



REPÚBLICA DE MOÇAMBIQUE
MINISTÉRIO PARA A COORDENAÇÃO DA ACÇÃO AMBIENTAL
Centro de Desenvolvimento Sustentável para as Zonas Costeiras

REPORT ON THE CONSERVATION STATUS OF MARINE TURTLES IN MOZAMBIQUE



Maputo, January 2006

Funded by DANIDA, PGCI-Phase II



REPÚBLICA DE MOÇAMBIQUE

MINISTÉRIO PARA A COORDENAÇÃO DA ACÇÃO AMBIENTAL

Centro de Desenvolvimento Sustentável para as Zonas Costeiras

REPORT ON THE CONSERVATION STATUS OF MARINE TURTLES IN MOZAMBIQUE

Cristina M. M. Louro¹

Marcos A. M. Pereira²

Alice C. D. Costa³

¹ Grupo de Trabalho Tartarugas Marinhas de Moçambique and School of Tropical Environment Studies and Geography, James Cook University. E-mail: cristina.louro@jcu.edu.au

² Grupo de Trabalho Tartarugas Marinhas de Moçambique. Email: marcospereira@gmx.net

³ Fundo Mundial para a Natureza. Email: adabulacosta@wwf.org.mz

Cover: Green turtle and its nest, Bazaruto Archipelago National Park (Photo: Eduardo Videira).

Maputo, January 2006

TABLE OF CONTENTS

ABSTRACT	ii
LIST OF ACRONYMS	iii
INTRODUCTION	01
BRIEF DESCRIPTION OF THE MOZAMBICAN COASTAL ZONE	03
BIOLOGICAL ASPECTS	04
THREATS	10
ECOLOGICAL, ECONOMICAL ANC CULTURAL VALUES	14
CONSERVATION AND MANAGEMENT	17
RELEVANT LEGISLATION	29
RECOMMENDATIONS	34
REFERENCES	37

ABSTRACT

Five species of marine turtles occur and nest in the marine and coastal zones of Mozambique. Marine turtles possess high ecological, social and economic values, are considered symbols of biodiversity conservation and are protected under national legislation as well as international conventions. However, in Mozambique, marine turtles have received little attention in regards to research and conservation measures. This report is a review of the current state of knowledge and conservation of marine turtles in Mozambique, based on published and available literature. In general, marine turtles occur and nest throughout the Mozambican coastline, with a few areas of higher incidence. Several natural and anthropogenic factors threaten their survival. It is believed, that these populations are facing a continuous decline, which will persist unless appropriate management and conservation measures, such as legislation implementation and enforcement, education and public awareness, are implemented.

LIST OF ACRONYMS

BANP – Bazaruto Archipelago National Park
CDS-ZC – Centro de Desenvolvimento Sustentável para as Zonas Costeiras
CTV – Centro Terra Viva
CESVI – Cooperazione E Sviluppo
TED – Turtle Excluder device
DNFFB – Direcção Nacional de Florestas e Fauna Bravia
DNAC – Direcção Nacional para Áreas de Conservação
DNGA – Direcção Nacional de Gestão Ambiental
FNP – Fórum para a Natureza em Perigo
FUTUR – National Tourism Fund
GTA – Grupo de Trabalho Ambiental
GTT – Grupo de Trabalho Tratarugas Marinhas de Moçambique
MCS – Marine Conservation Society
MICOA – Ministry for the Coordination of Environmental Affairs
MSR – Maputo Special Reserve
UEM – Universidade Eduardo Mondlane
QANP – Quirimbas Archipelago National Park
WWF – World Wide Fund for Nature

INTRODUCTION

The five species of marine turtles that occur throughout the Indian Ocean also occur along the Mozambican coastline. These are the loggerhead turtle (*Caretta caretta*), the green turtle (*Chelonia mydas*), the leatherback turtle (*Dermochelys coriacea*), the hawksbill turtle (*Eretmochelys imbricata*) and the olive ridley turtle (*Lepidochelys olivacea*). They make use of a variety of coastal and marine ecosystems as feeding, growth, breeding and nesting grounds (Hughes, 1971).

Marine turtles are slow growing with a long and complex life cycle. As consequence, they are extremely susceptible to human activities in all stages of their life cycle. It is believed that these species of marine reptiles protected by law worldwide are facing a serious and uncontrolled decline in Mozambique (Gove & Magane, 1996), mainly due to human actions.

The present knowledge regarding marine turtle biology and conservation in Mozambique is scarce and is mainly comprised by the work done in the 1970s by Hughes (1971), Tinley (1971) followed by Gove, Magane and colleagues (Gove & Magane, 1996, Gove *et al.*, 2001, Magane & João, 2002) and Lombard (1997, 2004, 2005). The first conservation and management initiatives took place in the 1990s, mainly in the southern part of the country, being very localized.

The preparation of this report arises from the need to develop and implement an action plan for the signature by the Mozambican Government of the *Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia – MOU IOSE*. It also contributes to the implementation of the country's obligation in respect to international conventions and treaties signed, regarding biodiversity protection and conservation, as well as the implementation of national conservation goals.

The specific goals of this report are to: (i) describe the specific diversity, habitats of occurrence and marine turtle distribution throughout the Mozambican coastline; (ii) describe the main threats and actual levels of mortality; (iii) identify the social and economic value and potential of marine turtles in Mozambique, as well as its use; (iv) analyze the efficiency of the existing marine turtle protection and management programmes in Mozambique, as well as propose appropriate measures to improve them; and (v) analyze the existent relevant legislation, including international conventions and agreements for the protection of marine turtles and propose alternatives for the improvement of the national legal framework.

This report presents published information that was available to the authors. Several individuals have been consulted, especially tourism operators from remote locations in the coast that have provided data regarding occurrence and threats to marine turtles. Therefore, this document should be revised and updated periodically.



A tagged green turtle is released at BANP (Photo: Eduardo Videira)

BRIEF DESCRIPTION OF THE MOZAMBICAN COASTAL ZONE

Mozambique possesses 2700 km of coastline, that stretches from the Rovuma River, in the north, in the border with Tanzania, to Ponta do Ouro, in the south, in the border with South Africa. The coastal zone comprises eight of the eleven provinces of the country, namely Cabo Delgado, Nampula, Zambézia, Sofala, Inhambane, Gaza, Maputo and Maputo-City. The coastal zone has been divided into three natural ecoregions (Figure 1), namely the coralline, swamp coast and the parabolic dune coasts (Massinga & Hatton, 1996). A fourth ecoregion, the delta coast, is restricted in distribution and occurs only at the mouths of the Zambeze and Save rivers.

The coralline coast is found between the Rovuma River and the Primeiras and Segundas Archipelago, and is approximately 770 km long. It is characterized by numerous islands of coralline origin and an almost continuous fringing reef (Tinley, 1971; Massinga & Hatton, 1996). The swamp coast extends from Pebane to the Bazaruto Archipelago and is 950 km long (Massinga & Hatton, 1996). Twenty-four rivers drain to the Indian Ocean in this area, each sustaining a well developed complex of mangroves. Lastly, the parabolic dune coast extends from Bazaruto Island to Ponta do Ouro for approximately 850 km. Vegetated dunes that attain heights in excess of 100 meters, capes, barrier lakes and extensive sandy beaches are typical of this section (Hatton, 1995; Massinga & Hatton, 1996).

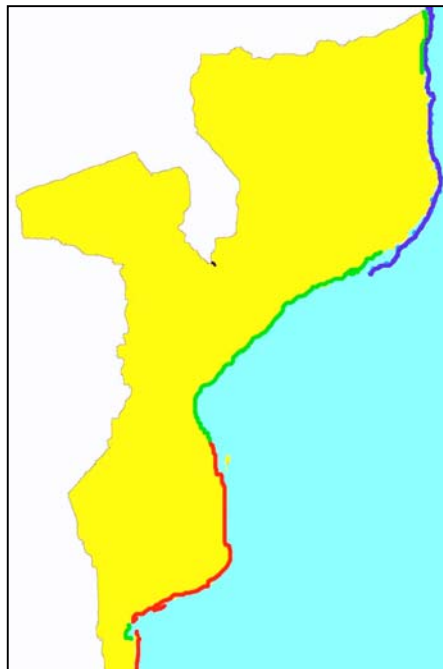


Figure 1. Schematic representation of the main coastal regions of Mozambique (adapted from Massinga & Hatton, 1996).

— = coralline coast; — = swamp coast; — = parabolic dune coast

BIOLOGICAL ASPECTS

There are seven living species of marine turtles worldwide. They are classified in two families: Cheloniidae e Dermochelyidae. Of these, five species occur in Mozambican waters and nest on its beaches.

Little is known about the biology and ecology of these species in Mozambique. Population size, distribution, nesting grounds, growth rates, level of mortality, migratory routes, among other relevant ecological aspects are not well understood (Gove & Magane, 1996; Louro, 2005b).

CHELONIIDAE

Four of the six species that belong to this family occur in Mozambique, namely: *Caretta caretta* (loggerhead turtle), *Chelonia mydas* (green turtle), *Eretmochelys imbricata* (hawksbill turtle) and *Lepidochelys olivacea* (olive ridley turtle). All these species are globally distributed and occur in tropical and temperate seas.

Loggerhead Turtle

Scientific Name: *Caretta caretta* (Linnaeus)

General Characteristics (Shanker *et al.*, 2003):

- Maximum weight 200 kg;
- Carapace length 80 - 100 cm; with the carapace shape being moderately wide. It possesses 5 pairs of lateral scutes; adults and sub-adults are red brownish in color;
- Head is big and triangular, with 2 pairs of pre-frontal scutes;
- Flippers with 2 claws each;
- Plastron yellow to orange;
- Nest at night and for each nesting season 3 - 5 nests are made. At each nest, between 100 and 120 eggs are laid. Re-nesting interval occurs between days 12 and 16 and re-migration occurs between 2 - 3 years. Eggs are approximately 4 cm in diameter.

Distribution in Mozambique: Hughes (1971) has reported that *C. caretta* is found throughout the entire Mozambican coastline, although being more common in southern Mozambique (Figure 2).

