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UNITED NATIONS ENVIRONMENT PROGRAMME

*Environmental problems of  
the marine and coastal area  
of Maldives: National Report*

*UNEP Regional Seas Reports and Studies No. 76*



## PREFACE

The Regional Seas Programme was initiated by UNEP in 1974. Since then the Governing Council of UNEP has repeatedly endorsed a regional approach to the control of marine pollution and the management of marine and coastal resources and has requested the development of regional action plans.

The Regional Seas Programme at present includes ten regions<sup>1/</sup> and has over 120 coastal States participating in it. It is conceived as an action-oriented programme having concern not only for the consequences but also for the causes of environmental degradation and encompassing a comprehensive approach to controlling environmental problems through the management of marine and coastal areas. Each regional action plan is formulated according to the needs of the region as perceived by the Governments concerned. It is designed to link assessment of the quality of the marine environment and the causes of its deterioration with activities for the management and development of the marine and coastal environment. The action plans promote the parallel development of regional legal agreements and of action-oriented programme activities<sup>2/</sup>.

In May 1982 the UNEP Governing Council adopted decision 10/20 requesting the Executive Director of UNEP "to enter into consultations with the concerned States of the South Asia Co-operative Environment Programme (SACEP) to ascertain their views regarding the conduct of a regional seas programme in the South Asian Seas".

In response to that request the Executive Director appointed a high level consultant to undertake a mission to the coastal States of SACEP in October/November 1982 and February 1983. The report of the consultant on his mission was transmitted to the Governments of the South Asian Seas region in May 1983, and the recommendations of the Executive Director were submitted to the Governing Council at its eleventh session.

By decision 11/7 of 24 May 1983, the UNEP Governing Council noted "the consultations carried out in accordance with Council decision 10/20 of 31 May 1982" and requested "the Executive Director to designate the South Asian Seas as a region to be included in the regional seas programme, in close collaboration with the South Asia Co-operative Environment Programme and Governments in the region, and to assist in the formulation of a plan of action for the environmental protection of the South Asian Seas".

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<sup>1/</sup> Mediterranean Region, Kuwait Action Plan Region, West and Central African Region, Wider Caribbean Region, East Asian Seas Region, South-East Pacific Region, South Pacific Region, Red Sea and Gulf of Aden Region, Eastern African Region and South Asian Seas Region.

<sup>2/</sup> UNEP: Achievements and planned development of UNEP's Regional Seas Programme and comparable programmes sponsored by other bodies: UNEP Regional Seas Reports and Studies No. 1. UNEP, 1982.

As a first follow-up activity to decision 11/7 of the Governing Council, the Executive Director convened, in co-operation with the South Asia Co-operative Environment Programme (SACEP), a meeting of national focal points of the States of the region in order to seek their views on how to proceed in developing a comprehensive action plan for the protection and management of the marine and coastal environment of the South Asian Seas region (Bangkok, Thailand, 19-21 March 1984).

The meeting discussed the steps leading to the adoption of an action plan and reached a consensus on the items to be considered for further development of the action plan<sup>3/</sup>.

The meeting recommended that the Governments, with the assistance of UNEP and other organizations as appropriate, should initiate the preparation of country reports reviewing their:

- national environmental problems defined as priority areas of regional concern;
- activities which may usefully be carried out under the action plan to resolve or mitigate these problems; and
- national institutional and manpower resources which are, or may be, involved in dealing with these problems, including the identification of the need to strengthen their capabilities.

It was also recommended that UNEP prepare in cooperation with SACEP, and other organizations as appropriate:

- a draft overview report, based on the country reports, reviewing the environmental problems of the region defined as priority areas;
- a document addressing the essential legislative aspects relevant to the action plan; and
- a draft action plan reflecting the conclusions of the country and regional reports.

