First National Report to the Conference of the Parties to the Convention on Biological Diversity

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Executive Summary

1. The Republic of Maldives ratified the Convention on Biological Diversity in November 1992. The Government of the Maldives has prepared this First National Report to the Conference of the Parties to the Convention on Biological Diversity, with the assistance of the Global Environment Facility (GEF), in response to Decision II/17 of the Second Conference of the Parties (1995). This document reports on measures taken for the implementation of Article 6 of the Convention, "General Measures for Conservation and Sustainable Use". This report further takes into account other COP decisions that have explicit implications for national reporting.

2. This report has the following objectives:
   (a) identify the status and trends in biological diversity and the factors which affect biodiversity conservation and use;

   (b) report on the status of implementation of the articles of the Convention and the COP decisions that apply to Contracting Parties.

3. Status and trends in biological diversity are being monitored through monitoring of biodiversity services, uses, threats to biodiversity and conservation oriented monitoring and evaluation. Trends in biodiversity use are towards more intensive and multiple use of marine biodiversity. Trends in the use of terrestrial species are more closely regulated through the established permit systems. However, information is sparse on biodiversity inventories for both marine and terrestrial species and ecosystems. Isolated studies have been carried out with regard to specific species and habitats, yet documentation and listings are mostly unavailable.

4. Factors that affect biodiversity conservation and use include changes in the economy, realisation of economic value as "resources" of components of biodiversity, notably marine and fisheries resources. In addition, changes in lifestyles and practices have led to critical issues of waste disposal and management. Habitat loss and degradation is a serious issue in the Maldives. Regulatory frameworks are in place for the conservation of biodiversity components such as protected areas management, species based conservation measures including moratoria, quota systems, bans and protected species listings; and restricted and monitored use listings.

5. The National Biodiversity Strategy and Action Plan has been formulated through a participatory approach, with widespread consultation in all regions of the country with respect to issues, constraints, and necessary actions for biodiversity conservation. Public and private agencies and parties involved in various sectors, and NGOs were also consulted.

6. The legal, regulatory and administrative framework needs to be strengthened through more comprehensive and integrated approaches to biodiversity conservation, and the development of human resources and financial mechanisms for such action. The institutional framework for sustainable use, development and conservation of biodiversity has gaps and weaknesses that can be reduced through collaboration and partnership by adopting integrated frameworks, as well as institutional streamlining and capacity building initiatives. Collaboration with regional networks for biodiversity research and management must be strengthened.

7. There are several ongoing programmes in the Maldives for biodiversity conservation and sustainable use of its natural resources together with which synergies can be developed for implementing strategies and actions identified in the NBSAP. However, technical training, public education and awareness building, development of innovative and appropriate financing and management mechanisms, and institutional reform are necessary for the Maldives to better fulfil its obligations under the Convention on Biological Diversity.

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Abbreviations

ADB	Asian Development Bank
AusAid	Australian overseas development aid agency
BOBP	Bay of Bengal Programme
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COP	Conference of the Parties
CORDIO	Coral Reef Degradation in the Indian Ocean
ECF	Environment Conservation Fund
EEZ	Exclusive Economic Zone
EIA	Environment Impact Assessment
ERC	Environment Research Centre
GCRMN	Global Coral Reef Monitoring Network
GDP	Gross Domestic Product
GEF	Global Environment Facility
GoM	Government of Maldives
HDI	Human Development Index
IDA	International Development Assistance
IFAD	International Fund for Agricultural Development
IRRM	Integrated Reef Resources Management
IUCN	World Conservation Union
MHAHE	Ministry of Home Affairs, Housing and Environment
MOFAMR	Ministry of Fisheries, Agriculture and Marine Resources
MPND	Ministry of Planning and National Development
MRC	Marine Research Centre
NBSAP	National Biodiversity Strategy and Action Plan
NCPE	National Commission for the Protection of the Environment
NDP	National Development Plan
NEAP II	Second National Environment Action Plan
NGO	Non-governmental organization
RETA	Regional Technical Assistance
SACEP	South Asia Cooperative Environment Programme
SEIA	Socio-Economic Impact Assessment
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
VPA	Vulnerability and Poverty Assessment

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1. Biodiversity Conservation Goals and Objectives

1.1 Background

1.1.1 Geographical background

1. The Maldives is a chain of coral atolls in the central Indian Ocean, 80 - 130 km wide and stretching for around 820 km. The 26 natural atolls are grouped into 21 units for administrative purposes. The 1190 islands of the Maldives make up less than 1 per cent of the total area of the country, which is 90,000 sq km (Figure 1).

2. The atolls of the Maldives vary in shape, and lagoon waters containing micro-atolls, faros, patch reefs and knolls vary from 40 to 60 m depth. The islands are built of bioclastic sediments and vary in size from 0.5 to several square kilometres. Maximum recorded height above mean sea level in the Maldives is around 3 m and approximately three quarters of available land area is no higher than 1 m above mean high tide.

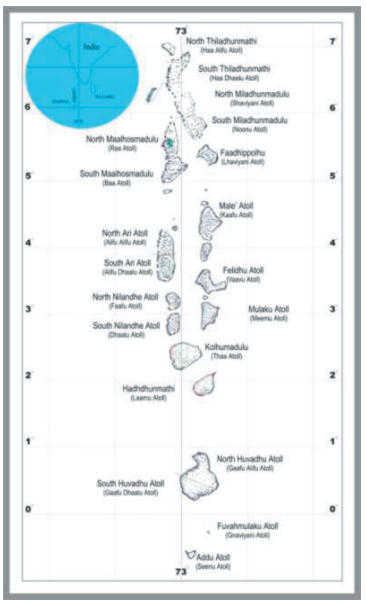

Figure 1. Map of the Maldives

3. Most low-lying islands of the Maldives lack the resources to support human settlement. The resulting dispersal of the population increases the cost of building infrastructure to support the basic needs of the population and to ensure protection against natural hazards. The islands are subject to short-term weather fluctuations on two time-scales: (1) the annual cycle of seasonal variations, and (2) episodic events associated with the occurrence of either externally generated or more localized storm events. These episodic events, while not predictable, can induce considerable impacts on islands and their populations. The short and long term changes induce gross morphological changes to islands and their beaches (Hameed and Ali, 2001). Most islands are extremely vulnerable to storm events and encroachment of the sea. This vulnerability is expected to be exacerbated by climate change and sea level rise.

4. The Maldives has a warm and humid tropical climate, dominated by two monsoon periods: the South-West monsoon from April to November and the North-East monsoon from December to March. Strong winds and gales are rare and cyclones are unknown. The annual mean temperature

is 28°C, with a maximum average of 32°C and a minimum of 25°C. Relative humidity ranges from 73% to 85%. The average annual rainfall of approximately 1980 mm is evenly distributed throughout the year. However, monthly variations in rainfall are significant, ranging from 12.3 mm in February to 250 mm in May.

5. Land is scarce in the Maldives and only around 10 per cent of the land is suitable for agriculture. Soils are generally young and thin, being no more than 20 cm deep, and contain substantial quantities of parent material, coral rock and sand. Soils are highly alkaline with generally poor fertility and deficient in nitrogen, potash, manganese and aluminium.

1.1.2 Socio-economic background

6. Throughout the ages, the Maldives has retained a unique cultural identity, script and language. It has also maintained traditional systems of health care and education. The people follow the Islamic faith and belong to the Sunni sect. The official language is *Dhivehi*, written in *Thaana* script.

7. The population is dense (about 270,101 in 2000) relative to available land area. Population growth rate dropped sharply from 2.79% in 1995 to 1.96% in 2000. The median age of the population is now 16 years. The geographical distribution of the population is unequal. Of the 200 inhabited islands, nearly 70 have fewer than 500 people. At present, about 25% of the population live in Male', the capital (about two sq km). The rapid growth in the population of Male' is associated with the bulk of economic development activities centred on North and South Male' atoll as a consequence of the location of the capital, the international airport, the port of Male' and tourist resort islands.

8. The Maldives has a high adult literacy rate with less than 3% of adults classified as illiterate in 1999. The literacy rate is marginally higher for females than for males and presents no rural urban disparities. Improvements in social sectors are reflected in the steady improvement of human development indicators. The Maldives Human Development Index (HDI) of 0.534, ranking 93rd of 160 countries in 1991, has improved to an HDI of 0.725 and a rank of 89th of 174 countries in 2000. However, the Vulnerability and Poverty Assessment (VPA, Ministry of Planning and National Development and UNDP, 1998) showed important disparities between Male' and the atolls, the alleviation of which are now being addressed in government development programs.

9. Economic life in the Maldives was dominated in the past by fishing and subsistence agriculture with some exchange of marine and other products for rice and other necessities from abroad. Rapid social and economic development is recent, with living standards rising substantially since the

late 1970's. The impressive annual growth in the economy (over 10% of GDP per year in the 1980s) was due largely to increased revenue from tourism and fishing as well as government investment in infrastructure.

10. The Maldives, with a per capita Gross Domestic Product (GDP) of about US$ 1,968, has a typical small island economy that is limited by natural and human resources, an acute shortage of raw materials, heavy imports of most requirements, high social and economic infrastructure costs due to geographic constraints and dispersal of the population, and an ever increasing demand on government revenue to cater for the basic needs of an expanding population.

11. The mainstay of the economy are tourism and fisheries. The number of annual tourist arrivals (467,154 in 2000) now exceeds the total local population. Tourism operations rely heavily on imported equipment, facilities, food, and skilled labour. Fishing has always been a central activity in the Maldivian society, providing around 80% of export revenue. Approximately 25-30% of the population depend directly or indirectly on income from fishing. The major local fishery, the skipjack tuna fishery, is based on pole and line fishing and trolling, thus producing a "dolphin-safe" product.

12. Although traditional resource use and management practices had little or no adverse impact on the environment, changes in lifestyles, increased population pressure, expansion and diversification of tourism, fisheries and related sectors are putting the environment under increasing pressure and pose threats to the quality and sustainability of the natural environment.

1.2 National goals and objectives in conservation and sustainable use of biological diversity

13. The Maldives is renowned for its unique, diverse and pristine marine environment. Given the scarce terrestrial and other natural resources, the major economic sectors of the nation, tourism and fisheries, are based upon this marine environment. The Maldives is cognizant of the fragile nature of its limited natural resource systems and thus, has a strong conservation based approach to resource use and resource management.

14. National policy objectives in conservation and sustainable use of biological diversity are legally instrumented in Law No. 4/93 (Environment Protection and Preservation Act of the Maldives). In its preamble statement, the Act states: "*The natural environment and its resources are a national heritage that needs to be protected and preserved for the benefit*

of future generations. The protection and preservation of the country's land and water resources, flora and fauna as well as the beaches, reefs, lagoons and all natural habitats are important for the sustainable development of the country".

15. The Environment Law is supported by the Law on Fisheries (Law No. 5/87) which is the major law governing conservation and use of marine biodiversity. This law contains provisions on use of living marine resources, especially fisheries resources, and on foreign licensed fisheries. It empowers the Ministry of Fisheries, Agriculture and Marine Resources to conserve and manage the sustainable use of marine and fisheries resources. Other relevant laws that contain provisions relating to biodiversity conservation and environmental protection include the Act relating to Uninhabited Islands[1] (Law No. 20/89) and the Act relating to Coconut Palms and Trees of Inhabited Islands[2] (Law No. 21/89) and the Maritime Zones Act of the Republic of Maldives (Law No.6/96).

16. The policy statement of the Environment Law is translated into national goals and objectives in the conservation and management of natural resources in the Second National Environment Action Plan (NEAP II). The aim of the NEAP II is to: "*protect and preserve the environment of the Maldives, and to sustainably manage its resources for the collective benefit and enjoyment of present and future generations*" (MHAHE, 1999a).

17. The main strategies forming the framework of NEAP II are:

    - continuous assessment of the state of the environment in the Maldives, including the impacts of human activities on land, atmosphere, freshwater, lagoons, reefs and the ocean; and the effects of these activities on human well being;

    - development and implementation of management methods suited to the natural and social environment of the Maldives, and maintain or enhance environmental quality and protect human health, while at the same time utilizing resources on a sustainable basis;

    - consultation and working with all relevant sectors of society to ensure stakeholder participation in decision making;

    - preparation and implementation of comprehensive national environmental legislation in order to provide for responsible and effective management of the environment;

1 Unofficial translation of title

2 Unofficial translation of title

- adhering to international and regional environmental conventions and agreements and implementation of commitments embodied in such conventions;

- strengthening of national capabilities, including institutional arrangements and human resource development for effective public participation, management and administration;

- financial support, cooperation and commitment to enable the action plan to be implemented in an efficient and cost effective manner.

18. Recognizing the importance of conservation of biological diversity, the Maldives signed the Convention on Biological Diversity on 12 June 1992 and ratified it on 28 October 1992, becoming one of the first nations to do so. Actions, policies and measures stated in NEAP II specifically focused on conservation of biological diversity are:

    - Undertake a detailed assessment of biological diversity including detailed inventories of existing flora, fauna and ecosystems, in order to provide the basic data needed for the conservation of biological diversity;

    - Identify and analyse options to meet the objectives of the Convention on Biological Diversity, including strategies for conservation, sustainable use and benefit sharing;

    - Prepare and implement a National Biological Diversity Strategy and Action Plan;

    - Prepare the first national report to the Conference of the Parties to the Convention on Biological Diversity;

    - Identify sites of high biological significance for the conservation of biological diversity, tourism, and other sustainable development opportunities and designate them as protected areas;

    - Accede to and implement the Convention on International Trade in Endangered Species of Wild Fauna and Flora and other relevant international and regional conventions;

    - Protect and regenerate endangered species, sustain bird populations and conserve the habitats of threatened species.

1.3 Participation in international agreements and programmes

19. The Maldives is party to the United Nations Framework Convention on Climate Change (1992) (UNFCCC) and was the first country to sign the Kyoto Protocol to the United Nations Framework Convention on Climate Change (1997). The Maldives has been actively participating in the convention related activities since its inception and throughout the IPCC process. Other environmental conventions signed and ratified by the Maldives include: the United Nations Convention on the Law of the Sea (1982), Vienna Convention for the Protection of the Ozone Layer (1985), Montreal Protocol on Substances that Deplete the Ozone Layer (1987) (and amendments to the Montreal Protocol), Basel Convention on the Transboundary Movement of Hazardous Waste and their Disposal (1989), International Convention for the Prevention of Pollution of the Sea by Oil, (1954) Convention on Biological Diversity (1992), and the United Nations Agreement relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks (1993). The Maldives is also party to the South Asian Regional Seas Programme and resolutions concerning its implementation (1994), and the Washington Declaration on Protection of the Marine Environment from Land-Based Activities (1995).

20. Participation of the Maldives in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is presently under review.

2. State of the Nation's Biological Diversity

2.1 Introduction

21. The Maldives is built upon coral reefs renowned for their aesthetic beauty and species diversity. These reefs support terrestrial ecosystems that are fragile yet biologically rich and diverse. The small size, insularity and fragility of the Maldivian small island ecosystem means that biological diversity is constantly under threat. Growing populations and concomitant demands on the natural resource base are increasingly leading to environmental degradation and loss of biological diversity, especially coral reef deterioration and habitat degradation.

22. There have been no comprehensive surveys of terrestrial or marine biological diversity in the Maldivian archipelago as a whole. While program oriented research in biodiversity assessment has yet to be carried out, isolated surveys such as geological surveys of the archipelago, Addu Atoll fauna, terrestrial biodiversity, and fishes of the Maldives provide valuable information on its biological diversity. However, significant gaps still remain and more surveys of the status of terrestrial and marine biological diversity need to be carried out and documented.

23. Existing studies show that endemism of both terrestrial and marine species is low in the Maldives. A lack of ecological opportunity and the high dispersal potential of the true native plants, account for the negligible occurrence of endemic plant species (Adams, 1988). It is believed that Maldivian atolls situated as they are in the middle of the Indian Ocean, act as a stepping-stone for transport of planktonic larvae of reef organisms between western and eastern Indian Ocean.

2.2 Status of biological diversity

2.2.1 Ecosystem diversity

24. Ecosystems in the country can be categorised as island, reef, mangrove, swamp, sea grass and open ocean ecosystems. Maldives being a nation of atolls, the dominating environment is the marine environment with coral reefs forming the major ecosystem. The coral reefs of the Maldives are significant on a global scale as well, being the 7th largest in terms of area covered, with a total area of 8,920 sq km and contribute up to 5% of the worlds reef area (Spalding et al. 2001) . The other ecosystems such as, sea grass beds, mangroves and swamps are limited spatially and therefore of significant importance to the nation.

