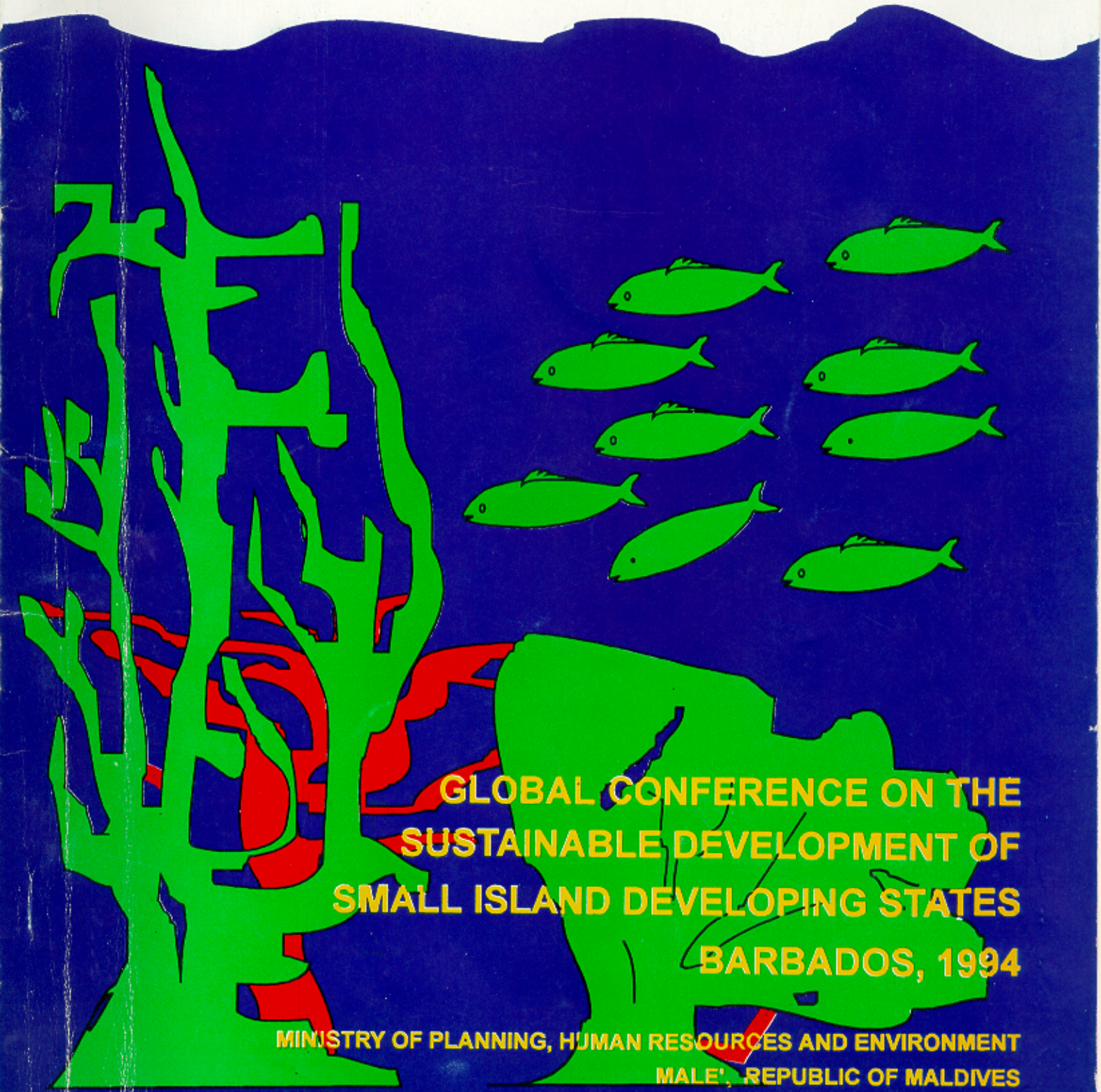
STATE OF THE ENVIRONMENT

MALDIVES



GLOBAL CONFERENCE ON THE SUSTAINABLE DEVELOPMENT OF SMALL ISLAND DEVELOPING STATES

BARBADOS, 1994

MINISTRY OF PLANNING, HUMAN RESOURCES AND ENVIRONMENT
MALE', REPUBLIC OF MALDIVES

GLOBAL CONFERENCE ON THE SUSTAINABLE
DEVELOPMENT OF SMALL ISLAND DEVELOPING STATES

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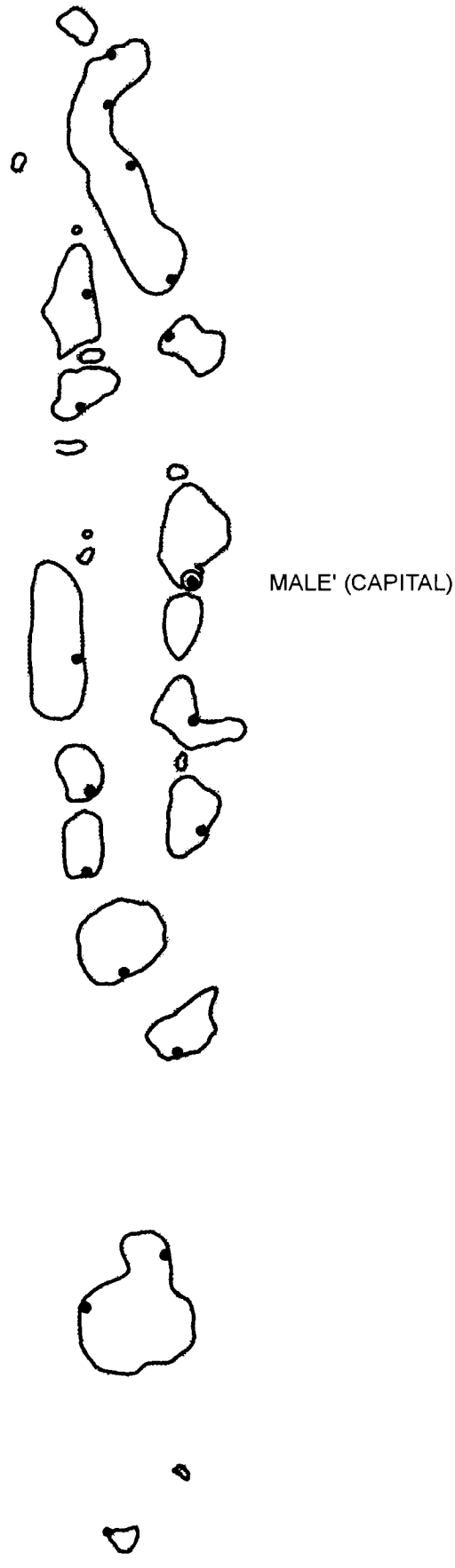
Republic of Maldives



⊗ ATOLL CAPITALS

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EXECUTIVE SUMMARY

Many of the outside world may consider the Maldives, blessed as it is with a relatively small population and liberal amounts of sun, sand and coral, as a country not plagued by the usual problems that afflict countries of the third world. While this is correct to some extent, there are in fact a number of serious issues affecting the day to day lives of the people.

Though the estimated population in 1994 is only 245,900, people live on 199 islands spread over a large area of the Indian Ocean, separated by varying extents of sea. The chain of atolls which is about 80-120km wide, stretch about 860km north-south in the equatorial belt, the bulk of it being north of the equator. This dispersion brings about diseconomies of scale and make provision of physical and social infrastructure extremely costly. While a large expanse of sea forms the bulk of the Exclusive Economic Zone of 90,000km^2, the land area is divided between 1,190 islands of varying extent, totalling no more than 300km^2. Geographically the country straddles key sea routes in the Indian Ocean and this position influenced historical trade and culture.

In economic terms the country is one of the least developed. Per-capita Gross Domestic Product in 1993 was US$ 703.5. Much of the food, construction materials, consumer goods and all of the petroleum products are imported. Until about the 1970s the economy had been somewhat inward-looking, with fisheries and shipping as the mainstays. Since then, tourism has made inroads as a strong economic sector and currently is the second largest contributor to national income through 69 resorts that have been developed on uninhabited islands. The economy has, in the last decade or so, registered an impressive annual growth due largely to increased receipts from tourism and fishing, and also government

investment in infrastructure. The other economic sectors such as industry and agriculture do not play a major role. However, diversification of the economy is being pursued within limits of the national resource base.

There are no minerals of economic importance. Coral rock and sand have provided the base for the construction industry over time immemorial. However over-extraction in some areas, has spurred the government into discouraging the use of coral and actively promoting alternatives for coral as a building material.

Currently population is increasing at 3.4% and is expected to double by 2010. A large proportion, (about 47%) of the population are under 15 years. Overall unemployment is low but there is significant under-employment, particularly among women. The island of Male' is over-crowded with more than a quarter of the total population living on a land area less than 2km^2. This has placed severe burdens on existing infrastructure and resources such as the freshwater aquifer. A nearby island is being developed to ease the congestion in Male'.

The Maldives has a very high literacy rate of 98%. However, tertiary education is not as yet available in-country and few have qualified at this level overseas. Trained manpower is inadequate, and skilled labour is also in short supply which accounts for the large expatriate labour force. Considerable progress has been made in social infrastructure. Infant mortality has been more than halved from 1980 to 1992. Maternal mortality has come down too and life expectancy has increased from 42 years in 1977 to 67 years.

As major economic activities are based on the coastal and marine environment, the protection of this lifeline is all important. The fishery resource is still under-utilised. Tuna canning has recently expanded the profitability of the industry.

The coral reef environment supports the tourist industry, and the fishery as well. A unique biodiversity in these areas remains to be documented and managed appropriately.

Given the very narrow resource base future development will necessarily have to look at long-term perspectives. The tourism product does not lend itself to a broad diversification. The fisheries sector, holds promise for rational management and exploitation through its vast geographical area, manner of harvest, product diversification and marketing.

The wealth of the marine resource should not mean overlooking the terrestrial environment in spite of its narrow base. It appears that horticulture can still hold its own by greater productivity through techniques of conservation farming for import substitution, in supplying the local populace and the resorts with certain high value vegetables and fruits.

The Maldives is subject to a variety of natural hazards, such as coastal flooding due to ocean swell. Hazard management is weakened by the non-availability of baseline data, and the absence of an environmental data base is a further constraint. Meteorological and hydrographic data are inadequate and the islands are not fully surveyed. Geographic distribution, inadequate manpower and difficulties of coordination are contributory factors to the paucity of data.

The impending sea level rise is cause for concern. Various scenarios have been put forward on the degree of impact and the effects. The range of adverse impacts envisaged include loss of land, loss of investment, displacement of people, depletion of fresh water aquifers, unpredictable weather and ocean conditions, destruction of reefs and loss of fish stocks. It is believed that global climate change has already been experienced by way of mid-latitude storms and

long distance ocean swells. The serious flooding of 1987 and the strong winds of 1991 are cases in point. Other issues considered significant to the Maldives are risks from oil spills, management of the Indian Ocean tuna stocks, unfavourable world trade, scale of technology transfer, information gaps and funding constraints.

Despite the constraints of technical know-how, manpower and finances, the Maldivian Government has instituted appropriate policy legislations, regulatory and institutional measures for sound environmental planning and management. Foremost is the recognition that environment and development are inter-linked and that, one mutually supports the other. This had led to the location of the subject of environment along with planning, since 1988.

In 1989, the National Environment Action Plan was developed and is a blueprint for addressing issues of development, planning and environmental management. Through the adoption of the National Environment Action Plan, the Government is committed to the concept of sustainable development and is seeking, as a matter of priority, appropriate policies and mechanisms for translating word into deed. In sectors such as tourism, health and fisheries, environmental policies are committed to action by enforcing development controls. For example, coral mining has been banned or restricted in certain areas and alternative building materials are encouraged.

In the sphere of international affairs, the Maldives has played a key role in focusing attention of the international community on matters that concern the small island developing states. Sustainable development of these states are only possible through transfer of environmentally sound technologies and the provision of new and additional financing to these states by the developed

countries. Concerns to this effect have been raised by the Maldives at appropriate forums notably at the Commonwealth, the South Asian Association for Regional Cooperation, the United Nations and at the Earth Summit in Brazil.

In 1989, the Maldives hosted a ministerial-level meeting of small island states concerned with sea level rise and it concluded with the Male' Declaration. The Government has actively participated at meetings of the Intergovernmental Panel on Climate Change and at the Second World Climate Conference in 1990. Along with members of Alliance of Small Island States (AOSIS), the Maldives played a significant role in modifying the oceans chapter of Agenda 21 to include a programme area devoted to sustainable development of small islands. The government is a signatory to both the United Nations Framework Convention on Climate Change and the Convention on Biodiversity, adopted at the Earth Summit.

Another major problem area is the proliferation of agencies that handle specific subject areas that effect the SIDS. This calls for membership of many groupings which not only sap meagre human resources but financial resources as well. For example, ocean and maritime affairs are covered by IMO, UN office for Ocean Affairs and the Law of the Sea, UNEP, UNESCO, IOC and FAO. Most countries are hard pressed to fulfill obligations as members, and this matter calls for early resolution.

Some of the issues stated above which are essentially generated within the country and others that are generated outside Maldivian shores, over which no effective control is possible by local inputs, demand immediate action on a global, regional or sub-regional basis with the assistance and cooperation of the international community.

