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PROCEEDINGS OF THE SECOND MEDITERRANEAN CONFERENCE ON MARINE TURTLES

Kemer, Turkey, 4-7 May 2005

Editors:
Andreas Demetropoulos
Oguz Turkozan

T.C.
Çevre ve Orman Bakanlığı

IUCN/SSC Marine Turtle Specialist Group
Mediterranean Region

WWF

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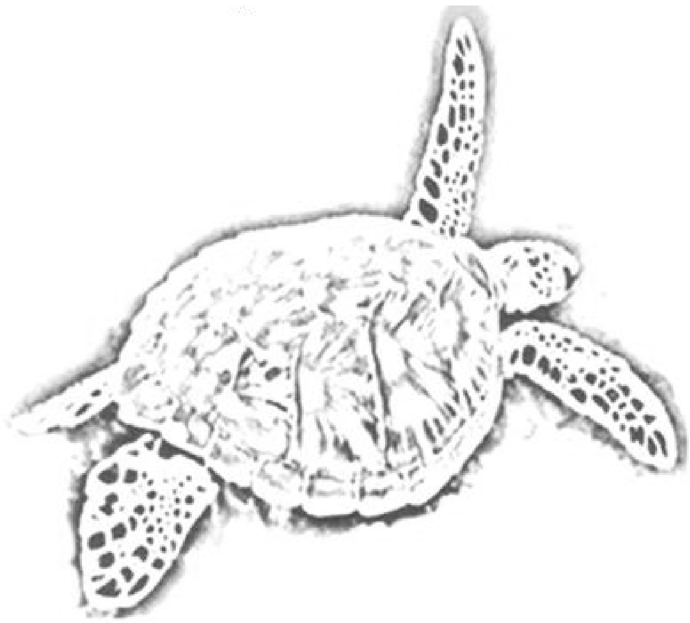

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TÜBİTAK

MİLLİ PİYANGO

PREFACE

In view of the success of the first conference on marine turtles, held in Rome in October 2001, and the growing interest in these animals and in their conservation, the Second Mediterranean Conference on Marine Turtles aspired to bring together again, biologists, conservationists, government administrators and other professionals from all Mediterranean countries involved in sea turtle research and conservation.

The Second Mediterranean Conference on Marine Turtles was organised and funded by the Barcelona Convention (RAC/SPA, UNEP/MAP), the Bern Convention (Council of Europe) and the Bonn Convention (CMS/UNEP). The event was organised with the support of IUCN's Marine Turtle Specialist Group (IUCN/MTSG - Mediterranean Region). The Host Organisation was the Ministry of Environment and Forestry of Turkey and the local facilitator was WWF-Turkey.

The most recent scientific findings and developments associated with sea turtle research, management and conservation aspects in the Mediterranean region, were presented during this conference and many turtle issues were discussed, emphasizing the value of regional cooperation. Interactions of the kind facilitated by the conference, combined with the broad spectrum of issues covered by it, is a prerequisite to understanding and adopting sustainable solutions to the numerous contemporary problems that turtle research and conservation face.

The conference took place at the Mirage Park Resort in Kemer near Antalya, from the 4 to the 7 May 2005. The general subject of the Conference was the biology and conservation of marine turtles in the Mediterranean. The programme was organised into five main thematic sessions:

Session 1: Networking and Social Issues
Session 2: Turtles at Sea
Session 3: Nesting Populations
Session 4: Ecology and Ecophysiology
Session 5: Management and Conservation

Four workshops were also held at the same time on the following themes:

- Tagging Standardisation
- Fisheries Interactions
- Regional Red Listing
- Education.

Keynote presentations were made at the opening of the conference, after the opening speeches, and at the beginning of each thematic session. A number of other side events also took place during the conference, including a regional meeting of IUCN's MTSG (by invitation), an after dinner presentation of short films, a discussion on Mediterranean networking and on "what next?" Each thematic session had a Chairman who guided discussions.

The present volume contains all the contributions made during the conference. The volume is divided into the following sections: Introductory speeches, Key-note presentations and Oral and Poster presentations (not separated). Within each section the contributions are listed in alphabetical order, by author. The Conference Highlights which were adopted by the Conference are presented at the end of this volume before the Index to Authors.

We are privileged to have undertaken the edition of the Proceedings. Our editing was minimal and has concentrated mostly on the appearance of the contributions. So the responsibility for the content falls on the authors whom we thank for their cooperation and patience. We also wish to thank Dimitris Margaritoulis for his kind advice and very valuable help during the preparation of these Proceedings, Michael Coyne for kindly hosting the pdf file at seaturtle.org and Simon Demetropoulos for editorial assistance.

Andreas DEMETROPOULOS and Oguz TURKOZAN
The Proceedings Editors

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4. ORAL AND POSTER CONTRIBUTIONS

ABOUT THE CONFERENCE

The **Second Mediterranean Conference on Marine Turtles** is a joint initiative by the Secretariats of the following Conventions:

- Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention, 1976)
- Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979)
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1982).

The event was organized with the support of IUCN's Marine Turtle Specialist Group (IUCN/MTSG). The hosting organization of the Conference was the Ministry of Environment and Forestry of Turkey and the local facilitator WWF Turkey.

ORGANISING COMMITTEE	**Aybars ALTIPARMAK (Ministry of Environment and Forestry)** **Marco BARBIERI (Bonn Convention)** **Eladio FERNANDEZ-GALIANO (Bern Convention)** **Dimitris MARGARITOULIS (Regional Chair of IUCN's MTSG)** **Atef OUERGHI (RAC/SPA, Barcelona Convention)**
PROGRAMME COMMITTEE	**Dimitris MARGARITOULIS (Coordinator)** **M. Nejmeddine BRADAI** **Paolo CASALE** **Andreas DEMETROPOULOS** **Jesus TOMAS** **Oguz TURKOZAN**

The Organising Committee would like to thank all the conference participants and particularly the Programme Committee, the Invited Speakers (Ibrahim Baran, Andreas Demetropoulos, Filiz Demirayak, Guner Ergun, Dimitris Margaritoulis, Roderic B. Mast, Jeffrey A. Seminoff and M. Kemal Yalinkilic) the Session Chairs (Andreas Demetropoulos, Paolo Casale, Mohammed Nejmeddine Bradai, Jesus Tomas and Oguz Turkozan) and the Workshop Coordinators (Andreas Demetropoulos (Tagging), Paolo Casale (Fisheries Interactions), Jeffrey Seminoff (Regional Red-Listing) and Ian Bride (Education)). Last but not least our greatest thanks to the Conference's local host, the Ministry of Environment and Forestry and the local facilitator, WWF – Turkey, which had undertaken the organization of the Conference locally.

The visit that was arranged to Cirali beach, where WWF - Turkey is coordinating a turtle conservation project, was memorable and inspiring as the project demonstrates the successful work of the native people in conserving marine turtles. They, together with university students, work on the beach in the summer.

INTRODUCTORY SPEECHES

THE ACTION PLAN FOR THE CONSERVATION OF THE MEDITERRANEAN MARINE TURTLES ADOPTED WITHIN THE FRAMEWORK OF MEDITERRANEAN ACTION PLAN (MAP)

Atef OUERGHI

UNEP/MAP, Regional Activity Centre for Specially Protected Areas
Barcelona Convention Secretariat

There are several international conventions containing provisions for the protection of marine turtles in the Mediterranean region. These conventions are applied to various degrees in the Mediterranean countries with the exception of the Barcelona Convention to which all riparian Mediterranean nations are signatories. The significance of the Barcelona Convention, as far as marine turtles are concerned, is reflected not only in the Protocol concerning specially protected areas and biological diversity in the Mediterranean but also in the elaboration of an Action Plan for the Conservation of the Mediterranean Marine Turtles in 1989 and its recent revision in 1999.

The Revised Action Plan takes a holistic approach to processes threatening Mediterranean turtle populations. Its main objectives are to enhance the population of marine turtles, conserve their critical habitats in the Mediterranean region and to improve scientific knowledge about these species.

After 17 years from its adoption, several questions should be asked. Do we know enough about the marine turtle species in the Mediterranean? Do we know enough about the different populations? Do we know exactly the size of the damage caused by the different fisheries in the Mediterranean? Do we know their migration routes? Do we know the nesting beaches? Are they efficiently protected and managed? Do we exchange really data in the Mediterranean? Data on marine turtles could be compared and analysed to get a regional view of their conservation status?

THE BERN CONVENTION AND THE PROTECTION OF MARINE TURTLES IN THE MEDITERRANEAN

Eladio FERNANDEZ-GALIANO

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Council of Europe, Strasbourg, France

The Convention on the Conservation of European Wildlife and Natural Habitats (Bern, 1979) is an international legal instrument aimed to conserve endangered species of flora and fauna and their natural habitats, and encourage co-operation between states.

All the species of marine turtles found in the Mediterranean appear in Appendix II to the Convention, which confers these species full protection (a prohibition of deliberate capture, keeping and killing of individuals or deliberate damaging or destruction of breeding or resting sites) and obliges states to protect their habitats, both breeding beaches and wintering grounds. To date, thirteen Mediterranean states - Albania, Croatia, Cyprus, France, Greece, Italy, Malta, Monaco, Morocco, Slovenia, Spain, Tunisia and Turkey - are contracting parties to the Convention.

The Convention's Group of Experts on the Conservation of Amphibians and Reptiles monitors the implementation of the Convention by Parties and submits its recommendations to the ruling body of the Convention, the Standing Committee, which meets annually. In the last 20 years the Convention has issued 11 recommendations on marine turtles (12 % of all adopted).

The Standing Committee may open "files" to states for presumed non respect of the Convention. Around 10% of the files opened by the Convention, concern mainly marine turtles (mainly when their nesting beaches are not properly protected). Non-governmental organisations notify cases of non-compliance to the Secretariat, and often exert useful pressure on governments. In the past 15 years the Committee has discussed on sites such as the Akamas Peninsula (Cyprus), Zakynthos (Greece) and Kazanli (Turkey) and has devoted much attention to the conservation of green turtles.

THE ROLE OF THE CONVENTION ON MIGRATORY SPECIES (CMS) IN THE CONSERVATION OF MARINE TURTLES

Marco BARBIERI

UNEP/CMS Secretariat, Bonn, Germany

The Convention on Migratory Species (also known as CMS or the Bonn Convention) is an intergovernmental treaty aiming at the conservation of migratory species that cross national jurisdictional boundaries in the course of their migration. The conservation of marine turtles has a prominent role within CMS. The Convention contains strict measures for the protection of marine turtles at the national level. CMS Parties that are Range States to marine turtles are to endeavour to conserve their habitats, to counteract factors impeding their migration, and to control other factors that might endanger them. Above all, Parties are obliged to prohibit the taking of these species, with few possibilities for exceptions.

The Convention also encourages regional co-operation through specialized Agreements. These may range from legally-binding treaties to less formal memoranda of understanding. CMS Agreements provide for co-ordinated species conservation and management plans; conservation and restoration of habitat; control of factors impeding migration; co-operative research and monitoring; and public education and exchange of information among participating countries.

The Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia, concluded in July 2000, has a potential membership of at least 40 countries. The contents of a detailed Conservation and Management Plan to accompany the Memorandum were agreed in Manila in June 2001. Twenty States have signed the Memorandum thus far, and it formally took effect on 1 September 2001. A Secretariat for the MOU was established in Bangkok (Thailand) in 2003.

A comparable instrument for Africa “the Memorandum of Understanding concerning Conservation Measures for Marine Turtles of the Atlantic Coast of Africa” was concluded in Abidjan in May 1999. The first Meeting of Signatory States to the MoU (Nairobi, 2002) finalized a comprehensive conservation and management plan. Nineteen Range States have signed that instrument. Efforts to conserve marine turtles in Africa received a further boost with CMS. Release of an invaluable information resource, Biogeography and Conservation of Marine Turtles of the Atlantic Coast of Africa, authored by Jacques Fretey.

The Convention on Migratory Species also promotes co-operation through sponsorship of basic research (e.g. surveys of nesting beaches, genetic and satellite-tracking studies to help elucidate migration patterns, assessment of incidental catches), production of information materials (e.g. identification posters, and a GIS mapping facility for nesting beaches of the Indian Ocean) and capacity building (e.g. regional training/policy workshops, conservation techniques manual).

Starting at a regional level and focusing in particular on developing countries, CMS is working towards an interlinked, global framework for the conservation of marine turtles. Mediterranean initiatives that make use of all appropriate instruments and tools are best seen in this wider context.

KEY-NOTE PRESENTATIONS

RESEARCH AND CONSERVATION STUDIES ON MARINE TURTLES OF TURKEY

Ibrahim BARAN

Dokuz Eylul University, Faculty of Education, Department of Biology Education, Buca, Izmir, Turkey

The first nesting records of *Caretta caretta* and *Chelonia mydas* in Turkey were reported by Hathaway in 1972. In 1973 Basoglu and in 1982 Basoglu and Baran provided information on the carapace plates of *C. caretta* measured in Izmir, Koycegiz and Fethiye. Further, Geldiay and his associates described in 1982 the marine turtle populations and their protection along the Mediterranean coast of Turkey. In 1988, Baran and Kasparek, with financial support from WWF, conducted the first comprehensive survey of the Turkish Mediterranean coast for turtle nesting sites. During this study, 17 important nesting grounds were identified. Of these, 5 nesting sites were designated as "Specially Protected Areas" by the Turkish Government. Furthermore, a large tourist investment, which would impact the future of marine turtles, was prevented on Dalyan beach. Since 1988, with the financial support of the Ministry of Environment and Forestry, a series of population studies were carried out on selected beaches, and problems affecting the turtles were determined. A total of 71 scientific papers were produced during this time. In addition, 4 PhD students and 14 MSc students completed their thesis on marine turtles.

In recent years, the numbers of nests in the Turkish Mediterranean have dramatically declined due to destruction of nesting habitats. Fethiye beach, where a marine turtle monitoring program has been carried out since 1993 without interruption, is a good example of such a decline. However, this decline can be attributed to two major factors: anthropogenic and natural. The natural factors can be somehow regulated but the accelerated, over the last years, tourist usage of nesting beaches, increases largely the importance of the anthropogenic factors for the conservation of marine turtles.

The adverse effects of anthropogenic factors can be decreased by the following precautions.

1. Nesting beaches should be monitored during the breeding season.
2. Sand extraction should be prevented.
3. A special plan should be designated for the education of local people.
4. Information desks should be set up and leaflets on marine turtles and its conservation should be distributed.
5. Founding of local NGOs should be supported since nature conservation can succeed in the long- term only with the participation of locals.

THE CYPRUS TURTLE CONSERVATION PROJECT - 29 YEARS ON

Andreas DEMETROPOULOS (1) and Myroula HADJICHRISTOPHOROU (2)

(1) Cyprus Wildlife Society, P.O. Box 24281, 1703 Nicosia, Cyprus
(2) Department of Fisheries and Marine Research, Eolou str. 13, 1416 Nicosia, Cyprus

INTRODUCTION

The project started in 1976, with beach surveys after the first turtle tracks were noticed. In 1978 the Lara Turtle Station was set up on the west coast of the island. The Project evolved with time from a primarily hatchery project, with some head-starting, to a much wider project involving habitat protection, which started in 1989 with the setting up of the Lara/Toxeftra Reserve. *In situ* protection of nests on all the beaches followed the implementation of the management measures foreseen by the legislation which was introduced with the setting up of the Reserve. The Reserve covers the adjacent sea and the beaches. The Polis/Limni nesting beaches on the northwest coast of the island are now also receiving protection and are to be included in the Natura 2000 network which is being set up. The project is a government project, run by the Department of Fisheries and Marine Research (DFMR). The Cyprus Wildlife Society (CWS) helps with the project with experienced biologists (Demetropoulos and Hadjichristophorou 2004).

As a long term project run by the same small team, it resulted not only in an accumulation of information but also of experience. This helped in giving weights to the various actions, in clearly defining what is conservation and what is monitoring and research. This also helped in the evolution of conservation techniques and practices, giving emphasis to conservation over other interests. Nonetheless data collection and some research were ongoing as even basic information on turtles at the time (in the late 1970s) was scarce and difficult to access. The internet has of course revolutionised this in recent years. This continuity in running the project also helped in the interpretation of results. In 1989 practical training courses in turtle conservation techniques started being run to help in building capacity in other Mediterranean countries.

Between 200 and 400 nests are usually laid every year. All are protected. The main nesting areas are the West Coast, which is not limited to the Lara/Toxeftra Reserve and the Chrysochou Bay beaches which again are not limited to the beaches in the Natura 2000 site. Some regular nesting takes place on a number of other beaches and occasional nesting is noted on most other beaches of the island.

Tangible results on the ultimate success of the project – to see turtle populations nesting in Cyprus recover – are as yet elusive, as turtles need a long time to mature and as other factors get in the picture, e.g., losses due to incidental catches in fishing gear. There have been signs of change however, in the last 10-15 years, e.g., a large number of juvenile green turtles, and some sub-adults, are now seen in Cyprus waters, which were never seen before.