25. Atoll lagoons contain a variety of reef structures including faros, micro-atolls, patch reefs and knolls. Faros are ring shaped reefs emerging during tidal low water, with their own sandy lagoon and a rim of living coral consisting of branched and massive type of corals. Deep channels surround these reefs. The formation of faros is virtually unique to the Maldives (Woodroffe, 1989). Patches rise to 30m above the lagoon floor the top of which has robust wave-breaking corals. Knolls do not reach the surface and often support profuse coral growth (Naseer, 1997).

26. The reefs associated with islands have the general characteristics described by Bianchi et al. (1996) for the fringing reef around Alimatha island (Risk and Sluka, 2000). The island itself is sand, changing to coral rubble as the reef edge is approached. The outer slopes are very steep and area down to about 15m is covered with lush coral on a healthy reef. The outer reef slope is characterised by a series of reef terraces at depths of 3-6m, 13-30m, and a deeper one at 50m representing past sea level still stands. The modern coral growth is veneer over older reef rock, but the existing community is constructional down to a depth of at least 50m. In the upper levels, reef building is by zooxanthellate corals. In deeper zones, reef building is sometimes by azooxanthellate branching coral.

27. On healthy reefs in the Maldives prior to the major coral bleaching event of 1998 the lushest growth and highest diversity of corals was found to a depth of about 10 m. Coral cover in these areas ranged from 100% to average values of 35% to 40%. Maldives reefs typically displayed a high abundance and diversity of branching corals (Risk and Sluka 2000). However, the severely bleaching event in 1998 killed much of the branching corals throughout the country and the current status has not been well studied.

28. There is little documented information available on the mangroves of the Maldives. With very little land area and no major fresh water bodies to support such ecosystems, the mangroves of the Maldives are not well developed. The mangrove swamps of most islands are of the closed type, in the depressions of islands with large quantities of humus. The luxuriant tall thickets of mangroves are generally found in depressions of islands. However, some islands have fringing type of mangroves along brackish water regions (Untawale and Jagtap, 1991). The distribution of mangroves is not even across the archipelago. Mangroves are generally regarded as being more abundant and diverse in the southern region. However, larger mangrove areas are also found in Shaviyani and Haa Dhaalu Atoll in the north.

29. Very little information is available on the sea grass beds of the Maldives. Sea grass beds are often associated with inhabited islands and it is widely believed that the beds develop with human activity on the islands. Frazier et al. (1984) noted of a large sea grass pasture with *Syringodium*

isoetifolium and *Thalassia hemprichii* east of Baa Thulhaadhoo. They also found large pastures of *T. hemprichii* with patches of *Thallassodendron cilliatum* in Laamu Atoll and identified this as turtle feeding areas.

30. Coral reefs provide the building material for the islands of the Maldives. Most of the islands are dominated by coral sand and/ shingle. The islands differ from mere sand banks to larger islands with different types of vegetation. The soil in the middle of the islands is generally richer than the peripheral soils which have more calcareous sand and more drainage. Adams (1988) recognized five categories of vegetation into which native plants of the islands had grouped themselves ecologically. They are namely beach pioneers, littoral hedge, sublittoral thicket, climax forest and mangrove and swamp forest.

31. The first category the "beach pioneers" include about twenty characteristic species and are the first plants on a natural beach. These are highly salt tolerant and tend to be low and herbaceous. About half of these are grasses and sedges. The non-grasses often have succulent leaves and the commonest is *Launnaea sarmentosa* (kulhafilaa). The second category is the "littoral hedge" with about ten or so common species. These are usually scrubby with numerous branches. The most common species are *Scaevola sericea* (magoo) and *Pemphis acidula* (kuredhi).

32. The third category, the "sublittoral thicket" is described as a distinct community of small trees comprising of more salt sensitive species, existing behind the beaches in areas not completely dominated by coconut palms (which are described as "ubiquitous"). These areas contain about twenty common species of mixed life form including shrubs, climbers and shade tolerant grasses; the prevalent trees being *Cordia subcordata* (kaani), *Guettarda speciosa* (uni), *Hibiscus tiliaceus* (diggaa) and *Premna obtusifolia* (kude).

33. The fourth category is named the "climax forest" which comprises of mature trees from the "sublittoral thicket" in addition to *Hernandia nymphaeifolia* (kandhu) and *Terminalia catappa* (midhili). This is described as the most luxuriant and complex vegetation occurring in the islands. Adams (1988) explained that the inland communities were not always clearly distinguishable because the islands were either too small or too disturbed by the planting of coconuts or other human activity. The natural vegetation pattern of many islands especially the inhabited and the agricultural islands have been severely altered.

2.2.2 Terrestrial Species Diversity

Vegetation

34. The primary source of botanical information on the Maldives is a report by Gardiner (1906) based on the first extensive botanical journey through the archipelago. Subsequent investigations have been carried out by Fosberg (1957), Fosberg *et al* (1966), Groves (1966, 1979), Candollea (1982) and Adams (1984) amongst others.

35. Adams (1984) reports the status of knowledge on the flora of the Maldives as 583 vascular plant species, of which cultivated plant species totalled 323 and native and naturalized plants, 260. These include 214 flowering plants and 5 ferns and *Psilotum* identified by Gardiner (1901). Of these 260 native or naturalised plant species, a very small component, probably fewer than 100 is truly indigenous (Adams, 1988).

Table 1. Development of awareness of the flora of the Maldives.

Group	Families	Genera	Species	Native/ Naturalized	Cultivated	% Cultivated[a]
Willis & Gardiner (1901)	69	201	284	160	124	43.7
Fosberg (1957)	81	231	324	177	147	45.4
All reports published to 1982	86	265	418	220	198	47.4
Unpublished to August 1983	-	-	459	238	221	48.1
Adams (1984)	107	374	583[b]	260	323	55.4

[a] The proportion of cultivated plants in the total reflects the fact that these items stimulate greater interest and are acquired at a much faster rate than additional native and naturalized species are discovered.

[b] The present overall total of vascular plants.

Source: Adams (1984).

36. Traditional knowledge on medicinal plants is significant and has been sustained primarily due to the continued practice and sustained use of traditional medicine in the atolls. However, the practice of traditional medicine is under severe strain as modern allopathic medical care reaches more atoll communities. Reports indicate that over 300 species of plants are used in traditional medicine.

37. Variations in nomenclature and levels of classification (in Maldivian) used by the local populace, compounded by the basis of local classification often being on extrinsic characters such as usage, habitat preference of seasonal responses (Adams, 1984) make it difficult to compile a full listing of the plant population of the country without extensive botanical surveys.

38. The expansion of tourism has boosted domestic market demand for ornamental plants, a need that has been primarily been met by heavy imports of ornamental plants. Given the lack of robust arrangements for quarantine procedures and facilities, this has increased exposure of local plants to pests and plant diseases. Present trends indicate increased investment by tourist resort operators and local entrepreneurs in local production of ornamental plants to meet this demand. However, the demand for ornamental plants is primarily met through imports.

Invertebrates

39. Little is documented on the terrestrial invertebrate fauna of the Maldives. Indigenous knowledge being handed down by oral traditions has yet to be documented. During a study on fruit bats, a collection of insects, arachnids and mollusc specimens were made, and among this spiders were found to be particularly rich. In the same study four species of bumble bees were collected as well (Holmes 1993).

Amphibians and reptiles

40. In contrast to marine fauna, the amphibian and reptile fauna of the Maldives is very small (Anderson, 1996c). No comprehensive survey has been carried out on amphibians and reptiles.

Mammals

41. Anderson (1996c) reports that the terrestrial mammalian fauna is highly depauperate. Apart from a general review by Hill (1958), documented reviews are scarce. Two endemic subspecies of fruit bats, *Pteropus gigantus ariel* and *Pteropus hypomelanus maris* have been recorded (Holmes 1993). The latter is known only from one record from Addu Atoll (Holmes, 1993)

2.2.3 Mangrove species

42. A study by Untawale and Jagtap (1991) of the distribution on mangroves in the Maldives identified 13 species belonging to nine genera (Table 2) with the flora being dominated by *Bruguiera cylindrical, Ceriops tagal* and *Lumnitzera racemosa*. In addition to 13 species of mangrove plants, Untawale and Jagtap (1991) recorded 6 species of plants and 37 species of fungi associated with mangroves.

Table 2. Mangrove species identified in the Maldives.

Maldivian name	Scientific name
Thakafathi / Ran'doo	*Rhizophora mucronata* Lamk
	Rhizophora sp.
	Rhizophora sp.
Kan'doo	*Bruguiera cylindrica*
Bodavaki / Bodu kan'doo	*B. gymnorhiza* (L) Lamk
	B. Eriopetala (W.A)
Kharnana	*Ceriops tagal* (Perr).C.B Robins
	Avicennia marina (Vierh)
Burehi	*Lumnitzera racemosa* L.Gaertn
Kulhlhavah	*Sonneratia caseolaris* (L) Eng.
Thella	*Exoecaria agallocha* L
Maakeha	*Acrostichum aureum* L
Kuredhi	*Pemphis acidula* (Forst)

Source: Untawale and Jagtap, 1991.

2.2.4 Marine Species Diversity

Algae, Sea grass and Marine Fungii

43. The marine algae recorded from the Maldives is about 285 including, 21 species of bluegreen algae, 163 red algae, 83 species of green algae and 18 of brown algae (Hackett *et al.*, 1977)

44. Ahmed and Saleem (1999) report that five species of 4 genera of sea grass (*Syringodium isoetifolium, Thalassia hemprichii, Thallassodendron ciliatum, Cymnodoea rotundata, Cymnodocea* sp.) have been identified by two studies (Frazier et al. 1984; Untawale and Jagtap 1991). *Thalassia hemprichii* is reported to be the most dominant sea grass species in the Maldives, while *T. ciliatum* was only reported from Addu Atoll. The other three species were distributed evenly throughout the country.

Marine Invertebrates

45. Documented information on marine biodiversity of the Maldives is very limited compared to the richness of marine life occurring in the country. The most comprehensive information on marine invertebrate species diversity can be obtained from the records of the Gardiner Expedition which was undertaken over a century ago. While there are only a few studies conducted, the information on many of these studies are not readily available in the Maldives and are difficult to access. Ahmed and Saleem (1999) provide summarised information from available studies on the status of biodiversity in the Maldives. These include sponges, coelenterates, molluscs, arthropods and other marine species (see Table 3). While most studies report on species identification, documentation on

relative abundance and distribution of identified species is scarce as most studies are area specific or data gathered as a secondary activity.

Corals

46. Corals are one of the groups of marine life that is relatively well studied in the Maldives. Sheppard (1987) recognised 166 species of corals from the Maldives. A latter study lists 209 species of corals identified from the Maldives (Clark 1995 in Zahir and Naeem, 1996). A more recent analysis of Indian Ocean corals recognises 187 species of corals from the Maldives (Sheppard 2000). The highest species diversity in the Maldives has been recorded within the family Acroporidae. However, during the major coral bleaching event in 1998, branching corals were the most highly affected. However, post bleaching recruitment showed high recruitment of branching corals, acroporids and pociloporids (Edwards et al. 2001)

Molluscs

47. Available literature record a little over 400 species of molluscs from the Maldives. These include about 300 species of Gastropods (Smith 1906, Coleman 2000), 92 species of bivalves (Smith 1906), 14 species of cephalopods and a few species of chitons. Of the univalves, the most diverse groups are the murex shells (Muricidae) and cowry shells (Cypraeidae).

Crustaceans

48. Only a limited number of studies have concentrated on this highly diverse and large group of marine life. Several species of small crustaceans have been recorded from the Maldives, these include 120 species of copepods (Wolfenden (1906) collected "around the Maldive Islands"), and 15 species of amphipods (Walker 1906). Over 145 species of crabs (Borradaile 1906, Alcock 1906, Borradaile 1903a Borradaile 1903b Borradaile 1903c) and 48 species of shrimps (Nomura 1996) have been identified. Coral crabs belonging to the family Xanthidae represented high diversity within crab families with 79 species (Borradaile 1903b). Snapping shrimps belonging to the family Alpheidae which are normally dominant in coral reefs are represented by 40 species (Nomura 1996).

Echinoderms

49. At least 83 species of echinoderms have been recorded from the Maldives of which the sea stars are the most diverse. Of these, the distribution and abundance of sea cucumbers have been studied (Joseph, 1991) due to their importance as a commercially exploited group.

Table 3. Summary of marine invertebrates identified in the Maldives.

Taxonomic group	Common group	No. of species	Reference
PROIFERA			
	Sponges	36	Thomas et al. (1991)
CNIDARIA			
Alcyonaria	Soft Corals	66	Hickson (1906a), Hickson (1906b) and Pratt 1906
Madreporaria	Stony Corals	187	Sheppard (2000)
Antipatharia	Black Corals	11	Cooper 1906
PLATYHELMINTHES			
Turbellaria	flatworms	10	Coleman (2000)
ANNELIDA			
Polychaeta	segmented worms	35	Nomura (1996)
MOLLUSCA			
Prosobranchia	univalves	258	Smith 1906
Opisthobranchia	nudibranchs, sea hares etc.	42	Coleman 2000
Bivalvia	bivalves	92	Smith 1906
Cephalopoda	cephalopods	14	Hoyle 1906
CRUSTACEA			
Copepoda	copepods	120	Wolfenden (1906)
Cirripedia	barnacles	13	Boradaille (1903c)
Stomatopoda	mantis shrimps	2	Boradaille (1903c)
Paguridae	hermit crabs	24	Alcock (1906)
Brachyura	crabs	145	Borradaile 1903 a,b & c, Borradaile 1906 and Alcock 1906,
Caridea	shrimps	48	Nomura 1996
Lobsters		5	Ahmed et al. 1996. Anderson pers comm..
ECHINODERMATA			
Crinoidea	Feather stars	10	Coleman 2000
Asteroidea	sea stars	27	Coleman 2000
Ophiuroidea	Brittle stars	15	Coleman 2000
Echinoidea	sea urchins, sand dollars etc.	14	Coleman 2000
Holothuroidea	sea cucumbers	17	Joseph 1991, Coleman 2000

Chordates

Turtles

50. The most recent report on the status of turtle populations in the country identify five species of turtles (see Table 4) (Frazier *et. al* 2000). The major study on marine turtles in the Maldives was Frazier *et al* (1984), which brought together new and existing data, and published, unpublished and oral information on marine turtle populations in the Maldives.

Table 4. Status of marine turtles in the Maldives.

English name	Maldivian name	Scientific name	Status (tentative)
Loggerhead turtle	Boa bodu velaa	*Caretta caretta*	Rare
Green turtle	Velaa	*Chelonia mydas*	Common
Hawksbill turtle	Kahan'bu	*Eretmochelys imbricata*	Common
Olive Ridley turtle	Va woshi velaa	*Lepidochelys olivacea*	Rare
Leatherback turtle	Musimbi	*Dermochelys coriacea*	Rare

Source: Frazier et al., 2000

51. Turtles are protected in the Maldives by Law. A 10 year moratorium on catching of turtles was declared in the year 1995. However collection of turtle eggs are allowed in view of their traditional importance as a protein source. Although the Green turtle and the Hawksbill turtle are the commonly found species in the Maldives, they were heavily exploited until the time the moratorium was declared. Since the declaration of the moratorium, turtle sightings are reported to have increased.

Fishes

52. This is the most well studied group of marine fauna and work is ongoing in the Marine Research Centre of MOFAMR to document all newly identified species, and to complete listings of identified marine fauna. The most comprehensive set of reviews, study and documentation of demersal and epipelagic fish fauna of the Maldives carried out to date recorded a total of 1,090 species of fish including sharks (Anderson et al. 1998; Randall and Anderson, 1993; Adam et al. 1998). Randall and Anderson (1993) recognized records of 899 species of epipelagic and shore fishes. Of these 899 species, 32 were recorded by generic name only. A subsequent study and review by Anderson et al. (1998) raised the number of shore and epipelagic fish fauna to 1,007 species. In addition, in a corresponding study on deep demersal fishes of the Maldives, Adam et al. (1998) reported a total of 99 deep demersal species from depths greater than 180m in the Maldives; 83 of these species were not recorded by Randall and Anderson (1993). An additional 30 species have been identified but the information is yet unpublished. The mesopelagic fishes

of the Maldives have not been reviewed properly and bathypelagic fishes are completely unstudied (R. C. Anderson pers comm.)

53. The most diverse group of fishes are the gobies with records of about 90 species, followed by the wrasses and serranids with about 70 and 60 species respectively. Nearly 40 species of sharks belonging to 17 families and 16 species of skates and rays have been recorded (Anderson et al. 1998, Shiham et al. 1998; Randall and Anderson, 1993).

54. Endemic species are relatively few in the Maldives. The Maldive Blenny, *Ecsenius minutes,* has so far been identified only in the Maldives, while the distribution of certain species such as the Maldive anemonefish, *Amphiprion nigripes*, is restricted to the Maldives, Laccadives and Sri Lankan waters (MRS 1997). Few species of fish collected from the Maldives are believed to be new species (Anderson et al. 1998). These include two species belonging to the family Malacanthidae and one species from the family Apogonidae. A completely new genus of a labrid that had not been described before was recorded by Anderson et al. (1998). Anderson and Ahmed (1993) recorded a previously undescribed species of shark from the family Pseudotriakidae.