1. INTRODUCTION

This document outlines the basic physical, biological, social and economic characteristics of the Republic of Maldives; reviews current environmental problems and steps taken by the government to initiate mechanisms for their control and management; and examines past development strategies in the framework of current ideas concerning sustainable development in small island states.

The problems of sustainable development in the Maldives are discussed in relation to: the limited natural resource base; constraints relating to the nature and extent of the available resources; manpower; investment capital; management structures; and legislative and control mechanisms already in place within the country.

The future alternative strategies for development over the short term are reviewed and the problems of implementing a medium to long-term strategy of decentralized development are discussed in relation to existing constraints. Relevant statistical data are presented in appendix 1.

2. BACKGROUND TO THE MALDIVES

2.1 Physical environment

The Republic of Maldives consists of a chain of coral atolls, 80-120km wide, stretching 860km, from latitude 7°6"N to 0°41"S, and lying between 72°32" and 73°45"E. There are 24 geographic atolls grouped into 19 administrative atolls, with the capital city island of Male' forming a separate administrative unit. Although the maritime area of the Exclusive Economic Zone (EEZ) under the jurisdiction of the state amounts to more than 90,000 square kilometers, the land area is estimated, on the basis of inadequate admiralty surveys, at only around 300 square kilometers. The land is divided between 1,190 islands, of which some 199 are currently inhabited.

Geologically, the chain is stable with the atolls lying on top of two parallel submarine ridges, 300-450m deep, which rise from a flat submarine plateau. At the margins of the chain the ocean floor falls abruptly to a depth of between 2,600 and 3,000m to the west. The main channel separating the eastern and western chain of islands is generally between 250 and 300m deep. The atolls are separated by east-west channels more than 1000m deep, penetrating to the top of the submarine plateau which supports the ridges on which the islands stand.

The atolls vary in shape from circular, oval and elliptical to pear-shaped. Lagoon waters vary in depth from 40 to 60m and most open to the Indian Ocean although a few are almost closed, and channels through the atoll margin are in some instances as deep as the lagoon itself. Lagoons may contain microatolls, faros, patch reefs and knolls. Faros and microatolls are ring shaped coral structures, unique to the atolls of the Maldives.

The islands themselves vary in shape and size from small sand banks with sparse vegetation to elongated strip islands and many have storm ridges at the seaward edges with swampy depressions in the centre. The islands vary in size from 0.5 to around 2 square kilometers. No detailed topographic surveys of any island except Male' have been made to date. Maximum height above sea level within the Republic is around 3m although in excess of 80% of the land area is less than 1m above mean high tide level.

There are no general studies of local wave directions and currents in the Maldives. Recent observations and measurements relate to the construction of harbour and shore defence structures, primarily in the vicinity of Male', which were initiated following flooding experienced in 1987 and 1988. Wind generated waves and oceanic swells are conditioned by monsoon wave directions and have long fetch distances. Waves generated by the SW monsoon in the Indian Ocean north of the equator, having heights of 2-3 metres and periods of 18-20 seconds, have been recorded in nearby SriLanka.

Hydrographically the Maldives are characterised by a seasonal fluctuating mixed layer of relatively saline water from the Arabian sea ($36^{o}/_{oo}$) and less saline water from the Bay of Bengal ($34^{o}/_{oo}$). A rapid downward decrease in temperature to below 20°C occurs at 90-100m depth with surface temperatures varying between 28°C and 29°C.

The Maldives experiences a tropical climate with a mean annual temperature of 28°C, daytime highs reach 32°C but nighttime lows rarely drop below 25.5°C. During the last 20 years the lowest recorded temperature was 22°C the highest 36°C. There is little seasonal variation in temperature. Monthly mean rainfall for Male' is around 161mm and some variation is evident north to south through the atoll chain, with the north being drier and the south wetter. On average, rainfall amounts to around 1.9m per annum but there is considerable inter-annual variation from 1530mm to 2700mm over the last 20 years. The wettest months are May, August-September and December, the driest January to April. Open water evaporation rates are in the range of 6mm per day and transpiration from plants is also high.

Air circulation is controlled by the north-south migration of the equatorial westerlies and the weather is dominated by two monsoon periods: the SW monsoon from April to November and the NE monsoon from December to March when winds blow predominantly from either of these two directions. Strong winds and gales are relatively rare and cyclones are unknown, maximum wind velocities recorded at Male' during June/July can reach 25-30m sec^{-1} (50-60 knots).

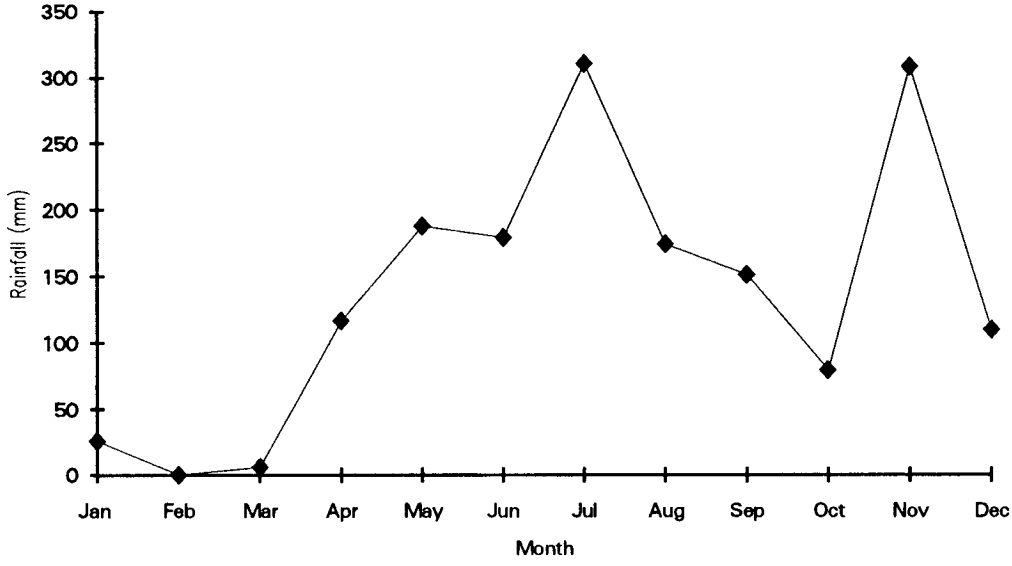

Figure 1a: *Rainfall in millimeters for 1992.*

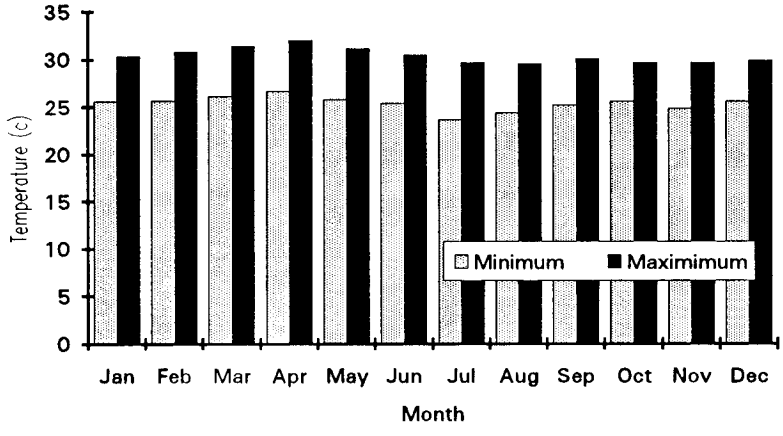

Figure 1b: *Monthly minimum and maximum temperature (in °C) for 1992*

2.2 Social environment

The prehistory of the Maldives is not well known, although recent archaeological investigations clearly indicate the presence of pre-Islamic, Buddhist cultures dating back to around 2,000 years B.C. Some evidence for pre-Buddhist cultures dating back to 2,500 to 1,500 B.C. has been found, indicating cultural links with the Indus Basin. Scattered evidence of pottery, glass and metal artifacts attest to the important geographic position of the Maldives on the major sailing routes between Arabia and Sri Lanka. Chinese pottery and Roman coins of the first century AD have also been found.

Modern history commences with the conversion to Islam in 1153, but as early as the 9th century Arab traders used the Maldives as an entrepot taking on water, dried fish and coconuts although the major attraction was the cowrie, *Cypraea moneta*. Following the decline of the Arab trading empires in the Indian Ocean and Southeast Asia, the Maldives became more closely involved economically with Sri Lanka and southern India. In 1552, the Sultan Hasan IX ceded the country to the Portuguese although the bulk of the population resisted before being over-run in 1558. In 1573 a popular revolt resulted in the massacre and expulsion of the Portuguese and the Dutch established relations with the ruling Sultan. In 1796 following cession of Ceylon by Holland to the British, the Maldives came under British influence although Maldivian sovereignty was guarantied under the treaty. The Maldives became a British Protectorate in 1888 following a local revolt against the Borah merchants of South India who controlled most of the Maldivian trade. Protectorate status was relinquished by the British in 1965 and the sultanate was abolished in 1968. Subsequently, the country has followed a republican system of government, with the president as executive head of government. The Citizens' Majlis or parliament is the supreme law making body.

The language is Dhivehi which displays affinities to several languages from North India, Sri Lanka and S.E. Asia, it contains a number of Arabic, Hindi and English words. Written Dhivehi, or Thaana is based on a twenty four letter alphabet; the letters being derived from variants of the nine Arabic numerals. Modern Thaana was invented in the 16th century following the overthrow of the Portuguese and differs from earlier scripts in being written from right to left. Earlier writings from the 12th century were incised on copper plates.

Modern culture is Islamic, with people belonging to the Sunni sect. Society is stratified with status being based on political and hereditary connections, wealth and education. Five calendar systems were traditionally in use in the Maldives including an indigenous Nakaiy calendar having twenty-seven divisions of thirteen or fourteen days each.

3. DEVELOPMENT TRENDS AND ECONOMIC CHARACTERISTICS

3.1 Economic growth

The Maldives with a *per capita* Gross Domestic Product (GDP) of US$ 703.5 in 1993, is recognised as one of the least developed countries (LDC's) within the United Nations System (Table 1). Between 1978 and 1988, GDP grew at 7.9% per annum from the 1978 level of 385.1 million Rufiya (US$1 = 7.0981 Rufiya at 1985 constant price). Between 1989 and 1992, growth was around 9.1% reaching 1,190.2 million Rufiya in 1993 (fig. 2).

Table 1. *Gross Domestic Product in million Rufiya at 1985 constant prices.*

Sector	1981	1990	1991	1991 % by sector	Average annual growth (%)1981 - 1991
Agriculture	67.4	87.1	90.4	8.6	3.0
Fisheries	82.8	147.6	159.1	15.1	7.1
Coral & Sandmining	9.0	17.9	19.3	1.8	8.0
Construction	28.5	83.9	92.4	8.8	12.6
Manufacturing incl. electricity	19.3	55.6	61.2	5.8	12.5
Distribution	36.6	166.8	183.5	17.4	18.0
Transport	43.0	57.0	66.3	6.3	-14.7
Tourism	39.8	177.8	183.5	17.4	17.1
Real estate	15.3	40.6	43.8	4.2	11.2
Services	8.2	55.6	61.2	5.8	28.3
Gov. Admin.	18.6	90.1	94.1	8.9	18.9
Major sectors					
Primary	159.2	252.6	268.8	25.5	5.5
Secondary	47.8	139.5	153.6	14.6	12.5
Tertiary	161.5	587.9	632.4	59.9	15.5
All sectors	368.5	980.0	1054.8	100.0	11.3

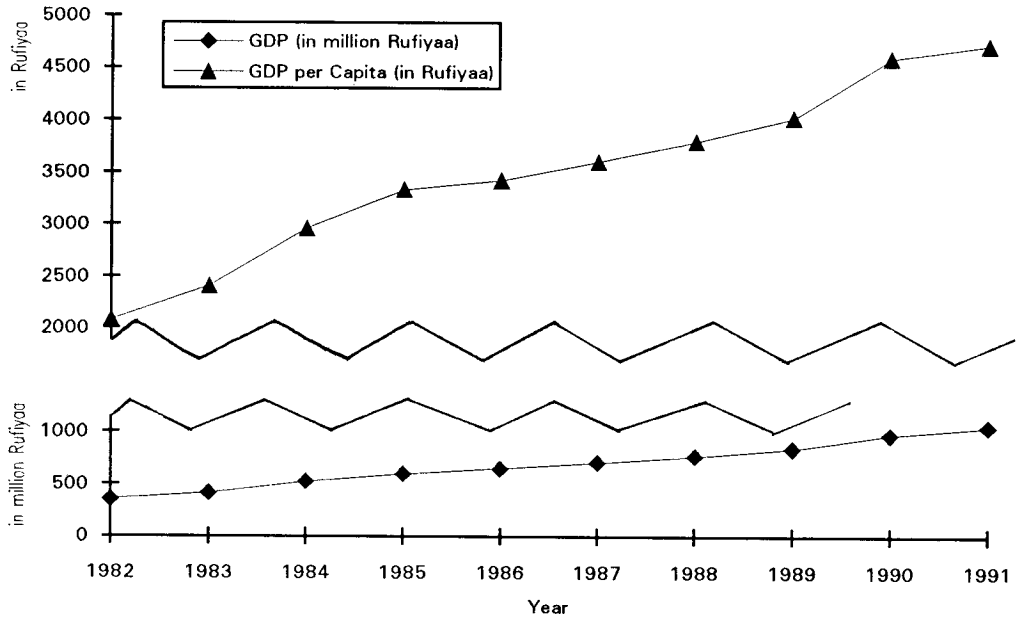

Figure 2: *GDP (in MRf) and GDP per Capita (in million MRf) from 1982 to 1991*

Until the 1970s the Republic of Maldives was rather isolated and its economy was based on fishing, shipping and the cultivation of coconuts. The situation changed with the advent of tourism in the early seventies which initiated a period of accelerated economic growth. The Maldives however has a typical small island economy limited by natural and human resources, an acute shortage of raw materials, heavy imports of most requirements and an ever increasing demand on government revenue to cater for the basic needs of an expanding population.

