



REGIONAL SEAS

STATUS OF SEA TURTLE CONSERVATION IN THE WESTERN INDIAN OCEAN

*Proceedings of the Western Indian Ocean Training
Workshop and Strategic Planning Session on Sea Turtles,
held at Sodwana Bay, South Africa,
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PREFACE

In contrast to their importance to mankind, the marine component of biological diversity requires considerably more attention to improve our current state of knowledge. Information on the status of marine living resources and ecosystems remain much less readily available than in terrestrial ecosystems.

This document is a compilation of information from the region needed as a basis for sound conservation and management of sea turtles in the western Indian Ocean.

The overall coordination of UNEP's role for the management and conservation of marine biodiversity is the responsibility of the Water Branch (which comprises the former Oceans and Coastal Areas Programme Activity Centre - OCA/PAC and Freshwater Unit). The Water Branch is action oriented and focussed not only on mitigation but also on the causes of environmental degradation. It was created as a global programme that is implemented through regional components as represented by the Regional Seas Programmes. The focus of the Water Branch comprises both inter-regional and regional activities on management of coastal, marine and freshwater resources and ecosystems. These include activities which will specifically promote implementation of the Regional Seas Protocols on Specially Protected Areas and Wildlife (SPAW) and are an integral part of UNEP's contribution to the implementation of the Convention on Biological Diversity adopted in June 1992.

The support provided to convene this workshop contributes to the implementation of the Protocol Concerning Protected Areas and Wild Fauna and Flora in the Eastern African Region, adopted by the parties to the Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region, Nairobi, 21 June 1985. The five species of Sea Turtles found in the western Indian Ocean are listed in Annex IV of the Protocol on "Protected Migratory Species".

UNEP is pleased to have been associated with this initiative for the conservation and management of living resources of the western Indian Ocean. It is hoped that increased cooperation will arise among the scientific community along with Governments who are engaged in efforts to conserve sea turtles in the region.

Note: This document was edited by IUCN- The World Conservation Union, Eastern Africa region office based on the contributions of the participants to the western Indian Ocean training Workshop and Strategic Planning Session on Sea Turtles, held at Sodwana Bay, South Africa (12-18 November 1995). This workshop was sponsored by: Worldwide Fund for Nature (WWF International), Convention on Migratory Species of Wild Animals (CMS), Natal Parks Board, United Nations Environment Programme (UNEP-Water Branch), Netherlands Assistance to Department of Environment Zanzibar, Royal Netherlands Embassy Nairobi, FINNIDA and WWF South Africa. The financial support for reproduction of this document was provided by UNEP and technical support by Ms. Monica Borobia, Programme Officer, UNEP-Water Branch.

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FOREWORD

There are many compelling reasons for holding a regional meeting on the management and conservation of sea turtle, chief among them being the far ranging nature of turtles which swim many hundreds, even thousands of kilometres between their nesting and feeding sites, crossing through the waters of several different national jurisdictions in the process. Turtles are a shared resource, and their survival requires the collaboration of all states in the region that share them. There are more pragmatic reasons too, such as the opportunity to address the training needs of many different institutions and states at one time, and the changing strategy of many donor agencies away from bilateral to regional programmes.

IUCN - The World Conservation Union was requested through its Eastern Africa Regional Office to develop a regional marine turtle conservation initiative as part of a broader western Indian Ocean marine biodiversity conservation programme. This fits well with the priority actions identified in *A Global Strategy for the Conservation of Marine Turtles* recently developed and published by the IUCN/SSC Marine Turtle Specialist Group. The Strategy specifically calls for "... *management through regional and international cooperation and coordination.*"

Dr George Hughes, Chief Executive of the Natal Parks Board, kindly agreed to host the workshop at Sodwana Bay, site of one of the world's longest running and most successful turtle research and management programmes, and a location well suited for practical training in turtle and nesting beach research, monitoring and management techniques. This provided the necessary impetus for IUCN, through its Eastern Africa Regional Office and Marine Turtle Specialist Group Programme, to proceed with the organisation and implementation of the workshop.

This workshop represented the first effort to develop a regional turtle conservation strategy under the global IUCN strategy. The principal objectives of the workshop were to:

- initiate networking among marine turtle researchers and managers;
- formulate a regional conservation strategy for turtles; and,
- train senior researchers and managers.

The workshop brought together researchers and managers from South Africa, Mozambique, Comoros, Mauritius, La Réunion, Mayotte, Seychelles, Tanzania mainland and Zanzibar, Kenya and Eritrea, as well as international experts. We had as our trainers Dr George Hughes of South Africa, Dr Colin Limpus of Australia and Dr Jeanne Mortimer of the USA, all of whom are widely recognised as world leaders in their field. We were privileged to have this team leading the training programme, and to have had the opportunity of conducting the workshop at the Sodwana location.

We are most grateful to all participants for their interest and enthusiasm for this workshop and the excellent calibre of their national reports that follow in this volume, and to all of our sponsors for enabling implementation of the workshop. In particular, we would like to thank our hosts, the Natal Parks Board, and the major sponsors, the Convention on the Conservation of Migratory Species of Wild Animals (CMS) and WWF International.

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IUCN/SSC Marine Turtle Specialist Group

TABLE OF CONTENTS

Preface	ii
Foreword	iii
Table of Contents	v

PART I: BACKGROUND

Welcoming Speech	3
An Introduction to Sea Turtle Biology and the Role of Research in Sea Turtle Conservation and Management	5
Identifying and Addressing Sea Turtle Conservation and Management Priorities J. Mortimer	11
Research and Monitoring for Sustainable Management of Sea Turtles: A Regional Strategy C. Limpus	15
Integrated Approaches to Sea Turtle Conservation in the Western Indian Ocean R.V.Salm, S. Humphrey & M. Donnelly	19
Local Community Participation in Sea Turtle Conservation in Kenya F. Kaloki & G. Wamukoya	27
The Convention on Migratory Species and Sea Turtle Conservation D. Hykle	31
Notes on CITES and the International Trade in Sea Turtles T. Milliken	33

PART II: NATIONAL REPORTS

The Status of Sea Turtle Conservation in:

Eritrea	41
Kenya	57
Tanzania	73
Zanzibar	81
Mozambique	89
South Africa	95
Seychelles	103
Madagascar	117
Mauritius	121
Comoros	125
French Territories of the Indian Ocean:-	
Mayotte	133
Other Islands	145

PART 1

BACKGROUND

WELCOMING SPEECH

INKOSI N.J. NGUBANE

MINISTER OF TRADITIONAL & ENVIRONMENTAL AFFAIRS

Dr. Rodney Salm, Dr. Colin Limpus, Dr George Hughes, Ladies and gentlemen.

It is my great privilege and pleasure, as Minister of Traditional and Environmental Affairs in KwaZulu-Natal, to welcome you all to this Sea Turtle Workshop at Sodwana Bay today.

I know most of you - besides our South African Delegates - have come from many far places both on and off this great continent of Africa of ours to be here this week. From Kenya and Tanzania, from Madagascar and Zanzibar, from Réunion and the Seychelles, from the Comoros, from Eritrea and several other places. Indeed, from as far even as the United States of America.

Over the past 30 years, the St Lucia Marine Reserve along the Maputaland Coastline has been used increasingly by these great creatures of the ocean as their preferred nesting grounds. In order to do so, they themselves travel great distances along the African Coast to benefit from the protection they find in this region.

This fact may be seen (Both symbolically and, indeed, in reality) as representing a link between our many nations, as we work together to conserve the natural resources not only of Africa, but of our planet as a whole. We do this, of course, not only for the benefit of all mankind, but also to ensure the continued existence of our fellow creatures on earth.

We all know that man cannot live in isolation. that we can no longer afford to plunder the Earth's resources, that we dare not allow the continued rape of our oceans, that the whole of the life-chain of nature must be allowed to survive if we ourselves are to survive.

So it is with this in mind, ladies and gentlemen, that I would now like to express on behalf of us all, very great appreciation of the work carried out by the IUCN - the World Conservation Union.

It is our privilege to work together with this fine organisation, and I extend special thanks to the IUCN for convening this week's workshop on Sea Turtles.

I should like to take this opportunity of paying tribute also to the many locally based people who live in this vicinity who have given their own support over the years to ensure the continued success of our Sea Turtle Breeding Programme as well as the protection and monitoring of nests that they carry out in support of the programme.

As an ecotourist destination, Sodwana must surely rank among South Africa's top echelon of attractions. Not only for its fine ocean fishing and for its superb scuba diving opportunities (both of which boost the local economy of this region enormously), but also for the ever growing interest in turtle watching tours which have become famous over the years.

The wholehearted participation of so many local people in the programme is a good example of how conservation and community development can go hand in hand.

The turtle breeding programme along the Sodwana Coastline has become one of the world's conservation success stories, and has gone from strength to strength over the years. So much so that I am told the 1994/5 season was a record year for leatherback turtle nesting here, and that no less than 164 females nested in this vicinity as opposed to 71 the previous year.

My friend and colleague, Dr George Hughes of the Natal Parks Board - himself a leading world protagonist of Turtle Conservation - told me that there have been several returns over the past two years from Madagascar as well as from Mozambique, for instance and that there was an especially exciting loggerhead turtle recovery from Zanzibar which was re-released. I am told that, as her tag number is 007, conservationists in Zanzibar have named her "JAMIE" and have requested to be kept informed when she returns home in future nesting seasons.

Such, ladies and gentlemen, is the spirit of cooperation and goodwill which prevails among us.

While the figures I quoted just don't speak for themselves, there is always so much still for us to learn about this planet of ours. Not least about the world of Sea Turtles.

So it is with a sense of great anticipation, that I welcome you all today, and I look forward eagerly to the dynamic outcome of your pooled knowledge being used for the benefit of world conservation - and specifically, for the development of Marine Conservation in the Western Indian Ocean.

Environmental Conservation has long been a field known for International Cooperation among its practitioners. Hence the very existence of the IUCN, for instance and just as the great turtles of our ocean are happy and able to traverse the vast distances which separate our various national regions, so must we remain free and generous in our willingness to extend to each other a shared, communal source of knowledge and expertise in pursuit of better ways to sustain what our planet has to offer.

"THANK YOU"

LADIES AND GENTLEMEN

AN INTRODUCTION TO SEA TURTLE BIOLOGY AND THE ROLE OF RESEARCH IN SEA TURTLE CONSERVATION AND MANAGEMENT

SUMMARY OF TRAINING SESSIONS

The training component of the workshop covered a range of issues from the lifecycle, biology and ecology of sea turtles to the role of international treaties and conventions in sea turtle conservation. The training took place through a series of presentations, facilitated discussions, demonstrations and practicals. The principle trainers were Colin Limpus, George Hughes, Jeanne Mortimer and Rodney Salm, with additional presentations by Marydele Donnelly, Doug Hykle, George Wamukoya and Ashish Bodasing. This was an interactive workshop, and the contributions and sharing of experience by participants from around the region greatly enriched the discussions.

Given the incomplete knowledge of the sea turtles' lifecycles (see below) and of their status in the western Indian Ocean, a central theme for the workshop was the role of research in conservation and management. The following papers address these themes in more detail, examining conservation and management priorities and setting out a model for a regional research strategy, based on experience from Australia and the South Pacific.

Survey techniques for census and monitoring of turtle populations involving foot patrols, vehicles and boat patrols and aerial surveys were presented by Col Limpus and George Hughes, and the appropriateness of different techniques according to circumstances discussed at some length. In particular we looked at how to optimise allocation of survey effort and resources (especially where manpower and equipment is limited), including when and where to survey and the selection of reference sites which provide an indication of overall population status

The apparent loyalty of turtles to their natal region, and often subsequently to a specific nesting beach, means that separate breeding populations can be distinguished within each turtle species. The range of these breeding populations can be determined to a large extent by analysis of tag returns, while genetic testing can confirm to which breeding population an individual belongs. In terms of turtle conservation these breeding populations can be regarded as "management units" which require an integrated and regional effort for their survival.

The pros and cons of different tagging methods and systems were discussed - including different types of external tags, mutilation tagging, PIT tags, smart tags (continuous data logging, including environmental variables) and markers for satellite tracking - in terms of costs and difficulties of placement, detection and retrieval, and of the degree of detail of information and period over which it is obtained. Data collection, storage, backup and retrieval, were also discussed, including the need to design an appropriate data management system (manual or computer) and means to share and standardise data between different researchers, institutions and countries for conservation management within a region.

Further training sessions, both indoors and in the field, addressed the practicalities of working with turtles, both when nesting at night on the beaches and in water. The sessions

measuring, and data recording, were demonstrated and practised by the participants. The need to avoid disturbance including lights and movements, particularly at the start of the nesting cycle when the turtle may be deterred from laying, was stressed (see figure 1).

Other interventive methods for turtle conservation were also discussed, including management of hatcheries and handling techniques for egg relocation. A key factor to be aware of in hatchery management is the influence of incubation temperature in determining hatchling gender, and thus the importance of factors which influence nest temperature over and above local climate, such as the degree of beach shading and the direction of beach slope. It is essential that hatcheries provide variable incubation temperatures, perhaps by shading of some nests, to ensure that not all the hatchlings are the same gender.

It was emphasised that eggs should be relocated only where this is critical for the successful hatching, for example where the nest is likely to be flooded or washed away, or where predation or poaching cannot be controlled at the original nest site. Handling and movement of eggs is always a delicate task, but embryos are particularly vulnerable to egg movement from a few hours after being laid, and become gradually more resilient as they mature. Ideally eggs should be relocated within two hours of being laid before the embryo has started to develop. A second option is to store eggs temporarily, and then relocate the eggs shortly before hatching. Methods to transport eggs avoiding unnecessary movement and rotation were described.

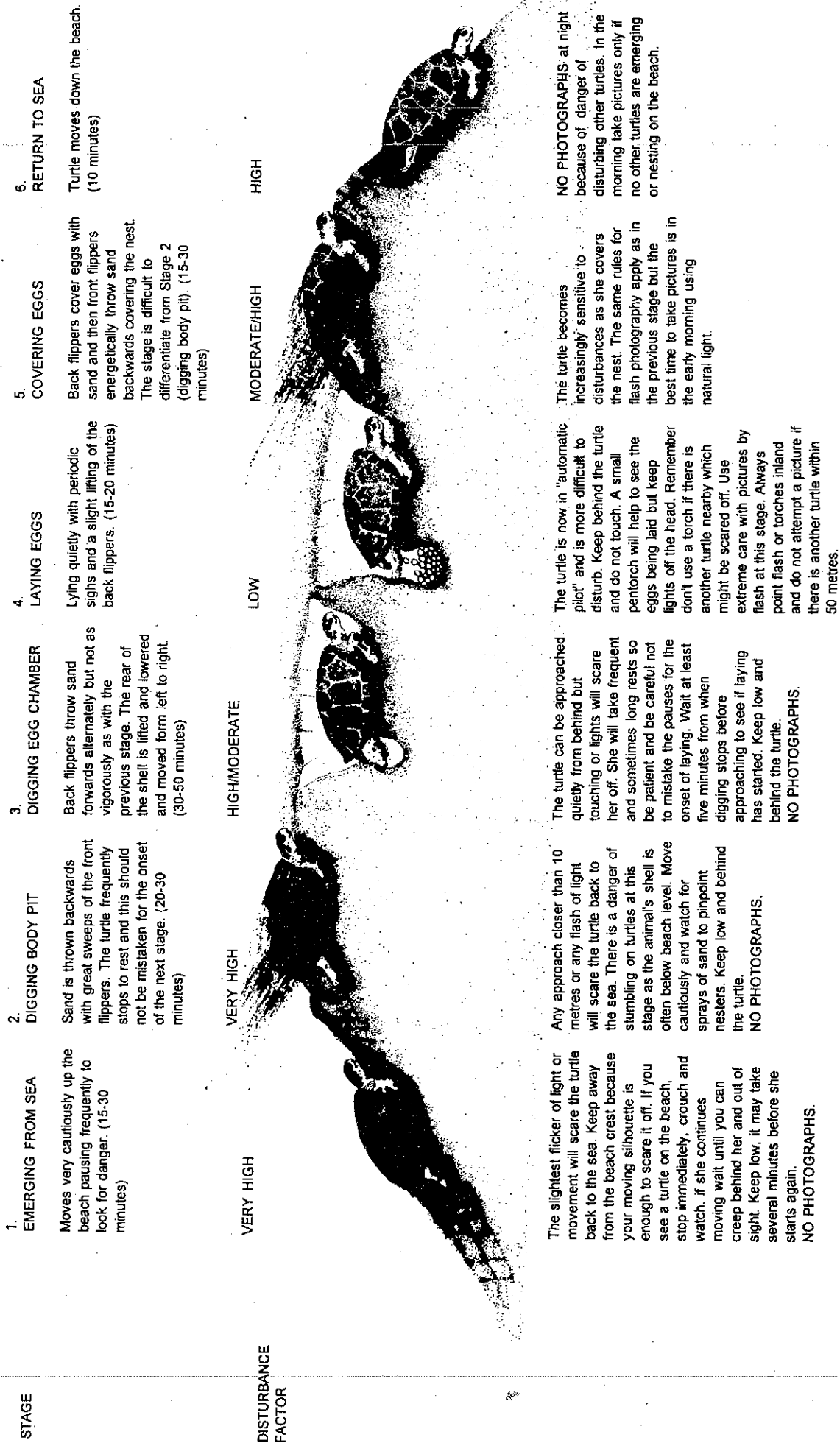
Details of the techniques discussed in this workshop will be provided in a manual being produced by IUCN/SSC Marine Turtle Specialist Group which will cover all the practical aspects of turtle research and of management interventions for conservation of turtles in the early stages in the lifecycle. This is expected to be available in mid-1996.

Discussions continued on a number of broader management issues including the role of sustainable use in marine turtle conservation and management, integrated management of sea turtle populations, sea turtle ranching, community participation in sea turtle management, and the direct and indirect benefits to people and to coastal and marine ecosystems of turtles.

One special interest group which can be of direct economic benefit to local communities is tourists. However, the enthusiasm of tourists to see turtles while providing a valuable incentive for sea turtle conservation may in itself be disruptive. Examples were provided (and demonstrated to the group) on how to handle tourists taking part in activities on nesting beaches from simple turtle watching to active participation in nest relocation.

Many of these issues are discussed in more detail elsewhere in this report, and in particular there is a wealth of information, ideas, and experience in the national reports.

Figure 1. The Sea Turtle Nesting Cycle



Based on a leaflet published by the Petroleum Development Oman in association with the Department of Tourism and the Marine Sciences and Fisheries Centre. Artwork by S.J. Prakash.

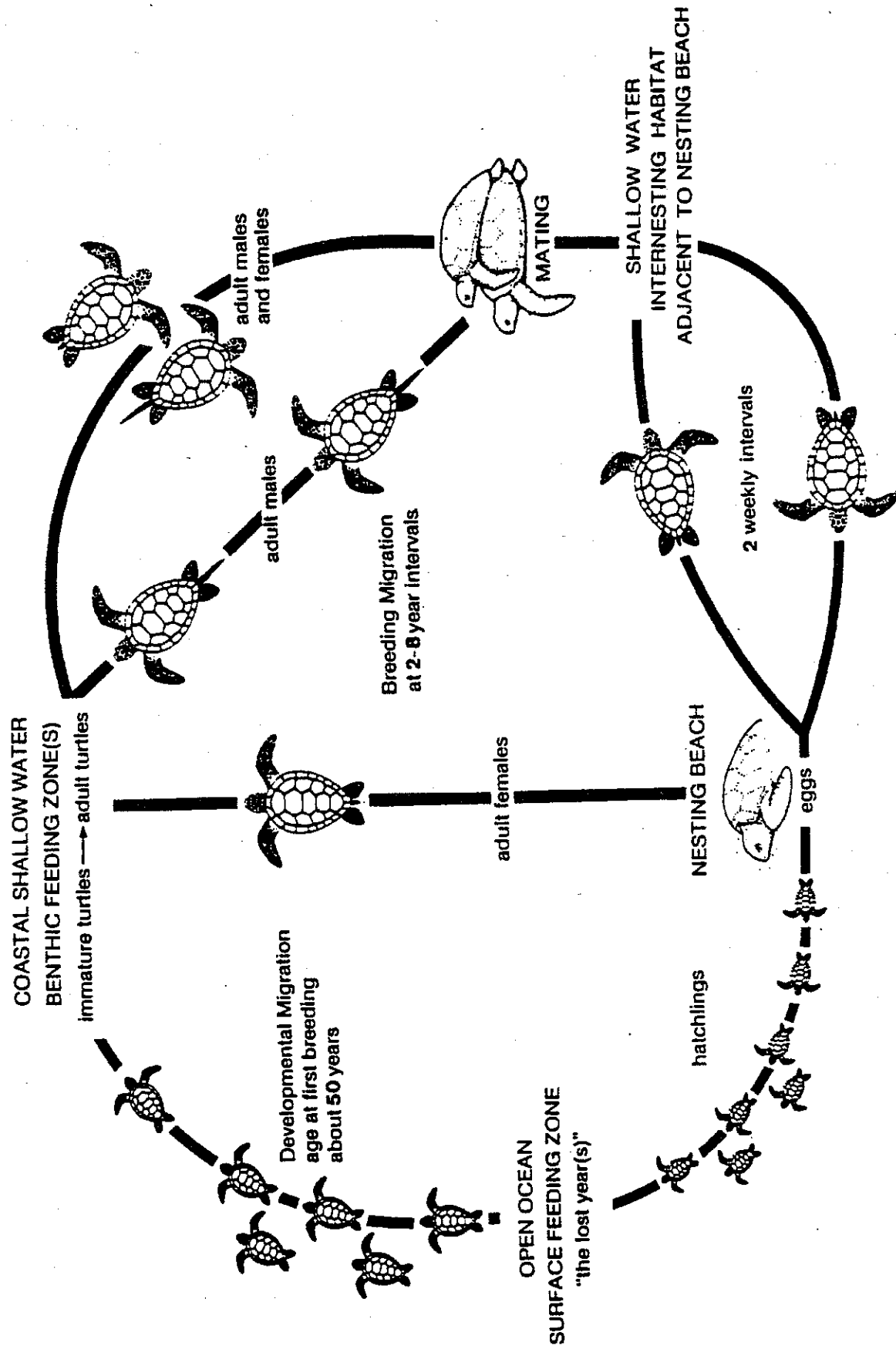
THE SEA TURTLE LIFECYCLE

Sea turtles all share a similar life cycle that is summarised in Figure 2. Females lay their eggs high up on the beach usually within the vegetated strand. No parental care is exercised. The incubation period and the sex of the resulting hatchlings is a function of the temperature of the surrounding sand. A warm nest at mid incubation results in all or mostly female hatchlings while males come from cool nests. The eggs hatch about 7 - 12 weeks after laying. The hatchling turtles dig their way unaided and as a group through the 50 cm or more of sand to the surface. On surfacing, they immediately cross the beach to the sea. This hatchling emergence is almost entirely nocturnal. Immediately the hatchlings reach the water they begin oriented swimming which takes them away from the beach and into deep water. The hatchlings at this stage do not feed but are living off a yolk sac internalised just prior to hatching. In coral reef areas when the hatchlings are crossing the reef flat, they are probably exposed to the greatest level of predation during their life cycle. This is a period of transfer to predatory fish of nutrients derived from adult turtles via eggs and hatchlings. In all species except the flatback, the hatchlings on reaching the deep water areas, continue to swim away from the beach and this activity presumably brings them under the influence of the open ocean currents where they drift for the first few years of their lives.

When the hatchlings disperse from the nesting beach they are virtually lost to study for the next few years. While in this drifting phase the turtles presumably feed on the macroplanktonic algae and/or animals at the surface. The young of all marine turtles except the leatherback turtle "reappear" at the size of a large dinner plate (curved carapace length 35-40 cm, age undetermined but probably 5-10 yr old). At this size they take up residence in the shallow water habitats of the continental shelf feeding principally at the bottom on plants and animals depending on the turtle species. Green turtles feed mostly on seaweed, seagrass, and mangrove fruits; loggerhead turtles feed mostly on shellfish and crabs; olive ridley turtles feed mostly on small species of crab and hawksbill turtles feed mostly on sponges. These turtles will also eat jellyfish and Portuguese man-of-war on occasions. These immature turtles may remain in one feeding ground for extended periods, perhaps years, before moving to another major area. At least several such shifts occur in the life of the turtle in this coastal shallow water benthic-feeding phase. The leatherback turtle, which remains an inhabitant of oceanic waters for almost all its life, feeds mostly on jellyfish.

Sea turtles utilise feeding grounds often far removed from the nesting beaches. With the onset of the breeding season adult males and females migrate to copulate near the nesting area. There is no pair bond between individuals and copulation with a number of different partners during the mating season is normal. The female stores the sperm from her several mates for use later in the breeding season. At the completion of mating the males depart, presumably returning to the distant feeding grounds. Each female moves to an area adjacent to her selected nesting beach and commences making eggs, fertilising them from her sperm store. Because of the mixture of sperm she carries, several males usually contribute to the fertilisation of any one clutch. The female comes ashore, usually at night, to nest several weeks after her first mating. For those beaches fronted by reef flats nesting coincides with the higher tidal levels. Within the one nesting season each female typically lays several clutches at about two weekly intervals. During that two week period she does not need to find a new mate, she moves just offshore from the nesting beach to make the next clutch of eggs, again fertilising them from her sperm store. The breeding turtle does not feed, or else feed to only a limited extent, while migrating, courting or making eggs at

Figure 2: The sea turtle lifecycle



the nesting beach area. She lives off the stored fat reserves deposited before the breeding season began.

Tagging studies of sea turtles suggest that they are already many decades old at first breeding and can have a breeding life spanning many more decades. Each female usually chooses to return to the same beach or island to lay several clutches within the one nesting season. However, several percent of females can be expected to lay on more than one beach within 100 km of the initial nesting site. At the completion of the nesting season the females do not use the adjacent shallow water habitats as year round feeding grounds but return to their respective distant feeding grounds, each to the same area that she left at the start of her breeding migration. After two to eight years many of these females will make yet another breeding migration, each generally returning to nest on the same beach as before. This behaviour and the annual use of traditional nesting beaches has led to the assumption that a marine turtle returns to nest on the precise beach of her birth. In reality the homing is probably not that exact. Genetic studies suggest that the female returns to breed in the general region of her birth.

At no stage in their life are sea turtles free of predation. The young to adult sized turtles are potential prey to large cod, grouper, sharks, crocodiles and killer whales. In many countries, however, man continues to be the most significant predator. Green and olive ridley turtles are harvested in big numbers especially for meat; the hawksbill turtle for tortoiseshell. All species are hunted for leather, oil and their eggs.

Incidental capture of turtles in fishing gear can also cause significant mortalities of marine turtles, especially in prawn trawls, drift nets, large mesh set nets and long lines. In some areas, ingestion of plastic and other debris has been identified as a significant cause of mortality. Boat strikes are common in shallow areas with high density recreational boating.

Wherever there has been organised harvesting or large scale killing of the turtles and/or their eggs over several decades, the turtle population has undergone significant decline. No one has ever successfully managed a marine turtle population at stable population levels while subjecting them to large scale mortalities.

IDENTIFYING AND ADDRESSING SEA TURTLE CONSERVATION AND MANAGEMENT PRIORITIES

JEANNE A. MORTIMER

INTRODUCTION

In order to establish and implement a successful marine turtle conservation and management programme, we must first identify the priorities of our programme. We need to make smart choices in setting priorities because we are limited by funding, personnel and time. Many turtle management programmes in the past have suffered because they were too localised. In defining our priorities we must have a broad perspective on the problems both geographically and temporally. We must look think regionally as well as locally. This workshop offers us a superb opportunity to identify and begin to solve problems at the regional level. We must also think long term. It is not enough to look at the problems sea turtles face today. We must look into the future and predict what problems turtle will face, and where possible, prevent these problems before they arise. We must also look into the past, and evaluate the status and health of our sea turtle populations in the light of any exploitation to which they have already been subjected.

To identify conservation and management priorities for our turtle populations, we need to conduct research to evaluate their biological status and also to identify the greatest threats to their continued survival.

EVALUATING THE BIOLOGICAL STATUS OF SEA TURTLE POPULATIONS.

Five species of sea turtle occur within our region - the green turtle (*Chelonia mydas*), the hawksbill (*Eretmochelys imbricata*), the loggerhead (*Caretta caretta*), the leatherback (*Dermochelys coriacea*), and the olive ridley (*Lepidochelys olivacea*). Not every species occurs in each country. Some countries have nesting populations, some have feeding populations, and some have both. Individual turtles, however, usually forage far from where they nest. So, if a country has both nesting and feeding populations of a given species, the nesting and feeding animals are not from the same population (or stock).

To evaluate the status of a turtle population, we need to understand the biology of the animals and what impact people are having on them. For any given area, the major biological questions are the following:

- What turtle species occur?
- What life stages occur? (eggs, juveniles, subadults, foraging adults, breeding adults)
- During what months of the year do the turtles occur?
- What is the geographic distribution of turtles within an area?
- How many turtles occur?
- Where do the turtles go when they leave an area?

Methodologies to answer these biological questions are described in the following sections.

BIOLOGY OF NESTING ANIMALS

Turtle track counts: Regular beach surveys during which turtle tracks are examined and counted will tell us: what species occur, how many clutches are laid annually, and the seasonal and geographic nesting distribution.

Turtle tagging programmes: Placing tags on turtles will tell us how often turtles come to nest during the course of a nesting season; how many years pass between nesting seasons; the precision with which turtles return to the same nesting beach; and their rates of survival. It can tell us how many years turtles remain reproductively active. When a tagged turtle is captured at a distant locality and the tag is reported or returned, we learn about migrations and also about the extent of harvest or incidental capture by people.

Determination of egg and hatchling mortality: By counting eggs as they are laid, marking their location on the beach, and then excavating the nest at the end of the incubation period and examining its contents, one can determine the rates of mortality in the nests. In most situations, however, natural predators are not a serious threat to the turtle population. The most destructive predators are usually human egg collectors and the animals that are associated with humans - especially feral dogs, pigs and cats. To evaluate the extent of *predation by humans and feral animals*, it is often sufficient to examine footprints on the beach and determine whether they are associated with nests that have been dug up.

MIGRATION OF TURTLES WITHIN THE REGION

Tagging studies: Until recently, most of what we know about turtle migrations was determined by tagging animals on their nesting and foraging grounds and then waiting for the tags to be returned by fishermen who killed the animals at distant locations. Unfortunately, the information based on tag returns is limited.

Genetic studies: A more effective method of determining migratory patterns in sea turtles is by using genetic markers. Blood or tissue samples are collected from turtles at their nesting beaches and characteristics of the DNA from these samples are examined in the laboratory. Scientists have shown that turtles from different breeding populations can be separated according to differences in their DNA. Once a particular breeding population has been described in terms of these genetic characteristics, individuals from that breeding population can be recognised by their genetic characteristics when they are encountered on distant foraging grounds. Information derived in this manner is valuable for regional cooperation in managing shared turtle resources. At the present time, genetic analysis is costly (about USD 1,000 per sample). Approximately 20-30 samples are needed to characterise a breeding population; 60 or more samples are needed to assess the origins of a foraging population.

Satellite tracking: Satellite telemetry can be used to track the exact migratory pathways utilised by an individual animal. With this information we can protect important migratory corridors. Unfortunately because the procedure is expensive (costing more than USD 5,000 to track the movements of a single animal) information can be obtained from only a limited number of animals.

BIOLOGY OF FORAGING ANIMALS

Turtles spend most of their lives at their foraging habitats, yet we know relatively little about them during that time. More studies of foraging animals are needed. By tagging, weighing and measuring them, we can learn about their distribution, their growth rates, and the size of their populations. If hunters and poachers can catch turtles in open areas, there is no reason why scientists and resource managers cannot.

HUMAN IMPACTS ON TURTLE POPULATIONS

EVALUATION AND MITIGATION OF SPECIFIC PROBLEMS

Purposeful harvest: Throughout the western Indian Ocean region people have long been harvesting turtles for meat, eggs, shell, skin and oil. Ideally we would strive for a sustainable harvest of the resource. In fact, however, sustainability is very difficult to achieve, especially when there has already been a long history of overharvest, as has been the case in much of the region.

Turtles have a complicated life history. Most take from 25 to 50 years to reach sexual maturity, and thus in a healthy turtle population, there are 25 to 50 age classes of juvenile and subadult turtles in the process of growing into adult turtles. This can give a false impression that there is an "over-abundance" of turtles in the sea when, in fact, such large numbers of immature turtles are necessary to maintain the adult population. Because there are so many age classes in a turtle population it is possible to go on for several decades slaughtering every nesting female or harvesting every egg clutch laid before a serious decline in numbers of nesting turtles would be apparent. By the time a decline is noted, it is usually too late to save the population (see Mortimer, 1995* for more details).

Past levels of exploitation contribute to the present vulnerability of a population. In many situations, total protection may be the only way to save a turtle population from extinction, especially if there has been a long history of overexploitation. Some people argue for the continuation of "traditional harvests". Unfortunately, in most parts of the world, as the human population is rising, the turtle population is declining. In such situations a traditional harvest would not be sustainable.

Accidental harvest: Possibly the most serious threat facing turtle populations today is the accidental harvest of turtles in fishing gear. Estimates indicate that worldwide, many thousands of turtles per month are accidentally captured in trawls. The proper use of turtle excluder devices (TEDs) can eliminate much of this problem. Wide-mesh nets also entangle turtles - especially pelagic drift nets, shark nets and many types of gillnets. Turtles, especially leatherbacks, get snagged by longliners. Leatherbacks are also vulnerable to entanglement in the float lines of lobster pots and squid traps.

Reporting programmes and placement of observers on fishing vessels will identify the extent of the problem. Turtle mortality can then be minimised by placing restrictions on the type of gear that can be used, by mandating that TEDs be used in areas inhabited by turtles, and by establishing fishery exclusion zones and closed seasons in "turtle hot spots".

Habitat destruction: Turtle habitat is being destroyed when development occurs too close to the sea. Artificial light discourages females from nesting and disorients hatchlings. Because erosion and accretion are natural processes occurring on all beaches, adequate setback lines are critical aspects of land use planning if property loss or construction of sea walls and jetties are to be avoided. Sand mining on nesting beaches should be prohibited.

The best way to ensure the long term protection of nesting habitat is to procure it and place it within a system of nature reserves or national parks. Assume that all privately owned coastal land will be developed - set aside turtle nesting sanctuaries now!

Important foraging habitats and migratory corridors need to be identified and protected.

Pollution: Pelagic drift lines are created when ocean currents meet and down-welling occurs. It is here that turtles spend their early years - nourished by an abundance of small prey items concentrated by the currents. Unfortunately, pollutants such as garbage, plastic bags and other debris, tar balls and oil also accumulate along these drift lines. We must stop such materials reaching the sea immediately - from the land, and from ships.

Disease: Epidemics caused by the translocation of exotic micro-organisms are devastating populations of marine organisms in many parts of the world. Turtles are subject to such diseases, among them the fibropapilloma epidemic which is spreading to turtle populations throughout the world.

Global warming: Sea level rise caused by global warming is a potential threat to nesting beaches.

MANIPULATIVE MANAGEMENT STRATEGIES

Hatcheries: Establishment of hatcheries is sometimes necessary - especially in situations where predation by humans or feral animals is intense. Ideally, eggs should be allowed to incubate in their natural nests.

Headstarting: Headstarting the practice of growing hatchlings in captivity for a period of months or years prior to releasing them into the sea, is *not recommended* as a management technique.

BROAD BASED STRATEGIES INVOLVING PEOPLE

Public education and awareness campaigns: These need to be focused at all levels of society including politicians and decision makers, the general public, school children, and enforcement personnel.

Community involvement: Enabling local communities to benefit from conservation is critical to gaining long term support for conservation programmes. The most effective involvement occurs when people benefit economically, for example in programmes associated with ecotourism.

* **Mortimer, J.A. 1995.** Teaching critical concepts for the conservation of sea turtles. *Marine Turtle Newsletter* 71:1-4.

RESEARCH AND MONITORING FOR SUSTAINABLE MANAGEMENT OF SEA TURTLES: A REGIONAL STRATEGY

COLIN LIMPUS

INTRODUCTION

Total protection of our turtle stocks is not a practical final solution for marine turtle conservation in Australia. Human activities have already had and will continue to have negative impacts on the suitability and the availability of marine and beach habitats for the turtles. There will be an on going harvest by coastal peoples in neighbouring countries, again on the basis of traditional use, and possible for commercial use, of turtles shared with Australia. And there will be accidental turtle mortality from a variety of anthropogenic causes including boat-strike, ingestion of synthetic debris and from health problems induced by our alteration of their habitats.

This presentation considers only those aspects related to gathering biological data necessary for developing models applicable to planning for sustainable utilisation of the species. It does not address the harvest and trade methods, political issues or legislation that would need to be addressed if these models were to be used in establishing sustainable management.

For success, future conservation management of marine turtles needs to focus on three major issues.

- understanding the functioning of a turtle population to the level of having a reliable estimate of the level of mortality that the population can sustain.
- identifying and quantifying the sources of mortality impacting the population.
- managing these individual mortalities to bring the total mortality impacting the stock back to a level that is sustainable.

The first two of these issues which are "research and monitoring" issues are addressed in the present summary.

RESEARCH STRATEGY

The following is a summary of the essential components of a regional research program to provide the essential data for conservation management planning. It provides a framework for identifying the necessary data and each species and/or stock can be assessed to determine the state of existing knowledge and starting point for future studies identified.

For the species

1. Define the breeding sites (rookeries):
 - map the distribution of rookeries.
 - define the duration of the breeding season
 - quantify population size by rookery

2. Identify the breeding units (stocks), by use of tagging studies and population genetic studies
 - define the rookeries within a breeding unit.
 - define the feeding area (migration) distribution for each breeding unit.
 - identify sources of anthropogenic mortality within the breeding unit.