A BRIEF HISTORY OF TURTLE CONSERVATION IN CYPRUS

Benchmarks

1971	Turtles were protected by law (Fisheries Law and Regulations)
1976-1977	First beach surveys
1978	Launching the Turtle Project and setting up the Lara Turtle Station
1989	Habitat protection with Lara/Toxeftra Reserve set up under the Fisheries Legislation, with Management Regulations included in the law. The protected area includes the foreshore and the adjacent sea down to the 20m isobath
1989	Training courses for other Mediterranean countries started, with trainees from RAC/SPA (UNEP/MAP) mainly.
2002	Polis/Limni was declared a "Shore for Ecological Protection" (Town and Country Planning legislation) – it includes conditions for the adjacent area regarding lights and no permits for commercial use of beach, no breakwaters or marinas
2005	Polis/Limni/Yialia area (land and sea to 50m isobath) proposed to EC as a Natura 2000 site (management plan pending)

In the seventies and much of the eighties work concentrated on hatchery techniques and on the relocating nests to a hatchery on the Lara beach where the turtle station was set up. The hatchery was set up there as the Lara beaches were adjoining government owned land (state forest land) and were thus considered to be protected from development and, therefore, provided a safe future for the coming generations of turtles. It was a period of gaining knowledge and experience - and raising awareness in the public and in government circles. Head-starting was also experimented with and several hundred head-started turtles, 1 to10 years old, were released. Head-starting has now stopped pending results from it.

In 1989 the west coast nesting area (10 km of coastline) was declared as a turtle reserve, the Lara/Toxeftra Turtle Reserve. This included the foreshore and the sea area down to the 20 metre isobath (about 1-1.5 km from the coast). It includes the 5 main green turtle nesting beaches, which have a total length of about 4 km. There is also loggerhead nesting on these beaches. The following three years were focused on implementing the management regulations that were passed by law, which was no easy task. After some court cases (and other battles) this succeeded and the management measures for the area were generally accepted.

In the Protected Area from the 1st June to the 30th September of every year it is forbidden to:

- Stay on the beaches or the coastal area at night (one hour before sunset until sunrise)
- Place any sun-bed, umbrella, caravan, tent, etc on, or near, the beaches
- Use or anchor a boat without a special permit or tolerate such action, in the adjacent sea area where the sea is shallower than 20m
- Drive any vehicle on a beach or tolerate such action
- Fish, except with a rod and line (to the 20 m isobath)

With the changing legal regime of the area, the protection methods shifted from hatchery work to *in situ* protection of nests. There was an evolution of protective cage design from hatchery "retention" cages to cages which protected nests from foxes, but which allowed hatchlings to go to the sea as they emerged from the nests. Cage design also changed with the knowledge gained on the role of geomagnetic forces in turtle navigation, imprinting etc and cages were hence made of non magnetic material (anodised aluminium).

The scope of the project also changed to cover more thoroughly all the other important turtle nesting beaches, including the very important loggerhead nesting beaches of Polis/Limni/Yialia in Chrysochou Bay in the north-western part of the island. This is the main loggerhead nesting area. This area has now been proposed as a "Natura 2000" site and in early 2005 it was submitted as such, to the European Commission on the basis of the Habitats Directive. The coastal strip of the Polis/Limni/Yialia area was declared, in the meantime, and as first step, as a Coast of Ecological Importance on the basis of the Town and Country Planning legislation. This carried with it a number of measures regarding building etc (e.g., lights) in the coastal strip adjoining the planned "Natura 2000" site. The site proposed as a Natura site includes 11 km of coastline, mainly consisting mainly of nesting beaches, and the adjoining sea area down to the 50m isobath. This includes a marine area which has been identified as a foraging area for green turtles of all ages, with *Posidonia* and *Cymodocea* meadows, in is foreseen to be closed to fishing throughout the year. The limits of the area on the land side are however still the subject of some concern as the area is developing fast, with seaside villas and an urban sprawl along the coast which will be difficult to manage from a turtle conservation point of view (Demetropoulos 2003a). Some of the beaches in this area and on the west coast were damaged by massive sand extraction in the late 1970s and early 1980s mainly and though this was effectively stopped, there is some residual damage to a number of beaches.

On all the beaches in the Lara/Toxeftra Reserve, in Chrysochou Bay and in most other places where there is consistent nesting, all nests are protected *in situ* by cages (each with a sign warning people not to disturb the nest). These are, to a very large degree, respected by the public and are effective in controlling predation. The use of cages and signs has had a significant impact of public awareness. Relocation of nests to the hatchery in Lara is only undertaken for a small number of nests (10-20 nests a year) from a couple of very touristic beaches, in Coral Bay on the west coast,.

WHAT THE PROJECT IS DOING NOW

The project and the activities, methods and strategies used, evolved with time following:

a. the knowledge and experience gained through the project
b. the knowledge gained by the scientific community elsewhere
c. changing circumstances and opportunities

The main activities of the project are summarised below:

- Management of the Lara/Toxeftra Reserve coastal area and adjacent sea. This includes law enforcement by the DFMR. Management also of the Chrysochou Bay beaches and adjacent sea and law enforcement (though some of the specific management regulations for the area are pending).
- All beaches are monitored and all nests are protected *in situ* on all the beaches they were laid on. Non-magnetic, self releasing cages are used.
- Nests laid too near the sea are relocated up the same beach (about 5% of the nests)
- Nests from intensive tourism beaches, mainly from the two beaches in Coral Bay on the west coast, where they have no future, are relocated to the "hatchery" at Lara. About 10-20 nests p.a. are relocated from there.

- The egg chamber is located with an aluminium tube/rod when the nests are fresh (1-3 days after laying) – and the nest is not dug at this stage so as not to destroy the structure of the "lid" of the chamber.
- All green turtle nests are dug up after emergence of hatchlings from the nest has finished, to ascertain the fate of the eggs. Most loggerhead nests are also dug the same way.
- Turtles are double tagged on the front flippers with plastic Dalton tags. Tagging is on the soft trailing part at the distal end of the flipper. This ensures that the tag will tear off the flipper if it gets entangled in nets. Tagging is undertaken when egg laying and covering up of the chamber have finished.
- A rescue facility is run - as needed.
- Hands-on training courses are held for scientists and protected area managers and rangers. Most trainees are sponsored by RAC/SPA (UNEP/MAP).
- The project is a government project, run by the DFMR, with no volunteers. The Cyprus Wildlife Society (CWS) has been helping with the project with experienced biologists since 1989. It runs the training courses in cooperation with the DFMR.

LESSONS LEARNT

First (obvious) lessons:

- Let nature take its course as much as possible. Turtles "know" what they are doing. Keep any intervention with nests and hatchlings, at any stage, to the minimum. Predation from foxes, however natural, needs to be curbed however, as the state of turtle populations in this region has been affected by man and new equilibriums need to be reached.
- Monitoring and research as well as tagging provide information but do not by themselves conserve turtles.
- Conservation means taking positive action to aid the survival of turtles; this includes the protection of turtles at sea and on the beaches, the protection of their key marine habitats as well as their nesting habitats and their nests and hatchlings.
- There is plenty of information on which to base conservation (more is always useful – but it should not be an excuse for no action).
- Setting up hatcheries on beaches destined for development is not only futile but in fact reduces the chance turtles have to survive.

More (less obvious) lessons learnt:

- The two species have different needs in beaches with different characteristics. On some both can nest successfully. Green turtle nests are generally laid higher up the beach than loggerhead nests, where nesting of both species takes place on the same beach. Relocation to hatcheries of nests needs to take the species needs into consideration.
- Different beaches have different sand temperature regimes depending on grain size etc (with higher temperatures on larger grain beaches). Different zones on the same beach also have different temperature and humidity regimes (lower temperatures lower down the beach).
- The depth turtles lay their eggs at, varies with the beach (lower down on large grain beaches) but also with the location of the nest on the beach (distance from the sea).

Generally the depth of chambers on the same beach is fairly constant if measured from the level (depth) the wet sand starts.

- Nests laid early and very late in the season obviously have a lower incubation temperature and will have a tendency to produce more males than the nests laid in the middle of the season. So protection of nests needs to be spread throughout the season.
- The beaches the turtles "choose" to lay their eggs on, are the result of the suitability of these beaches, as nesting grounds. It makes good biological sense, from an evolutionary point of view, to nest on a beach that proved good for the parent. In other words it is the result of a kind of "natural selection" that has approved suitable beaches and rejected unsuitable ones. One single factor, not always obvious, is enough to stop a beach being a good nesting beach, e.g., if the sea in the area adjacent to the beach is cold, due to currents, in the nesting season (Demetropoulos and Hadjichristophorou 1995, Demetropoulos 2003 a).

"BEST PRACTICE"

The following are the main conservation practices used in the project for the nesting beaches. They are viewed as "Best Practice" - under our circumstances at least:

On protecting and digging up nests:

- **Protecting nests**. "Open", self releasing, non-magnetic (aluminium) cages are used for protecting nests from predators. These are cages with no netting of any sort, which allow hatchlings to head for the sea as soon as they emerge from the sand. Non-magnetic material is used for the cages so as not to risk unintended behavioural consequences by distorting the magnetic field in the area of the nest. The use of non-magnetic cages therefore safeguards that there is no interference with imprinting mechanisms that may affect orientation and navigation. These cages have been used in the Cyprus Turtle Conservation Project since 1995. Since then studies have confirmed the assumptions made (Irwin et al. 2004). A square aluminium frame (grid) may be used as an alternative. These are buried in the sand 10cm or so deep, on top of the nest. They are best used where the presence of cages on the beach is counter productive, e.g. where the use of the cages will attract unwanted attention to the nest (and cause interference with the eggs or hatchlings). The choice between cages and frames (grids) needs to be made depending on the threats faced. The use of frames is not as simple as the use of cages, as the central gap of the frame needs to be located accurately on top the chamber. Hatchlings that get stuck under a bar/strip may not be able to reach the surface of the beach as they cannot dig sideways and whole groups of hatchlings have been found dead under such frames. The use of an accurate GPS is also needed to relocate such nests.

- **Locating the chamber**. The egg chamber is located with a thin stick (an aluminium tube/rod) when the nest is fresh (less than 3 days after laying) – after that probing may cause dry sand to collapse into the nest. Keep in mind that nests on coarse sand beaches are more likely to collapse when using the stick to probe for the chamber. The nest is not dug to verify the presence of eggs at this stage. This destroys the structure of the "lid" of the chamber and may result in collapsed nests, with sand falling between the eggs filling up the air spaces between them and depriving them of the oxygen needed for successful incubation and hatching and of the space needed for the movement of hatchlings within the chamber upon hatching. Properly covering the chamber again requires training.

- **Relocation.** Nests should not be relocated unless they very obviously need to be moved. Such relocation may be necessitated in two cases, in our situation at least. Firstly in cases of nests threatened with swamping by high seas (waves etc) and secondly in cases of nests on beaches very heavily used for tourism. Relocation is a complex issue, in spite of its apparent but deceptive simplicity. Replicating an egg chamber in a different part, even of the same beach, is no simple matter. The incubation environment may change and hatching rates and sex ratios may be altered. It needs to be kept in mind that the depth of the chamber on the same beach varies significantly not only with the species but also with the location of the nest on that particular beach. As a rule the turtle makes the chamber at the same depth measured from the level at which she reaches the moist sand. This means that chambers in nests low down on the beach are shallower than chambers in nests made high up on the same beach, when measured from the surface of the sand on that beach. Whenever possible relocation higher up the same beach is recommended. The distance from the sea to relocate to depends on the species – as a guideline use the average of the distance of nests from the sea, of that species, on that particular beach. There is often a zone within which turtles dig their nests. Dig the chamber to the depth the original chamber was dug below the level the wet sand starts.

- **Excavating nests.** Nests are dug up when emergence of hatchlings from the nest has finished. This is several days after emergence of hatchlings starts. Earlier digging up may cause problems to any hatchlings remaining in the nest and though it may feel good "saving" hatchlings from the nest, this may in fact be interfering with natural selection processes, as it is often the weaker hatchlings that are left behind. Digging up a nest after emergence has finished verifies that it is in fact a nest (important for some elusive green turtle chambers) and provides information on hatching success and clues on possible problems e.g., dead hatchlings in the late embryonic state denote a collapsed chamber from possible interference with the nest, dead embryos at an early stage may mean bad relocation (for relocated nests) – or swamping or human interference with the nest at an early stage.

- **Dealing with hatchlings.** Hatchlings should be allowed to go to the sea by themselves as soon as they emerge from the sand – they should not be handled or guided or restrained or kept for any purpose. Hatchlings emerge naturally from the nest during periods of "frenzied" activity, which helps them scramble quickly down the beach to the sea and swim out to safer waters. On surfacing from the nest they quickly orientate towards the sea. Crawling to the sea helps in getting muscles working, which helps in the initial swim etc. If handled or their crawl to the sea is interfered with, they will be confused and their navigation and imprinting mechanisms may be interfered with (Lohmann et al 1995, Lohmann and Lohmann 2003). Hatchlings (or pipped eggs) cannot and should not be reburied – they will die. Hatchlings held for any reason should not be released in the evening or early morning – it is good for photos but it is prime feeding time for the fish. That is why fishermen fish at those periods of the day.

ASSESSING SUCCESS

Keeping in mind that, on present information, turtles need 25-35 years to reach maturity, results from turtle conservation work, in terms of increased number of nests, cannot be expected in less than 25-35 years after conservation measures are implemented. Even then it is not certain that there will be increases in populations and in nesting, as other parameters enter the equation (mortality at sea from fishing etc). Any results from the project, therefore, are not expected to start until after that period. Nonetheless in the last ten to fifteen or so years, a large number of juvenile green turtles and some sub-adults can be seen in our waters, especially in Chrysochou Bay, which were never seen before. Whether they will survive long enough to start nesting, remains to be seen. Fluctuations in the number of nests from year to year are normal and are to be expected, particularly in green turtles. Such fluctuations need to be seen in perspective and long term trends need to be ascertained, without jumping to conclusions on the basis of short term observations. Fig. 1 and Fig. 2 give the nesting data and nesting fluctuations since 1989 for the West Coast and since 1999 for Chrysochou Bay. Such fluctuations are also influenced inter alia by surface seawater temperatures off the beaches mainly. These temperatures may in turn be influenced by water circulation patterns, by currents and winds. Warm waters in the coastal area, off the nesting beaches, just before and during the nesting season, usually lead to regular nesting, while spells of cold waters put nesting on hold, probably affecting the number of clutches laid in a season, at least on those beaches. Such effects have been noted during the life of the project and are given due attention. The effects on nesting of global warming and climate change need also to be taken into consideration in assessing success (Demetropoulos 2003b).

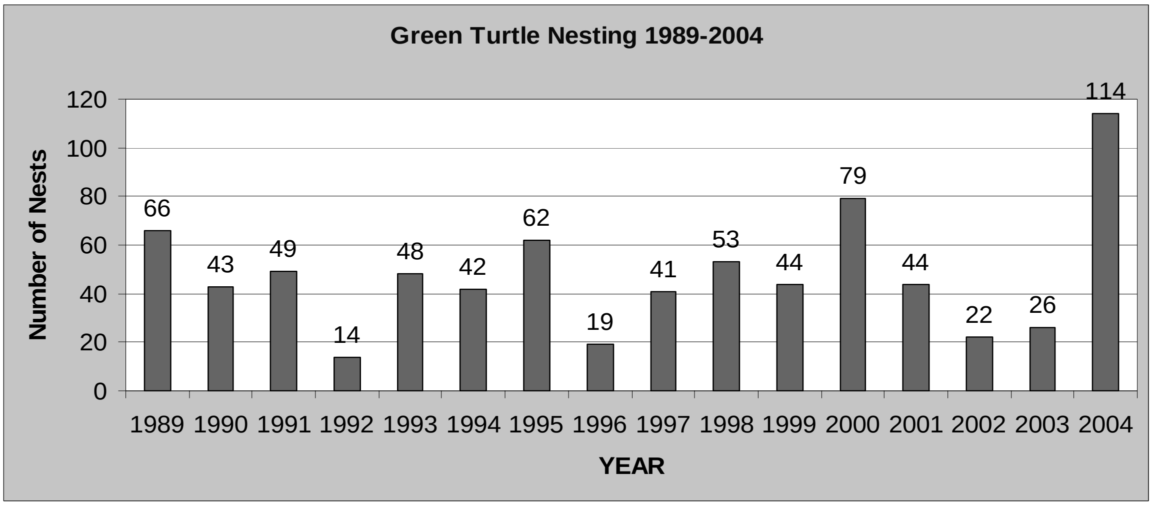

Fig. 1. Green turtle nesting on the West Coast

The fact that this was a government-run and government-sponsored project, helped in the effectiveness of the project, as did the fact that the project (and turtle conservation as a whole) was being implemented on the basis of legal provisions approved by the House of Representatives, which include the basic management measures. The determined enforcement of these Regulations by the Department of Fisheries and Marine Research also helped conservation in a variety of ways.