55. Freshwater fish fauna in the Maldives is scarce, possibly due to lack of suitable habitat. The identified species appear to be recently introduced species (Anderson, 1996c). Most imports are for the growing trade in freshwater aquarium fish. The demand is located primarily in Male' for home aquariums and showcase aquariums in business offices.

Mammals

56. Marine mammalian fauna have been reported by various studies such as Anderson (1990, 1996b) and Leatherwood *et al* (1984). Although the Marine Research Centre has an ongoing programme for the study of marine fauna, more comprehensive studies on biological diversity in marine mammalian fauna in the Maldives need to be carried out.

57. The rich cetacean fauna of the Maldives have not been researched much to date. Approximately 21 species of whale and dolphin have been recorded (Anderson, 1996c, Anderson pers. comm.). Anderson *et al* (1999), in their documentation of records of cetacean 'strandings' from the Maldives, positively identify 10 species of cetaceans, including blue whales (*Balaenoptera musculus*), with the most common being the sperm whale (*Physeter macrocephalus*) accounting for over half of all reported strandings.

58. Seven species of dolphins have been identified in the Maldives. The most common inshore cetacean in Maldivian inshore waters is the spinner dolphin (*Stenella longirostris*). The report of the Whale and

Dolphin Survey conducted by the National Marine Fisheries Services in the Northern Atoll of Maldives during a cruise by the Marine Research Section during April 1998 reports sightings of 9 species of whales and 7 species of dolphins (see Table 5a and 5b).

Table 5a. Species of whales encountered.

English name	Scientific name
Bryde's whale	*Balaenoptera edeni*
Blue whale	*Balaenoptera musculus*
Dwarf Sperm Whale	*Kogia simus*
Sperm Whale	*Physeter macrocephalus*
Blainville's beaked whale	*Mesoplodon densirostris*
Cuviers' Beaked whale	*Ziphius cavirostris*
Pygmy killer whale	*Feresa attenuata*
Short-finned Pilot whale	*Globicephala macrorhynchus*
False killer whale	*Pseudorca crassidens*

Source: Marine Research Section, 1998.

Table 5b. Species of dolphins encountered.

English name	Scientific name
Striped Dolphin	*Stenella coeruleoalba*
Pantropical Spotted Dolphin	*Stenella attenuata*
Rough-toothed dolphin	*Steno bredanensis*
Bottlenose dolphin	*Tursiops truncatus*
Risso's dolphin	*Grampus griseus*
Fraser's dolphin	*Lagenodelphis hosei*
Spinner Dolphin	*Stenella logirostris*

Source: Marine Research Section, 1998.

59. Cetaceans are not hunted commercially in the Maldives, nor is there cetacean by-catch from Maldivian fisheries. The capture of cetaceans is specifically banned by Government directive under the Fisheries Law (Government directive of 15 May 1993) as is the export of cetacean products under the Export-Import Act of the Republic of Maldives (Law No. 31/79). Anderson *et al* (1999) report evidence that cetaceans killed in fishing activities of other countries occasionally drift into Maldivian waters. Maldivians traditionally used stranded cetaceans to extract oil for treatment of wooden fishing vessels. However, this usage is declining as other substitute materials are imported, and as more and more vessels are constructed from fibreglass materials. Teeth, skulls and bones of stranded cetaceans are often sold to tourist souvenir shops.

60. Whales and dolphins have been given protected status in the Maldives since 1993.

2.2.5 Birds

61. Over 170 species, including 36 seabirds, 91 shorebirds and 63 land birds have been recorded from the Maldives (Zuhair and Shafeeg unpublished list compiled from, Anderson 1996a; Shafeeg 1996; Ash and Shafeeg 1994; Holmes *et al*. 1993; Shafeeg 1993; Ali and Ripley 1987; Phillips 1963). Given the small island ecosystem, most bird species resident in the Maldives are seabirds. The rest are seasonal, migrants, vagrants, introduced species or imported species. While a comprehensive ornithological study of the Maldives has not been carried out, some information on distribution and status of species is available from isolated research for various projects.

62. Traditional knowledge of seabird species is more extensive than of other bird species as seabirds are used by local fishers as indicators of the presence of tuna schools. Provisional information on seabirds positively identified in the Maldives have been compiled and reported by Anderson (1996a) (see Table 6 below). As Anderson (1996a) notes, regional variations in nomenclature and the common use of only "generic" names by fishermen make it difficult to identify specific names of seabird species. Endemicity and the frequency of unique sub-species is high in the south.

Table 6. Certain identified Maldivian seabird species and their status.

English name	Maldivian name	Scientific name	Status (tentative)
Bulwer's Petrel	Hoagulhaa	*Bulweria bulwerii*	Uncommon visitors, SW season
Flesh-footed Shearwater	Maa Hoagulhaa	*Puffinus carneipus*	Visitor, southern winter
Wedge-tailed Shearwater	Bodu Hoagulhaa	*Puffinus pacificus*	Possibly resident
Audubon's Shearwater	Dhivehi Hoagulhaa	*Puffinus therminieri*	Resident
White-faced Storm-petrel	Raalhu Kotti	*Pelagodroma marina*	Uncommon visitor, S. winter
Wilson's Storm-petrel	Raalhu Kotti	*Oceanitis oceanicus*	Visitor, southern winter
White-bellied Storm-petrel	Raalhu Kotti	*Fregetta grallaria*	Uncommon visitor, S. winter
White-tailed Tropicbird	Dhandifulhu dhooni	*Phaethon lepturus*	Resident
Masked Booby	Hudhu Maadhooni	*Sula dactylatra*	Uncommon visitor
Brown Booby	Kalhu Maadhooni	*Sula leocogaster*	Uncommon visitor
Red-footed Booby	Maadhooni	*Sula sula*	Uncommon visitor
Lesser Frigatebird	Hoara	*Fregata ariel*	Resident
Great Frigatebird	Maa Hoara	*Fregata minor*	Visitor
Skuas	Kukulhu Maadhooni	*Catharacta* spp.	Uncommon visitors
Seagulls	Boyah guirey	Fam. Laridae	Uncommon visitors
White-winged Black Tern	Valla	*Chilidonias leucopterus*	Uncommon visitor, N. winter
Gull-billed Tern	Kanifulhu Dhooni	*Sterna nilotica*	Possibly resident
Caspian Tern	Miyaremu Dhooni	*Sterna caspia*	Uncommon visitor, N. winter
Lesser Crested Tern	Gaa Dhooni	*Sterna bengalensis*	Resident
Great Crested Tern	Bodu Gaa Dhooni	*Sterna bergii*	Resident
Common Tern	Valla	*Sterna hirundo*	Visitor, northern winter
Roseate Tern	Valla	*Sterna dougallii*	Resident
Saunders' Little Tern	Bondhu Dhooni	*Sterna saundersi*	Common resident
White-cheeked Tern	Valla	*Sterna repressa*	Uncommon visitor, N. winter
Black-naped Tern	Kiru Dhooni	*Sterna sumatrana*	Common resident
Bridled Tern	Vaali	*Sterna anaethetus*	Resident
Sooty Tern	Beyndu	*Sterna fuscata*	Resident
White Tern	Dhon Dheeni	*Gygis alba*	Resident, in south only
Brown Noddy	Maaranga	*Anous stolidus*	Common resident
Lesser Noddy	Kurangi	*Anous tenuirostris*	Resident

Source: Anderson, 1996a.

63. Five subspecies of bird have been identified as endemic to the Maldives (Table 7). More surveys need to be carried out in order to identify others.

Table 7. Bird subspecies identified as endemic to the Maldives.

English name	Maldivian name	Scientific name
Maldivian Pond Heron	Huvadhoo Raabondhi	*Ardeola graii phillipsi*
Maldivian Little Heron	Dhivehi Raabondhi	*Butorides striatus albidulus*
Central Maldivian Little Heron	Medhu Raajjetherey Raabondhi	*Butorides striatus didii phillipsii*
Maldivian Water Hen	Dhivehi Kan'bili	*Amouronis phoenicurus maldivus*
Asian Koel	Dhivehi Koveli	*Eudynamys scolopacea scolpacea*

Source: Ministry of Home Affairs, Housing and Environment.

64. Native birds are hunted to some extent in the Maldives but not widely sold for commercial purposes. Seabirds are occasionally kept as household pets. Certain species of parrots and other species are imported and sold as household pets. Increasing numbers of various bird species are imported and sold commercially as household pets. Certain seabird species are protected by the Government under the Environment Law (Law no. 4/93) due to declining populations perhaps as a result of degradation or loss of habitat (Table 8).

Table 8. Maldivian seabird species protected under the Environment Law (Law no. 4/93).

English name	Maldivian name	Scientific name
Flesh-footed Shearwater	Maa Hoagulhaa	*Puffinus carneipus*
Wedge-tailed Shearwater	Bodu Hoagulhaa	*Puffinus pacificus*
Audubon's Shearwater	Dhivehi Hoagulhaa	*Puffinus therminieri*
White-tailed Tropicbird	Dhandifulhu dhooni	*Phaethon lepturus*
Lesser Frigatebird	Hoara	*Fregata ariel*
Great Frigatebird	Maa Hoara	*Fregata minor*
Gull-billed Tern	Kanifulhu Dhooni	*Sterna nilotica*
Lesser Crested Tern	Gaa Dhooni	*Sterna bengalensis*
Great Crested Tern	Bodu Gaa Dhooni	*Sterna bergii*
Common Tern	Valla	*Sterna hirundo*
Roseate Tern	Valla	*Sterna dougallii*
Saunders' Little Tern	Bondhu Dhooni	*Sterna saundersi*
Black-naped Tern	Kiru Dhooni	*Sterna sumatrana*
Bridled Tern	Vaali	*Sterna anaethetus*
Sooty Tern	Beyndu	*Sterna fuscata*
White Tern	Dhon Dheeni	*Gygis alba*
Brown Noddy	Maaranga	*Anous stolidus*
Lesser Noddy	Kurangi	*Anous tenuirostris*

Source: Ministry of Home Affairs, Housing and Environment.

2.2.6 Other groups

65. Marine and brackish water species known to be introduced include: *Tilapia* sp. (introduced in 1964 as baitfish by Japanese consultants), *Holothuria scabra* (introduced in late 1990s from India as a mariculture pilot project) and *Euchema cottoni* (introduced in the early 1990s from the Philippines for a mariculture pilot project) (Ahmed and Saleem, 2000).

66. Other introduced species include ornamental plant varieties, various bird species, vegetable plant species and various pests. Imports of live plants in 2000 amounted to nearly 26,000 USD by C.I.F. value. These figures remain relatively stable over recent years. Little is documented on introduced species apart from studies on various pests that have impacted on existing plant populations.

2.3 Changes in the use of biological resources and their sustainability

2.3.1 Marine biodiversity

67. Trends in fish exploitation show increasing diversification of harvested species. Until recently, Maldivian fisheries was primarily a pole and line tuna fishery. The main species caught are skipjack tuna (*Katsuwonus pelamis*), juveniles of yellowfin tuna (*Thunnus albacares*), and to a lesser extent bigeye tuna (*Thunnus obesus*). Skipjack tuna represents over 85 percent of the total annual fish catch. Other fisheries included a shark fishery and a very limited reef fishery as reef fish were traditionally regarded as poor quality food for consumption. However, export oriented fisheries targeting species such as grouper, sea cucumber and aquarium fish have started and have been established over the last two decades, and are potential threats to biological diversity.

68. The livebait fishery is one of the most important fisheries in the Maldives, given that the pole and line tuna fishery depends on availability of livebait. Fishers secure an adequate amount of live baitfish, by lift nets near the reefs at dawn or at night, and keep the bait alive throughout the day in a bait well of the fishing vessel (*masdhoni*). Baitfish availability and utilization is highly seasonal, with the volume and species used varying from atoll to atoll. Commonly used species are sprats (*Spratelloides gracilis* and *S. delicatulus*), fusiliers (*Gymnocaesio gymnopterus* and *Pterocaesio pisang*), anchovies (*Encrasicholina heteroloba* and *Stolephorus indicus*), and cardinal fishes (*Archamia leneolata* and *A. buruensis*). Fishers report serious decline in baitfish availability in certain areas, leading to innovative methods of bait fishing such as the use of halogen lights at night. The status of stocks of livebait fish species targeted by Maldivian fishers has not been scientifically determined yet. Anderson (1997) suggests that although there are no

clear signs of overfishing so far, it would be prudent to initiate stock assessment activities given the prime importance of the fishery. All types of baitfish used in the pole and line fishery were banned from export in June 1995.

69. The grouper fishery was launched in 1993 as a specific commercial fishery targeting markets in certain Far East countries. The mortality rate is estimated to be high. Further, there are indications that the grouper fishery may be under stress in certain areas. Hence, the Ministry of Fisheries, Agriculture and Marine Resources is presently formulating conservation measures for the grouper fishery.

70. The sea cucumber fishery that began in the Maldives in 1985 exports nine sea cucumber species to Far East and Asian markets. The most valuable of these species, *Thelonata ananas*, was rapidly overfished, and other medium value species subsequently overfished. As a conservation measure limiting the depth at which sea cucumber may be harvested, a ban on the use of SCUBA diving gear for sea cucumber harvesting was introduced by the Government in 1993. However, violations of this regulation are common and has proven to be difficult to enforce given the geographic dispersal of the fishing effort in this fishery. Hence, the Government is presently considering more stringent measures targeting the sea cucumber fishery at the export point.

71. The giant clam fishery, begun in 1990 with clam meat being exported to Taiwanese markets, was based entirely on *Tridacna squamosa*. The unsustainable rate of harvest of *T. squamosa* resulted in closure of this fishery by the Government in 1991.

72. Five species of spiny lobsters are reported in the Maldives. These are *Panulirus longipes, Panulirus penicillatus, Panulirus ornatus, Panulirus versicolor, and Panulirus polyphagus* (Ahmed *et al*, 1997). All five species are reportedly harvested by the lobster fishery. The lobster fishery is mainly targeted for the tourist resorts. Local consumption of lobster is limited. In 1987, the Government passed a regulation to control the lobster fishery as a precautionary measure against possible over exploitation. Under this regulation, harvesting of berried lobsters and small lobsters with carapace lengths less than 25cm was banned.

73. Although shark fishing is a well-established and traditional fishery, fishing for reef sharks only started in the early 1980s when export markets for shark fins developed (Anderson and Ahmed, 1993). The main finished products are salt dried shark meat and dried fins. Shark meat is exported to Sri Lanka and dried fins to Chinese markets in Singapore and Hong Kong. Jaws of some species are also sold to tourists. Another product used by locals is shark liver, which is utilised to extract oil used for sea faring vessels.

74. Anderson and Ahmed (1993) classify the Maldivian shark fishery into three groups based on their type of operation: 1) Reef shark fishery; 2) Deep water Gulper shark fishery; and 3) Oceanic shark fishery. The reef shark fishery is more valuable as it generates revenue for both fisheries and tourism. Anderson and Ahmed (1993) concluded that the reef shark fishery is moderately fished and if continued, the stock would be adversely affected. They further concluded that deepwater shark stocks appear to be limited, and probably very heavily or overfished in certain areas. Pelagic shark stocks are suggested to in robust condition and possibly under-exploited.

75. A recent survey of the northern shark fishery (Mac Allister *et al*, 2000) notes that fishers report dramatic decline in catch rates of shark within the atoll in recent years. Fishers also report having to go further offshore to catch pelagic sharks. This suggests that reef and nearshore pelagic shark stocks have been overexploited and that fishers are now exploiting offshore pelagic shark stocks. These indications of overfishing are supported by reports from shark processors that the average sizes of sharks landed have declined in recent years. The survey noted that this may also be an indication that fishers are more likely to catch and land juvenile Silky Sharks now than they were before. Processors also report that oceanic Blue Sharks are landed more frequently now than before. This may be a direct result of fishermen fishing further offshore (Mac Allister *et al*, 2000).

76. The Government of Maldives has introduced regulations aimed at promoting shark conservation. In 1995, and 1999, it banned all types of shark fishing inside and within 12 miles of atolls in the main tourism zone defined as Baa, Lhaviyani, Kaafu, Alifu Alifu, Alifu Dhaalu, Vaavu, and Seenu Atolls. Shark fishing is also banned in certain specified zones. Expansion of this shark conservation zone is presently under review. Whale shark fishing was banned in all areas of the country in 1993.

77. The Government has also imposed conservation measures for rays, an occasional or bycatch from other fisheries. Sting rays and manta rays were target species traditionally for oil, bait and skins. Government banned the export of rays in 1995, and the export of ray skins in 1996 (Ahmed and Saleem, 1999). Other reef species exports banned in June 1995 include eels, pufferfish and parrotfish.