The present economy is based on two principal activities; capture fisheries and tourism. Since the latter part of the 70s the economy has registered an impressive annual growth, due largely to increased receipts from tourism and fishing, as well as government investment in infrastructure. The latter include projects such as the development of the international airport, harbour expansion, land reclamation, government buildings, schools and road upgrading projects.

Major export partners in 1992 were the United Kingdom (29.3% of total exports) Sri Lanka (26%) the USA(14%) and Thailand(6%). The United States and Sri Lanka have remained among the major partners over the last few years, while exports to Thailand have declined recently as the export of

frozen tuna has been replaced by canned products. Over this period exports to the European Community, particularly Britain and Germany, have increased.

The trade balance is negative, showing a deficit of around 31.6 million US$ in 1987 and this had grown to 82.6 million by 1991. The overall balance of payments is precarious with net foreign reserves not exceeding one month's imports. Annual imports amounted to a three year average of US$ 96 million in the late eighties growing to US$ 138 million in 1990 and US$ 189 million by 1992. Principal imports in 1992 included consumer goods, foodstuffs, tobacco, beverages, and manufactured goods (50%); petroleum products (12%) and intermediate and capital goods, mainly construction materials, (38%). The proportion of total imports comprising intermediate and capital goods has grown considerably over recent years.

The grant component of annual revenue was estimated at 90 million Rufiya in 1987 when expenditure on projects financed by foreign loans totalled 33.7 million Rufiya (fig. 3). By 1991, the loan component of expenditure on major projects had grown to 190.1 million Rufiya (US$19 million). Government expenditure (including net lending) of 356.3 million Rufiya in 1987, outstripped total revenue of 291.2 million Rufiya but was less than the total revenue and grants. The budget deficit has increased since that time to an overall deficit of about 382.6 million Rufiya (US$36 million) in 1992.

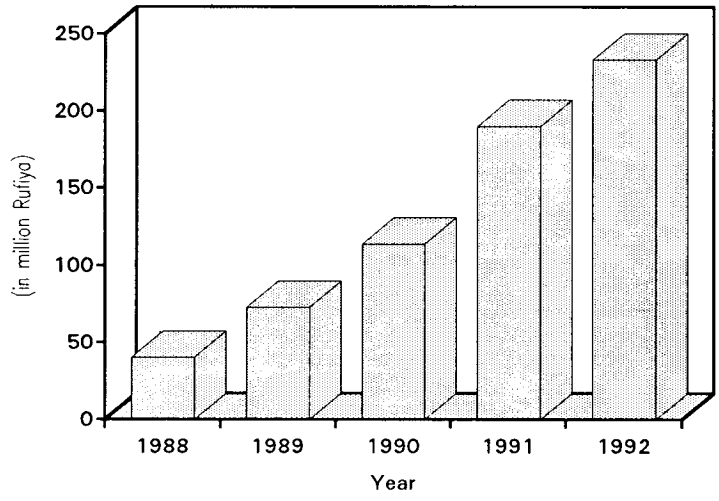

Figure 3: *Total spending on major projects financed by foreign loans (1988- 1992)*

3.2 Human resources

Between 1900 and 1960, the population remained fairly stable at around 70,000 and 80,000 and the subsequent exponential increase is a consequence of the control of malaria, cholera and shigella control and the significant reduction in infant mortality from gastro-intestinal infections resulting from improved sanitation and water supplies (table 2).

Table 2. *Population growth 1921-1990.*

Census year	Population size	Growth rate
1921	70413	-0.27
1931	79281	1.18
1946	82068	0.23
1957	83075	1.81
1961	92793	0.59
1965	97743	3.95
1970	114469	3.28
1974	128697	2.40
1985	180088	3.20
1990	213215	3.43

The total population of the Republic as enumerated in the 1990 census was 213,215 (males 109,336; females 103,879) of whom 55,130 lived on Male' (males 30,150; females 24,980). Only four islands have populations of more than 4,000 people. Less than 1,000 people live on 162 islands and 90 or nearly half of the total inhabitated islands have populations of less than 500 people. The annual growth rate between 1977 and 1985 was 3.2% per annum and between 1985 and 1990 this had increased to 3.4% per annum.

Recent projections suggest, that under present conditions, population could double by around 2010 and be over half a million people by 2020 (Table 3).

Table 3. *Population projections, 1990-2000.*

Year	Scenario	
	High growth	Low growth
1990	213215	213400
1995	253298	250800
2000	289800	286350

As a consequence of the present high rate of population growth (around 49% of the population are under 15 years of age) the dependency ratio has increased from 1:0.88 in 1977 to 1:0.99 in 1990. Overall unemployment is low (0.85%) at present but there is significant under-employment in the wage sector, particularly amongst women. Fishing being the largest employer accounted for 24% of all employment in 1985, followed by manufacturing 22%; tourism at 10%; and agriculture, only 6%. By 1990, of the total 55,949 employed workers, 20% were employed in fishing, 15% in manufacturing and 5% in agriculture, reflecting growth in the trading and services sectors, a trend which is continuing (fig.4).

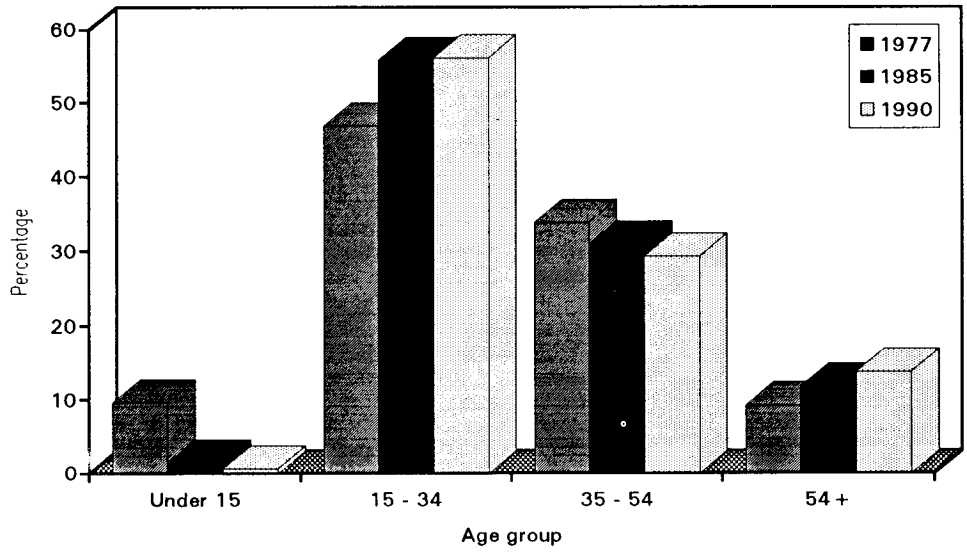

Figure 4. *Percentage of economically active population by age for 1977,1985 & 1990.*

One consequence of the demographic trends in the country, is a lack of trained manpower in the government service sectors associated with health, education, and management. Not only is skilled manpower in short supply, even basic labour for large projects has to be imported due to the shortage of working age males most of whom are fully employed in the fishing and tourist industries.For example, of the 2,510 expatriate workers employed in the country in 1986, for example, there were 130 barmen, 117 cooks, 289 factory workers and 230 labourers. A quarter of all expatriates were employed by the government and one third in the tourist industry. Seventy

five percent of the expatriate workforce was from South Asian countries. By 1992 the number of expatriate workers had increased to 14,701 of whom 12,929 (88%) were from Asian countries, predominantly Sri Lanka (8,351; 57%), Bangladesh (1,989; 13.5%) and India (1,872; 12.7%). Seventy five percent of expatriate workers are employed in the private sector, and half of them are in the tourist industry.

3.3 Health and social services

There have been significant improvements in health status since the early 1970s. Infant mortality has declined from 95 per thousand in 1980 to less than 31 per thousand in 1992 (fig 5). Maternal mortality has been greatly reduced to less than 3 per thousand and life expectancy has risen to around 67 years.

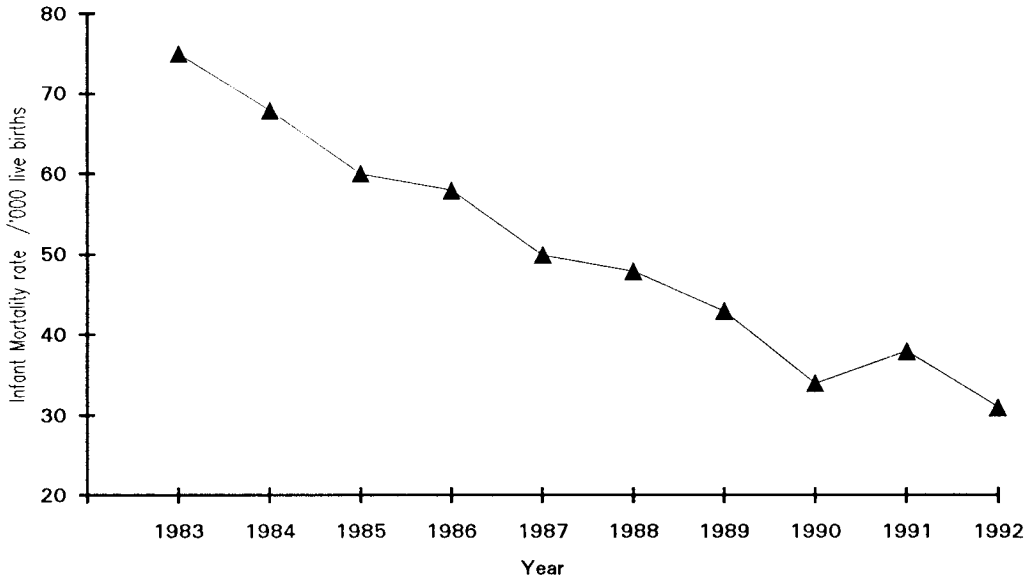

Figure 5: *Infant mortality rate /'000 live births*

There is now almost universal immunization of children against five infectious diseases and clean water supplies are available to around 60% of the population outside Male'. Major outbreaks of water-borne diseases such as typhoid and cholera occurred upto the 60's. However, subsequent improvements to sanitation and water supply systems have greatly reduced

the frequency and severity of outbreaks of these diseases. A major cause of infant mortality in the past was gastro-intestinal infection, a problem which has been significantly reduced as a consequence of improved drinking water quality.

In addition, malaria has been virtually eradicated since no indigenous cases have been detected since the 1980s. A leprosy control programme has resulted in considerable reduction in the transmission of this disease but the control of tuberculosis has been less successful. Acute respiratory infections continue to be a major cause of mortality amongst children. Some evidence for malnutrition amongst school children does exist.

Emphasis has been on primary health care and a network of health care workers exists throughout the country which includes family health workers and trained midwives (*foolhumaas*) on the islands, community health workers in atoll health centres. There are also four regional hospitals in Haa Dhaal, Raa, Meem and Addu Atolls and a central referral hospital in Male'.

3.4 Education

The literacy rate is extremely high, around 90% for both sexes over the age of six years. At the time of the 1990 census only 6,954 males and 5,951 females over the age of six were classed as illiterate. The young age of the population places significant strains on the education service sector, and these are likely to increase for the foreseeable future. Recent projections suggest that over 45% of the population will remain under the age of 15 until at least the year 2010. Between 1990 and 2005, an additional 24,600 students between the ages of 5 and 14, will require educational services, while the secondary and higher secondary school populations will grow at around 4% annually.

Until recently all secondary and higher secondary schools were located in Male'.However, in January 1993, the first secondary school outside Male' opened at Hithadhoo in Addu Atoll and a number of well established island primary schools are now providing education up to the age of 12. Education is free with the exception of external examination fees for "O" and "A"

level.There are a few free-levying private schools. Students attending overseas tertiary level institutions on government scholarships are expected to complete a government bond period on their return.

By 1990, 5,190 students had completed secondary school education and 617 pre-university level. Pre-university level high schooling is available only on Male'. A further 966 had obtained a diploma or certificate and 219 had completed university degree programmes. The availability of post-graduate trained manpower and trained professionals in fields such as accountancy, education, and medicine remains critically low resulting in the high numbers of expatriate professionals currently being employed in the country.

3.5 Housing and urbanisation

Presently the capital city of Male' is the only urban centre in the country although some other islands are rapidly approaching an urbanised state. Problems of land shortage, over-crowding, declining freshwater quality and quantity are characteristic of these islands. Male' underwent extremely rapid population expansion following the closure of the air base at Gan, which occurred simultaneously with the initial growth of the tourist industry in Male' Atoll. By 1990 almost half the 55,130 people living in Male' were in-migrants attracted by the economic opportunities, and the education and health services provided by the city.