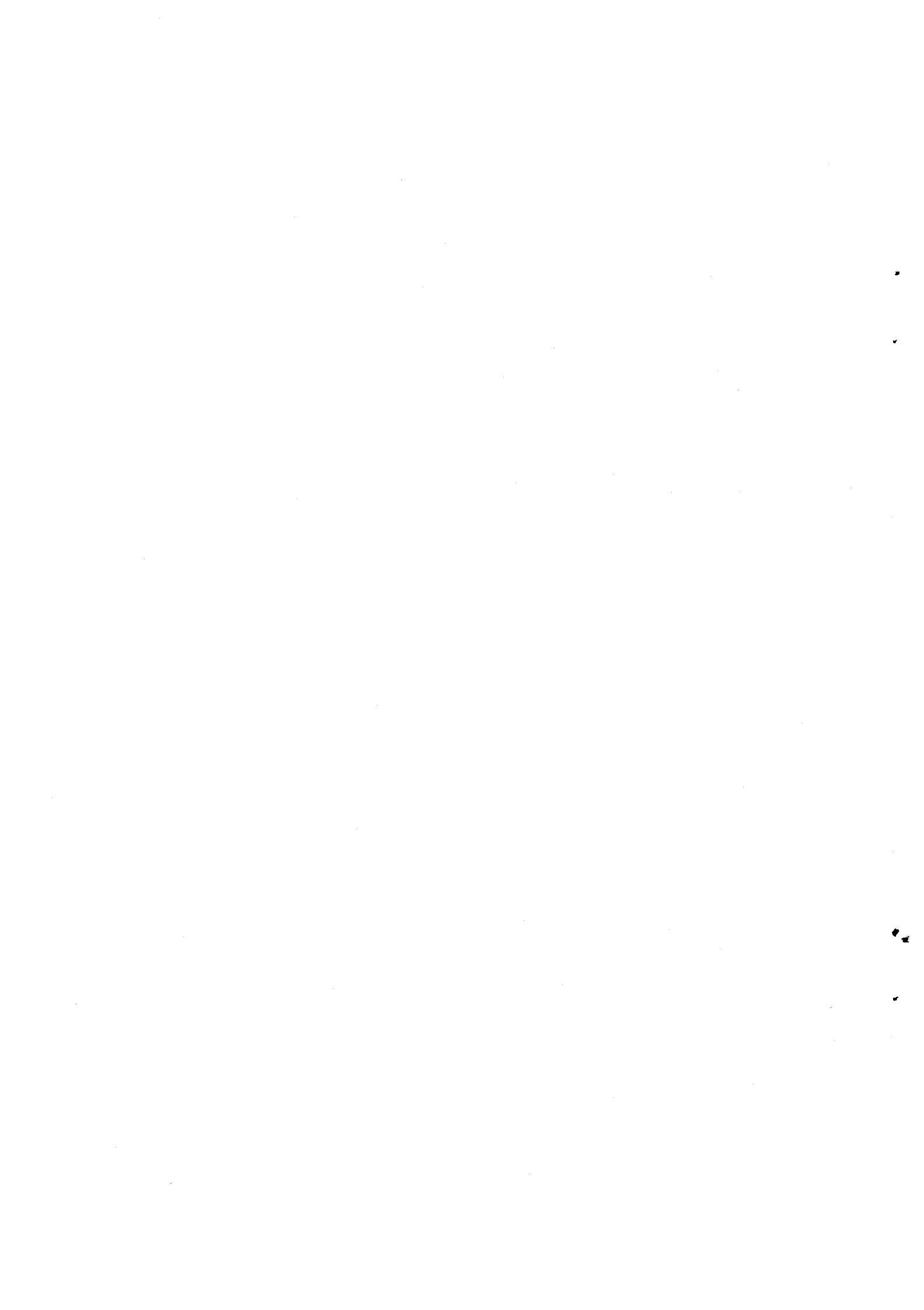
The present document is the country report on environmental problems in Maldives prepared by experts designated by the Government of Maldives. The assistance of a consultant, A.H.V. Sarma, was provided to the Government of Maldives to facilitate the preparation of this report. The authors' contributions are gratefully acknowledged.

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<sup>3/</sup> Report of the meeting of national focal points on the development of an action plan for the protection and management of the South Asian Seas region, Bangkok, 19-21 March 1984 (UNEP/WG.105/5).