Nesting in Mozambique: Loggerhead turtles nest south of the Tropic of Capricorn, in the southern coast, from the Bazaruto Archipelago to Ponta do Ouro (Hughes, 1971; Gove & Magane, 1996;

Figure 2). In the Bazaruto Archipelago National Park (BANP), the loggerhead turtle is the most abundant nesting species (51.76%; Videira & Louro, in prep.). Hughes (1971) and Tello (1973) reported that the Maputo Special Reserve (MSR) was an important nesting ground for this species. Magane & João (2001, 2002a, 2002b) have reported similar results. In the 1999/2000 nesting season, 255 nests were reported. This indicates a slight increase when compared to past seasons (Magane & João, 2001). In this region, the most preferred nesting grounds are Dobela – Matondo (Magane & João, 2002b). Tello (1973) reported that in this area, nesting occurs between the end of October and February. Magane & João (2002b) have observed the same, but the highest nesting activity occurs between November and January, as also reported by Hughes (1971). Data of an 11-year tagging program (1994/1995 to 2004/2005 nesting seasons) in Ponta Malongane (southern Mozambique) indicate that approximately 300 loggerhead turtles were tagged (Lombard, 2005). In this region, two areas of high nesting density have persisted through the years, on the 7th and 27th kilometer north of Ponta Malongane (Lombard, 2005).

Green Turtle

Scientific Name: *Chelonia mydas* (Linnaeus)

General Characteristics (Shanker *et al.*, 2003):

- Maximum weight 250 kg;
- Carapace length 90-120 cm; carapace oval-shaped with 4 pairs of lateral scutes; juveniles are brownish and adults greenish in color;
- Head round in the anterior region and a pair of pre-frontal scutes;
- Each flipper with only one claw;
- Plastron white in hatchlings and yellow in adults;
- Nests at night, with approximately 4-6 nests per season. For each nest 100-120 eggs are laid; Re-nesting interval occurs between days 10 and 14 and re-migrating interval occurs between 3-5 years; Eggs are approximately 4.5 cm in diameter.

Distribution in Mozambique: Considered by Hughes (1971), the most common marine turtle along the Mozambican coast, even though there are certain regions where it is more abundant (Figure 2). Although more studies are necessary, the protected waters of the Bazaruto Archipelago are thought to be feeding and growth grounds of *C. mydas* (Hughes, 1971; Louro, 2005b). The Zenguelemo area, in Bazaruto Island is the area where most green turtles have been captured and recaptured (Videira & Louro, in prep.).

Nesting in Mozambique: In 1971, Hughes reported that south of the Sofala province there was no record of nesting of this species, except for two small islands in the Cabo de Sebastião. Gove &

Magane (1996) reported that it only nested north of the Tropic of Capricorn, in the Quewene Peninsula and the Quirimbas Archipelago. However, it has been recently observed to nest at the Bazaruto Archipelago (Videira, pers. obs.). Monitoring has shown that *C. mydas* is the second most common species nesting in the BANP (Videira & Louro, in prep.). Hughes (1971) identified the Primeiras and Segundas Islands as areas of high concentration for nesting. In this area, the nesting population is estimated to be about 40 turtles per nesting season (Costa, pers. obs.; Figure 2).

Hawksbill Turtle

Scientific Name: *Eretmochelys imbricata* (Linnaeus)

General Characteristics (Shanker *et al.*, 2003):

- Maximum weight 150 kg;
- Carapace length 80 - 100 cm; carapace oval-shaped with the posterior margin highly serrated, scutes overlaid; lateral scutes are formed by 4 pairs with a brown coloration;
- Head thin, with a bird-shaped beak, and 2 pairs of pre-frontal scutes;
- Flippers with 2 claws each;
- Plastron light yellow to white;
- Nest during the day or at night, with approximately 3 to 5 nests per season; at each nest 120 to 150 eggs are laid. Re-nesting interval occur between 12 and 14 days and the re-migration interval occur between 2 to 5 years; eggs are approximately 3.5 cm in diameter.

Distribution in Mozambique: found throughout the coastline, but is mostly abundant in the northern part of the country, where shallow coral reefs are most common (Hughes, 1971; Figure 2). Through the tagging program two hawksbill turtles have been tagged, one at the MSR (João, pers. obs.) and the other at the BANP (Louro, 2005b). It is believed that Santa Carolina Island, in the Bazaruto Archipelago, is a growing habitat for this species (Videira & Louro, in prep.).

Nesting in Mozambique: Nests most frequently on islands and sporadically in the mainland in the northern part of the country (Hughes, 1971; Figure 2). The same author has suggested that the islands of Quirimbas, Sencar and Mefunvo were used as nesting grounds, however this needs confirmation. There are records of nesting at the Quirimbas Archipelago, more precisely at Vamizi Island (Hill & Garnier, 2003). In the BANP there are some signs that this species might nest, however, this also requires confirmation (Videira & Louro, in prep.).

Olive Ridley Turtle

Scientific Name: *Lepidochelys olivacea* (Eschscholtz)

General Characteristics (Shanker *et al.*, 2003):

- Maximum weight 50 kg;
- Carapace length between 60 and 70 cm; smooth, tectiforme shaped with 5-9 pairs of asymmetric lateral scutes; olive green;
- Flippers with 2 claws each;
- Plastron with pores and yellow cream color;
- Nests at night with 1-3 nest per season. At each nest, between 100 and 120 eggs are laid. The re-nesting interval occurs between days 20 and 28 and the re-immigration interval occurs within 1-2 years; eggs are approximately 4 cm in diameter;

Distribution in Mozambique: this species is considered common north of Pebane (Hughes, 1971). Carapaces of *L. olivacea* were found from the Segundas Islands northwards (Hughes, 1971). A piece of the carapace was identified at Tofo Beach, Inhambane (Louro, pers. obs.). The Cabo Delgado Biodiversity Project has reported this species to occur between Vamizi and Rongui islands, as well as close to Quiterajo, all year round. Its relative abundance suggests that this species uses this area as foraging and developing ground (Hill & Garnier, 2003).

Nesting in Mozambique: According to Hughes (1971), this species nests both on islands and the mainland, of the northern part of the country, presenting almost the same nesting distribution as *E. imbricata* (Figure 2). The use of nesting beaches of the BANP by *L. olivacea* needs confirmation. In the 2004/2005 nesting season an individual was identified at the BANP (Videira & Louro, in prep.).

DERMOCHELYIDAE

This family is represented solely by *Dermochelys coriacea* (leatherback turtle). The genera, possesses a global distribution in tropical and temperate seas.

Leatherback Turtle

Scientific Name: *Dermochelys coriacea* (Linnaeus)

General Characteristics: (Shanker *et al.*, 2003):

- Weights more than 500 kg;

- Carapace length between 140 and 170 cm, elongated with 7 longitudinal stripes. Scutes are absent. Black with white dots.
- Head is big and triangular;
- The anterior flippers are longer than the posterior ones;
- Plastron is small;
- Nests at night, with 4-6 nests per season. For each nest 80-100 eggs are laid. The re-nesting interval occurs between days 9 and 10 and the re-immigration interval occurs between 2 and 3 years.
- Eggs are approximately 5 cm in diameter with a varied shape;

Distribution in Mozambique: In southern Mozambique, from the BANP to Ponta do Ouro (Hughes, 1971).

Nesting in Mozambique: Nesting occurs on mainland beaches, in southern Mozambique (Hughes, 1971; Figure 2). In the BANP, *D. coriacea* ranked third in nesting incidence (12.94%; Videira & Louro, in prep.). At the 1999/2000 and 2000/2001 nesting seasons, 92 and 105 nests, respectively, were identified in the MSR (Magane & João, 2001). Twelve to 13 females were estimated in both nesting seasons (Magane & João, 2002b). In terms of spatial distribution this species prefers the Dobela – Matondo and Chimucane – Mucombo regions. The *D. coriacea* nesting period coincides with that of *C. caretta* (Magane & João, 2002b). Lombard (2005) reported that 82 nesting females were tagged, in a period of 11 years, from 1994/1995 to 2004/2005.

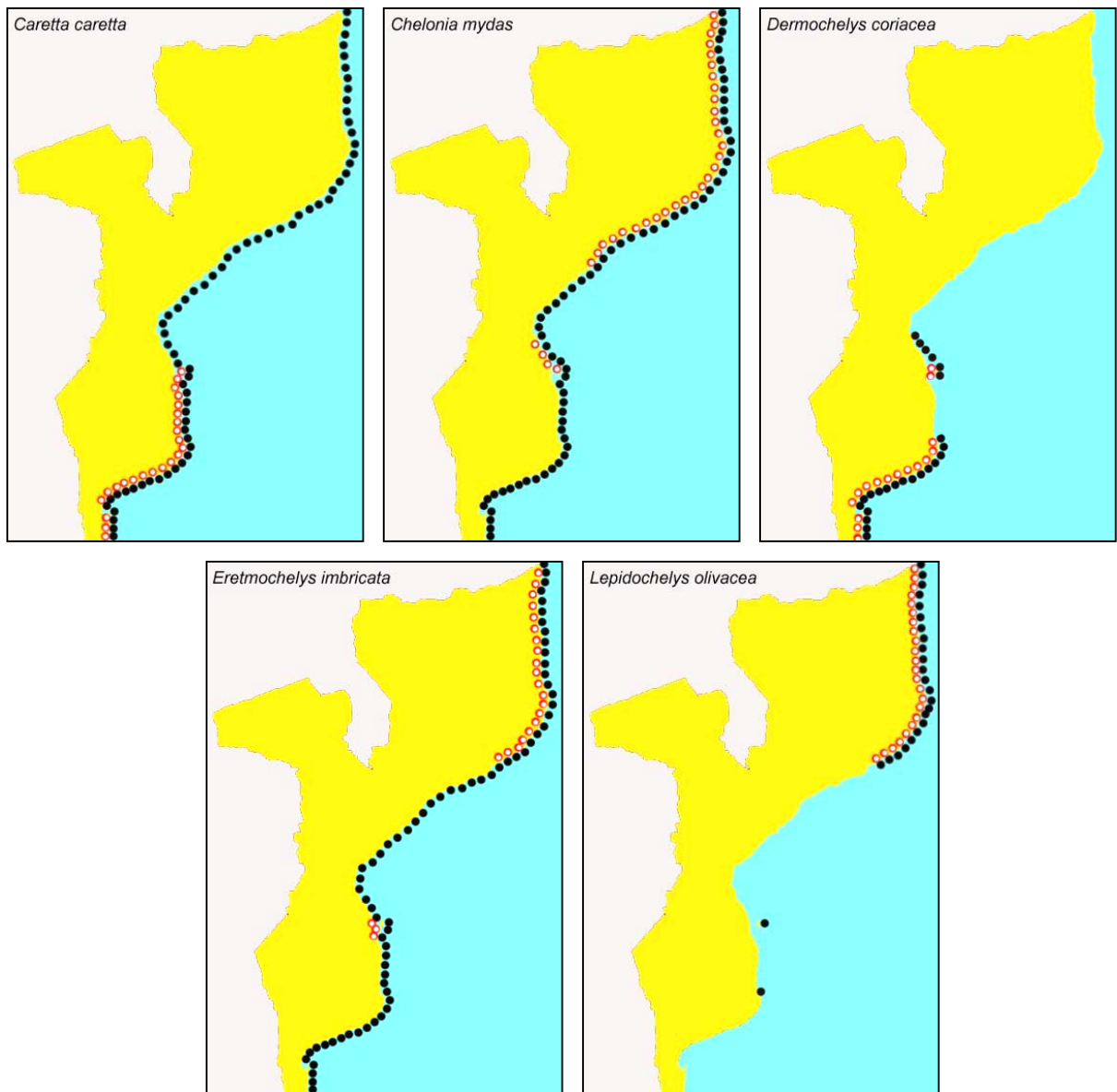


Figure 2. Distribution (●) and nesting grounds (◐) of the five species of marine turtles that occur in Mozambique. Maps adapted from Hughes (1971; 1974a,b), Videira & Louro (in prep), N. Telle (pers. comm.), Louro (pers. obs.).



