

Sustainable Management of Protected Areas in the Andaman and Nicobar Islands



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Abbreviations

A&N	Andaman and Nicobar
ANI	Andaman and Nicobar Islands
ANIFPDC	Andaman and Nicobar Islands Forest and Plantation Development Corporation
CARI	Central Agricultural Research Institute
CRZ	Coastal Regulation Zone
Cum, m ³	Cubic meter
EEZ	Exclusive Economic Zone
FD	Forest Department
GBH	Girth at breast hight
GDP	Gross domestic product
Ha	Hectares
IDA	Island development Authority
Km	Kilometre
MoEF	Minsitry of Environment and Forests (Government of India)
p.a.	Per annum
UNDP	United Nations Development Programme

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1. OVERVIEW

- i. The Andaman and Nicobar Islands (ANI) are a group of 306 islands spread out in the Bay of Bengal. They are about 1,000 kms from Kolkata and Chennai, in India, and closer to Burma and Indonesia than the Indian mainland.
- ii. The tribal populations in these islands have been here from time immemorial. There are two major tribal groups, the Negritos in the Andaman group and the Mongoloids in the Nicobar group. The Andaman tribals consist of the Jarawas, the Onges, the Andamanese and the Sentinelese. The Nicobar tribals are the Nicobarese and the Shompens.
- iii. The islands were initially colonised by the British towards the end of the eighteenth century, but were abandoned due to harsh and inhospitable climatic conditions. They were again colonised in the second half of the nineteenth century and converted into a penal colony by the British.
- iv. The British occupation of the islands took a heavy toll of the local tribals, especially the Andamanese, who were all but wiped out.
- v. The islands were captured by the Japanese during the Second World War and remained under their occupation for over two years.
- vi. At present, the islands are administered directly by the Government of India, as a Union Territory, and have a Lt. Governor who is the administrator.
- vii. Forestry operations also started towards the end of the nineteenth century and have become one of the main economic activities of the islands.
- viii. The ANI have vast fish resources and an exclusive economic zone covering approximately 600,000 km² of sea.
- ix. These islands are an internationally acknowledged hot spot for biodiversity, with over 3,552 species of flowering plants (223 species endemic), 5,100 species of animals (100 freshwater, 2,847 terrestrial, 503 endemic) and 4,508 marine species (of which 220 are endemic), 52 species of mammals (33 species endemic), 244 species of birds (96 endemic) and 111 species of amphibians and reptiles (66 endemic) (Das 1994, 1997a, 1999; Andrews 2001). The islands also have a reported 197 species of corals, with about 80% of the maximum coral diversity found anywhere in the world. This makes them the richest coral reefs in the Indian Ocean and an area of global significance (Turner *et al.* 2001, Vousden 2001). The fact that these islands have a

relatively small population and low population density, and that they are remote and difficult to access, makes them one of the last places in India where, with a little effort, biodiversity can be effectively conserved, without serious adverse impacts on the local inhabitants.

- x. Given the unique biodiversity values in the Andaman and Nicobar Islands (ANI) and their extreme ecological fragility, the major objective of forest and ecosystem management in these Islands should be biodiversity conservation and protection of the habitat of the tribals living in the forests. ANI has a preponderance of evergreen and semi-evergreen tropical rain forests, which are not only the richest biodiversity pools in the world but are also very fragile.
- xi. One of the major threats to the biodiversity of the forests of ANI is the emphasis on commercial forestry. The Forest Department and the Andaman and Nicobar Islands Forest Plantation and Development Corporation (ANIFPDC) currently follow a “conversion” forestry system where natural forests are worked, commercial species extracted and the worked forests regenerated and managed in a manner such that there is a resultant preponderance of commercial species for future harvesting. In the process, biodiversity is deliberately destroyed. Surprisingly, this is being done according to prescriptions in Working Plans that have been approved by the MoEF. In some areas, the natural forests have been totally cleared and replaced with plantations of padauk, gurjan, teak, or a combination of these and other commercial species. As per decisions taken by the Island Development Authority (IDA), under the Chairmanship of the Prime Minister, and recommendations of the Director General of Forests, the Ministry of Environment and Forests (MoEF) and the ANI Administration started phasing out forest working and lowered extraction levels from 123,678 m³ in 1988-89 to 103,660 m³ in 1990-91. However, they subsequently arbitrarily raised the level of extraction to 135,523 m³ in 1994-95. Fortunately, with the closing down of three of the main wood based industries, the extraction levels have now come down. Nearly 60% of the exploitable forests (excluding the tribal reserve and protected areas) in South Andamans, Mayabandar, Little Andaman and Baratang, have already been “worked” and exploited and, consequently, their natural profile significantly changed and their biodiversity value compromised, perhaps forever.

- xii. Another major threat to the forests of the Islands is because of encroachment of forest areas. The A&N Administration had already identified and regularised the forest encroachments of 1,367 families who had encroached up to 1978, on over 2,500 ha of forestland. However, a large proportion of these families continue to occupy additional forestland and continue to further expand and degrade their holdings. Even the families shifted to their designated sites have reportedly encroached additional land. Also, some of the families that had been identified as pre-1978 encroachers have, since then, sold their encroached land and shifted elsewhere. The families that have bought these encroached lands are now claiming to be pre-1978 encroachers. In addition, an estimated 2,325 families have encroached subsequent to 1978 on 2,634 ha of forestland. Most of these encroachments are in some of the last remaining natural lowland forests in North Andaman (Andrews 1999a & b; Andrews & Whitaker 1994a). They also appear to be growing in size and in number.
- xiii. The most significant of the remaining natural forests in Andamans are those within the Jarawa Reserve in South and Middle Andaman and the Onge Reserve in Little Andaman. In recent years the Andaman Trunk Road has been opened and passes adjacent to and in some cases through the tribal reserve. This road, and the increased access to the Jarawas, poses a major threat not only to the Jarawa tribals but also to the forests that they have protected for so many years.
- xiv. The Ministry of Environment and Forests (MoEF) has been granting permission under the Forest (Conservation) Act 1980 for the diversion of forestland for non-forest uses on a case-by-case basis without determining the optimality of the land use and the future options that such a clearance could compromise.
- xv. Poachers from Burma, Sri Lanka, Thailand and Indonesia come to poach timber, sea cucumbers, sharks, crocodiles, turtles and fish around the Andaman and Nicobar Islands. There is also a large population of local poachers operating in the Islands. The Forest Department does not appear to have the requisite legal powers and the infrastructure, especially in terms of human resources, arms, and fast boats, to prevent poaching.
- xvi. Many exotic species of animals and plants have been introduced in the Islands, with a very destructive impact on forest regeneration and on local

species. The introduction of oil palms in Little Andaman, and *Acacia auriculiformis* (from Australia), rubber and teak in various parts of the islands has also had a significant negative impact.

- xvii. Approximately 223,937 m³ of sand was officially extracted from the beaches of the Islands in the three years 1998-2001. A total of 72 beaches around the islands were used for extraction. In addition, it is alleged by local people that there is illegal extraction of sand in considerable quantities. The extraction of sand is being arbitrarily allowed by the MoEF and is causing a great deal of environmental damage. Between 1981 and 2000, 21 marine turtle nesting beaches in ANI have been completely destroyed due to sand mining (Bhaskar 1993, Andrews 2000c, Andrews *et al.* 2001). It is also not a sustainable method of resource use. However, there appears to be no effort to phase out the extraction and to move towards other, more sustainable and safer, methods of construction.
- xviii. The ability of the fragile ecosystem of these islands to withstand the impact of tourism is limited. Apart from disturbance to the forests, there is also disturbance to the marine and coastal ecosystems, especially to the coral reefs. The Islands offer a great potential for high value, low volume, specialised ecotourism that can be undertaken with minimal infrastructure and follows the principles of dispersion and flexibility.

2. PHYSICAL PROFILE

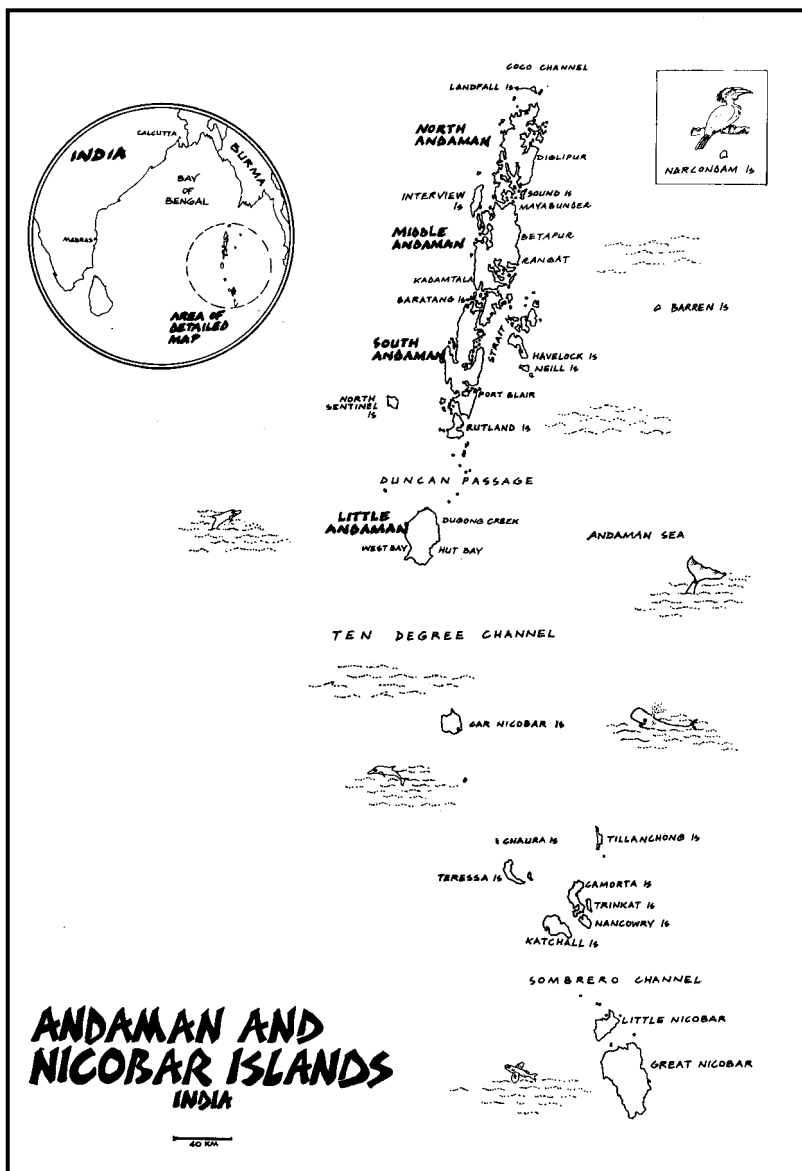
2.1. Geography

The Andaman and Nicobar Islands (ANI) are an archipelago of 306 islands and 206 rocks (see Table 2.1 and Fig. 1.1 below) in the Bay of Bengal, separated by a vast stretch of sea from the eastern coast of the Indian mainland (Pande *et al.* 1991, Anon. 1986). In the entire archipelago, only 38 islands are inhabited, 11 in the Andaman group and the rest in the Nicobars.

Table 2.1: Number of Islands

1	Number of named islands	188	306
2	Number of unnamed islands	118	
3	Number of named rocks	61	266
4	Number of unnamed rocks	205	
Total			572

Source: Planning Commission (Anon. 1986)



The total geographical area is 8,249 km² (Anon. 1986) and the islands stretch 700 kilometres from north to south. The Ten Degree Channel, which separates the northern (Andaman) group from the southern (Nicobar) group, is 160 kilometres wide. The highest point in the archipelago is Saddle Peak, in North Andaman, which rises to a

height of 732 metres above sea level.

The Andaman group of islands is made up of North, Middle and South Andaman Islands, with Baratang Island located between the Middle and the South Andaman Islands. Ritchie's Archipelago is to the east of Middle Andaman and the Tarmugli group of islands lies to the southwest of South Andaman. Rutland is situated off the southern coast of South Andaman, and Little Andaman forms the southern end of the Andaman group of islands. Port Blair, in South Andaman, is the capital of ANI as well as the district headquarters of the Andaman group of islands.

The Nicobar group has twenty-four islands, which cluster into three identifiable groups. Of these, only thirteen are inhabited. The northern section has two islands: Car Nicobar and, to its south, the small island of Battimalv. Car Nicobar is the headquarters of Nicobar district. The middle section of the group is made up of nine islands, with Chowra, Teressa, Bompoka and Katchall to the west, and Nancowry, Camorta, and Trinket to the east. Tillangchong and the Isle of Man lie slightly to the northeast. The southern section consists of two large islands, Little and Great Nicobar, together with the eight smaller islands of Meroe, Trak, Treis, Pulo Milo, Kabra, Menchal, Kondul and Megapode which are smaller islands (Saldhana 1989).

There are 504 inhabited villages in ANI, of which 334 villages are in the Andaman district and the remaining 170 villages are in the Nicobar district (Census of India 1991). The geographic and physical profile of the islands is given in Table 2.2 below.

Table 2.2: Geographical and Physical Profile of ANI

Total Area	8,249 km ²
Area of Andaman District	6,408 km ²
Area of Nicobar District	1,841 km ²
Latitude	6° 45' N to 13° 41' N
Longitude	92° 12' E to 93° 57' E
Mean annual rainfall	3180.5 mm
Average relative humidity	77%
Coastline	1,962 km
Exclusive Economic Zone	600,000 km ²

Source: Pande *et al.* (1991)

“Most of the islands except some smaller ones in the Nicobar group have an undulating terrain with main ridges running north-south. There are also hill

spurs to the east and west. In between the main ridges, submerged valleys form deep inlets and creeks. The average width of the islands is only 20 kilometres. There are a few flat lands and perennial streams. In Great Nicobar there are five perennial rivers. Coral reefs surround most of the Nicobar group” (Anon. 1986).

2.2. Geology

The islands in the ANI group are summits of a submerged mountain range connecting the Arakan Yoma (Manipur-Burma) ranges, through the Coco and Preparis Islands of Burma, to Banda Aceh in Sumatra and the Lesser Sundas. They swing out as an arc into the Bay of Bengal. The origin of these islands is believed to be from a single eruption, tentatively dated late Pliocene to Pleistocene (Chibber 1934). “Geologically these islands belong to a geosynclinal basin. The rocks are highly folded due to frequent tectonic movement in the past. The geological formations represent a period of sedimentation from the Cretaceous to the Sub-Recent period. The surface deposits of gravel beds and raised soil covers are of recent origin. The present configuration took shape only 26 million years ago. The two islands of volcanic origin found here are Narcondam and Barren Islands. The former is apparently extinct while the latter is still active” (ANI F&E 2001). Oldham (1885) Gee (1925) and Rudolf (1969) have previously discussed the geology, fossils and hydrography of these islands.

2.3. Climate

The Andaman and Nicobar Islands are located in the equatorial belt and are exposed to maritime influences. These islands have a tropical climate, which is warm, moist and equable. The temperature ranges from 18°C to 34°C. The proximity of the sea and the abundant rainfall prevent extremes of heat. The islands come under the influence of both the northeast and southwest monsoons. The southwest monsoon, commencing from May, is usually accompanied by high winds. Heavy downpours usually occur in July. The northeast monsoon commencing in November brings in heavy rains from its onset. The rains continue from May to December with a short dry period in October. The average annual rainfall is around 3,000-3,500 mm. Humidity is high, varying from 66% to 85%.

Cyclones often accompany the monsoons and bring in very strong winds, especially during November and May. The cyclonic disturbances are more pronounced during the northeast monsoon.

2.4. Biogeography

India is one of the richest countries in the world in terms of biological diversity and the Andaman and Nicobar Islands contribute to this high level of diversity.

The ANI are purely oceanic in origin and the closest they came to the continent was during the Pleistocene glaciation, when sea level sometimes receded over 150m. It was probably during this period that maximum dispersal of species to the ANI occurred. The biota of the Andamans is closely related to that of Burma and the Malay Peninsula, and that of the Nicobars to Sumatra (Davidar 2001b, Das 1999, Gadgil 1997).

ANI are rich in endemic species because of their long isolation from the adjoining landmass. The Islands are the third most significant area for biodiversity in India, the first two being the Western Ghats and the Eastern Himalayas. For example, the ANI have 144 species of flowering plants and 75 species of land snails that do not occur anywhere else in the world (Gadgil 1997).

a) Biogeographic History

The same tectonic processes that resulted in the uplift of the Himalayas and the Arakan Yomas of Myanmar (Burma) formed the Andaman and Nicobar Islands. The Himalayas are the result of the shock of collision between two continental plates. The Andaman and Nicobar islands were created from the subduction of the Indian Ocean oceanic crust under the Asian plate. When the Indian plate collided with the Asian plate during the Tertiary period, the uplifting of the sea floor and accumulation of debris created this chain of islands, which lie parallel to the fault line (oceanic trench) further west. The island chain probably acquired its present structure in the early Tertiary period, around 25 million years ago. Later upheavals of the sea floor during the Miocene epoch resulted in the formation of several of the archipelagos (Gee 1925, Chibbers 1934, Das 1999, Davidar 2001b).

The Andaman and Nicobar Islands are true oceanic islands because they were formed from sedimentary and volcanic material from the ocean floor. In contrast, islands that geologically are part of a continent and therefore close to it, are known as landbridge islands (Gee 1925, Chibbers 1934, Rodolfo 1969, Das 1999, Davidar 2001b)

The fauna and flora of the Andaman and Nicobar Islands are much richer than many other oceanic islands, probably because of their geological history.

Geological processes such as the uplifting of the ocean floor in the Tertiary period and climatic variations, which caused the drop in sea levels during the Pleistocene epoch, probably brought these islands very close to the continent. The colonisation of flora and fauna, predominantly from Burma for the Andamans and the Greater Sunda Islands for the Nicobars, was therefore comparatively easy. The flora of the Andamans is predominantly allied with that of Burma, and that of the Nicobars to Sumatra and the Malay Peninsula. For the avifauna, there are indications that the Burmese element was predominant, and that the Nicobars have an impoverished subset of the Andamanese avifauna, rather than a distinct Nicobarese avifauna (Davidar 2001b).

The herpetofauna of the Andamans is considered to have Indo-Chinese affinities, being a subset of the Rakhine (Arakan) Yomas of Burma. The herpetofauna of the Nicobars has Indo-Malayan affinities, established largely through waif dispersal across the Great Channel from Sumatra (Das 1999, Andrews 2001).

The distribution patterns of certain taxa in the Andaman Islands are 'nested'. In other words, species on a smaller island are a subset of species on a larger island. Ecological theory indicates that such patterns are typical of extinction-dominated systems. Therefore, it is likely that species on smaller islands are extinction-prone, due to entirely natural processes (Davidar 2001b).

The wet evergreen and semi-evergreen forests on larger islands are the reservoirs of Andaman biodiversity, containing many rare and endemic species and habitat specialists. However, as will be discussed later, they are under severe pressure due to logging and encroachments (Davidar 2001b).

b) Biogeographic Classification

The biogeographic history of the ANI indicates their uniqueness. The scattered islands, covering a small area, have been divided into 11 biogeographic subdivisions (Rodgers and Panwar 1988).

The ANI zone is split into two distinct units:

- 9A: Andaman Islands (with Barren and Narcondam Islands)
- 9B: Nicobar Islands

The Andaman group has by far the larger land area, totalling 6,408 km². Most of the land mass is that of "Great Andaman", which consists of five islands

separated by creeks. These are the North, Middle, and South Andaman, Baratang, and Rutland Island. Little Andaman is some distance to the south. For conservation planning several subdivisions or biogeographic regions are recognised. These are:

- North Andaman
- Middle Andaman
- South Andaman, Baratang and Rutland
- Little Andaman
- Ritchie's Archipelago (geologically recent with calcium-rich soils)
- Off-shore volcanic islands
- East Coast islands
- West Coast islands

The Nicobar group is much smaller, with only 24 islands, and has three subdivisions:

- North group: Car Nicobar and Battimalv
- Teressa, Tilangchong, Camorta, and other small islands
- Little Nicobar and Great Nicobar

There are two levels of variation in the Andaman and Nicobar Islands. One is an ecological separation into different biomes: beach and reef systems, mangroves, littoral forests, deciduous forests, semi-evergreen, valley evergreen and hill slope evergreen forests, with further variation between calcium-rich and calcium-poor strata. The second is a separation by species composition, with each island having its own characteristic community composition, with its own proportion of endemics.

The biological values of the Andaman & Nicobar forests differ from other biogeographical zones in India in that mammals do not dominate their 'conservation merit'. Here it is the plants, the birds and the coastal resources that have the greatest diversities and levels of endemism, and hence are of most conservation significance. Champion and Seth (1968) recognise eleven major forest types in ANI (see the Flora section of Section 2.4.d).

The Andamans have affinities with Burma and northeast India and share many species of Dipterocarpaceae and other forest groups. They, however, have no Dipterocarp affinities to South India. The Nicobars have affinities with

Indonesia. They have no Dipterocarps, and have a high diversity of tree-ferns and palms. The orchid flora of Great Nicobar is particularly illustrative of its floristic affinities.

Though plants have greater powers of dispersal than most animal groups, due to wind, water and animal seed transport, it is not uncommon to find even large trees with tiny restricted distributions within the Andaman & Nicobar Island chain.

Some clues to the understanding of the fauna and flora of ANI can be obtained from the biogeographic theory dealing with island ecosystems. A study of southeast Asian archipelagos shows that the proportion of the archipelago's total number of bird and plant species found on any one island is largely dependent on the area of the island. Species number and island area are related by a significant logarithmic regression. Using published regression coefficients for Indonesian island groups, it is possible to estimate the probable species number for birds and higher plants for islands of varying sizes. To conserve a sizeable proportion of the species of an island system, large and carefully distributed protected areas are needed (Rodgers and Panwar 1988).

c) Ecosystems

An extraordinary variety of habitat types, ranging from sandy beaches to coral reefs, mangroves, and mountains with dense forests, characterize the Andaman & Nicobar Islands. They are located in the equatorial belt and have been endowed with an abundance of flora and fauna. A number of species are endemic and restricted to small areas because of the islands' geographic isolation.

The land area of the island chain is restricted but the diversity of forest types, each with its own distinctive floral and faunal composition, is staggering. Some of the larger islands display a veritable mosaic of forest types. The tropical forest ecosystem continuously recycles water. Since most of the islands have very few perennial rivers and streams, the inland wetlands are restricted. Basically, small ponds formed by rainwater accumulate inside the forests. The ponds are valuable sources of freshwater for wildlife and they also serve as a refuge for endangered species, such as the Andaman teal, and several endemic amphibians that are habitat specialists.

The least disturbed, and the best preserved, mangroves in India can be found on the Andaman & Nicobar Islands. Along with the inland forests, the

mangroves are the predominant terrestrial ecosystem of the islands. Their value in conserving soil and protecting creeks and harbours from siltation and erosion cannot be over-emphasised, particularly in the small islands. The mangrove cover has been variously estimated to be 929 km² in the Andamans and 37 km² in the Nicobars (Anon. 1999), and 1,011 km² in the Andamans alone (Balakrishnan 1998). These mangroves support a rich diversity of fauna and in particular provide breeding and spawning habitats for many aquatic species (Rao & Khan 1990), and to the saltwater crocodile and several species of birds and reptiles.

Grasslands, on the other hand, are an unusual feature found only in a few islands of the Nicobar group. They occur as patches on low hillsides, surrounded by good forest growth, on the islands of Bompoka, Teressa, Katchall and Camorta. There are varied viewpoints regarding their origin. According to one school of thought, they are man-made. This view suggests that the grasslands were created when the forest was cleared over a hundred years ago as part of a Danish effort to develop dairy farming. However, this view is not accepted by a number of scientists who consider the grasslands to have occurred naturally.

The Andaman & Nicobar Islands have a significant marine ecosystem. Although the land area is only 8,249 km², the exclusive economic zone (EEZ) of the islands extending to 200 nautical miles from the shoreline is 75 times larger, approximately 6 lakh (0.6 million) km² (Saldanha 1989). The extraordinary marine biodiversity recorded includes more than 1,200 species of fish, 350 species of echinoderms, 1,000 species of molluscs and many more species of lower forms of life (ANI F&E 2001).

The Andaman & Nicobar coral reefs are the second richest found in the world. Coral reefs surround every island and are estimated to cover around 11,939 km² (Turner *et al.* 2001). They consist mainly of fringing reefs with a barrier reef only on the western side. They are the largest reef formations of the Indian sub-continent and contain as many as 197 species belonging to 58 genera (Turner *et al.* 2001, Vousden 2001). However large tracts of coral and the four west coral banks of the Andamans have yet to be surveyed. Seagrass beds occur in shallow coastal waters and sheltered bays, where clear water allows light penetration. Highly threatened marine animals, such as dugongs and marine turtles, use this habitat essentially as a feeding ground (Das 1996).

d) Fauna and Flora

Fauna

The fauna of both the Indo- Chinese and Indo-Malayan regions has influenced the faunal distribution in ANI. Large mammals are absent in both the Andaman and Nicobar Islands.

Table 2.3: Faunal diversity and endemism in ANI¹

Animal Group	No. of special Subspecies	No. of Endemics	% Endemism
<i>Terrestrial Fauna</i>			
Mammalia	55	32	61.5
Aves	246	99	40.2
Reptilia	76	24	31.6
Amphibia	18	3	16.7
Mollusca	110	77	70.0
Arachnida	94	38	40.4
Hemiptera	146	22	15.0
Diptera	214	24	11.2
Coleoptera	878	92	10.5
Lepidoptera	426	52	12.2
Isoptera	40	19	47.5
Odonata	36	4	11.1
Annelida	30	9	30.0
Total	2,366	495	20.9
<i>Marine Fauna</i>			
Mammalia	7	0	0
Reptilia	12	0	0
Pisces	1,200	2	0.2
Echinodermata	350	4	0.4
Mollusca	1,000	18	1.9
Crustacea	600	6	1.0
Polychaeta	184	4	2.2
Anthozoa	326	2	0.6
Porifera	72	-	-
Meiofauna	490	102	21.0
Total	4,241	138	0.11

(Source: ANI F&E 2001)

The geographic isolation of these islands has resulted in a high degree of endemism. The surrounding seas are equally rich in marine biodiversity. Endemism is more pronounced in land animals (ANI F&E 2001).

The main terrestrial mammals are crab-eating macaque (only in the Nicobars), wild boar, civets, and several species of bats, rats and shrews. “The inland mammals are more interesting, particularly to zoologists, as the islands have been treated as ‘evolutionary laboratories’ since the Darwin-Wallace era.

¹ Das (1999) gives different figures for amphibians and reptiles, listing 12 amphibian species (with 7 endemics) and 45 reptile species (with 15 endemics) for the Andamans. He lists 11 amphibian species (with 2 endemics) and 43 reptile species (with 14 endemics) for the Nicobars. However, there are overlaps in the two lists.

