vacant (Fig. 5.3). The situation remained same in the following decades (Fig. 5.4). The Onges, who were once the sole inhabitants of the Little Andaman, were settled in 1974 at two places namely Dugong Creek and South Bay and since then the situation has remained more or less same (Fig. 5.4). The Little Andaman also witnessed rehabilitation of refugees from the erstwhile East Pakistan (Kumar, 2002:131). The Sentinelese are the only human group whose territory and most probably the population have remained more or less intact owing to the absence of any contact of the Non-Sentinelese with them.

As discussed earlier that because of the growing hostility with the Jarawa, the British Government established Bush Police Force in 1905 to contain the Jarawa and to protect the settlers and convicts. As such, several outposts of the Bush Police Force were established on the periphery of the Jarawa territory. Many of these out posts continued to exist even in the post-Independence period (Fig. 5.3). After 1997, when the Jarawa became friendly with the Non-Jarawa, the name of the Bush Police Force was changed and now it is known as the Jarawa Protection Force. Only few outposts of the Jarawa Protection Force exist now. From the above discussion, it can be inferred that the population size of the aborigines declined to a great extent for which following reasons may be attributed:

1. War was one of the major factors. The British used to conduct punitive expeditions against the warring tribes. Though some information are available on the number of persons (of expedition party) killed in such war but it was never known as how many of the tribes' men were wounded in the war and

afterwards succumbed to their injuries. However, it certainly disrupted their sex and age structure and that had implication on their over all population.

2. War was followed by the spread of diseases among the Islanders in the aftermath of the taming of them. The physical contact because of their being friendly with the outsiders led to the emergence of many diseases like the syphilis, measles, influenza and small pox, which proved fatal for the Great Andamanese group and the Onges. In 1870, the tribes of South Andaman were contracted with syphilis that soon spread to other tribes and took the form of an epidemic. Similarly, in March 1877 epidemic of measles spread out among the Andamanese killing many of them (Sen, 1962:86). In the year 1897, the measles and small pox killed almost half of the total lives of the Island of the South Andaman (Sarkar, 1993: 18). The measles proved fatal for the Onges also as it struck disastrously on number of occasions (Cipriani, 1966:46). The Jarawa were not reported to suffer from any such diseases as they were not in the friendly fold or in regular contact with the Non-Jarawa people.
3. A large number of aborigines of the Great Andamanese group and the Jarawa died due to traditional tribal warfare prevailing among them.
4. A large number of aboriginals, particularly the Jarawa, were killed due to the Japanese bombardment in the tribal areas during the Japanese occupation of the Andaman Islands between 1942 and 1945.

### **5.2.2 Impact During the Post-Independence Period**

The independence of India ushered in a new era for all the tribal groups of the country including the Jarawa. Initiation of a number of developmental activities, the rehabilitation of the refugees from the erstwhile East Bengal after the formation of Bangladesh, redefining of the Jarawa territory etc. were crucial events that had telling impact on the Jarawa and their territory.

### 5.2.2.1 Shrinkage of territory

The historical events in the Indian subcontinent following the termination of colonisation led to the opening up of the Andaman Islands for the rehabilitation and resettlement of refugee population. It has the far-reaching consequences for the surviving Negrito populations of the Andaman Islands, particularly the Jarawa and the Onges, as their territories were chosen by the Government for the rehabilitation. However, in order to facilitate the rehabilitation and to protect the Jarawa area, a regulation for the protection of aboriginal tribes of the Andaman and Nicobar was notified in 1956. Exercising this power in April 1957, the Chief Commissioner declared certain areas reserved for the 'aboriginal people'. Consequently, the 'Jarawa Reserve' boundary was described but never delimited and demarcated. A subsequent notification was issued in 1979, which modified the boundary of the 'reserved areas' in South and Middle Andaman (Mukhopadhyay, 2002 : 40-41). Under the notification a large part of the 'Jarawa Reserve' was de-notified, particularly the area east of the Andaman trunk road, thus causing a reduction in the Jarawa territory. This exposed the denotified area of the Jarawa territory to logging, plantation and construction of road, leading to erosion of their resource base in terms of thinning of resources and reduction in diversity of food species in the areas close to the increased forestry operation.

Under the resettlement plan, about 68 villages consisting of 2328 households with a total population of 10,018 persons were established in the Jarawa territory in South and Middle Andaman Islands (Table 5.3 and 5.4). In order to rehabilitate the population and develop the required infrastructure, forests were cleared from a considerable area. For the rehabilitation alone about 13,417 hectares of lands were cleared of forests. All these resulted in the shrinkage of the Jarawa territory.

Moreover, the refugees were settled near sources of fresh water, which effectively barred the Jarawa from having access to this vital resource.

At the time of Independence of India, the Jarawa territory extended over northern part of the South Andaman and entire Middle Andaman Islands with a total area of approximately 2950 sq km. Besides, the forest areas of Baratang Island were also well within the functional resource region of the Jarawa. However, in the post-Independence period, the opening of the Islands for resettlement and rehabilitation of the refugee population, and modifications in boundary of the Jarawa territory in subsequent Gazette notifications resulted in huge reduction of the Jarawa territory from 2,950 sq km to 765 sq km. This shrinkage entailed loss of the life sustaining resource base of the Jarawa. Besides, in those notifications, the Jarawa Reserve was defined only on the paper but no attempt was made to delimit and demarcate it on the ground. As a result it always remained some vague on the ground. In addition, there was no buffer area between the Jarawa Reserve and the settlement areas of the Non-Jarawa. Subsequently it resulted in illegal extraction of resources and encroachment in the Jarawa Reserve.

#### **5.2.2.2 Illegal extraction of resources from the Jarawa territory**

As discussed earlier, the Andaman Islands were opened for the resettlement and rehabilitation of the refugees from the erstwhile East Pakistan between 1949 and 1959 (Table 5.3 and 5.4). In the initial days of rehabilitation, the settlers were primarily involved in agricultural activities. In addition, some of them also worked as agricultural labourers as a secondary source of income. A few of them worked as wage labourers in the Forest Department. Those immigrants who reached the Andaman Islands on their own and were not allotted any land by the authorities,

started carpentry work with wood and cane, in addition to working as wage labourers in various works.

With increase in population over decades (Table 5.5), the tendency to exploit both forests and aquatic resources increased. In the beginning, only jobless and landless persons entered the forest in search of some livelihood. Later, people who had land or other means of livelihood also started exploiting the natural resources on a regular basis. Even the cultivators, whenever they were free, entered deep into the forest either for hunting or for collecting non-timber forest produce. In this way, people were involved in illegally extracting valuable timber and collecting various non-timber forest produce like resin, honey and fruits. Besides, they were also involved in hunting of wild boars and deer (Chakraborty and Dinda, 2002:48-50). However, all these activities were restrained and under control because the hostile relationship with Jarawa acted as deterrent.

**Table 5.5 Population Growth in Census Years**

<b>Area</b>	<b>South Andaman*</b>					
<b>Year</b>	1951	1961	1971	1981	1991	2001
<b>Population</b>	16844	30,644	86,530	1,02,394	1,62,781	2,08,471
<b>Area</b>	<b>Middle Andaman</b>					
<b>Year</b>	1951	1961	1971	1981	1991	2001
<b>Population</b>	5,392	11,082	23,686	55,239	46,820	66,789

Source : Census of India, 2001; 91; 81; 61 and , Directorate of Economics and Statistics, 2002.

\* South Andaman includes the population of Port-Blair also.

However, in post-hostility phase, i.e., after 1997, the situation changed. With the absence of hostility, the illegal exploitation of resources from the Jarawa territory has increased manifolds. Based on fieldwork and discussion with a large number of the people, it has been found that poaching activities are quite high in the Jarawa territory. Such activities include the illegal extraction of the minor forest produce, fishing and hunting, discussed below in details.

#### **5.2.2.2.a** *Extraction of timber and minor forest produce*

For some villagers, illegal extraction of timber from the forests for making furniture has become a ready means of earning. Even foreign poacher are found to extract good quality timber, particularly of Padauk and Black Marble woods from the 'Jarawa Reserve', for this area is rich in such resources. In order to accomplish their illegal task, they first befriend the Jarawa by offering them some edible items so that they do not resist them. However, the illegal extraction of timber is not very high.

In order to meet the day-to-day requirements of minor forest produce, the villagers extract the required materials from the forests. These minor forest produce include fuel wood, wooden poles, leaves for thatching and cane as building material and for making furniture. In addition to the villagers, there are some businesspersons who engage persons to collect forest produce like certain fruits and seeds, which have commercial value. Such extraction might turn out to be harmful in the long run as indiscriminate plucking and picking of fruits would interfere in the natural regeneration of the forests. It is done by misusing the forest permit which is given to the villagers for collecting minor forest produce from the forests outside the Jarawa Reserve. But the forest or vegetation outside the Reserve is so much so degraded that the villagers are tempted to sneak in to the Jarawa territory, where the vegetation is abundant, to meet their needs.

### 5.2.2.2.b *Fishing and hunting*

A study by Chakraborty and Dinda (2002:47-50) shows that persons from both landowning and landless households earn part of their livelihood from fishing or from trading in aquatic items like fish, crab, sea cucumber, lobster and prawn. Now, their favourite hunting grounds are the coastal waters and creeks of the 'Jarawa Reserve'. The presence of many fishing canoes in the creeks and along the western coast of the 'Jarawa Reserve' during the course of the field work indicates the extent of the illegal fishing in the Jarawa area. Interview with the villagers revealed that most of them are ignorant about the extension of the Reserve by 200 metres in the sea. Earlier fishermen used to stay away from the shoreline to save themselves from Jarawa arrows. Now they lay nets pretty closer to the shore, sometimes they even seek help of the Jarawa while fishing. 'The Jarawa Report' of Anthropological Survey of India (An.S.I., 2002) also mention of illegal fishing, hunting and extraction of timber and non-timber forest products from the Jarawa area. Further, it cites one case where five persons were arrested along with three dinghies along the western coast of the Reserve with catch of shark, turtle, ray fish, flat fish, king shell and other marine animals (Table 5.6).

**Table 5.6 Animals Found in Poachers' Net**

Species	Total number	Live	Dead
Shark	3	2	1
Golden turtle	3	-	3
Green turtle	1	1	-
Ray fish	16	4	12
Flat fish	2	-	2
King shell	2	2	-
Miscellaneous	17	5	12

Source: An.S.I., 2002.

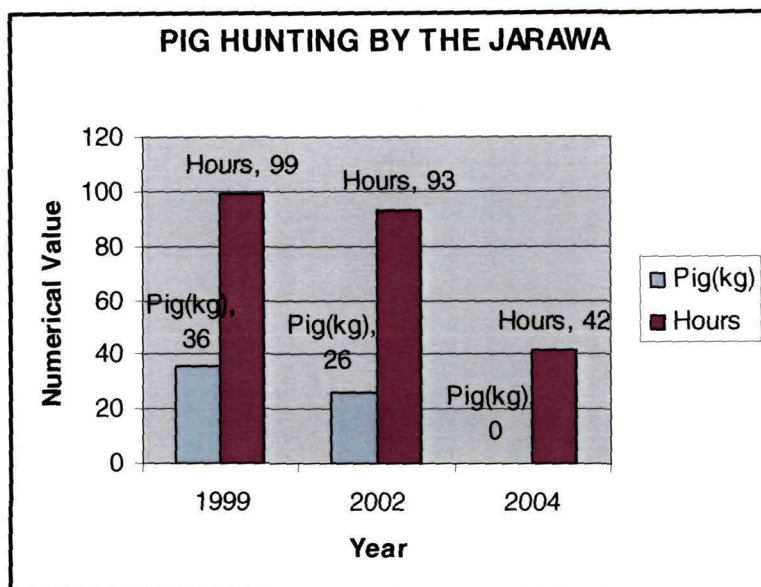


Fig. 5.5

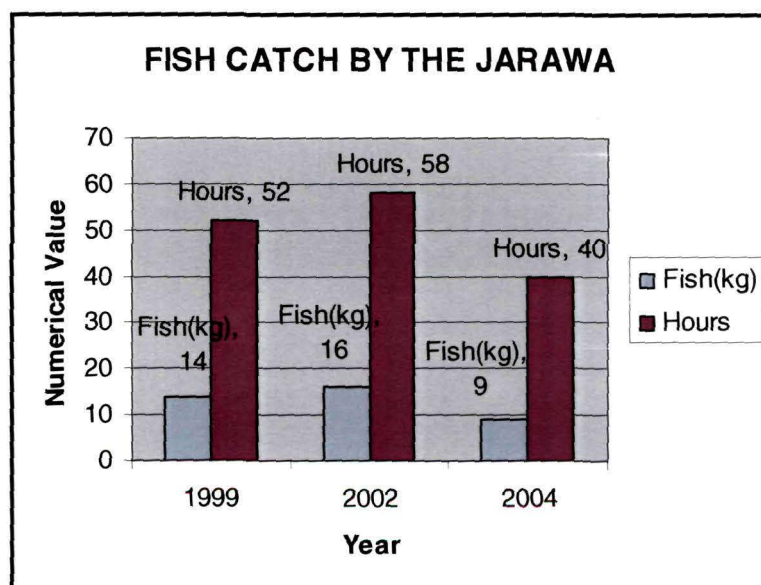


Fig. 5.6

Similarly hunting of the wild pigs and deer during the hostility phase was very limited and it used to be mainly for the purpose of domestic consumption. However, after 1997, poaching of these game animals has become another way of income generation for the modern neighbours of the Jarawa.

Data were collected on fish and pig catch for 10 days in the month of September in the years 1999, 2002 and 2004 near Dhani Nala in Kadamtala area (Fig. 5.5 and 5.6). The objective was to find out whether there was any impact of poaching on the resources, particularly, on the pig and fish population in those areas of the Jarawa territory which are close to the villages of the settlers (Non-Jarawa). One such point of study was Dhani Nala, a place close to Kadamtala and frequented by both the Jarawa and the settlers.

Figure 5.5 reveals that the Jarawa hunted wild boar weighing about 36 kg by spending 99 hours in 10 days in 1999. The pig hunting registered a decline in 2002 because even after spending 93 hours in 10 days (almost nearing the time spent in 1999) they could hunt pigs weighing about 26 kg only. However, in 2004 they could not hunt any pigs even after spending 42 hours. Though it would be incorrect to deduct from the above analysis that there are no pigs available now in that area for the pig is a mobile prey, it certainly reveals the fact that pig density has decreased owing to poaching in that area. Poachers do not take care of the regeneration cycle, but the Jarawa do. However, in case of fishing no significant change was observed in the total fish catch between 1999 and 2002 (Fig. 5.6). But in 2004, a marginal decline in the total fish catch was observed as the Jarawa could catch only nine kg of fish after spending 40 hours. Though it did not tell much about decline in the fish density, it did show that fishing grounds of the Jarawa, which are nearer to settlements, have begun to exhibit the sign of taxation owing to fishing by the villagers.

