

DRAFT ONLY

Plan of Management of Marine Turtles in Baa Atoll



Photo courtesy SEMARC



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ACKNOWLEDGEMENT

Information detailed in this plan of management for all turtle species in Baa Atoll has been developed through community stakeholder discussion with Baa Atoll government representatives and residents, Baa atoll resort staff, the national government ministries (MHTE and MFA) and their research entities (MRC and EPA) and the scientific literature provided to the AEC.

ACRONYMS

AEC	Atoll Ecosystem Conservation Project
BAMP	Baa Atoll Management Plan
CITES	Convention of the International Trade in Endangered
CMS	Convention on Migratory Species
EPA	Environmental Protection Agency
GEF	Global Environmental Fund
IUCN	International Union for Conservation of Nature and Natural Resources
MHTE	Ministry of Housing, Transport and Environment
MFA	Ministry of Fisheries and Agriculture
MRC	Marine Research Centre
UNDP	United Nations Development Programmes

EXECUTIVE SUMMARY

Five species of marine turtles (Green - *Chelonia mydas*, Hawksbill - *Eretmochelys imbricata*, Olive Ridley - *Lepidochelys olivacea*, Leatherback - *Dermochelys coriacea* and Loggerhead - *Caretta caretta*) are recorded from Baa atoll, two of which (Green and Hawksbill) are the dominate species and appear to be semi-permanent residences that reproduce and nest annually within the atoll. Green and Hawksbill turtles and their eggs have been traditionally and remain harvested in Baa (the former the preferred species) and have supported a small artisanal fishery in the past. Teh three other species are rare and are no specifically targeted.

Turtle populations of all species within Baa atoll and the Maldives have declined considerably over the past half a century which is consistent to turtle populations world wide and is a direct result of changing traditional practises, increasing exploitation of turtles (including their eggs) and habitat alteration. Current unsustainable anthropogenic activities associated with direct turtle harvesting of juvenile and adult individuals, the collection of eggs from nests and the alteration and in some cases destruction of key feeding habitats and nesting beaches are the most important issues determining the decline of turtle populations stocks with Baa atoll.

The conservation of marine turtles in Baa atoll has been defined by the Atoll Ecosystem Conservation Project (AEC) through stakeholder discussion as the “*management of turtles for sustained utilisation*”. This definition provides for the long term preservation of each species and associated habitats whilst ensuring the atolls residence can utilise turtles for social, religious and economic opportunities (e.g. tourism) now and for future generations. To ensure this goal is attained, a strategy based on species specific management plans is required.

Therefore this report “Plan of Management for Marine Turtles of Baa atoll” details the methodologies and management concepts that can be deployed to reduce and/or mitigate current concerns and ensure the long term sustainability of all five turtle species populations within Baa atoll. Furthermore this plan is an integral component of the Baa Atoll Management Plan (BAMP).

All management measures incorporated into this document are consistent with regional and international turtle management initiatives, are compatible and can be incorporated into a Maldivian national turtle management plan. The management plan and its objectives should be seen as a dynamic working document that enables the specific management tools to be altered to accommodate new data and stakeholder issues.

The four major issues that are addressed to ensure the Baa atoll turtle management intervention is successful include the management of;

- Juvenile and adult animals,
- Feeding grounds,
- Nesting Sites (beaches), and
- Eggs.

Therefore the objectives of a turtle management plan for Baa atoll is to provide a mechanism to promote and ensure the long term survival of each turtle species population, including the sustained recovery of depleted stocks, the safeguarding of

critical habitats (marine and terrestrial) and maintain the requirements of the human populations in which they interact. This includes;

- To manage the subsistence capture and use of certain species of turtles, their eggs and products,
- To prohibit (ban) the commercial and artisanal capture of all juvenile and adults turtles,
- To prohibit (ban) the commercial and artisanal collection of all turtle eggs,
- To prohibit the sale of all turtle products within and outside of Baa atoll,
- To regulate and enforce the turtle management plan and nation's laws and regulations associated with turtles,
- To prohibit and/or manage turtle nesting sites to ensure habitats are useable for nesting turtles, and
- Ensure the turtle management plan is consistent with and can be directly incorporated into the Baa Atolls Plan of Management and marine protected area zonation system.

The Government of Maldives established the Atoll Ecosystem Conservation Project – AEC (with support of UNDP and the GEF) with the purpose of designing and demonstrating an effective management system for atoll ecosystem conservation and sustainable development on Baa Atoll, which could then be replicated throughout the Maldives.

The Baa Atoll Management Plan (BAMP) encompasses all the islands, waters and resources (biological and non biological) of Baa Atoll with an outer perimeter that extends 12 nautical miles from the outer reef zone of the atoll. BAMP is being developed through a comprehensive stakeholder consultative process and will be implemented in line with the Ecosystem Approach of the Convention on Biological Diversity. This is “*A strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way*”. The long term goal of the BAMP is to ensure the ecosystem and all species of Baa Atoll remain healthy, productive and resilient into the future.