From the faunistic point of view, the most interesting feature is the absence of large mammals and the presence of a considerable number of endemics among the inland vertebrates” (Ellis *et al.* 2000).

The Andaman horseshoe bat *Rhinolophus cognatus* and Car Nicobar flying fox *Pteropus faunulus*, rats such as *Rattus burrus*, *Rattus palmarum*, and *Rattus pulliventer* and shrews such as the Andaman Island spiny shrew *Crocidura hispida* and Nicobar tree shrew *Tupaia nicobarica* are among the endemic mammalian species found here. Endemic subspecies include two subspecies of the wild boar: the Andaman wild pig *Sus scrofa andamanensis* and the Nicobar wild pig *Sus scrofa nicobarensis*. The only other species of large land mammals, spotted deer *Axis axis* and a population of elephants *Elephas maximus*, were introduced into the region. The spotted deer have proliferated and are now widespread. The elephants, abandoned after the discontinuation of logging operations, have now become feral. Ali (2000), Aul and Ali (2001) and Aul (2002) have discussed the effects of browsing by spotted deer and elephants on the ecosystem.

Although marine mammals are not endemic, they are often highly threatened. Dugongs *Dugong dugon*, which are listed as Vulnerable in the IUCN Red List of Threatened Species (IUCN 2000), occur in limited and scattered small populations in areas where there are good seagrass beds. The current status of dugongs in ANI is however virtually unknown and they are very rarely sighted. Settlers in the Andamans have extensively hunted the dugong for meat and oil. Currently fishermen and Nicobarese people have reported seeing large numbers of dead dugongs and whales floating close to the 6° channel south of Great Nicobar Island. These deaths are mainly due to propeller strikes due to the heavy ship and boat traffic from other parts of South-east Asia that transits through the Strait of Malacca between peninsular Malaysia and Sumatra, and passes south of Great Nicobar. The same phenomenon has been observed for leatherback turtles that come to nest on Great Nicobar Island (Andrews *et al.* 2001). The common dolphin *Delphinus delphis* is abundant and is frequently seen in open waters and near the shore. Sightings of blue whale *Balaenoptera musculus* (Endangered) and sperm whale *Physeter catodon* (Vulnerable) in the open seas are occasionally reported.

With a total number of 270 bird species and subspecies (Sankaran & Vijayan 1993) the bird diversity of the ANI is remarkable. Of these, 126 are exclusive to the Andamans and 56 to the Nicobars. BirdLife International (Stattersfield *et al.* 1998) has separately designated the Andaman Islands and the Nicobar Islands as two of the 221 major 'Endemic Bird Areas' of the world. Among the well-known flagship species are the Nicobar scrubfowl or megapode, the Narcondam hornbill and the Nicobar serpent-eagle. The Andaman serpent-eagle, brown coucal (or Andaman crow-pheasant), and the Andaman tree-pie are some of the other endemic species in the Andaman group. The Nicobar sparrowhawk, Blyth's parakeet and Nicobar bulbul (see Table 2.4a for fuller details and scientific names) are among the endemics in the Nicobar group. The endemic subspecies include the Andaman flowerpecker *Dicaeum concolor virescens*, large Andaman parakeet *Psittacula eupatria magnirostris*, Andaman glossy starling *Aplonis panayensis tyleri*, Nicobar ground thrush *Zoothera citrina albogularis*, Andaman teal *Anas gibberifrons albogularis* etc. The Andaman grey-rumped swiftlet *Collocalia fuciphaga inexpectata* belongs to the 'white nest swiftlet' group, whose nests are made entirely of agglutinated saliva and are of very high commercial value in the international market (Sankaran 1995). Over-collection of nests has led to a considerable depletion of its population.

The reptiles include a number of species of snakes. Geckos and lizards are also found along with several threatened species like the Andaman water monitor *Varanus salvator andamanensis*, the saltwater crocodile *Crocodylus porosus* and four species of marine turtles, viz. the endangered olive ridley *Lepidochelys olivacea* and green turtle *Chelonia mydas*, and the critically endangered hawksbill *Eretmochelys imbricata* and leatherback *Dermochelys coriacea* (Bhaskar 1993, Andrews 2000c & 2001, Andrews *et al.* 2001). All of these species breed in the islands. One of the most data deficient groups on the islands are the Amphibians, though some work on them has been done in the Andamans and on Great Nicobar Island (Daniels 1997; Das 1994, 1997a & 1999).

Over 700 species of fish have been identified on the Islands. Of these, the deep-sea fish are a commercially valuable resource for the fishery industry. A special mention must be made of the vast diversity of reef fish. These brightly coloured species are in great demand for live export as ornamental fish. Other

reef-associated fish, such as the clupids and apogonids, are important as live bait for the tuna industry.

There is also an extraordinary diversity of corals and reef-associated invertebrates. The reefs are rich in soft corals. (Pillai 1996, Kulkarni 2001, Turner *et al.* 2001) and arborescent genera like *Acropora*, *Protillopora*, *Seriatopora*, *Stylophora*, etc. are abundant. The reefs harbour a rich diversity of sponges, coelenterates, worms, molluscs, echinoderms, etc. Some are known to possess antibiotic, anti-coagulant and anti-leukaemic properties and they have an enormous potential value in the pharmaceutical industry. Important molluscs include the 'top' and 'turbo' shells, five species of pearl oysters, giant clam *Tridacna* sp., the beautiful pearly nautilus *Nautilus* sp. etc., which are used to make ornaments. Sea cucumbers such as *Holothuria* spp., *Stichopus* spp., *Actinopyga* spp. and *Synapta* spp. are found in the shallow lagoons and have become extremely rare.

The giant robber crab *Birgus latro*, which occurs only in the Southern Nicobar Group, southwestern part of Little Andaman, and South Sentinel Islands, is a flagship species of the inland invertebrates. There is a remarkable diversity among insects, of which several species are rare and threatened. Tables 2.4a & b indicate the distribution of threatened and endemic birds in the different island groups.

Table 2.4a: Distribution of threatened and endemic bird species

ENGLISH COMMON NAME	SCIENTIFIC NAME	IUCN THREAT CATEGORY	DISTRIBUTION	
			ANDAMANS	NICOBARS
Narcondam Hornbill	<i>Aceros narcondami</i>	Vu (D1; D2)	Narcondam	
Nicobar Scrubfowl	<i>Megapodius nicobariensis</i>	Vu (C1)		All islands except Car Nicobar, Pilo Milo & Chaura
Nicobar Bulbul	<i>Hypsipetes nicobariensis</i>	Vu (C1)		Nancowry island group: Camorta, Trinkat, Nacowry, Katchall, Teressa, Bompoka & Tillanchong
Brown-chested Jungle Flycatcher	<i>Rhinomyias brunneata</i>	Vu (C1)	Andamans?	Nicobars?
Nicobar Serpent-eagle	<i>Spilornis minimus</i>	LR / nt		Little Nicobar, Camorta, Nancowry, Teressa, Menchal, Katchall & Trinkat
Andaman Serpent-eagle	<i>Spilornis elgini</i>	LR / nt	Andamans	
Nicobar	<i>Accipiter butleri</i>	LR / nt		Great Nicobar, Little

ENGLISH COMMON NAME	SCIENTIFIC NAME	IUCN THREAT CATEGORY	DISTRIBUTION	
			ANDAMANS	NICOBARS
Sparrowhawk				Nicobar, Nancowry islands, Camorta & Car Nicobar
Beach Thick-knee	<i>Esacus magnirostris</i>	LR / nt	Andamans	
Andaman Wood-pigeon	<i>Columba palumboides</i>	LR / nt	Andamans	Great Nicobar, Nancowry islands, Car Nicobar & Battimalv
Andaman Cuckoo-dove	<i>Macropygia rufipennis</i>	LR/ nt	Andamans	Great Nicobar & Nancowry islands
Nicobar Pigeon	<i>Caloenas nicobarica</i>	LR / nt	Andamans	Nicobar Islands
Nicobar Parakeet	<i>Psittacula caniceps</i>	LR / nt		Great Nicobar, Little Nicobar, Menschal & Kondul
Long-tailed Parakeet	<i>Psittacula longicauda</i>	LR / nt	Andamans	Nicobars
Andaman Scops-owl	<i>Otus balli</i>	LR / nt	Andamans	
Andaman Hawk-owl	<i>Ninox affinis</i>	LR / nt	Andamans	Nicobars
Andaman Woodpecker	<i>Dryocopus hodgei</i>	LR / nt	Andamans	
Andaman Treepie	<i>Dendrocitta baylei</i>	LR / nt	Andamans	
Andaman Drongo	<i>Dicrurus andamensis</i>	LR / nt	Andamans (and Coco Islands, Burma)	
Andaman Crake	<i>Rallina canningi</i>	DD	North, Middle & South Andaman	
Nicobar Scops-owl	<i>Otus alius</i>	DD		Great Nicobar
Brown Coucal	<i>Centropus andamensis</i>	-	Little, South, Middle & North Andaman, Table and Coco Islands (both Burma)	
White-headed Starling	<i>Sturnus erythropygius</i>	-	Andamans	

Source: IUCN (2000), BirdLife International (2000).

Key to threat categories: VU = Vulnerable, LR = Lower Risk, NT = Near Threatened, DD = Data Deficient

Note: Of the 22 species in this table, 20 are threatened. Four species, namely the Brown-chested Jungle Flycatcher, Beach Thick-knee, Nicobar Pigeon and Long-tailed Parakeet, are not endemic, being found also in mainland SE Asia: all the remaining 18 are restricted range species *sensu* BirdLife International (Stattersfield *et al.*1998). Of these 18, 16 species are endemic to India (7 to the Andamans, 6 to the Nicobars and 3 to both), and 2 are near-endemic (being also found just to the north of the Andamans on the Table and Coco Islands which belong to Burma). The Brown-chested Jungle Flycatcher breeds in South-east China and winters in Thailand and Peninsular Malaysia. Its status on the Andaman and Nicobar Islands is unclear, and it is not listed as an Indian threatened species by BirdLife International / IUCN..

Table 2.4b: Distribution of Endemic Bird Taxa

Island Group	Island	No. of endemic bird taxa (includes species and subspecies)
Andamans	North Andaman	40
	Middle Andaman	48
	South Andaman	53
	Little Andaman	34
Nicobars	Teressa	26
	Camorta	31
	Trinkat	28
	Katchall	27
	Little Nicobar	26
	Great Nicobar	31

Source: (Gandhi 2000). NOTE: This table is based on information compiled from several literature sources.

Flora

The vegetation of the islands can be described as belonging to the “island ecosystem which is influenced mainly by edaphic factors and availability of water since there is little climatic variation in the island group” (Ellis *et al.* 2000). The following vegetation types have been differentiated on the basis of climate and soil:

- Andaman moist deciduous forests
- Andaman tropical evergreen forests
- Giant evergreen forests.

Edaphically, the following can be differentiated: Tidal swamp forests (mangroves), Andaman semi-evergreen forests (also called low-altitude evergreen forests), Littoral forests, and Southern hilltop evergreen forests. Champion & Seth (1968) recognised eleven types:

Giant evergreen forests (1A/C1), Andaman tropical evergreen forests (1A/C2), Southern hilltop tropical evergreen forests (1A/C3), Andaman semi-evergreen forests (2A/C1), Andaman moist deciduous forests (3A/C1), Andaman secondary moist deciduous forests (3A/C1/2S1), Tidal swamp forests (4B/TS2), Littoral forests (4A/L1), Cane brakes (1/E1), Wet bamboo brakes (1/E2), and Sub-montane hill valley swamp forests (4C/FS2).

The endemic flagship floral species of the Andamans are *Dipterocarpus andamanicus*, *Dysoxylum andamanicum*, *Planchonella kingiana*, *Litsea leiantha* and *Glochidion subsessile* while the keystone endemic species are *Garcinia andamanica* var. *andamanica*, *Mangifera andamanica*, *Syzygium kurzii* var. *andamanica*, *Syzygium manii*, *Canthium andamanicum*, *Canthium gracilipes*,

Phyllanthus andamanica. The endemic flagship species of the Nicobar group of islands are *Nathophoebe panduriformis* var. *paucinervia*, *Nathophoebe nicobarica*, *Macaranga nicobarica*, *Trigonossiemon nicobaricus*, *Amoora wallichii* and *Terminalia manii*, while the keystone endemic species of this region are *Embelia microcalyx*, *Dillenia andamanica* and *Measa andamanica* (Nayar 1996, quoted in Ellis *et al.* 2000). The World Conservation Monitoring Centre, U.K., has recorded 365 species of plants in the Andaman & Nicobar Islands as threatened (WCMC, 1994).

Surveys report that, in Great Nicobar alone, 11% of the vascular flora are endemic to the island, 30 species are rare, endangered and confined to a few locations on the island, and about 30% of the flora are extra-Indian, i.e. not found on the Indian mainland. Characteristic endemics such as the tree-fern *Cyathea albo-setacea* and an ornamental orchid *Phalaenopsis speciosa* are found only on Great Nicobar and adjacent islands (Pande *et al.* 1991).

The Islands are a vast and precious storehouse of plant genetic resources, medicinal plants, and wild relatives of economically important cultivated plants. Rao (1996) reported 2000 species of which 14 % were thought to be endemic. Table 2.5 shows the distribution of endemic and threatened plants of the ANI, while Table 2.6 gives the patterns of exploitation of the Andaman islands' wildlife, including naturally occurring plants.

Table 2.5: Distribution of Endemic and Threatened Plants of Andaman and Nicobar Islands

Island Group	Island	No. of endemic plants	No. of threatened plants
Andamans	North Andaman	17	6
	Middle Andaman	16	14
	Narcondam	2	2
	South Andaman	61	54
	Little Andaman	7	-
Nicobars	Car Nicobar	1	-
	Camorta	-	11
	Katchall	-	10
	Great Nicobar	29	38

Sources: 1) Threatened Plants from Pande *et al.* (1991)
2) Endemic Plants from Saldanha (1989).

Table 2.6: Status and Exploitation of Wildlife Resources of the Andamans

Name	Species	Status	Use
Sea cucumbers	Holothurians 40 species including commercial species	Critically endangered	Food (export)
Shells (molluscs)	Many species including <i>Trochus</i> , <i>Turbo</i>	Endangered	For mother of pearl and fancy work (export)
Lobsters	12 species	Endangered	Food/export
Prawns	12 species	Abundant locally	Food/export
Crabs	60 species including 3 commercial species	Abundant / commercial species / endangered	Food/export
Sea weeds	55 species including commercial species	Abundant	Food
Oyster	Blacklip pearl oyster	Status unknown	For mother of pearl and fancy work (export)
Giant clam	<i>Tridacna</i>	Highly endangered	Food
Fish	1200 species, 2 endemic	Most status unknown	Food, sport
Deer	<i>Axis axis</i> , <i>Muntiacus muntjak</i>	Abundant in most areas but not Little Andaman	Food, sport, skin, velvet (export)
Wild pig`	<i>Sus andamanensis</i>	Critically engangered	Food for tribals
Crocodile	<i>Crocodylus porosus</i>	Critically endangered	Food, leather, medicine (export)
Sea turtles	Green turtle, olive ridley, hawksbill & leatherback	Critically endangered	Food, leather, calipee (export)
Water monitor lizard	<i>Varanus salvator</i>	Endangered	Food, leather (export)
Venomous snakes	Six species	Critically endangered	Venom (export)
Orchids	Many species	Some species abundant on felled trees	Export market
Bee honey	Several species	Seasonally abundant	Trade item for tribals
Butterflies, moths, other arthropods	Many species	Some species abundant most status unknown	Export market
Swiftlet nests	<i>Collocalia fuciphaga</i>	Critically endangered	Trade item for tribals (export)
Medicine herbs	Many species	Status unknown	Medicines (export)

Source:Harry Andrews, 2001 & personal comments, 2002

3. SOCIAL PROFILE

The total population of the islands, according to the 2001 census, is 356,265. The population comprises of tribals (indigenous) groups, of former convicts and their descendants, of settlers from the mainland brought especially by the government to populate the islands, of subsequent spontaneous immigrants, of refugees and a small Karen population. There are also many civil servants and other professionals who are in the islands temporarily. There has been a steep rise in population in the last two decades and the islands are commonly seen to be facing a “carrying capacity” crunch.

3.1. The Indigenous People

ANI has six groups of indigenous people. Four groups of Negrito, hunter-gatherer tribes, each with a small population, live on the Andaman Islands. The Nicobar Islands have the remaining two, of which, one is a small, primitive, hunter-gatherer-horticultural group, and the other is a larger group who are agriculturalists. Both belong to the Mongoloid race. There are various vague references to them in the early written records (mentioned later) of these Islands. The indigenous groups are a part of the rainforest ecosystem and know the art of living in harmony with nature. The hunter-gatherer tribes historically had no fixed settlements, only fixed territory, which was their range. They moved around in bands, which consisted of a few related families.

Box 1: The Andaman and Nicobar Islands (Protection of Aboriginal Tribes) Regulation 1956

1.(2) No land held or occupied by any member of an aboriginal tribe shall be liable to attachment or sale in execution of any decree or order of a civil or revenue court.

7. The Chief Commissioner may, by notification, prohibit any person other than a member of -an aboriginal tribe or any class of persons other than members of an aboriginal tribe from entering a reserved area except on the authority and subject to the observance of conditions and restrictions of a pass granted by the Deputy Commissioner or by such other officer the Deputy Commissioner may authorize in writing on this behalf.

8.(2). Whosoever, in contravention of a notification issued under section 7, enters a reserved area shall be punishable with imprisonment which may extend to one year, or with fine which may extend to one thousand rupees, or with both.

9. The Chief Commissioner, or any person authorized by him in this behalf, may arrest without warrant any person who has committed, or is suspected of having committed, any offence punishable under this regulation.

10.(1) The Chief Commissioner may, by notification, make rules to carry out the purposes of this Regulation

Notification number ANPATR/3(1), dated 2nd April 1957 describes the areas declared as tribal reserves.

Under subsection of Section 3, (a&b) much of the area of -South Andaman and Middle Andaman were reserved for the Jarawas.

(c) The entire area comprised in and within the coastline of each of the following Islands

(vii) South Sentinel and other Islands and Islets situated south-wards in the territory of the Andaman and Nicobar Islands up to and including Little Andaman.

With colonisation, their lands were usurped and they were herded together into smaller areas. The six tribal groups have been exposed to various levels of contacts with outsiders and some, like the Nicobarese, have integrated well with the Indian “mainstream” (cultural milieu). Others, like the Sentinelese, have been resisting contact. The Jarawas were doing the same until recently. The Onges have accepted the presence of outsiders and the Shompens are shy but not hostile. Some of them, like the Great Andamanese, who eventually became friendly with the colonisers, became prone to new infections and perished in large numbers. Many tribal lives were also lost in unequal battles with the colonisers.

These factors have resulted in the primitive tribes being reduced to an alarmingly low and unviable population (see Fig. 3.1). The Government and the scientific community have realised their past mistakes and have tried to make amends. The Government has designated various areas (see Table 3.1) as Tribal Reserves under the Andaman and Nicobar Islands (Protection of Aboriginal Tribes) Regulation of 1956 (to be called The Regulation 1956, hereinafter).

Table 3.1: ANI (Protection of Aboriginal Tribes Regulation) 1956

Area and Location of Tribal Reserve	Beneficiary Tribe
853.19 km ² of Great Nicobar Island	For the Shompens/ Nicobarese
520 km ² of Little Andaman	For the Onges
59.67 km ² of North Sentinel	For the Sentinelese
6.01 km ² of Strait Island	For the Andamanese
912.19 km ² of western part of Middle and South Andaman and Bluff and Spike islands	For the Jarawas
914.81 km ² of several islands in Nicobars	For the Nicobarese

(Source: Singh 2002)

The Regulation 1956 mentions many more islands in the Andaman and Nicobar groups of Islands. Strict protection of these tribes is enforced only in the reserves mentioned in Table 3.1 above.

a) Sentinelese

The Sentinelese live on North Sentinel Island, 60 km southwest of Port Blair. The estimated population of the Sentinelese is between 100 and 150. They occupy the entire island, which is estimated to be 60 km² (Pande *et al.* 1991) and 20 km² according to Reddy and Sudarsen (undated).

They live in complete isolation and spurn all attempts at “friendly contact.” In 1967, two different teams landed on North Sentinel Island. The teams spotted the Sentinelese and left presents for them in their huts. It is reported that in one of the later expeditions, a member of the contact party fired in the air and this might have antagonised the tribals. For a long time they were hostile towards outsiders but in January and February 1991 anthropologists were able to establish friendly contacts (Pande *et al.* 1991).

Box 2: Let us leave the tribes alone

In 1896, Portman, a British anthropologist wrote, “Years of intercourse with the Andamans have taught us that civilization can give them nothing to compensate for the life in their own jungle, and however kindly and well-treated they may be, they are always ready to leave the settlement -with its comforts (and to them luxuries), for their wild jungle life, its sport, food and amusements. If we ask why the Andamanese have not been civilized, the answer is that civilization cannot be forced upon a race; a want must be created before it can be gratified and to attempt as at one time was done, to force a nomadic hunting race to become agriculturalist, when the labour of agriculture is irksome, takes people from pursuits they like, and does not supply any want they feel, is both absurd and impolite”

The Andamanese today are a ruined lot. But in the case of Onges, Jarawas, Shompens and Sentinelese, there is still time. Let us stop the contact missions before it is too late. Source: Business Standard (25 Aug, 1993).

Very little information is available on Sentinelese ethnography. Occasional

Box 3: The Jarawas and The Andamanese

“The tribes living in these islands had their own territory for movement and the entry of a stranger who causes damage to the area could not be liked, naturally by the aborigines. By the time the British authorities tried to establish friendly relations with the Jarawa a lot of encroachment and deforestation had taken place in their neighbouring Great Andamanese area, which the Jarawa must have observed with great fear and suspicion. The fear and suspicion further increased as they saw the British taking active help from the Great Andamanese in punitive expeditions. The Great Andamanese and Jarawa had their own territory for hunting and gathering. As a tribal characteristic, any encroachment in another’s territory caused provocation and infighting. Moreover there might have been an inherent rivalry between these two tribes, as the Jarawa seemed to be a later migrant into the Great Andamanese land. Cipriani from the data on ‘kitchen midden,’ material culture and nature of movement of the Onge and Jarawa deduced that a section of the Onge migrated towards the north from Little Andaman via Rutland and entered Andaman and encroached Andamanese territory (Cipriani 1966: 86). This naturally could create a feeling of traditional mutual hostility between the two tribes. Therefore, when the British took the help of the Great Andamanese, the traditional enemies of the Jarawas, in the course of punitive expeditions, they marked the British as their enemy like the Great Andamanese. The latter after getting firearms from the British authorities for fighting the Jarawas, also took full advantage of using these against their rival and killed a large number of Jarawas and damaged their habitat in the course of several punitive expeditions.” (Census of India 1931: 16). Source: Sarkar (1989).

visits and landings on the Islands have indicated small, lean-to, types of thatched huts, open from the sides, and used as living quarters. Like other Negrito tribes, perhaps they also move in small bands for hunting purposes. They have small dug-outs, outriggered canoes which they ply on shallow waters with the help of a long pole. They apparently know the use of iron because they have arrowheads and harpoons. Raw honey stored in wooden buckets was found inside their huts (Sarkar 1989).

Lately, the Government has started sending out contact teams with gifts to North Sentinel Island. Initially the Sentinelese did not touch the gifts, but during later visits they started picking

them up after the visitors had left. So far their isolation has protected them, but if “contact missions” (see under Jarawas for more information on contact missions) win them over, it is difficult to predict their future (Anon. undated).

The master plan by S.A. Awaradi is critical of the inclusion of VIPs and special visitors in the “contact missions”. The gifts of coconuts and machetes that are dropped on the island also may not be necessary or helpful to them. “The Sentinelese do not require the benevolence of modern civilization and if at all they require anything it is non-interference” (Awaradi 1990). He feels that introducing new food items may create complications to their digestive systems. He recommends that expeditions to North Sentinel Island be organised only occasionally and that the ship should be anchored at least 50 metres from the shore. This could facilitate observations of the island and its inhabitants without unduly disturbing them.

b) Jarawas

The Jarawas, estimated to be around 250 in number, are another Negrito tribe living in the west coast of South and Middle Andaman. They are hunter-gatherers and are semi-nomadic. The history of the British contact with the Jarawas and some probable reasons for their hostility has been discussed in Section 5.1. The Jarawas suffered loss of life in numerous punitive expeditions sent by the British and suffered at the hands of the Japanese during the Second World War. The attempts to study Jarawa ethnography did not succeed for a long time as they were hostile to visitors to their territory. In the last few years, however, more information about their way of life has been available because of the establishment of friendly contacts due to the "contact missions / parties". Anthropologists have located three areas in Middle Andaman where their community huts are found. Besides these community huts, there are a number of smaller shelters where individual families stay when they move out of these huts. All their shelters are located near freshwater streams. Their customs and habits are very similar to the Onges. Adult men paint their faces with white and red clay. They do not have canoes like the other Negrito tribes. They are known to fish with small nets and use small rafts to cross the creeks.

In 1968, three Jarawa boys were captured and brought to Port Blair. They were kept for a month, showered with gifts and then released. This may have had some impact, and in 1974 the Jarawas made their first efforts to come forward to

Box 4: Public Interest Litigation by SANE

In the PIL, it has rightly been pointed out that depletion of the forest areas reserved for the Jarawas, frequent intrusion and encroachment in the said area and construction of the Andaman Trunk Road through the reserved area have caused problems to the Jarawas. The area reserved as a tribal reserve as per the notification ANPATR/3(1) of 02.04.2957 and a subsequent partial modification dated 19.07.1979, has been violated in many ways.

a) Today, the northern region of the tribal reserve has been encroached upon by settlers/immigrants establishing the following villages: 1) Ganesh Nagar, 2) Sippi Tikry, 3) Khokdi Dubla and 4) Balu Dabla.

In the southern region of Middle Andaman Island, a village called Phool Tala was encroached and is now occupied by non-Jarawas immediately next to the Jarawa reserved area. Further, forest camps such as at (1) Jirkatang No. 7, (2) Puttatang in South Andaman Island, (3) Kesri Deva, (4) Boroinyol and (5) Chanlungta in Middle Andaman Island are located both within and next to the tribal reserve.

In this regard, the report of the committee of anthropologists on the Jarawa and Shompen situation, Part 1, 1981, states, "No habitations, either official or private, should be located in the vicinity of the boundary of the Jarawa reserve, and certainly not in the reserve."

b) Further settlement areas at Jirkatang, Tirur, Kadamtala and Kalsi have grown in population over the years leading to an increased dependence on the reserved forest for natural resources such as minor timber products, meat of wild animals and also sand for construction.

meet the bush police when they came to drop off the gifts. After this, a formal contact mission was established to go to the Jarawa area with gifts. A doctor and an anthropologist were included and the constitution of the contact party was entrusted to the Deputy Commissioner of Andaman (Anon. undated).