Within each breeding unit

3. At the rookeries
 - Census the nesting population:
 - use total tagging census at selected rookeries
 - sample other rookeries using an index of population size.
 - Quantify recruitment, survivorship/mortality, fecundity, age for each phase (breeding adults, eggs, hatchlings):
 - use whole season studies of a representative tagged population(s).
 - minimum of 5 year study
 - visual examination of the ovary can be used to identify long-term breeding history of a turtle
 - Monitor hatchling sex ratio:
 - measure pivotal temperature
 - describe temperature profiles of rookery (s)
 - sample hatchlings for sex ratio at selected sites/times.
4. In the feeding areas
 - Describe feeding area population structure:
 - use representative tagged populations at replicate study sites
 - quantify size class distribution
 - visual examination of gonads provides data for determining:
 - sex ratio.
 - adult/immature ratio.
 - proportion of adults breeding in any one year.
 - proportion of adults that are new recruits to the breeding population
 - Quantify annual recruitment, survivorship, age classes:
 - use mark and recapture study.
 - minimum of 5 years study.
 - quantify growth rates and estimate age structure
 - visual examination of gonads can provide date for determining proportion of adults that are new recruits to the breeding population and to identify annual proportion of adult breeding.
5. Define the pelagic life phase (difficult to measure):
 - define temporal and spatial distribution
 - quantify recruitment and survivorship
6. Assess regional significance of the turtle population for:
 - wildlife values.

- traditional harvest.
- commercial harvest.
- ecotourism.

7. Quantify anthropogenic mortalities:

- census of harvests, incidental catch and sources of mortality throughout the region.
- quantify size, sex and maturity of turtles killed.

8. Analyse integrated data for whole breeding unit

- predictive population models.
- determine usage on the basis of cultural priorities and sustainable utilisation principles.

Logistic constraints

The following is a summary of logistic constraints that need to be considered when planning for marine turtle population dynamics research project that is to have a high probability of delivering good quality results.

- The total research programme could be developed as a single integrated study or through the coordination of a number of smaller studies. If the latter were the case then maintaining unity of purpose and comparability of data must be addressed in the planning.
- Because of the potential for feeding areas to be widely separated from the nesting beaches, the research project must of necessity encompass a large geographical region.
- Given that time and money are limited for these studies, it is imperative that the maximum data obtainable be gathered wherever possible.
 - Use a team of diversely skilled researchers.
 - Apply recent advances in research methodology:
 - population genetics.
 - assessment of sex and reproductive condition.
 - hormone assay (sex data)
 - laparacopy and ultrasound (most comprehensive potential for supplying sex and reproductive condition data).
 - radio tracking and telemetric data gathering.
 - tags with a long half-life on the turtles.
 - computerised databases and models.
- A study site should provide sufficient numbers of turtles for the study to ensure rigorous statistical analysis of the data obtained.
 - Some populations are seriously depleted.
 - Intensively harvested populations may be unsuitable for supporting some

- Select study sites on a regional basis rather than on an individual state basis.
 - Very large nesting aggregations or rookeries that encompass very large beaches are unsuitable for detailed study of the properties of individual turtles.
- The study will have to be conducted over several years.
 - Minimum of 5 years recommended for both nesting and feeding area studies.
 - Considerable savings in time and resources can be made by supporting suitable studies that have already commenced. While new study sites may need to be established, several suitable studies are already in progress and could produce better results with increased funding support, for example:
 - comprehensive nesting studies addressing population dynamics;
 - feeding area/mark recapture studies addressing population dynamics;
 - fisheries catch statistics; and
 - population genetics of marine turtles.
- When a tagged population is established, there needs to be a high probability that the tagged turtles will be available for study during subsequent visits to the study site.
 - Long term tagging studies for mark/recapture studies are not viable in areas where turtles are actively hunted or subjected to other high levels of anthropogenic mortalities.
 - In tagging studies, the tag design should be selected to maximise long-term tag retention and reduce tag loss:
 - titanium or inconel 625 turtle tags are recommended for general use; and,
 - there is a need for further tag design improvement for flatback studies. In the interim, a double tagging combination of titanium and PIT tags is recommended.
- Because marine turtles are long lived and their research and monitoring will be ongoing responsibility of the conservation management agencies, it is imperative that data be secure and available for the long term:
 - copies of tagging data should be maintained by central agencies;
 - copies of data from individual researchers should be archived; and
 - State/Territory and National census statistics should be gathered and maintained by relevant management agencies.
- For community acceptance of the results of the studies.
 - the research needs to be scientifically rigorous;
 - the research program should be open to inspection by the scientific and conservation community; and
 - the results need to be subjected to peer review.

INTEGRATED APPROACHES TO SEA TURTLE CONSERVATION IN THE WESTERN INDIAN OCEAN

RODNEY V. SALM, SARAH HUMPHREY AND MARYDELE DONNELLY

"The issue of conservation is no longer sectoral but multisectoral and cannot be undertaken without the support of local communities. We have to involve all parties and partners and especially coastal people in conservation of marine resources."

Wilbur Ottichilo, Acting Deputy Director for Research and Planning, KWS

INTRODUCTION

Sea turtle populations are declining in many areas of the world as a result of overexploitation, the destruction and alteration of nesting, foraging and developmental habitats, international trade in products, accidental capture in fisheries, and marine pollution. Increasing human use of coastal habitats and beaches has contributed significantly to the decline of the world's seven species of sea turtles. In the last few hundred years few if any turtle populations have remained unaffected; many have been reduced or eliminated altogether.

Reversing the decline of sea turtle populations will require years of effort, substantial financial resources, and the participation of many people at local, national and regional levels. Efforts to address declining populations have been hampered by our lack of knowledge of the turtle's complex life cycle -- sea turtles are long-lived, slow to mature, late to reproduce, far ranging, and do not spend their lives in the waters of any one nation.

The recently published Global Strategy for the Conservation of Marine Turtles, produced by the IUCN/SSC Marine Turtle Specialist Group, identifies the need to incorporate sea turtle conservation into integrated coastal management as a top priority. Our goals to promote the restoration of sustainable sea turtle populations and maintenance of the coastal ecosystems of which they are a part can be accomplished in a more coherent manner by integrating sea turtles into programmes with a broader management focus, including regional efforts and coastal zone planning and management. This paper discusses ways in which elements of this global strategy can be reinforced by such integrated approaches.

THE CHALLENGE FOR TURTLE CONSERVATION

The ratification of CITES¹ and education of tourists to control international trade in turtle products and curios, introduction and enforcement of national legislation to control turtle hunting and sale of meat, and introduction of better fishing techniques including turtle excluder devices (TEDs) in shrimp trawl nets are just some of the specific actions which are needed towards protection of turtles. The other main focus for conservation action, which is increasingly urgent, is the protection of turtle habitat and of the turtles in these

Marine turtles need beaches on which they can nest and the hatchlings can emerge successfully. They need unpolluted coastal habitats in which to feed and they need safe coastal developmental habitat. The goal of many turtle conservation efforts is to keep beaches accessible for nesting turtles, and keep beaches safe from egg predation and for hatchlings. Fewer efforts are directed at protecting other critical habitats (feeding and developmental), and often the needs of turtles are considered only where an area is being considered for designation as a marine protected area. Beyond these sites, the coast is subject to increasing pressure as a direct and indirect result of human activities.

Coastal areas, with their rich and diverse habitats and ready communication links have been favoured in the western Indian Ocean (WIO) for many centuries as centres for settlement and trade, and as sources of living and non-living resources. Coastal areas are subject to intensive and diverse uses which all too often develop in an *ad hoc* manner without regard for other needs in the area. The associated impacts of habitat loss and degradation may be expected to grow apace unless actions are taken to plan and manage activities and developments of the different sectors operating in the coastal zone. According to a recent review, the major issues affecting the East African coastal zone are destructive fishing methods and associated habitat degradation, eutrophication and siltation of coastal waters, and marine oil pollution from tanker traffic and ballast discharge (World Bank, 1995).

An additional issue is tourism, one of the fastest growing sectors in the region, with its direct and indirect impacts on coastal habitats. Coastal tourism accounts for 60% of all tourism in Kenya and almost 100% in island states such as the Seychelles where it is the major industry and dominated by "beach tourism" (Shah, 1995). Fisheries and tourism are the mainstays of the economy in many coastal areas, but are also the activities having the most immediate impacts on turtles. Turtles are especially vulnerable to increased net fisheries over their feeding grounds and to hotel and other tourism related development on their nesting beaches.

With all these pressures on the coastal zone, there is a serious danger not only that the needs of turtles will continue to be disregarded or pushed aside, but also that those small but critical steps which have been taken to protect turtles will be rendered futile or simply overtaken by development pressures on the coast. This is not necessarily because the needs of turtles are incompatible with other needs, but simply because those responsible for activities affecting turtles are unaware of the problem, or of the simple steps which may be taken to avoid conflict.

It is challenging enough to conserve turtles today, but if our efforts today are to last, we need to consider integration into a fourth dimension - time. Our management efforts today need to account for, or at least to allow for, situations that may be very different in the future. At present some 25 million people are estimated to live in the coastal zone between Somalia and Mozambique and including the offshore islands, averaging 20% of the population. But population growth in coastal areas of the region, including by migration is some 4-7% per year and, while much of this is around existing urban centres, population centres are expected to merge to form a continuous band along the coast by 2020 (World Bank, 1995). These statistics are a signal that we will face challenges unlike any we have experienced to date. The issue we face today is how to

There are no quick answers, but for turtles to survive their interests need to be fully integrated into sectoral development plans. Ideally this should be achieved through a process that facilitates dialogue between different sectors, communities and other stakeholders to safeguard the interests of all parties, to reduce conflict, and to minimise loss of natural assets during development. This process is known as integrated coastal management.

AN INTEGRATED APPROACH FOR THE WESTERN INDIAN OCEAN

A great deal of good work is being done towards the conservation of turtle populations, often providing protection at the most vulnerable stages of their lifecycles, but much remains to be done. Efforts to conserve turtles in the region are generally aimed at controlling actions which have very direct and preventable impacts on turtles, such as by the protection of major nesting beaches, control of sale of turtle products, and more recently the promotion of turtle excluder devices in trawlers. These efforts are all too often carried out by one country in isolation and may be undermined by impacts on the same populations as they move on to a new area, perhaps in the waters of an adjacent or distant country.

Attempts to conserve sea turtles are hampered by our incomplete knowledge of these animals' life history. Turtles are long-lived and slow growing and reach sexual maturity only after decades. We know they spend their early lives somewhere at sea and that they return to nest on the same beaches where they were hatched. But in the interim these animals migrate over vast and poorly known areas, and move through the waters of several neighbouring states where they are subject to different levels of exploitation and conservation efforts.

MECHANISMS FOR INTEGRATION AT THE REGIONAL LEVEL

The first level of integration which is required to achieve effective conservation of turtles is across national boundaries in regions. While much more knowledge is required to define turtles' ranges, a coordinated regional approach to turtle conservation will ensure that efforts made in one country will be supported by complementary activities in another and are not undermined by the lack of protection elsewhere in the region.

When it enters into force, the Nairobi Convention - *The Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region*, and its related *Protocol concerning Protected Areas and Wild Fauna and Flora in the Eastern African Region* (United Nations, 1985) - will provide a framework for a regional approach in the western Indian Ocean.

Article 4 of this protocol affords strict protection to species listed under Annex II, and prohibits activities which may have adverse impacts on their habitats. Three Indian Ocean species, the olive ridley, loggerhead and leatherback are listed in Annex II of the protocol as *species of wild fauna requiring special protection*. The remaining two species, green and hawksbill are listed under Annex III as *harvestable species of wild fauna requiring protection*. Article 5 requires that states undertake measures to ensure

their exploitation. The plan may be used to regulate the nature, locality and timing of harvest and the trade of wild and captive stocks, and to ensure protection of critical habitats and breeding stocks.

Finally, Article 6 calls upon states to coordinate, through the body appointed with secretariat functions for the Convention, their efforts for the protection of migratory species listed under Annex IV - *protected migratory species*. For harvestable species this includes coordination concerning management plans. All five species of Indian Ocean sea turtles are listed under Annex IV.

Other important international Conventions are the Convention on International Trade in Endangered Species (CITES), and the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention) which are discussed elsewhere in this document. The Bonn Convention offers an additional framework for regional cooperation through the establishment of multilateral Agreements for Appendix II species, including sea turtles. Two other relevant conventions are the Convention on Biological Diversity, and the Convention on the Prevention of Marine Pollution from Ships (MARPOL). The accession of different states of the western Indian Ocean to these Conventions is shown in Annex 1. The recognition of the need for regional integration was expressed very powerfully through the UN Conference on Environment and Development, more commonly known as the Earth Summit or UNCED. This was an attempt to integrate global efforts for the conservation of biodiversity.

This regional meeting provides us with the first opportunity to develop a coordinated regional approach to sea turtle conservation. This is a chance to integrate the research and management activities of each WIO State with the others and in this way to conserve the species in all parts of their ranges and throughout their lifecycles. We, the people of the WIO, share a common resource in sea turtles, and we also share a common challenge which is their effective conservation. We need to draw together and share in our management efforts for their conservation.

MECHANISMS FOR INTEGRATION AT THE NATIONAL LEVEL

An integrated coastal management programme has strong potential as a means to achieve turtle conservation for two reasons. First, it ensures that measures taken for the conservation of turtles are sustainable through their being fully integrated with other activities and developments occurring or planned in the coastal zone; and, second, it provides a framework for implementation of different aspects of the Global Strategy (Research and Monitoring; Integrated Management for Sustainable Marine Turtle Populations; Building Capacity for Conservation, Research and Management; Public Awareness, Information and Education; Community Participation in Conservation; Regional and International Cooperation; Evaluation of the Status of Marine Turtles) as well as for specific turtle conservation measures.

In addition to the more usual protected area approach, the specific tools of integrated coastal management that are valuable for turtle conservation are the policies, plans, and relevant legislation guiding coastal development. For example, coastal setback policies

example). These setbacks are generally designed to safeguard the lives and property of the general public, and guarantee access to water, beaches and the sea. They can also be used to prevent coastal erosion (by keeping buildings off dune or unstable beaches) and to protect turtle nesting beaches (by keeping buildings far enough behind the beaches). A stable or rocky shore may have a narrow setback (e.g., 20 metres), whereas a highly dynamic sandy coast would have one extending 50 metres or more inland. In the same way, the setback can be made wider still adjacent to turtle nesting beaches (300 metres in the Sultanate of Oman).

When accompanied by other development policies, such as the control of lighting and protection of indigenous vegetation (which functions as an effective screen for lights), the setback policy becomes a powerful tool for turtle conservation, and will be vital to ensure secure nesting beaches as urban centres spread and join-up along the coast.

Development and acceptance of the policies requires a process of consultation between all interested or affected parties, including government and private sectors and local communities. This integrated approach to turtle conservation has proved effective in Kenya where the Kenya Wildlife Service (KWS) and Coast Development Authority (CDA) have taken the lead to bring together the provincial administration, marine research and fisheries authorities, hoteliers and private land owners to formulate and implement plans that include incentive schemes for the coastal people. This has significantly raised awareness among coastal residents, government sectors and administrations of the plight of turtles and the special planning and management needs on and adjacent to nesting beaches.

In a similar way, KWS and CDA are bringing together the concerned authorities to address turtle conservation issues over their feeding grounds. This involves working with fishermen and trawler companies to reach a common view on how to resolve the issue of accidental capture and drowning in fishing nets. Discussions with trawler companies have proved fruitful and legislation concerning the use of TEDs on the shrimp grounds is under development as a collaborative effort of the conservation, planning and fishing authorities.

Development plans formulated through the integrated coastal management (ICM) process are built on consensus. This means that the specific interests of all sectors, including the coastal communities have been considered and balanced against the wishes of others. This is a powerful mechanism that enables conservation authorities to get conservation issues weighed equally alongside development ones, and to facilitate the allocation of land and development rights in ways that help to safeguard vulnerable species or environments.

The policies mentioned above are built into the planning process and help to determine the land use allocations. Areas adjacent to turtle beaches are reserved through special easements to prevent conflicting developments and activities. "Hotspots" corresponding to the critical nesting, feeding or development habitats can be identified on land use plans and related environmental sensitivity maps. The sooner critical turtle habitats are integrated into land use plans, the more of them we can expect to survive the process of coastal development predicted by the World Bank review.

Integration in coastal management takes place not only among different sectors and authorities, but through different levels of government from local to national. The institutional arrangements which are developed to facilitate ICM provide a means to redefine or clarify the roles and responsibilities of different authorities with respect to sea turtle conservation, including enforcement agencies. Similarly, a common activity in the ICM process is the review and revision of legislation concerning coastal zone activities, and this provides an opportunity to ensure that national policies on turtles, for example as expressed through accession to treaties or conventions, are incorporated into law.

The need for integrated coastal management in the WIO was acknowledged at the *Workshop and Policy Conference on Integrated Coastal Zone Management in Eastern Africa including the Island States* held in April 1993. Coming out of this meeting, the Arusha Resolution, signed by ministers of six states (Kenya, Madagascar, Mauritius, Mozambique, Seychelles, Tanzania), has encouraged the development of integrated coastal management in the WIO.

Integrated coastal management activities are being initiated through *the Action Plan for the protection, management and development of the marine and coastal environment of the Eastern African Region* starting in Zanzibar and Kenya, in the Island States through the Indian Ocean Commission, and through regional authorities such as in Tanga, with the assistance of IUCN.

We have a very real opportunity in the WIO region to use these initiatives to support conservation of turtles and their habitats in a manner that is sustainable through being fully integrated with other activities, and the needs and expectations of the coastal communities. It is now up to each one of us to follow the lead of the Kenyans and ensure dialogue among different sectors to facilitate integration of turtles' needs into the development planning process.

CONCLUSIONS

The *Global Strategy for the Conservation of Marine Turtles* sets out measures needed for the conservation of turtles around the world. These steps need to be implemented at local levels, but within a regional context, addressing the conservation needs of different populations of turtles and their habitats in an integrated fashion. We need now to develop a regional strategy for the western Indian Ocean which specifically addresses conservation issues affecting our shared turtle resources and which ensures that actions taken for conservation by one nation are not undermined by actions elsewhere.

There are a number of international conventions and treaties which provide a policy framework for such a regional strategy, although not all of these have been signed or ratified by all the states in the region. We need to encourage their ratification to facilitate a regional approach. In particular, the *Protocol concerning Protected Areas and Wild Fauna and Flora in the Eastern African Region* sets out specific requirements for management of turtles across the region. With the entry into force of the Nairobi Convention anticipated we need to discuss how we can help our countries to meet their obligations under this protocol. We should also consider whether the

were first proposed, the different categories into which turtles are placed are still appropriate, especially the harvestable species category.

Finally, to make our turtle conservation efforts in and across the region sustainable, we need to ensure that these are fully integrated into sectoral development plans, and where possible need to take advantage and encourage the development of integrated coastal management activities.

"With good science and goodwill turtles and people can live together"

David Ehrenfeld

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Annex 1

Accession of WIO States to International Treaties and Conventions

	Nairobi ¹	CITES ²	CBD ³	Bonn ⁴	MARPOL ⁵
Eritrea	na	X	X		
Kenya	X	X	X		X
Tanzania		X	(in process)		
Mozambique		X	X		
South Africa	na	X	(in process)	X	X
Comores	X	X	X	X	
Madagascar		X	X	(signed)	
Mauritius		X	X	X	X
Seychelles	X	X	X		X
France	X	X	X	X	X

¹ Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region and related protocols

² Convention on International Trade in Endangered Species of Wild Fauna and Flora

³ Convention on Biological Diversity

⁴ The Convention on the Conservation of Migratory Species of Wild Animals

⁵ International Convention on Prevention of Marine Pollution from Ships

LOCAL COMMUNITY PARTICIPATION IN SEA TURTLE CONSERVATION IN KENYA

**FELIX KALOKI
GEORGE WAMUKOYA**

INTRODUCTION

Four of the species of sea turtle - the green, hawksbill, olive ridley and leatherback - are recognised as endangered by IUCN - The World Conservation Union, and a fifth - the loggerhead - is recognised as vulnerable (Groombridge, 1982, 1994).

Traditionally, sea turtles have been exploited along the Kenya coast particularly by the Bajuni community for many years. They have been harvested for both subsistence and commercial trade (Frazier, 1980), primarily for meat, shell, oil and skin.

In the past, conservation efforts have tended to rely on strict protection of habitat through the establishment of National Parks and other protected areas. However, coastal communities have often borne the costs and rarely received the benefits associated with neighbouring protected areas and hence have usually had little vested interest in their protection. As a result people's attitudes have often been biased against the protected areas. In the case of sea turtles their migratory nature and the weak enforcement of protective laws makes them especially vulnerable to unsustainable exploitation.

Local people value sea turtles in a number of ways - spiritually, economically, culturally, and more recently aesthetically and scientifically. These values encompass a constellation of social norms and individual attitudes all of which may play a role in the conservation of sea turtles.

It is recognised that value systems compatible with sustainable use patterns cannot be prescribed but must emerge through local participation and with respect for traditional beliefs and practices which have effectively allowed sea turtles to exist alongside humans for centuries. It has been realised that these traditional systems and roles are important as specific conservation techniques in helping to reverse the present trend of decline in sea turtle populations.

It is against this background that it became clear that the future viability of sea turtle conservation appears to hinge on the cooperation and support of local people. This cooperation and support in turn depends on whether the local people will be able to derive some benefits to warrant their participation. "Save The Turtle Fund" was started to reward participating individuals. With the Incentive Reward Scheme, it has been possible to secure constructive cooperation and dialogue with the local people. Although the initiative is only five years old, it is already beginning to positively influence local attitudes towards sea turtle conservation.

PEOPLE'S PARTICIPATION

The sustainability of sea turtle conservation efforts depends upon the participation and motivation of local people. Fundamentally, motivation comes from a realisation that it is their own resource and that they are likely to benefit.

According to Paul (1987) community participation is the process "whereby people act in groups to influence the direction and outcome of development programmes that will affect them." Participation may be thought of as the deliberate action of people and government to respond jointly in the formulation, planning, and implementation of a strategy to satisfy a particular need.

To initiate such a process it became necessary to determine the primary stakeholders (ie. individuals and groups with a vested interest in the outcome of the project). Once identified we had to make them feel comfortable with their roles in the sea turtle conservation project.

As a result the Turtle Conservation Committee comprising representatives from the Kenya Wildlife Service (KWS), Kenya Marine and Fisheries Research Institute (KMFRI), Fisheries Department, Coast Development Authority (CDA), Wildlife Clubs of Kenya (WCK), Baobab Trust and some hoteliers have established the "SAVE THE TURTLE FUND" to provide incentives for local people (mainly fishermen) to report and guard turtle nests. An individual reporting the presence of a nest is rewarded Kshs 500, guarding of eggs another Kshs 500, and when the hatchlings emerge, Kshs 2 per egg hatched.

The number of eggs hatched is confirmed when the nest is unearthed and the hatched shells counted. This incentive has generated a lot of enthusiasm among the local people with an increasing number of people participating. Similarly, along some nesting beaches the local people have organised beach patrol groups that patrol the beaches each morning to safeguard turtle nests. To reduce the deaths of foraging turtles through accidental capture, there is also a scheme to repair nets which are damaged by fishermen who cut them to release trapped turtles. This scheme has become very popular and there are reports every day of turtle nest protection or of turtle rescue by fishermen, thus turning a "poacher into a protector".

Among the hoteliers and some beach front property owners, enthusiasm for the project has developed through the opportunity to participate in conservation; for others it has been a business gain, providing an attraction for environmentally sensitive tourists. Youth participation in the turtle conservation effort along the Kenyan coast has been dramatic with youths, both in and out of school, participating in a "Save the Turtle Walk" and in other turtle programmes such as art, essay and poetry competitions.

CHALLENGES

In promoting community participation in sea turtle conservation, we have faced several challenges including:

- Not being able to match the unexpectedly high and widespread enthusiasm with resources (human, environmental education materials and fiscal) immediately available to the Turtle Conservation Committee.
- Long term sustainability of incentive arrangements and institutional framework. There is a growing need to have a broad community based organisation whereby government, local and international agencies play only a facilitating role.

FUTURE PLANS

Future and immediate community based strategies to promote and sustain interest in turtle conservation include the following:

- Recruitment of groups along the entire coastline to report turtle nesting;
- Formation of a non-governmental organisation with a specific mandate to conserve turtles and endangered marine mammals;
- Integration of turtle conservation with the dugong awareness programme;
- Production of materials to promote awareness and provide basic information, both written and electronic, to facilitate monitoring and handling of turtles;
- On-site training programme for fishermen on the recovery of turtles caught in fishing nets;
- Sustainable incentive programme and possibly provision of alternatives for turtle products.

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THE CONVENTION ON MIGRATORY SPECIES AND SEA TURTLE CONSERVATION

DOUGLAS HYKLE

The Convention on the Conservation of Migratory Species of Wild Animals (also known as the Bonn Convention or CMS) aims to conserve terrestrial, marine and avian migratory species throughout their range. It is one of a small number of intergovernmental treaties concerned with the conservation of wildlife and wildlife habitats on a *global* scale. Since the Convention's entry into force on 1 November 1983, its membership has grown steadily to include 47 parties from Africa, Central and South America, Asia, Europe and Oceania. A secretariat under the auspices of the United Nations Environment Programme (UNEP) provides administrative support to the Convention.

Parties to CMS work together to conserve migratory species and their habitats by providing strict protection for the endangered migratory species listed under Appendix I of the Convention; by concluding multilateral Agreements for the conservation and management of migratory species listed under Appendix II; and by undertaking cooperative research activities.

CMS has a unique role to play in focusing attention on and addressing the conservation needs of the 55 endangered species presently listed under **Appendix I** - including among others, six species of sea turtles. Article III of the Convention requires Range States to prohibit the taking of Appendix I species. However, some specific exceptions are allowed (e.g. for scientific purposes, for enhancing propagation of species, and traditional subsistence use) provided they are limited in space and time.

Appendix II lists migratory species that require or would benefit significantly from international cooperative Agreements under CMS. These may range from legally-binding treaties to less formal memoranda of understanding. The more formal Agreements should provide for coordinated species conservation and management plans; conservation and restoration of habitat; control of factors impeding migration; cooperative research and monitoring; and public education and exchange of information among parties.

Four Agreements have been concluded to date under the auspices of CMS. Three of these focus on the conservation of species found in Europe: seals of the Wadden Sea, European bats, and small cetaceans of the Baltic and North Seas. A major Agreement for the conservation of African-Eurasian migratory waterbirds was concluded in June 1995. Memoranda of Understanding have also been concluded among the Range States of the western and central Asian Populations of Siberian crane, as well as those of the slender-billed curlew. Further initiatives are envisaged for a wide range of migratory species, including Sahelo-Saharan ungulates, albatrosses, bustards, Mediterranean and Black Sea cetaceans, and sea turtles.

The Convention on Migratory Species is fully compatible with and complementary to the Convention on International Trade in Endangered Species (CITES). With regard to sea turtles, CITES deals primarily with aspects of international trade in their products, but does

Although no Agreements have yet been concluded for sea turtles, the decision making body of the Convention (the Conference of the Parties) decided in June 1994 to give high priority to this group. The CMS Standing Committee met in March 1995 to discuss funding and priorities for the next three years. Several regions with sea turtle populations have been considered as possible candidates for the development of regional Agreements, including the eastern Pacific Ocean, the Mediterranean Sea, the coast of West Africa, the western Indian Ocean, the Persian Gulf-Gulf of Oman, and the Indo-Pacific. Work on sea turtles is expected to intensify during the remainder of 1995 and 1996, in cooperation with the IUCN/SSC Marine Turtle Specialist Group. Dr Col Limpus (Australia) has been appointed to serve on the CMS Scientific Council to assist with these initiatives.

The CMS Scientific Council met in November 1995, and endorsed a number of proposals relating to sea turtles which shall benefit from financial support from the Convention. As a first step, CMS has provided funding for the Western Indian Ocean Training and Strategic Planning Session (Sodwana Bay, South Africa, 12-18 November 1995) and will contribute to other regional and global initiatives over the coming months.

NOTES ON CITES AND THE INTERNATIONAL TRADE IN SEA TURTLES

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INTRODUCTION

Exploitation of sea turtles for international commerce has been going on for centuries. In recent decades, sea turtle fisheries have largely focused on three main species. The hawksbill (*Eretmochelys imbricata*) was traditionally targeted for its shell (known as "bekko" in Japan) or as stuffed specimens; the green (*Chelonia mydas*) for its meat and edible cartilage (the famous turtle soup), skin, as stuffed specimens, and occasionally for its shell; and the olive ridley (*Lepidochelys olivacea*) for its skin. Virtually all sea turtle species suffer from the collection of eggs and hunting for meat, which can be significant sources of protein in many protein-deficient coastal regions of the tropics, but most trade in these products is local in nature. There has also been limited trade in other derivatives, such as oil, in the past, but this is no longer considered to be a significant threat in recent decades.

International trade in sea turtles and their parts, derivatives and products has long been regulated under CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora). The hawksbill, green and olive ridley sea turtles, along with the leatherback (*Dermochelys coriacea*), the loggerhead (*Caretta caretta*) and Kemp's ridley (*Lepidochelys kempii*) were originally listed on Appendix I of the Convention in 1975. The flatback (*Chelonia depressa*) was later added. These listings prohibit all international commercial trade, except under exceptional circumstances.

Though not encouraged, the Convention provides a basis for Parties to place "reservations" against selected species and treat them as if they were not listed on the CITES Appendices. This provision allows for otherwise prohibited trade to continue legally under the Convention. However, through Resolution Conf. 4.25 (Effects of reservations) passed in 1983 at the fourth meeting of the Conference of the Parties, it was agreed that trade in Appendix 1 species under reservation should only transpire between non Parties or with Parties which have a corresponding reservation on the species. Over the last two decades, a number of consumer and producer states have placed reservations on sea turtle species. Today, only three Caribbean nations continue to hold reservations: Cuba on the hawksbill and the green; St Vincent and the Grenadines on the hawksbill; and Surinam on the green and the leatherback.

LARGE SCALE INTERNATIONAL COMMERCIAL TRADE IN SEA TURTLE PRODUCTS

Traditionally, many countries around the world were engaged in various aspects of sea turtle trade. The leather industries in Italy, France, Germany and the United Kingdom all formerly produced a variety of leather products made from sea turtles. Hawksbill shell was also widely used in Europe for the production of expensive eyeglass frames and other items. France traditionally led the world in the production of sea turtle soup. However, under CITES and through European Union regulations, legal avenues for Europe's sea turtle trade were eventually closed.

By the 1980s, only the Japanese trade remained, with Japan ranking as the world's foremost importer of sea turtle products. Although Japan joined CITES in 1980, the government placed reservations on the hawksbill, green and olive ridley sea turtles in order to safeguard traditional industries which relied on sea turtle products. Consequently, Japan's trade was repeatedly singled out in CITES fora as having a deleterious impact on the populations of these three species and over the last 25 years, it is estimated to have consumed over 2.4 million sea turtles worldwide. (Table 1).

Under pressure, Japan gradually reduced import quota levels allowed for hawksbill sea turtle shell, curtailed all imports of stuffed sea turtles and worked sea turtle products from other countries, gave up the reservation on the green sea turtle in 1988, and finally restricted trade in the remaining two species to the terms of Resolution Conf. 4.25. Regardless, in March 1991, Japan was formally censured by United States for its sea turtle trade under the Pelly Amendment to the Fisherman's Protective Act of 1967 - legislation which allows for the imposition of economic sanctions. In subsequent negotiations, Japan agreed to give up the reservation on the olive ridley sea turtle, effective 31 January 1992, and to phase out all imports of hawksbill sea turtle shell by December 1992, finally dropping the reservation, effective 29 July 1994.

With this last act, Japan formally closed the last chapter in large-scale, commercial international trade in sea turtle products. In fact, the Africa/Indian Ocean region appears to have been the region least affected by the Japanese trade. Hawksbill shell was the only commodity regularly imported, while only minor trade in other sea turtle products transpired from the region. For hawksbill shell, 86% of the Japanese trade emanated from the Latin America/Caribbean and Asia/Pacific regions, and only some 12% overall was imported from the Africa/Indian Ocean nations. Between 1970 to 1987, the largest suppliers of hawksbill shell in the region were Tanzania (27,666 kg); Kenya (22,426 kg); the Maldives (9,661 kg); the Seychelles (6,547 kg); India (3,303 kg); Ethiopia (3,139 kg); Somalia (1,781 kg) and Madagascar (1,282 kg). Other minor suppliers included Mozambique, Réunion, Comoros, Saudi Arabia and Sri Lanka. Since 1987, the only hawksbill shell imports from the African mainland or Indian Ocean islands were a total of 11,163 kg from the Maldives, 5,874 kg from the Comoros and 600 kg from Ethiopia.

Table 1. Japanese Imports of Sea Turtle Products 1970 - 1994

Sea turtle commodity	Volume (kg) approximate	Number of Sea Turtles	Comment
Hawksbill Sea Turtle Shell	765,910	722,557	Imports ceased in January 1993
Green Sea Turtle Shell	86,690	? 100,000	Imports ceased in January 1988
Stuffed Hawksbill Sea Turtles	704,647	612,737	Imports ceased in January 1990.
Stuffed Green Sea Turtles	1,014,684	394,819	Imports ceased in January 1988.
Olive Ridley Sea Turtle Skins	426,277	170,511	Imports ceased in January 1991
Green Sea Turtle Skins	251,591	50,318	Imports ceased in January 1988
Olive Ridley Sea Turtle Leather	115,263	384,210	Imports ceased in January 1991
Green Sea Turtle Leather	2,875	? 4,792	Imports ceased in January 1988
Total Estimated Number of Sea Turtles		2,439,944(?)	

*Conversion factors are taken from Milliken T. and H. Tokunaga. 1987. *The Japanese Sea Turtle Trade*

SMALL SCALE TRADE IN SEA TURTLE PRODUCTS

In spite of the cessation of large-scale commercial trade, sea turtle products continue to be found throughout the world's tropical tourist centres. Many countries even those which prohibit the export of raw sea turtle material, allow for domestic harvest and the manufacture and sale of sea turtle products. Other countries may have domestic restrictions in place, but trade in sea turtle products continues due to poor law enforcement.

The African/Indian Ocean region is no exception: stuffed sea turtles and sea turtle trinkets, largely fashioned from hawksbill shell, have been noted in tourist markets in mainland Tanzania, Zanzibar, Mozambique, Madagascar, Mauritius, Seychelles, and many other Indian Ocean island and mainland areas. While trade volumes do not appear to be particularly high, few formal assessments have been conducted. The extent of local, cottage-industry processing operations remains to be examined, but in some instances it appears that most hawksbill shell handicrafts are actually imported and not produced locally.

CITES does not allow for these products to be traded internationally, even as "personal effects." As most sea turtle products available in the region are marketed to tourists, they are often confiscated upon entering the home country of the purchaser. In fact, sea turtle products are the single most frequently confiscated wildlife trade item in the United States, with thousands of tourist trinkets seized annually. Available data indicates that seizures are also fairly frequent in a number of European countries. Apart from its impact on local populations of sea turtles, because it is directed at international travellers, such trade is problematic under CITES and should not be encouraged.

Apart from the trade in tourist trinkets, it would appear that the major threats to sea turtles in western Indian Ocean are not international trade-related. Subsistence collection of eggs and the hunting and sale of sea turtle meat is generally not a CITES issue as transactions are local, and not international, by nature. Other significant threats to sea turtles - beach development and disturbance, pollution, incidental take in fisheries - are also not directly related to the Convention.

SEA TURTLE RANCHING AND CAPTIVE BREEDING UNDER CITES

CITES provides for specimens of Appendix I species which have been "bred in captivity" or which are subject to approved "ranching" operations to be exempt from the prohibition on commercial international trade.

Although many terrestrial species have benefited from these provisions, their application with respect to sea turtle species has proved to be very problematic for a number of reasons. Firstly, many fundamental aspects of the biology and life cycles of sea turtles remain unknown. Secondly, sea turtles are slow-growing, long-lived animals that take two decades or more to reach reproductive age in the wild, a fact which greatly complicates their management. Thirdly, as a marine species which spends less than 1% of its life on land, accurate population data for individual populations is extremely difficult to obtain, and population dynamics, including recruitment, are poorly understood. Finally, the migratory habits of sea turtles often makes them a shared resource within a region, adding another complicating factor to the equation.

In 1979, through Resolution Conf. 2.12 (Specimens bred in captivity or artificially propagated), the CITES Parties ruled that the captive bred exemption established under the Convention could only be applied to commercial operations which were managed in a manner which has been demonstrated to be capable of reliably producing second generation (F2) offspring. Table 2 indicates the significance of this ruling for trade in sea turtle products. In fact, sea turtles appear to be a difficult species to maintain in captivity in large numbers indefinitely, much less reproduce to the F2 generation. The world's most advanced sea turtle breeding experiment, the Cayman Island Turtle Farm, has yet to produce an F2 generation after nearly three decades.

In 1981, the third Conference of the Parties passed Resolution Conf. 3.15 (Ranching) which established criteria for transferring populations of Appendix I species to Appendix II pursuant to ranching. Ranching allows for a country's entire population of the species to be transferred to Appendix II if certain conditions are met. While ranching also involves bringing young animals or eggs into a controlled environment for rearing and eventual harvest, captive breeding is not a key element. However, for a ranching programme to be approved, among other criteria, it must have demonstrated that "the operation must be primarily beneficial to the survival of the local population (i.e. where applicable, contribute to its increase in the wild)".