MORTALITY CAUSES

Trawling

Trawling, especially the shallow-water prawn fishery, concentrated in Maputo Bay and the Sofala Bank (Brinca & Palha de Sousa, 1984; Tomás, 2001), is recognized, at least from the 1990s, as one of the greatest causes of marine turtle mortality in Mozambique. However, data has never been collected. Guissamulo (1993) reported turtle captures in Maputo and Bazaruto Bays, and more recently, Gove *et al.* (2001), analyzed the effects of the prawn fisheries on marine turtles in the Sofala Bank, constituting the only such study in the country.

In this study, Gove *et al.* (2001) estimated that between 1932 and 5436 marine turtles were accidentally caught every year in the Sofala Bank during the prawn fishery season. Although not all turtles are killed, a great majority is sacrificed and eaten by the fishermen (Gonçalves, M., pers. comm). Consequently, this fishery is one of the major, if not the major, cause of turtle mortality in the central region of the country (Gove *et al.*, 2001). With the approval of the new General Regulation of Maritime Fisheries (see Legislation chapter), the Turtle Excluder Devices (TED) are of obligatory use in any trawling fishery aided by a motor, and therefore it is hoped the situation might be reversed.

Beach Seining

Beach seining using tractors, is a fishing art perfected in the Inhassoro area, Inhambane, and apparently restricted to this area. Traditionally, these nets have caught numerous marine turtles, which prompted the Grupo de Trabalho Ambiental (GTA) to develop a marine turtle conservation project in the late 1990s. However, the information produced is not readily available. It has been estimated that 20-35 marine turtles were killed every month, for eight months of the fishery (Gove & Magane, 1996; Hughes, 1971; Magane *et al.*, 1998). More recently, Balidy (unpublished data), registered, at Inhassoro and Vilankulos districts, the incidental capture of 46 marine turtles (of these 38 were greens, 4 loggerheads and the remaining 4 were not identified). The Inhassoro district showed the highest number of incidental captures. Eleven of these were already dead when observed.

Illegal Long Lining

The longline illegal fishery is, apparently, a relative new phenomenon, regarding marine turtle mortality in the Mozambique. However, it has already been extensively studied in other countries

(e.g. Frazier & Montero, 1990; Kotas *et al.*, 2004; Nishemura & Nakahigashi, 1990; Tobias, 1991). This fishery, perpetrated by vessels of Asian origin, is directed primarily to sharks and tuna. However, and due to the omnivore feeding behaviour of the green turtle (cf. Heithaus *et al.*, 2001), these are captured as bycatch (Figure 3). In order to achieve a more dynamic operation, and due to the weight attained by some marine turtle species, these are immediately beheaded during the recollecting process of the longline. Tourists reported an alarming case in January 2003. Forty-two beheaded green turtles were found on the beach between Inhassoro and Bartolomeu Dias (Figure 3). These were caught by illegal vessels of Chinese/Korean origin using a longline of about 25 km, with a hook in every meter. This incident has generated international attention and awareness campaigns promoted by environmental agencies, towards Mozambican governmental authorities. Nonetheless, these have had little impact. In the following two years new incidents regarding illegal vessels are commonly reported.



Figure 3. Marine turtle (probably a green turtle) captured by a longline in the waters off the Bazaruto Archipelago (inside the limits of the National Park) by an illegal vessel (Photo: PNAB). Inset: Decapitated marine turtle found in one of the beaches of the BANP, as a result of illegal Asian fishing vessels (Photo: Judy Hamilton).

Artisanal/Subsistence Fisheries and Traditional Use

This has been an ancient practice and has been relatively small in dimension, given the restrictions associated (myths, taboos, etc). Nevertheless, Hughes (1971), warned that already in the 1970s there were high levels of turtle mortality caused due to traditional use. Certainly, this mortality must have increased with the degradation of traditional values during the 1980s and 1990s. Due to the

lack of law enforcement and control, little is known about the number of marine turtles killed by the artisanal fishery and traditional practices.

Currently, the practice of capturing marine turtles for feeding and posterior sale of its carapace is becoming a common practice in the coastal zone of the country, with turtles being “accidentally” caught in trawling or gill nets, caught on the beach during nesting or using spear guns (Figure 4).



Figure 4. Green turtle captured in BANP (Photo: Eduardo Videira). Inset: carapace of a green turtle captured by spear gun at Tofo beach, Inhambane (Photo: Marcos A M Pereira).

Habitat Degradation – Coastal Erosion

Caused by a variety of factors (see revision by Louro, 2005), coastal erosion (i.e. disappearing of sandy beaches for nesting) is one of the most serious threats to the survival of marine turtles in Mozambique (Gove & Magane, 1996), the cases of Inhassoro and Macaneta, constituting good examples (Louro, 2005). Nonetheless, there are no studies detailing the magnitude of impact on marine turtles. Judging by the areas mentioned earlier (nesting areas) it might be expected that the survival of the hatchlings may be affected as reported by Rumbold *et al.* (2001) in Florida.

Tourism

Coastal tourism has been growing notably in the last few years in Mozambique (Abrantes & Pereira, 2003). Unfortunately, this has been followed with negative tourism practices with consequences not yet quantified for the fauna and flora. Driving of 4x4 vehicles in the southern beaches is such an example. It is known that traffic of 4x4 vehicle has impacts on nesting marine turtles, nest preservation and hatchling survival (e.g. see review by Stephenson, 1999). However, there are no such studies in Mozambique. Coastal development, especially the lighting on the streets, houses and hotels affects hatchling orientation and possibly causing extensive mortality (Bertolotti & Salmon, 2005; Mayor, 2002).

AREAS OF HIGHEST MORTALITY

Due to the lack of information from remote areas, it is difficult to predict in which areas marine turtle mortality is highest. As mentioned before turtle mortality is widespread throughout almost the entire coastline. Nevertheless, the Sofala Bank (Gove *et al.*, 2001), Vilankulos - Inhassoro (Gove & Magane, 1996), and Barra-Tofo-Tofino and Bilene (Pereira, M.A.M., pers. obs.; Figure 5) deserve especial attention. Up in the northern part of the country, although there is a great occurrence of marine turtles (Hughes, 1971), information is still scarce. Therefore, one should consider that mortality should also be high in areas with the greatest concentration and nesting of marine turtles, as reported by Hughes (1971).



Figure 5. Remainings of the carapace of marine turtles captured, grilled and consumed in the coastal dunes in Praia do Tofo (Photo: Marcos A M Pereira).

ECOLOGICAL, ECONOMICAL AND CULTURAL VALUES

ECOLOGICAL VALUE

Marine turtles play a fundamental ecological role. As consumers (algae, seagrass, sponges, crustaceans and cnidaria) and as prey (eggs, juveniles and adults), they are important in the food chain of coastal and marine ecosystems. Their movements during nesting and feeding between the different habitats (seagrass beds, coral reefs, oceanic waters and beaches) are important in the exchange of energy and nutrient recycling (Bjorndal, 1997).

The extinction of marine turtles, which represents about 150 million years of evolution (Pritchard, 1997), will create an ecological emptiness impossible to substitute. Due to their long life cycle, these species are used as a study model to better understand how superior species have evolved to support the different environmental conditions. They are equally important in vertebrate longevity studies (a marine turtle may live up to 100 years - Pritchard, 1997).

ECONOMIC VALUE

The sale of marine turtle carapaces, in handcrafted form (necklaces, earrings, rings, bracelets, etc.) or whole, in shanty craft markets and tourist centres (Figure 6) is an old practice. Hughes (1971) referred to this practice especially regarding the green and the hawksbill turtles in the Inhassoro region and Mozambique Island, respectively. Recently, a study conducted by the WWF – Mozambique, found that this practice is also common in shops (including the Maputo International Airport and other commercial centers) and markets of Maputo City (Costa, A., pers. comm.). This is considered as an illegal practice and therefore it must be discouraged. One alternative is the development of a tourism industry of marine turtle observation, as proposed by Pereira (2004) for the Matutuíne region. There are already several successful cases in at least 42 countries. South Africa (Maputaland) constitute a good example where 45,000.00 US\$ in 2003 were raised (Troëng & Drews, 2004).

Currently, there is no tourist operation focusing on turtle watching. Mr. Pierre Lombard has integrated within his monitoring program in the Matutuíne coast, a turtle watching activity during the nesting season. Since at least 1996, almost 200 tourists have participated (Kyle & Lombard, 1996). However, these activities are very restricted and not well publicized and the number of people involved is actually very low. Around 4-6 people per night participate and pay a value of around ZAR50.00 per person. This value is used to support petrol costs related with the monitoring activities (Lombard, 2004).



Figure 6. Green turtle carapaces (*Chelonia mydas*) for sale in the local market, Bilene beach (Photo: Marcos A M Pereira).

The growth of coastal tourism in the country (Abrantes & Pereira, 2003), could stimulate the development of this activity, which could be undertaken by both tourism operators as well as by the local communities. However, being a highly seasonal activity it would not support a large industry. It could be an extra service offered by settled tourism operators or an alternative for the local communities. Either way, these operations will require specific regulations to be sustainable.