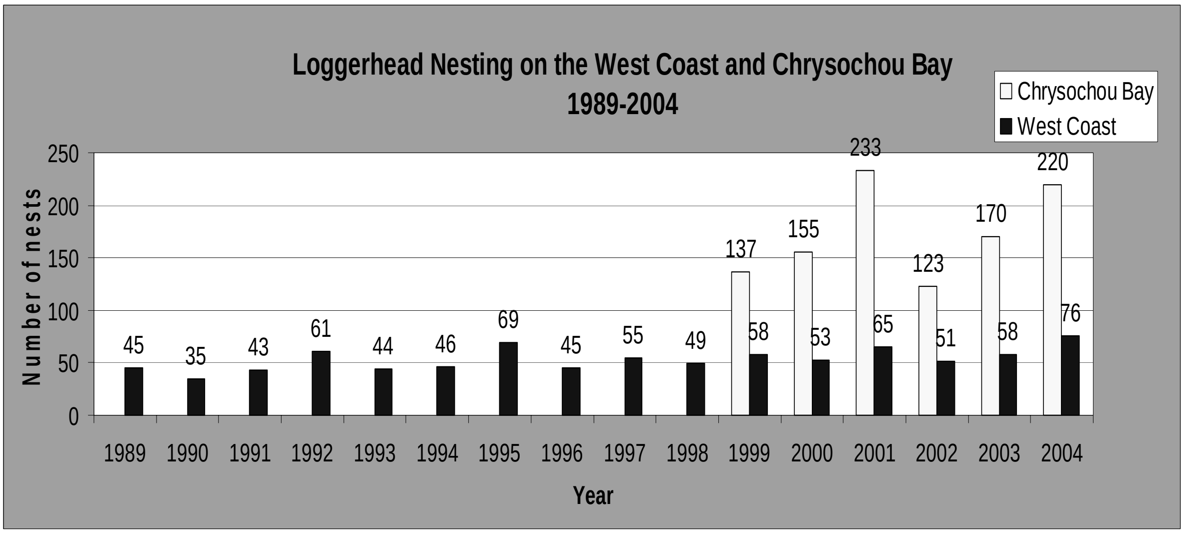

Fig. 2. Loggerhead nesting on the West Coast and in Chrysochou Bay 1989-2004. The data for Chrysochou Bay prior to 1999 are not compatible with the rest of the data and are not included

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CONSERVATION EFFORTS ON MARINE TURTLES IN TURKEY

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Marine turtles are fascinating creatures that have lived on the earth for over 100 million years. This remarkable reptile, of which there are seven species, is revered in culture and custom around the world. It symbolises longevity, fertility, strength and protection from the harm. For thousands of years, marine turtles have provided sustenance to coastal communities around the world. Unfortunately, their populations have declined drastically due to unplanned human activities. Economic factors are often behind marine turtle declines.

In Turkey, as elsewhere in the Mediterranean, marine turtles are under serious threat from loss of nesting, breeding and wintering habitats due to beachside urban and unplanned tourism investments, sand extraction and the associated coastal erosion, pollution, by-catch, and collisions with boats. The last report of WWF-Turkey shows that 64% of the 17 most important nesting sites are not adequately protected.

Marine turtle conservation requirements should be included in coastal zone management plans as well as in ecosystem conservation programmes. And we should reduce our footprints on nature.

RESEARCH AND CONSERVATION STUDIES IN SPECIALLY PROTECTED AREAS DURING THE LAST FIVE YEARS

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The total length of the Mediterranean coast of Turkey has at least 17 areas with suitable nesting grounds for sea turtles. Only 481 km of this coast are sand and less than half of that (221.1 km) is used for turtle nesting. The significance of 5 Specially Protected Areas (SPA), which have a 72.8 km coastline, include Dalyan, Belek, Patara, Fethiye and Göksu Delta, which are the most important nesting areas for the Loggerhead Turtle (*Caretta caretta*), and partially for the Green Turtle (*Chelonia mydas*) as proved by various surveys carried out since 1989. In fact dense nesting areas are confined to 40.5 km, which *C. caretta* uses, while *C. mydas* uses only some parts of the beaches in Belek, Patara and Göksu Delta SPA's.

In the last 15 years, Turkey has made significant progress in ratifying most of the main international conventions on nature and species conservation. Pursuant to article 9 of the Turkish Law of Environment and the protocol to the Barcelona Convention (Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean), the Authority for the Protection of Special Areas (APSA) was established in 1989 by decree having the force of law (KHK/383).

The SPA's are unique regions with historical, natural and cultural and other values, based on national and international ecological criteria. The aim is to protect wild animal and plant species and a number of particularly endangered species and their habitats, protected under International Conventions and National Regulations in SPA'S as declared by the Cabinet of Ministers.

Along this line; scientific research, monitoring and training programmes have been carried out during the breeding season in each SPA so as to determine the nesting places and to eliminate harmful factors, such as natural and anthropogenic adverse effects on the sea turtles (OCKKB, 2000, 2001, 2002, 2003, 2004). This was carried out in collaboration with the universities.

In order to fulfil the aim of scientific research, the distribution of nesting activities and densities with respect to dates and sections were determined. On the each beach, negative factors on the eggs, hatchlings and adults were recorded. Some nests considered to be threatened by tidal inundation or human activities were transferred to artificial hatcheries on the beach. Transplantation of the nests occurred within the first 6 hours after egg deposition.

In cases of partial animal predation, the nest chambers and surrounding area were cleared of destroyed eggs and fully covered with moist sand to its original level. Care was taken not to move intact eggs still in the egg chamber. All destroyed eggs and egg shells were also counted and then buried elsewhere. For all in situ nests, where pressure from land predators such as the fox (*Vulpes vulpes*) was severe, a protective metal grating (72X72 cm) with a mesh opening of 9 cm was placed over the eggs. This was centered on the egg chamber. Nests near the influence of human activities were protected by wire cages with a sign placed on the surface of the sand. The beaches were regularly patrolled by research team every day during the breeding season. Furthermore, some of the adults were tagged after they had completed their nesting process.

According to results obtained from the nesting beaches in the 5 SPA's, the area with the greatest number of nests was Belek, for *Caretta caretta,* with an average of 504 nests in the last 5 years (Tab.1). Of these 5 SPA's only Göksu delta is an important nesting ground for *Chelonia mydas,* with 14 nests recorded in the 2004 breeding period.

		Year/Number of nests				
Nesting Site	**Beach length (km)**	**2000**	**2001**	**2002**	**2003**	**2004**
Dalyan	4.8	264	197	286	232	223
Fethiye	8.0	110	114	85	106	58
Patara	11.8	85	53	81	n.a	72
Belek	13.3	490	479	588	554	409
Goksu Delta	35.0	n.a.	n.a.	n.a.	n.a.	137

Tab. 1. Nest number of *Caretta caretta* in 5 SPA's from 2000 to 2004

		Year and nests/km				
Nesting Site	**Beach length (km)**	**2000**	**2001**	**2002**	**2003**	**2004**
Dalyan	4.8	56.2	41.9	60.9	49.4	47.5
Fethiye	8.0	13.7	14.2	10.5	13.2	7.6
Patara	11.8	6.7	4.0	7.4	n.a.	10.4
Belek	13.3	36.8	36.0	44.2	41.7	58.4
Goksu Delta	35.0	n.a.	n.a.	n.a.	n.a.	5.0

Tab. 2. Nesting densities (nests/km) and beach lengths in 5 SPA's from 2000 to 2004

Nesting density varies among the beaches in the SPA's between 4.0 and 60.9 nests/km for *C. caretta* (Tab.2). The nesting beaches in the 5 SPA's with the highest density are Dalyan beach for *C. caretta* and the Göksu Delta region (5 nests /km) for *C. mydas*. In general, annual nest numbers for all the nesting beaches in the 5 SPA's fluctuated between 850-1000 nests/year for *C. caretta* and *C. mydas* in the 5 last years.

Nesting beaches in the SPA's face three major problems. All the beaches are exposed to tourism-related problems and have a relatively high predation rate. Coastal erosion is also another important problem in Patara and Goksu Delta beaches. In the beaches of Belek and Göksu Delta, certain activities of the local people are also of concern, such as secondary house development behind the beach.

Development in the SPA's is controlled by physical land use planning systems, based on protection decisions and with ecological dimensions. Also, the SPAs has been organised as Ecological Planning Governmental Bodies, which were charged with the principle tasks of conservation and land use planning.

The protection and management of nesting beaches are of primary importance to turtle conservation. A management strategy based on the sustainable use of the highly fragile ecosystems of the SPA's, has been drawn up and put into effect. Rules and restrictions for recreation on the beach aim at the co-existence of both marine turtle reproduction and visitors. Visitors are not allowed to enter the beach from dusk until dawn. Driving of vehicles especially of 4-whell drive cars on the beaches was prohibited. Human access to nesting areas during day time was controlled. Walking, promenading, sunbathing on the nesting strip was forbidden. Visible lights from the beach were blocked. Erection of powerful, high, seaward facing lights is avoided. Hunting and Fishing activities were prohibited in sensitive zones by the decision of Central Hunting Commissions and legislation. The number, size and speed of motorboats were controlled by legislations and the limitations of visitors to the general beach area have been enforced by official personnel. Tourists are kept informed by means of leaflets handed out and signposts informing them on how to behave on a nesting beach during the reproduction season. Public meetings and training programmes have been carried out for the conservation of sea turtles and their habitats. Local authorities also receive adequate information, regarding the protection of species, by environmental educators, NGOs and other volunteers. Temporary information offices were set up, during the breeding season carrying out education and training programmes for the local people, native and foreign visitors. They were informed by the signpost and leaflets prepared by the APSA.

The first concerns about sea turtle populations in Turkey started in the 1980's. In accordance with public awareness and international conventions, there was a substantial increase in research and conservation activities during the mid 1990's. The establishment of APSA strengthens the efforts to protect wild animal and plant species and, in particular, a number of particularly endangered species and their habitats, which are protected under International Conventions and National Regulations. In this sense, APSA has been allocating a special budget and great effort for sea turtle monitoring and research projects, effecting protection and conservation management of turtle nesting beaches for the last 15 years.

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THE MEDITERRANEAN SEA: A WORLD EXAMPLE OF REGIONAL COOPERATION IN SEA TURTLE RESEARCH AND CONSERVATION EFFORTS

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The Mediterranean Sea covers an area of about 2.5 million km^2 with a coastline of approximately 46,000 km bordering three continents, i.e. Africa, Asia and Europe. The communications of the Mediterranean Sea to other seas are very restricted. At Gibraltar there is a very narrow strait across which lies a relatively shallow sill. As the Mediterranean Sea has a negative hydrological balance, with losses through evaporation exceeding the input of water through runoff and precipitation, a permanent incoming surface current, through the Gibraltar Strait, is created. A weaker subsurface counter-current spills saltier Mediterranean water into the Atlantic.

Presently there are 21 states bordering Mediterranean and more than 50 million people living along its coasts, exhibiting a multitude of cultures, languages and religions. The wider area, behind the coasts, supports about 400 million people. Although the Mediterranean Sea is not considered very productive due to the lack of currents and nutrients it is heavily fished and runs severe risks of pollution and contamination by the many cities and industries on its coasts. Further, around 150 million tourists visit Mediterranean each summer causing a serious pressure.

Three circumglobal species of marine turtles (*Caretta caretta, Chelonia mydas, Dermochelys coriacea*) are regularly encountered in the Mediterranean; two of them (*Caretta caretta* and *Chelonia mydas*) have evolved local populations, which are genetically distinct from their con-specific non-Mediterranean stocks. Further, a substantial contingent of loggerheads from the western Atlantic exploits the Mediterranean as a foraging area. Past exploitation, continuing restriction and degradation of nesting areas, and substantial incidental catch in fisheries are the main causes of concern to the sea turtles' abundance in the Mediterranean.

Although sea turtle research and conservation efforts have started relatively late, in the last few years they have gained a significant momentum. The first research and monitoring activities (Demetropoulos and Hadjichristophorou 1982, Geldiay et al. 1982, Margaritoulis 1982) were rather localized and remained mostly within national boundaries. An exception is Roberto Argano's work in the late 70s, when he visited several fishing ports in the western Mediterranean and questioned fishermen, providing a first insight on the great numbers of turtles caught in fishing gear (Argano and Baldari 1983).

However, some long-term projects, despite their seemingly localized nature, started to produce results affecting a great part of the Mediterranean. This was effected through flipper tagging and subsequent long-distance tag recoveries accumulated little by little over the years (Margaritoulis 1988, Argano et al. 1992, Margaritoulis et al. 2003, Lazar et al. 2004). The wide dispersion of tagged turtles in the Mediterranean manifested the international character of sea turtle research and conservation. For example, the discovery that female loggerheads nesting in Zakynthos and Kyparissia Bay forage in the Gulf of Gabes and in the northern Adriatic, showed that the survival of marine turtles cannot be effected by protection of the nesting areas alone. Indeed, when Greece passed the first legislative acts to protect the nesting beaches at

Laganas Bay, admittedly with a high political cost, the turtles using these beaches were actually traded for human consumption in the Gulf of Gabes; an activity declared as banned soon afterwards.

Regional efforts for marine turtle conservation in the Mediterranean started at the beginning of the 80s by international institutions and conventions. The Barcelona Convention (adopted in 1976) and its protocol concerning Mediterranean SPAs (adopted in 1982 and replaced in 1996) covers all Mediterranean countries and the European Union and has sanctioned a specific Action Plan for the Conservation of Marine Turtles in 1989 (revised in 1999) which plays a decisive role in pressuring governments to take action for the benefit of sea turtles (Ouerghi 2001a). The Bern Convention or the Convention on the Conservation of European Wildlife and Natural Habitats, a legally binding instrument within the framework of the Council of Europe, came into force in 1982; now 13 riparian Mediterranean countries are contracting parties. The Bern Convention is very active on marine turtles and frequently reminds governments in fulfilling their obligations stemming from the Convention; several important cases concerning protection of marine turtle habitats are known (Fernandez-Galiano 2003). Further, the CMS (otherwise Bonn Convention or Convention on the Conservation of Migratory Species of Wild Animals) is working towards establishing an interlinked, global framework for the conservation of marine turtles, where Mediterranean initiatives can either be included or take advantage of it (Barbieri in press).

The expansion of research, monitoring, public awareness and capacity building actions in the Mediterranean, conducted in most cases with the assistance of a large contingent of multi-national volunteers, resulted in a wide participation and a concomitant increase of sea turtle workers. However the results of research work and other findings could not reach the “official” levels in a meaningful timeframe, and therefore a communication gap was created between intergovernmental conventions and governments, and the many turtle workers in the region. This is fairly understandable as generally the average sea turtle researcher and/or NGO could not participate directly in the appropriate intergovernmental or governmental meetings where recommendations are proposed or decisions taken. Of course, there are many examples on the part of the Conventions in attempting to solicit the opinions of researchers through ad hoc expert meetings or creating “group of experts” or allowing NGOs’ reports as information documents in official meetings.

In the meantime, regional cooperation among researchers flourished. The old mood of suspicion and distrust dissolved gradually and soon communications were enhanced, data were exchanged to a certain degree, and various ideas and proposals were brought forward. To this end, the decentralization of IUCN’s Marine Turtle Specialist Group (MTSG) played a decisive role. This group, one of about 120 of the IUCN’s Species Survival Commission (SSC), is exclusively devoted to marine turtles. Recently the MTSG’s Vision Statement was reinstated as follows: “We envision marine turtles fulfilling their ecological roles on a healthy planet where all peoples value and celebrate their continued survival.”

In 1998 it was decided by the then MTSG Chair Alberto Abreu Grobois to decentralise the structure of the MTSG. Regional Vice-Chairs were appointed to large geopolitical regions around the world; one of the first to be created was the Mediterranean region. It is recognized that since then the Mediterranean region started to appear in the global sea turtle scene with its own identity. Certain facts below reflect the progress made towards the goal of regional cooperation:

1. The creation of MedTurtle, a listserv established by the MTSG for free exchange of information and discussion among marine turtle researchers and conservationists. Its operation started in 1998 and in 2005 featured more than 140 subscribers.

2. The meetings of the Mediterranean sea turtle specialists in the context of the Sea Turtle Symposia (STS). The STS is an annual global event, convened by the International Sea Turtle Society, which brings together many sea turtle scientists, students and enthusiasts around the globe. In 2001, at the 21st STS in Philadelphia, sea turtle workers in the Mediterranean met for the first time and decided to convene annually a regional meeting in the context of the STS. This has been unfailingly effected since then with the fourth Mediterranean meeting conducted in January 2005 at the 25th STS in Savannah (Casale et al. 2005). At these meetings issues of common interest are discussed, regional policies are developed, and collaborative proposals or even projects are elaborated (Margaritoulis and Glen 2002, Margaritoulis 2003, Margaritoulis 2004). It should be noted that at the 23rd STS a Discussion Forum concerning reduction of mortality in fisheries, organized by Mediterranean experts (Casale 2003), attracted several international experts on fisheries to provide their opinions.

3. In 2001, following a recommendation by the contracting parties of Barcelona Convention, the three international conventions pertinent to the conservation of marine turtles in the Mediterranean, i.e. the Barcelona, Bern, and Bonn Conventions, organized the First Mediterranean Conference on Marine Turtles (Rome, 24-28 October 2001) (Ouerghi 2001b). This brought together a great many Mediterranean researchers, conservationists, representatives of governments and international institutions, and students to present their works and to discuss various regional issues concerning sea turtles (Margaritoulis and Demetropoulos 2003). In view of its success the Second Mediterranean Conference on Marine Turtles followed suit and took place in Turkey (Kemer, 4-7 May 2005), with an even greater success as to the quality of the scientific contributions and the more specific workshops effected. Further, the future of these valuable regional conferences was secured in a more efficient way (Margaritoulis 2005).

4. Various one-off meetings that took place in the region and provided a great opportunity in bringing together Mediterranean colleagues. Some of these meetings that come to mind are the Darwin Initiative Workshop (Cairo, Egypt, 13-16 November 2000) (Edwards and Campbell 2001), Workshop on sea turtles and the long-lining fishery (Malaga, Spain, 30-31 October 2003), Workshop on Rehabilitation of Injured Sea Turtles (Glyfada, Athens, 19-20 November 2004) (Panagopoulou 2005).

5. A collaborative multi-authored chapter on a global loggerhead turtle book made known a great wealth of unpublished data from several long-term projects in the Mediterranean (Margaritoulis et al. 2003).