Since 1981, five countries on ten different occasions have submitted amendment proposals to transfer populations of sea turtles onto Appendix II and begin trade in sea turtle products. None of these proposals have been met with approval by the CITES parties. In fact, after the defeat of France's third successive ranching proposal in 1987, the CITES Parties mandated that specific guidelines for the evaluation of sea turtle ranching proposals be developed. Under the auspices of IUCN, this proved to be a very difficult task, with successive drafts referred to the committee for further consideration and revision. Finally, in November 1994, at the ninth meeting of the Conference of the Parties, Resolution Conf. 9.20 (guidelines for evaluating marine turtle ranching proposals submitted pursuant to Resolution Conf. 3.15) was adopted. These guidelines address a wide range of issues, including resource management, trade controls and other operational concerns. These guidelines will not be used until the next time a sea turtle ranching proposal is submitted for consideration of the CITES Parties at a future Conference of the Parties.

Table 2. Captive Breeding of Sea Turtles under CITES

WILD: PARENT STOCK	CAPTIVITY: PARENT STOCK	CAPTIVITY: F1 GENERATION	CAPTIVITY: F2 GENERATION
Eggs, hatchlings, sub-adults or mature sea turtles are collected in the wild and placed in captivity.....>	... to become the parent stock. If these animals are sustained and eventually reproduce in the captive environment...>	... their offspring are the F1 generation. These animals must also mature and reproduce in captivity...>	... to produce the F2 generation. At this point, stock can qualify for the "captive-bred" under CITES and legal trade authorised.

CONCLUSIONS

Although it took some twenty years to achieve, under CITES, all commercial international trade in sea turtles has ceased. With the Japanese withdrawal of their long-standing reservation on the hawksbill sea turtle in July 1994, the last vestige of large-scale commercial trade pressure was removed. However, small-scale, tourist-directed trade in sea turtle products remains a feature in many tropical countries, including some in the western Indian Ocean. While CITES cannot interfere with domestic trade options, the export of these products is not sanctioned under the Convention and remains a law enforcement problem of concern for many countries.

In the past, attempts to rear sea turtles in captivity for commercial trade purposes have not met with success in CITES fora and this option, for the moment, remains blocked under the terms of the Convention. Sea turtle ranching has also not fared well under CITES in the past. It remains to be seen if any such operations will be further pursued under new ranching criteria. The earliest that this can happen will be at the tenth meeting of the Conference of the Parties scheduled for early to mid-1997.

PART II

NATIONAL REPORTS

THE STATUS OF SEA TURTLE CONSERVATION IN ERITREA

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TECLEGIORGIS GEBREMARIAM

ABSTRACT

The limited information available from the Eritrean coast on marine turtles indicates a population of global significance in terms of numbers and breeding. Five species are known, two - the green and hawksbill - making up the bulk of the animals recorded. Nesting and occurrence of evidence are widespread. Foraging and nesting habitats are known at the extremities of this long coastline, and similar conditions probably pertain along most of the coast and on the 355 islands. Use of turtles meat and eggs by the small and scattered local communities is at a largely subsistence level. Given the early stage of the development of the new country of Eritrea, its recent past history, its limited human population, skills and resources, much has been achieved with respect to knowledge of turtles, and to the integrated management of the maritime environment, including turtles and their habitat. The required legislation, regulatory and enforcement procedures, and accession to the requisite international conventions are well-advanced. Turtles are a significant aspect of the Eritrean maritime environment, they have supported the coastal human population for at least two thousand years, and hopefully though the actions already proposed and initiated, will be able to do so for the foreseeable future.

INTRODUCTION

Eritrea with a mainland coastline of 1,200 km, is responsible for some 18% of the Red Sea coast. In addition there are 355 offshore islands under the country's jurisdiction, with their own total coastline of over 1,300 km. The coast and islands area provides important turtle habitat and nesting beaches whose global significance has yet to be accurately determined.

Human populations are very limited, there being an estimated 70-110,000 people on the entire coast, of which 50-60,000 are in the two ports of Massawa and Aseb. Only ten of the 355 islands have any people on, their total population being in the order of only 2-3,000, the majority in seven villages on the large island of Dehalak Kebir (640 km²). The people of the coast and islands depend upon a variety of support systems, including marine products harvesting, local and international trading by boat, and livestock rearing.

At present, the new Ministry of Marine Resources bears the major responsibility for the management of the area with respect to living natural resources including turtles and their habitat. There is a dearth of information concerning turtles, and management policy and initiatives are just beginning, with as yet minimal assistance. It is to be hoped that the maritime ecosystem, including - but not exclusive to - turtles and their habitat, will be managed in an integrated manner in the future, and significant moves in this direction have already been made.

The information presented here is limited by the brief time since observations began to be recorded (2 years), limitations of suitable transport and personnel qualified to identify turtle evidence, and the extent and harshness of the area under consideration.

STATUS AND DISTRIBUTION OF MARINE TURTLES IN ERITREA

Marine turtle species found in Eritrean waters: Five turtle species occur in the Red Sea, and have all been recorded from the Eritrean maritime ecosystem, considered here as the mainland coast, offshore islands, and approximately 55,000 km² of open sea to the mid-line of the Red Sea. Species reported in Frazier *et al.* (1987) and Lagen (in press) are as follows:

Caretta caretta (Linn. 1758) - Loggerhead turtle - the range includes the Eritrean Red Sea coast (Iverson, 1986; King & Burke, 1989). No recent substantiated records of either sightings or skeletal evidence.

Chelonia mydas (Linn. 1758) - Green turtle - (Eritrean Red Sea coast - Hoofien & Yaron, 1964). Commonly seen and skeletal remains often found. Nests found.

Eretmochelys imbricata (Linn. 1766) - Hawksbill turtle - (coast of Eritrea - Rüppell, 1835; del Prato, 1891; Steindachner, 1901; Hoofien & Yaron, 1964). Commonly seen and skeletal remains often found. Nests found.

Lepidochelys olivacea (Eschscholtz 1829) - Olive ridley turtle - (Eritrean Red Sea coast - Rüppell 1835; Iverson, 1986; King & Burke, 1989). No recent records of either sightings or skeletal evidence.

Dermochelys coriacea (Vandelli 1761) - Leatherback turtle - (Eritrean Red Sea coast - Iverson 1986, King & Burke, 1989). Two recent records - one carapace, one live animal regularly seen at one location. In addition, there are unsubstantiated trawler records, and the species is well known by local fishermen, who have no use for it.

General distribution in Eritrean waters: Green and hawksbill turtles form the bulk of the population, with almost no records of the other three species to date, but data are generally scarce. Interviews with fishermen indicate that turtles generally are common along the entire coast, but since few people live or fish along the northern third (north of Massawa) this area remains little known. Our own limited observations corroborate the local knowledge, with turtle evidence gleaned from almost all mainland and island sites, and inshore waters.

One green turtle tagged at Ras al Had, Oman, was recovered at Aseb, Eritrea; the distance between the two locations was 2,220 km, covered in only 3 months (Ross & Barwani, 1982). This is an early indication of the regional nature of the turtles using Eritrean waters.

Known population trends: From the limited investigations conducted among communities, it appears that turtles are less numerous now than previously. There are no historical records that we are aware of with which to compare present levels, and censuses are required to establish present population levels.

Nesting beaches: Definite locations where nests have been found, together with information from local communities, have been collated in Table 1. This is by no means an exhaustive examination of nesting areas, but rather opportunistic information that we have been able

is considerable. The locations recorded to date are extremely widespread and the potential nesting habitat in between may also be significant.

There appears to be some separation of the two main species in terms of nesting periods (see Table 1), but given the broad overlap of the nesting grounds and times attributed to unknown species this cannot be confirmed. Data for the Indian Ocean suggests a year-round nesting period for the green, while hawksbill may have a more restricted period in this area, early in the year (Márquez, 1990).

Foraging/feeding grounds: Areas where turtles have been sighted or collected as trawler bycatch, have been collated in Table 2. This is not definite evidence for foraging, but the assumption is made that turtles are there since the habitat is suited to their needs at that time. Extensive seagrass beds are known from the Mersa Ibrahim, Mersa Mubarak, Nora Island areas, as well as from Aseb and Ras Terma in the south. These are mainly extensive mangrove sites, and numerous turtles were noted at the first two sites on the north coast in October 1993. Jellyfish at certain times of year (early hot season) appear in massive swarms, particularly *Aurelia aurita* and *Cassiopea andromeda*.

Developmental habitat: No data exists for the occurrence of developmental habitat for turtles in Eritrea. One hatchling was recorded from Gurgussum beach just north of Massawa, where earlier nesting (of a different species) had been recorded. Several small to medium-sized hawksbill shells have been obtained from Dehalak Kebir Island, but with no definite information on where the animals were caught.

EXPLOITATION

Traditional uses of marine turtles and their products by local communities: From the distant past to the present century, turtles have been a major commodity in the Red Sea, supporting trade and seafaring as well as coastal communities with "tortoise shell", live animals as meat, and eggs. Records date from as early as A.D. 30-230 (Casson 1989). The end of the seafaring lifestyle and recent instability in the area have reduced this to mainly subsistence harvesting for meat and eggs. Carapaces are discarded at the fishing camps along the beach, or used as containers for water or other products being processed (*trepang, bêche de mer*).

While turtle meat is a commodity on sale at the Aseb fish market, this practice is confined to that centre of population. Turtle meat is sold at EtBirr 3 (US\$ 0.50) per string (<1Kg), and it is estimated that 20-30 animals per month are sold during the hot season (Jun-Sep), with the total number marketed at least 120 per year. A similar number is used in the Aseb Bay area for subsistence. Turtles are hunted using steel spear heads attached to long wooden shafts with a lead rope. The ratio is in the order of 8 green to 1 hawksbill. Fishermen are aware that the meat may be toxic and test for this by cutting open the heart - a peppery taste to the blood is taken to indicate toxicity.

Elsewhere along the coast to the north of Aseb and particularly on the Dehalak islands, turtle meat has no commercial value. Animals are mainly opportunistically harvested, usually tangled in fishing nets, and will be consumed by the families of the fishermen concerned, and surplus meat given to neighbours free of charge. Until recently the shells had no commercial value, although some medium and small-sized shells are beginning to

Local community knowledge of population trends: Data is still very limited but there has been a recent survey of seven communities along the southern coast from Massawa. Of the seven communities investigated between Massawa and Aseb, the northern three (at Morah, Sahel and Maeder) and southernmost (Harasan) reported turtles incidence declining over the past 10-20 years, while the south central three (at Tio, Dewolo and Edi) recorded turtle incidence increasing. Informants in the Aseb area (Bera'sole, and Senaabur, Fatuma and Um Ubeid islands) were divided in their opinions.

Commercial and international trade in marine turtles and their products: There is no formal international trade in turtles or their products from Eritrea. A few small hawksbill shells are still to be found in one tourist shop in Massawa, and another in Asmara. These will be the subject of control on compliance to the recently signed CITES Convention (see below).

The Massawa shop reported that in past years the previous owner used to collect and sell dried turtle penises, but their ultimate destination was not known. Islanders from Dohul report a continuing trade in dried turtle penises with Saudi Arabia. One piece reportedly fetches a price of Saudi Riyal 100 (Mohammed Haj, pers. comm.).

Turtle meat is sold at the Aseb fish market and records so far obtained suggest that at least 120 animals per year are sold there as butchered meat, at up to 20-30 animals per month. The meat is sold outside of the formal market and is therefore not formally recorded. Further, since it is butchered before coming to the market, it is difficult to ascertain actual numbers or species of animals harvested.

It is not clear whether turtles form any part of the harvest of Eritrean marine products taken by Yemeni fishermen, who cross the narrow stretch of water from Hodeidah, where they market their catch. Turtles might constitute significant used bycatch but it will be some time before figures are available about this essentially illegal fishing exercise.

Turtles have also been recorded as bycatch in shark nets set by fishermen. These are butchered and used immediately as subsistence food while fishing.

THREATS (MANAGEMENT CONCERNS)

Natural threats to nesting beaches: No records exist yet of nests dug out by natural predators. Monitor lizards are not yet known from the coastal areas or islands. No larger carnivores (including domestic dogs) are known from the islands, but jackals and other smaller carnivores are known along the mainland coast. We have no data as yet from the areas visited of any natural significant erosional threats to nesting beaches. By and large islands have southern sandy beaches, continually replenished in the winter months.

Egg collection by humans: All people questioned on this topic to date mention collecting turtle eggs as a source of food. They do not appear as a trade commodity however.

Fishery-related threats to turtles: Eritrea's fishery was significant in the past with tonnages of 25,000 tonnes per year being landed by a number of trawlers operating out of Massawa. Their impact on the turtle population was not recorded. The fisheries were strictly controlled and finally banished during the Dergue period, and trawling did not start again until March 1994. Records exist but are basic, and fisheries observers not consistent in their record keeping, particularly of bycatch. The records that we do have indicate a significant offtake of turtles (see Table 2), which observers complain are usually dealt with last, thus often suffocating under the heap of landed fish, if they have not already drowned in the net. One record cruise recently netted over 300 turtles on a single cruise of 17 days duration.

Other human related threats: Development along the Eritrean coast has changed little in the recent or longterm past, and may even have declined as a result of suppression of boat-dependant activities in the area over the past 30 years. New developments may impose threats, for example if large tourist hotels, oil exploration and oil exploitation develop.

MANAGEMENT STRATEGIES

Turtle management responsibilities: Management of marine resources, and de facto of the coastal and maritime environment, lies with the Ministry of Marine Resources. This includes amongst its departments, the Resources and Environment Division (R & ED) which gathers, processes and disseminates information for management planning purposes, and the Resources Protection and Enforcement Division (RP & ED), responsible in the main for regulating the marine products harvest.

The contact point for the CITES Convention in Eritrea is the Wildlife Department of the Ministry of Agriculture. Eritrea acceded to CITES in November 1994, but the operating mechanisms have not yet been established with respect to turtles. This will address International Trade, which may be insignificant, and not local use and its regulation.

Legal basis for turtle conservation and management: Eritrea's laws are in the process of formulation, since independence 2 years ago. A Coastal Zone Management Proclamation has been drafted, which includes aspects of the management of the environment with respect to threatened and endangered species of marine megafauna, and the harvesting and use of their products.

Effectiveness of existing turtle protection mechanisms: Formal protection mechanisms do not yet exist, beyond the discouragement of turtle harvesting, particularly with an aim to commercial selling of products and supplying curios for the tourist market. The turtle as a source of food for communities living under extremely harsh conditions has to be acknowledged and respected, provided the harvest is sustainable in the long term. We still have an inadequate knowledge base in this respect.

International Treaties and Conventions:

Name of Convention	Yes	No
Convention for the protection management and development of the marine and coastal environment of the Eastern African Region and related protocols (Nairobi Convention)	NA ¹	
Convention on the Protection of the Environment of the Red Sea and Gulf of Aden (PERSGA)		No ²
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Yes ³	
Convention on Biological Diversity	Yes	
The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)		No
International Convention on the Prevention of Marine Pollution from Ships (MARPOL)		No ⁴

Notes:

- ¹ Eritrea is not generally considered to lie in the Eastern African Region.
- ² While appropriate geographically, signatory would appear to be limited to Member States of the Arab League, thus excluding Eritrea, Djibouti and Israel in the Red Sea area.
- ³ Contact organisation is the Ministry of Agriculture.
- ⁴ Initial arrangements towards accession are in process.

Incorporation of international agreements into National Law: Once international agreements have been acceded to they will be incorporated into national law as it is formulated.

Limitations of the National Law with respect to marine turtle management, and their resolution: The National Law does not as yet address the marine environment, nor management of its natural resources. Eritrea has inherited laws from Ethiopia, in use until its own laws can be brought into force. These existing laws barely touch on the maritime environment, and do not cover turtles in any respect. The new *Draft Proclamation for the Protection of the Coastal and Marine Environment* has been submitted and is in the course of process into legislation.

Management strategies to address threats to marine turtles: The present management strategy within the responsibility of the Ministry of Marine Resources, is to develop a knowledge base as rapidly as possible, as well as a base of communication and links with the local communities in particular, and other stakeholders. This is being established through the Marine Environment Protection Committee, integrating government and non-government stakeholders and exploiters of the marine environment, as well as local community representatives. The means to reach the scattered areas and populations have not been available to date, but through opportunistic surveys and incoming data, some knowledge now exists as this paper demonstrates, and is being acted upon.

Eritrea has recently been granted a Pre-Investment Fund (PRIF) assistance, towards a Global Environment Facility (GEF/UNDP) Project, and entitled *The Conservation of Coral Reef Biodiversity Resources through Community-based Management*. It is foreseen that Marine Protected Areas will form a part of the future management scenario, together with species-specific management techniques and harvesting regulation for widespread species such as turtles.

Nesting beaches and turtle populations in protected areas: There are as yet no marine protected areas. The oft-quoted "*Dahlak Islands Marine National Park*" never existed except on paper. The proposed islands in the drafted boundary, comprised the 5 islands closest to the shore (Minot, 1970), but are not representative of the area as a whole, although three of these were reported to support green turtle nesting (Urban, 1970).

Local communities and turtle conservation and management: The recruitment of local communities, especially the fishermen who are wide-ranging in their movements, to the understanding of the needs of their marine support base, is seen as crucial to the future management of this area, and thus of its turtle populations. The local community as primary users of the turtle resource have considerable knowledge of its movements, requirements and other parameters.

Traditional resource management practices and community-based turtle management potential: No traditional management practices have yet been identified, beyond the consideration of some areas as a reserved harvesting area for the least fortunate members of local communities.

On-going turtle research: The R & ED of the Ministry of Marine Resources maintains a data base on turtle information, added to as opportunity arises. Priority data acquisition and the means at our disposal do not yet allow for dedicated turtle research, however one of us (TG) is assigned with responsibility for marine megafauna. At the port of Aseb in the south, the small team attempts to monitor turtle harvesting on the islands of Aseb Bay and at the local fish market.

MANAGEMENT NEEDS TO CONSERVE TURTLES

Institutional Arrangements Needed for Turtle Conservation

Responsibilities: Clear responsibilities and a clear mandate need to be established, with regulatory guidance, taking into account local needs for protein and a source of livelihood. This should cover tourism issues such as curios trade and disturbance to turtles and their nesting beaches.

Staffing and training: While it is fairly straightforward to train Ministry staff about turtles and their management needs, the extensive coast area demands that the community be brought into the management force, especially considering that turtles are a part of their support base. Tourism operators and regulatory (customs) staff located at international airports and border crossings should also be trained.

Legislation: The formulated legislation that includes management of turtles and their habitat

and trends develops, legislation will require modification, including the development of regulations and means of enforcement.

Collaboration mechanisms among agencies: The management of Eritrea's environment requires close integration between stakeholders, government and non-government, and between those involved at the coast, and those elsewhere in the highlands (e.g. Custom officers at Asmara International Airport). This will be established to a large extent through the Marine Environment Protection Committee (MEPC) and the Eritrean Agency for the Environment (EAE).

Turtle Protection Needs

Control and mitigation of the impact of accidental capture in fisheries: The Ministry of Marine Resources intends to investigate the application of turtle excluder devices (TEDs) to trawl nets. Turtle excluding devices are not yet in use and while they are a part of Eritrean fisheries legislation, our attempts to obtain details for their construction have so far failed. Better enforcement of the requirement for industrial trawlers to return live turtles to the sea as rapidly as possible will be attempted.

National harvest: The national harvest of turtles will be closely studied to determine its sustainability as a food source. Commercial sale of turtle meat in urban centres (Aseb) in particular will be examined and probably discouraged or banned.

International harvest: The illegal harvesting of turtles by fishermen from neighbouring countries, particularly near Aseb, will be controlled along with the illegal fishing itself.

Predator control : Predators do not appear to be a significant threat in Eritrea. No domestic dogs exist on the islands since these are anathema to the local Muslim culture.

Recreation and tourism: Education and regulation will be employed to ensure that tourism has minimum impact on turtles, and will address curio sales, as well as disturbance to nesting turtles or turtles found while diving/snorkelling.

Community incentives and participation: Local communities are already being contacted and will be drawn into active and substantive participation in management of these environments, including the turtle resource. Full consideration will be given to their traditional sources and legitimate needs for food and other support from their marine environment, now and in the future.

Public awareness and education: Environmental awareness is already high, and education programmes will be encouraged and fully supported. Environmental issues, including the marine environment and turtles, are already a part of the school curriculum.

Habitat Protection Needs

Conservation areas: Better knowledge is required of key turtle nesting, foraging and developmental areas, for the establishment of conservation areas. The mangrove and seagrass areas of Mersa Ibrahim and Mersa Mubarak in the north, and around Aseb Bay in the south, are very important for turtles. The huge turtle trawl which occurred earlier this

of Tio and Edi, unless this catch coincided with a migration along the coast.

Beach erosion control: Eritrea's coastline is not a highly dynamic one, thus beach erosion does not appear to be an issue at present.

Mitigation of lighting effects: No major developments have been planned for known turtle beaches that would result in lighting confusion occurring. A green turtle nest, and hawksbill hatchling were found close to the only two beach hotels near Massawa, but lighting there is minimal and unlikely to be an issue for turtles at present.

Feeding ground protection: Major seagrass areas are intended to be conserved (see above "Conservation Areas") and managed.

Integration into coastal development policies, planning and management: Turtles have already been included in all potential legal, regulatory and management proposals for the Eritrean maritime environment. These need to be actively applied.

Management Related Research Needs

Strengthening research capacity: The research staff for the entire coastline and islands comprises 13 graduate biologists, all but one with less than 4 years experience of marine environments and their management. The use of foreign experts and the supplementation of this research task force is a major priority of the Ministry. Five new graduates are being taken on this year from the University of Asmara. Clear applied significance of assistance projects and personnel needs to be exhibited, to ensure that their research is appropriate to Eritrea's needs, and not just of academic interest to external institutions and interests.

Clearly regular and systematic surveys of the marine environment need to be established in order to move from reactive to predictive management of all aspects including turtles. It will be some time however before this can be done, given the harsh nature of the environment, its extent, and Eritrea's limited skilled manpower and material resources.

Tagging: There have been few opportunities for tagging live turtles and no equipment yet exists for turtle tagging in Eritrea.

Stranding network: Communication in Eritrea is in its infancy and the setup of such a network would have limited practical application. Turtle stranding has not been recorded, but the R & ED is beginning to be known for its interest in any relevant information, including turtles on beaches.

Determining causes of mortality: All turtle carcasses encountered are examined to determine cause of death. To date, most would appear to be remains of butchered turtles. No clear causes of death have been established for the few entire carcasses found due to the lack of experience and knowledge of staff.

CONCLUSIONS

Initial findings from the past two years, and the little information available prior to this, indicate a healthy breeding marine turtle population off Eritrea's coast and islands. This

known. The wide distribution, ease with which local communities harvest them, long past history of harvesting, numbers reported, and widespread nesting, all suggest a significant turtle area. The one tagging return illustrates a link with the Gulf of Arabia and Oman-Yemen coast. Other links may well exist, and in time the significance of the extensive nesting habitat with reference to the Indian Ocean populations will hopefully become apparent.

It is clear that Eritrea has a significant turtle population, to be managed as a part of its very varied marine habitat, along with other endangered and significant resources. The priority is to acquire an adequate knowledge base, and to develop an integrated management approach with other marine and coastal resource users.

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Table 1. Marine turtle nesting areas in Eritrea

Place name	Location	Beach length (km)	Species	Total nests	Peak nesting season	Date
Shurmma I.	15°32'30N 40°00'00E		Green	3		Mar 6
Assaroca I.	15°31'30N 39°55'30E		Green	3		Mar 6
Ito Um Namus I.	15°24'00N 40°02'30E		Green	12		Mar 6
Um es Seil I.	16°03'30N 39°53'30E		unk			Jan 92
Awali Shaura I.	16°28'30N 39°40'00E		unk			Oct 92
Beylul mainland	13°12'00N 42°23'30E		unk		Jun - Aug	
Isratu I. Harmil I. Mersa Ibrahim Mersa Hamdan	16°19'45N 39°50'00E 16°31'30N 40°09'30E 16°29'45N 39°10'15E 16°32'00N 39°09'30E		Hawksbill		Oct - Dec	
Isratu I. Harmil I. Mersa Ibrahim Mersa Hamdan	16°19'45N 39°50'00E 16°31'30N 40°09'30E 16°29'45N 39°10'15E 16°32'00N 39°09'30E		Green		May - Jun	
Tor I.	15°36'00N 40°37'30E		Hawksbill	1		8 Feb
Mojeidi I.	15°30'30N 40°51'30E		unk			17 Au
Dissei I.	15°28'00N 39°45'00E		unk			02 Fe
Madot I.	15°34'45N 39°45'45E		unk	1		10 Ma
Green I.	15°30'05N 39°30'00E		unk	1		17 Ma

Place name	Location	Beach length (km)	Species	Total nests	Peak nesting season	Date
Gurgussum, Massawa	15°40'05N 39°27'45E		Green ?	1		Apr 9
Hamasien, Massawa	15°41'30N 39°27'00E		Hawksbill hatchling			15 Ma
Bulisar I.	15°38'33N 40°64'16E		unk			15 Ma
Ertantor I.	16°33'33N 40°24'16E		unk			24 Ma
Rakhama I. (Tekay Desef)	13°40'30N 42°12'30E		Green			25 Ma
Dohul I.	15°54'45N 39°38'30E		unk			15 Au
Norah I.	16°02'12N 40°03'30E		unk			09 Se

Notes: ¹ Old egg shells found on sandy beach.

Summary of nesting recorded:

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Green				?????				
Hawksbill					HHHH			
Unknown								

Notes: ????? - species uncertain; HHHH - hatchling recovered.

Table 2. Areas in Eritrea where turtles have been sighted, caught by trawlers, or remains found.

Area name	Location	Site description	Species	Approx. numbers
Harmil Island	16°52'50N 40°15'83E	S, M, R	Green	1 ad & 1
Difnein I.	16°36'45N 39°19'30E	M, R	Hawksbill	1
Harmil I.	16°31'30N 40°09'30E	S, M, R	unk	1
Entasila I.	16°30'15N 39°19'15E	R	Hawksbill	1
Mersa Ibrahim	16°29'45N 39°10'15E	S, M	Green	7
Mersa Ibrahim	16°29'45N 39°10'15E	S, M	unk	5
Mersa Ibrahim	16°29'45N 39°10'15E	S, M	Green	1
Mersa Ibrahim	16°29'45N 39°10'15E	S, M	Hawksbill	1
Mersa Ibrahim	16°29'45N 39°10'15E	M, S, R	Green	1
Entaentor I.	16°20'00N 40°14'30E	R	Hawksbill	1
Isratu I.	16°19'45N 39°50'00E	R	unk	1
Dhu-I-Kuff I.	15°51'15N 40°29'45E	R	Olive Ridley ?	1
Dur Gaam I.	15°47'15N 39°45'30E	R	unk	2
Dhu-Nishab I.	15°43'30N 40°33'45E	R	unk	1
Dur Gella I.	15°43'30N 39°47'31E	M, R	unk	2
Nocra - Dehalak Kebir south channel	15°42'00N 39°56'30E	R	Leathery	1

Area name	Location	Site description	Species	Approx. numbers
Gurgussum beach	15°40'05N 39°27'45E	R	Green	1
Massawa port	15°40'00N 39°20'09E	R	Green	1
Massawa	15°35'45N 39°27'45E	M, R	Hawksbill	1
Twalet near fish landing	15°36.05'N 39°27.06'E	M, R	Hawksbill	1
Twalet fish landing	15°36.05'N 39°27.06'E	M, R	Leathery turtle	1
Erfan I.	15°35'00N 40°01'30E	R	Hawksbill	2
Assarca I.	15°31'30N 39°55'30E	R	Hawksbill	1
Dhu-I-Kurush I.	15°29'00N 40°45'00E	R	unk	1
Mashllagha I.	15°28'12N 40°43'30E	M, R	unk	1
Zula Bank	15°24'01N 39°40'04E		?	1
Bullisar I.	15°23'00N 40°38'30E	M, R	Hawksbill	2
Bullisar I.	15°23'00N 40°38'30E	M, R	Green 1, unk 1	3
N. of Tio	14°56'21N 41°06'17E		?	4
Tio Area	14°40'05N 41°10'05E		?	11
Tio Area	14°40'05N 41°10'05E		?	2
Tio Area	14°40'03N 41°10'05E		?	3
Edi & Tio Area	14°25'03N 41°25'04E		mainly Green, few Hawksbill, leathery 2	>300
Edi & Tio area	14°23'55N 41°22.99E		Green 4, Hawksbill 5	9

Area name	Location	Site description	Species	Approx. numbers
Ras Cosar	14°19'28N 41°25'30E		?	5
Hannish	13°40'N 42°40'E		mainly Green few Hawksbill	39
Biheta	13°30'87N 42°24'17E		Hawksbill	1
Biheta	13°28'80N 42°23'84E		?	10
N. of Beylul	13°18'89N 42°25'82E		?	8
Beilul Area	13°15'04N 42°30'03E		?	30
Close to Beilul	13°15'04N 42°25'03E		?	8
N. of Beylul	13°14'21N 42°35'20E		Hawksbill	1
N. of Beylul	13°14'21N 42°35'20E		Loggerhead ?	2
Ras Terma	13°13'15N 42°33'15E	S, R	Green 10, Hawksbill 1	11
Ras Terma	13°13'15N 42°33'15E	S, R	unk	several
Beylul	13°12'00N 42°23'30E		Green	14
close to Assab	13°05'03N 42°45'00E	M, S, R	?	1
Ras Fatuma	13°02'40N 42°52'30E	M, R	Green 7, Hawksbill 2	9
Dermekia I.	12°58'40N 42°48'45E	R	Green 12, Hawksbill 3	15

Note: Habitats: M - Mangrove; S - Seagrass beds; R -Coral reef

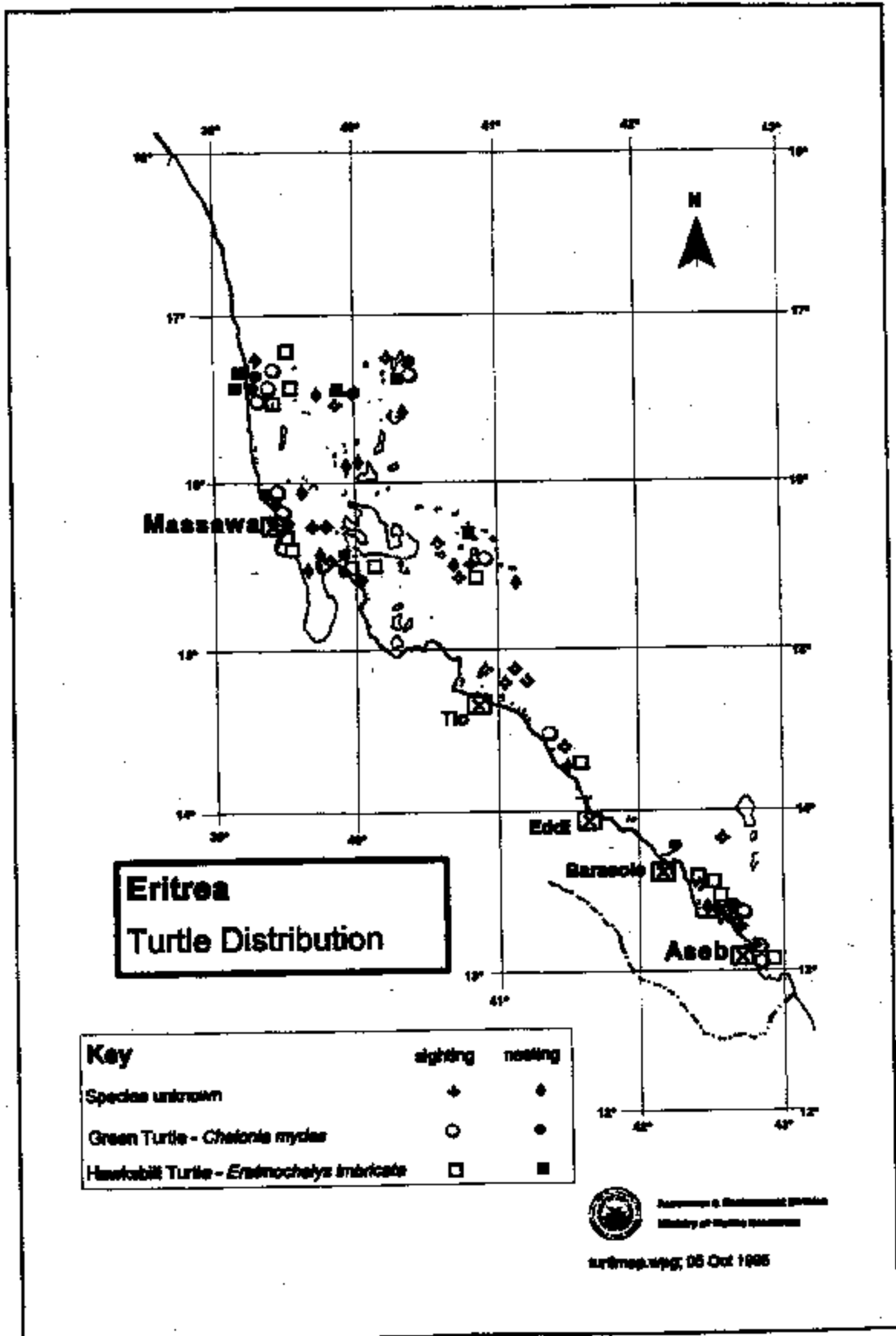
None of these sites is protected since no Marine Protected Areas have yet been formally declared in Eritrea.

Remains may have been carried some distance by boats or currents and may not therefore indicate foraging grounds.

NA - not applicable, since remains may have been at the site for years before being recorded.

¹ - details: up to 20 animals in a single haul; mainly Green, some Hawksbill, 2 Leathery; sizes from medium to large; n

Figure 1



THE STATUS OF SEA TURTLE CONSERVATION IN KENYA

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ABSTRACT

Five species of sea turtles are reported to occur in the Kenya's waters, namely, the green turtle (*Chelonia mydas*), the hawksbill (*Eretmochelys imbricata*), the loggerhead (*Caretta caretta*), the olive ridley (*Lepidochelys olivacea*) and the leatherback (*Dermochelys coriacea*). Of these, all except the leatherback turtle nest on Kenya's beaches. The leatherbacks, and probably some of the other turtles found in Kenya's waters, nest elsewhere. This demonstrates the need for regional cooperation in sea turtle conservation as efforts in one country may be negated by activities in another country.

Traditionally, sea turtles have been utilised by the local communities in various ways including spiritually, culturally, economically and more recently for aesthetic and scientific purposes. However overexploitation, incidental capture in fishing nets and coastal developments now threaten their survival. Despite the stiff protective laws, exploitation of turtles and their eggs has continued unabated.

Recognising that the future viability of sea turtle conservation in Kenya appears to hinge on the cooperation and support of the local people who exploit the resource, a Sea Turtle Community Participation Project was started with an incentive scheme to reward participants. The initiative is only about five years old but it is already beginning to positively influence local attitudes towards sea turtle conservation as evidenced by increasing number of turtle nest reported by the local people. There is increasing enthusiasm among beach hoteliers and other beach front property owners to participate in turtle conservation and the relevant government and non-governmental agencies are working together towards a holistic approach to management of coastal resources including turtles.

INTRODUCTION

Five species of sea turtles have been recorded in Kenya's waters, namely the green turtle, hawksbill, loggerhead, olive ridley and the giant leatherback (Frazier, 1975). Leatherback turtles are not known to nest on Kenya's beaches, but use Kenya's waters for foraging. The green, hawksbill, loggerhead and olive ridley turtles have been reported to nest along the Kenyan coast.

Sea turtles, particularly the green and hawksbill turtles have been traditionally exploited along the Kenyan Coast particularly by the Bajuni community for both subsistence and commercial trade (Frazier, 1980; Groombridge, 1982). They are primarily hunted for meat, oil and for economically valuable products such as shells and leather.

Nesting females are predictable and defenceless targets and hence are easier to capture than pelagic turtles. They are caught with the help of sucker fish (remora). The effects of removing most females from the population either by killing or degradation of nesting habitats may not be noticed for many years and by the time it is obvious that a population is crashing, it may be too late to stop the decline. The problem is worsened further by the illegal collection of the eggs and the increased number of casualties resulting from incidental capture in trawl nets and gillnets.

In the past, the local people have used these animals sustainably despite their vulnerability to exploitation. But today's exploiters are far more numerous, their technologies are more sophisticated and the cultural inhibitions that prevented overexploitation have largely waned. Instead we see more turtle killings and habitat destruction. Interviews with the local people and older fishermen reveal a rapid and drastic decline in turtle numbers and nests along the Kenya coast in the past two decades. In addition, coastal developments for tourism and other human activities now threaten their survival.

STATUS AND DISTRIBUTION OF MARINE TURTLES IN KENYA

Marine turtles found in Kenyan waters: Along the Kenya coast, five species of sea turtles have been recorded, namely the green turtle (*Chelonia mydas*), the hawksbill (*Eretmochelys imbricata*), the loggerhead (*Caretta caretta*), the olive ridley (*Lepidochelys olivacea*) and the leatherback (*Dermochelys coriacea*) (Frazier, 1975).

General distribution in Kenyan waters: Green turtles appear to be the predominant species in Kenya's waters followed by the hawksbill (Wamukoya & Haller, 1995). Both species are widely distributed along the entire Kenya coast within the 20m isobath in areas associated with seagrasses and coral reefs, with aggregations in some areas such as Mpunguti, Takaungu, Bofa, Ziwayuu island and Kiunga which serve as feeding grounds (Olendo, 1993 unpubl.; Wamukoya *et al.*, 1995).

Olive ridleys have been reported to be localised in Ungwana Bay, in the north (Frazier, 1975). This is also the area with an abundant shrimp fishery - which is their main food. There have been reports of olive ridleys from the south coast (Mbendo & Mbwana, 1995 unpubl.), but we have not been able to verify whether these are resident in the area or are migrants from another area. Thus, more work needs to be done to establish the actual sites and the turtles' home ranges.