Non-sustainable human activities are the root cause of the damage and degradation to Baa Atoll’s ecosystem including its biological and non biological resources. Through stakeholder workshops and consultation the AEC project identified the main threats to the atolls ecosystem and resources. These threats were prioritised into three categories (High, Medium and Low) through a consultative stakeholder process in terms of three criteria, which included;

- Conservation Importance,
- Urgency, and
- Ease with which it can be addressed.

These threats form the basis of the BAMP which include strategies to directly address these activities and their impacts on the biodiversity and function of Baa atolls resources.

Five high priority threats were identified one of which was sea turtles. The current unsustainable anthropogenic issues associated with direct turtle harvesting of juveniles and adult individuals, the collection of eggs from nests and the alteration and in some cases destruction of key feeding habitats and nesting beaches are the most important issues determining the decline of turtle populations stocks with Baa atoll.

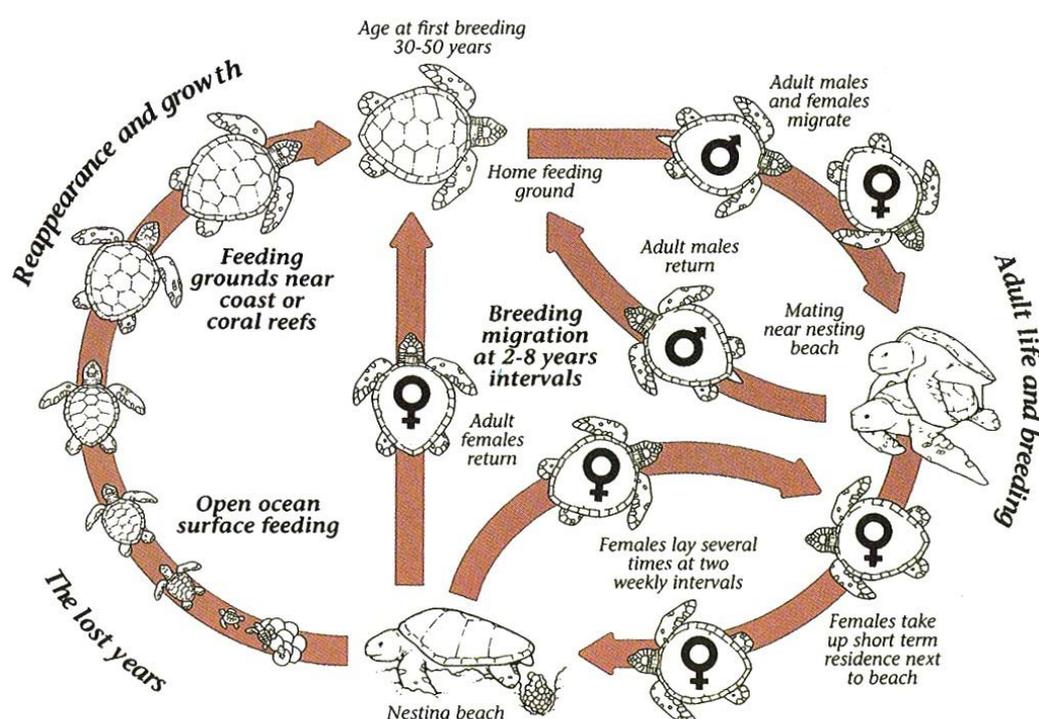
The strategy to address the threats to turtles is through the development of a management plan for each of the individual species of turtles that are located within Baa Atoll. This report “Plan of Management for Marine Turtles of Baa atoll” details the methodologies and management concepts that can be deployed to ensure the long term sustainability of all five turtle species populations within Baa atoll.

2.0 TURTLES

Sea turtles typically show a slow growth-rate, a long life-span, a high age at maturity and are highly migratory (Miller, 1996), making them generally vulnerable to anthropogenic impacts (i.e. over exploitation of juveniles and adults as well as unregulated long-term collection of eggs, and the loss of nesting beaches due to and mining, lights and the construction of sea walls (Zahir 2000).

Figure 2 shows a generalized life cycle of sea turtles together with estimates for the duration of the different phases and intervals. After leaving the beach as hatchlings sea turtles acquire an aquatic lifestyle, with the males never returning onto land and only the females regularly coming ashore briefly to lay eggs. (Bers, 2005).

Figure 2. Generalised Life cycle of Turtles (adopted from Bers, 2005).



Of the eight species of sea turtles, all five pan-tropical species have been recorded in Baa Atoll all of which are listed under the IUCN Red List of Threatened Species (refer section 2.1) and include;

- Green turtle (*Chelonia mydas*)
- Hawksbill turtle (*Eretmochelys imbricata*)
- Olive Ridley turtle (*Lepidochelys olivacea*)
- Loggerhead turtle (*Caretta caretta*)
- Leatherback turtle (*Dermochelys coriacea*)

The Green (*Chelonia mydas*) and Hawksbill (*Eretmochelys imbricata*) turtles are located and breed regularly throughout the Maldives archipelago and are the dominate turtle species whom feed and nest annually within Baa atoll. The three

other species Olive Ridley (*Lepidochelys olivacea*), Leatherback (*Dermochelys coriacea*) and Loggerhead (*Caretta caretta*) are infrequent visitors to Baa atoll the and to nation (Frazier et al, 2000). Only the Olive Riddley turtle has been reported to nest within Baa (Guy Stevens personal Communications) whist the other two species of turtles utilise the waters of Baa atoll during seasonal migrations mainly for feeding and resting.