A large number of VIPs and their friends were included in the contact party. It was difficult to collect information because the members of the contact party were changing according to the wishes of the authorities. The Master Plan admits that the present way of organising contact missions needs to be reviewed. The original purpose was to establish friendly contact with Jarawas, which was accomplished in 1974 in Middle Andaman and in 1989 in South Andaman. The continuation of this practice may now cause more harm than good, as members of the contact mission may introduce communicable diseases. Though therefore a screening of members is mandated, in practice this does not always happen. The earlier practice of giving cooked rice has been discontinued on the grounds that if it turns stale, it may cause health problems. The presentation of gifts like puffed rice, coconuts and bananas too may turn hazardous. Furthermore, the Jarawa may become dependent on these food items. Such gifts may ruin their health and culture by making them dependent on the government (Awaradi 1990). This system continues to date. However, some experts still feel that hunter-gatherer

tribes like the Jarawas should be left alone to continue their traditional mode of life.

The Jarawa habitat has also been affected by the construction of the Andaman Trunk Road (ATR) connecting Port Blair to Diglipur in North Andaman. The rainforest was clear-felled for construction of the road and labour camps that were pitched along its length. Though these camps were

Box 5: Poachers in the Jarawa Reserve:

Poachers enter Jarawa areas to hunt deer. Wherever and whenever these poachers encounter Jarawas, they kill them with their firearms and burn their huts. These poachers do not hesitate even to kill their small children, according to information. Whenever there is a feast in the residence of some influential politician or a bureaucrat, hunting parties are sent into the prohibited areas to kill deer for the feast. (*The Light of Andaman 1988*). Source: Reddy and Sudarsen (undated).

supposed to be temporary, the labourers were allowed to build their own huts. After the completion of the construction of ATR, many labourers have stayed on and use the forest resources for their livelihood. "The encroachers on this land that rightfully belongs to the Jarawas have actually been rewarded by the administration's decision to legalise illegal occupancy of land belonging to the tribals, who are unable to defend their rights in courts. The administration has legalized all encroachments made up to 1978" (Anon. undated).

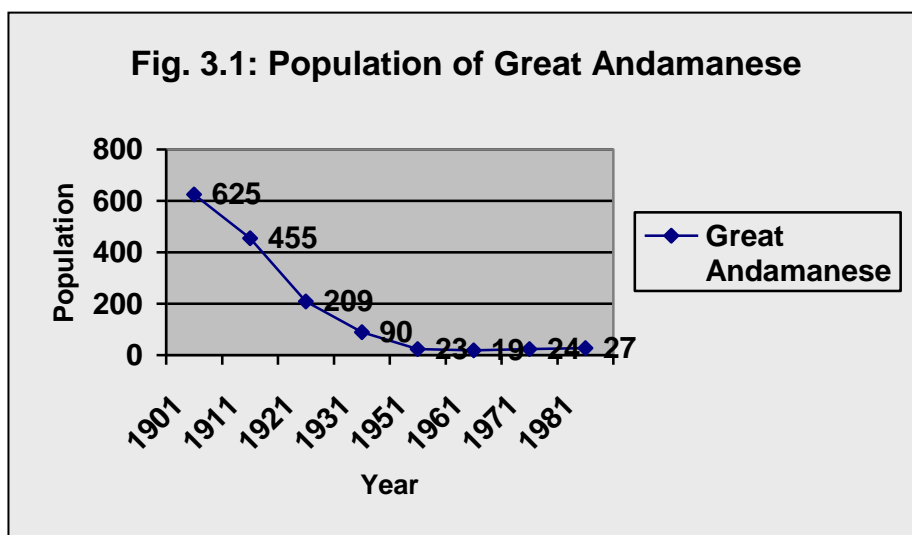
Recently, the administration made a welcome decision. It has stopped issuing live ammunition to the Bush Police (see Section 5.1 on history). It has drastically cut down the total arms license near tribal areas. The new rule makes the possession of more than 10 cartridges at a time, subject to a maximum of 50 cartridges annually, illegal. This may help the Jarawas to have a more peaceful life in their reserve, as poachers, loggers and other settlers are unlikely to venture into the reserve without sufficient arms (Anon. undated). However, they still have a host of other problems and impacts on their Reserve by poachers and fishermen (mainly local), and in particular with the increased contact with outsiders in recent years (Sarkar, 1990; Andrews 1999b).

c) Great Andamanese

From a reported 5,000 population at the beginning of the 20th century, the Andamanese declined to 19 persons in 1961, and then increased to 24, according to the 1971 Census of India (see Fig. 3.1). In 1970, a few individuals of this tribe lived around Port Blair in miserable conditions, but preserving their identity. "Near Memyo village in South Andaman, there were 18 people living in Pipaldera and Nanmaria hamlets. Four individuals were attached as labourers to Burmese families at Memetora hamlet in South Andaman" (Sarkar 1989).

The Andamanese had become indebted to the Burmese and therefore were their bonded labourers due to their addiction to opium and alcohol. It is reported that in some cases they even married their women to Burmese men. Some of them were employed in government departments. Some elders living near Tirur were dependent on hunting, fishing and collection of shells.

In 1970, the Andamanese were resettled on Strait Island, which has an area of 6 km². Their traditional occupations of hunting and fishing are rarely practised (Awaradi 1990). They depend on rations handed out by the administration. Medical teams appointed by the Government examine the health of the Andamanese (Anon. 1988, Verma 1989). The medical missions are critical



of this forced change of diet in the tribal communities like the Onge and the Andamanese. They feel that this dependence

must be reduced and the tribals must be encouraged to keep to their original diet.

The Great Andamanese now speak a form of 'Aka-jeru' dialect among themselves. But the younger generation no longer remembers or learns their own language: they now communicate, even among themselves, in Hindi. They neither practice their traditional subsistence economy nor are they profitably engaged in economic activities like raising coconut plantations, introduced by the administration (Awaradi 1990).

Awaradi (1990) further states that the issue of rations and cash compensations should be withdrawn in a gradual manner and they should be encouraged to live both through hunting and gathering, and through working for cash compensation in plantations. Gradually they must be made to own the coconut plantations and operate them themselves. They should also be encouraged to continue their cultural practices such as dances and rituals.

d) Onges

The Onges inhabit the island of Little Andaman. The entire island of 732 km² was their home before 1967. The Onges became friendly with outsiders about 20 years after their initial contact with the British in 1886 (see Section 5.1 on History). Originally they consisted of three groups, each having their own foraging territory. Each area had its own community huts to which individual bands would retire during the rainy season. Depending on the season, they would either hunt or fish, and erect lean-to types of individual huts wherever they were engaged in these activities.

Until recently, the Onges lived on the food collected by hunting, fishing and gathering. Their diet included meat of wild boar, dugong, turtle and other smaller marine organisms, as well as roots, tubers and honey. Awaradi cites various anthropological works which say that they must have been originally dependent entirely on fish and that the pigs were introduced by the Nicobarese and the Onges learnt to hunt them. Later accounts by anthropologists record the ritual hunting (*tanageru*) of pigs by Onge youths to celebrate the coming of age. However, in recent years the continuation of the traditional Onge way of life has become a problem because pigs are becoming rare on Little Andaman and there are major impacts in their reserve (Andrews 2000a).

In 1969, the Government started a programme of settling refugees on Little Andaman. Nicobarese from Car Nicobar were also brought here and settled in Hut Bay. The Onges' area of foraging was restricted and settlers started competing with them to hunt pigs. Increased sea traffic also reduced their fish catch.

In April 1972, the tribal reserve of the Onges comprising the entire area of Little Andaman was partly denotified to exclude the eastern coast located between longitudes 92°28' East to 92°35' East and latitudes 10°34' North to 10°44' North. In 1974, the administration decided to settle the Onges in two areas, viz. Dugong Creek and South Bay. As a welfare measure in the third Five Year Plan, 100 acres of land in Dugong Creek was brought under coconut plantation in the hope of introducing a plantation economy to them. Meanwhile, the Onge population was declining at an alarming rate. From an initial population of 672 in 1901, it reduced to 112 in 1971 and to 97 in 1987 (Sarkar 1989, Paul 1992).

There were many causes for the disturbance to the equilibrium of Onge society. "In 1977, more than two-thirds of the 732 km² of Onge land on Little

Andaman was allotted to settlers and the Forest Development Corporation (see Box 1 on the Regulation 1956). For centuries, the Onge camps were spread out all over the island, and were frequently visited. Since 1972 they have been marginalised to a reserve of 520 km² and confined to two areas, Dugong Creek (on the northeast side of the island) and South Bay (on the southwest) (Pandya 1993, Reddy 1994, Andrews 2000a). The bands have decreased in number and their social customs like exogamous marriages are also under stress because of their reduced population. Many anthropologists and medical missions have studied the problem of dwindling numbers in detail (Swaminathan & Rao 1971, Cooper 1992).

The Onges are settled in houses with asbestos roofing, built on wooden stilts, in Dugong Creek. People who once roamed free are made to live in these houses. However, they still carry on a part of their earlier tradition of hunting and gathering. When the weather becomes too hot, they shift to a community hut (*corale*), which they have built in the settlement. This hut is much cooler than their wooden houses. They work in the coconut plantations for part of the time. They have not yet developed a sense of ownership towards the plantations. They are paid some cash income for working in the plantations. The administration gives them a monthly subsistence ration, as in the case of the Great Andamanese. The medical missions are against this dole as it introduces alien food and makes them indolent and dependent on the Government.

Box 6: Settlement on Little Andaman

The Onges had to shift from their prime habitat near the Eastern Coast, which had freshwater sources. The settler population increased from 7,114 in 1981 to 11,247 in 1991, whereas the Onges declined from 672 in 1901 to 101 in 1991. The construction of roads and the jetty, and the clearing of 5,200 hectares of forest for settlements and for red oil palm plantation, further displaced the Onges from their traditional ranges. "Thus the Onge land which once extended from Little Andaman to Rutland Island adjacent to South Andaman and included the Brother, Sister, Passage and Cinque Islands shrunk to a tiny segment of Little Andaman" (Anon, undated).

Changes have also occurred in their socio-political system. Representatives of the Onge and Great Andamanese are nominated to the Andaman Pradesh Council and are consulted to ascertain their needs. The nominated representatives are normally young. Traditionally, the Negrito tribes have had no leaders, but their elders are respected for their experience and wisdom. Since the elders do not have the necessary communication skills to deal with outsiders, younger members are co-opted. The views of these members are not always the views of the tribe (Sarkar 1989).

e) Shompens

The Shompen (a Mongoloid tribe) live on Great Nicobar Island and are hunter-gatherers. Their settlements are found near fresh water sources, like hill streams and at least 12 groups live along the inland forest of Great Nicobar Island (Harry Andrews, personal observations). During the dry season, they shift their camps to new areas within a radius of five to ten kilometres. They get their protein intake from wild boar, from fish caught in the streams, and from crocodiles, monitor lizards and pythons.

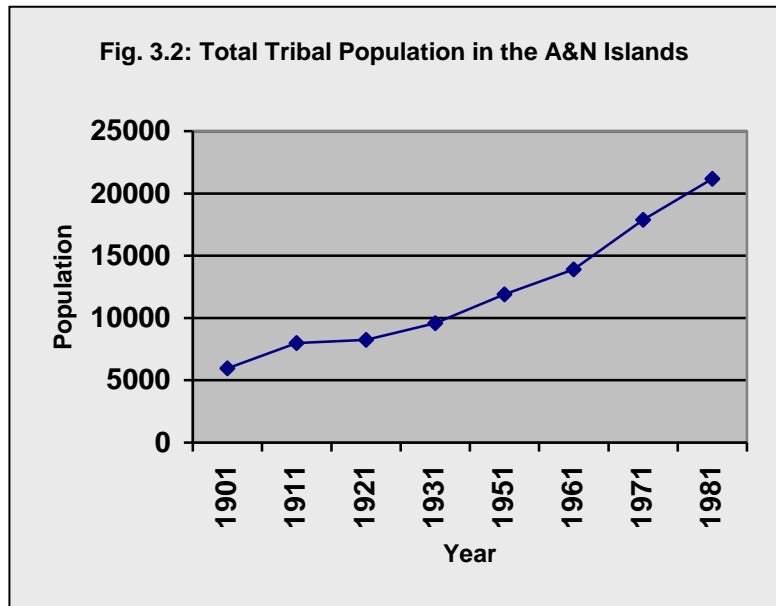
Sarkar (1989) mentions the various groups of Shompens inhabiting the forests of Great Nicobar. The group living near Laful and Trinket Channel in the eastern coast of the island visits Campbell Bay, the administrative headquarters of the island. Another group lives on the west coast, 25 km east of the Nicobari village of Pilo Bhabi. A fourth group lives inside the forest at a place called Nariel Tekri. They have contacts with the Nicobarese of South Bay and Nicobarese on the west coast as well. There is one more group living deep inside the forest below Mount Thullier. This group is known to be unfriendly and aloof but some times they mingle with Nicobarese and Forest Department workers.

Individual settlements of Shompens have only four to five huts, perhaps of related families. Many groups have barter exchanges with coastal Nicobarese. Some even work for the Nicobarese. Sarkar (1989) estimated their population to be 214 in 1981. Awaradi in his Master Plan estimates the population to be 135. He reports that during the year 1985 – 87, an epidemic of dysentery occurred, which could have wiped out many people. “The bacillus causing dysentery invaded the Shompen camps through the coastal Nicobarese of Great Nicobar and Kodul” (Awaradi 1990). Current estimates indicate their population is around 280.

Nicobar has not yet experienced a huge influx of immigrants like the Andaman Islands. Yet there has been enough disturbance caused to the Shompens through the settling of 303 families of ex-Servicemen along the road constructed from Campbell Bay in the east to Indira Point. “The settlements of these families have come up to the fringe of the Shompen habitats. Another road recently constructed from east to west has also opened the area to outsiders. Besides the age-old restriction of movement of the Shompens towards the coastal areas due to the presence of the Nicobarese, the establishment of settlements

under rehabilitation programmes and clearing of forests for other infrastructural development have already affected the free movement of the Shompen for hunting and gathering” (Sarkar 1989).

Their contact with outsiders has increased because of all these developments. Today some of them visit Campbell Bay and exchange honey and other forest products with the Nicobarese and also collect the rations



supplied to them by the Government. In the recent past, a “Shompen Complex” has been developed on the East-West road. Horticultural plants are grown here for demonstration. There is a government-appointed doctor who visits periodically and a social worker who lives in the Shompen camp. Interestingly, over the last six years, only the same 50 odd Shompens have been visiting this camp, perhaps because the camp is on their hunting and transit route (Andrews, in prep.).

f) Nicobarese

The Nicobarese are the largest tribal group in the island. Their population was estimated to be 22,000 in 1988 (Saldanha 1989). They live in 156 villages spread throughout the Nicobar district, with the greatest concentration in Car Nicobar (13,574). They grow coconuts, roots and tubers and rear pigs, chickens and some cattle. They are also good fishermen and catch fish in coastal waters, using nets or harpoons, and traditional dugout canoes with outriggers.

Earlier encouraged by missionaries and presently supported by the Government, 18% of the Nicobarese have become literate. They have adjusted to the external culture and their population, unlike that of the other primitive tribal groups, is growing. The Integrated Tribal Development Programme covers the entire Nicobar district, which has specific programmes to cater to their needs. Besides, many islands of the Nicobar group have been declared Tribal Reserves under the Andaman and Nicobar Islands (Protection of the Aboriginal Tribes

Regulation) 1956. The barter trade of earlier years has been presently replaced by co-operative societies.

The pressure of the Nicobarese population on land is building up. Originally, 60 families were shifted from Car Nicobar to Harmender Bay in 1973. Now they have grown to 165 families and the original allotment of 200 ha of land has now become inadequate (Saldanha 1989). Table 3.2 shows the population statistics of the various tribal groups.

Table 3.2: Tribal Population in ANI

Tribes	1901	1911	1921	1931	1941	1951	1961	1971	1981
Great Andamanese	625	455	209	90	-	23	19	24	27
Onges	572*	631*	346*	250	-	150*	129	112	97
Jarawas	468*	114*	114*	70*	-	50*	500*	275*	200*
Sentinelese	117*	117*	117*	50*	-	-	50*	82*	100*
Shompens	348*	375*	375*	200*	-	20*	71	92	214
Car Nicobarese	3451	5550	6087	7182	-	8274	-	12338	13514
Chowrite	522	548	234	615	-	1076	-	1323	1114
Terressan	702	656	640	506	-	596	-	788	1215
Central Nicobarese	1095	1165	1071	1041	-	1551	-	2876	4349
Southern Nicobarese	192	272	216	245	-	405	-	549	980
Total	5962	7991	8248	9589	-	11902	13903	17874	21172

Source: Census of India (1991). * = Estimated population.

Fig. 3.2 shows the growth of the total population of tribal people in the ANI. The increase in population is mostly due to the growth of the Nicobarese population, as can be seen from Table 3.2.

3.2. The Settlers

a) Convicts

The first settlers of the islands were mainly convicts and ex-convicts. The convicts first came to ANI with the first penal settlement, which was established in March 1858. The first batch consisted of 733 convicts and 4 officers (see section 5.1). The forests in Chatham Island and around Port Blair were cleared for the settlement (Mathur 1968). In 1874, the settlement was placed judicially under the Government of India and provisions were made for the release of life-term convicts, after 20-25 years of penal servitude with good conduct (Portman 1899, Awaradi 1990). In 1869 a penal settlement was also established in Great Nicobar. There were a series of visits / inspections of the settlement by different officers. This was also due to high mortality among convicts. One of the inspection reports

(1890) favoured the settlement of released prisoners in the Andamans instead of allowing them to return to the mainland. In 1904, the Superintendent of Port Blair, in his note to the Government, recommended that the settlement should be abolished.

In the 1920s, the policy of the Government was directed towards converting the penal settlement into a self-supporting community. In 1926, out of a total convict population of 7,740, there were 2,105 self-supporters drawing wages from the government and 2,272 agricultural self-supporters. The transportation of convicts from the mainland to the Andamans came to an end after the penal settlement was abolished in 1945 (Mathur 1968).

In addition, the Moplahs of Kerala were also deported to the ANI after the Moplah rebellion, and settled here in 1921. The Bhattus, a criminal tribe of Uttar Pradesh, were also settled in ANI in 1926. All these settlements were in and around the town of Port Blair (Awaradi 1990).

b) Refugees

Refugees from Bangladesh (East Pakistan) were settled in the Andaman Islands between 1950 and 1960. Each family was given two hectares of flat land for paddy cultivation, two hectares of hilly land for tree crops and 0.4 hectare of land to build a home. Twelve tons of timber was given for building the houses. Besides this, five tons was given once every five years for repairs, and one ton for making tools or a dinghy (boat). Licenses to extract liberal quantities of firewood, bamboo posts, thatching leaves and canes were also given. These privileges continue, but have been slightly reduced (Saldanha 1989).

Between 1969 and 1979, 614 families of displaced persons from East Pakistan were also settled in Little Andaman. Some 300 Sri Lankan refugees were also settled in the Central Nicobars and their population has now grown to thousands and has become a major concern for the people of Nicobar.

c) Mainlanders

The other large groups are from Tamil Nadu, Andhra Pradesh and Kerala and they all work in the service (tertiary) sector. The labour force working in forestry operations, the Public Works Department and the harbour are from Chotanagpur in Bihar. Though some have returned home, many have stayed on the island. With the establishment of forestry operations in Little Andaman, a number of government officials, labourers and contractors also settled there.

**Table 3.3: Decadal Population Growth in ANI
1901-2001**

Year	Andaman Islands	Nicobar Islands	Total
1901			24,649
1911			26,459
1921			27,086
1931			29,463
1941			33,768
1951			30,971
1961	48,985	14,563	63,548
1971	93,468	21,665	115,133
1981	158,287	30,454	188,741
1991	241,453	39,208	280,661
2001			356,265

Besides the refugees settled on the islands by the Government, there has been a steady inflow of voluntary immigrants from various parts of the mainland since independence. This massive population growth is straining the Islands' fragile ecosystem. Only a limited area of the ANI (14%) is allocated as revenue land for settlements and socio-economic development (see Section 4.1 on Land use). However, the population growth is not regionally uniform. Car Nicobar has the highest population density (152 people per km² in 1991), and has the largest number of settled Nicobarese. The Nicobarese population has a very high growth rate. Forest cover on this island is negligible. It is reported that the erosion rate is high and the coastal ecosystem is under threat.

Port Blair and Ferrargunj tehsils also have very dense populations. The population is placing an enormous strain on resources while simultaneously generating large quantities of waste. The UNDP Report (1999) shows that the Gross Domestic Product (GDP) of the islands has increased from Rs 532.9 million in 1980–81 to Rs 5,152.3 million in 1996–97. But the Net Domestic Product, which corrects the GDP for the population growth in the corresponding period of time and allows for capital depreciation, does not show any significant improvement. The Report states that population growth has placed a huge demand on local resources and state resources (subsidies, etc.) for improving the standard of living. ANI is increasing food imports from the mainland. A projection of the likely deficit of major food crops in the future shows a higher deficit in grains, vegetables

and pulses. Prices of these crops may therefore go up and the Government may be forced to increase the area of land under cultivation (Sirur 1999).

There is a change in population pattern brought about by large-scale immigration from South India, mainly from Tamil Nadu. This may have repercussions on the political front. The four dominant groups, the ex-convict population, the Bengali settlers, the South Indians and the Nicobarese, have lived in amity all these days. But the tilting of the balance towards one regional group may not be welcome, as the larger group will have the potential to develop into a more powerful political force (Sirur 1999). Table 3.3 gives the decadal growth of population in the Islands, which is also shown diagrammatically in Figure 3.3.

d) Ex-Servicemen

The first group of ex-Servicemen were settled on the eastern coast of Great Nicobar in 1969. A forest area of 1,499.65 ha was cleared for 337 settled families. Each family was given 11 acres of land. Schools and primary health centres were established for their benefit (Saldanha 1989).

e) Karens

The Karens inhabit coastal areas of Middle and North Andaman Islands, especially at Webi, near Mayabundar. They are the descendants of the Burmese Karen (tribes) who were brought to the Andamans as labourers by the British. An American Baptist Mission in Burma sent 45 families in 1925 at the request of the British Government. After Independence these people were settled as agriculturalists in Middle Andaman (Pande *et al.* 1991). The Karens have now acquired excellent knowledge of the rainforest and the seas. The single keel mechanized Karen boat is very popular in the islands.

4. LAND USE AND ECONOMY

4.1. Land Use

Out of the total geographical area of 8,249 km², forests occupy 7,606 km² or 92.2% of the area (5,883 km² in the Andaman group of islands and 1,723 km² in the Nicobar group). Of the total forest cover, dense forests with a crown density of 40% and above, constitute 85.6%, open forests with crown density less than 40%, constitute 1.7% and mangroves constitute 12.7% (ANI F&E 2001, Anon. 1999).

However, the legal forest area is 7170.69 km², which constitutes 86.93% of the geographic area of these Islands. Out of this, 4,242 km² are protected forests and 2,929 km² are reserved forests (ANI F&E 2001). For further details, please see Table A in the Appendices.

The remaining 14% of land is revenue land and is used for human settlements, cultivation and other human use activities. Most of the revenue land is along the coast, where people have been

settled. "The entire rural / revenue area is under CRZ-IV (Coastal Regulation Zone – Category IV), except a very small area under CRZ-II. No new construction is permissible within 200 metres of the High Tide Line in CRZ-IV areas" (ANI F&E 2001).

Box 7: Distribution of villages according to land use (1991):

Land use data is available only in respect of some revenue villages. The non-revenue villages which are spread over all the Community Development Blocks (CDBs) of Andaman district, and the tribal villages spread over the various islands of Nicobar district have not yet been surveyed for boundary delineation and hence even the total area of such villages are not available.

Table 4.1: Land use pattern in ANI

Area under cultivation	150 km ²
Area under plantation	300 km ²
Area under forests	7,094 km ²

Source: Pande *et al.* (1991)

Of the available revenue land, only 21% is under intense cultivation, another 11% is classified as fallow and cultivable waste (land that is cultivable, but currently lies fallow). Plantation crops cover 45% of the revenue land (Sirur 1999).

Table 4.2: Distribution of Community Development Blocks according to Land Use in Andaman & Nicobar Islands

Community Development Blocks	No. of inhabited villages	No. of villages for which area data available	Total Area (ha)	% of cultivable area to total area	% of irrigated area to total area
A&N Islands	504	178	72,058	21	0.5
Andaman District	334	178	72,058	21	0.5
North Andaman	73	32	20,017	18	2
Middle Andaman	101	56	19,162	20	Nil
South Andaman	160	90	32,880	23	Nil
Nicobar District	170	Nil	NA	NA	NA
Car Nicobar	16	Nil	NA	NA	NA
Nancowry	154	Nil	NA	NA	NA

Source: Census of India (1991)

4.2. Economy

a) Forestry

The recorded forests in ANI cover approximately 7,170.69 km². Tribal reserves constitute 41% of this area. There are many small forested islands, which are not profitable for timber exploitation.

Forests are worked to meet the requirement of timber based industries, both small and medium, and to meet the needs of the local population for wood and non-timber forest produce. The major commercial tree-species on the island include gurjan (*Depterocarpus species*), padauk (*Pterocarpus dalbergioides*), white chuglam (*Terminalia bialata*), and badam (*Terminalia procera*).

The rugged topography and poor communication facilities have made forestry operations difficult and wasteful. Harvested logs are shipped to the mainland, or to local plywood factories, or sawmills. Forestry work is carried out with labour from settlers and tribals from Ranchi, in Jharkhand state in the Indian mainland, who immigrated especially to work in the forestry sector. Since the logs are huge and heavy, elephants are used in forestry work, to help in loading and unloading. During the colonial period, demand for wood was not high. A Government sawmill was established at Chatham Island in 1883 and supplied cut timber to the settlements around Port Blair. A matchstick unit was established at Port Blair in 1926 by WIMCO. Logs of padauk and gurjan found a ready market on the mainland.

The colonisation of the island by settlers from the mainland led to an increased demand for wood. They were given free timber for building houses and had access to free supply of wood products. Wood-based industry also expanded.

The extraction of timber in 1950 was around 49,000 m³ per annum, which increased to 145,000 m³ per annum by 1986. The number of commercially exploited species has increased from 4 in 1952 to 40 in 1990.

ANIFPDC was given the task of harvesting the forests scientifically on the principle of sustained annual yield, with the least disturbance to the local ecosystem. The Corporation was also responsible for the regeneration of the forest, under the 'Andaman Canopy Lifting Shelterwood System' (ANI F&E 2001). Table 4.3 given below gives the amount of timber extracted from 1980 to 2002.