Virtually nothing is known of the pelagic distribution of either the loggerhead or leatherback turtles although they have been reported to occur in Kenya's waters by several authors (Frazier, 1975; Olendo, 1993; Wamukoya & Haller, 1995b; Wamukoya *et al.*, 1995). Efforts to determine the loggerhead and leatherback distribution and numbers have not been successful due to lack of adequate indigenous knowledge of these species. However, a 1994 aerial survey of the Kenya coast described leatherbacks as "uncommon" as only one individual leatherback was sighted in contrast to the high number of green and hawksbill turtles (Wamukoya *et al.*, 1995). The leatherback was in very deep waters outside the 20m isobath.

There are no records of loggerhead and leatherback sightings by the previous aerial surveys as all turtles were grouped together (Ligon, 1975; Pertet & Thorsell, 1980; Watson, 1973). Thus the extent of the distribution and abundance of the loggerhead and leatherback turtles in Kenya's waters is presently unclear.

Known population trends: There is a general feeling among the older fishermen in the community that the sea turtles presently encountered during their fishing expeditions are smaller in size than previously. There appears to be no direct relationship between the relatively large number of young turtles foraging in local waters and the small breeding assemblage on the Kenya coast (Groombridge, 1982). This would imply that there are two

migratory non-nesting turtles (Wamukoya *et al.*, 1995). Hughes (1971) reported that loggerheads nesting in Natal and marked with metal tags have been captured in Madagascar, Mozambique and Eastern Africa. Also, Hirth and Carr (1962) reported on the migration of the green turtle between breeding grounds in South Yemen and the Horn of Africa.

Nesting beaches: Recent surveys have shown that both green and hawksbill turtles nest throughout the Kenya coast with concentration in certain areas (Table 1) (Olendo, 1993; Mbendo & Mbwana, 1995 unpubl.). There are no records showing the nesting of the olive ridley and loggerhead but unconfirmed reports from fishermen claim there is local nesting. It would appear that they forage in Kenya's waters but nest elsewhere.

Green turtles are the most common turtles nesting on the Kenya's beaches. Their most important nesting beaches include: Sii Island, Chale Island, Diani, Nyali/English point, Watamu, Robinson Island, Ras Tenwi and Shella. Green turtles nest mainly on open sandy beach platforms (high energy beaches).

The nesting season for green turtles is during the southeast Monsoon (April-September). The average clutch size is usually 110-120 eggs with incubation period varying from place to place.

Hawksbills seem to prefer small isolated beaches, often nesting deep in the shelter of beach vegetation. The most important nesting beaches for hawksbill include: Msambweni, Nyali, Jumba Ruins/Mtwapa, Msumarini, Siwayu Island and Kiunga. The nesting season for hawksbill is during the northeast Monsoon (October-March). The average clutch size is usually 160-165 eggs.

Decline in the number of nesting females on the Kenya coast has been documented (Olendo, 1993). It is not known whether the sea turtle population along the Kenya coast is stable, increasing or declining, but there is no question that some nesting populations have been virtually exterminated. This is supported by the wide extent of remnant sea turtles nesting on the entire coastline and fishermen's reports that there has been no nesting on some formerly favoured sites for the last two decades.

The inconsistent nesting pattern exhibited by sea turtles nesting along the Kenya coast could be an indication of a population that has been reduced to such a low level that characteristic behaviour including site fidelity has been broken (Eckert *et al.*, 1992). In the absence of adequate survey data, population size and trends in population size cannot be estimated and observed.

Most of the nesting beaches for both green and hawksbill turtles are threatened by coastal developments. If these developments go on unchecked, these beaches will be rendered unsuitable for turtle nesting with devastating consequences to the sea turtle population in Kenya.

Foraging/feeding grounds: These are several sites along the Kenya coast where foraging turtles are regularly seen. The areas include Mpunguti, Chale, Nyali, Takaungu and Ziwayu Island (Table 2). The common feature among these areas is the well developed seagrass beds and coral reefs which provide food for sea turtles. Seasonal abundance of jellyfish

turtles (Wamukoya, Pers. obs.). This implies that the occurrence of leatherback turtles in Kenya's waters is dependent on the availability of food particularly jellyfish. It is difficult to distinguish or categorise the foraging turtles into resident and migratory populations.

Developmental habitat: Although efforts have been made to track small and immature turtles, interviews with fishermen have identified only two sites which always seem to have a large concentration of small and immature turtles. These areas are Mpunguti in the south and Ungwana Bay in the north. These areas are generally well protected and harbour well developed seagrass beds and coral reefs. In view of the importance of these areas as developmental habitats for sea turtles, efforts should be made to protect them. The most vulnerable is Ungwana Bay which is subject to shrimp trawling activities. Occasionally, there are several immature turtles washed ashore dead as a result of incidental capture in trawler nets (Wamukoya, Pers. obs.).

EXPLOITATION

Traditional uses of marine turtles and their products by local communities: Green turtles and other marine turtles are a traditional food for the coastal peoples of Kenya particularly the Bajuni community. They have been hunted and eaten for thousands of years without any serious threat to the stocks of these species.

Turtles are mainly used for nutritional, economic and cultural purposes (Frazier, 1980). The meat and eggs as food, tortoiseshell as ornaments and for export. Turtle oil is valued for medicinal purposes as it is believed to cure several ailments and also for protection against evil spirits. Collection of sea turtle eggs is widespread and is an old tradition.

There are no longer fishermen relying specifically on turtle fishery. Turtles are caught accidentally in nets but no purposeful hunting is practised. The most serious threats facing sea turtles now are the intensive harvest of eggs, incidental capture in fishing gear and degradation of nesting and foraging habitats.

Commercial or international trade of marine turtles and their products: The most valuable material obtained from turtles is tortoiseshell. This beautiful raw material that is easily worked into a wide variety of products has proved costly to the hawksbill turtles. The local people who consumed turtle flesh used to take the tortoiseshell as a by-product. But with the increased demand for tortoise shell worldwide, commercial and international trade for sea turtle product from Kenya became significant. Trade statistics indicate that up to 2,850 kg of green and hawksbill tortoiseshell were exported in 1978, although well below 500 kg was taken annually (Frazier, 1980). However with the introduction of stiff legislation to protect sea turtles and their products in 1989, the commercial and international trade has subsided though probably still operates illegally. However there are no fishermen depending on the sale of sea turtles and their products.

THREATS (MANAGEMENT CONCERNS)

Natural threats to nesting beaches: Beach erosion and natural predators including crabs, birds, mongoose, dogs, contribute to the loss of eggs and hatchlings. In addition to losses on the nesting beach, birds and reef fishes consume hatchlings at sea and sharks hunt juvenile and adult turtles (Wamukoya *et al.*, 1995). Adult female nesting turtles are also killed while nesting on the beach.

Egg collection: Egg harvesting by the local people is widespread and common, and needs to be controlled to prevent further decline of turtle populations in Kenyan waters.

Fishery-related threats to turtles: Trawlers and gill nets are the major threats to the survival of sea turtles in Kenya's waters. Shrimp catches using trawls usually take large quantities of fish, sea turtles and other organisms as by-catch which is later discarded into the sea as "trash". Because nets sometimes are dragged for hours before they are brought up turtles often drown, but in any case the manner in which turtles are discarded leaves them with no chance to survive (Wamukoya *et al.*, 1995). Artisanal fishermen often lay their nets for days, catching sea turtles which eventually drown.

A large number of traditional boats are non-mechanised consisting of dug-out canoes and sail boats. The small non-mechanized traditional vessels are powered by oars and sails and are more concentrated in the south than in the north. Mechanized dhows are preferred in the north owing to the stormy weather conditions which require larger and stable vessels.

Overseas fisheries: Although all the registered fishing vessels are operated by "Kenyan" nationalities, their origins include China, India, Greece and Italy. Occasionally there have been reports of Korean and Japanese vessels pursuing tunas into Kenyan waters.

Other human-related threats: The sophisticated tourism industry that has developed along Kenya's coast has led to the proliferation of hotels and other recreational facilities close to the beaches resulting in widespread loss of nesting beaches. The strong nest site fidelity exhibited by sea turtles means that populations displaced by these developments are not likely to nest in other areas.

Similarly, the powerful security lighting facing the beach in front of these developments tends to scare off females emerging to nest and attract hatchlings away from the sea towards land where they die. The high number of tourists and beach operators on the beach also causes considerable disturbance to nesting turtles.

Marine pollution is a factor of increasing concern for survival of the turtles. Most worrisome is the danger of polythene bags and plastic fragments to indiscriminate eaters including hatchlings. A transparent plastic bag or particle can look like a jellyfish, plankton or the larval stage of a crab. Once in the turtles intestines, the indigestible material can block faecal matter, prevent assimilation of nutrients and make the turtle too buoyant to dive for food.

MANAGEMENT STRATEGIES

Turtle management responsibilities and legislation: Turtles are protected under the Third Schedule of Cap 376 Wildlife (Conservation and Management) Act 1977, for which Kenya Wildlife Service (KWS) is the implementing agency. KWS therefore is responsible for the protection, conservation and management of sea turtles. The Fisheries Department also has management roles, as provided for Cap 378 Fisheries Act 1989.

The Coast Development Authority Act of 1990 mandates the Authority to plan and monitor sustainable development on the Kenya coast. Finally, the National Environmental Action Plan for Kenya is the process of enactment.

Effectiveness of existing mechanisms: The present legislation on sea turtle conservation is inadequate to promote the recovery of depleted stocks. In addition, enforcement of the present laws is ineffective due to lack of adequate personnel and resources. KWS is concerned mainly with marine protected areas (MPAs), and elsewhere the Fisheries Department lacks the capability for long distance surveillance or pursuit. There is no provision for habitat protection particularly of the nesting beaches.

To effect an integral approach, the Turtle Conservation Committee comprising of government agencies, private stakeholders, fishermen and conservation NGOs has been formed to create necessary awareness and develop management strategies including appropriate legislation.

International Treaties and Conventions:

Name of Convention	Yes	No
Convention for the protection management and development of the marine and coastal environment of the Eastern African Region and related protocols (Nairobi Convention)	Yes	
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Yes	
Convention on Biological Diversity	Yes	
The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)		No
International Convention on Prevention of Marine Pollution from Ships (MARPOL)	Yes	

In addition, Kenya is signatory to the Ramsar Convention (wetlands); the United Nations Convention on the Law of the Sea; the OAU Charter on Natural Resources, and the Arusha Resolution on integrated coastal zone management.

Incorporation of international agreements into National Law: Although Kenya has ratified all these conventions, they have not been incorporated into National Law and this hinders their enforcement. However, there are efforts to amend the law to accommodate conventions as appendices to the Kenyan laws to facilitate enforcement.

Some of the conventions are enforced through existing legislation; including CITES which is partly implemented through the Wildlife Conservation and Management Act, and Fisheries and Forest Acts.

Limitations of National Law with respect to marine turtles:

- (i) There is no provision for the protection of nesting and foraging habitats critical to the continued survival of sea turtles. There are no areas (seagrass beds and coral reefs and sandy beaches) protected specifically for sea turtles at the present time. Beaches are already under intense pressure for tourist development and it is therefore recommended that the most significant beaches and foraging habitats be identified quickly so that specific management plans can be formulated before these important habitats are lost or irreparably degraded.
- (ii) The lack of planning of the coastal zone and of land-use planning sensitive to sea turtles nesting beaches represents one of the most significant omissions within the policy of protection of these animals. Land-use zoning of the coastal zone with clearly defined policies to preserve biodiversity is recommended. Zones should be planned according to their biodiversity value and sensitivity to biodiversity loss. Categories of land uses should be varied, including strict protection and sites allowing sustainable use with minimal impacts. However, it is imperative that local traditions and conditions are incorporated as important factors in the land-use planning and conservation methods. The local people must be involved at every step from planning to implementation.
- (iii) Lack of legal provisions to enforce at least a mandatory 100 feet beach set-back.
- (iv) Legislation which assigns to more than one institution an enforcement mandate risking duplication or non-accountability.
- (v) Existing legislation does not provide for establishment of community based marine conservation areas. Already established Government controlled Marine Parks and reserves are generally justified in view of contribution to national treasury rather than direct benefit to local populace.

Management strategies:

- (i) Formulation of an Integrated Coastal Zone Management plan has been initiated with a view to harmonising coastal development and resource use activities without impacting biodiversity (including consideration of sea turtle nesting beaches).
- (ii) A tourism master plan is being developed to regulate and monitor tourist and recreational development.
- (iii) Land-use planning has been provided for in the National Environmental Action Plan to be enacted soon.
- (iv) Integration of existing law enforcement efforts has been started aimed at harmonising and improving the existing local laws and regulations concerned with

recognises the need to incorporate the regional and international treaties, agreements and conventions into the local national laws. This will facilitate their enforcement.

Nesting beaches in protected areas: Less than 1% of the nesting beaches and nesting turtle population are within protected areas: the rest of them are outside and more vulnerable to human activities.

Local communities and turtle conservation and management: Recognising that the future viability of sea turtle conservation and management hinges on the cooperation and support of the local people, a community-based sea turtle project has been established to give the local community a chance to participate in the planning and implementation of turtle conservation efforts. An incentive scheme rewards those participating in reporting and protection of nests, and for each successful hatchling, thus reducing egg collection among the local people. A fund "SAVE THE TURTLE FUND" has been established. This initiative is about five years old, but is already beginning to positively influence local peoples' attitudes toward sea turtle conservation (Kaloki & Wamakoya, 1995).

Traditional resource management practises and community based-turtle conservation potential: Indigenous knowledge and practices should be used as a basis for developing and implementing indigenously rooted sea turtle conservation programme. This not only integrates local knowledge into programme planning but also increases the likelihood of the programme being sustainable. Recognition by planners of knowledge that the local people already have on sea turtle will help facilitate its transfer and adoption as a means to protect sea turtles.

On-going turtle research: A turtle research programme has initiated under the umbrella of the multisectoral turtle conservation committee comprising of KWS, the Fisheries Department, CDA, KMFRI, NGOs, hoteliers and private individuals with the sponsorship of KWS Netherlands Wetlands project and with technical guidance provided by Dr Rodney Salm of IUCN-EARO, and a member of IUCN-MSTG. The project's objectives are to:

- (a) Collect information relating to the distribution and abundance of sea turtles at sea based on sightings data assembled by aerial survey and vessel surveys, as well as taking advantage of a volunteer sightings network (e.g. divers, deep sea fishermen etc).
- (b) Identify critical nesting and foraging habitats based on these field surveys in order to develop site specific management plans for critical nesting and foraging habitats.
- (c) Monitor nesting beaches to maximise hatchling production.
- (d) Increase the understanding of the residency patterns and movements of local sea turtles including evaluating the extent to which turtles are shared with neighbouring states (e.g., Somalia, Tanzania and the offshore Indian Ocean Islands).
- (e) Assess the mortalities caused by accidental capture in commercial fisheries with a view of recommending mandatory use of turtle excluder devices (TEDs).

- (g) Enhance protection enforcement by volunteers.
- (h) Promote community support and participation in sea turtle conservation by enhancing the incentives scheme and increasing public awareness through education programmes in schools, public talks, media, brochures, posters, tourist turtle release programmes etc.

MANAGEMENT NEEDED TO CONSERVE MARINE TURTLES

Institutional arrangements needed for turtle conservation

Responsibilities: The Fisheries Department, KWS and KMFRI have protection, conservation, management and research responsibilities. There is however a need to develop clear research and management priorities. The Coast Development Authority has responsibility for development and use of the coastal zone. It is imperative that CDA be provided appropriate environmental information for decisions. In the case of sea turtles information should be provided on significant foraging and nesting areas.

Staffing and training: Effective implementation of the sea turtle conservation programme is greatly hampered by the lack of properly trained personnel in sea turtle biology. The Fisheries Department, KWS and KMFRI have each assigned only a single officer to the turtle project: too few for the 500 km coastline stretch. It is therefore recommended that urgent measures be taken by each of the responsible institutions to increase the personnel on the turtle project and to seek appropriate training either locally or abroad for the officers involved in sea turtle biology, conservation and management.

Legislation: Sea turtle conservation legislation as provided for in the Fisheries Act 1989 and the Wildlife (Conservation & Management) Act 1977 is inadequate to promote the recovery of depleted stocks. Law enforcement needs to be improved and enhanced. Despite the distinct lack of personnel available for patrol of beaches, markets and boat landings, with open interaction of the local communities a lot can be achieved. However, even in areas where Fisheries personnel are on the ground, enforcement has remained wanting. It is recommended that the fishing scouts who are at each landing beach be retrained in formal law enforcement and arrest procedures to curb the illegal harvesting of sea turtles. Enforcement capacity has also been hindered because Kenya's police officers generally lack awareness of conservation laws and regulations protecting sea turtles and other endangered animals and plants, and this too should be addressed through workshops.

Collaboration mechanisms among agencies: It is heartening to note that those institutions with responsibilities on sea turtles - KWS, Fisheries, CDA and KMFRI - have developed memorandum of understanding that will facilitate working together of these institutions. The establishment of a multisectoral Turtle Conservation Committee has shown how much can be achieved when issues are approached in a multidisciplinary manner.

Turtle protection needs

Control and mitigation of the impact of accidental capture in fisheries:

- (i) use of selective fishing gear particularly Turtle Excluder Devices (TEDs), currently being forwarded through IUCN-MTSG.
- (ii) restrictions on gill nets during a certain time of the year and in specified areas.

National harvest: The current legislation bans the use of sea turtles and their products. Enforcement of the law is being strengthened by integration of volunteers from the local communities reducing the need for enforcement personnel but requiring a strong coordinating office. It is recommended that funds be made available to reward the increasing number of nest-reporters in order to sustain the local people's participation. We plan to offer a token payment to volunteer scouts from the local communities who patrol beaches every morning and disguise nests.

International Harvest: Since trade in sea turtles and their products is prohibited in Kenya and by CITES, collaboration with the TRAFFIC Network will help to eradicate any illegal trade. Information received from the TRAFFIC Network will be treated in confidence and appropriate action taken.

Predator Control: Predation of eggs and hatchlings by ghost crabs, dogs, hyenas and other animals can be minimised by permanent beach patrol teams established along the entire coastline. Enclosure materials are provided to cover the nests which are monitored to ensure that emerging hatchlings are not entrapped in the enclosures. Such enclosures are usually removed after 45 days. Eggs laid in vulnerable places are translocated.

Recreation and tourism: It is imperative that visitors be made more aware of how their activities may impact turtles. Tourism is a significant source of foreign exchange for Kenya and it would be ironic if tourists were allowed to destroy the very resources that attracted them to the area in the first place. Tour operators, divers and hoteliers should have materials available to tourists explaining how they can help to protect sea turtle by not buying turtle souvenirs etc. Colourful displays at the airport, in hotels, and in boats would be useful. Posters, T-Shirts, video shows and brochures aimed at the education of tourists and tourism developers need to be developed.

Controlled turtle release programmes, already taking place in some hotels, are another way of involving tourists in sea turtle conservation as well as raising funds to assist in the community incentive schemes. Areas where turtles nest and foraging areas could become attractions for tourist through organised trips. However, this must be organised with great care.

Community incentives and participation: It is already recognised that incorporating local participation in sea turtle conservation efforts is crucial to achieving both short and long term sustainability.

Public awareness and education: Present efforts in education and training to strengthen awareness about sea turtle conservation are inadequate. Awareness raising using both formal and informal mechanisms for education, training and human resource development are necessary steps in the implementation of strategies to conserve sea turtles.

Both traditional and modern knowledge systems and values need to be integrated into school curricula. It is important to pass local knowledge to young people through such means as folklore, proverbs, handicrafts, posters, leaflets, brochures, audio-visual materials, news media, slides, competitions, rallies and walks with the help of Wildlife Clubs of Kenya (WCK).

Many other informal ways to increase in villages and urban centres exist and can be enhanced by building on community input. Experience shows that people respond positively when they understand the long-term consequences of the loss of sea turtles. Exhibitions, fairs and shows can be organised around themes relating to sea turtles. Radio in particular is one of the most effective means to reach a majority of the local populace. In addition, private sector involvement in awareness campaigns should be promoted. For example, the local commercial companies or tour operators could sponsor sea turtle messages carried on TV, newspapers or advertisements.

Other institutions not primarily involved in education can nevertheless make significant contribution. National Museums of Kenya, youth groups, religious groups and other government and NGO extension service are appropriate institutions that can take a leading role in developing and implementing programmes for sea turtle conservation education.

Refresher and in-service courses on sea turtle conservation techniques and participatory methods are useful steps toward strengthening the understanding of professionals, managers and field extension officers involved in sea turtle conservation. Exchange among students and specialists, as well as seminars and workshops are also very useful as training of the local expertise is critical.

Efforts should also be made to identify and strengthen activities that transfer or disseminate lessons learned for example through regional sharing of information. The transfer of ideas and technologies is an important aspect of the challenge to strengthen Kenya's capacity (and that of the entire region) to take responsibility for the management of sea turtles in ways that are sustainable in the long term. Sharing of research findings and other information should be given a priority. However, this also calls for a Regional Centre to serve as a database for information on sea turtles in the Eastern African region.

Habitat Protection needs

Conservation areas: Once these areas have been identified, area (site) specific plans should be drawn up. These special conservation areas should encompass the most important nesting and foraging areas and should serve as focal point for conservation, management and monitoring of sea turtles. However, these areas should not exclude the local communities from recreational, fishing and other activities if guidelines to are developed for activities that may impact sea turtles.

Beach Erosion Control: Beach erosion is one single factor that can have far reaching impact on the nesting turtles. Some of the factors that contribute to beach erosion include:

- (a) Sand mining which disrupts stabilising vegetation, may seriously exacerbate erosion and can easily result in complete loss of some beaches (and hence the disappearance of some sea turtle nesting grounds). In addition the mining pits may not only invite injury to humans and sea turtle but they could accumulate water and may serve as breeding areas for mosquitoes. It is therefore recommended that sand mining should be prohibited on all sandy beaches as there are no such provisions in the present legislation. Stiffer penalties including higher fines for violators are needed, as is vigilant field enforcement and judicial follow-up.
- (b) Beach stabilisation structures: Permanent impermeable structures (including breakwaters and seawalls) should not be constructed on sandy beaches or in any near shore zone as they are likely to promote beach erosion or contribute to the loss of adjoining sandy beaches where sea turtles nest. Apparently, there is an increasing trend in the construction of sea walls. Instead it is recommended that setback lines of at least 150m be established for all constructions. Setback lines will help to protect coastal properties from storm damage.
- (c) Coastal vegetation cover: All attempts should be made to preserve vegetation above the mean high water mark. Creeping plants stabilise the beach and provide protection against destructive erosion by wind and waves. Vegetation can also enhance nesting habitat for sea turtles.

Mitigation of lighting effects: A brochure on lighting has been developed to provide guidance to the coastal developers. It is, however, recommended that lighting regulations be developed and enacted to facilitate enforcement and compliance by all coastal developers.

Integration into coastal development policies, planning and management: Sea turtle conservation is affected by a wide array of policies in many sectors. The ways that policies affect sea turtles are also varied ranging from indirect creation of incentives for the unsustainable exploitation of natural resources all the way through to direct requirements to protect sea turtles. Although sea turtle are protected both in and beyond protected areas (MPAs), the enforcement of these protective laws is impeded or negated through policies in other sectors, particularly coastal development, which directly or indirectly have adverse consequences for turtle conservation. The conflicts in policies need to be identified and their implications fully analysed so that appropriate adjustments or reforms can be instituted. This can only be done with the development of an Integrated Coastal Zone

coordinate and monitor coastal development, resource use and management activities. It is encouraging to note that CDA is spearheading the development of ICZM.

Management related research needs

Strengthening research capacity: Training of personnel in hands-on sea turtle conservation and management through exchange programmes or post-graduate training will improve and strengthen research and management capacity. Local workshops and seminars for junior cadre and local people will also increase the number of people knowledgeable in research and conservation management of sea turtles.

Tagging: There is need to train personnel and initiate long term tagging studies at accessible and significant nesting grounds, capture-tag-release studies at important foraging grounds and if possible telemetry (movement, behaviour) studies of both juvenile and nesting adult turtles. Training in proper methodology and funding should be solicited through IUCN.

Stranding network: A network with divers, deep sea fishermen and others has been established to rescue injured or trapped sea turtles. However, there is need to have training sessions for these participants on the treatment and revival of a turtle. A rehabilitation centre for the recovering sea turtles needs to be established.

Determining causes of mortality: Similarly a network to collect information on the sea turtle mortality has been established. Guidelines have been provided on the kind of data to be collected from a dead turtle. These include visible injuries to assist establish the cause of death, carapace length, weight as well as information on the species identity and stomach content. Autopsy of all recovered dead turtles is now institutionalised.

Others:

- (i) **Waste disposal and general pollution:** No dumping should be permitted in nearshore areas, on beaches, dunes, or coastal wetlands (including mangrove environments). On the beach, discarded glass and metal can injure sea turtles and larger objects can prevent sea turtles from reaching a nest site. Trash cans and regular collections should be provided in high use areas. Regular beach cleanup is recommended.
- (ii) **Driving on the beaches:** The use of motorised vehicles should be prohibited on beaches at all times. Where vehicles are not needed to transport heavy fishing or recreational equipment, multiple access points should be provided and vehicles parked landward off the permanent vegetation. Driving on the beaches creates unsightly ruts, exacerbates erosion and can lower sea turtle hatching success by compacting nests and crushing embryos. Tyre ruts can also present a significant hazard to hatchlings crossing the beach. The tiny turtles fall into the ruts, which often run parallel to the sea, and because they cannot get out they die in the morning sun or become easy prey for predators. It is therefore recommended that driving on sandy beaches as occurs in the Mambui and Malindi areas, be prohibited by law
- (iii) **Industrial and domestic discharges:** Most coastal municipalities discharge their raw

of land and marine based discharges has been or will be on local populations of sea turtles. However, it is logical to conclude that damage to coral reefs and seagrass beds, which are foraging areas for sea turtles will further harm sea turtles. In addition, there is a possibility for episodes of debilitating or lethal poisoning of sea turtles by industrial sewage or accidental spill. It is therefore recommended that proper treatment of wastes be given serious consideration. Routine monitoring for compliance with environmental standards is essential.

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Table 1. Marine turtle nesting areas in Kenya

Beach/area name	Beach length	Nesting Species	Total nests	Peak nesting sea
Bazo		Green		
Mpunguti Island		Green, hawksbill		
Funzi		Green		
Meambweni		Green, hawksbill		
Chale Island		Green		
Diani		"		
Tiwi		"		
Shelly Beach		"		
Nyali		"		
Jumba Ruins		Green, hawksbill		
Kikambala		Green		
Vipingo		Hawksbill		
Kilifi Plantation		Green, hawksbill		
Bcfa-Kilifi		Hawksbill		
Watamu		Green		
Matindi-Causorina		"		
Robinson Island		"		
Ras-Tenewi		Green, hawksbill		
Ziwa-Yuu Island		"		
Shella		Green		
Pate Island		Green, hawksbill		
Takwa		Green		
Mkokoni		Green, hawksbill		
Kiunga		Hawksbill		

Table 2. Marine turtle foraging areas in Kenya

Area name	Description of site	Species Feeding
Mpunguti	Predominantly seagrass beds	Green, hawks
Nyali	Seagrass and coral reefs	"
Bofa-Kilifi	Predominantly seagrass beds	Hawksbill
Takaungu	Seagrass beds	Green
Watamu	Seagrass and well developed corals	"
Ungwana Bay	Predominantly seagrass and isolated coral island	Green, hawksbill, olive loggerhead, leather
Ziwayuu Island	Seagrass beds and coral reefs	Green, hawks
Manda Toto	Predominantly seagrass beds	Green

Table 3. Marine turtles developmental habitat in Kenya

Area name	Description of site	Species Present
Mpunguti	Seagrass with coral reef patches	Green, hawks
Ungwana Bay	Seagrass	Green, hawksbill, olive ridley, leather

THE STATUS OF SEA TURTLE CONSERVATION IN TANZANIA

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ABSTRACT

Five species of turtles are recorded from Tanzania. Of these the green and hawksbill are regularly reported and nest on Tanzanian beaches. Populations of all species appear to be declining. Certainly nesting habitat has decreased as a result of erosion and deteriorated in quality owing to human disturbance. In addition, people take adult turtles and eggs whenever the opportunity arises, despite protective legislation. Incidental catch by artisanal fishing communities and commercial trawlers may be considerable but is as yet unquantified.

There is a need to improve baseline data on the status of turtles and their habitats, to involve local communities in monitoring and conservation activities, and to improve the fisheries and wildlife staff capacity with regard to sea turtle conservation and management.

In addition there is a need to raise the awareness of a broad spectrum of planners, policy makers, business community, private landowners, commercial fishermen and trawlers, about sea turtle conservation issues. Current government structure and management is highly sectoral in nature, and there is not yet a unified, functional environmental policy or suitable legislation to adequately protect sea turtles and their environment. It is important to create the institutional capacity to monitor and conserve sea turtles. This is a long term commitment, and it is suggested that regional cooperation would be a suitable mechanism to help provide specialist scientific and managerial training.

INTRODUCTION

Most information regarding sea turtles in Tanzania has been produced by J. Frazier and dates back to the year 1974. Despite the availability of identification guides for the Tanzanian species (Marquez, 1990; Broadley & Howell, 1991) no one has continued to study the biology of sea turtles in detail (Howell, 1993).

STATUS AND DISTRIBUTION OF MARINE TURTLES IN THE TANZANIA

Marine turtles found in Tanzanian waters: Five species of sea turtles occur in Tanzanian waters, the green turtle (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), leatherback (*Dermochelys coriacea*), olive ridley (*Lepidochelys olivacea*) and loggerhead (*Caretta caretta*), but the first two of these are the most frequently encountered. (Howell, 1993).

General distribution in Tanzanian waters: The green turtle is renowned for its abilities in transoceanic migration, and it is unlikely that any of the green turtles in Tanzania live their entire life there. There are almost certainly migrants to Tanzania coming to and from breeding grounds as far away as Somalia and possibly Aden on the one hand, and Seychelles and Madagascar on the other. These migrants probably form the bulk of this species in Tanzania.

Some hawksbill turtles in Tanzanian waters may be resident but the hawksbill is known to be a migratory species. The number of hawksbills are low as a result of consistent exploitation (Frazier & Rodgers, 1974)

Loggerhead turtles taken in southern Tanzania have been known to bear tags from Natal and it appears that Tanzania serves as a feeding ground for this migratory species. Judging by the number of breeding animals reported from the only important breeding area close by (i.e. Natal), the number of this species must be very low (Frazier & Rodgers, 1974).

Known population trends: Populations of all species are believed to be declining.

Nesting beaches: Frazier (1976) noted that Maziwi Island was the most important breeding ground in Tanzania and East Africa as a whole, yet it had less than 100 females nesting annually. Unfortunately, as a result of erosion Maziwi now exists as a mobile tidal sand bank on top of Maziwi reef.

The small remote islands near Mafia (e.g. North Fonjove, Shungu-Mbili, Niororo, and Bariakuni) have concentrated nesting; but the total number of females nesting annually on all these islands has been estimated at less than 100. Nesting has been observed or reported on mainland beaches at Mwera (Pangani District) and from Ras Dege to Ras Kimbiji (Kisarawe District). Although the mainland offers vastly more beach area than do the islands, island beaches are far superior for turtle nesting, and there are fewer turtles nesting on the mainland (Frazier, 1976).

In a survey carried out by Frazier in May 1976, evidence of concentrated nesting was found along the Ras Mwanamkuru beach, 25 km southeast of Dar es Salaam. Other signs of nesting by large, and therefore presumably green, turtles were seen at Ras Ngumbe Sukani and Msungu Bay (Frazier, 1976). Frazier (1982) estimated that 300 green turtles nest annually in Tanzania during the southeast monsoon winds period (June-October). In contrast, only about 50 hawksbills nest annually, during the northeast monsoon period (February-March). Green turtle nesting has been reported in the Songo Songo Island area (one nest), and this year from the Tanga region at Mdele Beach (16 nests), Sadani Beach (one nest - eggs taken by villagers) (G. Fox, pers. obs.) and near Kigombe (3-5 nests, A. Galbraith, pers. obs.). Darwall *et al.* (1994) indicate that turtles, probably hawksbills and green, also nest in the Songo Songo island groups. Hawksbill nesting in the Mafia area has been recorded at five sites but the females exhibit disturbed behaviour, and numbers have declined (Howell, 1993).

Little information is available as regards nesting of other species. Frazier (1976b) reports evidence of leatherback turtles nesting on Zanzibar. The same species is known to nest in Natal, as is true for the loggerhead. The olive ridley occurs but little is known of its status (Howell, 1993). Records of loggerhead turtles suggest that it is relatively common in southern Tanzania but does not nest here (Frazier, 1976).

Observations indicate that former nesting sites are no longer being used and despite Tanzania mainland legislation prohibiting the capture of sea turtles, they are still taken regularly both in nets and at the nesting sites, and that carapaces are openly on sale virtually on the doorstep of the CITES management authority. Furthermore, surveys undertaken in connection with the proposed Marine Reserve on Mafia Island indicate heavy

Foraging/feeding grounds: Tanzania has extensive seagrass beds which can support a considerable number of green turtles. Seagrasses are absent from areas near large river mouths e.g. Rufuji River. The sheltered bays of Tanga and Kilwa, as well as the lee of Mafia have extensive seagrass beds. The vast marine expanses of Mafia and Zanzibar have shallow water areas in which marine turtles feed and spend most of their lives, (with the exception of the leatherback turtle which is pelagic, living in deep oceanic waters) (Frazier & Rodgers, 1974).

Developmental habitat: There are no reports concerning developmental habitat.

EXPLOITATION

Traditional uses of marine turtles and their products by local communities: Turtles have probably been used for local consumption for many centuries. Historically, the establishment of an entrepôt for tortoiseshell on Zanzibar had wide ranging effects on the exploitation of turtles in East Africa. Turtles were taken accidentally in fishing nets, illegally from Maziwi Island Reserve, before its disappearance, and by specialist turtle fishermen in the Kilwa area (Frazier & Rodgers, 1974).

A recent study carried out by the Wildlife Conservation Society of Tanzania reported that the flesh of turtles was much used as food, the carapace for decoration and curios, and the oil as medicine for sore muscles and hernia. It was also confirmed that sale of turtles and their products is widespread in most tourist areas, especially Dar es Salaam (Howell, 1993).

Turtle meat is regarded as a highly priced delicacy and a welcome change from fish. In some areas, female turtles are killed when they come ashore to nest and the eggs are collected for sale.

Community knowledge of population trends: Populations are believed to be declining.

Commercial or international trade in marine turtles and their products: Trade in the past has been considerable. There may be a small amount of trade in turtle meat ongoing with Mozambique and in oil with Kenya (Howell, 1993).

THREATS (MANAGEMENT CONCERNS)

Natural threats to nesting beaches: Predators are numerous and there may be an increase in predation by Indian house crows, (*Corvus splendens*) on any hatchlings which emerge during daylight hours.. The other principle threat is erosion, illustrated vividly by the loss of Maziwi Island.

Egg collection by humans: This is continuing.

Fishery-related threats to turtles: Gillnets, large sharknets and trawlers (fish and shrimp) present threats. The larger commercial fisheries are mechanised. Dynamite fishing may kill turtles and certainly damages habitats.

Overseas fisheries: These are often listed under Tanzanian companies, but other nations

Other human-related threats: The availability of suitable nesting sites is decreasing with coastal development concentrating on the construction of beach hotels in many areas, thus disturbing traditional nesting sites (Semesi & Ngoile, 1993). Other problems are beach lighting, solid waste disposal, feral cats and dogs, and perhaps roof rats, *Rattus rattus*, which may be present in large numbers on some offshore islands.

MANAGEMENT STRATEGIES

Turtle management responsibilities: The Tanzania mainland Ministry of Tourism, Natural Resources and Environment (MTNRE) administers all natural resources, including coastal resources, through the Divisions of Fisheries, Forestry, Tourism, Environment and Wildlife. Responsibility for turtles rests with Fisheries.

Legal basis for turtle conservation and management: The Fisheries Act of 1970, under the control of the Minister of Natural Resources and the Director of Fisheries provides for the development, protection, and conservation of marine products, namely finfish, shellfish, marine algae and invertebrates, and other species including turtles and dugongs. The act is implemented by the Fisheries Division.

Through Government Notice No. 140, published on 27 June 1975, the Minister (NTNRE) sought to clarify The Fisheries Act of 1970 as follows: "Definition of Fish - for the avoidance of doubts it is hereby declared that as turtles and dugong do not fall within the scope of the Wildlife Conservation Act, 1974 (Act No. 12 of 1974) they fall within the definition of the term "fish" in the Fisheries Act, 1970, and their protection, preservation, capture and killing, or any dealing in them, are regulated by the Fisheries Act, 1970 and subsidiary legislation made thereunder" (Howell, 1993).

Effectiveness of existing mechanisms: These are not very effective.

Enforcement agency: Fisheries Division.

International Treaties and Conventions

Name of Convention	Yes	No
Convention for the protection management and development of the marine and coastal environment of the Eastern African Region and related protocols (Nairobi Convention)		No
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Yes	
Convention on Biological Diversity		No*
The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)		No
International Convention on Prevention of Marine Pollution from Ships (MARPOL)		No

Incorporation of international agreements into National Law: Though Tanzania acceded to CITES in 1980, no legislation has been produced to deal specifically with this Convention, but the Minister of Natural Resources supported by the Wildlife Conservation Act can declare any area to be a game controlled area.

Groombridge & Luxmoore (1989) point out that although Tanzania has ratified CITES, turtle products continued to be regularly exported since then - although no reservations on the species concerned have been registered by the Government of Tanzania. Official reports indicate the export of carapaces mostly for personal use, but two commercial shipments in 1982 and export of 40 kg of hawksbill scales to France in 1985 appear to indicate major infractions to CITES (Howell, 1993).