Turtle populations of all species within the Maldives are reported to have declined considerably over the past half a century (Frazier, et. al., 2000, Bers, 2005). This decline which is apparent for green turtles in Baa atoll (Le Berre et. al., 2008) is consistent to turtle populations world wide and is a direct result of changing traditional practises, increasing exploitation of turtles (including their eggs) and habitat alteration.

Green and Hawksbill turtles have been traditionally harvested in Baa and have supported a small artisanal fishery in the past. Turtles are still harvested (irrespective of the 10 year nationwide ban 1995-2005 and its recent extension (2006 – 2016) with adult green turtles the preferred harvested species. Similarly, turtle eggs have and remain collected for subsistence and small scale commercial purposes. In more recent times turtles have generated an indirect income to the atoll through dive tourism.

Turtle harvesting rates of juveniles, adults and eggs and the continued loss of nesting sites within the atoll are the major threats to the continued existence of these animals within Baa atoll. Baa atoll has globally significant stocks of Hawksbill and Green turtles.

Bers (2005) reported turtle populations are highly vulnerable and threatened in Baa Atoll due to the uncontrolled, and sometimes even commercial, harvesting of turtle eggs, juvenile and adult collection and the loss of nesting beaches due construction of sea walls, development of tourist resorts and beach erosion. Resulting in long-term (20-60 years) consequences for population sizes, and populations of both hawksbill and green turtle that nest within Baa atoll are likely to crash within the next years. The author clearly indicated there is an urgent need for community to comply with the turtle regulations, enforcement of these regulations need to be undertaken and a community wide education program delivered to ensure information on these regulations are provided to the communities of Baa. The author provides a sound background summary of past turtle activities within Baa atoll and should be referred if additional information is required.

A rapid marine assessment undertaken in Baa atoll in 2008 (Le Berre et. al., 2008) for the UNDP AEC project reported a high abundance of hawksbill turtles (regionally and globally significant numbers) and low to moderate abundance of green turtles. The authors concluded that the latter species population numbers are decreasing due to anthropogenic impacts associated with egg collection and the preference of the community to selectively harvest juveniles and adults of this species. The authors of this report recommended immediate management measures to be in place to ensure the long term survival of both turtle species in Baa Atoll.

Le Berre et. al., (2008) recorded three (3) and seven (7) hotspots within Baa atoll for the green turtle (*C. mydas*) and Hawksbill (*E. imbricata*) turtles respectively during the visual assessment. These include: Hitaadhoo, Angaafaru and Vakkaru for the green turtles and two sites at Bathalaa, four sites in Goidhoo atoll and R9 for the Hawksbill turtles. The authors reported that they felt there was a strong correlation to abundance of juvenile and adult specimens of both species associated with the

specific food preference within the atoll. Resulting in higher numbers of hawksbill turtles located in water associated with high population densities of zoanths and sponges whilst the green turtles were located associated with sea grass beds. This information has been directly incorporated into the Baa Atoll Management Plan (BAMP).

Detailed and specific information pertaining to the life cycles, specific breeding cycles and nesting sites for the green (*C. mydas*) and hawksbill (*E. imbricata*) turtles within Baa atoll is incomplete. Nevertheless both species have been recorded to nest within Baa atoll.

27 turtle nesting islands were recorded by local fisherman for both the Green and Hawksbill turtles in Baa atoll in 2001 (Bers, 2005). This included the islands of; Bathalaa, Anhenunfushi, Dhakandhoo, Ahivahfushi, Fares, Landaa Girava, Thiladhoo, Mudhdhoo, Mendhoo, Vakkaru, Horubadhoo, Hanifaru, Dharavandhoo, Hibalhido, Maalhoss, Kunfunadhoo, Maadhoo, Hulhudhoo, Miriyandhoo, Muthaafushi, Eboodhoo, Olhugiri, Maamaduvvari, Kanifushi, Medufinoihu, Innafushi and Dharukandu Huraa.

Through stakeholder workshops and discussions with local fisherman and communities the AEC project (2009) identified 14 additional (Kihaadhuffaru, Dhunikolhu, Eydhafushi, Fonimagoodhoo, Finolhoss, Dhonfanu, Funadhoo, Voavah, Hirundhoo, Dhaandhoo, Madhirivaadhoo, Gaagandafaruhuraa, Vinaneyfaruhuraa and Undoodhoo) turtle nesting sites in Baa Atoll (Appendix 1). In total this included 6 resort islands, 4 community islands and 21 uninhabited islands. Green turtles were reported to nest or had nested in the past at all 41 identified nesting islands, 13 islands were recorded nesting sites for Hawksbill turtle and one site (Landaa Giraayaru Island) for the Olive Riddley turtle. Each turtle nesting site has been identified on Figure I.

The identification and conformation of turtle nesting sites within Baa atoll has enable site species management plans to be developed for each location and species within Baa atoll. All new nesting site information will need to be fully incorporated into all future turtle management plans.