Initial land shortages for housing in Male' led to extensive reclamation of the ocean facing reef flat such that the original island area has nearly doubled and the island shores are in close proximity to the edges of the underlying reef platform. By relieving the initial land pressure and effectively increasing the physical carrying capacity of the island the government unintentionally encouraged further migration. The shortage of land for housing is further exacerbated by the present land tenure system which allows for the splitting of building plots between the heirs of the original holder. Originally housing plots on old Male' were around 230m^2, but recent allocations on the reclaimed area are much smaller and government owned plots cannot be sub-divided into units smaller than 74.3m^2. The small individual plot size combined with multiple ownership precludes the amalgamation of plots for multi-storey housing.

The 1990 census indicated that of the 6,154 houses on Male', 5,613 are occupied, 541 are vacant and 447 are occupied by foreigners. In the atolls 24,210 houses out of 27,737 are occupied, 3,527 vacant and 53 occupied by foreigners. Hence Male' contains only 18% of the total national housing stock yet 26% of the population is resident on this island. In addition, at the time of the 1990 census, 12.7% of the housing stock on the atolls was vacant whilst only 8.8% was vacant on Male'. Although data are not available it is likely that the time during which houses remain vacant on Male' is considerably shorter than is the case on many of the atolls.

One of the attractions of Male' for original settlement was the extensive and deep freshwater aquifer, which has been progressively depleted leading to the installation of desalination plants to supply drinking water to the residents. In Male' a major source of drinking water is rainwater and most households (72%) are equipped with storage tanks whilst 940m^3 of desalinated water are consumed per day. In the atolls, well water still supplies drinking water to around half of the population although the number of rainwater storage tanks is growing. Around 83% of the atoll population have no form of water treatment.

The high density population necessitated the installation of a mains sewage system which caused further depletion of the aquifer. Plans are in hand to convert the sewage system to seawater flushing as a mechanism to reduce the overdraw on the aquifer whilst a vigourous programme of road surfacing with associated drainage facilities for aquifer recharge has been in place over the last few years. Of the 5,613 households on Male', 91% are connected to mains sewage compared with only around 5% in the atolls, where 13% of households have septic tanks and 80% use traditional *gifili* or beach systems.

3.6 Transportation

Given the geography of the Maldives, the provision of transport services for people and goods, represents a major constraint to equitable distribution of goods and services throughout the country. The centralised model of development which was followed in the past, resulted in Male' being the

major transport centre and the sole point of contact for external trade. The major commercial harbour is also located at Male' while the only international airport is located on the neighbouring island of Hulule.

Existing transport networks within the country are limited and regular services are not well developed. Traditionally the sole mode of inter-atoll transportation was by sailing *dhonis* which have been largely replaced over the last two decades by mechanised craft of various types. Of the total fleet of 3,401 (including yacht-*dhonis*, launches and boats) registered in the Republic in 1992, 692 were registered in Male' Atoll. These are used in the tourist industry, together with a variety of vessels used for inter-island trade and commerce.

Internal air transport is even more limited, based on the international airport at Hulule and the domestic airports at Hanimadhoo in the north which was completed in 1991; Kadhdhu and Gan in the south. The latter airport, which was constructed by the British in 1943, has recently undergone extension and up-grading and the possibility of further upgrading to receive international flights is being investigated. A fourth airport was recently opened for South Huvadhu Atoll in the south of the country.

Domestic scheduled flights connect Hulule with the other airports and a helicopter service has commenced operation, largely to service the tourist industry. Domestic flights from Male' international airport totalled 1,814 scheduled and 4,841 unscheduled flights in 1992 carrying a total of 36,438 passengers. International arrivals at Hulule continue to grow, reflecting the overall growth of the tourist sector. In 1992 4,295 flights carried 273,982 passengers to Male' international airport, compared with only 80,390 incoming passengers in 1982. International inward freight handled at the airport during 1992 totalled in excess of 7,158 tonnes.

Between 1982 and 1992 the number of registered vehicles rose from 18,103 to 45,236 including (284) handcarts. The majority of these vehicles were bicycles (85%) and motorcycles (9.1%). The number of cars, lorries/trucks and pickups have risen from: 326 to 725; 156 to 455; and, 46 to 267 respectively between 1982 and 1992. A significant proportion of these vehicles are based in Male' contributing to significant compaction of the road surface and consequent reduction in natural aquifer recharge.

3.7 Minerals and energy

Geologically the islands lack mineral wealth, although surveys for oil were made by Esso and Elf Aquitaine in the 70s and sonar testing by Shell was followed in 1991 by drilling of a single test well. Significant reserves of natural gas or oil have not been located to date, hence all energy sources for transport and electricity generation are imported. Firewood is still extensively used both in the Atolls and in Male' for cooking.

Fuel consumption for electricity generation has dramatically increased from around 0.4 million gallons in 1981 to 1.9 million gallons in 1992, and petroleum products account for 12 % of total imports, by value. Around 80% of electricity generated in the country is consumed in Male'. Total electricity consumption in Male' grew from around 2 million KWh in 1981 to 27 million in 1992 of which 50% was used for residential purposes, 28% for manufacturing and commercial premises and 22% for government buildings and public places.

In Male' most households use kerosene for cooking although, firewood still remains the major form of energy in around 20% of households (Table 4). In contrast this is the dominant form of energy used for cooking in the atolls (93% of households)

Table 4. *Energy sources used in cooking by households (Data from the 1990 census).*

Energy source	Male'	Atolls
Firewood	1139	22453
Kerosene	3567	1445
Electricity	43	44
Gas	470	56
Other	155	24
Not stated	239	188

The islands are built of bioclastic sediments forming unsuitable materials for construction and a comparatively unstable base on which to construct major engineered structures. Construction of large buildings therefore requires excavation of the foundations to the underlying limestone, which on most islands is not far from the surface.

Local building materials include coral, the traditional building material, and extensive supplies of coralline sand from the atoll lagoon floors. Manufacture of cement blocks using coralline sand is increasingly taking the place of natural coral for building purposes. Other building materials including non-coralline aggregate, cement, timber and roofing materials have to be imported.

3.8 Tourism

At 17% of gross domestic product which provides over 25% of government revenue, tourism is the second largest contributor to the economy and it is increasing in importance year by year (Table 5). The number of annual tourist arrivals (241,852 in 1993) now exceeds the total indigenous population (fig. 6). Therefore the resort islands represent critical areas for environmental management during construction and operation.

Table 5. *Percentage contribution of Tourism to the GDP from 1981 to 1993*

Year	% Share of Tourism Contribution
1981	10.8
1982	15.7
1983	15.6
1984	15.2
1985	18.1
1986	17.2
1987	17.3
1988	17.4
1989	17.5
1990	18.1
1991	17.4
1992	17.7
1993	17.1

At present there are 69 resorts, mostly on small islands in North and South Male' atolls and in Ari atoll, although plans are in hand to expand the number and distribution of resorts to some of the other atolls. Resorts vary in size from a bed capacity of 16 to 500, with an average size of 123. In 1993, a total of 9,219 beds were available in resorts.

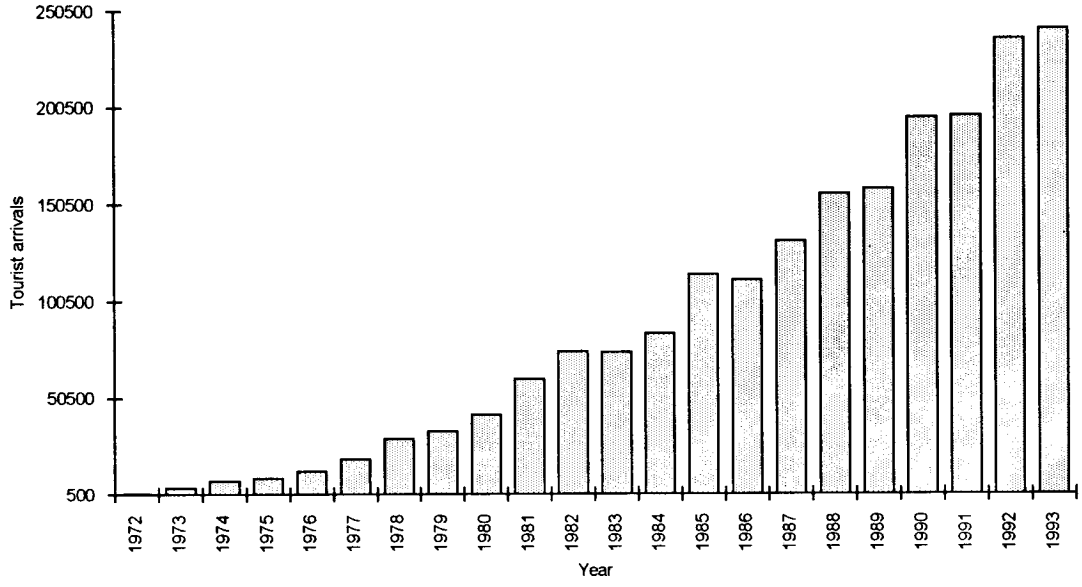

Figure 6: *Tourist arrivals since 1972*

Resorts are established on uninhabited islands leased to resort developers for a five-year period. Resort development relies heavily on imported equipment, facilities, foodstuffs and skilled labour, although about 3,000 Maldivians are employed. Over 61% of tourists came from Europe, mainly Germany and Italy in 1992.

The tourism industry is dependent upon the maintenance of environmental quality. Most of the present visits relate to marine-based activities such as scuba diving in the coral reef environments and visitors expect a high level of water quality and pristine reef environments. The Ministry of Tourism has therefore established regulations controlling aspects of environmental quality on resort islands including *inter alia* the numbers of buildings which may be constructed and the disposal of solid waste.

3.9 Fisheries

The fisheries sector in the Maldives is extremely important, contributing around 15% to GDP in 1990 and 1991 and around 80% of export income during the same years. The proportion of GDP declined to 12% in 1993 as a consequence of accelerated growth in the tourist and other sector. Fishing has always been a central activity in Maldivian society and this has been

expanded through mechanisation of the traditional fishing fleet, fuel distribution systems and fish collection facilities. Fishing is widespread throughout the atolls although concentrated mostly around good fishing grounds. Less than 10% of the fishing fleet supplies the Male' market.

The tuna fishery is based on trolling and pole and line fishing from mechanised *dhonis*, thus producing a "dolphin-friendly" product. Boats operate within about 75 miles of the atolls. Thus only a fraction of the total EEZ is exploited by the local fleet at the present time. Collector boats and mother vessels purchase fish from fishermen, consolidate and freeze the supplies and deliver them to the plants for further processing. Unfortunately this system is operating at less than optimum efficiency and until recently the Felivaru cannery operated at a loss. Changes are in hand to address these problems, and additional freezer plants are under construction in Laamu Atoll and Ḳooddoo.

The total catch doubled between 1981 and 1985 to around 60,000 tonnes, reaching 82,000 tonnes in 1992 (Table 6).

Table 6. *Annual fisheries production in thousands of metric tonnes, 1981-1992.*

Year	Local Consumption	Exports	Total Catch	Skip-jack	Yellow-fin	Other Tuna	Other Fish
1981	15.0	19.9	34.9	10.9	5.3	3.2	5.5
1982	13.6	16.7	30.3	15.6	4.0	4.0	6.7
1983	23.4	15.1	38.5	19.7	6.2	5.6	7.0
1984	31.5	19.9	55.1	32.0	7.1	5.0	11.0
1985	27.8	31.1	61.9	42.6	6.1	5 0	8.2
1986	23.8	32.0	59.3	45.5	5.3	2.9	5.6
1987	19.1	36.0	56.9	42.1	6.6	3.2	5.0
1988	28.8	35.2	71.5	58.6	6.5	3.0	3.4
1989	21.2	44.3	71.2	58.1	6.1	3.6	3.4
1990	19.7	52.9	76.4	59.9	5.3	5.2	6.0
1991	21.1	55.2	80.7	58.9	7.7	4.5	9.6
1992	33.1	46.3	82.0	58.6	8.7	6.2	9.6

The main product is skipjack tuna and 73% of the total annual catch of skipjack was exported in 1991. In 1987, 88% by weight of the exported fish was frozen skipjack and salted dried fish (tuna, shark and reef fishes) exported to Thailand and Sri Lanka. By 1992, the production of frozen skipjack had declined and the proportion of canned fish had risen, reflecting investment in cannery facilities, and resulting in changes to the export markets. Other exported marine products include dried, salted fish; dried skipjack; shark skins and fins; shark liver oil; sea cucumbers; cowrie shell and aquarium fishes. Minor items whose export varies considerably from year to year include frozen giant clam meat and red coral. The latter being exported to India for use in traditional medicine.

3.10 Industry

Industry is in its infancy but includes garment production and fish canning, for export. The garment factory on Gan utilizes the old Royal Air Force buildings, and is dependent upon both imported materials and labour and the finished products are exported to the USA. Two other garment factories have been established on Gan in Laamu Atoll and Thulusdhoo. The fishing industry includes a fish cannery and a number of fish collecting and processing centres for the collection of dried fish products traditionally produced on a cottage industry scale. The contribution is significant since dried fish products amount to around 30% of the value of total marine product exports in 1992.

Small scale industry has developed recently, mainly centred on Male' and some islands of Male' atoll, and includes soft drink manufacture for local consumption, and manufacture of PVC pipe, fibre glass boats, cement blocks, toilet soap, furniture and a number of food products.