Limitations of the National Law with respect to marine turtle management: The study carried out by the Wildlife Conservation Society of Tanzania indicates that sea turtles receive little protection under the present national legislation and levels of enforcement, and that the CITES management authority is marginalised because of national (mainland) legislation, which places sea turtles under fisheries rather than wildlife legislation (Howell, 1993). Legislation is weak with respect to broader issues such as pollution and environmental protection.

Management strategies: Strategies for environmental protection in general are being prepared. There is a need to include nesting and feeding grounds within the protected area network.

Nesting beaches in protected areas: Beaches are protected only in Mafia Marine Park; Marine reserves have been identified but are not formally managed.

Local communities and turtle conservation and management: Local communities have been involved on Mafia.

Traditional resource management practices and community-based turtle conservation potential: This may be possible on a small scale, but could be difficult with socially mixed villages in areas visited regularly by transient fishermen.

On-going turtle research: Ongoing research is limited - general surveys are carried out in Mafia and Songo Songo by Frontier Tanzania, and in Tanga through the IUCN advised Coastal Zone Conservation and Development Programme.

MANAGEMENT NEEDS TO CONSERVE MARINE TURTLES

Institutional arrangements needed for turtle conservation

Responsibilities: Responsibilities need to be defined for the management of turtles in estuarine and deeper waters, including incidental capture in nets, etc. There is also the need to generally define responsibilities for coastal resources, and to actively involve local people in conservation management.

Staffing and training: In addition to fisheries staff, wildlife and parks officers need specific training about turtle biology and conservation. There is also a need to raise awareness among decision makers of the regional and international importance of sea turtles so that turtles can be included as an integral part of environmental planning, policy, and management.

Legislation: More specific legislation concerning turtle management and protection is needed, rather than a blanket ban on the taking of turtles. Broader legislation dealing with pollution and general environmental protection is also needed; this also needs to be integrated with overall environmental and conservation legislation. The current strongly sectoral approach to management and legislation is ineffective.

Collaboration mechanisms among agencies: There is a need for integration of legislation and environmental planning. The current system is ineffective and there are too many loopholes.

Turtle protection needs

There is a general need for monitoring of turtle populations on the nesting beaches and in the nearshore waters which are important feeding grounds. There is also the need to monitor any management efforts taken and assess their efficacy.

Control and mitigation of the impact of accidental capture in fisheries: This is needed both for non-mechanised local fisheries (shark nets) and probably for trawlers, although there is no data on this. Official observers should be present on commercial vessels to monitor the effects of fishing on turtles.

National harvest: The current total ban is ineffective, but a legal harvest would be difficult to control.

International harvest: This may be continuing illegally and there is the need to monitor this and to link such efforts with TRAFFIC and CITES.

Predator control: This may be important in some areas, and there is certainly a need to assess the significance of predation losses. Options to control predation include exclusion of predators or relocation of eggs from vulnerable nests.

Recreation and tourism: This is not yet an issue but may soon become one. There is a need for caution and to learn from experience in mitigating impacts from other areas.

Community incentives and participation: These are most likely to be effective if related to tourism, although some communities may be motivated by pride or a commitment or bond to conservation objectives.

Public awareness and education: There is much room for improvement here, and the need to develop suitable approaches for different audiences, and at several educational levels.

Habitat protection needs

Conservation areas: There is a need to identify breeding and feeding sites and to develop strategies for their protection.

Beach erosion control: This is needed generally in Tanzania; the loss of Maziwi island illustrates the importance of this problem.

Mitigation of lighting effects: This is needed and suitable policy and legislation should be developed and put in place as soon as possible.

Feeding ground protection: Feeding grounds need to be protected, but the issue is how, particularly with respect to pollution. Such areas need to be considered in planning for protected areas and in integrated coastal zone management.

Integration into coastal development policies, planning and management: There is an urgent need to include turtle management issues in current integrated coastal zone management efforts.

Management related research needs

Strengthening research capacity: Currently there is no Tanzanian sea turtle biologist. Certainly graduate turtle specialists are needed, but in addition, it is important to focus training efforts at the District and village level, in particular taking advantage of local interest in turtles. Also, seminars and workshops to sensitise planners, wildlife and fisheries staff on turtle issues are needed. As noted above, the need for regular surveys and monitoring is critical, as is the need to critically monitor the efficacy of any management actions.

Tagging: Tagging should be encouraged so long as it is not detrimental to turtles. This would provide a means to create interest among local fishermen as well as initiate research and monitoring capabilities within Tanzania and the region.

A suitable centre for deposit of data and maintaining is required; this could be the University of Dar es Salaam Department of Zoology & Marine Biology on the mainland and/or the Institute of Marine Sciences, University of Dar es Salaam, Zanzibar.

Stranding network: This would be difficult to establish, but would be possible with District and village level trained "experts" and involving Mafia Marine Park, Tanga, and other coastal zone projects.

Determining causes of mortality: Similarly, local level expertise would facilitate this; but a link with research institutions is needed (Department of Zoology, University of Dar es Salaam; Sokoine University of Agriculture, Veterinary Faculty, for example.).

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THE STATUS OF SEA TURTLE CONSERVATION IN ZANZIBAR

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ABSTRACT

Of the five species of turtles found in western Indian Ocean, only four have been reported and confirmed in Zanzibar: hawksbill, leatherback, green and loggerhead turtles. The exact number of turtles nesting in Zanzibar is not known but the population is believed to have declined in the last few decades. Two species - green and hawksbill - nest on the islands.

Green turtles the most frequently seen species while hawksbill turtles are exploited as a source of meat, which is regarded as a delicacy, and for medicinal purposes. Turtles are threatened naturally by crabs and beach erosion. They are also affected by tourism development along beaches, and human collecting eggs and hatchlings. In order to conserve turtles some efforts have been initiated by Departments of Fisheries and Environment including banning the sale of turtle products in Zanzibar Town and transport of live turtles from rural to urban areas. Posters, newspaper articles, radio and television programmes have been used to raise awareness among the general public. To support these efforts, immediate action needed is to enforce the Fisheries regulations which prohibit turtle hunting and in addition, the legislation should be amended to offer full protection to the turtles. Community participation is also crucial to the success of conservation efforts.

INTRODUCTION

Previous researchers have reported variously that some or all of the five species of sea turtles occurring in the western Indian Ocean could be found in Zanzibar. Frazier (1976) reported the presence of five species: green turtle, hawksbill turtle, loggerhead turtle, leatherback turtle and olive ridley turtle. Jidawi and Muhando (1990) stated that the most important species of turtles in Zanzibar were the green turtle, hawksbill turtle and olive ridley turtle. Thiagarajan (1991) reported that the number of sea turtles nesting in Zanzibar has decreased significantly over the last few decades.

The most recent survey by Clark and Khatib reported that four species of sea turtle in the waters around Zanzibar. The commonest are green, hawksbill and loggerhead turtles, while leatherback turtle appears to be an occasional visitor. Occurrence of nesting activity in most areas is less than ten times a year (Clark & Khatib, 1993).

STATUS AND DISTRIBUTION OF MARINE TURTLES IN ZANZIBAR

Marine turtle species found in Zanzibari waters: Clark *et al.* (1994) confirmed four species of sea turtles in Zanzibar: the green turtle (*Chelonia mydas*), the hawksbill turtle (*Eretmochelys imbricata*), the loggerhead turtle (*Caretta caretta*) and the leatherback turtle (*Dermochelys coriacea*).

studies show little evidence of its existence (Clark & Khatib, 1993a)

General distribution in Zanzibari waters: The green turtle is the most common species and is known to nest in several areas, mostly in Pemba. The hawksbill turtle also appears to be relatively common but it does not nest as frequently as the green turtle. The loggerhead turtle and the leatherback turtle are both rare. There is no indication that they use Zanzibar as a nesting ground but the reefs seem to be an important feeding area for the two species.

Known population trends: According to fishermen, sea turtles have declined in the last few decades.

Nesting beaches: It is impossible to make a definitive statement on the total number of sea turtles nesting in Zanzibar, since most information comes from unconfirmed estimates given by fishermen (Clark & Khatib, 1993a). Green turtle have been confirmed to nest on the islands, but evidence of hawksbill nesting is limited to fishermen's reports.

Turtles used to nest on most sandy beaches but the number of nesting turtles and nesting sites has decreased drastically in the last few decades. The most important nesting beaches seem to be located along the north coast of Pemba (Clark *et al.*, 1994). Areas reported to have highest concentration of nesting sea turtles in Pemba include Misali, Kwata, Matumbini Islands, Fundo Islands, Ngezi peninsula and Kiuyu peninsula. In Unguja main nesting areas include Fumba, Nungwi, Mnemba Island Makoba, Kijini Kizimkazi (Clark & Khatib, 1993b). Maziwi Island was thought to be the most important sea turtle nesting site in Tanzania (Frazier, 1976) but is now no more than a tidal sand bar as a result of erosion.

Green turtles nest mainly during kusi period (when the southeast trade winds blow from June to September) while the hawksbills are believed to nest primarily in kaskazi (the period of the northeast monsoon which occurs from December to March) (Frazier, 1976). Hawksbill turtles have been reported to nest during daylight hours. In many places, the number of turtles may be too low for any seasonal peaks to be apparent (Clark & Khatib, 1993b).

Tagged turtles from Seychelles, Europa Island and South Africa have been found around Zanzibar and it is likely that many of the turtles currently caught here are from populations that nest in these other areas (Clark & Khatib, 1993a). The main ocean current affecting Zanzibar (the East African Coastal Current) is permanently north bound (Ngoile, 1990). This may well influence the migratory movements of sea turtles and non-nesting populations probably come from nesting sites in the central and southern parts of the western Indian Ocean (Clark and Khatib, 1993b)

Foraging/feeding grounds: None reported

Developmental habitat: The major area where small and immature turtles concentrate is Uroa in Central District of Unguja. The area is not protected and comprises seagrasses, coral reef, and algae. The turtles reported include green and hawksbill. However, the population is not known.

EXPLOITATION

Traditional uses of marine turtles and their products by local communities: Many Zanzibaris enjoy eating turtles, and will choose it in preference to fish or other meat as a delicacy. Turtles have traditionally provided a source of income through sale of meat. Although not usually sold, turtle eggs are also eaten whenever they are found. In addition, many Zanzibaris believe that turtle products (meat, oil, eggs, shell, skin, internal organs) have medicinal properties and use them to treat a wide range of diseases (Clark & Khatib, 1993b).

According to Thiagarajan (1991), some fishermen in Zanzibar claimed that Islam prohibits the consumption of turtle meat since animals that live on both land and water are considered impure. Muslims in other countries such as Indonesia (Greenpeace) and Thailand (Hill, 1991) are also said to avoid turtle meat, although turtle eggs are eaten in large quantities. Over 95% of the population of Zanzibar is Muslim, but the meat and eggs of turtles are eaten by many people. The status of turtle in Islam appears to be a matter of personal interpretation (Clark & Khatib, 1993a). Turtles are still being caught for food and medicine, although in Unguja the number of turtles in the market has decreased and the meat is only used for subsistence. Transport or sale of live turtles from rural to urban areas is prohibited.

Community knowledge of population trends: Clark & Khatib (1993b), reported that although sea turtles still nested on many sandy beaches around Zanzibar, fishermen's estimates of nesting numbers indicate that the concentration was generally very low, with evidence of sea turtle nesting being seen less than ten times per year in most areas. It was generally accepted that a number of turtles nesting annually had decreased significantly in the last few decades. Fishermen from Kangani reported that turtles no longer nested at all, and in Tumbe it was reported that, whereas in the past one hundred or more turtles used to nest every year, in the recent years only around four turtles would come to lay their eggs.

Commercial or international trade of marine turtles and their products: With the closure of the centre for international trade in hawksbill turtle shell (Frazier, 1980), accession to CITES, and the closure of the Kenya and Tanzania markets, trade in turtle products from Zanzibar has decreased (Thiagarajan, 1991).

THREATS (MANAGEMENT CONCERNS)

Natural threats to nesting beaches: The natural threats facing turtles include beach erosion and predation of hatchlings by crabs, which was observed by a hotel owner on Mnemba island. The Zanzibar coastline is threatened by beach erosion according to a recent beach erosion study commissioned by Department of Environment. The areas most affected in Unguja include Nungwi, Bwejuu, Jambiani and Mnemba island (Mohammed, 1995 pers. comm.). The beach is being eroded at a rate of 1 to 3 metres per year.

Egg collection by humans: Eggs are collected by humans for two main reasons - traditionally, as a source of protein, and to incubate. This latter use is recent, and stems from the desire to copy the example of a villager who raised three hatchlings from eggs which he buried.

Fishery-related threats to turtles: Although the turtles get caught in all kinds of nets and fishing lines, the main methods of capture are nets and speargun. The introduction of snorkelling gear, spears and spearguns in recent years has led to an increase in number of turtles caught (Clark *et al.*, 1994).

Fishing in Zanzibar occurs mostly in inshore waters and is done by artisanal fishermen using variety of techniques like line, gillnet, trap, longlining and spear fishing, purse and beach seining and weirs and pots (Faki & Salim, 1995). Jidawi (1990) estimated that there were about 15,564 fisherfolks in Zanzibar. Turtles frequently get entangled in large mesh gill nets which are set in the sea bed and left there for long periods. Even when fishermen are willing to release such an incidental captured turtles, many drown before the nets are retrieved (Clark *et al.*, 1994).

Lack of efficient gears and vessels are the main reasons for the fishermen to concentrate in inshore waters. Faki and Salim (1995) suggest that such concentration is causing overfishing in several areas.

Other human-related threats: The recent growth of tourism created a new market for turtle shells and shell products such as jewellery for souvenirs. This increased the overall value of captured sea turtles, and may have encouraged hunting of them. Such souvenirs have been sold through in curio shops in Zanzibar town and at the road side stalls in the east coast of Unguja, particularly at Pwani Mchangani and Matemwe (Clark & Khatib, 1993a). A recent report by Clark (1995) indicates that the trade has ceased after a vigorous effort to exchange turtle products on sale for turtle T-shirts. Five hundred and sixty seven turtle shell products were removed from curio shops in exchange for 134 T-shirts. These were burnt with the exception of 13 bracelets, one hairpin and two earrings which will be used for educational purposes.

Turtle nesting sites are being lost to tourist developments on the beaches (Clark *et al.*, 1994). Sand movements and excavations are now becoming the major threat to turtle nesting. The disturbance of turtles through electric lights and turtle watchers is not yet a serious issue but remains a potential threat. Pollution of feeding habitats, especially with plastic bags which turtles might swallow, and erosion of the nesting beaches, are additional and recent man-made threats to sea turtles (Clark *et al.*, 1994).

Some people, especially tourists and expatriates, are distressed by the sight of captured sea turtles and occasionally buy them for release. Prices paid for release are usually higher than the market prices and this "buying for release" provides an added incentive for further capture of sea turtles (Clark & Khatib, 1993a; Clark *et al.*, 1994). Finally, a recent threat is the attempts by villagers to raise turtles in captivity. With a desire to raise as many as possible, the hatchlings are kept crowded in small water or wash basins and many die.

MANAGEMENT STRATEGIES

Turtle management responsibilities: While the Fisheries Sub-Commission is responsible for the management of sea turtles, the Department of Environment appears to be more active with respect to sea turtle conservation and management. Wildlife Protection Decree Cap 128 (1919) includes hawksbill turtles among 13 prohibited species of wild animals and

Legal basis for conservation and management of marine turtles: The outdated Wild Protection Decree of 1919 gives a total protection to hawksbill turtles but other species of turtles are not mentioned. The Fisheries Act of 1988 classifies sea turtles and their eggs under the heading "fish". Under this Act, the Minister or Director has powers to make regulations on how, when and where and what species may be caught.

Sea turtles are protected by the 1993 Fisheries Regulation which prohibits fishing of sea turtles as well as possession of hawksbill or any other species of "fish" which are considered endangered or threatened under international convention or agreements. Violation of this regulation may lead to fine of T. Shs 20,000 to 40,000, a jail term of not less two year or both. There are no reports of prosecution on the basis of violation of this Regulation. Regulation 33 protects fish eggs or any place where eggs are found or laid from destruction.

Effectiveness of existing turtle protection mechanisms: The existing mechanism to protect marine turtle is not effective. The Fisheries Sub-Commission is understaffed and ill-equipped to do anything about marine turtles. Initial efforts are being made by the Department of Environment which has assigned two staff to the turtle programme. Some hoteliers have taken an informal initiative to fund a "buy to release" scheme, to address incidental captures by fishermen.

Responsibility for enforcement: The Fisheries Sub-Commission in collaboration with police department and Zanzibar coast guard (navy) are responsible for enforcement of the fisheries legislation. However, the initiative should come from Fisheries Sub-Commission, and police and navy only react after being informed. This collaboration has not been effective as the fisheries and police do not have patrol boats and the navy boats usually lack fuel.

International Treaties and Conventions:

Name of Convention	Yes	No
Convention for the protection management and development of the marine and coastal environment of the Eastern African Region and related protocols (Nairobi Convention)		No
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Yes	
Convention on Biological Diversity		No
The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)		No
International Convention on the Prevention of Marine Pollution from Ships (MARPOL)		No

Incorporation of International Agreements into National Law: The fisheries sector has suggested a strategy for conservation of biodiversity in Zanzibar which would include protection of rare and endangered species such as sea turtles.

Limitations of National Law with respect to marine turtle management: There is no comprehensive law which caters for endangered or threatened species. The existing Fisheries legislation and regulations do not adequately address marine turtle issues apart from banning the fishing of turtles. Existing legislation does not protect beaches which are regarded as public land. Environmental legislation which is expected to address some of the issues is still on the drawing board.

Proposed changes to meet conservation objectives: The proposed Environmental Legislation needs to be expedited in order to provide legal protection to endangered and threatened species and to incorporate CITES into National Legislation. Fisheries legislation needs further amendment to protect turtle eggs and nesting beaches specifically, and not just under the general heading of fish eggs.

Nesting beaches in protected areas: none

Local communities and turtle conservation and management: Education and awareness raising on turtle issues has involved newspaper articles and radio programmes. Over 1,000 sea turtle posters have been distributed by the Department of Environment and Fisheries Sub-Commission to shops, tour operators, hotels, restaurants, schools, government and private offices in Unguja and Pemba. The poster in English and Kiswahili covers issues from turtle fishing, turtle egg collection and trade of turtle shell products. Youth clubs in Bububu and Bweleo were given an educational pamphlet, played related games, and watched a slideshow on the life of turtles.

The Department of Environment established a network of turtle contact persons in the community for the 1993 turtle survey, but the network was dissolved after the survey.

Traditional resource management practices and community based turtle conservation potential: The existing tradition puts more emphasis on hunting turtles than on conservation and cannot be used or fostered to bring about turtle conservation. However, the tradition is dying because currently the market for turtle is declining in Zanzibar Town and transport of live turtles to the town is no longer allowed.

On-going turtle research activities: none reported

MANAGEMENT NEEDS TO CONSERVE MARINE TURTLES

Institutional arrangements needed for turtle conservation

Responsibilities: The current arrangement should be reinforced with more collaboration between the Fisheries Sub-Commission and Department of Environment to educate the community, tourists and investors. The Fisheries Sub-Commission needs assistance in law enforcement probably by incorporating the community. Involving the community may achieve more than patrols and marine rangers.

Staffing and training: There is an urgent need for training of the existing staff in the Department of Environment and Fisheries Sub-Commission.

Legislation: There is a need to amend or update the 1988 Fisheries Act and the 1993

to ensure adequate protection for marine turtles.

However, to create a legislation is one issue and to implement it is another. Enforcement, even of existing law, is the major problem in Zanzibar. Therefore, unless there is strong commitment new legislation would not work.

Collaboration mechanisms among agencies (research, planning, management): The *ad hoc* arrangement for dealing with an Integrated Coastal Zone Management Pilot Project should be considered as an arrangement for turtle conservation issues. The Department of Environment, Fisheries Departments and the Institute of Marine Sciences need to collaborate on research and planning, with the Institute providing advice to support management.

Turtle protection needs

Community incentives and participation:

Cash incentives have been found to be counter-productive to obtaining committed public participation.

Public awareness and education: Continue with education on the plight of turtles. Use radio, television, video programmes; hold talks in schools and environmental clubs, women's groups, and others. In particular, villagers need to be discouraged from attempting to raise large numbers of hatchlings.

Habitat protection needs

Conservation areas: Areas which are known to have high concentrations of marine turtles or nesting beaches should be protected.

Beach erosion control: Investors and hoteliers should be forced to follow the set back limit of 30 m before building any structures. Excavation of sand from beaches should be strictly prohibited, and use of beaches as roads for motor vehicles should be banned.

Mitigation of lighting effects: Not at present an issue.

Feeding ground protection: See conservation areas

Management Related Research Needs

Research capacity needs to be strengthened, and systems designed for regular tagging, determination of causes of mortality, as well as a stranding network.

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THE STATUS OF SEA TURTLE CONSERVATION IN MOZAMBIQUE

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ABSTRACT

All five species of Indian Ocean sea turtles nest on beaches along the Mozambique coast. Three species - the green, hawksbill and olive ridley - nest to the north of the Tropic of Capricorn, while the remaining two - loggerhead and leatherback - nest mainly to the south. Little is known of the status and distribution of turtles or of their nesting, feeding and developmental habitats, and there is little ongoing research. Protection of marine turtles is currently underway only in the southern part of the country.

Turtles are threatened through natural causes - predation of hatchlings and beach erosion - and by human activities, including slaughter of nesting females and removal of eggs, selling of carapaces to tourists, craftsmen and witchdoctors, and accidental capture in gillnets. Populations are believed to be in decline as a result of overexploitation.

Of the international treaties and conventions pertinent to regional sea turtle conservation, Mozambique is party only to CITES and the Convention on Biological Diversity. Turtles are protected by National Law under the responsibility of National Board for Forestry and Agriculture. Conservation activities have been undertaken with communities in the Bazaruto Archipelago, by the Maritime Authorities in various parts of the country outside protected areas, and by the Department of Biological Sciences, Eduardo Mondlane University, on Inhaca Island.

INTRODUCTION

Mozambique, situated between 10°20' and 26°50'S with a tropical humid to sub-humid climate, has one of the longest coastlines of Africa characterised by diverse and productive ecosystems, including estuaries, deltas, barrier islands, rocky coasts, sand dunes, mangroves, mudflats and coral reefs. The coastal zone supports important artisanal and commercial fisheries (particularly shrimp), and a rich and diverse marine fauna, including marine turtles.

The human population was estimated in 1994 at 16.6 million inhabitants (World Bank, 1995). A high portion of the population is concentrated along the 40 km wide coastal strip, a result of climate and the war (UN/UNESCO/UNEP, 1982; GTA, 1990). The geology of the coastline is described by Tinley (1971) and oceanography by Saetre and da Silva (1982).

Threatened marine species in Mozambique include marine turtles (IUCN/UNEP, 1985). Apart from the survey carried out by Hughes in the 1970s and the current work on Inhaca Island, Bazaruto Archipelago and recently in Maputo Game Reserve (Samiro, pers. comm.) and Ponta Malongane (Lombard, pers. comm.), very little is known regarding the situation of sea turtles in Mozambique. Some effort is currently underway to protect nesting turtles and their eggs at Inhaca Island (since 1987); Bazaruto Archipelago (since 1990) and very recently in Ponta Malongane and Maputo Game Reserve, all in the southern part of the country.

STATUS AND DISTRIBUTION OF MARINE TURTLES IN MOZAMBIQUE

Marine turtle species found in Mozambican waters: Five species of marine turtles nest along the Mozambique coast, mostly on the offshore islands. The species are *Chelonia mydas*, *Eretmochelys imbricata*, *Lepidochelys olivacea*, *Caretta caretta* and *Dermochelys coriacea* (UNEP/IUCN 1988).

General distribution in Mozambican waters: The green turtle is widespread but only nests north of the Tropic of Capricorn. The hawksbill is found only in the northern part of the country as is the less common olive ridley. The loggerhead and leatherback are mainly located south of the Tropic of Capricorn where they nest, but are known further north.

Known population trends: The current population of marine turtles has not yet been estimated, but populations are believed to be in decline. This is in part due to the war which, apart from preventing sea turtle protection, provoked displacement of people from the interior to the coast increasing tremendously the pressure on marine resources (see other threats below).

Nesting beaches: Loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) nest along the entire coast from Ponta de Ouro to Bazaruto Archipelago. The most important areas are Ponta de Ouro region, Maputo Game Reserve, Inhaca Island, Quewene Peninsula and Bazaruto Archipelago (Hughes, 1971). The peak nesting season is between November and January (Hughes, 1971; Costa, 1989; Data from Marine Biological Station of Inhaca). At Inhaca Island they nest on a 12 km strip of beach with an average of 40 nests per year.

The green turtle (*Chelonia mydas*) nests from Quewene Peninsula to Quirimbas Archipelago. The biggest concentration appears to be in the Primeiras and Segundas Islands (Hughes, 1971). Nests of this species were found recently in Bazaruto (Samiro, pers. comm.). The nesting sites of hawksbill (*Eretmochelys imbricata*) and olive ridley (*Lepidochelys olivacea*) are unknown, but appear to be in the northern coast (Hughes, 1971).

Foraging/Feeding grounds: Inhaca Island is a known foraging area of the green turtle, *Chelonia mydas*. No further information is available concerning habitat use and range.

Development habitat: Small and immature green turtles are concentrated around Bazaruto Archipelago and Inhassoro (Hughes, 1971) and some are found in Maputo Bay (Costa, 1989). No information is available concerning the other species.

EXPLOITATION

Traditional uses of marine turtles and their products by local communities: The use of marine turtles and their products in Mozambique by the local people is a secular practice. The turtles and their eggs are essentially used as food, although the market is small. The carapaces, mainly of hawksbill and green turtle, are used as ornaments or by craftsmen and witchdoctors. In Inhassoro, the eggs are used to treat sexual complaints (Samiro, pers. comm.). Hughes (1971) reports that in southern Mozambique north of Delagoa Bay the

practice probably disappeared due to disruption of traditional structures after national independence. In many areas, nesting females are killed whenever encountered and their eggs dug up. A notable exception is Bazaruto where the local population is actively participating in the sea turtles protection scheme.

Local community knowledge of population trends: Local people believe that the turtle population has decreased (IUCN/UNEP 1985).

Commercial or international trade in marine turtle and their products: Airport staff are enforcing the confiscation of shells where attempts are made to export these without proper permits (Costa, 1989). However, in many places, including Cabo Delgado and especially Nampula provinces, carapaces are prepared and sold as curios to tourists. There is a prosperous market for sea turtle carapaces and other products in Beira, Nampula, Inhaca and Maputo (including at the international airport).

THREATS

Natural threats to nesting beaches: Natural threats to nesting beaches include erosion processes and predation by ghost crabs.

Egg collection by humans: Eggs are still collected by the local people wherever protection is lacking.

Fishery-related threats to turtles: Entanglement of sea turtles in fishing nets has been reported in Maputo Bay and Bazaruto (Guissamulo, 1993). Trawl fishing in Inhassoro, using tractors (the only place in Mozambique where this fishing technique is used) results in the deaths of on average 30 to 35 of sea turtles per month, mainly green turtles (Hughes, 1971; Samiro, pers. comm.). Fishing pressures have increased since independence. Other countries fishing in Mozambique waters include Japan, Russia and Spain.

Other human related threats: Other threats include beach traffic (off-road vehicles) and the recent uncontrolled development of tourist facilities along the coast (since the ceasefire in 1992), some located in the sand dune zone.

MANAGEMENT STRATEGIES

Turtle management responsibilities: The National Directorate for Forestry and Wildlife, under the Ministry of Fisheries and Agriculture, is responsible for the conservation and management of forestry, wildlife (including sea turtles) and protected areas. Maritime Authorities are responsible for controlling the coast and their resources in those areas not under the mandate of DNFFB, that is, outside protected areas. At Inhaca Island activities for the conservation of all resources, including sea turtles, are carried out by the Department of Biological Sciences of the University of Eduardo Mondlane.

Legal basis for turtle conservation: Hunting Law 7/1978 and Decree 117/1978, protects marine turtles. A limited degree of protection is afforded to some nesting/breeding sites and feeding grounds, but these are small or within existing reserve areas (Maputo Game

Effectiveness of existing turtle protection mechanisms: Given the great length of the country, the places where sea turtle protection is underway only represent a small portion of the coast. However, according to Hughes (1971), these areas may well be the most important for leatherback and loggerhead. The existing mechanisms to protect marine turtles are effective at Inhaca Island, where only 4% of the eggs laid yearly are stolen by the local people. In the Bazaruto Archipelago, where the local communities have been integrated into the conservation and management of turtles, losses are probably of a similar order.

Enforcement agency: The institution responsible for enforcement of the law is the National Board for Forestry and Wildlife, but officers responsible for enforcement are often unaware of the regulations relating to sea turtles.

International Treaties and Conventions

Name of Convention	Yes	No
Convention for the protection management and development of the marine and coastal environment of the Eastern African Region and related protocols (Nairobi Convention)		No
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Yes	
Convention on Biological Diversity	Yes	
The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)		No
International Convention on the Prevention of Marine Pollution from Ships (MARPOL)		No

Incorporation of international agreements into National Law: The international conventions that Mozambique signed are still not incorporated into National Law.

On going turtle research: There is no information concerning research activities for marine turtles, except from Inhaca Island where there is an ongoing study on reproduction of loggerhead and leatherback turtles. Information is being gathered from those areas mentioned above where conservation measures are being taken.

MANAGEMENT NEEDS TO CONSERVE MARINE TURTLES

Institutional Arrangements Needed For Turtle Conservation

Responsibilities and collaboration: Despite the fact that DNFFB is the institution responsible for the conservation and management of sea turtle, this institution does not have the mandate or sufficient human and financial resources to control the entire Mozambique coast. It is suggested that the Directorate for Maritime Administration in collaboration with

DNFFB, carry out law enforcement and protection of nesting beaches, feeding areas and habitats outside the protected areas.

To improve the collaboration and coordination among the above institutions it is suggested that these two institutions, plus the Ministry of Environmental Coordination and Biology Department, each identify one person to coordinate all the turtle conservation efforts in their institutions.

Staffing and training: There is a serious lack of trained personnel for sea turtle work. Personnel with existing knowledge on sea turtle management need further training, including in how to train field staff.

Legislation: A more specific and clearer legislation for the protection of turtles, as well as their nests and habitats, which incorporates international agreements needs to be developed, promoted and implemented.

Turtle Protection Needed

Control and mitigation of the impact of fisheries: Gillnets should be banned in places where turtles are more abundant, because of their impact on sea turtles and others endangered species. The impact of trawlers on turtles needs further investigation.

Community incentives and participation: The most effective means to protect the sea turtles is to involve the local community in their conservation. The pilot project in Bazaruto Archipelago involving the local community in the management of natural resources has provided some good results for the protection of sea turtles. The number of nests recorded increased from 6 in 1989/90 to 24 in 1994/95 and no females have been killed. The most important achievement is gradual change of attitude relating to sea turtles. This was achieved through frequent consultation and educational meetings with the local communities.

Public awareness and education: As illustrated above, awareness and education campaigns are critical to the success of turtle conservation efforts.

Other important needs are to increase patrols on nesting beaches during the nesting season; and to control movements and noise on the beaches, driving along the beaches, and other damaging activities during the nesting seasons.

Habitat Protection Needed

Mozambique has one Marine Park, Bazaruto National Park; three coastal Game Reserves, Maputo, Pomene and Marromeu; one area under observation, "Zona de Vigilância Especial da Inhaca"; and one coastal hunting area, "Coutada 10", which do serve to protect turtles, but there is a need to create a marine protected area in the northern part of the country, preferably in Primeiras and Segundas Islands or Quirimbas Archipelago, to protect marine endangered species and their habitats.

Management Related Research Needed

Strengthening research capacity: The lack of people experienced in sea turtle conservation is limiting research activities. As mentioned above, in order to strengthen the research capacity and to make best use of the few human and finance resources existing in DNFFB and Biology Department of University Eduardo Mondlane, it is recommended that the two institutions increase their collaboration and cooperation. These institutions together should identify the national priority research areas and staff training needs to conserve sea turtles.

A research and information network on sea turtles, involving researchers, managers and field workers needs to be developed, initially at national level and if feasible at regional level, in order to share experience among those people involved in turtle conservation.

Tagging: Given the importance of tagging for scientifically based management, and the fact that one person at Inhassoro is tagging turtles privately, there is an urgent need to control and coordinate tagging in Mozambique. At a regional level it is important to share tagging information.

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THE STATUS OF SEA TURTLE CONSERVATION IN SOUTH AFRICA

GEORGE R. HUGHES

ABSTRACT

There are five species of sea turtle in South African waters of which two - the leatherback (*Dermochelys coriacea*) and loggerhead (*Caretta caretta*) - nest in KwaZulu-Natal. Three species do not nest: the hawksbill (*Eretmochelys imbricata*) which is uncommon; the olive ridley (*Lepidochelys olivacea*) which is rare; and the green (*Chelonia mydas*) which is relatively common.

There is no legal exploitation and major breeding grounds are all contained within protected areas. The only local threat is the presence of shark nets along the KwaZulu-Natal coast. These catches are carefully monitored and do not appear to be damaging the population.

Nesting populations of loggerheads and leatherbacks have enjoyed total protection for 33 years and both populations have shown good signs of positive growth. The turtle protection programme is well publicised and there is good public support.

INTRODUCTION

Sea turtles nested extensively along the eastern seaboard of South Africa until the arrival of European settlers. From 1850 there were dramatic and at one stage believed to be terminal declines in populations. Only in 1963 were nesting loggerheads and leatherbacks rediscovered nesting on the south-east coast of what is now called KwaZulu-Natal. It would appear that the killing of nesting sea turtles was a not traditional activity but a relatively new practice learned from Mozambique.

The population programme put in place was timely. In the case of leatherbacks the population was in sharp decline reaching an all time low of only five nesting females during 1966/67. Since then, both leatherbacks and loggerheads have shown strong recovery and indeed illustrate one of the most dramatic recoveries of sea turtle populations in the world.

Green turtle, hawksbill and olive ridleys are non-nesting species, and are monitored only from shark net catches which provide regular data. There do not appear to have been any dramatic changes in status since netting began in the late 1960s.

All management and research effort takes place in KwaZulu-Natal within the two contiguous protected areas south of the Mozambique border, namely the St Lucia and Maputaland marine reserves.

STATUS AND DISTRIBUTION OF MARINE TURTLES IN THE SOUTH AFRICA

Marine turtles found in South African waters: Dermochelys coriacea, Caretta caretta, Eretmochelys imbricata, Chelonia mydas, Lepidochelys olivacea.

General distribution in South African waters: The leatherback nests on the beaches of

Green and hawksbill are extremely rare in west coast waters. Olive ridleys are so rare that they must be regarded as occasional visitors. We have no records from the west coast.

Known population trends: Loggerhead and leatherback nesting populations are increasing (see attached graphs).

Nesting beaches, feeding/foraging grounds, developmental habitat: See tables

EXPLOITATION

Traditional uses of marine turtles and their products by local communities: Turtles were killed for food but this has ceased. The practise was probably not traditional, but imported from Mozambique.

Local community knowledge of population trends: These are increasing.

Commercial and international trade in marine turtles and their products: None

THREATS (MANAGEMENT CONCERNS)

Natural threats to nesting beaches: There are no major direct threats. There is some predation on nests by varanids and mongoose but this is negligible. Beach erosion varies annually but only has serious impacts where beaches are hit by a cyclone. This has happened three times in the last 33 years.

Egg collection by humans: None.

Fishery-related threats to turtles: Shrimp trawling in northern Mozambique and Madagascar definitely poses a threat but this does not appear to be too serious.

Other human-related threats: There are no other threats at present. Vehicles are not permitted on beaches at night during the nesting season and there is virtually no development along the nesting beaches.

MANAGEMENT STRATEGIES

Turtle management responsibilities: The Natal Parks Board has primary responsibility and is supported by the KwaZulu Department of Nature Conservation.

Legal basis for turtle conservation and management: Sea turtles are fully protected under Ordinance No. 15 of 1974 (Province of KwaZulu-Natal) and are also protected under the Cape of Good Hope Ordinance. All species of sea turtle will be included in a new Endangered Species Act to be promulgated in South Africa.

Effectiveness of existing mechanisms: These are extremely effective.

International Treaties and Conventions

Name of Convention	Yes	No
Convention for the protection management and development of the marine and coastal environment of the Eastern African Region and related protocols (Nairobi Convention)		NA
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Yes	
Convention on Biological Diversity		No*
The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	Yes	
International Convention on Prevention of Marine Pollution from Ships (MARPOL)	Yes	

* in process

Incorporation of international agreements into National Law: CITES has been incorporated.

Limitations of the National Law with respect to marine turtle management: The existing law is adequate.

Management strategies: Strategies are in place to deal with the threats mentioned above.

Nesting beaches in protected areas: Almost 100% of the nesting beaches in South Africa rest within the fully protected St Lucia and Maputaland Marine Reserves.

Local communities and turtle conservation and management: Local communities are integrated into the turtle conservation programme.

Traditional resource management practices and community-based turtle conservation potential: There are no traditional management practices existing which could be used for turtle conservation.

On-going turtle research: Annual monitoring is fully integrated into the management of the protected areas.

MANAGEMENT NEEDS TO CONSERVE MARINE TURTLES

Institutional arrangements needed for turtle conservation: The existing arrangements are satisfactory.

Turtle protection needs

Control and mitigation of the impact of accidental capture in fisheries: There is no

National harvest: None

International harvest: None - there is no known international harvest.

Predator control: None

Recreation and tourism: None - adequate controls are in place.

Community incentives and participation: There is growing participation.

Public awareness and education: There is an ongoing and popular programme.