All these events improved greatly the relations among scientists, changed old-fashioned attitudes and provided the forum for establishing cooperative projects with a high regional value. Two examples of cooperative projects are the following. The so-called European Marine Turtle Project (EMTP) or Assessing Marine Turtle By-catch in European Mediterranean Fisheries, investigated sea turtle by-catch in fisheries having a great impact on population dynamics, i.e., trawling in Italy and Greece, and drifting long-lines in Spain, Italy and Greece. This project, co-financed by the European Commission, was organized in collaboration with fisheries and turtle researchers as well as fishermen to ensure that the methods are acceptable by fishery managers, and that biological data collected from turtles are useful to sea turtle research. The project's main objective was to reliably assess the impact of fishery-related mortalities through an integrated approach involving stock identification, estimation of total catch and mortality, and population modelling development (Laurent et al. 2001).

The second collaborative project assessed the genetic structure of the loggerhead turtle nesting populations in the Mediterranean. Samples from nesting turtles, collected from several countries in the Mediterranean and analysed in the Laboratory of Genetics at the University of Barcelona, provided very important results as far as the long-term conservation of the species in the Mediterranean is concerned (Carreras et al. in press).

Mediterranean is a bright example of regional cooperation for the conservation of marine turtles. Regional cooperation at the official level will benefit greatly by incorporating the knowledge and opinions of sea turtle specialists. This can be facilitated with the involvement of IUCN's MTSG. Further, on the part of the conventions more pressure and lobbying should be exerted towards other bodies (e.g. FAO's GFCM) in order to promote policies influencing the long-term conservation of marine turtles in the Mediterranean.

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THE STATE OF THE WORLD'S SEA TURTLES (SWOT) 2004

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The "State of the World's Sea Turtles" Initiative (SWOT) was launched in late 2003, and is now gathering data from dozens of sea turtle researchers worldwide. Founded by Conservation International, the International Sea Turtle Society, the Marine Turtle Specialist Group and Duke University's OBIS-SEAMAP project, SWOT is a long needed effort to create a publicly available, high quality, consensus driven, permanently evolving, global geo-referenced database of nesting beaches, migration routes, and foraging areas for all species of marine turtles. This tool will allow the sea turtle movement as a whole to identify conservation priorities and gaps, readily see global or regional trends in turtle numbers, and the mapped results will be used to engage governments, donors, corporations, and lawmakers.

For SWOT's first year, we have chosen to map all leatherback nesting beaches worldwide with nesting data from the most recent season. To date, more than 75 people and institutions from 35 countries have joined the growing "SWOT Team" by contributing data or providing technical support. In the future, the SWOT report will be expanded to include data on all sea turtle species and at-sea data, such as migratory routes and foraging areas. Advancing a global data sharing initiative of this magnitude presents a serious challenge. This presentation will focus on lessons learned, successes, failures, and future directions for the project, as well as discuss potential applications for the SWOT results; demonstrating how sea turtle researchers and conservationists worldwide can get the most out of the SWOT initiative.

IUCN RED LIST ASSESSMENTS OF MEDITERRANEAN SEA TURTLES: APPLICATION OF GLOBAL CRITERIA ON A REGIONAL SCALE

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Understanding the status of sea turtles is fundamental to their conservation. Clearly, management decisions regarding common themes like bycatch reduction and nesting beach protection, as well as more sensitive issues such as sustainable harvest and indigenous use, all require information on the status of sea turtle populations being impacted. Although few would argue this point, consensus regarding the most appropriate status assessment technique has been elusive. At a global level, the World Conservation Union's (IUCN) Red List Programme generates status assessments; identifying a species' 'extinction risk' based on past versus present abundance across its entire geographic range (Hilton-Taylor 2001). However, the spatial resolution inherent in global assessments of widely distributed species is often inadequate for addressing local and regional trends. In this paper, I describe the problems associated with global sea turtle assessments and explain why regional, or subpopulation-level assessments, are necessary. The IUCN's criteria for regional assessments are discussed as well as the IUCN Marine Turtle Specialist Group's efforts to undertake regional assessments for sea turtles in the Mediterranean.

GLOBAL SEA TURTLE ASSESSMENTS

Since the initial inclusion of hawksbills and leatherbacks in the Red Listing process over four decades ago (IUCN 1963), a number of new criteria for assessing a species' global status have been implemented and applied to sea turtles. In recent years these criteria have undergone substantial changes, shifting from a largely qualitative process, based on expert opinion, to one that is more quantitative and transparent, based on abundance data for distinct subpopulations (IUCN 2001). While this has proved challenging to assessors, this shift will likely result in more accurate assessments. However, despite increasing attention to sea turtle conservation, efforts to assess the status of several species and regional stocks may be hampered by a paucity of long-term data generated from monitoring programs. As a result, adequate assessments may not be possible for all species and/or subpopulations.

With sea turtles, the newest criteria were initially applied to the MTSG global assessment of green turtles starting in February 2001. Unfortunately, based on the resulting assessment document (Seminoff 2004), it is apparent that the risk of extinction as indicated by Red List global assessments doesn't always reflect the actual risk of extinction in the wild. Recall that the IUCN (2001) defines an Endangered species as one that is "considered to be facing a <u>very</u> high risk of extinction in the wild" and a Critically Endangered species as one that is "considered to be facing an <u>extremely</u> high risk of extinction in the wild." In the case of green turtles, despite their 'Endangered' status, few would agree that the species is going extinct anytime soon. This is particularly evident considering that some annual nesting subpopulations, particularly those in the Central Pacific, Central Atlantic, and Western Atlantic, are actually increasing (e.g. Bjorndal et al. 1999, Balazs and Chaloupka 2004). A similar situation can be seen with the leatherback turtle, a species that is currently listed as Critically Endangered by the IUCN despite the fact that a number of Atlantic nesting populations are actually increasing (e.g., Dutton et al. 2005). And with the hawksbill, a classification of Critically Endangered has been assigned, despite the fact that several sea turtle authorities have gone on record stating that the species is not going extinct any time soon. Indeed there are fewer adult nesting hawksbill turtles today than there were, say, 50 years ago, but that does not necessarily mean the species is on the verge of extinction. Examples such as this have resulted in considerable debate regarding the utility of global Red List Assessments for sea turtles (e.g., Webb and Carillo 2000, Lamoreux et al. 2003, Mrosovsky 2003, Pritchard 2004, Seminoff 2004, Seminoff and Abreu-Grobois 2008).

SUB-POPULATION ASSESSMENTS

The incongruity between the Red List category assigned to sea turtles and the actual probability of extinction in the wild underscores the need for a different approach. As illustrated above, the facts that most sea turtle species are globally distributed and are subjected to varying threats have resulted in disparate subpopulation trajectories in different global regions for some species. It therefore seems worthwhile to assess populations at a resolution below the global scale. In fact, I argue that this is absolutely requisite for effective conservation! By identifying subpopulations that are declining as well as highlighting those that are doing relatively well, finer-scale assessments will be more useful for resource managers on-the-ground. Moreover, finer-scale resolution in assessments would allow for a greater number of index sites in each region to be included in the process; some of which, although small, may represent important genetic diversity.

A regional approach would clearly benefit sea turtle status assessments and conservation efforts, but there are a number of important realities to keep in mind. For example, regional assessments will likely result in the down-listing or de-listing of some sea turtle populations. An example of this can be found with the Caribbean green turtle. Relative to estimates for the pre-Columbian Caribbean green turtle population (16-586 million turtles; Jackson 1997, Bjorndal et al. 2000), it is apparent that today's population is substantially depleted. Yet if we were to do a regional assessment of the present Caribbean green turtle population, the region would not qualify in a high threat category due to the apparent increase in population size over the last several decades. A similar situation is present for the Hawaiian green turtle stock that, relative to baseline numbers in the early 1970s, in on its way to recovery (Balazs and Chaloupka 2004). As with Caribbean green turtles, the Hawaiian population would likely be assigned a low threat listing. While lower threat listings may seem counterintuitive to the precautionary nature of sea turtle conservation, they are an important step forward if status listings are to be useful in the development of conservation priorities. Further, relating to this, regional assessments could result in a rearrangement of our conservation priorities. By revealing those subpopulations that are doing poorly, regional assessments may shift emphasis from those that are doing relatively well, even if they too are depleted. Although this may be necessary in today's climate of limited conservation funding, I think that any resulting changes in conservation planning should be done so with caution. Anthropogenic impacts are increasing throughout the world and it is therefore advisable that all sea turtle populations, even the healthy ones, continue to be monitored and effectively managed. After all, a nesting population should not need to be on the verge of extinction to be deserving of conservation action.

THE SUB-POPULATION ASSESSMENT PROCESS

Clearly, the IUCN is renowned for its efforts to develop global status listings of wildlife species, but it is important to note that the IUCN has also developed a set of criteria for regional and subpopulation assessments (Gardenfors et al. 2001, IUCN 2003). One of IUCN's primary requirements for assessing species at a sub-global level is that the subpopulation in focus represents a distinct, genetically unique population unit. With sea turtles, a taxon that is highly migratory with individuals spanning thousands of miles, the task of identifying a genetically distinct population unit necessitates considerable genetic data. Whereas genetic data at the mitochondrial (mt) DNA level may suffice, some cases may require finer-scale microsatellite genetic data. At the time of this writing, these requirements have not yet been distinguished for most sea turtle species in most oceanic basins.

Apart from the determination of the spatial scales that will meet IUCN's genetic distinctiveness criterion, subpopulation assessments will require substantial data from each focal region. Since the IUCN criteria as applied to sea turtles call for data spanning 3 generations, it is clear that considerable historic data will be necessary. In the case of green turtles, a species that has been the subject of human harvest and use for centuries (Parsons, 1962), such data are available for many areas of the world. A perfect example of this can be seen in the numerous historical data used for the 2004 Global green turtle assessment (Seminoff 2004). However, for species that have not been the subject of human use, have not been an economic commodity, or have not been recorded during early human explorations, such data may prove to be considerably more difficult to obtain. In many cases, it is likely that such data may in fact be non existent.

When historical data are unavailable, it may be necessary to invoke the IUCN criteria that allow the 3-generation time frame to be a sliding scale, in which part, or all of the interval can be protracted into the future. In such cases, however, assessors must be highly confident that their into-the-future population extrapolations are based on sound science. Clearly, the lack of historic data represents an inopportune situation. Deciding just how to deal with such situations from an extrapolation standpoint should be decided after careful thought and consultation with population modellers, social scientists, and species-specific experts.

REGIONAL SEA TURTLE ASSESSMENTS IN THE MEDITERRANEAN

The Second Mediterranean Conference on Marine Turtles marked a critical juncture in the participation of the Marine Turtle Specialist Group in IUCN Red List Assessments. For the first time, a team of sea turtle experts from the Mediterranean was assembled for a Workshop on Regional Red Listing of sea turtles in the Mediterranean. The Regional Assessment Committee consisted of 7 members; Jeffrey A. Seminoff (MTSG Red List Chair, USA), Dimitris Margaritoulis (MTSG Mediterranean Regional Chair, Greece), Juan Antonio Caminas (Spain), Paolo Casale (Italy), Andreas Demetropoulos (Cyprus), Yakup Kaska (Turkey), and Bojan Lazar (Croatia). The workshop consisted of a morning open session attended by 16 people including MTSG Co-Chair Roderic Mast and a closed afternoon session during which data were analyzed an a general strategy was developed for undertaking the assessments. The morning session had introductions of all the participants, a presentation on Red Listing by Jeff Seminoff, and updates for each of the three species in the Mediterranean that are being assessed with the IUCN Red List Criteria: the Mediterranean green turtle (coordinated by Andreas Demetropoulos), the loggerhead (coordinated by Bojan Lazar), and the leatherback (coordinated by Paolo Casale). During the afternoon session, the meeting was limited to the Red List Committee Members and was an opportunity for participants to discuss several issues pertaining to the Regional Red Lists such as, (1) the determination of Index Sites, (2) the finer details about the 2001 IUCN Red List Criteria, (3) the applicability of the Red List Criteria to each sea turtle species, (4) the use and method of extrapolations, and (5) the development of a timeline for completing the assessments.

At the time of this writing, each of the assessments is currently in preparation. Although the final status listings are not available at this time, a number of interesting challenges have surfaced. First, it is apparent that historic data are elusive for all species but the green turtle. Although contemporary data are available for species such as the loggerhead (Margaritoulis 2005), this paucity will undoubtedly make it difficult to estimate former abundances, and may call for the use of extrapolations protracted into the future. Second, although leatherbacks are present in the Mediterranean, the fact that they do not nest in this marine basin will preclude an in-depth examination of historic and present abundance estimations. In this case, there are considerable data on fisheries interactions (Casale et al. 2003), but it is not clear if these will be sufficient to develop a robust assessment. Finally, relating to the fisheries data, it is clear that significant interactions have occurred with all species. As such, we must develop a means to incorporate these impacts into regional assessments.

Many readers may be aware that the green turtle is among the species for which regional listings have been assigned by the IUCN; the Mediterranean population is listed as Critically Endangered. However, this regional listing was assigned prior to the implementation of the more quantitative criteria (IUCN 2001) and the circumstances regarding this listing are vague - it was originally listed in 1996 based on an assessment by the European Reptile & Amphibian Specialist Group, but to date no supporting documentation has been provided. Nevertheless, this regional listing was an important step toward greater resolution in sea turtle assessments. Moreover, it established precedent that I hope will be recognized by the IUCN when additional subpopulation assessments are submitted in the future.

As the first regional assessment initiative of its kind for the MTSG, this exercise will serve as a template for future similar efforts. Of course many challenges lay ahead, but I am confident that through teamwork and constructive collaboration we will be able to address any issue that arises. My hope is that this Mediterranean effort paves the way for future subpopulation assessments of sea turtles in other regions throughout the world.

CONCLUSION

The IUCN Red List is effective for red-flagging imperilled species on the global scale, but for globally distributed species such as sea turtles, the Red List global status descriptions often over-state the actual risk of extinction in the wild. To facilitate more appropriate status listings and to provide wildlife managers with an additional tool for developing conservation priorities, a series of regional assessments for all appropriate wildlife species should be undertaken. For species such as sea turtles that experience varied anthropogenic pressures in different parts of the world, this is requisite for effective management. Every effort should be made to have the MTSG regional assessments come out concurrently with the IUCN global assessment. Such efforts would meet the needs of the IUCN as well as regional and local conservation partners. They would not only help identify imperilled species and populations, but would also allow us to better understand when and where sea turtle populations are recovering, as well as the solutions that lead to recovery.

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CONSERVATION MEASURES ON MARINE TURTLES IN TURKEY

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The Ministry of Environment and Forestry is designated as the main responsible body for nature conservation and environmental management and charged with co-ordinating all national and international activities in Turkey.

After the 1980's the Ministry signed many international conventions related with nature protection. Bern and Barcelona Conventions and the protocols are major ones in species protection area. Within the framework of the Barcelona Convention, following the Genoa declaration, an Action Plan for the conservation of Mediterranean marine turtles was adopted. Marine turtle conservation studies become more active after this Action Plan. As a result of scientific studies which were carried out in the year of 1988, 17 important nesting sites were selected along the Mediterranean coast of Turkey. These sites were: Ekincik, Dalyan, Dalaman, Fethiye-Calis Kumsali, Patara, Kale, Kumluca, Tekirova, Belek, Kizilot, Demirtas, Gazipasa, Anamur, Goksu Delta, Kazanli, Akyatan and Samandag beach. These sites were legally protected with the Decision of Ministers Commission.

The "Marine Turtle Monitoring and Assessment Commission" was established in 1990 to coordinate overall studies. Three more sites were selected as marine turtle nesting sites: Olympos-Cirali, Alata and Yumurtalik beaches and seven sites including Ekincik, Dalyan, Dalaman, Fethiye, Patara, Belek and Goksu Delta were stated as "Specially Protected Areas".

Yumurtalik beach became a Wildlife Protection Site; Demirtas, Gazipasa, Anamur, Alata, Kazanli, Tekirova, Kale beaches became "First Degree Nature Protection Sites" (SIT); Kumluca, Samandag and Kizilot beaches became "Marine Turtle Conservation Sites".

There had been several excursions to the nesting sites between the years of 1990 and 2000. Several measures and precautions were taken into consideration and the bottlenecks were elaborated. Finally, three commissions on marine turtles, i.e. "Scientific Committee", "National Committee" and "Local Committee", were established with the decision of Marine Turtle Monitoring and Assessment Commission.

In addition, the Ministry focused on designing public awareness campaigns and supporting conservation projects for years.

ORAL & POSTER PRESENTATIONS

REPRODUCTIVE ECOLOGY OF *CARETTA CARETTA* AND *CHELONIA MYDAS* DURING 2002 AND 2003 NESTING SEASONS IN ALATA, MERSIN, TURKEY

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We investigated the nesting and hatching success of *Caretta caretta* and *Chelonia mydas* during the 2002 and 2003 breeding seasons at Alata Beach, Mersin, Turkey, as being an addition to the 17 principal nesting grounds. A total of 667 and 547 green turtle emergences were recorded in the years of 2002 and 2003 respectively. The numbers of green turtle nests were 134 (20.1 %) in 2002 and 121 (22.2 %) in 2003. The numbers of nests hatched were 127 and 111 for the years respectively. The numbers of loggerhead turtle emergences were 119 and 85 of which 27 (22.7 %) and 32 (37.6 %) were resulted in nests for two consecutive years respectively. All of the loggerhead turtle nests in 2003 and 26 of them in 2002 produced hatchlings. The negative factors affecting the sea turtle population on Alata beach were feral dogs, ghost crab and bird predations and natural causes of embryonic mortalities at different stages. The detailed information about the sea turtle nesting potential of Alata beach, with a total length of 3 km, was first established in this study. Alata beach, by having around 50 sea turtle nests per km per season, is one of the new important nesting grounds, mainly for green turtles and less for loggerhead turtles. These results are compared with the other three green turtle nesting areas in Turkey (Kazanli, Samandag, Akyatan), which were designated as important nesting grounds. Recommendations are made for the new nesting area.