The above findings on the poaching are also corroborated by the survey of five small hotels at Kadamtala, which revealed that meat of wild boar and deer is invariably available in one or two of the hotels. Though the deer is not the game animal for the Jarawa, the pig is. More importantly, if the poaching continues to grow at the same rate soon it would surpass the rate of natural replenishment, and that would be detrimental to the Jarawa because the Jarawa have a simple extraction based economy. In order to collect resources the technology used by the Jarawa is very simple and primitive i.e., bows, arrows and hand nets. Such economy coupled with simple technology requires very high resource density in order to get satisfactory collection of resources in limited time. This, in turn, gives them sufficient time for social and leisure activities. Now with the shield of hostility gone, the poaching inside the Jarawa territory has increased. As a result, the Jarawa are competing with poachers for the natural resources both terrestrial and aquatic. The poachers on the other hand have superior technology compared to the Jarawa. Such competition, if not controlled or curbed, may soon turn out to be fatal for the Jarawa for two reasons:

1. The Jarawa do not have access to any other set of resources except those available in the 'Jarawa Reserve'. So any scarcity or degradation of these resources on which the Jarawa are dependent would cause immense hardship to them.
2. The Jarawa have non-accumulative (except the seeds of wild jackfruit and *Cycus rumphii*) subsistence economy. They collect only that much of resources from the nature which is essential for their sustenance by practicing hunting and gathering. The poachers on the other hand indulge in getting as much of resources as possible and they are equipped with superior technology. In addition, they follow carpet approach in which they do not discriminate between adult and young animals in the course of poaching. The Jarawa, on

the other hand, shoot pig or fish with arrows and as such, the chances of getting bigger animal are much higher compared to small animals. Presently, the Jarawa and the poachers compete over same set of resources with their respective technologies. In such situation the latter has the advantage over the former in terms of technology. Moreover, the poachers always tend to over exploit the resources.

From the above analysis, it is apparent that many of the resources used by the Jarawa and Non-Jarawa are common to both. It was one of the reasons of development hostility between Jarawa and Non-Jarawa in the past (i.e., before 1997) and a matter of concern in the present (i.e., after 1997). In the post hostility phase, the Jarawa have to share in a big way their resource base with the Non-Jarawa. It is more so in the case of animal resources. Now, it has created a situation where the two groups of people are using same set of resources and that too from the same ecosystem. Such exploitation of the resources of the 'Jarawa Reserve' by the Non-Jarawa is disadvantageous to the Jarawa, as it may lead to the diminishing of the resources in the Jarawa territory, and in turn hardship for the Jarawa.

#### **5.2.2.3 Encroachment**

In the absence of a clearly delimited and demarcated boundary of the 'Jarawa Reserve' it is very difficult to discern the boundary of the 'Jarawa Reserve' on the ground. As a result, it is difficult to ascertain the extent of encroachment in the reserved area. However, it has been found that encroachment has taken place on two types of land- (i) the fringe area of 'Jarawa Reserve', and (ii) those parts of the forest, which are not in the 'Jarawa Reserve'. There are following three types of encroachers.

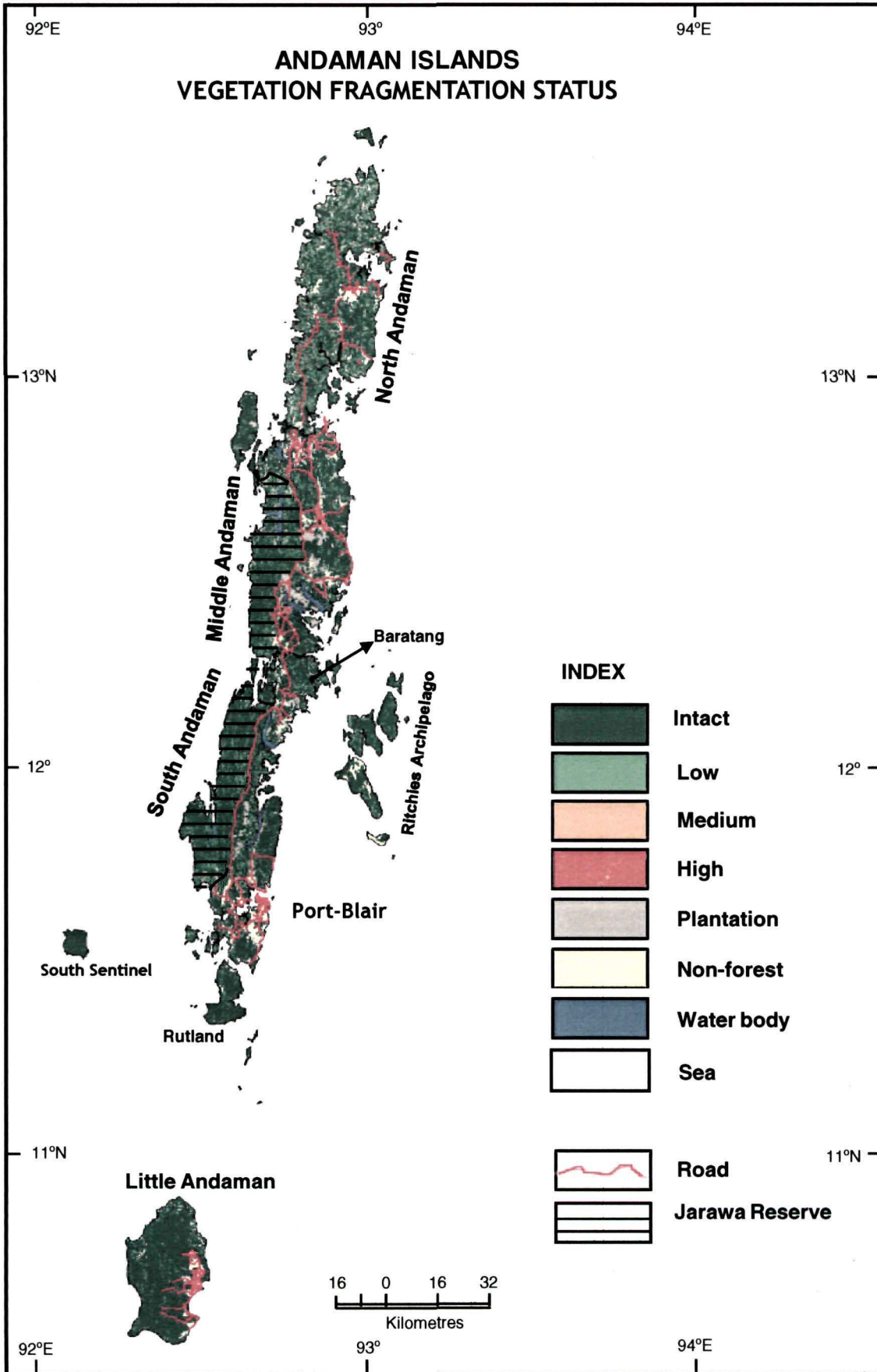


Fig. 5.7

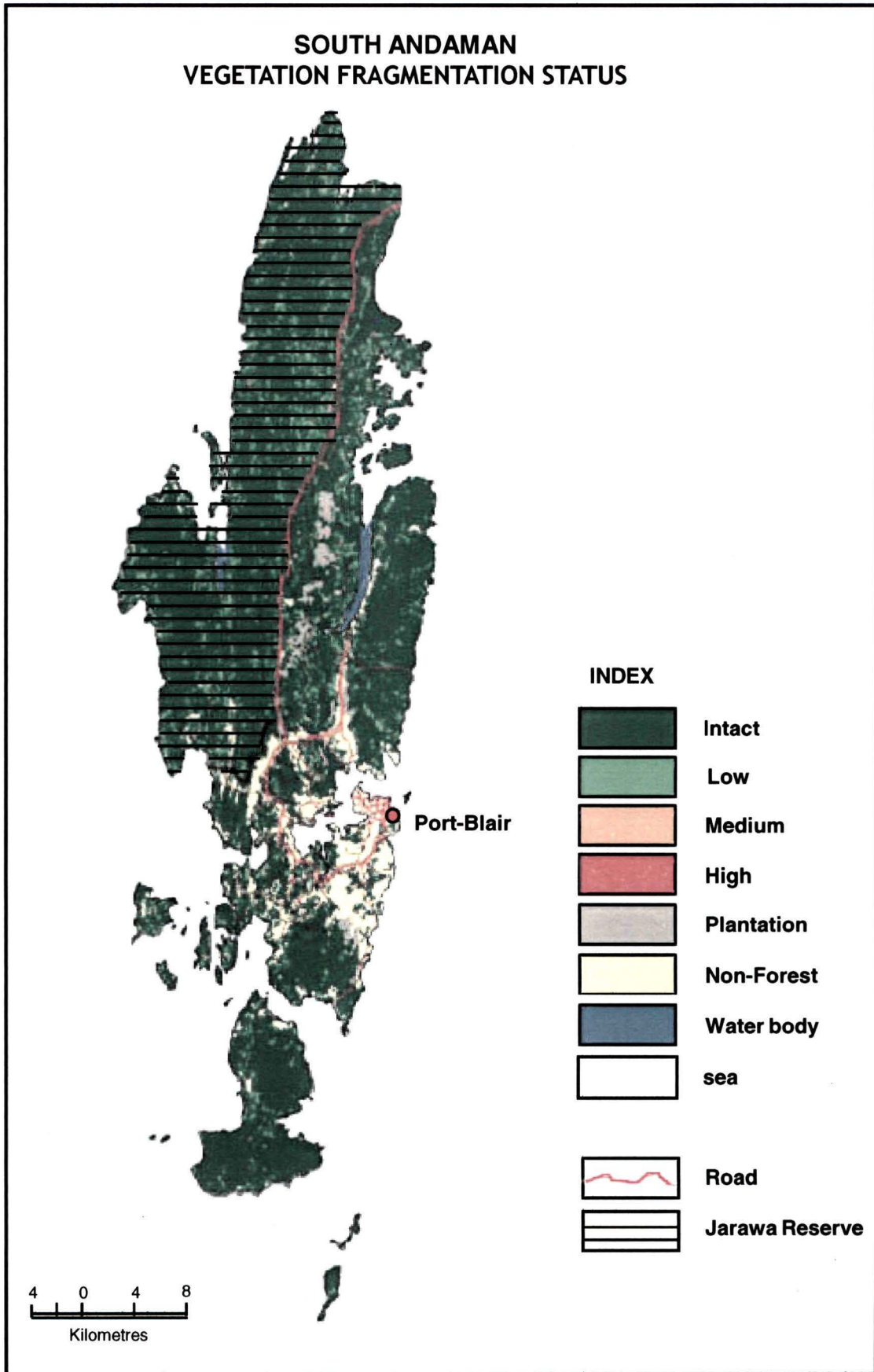


Fig. 5.8

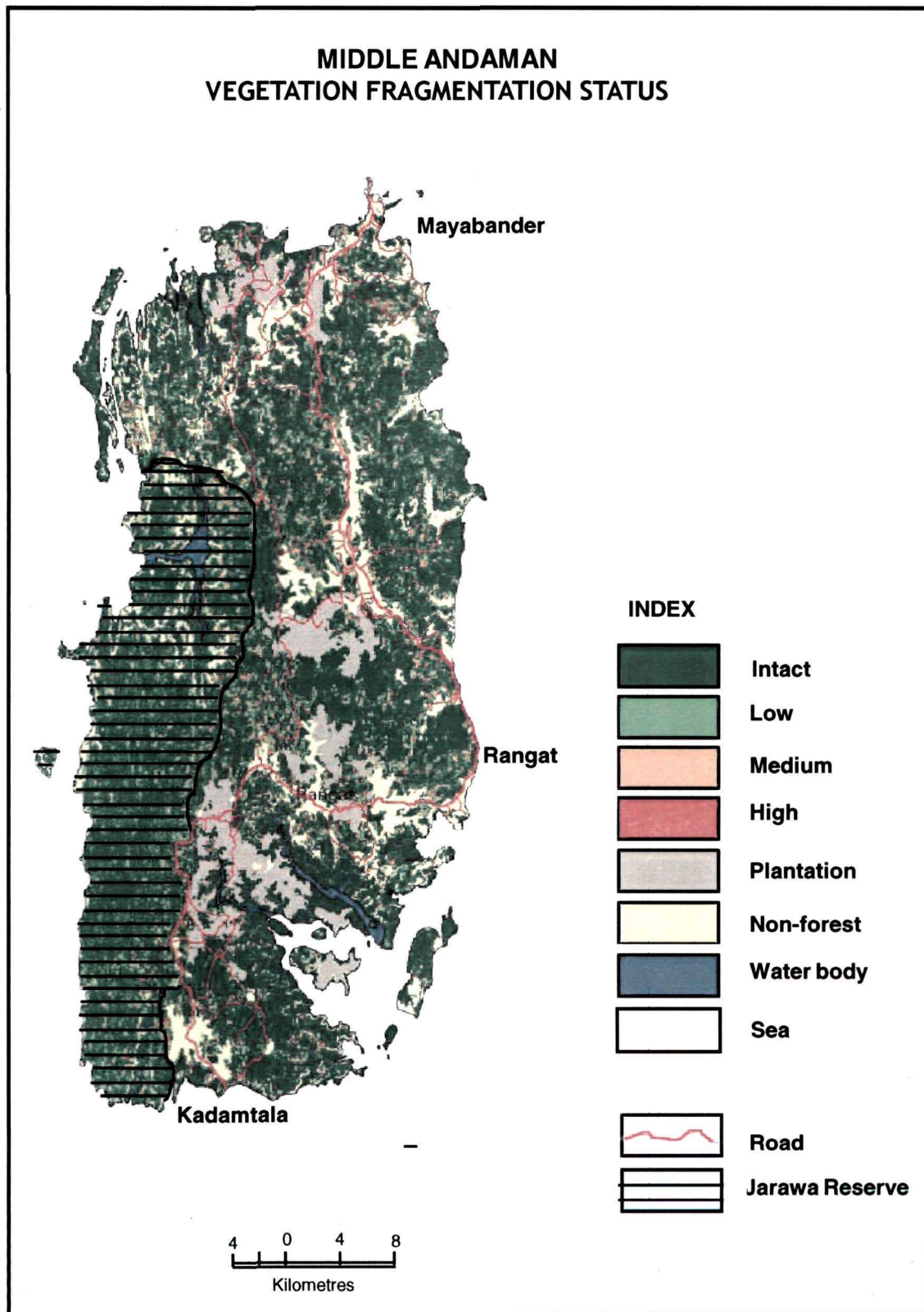


Fig. 5.9

1. One group is of those people who were refugees from the erstwhile East Bengal or East Pakistan and were settled by the Government of India under the refugee resettlement and rehabilitation scheme. Over the period as their population grew, the need for extra land was felt which found expression in terms of expansion of their land into the adjacent territory. The areas of many of the refugee villages are contiguous to the 'Jarawa Reserve' or reserved forest. Few such villages are Colinpur, Manpur, Ferargunj in South Andaman and Kadamtala, Shantanu, and Phootala in Middle Andaman. Instead of clear felling the people have thinned the forests, and have planted coconut, areca nut, banana etc. in the encroached lands. Consequently, there is vegetation fragmentation, which is very high near the settlements of the Non-Jarawa (Fig. 5.7, Fig. 5.8, and Fig. 5.9).
2. Second category is of those people who were working either in the Bush Police Force, which was later renamed as Jarawa Protection Force. They were tribes from the Chhotanagpur region who had been brought here as labourers and later found jobs in the Forest Department and Bush Police. Since most of the time they were posted in or around Jarawa areas, they constructed huts in the forest in the absence of any other proper residential facilities. Some of these settlements are Jirkatang-2, Jirkatang-7, Putatang, Beach Dera, Putatang, Bamboo Tikri, Sippi Tikri, Kesri Dera etc.
3. In third category are those people who moved into these Islands on their own, cleared the forests and settled down. In fact, it is mainly post 1970 phenomenon when the communication (ship) between these islands and main land became more regular on account of introduction of more ships plying between Andaman Islands and the main land.

The thinning of the forest and the degradation of the resources outside the Jarawa Reserve are also harmful for the Jarawa because forest adjacent to the Jarawa area function as buffer and reduce the pressure on the Jarawa area. Unfortunately, the forests outside the Jarawa area are completely denuded and have fewer resources now to offer. The above mentioned fact is also supported by the satellite imageries which clearly show about the fragmentation status of the forest which is considerably high near the settlements of the Non-Jarawa (Fig. 5.7, Fig. 5.8, and Fig. 5.9).