CULTURAL VALUE

Traditionally, coastal communities make use of marine turtle eggs and meat (Gove & Magane, 1996; Figure 7). This practice is quite common throughout the coastal zone where the concentration of marine turtles is high. There are reports of these practices in the Quirimbas Archipelago, Mozambique Island, Vilankulos, Bazaruto Archipelago, Maxixe, Tofo, Jangamo, Xai-Xai, Bilene, Macaneta, Inhaca and the Matutuine coast. Besides using the meat for human consumption, at Inhaca Island, the raw oil of the leatherback turtle is used to paint boats and when boiled is used for cooking (Impacto, 1997). Also, pieces of carapace are used by witch doctors (Gove & Magane, 1996) in the practice of traditional medicine. Little is known, however, about these practices, which are restricted and maintained in secrecy.



Figure 7. Marine turtle meat is commonly consumed by coastal populations. The photo shows a fire where a turtle was consumed, moments before, by fishermen at Tofo beach, Inhambane (Photo: Marcos A M Pereira).

CONSERVATION AND MANAGEMENT

CONSERVATION AREAS

There are seven coastal and marine conservation areas in Mozambique that directly or indirectly act on the conservation and management of marine turtles, namely: (1) Bazaruto Archipelago National Park; (2) Quirimbas Archipelago National Park; (3) Maputo Special Reserve; (4) Pomene Reserve; (5) Marromeu Reserve; (6) Special Control Zone of Inhaca Island; and (7) Coutada 10. Among these, the following will be given special attention:

Bazaruto Archipelago National Park

The first marine park in Mozambique, the BANP was created in 1971 with the main purpose of conserving marine species of high ecological value, such as the dugong, dolphins and marine turtles (Dutton & Zolho, 1990). In 2001 due to the need of an integrated management approach of the five islands (Bazaruto, Benguéra, Magaruque, Santa Carolina e Bangué) that compose the archipelago, the limits of the park were extended (MITUR, 2002). The Management Plan, approved in 2002, by Ministerial Decree, functions also as the legal instrument for the conservation of marine turtles, and establishes five use zones, which two being relevant: (1) Wildlife Zone, the first level of protection - maximum protection zones. Includes areas susceptible to erosion and those that serve as critical habitat for numerous species, in this case nesting beaches. In this zone, any form of development or extractive use is not allowed and no traffic of vehicles is allowed; (2) Total Protection Zone, second level of protection, it consists of specific habitats, reserved to the protection and management of certain natural resources (e.g. coral reefs and seagrass beds). Extractive activities are allowed but controlled, as well as certain low-impact activities (e.g. tourism, recreation, scientific and monitoring activities). The Management Plan strictly protects the five species of marine turtles.

Quirimbas Archipelago National Park

Located in the Cabo Delgado province, north of Mozambique, the Park includes 11 of the most southern islands of the archipelago and a vast extension of coastal forest in the mainland, with an area of approximately 7500 km² (WWF, 2004). Created in March 2002, in response to local communities demand, that greatly understood that their survival relied on the conservation and management of the natural resources (WWF, 2004). The QANP is recognized by its extreme scenery beauty, biodiversity and cultural heritage. The 1500 km² of the marine zone includes coastal and marine habitats that serve as feeding, breeding and nesting grounds of marine turtles (WWF, 2004). The Management Plan approved in 2003 by Ministerial Decree, defines the total protection zone, as the zone in which no extractive activities are allowed, where pristine representative inter-linked ecosystems occur (e.g. coral reefs, seagrass beds and mangroves),

areas suitable for development and nesting, and areas critical for the survival of rare species, threatened with extinction or threatened (MITUR, 2004). The management plan also lists activities not allowed in all other marine zones (MITUR, 2004).

Maputo Special Reserve

Created in April 1932, it is located in the southern part of Maputo Province, district of Matutuíne, between the Maputo River and the Indian Ocean (MITUR, 2002). There is a coastline of approximately 35 km, composed by sandy beaches and vegetated coastal dunes that offer excellent environmental conditions for the nesting of the loggerhead and leatherback turtles (Tello, 1973). The Management Plan was approved in March 2002, by Ministerial Decree and identifies two zones that serve as tools for the management and conservation of marine turtles: (1) Protected Zone, it involves the coastal forest, beach vegetation and the Membene area along the beach; and (2) Wildlife Zones, involves all the coastline, except the 500 meters at both sides of Ponta Dobela and Milibangalala, which is used by the local communities and tourists. Driving is not allowed. However, the plan recognizes the inadequate coverage of the marine zone of the reserve, with the main focus on the terrestrial part. As a strategy and conservation action the management plan, proposes the periodical monitoring of marine turtles. It also recommends the implementation of research and monitoring activities regarding marine turtles in this area.

Inhaca Island Special Control Zone

Includes several forest and marine reserves (Kalk & Costa, 1995). Since 1980, the control and management of the reserves is under the Marine Biological Station of Universidade Eduardo Mondlane. A group of guards, distributed through six strategic locations and a mobile patrol group, monitor the reserves (Kalk & Costa, 1995). Monitoring has proven useful in nest protection, eggs and hatchlings of the leatherback and loggerhead turtles on the dunes of the east side of the island that are part of the Yingwani Forest Reserve (Kalk & Costa, 1995).

Adding to this extensive list of coastal and marine conservation areas, three more areas have been proposed and will aid in the management and conservation of marine turtles in the country, namely: (1) Primeiras and Segundas Archipelago National Park; (2) Two marine transboundary conservation areas, between Mozambique-South Africa, in the south and Mozambique-Tanzania in the north; and (3) a Nesting Marine Turtle Area in Bilene beach, Gaza Province.

RESEARCH, MONITORING, CONSERVATION AND MANAGEMENT PROGRAMS

Hughes (1971; 1972; 1974) conducted the first studies in Mozambique with regards to species composition, distribution, conservation and threats to marine turtles. Dias *et al.* (1971) conducted a preliminar biodiversity assessment of Bazaruto Archipelago (Dias *et al.*, 1971). This involved an assessment of marine turtles and threats to their conservation. The main goal of the survey was to

assess the ecological status of the archipelago, in order to propose adequate protection measures. Tello (1973) also conducted an ecological assessment of the MSR and identified the main species of marine turtles that nested in the region, as well as the main nesting beaches. However, it was only after 1987, that action began to take place regarding research, monitoring and management of marine turtles in Mozambique, and these are as follows:

Ponta do Ouro to Cabo de Santa Maria – Maputo, Southern Mozambique

Two monitoring programmes have been developed in this region: (1) *The Monitoring and Conservation of Marine Turtles in Southern Mozambique Program*, which started during the 1994/1995 nesting season, and has been being implemented for almost 11 years. It covers the area between Ponta do Ouro and Ponta Dobela. It is a program that has the support of the Mozambican Government, more specifically the National Directory of Forests and Wildlife (DNFFB) and the Kwazulu Natal Wildlife (KZNW) from South Africa. The main objectives are to monitor and tag nesting females, to promote the awareness of the local communities and tourists, and to control beach driving (Kyle & Lombard, 1996; Lombard, 1997; Lombard & Kyle; 2004; Lombard, 2005); (2) *Monitoring and Conservation of the Nesting Females, Nests and Hatchlings of Dermochelys coriacea and Caretta caretta*, it started in 1996 and covers the entire coastline of the MSR, between the southern point of Ponta Dobela and north of Ponta Chemucane. It is implemented in collaboration with the local communities and the guards of the MSR under the management of National Directorate of Forests and Wildlife, currently the National Directorate of conservation Areas. In the 1999/2000 season improvements were made in the method of data collection in order to allow a systematic and more detailed analysis (Magane & João, 2000). Apparently, monitoring continued for one more season (2000/2001; Magane & João, 2001, 2002) and was terminated due to financial constraints.

Ilha da Inhaca – Maputo, Sul de Moçambique

The Inhaca Island Marine Turtle Conservation Program, more specifically in the east coast of the island, began in 1987 and the main goal was to monitor nesting females of leatherback and loggerhead turtles, nests and hatchlings (Kalk & Costa, 1995; Gove & Magane, 1996). This is the oldest marine turtle monitoring programme, however the data collected has not been systematically kept nor analyzed (Louro, pers. comm.). A peculiar aspect of the program is the famous story of guard Raimundo Singa, responsible for controlling the 12 km of beach at the east coast of the island to protect the nests. Mr. Singa has already walked 38 880 km, which equals two-way trips Maputo – London (Impacto, 1997).

Macaneta – Maputo Peninsula, Southern Mozambique

The *Project for Biodiversity Conservation and Sustainable Development of Macaneta* began in 2002 and is being implemented by CESVI and FNP. Among the several activities of this project, it

includes a program for the protection of marine turtles through the control of nesting females, nests, tagging of nesting females and turtles accidentally captured in fishing nets. A private ecotourism project, of which little information is available, also runs a tagging program. This is done with the support of the local communities, which receive a reward whenever a turtle is delivered and tagged.

Vilanculos Coastal Wildlife Sanctuary - Inhambane, Southern Mozambique

This initiative has created a great conflict of interests with the local communities, and is located in Inhambane Province, at the northern point of Península do Cabo de São Sebastião. It was created in October 2000, by the Council of Ministers and has an area of approximately 25 000 ha of land and sea. It is supported by foreign investment and its main aim is to establish an eco-tourism project to manage and conserve the natural resources, including a marine turtle monitoring program (Louro, pers. comm.). No information is available on this project, with only a reptile species list of the area being provided at the projects's website <http://www.thesanctuary.co.za>.

Inhassoro – Inhambane, Southern Mozambique

Gove & Magane (1996) mention a marine turtle tagging program established at Inhassoro, and implemented by GTA. However, information regarding the program's activities and data collected is not available.

Bazaruto Archipelago – Inhambane, Southern Mozambique

In partnership with the local communities and the park authorities, established the *Monitoring and Conservation of Marine Turtles Nests* during the 1994/1995 nesting season. It is implemented throughout the east coast of the islands (Videira & Louro, 2003). The *Monitoring of Occasional Occurrence, Abundance and Mortality of Marine Turtles, Dolphins and Dugongs* started in 1999, all around the archipelago (Videira & Louro, 2003). These monitoring programs are still being implemented by the Projecto de Gestão Comunitária dos Recursos Naturais (CBNRM – Community Based Natural Resource Management) that has the support of the WWF and FNP. It is important to mention that in 2005 an analysis was made using the data collected so far. The goal was to compile all data collected as well as to improve the system of data collection and analysis, especially with regards to the conservation status of marine turtles in the country (Videira & Louro, 2005). Periodical areal monitoring activities of dugongs, dolphins and marine turtles also takes place (Cumming & Mackie, 1995; Mackie, 1999; Mackie *et al.*, 2001).