The traditional sector is geographically dispersed and includes boat building, thatch and rope making, carpentry, tailoring, blacksmithing and the production of jewellery, curios and souvenirs. The manufacturing sector contributed 72.8 million Rufiya to GDP in 1984. Various development activities in the field of traditional handicrafts are designed to improve productivity and distribution networks enabling producers to reach potential markets of the tourist resort islands.

3.11 Agriculture

Soils are generally young and shallow, being no more than 20cm deep and contain substantial quantities of parent material, coral rock and sand. In wetter depressions, a thick clayey layer is present at a depth of around 10 to 15cm. Soils are highly alkaline with a pH of between 8.0 and 8.8; an average of those tested being around 8.5. Quantitative chemical analyses, although few in number have indicated that soils are: deficient in nitrogen both in the form of ammonia and nitrate; low in potash; fairly rich in phosphorus, magnesium and calcium; lacking in manganese and aluminium; but there is no deficiency of iron. Excess calcium interferes with the uptake of potash by plants, and turns iron into insoluble forms which are not available to certain species, particularly the leguminosae, causing fatal chlorosis in most plants.

Due to the generally sandy-loam nature of the soils water retention capacity is poor. In addition, close proximity of all land to the sea results in comparatively high soil salinity and as a consequence the natural vegetation contains a high proportion of salt tolerant species, both shrubs and trees.

Since soils are poor, agricultural production is not high. Unlike many other developing countries, agriculture accounted for 9% of GDP in 1990, having declined from around 18% in 1981. Total cultivable land is cited as 46,766 acres, of which most is used for subsistence production. Crops include coconut, fruits, vegetables, tubers, and coarse cereals. Vegetable production is, with the exception of onions and chillies, largely for local consumption and includes beans, cabbage, gourds and pumpkins. Of the fruit trees, breadfruit is an important component of the traditional diet in the rural islands whilst banana, papaya, water melon, mango and lime, amongst other fruits, are also grown on a small scale in the country.

Citrus and coconut production have been adversely affected by pests and diseases and coconut production declined significantly in the early seventies, remaining stagnant throughout the late seventies and early 80's. Productivity is generally low as a consequence of poor genetic stock, close planting and lack of use of fertilisers or manures.

Coarse cereals including finger millet, Italian millet, and maize were widely cultivated in the past. Yam, cassava and taro (*Colocasia esculenta*) production have declined as the import and distribution of rice and wheat flour has increased. Taro production over the period 1978-1982 averaged around 10,000 metric tonnes per annum, declining to around half by 1986.

3.12 Forestry

Much of the natural woodland has been cleared and replaced by grassland and coconut. Fuelwood shortages are now apparent in many areas and construction timber for housing and boat building are largely imported due to depletion of the 15 species traditionally used for *dhoni* construction. Casuarina planting is being encouraged by the government to serve as wind-breaks and also as sources of domestic fuelwood.

4. ENVIRONMENT AND NATURAL RESOURCES

4.1 Land and land use

The majority of the islands are fairly small; around one square kilometre or less. The total land area of around 300km^2 forms less than 0.01% of the total area within the Exclusive Economic Zone of the country. Most islands are extremely flat and low-lying, and approximately 80% of the land area is less than a metre above mean sea level.

The majority of land is government owned and uninhabited islands are leased by the government to individuals for various purposes. The lack of private ownership and extended tenure are potential constraints to investment. Islands are designated by the government for specific purposes, eg. tourist resort islands, agricultural leases, and industrial islands.

4.2 Freshwater resources

Beneath many islands lies a freshwater aquifer which may change in volume with season and which rises and falls with the tide. Most groundwater assessments conducted to date have been only for Male', where the supply of aquifer water for human use is now increasingly being replaced by desalinated water. The volume of untapped groundwater resources on other islands is unknown. Increased extraction, exceeding natural recharge through rainfall has dramatically depleted lenses on some populated islands. Poor sewage disposal has resulted in contamination of groundwater in the past, resulting in a high incidence of cholera and shigella, with major outbreaks in 1978 and 1982.

Calculations for Male' suggest that at the current rate of overdraw the aquifer will be exhausted in the next few years, and similar problems are likely to continue to arise in other heavily populated islands. The costs of replacing aquifer supplies through desalinators is high both in capital and recurrent terms.

4.3 Marine and coastal environment and resources

Unlike many atolls in the Pacific those of the Maldives support coral structures and islands within the lagoon itself, although, as in the Pacific, most land is concentrated on the outer reef which surround the lagoons. The diversity of coralline structures within the lagoons, enhances overall atoll productivity, hence the maximum sustainable yield of a single atoll, reef fishery in the Maldives is likely to be higher than elsewhere. Despite their high gross production however, coral reef communities have high respiration rates resulting in low overall net productivity and hence, low sustainable yields of marine products. This problem is further compounded by the high species diversity of reef ecosystems and the low density of finfish and other species such as clams and sea cucumber, suitable for exploitation. Localised, heavy exploitation of single species to supply local and overseas markets, often results in over-exploitation and loss of species.

Atoll and reef arrangements and configurations cause considerable wave refraction and interference within the archipelago as a whole, and in individual atoll lagoons. Deepwater swells are known to penetrate Male' atoll causing problems to ships and barges. Manual wave calculations have suggested that swells with periods over 5 seconds and heights of 0.5m could occur inside the Male' lagoon 5-6% of the time. Waves generated within the lagoon could be 1.4 m high with periods of 4.5 seconds for a wind speed of 20 $msec^{-1}$.

Precise and long-term data on tidal range and patterns of tidal flow are scarce or absent. Tidal variation averages less than a metre in the southern Maldives and mean high water intervals are said to be ten hours and twenty minutes. Tidal range at Male' is 1.1m.

4.4 Biological diversity

Based on published plant species lists and vegetation descriptions, 583 species of plants have been recorded. Of these, 323 or 55% are cultivated species. The numbers of species on individual islands vary according to land

area and the basic formations follow a typical atoll conformation with salt-tolerant species forming a fringe, surrounding forest dominated natural vegetation in the centre. Localised stands of mangrove are present, usually on the lower lying marshy lagoon side, or inner areas of larger islands particularly in the south.

The archipelago supports a diverse and extensive marine fauna with over 1,000 species of finfish, 140 species of coral, 63 species of marine benthic algae and between 11 and 14 species of nesting seabirds. Unlike many atoll countries in the Pacific basin the reef resources are generally under-exploited since tuna form the staple diet and are preferred to reef fish. The major subsistence use of reef resources in the Maldives at the present time involves mining living coral for construction and dredging coral sand for road surfacing and construction purposes. The impact of coral mining has been extensively reviewed and its impact on the sustainable use of reef systems is extreme.

4.5 Episodic events and natural hazards

In April 1987, a storm centre in the southern Indian Ocean resulted in long-distance wave transmission which passed through much of the Maldivian archipelago. The waves caused enormous economic losses through damage to infrastructure, reclaimed land and vegetation. Male' and the airport on the island of Hulule were the worst hit with extensive flooding and erosion. A new "island" approximately 250 metres long and 12 metres wide was formed on a submerged reef north of Male'

Other recent events of flooding such as those experienced at Thulhadhoo in 1988, were caused by high SW waves (2-2.5m high; duration 12-15 seconds) in association with a high spring tide and southwesterly wind. Damage caused was enhanced by the absence of natural beaches, reclamation of reef flat areas and the presence of low, vertical sea walls which magnified overtopping and flooding.

In 1991, the country experienced unusually severe storms with high winds causing extensive damage to buildings and trees. An estimated 3,000 dwellings were damaged and more than 100,000 trees and agricultural bushes such as chillies uprooted or damaged, causing an overall loss of an estimated US$30 million.

Although a degree of coastal flooding has been experienced in the past, risks of flood damage resulting from long distance swell propagation in association with high tides, have increased in recent years by the improper management of the coastal zone. Construction of poorly designed seawalls and coastal structures, and reclamation of land, reducing the extent of the protective reef flat have been contributing in varying degrees. Information on local current patterns is still scanty and at best, qualitative. Such information is vital in coastal construction work and in estimating the nature of sand transport within the reef system.

A recent review of historical records suggests that around eight major flooding events have occurred within the last 170 years, and that one such event in 1819, resulted in 12 islands having to be abandoned.

5. CONSTRAINTS TO SUSTAINABLE DEVELOPMENT

5.1 Role of natural resources in past economic development

Like most small archipelagic states, the economy and life style of the Maldives is essentially maritime and marine-based. The importance of the sea is indicated by the status of boat builders and *dhoni* captains, which was high in traditional society. Most men were traditionally involved in activities associated with the sea; fishing, boat building and long-distance trading; whilst agriculture was never a prominent activity and was largely the preserve of women.

Tuna fishing has always been a major activity in the Maldives. In the past, tuna were boiled to remove the oils, smoked and salted or sun dried as "Maldive fish"; a delicacy which was extensively traded with southern India and Sri Lanka. It forms an important component of traditional Sri Lankan cuisine. The major import was rice and without this trade, it is unlikely that the Maldives would have been able to support the large indigenous population, since agricultural production of food energy in the country would have been insufficient to feed a population of 70,000 people.

In addition to tuna, the cowrie shell, *Cypraea moneta,* was extensively collected in the Maldives and formed the second major trade item early in Maldivian history. The shells were traded by the Arab traders into northern India and east Africa during their trading cycles around the Indian Ocean. The trade in cowrie to Sri Lanka and southern India continued until the fifties and early sixties.

The advent of tourism in the 1970s, and the switch to the export of frozen fish not only continued the marine-based tradition of the economy, but also established new trading links primarily with Thailand, which processed Maldivian frozen tuna into canned products. The recent introduction of canning in the Maldives represents a deliberate policy shift to increase the value of the products. It resulted in the direct export of canned tuna and the production of fishmeal which is also exported.

As noted above, the tourist industry is essentially marine-based, with visitors arriving to swim, snorkel, dive and enjoy a wide variety of water sports against a backdrop of small tropical coral islands set in a warm and dry environment. The opportunities for broadening the basis of tourism in the Maldives are limited and it is likely that this style of tourism will continue to dominate the sector for the foreseeable future. Maintaining marine environmental quality in the lagoons and in the vicinity of small islands will therefore remain a high priority.

5.2 The nature of sustainable development

Sustainable development implies that the present resources used by the population should neither be degraded nor exhausted to the point where they can no longer support future generations. This in turn implies inter-general equity and justice such that the development choices of the present generation should not prejudice the choices of future generations. In the case of small island states with limited land area all development decisions involving land use changes will of necessity restrict the opportunities available to future generations.

In the case of Male' for example, past developments which have taken place both passively and as a result of active decisions have resulted in future generations having no choice but to defend the island, its inhabitants and infrastructure, against the adverse impacts of climate change and sea level rise. The entire periphery of the island is now enclosed in seawalls which must be raised as future sea levels rise. This may not however be totally effective since the water table itself will rise. Thus, future generations are already commited to an environment without a freshwater aquifer and to added expenditure in terms of expensive pumping to reduce the groundwater level.

Unlike some other small island states, the Maldives has a relatively pristine environment in the vicinity of many of its uninhabited islands. The choices which the government now makes, concerning the development of these islands, will determine the future range of alternative choices.

Sustainable development further implies that resources which are currently used should be managed on a sustained yield basis; that is, the rate of removal should not exceed the rate of natural replenishment. One of the major difficulties facing small island states in the tropics, is the absence of appropriate multi-species fisheries models which permit even a crude estimation of the maximum sustainable yield of coral reef fisheries. The need for innovative ideas and models concerning the management of such fisheries is therefore of paramount importance to small island states. The traditional experiences of Pacific island peoples in terms of restricting access to fisheries as a means of limiting catch, may provide appropriate management models for small tropical islands; models which, because of the dominance of tuna in traditional Maldivian society are not part of the Maldivian tradition.

Whilst there is no evidence that tuna exploitation is currently exceeding the sustainable yields the potential for this to happen in the future is great, particularly in view of the fact that the FAO has estimated that by the year 2000, world demand for fisheries products will have increased by some 20%. Since tuna stocks are largely migratory, the potential for over-exploitation of Maldivian tuna stocks by fishing fleets from other nations operating in the Indian Ocean is real.

The Tokyo Conference on the Human Environment and Global Response to Sustainable Development (Sept. 1989) recommended to governments and agencies that:

> "The imperative of sustainable development demands nothing less than a critical review of the internal economic and financial policies of each individual country as well the existing structure of the international economy such as trade, direct investment, international financing and official development assistance."

To achieve sustainable development therefore, development activities must be analysed from an holistic viewpoint including economic, social, cultural and environmental factors, and activities must be based on the sound use of the resource base of the nation. In the light of this it is important to consider the contributions and limitations of the natural environment towards sustainable development within the Republic of the Maldives.

5.3 Carrying capacity and self-sufficiency

The natural resource base of any country is required to support directly the internal consumption and indirectly the costs of imported goods and services required from external sources. It is imperative therefore, to consider the resource base in terms of its limitations and constraints, as well as its potential. A useful concept in such an analysis is that of carrying capacity.

The term carrying capacity has various definitions but basically refers to the potential or actual number of people which can be supported by a given area without irreparable damage to the resource base and natural environment. Carrying capacity may be viewed in terms of individual islands, whole countries or regions, and involves in the first instance examining the limits to population expansion.