Table 4.3: Volume of timber extraction between 1980 and 2002

Year	Timber (m ³)
1980-81	165726
1981-82	162241
1982-83	147308
1983-84	147309
1984-85	132579
1985-86	145305
1986-87	131888
1987-88	115801
1988-89	123678
1989-90	117746
1990-91	103660
1991-92	105319
1992-93	125670
1993-94	130136
1994-95	135523
1995-96	126579
1996-97	107443
1997-98	77097
1998-99	62623
1999-2000	47617
2000-2001	40053
2001-2002	Nil

Source: (Singh 2002)

As per decisions taken by the Island Development Authority (IDA), under the Chairmanship of the Prime Minister, and recommendations of the Director General of Forests, the Ministry of Environment and Forests and the ANI Administration started phasing out forest working and lowered extraction levels from 123,678 m³ in 1988-89 to 103,660 m³ in 1990-91. However, this increased again to 135,523 m³ in 1994-95. At present, due to the intervention of the Supreme Court of India, all forestry operations have been halted in ANI (Singh 2002).

Plantations

The Forest Department was set up in 1883. The teak plantations were created along with plantations of local species like padauk and pyinma, which were considered valuable timber at that time. Artificial planting of padauk was started in South Andaman in the year 1883. The following year, Burma teak was planted. Subsequently, various exotics, including eucalyptus, were planted. By 1976, 10,000 ha of teak had been planted. However, the observation, in 1970, of the then Inspector General of Forests that teak plantations were not coming up to expectations and were leading to degradation of the forest floor, finally led to the gradual phasing out of teak plantations.

Mahogany, teak, eucalyptus and tropical pines were raised as monoculture crops at various times. It was thought that they would provide commercially viable timber that could be exported to the mainland. The plantations failed, perhaps due to the local soil and ground water conditions (Saldanha 1989). The Corporation has leased 19,600 ha of forest area in Little Andaman and 11,188 ha in North Andaman. Rubber plantations occupy an area of 614 ha in Katchall Island.

There are over 12,500 ha plantations of hardwoods in ANI. However, since the 1990s no new plantations have been undertaken. Commercial exploitation of mangroves has also been stopped since 1988 (Singh 2002).

The Government of India had sanctioned a project for planting 2,400 ha of red oil palm plantation on Little Andaman. The Forest Corporation commenced implementation of the red oil palm plantation in 1979. Under this programme, an area of 1,593 ha was brought under red oil palm plantation up to the middle of the 1980s (ANI F&E 2001). It was envisaged that after the first phase of plantations involving 2,400 ha, the plantation area would be extended to 5,000 ha to make the project viable. However, in 1985-86, there was a sudden shift in policy and in January 1986 the Government of India imposed a ban on further extension of the plantations in these Islands in view of the adverse ecological impact perceived due to monoculture cultivation of red oil palm (ANI F&E 2001).

Industry

In order to facilitate the growth of industry, the Directorate of Industries was set up in 1978 and the District Industrial Centre also started functioning. The Khadi and Village Industries Advisory Board (small-scale sector) was also set up. However, industrial development is handicapped by the fact that all inputs, except perhaps

raw material in some cases, have to be procured and transported from the mainland. There is little demand for finished goods in ANI and these therefore have again to be transported to the mainland (Census of India 1991).

According to the 1991 census, 970 village and small industries were functioning in the Islands (Census of India 1991). The industrial sector contributes 10% of the Gross Domestic Product (GDP) and employs about 6% of the main workers.

The major industry in ANI is the timber industry. In the past, forests were leased out to private industry and, from 1977, to the Forest Corporation, in order to extract raw material for timber-based industry. Though the practice of leasing forests to private industry finally stopped in 1990-91, the Corporation continues to directly fell forests in Little Andaman and in North Andaman (Singh 2002).

The four medium sized wood-based industries (Singh 2002) that were established in the Islands were:

- a) WIMCO in South Andaman
- b) Andaman Timber Industry (ATI) in South Andaman (installed capacity 31,160 m³ p.a.)
- c) Jayshree Timber Products, Middle Andaman (28,300 m³ p.a.)
- d) Kitply Industries Ltd. in Middle Andaman (31,650 m³ p.a.)

Of these, WIMCO closed down some years back and the Andaman Timber Industry and Jayshree Timber Products closed down recently, for various reasons. Only Kitply Industries is still functioning (Singh 2002).

These industries, apart from getting timber from the forests, have also been provided with a handsome transport subsidy by the government, to bring in materials and to export their finished products (Singh 2002).

In addition, timber is also being supplied to the two government sawmills, one in Chatham, South Andaman, with an installed capacity 24,000 m³ per annum, and the other in Betapur, Middle Andaman, with an installed capacity of 5,000 m³ per annum (Singh 2002).

Some of the sawn timber is being exported to the mainland. This is mainly sold in Chennai and Kolkata. The ANI administration maintains depots in these two cities for selling the timber it exports. However, the quantity of sawn timber exported by the administration has not exceeded 1,000 m³ p.a. for the last 10 years and has fluctuated between 130.77 m³ in 1998-99 to 868 m³ in 1991-92

(Singh 2002). Table 4.4 gives the amount of sawn timber exported to Government depots.

Table 4.4: Sawn Timber exported to Government Depots at Chennai & Kolkatta

Year	Total Quantity (in m ³)
1991-92	868.1
1992-93	492.7
1993-94	140.0
1994-95	792.1
1995-96	385.2
1996-97	841.100
1997-98	649.50
1998-99	130.77
1999-2000	132.510
2000-2001	676.627
2001-2002 (up to Nov)	278.1

Source: (Singh 2002)

Locally, timber is used by small-scale sawmills, which numbered about 35 in 2001. In addition, there are also over 130 small furniture manufactures using about 1,600 m³ of sawn timber (equivalent to about 3000 m³ of logs) per year (Singh 2002).

The Government has supported the industrial sector in various ways. Sales tax is not levied on goods in ANI. Small-scale units are exempted from octroi duty when importing plant machinery and equipment from the mainland. Many other concessions are given while setting up an industry. As per the Government of India's policy since 1986, 90% of the freight charges of importing raw materials and exporting finished products are given as transport subsidy. During 1991–92, Rs. 17,160,000 was sanctioned as transport subsidy to 18 industrial units functioning in ANI (Census of India 1991).

b) Fisheries

“The ANI with a coastline of nearly 2,000 kms and about 35,000 km² of Continental Shelf provides ample opportunity for potential fishing grounds. With the declaration of a 200 miles economic zone for our country, the Exclusive Economic Zone (EEZ) of the Islands are about 0.6 million km². The estimated fishery potential is 160,000 tons of which tuna and tuna-like fishes comprise about 100,000 tons” (Census of India 1991).

A UNDP report (Sirur 1999) has graphically represented the data given by CARI (Central Agricultural Research Institute) scientist Soundarajan, which shows

that out of a total of 130,000 tonnes of pelagic stock, only 13,200 tonnes are currently exploited. The demersal stock is of the order of 225,000 tonnes.

As in the case of agriculture, the fisheries sector began by bringing fishermen's families from the mainland and settling them on the islands. Fishing operations around the Islands have been reported since 1908. A private fisheries company was floated in the 1940s. It was wound up despite having reported that the potential was enormous. Another operation started in 1951 also failed. The Department of Fisheries was set up by the A&N administration in 1955. Since the islands did not have a non-tribal population of local fishermen, a "fishermens settlement scheme" was initiated in 1955 and families of fishermen from Kerala and Andhra were brought and settled in the Andamans" (Saldanha 1989).

The administration also allocated land for housing and provided loans and fishing equipment. In subsequent years, presumably attracted by the vast fisheries potential, many more fishermen migrated from the mainland to the islands.

The inland aquaculture sector is also being developed, with inputs from the Central Agricultural Research Institute (CARI). There are a few freshwater ponds in the municipal area and CARI runs a demonstration farm for freshwater fish (Sirur 1999).

It was estimated in 1986 (Anon. 1986) that there were 2,250 full-time professional fishermen and 10,000 tribals engaged in part-time fishing. The annual catch was on the order of 6,000 tonnes. The current trends given by the Director of Fisheries (Workshop Report 2001) indicate an estimated fishery potential of 2,435 lakh tonnes. Current total fish catch per annum is 30,000 tonnes, licensed fishermen number around 2,524 and ply 1,983 craft on the seas. The catch is mostly consumed as fresh fish, though a small quantity is dried and exported from the islands. One processing plant and cold storage is available at Port Blair and another one at Campbell Bay.

Box 8: Lack of Community Organizations
A UNDP Report expresses concern over the lack of organization in the fishing and agricultural communities. Although Government organized primary level co-operatives officially exist in many fishing communities, most were inactive due to lack of interest. The settler communities in the Islands have come to depend heavily on Government assistance and subsidy. Therefore, the initiative and interest in forming co-operative organizations to help themselves is lacking.

There is no tradition of commercial fishing by the local inhabitants and fishing has mostly been for sustenance. The number of marine fishermen on the

islands is very small and most of the Bengali settlers prefer to eat freshwater fish. The islands are tuna fishing grounds (four species) and there is considerable potential for catching and exporting tuna. Two species of lobster, namely *Panilurus cranatus* and *Panilurus polyphagus* are also found in the Islands and two species of crab are being exported to Chennai and re-exported to Singapore. The fact that the Nicobar Islands lie close to international shipping routes makes the development of international trade in fisheries very feasible (Anon. 1986).

Some efforts have been made by the government to promote the growth of commercial fishing. Besides developing markets and infrastructure, the government has set up the Andaman and Nicobar Islands Integrated Development Corporation (ANIIDCO), which has floated a company called Andaman Fisheries Limited (AFL). AFL has cold storage and processing plants at Shippi Ghat near Port Blair, at Havelock and at Diglipur. The government has also started a leasing policy for allotment of land to entrepreneurs for prawn farming. The Marine Products Export Development Authority, funded by the Department of Ocean Development, Government of India, is also implementing a demonstration project for prawn farming (Census of India 1991). However, there is a lack of co-operatives or self-help groups among the fishing communities (Sirur 1999, Workshop Report 2001). Though the government has organized primary level co-operatives, they appear to be inactive (Sirur 1999).

c) Agriculture

A hilly terrain, with heavy rainfall and a thin and porous covering of soil, characterizes the Islands. The land is more suited for plantation crops rather than paddy cultivation (Census of India 1991).

Initially the government settled refugees in remote locations, giving each family two

Box 9: Agriculture in Mayabunder.

Agriculture in this area is hampered by the prevalence of sandy, porous soil, prone to erosion. Salinity is an added problem in some coastal stretches. Nevertheless, paddy is cultivated by 542 farmers on approximately 1,300 ha- of land in Mayabundar. Despite low productivity, plantation crops such as banana, coconut and areca_nut are becoming increasingly popular because of the relatively high financial returns. Fertilizers and pesticides use are on the rise, as plantation crops become more popular. Besides, poor soil and the virtual absence of proper land management practices have resulted in significant soil erosion along stream banks. There are high sediment loads in the waters off Mayabunder- (Sirur 1999).

hectares (five acres) of lowland and two hectares of hilly land. The Bengali settlers were mainly rice eaters and, as low-lying lands were suitable for rice cultivation, it was hoped that they would become self-sufficient in food (Census of India 1991). The total flat land on all the islands, suitable for agriculture, was

estimated to be 77,500 ha. Of this, the land brought under agriculture by 1981 was 14,953 ha (Whitaker 1985). Currently (in 2001) over 50,000 ha is under agriculture and of this 27,890 ha are coconut and areca nut (betelnut) plantations.

By the end of 1991-92, the land under high-yielding varieties of paddy was 12,000 ha. The cultivation of vegetables, pulses and oil seeds had also been encouraged, as an alternate rice-fallow crop, for utilization of residual soil moisture. Considering the nature of the land, importance was also given to tree (horticultural) crops. Six per cent of the total geographical area has come under agriculture and allied activities, including horticulture crops (Census of India 1991).

Box 10: Department of Agriculture

This Department is under the charge of a Director with a team of experts. The development schemes are being implemented under three main sectors, viz., agricultural production, soil conservation and minor irrigation. Agricultural production includes plant production, demonstration units and promoting plantation crops. Under minor irrigation schemes, the Government provides loan-cum-subsidy for the construction of ponds and installation of pump-sets. The department also provides loan-cum-subsidy to cultivators for soil conservation works (Census of India 1991). See Workshop Report (2001) for more information on loans for soil conservation measures.

Socio-economic surveys conducted (Ali 2000, Singh 1997) around Mt. Harriet National Park (N.P.) and Saddle Peak N.P. show that 41% of villagers raise paddy and plantation crops and 54% raise plantation crops alone. Reports and statistics indicate that plantation crops occupy a larger area and currently most of the hilly land is being used for banana and areca nut, which is causing land slides, huge runoffs of top soil and siltation of mangroves

and coral reefs. The Department of Agriculture (DoA) estimates that 53,315 ha of land are under various forms of agricultural production. According to estimates developed by the Food and Agriculture Organization of the UN and allied

organisations, ANI can support three persons/ha at an intermediate level of agriculture and five persons/ha at a level of intensive and technologically advanced agriculture. At the level of production in 1989, which has not significantly increased since

Box 11: Agriculture in Great Nicobar

"Paddy, coconut, areca nut and spices constitute the majority of agricultural production. Rice is grown on a subsistence basis, whereas horticultural crops generate income. Coconut plantations have developed in estuaries and inlets along the fringe of intact mangrove vegetation. As the coastal strip on the east side of the island is quite wide, most agricultural activities occur on flat land. Coastal erosion is not a significant threat except in isolated pockets where coastal vegetation has been removed. The tribal populations on the west coast also practice coconut cultivation. However, most natural vegetation is left alongside the plantation and erosion does not seem to be a problem." (Sirur 1999).

then, the Islands can support only 1.6 persons/ha. With the current increased population level, it can safely be presumed that the agricultural carrying capacity may well have been surpassed (Sirur 1999). Another alarming factor is that rice

yields are dropping both in North and South Andaman (Ali 2000, Singh *et al.* 2001). There is currently surplus rice in the Islands. This surplus is mainly due to an increase in cultivated land area through encroachments and people's preference for rice imported from Chennai. Farmers cannot sell the rice produced in the Islands to the Food Corporation of India (FCI) as the quality is not up to FCI standards (Agri. Dept. unpublished).

d) Tourism

ANI, famous for its pristine ecosystems and primeval beauty, is a natural tourist destination. On the recommendation of the Working Group on Tourism, constituted by the Island Development Authority, tourism was officially declared an industry in 1987. However, despite this, though expenditure on the tourism sector has increased from 1993, earnings from tourism have been almost stationary. The Directorate of Tourism has been incurring heavy losses (Sirur 1999).

There are many problems that affect the tourism sector. ANI imports much of its processed and some of its unprocessed food. The transportation of food and other items from the mainland is heavily subsidised, mainly to control prices for the local population. Travel to the islands by ship is also highly subsidised, for the same reason. Consequently, the food and other items used by tourists also have the same levels of subsidy, as it is impossible to have a variable price system.

Box 12: Tourism Strategy

In 1997, a joint UNDP / World Tourism Organisation (WTO) initiative prepared a 'Development Strategy for Environmentally Sustainable Tourism in ANI.' However, this study has been assessed to be of poor quality and does not adequately take into consideration the environmental, social, cultural, economic and security concerns in the islands.

Also, tourists who travel to and from the islands by ship also enjoy the travel subsidy given by the government. As a result, the net earnings from tourism are negligible.

There are also restrictions on infrastructure development, especially because of environmental considerations and the cost of building material. Most of the islands are legally forest land and the diversion of forest land to non-forest activities, like tourism, requires prior permission of the Government of India. There are also constraints because of the Coastal Regulation Zone (CRZ) notification, which restricts construction in coastal areas. Waste disposal is a problem which increased tourism might well aggravate. There is also a shortage of freshwater and the fragile ecosystem may not be able to cope with a large number of tourists.

5. GOVERNANCE

5.1. Administration

These islands are administered as a Union Territory (UT)² of the Union of India falling under the authority of the Ministry of Home Affairs, Government of India. They are divided into two administrative units, or districts. The Andaman district comprises the group of islands north of the Ten Degree Channel, and the Nicobar district consists of the group of islands to the south of it. The Islands are directly governed by the Central Government through an Administrator, currently a Lieutenant Governor (LG) appointed by the Central Government. The LG governs the Islands with the help of a Secretariat headed by a Chief Secretary and a number of secretaries who implement the policies and programmes of the government. An elected Member of Parliament represents the ANI in the lower house of Parliament (*Lok Sabha*).

At the local level, self-governance has been gradually introduced since 1950. A Municipal Board was established in Port Blair in 1958 consisting of 18 elected and three nominated members. In 1961, a single-tier *Panchayati Raj*³ system was established at the village level consisting of elected Gram Panchayats (Village Councils) in settler and settled tribal communities like the Onges and the Andamanese. In 1979, a Pradesh Council was constituted composed of the Lok Sabha representative, the Chairman of the Municipal Board and 25 other elected members. The Council acted in an advisory capacity to the LG and the administration.

The most recent and significant development occurred in 1995, when the Pradesh Council was superseded in areas outside the municipal jurisdiction, by a three-tier *Panchayati Raj* system. The lowest tier is composed of the Gram Panchayat at the village level. Above them is the Panchayat Samiti, which represents a group of villages. The highest tier is the Zilla Parishad or District Council, and is made up of members elected at the district level (Sirur 1999).

² As a Union Territory, the Andaman and Nicobar Islands are directly administered by the Government of India and do not have an elected legislature of their own, as is the case with states.

³ Panchayati Raj essentially refers to the process of decentralized decision making and administration that is being pursued by the Government of India. Under this process development funds from the Planning Commission are allocated directly to the *Panchayat*, the village level institutional structure of governance.

5.2. History

The history of the island can be divided into three phases, the pre-colonial phase, the colonial period and the post-independence period.

a) Pre-Colonial Phase

The existence of these islands was known from the second century A.D., when Ptolemy published an atlas that showed their location. Since then, there have been references to the islands and the islanders in the writings of various travellers. The tribals (indigenous communities) have been living on these islands for a very long time. This is evident from the fact that “from second century onwards till the sixteenth century, all travellers who wrote about the Andaman islands, describe all inhabitants of these islands as cannibals” (Mathur 1968). These accounts were mainly hearsay (the Malay pirates supposedly spread such tales to keep others away from the islands) as a lot of travellers either did not visit the islands or anchored for a very brief period (Portman 1899, Mathur 1968). Therefore, the history of the islands was relatively unknown till the British established a base in 1789 (Portman 1899, Awaradi 1990).

b) Colonial Period

In 1789, the East India Company asked Lt. Archibald Blair to survey and establish a port on the Andaman Islands, for ships to dock in during the monsoon. Besides, there were frequent attacks on ships on the high seas by Malay pirates, who plundered the ships and later took refuge in the natural harbours of the islands. To secure the islands and to provide a natural harbour, in 1789 Lt. Blair established a port, named Port Cornwallis, in Ariel Bay on the east coast of North Andaman. However, not long after, the settlement was wound up due to the inhospitable climate and rampant malaria (Awaradi 1990).

A second colonisation attempt aimed at establishing a penal settlement was made in 1857. A penal settlement was finally founded in March 1858, around the harbour of the present Port Blair. In the beginning, the settlement was administered by a British Superintendent. In 1872, the post of Superintendent was raised to the level of a Chief Commissioner. Convicts sent to the penal colony were encouraged to bring their families from the mainland and settle permanently in the Islands upon release after completing their sentences (Portman 1899, Awaradi 1990).

The British colonisation of the Andaman Islands proved very traumatic for the indigenous inhabitants. The Great Andamanese lived in and around Port Blair, and also occupied the eastern and western coastal areas. Further north inland, the Jarawas had their semi-permanent settlements (Portman 1899, Chandi 1999). The Onges had their nomadic settlements in Little Andaman and the Sentinelese in North Sentinel Island.

The first community to take on the mighty colonisers were the Great Andamanese, who were variously estimated to number between 5,000 and 8,000 in the late 1880s (Portman 1899, Sarkar, 1990; Awaradi 1990). They were divided into ten sub-groups (Portman 1899, Whitaker 1985). The settlements established by the British were located in the territory of one of these, the Aka-Bea. The Aka-Bea had a strong sense of territoriality and, therefore, resented the new settlers. They first attacked the British reconnaissance party, even before the establishment of the settlement. The British retaliated by opening fire and killed many of them. During the next 50-60 years, such skirmishes continued and many of the indigenous people were killed (Portman 1899, Reddy and Sudarsen undated).

By the beginning of the twentieth century, the British decided to change their tactics and adopted the strategy of befriending the Andamanese. It is said that Captain Haughton thought of establishing the "Andaman Home", where the tribals could stay as long as they wanted and enjoy the hospitality offered by the colonisers. It was here that the Great Andamanese came into contact with the convicts and other people and acquired the habit of chewing tobacco, drinking distilled liquor and smoking.

They had also fallen prey to diseases to which they had not been exposed earlier. Epidemics such as pneumonia (1868), syphilis (1876), measles (1877) and influenza (1892) reduced their number to 625 at the time of the first census in 1901. By 1931, their number had dwindled to 90 and by 1970, only 20 Great Andamanese survived. These survivors were finally settled in Strait Island (Whitaker 1985).

The Andaman Administration used the friendly Andamanese to track down escaped convicts and to make contact with the Jarawas. However, the Jarawas and the Andamanese were traditional enemies. There might have also been rivalry in the sharing of resources. The British made a mistake, as subsequently

realised by Portman (the British Administrator), in getting the Andamanese to accompany them on their expeditions into Jarawa territory. The British also supplied firearms to the Andamanese, which the latter used against the Jarawas. This resulted in the Jarawas becoming hostile not only to the British but to all outsiders (Sarkar 1989; 1990).

British encounters with the Onges followed a similar trend. The friendly Andamanese were used by the British to establish contact with the Onges. In 1867, the captain and crew of the ship 'Assam Valley' were killed when they docked in Little Andaman. In retaliation, a punitive expedition was organised by the British in which 70 Onge men were killed. In another encounter with the British 30 Onges were killed. After this, Portman took a sympathetic attitude towards the tribe and was successful in establishing friendly relations with them. He captured a few Onge boys, took them to Port Blair, treated them well and sent them back with gifts. This method worked in making the Onges friendly towards the British (Portman 1899, Sarkar 1989). However, due to their relative isolation in Little Andaman, the Onges survived, unlike the Great Andamanese, in spite of 'friendly contacts'.

The Sentinelese lived in total isolation on North Sentinel Island and were not contacted during the colonial period. The first recorded expeditions to North Sentinel Island occurred as late as the mid 1960s.

Early Arabs, Chinese and Portuguese travellers knew the Nicobar Islands. There were successive attempts by French, Danish and Austrian priests to settle there and convert the indigenous peoples to Christianity. None of them succeeded. In 1869, the British Government took possession of the Nicobars and established a penal settlement at Nancowry. The Andaman and Nicobar Islands were brought under a single administration in 1872, with the Chief Commissioner as the administrator. The penal settlement at Nancowry was withdrawn in 1888 (Justin, 1990; Awaradi 1990). During the Second World War, the Japanese occupied these islands and it was a traumatic experience for all, especially the Jarawas, some of whom were killed by constant air raids

Before the British left India, they created villages in the ANI where former convicts were settled. They also settled the Moplahs of Kerala, after crushing their rebellion, and some Burmese people, especially Karens, and started commercially exploiting the forests.

c) Post-Independence

India became independent in 1947 and the ANI became a part of the Union of India. During the partition of India into India and East and West Pakistan, many people were displaced. The Indian Government settled some of the refugees from East Pakistan (now Bangladesh) in the ANI. Unfortunately, many of the refugee colonies were established near perennial sources of fresh water in the vicinity of the Jarawa Reserve. This resulted in the Jarawas attacking these settlements, as they perceived their water resources to be threatened. Such attacks increased as more and more settlers flocked to the area. Also, nearly a hundred families of ex-military personnel were settled not only in the Jarawa area, but also in the territory of the Shompens in Great Nicobar (Reddy and Sudarsen undated; Anon. undated).

Box 13: The Settlement Process in Wandoor

The first seven families were settled at North Wandoor in 1949. The Government supplied the new settlers with household goods and agricultural implements to assist them in clearing allotted lands and in creating settlements. Old villagers describe lonely days and a fear of the forest and its denizens. The elephants and tramline of the forestry operation assisted the clearance of the unwanted growth. Water was virtually everywhere. Even a shallow pit would yield water. A well dug by the Japanese regime was the primary source of water. Source: Chandi (1997).

In the 1950s, there were incidents of Jarawa attacks on the forest camps and settlers and other labourers working in the traditional Jarawa area. Attempts were made to subdue them with force. Ccipriani (1959), Sarkar (1990) and Chandi (1998) have reported these incidents in detail.

In 1905, during the colonial period, a special armed police force called the Bush Police was created to contain Jarawa attacks. A second armed force, called the Forest Bush Police, was created to protect forest workers deep in the forest and forest camps. The Bush Police force grew in size particularly after settlements proliferated. However, the administration found that it was not possible to subdue the Jarawas. At about this time an officer of the Andaman Labour Force suggested dropping gifts in the Jarawa area in an attempt to befriend them. This idea was accepted and 'gift dropping' in the Jarawa reserve started in 1952. This came to be referred to as the 'Contact Mission' (Anon. undated).

Punitive expeditions against the Jarawas were stopped and 912.19 km² of forest in Middle and South Andaman was declared a Jarawa Reserve, under the *Andaman and Nicobar (Protection of Aboriginal Tribes Regulation) 1956*. Similar tribal reserves were created for the Onges and the Shompens (details given in Section 3.1).

The establishment of defence bases in the Andaman and Nicobar Islands closely followed the establishment of civil administration. It appears that the lessons learnt during the Second World War, when the Japanese captured the Islands, established themselves and attacked the mainland, had not been forgotten. The Andaman Islands have become an important strategic

Box 14: Provisions of the Indian Forest Act 1927 Relevant to ANI

Section 3. The State Government may constitute any forest-land or waste-land which is the property of Government, or over which the Government has proprietary rights, or to the whole or any part of the forest produce of which the Government is entitled, a **reserved forest** in the manner hereinafter provided.

Section 4(1) Whenever it has been decided to constitute any land a reserved forest, the State Government shall issue a notification in the Official Gazette (c) appointing an officer (-hereinafter called " the Forest Settlement Officer") to enquire into and determine the existence, nature and extent of any rights alleged to exist in favour of any person in or over any land comprised within such limits, or in or over forest produce, and to deal with the same as provided in this chapter.

Section 12. In the case of a claim to rights of pasture or forest produce, the Forest Settlement Officer shall pass an order admitting or rejecting the same in whole or part.

Section 29(1) The State Government may, by notification in the Official Gazette, declare the provisions of this chapter applicable to any forest land which is not included in a reserved forest, but which is the property of the Government, or over which the Government has propriety rights, or to the whole or any part of the forest produce of which the Government is entitled.