INVERTEBRATE INFESTATION ON EGGS OF THE LOGGERHEAD TURTLE *CARETTA CARETTA* AND THE GREEN TURTLE *CHELONIA MYDAS* IN ALATA, TURKEY

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The damage caused by some invertebrates to eggs of loggerhead turtle, *Caretta caretta*, and the green turtle, *Chelonia mydas*, was investigated during the summer of 2003 on Alata beach, Turkey. These invertebrates are *Pimelia* sp. (Tenebrionidae; Coleoptera), *Elater* sp. (Elateridae; Coleoptera), Myrmeleonidae (Neuroptera), Enchytridae (Oligochaeta), Acari, Scarabaeidae (Coleoptera). The most important effects on loggerhead turtle and green turtle nests were made by *Pimelia* sp. (Tenebrionidae; Coleoptera).

IMPORTANCE OF MEDIA CO-WORK IN SEA TURTLE CONSERVATION SCHEMES

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Sugozu Beaches are 4 small beaches located in the northeast of the Yumurtalik town (Akkum beach, Sugozu beach, Botas beach and Hollanda beach). The total length of the beaches is 3.4 km. It is determined that (during the 2003 and 2004 nesting seasons) these beaches are very important nesting beaches for green turtles (*Chelonia mydas*). Media attendance and support for the ST conservation projects are encouraged during the project period. 1 press conference, 1 press meeting, 2 joint field work, and regular press visit activities are conducted during the project period and 6 media bulletin were produced during the same period. Thus, local and national media coverage has been influenced by this particular project during July-August 2004.

SEA TURTLE STRANDINGS OFF THE NORTH-WEST COAST OF MOROCCO

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INTRODUCTION

The Western Mediterranean is an important feeding and development area for large stocks of juvenile loggerhead sea turtles (*Caretta caretta*) that originate from Atlantic and Eastern Mediterranean rookeries (Laurent et al. 1998, Tomas et al. 2001). Sea turtle strandings in NW of Morocco were, on average, 27 individuals/year, between 1988 and 2001 (Ocana et al. 2002). Near this area, the Valencian network (East Spain) recorded an average of 31 (range: 14-52) loggerheads per year between 1995 an 2000. They can generally be due to the interaction with fisheries and pollution (Benhardouze 2004, Tudela et al. 2005). Between 2003 and 2004, we undertook a census of the strandings in NW of Morocco to update the data. In the present study, we conducted contacts with fishermen in order to obtain information on sea turtle strandings in different coastal areas around Tangiers, at the northern tip of Morocco.

METHODS

Contacts were made with fishermen, soldiers of the coasts and the workmen in sand extraction to inform us on the presence of the strandings. In the event of a stranding, we visited the place and we took the following notes: identification of species, measurements (CCL: Curved Carapace Length, CCW: Curved Carapace Width, etc), determination of sex, occasional anomalies (ectoparasitic, lesions, wounds, etc) and photographs, which we placed on the SEATURTLE.ORG website. In the case of live sea turtles, the intervention had to be very fast, to increase the chances of rescue.

RESULTS

During 2003-2004, we noted 12 strandings (11 *Caretta caretta* and 1 *Dermochelys coriacea*) NW of Morocco (Tab. 1). Of the *C. caretta*, 10 had died and one was alive and saved. The individuals stranded had a CCL between 24 and 145 cm. With the exception of D. coriacea (145 cm - see photo 1881 on seaturtle.org website) the average size was 58.45 cm.

DISCUSSION

It appears that the majority of the strandings are loggerheads with very variable sizes. The causes of the strandings are fishing and pollution. The majority of sea turtles had traces of wounds caused by fishing boats. The stranded sea turtle of May 06, 2004 in Sidi Maghait beach (50 km in the south of Tangier) was alive but very polluted (see photo 1491 in the seaturtle.org website) by oil and could not move. It was cleaned and rehabilitated in an aquarium filled with sea water which was renewed each day. During this period, it was fed with anchovies. It was released (see photo 1475 in seaturtle.org) on the May 22, 2004, in the same place as it was stranded, for raising the awareness of the inhabitants of the area and of course in the interest of sea turtle conservation.

The CCL average of 4 stranded individuals in the Mediterranean (74.25 cm) is bigger than that of the Atlantic 7 stranded turtles (49.42 cm), (Tab. 1) testifying that the NE Atlantic is a feeding area (Fretey 2001) while large turtles in the Mediterranean indicate that this sea is also a nesting area. Amajoud (2002) noted in July 2002 one stranded *Caretta caretta* (CCL= 64 cm and CCW= 60 cm) on the Mediterranean coast of Morocco.

Location	**Date**	**spp**	**CCL** (cm)	**CCW** (cm)	**Turtle status**
M'diq (M)	15/03/02	*Cc*	66	61	Dead
Restinga (M)	01/03/03	*Cc*	74	73	Dead
Tangiers (A)	29/06/03	*Cc*	43	40	Dead
Tangiers (A)	31/01/04	*Cc*	57	55	Dead
Tangiers (A)	31/01/04	*Cc*	40	35.5	Dead
Asilah (A)	06/05/04	*Cc*	24	22	Alive
Asilah (A)	22/05/04	*Cc*	61	58	Dead
Tangiers (A)	28/05/04	*Cc*	54	52	Dead
Tangiers (A)	05/06/04	*Cc*	67	65	Dead
Restinga (M)	13/12/04	*Dc*	145	100	Dead
Restinga (M)	13/12/04	*Cc*	82	76	Dead
Restinga (M)	13/12/04	*Cc*	75	74	Dead
Average			58.45 (without *Dc*)	55.59 (without *Dc*)	

Tab. 1. Sea turtle strandings in the NW coast of Morocco (M = Mediterranean; A = Atlantic). *Cc* = loggerhead, *Dc* = leatherback

A long-term follow-up of the strandings in NW Morocco and in other areas especially by Mediterranean Marine Turtle Stranding Network (Godley 1995) is necessary to affirm this conclusion. More research is needed (particularly in ecology, morphology and genetics) to completely understand the geographical origin, spatial and temporal distribution, biology and population dynamics of sea turtles in the western Mediterranean. It is possible that the importance of this region to sea turtles, particularly to loggerhead turtles, has been underestimated in the past (Tomas et al. 2003).

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CAPTURE OF SEA TURTLES IN THE FISHERIES AROUND TANGIER, MOROCCO

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Moroccan waters support a large fishing industry. This is a preliminary study to evaluate the interaction between fisheries and sea turtles in the fishing zone around Tangier, Morocco. Data sheets and measuring tapes were distributed to fishermen willing to collect information on turtles caught in their fishing gear. Between June 2003 and September 2004, fishermen reported 20 accidental captures of loggerheads primarily during the spring and summer months. The size of turtles captured suggests that most individuals may have been juveniles or sub-adults, supporting results of market surveys around Tangier. More in-depth studies will be underway to evaluate the impact of fisheries along the Atlantic coast of Morocco.

HEAVY BOAT TRAFFIC THREATENS LOGGERHEAD TURTLES IN SOUTH-WEST ITALIAN WATERS

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Loggerhead turtles, especially juveniles, are commonly found travelling and foraging along the southwest Italian coasts. They tend to accumulate in highly eutrophic coastal zones with particularly dense human populations. Over the past 13 years the Stazione Zoologica of Naples (SZN) has built up a local stranding network to assess the human impact on sea turtle survival in the Gulf of Naples and adjacent areas. Although the SZN receives turtles from all over Italy, in this paper we concentrate exclusively on the turtles that were recovered in Campania, a region which occupies a strategic position within the Tyrrhenian Sea with its 512 km long coastline. It has already been shown in previous studies that the Tyrrhenian Sea receives many migrant turtles coming in from the eastern basin (Bentivegna et al. 2003). Moreover, within the reach of the Gulf of Naples favourable currents flow from the southwest to the northeast and bring turtles into the Gulf (Ovchinnikov 1966).

Between 1993 and 2004 a total number of 300 turtles were recovered, 210 of which were dead and 90 alive. Analysis of the morphometric data of all these turtles revealed that the Campanian waters are mainly visited by juveniles and sub-adult turtles with an average curved carapace length of 57.2 cm.

On the basis of veterinary diagnosis or observations made during necropsies of dead specimens, the reasons for turtle strandings were divided into 3 main categories, "boat collision", "fisheries" and "diseases". Within the “diseases” category we included, for example, pneumonia, parasites and other symptoms of turtles obviously debilitated by unfavourable environmental conditions. However, the cause cannot be established in all cases and such data are categorised as “not known”. It is important to note, that in 54 cases of dead turtles, the reason of death could not be established because the specimens were already too decomposed at the time of stranding, so that a necropsy could not be conducted. These animals were not considered in the further analysis. In total, the most frequent reasons for sea turtle stranding were either fisheries (33%) or boat collision (24%), while diseases occurred in 8% of the turtles and a minority of 1 % could not be assigned to either of these categories. For 34% of the cases the cause of stranding could not be established and were therefore assigned to the “not known” category.

Fishery-dependent turtle strandings were found all through the year, with an increase during the summer months. This corresponds to the year-round activities of the predominantly artisan fishery, which only avoid going out at sea in bad weather conditions. However, the majority (64%) of turtles survived their encounter with fisheries (Fig. 1).

Boat impacts on the other hand had a strong seasonal occurrence with peak time during the summer, which was directly related to the maritime traffic and the use of pleasure boats. In fact Naples hosts an important harbour, from which many ferries and freight ships connect both to other Italian and to international destinations. Moreover, Campania is the region that has the second highest number of small pleasure boats below 12m. Unfortunately 91% of turtles which had boat encounters did not survive (Fig. 1).

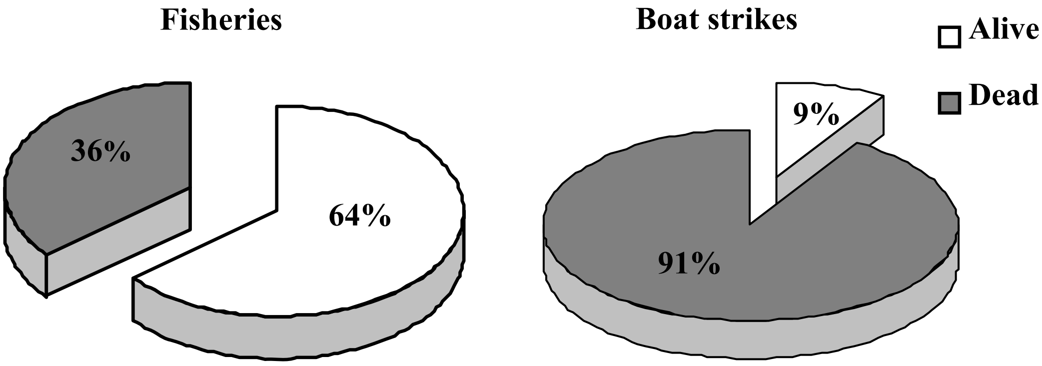

Fig. 1. The proportion of dead and alive loggerhead turtles stranded on the Campanian coast as a result of fisheries and boat impacts

There is an elevated chance to cure turtles in the Rescue Centre that were injured by fishing devices. Moreover, we mitigate the effect of fisheries on sea turtles with increasing success by awareness programs for the public and the fishermen. Boat strikes, however, have become an increasingly important problem to deal with, because they are almost always lethal. This becomes evident by comparing the proportion of dead and live turtles in the fisheries and the boat collision categories (Fig. 2). The effect of boat impacts is poorly documented in other Mediterranean areas. Kopsida et al. (2002) have reported a similar seasonal trend in sea turtle strandings caused by boat strikes in Greek waters, although a lesser proportion seems to be affected.

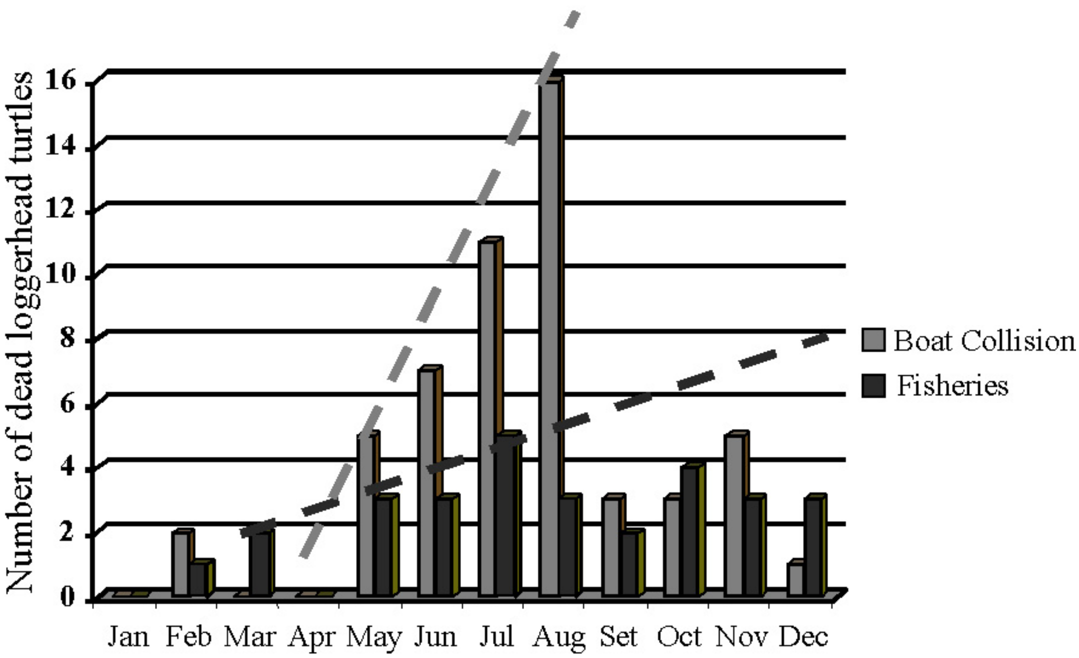

Fig. 2. The seasonal distribution of loggerhead turtle deaths caused by fisheries and boat collisions. The dashed lines indicate the increasing trends during the summer months only

Our data highlight that the water surface, the obligatory oxygen resource for air-breathing aquatic vertebrates, becomes a dangerous interface between sea turtles and human travellers and thus needs urgent consideration for future protection actions.

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EMBRYONIC ANALYSIS CONFIRMS: TRANSPLANTATION SAVED A RARE LOGGERHEAD TURTLE NEST ON THE TYRRHENIAN COAST

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A rare nesting event was observed in the evening of July 11th 2002 when a loggerhead turtle laid eggs on the Tyrrhenian coast, north of Naples. During the following 24 days the occurrence of several summer storms as well as tidal flooding threatened this exceptional nest. We thus transferred the nest, containing 89 eggs, to a more secure and higher location about 50 m from the high water mark. After 68 days, 44 of the eggs, found on the upper layers of the nest, hatched, while the other 45 eggs, found on the lower levels, never opened. The 45 unhatched eggs were examined by microscope in order to determine the approximate stage the eggs had reached in their embryonic development before their death. Five eggs were degenerated and could not be assigned to a developmental stage. Almost half (48.8%) of the embryos died at stage 6, and hence at the time of oviposition, while 16.3% reached stage 7, 7% reached stage 10, and 4.7% ceased development at each of stage 9, 11, and 12. Only 1 egg contained a fully developed dead hatchling. Since the time course of the developmental stages is well reported, we were able to determine that these unhatched eggs had ceased development before the transplantation. In this paper, we conclude that the unhatched eggs, found at the bottom of the nest, died from natural causes, perhaps from the tidal inundation, but not from the transplantation.

MONITORING OF A LOGGERHEAD SEA TURTLE, *CARETTA CARETTA,* IN THE CENTRAL MEDITERRANEAN VIA SATELLITE TELEMETRY

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INTRODUCTION

At the beginning the loggerhead turtle movements in the Mediterranean Sea were determined by tagging programs. Results show that dispersal after nesting appears to be widely distributed over the whole central and eastern basin; among the distant locations, two were identified as important neritic feeding grounds: the Adriatic Sea and the Gulf of Gabes.

Of the nesting females tagged in Greece between 1982 and 1999, 28 % were found in the Gulf of Gabes, mainly in winter (Margaritoulis et al. 2003).

According to Laurent and Lescure (1994), the south of Tunisia is a good wintering area for loggerhead turtles in the eastern basin, because:

(1) The very numerous individuals (more than 70 cm), probably adult, captured in winter in this zone cannot originate all from Tunisia since nesting along the Tunisian coasts is rare.

(2) The bottom shrimp trawlers capture only a few loggerheads in summer.

It is necessary to mention, in addition, that the discovery of an important nesting population in Libya may also partly explain the high number of turtles captured in winter in the South of Tunisia.

The use of satellite transmitters, to follow the turtles during their migration, allowed studying, in more detail, migration patterns and routes taken by the turtles. The works of Hays et al. (1991), Godley et al. (2003) and mainly of Bentivegna (2002) have shown a wide use of the whole Mediterranean basin by juvenile and sub-adult loggerhead turtles. We therefore decided to initiate a study on a rarely studied stage of the life cycle of loggerhead turtles. We were particularly interested in the movements of turtles in a winter and foraging habitat and selected a male turtle, to augment the knowledge on their behaviour

MATERIAL AND METHODS

The Tunisian coast stretches to about 1250 km (Fig. 1). The northern coast is under the influence of the Atlantic current. The continental shelf here is narrow and is characterised by a rocky bottom. Along the eastern coast, the bottom of the sea is homogeneous and the continental shelf is very wide, especially in Gabes Gulf.