#### **5.2.2.4 Detrimental effects of the Andaman trunk road**

After settling the refugees of the erstwhile East Bengal in different parts of South, Middle and North Andaman Islands, the need of a road connecting all these settlements was felt. The construction work for the 343 km long road, known as Andaman Trunk Road (ATR), began in 1970s and the road was fully operational by 1989. The road effectively cut off their (Jarawa) unhindered access to the eastern coast resulting in loss of habitat and shrinkage of area of resource gathering. Consequently, the Jarawa had opposed the construction of road. Apart from it, the road led to many encroachments *en route* and later facilitated forestry operation also. The Andaman Trunk Road had marginalized the Jarawa like never before, admits the Master Plan for the Tribal Development (Awaradi 1990).

The Andaman and Nicobar Islands experience rain for about eight months in a year, as such the maintenance cost of the road is very high. Every year 20 per cent of the total length of road is taken for repair. Such repair work alone require 38 metric tons of bitumen and 88 metric cord of firewood (approximately 249.04 cubic metres). The use of firewood for the 50 km stretch of road that is repaired every year is estimated to be 12,452 cubic metres. The said firewood is extracted from the Jarawa

Reserve. Thus, the very existence of road appears to be posing a threat to the forest too (Acharya, 2002:168).

In the post-hostility phase when the Jarawa first started coming out on road, there were certain risks involved in terms of road accidents. The Jarawa were a people without any knowledge about how to behave on road in presence of moving traffic. On the other hand, the drivers using the trunk road were not sure as what to do when confronted with some Jarawas who were either standing on the middle of the road or were trying to stop the vehicles. During initial two to three years, few road accidents did occur and in one of the accidents in 1999, a Jarawa boy even lost his right hand (AAJVS, 1999). With passage of time, the Jarawa have learnt ways to avoid accidents caused by the vehicles plying on the road. Now the risk of accident has decreased to a great extent but the risk still persists, particularly with respect to children.

Andaman and Nicobar Islands have been one of the preferred locations for the Indian tourists, but before 1997, the tourist flow to the island was not very high. In the wake of the Jarawa becoming friendly, the tour and travel operators have used this new situation as opportunity. The tourists are promised to be taken through the 'Jarawa Reserve' with all possibilities of seeing and meeting the Homo sapiens who are still in Stone Age. Consequently, it has found expression in terms of sudden spurt in the number of the vehicles plying on the Andaman Trunk Road, which passes through the Jarawa Reserve. It is directly related with the sudden increase in the number of the tourists visiting the Andaman and Nicobar Islands. In the year 1996, a total of 3,695 buses and 5,802 other vehicles crossed the Jirkatang Check post either way. By applying the IRC norms for calculation of volume of traffic, one finds that the road was used by only 515 persons daily or a total of 1,87,895 persons in the entire year (Acharya, 2002:169). By 2004, there was 150 per cent increase in the

traffic volume with more than 1500 persons crossing the 'Jarawa Reserve' every day. A large section of them is in fact tourists desirous of seeing the Jarawa. The movement of so many vehicles across the Jarawa Reserve disturbs the tranquillity of their habitat, scares away their preys and poses danger of accidents to the Jarawa people.

The commuters and tourists who travel along the Andaman Trunk Road meet the Jarawa at different points in the South and Middle Andaman Islands. They feel pity on the Jarawa and consider them hungry when they find the Jarawa to be begging for food. But the asking for the food on the part of the Jarawa is not due to the fact they are hungry or there is shortage of resources in their territory. It is rather an induced habit. The genesis of this habit is related with earlier practice and act of giving gift by the Andaman Administration.

During the contact mission in the hostility phase it was practice to give gift articles to the Jarawa whenever and wherever the contact party was able to contact them. In fact, this practice remained in vogue for few years even after the watershed year of 1997. Besides, during the initial years of post hostility phase most of the passengers of the vehicles passing through the Jarawa territory used to give gift items to the Jarawa. Now this practice of giving gift has been abandoned as well as banned by the Administration. Despite the ban, the both vehicle operators and tourists are still pursuing the practice of giving gift. As a logical corollary, whenever a Jarawa confronts a passing vehicle he or she asks for food or other articles. This behaviour of the Jarawa is being interpreted as begging and it is correlated with food scarcity in their habitat. However, there is no paucity of food resources in the 'Jarawa Reserve', except in some of the border areas adjacent to the villages. Many of the commuters are found to be carrying edible items like banana, biscuits etc. for the Jarawa.

Sometimes, they are found to dispense fried and spicy food items among the Jarawa. However, the oily and spicy food articles pose health hazards to the Jarawa, as they are not accustomed to such foods. Moreover, no one knows how far these items are hygienic and safe for eating.

#### 5.2.2.5 Spread of diseases

It has been observed throughout the world that whenever a hunting-gathering group is exposed to the outsiders, they suffer from some health problems. It is believed that this is primarily because of their long isolation from other human groups, and thus certain pathogens or disease-causing organisms could not reach them. As a result, such communities never develop immunity in their body against all such pathogens. Once contact is established, the pathogens get a chance to enter into their bodies that can offer little or no resistance. Diseases that are very common among sedentary populations can be fatal for such hunting-gathering communities. The same pattern has been repeated time and again in different parts of the world. For example, in the Andaman Islands, the Great Andamanese suffered from epidemic caused by such diseases like measles and pneumonia, which were largely responsible for rapid population decline of the Great Andamanese and to some extent of the Onges (Cipriani, 1966).

**Table 5.7 Diseases Detected Among the Jarawa Between 1998 and 2001**

<b>Year</b>	<b>Name of Diseases</b>	<b>Male</b>	<b>Female</b>	<b>Total</b>
As per records available between 1998 and 2001	Community Acquired Pneumonia	27	22	49
	Measles with its complication	45	50	95
	Mums	18	9	27
	Malaria	37	28	65

Source: Directorate of Health Services, 2002.

The analysis of data on diseases among the Jarawa since 1998 shows outbreaks of many disease like community acquired pneumonia in 1998, measles in 1999, malaria in 2000-2001 and mums (Table 5.7). Except the malaria and mums, the other two diseases are highly contagious. These diseases were probably absent among the Jarawa before their friendly relations and free mixing with the Non-Jarawa people. Out break of measles among the Jarawa in 1999 needs special mention. When there was an outbreak of measles in 1999, the Jarawa of the Tanmad and Thidong areas were quick to seek medical help and therefore timely medical aid could be provided that could save them. However, this was not the case with the Jarawa of Boiab area, as they were they were still hesitant to seek any medical help. Therefore, it could not be confirmed as how many of them, who were suffering from measles, died of it. However, through the field investigation it could be ascertained that that time approximately 25 to 30 Jarawas of Boiab died due to measles or secondary infection caused by measles.

Among other diseases, which have witnessed sudden increase, are anaemia, skin diseases, and respiratory tract infection. Besides these diseases, Hepato-megaly, Spleno-megaly and Hepatitis B are the new diseases detected among them (Table 5.8). In the past the Jarawa were not reported to be suffering from any infectious skin diseases, but after 1997 manifolds increase in the skin diseases has been recorded. The causative factors behind the sudden spread in the skin diseases are attributed to mixing of the Jarawa with the Non-Jarawa and giving of used clothes by the latter to the former. Moreover, consumption of alien food items prepared with oil, salts and spices is causing high blood pressure among many of the Jarawa .

**Table 5.8 Types of Diseases and Number of Affected Jarawas**

Diseases	Sample size	Number of persons affected			Per-centage	Remarks
		Male	Female	Total		
Anaemia (WHO criteria)	120	-	-	33	27.5	Nutritional
Chronic Energy Deficiency	96	11	4	15	15.6	Nutritional
Malaria	120	2	0	2	1.6	P. falciparum
Skin infection	231	50	41	91	39.3	Fungal & bacterial
Respiratory tract infection	231	15	11	26	11.2	Infective
Hepato-megaly	231	-	-	64	27.7	Chronic infection
Spleeno-megaly	231	-	-	32	13.8	Chronic infection
Hepatitis B carrier stage	120	35	24	59	49.1	Viral

Source: Directorate of Health Services, 2002

The laboratory investigation of 120 Jarawa blood samples with ELISA method for HBsAg have revealed some startling facts about the presence of deadly diseases among the Jarawa. About 49.10 per cent of the Jarawa were found to be HBsAg positive (Table 5.8). It is also known as *Hepatitis B*. Fortunately, all of them are healthy carrier of HBsAg. However, there is danger of contracting HBsAg (*Hepatitis B*) by chance by some of the Non-Jarawas who quite frequently come in contact with Jarawa for various purposes. Similarly the laboratory investigation of the blood sample of 231 Jarawa reveals the about 27.7 per cent of them are suffering from Hepato megaley while 13.8 per cent from Spleeno Magaly. Though these diseases are not as dangerous as the HBsAg, they are take place due to chronic infection. The diseases detected among the Jarawa can be put under the following four broad categories:

1. Nutritional diseases: Anaemia and chronic energy deficiency.
2. Infectious diseases: Pneumonia, measles, respiratory tract infection and fungal infection of the skin.
3. Endemic: HbsAg (Hepatitis B).
4. Other diseases: Hepato-megaly and spleeno-magaly.

Nevertheless, the acceptance of the new way of life by the Jarawa has made them understand the importance of taking timely medical aid from the nearby health centre or from the medical personnel who pay visits to their territory. It has resulted in reduction in their morbidity and mortality.

#### **5.2.2.6 Use of tobacco and betel leaf (*paan*)**

The friendly relations between the Jarawa and the Non-Jarawa has brought in its wake some of the vices and one of them is addiction to tobacco and *paan*. Until the year 2000, the Jarawa were never seen chewing tobacco and *paan*. Now many of the male Jarawa have become addicted to tobacco and *paan*. They have picked-up this habit from the villagers, drivers and police personnel who are in regular contact with the Jarawa. If the situation is compared with the Onges, Great Andamanese and the Shompen, it is found that the Jarawa, like their counter parts, have also fallen pray to these intoxicants after becoming friendly with the Non-tribal people. In fact, presently the Great Andamanese and the Onges are exposed to the liquor also, which is fortunately not the case with Jarawa yet. However, their addiction to intoxicants soon may prove Achilles heel for them. The burning examples are the Onges of Little Andaman, and the Shompen of the Great Nicobar who part with many of their valuable resources like honey, resin etc. for the sake of getting a little amount of the intoxicants.

### **5.3. JARAWA ADAPTATION TO THE CHANGING ENVIRONMENT**

The historical development of contact between the Jarawa and Non-Jarawa, is marked by incidence like, British policy towards the Jarawa during colonial period, post-Independence policy towards the Jarawa, settling of the refugee population in the Andman Islands and the resultant enmity of the Jarawa towards them, the reduction and erosion of the resources base of the Jarawa due to numerous factors, impact of contact and conflict on the Jarawa etc. In the backdrop of aforementioned incidence, it is worthwhile to understand how the Jarawa have adapted themselves to the changed environment/situation. It is also significant to know how far the Jarawa have been successful in retaining their traditional hunting-gathering way of life, culture, and growth (in terms of number and health). Therefore, the following lines are devoted to adaptation of the Jarawa to the changing environment.

#### **5.3.1 Staying Close to ATR**

It is well known that the Jarawa usually set up their huts at the transition of two ecological zones, but staying close to the road was never an option in the ambience of hostility. However, in recent times some of the huts of the Jarawa have been set up close to the road, particularly in Thidong area. Staying close to the road gives them certain benefits. As already mentioned that the daily movement of the Jarawa from the base camp is generally in the radius of five to six km. However, while camping at the roadside they make use of the vehicles plying on the road to cover longer distances in search of edible and no-edible resources. Thus, in less time they are able to reach distant places. In addition, the Jarawa also make use of the vehicles while shifting their camp from one place to another. Of course, the road, besides facilitating faster movement, also offers other attractions like foreign food, and lots of fun and amusement.

### **5.3.2 Use of Boat**

In the post-hostility phase, particularly after 2000, it has been observed that when the Jarawa camp in the vicinity of road or the villages of the settlers and have to shift their camp to a place along the coast, they make use of the boat (motorized canoe). In order to avail the boat, they approach either police personnel or the staff of the Adim Janjati Vikas Samiti, who are posted at that place and make them aware of their need. At times, they also ask the fishermen to help them shift by taking them in their motorized canoe to the place of their next encampment. Thus, the Jarawa are making use of both the water and the road transport to their advantage to cover longer distances in less time and with much ease.

### **5.3.3 Iron Implements for Making Tools**

The iron is of cardinal importance to the Jarawa. It was one article along with other metal items that was not naturally available in their territory. Earlier (during hostility phase) the Jarawa used to obtain these articles from the jetty, ships wreck and the settlements of the Non-Jarawa. The recent development, however, has assured them of regular supply of iron. These days they are getting a regular supply of iron both as raw material and as iron tools from the AAJVS (Andaman Adim Janjati Vikas Samiti). Now the Jarawa can be seen working with hammer, chisel, file, and makeshift anvil made of huge pieces of iron rails or thick iron sheets for making hunting and fishing implements. While some years back they used to protect each piece of iron very jealously, but now they do not mind to gift or barter an arrow or a knife for some other articles.

### **5.3.4 Acceptance of New Technology**

Instances of acceptance of a new technology by the Jarawa for their subsistence activity has not come to notice. It may be due the fact that they continue

to forage the way they were doing earlier. It is true that the Jarawa have observed and gathered information about some foraging techniques of the Non-Jarawa like the use of snare to catch pig or use of line and hook for fishing. However, they still do not use snares for the purpose of hunting, though the children sometimes playfully fix up snares collected from the forest. In case of the other two Negrito tribes of the Andaman Islands, namely the Onges and the Great Andamanese, it has been found that they have learnt the foraging techniques of the Non-Jarawa and are using them successfully. However, in case of the Jarawa the new techniques are yet to be accepted and adopted by them. It may take some more time for them to accept new technology because they are still able to fulfill their needs with the help of their own traditional tools and techniques.

### **5.3.5 Change in Raw Material**

Earlier the Jarawa used to make use of bark fibre as thread while making their fishing nets, baskets and few other articles, Now they also use nylon threads for making these items. However, there are certain articles, which are still made from bark fibre only like, the arrowheads are tied to the shaft with bark fibre.

### **5.3.6 Food**

Nowadays, the Jarawa procures many non-traditional food items from the Non-Jarawa people. These items were not consumed earlier. Prior to 1997, banana and coconut were the main non-traditional food items which used to be given to them as gifts by contact teams. However, after 1997, some more items have found their way into the Jarawa menu, though none of these items has yet become a part of their staple diet. The major non-traditional food items are banana, coconut, biscuits, bread, *paratha*, *vada*, *idli*, rice and tea. These are procured from the tourists, drivers of

tourist and other vehicles, shops located at the jetties, villagers and the policemen posted in the pickets near the huts of the Jarawa. This practice of procuring non-traditional food items influences their foraging behaviour also particularly when they camp near Andaman Trunk Road, for example, the Jarawa children and young boys invariably spend some part of the day on the road. Though it is done generally out of curiosity and to derive some entertainment, in the process they get some food items also which are given to them by the tourists passing through the Jarawa territory. Generally, the young Jarawa boys are more involved in it compared to the elderly persons.