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## INTRODUCTION

The Republic of Maldives is an archipelago consisting of a double chain of 22 coral atolls resting on a submerged mountain range and spread over an area of over 1 million km<sup>2</sup> of the northern-central Indian Ocean. It lies 750 km south-east of Sri Lanka and extends over 850 km in a north-easterly direction from 7°06'N to 0°42'S latitude between 72°31'E and 73°44'E longitude. The Maldivian archipelago is situated between two other archipelagoes. To the north, linked by the island chain Minicoy between the 8° and 9° channel, is the Laccadives archipelago, while 500 - 600 km to the south of the most southerly atoll of Addu, is the Chagos archipelago. The atolls are comprised of over 2,000 islands, only 215 of which are inhabited. The islands are small, with an average size of about 0.7 km<sup>2</sup> only, none being larger than 13 km<sup>2</sup>, with a total land area of about 260 km<sup>2</sup> for the entire archipelago. The islands are for the most part transient, building and eroding at a rapid rate. Large populated islands have completely disappeared within the memory of living natives, and because of this transient quality, the natives talk of reef types rather than islands. Many newly formed islands are nothing but sand banks a few centimetres above the sea level where some pioneering plant species and sea-birds colonize.

Most of the large islands have been planted with coconut palms among several species of succulent scrubs and low undergrowth that flourish on coral sand. A few islands have even developed large evergreen trees which eventually become small scrubby jungle growth.

The total population of the islands in 1982 was estimated at 160,000 (doubled since 1911), with a high population density of 600 persons per km<sup>2</sup>. Male, the capital, has a population of 40,000, which is expected to reach 65,000 by the end of the century. It is estimated that the population will level out at this peak for lack of land area.

The most important atolls are Addu, Ari, Fadiffolu, Felidhu, Hadummathi, Huvadhu, Madhosmadulu, Maladummadulu, Male and Mulakku atolls. The most important islands are the capital of Male, and Gan at the southern most extremity of Addu atoll (lying south of the equator).

The island surface consists of coral sand with scarcely any topsoil, which hardly supports vegetation other than coconuts and scrubby growth. Only 10 per cent is cultivated land (2,600 ha), mostly distributed on Thiladummathi, Huvadhu and Hadummathi atolls. Tropical fruits and vegetables such as breadfruit, coconut, pineapple, colocasia and banana are cultivated, and form a substantive part of the diet of the islanders. Millet, corn, pumpkin, sugarcane, and almonds are also cultivated to a much lesser extent.

The chief industry of the country is fishing, and fish forms one of the staples in the Maldivian diet. The annual export value of fish, exported mostly in the form of sun-dried "Maldivian fish", accounts for 90 per cent of the country's total exports. But the fisheries is organized on a small scale and technologically limited to local fishing grounds. Livebait fishing for tuna is the most common fishery. 35,000 tonnes of fish was landed in 1981, of which skipjack tuna alone accounted for 21,000 tonnes with an average catch per unit effort of 140 kg. Huvadhu and Madhosmadulu atolls were the most productive with annual landings of 6,400 and 5,300 tonnes respectively.

Major exports from the coral reefs are molluscan shells (40 to 50 tonnes), red coral products (25 tonnes in 1980), turtle shells (6 tonnes in 1977) and live ornamental fish (44,000 numbers in 1981). Export of black corals and turtle shells from Maldives is now prohibited and coral products are mostly exported in processed form only (such as jewellery). Plans are underway for declaring some atolls as biological preserves and/or sanctuaries for conservation purposes.

## THE PHYSICAL ENVIRONMENT

### Climate and seasons

Although located in the tropics, climatic conditions of the Maldives are equable being governed by the two monsoons, the south-west blowing from April to August and the north-east from October to February, bringing ample rains and cool winds to the islands. Rainfall is well distributed throughout the archipelago.

The average rainfall in the region amounts to about 1,950 mm per annum and is fairly well distributed throughout the year except for the January-March period which is considered to be the dry season. The country enjoys a typical tropical-island climate with the average daily temperatures ranging between 24° and 30°C. There is not much seasonal variation in temperature.

### Waves, tides and ocean current regimes

Tidal data for the area are scarce, but the U.S. Naval Hydrographic Office (1951) states that the mean high water intervals for Mukundu atoll in the north is 10 hrs 20 mins. Spring tide range on an average is about 1 m. Mean tide range is about 0.7 m. Tidal streams are irregular and much variation occurs because of the presence of numerous sand banks and shallow shoals.

The prevailing monsoon wind pattern regulates the seasonally reversing oceanic currents. In the northern parts of the Maldives the cross-bank currents move westwards from December to April, during the north-east monsoon season; they move more or less in an easterly direction from May through August during the south-west monsoon season.