2.1 IUCN Red List

The International Union for Conservation of Nature and Natural Resources (IUCN) through it species programme has for the past four decades assessed the conservation status of plant and animal species on a global scale in order to highlight taxa threatened with extinction, and therefore promote their conservation. The IUCN Red List of Threatened Species provides taxonomic, conservation status and distribution information on plants and animals that have been globally evaluated to provide information to determine the relative risk of extinction and to prioritise this risk. This includes three important categories; Critically Endangered, Endangered and Vulnerable.

Critical Endangered:	A taxon is Critically Endangered when the best available evidence indicates that it is considered to be facing an extremely high risk of extinction in the wild.
Endangered:	A taxon is Critically Endangered when the best available evidence indicates that it is considered to be facing an very high risk of extinction in the wild.
Vulnerable:	A taxon is Critically Endangered when the best available

evidence indicates that it is considered to be facing an high risk of extinction in the wild.

All five species of marine turtles recorded in the Maldives including Baa Atoll are listed under the IUCN Red List of Threatened Species and the their IUCN status are;

<i>Chelonia mydas</i> (Green Turtle)	Endangered
<i>Eretmochelys imbricata</i> (Hawksbill turtle)	Critically Endangered
<i>Lepidochelys olivacea</i> (Olive Ridley turtle)	Vulnerable
<i>Caretta caretta</i> (Loggerhead turtle)	Endangered
<i>Dermochelys coriacea</i> (Leatherback turtle)	Critically Endangered

2.2 CITES

In 1973, the international community adopted CITES, which is an international agreement to regulate international trade (import, export and re-export) of wildlife species listed (FAO, 2003). The aim is to protect wildlife by ensuring trade does not threaten the survival of a species in the wild, prevent further decline in wildlife populations, and ensure that international trade is based on sustainable use (Bruckner, 2001).

CITES provides for three levels of trade control depending on the conservation status of the species, and each level of protection has different permit requirements. (Bruckner, 2001 & FAO, 2003). The provisions of all annexes apply to species of fauna and flora, whether dead or alive, and also parts or products derived from these species (e.g. shell of a turtle) (FAO, 2003). These are:

- Appendix I:** Identifies immediately endangered species and all international trade in these species is totally prohibited.
- Appendix II:** Lists species that risk becoming endangered within a short period of time. International trade for these species is strictly regulated through licenses or permits.
- Appendix III:** Lists species that are endangered on the territory of one or more countries and are regulated by specific measures that aim to prevent or reduce their exploitation.

The five species of marine turtles recorded in the Maldives are listed on Appendix I of CITES. Furthermore, all five (5) recorded turtle species located within Baa Atoll and the Maldives are all listed in Appendix 1 of the Convention on Migratory Species (CMS). This convention monitors migratory species and all species that are listed as Appendix 1 are in danger of extinction throughout all or a significant proportion of their range.

3.0 TURTLE MANAGEMENT

3.1 Purpose of Turtle Management

The conservation of marine turtles in Baa atoll has been defined by the Atoll Ecosystem Conservation Project (AEC) through stakeholder discussion as the “management of turtles for sustained utilisation”. This definition provides for the long term preservation of each species and associated habitats whilst ensuring the atolls residence can utilise turtles for social, religious and economic opportunities (e.g. tourism) now and for future generations.

The goal of a sea turtle management plan is therefore to provide a mechanism to promote and ensure the long term survival of each turtle species population, including the sustained recovery of depleted stocks, the safeguarding of critical habitats (marine and terrestrial) and maintain the requirements of the human populations in which they interact (Eckert, 1999).

Turtles due to their unique life histories of laying eggs on a predetermined beach, their IUCN Threatened Red listed status and their nature of undertaking large ranging movements and migrations ensures that any management intervention undertaken in Baa Atoll must be fully incorporated into a national turtle management plan which in turn needs to consistent with regional and international management initiatives.

3.2 Management Considerations

All species of turtles are vulnerable to over fishing and nesting habitat loss. Turtle management plans have been implemented in a number developing nations that commercially and/or traditionally exploit this resource utilising a wide range of management tools, most of which restrict collection locations, numbers (animals and eggs) and/or species and are based on international codes of conduct for responsible fisheries. The effectiveness of these management interventions has had varying results world wide on the long term sustainable management of these valuable resources (refer section 3.3).

Turtle management plans by default should be based on a precautionary approach. Therefore, they should be conservative in nature reducing the risk of species being over exploited and the subsequent loss of mature breeding population stocks and critical egg laying terrestrial habitats.

For the development of a sea turtle management plan to be effective they need to be developed using a number of specific guidelines and important scientific criteria that are essential to provide the information upon which all management decisions can be based. These include but not limited to (modified from Eckert, 1999);

- Identification of each Species Population Size and Status: Including long term population’s trends (stable, decreasing or increasing), index habitats for foraging grounds and nesting beaches, reproduction data of females within the population.
- Identification and Preservation/Protection of Critical Habitat. Including foraging grounds and nesting beaches and their long term management and preservation.
- Identify and Manage all Sources of Mortality. Including direct and indirect.