Human populations are less dependent than plants and animals upon the resources of their immediate surroundings, as modern transport systems effectively widen the geographic scope of the resource base, and technological developments such as desalination plants may effectively increase supplies of limiting resources such as freshwater.

Widening the geographic resource base through importation of basic requirements such as food, or increasing the technological solutions to limiting factors such as space, energy or water supply, automatically place burdens on the economy which must be met through increased use of the resources which are available in the country concerned.

In principle, exceeding the "carrying capacity" of an island or country is not in itself a problem, provided that the economic burdens caused by increased importation and investments in technology to overcome the limitations to the carrying capacity can be balanced by increased export of other resources which are in plentiful supply. In this sense, carrying capacity of a country may be viewed in economic terms and the relationship between the present population and the carrying capacity may be measured via its balance of payments. The danger therefore, lies in over-estimating the extent to which the natural resource base can be exploited in the long-term to pay for development loans in the short-term.

Self-sufficiency lies at the heart of sustainable development and implies that a human population exists within the limits imposed by the carrying capacity of the environment or country concerned.

From an environmental planning perspective therefore, sustainable development involves the maximization of resource exploitation without lasting damage to the environment and the resources which it contains. Resource exploitation and management in the Maldives should be geared towards; export replacement, identification of alternate uses for existing resources and expanding the resource base through the identification of new resources and the technologies to exploit them sustainably.

5.4 In-country constraints to sustainable development

In addition to obvious resource constraints imposed by limited land area, less obvious physical parameters such as rainfall and hence the available freshwater supply, also limit development opportunities in the country. Inadequate human and financial resources further compound the problems.

(i) Coordination

Further constraints to development include communication and transport problems in a country of over 1,000 islands lying in a chain of atolls distributed over a distance of 860 kilometers. The geography of the country results in problems of coordination and provision of services.

(ii) Environmental data base

Even less immediately apparent is the constraint imposed by the inability to utilise existing environmental information efficiently. For example, innumerable studies have been undertaken to investigate and detail problems and possible solutions relating to Male's water and sewage supply but no synthesis of all the problems has been produced and equally important no archive of all such studies exists for referral by later workers. A key factor in

future, successful, sustainable development is the compilation of an environmental database to reduce duplication of effort and consequent waste of scarce financial and manpower resources.

(iii) Information

One area of environmental planning which is accorded separate status in many countries is disaster planning and risk assessment. In the Maldives disaster planning and control is an activity falling within the purview of the national Commission for the Protection of the Environment and in late 1989 oil spill contingency plans were drafted for the country. In the case of natural events such as severe flooding or tropical storms or man-made disasters such as oil spills, an environmental database could provide useful information on the frequency and severity of natural events and the vulnerability of different habitats and locations. Unfortunately such data are generally unavailable for the Maldives.

The complete absence of some environmental information is a major problem, not only in evaluating resources but in assessing risks from episodic events such as flooding, or in evaluating potential problems such as erosion resulting from coastal manipulation. Assessing the sustainability of freshwater resources in northern atolls is difficult in the absence of data on recharge rates which results from the absence of any long-term rainfall data for the country north of Male'.

(iv) Baseline data

The absence of baseline data, or a suitable data set for synthetic application to the development site is characteristic of most locations in the Maldives. Long-term meteorological data are available only for Male' and Gan; hydrographic surveys of lagoons are incomplete, topographic maps of islands are few; vegetation, soil and land-use maps are generally lacking and the state of the environment has generally not been assessed. Most EIAs in the Maldives, now required under recent legislation will therefore require initial establishment of site specific databases as a first step in their implementation.

(v) Organisation

Sectoral division of responsibilities leads to frequent duplication of effort in some areas and a failure to consider others. Monitoring of the Male' aquifer is currently undertaken by at least two government departments, whilst monitoring of coastal water pollution is not undertaken at all. Any programme of sustainable development planning must successfully address the various constraints imposed by resource limitations and the hidden constraints relating to organizational and management problems.

(vi) Waste management

Most human activities result in the production of wastes of different kinds which if dumped or permitted to flow unchanged into the environment, can have adverse effects on living organisms and environmental productivity. Managing wastes and their disposal is therefore important in not only avoiding degradation of the country's resource base but also in reducing the costs of waste handling and management through maximising the value which could be derived from alternative uses of such wastes.

(vii) Legislation

Consideration needs to be given to cost-benefit analyses of alternate forms of waste treatment and discharge. Such analyses must involve internalising the environmental costs of alternatives which involve disposal of wastes to the environment. It might well be the case that some form of sewage treatment in Male, combined with use of the resulting products would not only remove the pollution problem in nearby coastal waters (an external, environmental cost of the existing disposal system) but would enhance other activities or provide opportunities for new developments. Biogas digestion of human sewage, producing gas and fertiliser, may well be economically viable in comparison with discharge of raw or pre-treated sewage.

The legislative base in the Maldives has recently been strengthened although there is still a need for clearly defined standards in a number of areas. Monitoring programmes are non-existent outside Male' and enforcement procedures have yet to be developed and the manpower trained to implement them.

(viii) Environmental policy

The political will to avoid past mistakes in environmental matters is strong in the Maldives. Following the 1987 flooding, a high priority is placed on the environment, unfortunately experienced and qualified indigenous environmental scientists and managers are currently lacking.

Environmental policies as defined by government provide the range of possible outcomes within which the environmental consequences of development activities are deemed to be acceptable. Successful policy formulation depends upon the political will of the government concerned; the priority afforded the environment; and the presence of trained and experienced personnel to provide advice on the alternatives available for implementation.

(ix) Financial Gaps

In conclusion one can state that the narrow resource base both in terms of quantity and variety of resources; the limited land areas; limited freshwater resources; limited manpower in absolute terms; limited skilled and trained manpower; the distances separating population centres; the current demographic trends; and the non-availability of basic resource information within the country all provide constraints to future sustainable development.

5.5 Externally generated constraints to sustainable development and transboundary issues

Major transboundary issues affecting the country include:

- **joint regional management of the Indian Ocean tuna stocks** on which much of the development of the country currently depends. Although current rates of exploitation by all parties appear not to be adversely affecting yields the potential for future over-exploitation by long-distance fishing fleets cannot be ignored;

- **potential risks from oil spill accidents** which are high. The Maldives straddle the shipping lanes between the Arabian Gulf and Indian Ocean on one side and southeast Asia on the other. In addition, internal movements of fuel and their decentralised storage to supply the fishing fleet, constitutes a risk of future oil spill accidents;

- **global climate change.** Of particular importance to the Maldives are risks arising from increased frequency and or intensity of mid-latitude storms, resulting in increased frequency of flooding as a consequence of long-distance swells;

- **accelerated sea level rise.** This will lead to: reduced island stability; enhanced beach erosion; land loss; and, reduction in the quantity and quality of groundwater resources;

- **political stability of the region.** External events in the region over the last decade have dramatically affected tourist revenues, particularly during the recent Gulf War in 1991 and during the early 80s when ethnic violence in neighbouring Sri Lanka significantly reduced tourist arrivals;

- **world trade and pricing systems.** Like all small states, the economy of the Maldives is sensitive to external fluctuations in the price of its major export, tuna.

An area of major concern to many small island states and one which places an additional burden on the already inadequate environmental management and planning capability, is a consideration of the potential impacts of climatic change and sea level rise.

All environmental monitoring and assessment programmes initiated at the present time need to include a careful consideration of evidence which may indicate the rate and direction of sea level and climatic change in the Maldives and the implications of globally determined predictions for the country as a whole.

Only following a careful evaluation of the present resource base of the country; a review of the state of the environment; consideration of the future impacts of population growth on the resource base; and assessment of present development activities can the impacts of global change be fully evaluated in terms of potential impacts on the physical environment, resource availability, economy and society. Only after such a detailed evaluation has been made can policy and planning alternatives be considered and decided upon by government. Such an undertaking requires considerable investment of time and money, both of which are in short supply.

The fact that change will occur has to be accepted and needs to be incorporated into development planning in the country. Although the scale and direction of such changes cannot be accurately predicted, it would be foolish to totally ignore the fact of change in planning developments which have an economic life span of more than thirty years. Sound environmental planning has a role to play in advising the government of the Republic on the probabilities of different rates and magnitude of change and in providing advice on what scenarios should be incorporated into future development plans.

A further external constraint lies in the nature of international systems and in particular the scale and nature of technology developed by the industrialised nations. Modern technology is largely developed for use on a large scale, and is therefore, often inappropriate for application in small island environments. Whilst the industrialised nations understandably invest in research and development associated with large scale technological innovation small scale solutions to technical and environmental problems receive considerably less investment in research and development, yet it is on just such small scale innovations that the sustainable development of small islands depends. Small scale power generation; alternative energy systems for small isolated communities; economic problems of small, dispersed internal markets; multi-species fishery problems; enhanced and technically simple communication systems; and small scale waste disposal systems to name but a few are all problems requiring urgent research and development if the present problems of sustainable development on small islands are to be adequately addressed.

5.6 Future development opportunities

The government of the Republic recognises that future development in the Maldives must be based on the principle of sustainability, hence in the medium-to long-term there are limits to continued expansion in the tourism and capture fisheries sectors. In both cases however, continued growth is possible in the short-term.

Expansion of tourism is possible on the basis of the large number of uninhabited islands which can be developed along the lines of previous development. However the present style of tourism, based as it is, on mass market, package holidays from Europe, results in considerable loss of income to the Maldives since the bulk of the holidays are paid for outside the country and tourists spend little additional money in the country. A shift in the market towards a system catering for smaller numbers of tourists seeking a higher quality of service, or more specialised holiday packages, for game fishermen for example, may prove more profitable in the long run.

The reliance on Europe as the single major source of tourists exposes the industry to external influences such as has already occurred during the Gulf War and the height of the civil disturbances in Sri Lanka. Diversification of the tourist market, focussing particularly towards Japan and the newly industrialised countries of the Pacific rim should be actively encouraged.

Expansion of the tourist sector will require an active policy of decentralisation however, since Male' atoll and islands in neighbouring atolls which can be reached easily from the single international airport are already largely developed. Developing a tourist industry elsewhere in the archipelago would require either the development of another international airport or development of more efficient transport links in-country to convey both tourists and the necessary materials from the main international entry point to the newly developed resort islands.

Expansion of the fisheries sector appears to be equally possible. Over the last decade captures in all sectors of the fin fisheries have increased with no indication that the maximum sustainable yield has yet been reached. Some

indications of local over-exploitation of reef fish are apparent in Male' atoll and populations of giant clams, beche-de-mer and lobsters have all declined in areas of intensive fishing.

At present the tuna fishery is unique in that it is based on motorised traditional *dhonis* and pole and line capture. The product is therefore "dolphin-friendly" and a more aggressive marketing strategy for Maldivian canned tuna in Europe would undoubtedly result in increased sales, given the strength of the environmental movement in Europe. The present national fishing fleet is limited in terms of the distances which can be covered and the species which are captured. The full extent of tuna resources in the EEZ has yet to be either identified or exploited and the possibility for expansion lies in both the construction of larger vessels and the use of additional techniques such as purse seining or long lining for deeper swimming species. It would be a pity however to ignore the comparative advantage of the "dolphin-friendly" nature of present Maldivian tuna for short-term gains derived from introducing purse seiner operations. Hence, strategies should be directed towards expansion of vessel size and long-lining rather than the more capital intensive and environmentally less acceptable option of purse seiners.

Whilst it is possible that Maldivian reef fish could support increased fishing effort above the present level, successful sustainable use of coral reef fisheries for export has not been achieved anywhere in the world, to date. The high species diversity, wide size range of reef fish, low sustainable yields of individual species, and problems of market acceptability, all militate against economically successful reef fisheries designed to supply northern markets. From both the economic and environmental perspective it may be better therefore to develop the reef fisheries in a decentralised manner, to supply the local tourist market and hence contribute to import substitution.

A further area which is receiving increasing attention within the fisheries sector is the possibility of mariculture, primarily to supply high value, high quality products such as fresh giant clam adductor muscle, or live groupers and snappers to southeast Asian markets. The possibility of using fishmeal by-products from the canning operations in the country as feed, combined with the unique structures of micro-atolls and *faros* which form natural fish pens, suggest that the Maldives has a comparative advantage in this field.

It is clear that a number of opportunities for future development exist within the country and care must be taken to ensure that development decisions made now do not restrict the choices of future generations.

5.7 Planning for sustainable development

Sound planning for sustainable development needs to be based on a thorough understanding of the resource base of the country including items which are currently exploited and those which are not used at present. An initial environmental inventory needs to be developed to provide answers to the following basic questions:

"What is available ?"
"How much is there ?"
"Can it be used in a sustainable manner ?"

The present resources of the Maldives include its location (in the tropics) and climate (warm and sunny) blue sea, white sand and coral reefs which form the basis of its success as a tourist destination. Tuna populations exploited both for home consumption and export form an important renewable resource on which a substantial proportion of the modern Maldivian economy is based. Corals and sand provide building and construction materials, while agricultural production, based on the soil, water and climatic resources of the country although limited, provides food energy, while trees provide fuelwood, construction and boat building timber.

There appears to be scope for increased production of horticultural crops. There is a growing demand from the local and resort markets for high value vegetables and fruits and condotions on some islands favour successful production under techniques of conservation farming.