(2) The forest land and waste-lands comprised in any such notification shall be called a "**protected forest**".

Section 30. The State Government may, by notification in the Official Gazette,

(b) declare that any portion of such forest specified in the notification shall be closed for such term, not exceeding thirty years, as the State Government thinks -fit, and that the rights of private persons, if any, over such portion shall be suspended during such term, provided that the remainder of such forest be sufficient, and in a locality reasonably convenient, for the due exercise of rights suspended in the portion so closed.

base with the first combined command headquarters, with the Navy, Air Force and Army under a joint command, located at Port Blair. Port Blair is also the regional headquarters of the Indian Coast Guard.

5.3. History of Forest Management

Considering forests and forestry play an important part in the economy of these islands and nearly 90% of the islands are legally forests, it is important to look at the management of forests as part of the overall governance of the Islands.

The actual process of settling outsiders in the ANI started in the 1850s. The early settlers cleared the forest for cultivation and other activities, under the guidance of Royal Engineers. A small sawmill was also established for cutting timber for local use, though all forestry activities were confined to a small area around Port Blair. The Forest Department was established in 1883, under the charge of a Divisional Forest Officer. Mr Ferrar, the first Divisional Forest Officer, explored the South Andaman Forests and produced a report on them in 1886. Based on this report, selective felling of tree species like gurjan and white chuglum was undertaken in easily accessible areas. In 1890, C.J. Lyal, Secretary,

Home Department, visited the Islands and initiated a policy on forests. H.C. Gill, officiating Inspector General of Forests, visited the Islands in 1891. He demarcated some areas as Reserved Forests (RF), and suggested the preparation of a 'Working Plan' for the RF. However, the shortage of timber in Britain led the Forest Department to continue extraction in a haphazard manner (Khan 2001).

"The Working Plan for the Forests of Andaman" prepared by Mr Todd in 1906 and Mr Bonnington in 1914, could not be implemented due to the exigencies of war and the immense efforts needed for clearing the forests for penal settlements. Taking into account the problems of working and conserving a tropical rain forest, the first Working Plan based on scientific principles was prepared in 1935 by Mr H.S. Dean. However, even these prescriptions could not be followed due to various reasons. Later on, in 1951, Mr B.S. Chengappa, Assistant Conservator of Forests, prepared a Working Plan giving due importance to natural regeneration. This was the beginning of the 'Andaman Canopy Lifting Shelterwood System' (Census of India 1991).

a) Andaman Canopy Lifting Shelterwood System

"All commercially important trees, above 150 cm in the case of hardwood and 120 cm in the case of softwoods, breast height girths, in periodic blocks, are removed leaving the mother trees judiciously distributed. The regeneration technique aims at creating 'pepper-pot' openings in the multistoried forest and gradual lifting of the canopy in the area, through judicious removal of secondary species, up to 8-12 metres in height. Normally, there is no difficulty in getting a green carpet of new recruits by the end of the first year. In the difficult patches, the natural regeneration is supplemented with enrichment planting or broadcasting of seeds and subsidiary silvicultural operations consisting of weeding, clearing etc. carried out over a period of 2-3 years. The forest reproduced through this technique is very similar to the original natural crop" (Chana, undated). The current management practices involve a silvicultural system based on an irregular shelterwood system with floating periodic blocks. In each hectare about 10 to 15 silviculturally available trees, above 180 cm GBH (girth at breast height) in the case of hardwoods and 120 cm GBH for softwoods, are marked for felling. All other trees below the stipulated GBH are considered as part of the future crop. "Since natural forests contain a fair percentage of mature and over-mature trees

liable to disease etc. such trees have to be removed to avoid loss of timber "(ANI E&F 2001).

Reservation about the efficacy of this system has been expressed by Romulus Whitaker (Whitaker 1985) and the in a Planning Commission Report (Anon. 1986), for it is thought that this system is based on scanty scientific data, It has been argued that the practice of this system of forest working is leading to the transformation of evergreen forests into deciduous forests. The raising of artificial plantations of teak, padauk, matchwood and other species in these forest areas has further exacerbated the problem (Anon. 1986). A study conducted by a Pondicherry University researcher, in 1991, clearly shows that this system leads to a complete change in the species composition and in the density of stands (Pandit 1992).

Romulus Whitaker has analyzed Working Plans prepared between 1906 to 1983 and has come to the conclusion that projected yields and rotational periods are highly variable, pointing to the lack of adequate surveys and growth data. Forest working indicated that younger and younger trees were being extracted from the more accessible areas. 'For example in Chengappa's Working Plan (1951), the rotation period for hardwoods and softwoods was fixed at 150 years and 75 years respectively. These figures were based on sample plot measurements of the most important hardwood, padauk, which in 150 years had reached a GBH of only 195 cm. However, the present trend is to produce "more cellulosic material per hectare than higher girth logs", and thus the Inspector General of Forests recommended in 1970 that a conversion period of 75 years be adopted for both hardwoods and softwoods. This was decided on, despite available data indicating that both gurjan and padauk take 100 years to reach 150cm GBH. The main rationale in extracting them together is stated to be that an adequate number of softwood "floaters" are needed to facilitate rafting the hardwood "sinkers" to the ship (Whitaker 1985).⁴

b) Silvicultural System for Mangrove Forests

Here the system followed was "clear felling with standards". Most of the mangrove forests worked so far have regenerated well since a sufficient number

⁴ Hardwood and softwood are rafted together and floated down the waterways to the sawmills. This is a cheaper mode of transport for huge logs

of mother trees were retained. These forests were managed to supply firewood and small timber. The mangrove forests themselves are very sensitive ecosystems. Specialized conditions like fluctuating salinity, waterlogged soil, and soil acidity ensure that only mangroves can survive here and maintain a high level of biotic productivity. Any modifications of drainage patterns or alterations to the hydrological cycle will adversely affect the mangroves (Anon. 1986).

c) Wildlife Protection

Wildlife Management in the ANI aims at protecting and conserving both biodiversity and ecosystems. There are 96 Wildlife Sanctuaries and 9 National Parks (and one Biosphere Reserve) declared under the Wildlife Protection Act, 1972. For conserving biodiversity, the Forest Act, 1927; Wildlife Protection Act, 1972; The Environment Protection Act, 1986; Coastal Zone Notification, 1991; and the Wildlife (Protection) Andaman and Nicobar Islands Rules, 1973 are enforced.

5.4. Planning

The ANI have witnessed a consistent growth in GDP, from 532.9 million rupees in 1980, to an estimated 5,152.3 million rupees in 1996-97 at 96-97 prices (Sirur 1999). During this period, the per capita net domestic product at 80-81 prices had risen from 2,613 rupees to an estimated 3,456 rupees in 1996-97. It is clear that the population growth in the Islands has consumed the resources of the State at the cost of improvements in the general living standards. The growing need for imported items to sustain the local population has created a situation where the ANI are facing a massive trade deficit. The increasing trends in import of food items are most worrisome. The future projections for food crop deficits present a grim picture. Since agricultural productivity is not expected to keep pace with population growth, the islands are becoming increasingly dependent on the mainland for even basic foodstuffs. This may lead to a compelling situation to convert forestlands for agriculture.

For their part, the Department of Environment and Forests is currently implementing 15 schemes under the State Plan Sector. During the 8th Five Year

Plan (1992-97), an outlay of Rs. 250 million was approved and there was an expenditure of about Rs. 269 million during this period (ANI F&E 2001).

For the year 2000-2001 the proposed Plan outlay for the Forestry and Wildlife sector is Rs. 115 million out of which Rs. 87 million is under revenue account and Rs. 28 million is under capital expenditure (ANI F&E 2001). Table 5.1 presents the year-wise fund allocation to the Forestry and Wildlife Sector since 1992-93.

**TABLE 5.1: ANNUAL PLAN EXPENDITURE
(Rs. millions)**

Year	State Sector	Forest Sector	% of Expenditure against State Sector
1992-93	1258.3452	40.0382	3.18%
1993-94	1541.3062	43.8826	2.84%
1994-95	2011.6000	63.815	3.17%
1995-96	1938.9000	51.430	2.65%
1996-97	2150.7000	76.8078	3.57%
1997-98	2537.3000	84.4090	3.32%
1998-99	3550.0000	95.595	2.69%
1999-2000	4000.0000	114.710	2.86%
2000-2001	4100.0000	110.000	2.68%

Source: Statistical Cell, Dept of Env & Forests, A&N Admn, Port Blair, 2000

Under the Plan, the Department of Environment and Forests are implementing the following 15 schemes.

a) State Plan Schemes

i. Intensification of Management

Out of the total forest area, covering 86% of the geographical area, two-thirds is managed for protection and conservation of wildlife and biodiversity. This scheme envisages recruitment of staff; establishment of a VHF communication network for improving communication; procurement of vehicles, boats, and computers including networking for information storage, retrieval, and data sharing; procurement of arms and ammunition etc. The scheme also includes creation of technical posts, creation of a legal cell and a Little Andaman Forest Division. An amount of Rs. 9,310,000 is proposed during the year 2000-2001 for this scheme.

ii. Silviculture (Forestry) Research

This scheme envisages identification and establishment of seed production areas of important species and evolving standard nursery techniques to raise quality seedlings of important species, standard planting and tending techniques,

techniques for regeneration of mangroves and a farm forestry package / models for these Islands.

For such long-term studies silvicultural sample plots are maintained in representative areas in all the divisions. There are 6 sample plots in South Andaman division, 12 in Middle Andaman division and 1 in Baratang division. There are 39 experimental plots in South Andaman division, 12 in Middle Andaman Division and 1 in Baratang division. In addition in Middle Andaman division there are four preservation plots of natural forests containing (i) mixed evergreen species (ii) mixed deciduous species (iii) thitmin (iv) gurjan. An amount of Rs. 2,100,000 is proposed during the year 2000-2001 for this scheme.

iii. Training of Staff

The Forest Department runs one Forest Training School at Wimberly Gunj. This training school was established in 1966. The school trains newly recruited executive staff of the Forest Department and Forest Corporation up to the level of deputy ranger. The training school regularly conducts six-month courses for forest guards and a one-year course for foresters and deputy rangers. About 20 trainees can be trained in each batch. An amount of Rs. 2,125,000 is proposed during the year 2000-2001 for this scheme.

iv. Natural Regeneration of Forests

In the ANI the 'Andaman Canopy Lifting Shelterwood System' is followed to obtain successful regeneration in natural forests. The regeneration operation normally follows the harvesting of commercial trees. All the sound trees below the harvestable girth limit are left standing as future growth. If the area does not have adequate mother trees or future growth and the seed fall from these trees is expected to be deficient, dibbling of seeds of commercial species is done liberally. If the area is still found to be deficient in future growth, nursery-raised seedlings are planted at a spacing of 4mx4m.

By September the new recruits get established on the ground and at this stage second weeding and climber cutting is undertaken. Third weeding is carried out in the month of January wherever necessary. Table 5.2 shows annual regeneration figures during the last five years (in hectares).

TABLE 5.2: Area Regenerated

Year	Area Regenerated (in hectares)
95-96	2020
96-97	2036
97-98	1630
98-99	1684
99-2000	1496

An amount of Rs.12,900,000 is proposed during the year 2000-2001 for this scheme. Also see Table C in Appendices.

v. Survey, Demarcation, and Settlement

The scheme envisages survey, demarcation and settlement of forestland. Even though an area of 2,929 km² and 4,242 km² are declared as Reserved and Protected Forests respectively, physical survey and demarcation on the ground by erecting concrete boundary pillars have yet to be completed. An amount of Rs. 2,180,000 is proposed during the year 2000-2001 for this purpose (see Table A in Appendices).

vi. Working Plans

The object of developing working plans was to work the ANI forests in order to obtain a sustained yield without eroding the natural capital. At present there are five territorial divisions and one project division of ANIFPDC (at Little Andaman). Working plans for two divisions are due for revision and the process of revision has started. Considering the area under forests in these Islands, the Government of India has approved two working plan divisions, with the objective of facilitating the development of such plans. However only one of the divisions is fully functional at present, while the second one has yet to be provided with the necessary staff and the infrastructure in order to facilitate its proper functioning. The scheme provides for the manpower and equipment needed to undertake the preparation of the Forest Working Plan for this territory. An amount of Rs. 23,00,000 is proposed during the year 2000-2001 for this scheme.

vii. Enrichment Plantations

Certain special sites / patches of forest where natural regeneration is not adequate because of various adverse factors need restocking to improve productivity. The scheme therefore envisages undertaking enrichment plantation in such areas. An amount of Rs. 2,170,000 is proposed during the year 2000-

2001 for this scheme. Table 5.3 shows the details of work undertaken under this scheme for the last three years.

TABLE 5.3: Enrichment Plantation Achievement (in ha)

Item	1997-98	1998-99	1999-2000
1. Raising of Enrichment Plantation	150	187	205
2. Maintenance of second year Plantation	169	137	207
3. Maintenance of third year Plantation	190	207	210

viii. Development of Minor Forest Produce

The availability of Non-timber Forest Produce, such as cane, bamboo etc. for domestic consumption as well as for small-scale industries is declining with the increase in demand. These non-timber forest resources require regeneration through plantation. The scheme envisages the planting of 1,000 hectares of mainly cane and bamboo plantation during the 9th Plan at a rate of 200 ha per annum.

There are five species of bamboos found in these islands but all of them are hollow and thin walled. The scheme envisages planting bamboo plantations, not only of the local bamboos, but also of the solid bamboos from mainland, which are useful as structural materials and can replace *ballies* and poles, the collection of which cause degradation in forests.

An amount of Rs. 2,800,000 is proposed during the year 2000-2001 for this scheme. Table 5.4 shows the details of work undertaken during the last three years under this scheme.

TABLE 5.4: Achievement (in ha)

Item	1997-98	1998-99	1999-2000
1. Raising of Cane and Bamboo Plantation	290	227	278
2. Tending of Previous year Plantation	209	188	216

ix. Forest Extension

The main objective of the scheme is to promote the extension of tree cover beyond the conventional forest area and to educate the masses about the need for the conservation and protection of forests and wildlife. The scheme therefore envisages programmes to extend forest cover by promoting / creating plantations of fuelwood, fodder and fruit-bearing trees by farmers on their own lands as well as on community land, etc. To involve the Panchayat Raj institutions in extension forestry, the department has been providing grant aid for implementing area-

specific social forestry projects. An amount of Rs. 6,000,000 is proposed during the year 2000-2001 for this scheme. Table 5.5 shows the details of work undertaken during the last three years under this scheme.

TABLE 5.5: Forest Extension Works

Item	1997-98	1998-99	1999-2000
1. Road side plantation (in kms)	23.24	14.50	16.73
2. Coastal belt plantation (in kms)	22.50	4.50	18.85
3. Plantation in barren/waste/degraded land (in ha)	87.27	40	73
4. Community land Plantation (in ha)	7	8	4.9
5. Raising of seedlings for distribution among the public and other agencies (no. in lakhs)	4.16	1.41	0.80

x. Logging and Utilization

The harvesting of forest produce - mainly timber - is carried out under this scheme, and is implemented through five territorial divisions under two territorial circles.

The Department of Environment and Forests and ANIFPDC carry out timber extraction departmentally. Out of the total timber extracted annually from these islands (70,000 m³), the Department extracts 42,500 m³ and ANIFPDC extracts 27,500 m³. Departmental timber extraction activity is also funded under the State Plan scheme and is essential for ensuring the scientific harvest of timber and for facilitating follow-up regeneration works in the harvested area. Provision to harvest about 20,000 m³ is made under this scheme, which includes procurement of extraction equipment and maintenance of the existing machinery, boats etc. and employment of additional manpower. An amount of Rs. 32,615,000 is proposed during the year 2000-2001 for this scheme (see Tables D, F, G, and H in Appendices).

xi. Communication

The scheme envisages construction of fair weather roads for transportation of logs from the forest to road depot / ghat depot and for connecting regeneration areas in territorial forest divisions. During the 9th Plan it is proposed to construct about 60 kms of fair-weather road to take out harvested timber from the interior forest area to all-weather road depots for quick disposal of timber. During the current year 2000-2001 it is proposed to construct 18 kms of fair-weather road. An amount of Rs. 2,800,000 is proposed during the year 2000-2001 for this scheme.

Table 5.6 presents the details of work carried out during the last three years under this scheme.

TABLE 5.6: ANNUAL ROAD CONSTRUCTION 1997-2000

Item	1997-98	1998-99	1999-2000
Construction of feeder road for extraction of timber (in kms)	26	17	23

xii. Construction of Buildings

The Forest Department of the ANI has its infrastructure spread over the entire territory, covering some of the most remote and far-flung islands. The workers and the staff posted in such islands have to be provided with basic facilities like housing etc. and therefore the department proposed to construct various types of residential accommodation / office buildings.

During 1999-2000, 10 staff quarters, 3 labour barracks, 1 range office, 1 camp office, 1 store godown, 2 compound walls and 3 rainwater harvesting systems were constructed under the scheme. An amount of Rs. 9,600,000 is proposed during the year 2000-2001 for this scheme

xiii. Biodiversity and Wildlife Conservation

These Islands are very rich in biodiversity having a variety of flora, fauna and genetic resources, which need to be protected and conserved as part of India's natural heritage. This scheme envisages protection and development of national parks / sanctuaries all over the islands and the creation of infrastructure viz. VHF communication, speed-boats etc. so as to effectively protect the terrestrial as well as the marine ecosystems from damage by various threats. The Forest Department has been implementing a major project on the construction of a new Biological Park at Chidiyatapu. The administration has already signed an MOU with the Central Zoo Authority (GOI) to obtain funding for the construction of enclosures and other infrastructure.

In addition to protection and habitat improvement in National Parks and Sanctuaries, infrastructure development works were carried out in Mahatma Gandhi Marine National Park at Wandoor, Lohabarrack Sanctuary and Galathea Sanctuary. Improvements were also made in the Mini-zoo and staff quarters, and boundary walls etc. were constructed in the Biological Park at Chidiyatapu. An amount of Rs. 19,700,000 is proposed during the year 2000-2001 for this scheme.

xiv. Improvement & Renovation of Chatham Sawmill

Chatham Sawmill was established in 1883. Most of its machinery has become obsolete and quite old, because of which production is adversely affected. It needs modernization and renovation both in respect of machinery, timber yards, gantry and buildings to improve its efficiency and output. Therefore it is proposed to replace the existing plant and machinery with new equipment in a phased manner under this scheme. An amount of Rs. 7,500,000 is proposed during the year 2000-2001 for this scheme.

xv. Ecological monitoring system and awareness programme

This scheme aims at creating awareness and sensitivity at all levels about the importance of rainforest ecosystems and the conservation of endemic flora and fauna of the ANI. There is a specific thrust on educating the islanders on conservation of natural resources of these Islands and on the overall issue of environmental conservation. An amount of Rs. 900,000 is proposed during the year 2000-2001 for this scheme.

b) Centrally-Sponsored Schemes

The Department of Environment and Forests is also implementing a number of Centrally Sponsored Schemes particularly on Coastal Biodiversity and the development of the Biological Park at Chidiyatapu. A brief description of the major Centrally Sponsored Schemes is as follows:

i. Conservation and Management of Coral Reefs in ANI

The coral reefs found in the ANI cover an area of about 11,939 km² (Turner *et al.* 2001). In all, about 197 coral species belonging to 58 genera have been reported. The Forest Department carries out basic management and protection activities for the conservation of coral reefs in ANI. The following Projects / Schemes are being implemented:

- *Management Action Plan on Conservation and Management of Coral Reefs in ANI*

Under this Centrally Sponsored Scheme, Rs. 750,000 was sanctioned during 1999-2000 and Rs. 1,750,000 is sanctioned for 2000-2001. The scheme includes the survey and monitoring of coral reefs, training of Forest Staff, infrastructure development and awareness generation.

- *Management Plan for Mahatma Gandhi Marine National Park, Wandoor*

This two-year Project was started in 1998-99 by the Wildlife Institute of India, Dehra Dun, in collaboration with the Department of Environment and Forests, Andaman & Nicobar Administration. The fieldwork has already been completed and the final document is under preparation.

- *UNDP / GEF Project*

A UNDP / GEF PDF B project on coral reefs in the ANI is being implemented by the Zoological Survey of India. A budget of \$365,000 has been provided by the UNDP for Phase-I. In Phase-I a Management Plan for the Conservation of Coral Reefs will be prepared and in Phase-II, the Department of Environment & Forests, A&N Administration, will implement the plan.

ii. Management Action Plan for Great Nicobar Biosphere Reserve

The Great Nicobar Biosphere Reserve is the only Biosphere Reserve in the ANI, constituted under the Man and Biosphere programme of the United Nations. The Ministry of Environment & Forest, Govt. of India is providing funds for protection, habitat improvement, socio-economic activities, and eco-development activities and awareness generation. The Management Plan for 2001-2002 has already been submitted to the Govt. of India for central funding with a proposed budget of Rs. 18,500,000.

iii. Management Action Plan for Conservation of Mangroves

There are 966 km² of mangroves in the ANI. Whereas most of the mangrove areas in these Islands are in pristine condition, there are certain areas where mangroves have been degraded due to various pressures. However under a Centrally Sponsored Scheme a proposal has been submitted to the Ministry of Environment and Forests to undertake a management action plan for the conservation of mangroves in the ANI for three years i.e. 2000-2001 to 2003.

Under this action plan the entire mangrove area of the Andaman and Nicobar Islands will be surveyed and eco-restoration work will be carried out in identified degraded areas.

The approval of the Govt. of India is still awaited. For the year 2000-2001, an outlay of Rs. 1,070,000 has been approved for Conservation of Mangroves in Andaman District and Rs. 459,000 has been approved for Nicobar District.

iv. Development of National Parks and Wildlife Sanctuaries

Under this, the Govt. of India has provided funds for the development of infrastructure, habitat improvements, protection measures and awareness generation for various National Parks and Sanctuaries, which include Mahatma Gandhi Marine National Park, Cuthbert Bay Sanctuary, Cinque Island Sanctuary and Interview Island Sanctuary. Funding under this scheme has resulted in improved mobility, better communication efforts and awareness generation etc.

v. Central Zoo Authority (CZA)'s Grant for Chidiyatapu Biological Park

The Central Zoo Authority (CZA) is funding certain items for the establishment of a new Biological Park at Chidiyatapu. So far it has granted Rs. 9,700,000 for construction of four enclosures, a boundary wall (Phase-II) and improvement of water supply.

(NB. This section on schemes has been taken from ANI F&E 2000).

6. THREATS TO THE ENVIRONMENT

Island ecosystems, especially those of small islands, are very fragile because of their isolation. Small islands worldwide are known to be extremely vulnerable to biotic pressures on the environment. The Andaman & Nicobar Islands are no exception.

Although there are 105 protected areas (PAs) in the ANI, their ecosystems continue to be under threat due to at least one or more of the following reasons:

- Impact of agricultural activities
- Impact of human habitation
- Encroachment on forest land
- Mining of sand
- Inappropriate fisheries
- Inappropriate forest plantations
- Inappropriate and excessive forest working
- Inappropriate tourism activities
- Pollution, especially pollution of the coasts and the sea
- Inadequate coverage of the PA network
- Poaching of flora and fauna
- Extraction of corals
- Introduction of exotics.

Some of these threats are described in greater detail below.

6.1. Impacts Due to Agriculture and Habitation

As already mentioned earlier, the population of ANI has increased dramatically. According to a Socio-Economic Survey (1972) the area under agriculture in the ANI consists of “some of the best forest sites in rich valley areas”. The easy and usual way of expanding one’s holding has been to encroach on adjacent forest land. “Most of the encroachment has been in the North Andamans, where a large amount of forest has been illegally clear-felled. According to local farmers, one half of this area is being farmed; the rest has been abandoned, sometimes after a single crop, when found unsuitable for farming” (Whitaker 1985). The A&N administration has regularised the forest encroachments of 1,367 families who had encroached 2,500 ha of forest prior to

1978. In addition an estimated 2,325 families have encroached subsequent to 1978 on 2633.654 ha of forest (Singh 2002).

Unsustainable agriculture, coupled with tilling encroached rainforest land, has led to the problem of soil erosion. A survey by ANET in villages around Saddle Peak, and around the Wandoor area, shows that "rice yields have dropped in a very dramatic fashion" (Singh *et al.* 2001). The 1997 production is only 26.5% of the 1960 production in these villages (Ali 2000). This demonstrates yet again that rainforest cannot be converted into agricultural land – the soil condition degrades very rapidly (Ali 2000). There has been considerable emphasis placed by the government on raising plantations like red oil palm, rubber, coconut, areca nut, cashew etc. on the Islands. Coconut is a recent introduction to the Andamans, though in the Nicobars some reports suggest that coconut plantations started 200 years ago. However, most plantation crops, especially palm oil and rubber, are not giving a high yield and cultivators have observed a resultant loss of soil fertility leading to decreasing yield, besides a drop in groundwater level. Coconut plantations attempted in South Andamans, especially those using reclaimed mangrove swamps, have not been successful (Anon. 1986).

"Nearly 600 km² of the area, originally covered with luxuriant forests, have been released under colonization / resettlement schemes so far. These lands are not in compact blocks, but scattered in valley bottoms and coastal flats. Soil erosion is visible on hilly lands allotted to the settlers. From the hill slope settlements, silt eroding from cultivated lands, including forest plantations, is gradually

Box.15: Encroachment in Wandoor

The forested land is a source of useful forest products that sustain many livelihood patterns. Villagers know this and are aware of the effects of deforestation. In spite of this, encroachment in forested tracts continues without much control, as there is a great demand for living space. New Wandoor [-Protected forest I & II] has the largest number of forest encroachments. The system of control over encroached lands through the Public Premises Eviction Act, has not prevented further encroachment, which has multiplied all over the island. Being widespread and uncontrolled, this constitutes a serious threat to the forests of the Andaman Islands.

Loss of forest areas within the village does not seem to affect the community, even though most people realize the benefits of the forest. Protection of the forest is not entrusted to the adjacent communities, but is the function of the Forest Department. This view was not commonly voiced, but when people were asked how they could protect the forest, it was evident they had no stake in its protection and they would not do much for it. Source:- Chandi (1997).

accumulating in the coastal flats, resulting in the degradation of mangrove forests. Moreover, settlers are in the habit of abandoning unproductive cattle, which often turn feral, like goats on Barren Island and elephants on Interview Island and North Andaman Island" (Chana undated, Ali 2001). Ghosh (1966) wrote that denudation

of hill slopes in the Andamans and planting coconut thereon resulted in erosion of the worst type. As McVaen (1976) noted, "compared to successful natural regeneration, monocultural planting and agricultural crops resulted in fundamental and deleterious changes to most of the natural environment" (Whitaker 1985).