78. The local fishery targeting yellowfin and bigeye tuna is also relatively new. In terms of catch, yellowfin tuna (*Thunnus albacares*) ranks second amongst the tuna species utilized in the Maldives. The catch is seasonal, with juveniles being caught as bycatch in the pole and line fishery, and large adult yellowfin being caught by handline and longline. Although this local fishery and the foreign licensed longline yellowfin fishery combined do not harvest more than 15,000 MT (1999) annually within Maldivian

waters, scientific reports show that yellowfin stocks in the Indian Ocean may be at or above MSY. Stock structure and status of yellowfin are not definitively determined, with single and multiple stock structures being proposed. A single stock structure would mean that the stock is below or close to MSY, while a multiple stock theory would mean that the western Indian Ocean stock is close to or over MSY (see IPTP, 1995). Similarly, IPTP (1995) reports that Indian Ocean bigeye stocks are probably over exploited.

79. Major markets of the aquarium fishery that began in the early 1990s include Europe, Far East, and USA. In 1999, over 167,457 fish were exported and produced a revenue of about US$ 0.3 million. Exports of live tropical fish have decreased from 182,916 fish in 1988 to 148,000 in 2000. Over 100 species of live ornamental fish are exported in this trade, with about 75% of the trade comprising of 20 species (Adam, 1997). Adam (1997) reports that some of these exported species are rare in the Maldives and hence vulnerable to over exploitation. Although the Government has an established monitoring system, lack of institutional capabilities have meant that conservation measures in place are relatively ineffective. An export quota of 100,000 fish was set by the Government in 1988 and 1989, yet was not adequately implemented. This is supported by a species-based quota for species identified as over exploited or with exploitation levels close to MSY. However, inability to undertake close monitoring and evaluation has meant that these quota-based measures are not adequately implemented.

80. Sea turtle meat and eggs were traditionally used in the Maldives as integral ingredients in traditional dishes. Further, the Hawksbill turtle shell was exploited for its highly valued shell. Records as far back as the 12th Century report the Maldives as an important source of tortoise shells for foreign traders. The focus of harvest of turtles changed in the early part of this century when Muslim scholars convinced the population that it was against the religion to consume turtle meat. Turtle eggs were still used, and certain types of turtle meat were used as bait for shark fishing. Oil from sea turtle meat was also used as a preservative for the traditional wooden fishing vessels (Frazier *et al*, 1984). Although turtle conservation has been a target of legislative actions since 1978, exploitation of marine turtles increased with the expansion of tourism. A 10 year moratorium on the catch or killing of any turtle species under the Fisheries Law of 1995 effectively halted the trade in sea turtles, except for that in turtle eggs.

2.3.2 Terrestrial biodiversity

81. Vegetating and flowering plants and trees are the components of terrestrial biodiversity most used in the country. Rural agriculture is primarily based on home gardening. Timber is used for vessel and home building, while other species are used for wood stoves, medicines, local handicraft and decorations.

82. Increased stress on certain species used for timber and for fuel resulted in conservation measures by Government. Policies on conservation and use of terrestrial flora are legislated in the Act relating to Uninhabited Islands (Law No. 20/89) and the Act relating to Coconut Palms and Trees of Inhabited Islands (Law No. 21/89). The Law on Uninhabited Islands provides that trees and plants on uninhabited islands must be planted, cared for and protected by the party entrusted with the management of the island. Certain species of plant biodiversity are protected under regulations established under the Law on Uninhabited Islands. These regulations dictate logging procedures and replanting and reforestation requirements imposed on those who log timber and other species (see following sections).

83. Conservation measures with regard to terrestrial flora are targeted to achieve sustainable use while taking into account that the rural population requires the use of these species for their livelihood. Current trends indicate moves towards the adoption of other materials in vessel and home building, and the use of oil and gas stoves for cooking.

2.3.3 Mangrove and swamp areas

84. Changes in consumption habits and the use of more and more imported processed and packaged products have led to increased production of non-biodegradable waste in the capital, Male', and in the islands. While an established public service system disposes of waste from Male', island populations are increasingly using mangroves and swamp areas for waste disposal. While traditionally most waste generated in the islands were biodegradable food waste, current composition of waste include high percentages of plastic and other types of non-biodegradable packaging. The resulting degradation of mangroves and wetlands serve as justification for using these areas of biodiversity to dispose of dredge material from harbour dredging. Thus, mangrove and wetlands ecosystems are currently under threat due to improper waste disposal and management practices and destruction for land reclamation for human settlements.

2.3.4 Coastal ecosystems

85. Rapid increases in island populations and accelerated shift to increased built infrastructure and housing during the past years of economic development have had direct impact on island and reef ecosystems. In addition to coral and sand mining, encroachment of human settlement to active zones in island beaches have necessitated built coastal modifications that, in turn, have adversely affected island beaches and ecosystems. Severe erosion occurs on some islands in association with human-induced changes. Beach modifications and coastal 'protection' devices to arrest erosion such as groynes, jetties, and breakwaters impact beach dynamics and have either accelerated or extended the erosion, or have been ineffective (Hameed and Ali, 2001).

2.4 Social, political and economic factors affecting biodiversity conservation and use

86. The expansion of the tourism sector geographically and the increase in the number of tourist arrivals have led to a shift in the use of natural resources from primarily exploitative use to non-exploitative uses. This trend is most marked for marine resource use, especially in zones near the capital where tourism is well established. The economic value of marine biodiversity in terms of conservation and sustainable use has been estimated for reef sharks and incorporated into assessment of some coral reefs.

87. The Ministry of Home Affairs, Housing and Environment is presently formulating a monetary valuation system for assessing the impact of human activities on coral reefs. This system will be used to apply the user pay principle to conserve and rehabilitate coral reefs degraded due to marine pollution or accidents.

88. Coral reefs also provide vital sea defense services to the low lying islands of the country. In the capital island, Malé, where land reclamation has encroached onto reef flats and crests, sea defense is now provided by a series of detached breakwaters (composed of concrete tetrapods) at a cost of US$ 14 million to protect 1.52 km of shore. This gives a value of approximately US$ 9,000 per linear metre indicating replacement costs for low lying islands that are dependent upon the adjacent coral reefs for protection from waves.

89. Over the past years significant progress has been made in the development of programmes to evaluate and monitor the current status and trends in biodiversity, biodiversity "services", and to support conservation and sustainable use of biological diversity. Ongoing programmes include the Integrated Reef Resources Management (IRRM) programme (GoM), the National Biodiversity Strategy and Action Plan and Country Report to

the COP (GEF/UNDP), Conservation and Sustainable use of Biodiversity Associated with Coral Reefs in the Maldives (GEF/UNDP), Maldives Protected Areas System Project (AusAid), mariculture projects (GoM/UNDP), sustainable development and micro finance projects financed by UNDP and IFAD, and various other development projects.

90. The Integrated Reef Resources Management (IRRM) programme is conducted by the Marine Research Centre (MRC) under an annual budget allocation from government funds, which has met travel, educational material costs and subsistence costs. More recently the Bay of Bengal Programme has provided financial assistance for project activities including a workshop in 1996 to present a framework for IRRM. Since 1988, the MRC has conducted information gathering activities in the four central atolls of Faafu, Dhaalu, Meemu and Vaavu to work towards an integrated reef resource management system. Under this project, the MRC has successfully documented a range of detailed parameters for the atolls including locations of reefs used for different purposes during different seasons such as live bait fishing, demersal reef fisheries, beche de mer fishing, coral mining, locations used by tourist safari boats for anchoring and tourist dive sites, areas of the atoll used for sand mining, turtle nesting beaches by island, islands that provide habitats for sea bird roosting and breeding, areas of each atoll that the community would agree to set aside for marine protected areas, and regions of each atoll where conflicts between atoll populations on marine resources use occur. Planned activities in the programme include the establishment of interactive educational centres in each atoll where data on activities can be monitored and accessed, and which will serve as environmental education centres.

91. The CORDIO Project and the Global Coral Reef Monitoring Network (GCRMN) sponsored by IOC, UNEP, IUCN has now entered its second phase. GCRMN monitoring and training activities and provision of technical expertise for these activities are co-ordinated by the regional office for the South Asia node in Sri Lanka. Activities under the programme so far include: funding for Maldivian representatives to attend a regional workshop held in India to strengthen links within the region; hosting of a regional workshop in Maldives in April 1998; and provision of a small grant to Marine Research Centre to monitor coral reefs following bleaching in May/June 1998. Further activities are planned for 4-5 pilot sites around the region for comprehensive socio-economic and bio-physical monitoring activity by local institutions.

92. As part of its implementing activities under the CBD, in 2001 the Maldives has started the PDF B phase of a project on the Conservation and Sustainable use of Biodiversity Associated with Coral Reefs in the Maldives with GEF funding. Major activities under the project at two selected sites include application of biodiversity overlays in planning and

management of coral reef resources, implementation of an Integrated Environmental Education campaign, development of environmental guidelines for tourism resort island management, provision of support to the establishment of a marine protected areas system, development of strategies for reduction in coral and sand mining, and strengthening of reef fisheries management regulations and enforcement. Potential synergies exist between IRRM, GCRMN and the Maldives Protected Areas System project in the context of a complementary monitoring and management at selected pilot sites.

93. The Maldives Protected Areas System project funded by AusAid has the objective of development and implementation of three grades of protected area management systems. The management systems to be established are to be participatory and based on co-management by the government and local communities. Training of central and local government staff and community groups in such management systems are a component of the project. The project has experienced teething problems resulting in delays in implementation. Hence, after one year of its three year duration, the scope and implementation of the project is presently under review.

94. The Government has taken a policy decision to focus on development of mariculture programmes to support measures for the conservation and sustainable use of certain fisheries resources such as baitfish species, grouper species, sea cucumbers and also to demonstrate feasible fishing related activities that do not rely on capture fisheries. As such, the Ministry of Fisheries, Agriculture and Marine Resources is presently establishing a mariculture research centre in Vaavu Atoll funded through the national budget. Various collaborative programs are being pursued with regional centres. Ongoing mariculture projects include a pearl culture project (UNDP) and seaweed culture project (GoM).

95. Various other programmes and projects implemented by GoM such as those that aim to promote sustainable human development in atolls also support and supplement activities to monitor and conserve biodiversity.

3. Threats to Biodiversity

3.1 Threats to terrestrial biodiversity and its management

96. Direct threats to terrestrial vegetation arise from lack of compliance with logging regulations and firewood collection. Gaps in knowledge as to the existing terrestrial resource base, and appropriate technologies and farming systems that will ensure the proper management of the agricultural resources of the country, also contribute to degradation and loss of terrestrial biodiversity.

97. Increasing human population of small islands and gradual encroachment of human settlement on forested areas such as through land allocation for housing and service infrastructure also contribute significantly to loss of terrestrial biodiversity. Increasing population density of small islands has also contributed to loss of groundwater quality, and saltwater intrusion into the groundwater lens due to non-renewable rates of extraction. This has impacted on the terrestrial vegetation of some islands.

98. While conservation measures and economic incentives by GoM have resulted in significant shifts away from the use of island vegetative resources to supply firewood and construction timber, the use of mangroves and wetland areas for waste disposal is still highly prevalent. Mangrove and wetlands ecosystems, vital for maintaining natural ecological balances, are currently under threat due to improper waste management practices and land reclamation for human settlements. Mangrove areas are removed for firewood, house building material and used for garbage disposal. Degradation of these habitats has also reduced the number of nesting sites for birds.

99. Terrestrial biodiversity loss is also threatened by the spread of diseases and inadequate knowledge on timely and appropriate pest control methods. For example, in the 1980s, the spread of an imported bacterial disease, citrus canker, rapidly decimated the much-valued lime trees in the country before appropriate pest control action could be taken. The periodic spread of Gypsy moth (‘*huvani*’) to country almond (*Terminalia catappa*) (*midhili*) species has lead to the need to destroy country almond trees from many islands. The disease is most prevalent during the dry season, the northeast monsoon. There is a distinct possibility that country almond may be lost from the country if the disease continues to spread (Zuhair, 2000). The consequences of these threatening processes are high as technical knowledge is scarce and GoM lacks the capacity to send technical advisors to all islands at the time it is needed. Such delays lead to decimation of many tree populations before assistance can be rendered.

100. Increasing imports of ornamental plants, organic fertilizers, fresh vegetables and fruits, building materials and other imports have led to the introduction of many new pests and new species to the whole archipelago. Given the lack of robust arrangements for quarantine procedures and facilities, this has led to increased incidents of plant disease that local knowledge cannot treat. The demand for ornamental plants for the hospitality industry is primarily met through imports. Hence, sanitary and phytosanitary measures necessary for conservation of biological diversity need to be established, including the formulation of quarantine laws and other regulations to control import of alien species, pests and diseases. Appropriate quarantine facilities and procedures need to be established at entry points.

101. Extensive and indiscriminate import and use of fertilizers, herbicides and pesticides are also leading to problems of land degradation.

102. Increased imports of chemicals and hazardous substances, limited land areas and lack of appropriate sites and means of waste disposal available to rural populations is a serious problem most manifest in densely populated islands. Increased waste production and the production of non-biodegradable waste due to changing consumption patterns and increased imports of processed and packaged goods are exacerbating problems of waste management. Waste disposal options such as landfills are not feasible in the long run due to the small size of islands, while most waste disposal methods such as incineration are prohibitively expensive. Disposal at sea leads to reef degradation, and would impact the major economic sectors of tourism and fisheries. Improper disposal of waste has also adversely affected water quality of the small groundwater lens of some islands. Hence, urgent action is needed to address waste management problems in the country.

3.2 Threats to marine biodiversity and its management

103. One of the greatest threats to the coral reefs of the Maldives is coral bleaching due to impacts of climate change. The latest and most severe coral bleaching event occurred in 1998 and caused significant damage to reefs across the country, including severe coral mortality and reef degradation. This event reduced live coral cover to a mean of 2.1% as compared with pre-bleaching level of 30-45% live cover (MRC, 1999). Further assessments show early signs of recovery with recruitment of highly affected varieties such as acropprids and pocilloporids (Edwards et al. 2001). This event highlights the extreme vulnerability of the natural resource base of the country to human induced and natural phenomena such as global climate change.

104. As identified in the preceding section, other threats to living marine resources are posed directly by exploitative uses such as new fisheries, coral and sand mining, non-exploitative but damaging reef uses such as anchoring on reefs. Indirect threats are posed by waste disposal on reefs, pollution and intensive use of reefs by tourist who SCUBA dive and snorkel. The underlying causes of these direct and indirect threats are population growth, increasing population density, changes in consumptions patterns and use of non-biodegradable imported products.

105. Reef species are increasingly under threat as new and multiple uses develop including tourism and as high profit export oriented fisheries expand geographically. The consequences of the introduction and expansion of tourism and the development of the export market for reef fishery products include overfishing of some reef resources, degradation of the coral reef environment and an increase in resource user conflicts. Historically, the only reef fisheries in the Maldives were livebait for the pelagic tuna fishery and the money cowry for export to Asia and Africa. While most other pole and line fisheries in the world have ceased due to the lack of bait fish from over exploitation of coral reefs, the Maldives is unique in still retaining a coral reef habitat able to support bait fisheries. Pole and line caught tunas have a preferred status in international markets as the fishery is perceived to be sustainable and yield high quality product. In contrast, some of the newly developed export orientated fisheries such as beche-de-mer, giant clams, shark fishing and aquarium fish have reduced reef resources within a few years. There is anecdotal evidence that expansion of the relatively new grouper fishery is leading to individual atolls being overfished as the fishery spreads from atolls close to Malé to more remote areas. Hence, selective fishing on coral reefs for single species such as groupers and sharks as practised in recent years threatens the whole future of the two mainstays of the national economy, fishing and tourism.

106. Another major cause of reef degradation is coral mining. Maldivians traditionally mined coral for purposes such as building, making lime, or constructing religious structures. Coral mining reached a critical status with a boom in the construction industry since 1970s. In a study initiated by the Government, Brown and Dunn (1988) estimated that by the year 2000, nearly 400,000m^3 of coral would be mined to meet the needs in the capital island, Male', alone. Coral mining targets massive corals which are the longest lived species and form an essential element of the reef structure. This results in a loss of topographic complexity, diversity of corals and reef fish and leaves an unconsolidated substrate, which is subject to further erosion. Reef recovery from such physical disturbance is limited by the lack of suitable surfaces for new recruitment. Coral use was influenced by the dearth of alternative affordable building materials.