Sofala Bank – Sofala, Central Mozambique

The impact of the shallow-water prawn fishery on marine turtles was studied in the Sofala Bank (Gove *et al.*, 2001). Additionally the study also looked at the effect of the Turtle Excluder Devices (TEDs) on prawn catches.

Primeiras and Segundas Islands – Zambézia and Nampula, Northern Mozambique

In partnership with the local communities and with the support of the WWF, a Project regarding the Conservation and Monitoring of Nests and Marine Turtles was established in 2004 in this area (WWF, 2004). Information regarding activities and data collected has not yet been published (see Local Community Involvement).

Quirimbas Archipelago – Cabo Delgado, Northern Mozambique

In 1996, the Society for Environmental Exploration and MICOA started a biodiversity assessment program, for a two-year period in the Quirimbas Archipelago. Random observations were made along with the monitoring and analysis of the level of marine turtle exploitation in the region (Whittington *et al.*, 1998). Since 1998, The *Cabo Delgado Biodiversity and Tourism Project*, in partnership with a foreigner private investor, the Zoological Society of London (ZSL) and with the support of the Mozambican government (i.e. Provincial Directorate for Environmental Affairs in Pemba), the Natural History Museum in Maputo and the Department of Biological Sciences, Eduardo Mondlane University. The main objectives are to monitor and protect nesting *Chelonia mydas* and *Eretmochelys imbricata* females and their nests (Hill & Garnier, 2003). However, information published regarding this project is not easily available. It is also important to mention that this project is running a marine turtle tagging programme, where titanium tags are being used with the tag codes MZC0000 – MZC0999.

Mozambique Marine Turtle Tagging Program

It is being implemented by the Mozambique Marine Turtle Working Group (GTT), since 2003 with the support of national (CTV, FNP) and international organizations (WWF, MCS). The main aims of this project are to: (1) tag marine turtles, both nesting females and those accidentally captured in fishing gear throughout the Mozambican coastline; (2) develop and implement a national tagging system; and (3) develop a data base in order to facilitate future data analysis as well as to share information at a national and international level. The program has developed a tagging information sheet and the titanium tags being used have the MO801-1550 and MZ001-400 codes (Louro, 2005a). Various monitoring and conservation projects described in Table 1 collaborate with the program.

Table 1. Different conservation and monitoring projects that support the Mozambique Marine Turtle Tagging Program and the number of tagged turtles throughout the Mozambican coastline.

Monitoring Programs	Tags	Tagged Marine Turtles
Quirimbas National Park	MO 979 -1000	NA
Bazaruto Archipelago National Park	MO 821-850	25
	MO 1001-1050	
Vilankulos Coastal Wildlife Sanctuary	MO 851-900	NA
Biodiversity Conservation and Sustainable Development in Macaneta	MO 801-820	12
Maputo Special Reserve	MO 1051-1100	24
	MO 951-974	
Primeiras and Segundas Islands	MO 1501-1550	22
	MO 1101-1250	

The great majority of these monitoring and research programs are also considered conservation and management programs, and this can be seen by the different activities implemented, as described below.

LOCAL COMMUNITY INVOLVEMENT

In the first few years (1994 -1997) of the Conservation and Monitoring of Marine Turtles in Southern Mozambique Project, two local guards were controlling the beaches during the nesting season. They also conducted local community awareness regarding the value of conservation of marine turtles (Lombard, 2005). Efforts are being made to improve awareness, as well as the development of alternatives, for example subsistence agriculture and new job opportunities to reduce the need for marine turtle's eggs and meat (Lombard, 2005). Magane & João (2002) stated that the Program for Monitoring *Caretta caretta* and *Dermochelys coriacea* nesting females had the support of the local communities.

Nest monitoring in the Bazaruto Archipelago National Park has had great involvement of the local community through frequent educational and awareness meetings (Gove & Magane, 1996; WWF, 2004). This was confirmed by Gove & Magane (1996) that reported the increase of number of protected nests from 6 in the 1989/1990 season to 24 in the 1994/1995 season. Videira & Louro (2005) also reported that in the last three monitoring seasons 2002/2003, 2003/2004 and 2004/2005 no nests were lost due to theft, which implies a greater awareness in the protection of marine turtles and its nests. It is important to mention that 70% of the nests were found by the local communities (Videira & Louro, 2005). Another point of interest and support by the local communities is the Tagging Program. Whenever a marine turtle is accidentally captured in the nests, local

fishermen bring the turtle to the guards for tagging (Louro, 2005a; Videira & Louro, 2005). This involvement and support, is also reported in Macaneta Beach, north of Maputo City (Louro, 2005a).

Local communities with the support of the WWF, in the Primeiras and Segundas Archipelago are involved in the nest protection of *Caretta caretta*, *Chelonia mydas* and *Eretmochelys imbricata*. Nests were destroyed and the eggs collected for sale in Angoche (WWF, 2004). According with the same source, in April 2004, the fishermen of Njovo and Puga-Puga, created committees and selected guards for the protection of these marine species. It is expected that these activities will be extended to other islands of the archipelago and that these will be incorporated in the national marine turtle tagging program (WWF, 2004).

The Cabo Delgado Biodiversity and Tourism Project, with the support of the local communities, have trained, in September 2002, local patrol guards. The work aimed at contributing to a create awareness in the local communities of the benefits associated with preserving marine turtles, nesting females and nest monitoring as well as its protection. Whenever a marine turtle was killed or a nest destroyed, the guards would inform the local authorities at Palma (Hill & Garnier, 2003).

EDUCATION AND ENVIRONMENTAL AWARENESS

Capacity-Building Courses

The Wildlife Community Guards Project, known as "Mungonzices" was created in 1990, in the Bazaruto Archipelago with the support of FNP. The main goal was to develop awareness among local communities on ecological aspects and to develop a structure within the community to preserve and make a sustainable use of the natural resources, and therefore keeping their interests and actively participating in the management of these resources. Another objective was to turn the guards into a communication channel between the local communities and the conservation authorities.

One of the activities of the Mozambican Marine Turtle Tagging Program is to capacitate the local communities and wildlife guards as well as society in regards to the conservation and management of marine turtles. Between December 2003 and August 2005, four courses were given (at Macaneta, BANP, community representatives of the Gaza Province, through the Associação para Saúde Ambiental (ASA) and a group of students from UEM interested in matters related to marine turtles). These courses included information regarding species identification, biological and ecological aspects of each species, main threats, management and conservation measures, as well as common methods for tagging and nest monitoring (Louro, 2005a).

Awareness Campaigns

2000/2001 Welcome Campaign

Coordinated by FNP, in collaboration with MICOA, FUTUR, the Navy, Migration Authorities, Police and Local Administrations. This campaign focused on coastal tourism in southern Mozambique (Maputo, Gaza e Inhambane) and involved education and awareness to the conservation of coastal and marine environment, mainly sandy beaches, coral reefs and marine turtles (Figure 8). This carried out by the distribution of brochures, posters and stickers at the borders, hotels, camping sites, restaurants, etc. (Abrantes & Pereira, 2002).



Figure 8. Posters and brochures used during the 2000/2001 Welcome Campaign.

Trade of Marine Protected Species

This campaign was started in 2004 and focused its attention in the trade of marine protected species, including marine turtles, corals and some species of bivalves and gastropods. Developed and implemented by the WWF, with the support of other non-governmental organizations such as FNP, CTV and GTT. The main goals were to create awareness among more than 500 school pupils of 16 primary schools in Maputo and Matola. Shop owners and market outlets selling artefacts crafted from marine protect species were also involved, through plays, t-shirt and brochure distribution, as well as public environmental debates. An assessment on the trade of marine turtle artifacts in Maputo City was conducted (WWF, 2005).

GAPS, OPPORTUNITIES AND CHALLENGES

Although many of the conservation and management programs described previously play an important role in the conservation of marine turtles in Mozambique, through community involvement, nesting females and nest monitoring as well as tagging and awareness campaigns, there are still gaps in the knowledge of the current status of conservation of marine turtles. These gaps are:

- (1) the majority of the research and monitoring programs are taking place in southern Mozambique; therefore there is a deficit of pertinent information, for example regarding the main nesting and feeding grounds in the central and northern parts of the country;
- (2) within these programmes, the great majority focuses its attention only on the reproductive biology of females and nests, putting aside its developmental and feeding biology;
- (3) the information regarding populations and habitats is incomplete. The growth and feeding habitats are almost or totally unknown;
- (4) the information regarding the level of human impact on the marine turtle populations in different stages of its life cycle, is also almost, or totally, unknown;
- (5) the long-term programs, require systematic data collection and periodical data analysis, this could be made, for example per nesting season. Nest monitoring in the BANP started 1994/1995 and had the compiled in 2003 (Videira & Louro, 2003) and the analysis was only done in 2005 (Videira & Louro, in prep.). The same happened for the Inhaca Island monitoring program, where the data were only analyzed in 1989;
- (6) some programs are short-lived; studies on the reproductive biology and need to be long-termed, a decade or more, in order to analyze population size and trends. This is due to lack of financial and human resources;
- (7) although the Mozambique Marine Turtle Working Group was created and one of the goals is to improve the collaboration between several governmental and non-governmental environmental agencies, involved in the management and conservation of marine turtles (Table 2), with regards to research, management, control and implementation, this collaboration is currently still weak; and

- (8) the lack of publication of activities and the results achieved by the different programs, especially those supported by foreign private investment, as well as by national environmental agencies.

Table 2. Institutions involved in research, conservation and management of marine turtles in Mozambique.

Institution	Res/ Monit	Cons/ Manag	Contr/ Enfor	Net
<i>Ministério para a Coordenação da Acção Ambiental</i>				
Direcção Nacional de Gestão Ambiental			X	
Centro de Desenvolvimento Sustentável para as Zonas Costeiras	X	X	X	X
Comité Inter-Institucional de Gestão Costeira		X		X
<i>Ministério da Agricultura</i>				
Direcção Nacional de Florestas e Fauna Bravia	X	X	X	
<i>Ministério das Pescas</i>				
Instituto de Investigação Pesqueira		X		
Direcção Nacional de Administração Pesqueira			X	X
<i>Ministério do Turismo</i>				
Direcção Nacional de Áreas de Conservação	X	X	X	
<i>Universidade Eduardo Mondlane</i>				
Departamento de Ciências Biológicas	X	X		
Estação de Biologia Marinha da Ilha da Inhaca	X	X	X	
Museu de História Natural	X			
<i>CDBT – Cabo Delgado Biodiversidade e Turismo</i>				
<i>WWF – Fundo Mundial para Natureza</i>	X	X		X
<i>Fórum para a Natureza em Perigo/CESVI</i>	X	X	X	
<i>Associação dos Naturais e Amigos da Ilha da Inhaca</i>		X		X
<i>Ponta Malongane Resort</i>	X	X		
<i>Santuário de Vilankulos</i>	X	X		
<i>Grupo de Trabalho Tartarugas Marinhas de Moçambique</i>	X	X		

Res/Mon = Research and Monitoring; Cons/Manag = Conservation and Management; Contr/Enfo = Control and Enforcement; Net = Networking.