### Soils, sands and sediments

Being exclusively of coral origin, the islands of the Maldives are composed of coral rock base, coral rubble and coral sand. The beaches are covered solely with sugar-white coral sand which provides the main attraction to the tourists. As mentioned previously, the islands have scarcely any top soil, and lacking fertility are therefore mostly unsuitable for cultivation.

### Swamps and wetlands

Being small islands of coral origin, none of which is larger than 13 km<sup>2</sup> and with an average size of only 0.7 km<sup>2</sup> land surface, the country does not have any rivers, lakes or other inland water bodies.

The islands are low-lying with an average elevation of not more than 1.5 - 2 m above mean sea level. The higher elevations tend to be located towards the seaward side of the islands and the inner shores are frequently marshy. However, because of the limited total land surface of the islands and the relatively small tidal range, such marshy areas are rather small and rarely acquire any ecological importance as habitats. Small clusters of pioneering mangrove species are often seen to colonize the seaward side of these marshes on the inner edge of the lagoonal beach. The most important mangrove species are Avicennia marina, Bruguiera cylindrica, Rhizophora mucronata, Sonneratia caseolaris and S. acida.

## MARINE RESOURCES AND SPECIALISED ECOLOGICAL AREAS

### Non-living (non-renewable) resources

#### Offshore oil, gas and minerals

There has not been any exploratory work for offshore oil, gas or minerals in the waters of the Maldives. However, there has been some preliminary work on the geophysics and seismics in the area to evaluate the potential for the existence of any such deposits, but the chances are rather remote. The archipelago rests on a submerged mountain range which is probably of volcanic origin, and although the reefs are of an average depth of 20 - 30 fathoms (1 fathom = 1.8 m), the open ocean just outside the reef often dips down to 2,000 fathoms and the technology for the exploration and/or exploitation of these deep waters are still prohibitively costly.

#### Construction materials

Coral rocks, rubble and sand are the only materials available in the country for construction purposes and are therefore extensively mined for constructing houses, walls and other structures. Skin-divers from sail-boats collect the coral rock and sand materials from lagoonal and sand bank areas of not more than 2 m depth in the Male atoll within an average travelling distance of not more than 1 - 2 hours from the capital island of Male. Most of the coral mining is concentrated around the islands of Mamigilili and Thimarafushi. About seven sailing boats (locally called dhonis) are engaged in such mining everyday. The mode of mining is rather primitive, by skin-diving, and a boat collects about 2 m<sup>3</sup> of coral rock which is carried out by 4 divers. According to the statistics maintained by the Department of Public Works and Labour, the amount of coral material mined during the last 5 years is as follows:

1980	202 m <sup>3</sup>
1981	1314 m <sup>3</sup>
1982	6963 m <sup>3</sup>
1983	6325 m <sup>3</sup>
1984	6049 m <sup>3</sup>

According to law half the quantity of coral rock mined is given to the government for public works. Most of the mined materials are used for construction work on Male itself. Coral chips and blocks are used for concrete manufacture and for construction work. Coral and sand is also used for surfacing the roads on Male. There is very little mining for coral on the other atolls. The demand for mined material is expected to increase for the currently envisaged development projects.

There are reports of several sand banks and coral shoals around Male disappearing because of such mining, and Fedifinou island almost completely disappeared because of extensive sand mining. In such cases, the divers move over to other nearby sand banks for mining.

In order to avoid user conflicts, legislation has recently been promulgated which defines areas for such mining. According to this legislation, coral and sand mining can now be undertaken only on reefs, and is banned on or around inhabited islands. However, the inhabitants of the islands are allowed to mine coral and sand on their island for private use only.

### Living (renewable) resources

#### Seaweeds

The seaweeds of the Maldives have been studied during several scientific expeditions but most of the studies have been taxonomic in nature giving the list of species recorded with very limited observations on their extent, distribution, zonation and ecology. The Stanley Gardiner Expedition, Percy Sladen Expedition, John Murray Expedition and the Siboga Expedition describe 17 species of red algae, 5 green algae and 2 brown algae. The Cambridge Expedition added 7 species of blue-green algae, 20 red algae, 25 green algae and 7 brown algae to this list and Sigee (1966) published ecological notes on some of these algae. The Vega cruises undertaken as part of the International Indian Ocean Expedition made extensive collections of seaweeds from 9 atolls and Hackett (1977) also made some studies on the zonation and distribution of these species in several habitats. Based on the collections made so far on the above several occasions, 163 species of red algae, 83 green algae, 21 blue-green algae and 18 brown algae have been reported from the Maldivian waters including one new species of Dictyurus. The most abundant species belong to the genera Chondria, Laurencia, Hypnea, Polysiphonia, Lithophyllum, Tydemania, Acrochaetium, Padina, Ceramium and a large number of calcareous species.