107. Direct government intervention in regulating coral mining commenced in 1990, with a ban on mining coral from any house-reef, followed by restrictions on sand and coral mining from specific areas. By January 1993, Government introduced the use of hollow cement blocks instead of coral in the construction of government buildings. To encourage a shift to other building materials, the duty on imported aggregate and cement was reduced to 15% (1990), and to 10% in 1994. With the escalating cost of using coral for construction both in Male' and in the outer atolls, hollow cement blocks became a viable alternative. Small-scale operations to build these blocks increased to cater for increasing demand. Programs to increase the level of awareness about the significance of reefs for fisheries and tourism, and their role in the physical protection of islands, helped to reduce the demand for coral as a building material. Positive results include: a halt to coral being mined for building purposes in Male', and declining trends observed in the atolls. However, the high cost of imported materials and the unreliability of long term supply of imported materials also pose certain obstacles to full adoption of alternative building materials. Coral mining has severe implications for the tourism industry, as the loss of healthy reefs will reduce the very resources that attract visitors in the first place. The extraction of coral and sand from reefs and beaches has resulted in acceleration and changes to the natural order. Continued current practises are not sustainable and may result in high costs without necessarily providing long term solutions.

108. Coastal zone modifications including hard structures such as seawalls, breakwaters, jetties and groynes have become the norm in many inhabited islands as a direct result of encroachment of human settlement to active zones in island beaches. These structures, in turn, adversely affect island beaches and ecosystems, leading to severe erosion on some islands. Beach modifications and coastal 'protection' devices such as groynes, jetties, and breakwaters to arrest erosion, impact beach dynamics and have either accelerated or extended the erosion, or have been ineffective (Hameed and Ali, 2001). The nearshore systems are also adversely affected by dredging for harbour deepening and associated landfill activities. These human activities and human induced changes to the near shore system constitute serious threats to the conservation of biodiversity, especially reef and mangrove ecosystems.

109. Tourism in the Maldives is dependent upon environmental quality and has been developed in a form that is appropriate for small island developing states. Although tourism facilities were initially basic and with low impact on the environment, recent expansion has developed a diverse range of options within a more elaborate infrastructure required to support the facilities. As a result, a number of critical environmental issues arising from construction of resorts, harbours and other infrastructures in the coastal zone have been identified. These include the use of coral and sand in the construction of sea defences, breakwaters and jetties,

dredging plumes, construction debris and dust that is generated from land reclamation and construction activities, land reclamation and shoreline re-modelling, and disposal of solid waste and sewage on to reef tops. The introduction of environment impact assessment procedures under the Environment Law and implementation of management and mitigation actions within this process have improved resource use practice by tourist resorts. In addition, regulations and codes of practice for use of the resort land area and resort construction practices promote wise use of these islands. Resort operators have also shown coastal stewardship by taking the initiative to build jetties as pile structures, and tend to avoid building groynes for arresting erosion (Hameed and Ali, 2001).

110. Various regulations and standards including important regulatory measures for building standards, sanitation, disposal of waste, carrying capacity and tourist behaviour attempt to address these issues. Compliance with these regulations is variable between resorts.

111. Sand banks are important for biodiversity conservation since they are important bird roosting areas. These areas are increasingly utilised by the tourist industry for recreational purposes and they are often used by the local communities for sand mining as well. These anthropogenenic threats pose serious problems to bird populations by disturbing vital habitats. It is reported that many sandbanks, which were well known as bird roosting areas, no longer support large bird populations.

112. Introduction of new marine species is also cause for concern. Imports of live tropical fish for the aquarium trade have decreased from 49,670 fish in 1998 to 30,286 in 2000. The types of fish imported and their uses or introduction into the natural habitat need to be monitored.

3.3 Priority issues related to those components of biological diversity under threat

113. Issues and priorities concerning conservation and sustainable use of agricultural biodiversity identified in NEAP II as needing to be addressed at the national level, and currently being addressed through various programmes, include:

- encourage appropriate forms of land tenure, and improve legal and administrative capacity for land use management in order to facilitate sustainable land use;
- conserve the plant genetic resource base of the country;
- encourage use of composting to replenish and maintain soil fertility, and use integrated pest management to control pests and diseases on islands;

- manage forestry and firewood by adhering to planned schedules for re-planting, logging and firewood collection from designated sites; and

- continue extensive tree planting programmes and conserve trees of special significance.

114. Issues and priorities concerning conservation and sustainable use of reef ecosystem biodiversity identified in NEAP II as needing to be addressed at the national level, and currently being addressed through various programmes, include:

- assess the health of coral reefs including coral and coral reef growth, sand production by natural systems, and assessment of coral bleaching, coral mining and sand extraction, dredging and reclamation, crown of thorns predation, tourism and reef fisheries;

- initiate a collaborative, participatory reef resources monitoring and integrated reef resources management programme involving people directly engaged in reef resources utilization as well as GoM agencies, relevant NGOs and other stakeholders such as the Atoll Development Committees and Island Development Committees;

- increase awareness of the public and resource users on issues relating to integrated reef resources management, such as the dangers of over fishing, impacts of coral mining and the advantages of sustainable resource use;

- develop and implement a plan for phasing out coral mining and provide incentives and market mechanisms to make alternatives to coral acceptable, and encourage the use of alternative material in maritime structures;

- establish a network of marine protected areas, covering a percentage of the total atoll area appropriate to the local context, and including representative samples of all major habitats, designed to act as harvest refuges and to protect breeding stock and biological diversity;

- assess and evaluate reef fish stocks and regulate exploitation to ensure sustainability; and

- enforce existing laws and regulations concerning reef resources and strengthen the national institutional capacity to manage reef resources.

115. Issues and priorities concerning management of solid wastes and sewage identified in NEAP II as needing to be addressed at the national level, and currently being addressed through various programmes, include:

- assess the solid waste disposal problems in inhabited islands, tourist resorts and islands used for industrial purposes;
- develop and implement appropriate policy and regulatory measures for the reduction of waste, the safe and efficient management of solid wastes, and for the proper management of disposal sites;
- develop fiscal and policy incentives and other measures to encourage the import of environment friendly products with minimal waste and degradable waste content;
- formulate and implement public awareness and education campaigns designed to increase local recognition of the value of waste reduction, re-use, recycling, appropriate packaging and of the possibilities for converting wastes to resources; and
- introduce clean technologies in the industrial sector and appropriate technology for solid waste treatment and disposal.

116. Issues and priorities concerning finding solutions to and adapting to the consequences of climate change and sea level rise identified in NEAP II as needing to be addressed at the national level, and currently being addressed through various programmes, include:

- formulate national options for limitation of greenhouse gas emissions;
- assess the vulnerability of the Maldives to climate change and sea level rise in the context of integrated coastal area management; and on the basis of the assessment, establish a network of sites where sea level rise and coastal erosion can be monitored over time;
- formulate alternative options for adapting to climate and sea level changes that are evaluated and ranked in the context of integrated coastal area management; and
- fulfil Maldives commitments under the various international instruments relating to climate change and sea level rise.

4. Legislative and Institutional Framework

4.1 Legal framework for biodiversity conservation and use

117. The Maldives has just completed the formulation of its National Biodiversity Strategy and Action Plan. The NBSAP and priority actions identified under this will guide future programmes on biodiversity conservation and sustainable use of natural resources. Existing programmes discussed in preceding sections will also be modified to fulfil the objectives and strategies of the NBSAP.

118. The legal framework for biodiversity conservation and use in the Maldives is defined by major laws on the environment, and marine and terrestrial living and non living resources, effected by rules and regulations established under these laws by relevant government agencies. Government directives issued by relevant government agencies form a third tier of the legislative framework for biodiversity conservation and use.

4.1.1 Major laws

119. The key legal instrument defining the regulatory and institutional framework for biodiversity conservation and use is the Environment Protection and Preservation Act of the Maldives (Law No. 4/93). This is supported by the Fisheries Law (Law No. 5/87) and various laws pertaining to sustainable use and management of terrestrial natural resources.

120. The Environment Law contains provisions for conservation of biological diversity, management of protected areas and natural reserves, environment impact assessment procedures and guidelines, disposal of waste, oil and poisonous substances, and transboundary movement of hazardous, toxic or nuclear wastes.

121. The major law governing conservation and use of marine biodiversity is the Fisheries Law (Law no. 5/87). This law contains provisions on use of living marine resources, especially fisheries resources, and on foreign licensed fisheries. It empowers the Ministry of Fisheries, Agriculture and Marine Resources to conserve and manage the sustainable use of marine and fisheries resources. Article 10 of the Fisheries Law empowers the Ministry to protect any living marine species from being harvested or exploitated through banning fishing for that species or its extraction through any means, or declare its habitat a protected area, or declare a moratorium on its exploitation.

122. The Act relating to Uninhabited Islands (Law No. 20/89) and the Act relating to Coconut Palms and Trees of Inhabited Islands (Law No. 21/89) define the policy with respect to conservation and use of terrestrial flora and living resources in the Maldives. The Law on Uninhabited Islands provides that trees and plants on uninhabited islands must be planted, cared for and protected by the party entrusted with the management of the island. Logging on such islands may only be done after obtaining the written consent of the Agriculture Ministry, and in the presence of a local government official and the party entrusted with the management of the island.

123. Other relevant laws that contain provisions relating to biodiversity conservation and environmental protection include the Law on Ocean Territories of the Maldives (Law No.6/96) and the Law relating to vessels that sink or get foundered in the Maldives (Law No. 7/69).

124. Specific items relevant to biodiversity conservation are embodied in regulations and official directives issued under the different laws by government agencies. Important regulations with regard to conservation of biodiversity of terrestrial flora include directive no. FA-E-2/29/98/06 of the Ministry of Fisheries, Agriculture and Marine Resources (MOFAMR) prohibiting the logging of 20 species of plants without prior written consent of the Ministry.

125. The Regulation on Sand and Coral Mining issued by MOFAMR on 13 March 2000 regulates coral and sand mining in the Maldives through a system of designated areas which requires prior permission. The regulations list atolls and types of areas in atolls and on islands where coral and sand mining is prohibited.

126. Directive no. 29-E/95 by the Ministry of Planning, Human Resources and Environment on 1 October 1995 established 15 protected areas for biodiversity conservation. This was followed by directive no. 10-C/99/38 in 1999 which established a further 10 sites as protected areas. These sites are fully preserved sites without any extractive use for any purpose other than bait fishing using traditional methods. Directives 1-/96/34 of 5th June 1996 and 10-C/99/29 of 11 July 1999 by the Environment Ministry declared 18 species of birds as protected bird species (see Table 4). It also declared as protected species five bird species identified as endemic to the Maldives (see Table 3).

127. Fisheries regulations under the Fisheries Law ban the use of dangerous weapons and toxic chemicals and non-target species gear for fishing in Maldivian waters, while also declaring specified gear for specified fisheries as prohibited. The use of nets except for bait fishing is banned. Directive no. FA-A1/26/96/10 by MOFAMR declares that the use of any new type of gear other than that used by Maldivian fishermen in coastal waters

must first be approved by MOFAMR. Other directives ban fishing in certain areas. Directive no. FA-A1/29/98/39 bans fishing for sharks from 8th September 1998 in seven atolls (Baa Atoll, Lhaviyani Atoll, Male'Atoll, North and South Ari Atoll, Vaavu Atoll and Addu Atoll).

128. Living marine species protected from harvesting or exploitation under the Fisheries Law are dolphins, whales, whale sharks, turtles, napolean wrasse, berried female lobsters and those less than 25 cm in total length, giant clams and triton shells. Species prohibited for export under the Import Export Law are black corals, trochus shells, triton shells, pearl oysters, lobsters and lobster meat, all types of corals except organ pipe coral, turtles, puffer fish, eels, bigeye scad under six inches, skates, rays, dolphins, whales, parrot fish and all types of bait fish.

4.1.2 Key issues in implementation

129. As with other laws and regulations, problems of implementation impede the effectiveness of laws and regulations relating to biodiversity conservation. These problems include lack of awareness of the public and even local government officials of existing laws, regulations and policies, non-reporting of violations or non-compliance, lack of action on reported incidents, difficulties in monitoring, surveillance and enforcement, and lack of cohesiveness between various regulations on environmental conservation.

130. Lack of awareness of exiting laws, and more specifically of regulations pertaining to natural resource use, is a major contributor to problems of non-compliance with laws and regulations. The Maldivian system of announcing through media any changes to laws, regulations, and policies, are not supported by dissemination of this information through local government authorities. Nor are hard copies of laws, regulations and policies available for the public at island level.

131. The geographically dispersed nature of natural resource areas and users impose institutional and financial constraints on enforcement of existing laws and regulations. Further, inadequate human resources at central and local government level make monitoring and surveillance difficult. These difficulties are exacerbated by lack of reporting of defection, non-compliance or violations by resource users or late reporting. Reasons for lack of reporting include inadequate enforcement or action by central and local authorities; and perceptions that local authorities do not deal fairly or equally with violators in response to reports. Constraints upon local authority representatives in taking action against offenders include (i) inadequate human and other resources at their disposal; (ii) the small size of communities where local authorities need active community support and participation for most island development work and activities; (iii) the

strong need for community cohesion and solidarity.

132. Stakeholder consultations with regard to conservation of biodiversity highlighted recommendations for the implementation of awareness and education programs that support a move towards voluntary compliance, increased responsibility of users for resource conservation, change in community perceptions about the role of local authorities on sanctions against violations; and increased direct monitoring by the relevant authorities.

4.2 Policy framework for biodiversity conservation and use

133. National planning is embodied in three year national development plans and other development strategies of longer durations at the macro level. National development plans include specific sections on environmental conservation while at the same time ensuring that all social and economic activities take conservation of the environment into consideration. The 6th National Development Plan, a five year plan, for the period 2001 to 2006 has been released. Sectoral master plans and regional development plans all include strong environmental conservation objectives and strategies, while all programmes and projects must carry out an EIA prior to implementation.

134. The first National Environmental Action Plan (NEAP I) of 1990 represented the first attempt at establishing and implementing a comprehensive environmental strategy that focused on addressing contemporary environmental problems and establishing mechanisms for sound environmental protection and management for the future. The principal aim of NEAP I was to assist the Government in maintaining and improving the state of the environment, and to manage its natural resources for the collective benefit and enjoyment of present and future generations (MHAHE, 1999).

135. NEAP II builds upon NEAP I and translates national plans into national goals and objectives in conservation and management of natural resources.

4.3 Institutional framework for biodiversity conservation and use

136. The two major government agencies involved in biodiversity conservation and management are the Ministry of Home Affairs, Housing and Environment, and the Ministry of Fisheries, Agriculture and Marine Resources. Other Government agencies such as the Ministry of Atolls Administration, the Ministry of Planning and National Development, the Ministry of Tourism and the Ministry of Trade and Industries have

mandates with respect to natural resource use and planning.

137. Clause 3 of the Environment Law (Law No. 4/93) empowers the Ministry of Home Affairs, Housing and Environment to formulate policies, rules and regulations with respect to protection and preservation of the environment in areas that do not already have a designated government agency mandated to act. The Fisheries Law (Law No. 5/87) empowers the Ministry of Fisheries, Agriculture and Marine Resources to conserve all living and non-living marine resources in the ocean, reef and associated territories of the Maldives. The Act relating to Uninhabited Islands (Law No. 20/89) and the Act relating to Coconut Palms and Trees of Inhabited Islands (Law No. 21/89) together empower the Ministry of Fisheries, Agriculture and Marine Resources with the mandate to conserve all terrestrial flora and living resources in the Maldives.

138. Conservation and use of terrestrial biodiversity is shared between different government agencies depending on the type or use of the island or habitat. With respect to the conservation and use of terrestrial plants and trees, the Ministry of Fisheries, Agriculture and Marine Resources is responsible for those on uninhabited islands, the Ministry of Atolls Administration is responsible for those on inhabited islands, the Male' Municipality is responsible for those on Male', and the Ministry of Tourism is responsible for those on tourist resorts. This has led to the establishment of different policies and guidelines by the different agencies for conservation and use of terrestrial plants and trees, resulting in some confusion amongst the users as to which policies or guidelines to adhere to. Hence, there is a need to ensure a cohesive single policy and guideline with respect to conservation and use of terrestrial plants and trees, although implementation may be devolved to the different agencies (Su'ood, 2000).

139. Clause 4 of the Environment Law mandates the Ministry of Home Affairs, Housing and Environment to identify areas for protection and establishment of natural reserves, and for the establishment of rules and regulations for the protection and preservation of these areas.

140. The policy environment for biodiversity conservation and use is guided by the National Commission for the Protection of the Environment (NCPE). The NCPE was established in 1989, and later restructured in 1993. Its mandate is to advise the Government on environment assessment, planning and management, and to ensure that environment protection is a vital component of all development projects. The NCPE comprises of senior officials representing relevant government agencies (MHAHE, 1999).

141. Realising the necessity of strengthening the legislative framework for conservation and sustainable management of natural resources and the environment, the Government established a task force in 1996, with the mandate to review existing national legislation with respect to environmental management, and to examine the adequacy of the legislative and institutional framework.