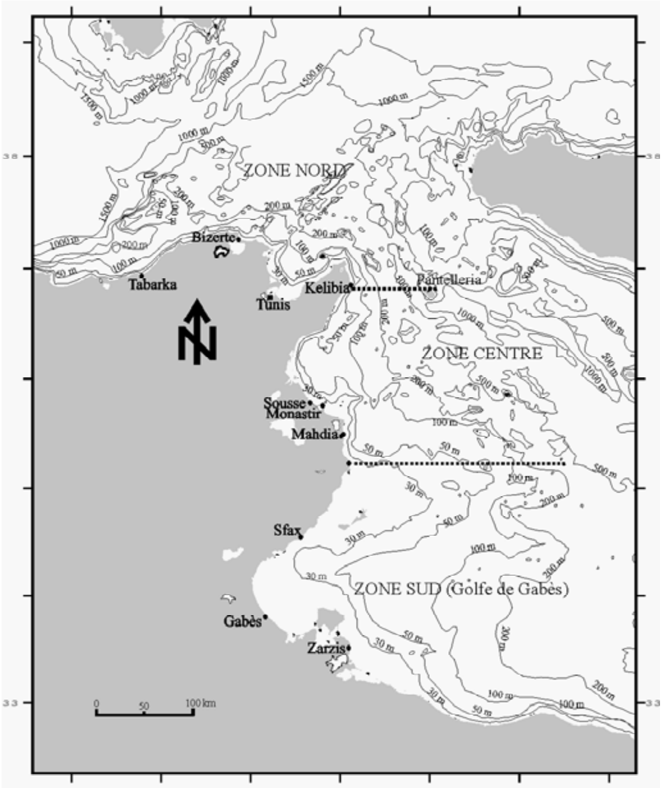

Fig. 1. Map of Tunisia

This region is characterized by a semi-diurnal tide with high amplitude (up to 2 m). In this sector, the Atlantic current loses its influence. The Gulf of Gabes presents hydro-dynamic and physical and chemical features different to those of the north. The temperature and the salinity are, for example, higher.

The large surface area of the continental shelf of the Tunisian southeast coast, the easy access to fishing zones and the presence of the *Posidonia* meadows, that constitute nurseries for several species of vertebrates and invertebrates, make this region the most important maritime fishing zone of Tunisia.

From a bio-geographic point of view, the zone's centre and especially the south, which are dominated by sandy and muddy bottoms, have a subtropical affinity, characteristic of the oriental basin

An adult male loggerhead turtle (*Caretta caretta*), baptised "Selma", which was accidentally caught in a bottom trawl in the Gulf of Gabes, Tunisia on January 21st 2001, was released from Monastir on the January 25th and tracked via satellite telemetry.

The transmitter type used in this monitoring was an ST-18 platform transmitter terminal (PTT) manufactured by Telonics (Mesa, Ariz.). The capacity of the internal batteries was higher in this PTT model. Duty cycles were 4 hours on and 20 hours off. The transmitter was attached to the turtle with epoxy resin, after the carapace had been carefully cleansed of grease and debris. The turtle was followed through the Argos satellite system.

RESULTS

The transmitter worked for a total of 314 days, during which the turtle travelled a distance of at least 2967 km. We obtained 63 valid positions, most of which from the first 3 months of the tracking (Fig. 2). Upon release the turtle stayed nearby for a couple of days before it started to move first southwards and then, more decidedly set on a journey to the east.

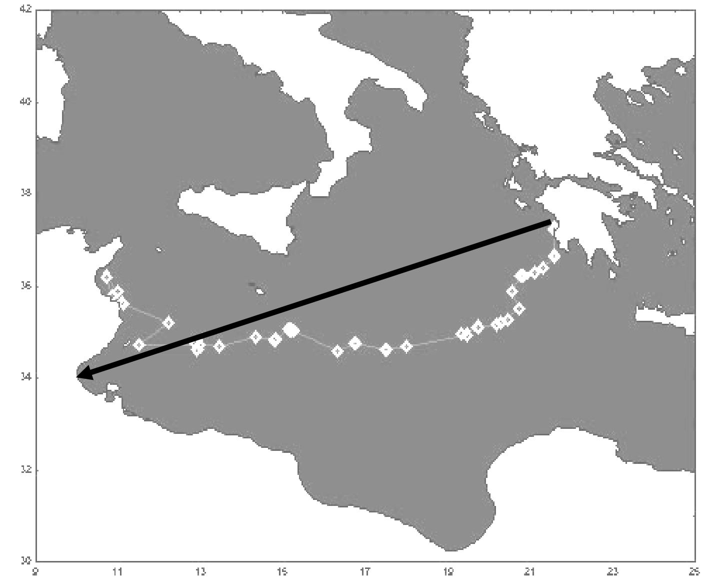

Fig. 2. The migration route of the turtle tracked by satellite

The turtle maintained this eastward course for the next three weeks, during which it determinedly followed a relatively straight line, covering on average 47.4 km per day. This is confirmed by the high straightness index of 0.83, which can be obtained by dividing the straight line distance between the start and the end point by the sum of the distances between the single positions of the route.

We have obtained average sea surface temperatures from the NOAA webpage to compare to the turtle's migration path. When the route and the monthly average sea surface temperature for February are overlaid it appears, that the turtle was moving along the isotherms and stayed within a narrow temperature range between 15 and 16.5°C.

On the 30th of February the turtle changed course again and moved towards Greece, now at a reduced travel speed of an average 20.8 km per day. It hit land at the Peloponnesus peninsula, and remained in the vicinity of Kyparissia Bay, which hosts an important nesting area. On the 27th of April transmissions suddenly ceased. By this time the water temperatures had risen to 19°C.

Five months later the PTT of our turtle suddenly started transmitting again, although not on a regular basis. The first position after this long break clearly showed that the turtle had returned to the Gulf of Gabes. The water temperature off the coasts of Tunisia was 27°C at the end of September.

CONCLUSION

This monitoring confirms the results of the different tagging projects and studies on interactions between turtles and fishing gears in this area, especially in winter (Bradai, 1992), which lead to the conclusion that the region of the Gulf of Gabes is an important wintering and feeding area for the loggerhead turtle.

Moreover we can underline the following points:

- This is the first recorded round-trip of a male between Gulf of Gabes and Kyparissia Bay (Greece)
- No obvious seasonal trigger was noted for the migration
- Determined open ocean travel towards destination was noted in part of the journey
- Fidelity to neritic feeding ground was confirmed.

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DIRECT MORTALITY ON MEDITERRANEAN LOGGERHEAD TURTLES. RESULTS OF THE SPANISH SURFACE LONGLINE FISHERY OBSERVATIONS

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INTRODUCTION

The surface longline is a common gear used in the Mediterranean, targeting swordfish and tuna species. These gears are considered an important threat to marine turtles worldwide (Heppel et al. 1999, FAO 2004, Lewis et al. 2004) and also are one of the major fisheries-related threats for the Mediterranean turtles (Caminas 1997, Godley et al. 1998). Although many countries fleets target swordfish and tuna species using the longline in the Mediterranean (Laurent et al. 2001), information on the hooks direct mortality on sea turtles is very infrequent (Caminas 2004). This paper discusses the relative direct mortality in the Spanish longline fishery, considering different gears and its relative effects on marine turtle conservation.

MATERIAL AND METHODS

The Spanish longline fleets target mainly swordfish (*Xiphias gladius*), although other species such as bluefin (*Thunnus thynnus*) and albacore (*Thunnus alalunga*) are captured depending on the period of the year and species abundance or price. Other species captured, such as sharks are considered a by-catch in the Spanish longline fleet. Some protected or charismatic species as sea turtles, marine mammals and sea birds are incidentally captured and are generally released in different conditions and injuries (Caminas and Valeiras 2001).

To evaluate the captures of target and non-target species of the Spanish longline fleet the IEO (Spanish Oceanographic Institute) is carrying out an onboard observers programme. A total 1,523 fishing operations were observed onboard from 1999 to 2004 representing 3,812,936 hooks. The direct mortality of the sea turtles was analysed by gear type and fleet strata yearly during the period.

RESULTS AND DISCUSSION

Table 1 summarises the total fishing operations directly observed during the period 1999-2004 by gear and year. This table also present (in brackets) the real numbers of turtles (Loggerhead) captured dead. From 2003 we observed the introduction by the fleet of a new gear type called “americano” and also “roller” characterised by a reduction in the hook number and by increasing of the main line length. The main gear characteristics are the total main line length, the hooks size and the baits (Caminas and Valeiras 2001). Table 2 shows the Spanish longline multiplicity according to: i) target species (Albacore, bluefin or Swordfish); ii) the number of variables observed by boat (fleet A and B, depending on boat length) and iii) the gear-type (with or without roller).

Direct mortality was observed in all boat strata as presented in Tables 1 and 2, but depending on gear and year strata. From a total 3,480 Loggerhead incidentally caught, 51 were directly dead representing 1.5 % of the total.

	BFT	BFTr	SWA	SWB	SWBr	ALB	ALL
Hooks	525,020	51,090	180,510	2,496,181	261,165	298,970	3,812,936
Fishing operations	266	31	145	800	211	70	1,523
Sea turtles - catch	746	54	125	1,837	354	354	3,470
Dead sea turtles	13	1	2	10	15	5	46
% Dead sea turtles	1.74	1.85	1.6	0.54	4.24	1.41	1.33

Tab. 1. Total mortality rates for each boat strata

ALB: fleet targeting albacore; BFT: fleet targeting bluefin tuna; BFTr, fleet targeting bluefin tuna, with roller; SWA: fleet targeting swordfish, without roller; boats< 12 m; SWB: fleet targeting swordfish, boats> 12 m; SWBr: fleet targeting swordfish, with roller, boats> 12 m.

Year	ALB	BFT	BFTr	SWA	SWB	SWBr	ALL
1999	63 (4)	14 (0)	0	21 (0)	180 (0)	0	279 (4)
2000	7 (1)	148 (13)	0	15 (0)	242 (8)	0	412 (22)
2001	0	37 (0)	0	74 (2)	143 (1)	0	254 (3)
2002	0	30 (0)	0	0	115 (0)	0	145 (0)
2003	0	23 (0)	12 (0)	0	87 (1)	56 (0)	178 (0)
2004	0	14 (0)	19 (1)	35 (0)	33 (0)	155 (15)	256 (16)
ALL	70 (5)	266 (13)	31 (1)	145 (2)	800 (10)	211 (15)	1,523 (46)

Tab. 2. Total number of observed fishing operations for boat strata during 1999-2004 fishing periods. In brackets the Loggerheads captured dead

ALB: fleet targeting albacore; BFT: fleet targeting bluefin tuna; BFTr, fleet targeting bluefin tuna, with roller; SWA: fleet targeting swordfish, without roller; boats< 12 m; SWB: fleet targeting swordfish, boats> 12 m; SWBr: fleet targeting swordfish, with roller, boats> 12 m.

The percentage of directly dead Loggerhead varies between the low value 0.54 % in the fleet > 12 m targeting swordfish (the traditional Spanish surface long-line) and the high value 4.24 % in the fleet >12 m targeting swordfish with the longline modified by the recently introduced roller. Intermediate values of dead turtles were registered in the fleet targeting bluefin tuna (3.23 %) probably because the gear is fishing in deeper waters (>60 m.) and the turtles drown before the gear is hauled.

The longlines in the artisanal fleet (SWA) are mainly used near surface depths when targeting the swordfish. In this case these are not as effective for the Loggerheads as the other longline type used by the rest of the fleet. When the fleet used the new longline with roller a great variation between years was observed. The number of Loggerheads captured and dead was zero in 2003 and 15 in 2004, probably because gear of modifications during the last year to increase swordfish catchability. This latter results need to be better analysed when more datasets become available.

ACKNOWLEDGEMENTS

This study was supported by three projects from the Oceanographic Centre of Malaga of the IEO: Project EMTP (Assessing marine turtle bycatch in European drifting longline and trawl fisheries for identifying regulations), SWOMED (Swordfish fisheries in the Mediterranean Sea) and PANLANDALIFE (Conservacion de Cetaceos y tortugas marinas en Andalucia y Murcia, LIFE02NAT E/8610).

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THE SPANISH MARINE TURTLE TAGGING PROGRAM: INTERNATIONAL IMPLICATIONS FOR THE LOGGERHEAD STOCKS CONSERVATION

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INTRODUCTION

The Mediterranean loggerhead (*Caretta caretta*) nesting grounds are almost exclusively confined to the eastern basin (Margaritoulis et al. 2003). Loggerheads from the Mediterranean stocks have feeding migrations towards the Balearic Sea (Caminas and De la Serna 1995). Immature and adult loggerheads from the Atlantic also migrate to the same area, increasing the Mediterranean population (Caminas 1997). The Atlantic origin for some loggerheads found in the Mediterranean was suggested by Argano and Baldari (1983) and confirmed through genetic studies (Laurent et al. 1998). Epibionts suggest Atlantic origin (Baez et al. 2001). Evidence of loggerhead W→E migrations has been reported in the eastern Atlantic (Bolten et al. 1990) and in the Mediterranean (Basso and Cocco 1986, Manzella et al. 1988).

Argano et al. (1992) registered a loggerhead tagged in Italian waters recaptured outside the Mediterranean Sea. Bolten et al. (1992) presented a transatlantic E→W migration of a loggerhead from the Canary Island to Cuba. This document reports new data of 13 loggerheads tagged in the Mediterranean, of which 11 were recaptured in the Mediterranean and 2 in the Atlantic. The two Atlantic recaptures correspond to an eastern (Lepe, Spain) and a western Atlantic (Cuba) site.

MATERIAL AND METHODS

The Spanish Oceanographic Institute tagging program started in 1990. From 1990 to 1994, the tags were provided by the Spanish Conservation Administration (MMA). Since 1994, the tag providers were the ACCSTR (Archie Carr Centre for Sea Turtle Research), and the MMA. Since 1999, we started to use our own tags in the context of different European Union Projects (EMTP - European Marine Turtle Project, "Assessing marine turtle bycatch in European drifting longline and trawl fisheries for identifying fishing regulations"; European Commission DG Fisheries Project 98/008 and LIFENAT - LIFE: "Conservacion de cetaceos y tortugas marinas en Murcia y Andalucia", Project LIFE2NAT/E/8610) as in Table 1. Two different tagging strategies were used, one that is intensive on board surface long liners and the other opportunistic (at sea and at rescue centres). An intensive tagging programme was included as part of the EMTP during 1999 and 2000. In addition, we used metal tags (22 mm long and 7 mm wide) provided by the MMA and used only on turtles smaller than 40 cm (SCCL). During 2000-2002 the turtles captured by surface long lines were tagged on board with metal tags from EMTP, MMA and ACCSTR. Two tags were attached at the proximal location of the posterior edge of front flippers. Observers recorded information on the fishing strategy, gear characteristics and collected biological samples of target and non-target species.

The Spanish fleet targets different species (bluefin tuna, swordfish or albacore) from the Gulf of Lion to the Alboran Sea, including the Strait of Gibraltar (Caminas 1997). The waters around the Balearic Islands are the main fishing ground during the summer season, an area which concentrates the fishery and consequently, loggerheads.

Years	Tag provider and type	Nº of *C. caretta* tagged
1990-1992	ICONA (MMA, Spain), plastic tags	2
1994-2003	DGCONA/MMA-AHE-IEO. I.O. Mekanista HB (Bankeryd, Sweden). Steel; Bahco 223: 22 mm long & 7 mm wide	141
1994-2003	ARCHIE CARR CENTRE FOR SEA TURTLE CONSERVATION. UNIVERSITY OF FLORIDA (Metal Tags Manufactured by I.O.Mekanista HB, Sweden)	250
1999 EMTP	Material: Monel-inconel, purchased from the National Band and Tag Company (Newport, United-States) stile 1005, size 681C: 25 mm long & 8 mm wide	143
2000-2002 EMTP	Material: Monel-inconel purchased from the National Band and Tag Company (Newport, United-States) stile 1005, size 681C: 25 mm long & 8 mm wide	408
2004-2005	LIFE02NAT/E8610 Electronic tags	15

Tab. 1. The IEO 1990-2005 Tagging Program Summary

RESULTS AND DISCUSSION

The tagging activity during 1990-2005 is summarised in Tab. 1. A total 944 loggerheads were tagged in Spanish waters with plastic (N=2), and metal (N=942) tags during the study period. Different strategies and tags were used depending on the boats and funding availability. During the 1994-2003, a total of 391 loggerheads were tagged (141 with the Spanish MMA + 250 with the ACCSTR tags) including loggerheads from rescue centres distributed along the Spanish coast and from the IEO research activities on board long liners. The loggerheads were tagged only when it was possible to haul onboard the turtle. Consequently, most tagged turtles were in the small to medium size categories. Few large and heavy specimens were tagged. The main intensive tagging activity corresponds to 1999-2002 where a total 551 loggerhead (57.31% of the total metal tags) were tagged. In 1999, 143 loggerheads were tagged: 127 (88.8%) were tagged on both fore flippers and 16 (11.2%) were just single tagged, 9 on the right flipper and 7 on the left flipper. In 2000, 408 loggerheads were tagged: 361 (88.5%) turtles were tagged on both fore flippers and 47 (11.5%) were just single tagged, 22 on the right flipper and 25 on the left flipper.