- Ensure Appropriate Regulatory Measures are implemented and enforced to reduce mortality, including public awareness and acceptance.
- Identify and Implement an Appropriate Research and Data Management system. Includes all data required to manage these resources and will require assistance from agencies and resort operators.
- Public Awareness and Education to ensure Baa atoll residence are actively engaged in the management of turtles.

Currently information and time series data on these important scientific criteria are limited at best for turtles within Baa Atoll and therefore consideration for an atoll wide long term scientific program should developed. This would require considerable cooperation and sharing of information between all stakeholders (e.g. fisherman, communities, resort/tourism operators and staff, government agencies). One agency will need to champion the collation and analysis of data and ensure these data are linked to the long term management of turtles within the atoll and nation.

3.3 Management Tools

In general, turtle management plans have been based on standard commercial fisheries management tools. They instigate control over levels of harvesting (animals and eggs), numbers of fishers, equipment usage and closed fishing seasons (including nesting sites), through regulations and enforcement based on licence agreements. These methods are very useful when dealing with commercial fishing operations and open access fisheries, however they are generally acknowledged to be less effective when developed to manage an artisanal or traditional fishery, especially fisheries associated with community based resource ownership. Therefore, there has been a tendency to incorporate a wide range of fisheries management tools that address specific individual issues whilst in combination provide a balance system that manages the harvesting of turtles and their eggs.

More recently, developments in tropical marine resource management incorporate community and/or co-management arrangements are increasingly being used as key fisheries management tools. These are becoming widely used in nations where communities and/or communities/governments have joint ownership over the marine resources. Partnerships between all stakeholders utilising best practises provides a suitable management system for Baa Atoll. The AEC project in collaboration with the projects partners and stakeholders are developing co-management arrangements for a number of species and critical habitats.

There are a number of fishery management tools that have been utilised internationally to manage the commercial, artisanal and traditional exploitation of turtles, some of which are directly relevant to the management of turtles including nest sites in Baa. These tools offer a range of management measures that exert a wide range of control over the exploitation of turtles. These include;

**No Take Zone
(Core Areas,
Sanctuaries)**

No take zones are used to protect all organisms and habitats in a define area, by restricting all fishing and harvesting activities, most of which use a predetermined area of a reef including islands and are normally incorporated under a larger more detailed marine protected area (MPA) management plan. No take zones are generally developed to protected habitats and the whole suit of organisms which reside within, not species specific. However they can be developed to specifically protect individual turtle species or specific sites (nesting beaches).

Total Fisheries Closures	Total fisheries closures prevent the harvest of individual species or a number of species within a defined area (i.e. all turtles of one or more species). This management tool is usually implemented as last resort management options when a fishery or organism has been over fished and the targeted species stock populations have been over exploited and are under threat from a stock population crash. Total closures can be used for different lengths of time which are dependent on the duration it is expected to take to allow recruitment and reestablishment of population stocks. They can be used for an individual or a number of species and can include the collection of turtle eggs as well as the juvenile and adult population.
Seasonal Fisheries Closures	Seasonal fisheries closures are used to control fishing pressure on a resource for specific periods of time. They are designed to protect population stocks during critically important biological periods usually when the targeted species reproduces (turtles laying eggs) thus allowing the mature animals within a population the time to reproduce and theoretically provide viable gametes that will provide the next generation. These systems are widely used but are reliant on accurate scientific information on the reproduction periodicity of the targeted species. Seasonal closures are also utilised to limit the number of time allocated to fishing and thus reduce overall catches.
Habitat or Location Closures	Specific habitat or locations closures are used to provide protection to a specific habitat or area that contains one or more species of turtles and/or nesting sites. These areas are usually relatively small in size and used when stock populations are over exploited (e.g. eggs harvested). Duration of the closers varies, based on scientific information and used for a species purpose. These closures can be designs as an independent management tool or used in combination with a larger more detailed marine protected area (MPA) management plans.
Species Ban	Species bans are used to provide protection to an individual species of turtle from fishing, normally associated with a wide range of habitats and areas (i.e. Atoll wide). They are utilised when an individual species stock populations is over exploited and vary in duration, most of which are several years. These closures can be designs as an independent management plan or in combination with a larger more detailed marine protected area (MPA) management plan. Species bans have been used in the Maldives for turtle management in the past.
Gear/Method Banning or Restrictions	Restricting or banning certain types of fishing gears and/or methods to collect turtles or eggs are used to protect a proportion of the population. These restrictions are generally utilised on a wide scale and for a number of species however they can be instigated for the control of an individual species.
Harvesting Limits (Quotas or Total Allowable Catch)	Limitations on the number or biomass of individual specimens of a certain species that can be permitted to collected within a defined area or populations based on a defined time period (e.g. annual, seasonal). Harvesting quotas are used theoretically to reduce the fishing pressure on populations of turtles. Harvesting limits have been used in the Maldives for the collection of turtle eggs in the past. Quotas should only be developed on accurate population time series scientific data.