### **5.3.7 Cooking and Storing Utensils**

Use of metal utensils was noticed among the Jarawa of Middle Andaman even in 1980s (Sarkar, 1990). In the post-Independence phase particularly after the settling of the refugee population at the fringe of the 'Jarawa Reserve' during 1950s, the Jarawa used to procure metal utensils stealthily, mostly of aluminum from the settlements of the refugee population. Before coming up of the refugee settlements, the Jarawa had been collecting flotsam, bottles, pans, iron pieces etc. for a long time from the coastal areas. Even now, one can see the huge amount of glass and plastic bottles accumulated along the western coast, carried there by the waves from the waste left by the vessels in the seawaters.

It has been observed that now the Jarawa depend more on the metal pans for cooking their food and less on their traditional pit ovens. Despite this, there are certain items which are broiled in oven pit or roasted, like jackfruit, flesh of wild pig etc. In the post-hostility period, the metal utensils for cooking and storing purpose are being supplied by the AAJVS. It is a welcome change.

### **5.3.8 Acceptance of Medical Treatment**

Prior to 1997 when the Jarawa were still hostile, they used to seek for first aid like bandage and ointments for the treatment the injured parts and fungal infected areas of the skin from the members of the contact team. During those days, the Jarawa never accepted tablets, syrup, or any other oral medicines for their injuries or diseases. After 1997 when they became friendly with the Non-Jarawa, the number of visits by the medical team to the habitat of the Jarawa and the number of the Jarawa being brought to the Primary Health Centre or Hospital at Port-Blair for treatment increased manifold. It created further confidence in the Jarawa people towards the Non-Jarawa. Of late, it has been observed that the Jarawa have no hesitation in accepting any kind of medicines, either orally or externally. Changes have also been observed with respect to their behaviour in the hospital.

It has been observed that initially during 1998-99 (i.e., post contact time) when there was an out break of pneumonia and measles among the Jarawa, they were very much apprehensive to send their fellow members alone, who were suffering from any of these diseases, to the health centre. Firstly, they always accompanied the patients to the hospital in large numbers. Secondly, they did not want to stay in the hospital for more than a day or two. With passage of time, the Jarawa have developed more confidence about the Non-Jarawa. Now, when a Jarawa patient is admitted in the hospital, he or she is rarely accompanied by more than two to three members of his/her community. Besides, they have also accepted the co-existence of other patients in the nearby wards, which they were earlier wary of. Further, in case they are required to stay in the hospital even for a week or so they do not long to go back to their habitat.

These are positive changes, which will go a long way in providing modern medical coverage to the entire Jarawa population. It assumes more importance in the light of the fact that in the post-hostility phase the entire Jarawa community has suddenly been exposed to new diseases, which they are unable to treat through their traditional system of healing or ethno-medicine. Even more, it will also be helpful in the treatment of some of the endemic diseases that the Jarawa have been found to be carrier, e.g., *Hepatitis B*.

#### **5.3.8.1 Preventive measures for diseases**

The acceptance of medical treatment has also paved the way for the taking preventive measures to curb the spread of certain diseases. Hepatitis B is the only endemic disease that could be detected among the Jarawa during the comprehensive health survey. Though the Jarawa are the healthy carrier of the hepatitis B, it can be prevented by launching immunization programme among the Jarawa. It becomes more necessary in the light of the fact that now the interaction between Jarawa and Non-Jarawa has increased manifolds and so has increased the risk of the Non-Jarawa contracting the *Hepatitis B*.

The other new diseases detected among the Jarawa are community acquired pneumonia, measles and malaria (*Plasmodium falsiparum*). Community acquired pneumonia can be prevented by maintenance of good sanitation and hygiene and avoidance of overcrowding at the Jarawa hut. Besides, early detection and prompt treatment would also help cure the disease and its spread. Occurrence of measles can be prevented by immunizing all the children at 9-12 months of age with measles vaccine. In recent times, the malaria cases have increased, including that of the fatalist. Occurrence of malaria among the Jarawa can be contained by detecting mosquito-breeding places and by introducing anti-larva measures around their habitat.

However, as a precaution, mass administration of anti-malaria drugs should be avoided as the Jarawa may develop some other complications. Administration of anti-malarial drugs, including treatment of *Plasmodium falsiparum*, should be based on clinical tests and thorough medical checkups to avoid any side effects and negative impact on the Jarawa, as they are already a small population, and cannot afford any risk, intentional or unintentional, to their health and survival. While popularising modern medicine all possible care should be taken to keep alive the traditional medicinal knowledge of the Jarawa.

### **5.3.9 Beginning of Barter System**

In the Jarawa community, there exists a system of reciprocity within different groups as it happens in most of the hunting-gathering communities. However, with growing interaction between the Jarawa and the Non-Jarawa the demand for certain articles by both sides have surfaced. It, in turn, has led to the beginning of the barter system. The Non-Jarawa, who are involved in it are the tourists, villagers, vehicle drivers and at times police personnel who are posted there. Generally, the Jarawa exchange resin and iron implements particularly bows and arrows in lieu of tobacco and pan. At times, they also exchange these articles for colourful garments and some non-traditional edible items. Sometimes, the Non-Jarawa give money to the Jarawa, the use of which is still not known to the latter. This kind of barter trade is disadvantageous to the Jarawa because for few small sachets of tobacco and few packets of *paan* they part with their bows and arrows and good amount of resins. Earlier, the Jarawa were never found to part with iron implements because procuring the iron was difficult and at times hazardous too. Now, with assured supply of iron from the AAJVS, they easily give away their iron implements. In the barter trade, the ultimate consumers of the Jarawa implements are the tourists, who never barter directly with the former. Instead, these articles of the Jarawa reach to the end users

i.e., tourists through intermediaries like tour operators and field level personnel of different Departments who are posted in the 'Jarawa Reserve'.

There is some sort of barter system existing between the Jarawa and the poachers also. In order to buy safe passage in the forests, the poachers offer tobacco, *paan*, and eatables to the Jarawa. The Jarawa do not give them any thing directly in exchange of it, but indirectly the poachers get unhindered access to the resources of the Jarawa territory. Such bartering is disadvantageous to the Jarawa as their resource base lay open to the poachers, but the Jarawa do not know the damages caused to their habitat by such bartering due to their innocence and ignorance.

Thus, considering the baneful impacts of the bartering and taking lessons from the Onges of the Little Andaman and the Shompen of the Great Nicobar, where they can part with almost any items in exchange of liquor and tobacco, it is necessary to ban any type of gift giving to and bartering with the Jarawa. Even more, efforts should be made to get them rid of addiction to *paan* and tobacco. This will not only help maintain health of the Jarawa but of their habitat as well.

### **5.3.10 Dress and Ornaments**

Traditionally, the Jarawa do not put on any clothes to cover their bodies. Instead, both males and females use various kinds of headband, necklace, armlet and waistband made of shells, barks, leaves and flowers to adorn them. In addition, both males and females decorate their body and face with white clay and red ochre. They also decorate their body with different types of seasonal flowers and young leaves. They, however, were not found to use any clothes to cover their body. Despite knowing the use of cotton threads, extracted from the pieces of red cloth given to them as gift, for making bands for head or arm or waist, they never covered their

bodies with clothes. However, in recent years, particularly after two to three years of their being friendly with the Non-Jarawa, a number of Jarawa individuals have been found to wear clothes. The clothes come from several sources, viz., hospital, villagers, tourists and Andaman administration. Ornaments are another gift item that the Jarawa adore a lot. Almost all of them, including those who are not attracted to garments, enjoy wearing bead necklace, plastic or metal bangles, rings and trinkets.

During the early years of friendly relationship, i.e., 1998-1999, whenever the sick Jarawas were brought to Port-Blair and admitted in the hospital, they were given clothes by either the hospital staff or the AAJVS officials. It was felt necessary because the Jarawa patients were visually exposed to the Non-Jarawa people present in the hospital. Later, when the Jarawa started visiting the villages, the villagers often presented them with used garments. Of late, many villagers have stopped giving clothes to them but some of the villagers continue with the practice of giving clothes to them. Besides villagers, the tourists also gift clothes, mostly used ones. The Jarawa generally carries all such used garments back to their huts.

It is the younger generation who is more interested in collecting and putting on such clothes (Plate 31). In the young generation, the boys show more fascination for clothes. This is because the boys are fond of frequently visiting the villages and public places like jetties and police stations. Contrary to it, the older ones and the less frequent visitors possess fewer clothes, which they put on less frequently. Territory wise analysis shows that the Jarawa of Thidong or Tanmad possess more clothes than those of Boiab because the contacts with outsiders are comparatively more prolonged and frequent in the case of the former than the latter. It also shows that the longer a person is in contact with outsiders, the more clothes he or she has in possession, and they use it more frequently than other Jarawas.

Covering the body with clothes is an induced cultural trait for the Jarawa. It is more pronounced among those who frequently meet the Non-Jarawa. They have come to realise that they are expected by their neighbours to put on clothes when they are meeting them. They might have also learnt a bit about the positive preference for covering the body or negative preference for nakedness prevalent among the Non-Jarawa. However, for the Jarawa, the wearing clothes are not a necessity. It is exemplified by the fact that when the Jarawa put-up their camp inside the forest, away from the villages and road, they rarely use clothes.

Clothes have also brought in its wake health hazards. Most of the clothes given to them by the outsiders except by the Andaman Administrations are used ones. As a result, when the Jarawa are wearing the clothes they often contract contagious diseases particularly skin diseases. Now most of the Jarawa suffer from the skin diseases, particularly ringworms. The situation gets aggravated in the light of the fact that the Jarawa have no concept of washing the clothes. Another danger lies in the fact that most of the time they take bath with clothes on their bodies and do not remove the wet clothes even after bathe. As a result, many of them get upper track respiratory infection. Therefore, both the tourists and the villagers should be sensitized about the health hazards associated with their act of giving clothes to the Jarawa and should be prevented from gifting clothes to the Jarawa. Further, the Jarawa should also be slowly trained to wash their clothes with soaps, and should be taught as not to put on wet clothes.

### **5.3.11 Language**

The Jarawa were a monolingual community until the other day. Their prolonged isolation from all other human groups did not warrant them to learn any other language. In course of the contact missions since 1974, they occasionally picked

up a few words of Hindi language like *khana* (meaning food) from the visitors. With the end of the phase of hostility in late 1997s, both the Jarawa and the Non-Jarawa have started coming in more regular and prolonged contacts with each other in comparison to the previous years. In such interactions, participation by some of Jarawas is more frequent compared to others. Similar is the case with the Non-Jarawa also. A handful of the AAJVS workers, some policemen and paramedical staff meet the Jarawa more frequently, while the tourists, vehicle drivers and the general villagers meet them only occasionally. Naturally, those Jarawa who are exposed to the outsiders more frequently have better opportunity of learning Hindi. Most of them are young boys of ten to twenty years of age. A few of them can speak the Hindi language better compared to others. Knowledge of Hindi also gives the Jarawa certain advantages while interacting with the Non-Jarawa. For example, in a contact situation on road while the tourists cannot make out what the Jarawa children are discussing among them, the Hindi-knowing children would be able to understand, at least partly, what the tourists or the drivers of their vehicles are talking about. Even a broken knowledge of Hindi puts them in slightly advantageous position. The knowledge of Hindi on the part of the Jarawa has proved very useful in case of medical treatment also as both the Jarawa and the medical attendant or Doctor are able to make each other understand. Thus, now the medical treatment of the Jarawa has comparatively become much easier.

While some of the Jarawa are picking up Hindi, few Non-Jarawa people also have learnt the Jarawa language to various extents. The most proficient speakers of the Jarawa language are some of the AAJVS workers, who can converse very fluently on subjects related to economic and other daily life activities. However, the knowledge of the Jarawa language among other people like villagers, policemen and shopkeepers is very rudimentary.

### 5.3.12 Keeping of Pets

The Jarawa, like the Great Andamanese and the Onges, never kept dogs during the hostility phase. The reason for it is attributed to the fact that in a hostile environment keeping the dogs would have been suicidal as the barking of dogs at their camps could have made it easy for their enemies to track them down. However, in the post-hostility phase the presence of dogs at Jarawa camps was observed for the first time in mid-1999 in certain parts of Middle Andaman (AAJVS, 1999). They reportedly collected the puppies from villages of settlers as well as from forest camps. Initially, the puppies hardly served any practical purpose, but when these puppies grew up, they started accompanying the hunters to the forest on hunting expeditions.

Relationship between the people and their dogs is noteworthy. Dogs have been accepted as members of the group (Plate 32). Food and living space are shared with them the way they share these two things with their children. Some lactating mothers were found to breastfeed the puppies. However, recently they have developed some aversion towards dogs. It is primarily because of three reasons. Firstly, they have found that the dogs create more disturbance than convenience for them during hunting expedition as the barking dogs scare away their prey. Secondly, the furs of the dogs soon become full of fleas, which, in turn, begin biting the masters of the dogs also. Thirdly, AAJVS workers have explained and convinced the Jarawa about the harmful effects of keeping dogs as the dirty dogs are the carriers of many skin diseases. Consequently, many of the Jarawa have driven away the dogs from their camps. There are very few dogs left with the Jarawa as pet animal. Presently there is almost no pet dog with the Jarawa of the Tanmad area.

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## **CHAPTER VI**

## **CONCLUSION**

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### **CONCLUSION**

The present Ph. D. Dissertation entitled 'Ecology, Conflict and Adaptation of the Jarawa in Andaman Islands' pertains to the study of form and process of human adaptation of the Jarawa to an island ecosystem, technology and strategy of resource utilisation, analysis of foraging behaviour, and impact of contact and conflict on the Jarawa and their resource base, and how the Jarawa are adapting themselves to the changing situation. Adaptation of the Jarawa to their environment is a process involving technology and strategy employed by them for harnessing the biophysical resources of the ecosystem.

The present study is fundamental as well as applied in nature. Fundamental because it shows how the hunting and gathering based immediate return economy of a hunter-gatherer group functions in an island environment, which has both terrestrial and aquatic resources. In addition, it reveals the pattern and process of adaptation of a hunting-gathering group like the Jarawa to the island environment. Since the Jarawa economy has a close approximation to the economy of classical forager, it helps in understanding the forging strategy and behaviour of a hunter-gatherer group. The study also illustrate that when human groups like the Jarawa are exposed to the technologically advanced group having production based economy, what are the impacts on their resources base, health, population, habits and material culture. Equally significant is how primitive groups like the Jarawa cope up with the changing situation in the aftermath of their exposure to the new people and changing environment. Vulnerability of such human groups to the changed conditions, in terms of their survival as hunter-gatherers, and as biological unit, is of great concern to the

geographers, ecologist, anthropologists, planners, technocrats and the humanity as whole. Here lies the significance of present study on ecology of the Jarawa in an island ecosystem.

The study is of applied nature because it deals with the impacts of contacts and conflicts with respect to the Jarawa in pre and post-Independence period. More importantly it also reveals how in post hostility phase (after 1997) the Jarawa as a hunter-gatherer community may soon face survival threat in terms of erosion of their resource base, introduction of new diseases and their addiction to intoxicants. It will help the planners in preparing and implementing plan for the betterment of the Jarawa. It also helps to look into the problems of post-hostility phase in which the Jarawa as a hunter-gatherer community are facing threat to their survival and may meet the fate of their counter part like Onges and Great Andamanese. Thus, it can be said that the study is basically fundamental in nature but it has applied implications as well.

Entire study has been organised into Six Chapters. The introduction to the Ph.D. Dissertation is presented in the First Chapter in which the literature review, objectives of the study, research questions, study area, data base (both primary and secondary data) and methodology have been discussed. The Second Chapter deals with natural environment of the Andaman Islands, which is the habitat of the four Negrito people including the Jarawa. This Chapter highlights the biophysical richness of the Island ecosystem (both terrestrial and aquatic) from which the Jarawa derive various plant and animal resources for their sustenance; and now in the post-hostility

phase, the same resource base is getting taxed by the Non-Jarawa in terms of illegal exploitation of certain resources from it.