For some of these resources, such as fuelwood the present rate of use appears to be exceeding the rate of renewal in some areas of the country, any programme of environmental assessment should address such issues of resource over-exploitation. Reforestation programmes even on limited scales,

using fast growing species for fuelwood supply reduces the demand for expensive imported energy whilst at the same time providing added benefits through stabilising the soil and reducing wind erosion of the surface.

Whilst the existence of some resources in the Maldives may be immediately obvious due to their past use by the population, other items not currently exploited may potentially be used for a variety of purposes. For example, the identification of a known resource such as the deep swimming tunas in the Maldivian Exclusive Economic Zone has not lead to its immediate exploitation, since the building and equipping of long liners is beyond the present economic capacity of the country. Nevertheless the identification of potential resources such as this provides a basis for future planning.

Of equal importance to assessing the potential of known resources is the process of identifying presently unused resources which might be exploited to broaden the basis of the economy of the country. At present some oil exploration is taking place but in general terms new resource identification of this type has to remain a low priority in the country since it is generally expensive, and represents a "high-risk" activity where the probability for an economic return on the initial research/exploration investment is low. It is therefore largely dependent upon investments by international companies and agencies.

An initial inventory of existing biological resources in the Maldives should be undertaken to identify all indigenous animal and plant species. Such a review may lead to the identification of species not currently exploited but which are used elsewhere in the world. Several seaweed species which occur naturally in the Maldives for example are used for food and agar production elsewhere; and several species of fin and shell fish known from the Maldives are currently cultured in Southeast Asia.

An inventory of resources should also review the physical features of the country to identify whether or not the physical environment itself presents development opportunities. For example does the existence of "*faros*", (the small circular structures enclosing a lagoon which are unique to Maldivian atolls) present a unique opportunity for the mariculture of reef organisms?

An important component of the resource review of the country is an evaluation of the human resources in terms of demographic and migration patterns, the structure and composition of the workforce and the educational and other skills which are available or potentially available in the country. The current workforce of the country is a small proportion of the total population due to its young age and skills are generally at a low level within the country as a whole.

It may well be the case that the absence of skilled labour at the present time places constraints on the nature and type of development activity which can be undertaken in the immediate future. The programming and scheduling of training and educational programmes will have to proceed hand in hand with research and development activities associated with resource assessment and environmental management.

A human resource which is frequently neglected in resource or environmental management and planning is traditional knowledge. Most coastal communities relying on fishing for their subsistence have a profound and detailed knowledge of the biology of many fish species both those which are exploited and those which are not. In addition knowledge of local current patterns and other physical environmental patterns is often extremely detailed. Recording and testing such traditional knowledge provides a rapid and inexpensive way of establishing an environmental database compared with a lengthy and expensive programme of environmental research and assessment.

The limited physical and biological resource base of the Republic necessitates careful evaluation of its potential from the perspective of sustainable development. Failure to solve the current problems of environmental management and planning within the country will preclude the development of a programme for sustainable development and negate the benefits of developing new resources.

5.8 Centralised and decentralised development

Past development planning in the Maldives, like that of many developing countries has been dominated in the recent past, by purely economic considerations. This has resulted in a centralised mode of development with most development occurring in and around the capital city of Male'. The environmental problems of the capital have been outlined above, and recognition of these problems, together with the costs of addressing them, has resulted in the government actively seeking ways in which future development can be decentralised. The adoption of this policy of decentralisation has resulted in recognition of the need for "centres of attraction" elsewhere in the archipelago, which will, it is hoped, result in reduced in-migration to Male'.

Such centres of attraction require not only services such as those of education and health but a sound economic base around which the communities can develop. Present migrants to Male' arrive in search of high school education, health care, employment and other opportunities for improving their economic status. The past policies of government in terms of subsidising the cost of living in Male' through subsidising the provision of education, health care, desalinated water, and waste disposal, are currently under review. It is likely that in the future, at least part of the high costs of providing these services, in Male' will be passed on to the end-user thus resulting in end-users experiencing the "real" cost of living in the capital. Such a radical change in policy cannot be undertaken quickly, nor can it be undertaken without the simultaneous provision of alternative opportunities in the atolls for those who need access to the services and opportunities which are presently only available in Male'.

Past policies which have resulted in subsidies to the cost of living in Male' although commendable, have resulted in inequitable development throughout the country. Development in and around Male' has occurred at the expense of development in the outer atolls. This has arisen in part, as a result of the relatively higher costs of providing dispersed services, and in part, as a result of the higher costs of production on islands at a distance from the single point of entry for imports and exports.

The government recognises that simply agreeing on a policy of future decentralised development will not however, solve all the problems of sustainable development in the Maldives. Without good models for atoll island development the danger is, that the problems now facing Male', will be merely replicated in three or four other islands. A major challenge facing not only the Maldives, but also other small archipelagic states over the next one to two decades will be, to develop appropriate models for decentralised development which are environmentally and economically sustainable.

Such models are not yet available, since the countries of the northern hemisphere have not had to face such problems during their own development and hence cannot provide small island states with examples of successful solutions. Whilst the government of the Maldives recognises that solutions to its problems of sustainable development are unlikely to arise during the 1994 Global Conference on Sustainable Development in Small Island Developing States, it nevertheless looks to this conference to put in place mechanisms which will permit it to develop such solutions in partnership with other countries facing similar problems.

6. NATIONAL RESPONSES TO ENVIRONMENTAL ISSUES

6.1 Recent developments in the environmental sector within the country

The environment sector was not formally recognised as an entity within government until the 1980s. Prior to this, individual measures were in force to control environmental problems in each sector. These included, for example, legislation under the Ministry of Tourism, controlling the development of infrastructure on tourist islands and disposal of solid wastes.

In 1984, the Council for the Protection of the Maldives Environment was established under the Ministry of Home Affairs and Social Services to act as an advisory body to the government on environmental matters. A small Environmental Affairs Division was created and gradual strengthening of this division occurred within the Home Ministry. In late 1988, environment was given elevated status, being combined with the then Ministry of Planning and Economic Development to form a new "Ministry of Planning and Environment". The rationale for this move being that environmental considerations needed to be fully and efficiently integrated into development planning within the country.

The gradual process of strengthening environmental management was accelerated following the unusual ocean storm surge in April 1987. This occurrence served as a warning, not only of the consequences of environmentally unsound development, but also of the possible future impacts of climate change and sea level rise.

In 1989, the National Environment Action Plan (NEAP) was developed through a national workshop to address the planning and management needs of the country. The lack of trained personnel and data, were and still are, limiting factors to the growth of environmentally sound management and full implementation of the National Environment Action Plan. Recognising the need to collect, collate and manage relevant information an Environment

Research Unit (ERU) was established in June 1990. The role of the ERU is to act as a facilitating organization for coordination of all relevant information and data, while undertaking appropriate research and monitoring. This is important as it provides a sound scientific basis for policy and regulatory mechanisms to be undertaken by the Ministry of Planning, Human Resources and Environment.

6.2 National principles and goals

The government recognises that sustainable development in the Maldives will not be possible without the maintenance of environmental health and quality and in particular, the maintenance of a productive marine environment. This recognition underlies the principle aim of the National Environment Action Plan which is:

> "To help the Government of the Maldives to maintain and improve the environment of the country, including the marine and ocean area contained within the Exclusive Economic Zone, and to manage the resources contained therein for the collective benefit and enjoyment of present and future generations."

The directive principles of the Action Plan are:

- The continuous assessment of the state of the environment within the country, including the impacts of man's activities on land, in freshwater, in lagoons, reefs and ocean and the effects of these activities on the quality of the human environment.

- The development and implementation of management methods suited to the natural and social environment of the country, which will maintain or enhance environmental quality, while at the same time, utilizing the resources on a sustainable basis.

- The development and implementation of comprehensive national environmental legislation and participation in international agreements to provide for responsible and effective management of the environment.

- The strengthening of national capabilities, institutional arrangements and financial support which will enable the Action Plan to be implemented in an efficient and economic manner.

- All components of the Action Plan are viewed as interdependent and provide a framework for comprehensive action which should contribute to both the protection of the environment and the continued development of the country.

Within the context of future development and as a mechanism to addressing the environmental and development problems resulting from in-migration to Male', the government has adopted a policy of decentralisation encouraging development projects and activities in the atolls.

6.3 National policies, legislation and institutions

Through its adoption of the National Environment Action Plan, the government is committed to the concept of sustainable development and is seeking as a matter of priority, appropriate policies and mechanisms for translating this goal into concrete action in the field of development.

The government is further committed to the development of appropriate sectoral policies covering areas such as freshwater resources and waste management. To date policies have been adopted requiring the assessment of environmental impacts for all development projects but the in-country capability for under taking or evaluating such assessments is limited.

Recognising the environmentally damaging effects of coral mining the, government has initiated a number of measures to restrict and control this activity. Initial controls banned the mining of coral on reefs surrounding inhabited islands, subsequently mining was restricted to designated sites selected by the Environment Division in consultation with the Atoll Chiefs. Simultaneously import duties on building aggregates were substantially reduced to encourage their use in place of coral. More recently coral mining

has been completely banned in all areas where an alternative supply of prefabricated building blocks are available, and no coral may now be used in the construction of any government building.

Sectoral policies covering environment and development already exist in the tourist, health and fisheries sectors. In the case of tourism, resort island developers are subject to requirements for waste disposal, coastal construction and density of accommodation which are all detailed . Such sectoral policies frequently include legislative powers of enforcement of agreed standards, but to date, no effective comprehensive mechanisms for enforcement are in place.

In April 1993, the Citizen's Majilis approved the Environmental Protection and Preservation Act which provides the Ministry of Planning, Human Resources and Environment with wide statutory powers of environmental regulation and enforcement. The Act covers transboundary movement of hazardous waste and the disposal of waste within the country. It empowers the Ministry to draft guidelines for the protection of the environment and makes it responsible for the identification and designation of protected areas and natural reserves. In addition, the Ministry is designated as the responsible body for formulating polices, rules and regulations regarding the environment and empowers the Ministry to levy fines of up to one hundred million Rufiya (10 million US$) for breaches of the law, or to terminate without compensation any project that has an undesirable impact on the environment.

Government support to institution building in the environment sector, in addition to providing the legislative base for the work of the Ministry, has concentrated to date, on training and the expansion of the Environment Division of the Ministry of Planning, Human Resources and Environment including support to the recently established Environmental Research Unit.

Substantial financial investments in capital and human resources are required if environmentally sound and sustainable development is to be assured in the Maldives. Regrettably, such resources are unavailable in-country at the present time and extensive financial and expert assistance will be required of the international donor community over the next two decades.

Some initiatives are being developed in the private sector in-country, particularly among tourist resort operators where environmental awareness is well developed and the need for maintaining environmental quality is a recognised prerequisite for a healthy tourist industry.

6.4 National environmental programmes and projects

To date few activities have been initiated in the environment sector due to financial and manpower constraints. Initial support from UNDP has been concerned with strengthening the relevant sections of government through enhanced in-service and overseas training in various environmental fields. In 1992 and 1993, a further nine officers were sent for overseas training in different environmental fields. It must be recognised that building an internal capacity for environmental management and planning in the Maldives is hampered by the small size of the manpower pool including:

- the absence of existing indigenous environmental expertise;
- the small size of the existing pool of trained and skilled personnel in all fields associated with development;
- the small numbers of high school graduates available for degree level training; and,
- the high demands placed on existing experts to respond to both internal and international requirements for action.

A number of programmes and development projects in other sectors have included environmental components, although the overall coverage has, to date, been limited to "one-off" environmental monitoring associated with harbour developments, or resource surveys associated with exploited and stressed resources such as the Male' freshwater aquifer. Expert assessments of the scale of some environmental problems such as waste disposal in Male' have also been undertaken.

Major development projects have been concentrated in the service and fisheries sectors and infrastructure development. To date few projects have taken environmental concerns into consideration during initial planning, although this is changing rapidly.

Environmental education and awareness have been given high priority with regular radio and television programmes and the production of various printed materials for distribution in the atolls. Much of this work is undertaken with the active participation of various non-governmental organizations active in environmental fields in the country.

Environmental research in-country is severely limited by the lack of trained national manpower and the absence of tertiary institutions which might foster such research. To date most environmental research work has been concentrated on coral reef biology and monitoring associated with specific problems such as coral bleaching and mortality from outbreaks of crown- of-thorns starfish.

No formal in-country training programmes in environment and development exist within the country, and the Maldives is likely to depend for sometime to come on courses offered in other countries. This is regrettable since all too often such courses are inappropriate for the working environment of Maldivian graduates on their return home. The Environment Division of the Ministry of Planning, Human Resources and Environment has commissioned various studies and has recently organised a series of in-house workshops for government personnel covering topics such as: environmental impact assessment; solid waste management; analysis of demographic trends; socio-economic assessment; disaster preparedness and management; and, marine ecosystem and coral reef survey techniques. Such activities are designed to increase awareness in the country of various aspects of environment and development.

An aquifer recharge project involving the paving of roads and establishment of storm water drainage to improve aquifer recharge on Male' has been carried out with the assistance of the Danish Government. Due to the extensive damage caused by the high waves in April 1987 and in view of the predicted sea level rise resulting from climate change construction of an extensive breakwater along Male's south shore has been undertaken with assistance from the Government of Japan. The 1,160-metre long breakwater cost more than US$ 14 million.