Fishing Limits (Limited Enter)	Limitations on the number of fishing vessels and/or fisherman permitted to harvest turtles and/or their eggs in a defined area can be used theoretically to reduce the fishing pressure on populations of turtles.
Size Limitations	Limitations on the linear length of an individual species of turtle that can be collected can be used to prevent the harvest of animals. Generally size limitations are used to prevent the collection of animals smaller or larger than a minimal size based on size of maturity to allow the populations to have a number of mature breeding animals within the population. Size limits are species specific and can only be used once scientific data is available on the animal length and reproduction relationship within populations. Size limits have been used in the Maldives for the collection of turtle in the past

3.4 Management Approaches

The successes of any management plan are directly dependent on three interrelated approaches. The first, which is usually referred to as a “Community Engagement Approach” and is designed at establishing a meaningful and in depth relationship with communities that make the day to day decision over the use of their natural resources and if necessary install a management ethic. The second is aimed at nesting the project within the government policies processes at all levels of the government and at supporting the resulting community based resource management regimes with the available legislative means. The third approach involves incorporating scientific information on stock abundances, population dynamics, ecological processes and other biological information required to inform communities and government decision making agencies (Lindsay, et al., 2004).

The long-term success of the approach rest with communities (resource owners) themselves determining the conservation and management strategies required for each resource and instigating the appropriate management measures. Therefore, extensive information exchange and appropriate capacity building programs are required to provide the information in a form that the communities can use to make inform decisions. Thus the success of this approach lies in the knowledge and interest of the communities to manage turtles (conservation and use) as a community.

3.5 Legislation

Turtles have been a traditional resource that have used by all communities within the Maldives for centuries. Commercial exploitation of turtles, mainly for the export of shell and products increased dramatically since the 1970’s. Resulting in heavy fishing pressure on all species and stock population declines throughout the nation prior to 1995. At which time the nation implemented a 10 year moratorium on the catching or killing of turtles and a ban on the export of turtle products (Fisheries Law 5/87, section 10). This moratorium greatly reduced fishing pressure on adult turtles and the harvesting of eggs however did not stop the exploitation of this resource (Zahir, 2000). Anecdotal information indicates that juvenile and adult turtles had been harvested in Baa atoll during the moratorium albeit at a lower level than previous years. Furthermore, anecdotal information indicates that turtle eggs were harvested for subsistence and commercial activities within Baa Atoll as well as many other locations throughout the Maldives.

Due to continued concern associated with the declining stock populations of turtles within the nation, their value to biodiversity and tourism (icon species for tourists) the Maldivian government instigated another 10 year moratorium (2006 - 2016) on the harvesting of adult and eggs of turtles and a complete export ban on all turtle products. This ban included the total protection for turtles, turtle nest and eggs in four islands within Baa Atoll. These include the islands of Maamaduvvari, Maadoo, Olhugiri and Miriyandhoo. For these regulations to have a meaningful effect at reducing current turtle populations declines an increased community/public awareness and education program needs to be instigated that is fully supported by the enforcement of these regulations, including appropriate penalties for all violations.

3.6 Species Specific Management Plans

All management measures recommended for Baa Atoll are consistent with regional and international management initiatives and have been designed to be compatible and can be incorporated into a Maldivian national turtle management plan. The management plan and its objectives should be seen as a dynamic working document that enables the specific management tools to be altered to accommodate new data and stakeholder issues.

The four major issues that need to be addressed to ensure the Baa Atoll turtle management intervention is successful include the management of;

- Juvenile and adult animals,
- Feeding grounds,
- Nesting Sites (beaches), and
- Eggs.

Therefore the objectives of a turtle management plan for Baa Atoll is to provide a mechanism to promote and ensure the long term survival of each turtle species population, including the sustained recovery of depleted stocks, the safeguarding of critical habitats (marine and terrestrial) and maintain the requirements of the human populations in which they interact. This includes;

- To manage the subsistence capture and use of certain species of turtles, their eggs and products,
- To prohibit (ban) the commercial and artisanal capture of all juvenile and adults turtles,
- To prohibit (ban) the commercial and artisanal collection of all turtle eggs,
- To prohibit the sale of all turtle products within and outside of Baa Atoll,
- To regulate and enforce the turtle management plan and nation's laws and regulations associated with turtles,
- To prohibit and/or manage turtle nesting sites to ensure habitats are useable for nesting turtles, and
- Ensure the turtle management plan is consistent with and can be directly incorporated into the Baa Atolls Plan of Management and marine protected area zonation system.

3.7 Recommended Turtle Management Measures

Species Specific Recommended Management Measures for all five species of marine turtles located in Baa Atoll include:

Turtle Species	Recommended Management Measure
<p><i>Chelonia mydas</i> (Green Turtle)</p>	<ul style="list-style-type: none"> ➤ Complete ban on all artisanal and commercial harvesting and capture of juvenile and adult turtles and their eggs*. ➤ Subsistence capture of juvenile and adult turtles and the collection of eggs allowed in specific designated areas within the atoll. These include (we need to work with the community to develop these sites. Do we need to place a number limit on turtles allowed to be captured and eggs collected?). All subsistence activities are prohibited in all Core Areas and Buffer zones as detailed by the Baa Atoll Management plan and islands associated with tourist resort. Subsistence in this context is designed to be immediate family needs and/or social functions (e.g. weddings). <p>OR</p> <ul style="list-style-type: none"> ➤ Complete ban on all harvesting and capture of juvenile and adult turtles and their eggs for all activities (subsistence, artisanal and commercial).
<p><i>Eretmochelys imbricata</i> (Hawksbill turtle)</p>	<ul style="list-style-type: none"> ➤ Complete ban on all artisanal and commercial harvesting and capture of juvenile and adult turtles and their eggs*. ➤ Subsistence capture of juvenile and adult turtles and the collection of eggs allowed in specific designated areas within the atoll. These include (we need to work with the community to develop these sites. Do we need to place a number limit on turtles allowed to be captured and eggs collected?). All subsistence activities are prohibited in all Core Areas and Buffer zones as detailed by the Baa Atoll Management plan and islands associated with tourist resort. Subsistence in this context is designed to be immediate family needs and/or social functions (e.g. weddings). <p>OR</p> <ul style="list-style-type: none"> ➤ Complete ban on all harvesting and capture of juvenile and adult turtles and their eggs for all activities (subsistence, artisanal and commercial).
<p><i>Lepidochelys olivacea</i> (Olive Ridley turtle)</p>	<p>Complete Protected Status* (Ban on the harvesting and collection of eggs, juvenile and adult turtles for the foreseeable future).</p>
<p><i>Caretta caretta</i> (Loggerhead turtle)</p>	<p>Complete Protected Status* (Ban on the harvesting and collection of eggs, juvenile</p>

	and adult turtles for the foreseeable future).
<i>Dermochelys coriacea</i> (Leatherback turtle)	Complete Protected Status* (Ban on the harvesting and collection of eggs, juvenile and adult turtles for the foreseeable future).

*With all management plans associated with marine life a clause should be written into the plan that under certain circumstances turtles can be harvested and used for food (e.g. typhoon). But these circumstances need to be clearly understood by all stakeholders and enforced.

Environmental and community specific recommended management measures for all five species of marine turtles located in Baa Atoll include:

Issues	Recommended Management Measure
Habitat Maintenance and Protection.	<ul style="list-style-type: none"> ➤ Long term Protection of critical beach and foreshore habitats is required to ensure all species of turtles have access to suitable nesting sites. ➤ Encourage active participation of Resort and Community Island to develop infrastructure programs that encourages turtles to nest and their subsequent protection of the sites. ➤ Long term protection of critical feeding grounds (e.g. sea grass beds, zoanths and sponge beds) to ensure all species can feed and support healthy populations of all sea turtles.
Public Education and Awareness	<ul style="list-style-type: none"> ➤ Increase Baa atoll's public stakeholder awareness and understanding; <ul style="list-style-type: none"> ▪ To prohibit the commercial and artisanal catch of all species of turtles and eggs. ▪ Of the management regulation to allow the subsistence collection of Green and Hawsbill turtles and eggs in permitted locations (Only Baa atoll residence should be permitted to use turtles for subsistence purposes). ▪ The recommendations and rules relating to turtles in the Plan of Management for Baa Atoll. ▪ Turtle biology and life histories and their importance to the biodiversity of the atoll and their lives. ➤ Increase neighbouring island communities (e.g. Raa, Kaafu and Lhaviyani atolls) and commercial fishers of Baa atolls Plan of Management associated with turtles. ➤ Develop educational programs (e.g. manuals, fact sheets) that are easy to understand would be of high benefit to school students and the community within Baa atoll.
Regulations and Enforcement	<ul style="list-style-type: none"> ➤ Develop a community/atoll based enforcement and penalty systems to ensure infringements are dealt with correctly and are a deterrent. Requires increase ability for surveillance and full cooperation of all Baa residents.
Research	<ul style="list-style-type: none"> ➤ Develop a long term turtle qualitative and quantitative research and monitoring program to provide scientific data on the ecology and population's dynamics of each species of turtle that is directly incorporated in to the

	<p>long term management of turtles in Baa Atoll and the nation.</p> <ul style="list-style-type: none"> ➤ Data to be collected by Atoll stakeholders (e.g. resorts, community groups, and fishermen) and managed by a government agency (e.g. MRC) responsible for the collection, storage, analysis and dissemination of all data and the development and modification of turtle management plans. ➤ Improve and strengthen the cooperation between the various governmental ministries, agencies, NGOs and with Atoll communities to manage environmental issues associated with turtles.
Revenue Generation	<ul style="list-style-type: none"> ➤ Encourage increase revenue generation from turtles from the tourist sector and develop a mechanism that distributes a proportion of incomes earned to the Baa Atoll community.

3.7.1 Green (*Chelonia mydas*) and Hawksbill (*Eretmochelys imbricata*) Turtle Management Justification.

Of the five (5) species of turtles that are recorded in Baa Atoll only three species have been recorded to nest within the atoll. This includes the Green (*Chelonia mydas*), Hawksbill (*Eretmochelys imbricata*) and Olive Ridley (*Lepidochelys olivacea*) turtles. The latter species has only been reported to nest once, whilst the two other species nest throughout the atoll annually.