The next three chapters are crux of the Dissertation. The Third Chapter begins with detailed information about the demarcation of the 'Jarawa Reserve', population and hunting-gathering activities of the Jarawa and their different territorial groups. The ecology of the Jarawa has been discussed in terms of their perception of the resources of the Island ecosystem in different physiographic zones and assemblage of resources in each physiographic zone. A detailed inventory of the terrestrial and aquatic resources in terms of edible and non-edible resources has been prepared, fulfilling the objective number one of the present study. The edible items of the Jarawa have been put under three categories as per the importance and uses like *major, supplementary and minor food items*. Seasonality of resources has been discussed through season-wise variations in availability of resources in the habitat, and seasonal variations in gathering of plant and animal resources from both land and water. In addition, the importance of metal, particularly iron, implements and utensils has been discussed. Since the Government has settled the Non-Jarawa people in the Islands, their economic activities have also been discussed in relation to plant and animal resources. Further, it points out a pertinent fact that since many resources are common between the Jarawa and the Non-Jarawa, it was the cause of conflict in the past and it is a cause of concern at present i.e., after 1997 (post-hostility). It is so because the resources of the Jarawa territory are coming under stress, particularly in those areas which are close to settlements of the Non-Jarawa, due to increased exploitation of the resources on the part of the Non-Jarawa in the post-hostility phase.

Adaptation of the Jarawa to the island environment and their response in terms of technology and strategy employed by them for the collection and utilisation of resources have been discussed in Fourth Chapter, as per the objective number two of the Thesis. The stress is on the foraging strategy of the Jarawa, which is a collective response to the island environment for harnessing its resources spread over space and time. The foraging strategy of the Jarawa has been discussed in detail with the help of location of camps, movement pattern, selection of resources, foraging methods, image search, role specialisation and sharing. The importance of the ecological edges in the location of camps in the process of food collection has also been described. The ecological context of the subsistence activity of the Jarawa has been worked out with the help of input–output analysis. The analysis explains that as a hunting-gathering community for how many days a week an economically active Jarawa works and what is the ratio of hunting and gathering in relation to total time devoted. It is followed by analysis of foraging behaviour of the Jarawa in relation to optimal foraging theory to understand that whether the hunting behaviour of the Jarawa conforms to that of a hunter-gatherer or not. Lastly, the work, resource and population relationship has been analysed.

The Chapter Fifth gives a detailed account of the history of contact and conflict in pre and post-Independence period. The reasons responsible for the change in the attitude of the Jarawa towards the Non-Jarawa in different phases have been described. Both the positive as well as negative impacts of the contact in the post-hostility phase (i.e., after 1997) have been dealt with in relation to resources, health, material culture, food, addiction to intoxicants and barter trade. It is followed by adaptation of the Jarawa to the changing environment, and how they are coping up

with the new situation. This Chapter fulfils the third objective set for the present investigation.

Summary and main findings of the study are given in the Sixth Chapter, which also include conclusions derived from it. Difficulties faced in carrying out the present study, limitation of the research and scope of further research on the topic have been incorporated in this Chapter. The last Chapter is followed by an exhaustive list of references, appendix and glossary.

## 6.1 SUMMARY

Floating in an splendid isolation east of the Indian mainland, the Andaman and Nicobar groups of Island are situated between 6° and 14° North latitudes and between 93° and 94° East longitudes in the eastern part of the Bay of Bengal. The Islands cover an area about 8,293 sq km. The Andaman group of islands are home to four Asiatic hunter-gatherer groups, viz., the Great Andamanese, Onges, Jarawa and the Sentinelese. The Sentinelese are inhabited in the North Sentinelese Island, the Onges in the Little Andaman, the Great Andamanese in the Strait Island and the Jarawa in the western part of the South and Middle Andaman Islands. The Jarawa territory, known as 'Jarawa Reserve', covers an area of 765 sq km. In addition to the aboriginal Negrito groups, the Non-Negrito people known as later settlers also inhabit the Andaman Islands.

The Andaman Islands have tropical climate which approximates the equatorial type in the south. The insular position of the Islands in the Bay of Bengal, location in

the tropical zone along the path of travelling storms and cyclones, elongated curved shape and the dominant controls of southwest and northeast monsoons have altogether created a distinct physical environment and have also shaped the human mosaic/fabric of the Islands. The wet tropical climate has average annual rainfall of 3400 mm and mean annual temperature of 26°C. This is responsible for luxuriant growth of tropical rain forests which are extremely diverse floristically but is poor in terrestrial fauna, but it is compensated by rich and diverse organic life of the marine ecosystem. The Jarawa rely upon both terrestrial and aquatic resources to fulfil their food and other requirements. The Non-Jarawa also exploit to some extent these resources to fulfil their needs. The total population of the Jarawa is 265 as per the last survey (2002). There are three territorial subgroups of the Jarawa, namely the *Tanmand* group, *Thidong* group and *Boiab* group. The *Tanmad* group inhabits the southern part of the Middle Andaman, while *Thidong* and *Boiab* groups inhabit the northern and southern parts of the South Andaman Island, respectively.

As the Jarawa have access to both terrestrial as well as aquatic resources it provides them a 'broad resource base' and that ensures them varied and rich food, and a balanced diet. At cognitive level, they categorise the resource base spread over four physiographic zones namely coastal area, marshy area, plain land and forested hilly area. Since each of these zones has different assemblage of biophysical resources, it helps them meet their all needs including food.

The availability and density of the resources is influenced by the seasons, and that in turn govern peak of specific hunting and gathering activities directed towards collection of a particular food resource. There are three major seasons in the Island,

which correspond with the availability of certain major resources. In the dry summer (mid-March to mid-May), wild jackfruit is abundantly available in the forested hills, incidentally pig hunting is minimum in this season. During rainy season (mid-May to November), the thrust is on pig hunting and collection of seeds of *Cycus rumphii* and *Nipa fruticans* as both are available in plenty. Gathering of honey and turtle eggs followed by pig hunting is at peak in winter season from December to mid-March. Though the Jarawa collect number of edible items from the Island ecosystem, the *major food* items consumed by them are limited in number. Therefore, according to order of importance the food items can be divided in to three categories- *major*, *minor* and *supplementary foods*. The major edible plant resources of the Jarawa comprise of *Dioscorea* (tubers), fruits and seeds of *Artocarpus chaplasi* (jackfruits), *Nipa fruticans* and seeds of *Cycus rumphii*, though the availability of many of these is seasonal. Among the animal resources, the major edible items are flesh of wild pig, fish, and bivalve shells, and the honey and turtle eggs. Of these, the flesh of the game animals is most preferred food of the Jarawa, and within that meat of the wild pig. Curiously enough, the Jarawa do not hunt deer that is abundantly available in their territory. This is probably because the deer is an exotic species, introduced by the British, hence does not figure in their traditional food items. The availability of many of these resources is subject to season; however, the wide resource base of the Jarawa helps them to overcome the shortage of a specific resource in a particular season or particular area or particular year. Nevertheless, there are certain resources that are available round the year and easy to collect, these are called 'key stone resources' for the Jarawa, and comprise of certain species of shell particularly bivalve shells, few species of fish and tubers.

To meet non-edible requirements, the Jarawa make use of about 85 species of plants mainly for construction of huts, implement making, ornamentation, medicinal purpose and as honeybee repellents. The ochre, red and white, is another valuable item for them. The ochre paste is applied on the body either for medicinal purpose or in relation to any rituals or for decorating the body. Though iron implements and utensils are extensively used by the Jarawa, these are not naturally available in the Jarawa territory, hence procured from different sources. In fact, iron is of cardinal importance to them for making many foraging implements like arrowheads and digging rods. In the past, they used to collect iron from jetsam, parts of broken ships washed ashore or from the settlement areas of the Non-Jarawa. After 1997, the *Andaman Adim Janjati Vikas Samiti* (AAJVS) make a regular supply of iron pieces, along with hammer, chisel and metal utensils to the Jarawa.

The Non-Jarawa also make use of resources of the Jarawa territory. Of these, first group consists of those persons who were brought to the Andaman Island as convicts and in due course of time settled here. In the second group are included the refugees from erstwhile East Bengal who were settled in post-Independence (i.e., after the partition) period between 1955 and 1960. As the Non-Jarawa to some extent depend on the resources of the Island ecosystem, many of the resources have become common to the Jarawa. It was the point of conflict between both the groups in the past and a cause of concern in the present as the resource extraction by the Non-Jarawa is detrimental to the Jarawa in many ways. The reason being the former have much developed tools and technology than the Jarawa. Even more, in long run it may affect the resource density of the ecosystem as well, thus the very survival of the Jarawa.

In the foraging strategy of the Jarawa, locations of the camp and movement pattern play a significant role in the adaptation of the Jarawa to the Island environment. In descending order as per size, the camps of the Jarawa can be put into three categories – *permanent*, *semi-permanent* and *temporary*. The functions of the first two camps are almost similar. These are large camps which remain occupied for longer period of time i.e., one to three months and hence, serve as the base camps. The third type is a *lean-to-type* hut where they spend a day or two in course of their logical movement from one place to another. The location of a camp is determined by combination of three factors *viz.*, ecological edges, proximity to drinking water along with easy availability of one of the edible resources, and season. The Jarawa locate the camps at the ecological edges (transitional areas between two physiographic zones) to have access to the resources of two or more than two ecological zones. At the ecological edges, the setting of camp is again governed by the two factors; firstly the proximity to drinking water and secondly the availability of one of the resources in plenty so that it could be gathered with least efforts and time. In case of the inland sites, generally the easily available resource is the bivalve shell followed by fish; and in case of the coastal sites it is different species of molluscs and fish that determine location of camps.

Seasons also play a decisive role in the location of the camp along the coast and in the forests. During the rainy season the preferred locations for permanent campsites are sheltered bays and creeks and raised grounds inside the forests, but the western coast is avoided as the sea remains turbulent due to southwest monsoon winds. With onset of winter season both seaward and landward locations are preferred for setting up the camps. The underlying strategy is to harness the abundantly available seasonal resources namely honey followed by turtle eggs. While the former

is available in the forests, the latter is found along the coast on sandy beaches. During the dry summer the camps are usually located a bit away from the coast in the forests with the purpose of gathering honey and jackfruits. As such the ideal location is generally inside the forest so that the both the resources could be exploited.

To carry out the hunting-gathering activities, movements of the Jarawa are strategically planned and executed to ensure optimum returns. It enables the Jarawa to collect the resources spread over space and time (season). Their movements oscillate between coasts and the forests depending on the seasons that determine not only the availability of resources but also the sea conditions on the western coast. There are two types of movement: residential and logistical. In case of residential movement, the entire group move from one place to another in their territory. Logistical movement, on the other hand, is the movement to and from a base campsite by an individual or a group.

At any given point of time, the Jarawa have between two to three permanent base camps in an area, from where all the logistic movements are made. The field work in three different seasons has revealed that the one-day trip of the Jarawa is within a radius of 10 km. Initially, the resources available at the least distance from the camp are exploited. With the thinning of resources in the vicinity, they travel longer distances to exploit the distant resources. However, in case of pig hunting the strategy of exploitation of an area in a sequential manner (i.e., first the nearest resources) is not applicable. Further, when the movement requires covering of more than 10 km, then they either stay overnight in the forest or organise longer foraging expeditions ranging from a few days to two weeks.

Movement pattern of the Jarawa is also controlled by the seasons. During the summer season when the wild jackfruits and seeds of *Cucus rumphii* are available in plenty, the movement of the Jarawa is oriented towards the collection of these resources. Since the former is available in the forest while latter is found in the creek, the movement of the Jarawa oscillate between creek and forest. During summer season, less numbers of logistical movements are made compared to other seasons because the gathering and processing of jackfruits require them to stay at a place for about 4 to 5 days at a stretch when they are away from the base camp. With the onset of southwest monsoon, it becomes virtually impossible to exploit the sea resources on the western coast as the sea remains rough and turbulent. Since it is the season of the collection of *Cycus rumphii* and pig hunting, both of which are found inland, the movement of the Jarawa is confined mainly within the forests. Maximum numbers of logistical movements are made during this season, as the pig is a mobile prey.

During the cool dry season, the western seas usually remain calm. Since it is also the season when turtles lay eggs on sandy beaches and honey is available in the forests, the movements of the Jarawa are oriented towards exploitation of both the resources. The stay of a family is comparatively longer, ranging from a minimum of four days to maximum of fifteen days at the base camp from where the daily foraging expeditions are made. The information dissemination pertaining to whereabouts of a group is very important in movement pattern of the Jarawa. This kind of information dissemination serves as a means of ensuring subsistence security and reduces the chance of many groups converging at the same place for the resources, without knowing about other groups.

Selection of resources is also a part of the foraging strategy. There are 221 plant and animal species eaten by the Jarawa, out of which 136 are plant species and 85 are animal species. Despite the wide edible resource base, the Jarawa tend to eat only the most palatable and abundantly available food items. However, exception is flesh of the game animals (wild pig, monitor lizard, turtle) which is the most desired food item though not available in abundance.

Hunting, fishing and gathering are three means of getting food. The technology used by the Jarawa in their foraging pursuits are simple and it comprises of simple implements like bow and arrow, pointed wooden stick and iron rod, fishing net, basket, bucket and knife. In their foraging pursuits, the meticulous execution of strategy undoubtedly enhances the chances of getting targeted prey. Besides location of camps and movement pattern, the foraging strategy of the Jarawa comprises of foraging methods, image search, role specialization and sharing. In course of hunting, the Jarawa follow three types of foraging methods that include- ambushing the prey while hunter is stationary, killing the prey when it is stationary but the hunter is mobile, and killing the prey when both hunter and prey are mobile. The first two are pursued individually while the third one is followed both individually and in groups.

Fishing provides an excellent opportunity for the examination of foraging methods, and tools and techniques employed by the Jarawa. This is precisely because the prey is small, quick, and has capacity of escaping away in the water. The usual fishing sites are the coastal areas, creeks, swamps and dammed-off channels. In fact, fishing is carried out generally during low tide. The males do fishing with bow and arrows while the females with hand net and pointed wooden stick and iron rod.

Group fishing is generally carried out in dammed off channels, creeks and marshy areas during the low tide. Though both men and women take part in fishing, predominance of women is found in this activity. The success rate in terms of catch is certainly very high in group fishing. However, in both individual and group fishing, the probability that an individual fish will be encountered is directly related to the number of persons fishing in the area, and it is inversely related to the size of the area. In gathering activities, except the collection of the grub larvae, no strategy is employed as such. The grub larvae are collected from the rotting trees.

Search image is another strategy followed by the Jarawa. They seek a certain species or set of species within a particular environment using a definite strategy. While searching for one category of prey the Jarawa seldom divert their attention to another prey. That means one kind of prey at a time. Again, this behaviour presumably enhances the effectiveness with which the targeted category of prey is pursued.

There is clear division of labour in the Jarawa society for every type of work. Hunting is exclusively carried out by the Jarawa males. Though the females do not hunt wild pigs, they do hunt small animals like snails, molluscs and monitor lizards. Most of the fishing and collection of bivalve shell are done by the women. In fact, most of the gathering is done by the women folk, though men also take part in it.

Sharing is another strategy of assuring supply of food to all the members of the group. The edible resources gathered and brought to the camps are shared

systematically among the constituent members or families. While the meat of the game animals is shared among the constituent families of a camp, sharing of other resources is intra-family. The sharing of the flesh of game animal is considered necessary because for the individual hunter, food sharing is really a way of storing food for future; his generosity gives him a claim in future on surplus of other hunters.