It is a well-known fact that evergreen forests have thin and nutrient-poor soil and hence are poorly suited for agriculture. The soil is generally acidic and almost saline in coastal areas. The natural ecosystem has adapted to this peculiar environment and any disturbance by replacing it with human-made ecosystems is unlikely to succeed. Clearing vegetation for cultivation has exposed the soil to high-intensity rainfall, which has led to erosion. In turn, the sediments have smothered the mangrove and coral ecosystems (Sirur 1999, Anon. 1986, Kothari 1989).

As in Rutland Island bordering the Mahatma Gandhi Marine National Park (one of the conservation priority areas), siltation caused by inland forestry operations is affecting the coral reefs of the national park. This can have serious consequences for the health of the coral reefs. This, in turn, can affect the tourist industry as the coral reefs make this marine park a major tourist attraction of the islands. Siltation (Venkataraman & Rajan 1998, Kulkarni 2000 & 2001, Singh *et al.* 2001) may be one of the main causes for coral mortality in the MGMNP. Coral polyps can be killed by direct deposition of silt, or indirectly through nutrients washed off from the land that increase the algal growth, which in turn increase the population of coral predators such as the Crown-of-Thorns starfish *Acanthaster plancii* (Soundarajan 1989).

Land allocation for settlement and agriculture appears to have been done without any attempt at studying land capability. The only consideration seemed to be the availability of flat land for paddy cultivation. No effective soil conservation measures were enforced. It is only now that such measures have been introduced. Even then, these measures are often abandoned, because of the non-availability of loans from the government. The whole system has become so dependant on government help, that there is no motivation to form local self-help groups among the farmers or fishermen (Sirur 1999; Ram, N. Director of Fisheries in Workshop Report 2001).

Friends and relatives of old settlers arriving from the mainland prefer to settle near their friends and relatives. Forest land surrounding the settlements are

encroached and, in the absence of adequate monitoring and enforcement capacities, these encroachments flourish and grow. Such encroachments have taken place even in national parks like Saddle Peak NP and satellite imagery has revealed extensive honeycombing of the forests by the encroachers (Kothari *et al.* 1989). In keeping with national policy, the ANI administration has now regularized all encroachments up to 1978.

Cases have been booked against encroachers who have occupied Government lands after 1978. Table 6.1 shows the number of cases booked between 1979 and 1999 and the area that has been occupied by encroachers. As can be seen, 97% of the cases have been booked in the Andaman Islands and only 3% of the cases have been booked in the Nicobar Islands, though so far no cases have been booked in the Little Andaman Island.

Table 6.1: Cases booked under the Public Premises Eviction Act (1979–1999)

Community Development Block	No. of Cases	Area in Hectares
Diglipur	907	949.56
Mayabunder	470	629.20
Rangat	411	399.76
Baratang	75	37.257
South Andaman	153	155.445
Nicobar	54	80.23
Total	2072	2251.452

Source: Forest Statistics 1998-99, E&F Department, Administration of ANI

6.2. Coastal Erosion Due to Sand Mining

Two of the major threats to marine and coastal biodiversity include sand mining on the sandy beaches and siltation of the coastal area. Increasing population and accelerated development have spurred the growth of construction activities. Earlier constructions were of wood, but now concrete is being used and the ANI administration imports large quantities of cement from the mainland for this purpose. However, cement requires sand to be mixed with it to make concrete and, as the Islands do not have large streams from which sand can be collected, most of the sand is mined from coastal areas. To facilitate sand extraction from beaches, a temporary CRZ waiver has been authorized by the Central Ministry of Environment and Forests (see Section 7.2). A Sand Allocation Committee has also been established in ANI, but as surveillance and enforcement are difficult, there is extensive illicit collection, leading to rampant erosion (UNDP 1999). ANI

has lost 21 marine turtle nest beaches between 1981 and 2000 (Bhaskar 1993, Andrews *et al.* 2001).

6.3. Impacts Due to Fisheries

In South Andaman, there are a few freshwater fishponds. They utilize chemicals for maintenance and feeding. Removal of unconsolidated soil for digging fishponds also causes problems of erosion (Sirur 1999).

Over-exploitation of shell-yielding marine molluscs, for use as ornaments, has decimated the local stock in many areas. “The lure of shell fishing and trade attracts many, as it has quick and better financial returns. Being a risky activity, only those who are good skin divers, or those who are in need of money for sustenance prefer this activity. Only a few realize that licensing and regulation can increase their income, rather than being dependent on middlemen for trade” (Chandi 1997).

The Zoological Survey of India has carried out studies on the *Trochus* and *Turbo* fisheries, as well as the giant clams of the genus *Tridacna*, of which four species are found in the islands. As a result of these studies, shell fishing has been regulated by the Fisheries Regulation Act of 1938 and the Shell Fishing Rules of 1978. The ANI Administration controls the extraction and export of shellfish. Nine areas have been identified in which shell fishing can be carried out and the sites are auctioned by the Administration (Saldanha 1989).

In recent years, there has been rampant fishing of sharks and the shark population in the waters around ANI has significantly decreased. Though the government, in response to warnings by environmentalists, banned the fishing of sharks for a while, pressure from the fisheries lobby and from political quarters has resulted in the ban being lifted again.

Several species of sea cucumbers, once abundant in coastal shallow waters, are now so depleted they cannot support the *Beche-de mer* industry that flourished in the past (Rao & Khan 1990). The turbo shell is practically extinct because of indiscriminate collection (Dorairaj & Soundarajan 1995).

6.4. Impacts Due to Forestry Operations

A number of forest management plans were formulated from 1906, but could not be put into operation for various reasons (see Section 5.1). Private companies were also given permission to have their own felling coupes. The Forest Department follows the ‘Andaman Canopy Lifting Shelterwood System’

(see Section 5.2) for regenerating worked forests. However, this system has led to the depletion of forest biodiversity and has resulted in most of the worked forests becoming repositories of commercial species at the cost of biodiversity. Whereas four tree species were commercially exploited in 1950, currently 40 species are being exploited.

“The rate of extraction and the girdling and thinning of the Natural Regeneration Area blocks have brought about a reduction in the total biomass and have adversely affected species diversity. The ecological impact on soil and water had not been quantitatively assessed. Nevertheless, rapid run-off during the rainy season, erosion on steep slopes and degradation of soil are evident in many parts of the Andamans. There are three new threats to natural regeneration. Invasion by the exotic climbing weed *Mikania cordata*, introduction of cattle, goats and deer into the islands that are devoid of native carnivores and continuous shrinking of the forest area because of diversion of forest land to non forest uses” (Saldanha 1989).

Box 16: Pollution from the Red Oil Palm Plantation in Little Andaman

The Forest and Plantation Development Corporation operates 1,591 ha of red oil palm plantation in the vicinity of Netaji Nagar. Much of the plantation covers sloping land and erosion of stream banks and sedimentation of the creeks has been observed. Approximately 35kg/palm/year of fertilizers are applied to the soil. More recently green manure and fruit residues have substituted chemical fertilizers. Farmers living adjacent to the plantation complained that large quantities of fruit husks are dumped into a nearby creek. The dumping has choked the creek and created a foul odour in the creek area. Dumping occurs close to the mouth of the creek and most of the waste flows directly into the creek (Sirur 1999).

One major impetus for extensively working the forests and promoting commercial species has been the imperative to supply raw material to the wood-based industries in the Islands. The Island Development Authority (1989) had recommended that wood extraction to feed wood-based industry should be gradually reduced and finally stopped, over a period of time. Accordingly, the Ministry of Environment and Forests issued instructions (vide D.O. no: 1-5/87-FRY/SUII, dated July 7, 1989) to the ANI Administration to notify a ban on new wood-based industries, as well as a ban on expansion of current units. Extraction was reduced from 150,000 lakh m³ to 100,000 m³ (Pande *et al.* 1991).

Unfortunately, extraction levels again went up in the mid 1990s and it was only in 2001, mainly because of the intervention of the Supreme Court, that the extraction of wood specifically for supplying wood-based industry has again come down.

There was one more problem: the energy needs of the industry were met either by running diesel generators or fuelwood. Diesel had to come from the mainland and proved expensive. The residual lops and tops left in the logging area were not being used because transportation costs were high. Mangrove wood, which has a high calorific value, was the next choice. The alarming rate of extraction prompted the Forest Department to impose a total ban on mangrove exploitation as mangroves also act as shore protectors preventing coastal erosion. "The power generated in the Islands is obtained from diesel sets, which consume costly petroleum oil and lubricant products and as such, the average cost per unit generated is quite high, as compared to rates being charged to consumers" (Census of India 1991). The highly subsidized power and transport facilities support the industrial sector at present.

6.5. Impacts Due to Tourism

Tourist activities in the Islands have also led to serious threats to the environment. For one, the infrastructure required to service the growing number of tourists, especially airports, hotels and roads, takes a toll on the natural environment. Besides, increase in the number of tourists means an increase in energy consumption, in pollution because of transportation, and in rubbish. The sites preferred by tourists, for example some parts of the Wandoor National Park, have also become degraded because of too many tourists and the inappropriate handling of tourist traffic. Some of the specific impacts are listed below.

The effect of human activity in developing infrastructure for tourism on hilly Tropical Rain Forest TRF: The soil of the islands is thin and poorly formed. Erosion is severe on such soil. The natural ecosystems have adapted to this condition and any disturbance can upset the equilibrium. Construction activities and road building can hasten the process of instability with consequent effects on other ecosystems.

The soil has very low moisture-retaining capacity, and the slope of the land and heavy rainfall results in rapid run-off of rainwater. Water for human consumption is therefore in short supply.

The effect of exploitation of mangrove forests: Mangrove forests are cleared to gain more land for various constructions, and are also cut as fuelwood, since mangrove species have a high calorific value. Both of these threats may increase with increasing human populations. The clearing of mangroves in the

creeks for building jetties can destroy the nurseries of marine organisms and increase the turbidity of water. Oil spillage from anchored mechanized boats can also smother the aerial roots of mangroves.

Effect of human activity in developing infrastructure for tourism on coral reefs: Construction of sea walls, jetties, etc. can alter currents, obstruct light and may become the point source of pollution.

Trampling, littering, overturning of coral boulders, snorkelling and scuba diving in the reef areas may damage coral formation. Anchoring of boats may damage the reef. Oil spillage pollutes the marine ecosystem. Mining of sand and coral boulders for construction in many places have adversely affected reefs. Collection of corals and shells in an unsustainable manner and scale will affect reef health. Tourism has also adversely affected sea turtle nesting beaches and the nesting of sea turtles (Andrews *et al.* 2001).

6.6. Impacts Due to Waste Disposal

Increasing population is posing an increasing threat of pollution. There is no proper plan to dispose of the solid waste accumulating on the Islands, which finally finds its way into the sea. The waste contains chemical pollutants and bio-medical waste. Dumping of waste from most urban areas, factories and ships continues, in spite of restrictions being imposed (see Workshop Report 2001 for details). “A report of the Central Marine

Fisheries Research Institute expressed concern over the dumping of sawdust timber waste from the Government sawmills at Chatham. But the dumping continues, despite protest letters written by members of SANE” (Kothari 1989). The current situation relating to waste disposal from the

sawmills is mentioned in a UNDP report (Sirur 1999). The Chatham Sawmill, the largest in the Islands, is located in Port Blair. It has an installed capacity of 24,000 m³ per annum. Although not responsible for significant waste production, wood fragments from the sawmill find their way into surrounding waters.

Box 17: Waste disposal at Mayabunder

All solid waste from the market area is dumped into the sea. There is no sign of a garbage collection system and most residents seem to dispose of waste independently. In outlying areas, farmers bury or burn most of their waste. A significant quantity of garbage floats in waters adjacent to the market area. Larger houses in Mayabunder have septic tanks, but most dwellings have no sanitation system. Source: (Sirur 1999).

6.7. Inadequate Protected Area Coverage

The existing protected area network is inadequate in some areas such as the Nicobar Islands, where some island groups with a large number of endemic species are not adequately protected. The Great Nicobar Biosphere Reserve has not been designed to sufficiently protect the habitat of the flagship bird, the Nicobar scrubfowl. Nor does it cover the southern tip of Great Nicobar, which has almost the only remaining lowland coastal forest left on the east coast of this island, harbouring good populations of endemic species of fauna such as the giant robber crab, habitats for small juvenile crocodiles, pythons and the Malayan box turtle (Sankaran 1995).

Human pressure on the restricted land space is now in excess of the carrying capacity of the Islands. This is causing heavy damage to biodiversity. Habitat degradation with resultant species loss, pollution, introduction of alien species and the adverse impacts of tourism are among the serious problems. The demands on the biological resources are overwhelming because of the continuous influx of migrants and settlers from the mainland. They encroach into forestland and into the boundaries of protected areas and allow their cattle to graze uncontrolled in these areas. Forestry operations, construction of roads and houses, mining, and clearing for cultivation continue to take place. Coral reefs in many areas are damaged by siltation, collection of decorative corals and disturbance by careless tourists.

In sharp contrast, the tribal reserves set aside for the aboriginal tribal populations are among the best-protected areas in the ANI. The inhabitants of these reserves are the original inhabitants of the Islands. Whether the negrito Jarawas, Sentinelese and Onges in the Andamans or the mongoloid Shompens in Great Nicobar, they have assiduously guarded their areas from degeneration through traditional conservation practices and a non-destructive lifestyle. Once widespread throughout Andaman & Nicobar, they are now restricted to a few reserves. In Great Nicobar, 11,900 ha of land is a tribal reserve for the Shompens, but this is in "disuse" (Rodgers & Panwar 1988). The unique culture and lifestyle of the Shompens is now threatened by a rapid increase in the rate of settlement of mainlanders, along with road building, quarrying and other development activities.

The Jarawa reserve is the largest tribal reserve and a priority site for conservation (Singh *et al.* 2000) and faces one of its greatest threats from the

Andaman Trunk Road which borders it. Indeed, in some places, the road cuts right through it, thereby reducing the size of the tribal area and causing irreversible damage and disturbance to the forest. The road has brought with it the inevitable string of settlements on either side, some of which have now become small townships. There is continuous traffic along the road. People from settlements outside constantly encroach upon the reserve. The settlers reportedly poach Wild boar, which is an important food species for the Jarawas, cut wood and fish in their streams. This severely depletes the food and natural resources of the Jarawas. The Jarawas will not survive if they are denied the land and resources they are used to and their ecosystem-based lifestyle and culture is threatened (see also Andrews 1999).

The Master Plan for Welfare of Primitive Tribes of Andaman and Nicobar Islands (Awaradi 1990) clearly recommends for the Sentinelese tribe: “the Sentinelese do not require the benevolence of modern civilization and if at all they require anything it is non-interference”. The case of the Great Andamanese and the Onges, who are reduced to a pathetic few families, dependent on government dole, amply demonstrates the disastrous consequences of interference, however ‘benevolent’ the intention. Biodiversity management efforts and strategies for conservation therefore will have to be formulated carefully in a participatory manner. They must take into consideration the complex human element and requirements of different categories of user groups, besides the fragility of the ecosystem and the distinctive biological features of this extraordinary island chain.

6.9. Introduction of Alien Species

The introduction of alien or exotic species has had adverse impacts through their unchecked proliferation. Take the case of the spotted deer, which were originally introduced for sport. In the absence of natural predators, they multiplied excessively. The deer have now become a pest since they browse indiscriminately and prevent natural regeneration in the protected areas. Abandoned after forestry operations, feral elephants are also causing damage in some of the PAs. Domestic dogs and cats disturb and destroy wild species. Dogs, for instance, dig out turtle eggs on nesting beaches and kill turtles (Bhaskar 1993, Andrews 2001, Andrews *et al.* 2001). The introduction of hardy and adaptable birds like the common mynah is a threat since they compete with the more vulnerable indigenous species. Among plants, apart from the exotic tree species

introduced in commercial plantations, which have replaced extensive areas of natural forest, some exotic weeds like *Eupatorium* are now getting established and overtaking natural undergrowth in some PAs.

6.10. Development Activities

As the island ecosystem of Great Nicobar is fragile, development activities pose a severe threat to the rich and varied terrestrial, coastal and marine biodiversity. Oil spills from tankers plying the shipping lanes to the south of the island, which is a regular international tanker route, and other disturbances seriously affect the coastal & marine fauna.

6.11. Poaching of Flora and Fauna

Poaching of fish and other marine resources has been prevalent for many years. Fishing boats from neighbouring countries regularly come and fish in the Exclusive Economic Zone of India, around the ANI. In recent years, poaching of valuable timber and of other plants and animals also seems to have increased. Allegedly, people come from some of the neighbouring countries (e.g. Thailand and Burma) and land in the various creeks to illegally cut timber and collect other wild resources, such as sea cucumbers. Poaching by local inhabitants is also common (Andrews & Whitaker 1994a; Andrews 1999a&b, 2000a,b&c, 2001; Andrews *et al.* 2001).

6.12. Other Factors

Small oceanic islands are susceptible to the vagaries of climate and weather conditions. Cyclones and storms can devastate large portions of the islands, uproot trees and submerge land areas. It is difficult to assess the magnitude of such damage, especially in remote islands and in inaccessible portions of protected areas. Excessive rain, sometimes even normal rainfall in high rainfall areas like the ANI, can cause landslides. The problem is more evident in areas with hilly topography, particularly where roads have been constructed inside the forest. When the loosened soil gets deposited in streams and watercourses in the valleys, it reduces the availability of freshwater, further exacerbating the problem. Lack of rain for extended periods, on the other hand, can create a drought situation, causing severe disruptions in the delicate tropical forest ecosystem, which requires optimum moisture levels for survival.

Major climatic changes too, like global warming, remain a serious threat. Sea-level rise and coral bleaching, which are the consequences of this warming, could be disastrous for these Islands.

The Andaman & Nicobar Islands, on account of their origin as a submerged volcanic mountain range, have experienced volcanic eruptions in the recent past, which can recur. Some PAs, such as Barren Island and Narcondam Island, are actually volcanoes. The latter is extinct, while the former erupted in 1991 burning a huge area, wiping out the flora and fauna and killing marine life by raising the seawater temperature. Such natural phenomena are unpredictable, making disaster preparedness a challenge and a necessity for PA management.

7. FUTURE PRIORITIES

Based on the findings of this study and on the recommendations emanating from the July 2001 Port Blair Workshop (Workshop Report 2001) - both part of the Darwin Initiative-funded project "Protected Areas Management Planning in the Andaman Islands" - and on recommendations made in other fora and studies, notably the Biodiversity Conservation Prioritisation Project (Singh *et al.* 2000), some priorities for future conservation action in the Andaman & Nicobar Islands have been determined. These are listed and described below. The major focus is on protected areas, however other related issues are also dealt with. The priorities are dealt with separately for protected areas, capacity development, research and other miscellaneous issues.

7.1. Protected Area Related Priorities

The BCPP identified a number of priority sites for biodiversity conservation in the Andaman & Nicobar Islands (Singh *et al.* 2000, Gandhi 2000). The sites were selected based on recommendations compiled from various sources. While most of the sites identified as priority sites for conservation were already within the existing PA and Tribal Reserve network, there were some other sites that were assessed to be priority sites but did not have legal protected status. These sites (listed location-wise from north to south) and their special features are briefly described below.

a) Strengthening the PA Network

The Andamans

- i) North Andaman / Saddle Peak National Park: Part of North Andaman has been earmarked for the proposed North Andaman Biosphere Reserve. Saddle Peak National Park covering an area of 32.5 km² and including the highest point in the ANI (737 m), is also located here. Maheswaren (1999) has reported four forest types within this NP. However, the NP is not large enough to include all the biodiversity present in North Andaman. At present less than 5% of the island is protected, but at least 10% should be (Davidar 2001b). The area has been identified as a conservation priority area on account of its thick and luxuriant littoral and evergreen forests. There are 10 perennial

streams and 132 seasonal streams inside the NP and it is a source of drinking water for Diglipur town (Maheswaren 1999).

- ii) Austin Strait: This site, which extends along the coastline of North Andaman north of Mayabundar up to Mohanpur, has been prioritised for its rich mangrove stands. The habitat supports a variety of typical mangrove fauna, such as crocodiles, snakes, birds, fishes, crabs and prawns, and is as yet fairly undisturbed. Andaman teal is also reported from Mohanpur (Vijayan 1997).
- iii) Narcondam Island Sanctuary: This tiny island (6.81 km²) is believed to be of volcanic origin. It has the distinction of being the only place on earth where the Narcondam hornbill *Aceros narcondami* exists. The Narcondam hornbill is listed as Vulnerable in the IUCN Red List of Threatened Species (IUCN 2000). The island is covered with Andaman tropical evergreen forest, Andaman semi-evergreen forest, Andaman moist deciduous forest, littoral forest and mangrove forest (Pande *et al.* 1991).
- iv) North Reef, South Reef and Interview Island Sanctuaries: Interview is the largest island sanctuary in the ANI, with an area of 133 km² while North Reef is 3.48 km². These islands, particularly North Reef, have one of the richest coral reef formations in the ANI with associated species such as sea cucumbers, *Trochus* and other shells. They are one of the last refuges for the endemic Andaman teal *Anas gibberifrons albogularis*, which appears to migrate between them. They offer nesting caves for edible nest swiftlets (on Interview Island). Marine turtles (hawksbill) and saltwater crocodiles are among the threatened reptiles found. These islands should be jointly constituted into a single Marine National Park.
- v) Middle and South Andamans / Jarawa Tribal Reserve: The Jarawa reserve area extends as a long strip along the western coasts of Middle and South Andaman. The total area of 911.08 km² consists of 560.69 km² along the west coast of South Andaman; an area of 338.69 km² including Bluff and Spine Islands up Louis inlet and Mt. William range in Middle Andaman; and the 11.7km² Spice Island (Forest Statistics 1998-1999). The two notifications, which were formulated to marginalise the

Jarawa people, did not take into consideration their structure and social organisation and their territorial range (Sarkar, 1990; Reddy 1994, Chandi 1999, Andrews 1999b). A mosaic of forest types with evergreen forests, deciduous forests, mangroves, large perennial freshwater streams, large freshwater marshes, and the largest remaining tracts of nypa palm (*Nypa fruitcans*), characterizes this area, which has been set aside for the Jarawas. Entirely dependent on forest and marine resources for their existence, the Jarawas were until recently hostile towards outsiders. This prevented documentation of their lifestyle and habits, or surveys of the flora and fauna of the reserve. As it provides full sustenance by way of edible plants, protein sources of meat and fish, wood and building material, medicinal plants and all other requirements for their daily lives, it is evident that the reserve area is rich in biological resources. Using their resources sustainably, the tribals protect the rich biodiversity of the forests as a result of which there is dense forest cover (IGCMC Forest Cover Map 1987-90, Andaman & Nicobar). However, local poachers and fishermen are now grossly violating the Jarawa reserve (Andrews 1999b). Encroachment, felling and other developments, and frequent penetration by fishermen of the Jarawas' territorial waters (which extend 3 km from the coastline of their reserve) are soon likely to destroy this pristine area. Rodgers & Panwar (1988) recommended that all or part of the tribal reserves should be declared as wildlife sanctuaries. This would act as a strong deterrent to any incompatible land use and allow the inhabitants to pursue their traditional way of life.

- vi) Ritchie's Archipelago (including Rani Jhansi Marine NP): This archipelago is located to the east of Middle and South Andaman Islands. It includes two sanctuaries viz. Inglis (or East) Island and Sir Hugh Rose Island as well as a national park, the Rani Jhansi Marine National Park, comprising a group of islands: John Lawrence (41.98 km²), Henry Lawrence (65.63 km²) and Outram Islands (19 km²). The protected area includes the territorial waters around these three islands. In the larger, well-forested islands such as Henry Lawrence, John Lawrence and Havelock, the bird and butterfly diversity is noteworthy

(Davidar *et al.* 1995). Deb (1998) has reported 51 species of birds for this national park. Das (1998) reported 45 reptile species and 12 species of amphibians, and 21 mammalian species including two species of shrew and seven bat species. A remarkable number of fruit-eating bat species indicates their importance as pollinators and seed dispersers. Maheswaran (1998) has reported three forest types for this NP and 99 tree and plant species for Outram, 108 for Henry Lawrence and 94 species for John Lawrence Islands. Andrews (2000b) reviewed the status of wetlands for this island group. Inland freshwater swamps in some of the islands support a good population of Andaman teal. The mangrove habitats along the shores and creeks are well-preserved. Garge *et al.* (1986) described the mangrove formations and reported 12 species of mangroves. Wilson, Nicholson, parts of Peel and John Lawrence, and North Passage and Long Islands (Davidar *et al.* 1995) are the other islands in this group with good forest cover.

In addition to the richness of the terrestrial habitats, this site was prioritised for the marine life it supports. Turner *et al.* (2001) reported over 80 coral species just around South Button Island. The coral reefs have an abundance of *Acropora* spp. staghorn corals, *Porites* spp. reef building corals, *Lobophylla* spp. brain corals, and all the associated marine life such as jellyfish, several species of sea cucumbers, including the commercially valuable species *Holothuria scabra*, brittle stars, starfishes, a wide variety of coral reef fishes, sea urchins, giant clams *Tridacna* spp. and other molluscs. Luxuriant seagrasses (Das 1996), along with food-forming algae in shallow coastal waters, support one of the last remaining dugong populations in the Andaman group. Green turtles nest on the beaches.

Although within the archipelago only Havelock and Neil Islands are inhabited, fishing and over-exploitation of marine resources, setting up of temporary fishing camps, tree felling, logging, plantations and fires cause much disturbance within the NP (Rao 1990, Deb 1998, Das 1998, Andrews 2000b). However it is very important, as a conservation and management priority, that Peel, Nicholson, Wilson, Inghish, South

Button, Middle Button and North Button Islands be included in the Rani Jhansi Marine National Park (Andrews 2000b).

- vii) North Sentinel Island: This 47 km² island is named after the Sentinelese tribe who are completely isolated from the rest of the world. Awaradi (1990) referred to it as 'the last bastion of the Andaman Negrito'. The tribe has no interaction with people outside the tiny island. Until now, it has shown a dislike of interference by aggressively attacking intruders into the territory with arrows and spears.

There are no detailed records of the biodiversity of North Sentinel. It can be assumed that the dense forest (> 40% shown on the IGCMC Forest Cover Map 1987-90, Andaman & Nicobar) and surrounding coast provide all the living requirements of food, shelter, medicine and implements for the tribal population. In order to conserve this island it will be necessary to allow the Sentinelese to pursue their lifestyle of 'eco-cultural equilibrium'. If their culture is altered, the ecology of the island will inevitably suffer.