142. The Government is presently in the process of drafting a new fisheries law, in order to cater for more comprehensive and integrated marine resources management taking into account increased and diversified threats to marine biological diversity at present and in the future. This draft new law is expected to pass through the law making procedures and get enacted this year or early next year.

5. Article 6: National Biodiversity Strategy & Action Plan

5.1 Status of Development of the National Biodiversity Strategy and Action Plan

143. The Maldives commenced work on formulating the national biological diversity conservation strategy and action plan in 1996. This initiative was supported by project assistance from the Global Environment Facility in 1998. Activities under this project included the conduct of a comprehensive assessment of the existing information on biodiversity in the Maldives and the carrying out of a participatory strategic planning process as well as the development of priorities for action in protecting the Maldives biodiversity.

144. Extensive consultations at community level were carried out for the formulation of the NBSAP through six consultative workshops, including one amongst government agencies, atoll communities, industry, private business sector, NGOs and other stakeholders. The draft NBSAP developed from the output of these consultations was reviewed and endorsed with amendments at a national workshop in April 2001.

145. The NBSAP adopts a comprehensive approach that attempts to integrate biodiversity conservation and sustainable utilization of biological resources into all areas of national planning, development, policy and administration. The NBSAP addresses protection and conservation of special habitats and ecosystems as well as species. Emphasis is placed on capacity building, strengthening of legislative and institutional frameworks, working through participatory approaches, and improving and disseminating knowledge while building awareness and competence at community level.

146. Priority activity areas in the NBSAP include:

- Develop and adopt planning procedures and processes that take into account biodiversity conservation. (*Action 1*)
- Formulate and adopt integrated national and regional land use plans that would ensure appropriate use of natural resources, development of infrastructure, conservation of the natural environment and serve as a guideline for utilization of national resources. (*Action 2*)
- Formulate and adopt an integrated marine policy which would facilitate and catalyze actions for effective management of marine resources while strengthening inter-sectoral relationship and ensuring consistancy in policies and strategies formulated by various government institutions regarding the marine environment. (*Action 6*)

- Adopt ecologically sustainable fisheries management measures based on best scientific evidence available, to ensure the attainment of maximum economic and social benefit from the sector while conserving resources for future generations. (*Action 7*)
- Promote biodiversity conservation while maintaining high standards of quality and delivery in providing tourist experiences, through sustainable utilization of natural resources and strengthening management practices in the sector to ensure tourism development is not detrimental to the ecological integrity of the area. (*Action 9*)
- Ensure biodiversity conservation is integrated into housing, physical development activities and other landuse practices. (*Action 10*)
- Strengthen and implement national policies and regulations for ecologically sustainable use of timber resources. (*Action 11*)
- Develop and implement a national representative system of effectively managed protected areas to ensure biodiversity conservation in the natural environment. (*Action 13*)
- Strengthen conservation and management measures for coral reef ecosystems. (*Action 15*)
- Phase-out coral mining to support conservation of the reef ecosystem. (*Action 16*)
- Ensure indigenous plant genetic resources are preserved through an economically efficient and sustainable system. (*Action 17*)
- Implement management measures to conserve wetlands and mangrove ecosystems. (*Action 18*)
- Establish sanitary and phytosanitary measures necessary for conservation of biological diversity, animal and plant life, and health. (*Action 19*)
- Develop and adopt mechanisms for the protection and rehabilitation of threatened components of biological diversity. (*Action 21*)
- Ensure that adverse impacts of pollution on biological diversity are minimised. (*Action 22*)
- Develop and implement measures at national level to deal with the effects of climate change and increase efforts internationally to support mitigation of green house gases. (*Action 23*)
- Adopt suitable economic incentives according to conservation needs of the component of biological diversity being utilised. (*Action 26*)
- Strengthen the system for assessing, monitoring and forecasting the status of biological diversity. (*Action 33*)
- Conduct research and develop appropriate technology to facilitate biodiversity conservation. (*Action 34*)

- Strengthen and expand existing information dissemination systems to facilitate easy public access to information related to biodiversity. (*Action 35*)
- Spread awareness on biodiversity conservation principles, issues and methods at all levels of society including grassroots level, through formal, non-formal and adult education systems. (*Action 36*)
- Conduct regular awareness programmes for policy makers and management level officials of both public and private sectors to update them on current issues and promote integration of biodiversity conservation principles into relevant programmes. (*Action 38*)
- Review and revise existing laws and regulations relating to conservation of biological diversity and formulate regulations with provisions for implementing them. (*Action 39*)
- Expand the role of island and atoll offices in implementation of regulations related to biological resource conservation. (*Action 43*)
- Establish institutional arrangements that are facilitative, responsive and support biodiversity conservation and sustainable management of natural resources. (*Action 46*)
- Assess national human resources development needs for biodiversity conservation in relevant areas of public as well as private sectors. (*Action 48*)
- Train biodiversity professionals to develop manpower in a variety of relevant fields including natural resource planning, conservation biology, natural resource economics, bioregional management, community organisation, and marine and terrestrial ecology and taxonomy. (*Action 49*)
- Train and appoint people at atoll and island level through short term training programmes to evaluate biodiversity conservation needs and assist in implementing conservation measures. (*Action 50*)
- Allocate funds explicitly for biodiversity conservation and sustainable use from the annual budget of concerned government offices and ensure that these funds are utilized fully for that purpose. (*Action 53*)

- Develop and adopt tools and participatory techniques to enhance public involvement and strengthen user group teamwork. (*Action 62*)

5.2 Other relevant strategies, plans and programmes

147. Major planning instruments within the planning framework that will impinge upon implementation of the NBSAP are the Maldives Vision

2020, the 6th National Development Plan, NEAP II and sectoral master plans and development plans. The Maldives Vision 2020 provides the broad strategic framework for all sectors for the next 20 years, including environment. Major policies under the environment sector in the Vision 2020 focus directly on conservation of biological diversity through adoption of conservation measures in all main economic sectors, establishment of reserves and protected sites and species, promotion of conservation and sustainable use of natural resources through public awareness and bioeconomic tools.

148. Short term development strategies under the Vision 2020 will be implemented through five year national development plans. The 6th National Development Plan has just been released and addresses implementation of sectoral strategies in Vision 2020, including that of environmental conservation. Formulation of strategies and actions in both the Vision 2020 and the 6th National Development Plan were heavily influenced by the outcomes of the consultative process for the NSBAP and NEAP II. Hence, the NSBAP is an integral part of the implementation strategies for the Vision 2020. All areas of national development planning and administration will incorporate the principles of biodiversity conservation in the NBSAP and its strategic action components.

5.3 Measures to stimulate and promote equitable sharing of benefits of biodiversity use

149. Equitable sharing of the benefits from biodiversity use is stressed in the vision of the NBSAP. "[a] nation which appreciates the true value of the natural environment, utilises its natural resources in a sustainable manner for national development, conserves its biological diversity, shares equitably the benefits from its biological resources, has built the capacity to learn about its natural environment and leaves a healthy natural environment for future generations".

150. Guiding principles of the NBSAP highlight the ways in which such equitable sharing will be achieved. These principles include:

- benefits derived from the use of biological resources shall be equitably shared;
- while government policies and plans will form the basis for biodiversity conservation, community participation is vital for implementing conservation measures;
- all Maldivians will be provided with opportunities to understand and appreciate biodiversity and to participate in decisions regarding the allocation, conservation and sustainable use of biological resources, especially those that affect them directly;

- those responsible for making and implementing decisions relating to biological diversity will be accountable to the public for their actions through explicit and transparent processes;

- decisions regarding policies, plans and projects will be guided by economic approaches which assess the full social and environmental costs and benefits.

151. Important specific measures contained in the NBSAP to stimulate and promote the equitable sharing of benefits of biodiversity use include devolution of management and decision-making authority through the establishment of community based property rights systems, marine tenure, establishment of co-management systems for resource management, and the use of participatory approaches in biodiversity conservation.

5.4 Challenges in the implementation of the NBSAP

152. While both the Vision 2020 and the NBSAP were developed through a wide consultative process, national planning and decision making is primarily top down in the country. Hence, one of the challenges for the implementation of the NBSAP will be the development, and the integration into the planning and decision-making process, a participatory approach that is efficient and appropriate to local conditions.

153. Anticipated constraints in the implementation of the NBSAP include inadequate institutional capacity, gaps and weaknesses in the institutional framework, and at the local government and community levels. Hence, the success of capacity building initiatives and community mobilization efforts will be determinants of the success and sustainability of actions under the NBSAP.

154. The NBSAP identifies and addresses numerous gaps and inadequacies in the existing regulatory framework for biodiversity conservation. A fundamental weakness of existing systems is the dependence on external enforcement of compliance by designated government authorities through monitoring and surveillance. However, institutional, financial and human resource constraints make such enforcement prohibitive. The lack of financial and technical capabilities to carry out the required monitoring and surveillance by the authorities limit their enforcement capacity, thereby resulting in high rates of non-compliance. Hence, in order to achieve its objectives, voluntary compliance based regulatory systems need to be implemented as priority activities under the NBSAP.

6. Article 7: Identification and Monitoring

155. As noted previously, no comprehensive survey has been done to identify the full scope of the marine and terrestrial biodiversity of the Maldives. However, several isolated studies have been carried out to identify certain types of species, and to provide listings of biodiversity in specified habitats and areas. As such, more cohesive identification, listing and monitoring programmes have been carried out with respect to the marine biodiversity of the country. However, current studies mainly concentrate on commercially exploited or useful marine flora and fauna. Several activities that support implementation of the NBSAP are ongoing and will be expanded under the NBSAP. These are discussed below.

156. The earliest known biological survey reports using modern scientific methods were from the J. S. Gardiner Expedition (1899 – 1900). Scientific reports from this expedition covered both marine and terrestrial biodiversity, but were concentrated primarily on biodiversity in the southern region of the Maldives. This expedition was the first extensive botanical journey through the archipelago and is the primary source of botanical information on the Maldives.

157. Of the ecosystems under potential threat from resource use and habitat loss and degradation, the Marine Research Centre has tested and adopted rapid assessment approaches appropriate for assessing and monitoring the biological diversity of reefs and reef ecosystems. Under the GCRMN programme, the MRC continues to monitor 14 transects of different reefs across the archipelago. Further activities are planned for 4-5 pilot sites for comprehensive socio-economic and bio-physical monitoring activity by local institutions. The introduction of GIS program to facilitate data analysis and use at all levels including at decision making level is presently underway. Outputs from these activities will be replicated in other atolls over time, leading to a national system of coral reef monitoring. (NBSAP Action 15).

158. In addition to this, the Ministry of Fisheries, Agriculture and Marine Resources (MOFAMR) together with its research arm, the MRC, has ongoing programmes to develop an inventory and full listing of the fish species in Maldivian waters. These programmes are implemented through collaborative research with regional and international research partners. (NBSAP Action 34).

159. The Ministry of Home Affairs, Housing and Environment is developing a listing of the biological diversity of bird species of the country. It has completed a partial listing, in which it has identified 5 endemic sub-species and 18 bird species as under threat from species loss and habitat loss and degradation. These species have been declared protected from capture. (NBSAP Action 14).

160. With respect to the major marine species utilized commercially in the Maldives, the Maldives has a total enumeration system of reporting to the MOFAMR, supported by sampling programmes that undertake stock assessment, structure and changes in stock levels. The Maldivian database is renowned regionally for being one of the longest duration and comprehensive resource use databases in the region. In response to changes in marine resource use and activities that may have significant adverse impacts on marine biological diversity, the Ministry also has a monitoring system established for monitoring of reef species utilization, especially grouper species. However, this latter system needs to be strengthened through awareness building and education of the public and private sector, supported by monitoring and analysis of data collected. (NBSAP Action 33).

161. The Ministry of Home Affairs, Housing and Environment has laid the foundations of a GIS database to maintain and organize data on biological diversity and natural resource use. This database is supported by the comprehensive database on marine resource use in the Ministry of Fisheries, Agriculture and Marine Resources. Maintenance and upgrading of both databases and the software and hardware used are required in order to complement the increased monitoring activities under the NBSAP. This will be addressed to some extent in the GEF Coral Reefs Project PDF B phase. However, greater assistance will be required to build up the GIS database and to establish a network amongst the different government agencies to utilize and feed into this database. (NBSAP Action 33).

7. Article 8: In-Situ Conservation

162. The Maldives is world-renowned for its fragile and well protected marine biological diversity, especially its coral reefs and reef ecosystems. The legislative framework for this is provided by strong environmental principles and policies in the Environment Protection and Preservation Act of the Maldives (Law No. 4/93).

163. Conservation strategies used by the Maldives include the establishment of protected terrestrial and marine areas for habitat conservation and in situ conservation of species. This is supported by species based conservation strategies that include establishment of protected species lists, integrated education campaigns and participatory approaches to conservation.

7.1 Resource Conservation through Protected Areas Systems

164. Clause 4 of the Environment Law (Law No. 4/93) empowers the Ministry of Home Affairs, Housing and Environment with the authority to designate and manage protected areas and reserves, including the establishment of management rules and regulations systems for the protection and preservation of these sites. Such action may be taken with their own diligence, or upon the request of other parties.

165. The first such action was taken by the Environment Ministry on 1 October 1995 when it designated 15 sites as protected sites. The normal procedure for officially declaring a marine area as a protected site has been nomination of the site by interested parties, followed by community consultation and intra-government consultation and endorsement. However, the level of community consultation to date has been limited. Beginning with the declaration of 15 protected dive sites by the Ministry in 1995, these have increased to 25 by October 1999 distributed in 10 atolls (see Table 1). Amongst these, Male' Atoll (North) has the highest percentage of total marine area (outside island lagoons) officially declared as protected sites.

Table 9. Marine areas designated as protected sites.

ATOLL	SITE	ESTABLISHED
Raa	*Villingillee Thila*	21 October 1999
Baa	*Dhigali Haa / Horubadhoo Thila*	21 October 1999
Lhaviyani	*Fusheevaru Thila*	1 October 1995
	Kuredhdhoo Kan'du-olhi	21 October 1999
Male'	*Makunudhoo Kan'du-olhi*	1 October 1995
	Rasfari and house reef	
	Than'burudhoo Thila	
	Gaathu giri / Adhdhashugiri	
	Giraavaru Kuda Haa	
	Dhekunu Thilafalhuge Miyaruvani	
	Gulhufalhu/ Kohavaanee	
	En'boodhoo Kan'du-olhi	
	Guraidhoo Kan'du-olhi	
	Lankan Thila	21 October 1999
North Ari	*Maayaa Thila*	1 October 1995
	Orimas Thila	
	Mushimasmigili Thila	
	Karibeyru Thila	21 October 1999
South Ari	*Kuda Rah Thila*	1 October 1995
	Faruhuruvalhi Beyru	21 October 1999
Vaavu	*Miyaru Kan'du*	1 October 1995
	Vattaru Kan'du	21 October 1999
Meemu	*Lhazikuraadee*	21 October 1999
Faafu	*Filitheyo Kan'du*	21 October 1999
Dhaalu	*Fushi Kan'du*	21 October 1999

Data source: *Ministry of Home Affairs, Housing and Environment*.

166. The Government has also designated two terrestrial sites as protected sites. These are A.Dh. Hurasdhoo, G.A. Hithaadhoo.

167. As Hameed (2000) concludes, based on the lessons from past experience with protected areas management in the Maldives, future attempts at marine resources management in the Maldives need to undertake a participatory decision-making approach aiming at resolving consultative and collaborative resolution of exclusion, coordination and compliance dilemmas. Sustainable management of common property resources such as the marine resources of the Maldives will only be viable with the involvement of the different groups of resource users in a collaborative arrangement (Hameed, 2000).

168. The Government is at present attempting to develop and implement a successful system of protected areas management based on participatory and co-management by the government and local communities through the Maldives Protected Areas System project funded by AusAid. The project was started in 2000. Deliverables from the project include a cohort of trained Male'-based and atoll-based government staff and

community groups in protected areas management systems, and three model systems based on participatory and co-management approaches.

169. The ongoing Integrated Reef Resources Management (IRRM) programme operated by the Marine Research Centre (MRC) is also expected to deliver appropriate methodologies and a trailed system of integrated reef resource management, while training central and community management staff. Recommendations from programme activities to date include the establishment of interactive educational centres in each atoll where data on activities can be monitored and accessed, and that will serve as environmental education centres.

7.1 Resource Conservation through Species-based Management Measures

170. In addition to the use of protected areas systems, the Maldives has adopted a species based approach to conservation of terrestrial and marine resource biological diversity (NBSAP Action 14). A number of marine species are protected in the Maldives under the Fisheries Law (5/97) of the Maldives, by the Ministry of Fisheries, Agriculture and Marine Resources (see Table 10 below).

Table 10. Marine species protected by the Government.