OPPORTUNITIES AND CHALLENGES

Considering the gaps, it becomes extremely important to turn these into challenges in order to improve our knowledge of the biology, ecology and conservation status of marine turtles in Mozambique. It is also important to acknowledge the existence of environmental agencies as well as a Working Group to facilitate the communication between these agencies, conservation areas,

monitoring programs, community involvement in some areas and to apply these, for example, where the level of exploitation is high, as is the case at Tofo Beach (see Threats). The interest and involvement of the private sector, environmental groups (e.g. ANAII, ASA) and regional programs in collaborative research, management and conservation of marine turtles must be explored and strengthened where appropriated.

INTEGRATION IN REGIONAL PROGRAMS

Management initiatives for the conservation of marine turtles need to be taken into consideration in all its life cycle stages, in different habitats and sometimes in remote areas, covering different nations (IUCN, 1996). For these reasons, and with regards to the dynamics of the marine turtle populations, regional programs are essential to cover the different distribution areas of reproductive groups or populations of marine turtles (IUCN, 1996).

There are several initiatives within the Indian Ocean region, for the conservation of marine turtles. The following are highlighted:

Western Indian Ocean Strategy and Action Plan for the Conservation of Marine Turtles

This strategy and action plan was developed to reduce national and regional gaps in relation to conservation of marine turtles. It was developed in November 1995 in South Africa by representatives and scientists of several Western Indian Ocean countries, namely: South Africa, Comoros, Eritrea, Kenya, Reunion Island, Mauritius, Mozambique, Seychelles and Tanzania (IUCN, 1996).

Eastern Africa Marine Ecoregion (EAME)

This includes the territorial waters and exclusive economic zones of southern Somaly, Kenya, Tanzania, Mozambique and South Africa (down to Sodwana Bay). An initiative promoted by the WWF, where different countries have adopted a regional approach regarding coastal and marine conservation challenges. The potential benefits that directly and indirectly serve in the conservation of marine turtles are as follows: (1) collaboration in conservation; (2) greater involvement of the different parties; (3) promotion of the government support; (4) greater variety of options in conservation efforts; (5) integrate the conservation concept in the vision for coastal development; (6) act on a geographic scale that corresponds to great ecological processes that support and maintain biodiversity; (7) support the maintenance of species, populations and ecological processes that require vast areas for their survival. EAME identified Maputo Bay – Machangulo Complex and the Bazaruto Archipelago, as areas of global value due to their importance to marine turtles.

TRANSMAP

Scientists and regional agencies have developed a research project with the goal of developing a scientific database that will support the creation and management of transboundary marine protected areas in the region. The TRANSMAP project will include the coastal and marine transboundary areas between Tanzania and the north of Mozambique and South Africa and southern Mozambique. This includes the Mnazi Bay and Rovuma River estuary in Tanzania, the islands of the Quirimbas Archipelago, Machangulo Peninsula, Inhaca Island in Mozambique and the Saint Lucia region in South Africa. This project represents a potential contribution to achieve the goals of the Nairobi Convention as well as the New Partnership for the Development of Africa (NEPAD; The Oricle, 2005).

Meeting on Marine Mammals and Marine Turtles

The meeting on the Western Indian Ocean Marine Mammals and Marine Turtles took place on Septemebr 1st, 2005 in Mauritius, during the WIOMSA Fourth Scientific Symposium. The purpose of this meeting was to discuss the potential for future collaboration between regional researchers, in regard to information exchange and resource sharing. The meeting was attended by regional and international researchers and managers, from South Africa, Reunion Island, Kenya, Mozambique, Madagascar, Mayotte, Sweden and Tanzania.

RELEVANT LEGISLATION

NATIONAL LEGISLATION

The current legislation in the country, with regards to the protection and conservation of marine turtles, includes the following:

Indirect Incidence

The Constitution

The Mozambican Constitution clearly shows a concern with regards to the conservation of the environment. Article 37 reads “The State promotes initiatives to guarantee the ecological equilibrium, conservation and preservation of the natural environment in order to improve the quality of life of the citizens.” Therefore, the constitutional setting has been created and the State is responsible for leading environmental conservation actions.

The Environmental Law (Law 20/97 of 1 October 1997)

The Environmental Law, especially in its Article 12, refers to biodiversity protection, and it reads in section 1 “All activities that endanger the conservation, reproduction, quality and quantity of the biological resources are forbidden”. Clearly, there is a window of opportunity for the protection of marine turtles, these being species threatened with extinction. Moreover, it is the Government’s responsibility to “... guarantee that appropriate measures are taken with the purpose of: a) maintaining and regenerating animal species, recover of damaged habitats (...), by controlling those activities or the use of substances susceptible capable of destroying wildlife and their habitats.”

Other environmental legislation of indirect incidence, that are worthy to mention are: i) Environmental Impact Assessment Regulation (Decree 45/2004 of 29 September 2004), refers for example, to any development initiative that might affect threatened species or sensitive ecosystems (e.g. coastal dunes and other relevant marine turtle habitats) require an environmental impact assessment; ii) Tourism Law (Law 4/2004 of 17 October 2004), refers in its Article 9, n^o 2, that “Tourism in conservation areas helps the conservation of the ecosystems, habitats and species of the referred area”; iii) the Strategy and Action Plan for the Biological Diversity of Mozambique; has its main goal “... to set directives and define priority actions to be implemented by the diverse economic sectors to guarantee a sustainable development.” More precisely, and with respect to marine turtles, goals for 2010 have been determined among others, the existence of a more profound knowledge and an improved conservation status of relevant species, threatened and/or endemic. It is also mentioned, the need for the knowledge on the biodiversity and dynamics of valuable and/or fragile ecosystems and of the interaction between adjacent ecosystems.

Direct Incidence

Forests and Wildlife Regulation (Decree 12/2002 of 6 June 2002)

This is currently, the piece of Mozambican legislation that directly protects marine turtles, among other wildlife species. The Articles 43 (5) and 44 (1a), fully protect the species listed in Annex II (of which all 5 species of marine turtle are included), and sets the fine for illegal hunting of marine turtles at 25,000,000.00 Mts.

The Regulation also predicts the aggravation of fines depending on the circumstances (Article 114 and Annex III) where the following is applies to marine turtles:

- Hunting in a forbidden area (e.g. Parks and Reserves) – 10,000,000.00 Mts
- Hunting with forbidden means or instruments (e.g. gill nets in forbidden areas) - 20,000,000.00 Mts
- Hunting without license (the Regulation predicts the issuing of special licenses for scientific research, Article 44 (2 and 3) – 30,000,000.00 Mts
- Hunting of protected species – 100,000,000.00 Mts
- Trade, importing or exporting of wildlife specimens without a permit – 10,000,000.00 Mts
- Actions against rare species or threatened with extinction, for which exploitation is forbidden– **1,000,000,000.00 Mts**
- Use of violence, threat or showing resistance to enforcement – total fine value plus 60%

Additionally there is the possibly of an aggravation of 40% of the fine, if the offenders are an organized group. The Regulation also stipulates an aggravation of 50% of the fine value if the offender is a wildlife officer, community guard, Police Officer, Military or a public worker of the Forests and Wildlife or Tourism Services.

For example, in an hypothetical situation, if three fishermen caught a marine turtle in the Bazaruto Archipelago National Park, where the capture of marine turtles is forbidden, using a gillnet (a forbidden method in the area), sell its meat and resist with violence to the authorities, the fine might reach a total value of 2,390,000,000.00 Mt (approximately 95,000.00 U\$D), corresponding to:

- Capture of marine turtle ----- 25,000,000.00 Mts
- Hunting/fishing in a forbidden area ----- 10,000,000.00 Mts
- Fishing using forbidden means ----- 20,000,000.00 Mts
- Capture without a permit ----- 30,000,000.00 Mts
- Capture of a protected species ----- 100,000,000.00 Mts
- Trade without permit ----- 10,000,000.00 Mts
- Capture of a species threatened with extinction ---- 1,000,000,000.00 Mts
- Fine value ----- 1,195,000,000.00 Mts

- Offenders are an organized group (+40%) ----- 478,000,000.00 Mts
- Resistance (+60%)----- 717,000,000.00 Mts
- Total value to pay ----- **2,390,000,000.00 Mts**

Recreational and Sports Fishing Regulation (Decree 51/99 of 31 August 1999)

This regulation acts specifically upon the recreational and sports fishery. It also forbids marine turtle fishing (Article 14 and Annex II). The fine in this case, for the capturing and possession of a protected species is of 8,000,000.00 Mts to 10,000,000.00 Mts per piece.

General Regulation of Maritime Fishing (Decree 43/2003 of 10 December 2003)

In this Regulation (Article 110.1), the use of the Turtle Excluder Device is mandatory to all trawling fisheries aided by a motor. According to section 2 of the same Article “Failure to use the device constitutes a serious fishing practice infringement in terms of section a) of Article 53 of the Fishing Law and is punishable in accordance with number 2 of the same article”. This has direct relevance to the shallow-water prawn fishery, as mentioned earlier.

Conservation Areas Management Plans

The management plans of coastal and marine conservation areas, namely the BANP, QNP and the MSR, clearly forbid any activities that might endanger marine turtles, its eggs, nests and in general its habitat.

CONVENTIONS, TREATIES AND RATIFIED AGREEMENTS

Indirect Incidence

African Convention for Nature and Natural Resources Conservation

Ratified in 1981 (Resolution 18/81 of 30 December 1981), this convention’s main goal is to ensure the use, development and conservation of soil, water, flora and fauna resources of its member States in accordance with the scientific principles and interests of its people. However, it does not explicitly mention the conservation and protection of marine turtles.

Convention of the Biological Diversity (CBD)

Ratified in 1994 (Resolution 2/94 of 24 August 1994), this convention generally covers aspects related with the conservation of the biological diversity, sustainable use of its components and fair and equal sharing of the natural resources at a global level. It was created has a practical tool for the application of the Agenda 21 principles of the Earth Summit that took place in Rio de Janeiro in 1992.