Habitat protection needs: None

Management related research needs: None

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Table 1. Marine turtle nesting areas in South Africa

Beach/area name	Beach length	Nesting Species	Total nests	
St Lucia Marine Reserve	180 km	Loggerhead and Leatherback	c. 2000 pa	Dec
Maputaland Marine Reserve			c. 500 pa	Dec

Table 2. Marine turtle foraging areas in South Africa

Area name	Description of site	Species feeding	Approximate number
KwaZulu-Natal	Rocky shores	<i>Chelonia</i> <i>Eretmochelys</i> <i>Lepidochelys</i>	Abundant Uncommon Rare
Eastern Province	"	"	"
South West Cape	"	"	"
		<i>Caretta</i>	Common
		<i>Dermochelys</i>	Common

Table 3. Marine turtles developmental habitat in South Africa

Area name	Description of site	Species present	Approximate number
KwaZulu-Natal	Rocky shores	<i>Chelonia</i>	Abundant

Figure 1. Leatherback nesting population numbers and remigration percent (refers to 56 km original protected area only)

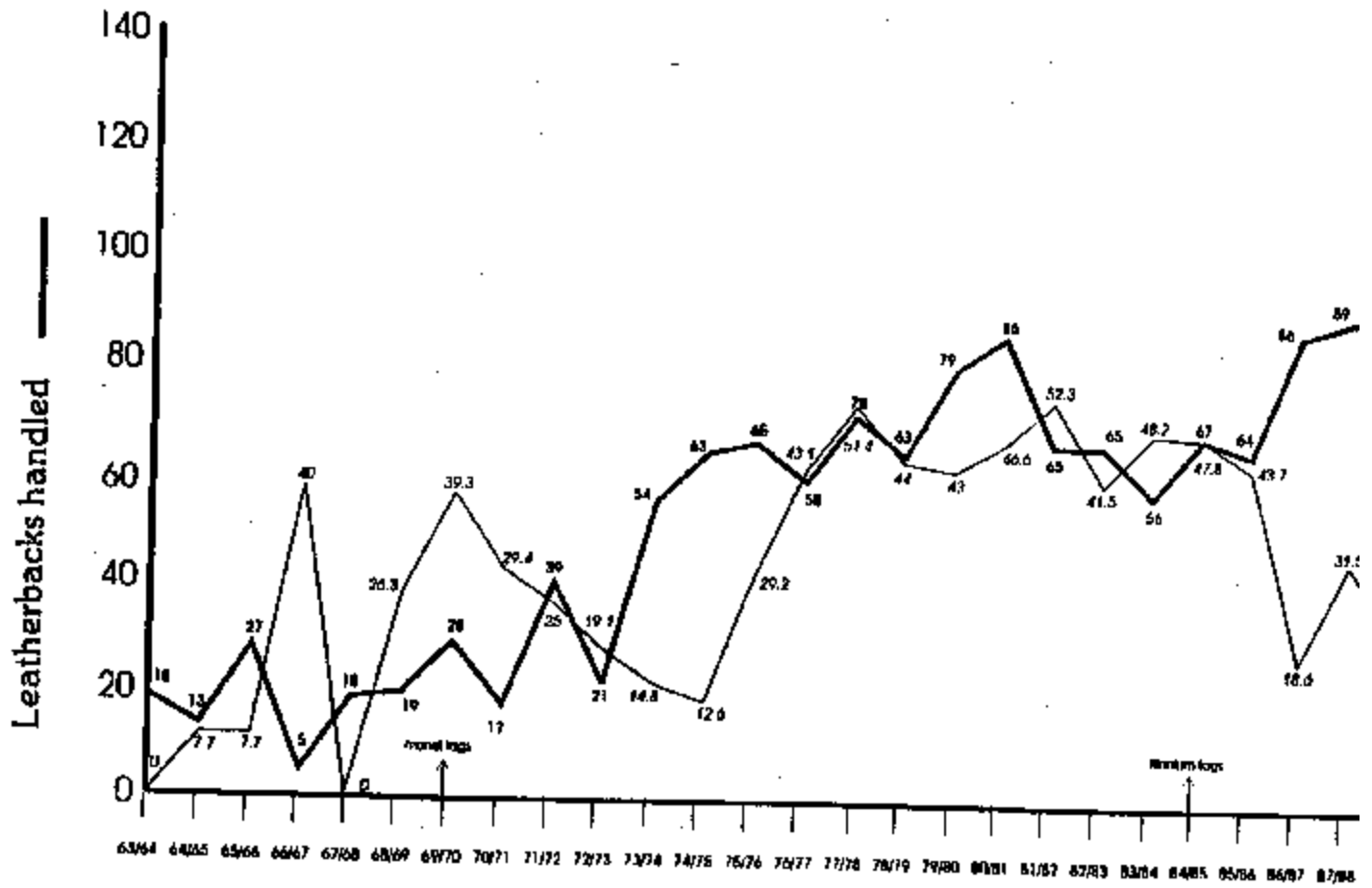
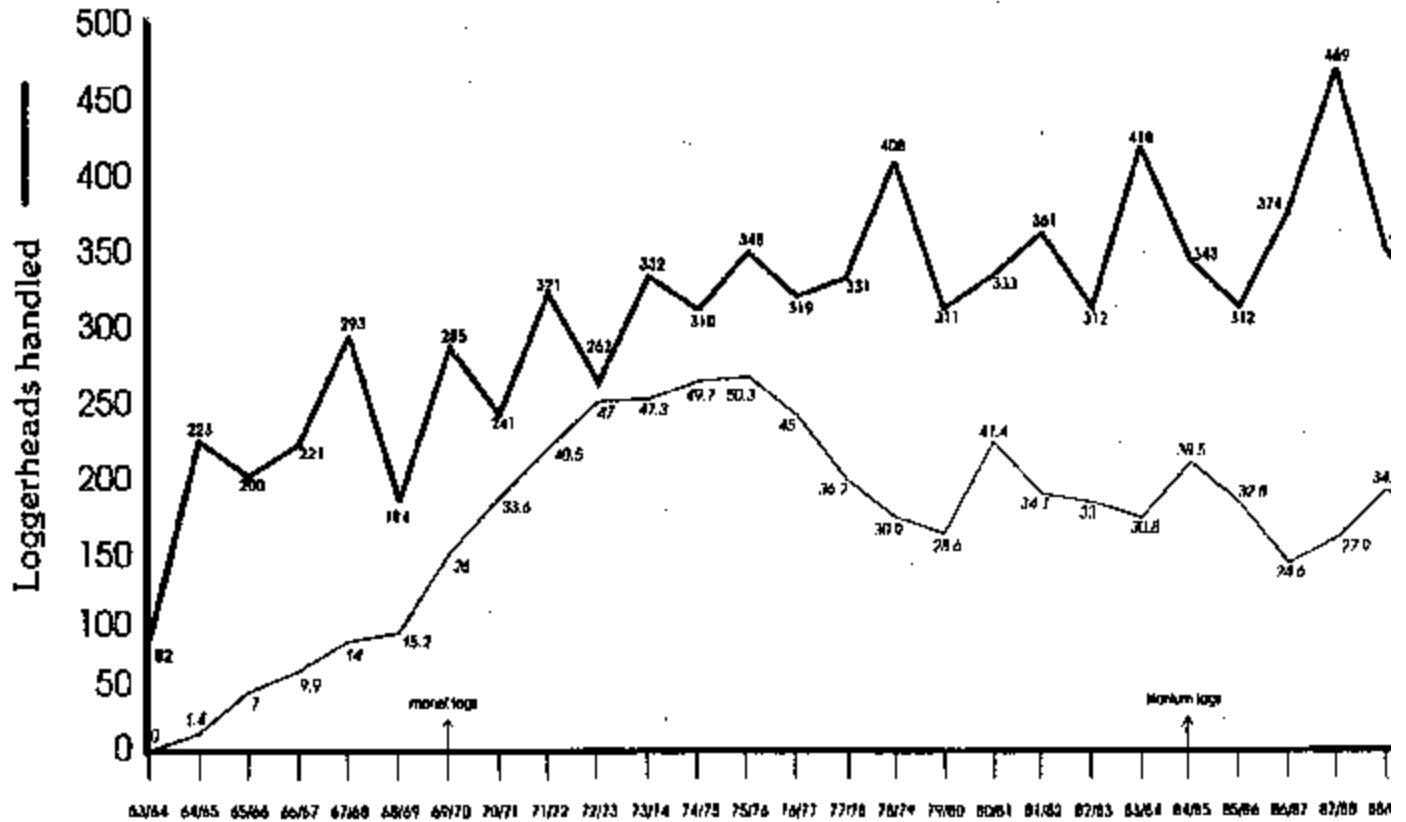


Figure 2. Loggerhead nesting population numbers and remigration percentage
(refers to 56 km original protected area only)



THE STATUS OF SEA TURTLE CONSERVATION IN THE REPUBLIC OF SEYCHELLES

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ABSTRACT

Both green turtles (*Chelonia mydas*) and hawksbills (*Eretmochelys imbricata*) nest throughout the Seychelles islands. Green turtles nest predominantly in the southern islands of Seychelles - especially at Aldabra, Assumption, Cosmoledo, Astove and Farquhar. Hawksbills nest most abundantly in the Granitic and Amirantes groups and at Platte and Coetivy Islands. Surveys conducted in Seychelles during the early 1980s estimated about 1,230 to 1,740 female hawksbills and 3,500 to 4,750 female green turtles nesting annually in Seychelles.

Greens and hawksbills forage widely in areas shallow enough to support seagrass pastures and coral reefs; hawksbills may also forage on deeper reefs. These habitats are abundant on the Seychelles Bank, Amirantes Bank and in shallow waters adjacent to the islands. Important juvenile foraging grounds exist for both species. Small numbers of loggerhead turtles (*Caretta caretta*) are regularly encountered foraging throughout the Seychelles, but have not been recorded nesting. The leatherback turtle (*Dermochelys coriacea*) which regularly forages in the pelagic waters of Seychelles nests on very rare occasions.

During the past two centuries populations of nesting turtle have been significantly reduced owing to harvesting. Legislation passed in 1994 provides complete protection for turtles and their eggs and forbids trade in turtle products. However, the law is difficult to enforce in the more remote islands and both green turtles and to a lesser extent hawksbills are still hunted for their meat. Nevertheless, export of hawksbill shell has been illegal since 1994 when a ban was imposed on the sale of hawksbill products within the Seychelles. Artisans were compensated for their economic loss and this ban is well enforced.

Aldabra Atoll and Cousine island were set aside as Nature Reserves in 1968. The protection afforded turtles there has been excellent and long-term monitoring has demonstrated significant increases in nesting activity at both islands. Since 1979, a degree of protection has been afforded turtles within the St Anne Marine Park, and at Curieuse, Aride and Cousin islands. Enforcement at all three sites has improved in recent years although poaching still occurs. Except for three documented cases of leatherback turtles being snagged by long-liners commercial fisheries in the Seychelles waters appear to pose little threat to turtles. Action priorities in Seychelles include campaigns to enhance public awareness and more effective programmes of law enforcement.

INTRODUCTION

Turtles have featured prominently in both the economy and traditional culture of Seychelles. Important revenues were provided by the export of green turtle calipee and of shell from hawksbill turtles. Turtles have been the subject of extensive legislation in the Seychelles (reviewed by Mortimer, 1984). The Seychelles turtle populations have also received considerable attention from scientists. One of the first serious studies on turtles conducted anywhere in the world is the excellent work produced by Hornell in 1927. Mortimer (1984)

Atoll (Hirth & Carr, 1970; Frazier, 1971; Stoddart, 1976; Gibson, 1979; Mortimer, 1985, 1988) and Cousin Island (Diamond, 1976; Garnett, 1979; Brooke & Garnett, 1983; Wood, 1986; Frazier, 1984; Mortimer, 1984; Mortimer & Bresson, 1994a, 1994b). Cousin Island is the site of the longest-running intensive monitoring programme of hawksbills. Hawksbill monitoring programmes have also been underway since 1980 at Curieuse Island, and since 1981 at the St Anne Marine Park and Aride Island. Nesting hawksbills have been monitored and protected at Cousine Island since 1993.

Although Seychelles still hosts some of the largest turtle populations remaining in the Indo-Pacific, this situation may not continue indefinitely. Permanent human settlement of the islands began in 1770, and within a span of only two centuries, the Seychelles populations declined significantly. The fact that relatively large numbers of turtles continue to nest in the Seychelles may be due in part to the extensive nesting and foraging habitat available to turtles in Seychelles - much of it located in remote uninhabited parts of the country. Unfortunately, the delayed onset of reproductive maturity in sea turtles can also give a false sense that the nesting population is healthier than it actually is (Mortimer, 1995). Although turtle meat remains a traditional food in Seychelles, Seychellois are increasingly aware of the vulnerability of their turtle resource. This is reflected in the comprehensive legislation now protecting turtles in Seychelles.

STATUS AND DISTRIBUTION OF MARINE TURTLES IN THE SEYCHELLES

Marine turtles found in Seychelles waters: The sea turtle species that breed in the Seychelles are the green (*Chelonia mydas*) and the hawksbill (*Eretmochelys imbricata*) (GEF, 1992). Foraging populations of both species are found throughout the Seychelles, and small numbers of foraging loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) are also regularly encountered in Seychelles waters (Mortimer, 1984).

General distribution in Seychelles waters: The green turtle was once plentiful in the northern granitic islands of Seychelles, but its breeding populations are now virtually extinct there and rare in the Amirantes Group. Its last wild refuge is on Aldabra where an estimated 800 to 2,000 females nest annually (Mortimer, 1988). Important smaller green turtle rookeries numbering several hundred females annually also occur elsewhere in the southern islands on Astove, Cosmoledo, Farquhar and Assumption islands (GEF, 1992). Green turtles forage throughout the Seychelles, although the foraging and nesting populations in the Granitic Islands have been greatly diminished (Fauvel, 1980). Important foraging grounds for both juvenile and adult green turtles still occur in the Southern Islands (especially at Aldabra) and in the Amirantes, and at Platte and Coetivy (Mortimer, 1984).

Hawksbills breed throughout the Seychelles. According to estimates made during 1981 to 1984 (Mortimer, 1984), the largest nesting populations occur in the Granitic Islands (where an estimated 500 to 900 females nest annually), the Amirantes, Desroches and Alphonse islands (with 300 to 500 females annually), and at Platte and Coetivy (200 to 400 females). During the same period an estimated 75 to 200 females nested annually in the southern islands (Mortimer 1984). Foraging habitat for both juvenile and adult hawksbills occurs throughout the Seychelles on fringing reef adjacent to islands and also on distant banks and shoals (Mortimer, 1984). The greatest expanses of suitable foraging habitat are found on the Seychelles and Amirantes Banks as well as in the vicinity of Platte and Coetivy. In

the southern islands good foraging habitat occurs in the immediate vicinity of each of the southern islands and at Wizard Reef.

Known population trends: The results of a three year long study conducted by Mortimer (1981-1984) indicate that green turtle populations of the granitic islands and the Amirantes group suffered a steady decline in numbers following human settlement of the islands in 1770 (Pridham, 1846; Fauvel, 1980; Mortimer, 1984). The organised exploitation of the species for calipee production, beginning at the turn of the century, caused a drastic decline in green turtles, particularly in the southern islands (Government of Seychelles, 1990; Frazier, 1984). Documented decline in green turtle nesting during recent decades in the Granitic Islands is apparently a response to the continued harvest of green turtles (Mortimer, 1984). Nevertheless, turtles have been well protected at Aldabra Atoll since 1968, and survey data gathered during the past 25 years indicate an increase in nesting activity there (Mortimer, 1985, 1988).

Hawksbills have been steadily exploited in Seychelles during the past two centuries for the tortoiseshell trade. Export statistics indicate a general decline in the population during the past 100 years (Seychelles Government Trade Statistics; Mortimer, 1984). Many of the outer islands (including Desroches, Poivre and D'Arros) formerly had larger populations of hawksbills that declined significantly by the end of last century (Dupont, 1929). Since 1979, hawksbills have been protected by law at the islands of Aride, Cousin, Cousine, Curieuse and South East Islands. But, high levels of poaching continued at most islands except Aldabra Atoll and Cousin Island. There is strong evidence that the numbers of hawksbills nesting at Cousin have increased since the island was acquired and protected by ICBP in 1968 (Mortimer & Bresson, 1994a).

Nesting beaches: Virtually all beaches in Seychelles provide breeding habitat for marine turtles. The highest density of hawksbill nesting occurs in the Granitic Islands, Platte and Coetivy islands, and the Amirantes, Desroches and Alphonse island groups. Because more than 99% of the human population resides in the Granitic Islands, and because Seychelles hawksbills nest primarily in the daytime, the Granitic Island turtle populations are particularly vulnerable to human exploitation, as are some at the outer islands that support human settlements. Hawksbills nest in low densities in the southern islands. At Aldabra, most of the hawksbill nesting occurs on beaches inside the lagoon while green turtles nest in large numbers on the outside (Mortimer, 1988).

Green turtles have been reported nesting on virtually every island in the Seychelles, with the highest densities in the southern islands. Green turtle populations appear to be declining at most islands except Aldabra Atoll. Due to its relative inaccessibility, Aldabra Island has retained a larger nesting population of green turtles than any other island in the Seychelles (Mortimer, 1985). The 2.5-3.0 km of available green turtle nesting grounds comprise some 50 beaches that are scattered along 83 km (Gibson, 1979) of inaccessible coastline. Aldabra was listed as a World Heritage Site in 1982.

Although turtles now enjoy complete legal protection throughout the Seychelles, varying degrees of enforcement occur within the Nature Reserves at Aride, Cousin, Cousine, and Curieuse Islands, and within the St Anne Marine Park. Turtles are well protected at Aldabra. The owners of D'Arros discourage turtle hunting.

Foraging/feeding grounds: Much of the Seychelles and the Amirantes banks provide suitable feeding grounds for both green and hawksbill turtles. In the southern islands, however, apart from the Wizard Reef, the only suitable feeding grounds are found immediately adjacent to the islands (Mortimer 1984). Aldabra and Farquhar islands both have good numbers of foraging hawksbill juveniles and adults (Groombridge, 1982).

Developmental habitat: The shallow waters of all the islands, and probably also the offshore shallow banks and shoals, harbor juvenile hawksbill and green turtles. Particularly large populations of juveniles occur at Aldabra (Mortimer, 1988), Farquhar (Groombridge, 1982), Poivre, Coetivy, Platte, as well as several other islands (Mortimer, 1984).

EXPLOITATION

Traditional uses of marine turtles and their products by local communities: Sea turtles have been an important resource to the inhabitants of Seychelles ever since the archipelago was first discovered in 1609 and permanently settled in 1770. Despite warnings about the dangers of overexploitation, exploitation and exportation continued virtually unchecked (Mortimer, 1984).

During the first two-thirds of this century, large numbers of green turtles were slaughtered in the Seychelles to produce a variety of products, of which calipee was the most important. Export was mainly to western Europe, notably England. Most of the turtles were taken from the southern islands, especially Aldabra, Assumption, Cosmoledo and Astove islands. This overharvest led to a drop in population levels (Frazier, 1974; Stoddart, 1976, 1984) and consequently a decline in calipee export (Mortimer, 1985).

The history of Assumption Island reveals overexploitation of green turtles (Frazier, 1975; Stoddart, 1976; Mortimer, 1985). In the early 1900s, as many as 200-300 females could be brought to the beach in one night (Hornell, 1927); and in 1927, about 1000 turtles were still being harvested annually (Dupont, 1929). Mortimer (1985) estimated that at the turn of the century, 6,000-8,000 green turtles nested each year on Aldabra alone.

There is a general feeling among Seychellois that a large number of green turtles that breed in the Seychelles are killed when they migrate to foraging grounds in the territorial waters of other nations (Mortimer, 1985). This argument was effectively employed in favour of the lifting of the 1968 ban on the killing of green turtles (Salm, 1976; Frazier, 1979).

Traditionally, Seychellois did not kill hawksbills for meat, because meat from this species is known to be occasionally poisonous (Mortimer, 1984). However, hawksbills have been harvested for shell in Seychelles for more than two centuries. During much of the present century virtually all the plastron ("bellies") and marginal ("hooves") scales were exported to Japan along with some of the carapace scales. A local curio industry worked the carapace shields into bracelets and various types of ornaments (picture frames, butterflies, etc) for local sale to tourists. Large numbers of hawksbill turtles were stuffed and sold to tourists and local residents as wall hangings. A law banning the sale of stuffed hawksbills was passed in 1979; the law has been effectively enforced since 1981.

Export of hawksbill shell is illegal, and in 1995 a ban on local trade in hawksbill shell was

Wild Animals (Turtles) Protection Regulations, 1994). Unfortunately, in recent years, people have begun killing large numbers of hawksbills for meat.

Local community knowledge of population trends: Most people are aware that the populations are declining.

Commercial and international trade in marine turtles and their products: There is no LEGAL trade in turtle products in Seychelles. Trade in turtle meat takes place clandestinely. Occasional shipments of hawksbill shell to Singapore have been intercepted by customs officials.

THREATS (MANAGEMENT CONCERNS)

Natural threats to nesting beaches: There are few natural threats to nesting beaches in Seychelles.

Egg collection by humans: Turtle eggs are rarely collected by people in Seychelles.

Fishery-related threats to turtles: The greatest fishery related threats to turtles are from tuna long-liners. Occasionally (on three documented occasions in recent years) leatherback turtles have been accidentally hooked by the skin.

Mechanised fisheries comprise long liners and purse seiners. No trawlers operate in the Seychelles.

Overseas fisheries: Purse seiners (Spanish and French); longliners (Taiwanese and Korean)

Other human-related threats: These include slaughter of green turtles and hawksbills for meat; occasional slaughter of hawksbills for shell; over-development of the coastline bordering nesting beaches; destruction of foraging habitats caused by dredging and land fill operations (especially along the east coast of Mahé); predation of eggs and hatchlings and disturbance to nesting females caused by feral animals on the nesting beaches. Dogs are a problem on some of the Nature Reserves in the Granitic Islands (i.e. St Anne, Moyenne, Cerf). Feral pigs released within the past three years are a problem on Cosmoledo and Astove. Feral cats are a problem on Aldabra.

In the Granitic Islands tourism-related activities such as swimming, boating, jet-skiing, and crowds on the beach during the day discourage hawksbill nesting.

MANAGEMENT STRATEGIES

Turtle management responsibilities: Division of Environment

Legal basis for turtle conservation and management: The legal basis for the management of turtle harvesting in the Seychelles is the Turtle Act of 1925. Although there have been amendments to this law, it was inadequate for present conditions (Mortimer, 1984).

In an attempt to fulfil its obligations to CITES, Seychelles passed a law in October 1977 which made it illegal for any person to buy, sell or preserve hawksbill turtles or parts thereof without a permit from the Ministry of Agriculture. This law was met with opposition by the curio dealers, and in 1978 the Government amended the regulation. As a compromise, the new regulation made it legal to take and stuff male hawksbills, but not females. At the same time, it set aside protected areas for female hawksbills at Aride, Cousin, Cousine, Curieuse, and Southeast Islands (Mortimer, 1984).

More effective legislation was passed in 1979; and it became illegal to kill any hawksbill turtles, male or female, within the protected areas. In addition, the 1979 regulations prohibit the sale, purchase or export of all stuffed hawksbill turtles regardless of sex. In 1981, in a further attempt to discourage exploitation of hawksbills, it was declared that only the parastatal company, Seycom, could export raw hawksbill shell.

In 1948, a six-month-long closed season (December to May) was established for female green turtles at Aldabra and Cosmoledo - S.I. No. 452 of 1948 (Seychelles Government, 1948). In 1962 a law (S.I. No. 29 of 1962) was passed making it completely illegal to kill female green turtles on some islands, and establishing a closed season for their slaughter on others. At Aldabra, the closed season was reduced to four months duration, from December to March (Seychelles Government, 1962).

In 1968, the same year that Aldabra was set aside as a Nature Reserve by the Royal Society, a total ban on the capture of green turtles was imposed. The ban was both unenforceable and unpopular. Hence, in 1976 it was replaced by a measure that allowed the taking of male turtles during the months from March through October. No green turtle products could be exported or sold in restaurants, and butchers could not sell more than 2kg of meat to any customer.

In the mid-1980s, a licensing system to regulate the capture of hawksbills was implemented, but proved to be ineffective in controlling the hawksbill harvest. Based on the discussions of the Mortimer study and on discussions during the September 1990 Technical Seminar to prepare the Environmental Management Plan of the Seychelles (EMPS), the issuance of licences to capture hawksbill turtles was stopped in December 1990.

In May and June 1993 a survey was undertaken by an economist from the Ministry of Industry with the assistance of an officer from the Bureau of Standards (Collie, 1995). Data were collected on the numbers of artisans, their ages, levels of education, earnings and taxes paid, the number of years they had been in the shell business, the size and facilities of their workshops, and the amount of turtle shell stock they had in their possession. Discussions were conducted with the artisans to determine what levels of compensation would be required to minimise the economic hardship to the artisans that would be caused by closing down the tortoiseshell industry and re-installing them into alternate livelihoods (Collie, 1995).

In mid-1994 in a closed meeting was held between officials from the Ministries of Environment, Industry and all the artisans, during which the precise details of the Compensation and Re-Installation Programme were spelled out. There would be a fixed lump sum of A\$5,714 compensation for those artisans who wanted to take it. Alternatively, artisans could choose a credit option which would give them access to financial assistance

earning powers but also enabled Government to limit excessive claims by insisting on using artisans declared tax records. An economist from the Ministry of Industry was appointed to assist the artisans in receiving their compensation according to their weighed stocks, their previous earning power and the outstanding tax owed to the Government. An important part of his work will be to help in the smooth transition into alternative projects by controlling and monitoring the funds so as to ensure complete accountability of all finances (Collie, 1995).

In 1994, the "Wild Animals (Turtle) Protection Regulations of 1994" banned the harvest of all sea turtles and the commercial utilisation of their parts (S.I. of 1994: Wild Animals and Birds Protection Act (CAP 143)).

Enforcement agency: The Division of Environment within the Ministry of Foreign Affairs, Planning and the Environment is ultimately responsible for enforcement of the laws and regulations. Seychelles Fishing Authority regulates the foreign fishing industries. SFA puts observers on some of the foreign vessels and does regular inspections of other vessels to check for infractions, such as the presence of demersal species amongst the catch.

International Treaties and Conventions:

Name of Convention	Yes	No
Convention for the protection management and development of the marine and coastal environment of the Eastern African Region and related protocols (Nairobi Convention)	Yes	
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Yes	
Convention on Biological Diversity	Yes	
The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)		No
International Convention on Prevention of Marine Pollution from Ships (MARPOL)	Yes	

Incorporation of international agreements into National Law: Only MARPOL

Limitations of the National Law with respect to marine turtle management: The legislation is comprehensive, but certain aspects of its enforcement are deficient.

Management strategies: The Seychelles Strategy for Sustainable Development (1990 - 2000) provides for the need to protect endangered sea turtles under the Marine Resources Management Programme. Proposed measures include enforcement of stringent and regulatory control measures on turtles caught and on shell trade; detailed stock assessment; and preparation and implementation of a management plan for the conservation of marine turtles (Government of Seychelles, 1990)

In the Environmental Management Plan for Seychelles (EMPS) (J.1, 1990 - 2000), a total

populations of marine turtles in Seychelles. This task is being undertaken by the GEF-financed turtle conservation programme which is intended to define the sustainable exploitation level for the green turtle to accommodate domestic consumption, and to carry out a feasibility study of hawksbill turtle ranching, a turtle trade compensation study, retrain and compensate artisans presently working on turtle shells, and produce educational materials for Seychellois and tourists on the consequences of trade in and purchase of turtle products (GEF, 1992).

Nesting beaches and turtle populations in protected areas: ALL turtle nesting populations are protected by law in Seychelles. Unfortunately, enforcement is effective only within the protected areas, and it varies from one location to another depending on geographic factors and human resources available.

According to the survey conducted by Mortimer between 1981 and 1984, the nesting populations were distributed in the following manner inside and outside the protected areas (Mortimer, 1984):

HAWKSBILL TURTLES:

Granitic Islands, and Bird and Denis islands:

Estimated total annual nesting females: 537-809
 Number nesting in protected areas: 159-229 (20-43% of the total)

Amirantes, Desroches, Alphonse, Platte and Coetivy Islands:

Estimated total annual nesting females: 515-890
 Number nesting in protected areas: 25-40 (3-8% of the total)

Southern Islands:

Estimated total annual nesting females: 85-155
 Number nesting in protected areas: 30-40 (19-47% of the total)

For all islands in Seychelles:

Estimated total annual nesting females: 1,137-1,854
 Number nesting in protected areas: 214-309 (12-27% of the total)

GREEN TURTLES:

Granitic Islands, and Bird and Denis islands:

Estimated total annual nesting females: 11-30
 Number nesting in protected areas: 0-1 (0-10% of the total)

Amirantes, Desroches, Alphonse, Platte and Coetivy Islands:

Estimated total annual nesting females: 109-260
 Number nesting in protected areas: 5-20 (2-18% of the total)

Southern Islands:

Estimated total annual nesting females: 3,415-4,465
 Number nesting in protected areas: 1,980-2,420 (44-71% of the total)

For all islands in Seychelles:

Estimated total annual nesting females: 3535-4755
 Number nesting in protected areas: 1985-2441 (42-69% of the total)

Local communities and turtle conservation and management. Efforts are being made to integrate the community into turtle conservation and management.

Traditional resource management practices and community-based turtle conservation

On-going turtle research: Monitoring, tagging and collection of biometric data is being conducted within protected areas, and surveys are being conducted outside protected areas.

MANAGEMENT NEEDS TO CONSERVE MARINE TURTLES

Institutional arrangements needed for turtle conservation

Responsibilities: Responsibility rests with the Division of Environment.

Staffing and training: Both areas need strengthening

Legislation: Already exists

Collaboration mechanisms among agencies: Greater collaboration is required with police and customs to enforce legislation.

Turtle protection needs

Control and mitigation of the impact of accidental capture in fisheries: This is probably not applicable.

National harvest: Better enforcement is needed to control the illegal harvest.

International harvest: Green turtles tagged on Aldabra have been recovered in Tanzania and Zanzibar.

Predator control: Feral animals need to be controlled or eradicated as appropriate.

Recreation and tourism: Recreational vehicles (jet skis, windsurfing, speedboats) need to be controlled and excluded from protected areas.

Community incentives and participation: Curio dealers should be compensated for lost revenue.

Public awareness and education: Efforts should be enhanced to raise public awareness through media including television, radio and newspapers.

Habitat protection needs

Conservation areas: Control of development adjacent to nesting beaches is needed.

Beach erosion control: Yes

Mitigation of lighting effects: This is needed on green turtle nesting beaches, but may not be a problem for hawksbills which nest diurnally.

Feeding ground protection: Yes

Integration into coastal development policies, planning and management: Yes

Management related research needs

Strengthening research capacity: Yes

Tagging: There is an established programme, currently being re-evaluated.

Stranding network: No network exists.

Determining causes of mortality: There is no expertise in this area, but purposeful harvest is usually obvious.

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Table 1. Marine turtle nesting areas in the Republic of Seychelles

Beach/area name	Beach length	Nesting Species	Total nests	Peak nesting season
¹ Aldabra Atoll	2.5 - 3.0 km	GT mostly; some HB	GT 4,500-11,800; HB 90-120	GT nest all yr, Jun-Sep/HB Se
Assumption		GT mostly	GT 480-720; HB 0-15	"
Cosmoledo		GT mostly; some HB	GT 1,680-2,175; HB 45-75	"
Astove		GT mostly; some HB	GT 900-1,800; HB 0-15	"
Farquhar		GT mostly; some HB	GT 1,200-1,350; HB 60-105	"
Providence/Cerf		GT mostly; some HB	GT 45-75; HB 60-125	"
St Anne Park/St Anne; Moyenne Cerf, SE Islands	<7 km	HB mostly; some GT	HB 270-375; GT <5	"
² Cousin	c. 1.5 km	HB mostly; some GT	HB 100-325; GT <5	"
Aride	<1 km	HB mostly; some GT	HB 15-30; GT <5	"
Curieuse	<5 km	HB mostly; some GT	HB 60-90; GT <5	"
Mahe		HB mostly; some GT	HB approx 525; GT <5	"
Praslin		HB mostly; some GT	HB approx 200; GT <5	"
La Digue		HB mostly; some GT	HB approx 200; GT <5	"
Other granitic Islands		HB mostly; some GT	HB approx 420; GT <5	"
Bird + Denis		HB mostly; some GT	HB approx 60; GT 10-20	"
Platte & Coetivy		HB mostly; some GT	HB 630-1110; GT 30-50	"
Amirantes		HB mostly; some GT	HB 675-1140; GT 150-420	"
Desroches; Alphonse group		HB mostly; some GT	HB 240-420; GT 90-210	"

Based on estimates made by Mortimer in 1981-1984 of numbers of nesting females assuming 3 nests per female. In fact, however, di killed before nesting successfully.

1 From Mortimer, 1988; 2 From Mortimer and Bresson, 1994a (based on 1986-1994 estimates)

Table 2. Marine turtle foraging areas in the Republic of Seychelles

Area name	Description of site (seagrass, coral reef, algae, other - specify)	Species feeding	Approx. numbers
All shallow water areas in the country including Mahe bank and the Amirantes bank	Seagrass and Algae	Green turtle	several thousands
All shallow and some deeper water areas in the country including Mahe Bank and the Amirantes Bank	Reefs (both coral reef and deep water?) Seagrass flats	Hawksbill	several thousands

THE STATUS OF SEA TURTLE CONSERVATION IN MADAGASCAR

COMPILED BY CHARLES MBINDO

INTRODUCTION

All five species of sea turtle found in the western Indian Ocean are known from Madagascar's coastal waters, namely, the green, hawksbill, loggerhead, olive ridley and leatherback (Rakotonirina & Cooke, 1994). All but the leatherback have been reported to nest here.

Petit (1930) reported the importance of turtles in Madagascan fisheries and noted that population declines were already evident. Hughes (1974) pointed to the apparent decline in numbers of the hawksbill turtle and the disappearance of its nesting sites. Rakotonirina (1987) reported decline in numbers and nesting occurrences for green, loggerhead and hawksbill turtles. Groombridge and Luxmoore (1989) carried out a comprehensive review of the available literature on green and hawksbill turtles and observed the virtual lack of data on nesting sites for either species. There is very little published information on leatherbacks. Rakotonirina and Cooke (1994) carried out a study to establish the status of sea turtles in Madagascar in 1989, and subsequently, around Toliara in 1992.

STATUS AND DISTRIBUTION OF MARINE TURTLES IN MADAGASCAR

Marine turtle species found in Madagascan waters: Five species of sea turtle are known from Madagascar's coastal waters: green turtle *Chelonia mydas*, hawksbill turtle *Eretmochelys imbricata*, loggerhead turtle *Caretta caretta*, olive ridley *Lepidochelys olivacea* and leatherback *Dermochelys coriacea* (Rakotonirina & Cooke, 1994).

General distribution in Madagascan waters: Except along the mid-eastern coast where all five species are sparse or absent, green and hawksbill turtles are widely distributed, with the hawksbill extending down the north-east coast to Masoala Peninsula. The olive ridley is less common, but has a similar distribution to the hawksbill turtle while the loggerhead turtle is found around the southern half of the island from north of Taolagnaro round to Morondava on the west coast. Leatherback distribution is similar to that of the loggerhead but sparser and offshore (Hughes, 1974).

Nesting Beaches: Four species of sea turtles are known to nest on Madagascar (Hughes, 1974). During surveys conducted in 1989/1992 (Rakotonirina & Cooke, 1994), the green turtle was found to be the most common nester, especially around Toliara, Mahajanga and Antsiranana. Nesting numbers seem to be decreasing, with a marked decline in some areas. For instance, no green turtle was reported to have nested on the Island of Nosy Ve, which officially has been a protected nesting site since 1987 (Rakotonirina & Cooke, 1994).

The hawksbill nests on the same sites as the green turtle but in lesser numbers.

Hughes (1974) noted that though good numbers of hawksbills nest

A stable nesting population of up to 20 loggerheads was reported on beaches north of Taolagnaro, with relatively small numbers around Mahajanga and Toliara (Rakotonirina & Cooke, 1994). Groombridge (1982) estimated an annual nesting population of about 300 loggerhead females.

The favourite nesting site for the olive ridley is along the coast of Morondava (Rakotonirina & Cooke, 1994). However, though nesting has been recorded in the northwest, no large-scale nesting is known, and reports indicate presence of a feeding population only (Groombridge, 1982).

There is no evidence of any leatherback turtle nesting on Madagascar (Rakotonirina & Cooke, 1994).

All turtle species nest during the southern summer (October to January). Recent interviews with fishermen indicate a reduction in nesting numbers for all species (Rakotonirina & Cooke, 1994).

Feeding/Foraging Grounds: All five species of sea turtles feed around the entire Madagascan coast, except for the leatherback which is confined to the south and western coasts (Taolagnaro, Toliara and Morondava). Common feeding grounds for the green turtle are off Toliara, Mahajanga and Antsiranana. Large feeding populations are found of hawksbills off Antsiranana, and of loggerheads off Toliara and Taolagnaro. The olive ridleys feed extensively on grounds between Morondava and Mahajanga (Hughes, 1974; Rakotonirina & Cooke, 1994).

Developmental Habitat: No information

EXPLOITATION

Traditional uses of marine turtles and their products by local communities: Sea turtle hunting in Madagascar is a long-established economic activity with cultural traditions. Traditionally, ritual practices were performed during turtle slaughter, and turtle meat was eaten only by the hunter's family and selected villagers. These rituals are still practised by older fishermen in remote areas. Egg collection has virtually ceased with the decline in nesting. In the Mahajanga region, green turtle excrement is used in chicken feed to eliminate intestinal parasites (Rakotonirina & Cooke 1994).