Most of the recaptured loggerheads correspond to the EMTP tagging period. The long line vessels recaptured 3 tagged loggerheads during the observers' embarkation (558 and 1085 days at sea during 1999 and 2000, respectively). Contacts with the fisheries sector in Spain, Algeria and Cuba facilitated the other 10 recaptures. Tab. 2 summarises the tag and recapture dates, the total days at sea and the causes of recapture. Of the total 13 recaptures, 9 (69.23 %) were in the same area (Balearic Sea) and the other 4 were from outside the tagging area. Two turtles (15.38 %) were recaptured in Algerian waters and the other two in the Atlantic (15.38 %). Another loggerhead tagged during the EMTP in the north Adriatic by Casale was also recaptured by a Spanish fisherman north of Mallorca in the Balearic archipelago, more than 500 days at sea after its tagging.

Nº	Tagging date	Recapture date	Total days at sea	Cause and place of recapture
1	081899	060600	291	Captured by a tuna long line. Liberated without hook and alive. Mediterranean
2	102999	060601	580?	Captured by a swordfish long line. Liberated alive. Mediterranean
3	082799	010700	317	Captured by a swordfish long line. Liberated with the hook, alive. Mediterranean
4	080200	050800	3	Stranded with a hook was de-hooked and liberated alive. Mediterranean
5	052400	071000	136	Stranded dead. Mediterranean
6	071300	071501	367	Captured death by an artisanal gill net in Alcudia (Mallorca). Mediterranean
7	051700	052400	7	Captured by a tuna long line. Liberated without hook and alive. Mediterranean
8	081900	070201	317	Recaptured near Algerian waters.
9	052000	060301	379	Entangled in a long line. Liberated alive. Medit.
10	?	082901	?	Entangled in a long line. Western Mediterranean. Liberated alive
11	081900	070201	311	Recaptured near Algerian waters. Mediterranean.
12	072700	021802	571	Dead. Captured in Nuevitas (NE of Cuba)
13	062101	042402	300	Captured with an affected fore flipper, off Lepe, (SW Spain). Atlantic

Tab. 2. *Caretta caretta* recaptures from the IEO tagging programs 1990-2005 (dates refer to month/day/year)

The results of our tagging program confirms the Balearic Sea, the Alboran Sea and Atlantic connecting waters as critical areas for marine turtle conservation (Caminas and Valeiras 2003). Nearly 70 % of the loggerheads were recaptured in the tagging area, which may represent an important remigration percentage and feeding site fidelity. The consequences of the two captures outside the Mediterranean are different. Turtle nº 13 tagged in front of Algeria was recaptured after 300 days in the south Atlantic Spanish region near Portugal. The second Atlantic recapture took place in Cuba, after 571 days, travelling a distance of more than 7000 km, a minimum estimated distance between the tagging and recapture sites. The loggerhead was a juvenile of 68 cm SLCLmin. Its minimum travel rate was about 13.5 km/day. The recapture of this loggerhead represents the first recapture of a loggerhead from the Mediterranean in Cuba and in the Caribbean Sea. The previous E→W recapture concerns a large juvenile loggerhead 84 cm SLCLmin tagged in the Canary Islands and later recaptured in the southern coast of Isla de la Juventud, Cuba (Bolten et al. 1992). Engstrom et al (2002), using maximum likelihood mixed stock analysis to identify the natal origin of immature loggerheads in Caribbean Panama, conclude that although the genetic results show an important contribution of the Mediterranean stocks to the Caribbean population, if true, it may represent an extraordinary biological phenomenon. The capture of our loggerhead number 12 tagged in the western Mediterranean and recaptured in Cuba could represent an important contribution towards a new analysis on the origin of the Caribbean population.

The preliminary results of the Spanish tagging program in the western Mediterranean and connecting Atlantic waters underline the importance of this region for the conservation of loggerhead stocks. Genetic studies indicate an important percentage of loggerheads of Atlantic origin in the western Mediterranean, and likewise some authors relate eastern Atlantic loggerheads with SE USA populations. The connection between Mediterranean and Caribbean loggerheads represent a new advance in the knowledge of the life cycle of the species, reinforcing the importance of the management measures to be considered in the western Mediterranean for the conservation of the Mediterranean and Atlantic loggerhead stocks.

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WHAT DO WE REALLY KNOW ABOUT CANID PREDATION IN MARINE TURTLE NESTING SITES IN TURKEY?

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Seventeen beaches in the Turkish Mediterranean coast have been identified, for the protection of loggerhead (*Caretta caretta*) and green turtles (*Chelonia mydas*), as Marine Turtle Nesting Sites in 1988. Human activities such as sand extraction, light-pollution caused by hotels and tourism complexes, fisheries activities, and poorly assessed tourism investments are generally listed as factors adversely affecting the marine turtle nesting and wintering grounds. Research has shown that predation on the turtle nests by foxes (*Vulpes vulpes*), jackals (*Canis aureus*), dogs (*Canis familiaris*) is a problem that results in decrease in successful nesting and hatchling. However, previous studies on predation being limited in their scope, there is a need to assess the affect of predation on nesting grounds by canid species today. This study reviews the data available on predation of canid species on marine turtle nesting sites since 1988 and then discusses the need for establishing a predation monitoring program in selected Marine Turtle Nesting Sites in the Turkish Mediterranean coast such as Dalyan, Anamur and Akyatan where the “Endangered” green turtle and “Endangered” loggerhead are both present.

A NEW GREEN TURTLE (*CHELONIA MYDAS*) NESTING SITE IN THE MEDITERRANEAN: SUGOZU BEACHES, ADANA (TURKEY)

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Green turtles are one of the two sea turtle species that nest in the Mediterranean coast (*Caretta caretta* and *Chelonia mydas*). Green turtles in the Mediterranean nest mainly in Turkey and Cyprus. There are three important nesting areas on the Turkish coastline (Kazanli, Akyatan and Samandag). Sugozu beaches are 4 small beaches located in the northeast of the Yumurtalik town (Akkum beach, Sugozu beach, Botas beach and Hollanda beach). The total length of the beaches is 3.4 km. 213 green turtle nests were determined in Sugozu beaches during the 2004 nesting season. Thus these beaches can be very important nesting sites for green turtles. This study analyses and evaluates the importance of these beaches as green turtle nesting sites in Turkey and in the Mediterranean.

IMPORTANCE OF ACHIEVING PUBLIC AWARENESS AND PARTICIPATION IN SEA TURTLE PROTECTION SCHEMES; CASE STUDY: SUGOZU BEACH

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Sugozu Beaches are 4 small beaches located in the northeast of the Yumurtalik town (Akkum beach, Sugozu beach, Botas beach and Hollanda beach). The total length of the beaches is 3.4 km. It was determined, during the 2003 and 2004 nesting seasons, that these beaches are very important nesting sites for green turtles (*Chelonia mydas*). Raising public awareness and achieving public participation in sea turtle protection projects took place in the nearby areas to these beaches between August 2003 and December 2004. Local authorities and local communities are included in education seminars, cafe conversations, beach meetings and field activities to inform on and to encourage participation in conservation schemes. During these activities the roles of local authorities and local community members in conservation schemes were discussed and analysed. Participative conservation schemes have been used as a successful model to achieve sustainable sea turtle protection.

EVALUATION OF THE POTENTIALREASONS BEHIND THE PREMATURE DEATHS OF SEA TURTLES *CHELONIA MYDAS* AND *CARETTA CARETTA* IN KAZANLI BEACH

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A beach monitoring study took place in Kazanli between 15 April 2002 and 15 September 2003 in order to determine the reasons behind the deaths of sea turtles in the area. Moreover, seashore studies took place between 25 November 2002 and 5 April 2003 in the area to determine the relation between fishery and sea turtles. Twenty-six (26) adult turtles were observed dead during these study periods and distribution of these deaths to the individual species (*Chelonia mydas* and *Caretta caretta*), mortality rates and the mortality reasons were also determined. Moreover, fishery accidental catch rates were also determined.

DALYAN BEACH AS A SEA TURTLE NESTING SITE DURING THE LAST SIXTEEN YEARS (1988-2003)

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Dalyan beach is the first determined and defined sea turtle nesting beach for *Caretta caretta* in Turkey and it is also one of the first Specially Protected Areas in Turkey. Dalyan beach has been one of the most high profile areas in Turkey in the eyes of public, foreign visitors, media and the central authorities. This study evaluates the development and the changes in protection schemes and the research activities in the area between 1988 and 2003.

SEA TURTLE NESTING IN BELEK BEACHES DURING FIVE SEASONS (1999-2003) AND FUTURE POTENTIAL THREATS

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Loggerhead sea turtles (*Caretta caretta*) in the Mediterranean nest mainly in Greece, Turkey and Cyprus. Belek beach is situated in the east of Antalya and stretches 29.5 km in length. The beach is divided into two main sections: Belek Tourism Area and Belek Specially Protected Area. Annually, 612 to 745 *Caretta caretta* nests were determined in the area during five nesting seasons (1999-2003). Subsequently, it was determined that this area is strategically important as a nesting area. Therefore, it would not be wrong to claim that the area should be protected. However, more tourist industry development (on the top of what already exists) was planned by the central agencies. Thus, the potential threats to this important nesting site will increase in the future. This study evaluates the relation between tourist industry development and sea turtle nesting in the area as it stands and it projects the future relationship between these two.

GENETIC STRUCTURE OF THE LOGGERHEAD TURTLE (*CARETTA CARETTA*) MEDITERRANEAN NESTING POPULATIONS

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We assessed the genetic structure of the Mediterranean nesting populations of the loggerhead turtle (*Caretta caretta*) using a mitochondrial DNA marker and seven microsatellites. Genetic structuring was identified with both kind of markers, thus suggesting that both females and males are philopatric and that gene flow between populations is restricted, although exists for nuclear DNA. This demonstrates that some males mate with females of other populations. Mitochondrial DNA data suggest that the populations nesting on the islands of Crete and Cyprus have suffered a recent bottleneck or have been colonized recently (founder effect). However, no bottleneck or founder effect has been detected with nuclear markers, thus suggesting that male mediated gene flow from other populations highly increases nuclear genetic variability. In this scenario, Crete and Cyprus are thought to play a central role in the male mediated gene flow between Mediterranean populations. Due to these connections, the negative effect of genetic drift or inbreeding on the smallest populations may be less important than suggested by reduced population size.

PASSIVE DRIFT GOVERNS DISPERSAL AND CAUSES GENETIC STRUCTURING OF IMMATURE LOGGERHEAD TURTLES IN THE WESTERN MEDITERRANEAN

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Passive drift, active swimming, or a combination of both, have been proposed as dispersal mechanisms in juvenile sea turtles. The analysis of a mitochondrial DNA marker in loggerhead turtles (*Caretta caretta*) from eight feeding grounds revealed deep genetic structuring within the Mediterranean, which can be explained by the pattern of sea surface currents. These findings support passive drift as the main mechanism that governs dispersal, although active swimming might also be involved. The populations in the north-western Mediterranean were almost entirely comprised of individuals from the highly endangered eastern Mediterranean rookeries, whereas individuals from the Atlantic rookeries dominate in southern foraging grounds. Conservation plans should make it a priority to reduce the mortality caused by incidental by-catch in these areas.

POSSIBLE MOVEMENT PATTERNS OF LOGGERHEAD SEA TURTLES (*CARETTA CARETTA*) IN THE MEDITERRANEAN SEA

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INTRODUCTION

The Mediterranean basin is relatively small if compared with oceans, but hosts both oceanic and neritic habitats for loggerhead turtles and Mediterranean turtles share some foraging areas with Atlantic ones. Fidelity and movement patterns to and between these areas are still unclear. The first tagging programme on turtles at sea in the Mediterranean was lunched in Italy in 1981, and provided the first insights on juvenile movements and trophic areas (Argano et al. 1992).

METHODS

We considered 94 turtles tagged and released from different sites, basically around Italy, and eventually re-encountered after a period between 30 days and 11 years, in Italy and other Mediterranean countries, in the period 1981-2003.

Specimens were assigned to a spatio-temporal pattern, as described below, adopting a conservative approach against the Erratic pattern (i.e. a specimen was classified as Erratic only if no other classification was possible). We classified re-encounters in the seven categories described below (a-g). Specimens were considered as possibly adult-sized if in one of the encounters had a carapace length, measured or estimated according to the mean growth rate observed from re-encountered turtles (2.82 cm/yr; unpublished data), exceeding the minimum length recorded for a nesting female in the nearest nesting sites in Greece and Libya (70 cm Curved Carapace Length; Margaritoulis et al. 2003). We considered as nesting season a period including possible pre- and post-nesting periods.

Fidelity Patterns

Specimens re-encountered in the same area of release and for which reproduction can be excluded as the reason of frequentation (not in a possible nesting season, or not adult/adult size, or not close to nesting areas).

a) stF (short-term Fidelity): re-encountered shortly (max. three months)
b) F (Fidelity): re-encountered after longer periods.

Potentially Erratic patterns

Specimens re-encountered in an area different from that of release.
If in the same season:
c) RM-E (Reproductive Migration or Erratic): Nesting season, adult/adult size and nesting area (near known nesting sites).
d) URM-E (Unlikely Reproductive Migration or Erratic): Nesting season, adult/adult size and unlikely nesting area (where nesting activity is very rare).

e) E (Erratic): either not in a possible nesting season, or not adult/adult size, or not close to nesting areas.
If in a different season:
f) RM-SM-E (Reproductive Migration or Seasonal Migration or Erratic): Nesting season, adult/adult size and nesting area.
g) SM-E (Seasonal Migration or Erratic): either not in a possible nesting season, or not of adult size, or not close to nesting areas.

RESULTS AND DISCUSSION

Present results (Tab. 1.) show the occurrence of two diametrically opposite patterns of movement in the sample, represented by the group showing fidelity to an area (F) and the one showing a change of area (E) which cannot be explained by migration patterns (RM, URM, RM-SM, SM). Moreover, since specimens were assigned to possible migration patterns by a conservative approach against E (i.e. whenever migration was a possible explanation of the observed change of area) it is likely that some of these specimens (especially those of URM and some unlikely SM patterns) had actually changed area and so should belong to pattern E.

Pattern	No.	%
stF	10	10.6
F	32	34.0
RM-E	3	3.2
URM-E	4	4.3
E	21	22.3
RM-SM-E	3	3.2
SM-E	21	22.3
Total	94	100.0

Tab. 1. Classification of specimens according to different patterns (see text)

These opposite patterns occur through the same size range, and pattern E is displayed even more in large size specimens. A possible solution to this puzzle may be found in two populations sharing the same area.

The Mediterranean is known to be frequented both by specimens of Mediterranean and of Atlantic origin and since the reproductive contribution of these Atlantic specimens to the Mediterranean populations is estimated to be very low (Laurent et al. 1998) it can be hypothesized that they return to their natal sites to breed.

Although it is likely that most Atlantic specimens in the Mediterranean are in the pelagic stage (Laurent et al. 1998) it is nonetheless possible that some of them shift to the demersal stage or begin to do so while still in the Mediterranean. This suggested by three specimens with mtDNA haplotype C caught by demersal fishing gears (bottom longline and bottom trawl) around Lampedusa, Italy (Laurent et al. 1998, unpublished data).

Atlantic specimens seem to enter the Mediterranean at a small size (the minimum size class recorded for specimens with mtDNA haplotype endemic to the west Atlantic was 26-30 cm CCL; Laurent et al. 1998). Concerning the size of the hypothetical return to the Atlantic grounds, the maximum length recorded for a specimen with haplotype C in the Mediterranean was 65 cm CCL (Laurent et al. 1998, unpublished datum), and Bjorndal et al. (2000) estimated that most loggerhead turtles recruit to the demersal habitats in the south-eastern USA between 46-64 cm CCL. The coincidence between this size range (46-64 cm CCL) and the one of specimens showing patterns of area change (E, but also URM, and some unlikely SM) is suggestive that most of them might be of Atlantic origin routing to their final (adult) demersal habitats. It should be taken into account that Atlantic specimens mature at a larger size (range of means of nesting females: 98.9-105.1 cm CCL; Dodd 1988) than Mediterranean ones (range of means of nesting females: 66.5-84.7 cm CCL; Margaritoulis et al. 2003).

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THE WWF'S MARINE TURTLE ACTION PLAN FOR THE MEDITERRANEAN SEA

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WWF International directs its global conservation efforts at three levels: conservation at the eco-regional level, conservation of endangered and other species, and addressing global threats. WWF has chosen to focus its species conservation efforts at the global level on a small group of "flagship" species, and prominent amongst those species, are marine turtles. Marine turtles also act as flagships for important conservation and environmental issues, as well as being charismatic ambassadors for their habitats, marine conservation issues and the lesser-known species which share their ecosystems. WWF is developing regional marine turtle action plans, designed to deliver three major objectives: (1) reduce the loss and degradation of critical habitats, (2) reduce the negative impacts of fisheries by-catch, and (3) reduce unsustainable use and illegal trade of the species and their products. There are two key elements in all WWF's marine turtle conservation work, namely, partnerships with a wide range of stakeholders including government, local communities, other NGOs, and academic institutions, and the use of the best available science to guide the work. WWF focuses on marine turtle conservation at all levels: local, regional and global. We are finalizing a new action plan for Marine Turtles in the Mediterranean that focuses on key threats and priority countries for ongoing and new work. It will be shared with key partners for scientific and technical comments, and will be finalized by July 2005. Our presentation will highlight our global and regional work, and highlight the key priorities in our new Mediterranean Action Plan.