In order to find out that how much effort is put in the foraging, an Input-Output analysis has been carried out. It shows that the Jarawa work between 3.7 to 3.9 days a week. It implies that they have sufficient time left for leisure, including socialisation. Limited days of work give them sufficient time for leisure and social activities, which is an indication of their successful adaptation to the environment. The less number of man-days in a week point to the fact that the Jarawa are still able to successfully pursue hunting-gathering way of life. It is further supported by the hunting behaviour of the Jarawa, which suggests that the Jarawa are still a hunter-gatherer group as the hunting behaviour of the Jarawa conforms to the hunting behaviour of a forager and they do not manipulate the encounter frequency of prey animals. This answers the research question number one that how far the Jarawa are truly a hunting-gathering community.

The Jarawa have been living in the Andaman Islands since time immemorial. The nature and impact of the contacts have been different in different periods of time and so has been the Jarawa adaptation to the changing situation. The Jarawa contacts with Non-Jarawa can be broadly put under three time periods *viz.*, pre-colonial, colonial and post-Independence.

The information about the Andaman archipelago and its inhabitants are found in the account of travellers, traders and sailors, in which the islanders are mentioned as barbaric. However, a documented account of contact with Negrito groups including Jarawa is available only after the British occupation of the Islands. The first occupation (First Penal Settlement) of the Islands by the British was short for from 1789 to 1796, and that time the Andaman Islands were inhabited by thirteen Negrito groups. Of them, ten belonged to Great Andamanese group, while other three groups were the Jarawa, Sentinelese and the Onges. Except the Sentinelese and the Onges who occupied North Sentinel and Little Andaman Islands respectively, the other eleven groups were living in different parts of South, Middle and North Andaman Islands. The Jarawa were in the Rutland Islands along with few other groups. All these groups had their well defined territories and inter-group war was prevalent among them. The British considered all of them to be the same. However, due to prevalence of tropical diseases, particularly malaria, the British vacated the islands.

Again in 1858, the Islands were occupied for the second time for the purpose of having penal settlement mainly for freedom fighters. As expected, skirmishes with different groups immediately started taking place immediately after the establishment of the Second Penal Settlement because the occupation of the territory and clearing of the forest and extraction of resources were treated as intrusion in the territory of the indigenous islanders. It may be noted that during the initial period of the Second Penal Settlement, these groups put-up the resistance. Despite the approved policy of the Court of Directors of protecting the aborigines, the cruel and vindictive policy of the British officials posted in the area generated among the aborigines a definite hostility against the British and a grim determination to drive them out from their habitat. It resulted in a series of attacks by them on the settlement of the British. The

most important and most organised of them was the attack of 17<sup>th</sup> May, 1859. Soon the Great Andamanese were subdued as the bows and arrows were no answer to fire arms. Like Great Andamanese, the Onges were also subdued by 1886 following the policy of punitive action and gift giving. The Sentinelese were not disturbed as they were away from main Andaman Islands inhabiting the North Sentinel Island.

The Jarawa were the second to display protest. The first recorded attack by the Jarawa on the settlement of the British was in 1872. The situation took a turn for worse in the following years and the hostility scaled-up. The reasons, which forced the Jarawa to be hostile, were intrusion in their territory, punitive action against them by the British and the employing of the Great Andamanese, which happened to be their traditional enemy of the Jarawa, against them by the British. British followed some reconciliatory approach toward the aborigines between 1880 and 1900 when the Portman was the Officer-in-Charge of the relation with aborigine. However, after his retirement, the reconciliatory approach toward the aborigines was abandoned and more punitive expeditions were carried out against the Jarawa, which resulted in to killing of many Jarawa.

The nature of contacts in post-Independence phase witnessed certain changes and had impacts of some events, which followed the Independence. In the first major change, the policy of sending punitive expedition was abandoned, and the habitat of the Jarawa was declared as a restricted territory and named as 'Jarawa Reserve'. But other events that took place kept the Jarawa suspicious of the intentions of the Non-Jarawa.

The second major event was the rehabilitation of the refugees from erstwhile East Bengal in different parts of the Andaman Islands. Of total refugee families, 2,328 families having a total population of the 10,018 were rehabilitated in different parts of the South and Middle Andaman, which was a direct invasion in the Jarawa territory. Consequently, the Jarawa resorted to occasional raids on the villages of the settlers. The construction of Andaman Trunk Road (ATR) was third event (1970-1986) as it passed through the 'Jarawa Reserve'. The Jarawa vehemently opposed it by attacking the workers' temporary settlements and damaging the vehicles engaged in the construction. In those skirmishes, both Jarawa and Non-Jarawa were killed. The construction of roads facilitated forestry operation in the 'Jarawa Reserves', which was resented by the Jarawa.

During the end of the 1960s, the local Administration initiated the policy of befriending the Jarawa by organising intermittent gift giving operations to their habitat. The first success was witnessed in 1974 when a group of Jarawa came out without arms and showed friendly gesture. This success encouraged the Administration to follow the policy of 'contact missions' with renewed vigour. After a gap of almost two and a half decades, the friendly contact mission finally bore the fruits in October 1997, when the Jarawa came out in open without any weapon. It was the watershed event as thereafter the Jarawa became friendly with Non-Jarawa.

The impacts of the contacts on the Negrito groups during the colonial period were devastating. It led to the complete elimination of seven out ten groups of the Great Andamanese by 1947. Now only three groups are surviving viz., Aka-Chari, Aka-Jeu and Aka-Bea. Their populations declined from strong 3500 in 1858 to 23 in

1951, which further fell to 19 in 1961. Similarly, the Onges too suffered decline in number from 700 in 1858 to 150 in 1951 and 93 in 1983. The population of the Jarawa also declined by half from 600 in 1858 to approximately 300 in 1951. The war with British was the one of the major factors for decline of population of the Negrito groups followed by introduction of new diseases like measles, syphilis, influenza and small pox, which proved fatal for them. Traditional warfare among different Negrito groups was another cause, though not very significant. The Jarawa, unlike their counterparts, did not suffer from any diseases during colonial period because there was no prolonged contact between them and the British or other groups. In addition to decline of population of the Negrito groups, the contact led to redefining of territories of different groups and the Jarawa who once occupied a part of the Rutland Island finally moved upward and occupied the parts of the South, Middle and North Andaman Islands.

In the post-Independence period, the major impacts of the Non-Jarawa have been on the size of the territory, resources base and health of the Jarawa. The rehabilitation of the 2,328 refugees families from the erstwhile East Bengal in South, Middle and North Andaman Islands, and giving of 10 acres of land to each of these families resulted in the sizeable decrease in the functional resource area of the Jarawa if not the formal territory. The Gazette notification of 1979 curtailed the Jarawa territory as it excluded many areas from it.

The rehabilitation of the refugee population in the Islands led to the illegal extraction of resources from and encroachment in the Jarawa territory. The major resources mainly extracted were forest produce and timber, poaching of deer and wild

pig and fishing. However, extractions of these resources were under control due to the overt display of hostility by the Jarawa. In the post-hostility phase (after 1997), the absence of hostility has resulted in many fold increase in illegal extraction of resources by the Non-Jarawa. Those areas of the 'Jarawa Reserve', which are close to the villages of the settlers, have begun showing the sign of depletion of edible resources, though the resources health in interior areas is still satisfactory. This answers the research question number two related with impact of the increased taxation by the Non-Jarawa on the Jarawa and their habitat.

There have been many direct or indirect influence of the Andaman Trunk Road (ATR) on the Jarawa and their habitat. Firstly, it has effectively cut off their free access to eastern coast resulting in loss of resource base. Secondly, in order to repair the road, fuel wood is cut from the forests of the Jarawa territory. Thirdly, the Road had facilitated forestry operations in Reserve until 1996. Fourthly, in post-hostility phase the stretch of the ATR that passes through the 'Jarawa Reserve' has become the contact point of tourists and vehicle operators with the Jarawa, which has led to introduction of non-traditional foods and new kind of diseases among the Jarawa.

The post hostility phase has witnessed spread of certain diseases like measles, community acquired pneumonia, skin infection and upper respiratory tract infection among the Jarawa. The cause of the skin infection is largely attributed to the wearing of the used clothes given by the tourists and villagers. Besides, most of the Jarawa, particularly male Jarawa, have become addicted to chewing of tobacco and *paan* (betel leaves).

As a response to the changed situation, the Jarawa now locate their camps along the ATR also as it gives them access to non-traditional food items, clothes and tobacco, which they get from tourists and drivers. They also make use of the vehicles plying on ATR to travel long distances in search of food items. Similarly, while camping near the coast or creek, they avail of boats during shifting of camps or while going on foraging trips of more than a day. These are the survival strategies adopted by the Jarawa to adjust to changing environment due to the arrival of the Non-Jarawa on the scene; an answer to the research question number three.

Unlike earlier times when they had to roam along the coast or stealthily come to the settlements of the settlers during the night for getting metal implements, now the Jarawa demand the iron and the metal utensils from the staff of the AAJVS who are posted there. Further, the raw materials used in the making of some of the implements have changed. Earlier the Jarawa were using bark fibre only for making of fishing nets and basket. Now they are using nylon thread too.

The Jarawa have now accepted the medical intervention and have no hesitation in accepting any kind of medicines either orally or externally. It has helped in treating many of the newly introduced diseases. More importantly, they have allowed themselves to be medically tested or examined. It has led to the revelation of the fact that many of the Jarawa are healthy carrier of *Hepatitis B*, and in friendly contact situation, it may be lethal to the Non-Jarawa. In addition to *Hepatitis B*, the Jarawa were also found to be suffering from Hepato megaley and Spleno Magaly.

## 6.2 MAJOR FINDINGS

Based on the present study, some findings have been derived. These are pertaining to the major theme of the Ph.D. research, i.e., adaptation of the Jarawa to the environment of the Andaman Island Ecosystem. The major findings have been mentioned below under certain relevant sub-headings for the sake of clarity.

### 6.2.1 Habitat and Resource Inventory

1. The Jarawa are one of the four Negrito human groups inhabiting the Andaman group of Island. The ecological niche of the Jarawa is called as 'Jarawa Reserve' or 'Jarawa territory' spread over nearly 765 sq km of area.
2. There are three territorial groups among the Jarawa, who inhabit the *Boiab*, *Thidong* and *Tanmad* territories of the Middle and South Andaman Islands. Each group has exclusive rights over its territory, and the other groups are forbidden to gather any resources from it. It means a strong sense of ownership and possession of resources exists at group level, which ensures sustainable subsistence and survival. The same is applicable to the Jarawa human group as a whole since they are traditionally used to defend their territory from being exploited by the Non-Jarawa. This, in fact, has governed their behaviour towards the outsiders, right through the known history.
3. As per the last count in 2002, the total population of the Jarawa is 265 persons, out of which 84 are in *Boiab*, 78 in *Thidong* and 103 in *Tanmad* territories.
4. The hunter-gatherer Jarawa eke out their livelihood through collection of roots, tubers and fruits, and hunting and fishing activities.
5. The Jarawa has a 'broad resource base', which is inclusive of both terrestrial and aquatic resources, ensures their subsistence in all seasons with adequate diet.

6. At cognitive level, the resource base is divided into five zones- *pilleh* (sea shore), *tagidh* (marshy area), *chanhanap* (plain land), *tinon* (thick forest area) and *wa* (fresh water bodies and streams), from which specific resources are gathered in different seasons of the year to maintain their survival.
7. Of the total resources used by the Jarawa, so far about 136 species of plants have been identified, of which 54 are edible and remaining non-edible. The major plant food includes tubers (*Dioscorea sp.*), *Cycus rumphii*, jackfruits, and *Nipa fruticans*.
8. The pig, monitor lizard and turtle are game animals of the Jarawa.
9. They have a dietary preference for meat, fish and molluscs, but pig is the most preferred one. Honey is another important food item.
10. The 'key stone resources' are the molluscs, fish and tuber (*Dioscorea sp.*).
11. In fact, the Jarawa rely upon a limited range of plants and animals to fulfil the bulk of their calorific requirements.
12. Hunting is an exclusively male activity while there is predominance of females in gathering activities. Interestingly, the Jarawa do not hunt the deer, as it is an exotic species.
13. Both males and females do fishing using different means but the success rate is directly related with the number of the person fishing in an area, size of the area and size and density of fish in that area.
14. The availability and collection of many of the edible resources are season specific. However, the seasonality is not applicable in case of pig though it is hunted most in rainy season when it has maximum fat due to availability of plenty of food.
15. There are three broad resource seasons: (i) Dry summer in which wild jackfruit collection is at peak along with honey; (ii) Rainy season in which thrust is on pig hunting and collection of the seeds of *Cycus rumphii* and *Nipa fruticans*; and (iii)

winter season which is meant for collection of honey and turtle eggs, followed by pig hunting.

16. The Jarawa get iron tools and metal utensils from the AAJVS and at times, they procure these items from settlements. However, in the past they used to collect iron from jetsam, i.e., broken ships washed ashore.
17. Sharing of flesh of the prey (game) animals at constituent families level and other foraged items at intra-family level is a strategy of better survival for all.
18. Though cultivation is the primary activity of the settlers, they do extract timber and minor forest produces, hunt wild pigs and deer, and catch crab, sea cucumber, lobster and prawn from the 'Jarawa Reserve', means sharing the resource base of the Jarawa.

### 6.2.2 Foraging Strategy

19. Selections of the site for location of the camps (*chadda*), the number of camps in an area and movement pattern of the Jarawa within their territory are part of the foraging strategy.
20. The permanent and semi-permanent camps are of large size and remain occupied for longer period than the temporary camps. Hence, the former two types of camps serve as 'base camps'.
21. Location of the base camps of the Jarawa is governed by combination of factors-ecological edges, proximity to drinking water, easy availability of one of the edible resources and season.
22. Now the camps are also located along the ATR to avail various benefits.

23. Surprisingly, despite living in an island environment the Jarawa do not have well built canoes like that of the Sentinelese, Onge, and the Great Andamanese.
24. Seasons play a decisive role in the location of the camp along the coast and inside the forests. The underlying strategy is to exploit both the terrestrial and aquatic resources.
25. The Jarawa make two type of movement i.e., residential and logistical.
26. The foraging expeditions are never more than 15 days at a stretch.
27. There is division of labour to carry out different activities related with food gathering. Hunting is exclusively a male activity; about 29 per cent of the total adult male population are involved in it, which account for 30 percent of the total man-days of work, while most of the fishing is done by the females.
28. The input-output analysis shows that the average value of Index of Subsistence Effort for the Jarawa is 0.295. The average work input varies between 3.7 to 3.9 days a week. About 3.1 to 3.3 days in a week are left for leisure, socializing, and other activities.
29. Testing of the Jarawa hunting behaviour conforms to the hunting behaviour of a true hunter-gatherer/forager as prey is encountered sequentially as a Poisson process. This answers the research question number one that how far the Jarawa are a true hunter-gatherer.
30. The net acquisition of resources in case of the Jarawa is satisfactory because on an average an adult Jarawa get approximately 2,500 KCal from the major resources alone. If the minor resources were also included then it would well be around 2,800 KCal.