English name	Maldivian name	Scientific name
Dolphin	Koamas	*family- Delphinidae*
Napolean Wrasse	Maahulhunbu landaa	*Cheilinus undulatus*
Whales	Bodu mas	
Whale shark	Fehurihi	*Rhincodon typus*
Lobster	Ihi	
Turtles	Velaa, Kahanbu	*family- Chelonidae*
Giant clam	Gaa haka	*family-Tridacnidae*
Triton shells	Sangu	*Charonia tritonis*
Black coral	Endheri	*family-Antipathidea*

171. The Fisheries Ministry also bans the export of a number of marine species and their products arising from concerns of degradation of biological diversity due to over harvesting for commercial purposes (see Table 11 below).

Table 11. Marine products prohibited for export from the Maldives.

English name	Maldivian name	Scientific name
Dolphin species	Koamas	*family- Delphinidae*
Napolean Wrasse	Maahulhunbu lan'daa	*Cheilinus undulatus*
Parrot fish	Lan'daa	
Puffer fish	Koli	
Bigeye scad (under 6")	Mushimas (under 6")	
Baitfish used in pole and line tuna fishery	En'	
Whales	Bodu mas	
Whale sharks	Fehuruhi	*Rhincodon typus*
Lobsters and lobster meat	Ihi, ihi mas	
Turtles and their products of any nature	Velaa, Kahanbu	*family- Chelonidae*
Skates and rays	Madi	
Eels	Ven	
Triton shells	Sangu	*Charonia tritonis*
Trochus shells	Gonu foo e'nburi	
All pearl oysters	Ithaa	
All stony coral excluding organ pipe coral	Hiri, gaa, muraka	
Black coral and all products of black coral	Endheri	*family-Antipathidea*

Source: Ministry of Fisheries, Agriculture and Marine Resources.

7.3 Terrestrial Plant biodiversity

172. Terrestrial plant biodiversity is protected under regulations established under the Law on Uninhabited Islands. Timber on uninhabited islands may only be logged after obtaining the written permission of the Agriculture Ministry, and in the presence of a local government official and the party entrusted with the management of the island. In compensation for each coconut palm tree felled in such manner, the permit holder shall replant two palms in a place designated by the Agriculture Ministry. In the case of other plant and tree species, each unit felled shall be replaced by another.

173. Terrestrial vegetation on inhabited islands except Male' come under the jurisdiction of the Ministry of Atolls Administration, in accordance with Law No. 21/89. Agricultural biodiversity on land other than private land must be conserved and maintained in accordance with regulations established by the Atolls Ministry. The felling of trees and plants, except

those protected by the Agriculture Ministry, on such land must be done in accordance with the advice of the Agriculture Ministry, and procedures established by the Atolls Ministry. Further, the pruning of such trees for firewood must follow the advice of the Agriculture Ministry and prior permit from the island office.. The law also dictates allowed practices with respect to such trees and plants. Violation of these allowed practices shall result in a fine not exceeding Rf. 5,000, or banishment or house arrest.

174. A further directive by the Agriculture Ministry in 5 February 1998 (Directive No. FA-E-2/29/98/06) places a moratorium on the harvest of certain plant and tree species on inhabited and uninhabited islands, except with the prior written consent of the Ministry (see Table 12).

Table 12. Tree and plant species in the Maldives that require permits for felling.

English name	Maldivian name	Scientific name
Beef wood /casuarina	Fithuroanu gas	*Casavarina equisetifolia*
Rubber plant	Rabaru gas	*Ficus elastica*
Jack fruit	Sakkeyo gas	*Artocarpus intergrifolia*
Burmese rosewood	Ofielhey gas	*Pterocarpus indiccus*
Tecoma	Madimas vakaru gas	*Tecoma spp.*
Teak	Haivakaru gas	*Tectona grandis*
Sapodilla plum	Sabudheli gas	*Acharas sapota*
Rose gum, Eucalyptus	Bodu Aavi gas	*Eucalypta grandis*
Ebony tree	Kalhuvakaru gas	*Diospyros ebenum*
Mango	An'bu gas	*Mangifera indica*
Golden apple	Jahaamuguri gas	*Aegle marmelos*
Cashew nut	Kaju gas (Furedhikaalu gas)	*Anacardium Occidentale*
Asoka	Asokaa gas	*Polythia longifolia*
Acacia	Ekeysiaa gas	*Acacia auriculiformis*
Flame of the forest	Bodu gas	*Delonix regia*
Norfolk Island pine tree	Thurravaas gas	*Araucaria heterophylla*
Rain tree	Reethi gas	*Samanea Saman*
Gamboge tree	An'bihi gas	*Garcinia Cambogia*
Nut gall / Chebulic myrobalans	Arolhi gas	*Terminalia Chebula*
Beleric myrobalan	Burolhi gas	*Terminalia bellerica*

Source: Ministry of Fisheries, Agriculture and Marine Resources.

175. Under Law No. 21/89, the Agriculture Ministry has the mandate to declare as protected, trees and plants over 50 years of age which are in danger or under threat of extinction in the Maldives, and to establish rules and regulations for the protection and preservation of such trees and plants. These activities are already being implemented and will be strengthened under the NBSAP (NBSAP Actions 12 and 17).

7.4 Degraded biodiversity

176. The Government already has programmes in place for rehabilitation and restoration of agricultural biodiversity. Under the NBSAP, a program will be implemented for the rehabilitation of degraded areas such as wetlands and mangrove areas (NBSAP Action 18). Activities under the NBSAP include setting aside representative areas of wetlands and mangrove ecosystems for biodiversity conservation; and undertake restoration programs for ecologically important wetlands and mangrove ecosystems that are endangered.

8. Article 9: Ex-Situ Conservation

177. At present, the Maldives does not have a programme of ex-situ conservation of components of biological diversity as the necessary expenses are prohibitive in relation to financial and human resources required. The existing legal framework for environmental protection, preservation and conservation does not identify such measures.

178. However, the NEAP II and the NBSAP both identify ex-situ conservation measures for conservation of biodiversity, especially terrestrial biodiversity. The NBSAP envisages ex-situ conservation through collaborative action with regional centres (NBSAP Action 17). Its strategies include ensuring that indigenous plant genetic resources are preserved through an economically efficient and sustainable system and through activities to:

- Identify, inventory and assess threats to endemic plant species;
- Develop cooperation with regional and international centres of gene banks for the ex-situ conservation of plant genetic resources, recognizing that states have sovereign rights over their own plant genetic resources;
- Establish botanical gardens and national parks to conserve vegetatively propagated plants and threatened species;
- Conduct research to develop improved methods of conservation of plant genetic resources, in particular low-cost techniques appropriate to local operating conditions and encourage and support farmers to grow distinct local varieties of food crops, to ensure biodiversity conservation through traditional practices;
- Educate the public of the value of plant genetic resources for their livelihood and thereby importance of conservation of this resource;
- Encourage the public to grow indigenous plant species in home gardens and public areas such as mosques, schools, graveyards etc.; and
- Promote development of traditional medicinal practices and assist the public to grow traditional medicinal plants.

179. Such programmes will require external assistance for effective implementation and for human resource development through such actions as those identified under NBSAP Goal 2 ("Build capacity for biodiversity conservation through a strong governance framework, and improved knowledge and understanding").

9. Article 10: Sustainable Use of Components

180. The national strategies in sustainable use of components of biological diversity are stated in the Second National Environment Action Plan (NEAP II) whose aim is to: "*protect and preserve the environment of the Maldives, and to sustainably manage its resources for the collective benefit and enjoyment of present and future generations*" (MHAHE, 1999).

181. Ongoing activities under the main strategies of NEAP II that are focused on sustainable use of biodiversity components include:

- continuous assessment of the state of the environment in the Maldives, including the impacts of human activities on land, atmosphere, freshwater, lagoons, reefs and the ocean; and the effects of these activities on human well being; and

- development and implementation of management methods suited to the natural and social environment of the Maldives, and maintain or enhance environmental quality and protect human health, while at the same time utilizing resources on a sustainable basis.

182. NEAP II is implemented through incorporation at the macro level into the major planning document of the Maldives, the Vision 2020. This is translated into medium term activities under the five year national development plan and economic strategy. Sectoral annual plans and master plans implement programmes and projects under these national planning strategies.

183. The present national development plan, the 5th NDP, emphasizes sustained social and economic development through wise use of its natural resource base. The 6th NDP has recently been endorsed by the Maldivian cabinet and the Economic Strategy Phase I is presently being completed. The Economic Strategy document stresses the need for conservation and sustainable use of natural resources in economic development. It recommends the continuation of the strong conservation based development approach of the Maldives in its major economic sectors, fisheries and tourism.

10. Article 11: Incentive Measures

184. While the terrestrial resource base of the Maldives is under various tenure systems, the marine resource base is primarily under a common property regime. Hence, various incentive measures are needed to promote the conservation and sustainable use of components of marine biological diversity.

185. In addition to this, national legislation and regulatory measures define criteria and measures that must be applied to ensure sustainable use of such resources. These are supported by national legislation and economic policies as discussed in previous sections. Regeneration and rehabilitation measures are made mandatory in return for use of certain species of terrestrial flora. Protected area management and species conservation measures are implemented, and supported through incentive measures such as nature-based tourism and sustainable fisheries programmes.

186. With respect to a few marine species whose stock may be low, incentive measures include assignment of market values to the species through catch and export quota systems. Species for which quota systems are used include target species for the live aquarium fish fishery, and yellowfin and bigeye tuna. Offshore foreign fisheries are also controlled through assigned total allowable catch, and imposition of royalty by volume of tuna caught.

187. Valuation systems are being developed for coral reefs, in order to promote conservation and sustainable use through incentive measures based on the users pay principle.

188. Biological diversity considerations are incorporated into impact assessments as a step in design and implementation of incentive measures. The mandatory EIA requirement for all major development projects ensures that environmental costs are included in project costs and operations. Strategies under the NBSAP are targeted to ensure that SEIAs are more fully integrated into cost-benefit analysis for development initiatives.

189. In addition, strategies under the NBSAP include the development of valuation systems for ecologically and socially important components of biodiversity through appropriate monetary valuation methods. Biodiversity valuation will be utilized within feasibility studies, including cost benefit analyses, for all infrastructure and development projects, and economic activities. In addition, NBSAP activities will include the development of a natural resources account incorporating biodiversity values, that complements standard national income accounts, to reflect costs of ecosystem degradation, loss of species and genetic diversity and

resource depletion. In addition to export and catch quotas, tradable permits to promote economically efficient and sustainable utilisation of resources will be introduced. Conservation and sustainable use will be promoted through initiatives to promote optimal economic benefit from utilization of biological resources through improved processing and efficient marketing. A key objective will be to ensure that economic instruments (e.g. licenses, quotas, taxes etc.) utilised in biological resource use promote equitable distribution of benefits from the use of biological resources and do not favour other nationalities over Maldivians.

190. In order to implement the appropriate incentive measures and actions under the NBSAP, and to promote private sector initiative in this regard, training and capacity building programs will be required in this field.

11. Article 12: Research and Training

191. The Maldives has carried out various short and medium term research programmes into biological diversity in the country through external funding and in collaboration with external research institutes. The primary focus has been marine research and is supported by two research centres, the Marine Research Centre and the Environment Research Centre.

192. The Marine Research Centre (MRC) is the lead agency for marine research in the Maldives. The MRC was established in 1984 as the Marine Research Section of the Ministry of Fisheries and Agriculture. At present it operates autonomously under policy guidelines established by the Ministry of Fisheries, Agriculture, and Marine Resources. The mandate of the MRC includes the mandate to plan, coordinate and conduct scientific research on marine resources of the country; to undertake marine research for the conservation, enhancement and management of the marine environment in general and for fisheries exploitation in particular; disseminate knowledge to the government and public in order to increase awareness of the marine environment; to study ways and means that will increase the fisheries sector's contribution to the economy of the country; to conduct resource surveys; to establish and maintain a database, holding data as well as scientific information on marine resources; to undertake research on technological innovations to promote rational utilisation of marine resources, and to introduce these technologies to the fishing industry; to publish research findings and reference materials in order to increase public awareness of the marine environment; and to undertake research on rational utilisation of reefs and reef resources.

193. The MRC has undertaken various research that ranges from basic cataloguing of fish species in the Maldives, to a substantive analysis of the tuna resource. Since its inception, the research activities of MRC have focused on research that have relevance to the development and management of marine resources while also generating important understandings, which contribute to conserving the health of the marine environment. Its various research programs include inshore and offshore research, species research and reef ecosystems research. While the Centre's research activities programs have been funded by the national budget and various multilateral, bilateral and individual development agencies, the drying up external financing for marine research in recent years has greatly constricted the scope of activities of the Centre.

194. The Environment Research Centre (ERC) was established in 1991. Presently active under the Ministry of Home Affairs, Housing and Environment, the mandate of the ERC includes to plan and implement coastal protection measures; to undertake work on biodiversity conservation; to analyze atmospheric and climate related data; to assess impacts of developmental activities on the coastal zone; to conduct relevant mapping using aerial photography and develop geographical information and data systems and to provide training, education/public awareness in relevant environment-related areas.

195. In addition to this, research on plant and terrestrial species are also carried out under the Agriculture Section of the Ministry of Fisheries, Agriculture and Marine Resources.

196. However, the state of knowledge of components of terrestrial and marine biodiversity in the Maldives is scarce due to inadequate numbers of trained and technical staff and financial resources to undertake surveys of biological diversity. The few trained and technical staff available are not adequately deployed nor their technical skills made use to the best ability due to shortage of general staff and hence their employment in administrative and technical jobs.

197. Research and training in environment and biodiversity conservation is primarily regarded as a function of state agencies. Hence, in addition to low funding and other demands on staff time, relatively low wages mean that the turnover of trained staff is high. Research programmes tend to suffer and lack sustainability as there is a continual need for new staff to be adequately trained in scientific research methods and techniques.

198. Training institutes in the country are primarily geared to support social sectors such as health and education, followed by designated institutes for tourism, maritime and engineering fields. Thus, technical training for biodiversity research and conservation is unavailable in the country, leading to a dependence on government funded opportunities overseas.

199. Various in-house training in research methods and skills are carried out within research and conservation oriented programmes and projects. However, the sustainability of such programmes is greatly diminished by the inability to develop and build on these skills once a particular programme is over.

200. Integrated planning and programme development in research to support biodiversity conservation is need as a first step in addressing the above gaps and weaknesses in active and sustainable research to understand the natural environment. Given the fragile and vulnerable ecosystems of the Maldives as a small island state, such action is urgently needed in order to ensure that the rapid economic development of the

country follows a path of sustainable development. Existing research institutes need to be strengthened in terms of financial, management and research capabilities.

201. Further investments into human resource development in natural sciences and applied research are required to increase the pool of human resource available to support biodiversity conservation.

12. Article 13: Public Education and Awareness

202. The Ministry of Home Affairs, Housing and Environment, the Ministry of Fisheries, Agriculture and Marine Resources, the Marine Research Centre, the Environment Research Centre and several NGOs have been active in conducting public education and awareness programmes to promote conservation of the environment. Activities include use of print, and electronic media to promote awareness, supported by rural mobilization through workshops conducted by mobile teams.

203. In addition, resource materials are developed in collaboration with the Ministry of Education for use within schools at various levels. Environmental Studies has been a primary school compulsory subject since 1984. In addition, environmental conservation and sustainable use concepts and activities are incorporated into Practical Arts subject taught at primary school level. At secondary school level, Fisheries Science is offered as an optional subject that can be studied up to University of London GCE Ordinary Level Examinations.

204. Extension and awareness campaigns held in rural communities have contributed a lot towards raising public awareness of environmentally damaging activities, and instilling conservation and sustainable use values into rural and urban livelihood strategies. The Ministry of Fisheries, Agriculture and Marine Resources has two dedicated units to run extension programs to promote sustainable development of fisheries and agriculture.

205. At the national level, the Maldives undertakes national programmes to mark World Environment Day annually, the Year of Oceans, the Year of the Coral Reefs, and for species based conservation, campaigns such as the Save our Turtles programme. Such collaborative activities to raise environmental awareness and conservation principles by government agencies are supported in these ventures by environmental and social NGOs, and by print and broadcast media.

206. Public awareness and education needs must be addressed if biodiversity conservation and sustainable use is to be achieved. The NBSAP identifies capacity building as one of the core areas that requires urgent action for implementing biodiversity conservation measures. Strategies and actions for capacity building through increased knowledge and understanding, institutional strengthening, human resource development and financing mechanisms, identified in the NBSAP include strategies to:

- Improve knowledge and understanding of biological diversity and resource management to promote conservation and sustainable use of biodiversity (NBSAP Actions 33 and 34);

- Strengthen and expand existing information dissemination systems to facilitate easy public access to information related to biodiversity (NBSAP Action 35);

- Spread awareness on biodiversity conservation principles issues, and methods at all levels of society including grassroots level, through formal and non-formal and adult education systems (NBSAP Action 36);

- Utilise popular culture to heighten awareness on biodiversity conservation (NBSAP Action 37);

- Conduct regular awareness programs for policy makers and management level officials of both the public and private sectors to update them on current issues and promote integration of biodiversity conservation principles into relevant programs (NBSAP Action 38); and

- Develop and increase human resources to plan and implement biodiversity conservation measures and assess conservation needs (NBSAP Actions 48 – 52).