Juvenile and adults Green and Hawksbill turtles are recorded in globally high and medium numbers respectively, are witnessed frequently feeding throughout the atoll and appear to be semi-permanent residents of the atoll (Le Berre et al., 2008). Both species have been traditionally harvested and have supported a small artisanal fishery and commercial activities in the past. Anecdotal information (Le Berre et al., 2008) indicates that turtles are still harvested, with the green turtle (*C. mydas*) the preferred species.

Both species are globally endangered (refer section 2.1), unique and increase the biodiversity of the marine environment of Baa Atoll. Therefore they have a high intrinsic value to the atoll, to the nation and globally and have the potential to provide additional revenue to the atoll through its tourism. However, both species, especially the Green turtle has and remains an important traditional food source and ceremonial/religious role within the communities of Baa.

To ensure the objectives of the turtle management plan are achieved a two tiered management approach is recommended. It is therefore recommended that;

- A “Complete Ban” on all artisanal and commercial harvesting and capture of juvenile and adult turtles and their eggs be enforced for the foreseeable future.
- A “Managed Harvest” for the subsistence capture of juvenile and adult turtles and the collection of eggs at specific designated areas within the atoll. These areas include (we need to work with the community to develop these sites and do we need to place a number limit on turtles allowed to be captured and eggs collected?). All subsistence activities are prohibited in all Core Areas and Buffer zones as detailed by the Baa Atoll Management Plan and islands associated with tourist resorts.

All designated subsistence collection areas, nesting beaches and juvenile/adult turtles need to be carefully monitored to ensure sustainable use practices are undertaken. Subsistence collection areas may need to be change through time to ensure the long-term sustainable management of these resources is attained.

3.7.2 Olive Ridley (*Lepidochelys olivacea*), Loggerhead (*Caretta caretta*) and Leatherback (*Dermochelys coriacea*) Turtle Management Justification.

Three of the five species of marine turtles recorded in Baa atoll are infrequently located and have not been recorded in any large numbers or aggregations. These species are considered temporary residence moving through the atoll and the Maldives on their migratory activities. This included the Olive Ridley (*Lepidochelys olivacea*), Loggerhead (*Caretta caretta*) and the Leatherback (*Dermochelys coriacea*). The latter species is very rare.

The Loggerhead and Leatherback do not nest within Baa atoll. Each species do however feed within the atoll and therefore the diversity and ecological status of the marine environment of Baa atoll may play a significant role in determining their migratory patterns. Anecdotal information indicates that these species have not formed a basis of any traditional fishery nor are these species selectively harvested for food or religious activities. They have been caught more by chance in the past as a by catch of other fishing activities. It is unknown if the recorded nesting site of the Olive Ridley turtle is regularly used by this species of turtle or a one off event.

All three species are globally endangered (refer section 2.1), unique and increase the biodiversity of the marine environment of Baa atoll. Therefore they have a high intrinsic value to the atoll, to the nation and globally and have the potential to provide additional revenue to the atoll through its tourism.

It is therefore recommended that these three species of turtles have a “Complete Protected Status” within the atoll with a ‘Complete Ban” on the harvesting or collection of juvenile, adults and eggs for any reason for the foreseeable future.

4.0 REFERENCES

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5.0 APPENDICES

APPENDIX 1. Nesting Islands used by Green, Hawksbill and Olive Riddley turtles in Baa atoll.

Island	Green	Hawksbill	Olive Riddley
Resort Islands			
Landaa Giraavaru (Four Seasons Resort)	Yes	Yes	Yes
Fonimagoodhoo (Reethi Beach Resort)	Yes		
Kihaadhuffaru (Kihaadhuffaru Resort)	Yes		
Horubadhoo (Royal Island Resort)	Yes	Yes	
Kunfunadhoo (Sonevafushi Resort)	Yes		
Dhunikolhu (Coco Palm Resort)	Yes		
Community Islands			
Dharavandhoo	Yes		
Eydhafushi	Yes		
Maalhoss	Yes		
Dhonfanu	Yes		
Uninhabited Islands			
Maaddoo*	Yes	Yes	
Hulhudhoo	Yes	Yes	
Miriyandhoo*	Yes	Yes	
Muthaafushi	Yes		
Eboodhoo	Yes		
Ohugiri*	Yes		
Maamaduvvari*	Yes		
Kanifushi	Yes		
Medufinoihu	Yes		
Innafushi	Yes		
Finolhass	Yes	Yes	
Funadhoo	Yes		
Voavah	Yes		
Hirundhoo	Yes		
Madhirivaadhoo	Yes		
Dhaandhoo	Yes		
Dhorukandu Huraa	Yes		
Bathalaa	Yes	Yes	
Anhenunfushi	Yes	Yes	
Dhakandhoo	Yes	Yes	
Ahivahfushi	Yes	Yes	
Fares	Yes	Yes	
Thiladhoo	Yes		

Mudhdhoo	Yes	Yes	
Mendhoo	Yes		
Vakkaru	Yes	Yes	
Hanifaru	Yes		
Hibalhidhoo	Yes		
Gaagandafaruhuraa	Yes		
Vinaneuyfaruhuraa	Yes		
Undoodhoo	Yes		

* Islands that have been designated total turtle protection by the national government in the 2006 – 2016 turtle moratorium.