- viii) South Sentinel Island is a small offshore flat island, situated southwest of Tarmugli Island in South Andamans. It is 1.6 km² in area and the highest elevation is only 6m. The topography, flora and fauna have been previously discussed by Davis and Altevogt (1976) and Pande *et al.* (1991), This small island is very significant in terms of being the last stronghold for the giant robber crab in the Andamans. It has the largest monitor lizards in the Andamans and annually, during the month of March, thousands of pied imperial pigeons come from South and Little Andaman Islands to nest in it. South Sentinel is also very important as a nesting habitat for green turtles. This small island is surrounded by some of the most spectacular inter-tidal coral reef flats and reef slopes and reef shelves, all of which are extensive and need to be assessed (Bhaskar 1993, Andrews 1997, Andrews *et al.* 2001).

- ix) South Andaman / Mount Harriet: Some of the highest peaks in the Andaman group are in the Mount Harriet range on South Andaman. It is covered with dense evergreen and semi-evergreen forests with remarkable diversity in flora and fauna (Das 1997, Balachandran 1998, Singh 1997). The park, which is elongated in a north-south direction,

comprises the major portion of this hill range over an area of 46.62 km² with another 1,700 ha area that has been proposed for inclusion. The steeper hills are on the east, the highest being Mount Hext at 424m. The mountain range is an important catchment area for the island. Although there are no rivers, about nine perennial streams flow through the park. The park's extraordinary plant diversity makes it a valuable conservation zone. It has a towering canopy of gurjan, padauk, taupeng, chuglam and other precious tree species. Balachandran (1998) reported 134 plant and tree species of which 74 are endemic and 51 introduced. Mount Harriet also has a rich bird-life (out of the 88 species recorded, 48 are endemic). Das (1997) reported 20 species of reptiles and eight amphibians, besides describing a new species of frog, *Rana charlesdarwini*, and recorded several species of freshwater fish, some new to science and some new records for the Andamans. The same author also reported several small mammals from this NP (Das 1999). Mount Harriet National Park is a popular day-trip for tourists because of its proximity to Port Blair, roughly 15 km away by the shortest route.

The easy availability of freshwater and the fertile valleys of the mountain range has attracted many settlements around the NP. Another contributing factor is that Port Blair and Hope Town jetty are nearby. Settlers also constantly extend the boundaries of their occupied areas, encroaching into forest land and harvesting the reserve forest illegally for timber and other forest produce. On the hill slopes bordering the park, land is being encroached and converted to areca and coconut plantations (Singh 1997). As a result the NP has no buffer zone. A number of industries, including quarries, plantations and plywood factories have sprung up in the immediate surroundings of the NP (Singh 1997).

- ix) Wandoor Marine NP (Mahatma Gandhi Marine NP): The national park, set in the Labyrinth group of islands to the south-west of South Andaman, comprises fifteen islands of different sizes, scattered over a total area of 281.50 km². Of this, 220 km² encompasses the territorial water around the islands. Perennial streams flow through most of the

islands, which are densely forested. While larger islands such as Alexandra, Tarmugli and Redskin have gently undulating hills, some of the smaller ones like Belle are nothing more than little outcrops of vegetation surrounded by a thin strip of white sand. This national park was established to protect and preserve biodiversity. Different habitats such as coral reefs (Kulkarni (2000) reportedly identified 115 coral species in this park) sea grass meadows (have been reported by Das (1996)), mud flats, estuaries, as well as several vegetation types such as tropical forests and mangroves are found in this area.

The Wandoor Marine NP is a major tourist attraction of the Andaman and Nicobar Islands. Many of the islands are fringed with beautiful beaches with clear lagoons displaying the underwater world of coral reefs. Disturbance caused by tourists poses a degradation threat to the coral reefs. Overexploitation of forest resources by the inhabitants of the surrounding villages and unchecked grazing by domestic cattle are other factors that are damaging the site. Spotted deer is also taking a major toll on the regeneration of vegetation on most of the islands in the park (Aul, 2002).

- x) Little Andaman / Dugong Creek Onge Settlement: the Onge tribe, whose population has now dwindled due to continuous interference in their land and lifestyle, occupies the area. Traditionally a hunter-gatherer people with immense ethno-biological and ethno-medical knowledge, the Onges have been responsible for conserving the biological resources of their area. Conservation and restoration efforts are now needed to improve the habitat, which has been degraded by illegal tree felling, clearing and the establishment of plantations. The vicinity of the Dugong Creek settlement in Little Andaman has been identified as a priority area because of its rich biodiversity of luxuriant littoral forests, mangroves and tropical evergreen forests (Ellis *et al.* 2000). This island is particularly important from the conservation point of view because it has habitats that are found nowhere else in either the rest of the Andaman Islands or in the Nicobars (Andrews 2000a). These include long mangrove creeks, large freshwater streams, very extensive freshwater marshes - some with floating vegetation - and the only peat

bog in the ANI. Little Andaman is the last stronghold for the saltwater crocodile and Andaman teal for the entire Andamans. It also has the last remaining pristine leatherback turtle nesting beaches in the Andamans (Andrews *et al.* 2001). It is recommended that at least 80% of good primary forest on Little Andaman should be protected as its forests harbour many new races and rare species and are laboratories for evolutionary processes.

- xi) Rutland Island: Rutland is the second largest island of the South Andaman group. It is well endowed with freshwater streams, which are a precious resource in the Andamans. Its terrain is hilly with rich evergreen forests on the hilltops. Despite selective logging, which has been carried out on the island for the past 14 years, the evergreen forests are still in good condition. Over 90% of the plants endemic to the Andamans occur here, including the wild relatives of mango, areca, rice, spices, cane and bamboo (personal comments of Dr T.V.R.S. Sharma in Gandhi 2000).

Several threatened species such as the Andaman wild pig, Andaman water monitor, saltwater crocodile, Andaman teal (Vijayan 1997) and edible nest swiftlet are found on the island. Some beaches are nesting areas for marine turtles, mainly the leatherback and green sea turtle. Rutland has a high diversity of butterflies (Mohanraj *et al.* 1997, Devy *et al.* 1995) and birds, particularly forest birds.

Table 7.1: A SUMMARY OF SOME OF THE PRIORITY SITES REQUIRING PROTECTION IN THE ANDAMAN ISLANDS

NAME OF ISLAND	STATUS	EXTENT OF PROTECTION REQUIRED	SPECIES	REMARKS
NORTH ANDAMAN	National Park – Saddle Peak Many small island sanctuaries	Larger extent of forest on main North Andaman island needs protection, e.g. Austin Point and other sites, besides a buffer zone for Saddle Peak	10 endemic and at least 20 rare bird species and 4 endemic butterflies	Areas with evergreen and semi-evergreen forest on main North Andaman island need protection
SOUND	Not protected	Whole island sanctuary	3 endemic and 4 rare bird species	Dry forest
MIDDLE ANDAMANS	Many small island sanctuaries and NPs	Forests on large islands need protection, particularly near Jarawa Reserve	10 endemic and at least 20 rare bird species	Good extent of wet forests on mid-sized and large islands

NAME OF ISLAND	STATUS	EXTENT OF PROTECTION REQUIRED	SPECIES	REMARKS
BARATANG	Not protected	Area with good forest cover can be protected	10 endemic and at least 20 rare bird species	Semi-evergreen forests
HAVELOCK	Not protected	Forested areas can be protected within Rani Jhansi Marine NP	10 endemic and at least 20 rare bird species	Good wet forest cover
JOHN LAWRENCE	Not protected	Forested areas can be protected within Rani Jhansi Marine NP	9 endemic and at least 20 rare bird species	Wet and deciduous forests
PEEL	Not protected	As above	8 endemic and at least 15 rare bird species	
WILSON	Not protected	Whole island should be included within Rani Jhansi Marine NP	6 endemic and at least 10 rare bird species	Evergreen and semi-evergreen forests
NORTH PASSAGE	Not protected	Whole island should be included within Rani Jhansi Marine NP	6 endemic and at least 10 rare bird species	Wet forests
NICHOLSON	Not protected	Whole island should be made a sanctuary within Rani Jhansi Marine NP	Few rare species, some the best coral diversity and sea grass beds	Dry forest
RUTLAND	Not protected	Forested areas can be included within Wandoor Marine NP	10 endemic and at least 20 rare bird species	Wet and disturbed forests
LITTLE ANDAMAN	Not protected	Large National Park (over 300 km ²) can be created, that includes areas from Dugong creek, entire west coast and inland	10 endemic and at least 20 rare bird species. Only stronghold for the last remaining fresh-water marshes. Only peat bog in ANI.	Wet forests. Very important island for speciation

Sources: (Andrews 2000a, Davidar 2001a)

The Nicobars

- i) Camorta and Teressa Islands: These are small hilly islands, located in the Nancowry group, in the Andaman Sea. They were identified for prioritization on account of the grass heaths on the hillsides surrounded by tropical evergreen forests. These grasslands are a peculiar feature of these islands and there is a debate over their origin. Rodgers and Panwar (1988) had recommended the establishment of a 50 km² protected area in Camorta. There is a problem of poaching and land clearing for settlements by new settlers and encroachers from the mainland, even though these islands are remote.
- ii) Great Nicobar Island: Great Nicobar, the southern-most island in the Andaman & Nicobar archipelago, lying below the 10 Degree Channel, is located nearer to Sumatra than to the Indian mainland. It is endowed

with immense genetic resources of wild plant species, of which 30% are South-East Asian flora not occurring elsewhere in India (Pande *et al.* 1991). There is a high degree of endemism among the flora and fauna of the island with special animal-plant inter-relationships. Great Nicobar has the highest number of endemic birds of the Nicobar group and also the highest number of 'near threatened' species (Sankaran 1995). The Nicobar scrubfowl (also known as the Nicobar megapode) *Megapodius nicobariensis* is the flagship bird species. Also found here are the Nicobar crab-eating macaque *Macaca fascicularis* and the endangered giant robber crab *Birgus latro* (Tikader *et al.* 1986), the largest land crab in the world. Extraordinarily rich coral formations can be seen on the fringing reefs in the sea around the islands. Several species of marine turtle nest in large numbers on the island's sandy beaches, such as South Bay, which is the most significant nesting site in the Indian Ocean and globally significant for the leatherback turtle (Andrews *et al.* 2001 & 2002; Andrews & Shanker, 2002). Among all the islands of the A&N archipelago, the seagrass beds around Great Nicobar are undoubtedly the best for the conservation of the highly endangered dugong.

As mentioned above, two distinct mongoloid aboriginal tribal groups, the Shompens and the Nicobarese, live on the island. The Shompens are a reclusive, forest-dwelling nomadic group. They are basically hunter-gatherers dependent upon forest resources. Their numbers are declining with increasing pressure on their territory. India will lose a valuable heritage if their traditional systems are disrupted. By contrast, the Nicobarese are seafarers, living along the coast, who have always had interaction with the outside world. Although they are also traditionally hunters, they are now increasingly changing their lifestyle to cultivation and other occupations, including government service.

Both the tribal populations, with their immense ethno-biological knowledge, were conserving the biodiversity of the island for centuries. The entire island was formerly designated as a tribal reserve. However, after it was de-gazetted for rehabilitation of ex-servicemen from the mainland, there have been dramatic changes in land use and considerable anthropogenic disturbances. The 'modernisation' of the

Nicobarese has also resulted in the over-exploitation of endangered species (this is discussed in further detail in Section 7.2a).

Great Nicobar was declared a Biosphere Reserve in 1986 and subsequently four protected areas were created: Campbell Bay NP, Galathea NP, Galathea Bay Sanctuary and the Megapode Sanctuary. Two areas on the island were prioritised in the BCPP project (Singh *et al.* 2000). One merged the Campbell Bay and the Galathea National Parks from north to south and covered almost the entire island, excluding only some settlement areas and the other was at Indira Point (formerly called Pygmalion Point), which is the southernmost point of India.

b) Improving PA Management

The Wildlife (Protection) Act is applied to manage ecologically important sites in the Protected Area network. There are general recommendations for improvement of PA management as well as specific recommendations for particular individual sites.

General Management Issues

The following general management measures are required to improve PA management in the ANI:

- i. Demarcation of boundaries of each PA
- ii. Inclusion of surrounding marine areas
- iii. Establishment of more large PAs
- iv. Notification of proposed extension areas and buffer zones
- v. Coastline, coral reef and marine ecosystem management
- vi. Improved equipment and communication systems for forest staff and bush police
- vii. More boats and vehicles to facilitate patrolling
- viii. Co-ordination between Forest Dept. and coastguards
- ix. Regular, extensive patrolling on land and sea, including at night
- x. Natural regeneration and / or habitat enrichment in disturbed areas
- xi. Removal of invasive weeds
- xii. Control of introduced animals, particularly spotted deer, dogs, cats and elephants.

PA-Specific Priorities

The following management measures are proposed for individual protected areas:

i. Interview Island Sanctuary

- Conduct regular elephant population census – updated information is needed on an annual basis (Ali 2001).
- Carry out phased removal of planted *Lagerstroemia* to allow for natural regeneration of original vegetation.
- Protect freshwater ponds where Andaman teal are found in good numbers.
- Remove *Eupatorium* weed, which has invaded forest paths and clearings.
- Enforce anti-poaching measures for terrestrial wildlife as well as for sea cucumbers, shells, etc.

ii. Cuthbert Bay Sanctuary

- Relocate the encroaching human population – they are already in an isolated, impoverished condition and may not resist relocation to areas with better opportunities.
- Control feral dogs, which are a threat to marine turtles (Andrews *et al.* 2001).

iii. North, South & Middle Button Islands

- Prevent illegal exploitation of swiftlet nests, as well as marine resources. The poachers are residents of Middle, North and South Andaman, and the two neighbouring inhabited islands, Havelock and Neil.
- Protect good patches of coral off South Button – damage is caused during illegal fishing and collection of corals, shells and sea cucumbers. Chartered launches from Thailand and Australia regularly organise scuba-diving tourist expeditions off the shores of this island without the knowledge of the A&N Administration.
- Incorporate the three Button Islands, Wilson, Nicholson, Peel and Inglis Islands, along with the surrounding sea areas, into the Rani Jhansi Marine National Park – a proposal already exists (personal comments of Dr. Alok Saxena, CWLW, July 2001; Andrews 2000b).

iv. West, East Island and Landfall Island Sanctuary

- Protect the seagrass bed located south east of Inglis towards Henry Lawrence Island which has been assessed to have high biological value.
- Prevent hunting of turtles and dugongs.

- Prevent damage to corals near Inglis Island and around the Archipelago including the Button Islands - damage could be attributed to dragging of anchors while fishing for coral reef fish, and collecting shells and other marine fauna.
- v. Rani Jhansi Marine NP
- Improve protection of John Lawrence Island – larger islands have more floral & faunal species, which have better long-term chances of survival.
 - Regularly patrol swiftlet nest sites.
 - Determine the status of seagrass beds.
 - Enforce conservation measures for dugongs.
- vi. Mt. Harriet NP
- Relocate the proposed LPG bottling plant in Shoal Bay, further away from the NP.
 - Halt sand mining on beaches of Villages 18 & 19.
 - Restore mangroves in Bamboo Flat.
 - Restrict the number of visitors and regulate their movements within the PA.
- vii. Lohabarrak Saltwater Crocodile Sanctuary
- Andrews (1997 & 1998) has studied the status of crocodiles and has found that there are small resident crocodiles in the sanctuary. However, the entire area of the sanctuary has been silted up and nesting habitats overrun by settlements and encroachments. The area is also affected by intensive fishing. There is a view (Harry Andrews') that it might be too late and not worth the while to try and rescue the area, unless nesting habitats are restored and fishing and related activities completely banned.
- viii. Mahatma Gandhi Marine (Wandoor) NP
- Improve maintenance and develop the Interpretation Centre.
 - Prevent any further damage to coral reefs caused by tourism – anchors of tourist boats break the corals, and tourists step on them while swimming and snorkelling especially around Jolly Buoy Island. Fixed anchor points or buoys need to be established.
 - Enforce measures to prevent sedimentation – disturbances on the sand beach of Jolly Buoy Island cause turbidity and sand deposits on the coral reefs.

- Control tree felling in neighbouring Rutland Island, which is outside the PA – tree felling causes erosion, and exposed soil gets washed down to the sea, choking live corals in the Jolly Buoy coral reefs.
- Regulate mangrove cutting and land clearing for housing / agriculture in the villages adjoining the NP – these activities also result in soil erosion, leading to the siltation of corals.
- Ensure park rangers are trained and give briefings to tourists at the Interpretation Centre in Wandoor or on the boats to the islands.

ix. Galathea National Park

- Redesign the boundaries since they do not include any part of the coastline. The southern-most tip of the island, which is the largest uninhabited lowland forest in the Nicobar group, has the greatest abundance of endemic avifauna, and is the primary nesting habitat of the Nicobar scrubfowl (Sankaran 1995), needs to be included in the National Park.
- Improve protection of the coastline, which is exposed to exploitation of precious corals, shells and reef fishes, and to sand mining.
- Reduce disturbance along the eastern beach, which is an important feeding zone of the crab-eating macaque.
- Impose conservation measures for seagrass beds found along the western coast and smaller patches on the east coast (Das 1996).
- Protect the buffer zone on both sides of the East-West road, which cuts through one of the largest contiguous stretches of primary forest in the Nicobar group.
- Control the exploitation of wildlife species such as pigeons, teals, parrots, fruit bats, snakes, wild pig, monitor lizard, cowries, conch shells and sea cucumbers (kaala keeda) by the residents of Gandhinagar, Shastrinagar and Govind Nagar.
- Prevent illegal collection of large amounts of the valuable red coral *Tubipora* sp. from a reef at the 35km point on the N-S road.
- Monitor stone quarries in the immediate vicinity of the NP.
- Control grazing by settlers' livestock, particularly cattle.
- Mitigate human / wildlife conflicts arising on account of crab-eating macaques raiding the settlers' plantations.

- Control feral dogs and cats that kill Nicobar megapodes and marine turtles.
- x. Campbell Bay National Park
- Clear litter washed ashore from the sea on the NP's coastline.
 - Protect the buffer zone along the East-West road - which is damaging the fragile forest ecosystem.
 - Control poaching of sea cucumbers, valuable shells like *Trochus*, *Turbo*, giant clams, red coral, edible swiftlet nests, reef fishes, sharks, crocodiles (including live captured ones) and many other marine fauna by foreign poachers from Burma, Thailand, Sri Lanka and even as far away as Taiwan, who come to the island with sophisticated equipment and fast boats to make a quick get away.
- xi. Galathea Bay Wildlife Sanctuary
- Strict control of local and VIP tourists and patrolling of the beach during the turtle nesting season.
 - Control of feral dogs that kill marine turtles and eat their eggs.

7.2. Capacity Development Priorities

The Andaman and Nicobar Islands (ANI) are rich in biodiversity and their ecosystems are fragile in nature. The majority of the people reside in small rural settlements. They depend heavily on natural resources for their livelihood. Over time, this has resulted in over-exploitation of these resources. Additionally, encroachment on forestland to increase the area under farming has led to habitat loss. Therefore there is an urgent need to initiate capacity development of institutions and individuals in conserving biodiversity.

Capacity development may be defined as “the process by which individuals, organizations, institutions and societies develop abilities (individually and collectively) to perform functions, solve problems and set and achieve objectives” (UNDP 1997).

This chapter sets out the priorities for capacity development along with generic and specific recommendations for implementation. The recommendations are derived from various literature sources as well as from the personal observations and communications of a wide cross-section of persons whose work and interests have a direct bearing on the subject.

Speakers at the Workshop on the Management of Protected Areas in the Andaman and Nicobar Islands held in Port Blair in July 2001 repeatedly stressed

that overexploitation of biological resources and chemical pollution contributed to habitat loss, species loss and the depletion of genetic diversity (Workshop Report 2001). The economic development of the human population, which is the objective of the Government, would further strain biological resources. Making biological resources available to rural communities and simultaneously conserving a healthy gene pool is of strategic importance and a priority. Individuals and institutions have to be alerted to the fact that prudent use of ecosystems is in their long-term interest. Capacity development assumes an important role in fulfilling this priority.

Capacity development has to be addressed at three different levels:

1. Systemic capacity development, which should address various lacunae in the system dealing with biodiversity
2. Institutional capacity development, to rectify the present inadequacies of the institutions concerned with conserving biodiversity
3. Individual capacity development, to aim at imparting training and improving the capabilities of the individuals who protect biodiversity and those who sustainably harvest biodiversity (Zakari *et al.* 2001)

a) Status of Systemic Capacity

Systemic capacity for conserving biodiversity comprises laws and policy as well as the institutions enforcing such policy, and the training of individuals in efficiently executing their tasks. On surveying the system, the following problems were noted.

Legislation

Legal regulations have already been enacted to protect biodiversity. Forests are managed under the Forest Conservation Act (1980). Wildlife is managed under the Wildlife (Protection) Act 1972. The Coastal Zone Regulation Notification of 1991 (CRZ) issued under the Environmental Protection Act 1986, protects the coastal and marine ecosystems. The Andaman and Nicobar Fishing Rules 1939 and Andaman and Nicobar Shell Fishing Rules 1978, as amended, protect the marine fauna. In addition, territorial waters are protected by the Indian Coastguard Act 1977 and The Maritime Zones of India (Regulation of Fishing by Foreign Fishing Vessels) Act 1981. Different departments enforce these laws and their common aim is to protect the natural resources and biodiversity. Cross-sectoral awareness of these laws is lacking.

The Director of Fisheries pointed out during the workshop that though there were many laws regulating fisheries, it was still not clear whether fishing was allowed inside a protected area. Since fishing nets do not have Turtle Excluding Devices, endangered marine turtles are affected. Recent studies show that 2,000 - 3,000 marine turtles of all sizes are annually trapped in fishing nets (Bhaskar 1993, Andrews *et al.* 2001).

The Wildlife (Protection) Act applies to specific sites, and other areas having similar biodiversity are not adequately protected. Many of the coral reefs have come under the protected area network, yet those that are found outside the protection zone are open to exploitation. The existing legal coverage under the Wildlife (Protection) Act, bestowed on National Parks and Sanctuaries, is not sufficient. More categories like Biosphere Reserves are needed to address the realities on the ground.

Regulations for Tribes

The Shompens of Nicobar and the Onges of Little Andaman are hunters and food-gatherers. Currently their populations are very small. The other tribe inhabiting the Nicobar Islands, the Nicobarese, have taken to settled agriculture and are also working in the tertiary sector. The Nicobarese population is much larger than the Shompen population. The Onges and Shompens live in special tribal reserves administered under the Andaman and Nicobar Islands (Protection of Aboriginal Tribes) Regulation 1956.

Section 65 of the Wildlife (Protection) Act 1972 allows the scheduled tribes of Nicobar the right to hunt wild animals for food⁵. Under the ANI (Protection of Aboriginal Tribes) Regulation 1956, the creation of Tribal Reserves for the Primitive Groups was notified and it does not confer any special rights to any of the tribes to hunt. Participants at the workshop felt that the right to hunt must be confined only to the Shompens, Onges, Jarawas and Sentinelese, and must exclude all other groups. Tribal groups such as the Nicobarese, having a large population and availing of this privilege, tend to overexploit wildlife. It was felt that

⁵ **Section 65. Rights of Scheduled Tribes to be Protected.** Nothing in this act shall affect the hunting rights conferred on the Scheduled Tribes of the Nicobar Islands in the Union Territory of Andaman and Nicobar Islands by Notification of the Andaman and Nicobar Administration No. 40/97/F. No. G-635, Vol. III dated the 28th April 1967, published on pages 1 to 5 of the *Extraordinary issue* of the *Andaman and Nicobar Gazette* dated the 28th April 1967.

Section 65 of the Wildlife (Protection) Act should be reconsidered to address this problem.

Stringent legal measures and special regulations for the protection of tribal reserves must be enforced in acknowledgement of the fact that some of the richest, best preserved ecosystems are those used by the aboriginal hunter-gatherer tribes such as the Jarawa. They protect some of the last remaining concentrations of threatened species like the Andaman teal, marine turtles and the saltwater crocodile. Now that the Jarawas have shed their hostility, encroachments and poaching have increased on their land, as they already have in the Onge reserve. A policy has to be formulated. 'Development plans' for these sensitive tribes must include strict protection of their reserve areas and prevention of disturbance and encroachment.

Enforcement

Laws are not being strictly enforced. The entire rural and revenue area of ANI is covered by CRZ category IV, except a very small area, which is under CRZ category II. CRZ-IV⁶ does not allow sand mining along the beaches, yet sand is being mined after amending the CRZ notification 1991 (ANI F&E 2001: pp10). Forest encroachments continue and often are legalised after the lapse of a specific period. Stringent enforcement of anti-poaching laws is also urgently required.

Co-ordination

Lack of co-ordination between different line departments of the Government, whose mandate is to protect biodiversity is another factor which creates problems in environmental protection. The Fisheries Department issues nets but they do not check the sites where the nets are used. It is illegal to use a shore seine, but seines are erected at the mouths of creeks in tribal reserves. This practice kills threatened species such as turtles and dugongs. Concerned departments such as Forests and Tribal Welfare are not informed about the issuing of nets to fishermen.

⁶ **CRZ-IV (Andaman and Nicobar Islands)**

- 1) No new construction of buildings will be permitted within 200 m of the High Tide Line (HTL)
- 2) Corals and sand from the beaches and coastal waters shall not be used for construction and other purposes.

The policies of various departments conflict with each other, though their common objective is sustainable development. It was mentioned in the Port Blair Workshop that though there are effective laws protecting the environment, the new economic policies pose a threat to biodiversity (Workshop Report 2001). The development of economic resources like power generation and irrigation facilities for agriculture will use natural resources, mainly found in forests. Similarly the schemes of the Fisheries Department such as introducing commercial species in natural water sources and constructing artificial reefs in protected areas are in direct conflict with biodiversity conservation.

Co-operation between local communities and the Forest Department is lacking at present. The earlier Forest policy was one of strict policing, but when the FD found that it no longer was an effective policy, some enlightened officials adopted schemes like *Joint Forest Management* and *Eco-development*. In a few areas, local communities have started co-operating with the FD and forest protection is successful. However, co-operation between the FD and local communities has to be strengthened in and around every protected area.

Summary of major issues

The status survey of the systemic capacity indicates that the following issues have to be addressed immediately:

- Ensure that there is cross-sectoral awareness of laws
- Create more categories of protected area such as biosphere reserves to address realities on the ground
- Ensure strict enforcement of laws
- Ensure co-ordination between different line departments of the government and resolve conflicts arising out of implementation of policies. For example ensure co-ordination between the coastguard and Forest Department
- Design a tourism policy to take care of the issues already mentioned
- Consider pollution control and solid waste management a priority issue
- Improve networking and dissemination of information
- Train specialists / scientists, for instance taxonomists
- Initiate discussions based on the available information and implement the suggestions

- Increase the budget allocation to the wildlife wing of the Forest Department

b) Status of Institutional Capacity

Training

There is a lack of infrastructure and research facilities in many of the institutions working for the protection of the environment. There is also a lack of trained technical personnel for carrying out research. Until a short time ago, marine biologists were not trained in scuba diving. This should have been a prerequisite for carrying out research on coral reefs. Now training has been initiated in scuba diving.