### 6.2.3 Impact of Contacts

31. The later half of the year 1997 was the watershed in the Jarawa history as it marked the end of the hostility between the Jarawa and the Non-Jarawa.
32. In the post-hostility phase, the poaching by the Non-Jarawa people inside the Jarawa territory has increased. As a result, the Jarawa are competing with the poachers for those resources that are common to both.
33. Though the resource density in the interior of the forests is still adequate to support the foraging pursuit of the Jarawa, there is thinning and receding of the resources base in the area close to the settlements of the Non-Jarawa. It is more discernible in case of fish and pig density.
34. The Jarawa have fallen prey to some of the vices of the Non- Jarawa, e.g., addiction to *paan* and tobacco.
35. A barter trade is emerging between the Jarawa and the Non- Jarawa particularly tourists, where in the Jarawa exchange hunting implements, honey and resin for *paan* and tobacco. There is some sort of barter system existing between the Jarawa and the poachers also wherein the poachers offer *paan*, and tobacco and eatables to buy safe passage in the forest to exploit the resources of the Jarawa territory.
36. In recent times there have been out breaks of various communicable diseases like community-acquired pneumonia (1998) and measles (1999), which were absent before the friendly and free mixing of the Jarawa with the Non-Jarawa. Many cases of *P. falciparum* malaria (2000-2001) were also reported recently.
37. Skin diseases have spread after 1997, primarily due to wearing of used clothes given by the Non-Jarawa, and not washing of these clothes by the Jarawa.

38. Now the Jarawa make use of boat (motorized canoe operated by the Non-Jarawa) during the shifting of their huts along the coastal area and while camping at the roadside they make use of the vehicles plying on the road to cover longer distances in search of edible and non-edible resources.
39. Nowadays the Jarawa get a regular supply of iron from the AAJVS (Andaman Adim Janjati Vikas Samiti). The Jarawa can now be seen using hammer, chisel, sharpening file, and makeshift anvil for making hunting and fishing implements. In addition, they also get the cooking and storing utensils.
40. Now they use nylon threads along with traditional bark thread for making nets.
41. Though the Jarawa observe and gather information about some foraging techniques of the Non-Jarawa, like the use of snare to catch pig or use of line and hook for fishing, they are yet to adopt these methods.
42. Now the Jarawa have no hesitation in accepting any kind of medicines either orally or externally (which have external application). There is a positive change in their hospital behaviour also as they are not wary of the other patients.
43. They have started eating non-traditional foods containing salts and spices, which have caused high blood pressure among a few of them, particularly among those who frequently visit the hospital, jetty and the settlements.
44. Recently some of the Jarawas, particularly young boys, have picked up Hindi. Even the broken knowledge of Hindi on the part of the Jarawa has proved very useful in case of medical treatment also as both the Jarawa and the medical attendant or Doctors are able to make each other understand.

### 6.3 CONCLUSIONS

The present study on ecology of the Jarawa has been able to reveal intricacies of the form and processes of their adaptation to environment of Island ecosystem of the Andaman. It has brought to light response of a hunter-gatherer human group to the wet tropical Island ecosystem that has its own potential and constraints on their survival. Based on the study following conclusions may be drawn.

- The Jarawa of Andaman Islands are one of the few remaining hunter-gatherers in the world whose subsistence economy is still in the elementary form, which approximates the economy of the classical hunter-gatherers, for it is based on extraction and the consumption of most of the immediate resources available in their habitat.
- The hunting, fishing and gathering activities are pursued with an in-depth indigenous knowledge of the ecosystem pertaining to edible and non-edible plant and animal species; different seasons and associated phenomena like rainfall, fruiting, flowering, regeneration of terrestrial and marine plants and animals, availability of resources; nature and characteristics of the coastal and shallow seas; and others.
- The subsistence activities are accomplished with intelligently designed strategy related to selection of sites for location of camps in different seasons and physiographic zones; timing, number and distance of foraging movements; selection of prey; image perception; division of labour; inter and intra-family sharing of gathered food items; and proper use of different tools and technology to ensure maximum returns from minimum efforts.
- The collection of food is subject to availability and density of food resources in particular zone and season and the distance from the camp.

- First of all, resources in the immediate vicinity of the camps are harvested then the distant ones, so that enough resources are available for longer time and regeneration of resources also go on in the already harvested area.
- They try to eat a balanced diet comprising of both plant and animal food items that provide them with sufficient carbohydrate, fat, glucose, nutrients, minerals etc. Though flesh of game animals is preferred, the key stone resources consist of plant food items and small animals which are perennially available.
- The Input-Output analysis reveals that there are still sufficient resources in the interior of the Jarawa habitat to support the hunting and gathering subsistence activities as exhibited by the less number of man-days in a week. It gives them sufficient time for leisure related activities which is one of the important preconditions for the happy survival of a foraging group.
- The hunting behaviour of the Jarawa conforms to the basic premise of the Optimal Foraging Theory by following a Poisson distribution curve. It shows that the Jarawa do not manipulate the frequency encounter of the game animal and thus, their hunting behaviour exhibits the hunting behaviour of a classical hunter-gatherer.
- In the post-hostility phase decline in the density of resources in the areas close to villages of the Non-Jarawa has been observed due to poaching and illegal extraction of resources. These are initial warning symptoms which need to be addressed immediately, because erosion of the resource base will force them to work for longer period per day/ week, which is undesired in any hunting-gathering society the world over.
- If the thinning and decline in resources base continues unabated, it would soon force them to be dependent on the dole given by the Government/Local

Administration as it happens in case of the Great Andamanese and the Onges-the Negrito neighbours of the Jarawa in the Andaman group of Islands.

- The friendly contacts after 1997 have some negative impacts on the Jarawa, e.g., spread of many communicable diseases like skin infection, measles and community acquired pneumonia. In addition, they have become addicted to *paan* and tobacco.
- The Jarawa are trying to adapt themselves to the changed situation as a part of their survival strategy like using the vehicles and boats plying on the roads and sea to reduce the distance, accepting the medical treatment and learning many of the material traits of the Non-Jarawa. But their failure to learn new techniques and use of new tools, which are used by the Non-Jarawa and which would make them survive in the situation when there is less density of resources in their habitat, is a matter of great concern.
- There are three major concerns which need immediate attention. These are related with the health problems, eroding resource base and lack of interest among the Jarawa youth in learning new techniques of hunting and gathering used by the Non-Jarawa; all having direct bearing on their survival as a pure hunter-gatherer group and the survival of the Jarawa as a human group adapted to typical island environment.

### 6.3.1 Limitation of Study

Any scientific research, however detailed it may be, can not cover all the aspects with the problem. In fact, it is only a link in the long chain of research to find the truth. The present Ph. D. research work has been completed in respect to fulfilling of all the objectives and answering the research questions. However, there are limitations in terms of the points that could not be covered in the present. In view of the investigator following are the limitations of the present work.

The island ecology, conflict and adaptation of the Jarawa, who inhabit the western parts of the South and Middle Andaman, have been probed into with the help of both primary and secondary data. The primary data have been collected through field work between 1998 and 2004. The study gives the first hand information about resource inventory of the edible and non-edible resources of the Jarawa, seasonality of resources, major food items of the Jarawa, their foraging behaviour and adaptation of the Jarawa to the changing situation. However, the resource inventory is far from complete as there are many minor resources used by the Jarawa but could not be observed. Movement pattern and foraging behaviour are largely based on the detailed study of only three months. In the absence of other detailed studies on the Jarawa it was difficult to correlate many of the observations and findings on these aspects. All the more, collection of information on the above stated aspects, in fact, requires a team work, because there is all possibility that alone one may not collect all the information about all three territorial groups of the Jarawa at a time. In order to know many aspects related with present topic a detailed field work spread over twelve months is required. Moreover, data have to be gathered about all three groups at a time in the same year.

The ignorance about the Jarawa language was one of the major handicaps of the investigator in the initial phase in collection of authentic data. In fact, there was no one who knew the Jarawa language to act as interpreter. Later with great effort a broken Jarawa language could be learnt. The dense tropical rain forest with thick undergrowth particularly of canes coupled with presence of leaches had made the field work hazardous and this may be considered limitation imposed by the environment. Besides, there is no logistic support available in the forests to stay for a long field work. Nevertheless, it was interesting to conduct the present research within these constraints. Main limitations of the present study are listed below.

1. The Jarawa use many terrestrial and aquatic resources, but only a limited number of the resources could be observed and only that have been discussed in the present study. The study lack sufficient data on edible marine resources and minor resources as well. Similarly, the seasonality of major edible plant resources has been discussed but there is lack of data on seasonality of minor edible plant products as well as marine animal resources.
2. Though the factors influencing location of the camps have been studied but the present study lack detailed information on the minimum distance between two camps and pattern of setting up of camps in a particular season. Reoccupation of the same camp is also related with regeneration capacity of the resources, but the present study lacks information on the renewable characteristics of the plant and animal resources.

3. The Input-Output analysis has helped find out work week of a Jarawa i.e., how many days in a week an economically active Jarawa works, but how many hours a day is spent towards foraging could not be calculated due to lack of sufficient data.
4. Perception plays an important role in the human adaptation to environment. Though the Jarawa's perception of the four physiographic zones and its resources has been briefly discussed but a detailed information on the Jarawa perception of the environment related with potentiality and constraints on adaptation could not be gathered due many inevitable reasons.
5. Though sharing of food items has been discussed, the study lacks enough quantitative data on it, particularly sharing of flesh of game animal among constituent families of a band.

### **6.3.2 Scope for Further Research**

The present investigation on the human ecology of the Jarawa is a maiden study as no prior study has been conducted on the Jarawa's adaptation to the island environment, impact of contact and conflict and adaptation to the changing situation. Though the aim of the study was limited to prepare an inventory of resources as perceived by the Jarawa, analysis of Jarawa adaptation by finding out technology and strategy of resource utilisation, and to examine the impact of contact on the resource base and adaptation of the Jarawa, it has opened up several new vistas that require a detailed scientific investigation as listed below:

1. The entire resource potential of the Island ecosystem is yet to be identified and documented. In addition, a complete inventory of the resources used by the Jarawa is required to be prepared in order to find out the total resources available in Island ecosystem and how many of these are used by the Jarawa.
2. At the same time, it is also necessary to find out environmental constraints (like endemic diseases, natural hazards, wild life menace etc.) on the human adaptation, and how many of these have been overcome by the Jarawa.
3. Regeneration rates of major and supplementary resources used by the Jarawa required to be investigated and have to be correlated with movement pattern/cycle of the Jarawa, i.e., after how many days they occupy the abandoned camps. It would throw light on the fact that how far the Jarawa are an eco-friendly group, have indigenous knowledge about the nuances of ecology and environment and the degradation of the ecosystem.
4. Except a few, seasonality of all major and supplementary resources, particularly of the marine life, is not fully known. Its investigation will definitely throw light on aspects related with location of huts and movement pattern. Further, it would give information on the nutritional aspect of the Jarawa and their calorie intake.
5. The net gathering rate of all the resources in terms of man-hour in a day needs to be calculated. This will reveal that on an average how many hours a day an economically active Jarawa works to eke out livelihood. It, in turn, would help find out how close they are to the concept of 'original affluent society'.
6. Sharing, particularly the flesh of the game animals like wild pig, monitor lizard and turtle, is a part of the survival strategy of the Jarawa. The quantitative information pertaining to inter-family distribution of meat is required to be calculated.

7. There is a need to map the exact ecological niche of the Jarawa territory for it plays an important role in demarcation of territory, location of the huts, movement patterns, and density of different plant and animal resources.
8. In the hunting-gathering society, the man-nature-spirit relationship needs to be investigated. A holistic study on such relationship is necessary to find out the organic relationship among the three factors. There is very little information on the spiritual world of the Jarawa too, and that needs to be probed.

Undoubtedly, detailed investigation on these points will help in understanding the intricacies of human adaptation of the Jarawa to Island environment, but keeping the present restrictions on visits to the Jarawa territory in mind it appears to be a difficult task if not impossible. However, there remains curiosity to understand the hunter-gatherer response to island environment, and present work is a sincere effort in that direction. If, by chance, unfortunately the Jarawa also meet the fate like that their neighbours have met, then the present dissertation may probably become an authentic and only source of information on the Jarawa human group and their hunting-gathering way of life in an island ecosystem.

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**Web site**

Google Earth

## **APPENDICES**

## APPENDIX - I

### SETTLEMENT LOCATION OF THE JARAWA

<b>BOIAB AREA</b>			
SL. No.	Name of Settlement	Location	Type of Camp
1	Jhaukona camp	11 <sup>o</sup> 42'58.6"N 92 <sup>o</sup> 34'31.2"E	Coastal, temporary settlement
2	Eno	11 <sup>o</sup> 43'04.6"N 92 <sup>o</sup> 33'13"E	Coastal, temporary settlement
3	Tatha-etha	11 <sup>o</sup> 42'28"N 92 <sup>o</sup> 34'38.1"E	Forest, temporary settlement
4	Tothi-duba	11 <sup>o</sup> 42'51.5"N 92 <sup>o</sup> 34'20.6"E	Forest, temporary settlement
5	Tinatho	11 <sup>o</sup> 57'08.2"N 92 <sup>o</sup> 40'57.4"E	Forest, temporary settlement
6	Lapaitala (Jarawa Ring)	11 <sup>o</sup> 44'15.9"N 92 <sup>o</sup> 36'26.8"E	Forest, temporary settlement
7	Alugithale	11 <sup>o</sup> 59'34"N 92 <sup>o</sup> 42'0.2"E	Forest, temporary settlement
8	Ginaitala	11 <sup>o</sup> 44'58.0"N 92 <sup>o</sup> 36'52.7"E	Forest, temporary settlement
9	Thapiliem (Billy Nalla)	11 <sup>o</sup> 56'56.0"N 92 <sup>o</sup> 41'02.2"E	Forest, temporary settlement
10	Eanathilia	11 <sup>o</sup> 42'45.7"N 92 <sup>o</sup> 34'28.2"E	Coastal, temporary settlement
11	Gangapo	11 <sup>o</sup> 44'35.9"N 92 <sup>o</sup> 35'47.5"E	Forest, semi-permanent settlement
12	Pechleg	11 <sup>o</sup> 59'28.8"N 92 <sup>o</sup> 37'02.1"E	Coastal, semi-permanent settlement
13	Nono-uge	11 <sup>o</sup> 47'0.2"N 92 <sup>o</sup> 33'13.0"E	Coastal, semi-permanent settlement
14	We-shekup	11 <sup>o</sup> 46'13.8"N 92 <sup>o</sup> 32'49.0"E	Coastal, semi-permanent settlement
15	Wg-tha-waw	11 <sup>o</sup> 43'33.3"N 92 <sup>o</sup> 33'57.6"E	Coastal, temporary settlement
16	Totha-wikiji	11 <sup>o</sup> 48'56.7"N 92 <sup>o</sup> 333'34.6"E	Coastal, temporary settlement
17	Mutu-tuweya	11 <sup>o</sup> 54'18.2"N 92 <sup>o</sup> 32'9.3"E	Coastal, temporary settlement
18	Horpotale (Badabalu)	10 <sup>o</sup> 50'50"N 92 <sup>o</sup> 204'56"E	Coastal, temporary settlement
19	Y-enen chadda (Jhaukona)	11 <sup>o</sup> 42'58.2"N 92 <sup>o</sup> 34'32.6"E	Coastal, Semi-Permanent
20	Totale	11 <sup>o</sup> 45'3.6"N	Forest, temporary settlement