Convention on the Management, Protection and Development of the Coastal and Marine Environment of Eastern Africa (Nairobi Convention)

Ratified in 1996 (Resolution 47/96 of 28 November 1996), the Nairobi Convention focuses directly on aspects related to the pollution of the marine and coastal environments, being less relevant to the protection and conservation of marine turtles *per se*.

Direct Incidence

Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)

Ratified in 1981 (Resolution 20/81 of 30 December 1981), this convention regulates and controls the international trade of threatened species through the listing in Annexes according to threat level. Annex I (where at currently all species of marine turtles are included), lists all species threatened with extinction and which trade can only be made in exceptional cases (e.g. scientific research). Therefore, any act of international trade of marine turtle (or its products) is illegal, included the import and export of jewellery pieces (e.g. necklaces, bracelets, rings, etc.).

International Union for Nature Conservation (IUCN)

The ratification of the Mozambique application as a member state was made in 1981 (Resolution 21/81 of 30 of December). As a world organization, the IUCN aims to influence, encourage and support society in the conservation of the diversity and integrity of nature and ensure that the use of the natural resources is made equitably and sustainably. The IUCN also maintains a large range of programs on the conservation of species and ecosystems, being the most relevant for marine turtles the following: IUCN Red Data List and the Marine Turtle Specialist Group.

Convention on Migratory Species (CMS) and the Memorandum of Understanding on the Conservation and Management of the Marine Turtles and its Habitats in the Indian Ocean and Southeast Asia (IOSEA-MoU)

These are probably the international legal devices with the greatest relevance for the conservation and protection of marine turtles. However, Mozambique has not yet signed the Convention nor the Memorandum of Understanding. All species of marine turtles are listed in the Annex of the Convention, as threatened species, that require the most immediate attention in respect to conservation.

COMPATIBILITY BETWEEN THE NATIONAL LEGISLATION AND THE INTERNATIONAL CONVENTIONS AND THE LEVEL AND CAPABILITY OF IMPLEMENTATION

With the exception of the Migratory Species Convention (which Mozambique has not yet ratified), all the remaining Conventions relevant to the conservation of marine turtles are in some way reflected

in the present national legislation. Actually, Mozambique's adhesion to the CMS and to the IOSEA-MoU, would not necessarily imply an alteration of the current legislation, due to the fact that it responds to the actual requirements. Marine turtles are fully protected and sanctions can be considered heavy as mentioned earlier.

The enforcement of the current legislation requires the utmost urgent attention. There are virtually no control activities outside the Conservation Areas or in areas where conservation programs are currently underway. These, however, face enormous financial and material difficulties. In most situations, the lack of control does not imply necessarily, the lack of means or human capacity. The maritime authority, Provincial Services of Fisheries or Forestry and Wildlife possess delegations in the majority of coastal districts where there is a high occurrence of marine turtles, with special focus to the southern part of the country. There is a lack of motivation regarding the enforcement of the law, and to a certain degree a total lack of knowledge regarding the law. In the cases mentioned earlier of marine turtles killings almost in public (which were also made public through the media, e.g. at Tofo, Bazaruto, Bilene), constitute clear examples. Although several local authorities (Park guards, Police, maritime authority, Provincial Services of Forests and Wildlife) were present, their action in respect to the conservation of marine turtles is null. There is a great need, therefore, for motivation and action by the relevant authorities at the central, provincial and local level to guarantee the implementation of the law. Education and sensitization activities are equally necessary and should be taken into consideration, firstly by the local authorities followed by the general public.



Education and enforcement activity by BANP guards (foto: Eduardo Videira)

RECOMMENDATIONS

The recommendations presented here, were prepared with the current necessities highlighted before in mind, and follow those proposed by Gove & Magane (1996) and IUCN (1996).

RESEARCH AND MONITORING

Nesting and Feeding Habitats

- Identify and map the nesting and feeding habitats throughout the entire coast, focusing in the central and northern parts of the country, particularly outside the conservation areas;
- Determine the main areas to start or continue with the long term monitoring programs: (1) Nest monitoring: determine species composition, main areas, intensity and nesting trends, determine nesting success, record annual mortality and main causes; (2) Feeding monitoring: determine population size, annual mortality records and main biological factors;

Nesting and Feeding Populations

- Encourage sightings of marine turtles by the local communities, fishermen, conservation areas guards, sporting clubs, flying schools, tourism operators, divers, etc;
- Encourage tagging and record of marine turtles in nesting habitats, feeding and growth habitats using standard methodology, in accordance with the Mozambican Marine Turtle Tagging Program;
- Encourage information sharing related with the capture and re-capture of tagged marine turtles at a national, regional and international level;
- Elaborate genetic assessments of marine turtles in the nesting, feeding and growth areas throughout the Mozambican coastline;

Threats

- Elaborate detailed studies with regards to threats to marine turtles and the possible mitigation measures, namely:
 - (i) accidental capture in the industrial, semi-industrial and artisanal fisheries;
 - (ii) quality, level of threat and vulnerability of the nesting, feeding and growth habitats (e.g. the impacts of trawling on the seagrass beds, driving on nesting beaches and coastal development activities on critical habitats);
 - (iii) assessment of factors associated with nest exploitation (e.g. human predation and predation by feral and wild animals);
 - (iv) assessment on the trade of marine turtles and its products and its impact on population survival;

Research and Monitoring Reports

- Compile historic information on nesting, feeding and growth habitats and on the exploitation of marine turtles;
- Promote the development and use of standard methods in the collection and analysis of data for all the research and monitoring programs;
- Produce and disseminate annual reports by each of the research and monitoring programme as well as a national annual report;

CONSERVATION AND MANAGEMENT**Habitat Protection**

- Develop protection areas denominated marine turtle sanctuaries or protected marine areas by the communities; these could be nesting and feeding areas currently unprotected;
- Implementation of the complementary legislation regarding for example, vehicle driving in sandy beaches and coastal dunes;

Accidental Fisheries Mortality

- Enforce the mandatory use of the Turtle Excluder Devices (TEDs), in the shallow-water prawn fishery;
- Control or suspend the use of fishing gear (e.g. gill nets) that endangers the survival of marine turtles, in areas where marine turtles are known to nest and feed;
- Identify important nesting and feeding habitats for marine turtles that require periodical no-take seasons;

Local Community Involvement

- Promote the participation of local communities in assessments, monitoring and management of marine turtles;
- Develop management measures in collaboration with the local communities;
- Develop alternatives for the local communities that live close or within conservation areas;
- Promote eco-tourism activities related with marine turtles, to ensure benefit sharing with the local communities;
- Collect local knowledge from the communities with regards to marine turtles (e.g. natural history, uses, myths, among others);

Legislation and Enforcement

- Strengthen the existent legislation to include the conservation of critical habitats, outside conservation areas (for example coral reefs and seagrass beds are not currently protected);

- Strengthen the law enforcement capability of governmental agencies (e.g. DNFFB, DNAC) in collaboration with the maritime authority, of nesting, feeding and growth areas outside conservation areas;
- Strengthen the governmental agencies capabilities for the implementation of the legislation, through capacity building and equipment supply (e.g. boats and communication systems);

Capacity Building, Education and Awareness

- Establish regional agreements with research and monitoring institutions;
- Encourage the participation of the local communities in monitoring and conservation activities;
- Encourage the involvement of Eduardo Mondlane University and ONGs in the capacity building of students and volunteers about species identification, ecology and management measures for marine turtles;
- Implement a periodical training in monitoring techniques and management for scientists, managers, guards, local communities, and teachers;
- Develop and implement an education and awareness program, having in mind the following interested parties: local communities, schools, civil society, conservation personnel at all levels, law enforcement personnel (maritime authorities, police, customs), planners and decision makers, private sector, tourism operators and local associations;

Funding

- Promote the search for funding in the long term for conservation activities in Mozambique;
- Incorporate conservation activities in the working plans of relevant government and non-government environmental agencies.

REFERENCES

- Abrantes, K. G. S. & M. A. M. Pereira. (2003). Boas Vindas 2000/2001: A Survey on Tourists and Tourism in Southern Mozambique. 21 pp. Maputo, BICO/FNP.
- Bertolotti, L. & M. Salmon (2005). Do embedded roadway lights protect sea turtles? *Environmental Management*, **36**: 702-710.
- Bjorndal, K. A. (1997). Foraging ecology and nutrition of sea turtles. In: Lutz, P. L. & J. A. Musick (eds). The biology of sea turtles, 199-231 pp. Boca Raton, CRC Press.
- Bouchard, S. S. & K. A. Bjorndal (2000). Sea turtles as biological transporters of nutrients and energy from marine to terrestrial ecosystems. *Ecology*, **81**: 2305-2313.
- Brinca, L. & L. Palha de Sousa (1984). O recurso de camarão de águas pouco profundas. *Revista de Investigação Pesqueira*, **9**: 45-62.
- Cumming, D. H. M., Mackie, C. S., Dutton, P., and S. Magane (1995). Aerial census of dugongs, dolphins and turtles in the proposed greater Bazaruto National Park, Mozambique: April 1995. WWF Project Paper. WWF Southern Africa Regional Programme Office. Harare.
- Dias, J. A. T. S., Macedo, J. M. A., Carmo, R. V. P. M., Carrilho, A. R. & A. J. B. P. Monteiro (1971). Reconhecimento Bio-Ecológico Preliminar do Arquipélago do Bazaruto. *Revista de Ciências Veterinárias*, **4**: 13-50.
- Dutton, T.P. & R. Zolho (1990). Plano director de conservação para o desenvolvimento a longo prazo do Arquipélago do Bazaruto. Moçambique. 96 pp. WWF/SANF/ORI.
- Frazier, J. G. & J. L. B. Montero (1990). Incidental capture of marine turtles by the swordfish fishery at San Antonio, Chile. *Marine Turtle Newsletter*, **49**: 8-13.
- Gove, D. & S. Magane. (1996). The status of sea turtle conservation in Mozambique. In: Humphrey S. L. & R.V. Salm (eds). Status of sea turtle conservation in the western Indian Ocean. Regional Seas Reports and Studies. No.165: 89-94 pp IUCN/UNEP. 1996.
- Gove, D., H. Pacule & M. Gonçalves (2001). The impact of Sofala Bank (Central Mozambique) shallow water shrimp fishery on marine turtles and the effects of introducing TED (Turtle Excluder Device) on shrimp fishery. 23 pp. Maputo, Report to the Eastern Africa Marine Eco-Region of WWF.
- Guissamulo, A. T. (1993). Distribuição e abundância de golfinhos e dugongos e suas interações com algumas pescarias nas Baías de Maputo e Bazaruto. Trabalho de Licenciatura. 93 pp. Maputo, Departamento de Ciências Biológicas, UEM.
- Hatton, J. (ed). (1995). A Status quo assessment of the coastal zone, Mozambique. Phase 1: Ponta do Ouro – Xai-Xai. IUCN: 1-60pp.
- Heithaus, M. R., J. J. McLash, A. Frid, L. M. Dill & G. J. Marshall (2002). Novel insights into green sea turtle behaviour using animal-borne video cameras. *Journal of the Marine Biological Association of the U.K.*, **82**: 1049-1050.
- Hill, N. & J. Garnier (2003). Monitoring of Populations of Endangered Species. In: Garnier, J. (ed). Cabo Delgado Biodiversity and Tourism Project. Report for the Marine Programme. 54-69 pp. CDBTP Pemba and ZSL – London.