13. Article 14: Impact Assessment and Minimising Adverse Impacts

207. Clause 5 of the Environment Law makes environment impact assessment (EIA) mandatory for all new projects in the Maldives. An EIA must be submitted to the Ministry of Home Affairs, Housing and Environment prior to starting any development project that may have an impact on the environment. EIA guidelines and procedures were established by the Government in December 1994.

208. The mandatory EIA requirement is applied by the Environment Ministry to all development projects and economic sector investments by both private and public sectors.

209. However, gaps exist in the existing EIA system, specifically in terms of EIA auditing, monitoring of mitigation measures, and ensuring community participation at all stages of the EIA process. Under NEAP II, the Government is working on strengthening the national EIA process. The NBSAP calls for review and strengthening of the EIA process to provide for mitigating the possible adverse environmental impacts of policies, programs, and projects in order to ensure conservation and sustainable use of marine resources (NBSAP Action 3). Specific actions in NBSAP include development of appropriate valuation methodologies, techniques and baseline criteria for components of biological diversity such as endangered species, keystone species and critical habitats, so that these can be used in completing EIAs; strengthening the monitoring process of environmental impacts stated in EIAs to improve environmental management, and providing the opportunity for public participation from the early stages of the EIA study and allow them to raise concerns and objections before final decisions have been made including the project site selection.

14. Article 15: Access to Genetic Resources

210. Access to genetic resources of the Maldives are at present only regulated with respect to marine resources. The Fisheries Law (Law No. 5/87) stipulates that no marine research activity can be undertaken without the prior written consent of the Ministry of Fisheries, Agriculture and Marine Resources (MOFAMR). This provision is implemented through the Marine Research Regulation of MOFAMR. Proposed marine research projects and access to genetic resources is approved after analysis and recommendation by a multi-agency committee, the Marine Research Evaluation Committee, chaired by MOFAMR.

211. The Marine Research Regulation stipulates conditions for access for research into marine genetic resources. Benefit sharing mechanisms for the use of marine resources for research have been developed and imposed by MOFAMR on an *ad hoc* basis. Hence, while some research programmes have resulted in benefits to the country, many programmes have been carried out and components of Maldivian biodiversity exported without legally binding agreements with the Government for equitable benefit sharing measures on the use of the country's genetic resources. Furthermore, end of research results are rarely made available to the public or non-government parties. This is a gap that must be addressed through the management framework.

212. Presently, there is no established legal framework for intellectual property rights protection in the Maldives. Therefore, in order to provide protection for intellectual property rights (IPR) associated with biological diversity, new legislation and regulations must be established, or related legislation and regulations must be revised to incorporate protection for IP rights. Intellectual property rights (IPR) associated with biological diversity such as biotechnology, ethno-biological knowledge need to be protected by incorporating suitable concepts of IPR protection in existing laws and regulations or by establishing new laws and regulations. These need to address gaps in existing categories of copyright protection and patenting that would not be able to protect such knowledge. At the same time, the regulatory regime must allow for access and equitable sharing of such IP knowledge, and facilitate transfer of technology and capacity building.

213. Under the NBSAP (Actions 44 and 45), strategies have been recommended to establish regulations for access to both terrestrial and marine genetic resources, and the mechanisms for equitable benefit sharing measures for communities for the use of their resources. Activities would include strengthening system for screening research proposals made by foreign and entering into contract with parties whose research proposals are accepted, so that IPR are protected; monitoring

the activities of parties who have been awarded contracts to use such material; introduce appropriate legislation setting out terms of access to genetic materials of/in the Maldives to control access to genetic resources and ensure that Maldivians gets their fair share of any benefits derived from the utilization of these resources; establishing appropriate forms of IPR protection to ensure that local/indigenous knowledge about living organisms and their use are protected.

15. Article 16: Access to and Transfer of Technology

214. The Maldives has not been able to implement its obligations to provide access to and transfer of technology to other contracting parties given the lack of technical knowledge within the country. Neither has the Maldives been able to take advantage of this provision from other Contracting Parties, due to a lack of cohesive policy and administrative and regulatory measures to regulate access to its genetic resources.

215. As identified in the preceding chapter, the strategies will be adopted under the NBSAP (Actions 44 and 45) to take legislative, administrative or policy measures with the aim of sharing in a fair and equitable way the results of research and development and benefits arising from the commercial and other utilization of genetic resources.

16. Institutional Capacity, Partnership & Collaboration

216. At present, there is inadequate institutional capacity within the relevant agencies to implement the required activities to ensure conservation and sustainable use of biodiversity using participatory approaches. Weaknesses include inadequate human resources, lack of trained technical expertise, financial constraints and poor organizational, administrative and management regimes. The dearth of information regarding the problems, issues, constraints, and appropriate methodologies in sustainable use and conservation of biodiversity is another constraint. While various studies, strategies, and plans have identified the problems, issues and constraints, and some, given the multi-sectoral nature of conservation and management of biological resources, these studies are silent on 'how to' integrate sectors, institutions, capacities, and participatory community-based approaches. Moreover, there are no studies that quantify the impacts of environmental mismanagement to the biological potential and long term sustainability of components of biological diversity of the country, and on the poor rural communities whose livelihood is dependent upon these resources. While quantitative data about the biological diversity of these resources are available, they are inadequate, scattered, and unreliable, and mostly outdated.

217. Overall institutional capacity of the country is further constrained by the existence of a large number of institutions mandated with the sustainable use, development and conservation of terrestrial and marine resources. While the mandates for terrestrial and marine resource conservation and use are shared by different agencies such as the Ministry of Fisheries, Agriculture and Marine Resources, the Ministry of Atolls Administration and the Ministry of Tourism, coordination among these agencies on policies, strategies and programmes needs to be strengthened. There are existing gaps in the institutional structure such as inadequate formal and non-formal vertical and horizontal linkages and mechanisms for coordinating policies, strategies and actions with respect to shared mandates over resource systems. Harmonization of policies and regulatory framework with respect to the resource systems is required. Institutional indifference consequent to ambiguity of their jurisdictions, results in user conflicts and lack of timely action, which if continued unabated, may lead to degradation of biological resources and loss of species, habitat, and ecosystem biodiversity.

218. The implementation of most government activities in the past, including environmental conservation and sustainable use, typically involved community participation only at formal consultation level during implementation stages. NGO participation was also typically limited to consultation at implementation level, except on specific projects. However, this situation is gradually changing with greater stakeholder

consultation and input at inception stages, and with feedback mechanisms into policy and decision-making. This is currently more the norm than the exception in rural development programmes and in conservation and resource use projects. However, gaps still exist in arrangements and procedural requirements for stakeholder consultation.

219. These gaps and inadequacies in partnership and collaboration within Government and between government and communities and NGOs will be addressed through the NBSAP in relation to biodiversity conservation. The NBSAP strongly advocates a bottom up approach to biodiversity conservation and sustainable use. Hence, extensive and directed input will be required to establish the skilled human resource base required for implementation of the strategies and action plans discussed in NEAP II and the NBSAP, and their implementation programmes (NBSAP Actions 48 – 52).

220. Three collaborative projects currently being implemented include activities to strengthen partnerships and collaboration between Government agencies, communities and NGOs. These projects are the GEF Coral Reef Biodiversity Project (currently in PDF-B phase), the ADB RETA project on coastal and marine resources use and poverty alleviation in South Asia, and Maldives Protected Areas System Project. Components of these projects are aimed at revising and streamlining the division of responsibilities amongst various agencies, establishment of regular and formal mechanisms for collaborative decision making, establishment of procedures and methodologies for NGO and community participation at all stages of decision making.

221. A facilitative and capable institutional environment needs to be established to ensure that biodiversity conservation and sustainable resource management goals and objectives are achieved. This would include establishment of institutional arrangements that are facilitative, responsive and support biodiversity conservation and sustainable management of natural resources (NBSAP Action 46).

222. Activities under this would include:

- conduct an institutional capacity analysis of existing institutions and organizations in order to identify their strengths, weaknesses, synergies, conflicts and gaps in relation to biodiversity conservation and sustainable management of natural resources. In doing so, assessment must be made of the institutional capacity gaps in the national or sectoral policy environment, laws and regulations; institutional mandates and inter-institutional relationships; the internal organization (distribution of functions, internal organization and management, physical and financial capacity); skills, expertise,

information (in relation to the tasks to be performed); financial resources and mechanisms available to the respective institutions; and the quality of their response to issues related to biodiversity conservation and sustainable management of natural resources.

- a review and restructuring of overall institutional framework for resource management, use and conservation need to be undertaken that takes into account the identified institutional capacity gaps; provides clear institutional mandates that complement each other; ensures inter-agency co-ordination and collaborative partnerships; and optimises the use of available institutional, financial and human resource capacities.

- Establish effective channels of communication and co-ordination between institutions to ensure information sharing and transfer; joint education and training (where appropriate); learning from policy experience; and joint project and policy monitoring and evaluation.

223. In addition, there is an urgent need to undertake institutional strengthening and capacity building to facilitate, provide timely response, and support biodiversity conservation and sustainable management of natural resources (NBSAP Action 47). Activities under this, inter alia, must:

- Formulate an institutional development strategy for each line institution aimed at overcoming any identified deficiencies and institutional capacity gaps in the distribution of functions, internal organization, and management, physical and financial capacity of the institution with respect to biodiversity conservation;

- Adopt an equitable and efficient decision-making process that is informed by stakeholder input and utilizes best available knowledge;

- Provide education and training to build skills and expertise on participatory management and regulation, integrated natural resource management, conflict resolution, institutional supervision, ability to implement economic policy instruments strategically;

- Establish financing mechanisms for fulfilling institutional functions and build capacity for revenue management;

- Implement public sector investments that support biodiversity conservation and sustainable management of natural resources.

224. With respect to regional and international programmes, the Maldives has working partnerships with regional countries for conservation and sustainable use of biodiversity components through collaborative initiatives under the Regional Seas Programme, SACEP, the BOBP and its current interim phase towards the establishment of an Inter-Governmental Organization, GCRMN.

17. Financial Mechanisms

225. Financial support for the implementation of the objectives of the CBD provided by the national budget has increased over the years. However, given budgetary constraints in an small island developing economy such as the Maldives, the various demands for development programs especially rural development, funding is limited for relatively many activities, including for biodiversity conservation. There is hence an urgent need to support domestically funded initiatives for biodiversity conservation, with external donor assistance. This is especially important given the major development projects currently underway, in order to ensure that such development takes into account biodiversity conservation and sustainable use of the natural environment.

226. Domestic funding for biodiversity conservation is supported to some extent by various externally funded conservation programmes and other overseas funded programmes such as those discussed in preceding sections of this report. These programmes include the Maldives Protected Areas System project, the GCRMN, the IRRM programme, the GEF Coral Reefs Project, the Southern Atolls Development Project, various IDA projects and initiatives for sustainable agriculture, fisheries and tourism development. However, these projects are also limited in scope of activities and geographical coverage due to funding constraints. Thus, their sustainability and that of follow on projects are questionable, in the event that funding is not available to replicate project outputs in the wider national context.

227. The NBSAP has identified as an objective the allocation of funds explicitly for biodiversity conservation and sustainable use from the annual budget of concerned government offices and ensure that these funds are utilised fully for that purpose; and to establish a national Environment Conservation Fund (ECF) with the support from all levels of the government and in which all sectors of the government participate (NBSAP Action 54 and 55). Activities to establish and operationalise a national Environment Conservation Fund (ECF) inter alia, will:

- Determine the most suitable structure for the ECF taking into consideration the various options available such as endowment funds, sinking funds, revolving funds or a combination of these;
- Manage the ECF through a Board of Trustees represented by relevant government offices, private sector, NGOs and donor agencies;
- Establish systems of banking, auditing and contracting including appropriate legislation and oversight;

- Establish guidelines for managing the fund including, acceptable funding sources, criteria for project proposals, allocation of funds;

- Ensure a large continual funding base through assistance from international donors as well as financing mechanisms at national level;

- Market the ECF to publicize the fund and give recognition to sponsors through websites, popular media and awards; and

- Establish precedents for a governance structure to ensure transparency between ECF donors and beneficiaries.

228. The acute shortage of human and financial resources to plan and implement necessary programs for biodiversity conservation is an important issue that needs to be urgently addressed in the Maldives. The institutional framework for facilitating conservation is weak and therefore it cannot effectively address the issues involved. Hence, financial assistance is needed from external donors to support domestic initiatives to promote conservation of biological diversity and sustainable management of the natural environment for the global benefit.

18. Monitoring and Evaluation

229. National efforts to monitor and evaluate the status and trends in the biodiversity of the country can be broadly grouped into three categories. The first category is monitoring and evaluation of the services provided by components of biodiversity and its use, while the second is monitoring of threats to that biodiversity. The third category falls under conservation and preservation oriented monitoring of the status of the environment.

230. Monitoring and evaluation of the services and use of biodiversity are carried out by economic sectors, primarily fisheries, agriculture and tourism, that utilize these resources. Hence, commercial and subsistence of fisheries resources is closely monitored through a daily reporting system based on total enumeration. This is supported by research on stock status of identified resources and status of marine habitats and ecosystems. Similarly, the use of agricultural resources is monitored and regulated by the agriculture sector. In addition, the sector monitors and undertakes mitigation action against potential threats such as land degradation, land mismanagement, inappropriate use of fertilizers, herbicides and pesticides.

231. The tourism sector has various regulatory measures that stipulate total environmental conservation in the use of marine and terrestrial resources allocated to tourism, supported by environmental criteria for carrying capacity of islands, forestation levels, waste management, shore protection and best practice in use of biodiversity components and services. These are monitored through mobile monitoring teams, regular reporting and use of the EIA system.

232. The second category of monitoring activities, monitoring of threats to biodiversity, is primarily undertaken with respect to the marine resources, habitats and ecosystems. These include regular monitoring of habitat status of coral reefs, monitoring of coastal areas, and monitoring of deforestation, waste disposal practices and coral mining practices.

233. The third category of monitoring and evaluation of status and trends in biodiversity include those resource inventories, stock assessment, evaluation of the status of the environment and coastal zone monitoring.

234. While these monitoring activities are regularly implemented, the output is often not of the quality or type that can be used to achieve conservation or management objectives. This is because most data are qualitative data and the validity of data is also not adequately verified. In addition, the type of data and method of data collection are often not rigorous by scientific standards due to several reasons including lack of technical staff, poor design of programme and monitoring activity, and

financial constraints on scope and implementation schedules. There is also limited data collection and data analysis capacity in terms of human resources, funds and equipment.

235. Given the above situation, there is a significant need to strengthen the system for assessing, monitoring and forecasting the status of biological diversity (NBSAP Action 33). A major effort is needed in the short term to strengthen the existing system of collecting fisheries, agricultural and environmental data from resource users, such as fishing vessel owners, dive schools, farmers, uninhabited island leaseholders by making it regular, timely and reliable. In addition, institutional and human resource capacity must be built to undertake regular analysis and forecasting of biodiversity status under the light of available stock assessment, resource use, environmental, and meteorological data so that if future remedial measures are required they can be taken with minimum negative socio-economic impacts.

236. Actions required in the medium term include the establishment of a data collection system specific for biodiversity so that data from this system combined with resource use data will give a better picture of the biodiversity status. This data collection system must be supported by the establishment of a biodiversity database for continued storage and analysis of biodiversity related data. Support must be provided to enhance the capability of stakeholder agencies to analyze and interpret data from the present fisheries, agricultural and environmental data collection system in order to assess the level of resource utilization and status of biodiversity.

237. Biodiversity conservation in fragile and highly vulnerable island ecosystems such as those in the Maldives require precautionary action and timely response to adverse changes. Hence, there is a need to establish monitoring systems for threatening operations and processes, such as land reclamation, dredging, deforestation and pollution, with the aim of assessing their status and taking timely and appropriate mitigation measures. Informed and timely decision making can be supported by the establishment of a GIS database of national biological diversity to enable scenario generation on biodiversity status, support decision making and promote wide dissemination and sharing of information.

238. As noted previously, the financial constraints of a small island developing country with most of the available finance diverted to providing basic services, leaves very little resources for nature conservation. Acute shortages of human and financial resources to plan and implement necessary components for biodiversity conservation such as monitoring and evaluation is an important issue that needs to be urgently addressed in the Maldives.

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