	(Hathi-Tikri)	92°35'45"E	
21	Totahikichi (Port- Campbell)	11°52'31.2"N 92°29'43.3"E	Coastal, temporary settlement
22	Kinethala (Near JPF No.-2)	11°44'16"N 92°36'52.7"E	Forest, temporary settlement
23	Tinetha	11°57'82"N 92°40'57.4"E	Forest, temporary settlement
<b>THIDONG AREA</b>			
24	Tahato	12°03'13.6"N 92°42'19.3"E	Forest, permanent settlement
25	Tuhi	12°07'29.2"N 92°43'09.3"E	Forest, permanent settlement
26	Tuterbeto	12°07'37.0"N 92°43'16.7"E	Forest, semi-permanent settlement
27	Mimun	12°2'33.5"N 92°42'19.6"E	Forest, temporary settlement
28	Inkamahe	12°11'59.8"N 92°39'37.4"E	Coastal, semi-permanent settlement
29	Othukunu (Hiran Tikri)	12°12'1.3"N 92°39'24.1"E	Coastal, semi-permanent settlement
30	Tanaoben	12°08'52.6"N 92°44'20.5"E	Coastal, semi-permanent settlement
31	Otathamele	12°9'23.1"N 92°44'50"E	Forest, temporary settlement
32	Moulahuchu	12°4'55.7"N 92°42'54.4"E	Forest, temporary settlement
33	Lebaitala	12°14'22.7"N 92°42'8.3"E	Coastal, Semi-Permanent
34	Thulug	12°14'32.4"N 92°41'58.0"E	Forest, temporary settlement
35	Thota-ulio	12°11'19.9"N 92°38'55.3"E	Forest, temporary settlement
36	Motebutu	12°10'29.1"N 92°38'45.1"E	Coastal, permanent settlement
37	Alo-ethala	12°06'55.2"N 92°42'51.1"E	Forest, temporary settlement
38	Huinaang (B. D. Nala)	12°02'18.3"N 92°42'17.9"E	Forest, temporary settlement
39	Ine-ethala (R. K. Nalla)	12°06'24"N 92°43'0.2"E	Forest, temporary settlement
40	Tutho-ela (R. K. Nalla)	12°07'37.1"N 92°43'16.7"E	Forest, temporary settlement
41	Ing-kathe-beda	12°08'25.6"N 92°38'21"E	Coastal, temporary settlement
42	Chaithe mane	12°06'21.9"N 92°42'15.0"E	Forest, semi-permanent settlement
43	Thallang	12°05'51.3"N	Forest, semi-permanent settlement

		92°41'33.4"E	
<b>TANMAD AREA</b>			
44	Daag-totembu	12°18'22.1"N 92°43'28.7"E	Forest, semi-permanent settlement
45	Oleg (Near Lakralungta)	12°18'2.9"N 92°43'22.5"E	Coastal, semi-permanent settlement
46	Hochu	12°22'12.6"N 92°42'20.9"E	Coastal, semi-permanent settlement
47	Hiulele	12°22'52.6"N 92°42'17.9"E	Coastal, semi-permanent settlement
48	Uli	12°26'50.0"N 92°46'29.3"E	Coastal, semi-permanent settlement
49	Tanmad	12°11'43.9"N 92°43'0.06"E	Coastal, semi-permanent settlement
50	Dhani Nalla	12°27'42.1"N 92°44'54.0"E	Forest, semi-permanent settlement
51	Ullia	12°26'56.2"N 92°46'31.6"E	Forest, semi-permanent settlement
52	Elag-wae	12°45'11.5"N 92°17'50.1"E	Forest, temporary settlement
53	Elag-O	12°17'49.1"N 92°45'12.2"E	Coastal, temporary settlement
54	Southern part of Spike Is.	12°14'32.9"N 92°42'24.3"E	Coastal, temporary settlement
55	Tentul Tikri	12°14'43.6"N 92°41'51.4"E	Coastal, temporary settlement
56	Mohua Tikri	12°31'56.4"N 92°40'45.1"E	Coastal, semi-permanent settlement
57	Motieta (Foul Bay)	12°19'40.6"N 92°42'32.5"E	Coastal, semi-permanent settlement
58	Nalla	12°22'49.4"N 92°42'29.7"E	Coastal, temporary settlement
59	Fia-Fia	12°23'52.1"N 92°41'30.6"E	Coastal, temporary settlement
60	Hochabotha	12°26'16.2"N 92°41'30.4"E	Coastal, temporary settlement
61	Terobetale	12°27'26.5"N 92°41'28.5"E	Coastal, temporary settlement
62	Filetina buchu	12°28'24"N 92°41'29.6"E	Coastal, temporary settlement
63	Watabo	12°29'36.9"N 92°41'32.3"E	Coastal, temporary settlement
64	Iyo-no	12°30'56.9"N 92°41'23.2"E	Coastal, temporary settlement
65	Tinetal	12°32'7.1"N 92°41'26"E	Coastal, temporary settlement
66	Tinodo (Flat Is.)	12°35'13.7"N 92°41'38.6"E	Coastal, temporary settlement

67	Tatoianka (Flat Is.)	12 <sup>0</sup> 36'10.5"N 92 <sup>0</sup> 40'40.3"E	Coastal, temporary settlement
68	Inkobuduche	12 <sup>0</sup> 40'03.6"N 92 <sup>0</sup> 44'19.7"E	Coastal, temporary settlement
69	Phillip Nalla	12 <sup>0</sup> 24'26.4"N 92 <sup>0</sup> 44'9.5"E	Nalla, Permanent settlement

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## **GLOSSARY**

## GLOSSARY

<i>Aav</i>	Bow
<i>Chadda</i>	Hut (camp)
<i>Chanhanap</i>	Plain area
<i>Iituugu</i>	Torch
<i>Kekad</i>	Chest guard
<i>Lepa</i>	Initiation ceremony for hunter hood
<i>Nappo</i>	Fish
<i>Orrugu</i>	Monitor lizard
<i>Ovu</i>	Pig
<i>Paattov</i>	Arrow
<i>Pilleh</i>	Coastal area
<i>Pootho</i>	Fishing net
<i>Taaheteyaalpaattoov</i>	Arrow with detachable arrowhead
<i>Taaiku</i>	Basket
<i>Tagidh</i>	Marshy area
<i>Thaahoodintaavpaattoov</i>	Arrow used while fishing
<i>Thoochalotuvopaattoov</i>	Arrow used in pig hunting
<i>Tinon</i>	Hilly dense forest
<i>Toomeedituvopattoov</i>	Arrow used in monitor lizard hunting
<i>Tottichale</i>	Machete (dao)
<i>Ukkele</i>	Turtle
<i>Uuhu</i>	Wooden bucket
<i>Wa</i>	Streams and inlets

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## **PLATES**

## PLATES



Plate 1. A group of Sentinelese receiving coconut from contact party



Plate 2. A Jarawa family



Plate 3. An Onge couple



Plate 4. A Great Andamanese man

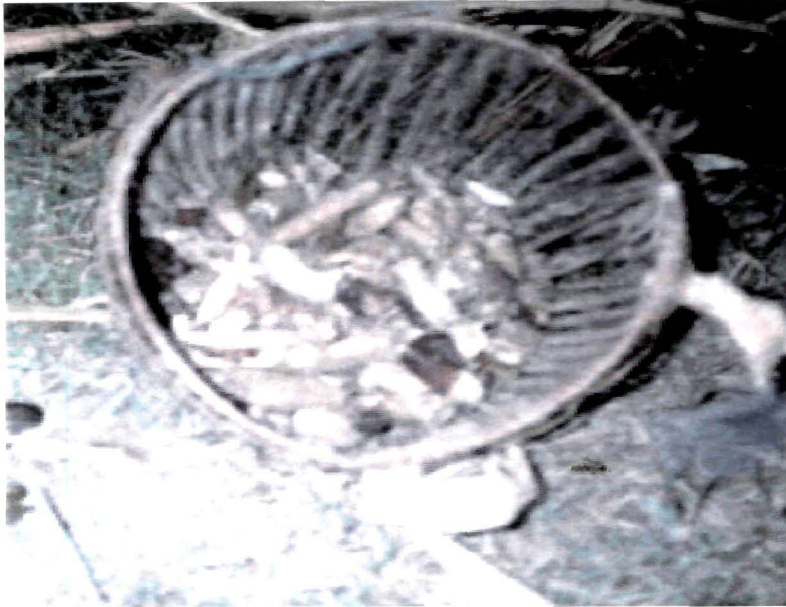


Plate 5. Collection of tubers



Plate 6. A Jarawa woman processing wild jackfruits



Plate 7. A Jarawa woman with collection of seeds of *Cycus rumphii*



Plate 8. A Pandanus fruit, occasionally consumed by the Jarawa



Plate 9. A kind of wild citrus fruit, occasionally consumed by the Jarawa



Plate 10. A Jarawa boy dressing the roasted pig



Plate 11. A Jarawa processing the monitor lizard before sharing



Plate 12. A Jarawa girl with her fish catch

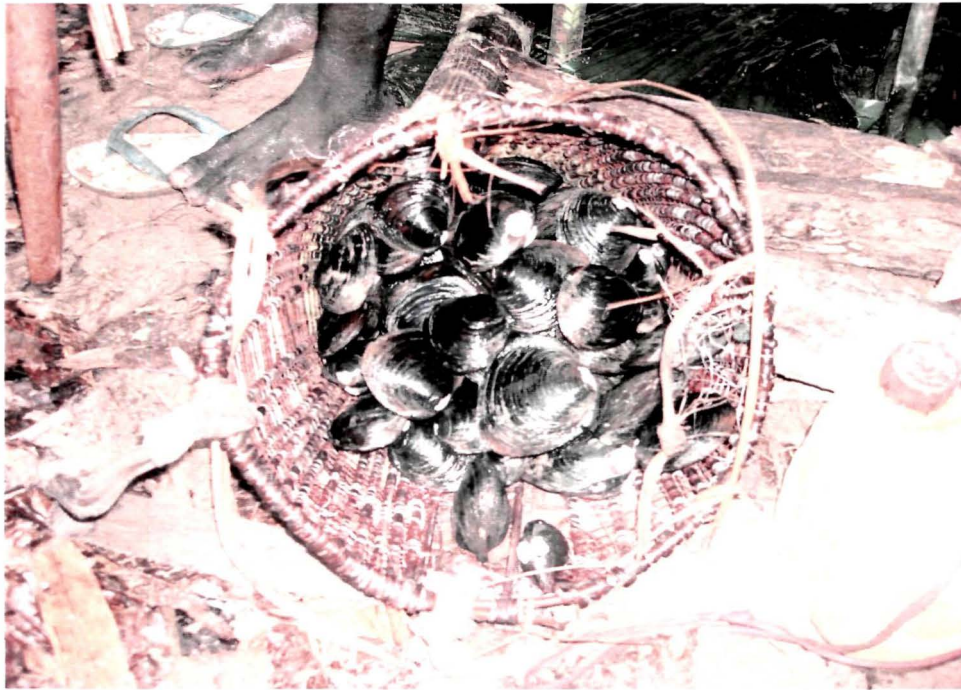


Plate 13. Bi-valve shells, a key stone resource, collected from the creek



Plate 14. Jarawa children playing with a fawn (deer) caught by them



Plate 15. Foraging implements of the Jarawa-  
bow, arrow, digging rod and knife.



Plate 16. Arrows with fixed and detachable arrowheads

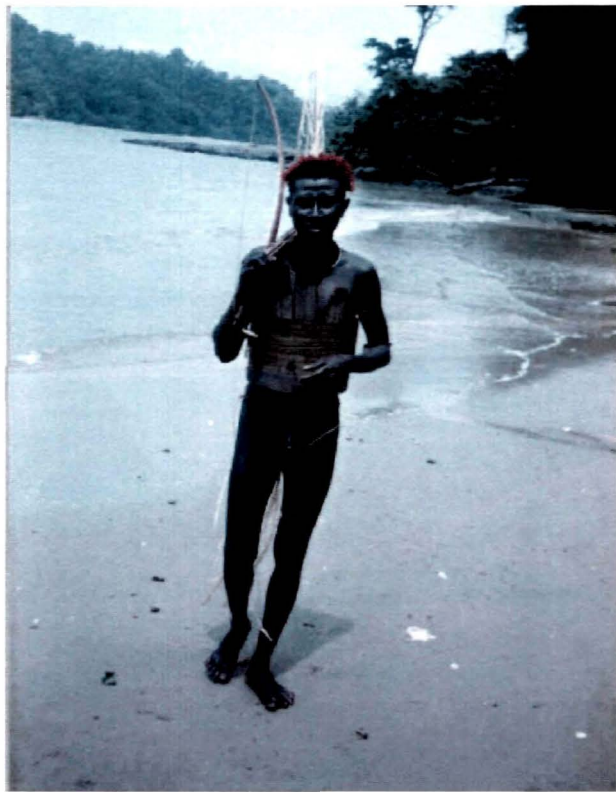


Plate 17. A hunter with bow and arrow and chest guard



Plate 18. A Jarawa woman making a cane basket

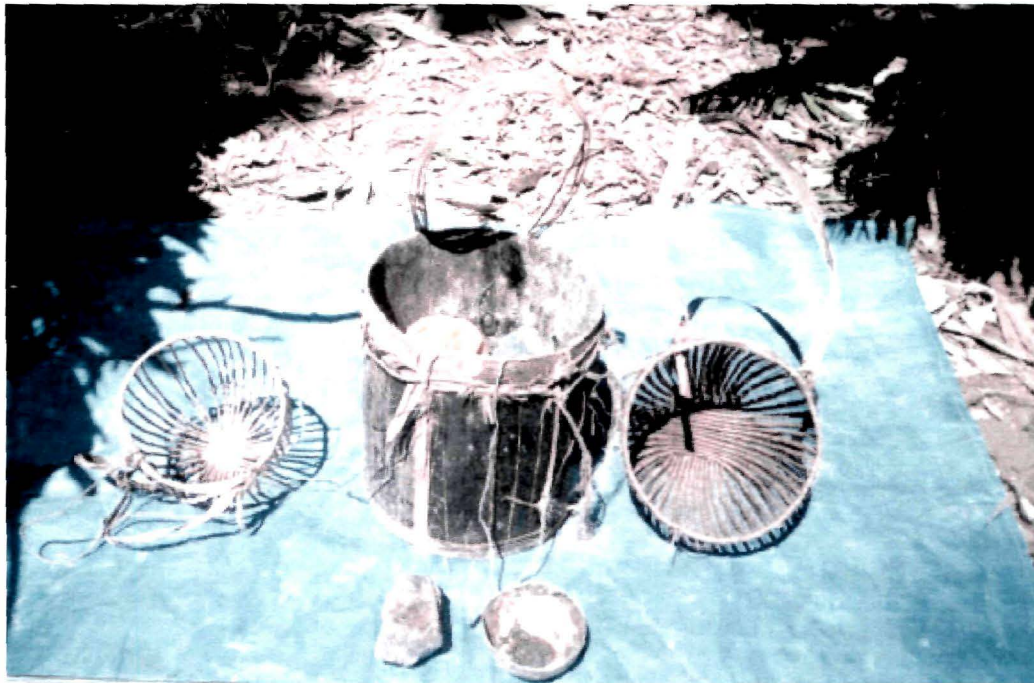


Plate 19. Baskets and buckets of the Jarawa



Plate 20. A group of Jarawa busy in making dugout buckets from the trunk of a tree



Plate 21. A fully decorated Jarawa- note painted body, head gear and chest guard



Plate 22. Making of an iron arrowhead



Plate 23. Conical fishing nets of the Jarawa



Plate 24. A permanent hut (camp) of the Jarawa



Plate 25. A temporary hut (camp) of the Jarawa



Plate 26. A rudimentary raft of the Jarawa



Plate 27. A Sentinelese in his out-rigger canoe



Plate 28. Residential movement of a group of the Jarawa  
(shifting of permanent camp)



Plate 29. Jarawa children fishing near the shore



Plate 30. A male Jarawa fishing with bow and arrow in the reef area



Plate 31. Jarawa children in clothes and with gifted banana



Plate 32. A Jarawa with his pet dogs

## BRIEF BIO-DATA

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