#### Fisheries

As mentioned above, the main industry of the country is fisheries. The entire fisheries of the country is marine in nature as the country is an oceanic island nation. Annual export value of fish, exported mostly in the form of sun-dried "Maldivian fish", accounts for 90 per cent of the country's total exports. But the fisheries is organized on a small scale and technologically limited to local fishing grounds. Livebait fishery for tuna is the most common fishery. 35,000 tonnes of fish was landed in 1981, of which skipjack tuna alone was 21,000 tonnes with an average catch per unit effort of 140 kg. Huvadhu and Madhosmadulu atolls were the most productive with annual landings of 6,400 and 5,300 tonnes respectively.

#### Mariculture

Aquaculture has not been practised in the country so far, but there is potential for its development in the vast shallow lagoon areas around numerous islands. The Government is aware of the potential for the development of mariculture, but lack of trained technicians and funds are some of the major constraints.

### Other marine living resources

Being the largest coral atoll growth in the world, the country has vast resources of shell-fish, sponges and other species that grow in association with coral reefs and are commonly found in the reef region, although the extent of this resource has not, so far, been investigated. The major exports of products originating from the coral reefs are molluscan shells (40 - 50 tonnes), red coral products (25 tons in 1980) and turtle shells (6 tons in 1977). There has also been collection of shells and coral as souvenirs by tourists and for sale to tourists around the resort areas in recent years, which has not been quantified so far. Collection and export of black coral and turtle shells in any form, and other coral products in "unprocessed" form from the country are now prohibited by law. Coral products are nowadays mostly exported in processed form only, such as rings, bangles, amulets, necklaces and other jewellery, and a small scale handicraft industry for such products has recently developed in some islands around the tourist resorts. As this is still undertaken on a rather small scale, it should be expected that this does not pose any threat to the exploited resources at least in the near future. Plans are underway for declaring some atolls as biological reserves and/or sanctuaries for conservation purposes.

The archipelago is considered to be an important breeding ground for marine turtles in the Indian Ocean region. However, very little work has so far been done on their taxonomy, extent, distribution, ecology and lifecycle on the islands and atolls. Deraniyagala (1956) reported 4 species of turtles as breeding on Male atoll, viz. Chelonia mydas, Dermochelys coriacea, Caretta caretta gigas and Eretmochelys imbricata. As an initial step towards their conservation, collection and export of turtle shells from the Maldives have now been prohibited by law.

It is known that some species of oceanic birds colonize and nest on certain islands and atolls. The islanders eat any bird that has webbed or semi-webbed feet. Very little information is available on these bird colonies and no scientific study has so far been undertaken. During the Stanley Gardiner Expedition, Gadow and Gardiner collected 24 species of birds from the Maldivian atolls. Philipps and Sims (1958) recorded 63 species of birds from the islands, of which 15 were described as resident breeders and only 2 species of terns (Sterna spp.) as visiting breeders. It was also reported that the Lesser frigate (Fregata ariel iredalei) colonize and breed on Mahlosmadulu atoll from where they are caught and sold live on the market. Several species of terns also breed in large colonies on some islands. Hackett (1977) reported a tern rookery on Filadu island in Tiladummati atoll.

Sightings of dolphins, porpoises and whales in the Maldivian waters have occasionally been reported, although whales are rarely known to enter the shallow and narrow waters between the atolls. Deraniyagala (1956) recorded the toothed dolphin, Delphinus delphis from the Male atoll. The islanders recognise the toothed dolphin, a long-beaked edentulous form and a toothless form, which, according to Deraniyagala is probably the beaked whale, Ziphius cavirostris indicus, which is often found in Sri Lanka waters.

Of the island fauna, Philipps (1958) recognised 3 species of birds and the flying fox Pteropus giganteus ariel as indigenous to the Maldives.