Within the framework of the current development plan which is presently being finalised, a series of projects have been formulated for funding by government and international agencies. These are considered additional to the ten unfunded projects originally formulated as the first work programme for the implementation of the National Environment Action Plan. The new project proposals include the development of an integrated coastal zone management and land use plan for the country as a whole. In addition, projects for the assessment of marine biodiversity and the protection of marine ecosystems, together with the development of a protected area system in the Maldives and assessment of tourist damage to coral reefs are all projects designed to assist the government in meeting its obligations under the Biodiversity Convention, and in managing its diverse reef ecosystems.Arising out of the NEAP, would hopefully be a national environmental management plan, seeking an integrated approach to resource management in the country.

6.5 The Maldives and international environmental affairs

Like a number of other small island states the Maldives has been at the fore-front of international developments in the field of environment. His Excellency President Maumoon Abdul Gayoom has played an important and formative role in drawing the attention of world leaders to the special situation and particular environmental problems of small island states, particularly in the face of global environmental issues such as climate change and sea level rise. As a consequence of his actions in international fora, the Commonwealth Secretariat initiated a study of global climate change and sea level rise impacts and the Director of Environmental Affairs was himself a member of the 6-man team which produced this assessment.

In 1989, the Maldives hosted a Ministerial level meeting of small island states concerned with sea level rise (Small States Conference on Sea Level Rise) and the resulting Male' Declaration calls on the UN, its agencies and other appropriate institutions to assist in the implementation of the recommendations contained in the declaration. Items 4,5 and 6 of the declaration recommend the establishment of an institutional capability to protect and manage coastal zones and it is perhaps significant that this call

preceded a similar call made by the Intergovernmental Panel on Climate Change and the second World Climate Conference in 1990. In addition the declaration calls upon all states to undertake environmental impact assessments for major development projects and recommends that steps be immediately taken to protect vulnerable natural ecosystems.

Subsequent to this Ministerial level meeting, a meeting of the Male' Declaration Action Group was held in January 1991. This meeting produced a recommended programme of action for small states. To be effective in implementing these recommendations, and the Declaration itself, technical and financial assistance are needed from the UN system to support the work of the Task Force.

The Maldives participated in the Second World Climate Conference in 1990 and was instrumental, along with other small island states in ensuring that the resulting Ministerial Declaration included mention of the particular problems that such states face in achieving sustainable development That declaration notes that the present rate of climate change "could even threaten survival in some small island states" and recommends that "adequate and additional financial resources should be mobilised and best environmentally sound technologies transferred expeditiously in a fair and most favourable basis."

During the preparations for the Earth Summit in Rio de Janeiro in 1992, the Maldives again played a prominent role in modifying the language of Agenda 21 to ensure that the particular concerns of small island states were taken into consideration. The Association of Small Island States, of which the Maldives is a member, played a significant role in ensuring that the Oceans Chapter (Chapter 17) contained a programme area devoted to the sustainable development of small islands. The 1994, Global Conference on the Sustainable Development of Small Islands Developing States, represents the first global conference convened to discuss this issue, and, is indeed the first concrete action to result from the small islands programme of Agenda 21.

In addition to participation in such internationally high profile activities the Maldives continues, within the limits of finance and manpower, to play a small but important role in various on-going international programmes and activities. Government representatives continue to participate actively in

environmentally-related regional activities of bodies such as UNEP, ESCAP and WMO and in the deliberations of the Intergovernmental Panel on Climate Change and its working groups. The Maldives also participates in a number of relevant programmes and activities of the UN specialised agencies, including the World Meteorological Organization, the Food and Agriculture Organization and the Intergovernmental Oceanographic Commission.The Maldives continues to participate in the TOGA programme and regularly contributes data to the WMO. Tide gauges have been established in Gan (February 1987) Male' (August, 1989) and Hanimaadhoo (July 1991).

Following the Earth Summit, and the Maldives signing and ratifying of the United Nations Framework Convention on Climate Change and the Convention on Biodiversity, representatives of the government have attended numerous meetings of the respective intergovernmental negotiating committees and meetings of the preparatory committee for the 1994 Global Conference on the Sustainable Development of Small Islands Developing States. Such active participation places strains on the limited skilled manpower resources of the Republic but is nevertheless seen as critically important, if the particular concerns of small island states are to be adequately encompassed within the framework of the United Nations activities.

Thus the Republic of Maldives, like most small island states, has adopted a dual approach to environmental issues; on the one hand, concern with international conventions addressing global issues and on the other, directly tackling local environmental problems. This strategy is exemplified in the phrase "Think globally and act locally".

7. FUTURE INTERNATIONAL CO-OPERATION

Given the concern of the country, faced with the potential impacts of climate change and sea level rise, the Republic of Maldives will continue to actively participate in the work of the International Negotiating Committee of the Framework Convention on Climate Change. The Maldives hopes that the meeting of the Conference of Parties would set in motion effective mechanisms to address climate change and its adverse impacts.

At the same time it is to be hoped that appropriate financial mechanisms will be put in place to enable vulnerable countries such as the Maldives to take appropriate mitigating action in advance of climate change and sea level rise impacts becoming a reality. The restrictive nature of present funding provided under the Global Environment Facility (GEF), which limits funding of climate change projects primarily to those designed to reduce green house gas emissions effectively excludes the Maldives from benefiting from the fund. The country's greenhouse gas emissions are, on a global scale negligible; yet its vulnerability to the adverse impacts of climate change are undeniably high.

The Republic of Maldives will continue to press for recognition by developed countries of their liabilities and responsibilities towards small island countries such as the Maldives which have contributed little to this and other global problems but which may be among the first and perhaps the most significantly affected, by changing climate and rising sea level.

The government of the Republic of Maldives recognises its global responsibility as the steward of the unique and diverse assemblage of plants and animals which make up its natural environment. It has therefore signed and ratified the Biodiversity Convention. However the country will need external assistance in successfully discharging its obligations under this treaty. It is hoped that the current restructuring of the Global Environment Facility will result in full transparency of its operations if it is to become the fund, operating in support of the Convention.

Given the unique problems of environment and development in small archipelagic states, it is vital that international and multinational corporations, bilateral donors and international financial institutions such as the World Bank, adopt approaches and policies which recognise the need for specialised technological solutions to these unique developmental problems and assist small island governments in identifying and adopting appropriate technological innovations.

At present, the United Nations and its specialised agencies adopt a sectoral approach to development assistance and the provision of advice making it difficult for small states with limited manpower to articulate successfully with each agency. Thus ocean and maritime affairs, an area of considerable concern to small island states such as the Maldives, are covered by the activities of International Maritime Organisation (IMO), United Nations Office for Ocean Affairs and the Law of the Sea, United Nations Environment Programme (UNEP), United Nations Education, Scientific and Cultural Organisation (UNESCO), Intergovernmental Oceanographic Commission (IOC) and Food and Agricultural Organisation (FAO), to derive full benefit from the United Nations system, each country needs to maintain membership of and contact with, each of these agencies individually. Membership of all of the specialised agencies of the United Nations and attendance at important meetings of each agency places an unacceptably high financial and manpower burden on small states. Many smaller countries therefore seek membership of none or only a few specialised agencies, thereby limiting access to and distorting the range of external advice and assistance which is potentially available to address the problems of environment and development. It is hoped that the Global Conference on the Sustainable Development of Small Island Developing States will not only address this issue but formulate and recommend appropriate solutions.

Due to their distribution largely centred in the Mediterranean, Caribbean Seas and the Indian and Pacific Oceans, small island states have difficulty in accessing and exchanging information and experiences of appropriate (and inappropriate) solutions, whether technological, scientific or managerial, to the unique problems of development in small country environments. To access and exchange such information and experience, a clearing house

mechanism is needed which will provide small state's governments with ready access to relevant information and experience. Such a function could be one of several assigned to a permanent secretariat for small island affairs located within the United Nations system

The Republic of Maldives looks to the Global Conference on the Sustainable Development of Small Island Developing States to provide, not only a review of the problems of sustainable development with which all small states are familiar, but also to providing innovative solutions which can be implemented by the international community at large.

APPENDIX 1

Statistical Summary

Development Indicators	1977	1982	Most Recent Estimate	(year)
Human development indicators				
Life expectancy at birth	46.5	n.a.	66.95	(92)
Population with access to health services (%)				
Total	39.8	n.a.	61.1	(90)
Urban	100.0	n.a.	100.0	(90)
Rural	24.2	n.a.	47.6	(90)
Population with access to safe water (%)	6.9	n.a.	63.6	(90)
Daily calorie supply (as % of requirements)	79	n.a.	91	(90)
Adult literacy rate	81.6	81.6	98.0	(90)
GDP per capita (MRf)	1927	2525	4840	(93)
Basic Indicators				
Population (000s)*1	142.8	165.7	246	(94)
Male'	29.5	34.3	64	(94)
Atolls	113.3	131.4	182	(94)
Projected population in 2000 (000's)	n.a.	278.9	286.0	
Population density (Km^{-1})	479	553	719	(90)
Male'	18,438	21,438	34,400	(90)
Atolls	380.2	443	533	(90)
Percentage of total population in Male'	20.6	20.7	26	(94)
Area of cultivable land per capita (m^2)	194	167	130	(90)
Annual average population growth	(1980-1985) 3.2%		(1990-1993) 3.2%	
Economic Indicators				
GDP (million Rf)	236	357.4	1,190.2	(93)
Annual average growth of GDP	(1977-1987) 10.6%		(1992-1993) 6.2%	
Composition of GDP (million Rf)				
Primary	103.6	150.4	266.1	(93)
Secondary	19.7	59.4	183.0	(93)
Tertiary	112.8	147.6	741.1	(93)
Employment and Labour force				
Labour force (15+ yrs) *2				
Total	60,903	79,086	56,018	(90)
Male	38,254	42,654	44,901	(90)
Female	22,649	36,402	11,117	(90)
Male'	20,205	18,429	17,438	(90)
Atolls	40,698	60,657	38,580	(90)
No of graduates	56	56	219	(90)

*1 1982 population figures are estimates based on the 1977 census.

*2 Figures for 1977 and 1982 are total labour force. Those for 1990 are numbers in paid employment.

Development Indicators	1977	1982	Most Recent Estimate	(year)
Merchandize Trade (million US$)				
Value of exports (fob)	3.4	9.8	34.6	(93)
% fish / fish products	3.4	6.3	78.0	(93)
Annual growth of exports (%)	(1977-87)		(1988-91)	
	8.8		14.5	
Value of imports (fob)	11.1	38.7	191.5	(93)
% consumer goods	7.3	19.3	96.7	(93)
% intermediate goods	n.a.	17.3	70.2	(93)
Annual growth of imports (%)	(1977-87)		(1992-1993)	
	11.1		1	
Balance of Payments (million US$)[*3]				
Trade balance	-5.1	-28.9	-139.5	(93)
Current account balance	-0.4	-20.2	-74.3	(93)
Overall balance	0.1	-0.5	-15.9	(93)
Investment & Consumption (million MRf)				
Private consumption	n.a.	n.a.	663.8	(90)
Government consumption	n.a.	n.a.	155.7	(90)
Private investment	n.a.	n.a.	209.7	(90)
Government investment	n.a.	n.a.	137.2	(90)
Consumption as % of GDP	n.a.	n.a.	97.2	(90)
Investment as % of GDP	n.a.	n.a.	41.4	(90)
Government Finance (million MRf)[*4]				
Government revenues	48.9	101.6	835.5	(94)
Tax revenues	20.7	41.6	505.2	(94)
Non-tax revenues	19.8	60	330.3	(94)
Grants & loans	8.4	25.5	537.5	(94)
Government expenditure	38.4	128.4	1,490.0	(94)
Current expenditure	9.3	96.5	778.2	(94)
Capital expenditure	29.1	31.9	711.8	(94)
External debt (million US$)				
Total debt outstanding including undisbursed	n.a.	n.a.	113.4	(90)
Total debt outstanding and disbursed	n.a.	n.a.	65.3	(90)
Public long-term debt	n.a.	5.3	55.5	(90)
Public short-term debt	n.a.	2.7	1.2	(90)
Debt outstanding & disbursed as % of GDP	n.a.		49.4	(90)
DSR as % of exports of goods & services	n.a.	16.3	4.6	(90)

*3 Figures for 1993 are projections.
*4 Figures for 1994 are estimated.

Development Indicators	1977	1982	Most Recent Estimate	(year)
Tourism indicators				
Tourist arrivals (000's)	18.7	74.4	241.0	(93)
Number of resorts	11	45	69	(93)
Number of beds	1000	3984	9219	(93)
Occupancy rate (%)	n.a.	46.1	64.8	(93)
Tourism Earnings (million MRf)*5	n.a.	20.2	213.6	(93)
Social indicators				
Nutrition				
Daily per capita clorie intake (as % of requirements)	79	n.a.	91	(90)
Daily per capita protein supply (as % of requirements)	73	n.a.	81	(90)
Health				
Crude birth rate (per 1000)	44	44	35	(92)
Crude death rate (per 1000)	17	12.7	6	(92)
Infant mortality rate (per 1000)	120	81	31	(92)
Population per physician (000)	15.9	13.8	6.6	(92)
Population per nurse (000)	20.4	16.5	7.7	(92)
Population per hospital bed (000)	3.5	n.a.	1.3	(92)
Education				
Primary school enrolment (as % of 5-1 age group)	26.9	n.a.	91	(92)
Secondary school enrolment (as % of 14-16 age group)	2.3	n.a.	35	(92)

*5 Figures for 1993 are provisional.