Green, olive ridley and loggerhead turtles are sold primarily for their meat, although some green turtles are stuffed and small carapaces are sold as ornaments. At Toliara and Mahajanga meat is the most important turtle product. Most tortoiseshell products are of hawksbill scale from Antsiranana and are sold in shops in Antananarivo, where turtle meat is little known. Antsiranana is a traditionally Muslim area where turtle meat is not eaten, though raw green turtle meat has started to find a market there (Rakotonirina & Cooke, 1994).

Most hawksbills are taken by the Vezo people in the southwest, hunting also occurs in the northeast, but northwest populations suffer less exploitation. It is estimated that over 2 500 hawksbills are killed annually, mostly juveniles of less than 40cm length.

In recent years, exploitation of hawksbill turtles for tortoiseshell has declined in economic importance. However, the trade still survives and could well be revived by an influx of tourists to Madagascar as economic conditions improve (Rakotonirina & Cooke, 1994).

MANAGEMENT STRATEGIES

Legal basis for turtle conservation and management: Decree 23 of May 1923 prohibited the capture of nesting females and individuals with carapace diameters of less than 50cm, measured beneath the plastron. Decree 24 of October 1923 declared protected nesting sites on the islands of Nosy Anambo (Diego Suarez), Nosy Iranja (Nosy Be), Chesterfield (Morondava), Nosy Trozona and Nosy Ve (Toliara), and Europa. These laws do not appear to have been enforced and only Europa (now a French territory) is protected.

Madagascar ratified the Convention on International Trade in Endangered Species of Wild Fauna and Flora in 1975 (Decree 75-014). Decree 88-243 of 1988, while specifically naming only the leatherback, appears to grant all marine turtles absolute protection from exploitation. This law is not enforced for domestic exploitation and is inconsistent with the granting in some areas of licences to sell turtle meat.

International Treaties and Conventions

Name of Convention	Yes	No
Convention for the protection management and development of the marine and coastal environment of the Eastern African Region and related protocols (Nairobi Convention)		No
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Yes	
Convention on Biological Diversity	Yes	
The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	Yes	
International Convention on Prevention of Marine Pollution from Ships (MARPOL)		No

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THE STATUS OF SEA TURTLE CONSERVATION IN MAURITIUS

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with additional information provided by
ROSELLE CHAPMAN

ABSTRACT

Two species of turtles are reported to occur and nest around Mauritius - the green turtle (*Chelonia mydas*) and the hawksbill (*Eretmochelys imbricata*). The population status of these two species is not known, but populations are believed to be heavily depleted as a result of irrational exploitation of turtles and their eggs. This is now illegal, but enforcement of the law is inadequate. Nesting beaches and turtles continue to be threatened and need to be the focus for conservation efforts, in particular through the establishment of protected areas or reserves. Accidental catch by trawlers is a second issue which needs to be addressed.

INTRODUCTION

Two species of marine turtles are commonly encountered in the shallow coastal waters of Mauritius, the hawksbill (*Eretmochelys imbricata*) and, less frequently, the green (*Chelonia mydas*). The hawksbill has in the past been freely hunted for its eggs and shell, while the green turtle has been exploited for meat, fat, cartilage, and skin, as well as eggs. The turtles are especially vulnerable during nesting period while on land. Marine turtles are protected in Mauritius under the 1980 Fisheries Act which bans hunting of turtles.

STATUS AND DISTRIBUTION OF MARINE TURTLES IN MAURITIUS

Marine turtle species found in Mauritian waters: Of the five turtle species known in the western Indian Ocean, two the green (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*) are common in Mauritian waters.

Known population trends: Population trends are not known, but populations of both species are believed to be declining.

Nesting beaches: Nesting beaches for green and hawksbill turtles are found around Mauritius, St Brandon, Agalega, and on the Mascarenes. Nesting peaks in summer.

Foraging/feeding grounds: Foraging and feeding areas take place in seagrass, algae and reef areas around Mauritius, Agalega, St Brandon and the Mascarenes.

Developmental habitat: Developmental habitats are believed to be similar to feeding and foraging grounds.

EXPLOITATION

Traditional uses of marine turtles and their products by local communities: The hawksbill has traditionally been exploited for its shell and eggs, the green for meat, eggs, fat (for oil

traditional cure for asthma in children in the Creole community. One spoonful per day for a week is prescribed, and it seems that a new turtle is killed each day rather than letting blood from one live one.

Local community knowledge of population trends: Populations are known to be declining. Fishermen consider turtles to be rare and valuable. Although no fishermen go out specifically hunting turtles they are almost always killed when encountered. Many elders in the communities remember when nesting turtles were a common sight on some beaches. The last recorded turtle nesting attempt on mainland Mauritius was in the mid-70s.

Commercial and international trade in marine turtles and their products: Port Louis market appears to be the centre of trade for stuffed turtles, turtle shells and processed products such as jewellery. Many hotel gift shops also stock processed products. Traders offer to pack the stuffed turtles and shells in special boxes for overseas travel. The number of turtles passing through the market is unknown but one local taxidermist stated he processes approximately 1000 turtles per annum. The traders say that all of the turtles are caught in Mauritius and that the jewellery and other crafts are produced locally. When questioned on the legality of their trade they say that they are clearing their stock but nevertheless deliberately mislead tourists into believing that it is all legal and that they will have no problems taking things home.

THREATS (MANAGEMENT CONCERNS)

Natural threats to nesting beaches: Turtle nests are threatened by storms and high seas, and nesting beaches in general by erosion. Predation by crows and exotic mammals is also a threat.

Egg collection by humans: This has ceased on mainland Mauritius since the last recorded turtle nesting attempt here was in the mid-70s. It is suspected that eggs are still collected from St Brandon.

Fishery-related threats to turtles: Fisheries do present a threat - in particular trawlers. This has not been quantified.

Other human related threats: Other threats are pollution in general, and in particular oil spillages, sand mining and hotel development.

MANAGEMENT STRATEGIES

Turtle management responsibilities: Fisheries Department

Legal basis for turtle conservation and management: Fisheries Act of 1980.

Effectiveness of existing turtle protection mechanisms: The law allows shopkeepers to sell off their existing stock of turtle products. Since no catalogue of their stocks was ever made, this loophole enables them to replenish stocks freely and continue trading. Turtles are regularly caught by fishermen and prosecutions are uncommon.

Agency responsible for enforcement: The Protection Service of the Ministry of Fisheries

International Treaties and Conventions

Name of Convention	Yes	No
Convention for the protection management and development of the marine and coastal environment of the Eastern African Region and related protocols (Nairobi Convention)		No
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Yes	
Convention on Biological Diversity	Yes	
The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)		No
International Convention on the Prevention of Marine Pollution from Ships (MARPOL)	Yes	

Incorporation of international agreements into National Law: Some have been incorporated.

Limitations of the National Law with respect to marine turtle management, and their resolution: The Law is adequate but not fully enforced.

Nesting beaches in protected areas: Protected areas are being created in Bluebay/Le Chaland on the south-east coast and Balaclava on the north-west coast.

Traditional resource management practices and community-based turtle management potential: There is potential for more involvement of communities in turtle management efforts. Fishermen in some areas have expressed concern over the decline in turtle numbers, and a desire to help conserve the turtle populations (Chapman, pers. comm.).

On-going turtle research: There is ongoing research on growth rates of green turtles (captive) at the Albion Fisheries Research Centre. A comparative study is being carried out of length/weight ratios of turtles at AFRC and those from Agalega.

MANAGEMENT NEEDS TO CONSERVE TURTLES

Institutional Arrangements Needed for Turtle Conservation

Responsibilities: The Ministry of Fisheries, through the Albion Fisheries Research Centre, should be responsible for research concerning the conservation of turtles at all life stages.

Staffing and training: Scientific staff require training.

Legislation: The law needs to be altered to stop the trade of turtle products immediately. Surveillance should be increased and breaches of law followed up with prosecutions.

Collaboration mechanisms among agencies: Collaboration concerning conservation of turtles should be sought with other institutions and NGOs.

Turtle Protection Needs

Control and mitigation of the impact of accidental capture in fisheries: Strict controls are required to avoid accidental capture. All trade needs to be stopped. Predation, and recreation are not current issues in Mauritius but will be if nesting incidences increase.

Community incentives and participation: Communities and in particular fishermen should be integrated into formulation of management strategies for turtle conservation.

Public awareness and education: All marine conservation issues need to be addressed in schools and fishing communities. A strong education programme should be integrated into the development of Mauritius' marine parks. Tourists need to be made aware of the international laws involving the trade in turtle products. When questioned many believe that because they are so openly for sale this must be legal. The main airline operators could play an important role through inflight entertainment - Air Mauritius already has an informative video about the conservation of endemic Mauritian birds.

Habitat Protection Needs

Habitat protection needs are considerable, including designation of conservation areas, control of beach erosion, mitigation of lighting effects, protection of feeding and nesting grounds, and integration into of turtle conservation efforts into coastal development policies, planning and management.

Management Related Research Needs

Research capacity needs to be strengthened, and systems designed for regular tagging, determination of causes of mortality, as well as a stranding network. Any nesting sites on mainland Mauritius and its outer islands needs to be identified and areas appropriately managed. The relocation of nests to predator free areas should be considered. Old records of nesting attempts should be combined with local knowledge to establish where turtles used to nest. The status of turtles on St Brandon needs to be researched. It is known that its beaches are a popular nesting ground for turtles but the species and numbers involved are unknown. It is also known that this population is exploited by the visiting fishermen.

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THE STATUS OF SEA TURTLE CONSERVATION IN THE COMOROS

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ABSTRACT

Two of the five species of Indian Ocean turtles are known to nest in the Comoros: the green and hawksbill turtles. Two other species - the leatherback and loggerhead - may occur. There is a significant green turtle population around Moheli. Nesting beaches have been lost through erosion and sand mining, but nesting still occurs on Moheli and Mayotte. There are rich feeding areas around Mayotte. Trade in turtle meat and products is illegal and uncommon, but Anjouan fishermen pose a significant threat to turtles around Moheli owing to the easy access afforded by motorised vessels.

Environmental policy and legislation are well advanced, and the Comoros has ratified a number of international treaties and conventions relating to the environment. There is also a high level of environmental awareness and motivation in the community. In Moheli, turtles are regarded as a threatened species which should be conserved, not least as a tourist attraction.

INTRODUCTION

There has been little biological research in Comoros, but Benson (1960) provided a useful summary of early work. The importance of the turtle populations of the Comoros was first noted during surveys conducted on the Islands of Grande Comore, Mohéli, Anjouan and Mayotte between January and July 1972, and again in May/June 1973 (Frazier, 1985).

The J.L.B. Smith Institute of Ichthyology Expedition to the Comoros in November 1987 included studies of turtles (Hughes, 1988; Bruton *et al.*, 1989).

From January to November 1991, a Turtle Protection Plan (submitted by the Director of Tourism for the Comoros) was carried out with funding from the World Food Programme. Ten guards patrolled beaches in isolated areas and collected statistics on turtles (Mortimer, 1993).

Noguera & Woodworth (1991) reported their observations of apparent over-harvest of turtles in the Comoros and local efforts to control it.

STATUS AND DISTRIBUTION OF MARINE TURTLES IN THE COMOROS

Marine turtle species found Comorian waters: Two species of sea turtles are known to nest in the Comoros; the relatively abundant green turtle (*Chelonia mydas*), and the rare hawksbill (*Eretmochelys imbricata*). Adults and juveniles of both species also forage in offshore waters. The Archipelago has one of the most important populations of green turtle in the Indian Ocean, though nesting is limited to Mohehi.

Other species that may occasionally occur in the vicinity of the islands are the leatherback (*Dermochelys coriacea*) (Frazier, 1985) and the loggerhead (*Caretta caretta*) which has been reported in the southern islands of Seychelles (Mortimer, 1984).

Known population trends: There has been a decline in the number of turtles since 1972, mainly as a result of uncontrolled hunting out of Anjouan. Fishermen are able to cross to Mohéli as a result of the introduction of motorised craft. Some eight hundred turtles are killed each year (Noguera & Woodworth, 1991).

Nesting Beaches: Groombridge (1982) estimated a total green turtle nesting population of 1,980 on the Comoros, of which 1,850 nested on Mohéli. Hawksbill turtles nest in lower densities, but possibly 50 females nest annually on Mohéli and around 25 on Mayotte.

On Grand Comore, Frazier (1985) reported 43 suitable nesting beaches (totalling about 10 km in length) of which only four showed evidence of turtle nesting in 1972 and 1973. Nesting seems to be lowest on this island largely because most of the beaches have been destroyed by erosion and sand mining.

At Anjouan, Frazier reported only 14 beaches (totalling about 6.5 km), and some of these were without sand. A small amount of nesting was reported by Hughes (1988). Today, fewer beaches are available for nesting due to erosion and intensive mining of sand (Mortimer, 1993).

Mohéli has more beaches suitable for nesting as it is geologically older and has suffered less human disturbance than either Grand Comore or Anjouan owing to poor accessibility (Mortimer, 1993). Frazier (1985) described 89 separate beaches totalling about 26.3 km in length. Of those, 40% (25% of the total beach length) showed signs of nesting activity in 1972-73, and Frazier calculated a total of 1,800 nesting females annually.

On Mayotte, Frazier (1985) recorded more than 137 beaches with a total length of 27 km. Frazier estimated that fewer than 600 female green turtles nested annually during 1972 and 1973. Large numbers of these animals were slaughtered on the nesting beaches and were thus prevented from laying the 1,800-2,400 egg clutches they might otherwise have produced.

Green turtles nesting in the Comoros appear to share the same seasonal pattern as those at Aldabra Atoll only 400 km away, with some nesting during every month of the year and a seasonal peak during the southeast monsoon (May through August) (Frazier, 1982; Mortimer, 1988). Noguera and Woodworth (1991) claimed that their informants also consistently reported the months of May through August as the peak nesting period.

Mortimer (1993) reports further evidence that nesting reaches a peak during the southern winter. In the same study, a higher nesting density was observed in May 1992 than that reported by Noguera and Woodworth (1991) five months earlier in December. In 1972, nesting activity increased between the months of February and June (Frazier, 1985).

Hawksbill turtle nesting in the Comoros reportedly peaks during the months of November through March (Frazier, 1985; Bonnet, 1986). This coincides with the hawksbill nesting season in the Seychelles (Mortimer, 1984).

Foraging/Feeding Grounds: The coastline drops abruptly to the sea bed within a few kilometres of the shore limiting the development of seagrass and coral reef. Much of these habitats (especially on the Grand Comore and Anjouan) have been overexploited or destroyed by the use of explosives and poisons to catch fish and invertebrates (Bruton *et al.*, 1989). The richest feeding habitat for both green and hawksbill turtles is found in the waters off Mayotte with extensive and complex barrier reefs and some 100 km² of seagrass beds. Both green and hawksbill turtles forage in the vicinity of all four islands of the Comoros Archipelago (Frazier, 1985).

Developmental Habitat: Little is known, but suitable habitat is presumably available around Mohehi.

EXPLOITATION

Traditional uses of marine turtles and their products by local communities: Most people in Comoros are Moslems and as such are usually subject to dietary restrictions. While traditionally people from Mohéli and Grand Comore do not eat turtle meat, and those from Anjouan do, there is some consumption of turtle meat on all three islands. The people of Mayotte are largely Moslems of Malagasy ancestry with few dietary restrictions and a long tradition of eating turtles. Frazier (1985) notes that although Comoros have one of the largest *Chelonia* nesting populations in the eastern Africa area, there is no organisation for slaughtering, preparing, transporting and marketing turtle products.

In 1972 and 1973 Frazier observed that the turtles of Mayotte were severely over-harvested, and that more than 90% of the females breeding on Mayotte were killed during the nesting season (Frazier, 1985). Hunting pressure on Mohéli was observed to be much lower than at Mayotte. Frazier concluded that prevailing levels of harvest did not pose a significant threat to turtle populations of Mohéli.

Mortimer (1993) concluded that rates of green turtle slaughter on Mohéli had increased due to the influx of people from Anjouan whose traditional diet includes turtle meat; and the introduction, by the Japanese, of the sea-going japawa boats that have enabled the development of trade in live turtles. It is worth noting that, apart from in the coastal villages of Bimbi, Kavani, Sima, Wani, and Mironsi, few Anjouans consume turtle meat unless for medicinal purposes.

There are also widespread reports of unsophisticated and wasteful slaughter techniques, with 75% of the turtle, including easily accessible meat, often discarded (Frazier, 1985). Turtle eggs are also commonly eaten especially by people from Anjouan (Noguera & Woodworth, 1991).

This practice is continuing despite the mobilisation of associations to protect the environment.

Commercial and international trade of marine turtles and their products: Reports indicate that there has been some trade in hawksbill shells, though no records exist that document significant export of hawksbill shell from the Comoros (Milliken & Tokunaga, 1978). Nevertheless, evidence that the hawksbill population in the Comoros has declined during

Comoros or in another country to which the turtles migrate at some stage in their life cycle (Mortimer, 1993). Hawksbills captured by fishermen are often prepared as mounted specimens and sold to tourists or used as wall ornaments in Comorian homes.

The importance of turtle trade in the Comoros is often overshadowed by the greater volume of trade from neighbouring states (Frazier, 1985).

THREATS (MANAGEMENT CONCERNS)

Natural threats to nesting beaches: There is widespread evidence of predation of hatchlings by crabs, bird such as frigates, grey herons and crows, feral dogs and civets. Beaches undergo serious erosion in the rainy season (January- February) as a result of gales and heavy runoff.

Egg collection by human: Eggs are collected by turtle meat eaters when they fail to catch a live animal.

Fishery-related threats to turtles: Use of fishing nets may threaten turtles, but is banned by many village associations. Use of dynamite and poisons in fisheries is also a threat. Motorised fishing craft also present a threat by enabling Anjouan turtle hunters to reach Mohéli.

Overseas fisheries: No other nations are reported to fish in Comorian territorial waters, but larger vessels have been observed offshore.

Other human-related threats: Other threats to turtles include the use of beaches for domestic waste disposal, sand mining, deforestation of coastal areas with associated increase in beach erosion, and pollution by tanker traffic.

MANAGEMENT STRATEGIES

Turtle management responsibilities: The Minister of Development, through the Direction Générale de l'Environnement (DGE) is responsible for the implementation of the National Environment Policy and Action Plan in collaboration with relevant national institutions and under the coordination of an Interministerial Consultative Committee on the Environment (CICE). The DGE is primarily responsible for protection of turtles, and for village associations.

Legal basis for turtle conservation and management: In the Comoros, community level activities are largely controlled by local NGOs which have authority over areas such as health, agriculture and environment. In Mohéli for instance, several village associations have become involved with turtle protection, and sensitivity is rising regarding the issue of influx of people from Anjouan to harvest turtles from Mohéli.

Resolution J.O 17/11/23, p. 865. of 24 October 1923 prohibited the capture of marine turtles when nesting or when the carapace was not greater than 0.5 m wide (as measured across the plastron) (Hughes, 1971). This legislation was enacted in Madagascar when the

islands. In any case it seems never to have been applied, but it may be of little value to protect small animals exclusively (Frazier, 1984).

Presidential Decree No. 79-012 of April 1979 forbids the capture of sea turtles in the territorial waters of Comoros, with a penalty of F 25,000 fine, eight days in prison, and automatic seizure of all turtles in the possession of the offender. Live turtles siezed are released, and dead or mortally injured turtles destroyed by incineration (Attoumane, 1991; Bonnet, 1986).

Interministerial decree No. 92-015 of March 1992 forbids the fishing of shells and corals and the capture of turtles, as well as their commercialisation, throughout the whole of the national territory, and in particular in those areas classified as marine reserves (Mortimer, 1993).

Framework environmental law was adopted in 1994.

Enforcement agency: Local and national police forces are responsible for enforcement of these laws. Village associations have also played a part in reporting violations to the police. Laws need to be more strongly enforced engaging and equipping a unit to undertake policing between islands.

International Treaties and Conventions

Name of Convention	Yes	No
Convention for the protection management and development of the marine and coastal environment of the Eastern African Region and related protocols (Nairobi Convention)	Yes	
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Yes	
Convention on Biological Diversity	Yes	
The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	Yes	
International Convention on Prevention of Marine Pollution from Ships (MARPOL)		No

Local communities and turtle conservation and management: Regional services have worked in close collaboration with village associations to raise awareness, and in Mohehi village associations have undertaken to patrol beaches. A participatory approach was integral to the National Environment Strategy and Action Plan, and communities, NGOs and other organisations were fully involved in decision making for the national strategy for sustainable development, as well as in follow-up activities.

Traditional resource management practices and community-based turtle management potential: A strong tradition of village organisation in communities and associations exists, and is motivated to address environmental issues. This is exemplified by Ulanga - an

On-going turtle research: Peace corps volunteers on Mohéli are working with associations of Itsamia and Hoani to develop a system of recording and tagging turtles, and recording evidence of nesting.

MANAGEMENT NEEDS TO CONSERVE MARINE TURTLES

Institutional arrangements needed for turtle conservation

Responsibilities: Comite National de Coordination du Developpement Durable (CNCD), Direction Générale de l'Environnement, Direction de Tourism, Centre Nationale de Documentation et de Recherche Scientifique (CNDRS), village associations, local and national police, Special Unit charged with environmental protection (coastal, forest etc).

Staffing and training: Training is required for those responsible for turtle management and for village associations. Workshops and a programme to educate and raise awareness of the general public about turtles would be valuable.

Collaboration mechanisms among agencies: International collaboration to study turtles on a regional basis, and in the high seas, would be valuable.

Turtle protection needs

National and international harvest: A unit needs to be assigned responsibility for policing the activities of fishing boats, and enforcing legislation relating to turtles.

Predator control: Prevention of predation of eggs and young turtles should be the responsibility of those charged with law enforcement.

Recreation and tourism: Tourists should be prevented from disturbing turtles during observation.

Community incentives and participation: Communities need to participate fully in environmental protection, including the conservation of turtles, and organisations such as Ulanga should be encouraged and assisted in their operations.

Public awareness and education: Awareness should be raised through events organised by the Ulanga associations, and by media campaigns directed at the general public.

Habitat protection needs

Conservation areas: Nesting beaches and other important turtle habitat should be protected. Turtle habitats will be protected by the creation of a marine reserve at Nioumachoua in the near future.

Fisheries threats: In particular, use of dynamite and poisons by fisherman and need to be controlled.

Integration into coastal development policies, planning and management: Coastal

coordinated manner to ensure compatibility and avoid duplication of effort. Broader issues of relevance to turtle conservation, such as control of coastal erosion and of the extraction of corals to produce lime, may be addressed in this way.

Management related research needs

Strengthening research capacity: Links should be established with other institutions with experience in turtle research, initially in neighbouring countries.

Tagging: A system of tagging should be developed building on the experience of the peace corps work in Mohéli to establish a team of field workers.

Stranding network: A network should be established to facilitate coordination of efforts to minimise turtle mortality.

Determining causes of mortality: Causes of mortality and their significance need to be investigated in a systematic manner.

CONCLUSIONS

Two species of turtles, the green and hawksbill are known to nest in the Comoros. Two other species - the leatherback and loggerhead - may occur around the islands. The turtles are threatened, and significant numbers are now seen only in Mohéli and Mayotte.

Steps have been taken to conserve turtles, including raising community awareness, development of national legislation, and accession to international treaties and conventions. Further encouragement and logistical support for enforcement are needed to ensure the survival of the turtles in Comorian waters.

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THE STATUS OF SEA TURTLE CONSERVATION IN FRENCH TERRITORIES OF THE INDIAN OCEAN : MAYOTTE

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ABSTRACT

The French overseas territories in Indian Ocean are made up of La Réunion, Mayotte and the Iles Eparses (Scattered Islands). Since 1976, Mayotte has a political status of "French Local Collectivity". French laws for environment protection (1976) are not applicable but a government ordinance (1991) allows several legal adjustments in this country. Since January 21th, 1977, a local decree has protected marine turtles and their eggs. CITES is in force in Mayotte but the Ministry of Environment in Paris is responsible for management.

A programme was established three years ago in Mayotte, dealing with the study and the protection of *Eretmochelys imbricata* and *Chelonia mydas*, both seen in those waters and nesting in several different places in the main island and the islets around. Main nesting beaches are currently being classified as protected areas, but females are still being slaughtered when they come ashore to nest in the islands. A permanent sea turtles and cetaceans observatory has been created.

INTRODUCTION

Mayotte is the eastern-most island of the Comoro Archipelago and the oldest of the four volcanic islands, located at the northern outlet of the Mozambique Channel, at the south-west of the Seychelles Archipelago and the Isles Glorieuses, and an equal distance from the north-west tip of Madagascar and the African coast.

Mayotte is a small archipelago with two main islands ("Great Land" and "Little Land"), and 23 satellite islets, ringed almost entirely by a barrier reef of 157 km length. The scattered but numerous seagrasses cover an area of about 100 km², and explain the permanent presence of the *Chelonia*, both male and female, in those waters.

The archipelago has around 140 beaches totalling approximately 27 km length (38% are less than 100 m long, 10% more than 500 m long). The sand is light (derived from coral) or very dark (basalt). The gently sloping beaches are often backed by trees which provide shelter for the turtles.

Research by Frazier (1977, 1982, 1985) throughout the Comoros Archipelago indicates that only two sea turtle species are common: *Chelonia mydas* and *Eretmochelys imbricata*. The exceptional coral system and the extensive seagrasses of Mayotte are attractive habitats for these two species. According to Frazier, the adult female population of *Chelonia* is estimated at over 600. Human developments and massive poaching have affected the turtle populations. Since 1990, the local Service des Eaux et Forêts (SEF/Waters and Forests Bureau) has been active in the protection of nesting turtles, particularly in the south of the main island. At the beginning of 1994, a research programme was initiated with the

STATUS AND DISTRIBUTION OF MARINE TURTLES IN THE FRENCH TERRITORIES OF THE INDIAN OCEAN: MAYOTTE

Marine turtle species:

Chelonia mydas

Local vernacular name: *nyamba*. Frazier (1977, 1982, 1985) reports the presence of this species in the Comoros and particularly in Mayotte. Based on observations of numerous immature and male individuals in the lagoon in addition to the nesting females, the author suggested that the species may be permanent in these waters. Fretey (1994, 1995) confirms the presence of individuals of both sexes all year round on the seagrasses and the regular nesting of the species on several beaches. Populations are threatened by large-scale slaughter of females on land.

Eretmochelys imbricata

Local vernacular name: *nyamba malé*. The species seems to be permanently resident throughout the Comoros Archipelago. Many immature individuals can be observed in shallow water in the north-east, east, south and west of Mayotte (Frazier, 1985; Fretey, 1994). They nest sporadically on several beaches.

Caretta caretta

No information.

Lepidochelys olivacea

No information.

Dermochelys coriacea

Frazier reports several accounts of a sea turtle, called in the vernacular *m'rouhie* or *roye*, whose flesh is poisonous and which he believes to be *D. coriacea*.

Nesting beaches: 4 large areas can be noted:

- I. The north: Chissioua Mtsamboro Islet, Rassi Douamounyo Peninsula, Chissioua Handréma Islet
- II. The east: Petite Terre Island
- III. The south: Mlima Sazilé, Mbouini, Tsiraka Bandrakouni, Mlima Kani Kéli, Rassi Ngouja
- IV. The west: Sohoa, Choungui, Tunambao, Tsiraka Apondra.

With the exception of the Mtsanga Antakoudja beach on the Island of Chissioua Mtsamboro, the northern beaches are unsuitable for the nesting of *Chelonia*. Nesting is sporadic on the Mtsanga Safari, West Mkadijou and Mtsanga Achimatso beaches. The 50 metre beach of Chissioua Handréma Islet seems to be an excellent nesting place for *E. imbricata*. The tiny beach of Rassi Mavoulé, composed of ocre-coloured sand and pebbles is another possible site. Frazier thought there might be a possibility of *E. imbricata* nesting on Rassi Mavoulé to the north but we have not found any traces of this species there. It is certain however that the species nests on the Mtsanga Mlima beach.

In the east the nesting of *Chelonia* is concentrated on the three beaches of Petite-Terre Island (Papani, Moya North, Moya South). The Moya North beach of coarse coral sand, lined at the back by low-branched bushy vegetation, seems to be one of the best sites for *E. imbricata*, after Kani-Kéli in the south.

The south of Mayotte is the most favorable area for the nesting of *Chelonia*. Frazier (1985) reported nesting on all the beaches of this region. Three sectors can be distinguished:

- A. Saziley sector: 8 beaches varying from 30 to 300 metres, some of which are composed of very black sand and pebbles. The main beach of Saziley is the best nesting site for *Chelonia* on Mayotte. *E. imbricata* nests there sporadically.
- B. Dapani-Mbouini sector: 8 beaches varying from 20 to 300 metres, composed of very fine brown or black sand. Three good sites exist for *Chelonia*: Dapani West, Charifou, Tsiraka Passi Bé South.
- C. Kani Bé - N'gouja: 8 beaches from 60 to 200 metres, composed of yellow or black sand. Only the N'gouja beach is suitable for *Chelonia* nesting, but tracks have been observed on the small Tsiraka Bandrakouni beach. Three beaches are suitable for *E. imbricata*: Kani Bé South, Mtsanga Mtiti, Kani-Kéli. The Kani-Kéli beach, approximately 70 metres long and composed of yellow sand, seems to be the most important site for this species on Mayotte.

In the west of Mayotte, only four beaches are of interest for *Chelonia*. The Mtsanga Nyamba site (a fitting name, for it means "turtle beach") to the north of Sohoa, is a small cove with coarse orange-yellow sand regularly visited by *Chelonia*. Moutsoumbatsou and Mtsanga Chanfi beaches are 150 and 300 meters long respectively and composed of dark brown sand. The Mtsanga Apondra beach mentioned by Frazier (1985) as a nesting site for *Chelonia* seems to be regularly visited. Traces of *E. imbricata* were noted on the Mtsanga Chanfi beach in March 1994.

Foraging / Feeding Grounds: In Mayotte there are thick or scattered seagrasses practically all around the main island and the islets. Adult *Chelonia*, both male and female, can often be observed grazing on these seagrasses all year round. The most visited seagrasses seem to be those of N'Gouja in the south and of the Petite-Terre islet at the end of the airport runway. Numerous turtles can also be observed in the seagrasses of Chissioua Mtsamboro island.

Developmental Habitat: No information

EXPLOITATION

Traditional uses of marine turtles and their products by local communities: Despite certain tribal religious beliefs holding that the beaches are sacred and the animals living on them untouchable, and the islamic precepts which consider sea turtle meat to be unclean (impure), many *Chelonia* females are butchered during nesting time. Except for young people the inhabitants of Mayotte are afraid of going on a beach at night because of the spirits, the "djinnns", which live there. The poachers are therefore people who do not believe in these precepts and who are not afraid. If they wish to kill a turtle on a nesting beach, it is relatively easy for them to do so at night since the beach is generally deserted. Our

investigation shows that locals consider that it is mainly the inhabitants including women, of Mtsahara and Chissioua Mtsamboro island who eat sea turtle meat, and they are therefore considered as strange people. Many inhabitants are afraid of turtles and will not touch them (whether alive or dead) or even walk in their tracks.

The Moslems, of whom there are large numbers in Mayotte, consider sea turtles to be unclean, maybe because of their "double life" in the sea and on land, and in theory they do not eat this meat. However, these same Moslems will kill turtles towards the end of Ramadan in order to sell the meat and thus have money to buy presents for the family on this festive occasion.

The inhabitants of Mayotte are of very diverse origins (Madagascar, other Comorian islands, Indonesia, East Africa, Europe, Pakistan...) and this may explain why their beliefs and eating habits are so different. Some believe that turtle meat makes one strong, and meat is consumed by the local football team for this reason. None of our informants mentioned beliefs in the aphrodisiac qualities of the eggs or of parts of the turtle's body.

Turtle meat eating in Mayotte is not a recent practice and *Chelonia* bones have been found in the archaeological excavations in the south-east of the main island which date back to 850-880 A.D. (Allibert *et al.*, 1989). Bones from the flippers and parts of the shell have been identified as leftovers from meals. Remains of land tortoises from Madagascar have also been discovered on these archaeological sites which seems to infer that Mayotte was a stopping-place between the large island and the African coast, and that turtles were a source of fresh meat for navigators.

The female turtles are butchered on land by cutting off the head and flippers; this is always done before nesting so that the flesh will be better. The belly part of the shell is then opened so as to empty the inside. The organs which are not consumed and the back shell are sometimes thrown into the sea but more often the shell is hidden in the bushes or the rocks. Out of the 68 beaches which we visited in March 1995, 15 had turtle corpses on them. We found very few skulls in the north of the island compared with the number of shells, suggesting that the heads have some use; whereas in the south there are generally as many skulls as shells. The four sites most visited by poachers are Moya Sud, Papani, Charifou and Dapani West. According to one informant, cooked turtle meat leaves Mayotte (Mtsahara) for sale on Anjouan island (Islamic Republic of the Comoros).

The flippers and heads are said to be eaten grilled or boiled in soup. The fat is heated to produce oil which is used as frying oil or sometimes as medicine. The eggs are not much in demand.

Three types of nets are used by the inhabitants of Mayotte who may capture turtles on seagrasses either deliberately or accidentally. According to Brenier (1982), turtle meat may sometimes be used as bait for lagoon fishing.

Commercial and international trade in marine turtles and their products: No varnished shells of *Chelonia* or *E. imbricata* are sold to tourists in the fishing villages or the souvenir shops, but several shops in Mamoudzou and a hotel in the north-east of the island sold

turtle shell objects until we intervened with the Customs at the beginning of 1995. After an inquiry, the conclusion was that these handicrafts (combs, jewelry cases and so on) came from Madagascar. Many legal actions against poachers are undertaken each year with fines ranging 300 FF to 3,000 FF (the average fine often under 1,000 FF).

MANAGEMENT STRATEGIES

Turtle management responsibilities: Locally, the Service des Eaux et Forêts (SEF/Waters and Forests Bureau) under the Direction de l'Agriculture et de la Forêt (DAF/Directorate for Forest and Agriculture) of Mayotte is in charge of protection and turtle management. This administration is representative of the French Environment Ministry on the island.

The technical and administrative responsibilities are shared with Réunion Island and under an institution called the Direction Régionale de l'Environnement (DIREN/Regional Directorate for Environment) to promote a global view of turtle management through all French overseas territories in the Indian Ocean.

Both administrations are working with different partners such as WWF-France, IFREMER (French Institute specialised in sea research), universities and museums, to provide a scientific basis for their work.

Legal basis for turtle conservation and management: For the moment, two kinds of legislation coexist at Mayotte: namely CITES (for Customs affairs) and an early local decree (1977) which forbids catching and destruction of marine turtles and their eggs. National decrees and departmental orders signed by ministers are missing.

However, a recent legal decision has permitted a French governmental institution (Conservatoire du Littoral/Littoral Conservatory) to buy several coastal areas including the best nesting beaches, in order to protect them against development pressures on the coast and to manage them as protected areas.

Effectiveness of existing mechanisms: The effectiveness is hampered by gaps in the legislation, inadequate fines, lack of awareness, and insufficient personnel to survey and protect the beaches. These gaps will hopefully be resolved in the coming years.

The French Environment Ministry is concluding several special national decrees and departmental orders which address nature protection in Mayotte (scheduled for 1996). These will enable fines to be increased to 60,000 FF and create protected areas that could be monitored in the future. With the help of the Conservatoire du Littoral, new jobs will be created in the areas of turtle protection and management and public education.

International Treaties and Conventions

Name of Convention	Yes
Convention for the protection management and development of the marine and coastal environment of the Eastern African Region and related protocols (Nairobi Convention)	accession: 22/6/85 ratification: 18/8/89
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	accn: 11/5/78 ratn: 9/8/78 1984 for turtles
Convention on Biological Diversity	adoption: 1992
The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	accn: 23/6/79 ratn: 1/7/90
International Convention on Prevention of Marine Pollution from Ships (MARPOL)	accn: 25/9/81 ratn: 2/10/83

Incorporation of international agreements into National Law: Except for CITES, agreements are not yet incorporated in the local laws. This is pending national decrees and a definitive French network through all this part of Indian Ocean.

Management strategies: Since 1993, these have included initiation of night patrols to deter poachers and to collect data; and, initiation of a public information programme, with several documents, media materials, brochures and posters

Nesting beaches in protected areas: More than 80% of the nesting areas will be protected during the next five years, and by 2015, all known nesting beaches will be protected.

Local communities and turtle conservation and management: Four permanent and twenty temporary staff from the local community are engaged in protection and turtle management. Some of them, in spite of low levels of formal education, have remarkable observation abilities and strong motivation for their job. Several young people from the Service des Eaux et Forêts want to join them to form a permanent team.

In addition, several environmental or nature associations have been created in recent months among the local youth. At present, they are not integrated into the local protection and turtle management programme but this may become possible.

Traditional resource management practices and community-based conservation potential: There is potential for involvement of traditional fishing communities close to nesting or breeding areas in data collection, and in particular involvement of villagers through tourism, which will benefit from the presence of turtles.

On-going research and research needs:

Research is continuing on the behaviours and populations of various species of turtles. A project was launched in 1995, with the help of WWF, to study the survival of turtles through incubation, hatching and emergence. There do not appear to be any natural threats through predation by crabs or birds.

A permanent observatory for marine turtles is being established, to open in 1996 in Saziley, and on a regional scale, a study network is being established for the French overseas territories in the Indian Ocean (Réunion, Mayotte, "Iles Eparses") linked to Réunion (DIREN) and Mayotte (DAF/SEF) with the active cooperation of the previously mentioned scientific partners.

A final goal is to associate this French network with a wider international network including all the countries of this part of the Indian Ocean. This wish seems to be shared by the organisers and participants of the Workshop.