Equipment

The efficiency of the Forest Department is severely hampered by inadequate and outdated equipment: boats, land vehicles, communication equipment etc. Poachers have state-of-the-art equipment and fast boats so they work efficiently and easily escape. The Pollution Control Board does not have laboratory facilities on the Islands to test samples obtained locally. Persons working for the Board in the Islands must be adequately trained in dealing with pollution in the aquatic environment.

Budget

Budgetary constraints and unattractive working environments result in qualified technical staff leaving institutions. NGOs and research institutions often complain that it is difficult to find research assistants to work in the ANI. Bureaucratic delays in filling up vacancies often affect the efficient working of the institutions.

Planning

Institutions are not properly and firmly integrated into the planning process. Strategic planning requires that research outputs are translated into information and recommendations, and fed into the planning process. Moreover, these research institutions are unable to assess correctly the priorities, as envisaged in the plan, and carry out studies that will strengthen planned development. There were suggestions at the Port Blair Workshop that timber should replace concrete as a building material on the islands (Workshop Report 2001). Timber has to be treated to withstand the climatic condition of the islands. Though plans may recommend the use of timber as a building material, research to make it suitable for the purpose of house building has not commenced.

Institutions engaged in research are not specifically oriented to working in a cross-sectoral environment. This in turn weakens the planning process. Dissemination of information from these bodies is very slow or totally absent.

Training institutions do not develop site-specific training programmes. They do not carry out a preliminary survey to assess the training needs for the individuals required to carry out specific tasks.

Institutions of the Ministry of Environment and Forests have to carry out Environmental Impact Assessments (EIA) individually for each development activity. Training Institutes have to train Forest Personnel and NGOs in carrying out EIAs. It is mandatory to do it at present, but often reports get diluted or over-ruled.

Development plans need to be formulated for settlements around PAs or sensitive areas, with provision for alternative fuels, livestock management, income generation and other measures to reduce pressure on PAs. Town planning is essential in urban areas.

Priorities for institutional capacity building

Improving the infrastructure and research facilities, training technical personnel so that they are qualified for carrying out research, increasing the budget and improving the working environment, would be some of the infrastructural changes required to strengthen the Islands' institutions. The research staff of institutions such as ZSI, BSI, ASI, CARI or universities should be trained to understand the planning process, so that they can make useful contributions. They should also be oriented towards working in a cross-sectoral environment.

c) Capacity Development for Individuals

Research & Training

Trained scientists such as taxonomists are not available. The ability to understand the significance of genetic resources is a prerequisite for conserving biodiversity. Training is often an in-house short-term programme, with very limited external information or knowledge flowing in.

The Wildlife Institute of India conducts training courses in wildlife management for Forest Department personnel. Often such trained staff are diverted to non-wildlife divisions, and their capability is not fully utilised. Forest Department staff such as guards and watchers need to be trained to understand the significance of conserving biodiversity and in essential skills like combat

training, use of firearms, use of wireless and communication equipment, census techniques and monitoring. The Wildlife Institute also conducts training in Participatory Rural Appraisal (PRA) techniques for executing eco-development projects. These training programmes should be held for all categories of staff. Introducing eco-development principles and PRA techniques in the rangers' training programme has begun. It may take some time to see the results percolating to the field situation.

Education & Awareness

Nature camps and awareness campaigns conducted especially for children and adults living around protected areas are sporadic. The Forest Department conducts such programmes and their sustainability depends on budget allocations. NGOs are more effective in conducting nature awareness campaigns, and they should be supported both financially and logistically.

Environmental education has not been given due importance in school curricula. The dearth of educational material and the inadequacy of properly trained teachers to impart environmental education were highlighted by one of the speakers at the Port Blair Workshop (Workshop Report 2001). There is an urgent need to build up an informative course content for environmental education in schools.

Low-impact Occupations and Alternatives

Awareness campaigns have to be initiated to educate people engaged in the agricultural sector. The growing population imposes an excessive strain on the limited agricultural land. The negative effects of chemical fertilizers and pesticides on ecosystems should be explained. Agro-forestry as an alternative to Non-timber Forest Produce extraction should be popularised. There is also an urgent need to commence an awareness campaign regarding restrictions on fishing.

Priorities for Improving Individual Capability

The training of scientists in various specialisations should be initiated, and training of trainers should commence so that fresh ideas and the flow of current knowledge is ensured. In addition, trained persons' capabilities should be properly utilised. Environmental education has to be given due importance and awareness campaigns should be initiated in sectors that need them urgently.

7.3. Research Priorities

a) Research Priorities for Protected Areas

- An island-wise species inventory of key taxa.
- Species inventories of key taxa such as birds, small and large mammals, reptiles, amphibia, freshwater fishes, butterflies and vascular plants are required. This will identify unique habitats as well as identify species that might be vulnerable to threats. It will also answer questions of biogeographical and evolutionary interest.
- A detailed vegetation map. The areas under various vegetation types and sub-types, their current status and extent of fragmentation are not known. The vegetation map should be prepared by a combination of gathering field data and recent satellite images, would identify vegetation types under threat, and would also identify areas that might be set aside as new protected areas.
- Initiating a database. There has been no attempt to gather all the information on the Andamans in one place. Creating a database that puts together all available information in an easily accessible format would allow planners to arrive at decisions regarding management of specific areas, species and reserves more easily, as well as being an invaluable tool for researchers. An outcome of gathering the information outlined above would be the delineation of new protected areas as well as a rationalisation of the boundaries of existing ones.

b) Research Required on Coral Reefs

- Mapping reef distribution. The extent of coral reefs is not yet known, since they have not been mapped in detail for both the island groups. The preparation of a map marking the different kinds of reefs, and the depth at which each reef is found, is necessary to any plan oriented towards long-term conservation of these areas.
- Preparing a database. The information gathered above in the mapping exercise, together with information on the species found at each reef that has actually been surveyed, would be input into a database. This would enable the identification of reefs with unique species and other special characters, and would help in determining which areas need to be protected.

- Water quality monitoring. Damage to the reefs has been reported at a number of sites. A significant proportion of this damage is believed to be due to inappropriate land-use practices resulting in sedimentation, and pesticide and chemical fertiliser runoff. A long-term monitoring programme for these substances would help in designing mechanisms to reduce their impact.
- Pollution monitoring. Recent industrialisation has resulted in water pollution in certain areas, especially near Port Blair. These include oil leakage from ships, which is likely to have a very adverse impact on marine resources. Even though water pollution is currently considered to be within acceptable limits, this might still be sufficient to damage coral reefs. It is necessary to initiate regular monitoring to ensure that actual and potential polluting sources are controlled.
- Identifying management models for tourism, etc. Tourism has resulted in considerable damage to corals in areas with heavy visitor pressure, such as Redskin and Jolly Buoy Islands. The rate of destruction caused by tourism in these places is unsustainable. Methods have to be evolved to both educate tourists and to restrict their access to coral areas in such a fashion that their presence does not cause damage to the reefs. Preventing damage and ensuring sustainability would apply to fisheries as well.
- EIA & its quality control for coastal projects. The Environmental Impact Assessments (EIA) carried out for coastal projects have been inadequate or lacking until now. This has resulted in a great deal of avoidable environmental damage. Future EIAs have to be made mandatory. A mechanism to ensure that the EIAs performed are of high quality needs to be put into place.
- Detailed monitoring of critical species (at 19 sites). Monitoring at specific sites to understand the changes that occur over time in coral reefs are a necessary adjunct to surveys, in any long-term management. This activity needs to be undertaken on a regular basis.
- Draft monitoring plan prepared by ICRMN and GCRMN. A draft monitoring plan has already been prepared by the Indian Coral Reef Monitoring Network (ICRMN) in collaboration with the Global Coral Reef Monitoring Network (GCRMN). This needs to be implemented. MOEF should pursue this and ensure its implementation.

c) Research Required on Mangroves

- A status survey. There are 36 species of mangroves in the ANI. In the past, considerable disturbance has been caused to mangroves, through both timber extraction and lopping for fuelwood by local communities. The status of many of the rare mangrove species is not clear, and a survey needs to be undertaken to obtain this information. At the same time, datasets can be gathered to enable mapping by remote sensing.
- An island-wide mapping. Mapping of the mangrove resource is a step that follows the status survey. This would involve analysis of satellite images using the datasets gathered in the status survey.
- Possibilities of mariculture. The possibilities of farming various marine products have not been explored in the Andamans. These include shellfish, sea cucumbers and cultured pearls. Experimental stations need to be established to check the feasibility of these activities as economic activities in the Islands.
- Mangrove Research Institute. Mangroves are a critical ecosystem that have an effect much beyond their physical boundaries. For instance they act as nurseries for economically important crustacea. They also act as filters for sedimentation from the mainland, and enable buildup of land in coastal areas. These effects are very little understood in India, and no integrated effort has been made to understand the values of mangroves, their impact on the environment and the effects of various disturbances on them. Establishing an institute in the Andamans, which meets this objective, is seen as a priority.

d) Research Required on Species

- Wetland surveys for teal and crocodile. Both the Andaman teal (*Anas gibberifrons albogularis*) and the saltwater crocodile (*Crocodylus porosus*) have been becoming scarcer over time. One of the reasons is the destruction of wetlands all over the Andamans. A proper survey and mapping of wetlands is required, with a view to protecting key wetland areas. After this, a mechanism for regular surveys of these wetlands to monitor population numbers of key species is required (Andrews 1999, Andrews and Whitaker 1994).
- Megapodes. Surveys done in the recent past on the Nicobar megapode (*Megapodius nicobarensis*) indicate that it is endangered on the east coast of

Great Nicobar. The main threat is due to habitat destruction of its coastal habitat for agriculture, and snaring of birds near mounds. The bulk of survey effort has been on Great Nicobar Island. Surveys need to be repeated and extended. More information on the biology and population dynamics of the species would assist in formulating any conservation plan (Andrews 1999, Andrews and Whitaker 1994).

- Other birds. Other bird species in the ANI that are threatened or vulnerable include:
 - Andaman Crake
 - Wood Pigeon
 - Narcondam Hornbill
 - Nicobar Shikra

Research on the status and population biology of each of these species is required in order to formulate conservation measures, if necessary.

- Marine life. Marine life in the ANI archipelago that is threatened or vulnerable includes:
 - Dugongs
 - Sharks
 - Soft shells
 - Groupers

Research on the status and population biology of each of these species / groups is required in order to formulate conservation measures, if necessary.

- Research and management of introduced species. Design and implement time-bound programmes for their eradication. It was stressed repeatedly during the July 2001 Port Blair Workshop (Workshop Report 2001) that introduced species had no place in these Islands and need to be removed. Some of these introduced species, such as elephant and chital, have recently been studied and the damage caused by them quantified. These and other species that are affecting the native fauna in a serious and adverse fashion, such as cats, dogs, and goats, need to be removed from the Islands, and a time-bound programme to achieve this end has to be designed.

e) Other Gaps in our Knowledge

- Tribals - understanding their needs. A debate still continues about whether the indigenous tribals in the Andamans should be left alone or assimilated. It is felt that not enough is known about them, most critically the Jarawa, to take an informed decision. Detailed studies, including communicating with them to establish what their wishes are, need to be undertaken.
- Archaeology - what existed here in the past? Oceanic islands worldwide have played a very important role in our understanding of evolutionary theory. Speciation and extinction play a major role in maintaining their faunas, and result in a high level of endemism. Knowing what species existed in the Islands in the past, and which have gone extinct, would help us understand the dynamics of island ecosystems. It would throw light on which species might be at risk in the future.
- Ethnobotany, and medicinal plant distribution. Medicinal plants have been found from most parts of the world, wherever people have experimented with local plants as treatments for various ailments. The indigenous tribals have a rich ethnobotanical lore that has been documented very cursorily if at all. The immigrants that have come to the ANI have also developed a rich pharmacopoeia based on local plants. These need to be documented and intellectual property rights assured wherever possible.
- Rare flora and fauna: distribution maps. There are a number of plants that are both rare and endemic. In many cases the localities of collection have not been noted with sufficient accuracy to locate the plants again. Systematic maps are required of rare flora both to determine their distributions and habitat requirements and to assess threats to them.

f) Human-based Problems

- Carrying capacities. This concept has three contexts here:
 - Fisheries. Are certain species overfished, and what measures are required to assure sustainability, in terms of both research and management?
 - Tourism. Current tourism practice is leading to unsightly development and destruction of coral reefs and marine turtle nesting beaches. It needs to be established what other kinds of damage are

occurring, and methods to mitigate these effects need to be evaluated and implemented.

- People. There is unchecked immigration into the Islands. Is there any method of assessing what the "carrying capacity" of these Islands is? What methods can be adopted to ensure that this number is not exceeded?
- Exploitation patterns.
 - Forests. Local pressures on forest resources need to be identified and the extent of degradation this is leading to, and the steps required to minimise damage assessed.
 - Reefs. There is a need to establish what the local pressures on the reefs are, the extent of degradation this is leading to, and the steps required to minimise damage.
 - Fishes: There is a need to establish where overfishing is happening, and to implement measures to ensure that catches are sustainable.
- Agroforestry - bamboo, rattan, others. A study has shown that rice yields have declined very dramatically in North Andaman. This pattern is likely to be true in other parts of the Islands too. It is therefore important to identify alternate land uses before the soil becomes totally degraded. Agroforestry and planting canes and bamboos is one such alternate use. This would also meet the demand for forest produce that is currently leading to forest degradation. Model demonstration plots need to be set up for this purpose.
- Alternate building technologies. Sand mining for construction has led to the disappearance of a number of beaches, and this activity has to stop. Research has shown that pulverised granite, which can be prepared from raw material available in the Andamans, is a good substitute. Other substitutes also need to be located, especially for the Nicobars where granite is not found. Research is also required into methods to treat timber to enhance its longevity, to reduce the pressure on timber resources.
- Encroachments. Encroachments have become a major problem in the islands. There is little understanding of this as a social phenomenon, and why this has assumed such major dimensions in the islands. Research geared towards eliminating encroachments is vital.

- Nicobarese rights on sea turtles. Nicobarese have traditional rights on turtle hunting. The exploitation of turtles, even by Nicobarese, is no longer sustainable and methods have to be found to reduce the hunting of turtles by Nicobarese.

g) General Issues

Various institutions of the Ministry of Environment carry out research studies in isolation from each other. Networking or dissemination of information is lacking. Discussions at the Port Blair July 2001 Workshop indicated that there was a paucity of specialists / scientists, such as taxonomists (Workshop Report 2001). Collation of basic data has yet to be undertaken. Extensive research studies by various universities and institutes are not available to the Government Departments and even if they are available, discussions on their findings, and suggestions for implementation are not initiated.

7.4. Other Priorities

The ANI have fragile and interconnected ecosystems. Unsustainable activity in one ecosystem can upset the equilibrium of another ecosystem, as in the case of erosion of forest land contributing to siltation of mangroves and coral reefs. The edaphic and climatic conditions of the Islands can support luxuriant tropical forests but not any other man-made ecosystem. Unrestrained population growth, with corresponding increase in economic activity, will only add to the pressures on the Islands' ecosystems. Some of the policies of the Government, formulated initially to help settlers in the 1950s, are proving to be damaging now. The highly subsidized transport and other infrastructural facilities have attracted immigrants, thereby swelling the number of settlers. The Islands have far surpassed their carrying capacity in agriculture, as indicated by various studies. The only economic pursuit, which can be expanded without causing environmental degradation, is fishing. As suggested by the Director of Fisheries, in the Workshop held at Port Blair in July 2001 (Workshop Report 2001), much more needs to be done to make that sector viable and profitable. However, three issues have to be tackled by the ANI Administration to save the biodiversity of the islands:

- Control immigration and process all development plans only after conducting an EIA.
- Save forests from further encroachment by strictly enforcing the Public Premises Eviction of Unauthorized Occupants Act, 1971.
- Reconsider the policy on subsidies as it appears to actually lower the GDP.

a) Development Programmes

- Model eco-development. Model eco-development activities need to be initiated, initially in the vicinity of protected areas. These eco-development programmes would be geared to meeting the demand for forest produce from outside reserved forest boundaries, and enhancing income so as to reduce pressures on the forest.
- Educational curriculum development. The educational curriculum used in the ANI is based on textbooks from the mainland, and is not appropriate for the local ecosystems. This needs to be modified, and a strong environmental component relevant to the Islands introduced.
- *In situ* and *ex situ* swiftlet conservation. Recent research has established the feasibility of maintaining colonies of free ranging edible-nest swiftlets in houses. Their nests can be harvested after breeding is complete, and this does not affect their population in any way. Given the very intense collection pressure, this is the only way to save the species from dying out in the ANI, and research into maintaining colonies of free ranging swiftlets as a way of providing income to rural populations is a top priority.
- Research into sustainable methods of utilising the saltwater crocodile in both island groups is also a priority.

b) Immigration

Uncontrolled immigration from the mainland has led to increased encroachment into the forests. As mentioned in various research findings the new immigrants want to settle near their friends and relatives and not finding adequate empty land encroach on the forest. Old settlers also expand their holdings if they feel that they can farm the additional land. Though there seems to be no policy on controlling immigration, encroachment can be controlled by the Public Premises Eviction Act enacted in 1978. However, at the Workshop on the Management of Protected Areas held at Port Blair in July 2001, it was mentioned that

encroachments of forestland prior to 1978 had been regularized and there was a plea to regularize subsequent encroachments (Workshop Report 2001). The absence of a policy on immigration coupled with lack of enforcement of the Public Premises Eviction Act has led to large areas of forest coming under the plough.

c) Agriculture

The subgroup discussing policy, law and planning priorities at the Workshop, identified agriculture and soil conservation as a major issue affecting the biodiversity of ANI. Soil erosion and its negative impact on coral reefs are a cause of concern. The policy on soil conservation needs careful consideration. The subgroup report says, "Subsidy to farmers for undertaking soil conservation measures needs careful planning. The existing scheme of subsidy-to-loan ratio of 1:1, with a repayment period of five years has not worked effectively. Many farmers who became defaulters were automatically debarred from getting the subsidy. This has resulted in such farmers not undertaking soil conservation measures" (Workshop Report 2001). Ecologically sound agricultural practices need to be introduced in the Islands.

d) Tourism

The policy on tourism should be re-examined as many problems are arising due to uncontrolled tourism. Some of the problems caused by the lack of a proper policy on tourism are listed below along with some recommendations.

There are no regulations for private tour operators for permitting certain activities, e.g. scuba-diving. Scuba-diving and deep sea fishing tours are being organised by foreign tour groups to pristine coral reefs in the outskirts of remote islands, without prior permission.

A recent disturbing trend among private tour guides, taking advantage of the Jarawas who are now coming out of the forest onto the Andaman Trunk road, is to organise bus trips to Baratang and other areas near the Jarawa reserve so that tourists can look at the Jarawa tribals like curiosities. The operators advertise these tours and are able to procure licenses to visit these restricted areas.

Though leaflets and pamphlets giving visitor information and instruction are available in Port Blair, these are generally not available at the protected area (PA) entrances. Wandoor (the village at the main entrance to Mahatma Gandhi Marine National Park) has an Interpretation Centre, which currently only interested tourists visit. A system needs to be established where it is compulsory for each

tourist to go through the Interpretation Centre before entering the NP, so as to understand the significance of the place, and the precautions to be taken to prevent damage. In the absence of an Interpretation Centre, a short video should be screened or a talk given by forest staff to all visitors before they enter the PA. Time-bound conducted tours with limited numbers of people on fixed routes should be organised in each PA. This is necessary to prevent disturbance of the fragile habitat.

e) Pollution

Pollution control is not strictly enforced on the islands. Regulations should be imposed on passenger ships and tankers. Instructions already exist, especially for waste dumping and cleaning of oil containers, and are publicised on decks and cabin walls of passenger ships, but they need to be enforced. Plastic bags, bottles and other litter is dumped indiscriminately. A policy for solid waste and garbage disposal is essential.

f) Financial Priorities

Studies done in the past by the Indian Institute of Public Administration on the management of protected areas, have shown that the overall budget allotted to the Wildlife Wing of the Forest Department is inadequate.

g) Networking

In coastal ecosystems, more than in any other ecosystem, effective management requires taking into account not only the biological and ecological parameters but also the socio-economic factors that govern usage by people. Conservation initiatives have to provide alternatives or compensate the local people for the resources no longer available for their use. Networking between different government departments, NGOs and the various stakeholders becomes very important in coastal areas. This is because of two basic reasons.

Firstly, coastal zones are especially susceptible to conflicts between various user groups. The coasts, representing a sequential series of ecosystems that constitute the interface between aquatic and terrestrial systems, consist of diverse habitats on land and water. In the ANI, the majority of the population lives on or near the coast and the linkages between human activities and impacts on land and sea are very intimate and immediate. They provide many resources and benefits, which are of interest to various stakeholders. Naturally, the potential for conflicts in such a situation is enormous.

Secondly, in a coastal zone, the marine portions are defined largely by an open-access regime. Also, the user rights among different stakeholders are not clearly specified. This makes conservation and management that much more difficult. In the absence of a well co-ordinated system of networking, this often leads to over-exploitation of resources. There is a need, therefore, for a system that integrates multiple user interests while ensuring the sustainable management of coastal systems.

It was agreed at the Port Blair Workshop to constitute subgroups on agriculture, fisheries, tourism, forestry and wildlife, public works, shipping & port development, & pollution abatement (Workshop Report 2001). These subgroups have consented to network amongst themselves and with the NGOs and the local self-administration groups. A transparent system of information sharing and exchange of ideas can go a long way to prevent the agencies involved from working at cross-purposes to each other.

APPENDICES

Table A
AREA CLASSIFICATION
LAND UTILISATION STATISTICS (in km²)
ANDAMAN AND NICOBAR ISLANDS

Serial No.	Particulars	Andaman Group of Islands	Nicobar Group of Islands	Total	% of total ANI area
1.	Geographical area	6408.00	1841.00	8249.00	
2.	Forest Land	5628.62	1542.07	7170.69	86.93%
i)	Reserved	2928.76	-	2928.76	35.50%
ii)	Protected	2699.86	1542.07	4241.93	51.43%

Source: Statistical Cell, Dept of Env & Forests, A&N Admn, Port Blair, 2000

Table B
FOREST CLASSIFICATION
DIVISION-WISE AREA STATISTICS (in km²) BY LEGAL STATUS

Serial No.	Forest Division	Geographical Area	Reserved Forest Area	Protected Forest Area	Total Forest Area
1.	South Andaman	1655	1208.28	111.66	1319.94
2.	Baratang	721	646.51	-	646.51
3.	Middle Andaman	965	53.07	804.05	857.12
4.	North Andaman	2325	314.41	1784.15	2098.56
5.	Nicobars	1841	-	1542.07	1542.07
6.	Little Andaman (Project Area)	732	706.49	-	706.49
Total		8249	298.76	4241.93	7170.69

Source: Statistical Cell, Dept of Env & Forests, A&N Admn, Port Blair, 2000

Table C
REGENERATION OF FOREST
ANNUAL PROGRESS OF REGENERATION (in ha)

Year	Natural Regeneration	Artificial Timber Forest Plantations	Regeneration of Non-Timber Forest Plantations	Total Regeneration (NR+TFP +NFTP)	Cumulative Total
Up to 92-93	59739	14213	3183	77135	77135
1993-94	2100	265	192	2557	79692
1994-95	2085	260	195	2540	82232
1995-96	2020	305	216	2541	84773
1996-97	2036	179	235	2450	87223
1997-98	1630	150	290	2070	89293

Source: Statistical Cell, Dept of Env & Forests, A&N Admn, Port Blair, 2000

Table D
TOTAL AREA (IN HECTARES) HARVESTED FOR TIMBER

Year	By Forest Dept.	By ANIFPDC	Total
1990-91	2231	764	3015
1991-92	2815	947	3762
1992-93	2673	1014	3687
1993-94	2052	1241	3292
1994-95	3007	1249	4256
1995-96	3365	1145	4510
1996-97	1963	739	2702
1997-98	1547	733	2280

Source: Statistical Cell, Dept of Env & Forests, A&N Admn, Port Blair, 2000

Table E
AREA BROUGHT UNDER SOCIAL FORESTY

Year	Road side (in kms)	Coastal (in kms)	Barren (in ha)	Community Land (in ha)
1992-93	30.00	25.00	200.00	7
1993-94	30.00	24.75	200.00	7
1994-95	30.00	27.50	200.00	7
1995-96	67.30	46.00	162.00	11
1996-97	25.75	26.40	60.20	5
1997-98	23.24	22.50	87.27	7

Source: Statistical Cell, Dept of Env & Forests, A&N Admn, Port Blair, 2000

Table F
ANNUAL PRODUCTION OF FOREST TIMBER PRODUCTS (in m³)

Year	Timber (in log form)	Fuel Wood
1993-94	130136	52456
1994-95	135523	54161
1995-96	126579	48585
1996-97	107769	42993
1997-98	77097	30510

Source: Statistical Cell, Dept of Env & Forests, A&N Admn, Port Blair, 2000

Table G
AGENCY-WISE ANNUAL TIMBER EXTRACTION
IN
ANDAMAN AND NICOBAR ISLANDS (in m³)

Year	Forest Department by Departmental Agency	Private Parties on Payment of Royalty	Free and Concessional Royalty	Forest Plantation Development Corpn.	Total
1993-94	65148	15378	1022	48588	130136
1994-95	64393	21490	1348	48292	135523
1995-96	65300	11551	727	49001	126579
1996-97	59760	3728	698	43583	107769
1997-98	49439	-	157	27501	77097

Source: Statistical Cell, Dept of Env & Forests, A&N Admn, Port Blair, 2000

Table H
REVENUE AND EXPENDITURE PER KM² OF FOREST AREA

Year	Area under forest Administration (km ²)	Per km ² (in rupees)	
		Revenue	Expenditure
93-94	7171	36728	31745
94-95	7171	41622	35782
95-96	7171	39163	38571
96-97	7171	39814	45404
97-98	7171	37141	55570

Source: Statistical Cell, Dept of Env & Forests, A&N Admn, Port Blair, 2000

Table I
DIVISION WISE ANNUAL NO. OF POST-1978 FOREST ENCROACHMENT
CASES REGISTERED IN A&N ISLANDS AS ON 31.03.99

YEAR	NO OF CASES	AREA (in ha)
1979	6	9.500
1980	123	134.038
1981	85	99.100
1982	104	120.100
1983	53	66.340
1984	85	96.900
1985	50	56.275
1986	129	158.960
1987	176	184.775
1988	135	156.058
1989	174	205.100
1990	138	166.885
1991	138	176.567
1992	104	87.082
1993	62	60.410
1994	110	145.680
1995	65	66.430
1996	102	84.310
1997	220	170.864
1998	13	6.098
1999	0	0.000
TOTAL	2072	2251.452

Source: Statistical Cell, Dept of Env & Forests, A&N Admn, Port Blair, 2000

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