- Hughes, G. (1971). Preliminary report on the sea turtles and dugongs of Moçambique. *Veterinária Moçambicana* **4** (2): 43-84.
- Hughes, G. (1974a). The sea turtles of south-east Africa I. Status, morphology and distributions. *Oceanographic Research Institute Investigational Report*, **35**: 1-144.
- Hughes, G. (1974b). The sea turtles of south-east Africa II. The biology of the Tongaland loggerhead turtle *Caretta caretta* L. with comments on the leatherback turtle *Dermochelys coriacea* L. and the green turtle *Chelonia mydas* L. in the study region. *Oceanographic Research Institute Investigational Report*, **36**: 1-95.
- Hughes, G. R. (1972). The Olive Ridley Sea-turtle (*Lepidochelys olivacea*) in South-east Africa. *Biological Conservation* **4**(2): 128-134.
- Impacto (1997). Mitos e lendas na gestão tradicional dos recursos naturais (Ilha da Inhaca). 57 pp. Maputo, Impacto.
- IUCN (1996). A marine turtle conservation strategy and action plan for the western Indian Ocean. IUCN East Africa Regional Office and IUCN/SSC Marine Turtle Specialist Group. Arlington, VA USA.
- Kalk, M. & F. Costa. (1995). Conservation and development. In: Kalk, M. (ed). A natural history of Inhaca Island, Mozambique. 362-368 pp. Witwatersrand University Press. Johannesburg.
- Kotas, J. E., S. Santos, V. G. Azevedo, B. M. G. Gallo & P. C. R. Barata (2004). Incidental capture of loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) sea turtles by the pelagic longline fishery off southern Brazil. *Fishery Bulletin*, **102**: 393-399.
- Kyle, R. & P. Lombard (1996). Sea turtle research in southern Mozambique. A brief overview and results of some recent monitoring and tagging activity. Relatório não publicado. 13 pp.
- Lombard, P. (1997). Marine Turtle Monitoring and Conservation in Southern Mozambique. Report update 1996/97 season. Ponta Malongane. Moçambique.
- Lombard, P. (2004). Marine turtle monitoring and conservation in southern Mozambique: 2003/2004 update. Relatório não publicado. 5 pp.
- Lombard, P. (2005). Monitoria e conservação das tartarugas marinhas no sul de moçambique. Sumário relativo a onze anos. 1995 – 2005. Ponta Malongane. Relatório não publicado. 7 pp.
- Louro, C. M. M. (2005a). Perfis ecológicos de espécies e ecossistemas costeiros de Moçambique: Dunas costeiras. Relatório de Investigação Nº 3: 28 pp. Maputo. Centro Terra Viva.
- Louro, C. M. M. (2005b). The Mozambique marine turtle tagging programme: preliminary results (2003-2005). Poster presented on the IV WIOMSA Scientific Symposium. 29 August – 03 September 2005. Grand Baie. Mauritius.
- Mackie, C. S. (1999). Aerial census of dugongs, dolphins and turtles in the proposed greater Bazaruto National Park, Mozambique: April 1999. WWF Project Paper. WWF Southern Africa Regional Programme Office. Harare.
- Mackie, S.; Guissamulo, A., Nhamtumbo, D. & C. Bento (2001). Aerial census of dugongs, dolphins and turtles in the Bazaruto National Park, Mozambique: May 2001. WWF Project Paper. WWF Southern Africa Regional Programme Office. Harare.
- Magane, S. & J. João. (2001). Resultados preliminares do monitoramento dos ninhos de tartarugas marinhas na Reserva de Maputo. Época de 1999/2000. Fórum para a Natureza em Perigo.
- Magane, S. & J. João. (2002a). Relatório final do monitoramento dos ninhos de tartarugas marinhas na Reserva de Maputo. Época de 2000/2001. Fórum para a Natureza em Perigo.

- Magane, S & J. João. (2002b). Local community involvement in monitoring and protection of sea turtles, loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) in Maputo Special Reserve, Mozambique. Poster presented on 22nd Annual Symposium on Biology and Conservation of Sea Turtle; Miami, USA 4-7 April 2002.
- Magane, S., L. Sousa & H. Pacule (1998). Summary of turtles and fisheries resources information for Mozambique. In: Wamukoys, G. M. & R. V. Salm (eds). Report of the western Indian Ocean Turtle Excluder Device (TED) training workshop. 18-20 pp. Nairobi, IUCN Eastern Africa Regional Office.
- Magane, S., L. Sousa & H. Pacule (1998). Summary of turtles and fisheries resources information for Mozambique. In: Wamukoys, G. M. & R. V. Salm (eds). Report of the western Indian Ocean Turtle Excluder Device (TED) training workshop. 18-20 pp. Nairobi, IUCN Eastern Africa Regional Office. Marine Turtle Programme. N° 1. Gland. Switzerland.
- Massinga, A. & J. Hatton (1996). Status of the coastal zone of Mozambique. In: Lundin, C. G. & O. Lindén (eds.). Proceedings of the National Workshop on Integrated Coastal Zone Management in Mozambique. Inhaca Island and Maputo, May 5-10, 1996. 7–68 pp. World Bank and Sida/SAREC.
- Mayor, V. V. (2002). Orientation of leatherback turtle hatchlings, *Dermochelys coriacea* (Vandelli, 1961), at Sandy Point National Wildlife Refuge, US Virgin Islands. 54 pp. MSc Thesis. Mayaguez, University of Porto Rico.
- MITUR (2001). Reserva Especial de Maputo – Plano de Maneio 2001-2006. MITUR. República de Moçambique
- MITUR (2002). Plano de Maneio: Parque Nacional do Arquipélago do Bazaruto 2002 -2006. 116 pp. Maputo. MITUR. República de Moçambique.
- MITUR (2004). Plano de Maneio do Parque Nacional do Arquipélago das Quirimbas (2004-2008). Maputo. MITUR. República de Moçambique.
- Nishemura, W. & S. Nakahigashi (1990). Incidental capture of sea turtles by Japanese research and training vessels: results of a questionnaire. *Marine Turtle Newsletter*, **51**: 1-4.
- Pereira, M A M (2004). Recursos turísticos e pesqueiros da zona costeira do distrito de Matutuine, Maputo. 25 pp. Maputo, Report submitted to WWF - Mozambique Coordination Office.
- Pritchard, P. C. H. (1997). Evolution, phylogeny, and current status in the biology of sea turtles. In: Lutz, P. L. & J. A. Musick (eds). Biology of sea turtles. 1-28 pp. Boca Raton, CRC Press.
- Rumbold, D. G., P. W. Davis & C. Perretta (2001). Estimating the effect of beach nourishment on *Caretta caretta* (loggerhead sea turtle) nesting. *Restoration Ecology*, **9**: 304-310.
- Shanker, K., Pandav, B. & B. C. Choudhury. (2003). Sea turtle conservation: population census and monitoring. A GOI – UNDP Project Manual. Centre for Herpetology/Madras Crocodile Bank Trust. Mamallapuram. Tamil Nadu, India.
- Stephenson, G. (1999). Vehicle impacts on the biota of sandy beaches and coastal dunes: a review from a New Zealand perspective. *Science for Conservation*, **121**: 1-48
- Tello, J. L. (1973). Reconhecimento Ecológico da Reserva dos Elefantes do Maputo. Revista de *Veterinária de Moçambique* **6** (1): 19 -76 pp . Lourenço Marques.

- The Oricle (2005). TRANSMAP. A new initiative to strengthening collaboration in East African marine conservation. Issue 41.
- Tobias, W. (1991). Turtles caught in Caribbean swordfish net fishery. *Marine Turtle Newsletter*, **53**: 10-12.
- Tomás, C. (2001). Pescarias semi-industrial e artesanal de camarão na Baía de Maputo. *Boletim de Divulgação do Instituto de Investigação Pesqueira*, **34**: 13-22.
- Troëng, S. & C. Drews (2004). Money talks: economic aspects of marine turtle use and conservation. 62 pp. Gland, WWF.
- Videira, E. J. S. & C. M. M. Louro (2003). Análise dos estudos feitos no Parque Nacional do Arquipélago do Bazaruto. 108 pp. Maputo. BICO/FNP/WWF.
- Videira, E. J. S. & C. M. M. Louro (em prep.). Análise da monitoria de ninhos e marcação de tartarugas marinhas no Parque Nacional do Arquipélago do Bazaruto, Moçambique.
- Whittington, M. W., António, C. M., Heasman, M. S., Myers, M. & D. Stanwell-Smith. (1998). Technical Report 6: Results summary and management recommendations. Marine biological and resource use surveys of the Quirimba Archipelago, Mozambique. Society for Environmental Exploration, London and MICOA, Maputo.
- WWF (2004). Marine Turtle Update. Recent News from the WWF Africa & Madagascar
- WWF (2005). Marine Turtle Conservation Activities in Mozambique. August 2004 to June 2005. Maputo.
- WWF Eastern African Marine Ecoregion (2004). The Eastern African Marine Ecoregion Vision: A large scale conservation approach to the management of biodiversity. WWF: Dar er Salaam, Tanzania. 53 pp.
- Zug, G. R., G. H., Balazs, J. A. Wetherall, D. M. Parker & S. K. K. Murakawa (2002). Age and growth of Hawaiian green seaturtles (*Chelonia mydas*): an analysis based on skeletochronology. *Fishery Bulletin*, **100**: 117-127.