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Table 1. Marine turtle nesting areas in Mayotte

Beach/area name	Beach length m	Nesting Species	Total nests /night, /year
E Petite Terre Is:			
Moya South	320	Green, hawksbill	mean: 2, 19
Moya North	250	"	mean: 1, 19
Papani	400	"	
Mtsanga Sazilé	400	Green	
Mtsanga Moudou	180	"	mean: 1, 29
Mtsanga Kombo Bato	200	"	
Mtsanga Kolo Batsoumou	350	"	
Saziley North	900	Green, hawksbill	mean: 2, 7
Saziley South	120	Green	
Mtsanga Sakouly	600	"	mean: 0, 16
Mtsanga Miti 1/2	200	Green, hawksbill?	
Kani-Kéli	200	Green, hawksbill?	
Kani Bé South	300	Hawksbill?	
Ngouja	800	Green	
SW Dapani South	100	"	
Dapani West	250	"	

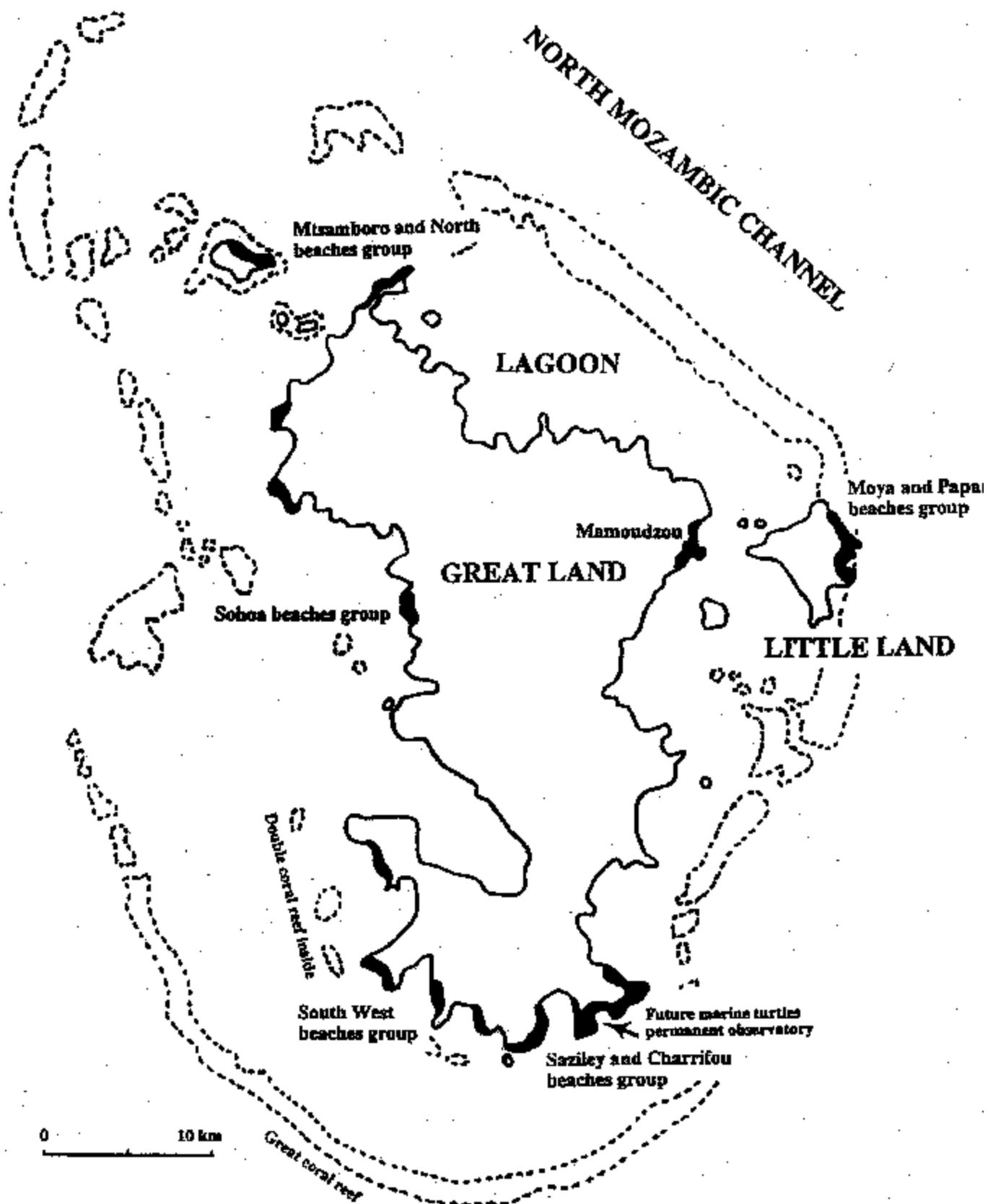
Table 1 ctd. Marine turtle nesting areas in Mayotte

Beach/area name	Beach length m	Nesting Species	Total nests
SW Charifou North	100	Green? hawksbill	
Charifou South	100	Green	
W Mtsanga Makoulatsa	~80	Hawksbill?	
Sohoa	~600	Green	
Mtsanga Nyamba	~60	"	
NW Mtsanga Chanti	~300	Green, hawksbill	
Moutsoumbatsou	~150	Green	
N Chissioua Mtsamboro:			
Mtsanga Mlima	~900	Hawksbill	
Mtsanga Bélieni		Green	
Mtsanga Safari	~80	Green, hawksbill	
N Rassi Douamounyo W 1/2	~10/10	Hawksbill?	
Rassi Douamounyo E	~20	"	
Rassi Mavoulé	~20	"	
NE Chissoua Handréma	~50	Green, hawksbill	

Table 2. Marine turtle foraging areas in Mayotte

Area name	Description of site	Species feeding	Approx numl
Mkakijou	Seagrass	Green	?
Ilot Chissioua Handréma	"	"?	
Poroani	"	"?	
2 Baobabs	"	"?	
N'Gouja	"	"	
Charifou	"	"	
Longoni	"	"?	
Rocher Blanchi	"	"?	
Anse Bandrélé	"	"?	
South Sada	"	"?	
Mlima Chiconi	"	"?	
Ilot Tanaraki	"	"?	
North Tsingoni	"	"?	
Tsiraka Kahirimtrou	"	"?	
Dzaoudzi-Pamandzi	"	"	
Chissioua Mtsamboro	"	"	
Lagoon	Coral reef	Hawksbill	

Figure 1. Sea Turtle Nesting beaches on Mayotte



THE STATUS OF SEA TURTLE CONSERVATION IN FRENCH TERRITORIES OF THE INDIAN OCEAN: LA REUNION

DIDIER DERAND

ABSTRACT

When humans first settled on La Réunion its beaches were frequently visited by sea turtles but these were ruthlessly massacred and turtles no longer nest on the island. The coastal regions of Réunion are now overpopulated and highly urbanised, particularly around the beaches. These beaches are few and not large, and it is most unlikely that we will observe nesting in the near or distant future. Nevertheless there are small numbers of green and hawksbill turtles in the waters of Réunion.

The greatest danger in the waters of Réunion is human actions. Poaching is intense and is sometimes tolerated by local authorities. Smuggling of turtle products from Madagascar, Mayotte, the Comoros and certain Asian countries continues. Réunion is the only portion of the national territory in the EEC, where sea turtles are not protected by a ministerial order.

The top priorities for sea turtle conservation are to inform of the public and appropriate departments of conservation issues; to publish a ministerial order protecting sea turtles on the territory of Réunion; and to enforce regulations against poaching.

INTRODUCTION

Réunion is a French department situated in the southwest Indian Ocean, 880 kms south-east of Tananarive (Madagascar) and 210 kms south-west of Port-Louis (Mauritius). It is a very mountainous island, with the highest point at 3069 metres.

The larger part of the population (85%) is concentrated on the coast which is therefore overpopulated, particularly near the sandy beaches. These beaches are not extensive (40 kms of 207 kms of coast) and are found exclusively in the west and south, namely,

- black sand (basaltic) beaches bordering the open sea: Etang Salé, Saint-Paul;
- white sand beaches protected by coral reef barriers: Saint-Gilles, la Saline, Saint-Leu, Saint-Pierre. The reefs form a discontinuous band over 25 kms.

The Réunionese fauna, including sea turtles, has been systematically massacred since humans first set foot on the island.

STATUS AND DISTRIBUTION OF MARINE TURTLES IN THE SEYCHELLES

Marine turtles found in Seychelles waters: Chelonia mydas and Eretmochelys imbricata. Caretta caretta was mentioned by G.R. Hughes (1976) as not very frequent, but there is no recent information about this species.

General distribution in Seychelles waters: Turtles are regularly seen on the western and southern coast (and probably occur to the north and east where access to the sea is more

hawksbills, one at Pointe au Sel, the other at Manapany. They were mostly of small size (40-50 cm shell length); only one green at Boucan Canot was more than a metre in length.

Known population trends: Unknown

Nesting beaches: Réunion beaches were important nesting sites when the island was first settled (17th-18th century). There are just two recent attempts to nest - a green turtle at Etang Salé in 1987 or 1988 which did not lay, and another in 1994 at Grand Fond (St Gilles) which laid 108 eggs, of which 50 hatched after 90 days (owing to cool weather).

Foraging/feeding grounds: Feeding grounds with seaweeds and seagrasses are not as extensive as in Mayotte and Madagascar, but there is significant development of seaweeds on the underwater coral sublayer and the basaltic platform. This is enhanced by organic pollution, and by mud deposits resulting from severe erosion.

Developmental habitat: Unknown

EXPLOITATION

Traditional uses of marine turtles and their products by local communities: The turtles captured are eaten by the fishermen themselves or sold to restaurant managers. Turtles are also used as ornaments - usually the fishermen simply polish the shells, but sometimes harden the whole body (after removing muscles, bones and viscera) using formalin and marine varnish. These specimens are used for the decoration of restaurants and for sale to individual customers (usually tourists) and to souvenir shops who then sell them to tourists. Live turtles have also been used for display in tanks, including in restaurants and in public aquaria.

Turtles continue to be harvested. Very recently, on 7 October 1995, poachers from Manapany offered the author a recently harpooned hawksbill.

Local community knowledge of population trends: There is little interest in turtles, except from poachers who clearly don't report their illegal catches.

Commercial and international trade in marine turtles and their products: Two sorts of trade exist in Réunion: that of the specimens poached locally, and that of the specimens smuggled from Madagascar, and to a lesser degree from the Comoros and Mayotte and occasionally Asia (Taiwan, China). Products, usually of hawksbill, such as jewelry, domino games, shells, and stuffed turtles are exhibited for sale in open markets and in some shops.

This illegal trade is exacerbated by the high sale prices of specimens from Coral Farm as well as through the artificial increase of the demand in turtle products through publicity campaigns for turtle shell and leather from Coral Farm. The large shell of a locally poached turtle will easily fetch USD 310, which represents quite a lot of money for the fisherman but is still much less than the USD 920 charged for a shell of the same size from Coral Farm. The trade is becoming less evident, probably a result of the joint actions of customs, the DIREN and of the Nature Brigade. Moreover, the trade of products from Coral Farm has been restricted to small objects since the end of 1994, with the sale of carapaces forbidden.

THREATS (MANAGEMENT CONCERNS)

Natural threats to nesting beaches: Erosion and sand movements.

Egg collection by humans: None

Fishery-related threats to turtles: The threat represented by industrial fishing seems unimportant. The only ships operating from Réunion are "long liners" or "palangriers". They use automatic drift "palangres" (fishing lines with a thousand hooks). According to IFREMER, only few turtles have been accidentally captured and these have been released alive.

Overseas fisheries: In principle, only French ships have the right to fish in the EEZ. Unofficially, 28 Taiwanese ships are allowed in the area, though according to IFREMER, they fish mainly around the Iles Eparses.

Other human-related threats: Poaching is the main danger that threatens the turtles in the waters of Réunion. The situation is improving with the establishment of DIREN in 1992 and the Nature Brigade in November 1994. The suitability of beaches for nesting is diminished by intensive use of all beaches by the public (even at night) and intensive urbanisation close by (with the exception Saint-Paul and Etang Salé); construction of hotels on the fringe of the beaches in the West; lighting from cars, streets and houses; intense traffic on the nearby road; removal of sand for building purposes; the building of protective walls in front of some properties; and presence of stray dogs and rats

MANAGEMENT STRATEGIES

Turtle management responsibilities: Regional Department for Environment (DIREN)

Legal basis for turtle conservation and management: Marine turtles are included in CITES Appendix I and in EEC Regulation Appendix C1.

EEC Regulation no 3626/82 of the Meeting of 3rd December 1982 modified pertaining to the application in the EEC of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Article no 5 states that the introduction of Appendix I specimens in the EEC depends on the presentation of an import permit to the customs office where the customs formalities are carried out. This permit can only be issued by the Department of Nature and Landscapes of the Ministry for Environment (DNP). Article no 6 paragraph 1 forbids the exhibition for purposes of trade, selling, holding for sale, offering for sale or transporting for sale of Appendix I specimens throughout EEC territory. Article no 13 states that the transport of live Appendix I specimens inside the EEC depends on permission granted by the Ministry for Environment.

The 1st March 1993 ministerial order fixes the modes of enforcement of CITES on national territory. Article no 2 subordinates the following activities to ministerial permission: import under any customs system, export and re-export of specimens registered under Appendices A, B and C of the EEC Regulation. Article no 3 subordinates the following activities to ministerial permission: holding for sale, transport for sale, putting up for sale, sale, buying, and use for commercial purposes of Appendix I specimens

Article 215 of the Customs Code and its application order of 24th November 1987 state that any person found with specimens protected by the Washington Convention (CITES specimens) should be able to prove their legal origin to any duly authorised officers, throughout EEC territory.

Effectiveness of existing mechanisms: The mechanisms to protect marine turtles will only have a limited efficiency as long as the poaching of marine fauna is tolerated, for whatever reasons.

Enforcement agency: These are (article L.215-5 of the Rural Code) customs and the Nature Brigade (which represents the National Hunting Office and the National Forestry Office). Responsibility for sea fishing rests with the Department for Maritime Affairs, the Maritime Brigade, and the Nautical Brigade at Le Port.

International Treaties and Conventions.

Name of Convention	Yes	No
Convention for the protection management and development of the marine and coastal environment of the Eastern African Region and related protocols (Nairobi Convention)	Yes	
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Yes	
Convention on Biological Diversity	Yes	
The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)	Yes	
International Convention on Prevention of Marine Pollution from Ships (MARPOL)	Yes	

Incorporation of international agreements into National Law: CITES and the Bonn Convention are incorporated, the Nairobi Convention partly so, and the Convention on Biological Diversity is being incorporated.

Limitations of the National Law with respect to marine turtle management: The major obstacle is the generalised poaching of marine fauna. Another obstacle is the gap in the law - at present in Réunion, no ministerial decree prevents a poacher from killing a turtle for his personal consumption. Réunion is the only portion of the national territory in the EEC where sea turtles are not protected by such an order. A solution would be to publish a ministerial decree protecting the wild marine turtles and those of unspecified origin on the territory of Réunion.

Management strategies: A marine turtle research centre is presently being set in Réunion, under the aegis of the Ministry for Environment represented by the DIREN. This will involve a number of organisations, including IFREMER, ORSTOM, the University of Réunion and the Natural History Museum.

Local communities and turtle conservation and management: Local inhabitants are not yet aware of the conservation needs of turtles.

On-going turtle research: see above

MANAGEMENT NEEDS TO CONSERVE MARINE TURTLES

Institutional arrangements needed for turtle conservation

Responsibilities: The jurisdiction of the Nature Brigade should be extended to the whole island, and not just marine reserves.

Staffing and training: Training is much needed, particularly in view of the new research centre being established. Staffing of enforcement agencies needs to be strengthened (including a management board for the marine park being established).

Legislation: The gap in the law which exists on the territory of Réunion should be closed as soon as possible through publication of a ministerial order protecting sea turtles on Réunion in the Official Gazette.

Turtle protection needs

Control and mitigation of the impact of accidental capture in fisheries: Very strict control should be maintained over the fishing activities of foreign countries in the French EEZ, in particular over those of Taiwanese ships. Destructive techniques like driftnets must be explicitly forbidden.

National harvest: There is an urgent need to control poaching.

International harvest: Control of international trade must be reinforced.

Predator control: A general campaign should be launched for the sterilisation of stray dogs.

Public awareness and education: Awareness of the public and of relevant authorities (the police, the "gendarmerie") is currently non-existent, but essential. Coral Farm could be converted to an education centre addressing marine issues, and in particular turtle conservation.

Habitat protection needs

Conservation areas: It may be possible to reintroduce turtles to certain protected nesting beaches through the translocation over a number of years of egg clutches from Tromelin.

Management related research needs

Strengthening research capacity: It is very important to establish a network of turtle researchers and managers in the southwest Indian Ocean region, and to strengthen research capacities. This is particularly timely since Mayotte and Seychelles have recently started research and conservation programmes on marine turtles and because Réunion is going to reactivate its own programme on the Îles Eparses.

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THE STATUS OF SEA TURTLE CONSERVATION IN FRENCH TERRITORIES OF THE INDIAN OCEAN: ISLES EPARCES

**BASED ON INFORMATION PROVIDED BY FRANCOIS RENE AND DAVID ROOS
IFREMER REUNION**

INTRODUCTION

The French Territories of the Indian Ocean comprise the Iles Eparses: Tromelin, Europa, Juan de Nova, and the Iles Glorieuses, plus Mayotte and La Réunion. Except for Mayotte and La Réunion, these islands are uninhabited apart from military and meteorological personnel who are stationed on the islands. There are no human threats to the turtles coming ashore to nest on these islands, and there is now over ten years data on green turtle nesting. However, the intensive offshore fisheries operating in the region, both within and beyond the Exclusive Economic Zones of the islands, may present a significant threat to turtle populations as a result of bycatch.

SEA TURTLE RESEARCH IN THE ISLES EPARSEES

The sea turtle nesting beaches of the Isles Eparses represent important and undisturbed reference sites for the study of turtle populations in the western Indian Ocean. Sea turtle research in the region was initiated by George Hughes, on Europa, in 1970, and continued during the 1970s by the Meteorological Services based in Réunion. The programme was taken over by IFREMER in 1977, and further strengthened in the mid-80s. Initiatives are now underway to develop new techniques for the estimation of sea turtle population using a satellite tracking system.

Figure 1 illustrates the number of green turtles recorded on the different islands over a period of ten years, on the basis of tracks. Figure 2 is an estimation of the number of green turtle hatchlings emerging on major nesting sites on Tromelin and Europa over a similar period.

The turtles display distinct seasonality in their nesting, as illustrated in figure 3. While the peak nesting season of green turtle at Tromelin, Europa, and Juan de Nova is similar (November - January), there is an apparent shift in peak in the Isles Glorieuses. This may be evidence for the presence of two distinct breeding population in the region.

For the purposes of conservation management of sea turtles it would be valuable to enter into a collaborative research programme with the other countries in the region, in particular with South Africa, Madagascar, Comoros and Seychelles, as well as Mayotte and Réunion. This would facilitate the determination of the ranges of the two or more distinct breeding populations of green turtles believed to exist in the region.

The principal threat to sea turtles around these islands may well be the increase in fishing - both in international and national waters. Industrial fishing carried out by international fleets (purse-seining by France, Spain, Mauritius, and Russia; longlining by Taiwan, Korea, Japan, France, and, most recently, China) is a less serious threat than inshore fisheries. The turtle bycatch of European purse seiners has been quantified through an EU funded

Figure 1. Green turtle nesting on the Iles Eparces (based on beach traces).
 IFREMER, La Réunion

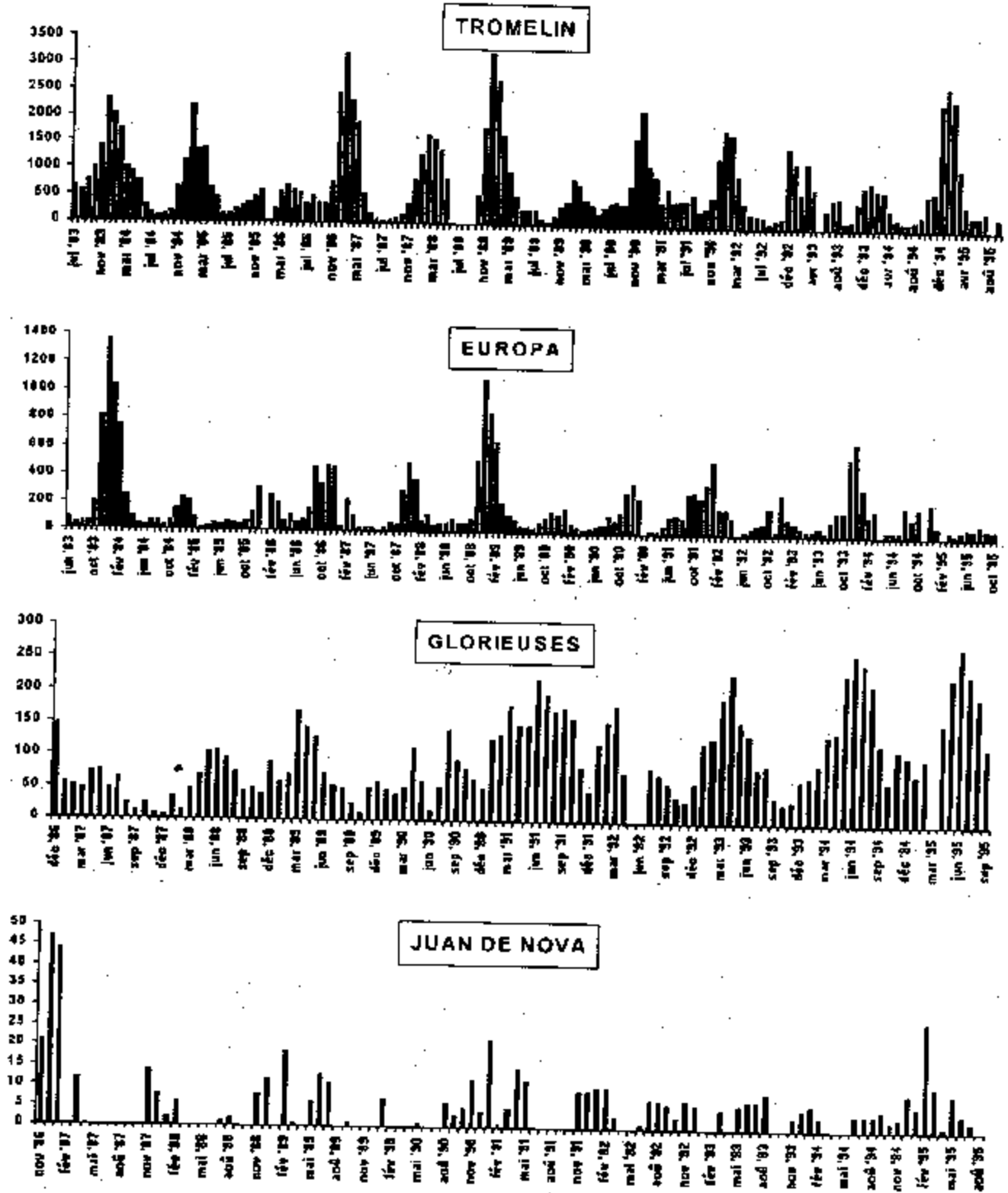


Figure 2. Estimate of green turtle hatching on two principal nesting beaches (IFR Europa (thin line); Tromelin (thick line))

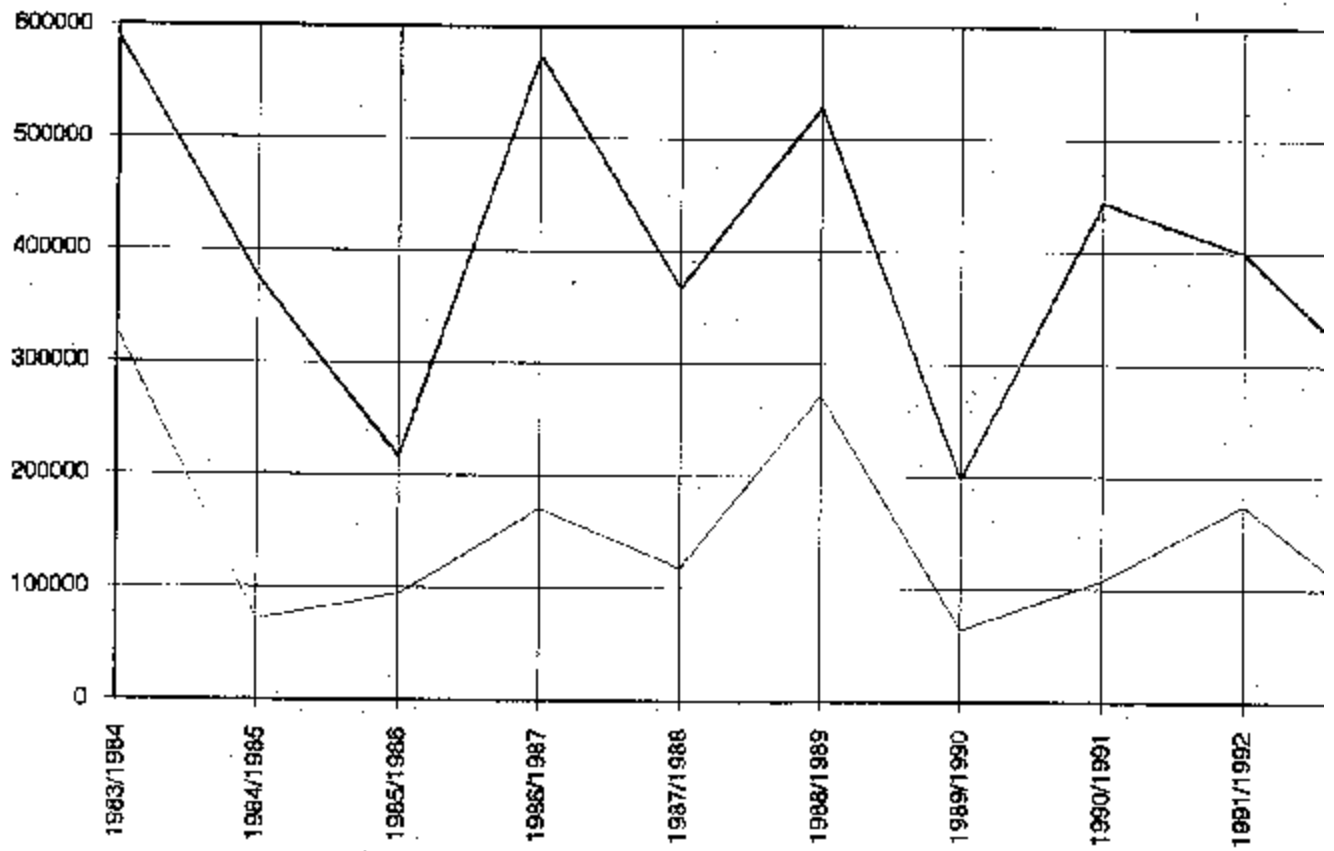
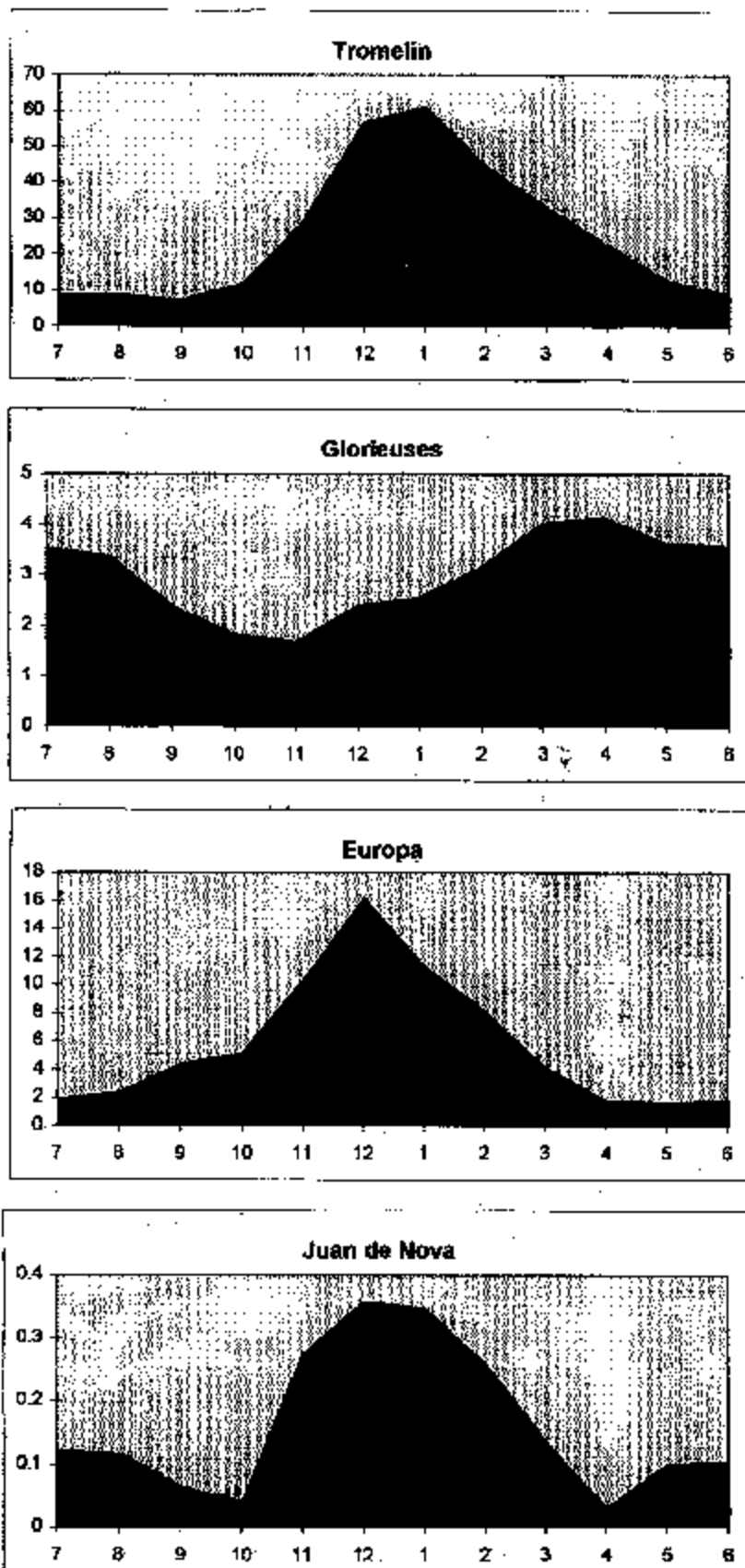


Figure 3. Seasonality of green turtles on the Iles Eparces IFREMER, La Réunion (1986-1995: Glorieuses & Juan de Nova; 1983-1995, Tromelin & Europa)



longliners is not known, but a monitoring programme on French vessels (logbook system and observers) indicates that the threat is insignificant. Turtles were released alive in the 3-4 cases reported over two years.

The increase in inshore fisheries operating in Madagascan and Mozambican waters, in particular shrimp trawlers and small domestic craft using drift nets, is a more serious threat which needs to be assessed through a programme of observation. These fisheries represent an important source of overseas revenue, and international pressure could be exerted to require the use of turtle excluder devices.

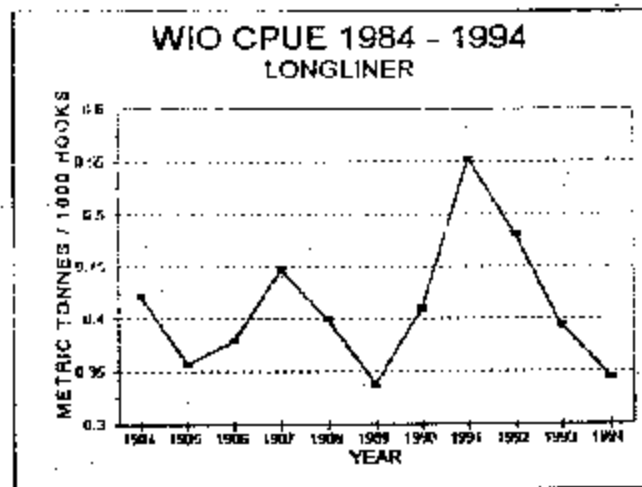
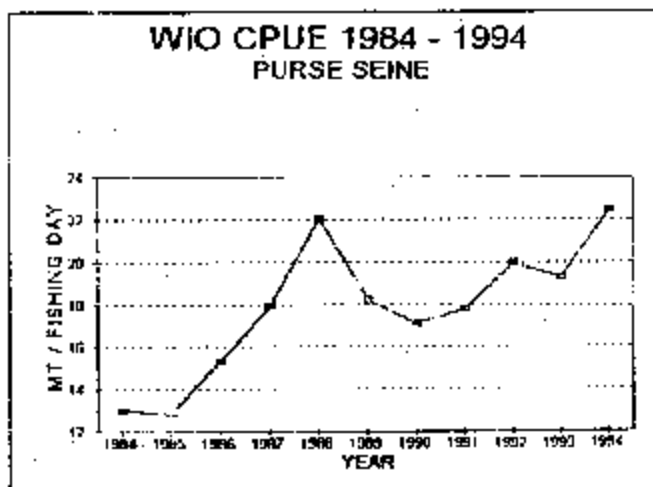
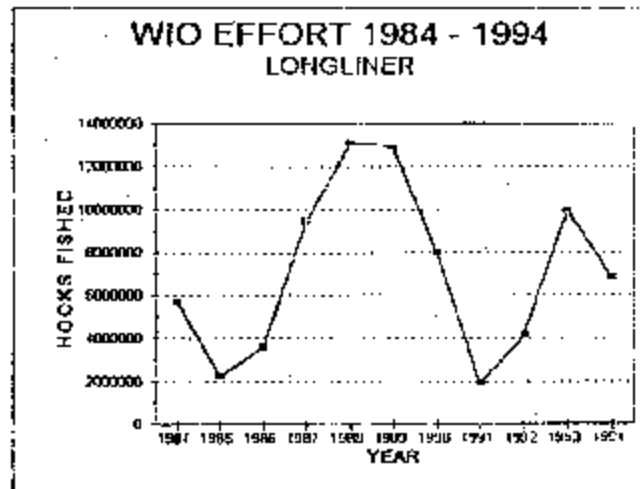
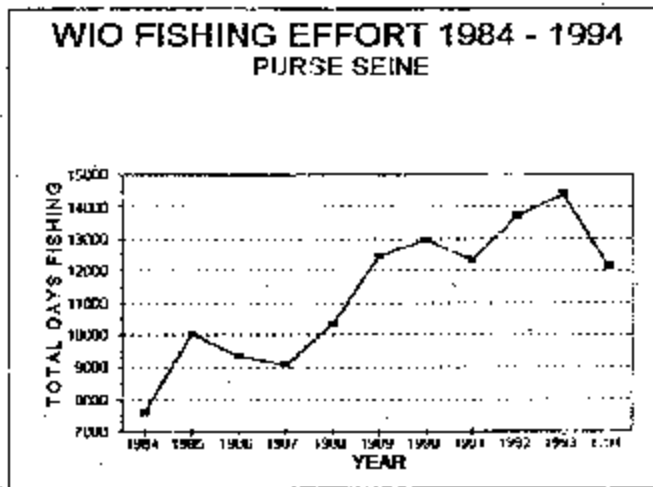
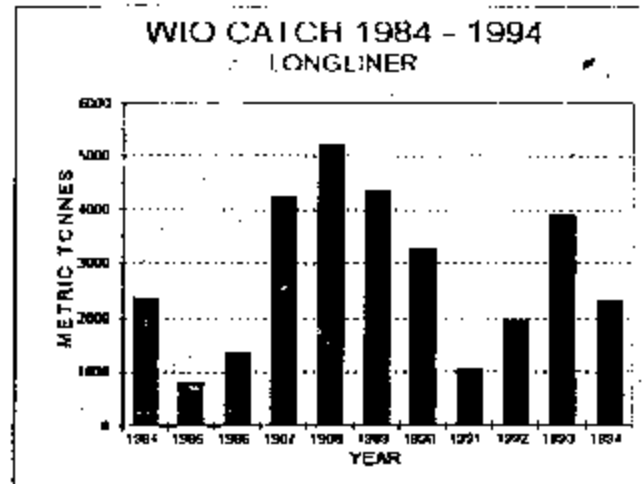
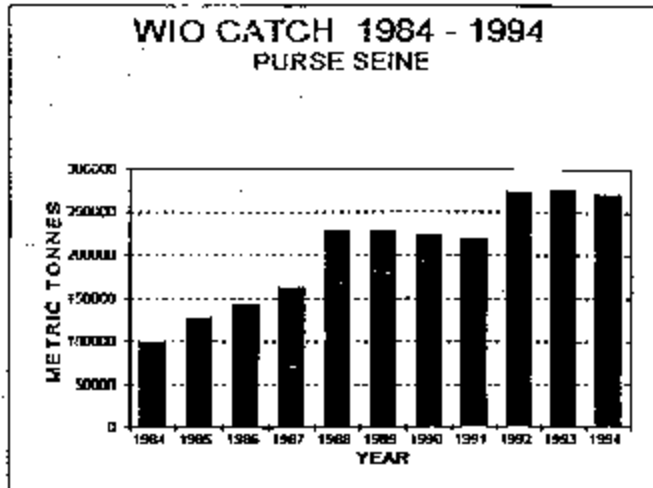
The increase in intensity of western Indian Ocean fisheries is illustrated in figure 4 which represents both international and national (within EEZ) catches.

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* This unpublished document which was reviewed by experts at the Sodwana meeting is available from the authors at IFREMER (French only) - see participants list for address.

Figure 4. Changes in fishing intensity (catch, effort and catch-per-unit-effort) in the western Indian Ocean, 1984-1994. Seychelles Fishing Authority.



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