1970s IN THE EOLIE ISLANDS: TURTLES FROM SEA TO SAUCEPAN

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Up to the nineteen seventies in the waters surrounding the Eolie Islands loggerhead sea turtles used to be caught by fishermen for food. From January to March nearly 10 rowing boats were used to fish *Caretta caretta* specimens. Boats and fishermen used to come from the islands of Alicudi, Filicudi, Salina and Stromboli. Every day up to 30 specimens/per boat were caught, mostly by hand and just a small number by net. Turtles were then sold in Salina still alive. Eolie inhabitants used to consider loggerhead as chicken: just a source of protein, cheap, abundant and easy to catch during the winter months, when links with Sicily were missing. Fishermen now remember that turtles were easier to sell when they ranged from 10 to 25 kg, so that was the size they fished for. But they also remember the presence in the sea of turtles of all different sizes. Some leatherbacks *Dermochelys coriacea* were also seen in these waters, but for some reason no one was inclined to eat them, so this species was never considered a target. Presence of loggerheads during the winter months suggests the hypothesis that the waters surrounding the Eolie Islands are a wintering area. Researches on that are currently in progress.

MULTIPLE PATERNITY IN LOGGERHEAD SEA TURTLE (*CARETTA CARETTA*) NESTS ON KURIAT ISLAND, TUNISIA

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INTRODUCTION

Loggerhead sea turtles are listed as threatened and protected species. These big migratory animals with a long life cycle are difficult to assess, and measuring many aspects of their biology is necessary in order to enhance conservation efforts.

Recent studies on clutches and nesting female characterization have permitted the collection basic data on the reproduction biology of this species. However, other parameters remain to be explored, notably the nature and the size of breeders as well as the contribution of males in reproduction.

In this study, an allozymic survey on Tunisian loggerhead sea turtle has been achieved in order to estimate the size of the population and to contribute to a better understanding of their reproduction biology and especially of the phenomenon of multiple paternity.

MATERIALS AND METHODS

Sample collection:
This study has been carried out on loggerhead hatchlings brought from the most important nesting site of this species in Tunisia: Kuriat islands (Fig. 1). They belong to four different nests: Two of which were sampled in 2002 and the two others in 2003. Sample sizes are included in Tab.1.

Year	2002		2003	
Nest	1	2	1	2
Sample size	14	25	12	12

Tab.1. Year and sample size

Fig. 1. Localization of nesting site: Kuriat islands

Proteins electrophoresis:
Livers, hearts, kidneys, lungs and gonads are moved from specimens and homogenized in an equal volume of an aqueous homogenizing buffer. After centrifugation of the resultant homogenates, the supernatants were stored at -80°C. Seventeen loci coding for twelve enzymatic systems were examined for polymorphism using horizontal starch gel electrophoresis (13%). Electrophoresis procedures follow Pasteur et al. (1987). For each protein resolved, tissue type, buffer system and number of loci identified are listed in Tab. 2

ENZYMATIC SYSTEMS	LOCUS	TISSUE	BUFFER*
Esterase-3	Es-3	heart	Tc 6.7
Glutamate-oxaloactate transaminase	Got-1	heart	Tc 6.7
	Got-2	heart	Tc 6.7
Glucose-phosphate isomerase	Gpi-1	liver	Tc 6.7
Glucose-6-phosphate dehydrogenase	G6pd-1	liver	Tc 6.7
Isocitrate dehydrogenase	Idh-1	liver	Tc 6.7
	Idh-2	liver	Tc 6.7
Lactate dehydrogenase	Ldh-1	heart	Tc 6.7
	Ldh-2	heart	Tc 6.7
Malate dehydrogenase	Mdh-1	liver	Tc 6.7
	Mdh-2	liver	Tc 6.7
Malic enzyme	Mod-1	liver	Tc 6.7
Phosphogluconate dehydrogenase	Pgd-1	liver	Tc 6.7
	Pgd-2	liver	Tc 6.7
Phosphoglucomutase	Pgm-1	liver	Tc 6.7
Sorbitol dehydrogenase	Sdh-1	liver	Tc 6.7
Superoxyde dismutase	Sod-1	liver	Tc 6.7

* Tc 6.7: Tris citrate, pH=6.7

Tab. 2. Enzymes surveyed, tissues and buffer used

Data analysis:
We estimated overall genetic variability, including allele frequencies, percent polymorphism, heterozygoties and mean number of alleles per locus using the Genepop 3.4 program.

RESULTS

Of the seventeen loci examined, only seven were polymorphic: Got-1, Es-3, G6pd-1, Idh-1, Mdh-1, Pgd-1 and Sdh-1. Percentage of polymorphic loci (P), mean number of alleles per locus (A) and mean heterozygoties (He: expected and Ho: observed) are reported in tab. 3.

The examination of the hatchlings genotypes reveals an important bit of information: in two out of four nests, the Es-3 locus exhibited three alleles, and the genotypes within each of these nests don't follow a mendelien segregation. Indeed, in the first nest of the season 2002, two homozygote genotypes have been observed: $Es\text{-}3^{100}$ and $Es\text{-}3^{110}$ and one heterozygote genotype $Es\text{-}3^{110/120}$. In the first nest of 2003, two different homozygote genotypes were present: $Es\text{-}3^{110}$ and $Es\text{-}3^{120}$ as well as two different heterozygote genotypes $Es\text{-}3^{100/110}$ and $Es\text{-}3^{110/120}$.

	H exp.	Ho.	P (0.95)	A
1_2002	0.115	0.038	0.29	1.35
2_2002	0.127	0.019	0.29	1.35
1_2003	0.135	0.088	0.29	1.35
2_2003	0.103	0.069	0.23	1.23

Tab. 3. Level of polymorphism (P), mean heterozygosity expected (H exp.) and observed (Ho.) and mean number of alleles per locus (A)

Overall, these data support the idea that at least two males intervened in the fertilization of each female.

DISCUSSION

A relatively high level of genetic polymorphism was observed in this study compared to other species of sea turtles such as *Chelonia mydas* (Bonhomme et al. 1987). This might represent an estimation of the genetic variability within the natural population which could be underestimated here, as we analyzed the hatchlings of a maximum of four nesting females. If we assume the neutrality of the enzymatic systems, the high level of polymorphism could reflect the efficient size of the Mediterranean population of this species.

On the other hand, the examination of genotypes at the Es-3 locus showed a deviation from mendelien segregation which suggests the hypothesis of multiple paternity (at least two males) in two out of four clutches.

According to this preliminary finding, multiple paternity seems to be more frequent in *Caretta caretta* species than in other ones like *Dermochelys coriacea* or *Chelonia mydas* where the phenomenon does not occur or has a very low incidence (Dutton 1998, FitzSimmons 1998).

Finally our results suggest that multiple paternity could be an important factor contributing to the relatively high genetic diversity in the Mediterranean population of loggerhead turtle.

CONCLUSION AND PERSPECTIVES

Multiple mating is of a high importance in the diversity and the survival of the species (Moore 2000). Considering the enormous female turtle energy investment in producing and laying eggs, the multiple mating assures a better result in avoiding inbreeding (Stockley et al. 1993) and a possible genetic incompatibility (Vala et al. 2000). Moreover, this permits the fertilization of the ovocytes by the most competitive sperm and the increase of genetic diversity of the progeny (Baer and Schmid-Hempel 1999). Multiple paternity seems to be very frequent in this species since in two among the four nests, hatchlings of the same clutch have at least two genetically different fathers; Nevertheless, it cannot be precluded that this phenomenon is more frequent as this technique does not permit discovering a multiple paternity in the case when a female mates with several males possessing the same alleles. Therefore, it would be important in further studies to enlarge our sample and use more polymorphic markers such as microsatellites. On the other hand, it would be very interesting to make direct observations in the field for better understanding of the reproduction behaviour of these turtles.

ACKNOWLEDGEMENTS

We are grateful to all the team who has voluntarily participated to the scientific monitoring of the loggerhead sea turtle nesting site in Kuriat Islands.

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SEA TURTLES OF MOROCCO: AN ECOLOGICAL CATALOGUE

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We provide new data on the origin, distribution, abundance, dynamics, ecology and threats of all species of sea turtles present along the almost 2000 km Atlantic and Mediterranean coastline of Morocco (Loggerhead, Leatherback and Green turtle) thanks to a 15-year survey, representing the longest study of this kind. Loggerhead turtle: A developmental area and a possible nesting area in the Atlantic and one feeding area in the Mediterranean, where they feed almost exclusively out of the portunid crab *Polybius henslowii*. Leatherback turtle: A wintering area at the beginning of the Mediterranean Africa, where they stay at the quiet bays and feed out of the gelatinous plankton, appearing here in form of blooms. Alive and dead strandings in the rest of the Mediterranean and in the Atlantic littoral are also recorded. Green turtle: A developmental area and evidence of a nesting area. Further, sightings at-sea, beach surveys, medical rehabilitation, necropsies, anatomo-osteological studies, satellite tracking, etc. were performed and are presented.

A MASSIVE STRANDING OF SIX LEATHERBACK TURTLES (*DERMOCHELYS CORIACEA*) AT THE WESTERN AFRICAN ALBORAN SEA: CONFIRMATION OF THE MOST IMPORTANT WINTERING AREA FOR THIS SPECIES IN THE MEDITERRANEAN SEA

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We registered the massive stranding of six leatherback turtles on a single beach, at the North West African coast, where the Atlantic Ocean and the Mediterranean Sea meet. These turtles were the last of ten which appeared in November 2004 in less than 20 km of coast. Every turtle was pictured, measured, necropsied and buried, so information about its life stage, pathology, feeding ecology, osteology etc, could be collected. To complete this information, we explain the fact that every winter and fall, leatherback turtles enter these waters (even in groups) through the Strait of Gibraltar, as confirmed by the numerous sightings and strandings recorded (another massive stranding of three individuals occurred in the 80s). A proper explanation of these phenomena is given in this presentation confirming that this coast is the most important wintering area for leatherback turtles in the Mediterranean Sea.

A REVIEW OF SEA TURTLE CONSERVATION IN TURKEY

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The Mediterranean coast of southern Turkey supports several internationally important breeding beaches for *Caretta caretta* and *Chelonia mydas*. MEDASSET, with a natural interest in the biology and conservation of marine turtles, and with observer status at the annual Contracting Parties meetings of the Bern Convention Standing Committee, has prepared reports, highlighted threats and made proposals regarding sites in Turkey, such as Patara, Kazanli, Belek and Dalyan. In particular, MEDASSET, with the support of the Societas Europaea Herpetologica, has highlighted the critically endangered status of *Chelonia mydas*, lobbying for case files to be opened at the Bern Convention and formal recommendations to be made to the Turkish Government. This paper reviews the last 17 years of marine turtle conservation issues in Turkey. Threats to important turtle rookeries have been numerous and have included major tourist developments, disturbance, pollution, sand extraction and erosion. A timeline of major events at specific sites provides a summary of MEDASSET's activities, since its inception in 1988, in response to these threats. A literature review lists major documents and other publications relevant to turtle conservation in Turkey. In this way, the successes and failures in preventing damaging developments and addressing specific problems via the Bern Convention, as well as promoting turtle conservation and local awareness, are assessed. Where possible, the breeding success of marine turtles in Turkey, and how this has been affected, is also reported.

REHABILITATION OF INJURED SEA TURTLES IN LAMPEDUSA WWF RESCUE CENTRE

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The main pathologies that our surgery has to face regard *Caretta caretta,* which are victims of the fishing habits related to Lampedusa. When swordfish fishing takes place, often hooks penetrate the gastro-enteric system of turtles, but also their eyes and flippers. Many more parts of the turtles' body are exposed to damage when fishing is carried out by trawl nets. Also the long tourist season of the island causes damages and injuries, mostly due to pollution and to speedboat strikes. Our Rescue Centre plays a social and cultural role to awaken public opinion to environmental problems. Because of a growing cooperation, many fishermen now bring us the turtles found in their gear. If the hooks are easily reachable, extractions are carried out immediately by hands. Otherwise the turtles undergo an operation at the Rescue Centre, after various clinical exams and then to reconstructions and sutures. Our Centre is developing and testing a new surgical technique called "rear breach" which means to reach the intestine area by opening a "breach" at the juncture of one of the rear flippers. During their convalescence, the turtles are treated with antibiotics and they are continuously monitored because of the importance of some parameters. When their conditions are best, the turtles are released after tagging. An autopsy is always carried out in cases of dead turtles, to reveal the cause of death. Data collected in the years 2000-2004 are presented.

ASSESSMENT OF THE UTILITY OF USING GEOLOCATION LIGHT LOGGERS TO INDICATE MOVEMENTS IN MEDITERRANEAN SEA TURTLES

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Marine turtles range across entire ocean basins which has led to large gaps in our knowledge of their at sea life. This paucity of knowledge has lead to the utilisation of a number of techniques to gather information on the movements of marine turtles. These techniques range from low-tech methods, such as mark and recapture using flipper tags through to expensive, satellite telemetry. Here we report the first use of geolocation by light, using relatively inexpensive GLS units (Global Location Sensing) in order to estimate the positions of marine turtles in the Mediterranean. To ascertain the accuracy of these devices in the study of marine turtles we attached both satellite transmitters and GLS units to remigrant green turtle (*Chelonia mydas*) and loggerhead turtles (*Caretta caretta*). During each subsequent nesting attempt data loggers were retrieved, data downloaded and new units redeployed. A total of 28 GLS units were recovered from 12 different individual (3 loggerhead turtles and 9 green turtles). When comparing the mean satellite positions with the mean GLS locations we attained a GLS accuracy of 50.3 km for green turtles and 57.6 km for loggerhead turtles. From this study that the estimation of location using GLS technology offers real utility when ascertaining sea turtle movements, migratory pathways and over-wintering or foraging sites.

ABSOLUTE ABUNDANCE OF LOGGERHEAD SEA TURTLE IN SPANISH MEDITERRANEAN AND ITS CONSERVATION IMPLICATIONS

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During two years (2001-2003) we performed seasonal aerial surveys in the central Spanish Mediterranean waters, following the transect line methodology, in order to determine the absolute abundance of loggerhead turtles. We surveyed a total of 16,996 km, recording 770 turtle sightings during the sampling effort. We used the program Distance 4.0 to estimate overall and seasonal changes in abundance of turtles. Loggerhead turtles were present in the area with a high abundance all year around, with densities varying from 0.05 to 0.43 turtles/km^2, depending on the survey. The average density of turtles in the whole study area was 0.21 turtles/km^2 (95%CI: 0.17 - 0.25) and the mean abundance was 6,653 turtles (95%CI: 5,514 – 8,027). This result represents only the abundance of turtles at surface because observers can not detect diving turtles. In the Balearic Sea, a recent study estimates that the mean proportion of time that loggerhead turtles spent at surface is 35.1%. We use this value in order to correct our estimates, obtaining an absolute density of 0.59 turtles/km^2 (95%CI: 0.21 - 1.68) and an absolute abundance of 18,954 turtles (95%CI: 6,679 – 53,786). In 1995 it was estimated that the Spanish long line fishery captures accidentally around 20,000 loggerhead turtles per year. Although this data is not updated, our estimates seem to indicate that western Mediterranean loggerhead stocks can hardly bear such numbers of captures. Conservation measures must be implemented in order to reduce the number of turtles captured.

MARINE TURTLES NESTING ACTIVITY IN LIBYA: NEW RECORDS OF NESTING SITES IN THE EASTERN LIBYAN COAST

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INTRODUCTION

As Libya occupies a large proportion of the Mediterranean southern shore, it deserves to have some studies conducted on its shores as an attempt to estimate the real stock of marine turtles in the Mediterranean. The recent information available lacked sufficient and adequate accuracy and details. Part of such information was logging of the existence of loggerhead turtles on the shores of the natural protectorate at Al-Kuf Valley (Schleich 1987) as well as the information already logged about the locations of marine turtle nesting within the field visits paid in the years 1992-1993 for the shores of the eastern region.

The first phase, to assess nesting activity, was conducted in 1995 between the Egyptian borders to Sirte (Laurent et al. 1995, 1997). The Second phase was carried out in 1996 from May to August and covered the coast from Sirte to Misratah. All the tracks were identified as *Caretta caretta.* The third phase was conducted in July 1998 between the Tunisian border and Misrata (Laurent et al. 1999): 15 crawl tracks of nesting were recorded and identified as *Caretta caretta*. Late in July 1999 and in July-August 2004, four beaches were surveyed in eastern part of Libya and recorded as new nesting sites. However, many sites need more surveying.

MATERIAL AND METHODS

Different survey methods were applied during the four phases in the nesting sites of marine turtles which have been surveyed. Some examples of these methods were: “walks (w), motorbike (m), vehicle (v), Quad (q)”. The targeted sandy beaches were surveyed once in Phase (I) and Phase (III) and several times for some shores in phase (IV). Also, some new nesting sites were visited by boats.

RESULTS

The total length of the Libyan coast is 1975 kilometres, of which 1144 kilometres are sandy. Within the first three phases, 81 shores (333.65 kilometres) were surveyed. They represent 29.16% of the length of the sandy beaches. The total crawl tracks recorded in the three phases are 415 (210 of which were identified as tracks of loggerhead turtle nests).

In Phase Four, the subject of this paper, 26 km of sandy beaches were surveyed in the eastern part of Libya, from Tolmetha to Tubruq (Fig 1). Eight beaches were identified as new nesting sites (Tolmitha (El-Gadri), Ras-Elhabon, Elhasi, El-Koria, Edes1, Edes2, Kashem-Elkalib and Musrata Aman) (Table 1). In all 15 loggerhead tracks were recorded, 8 of which resulted in nests. Turtle track densities, during the four project phases, ranged from zero to 5.8 nests/km.

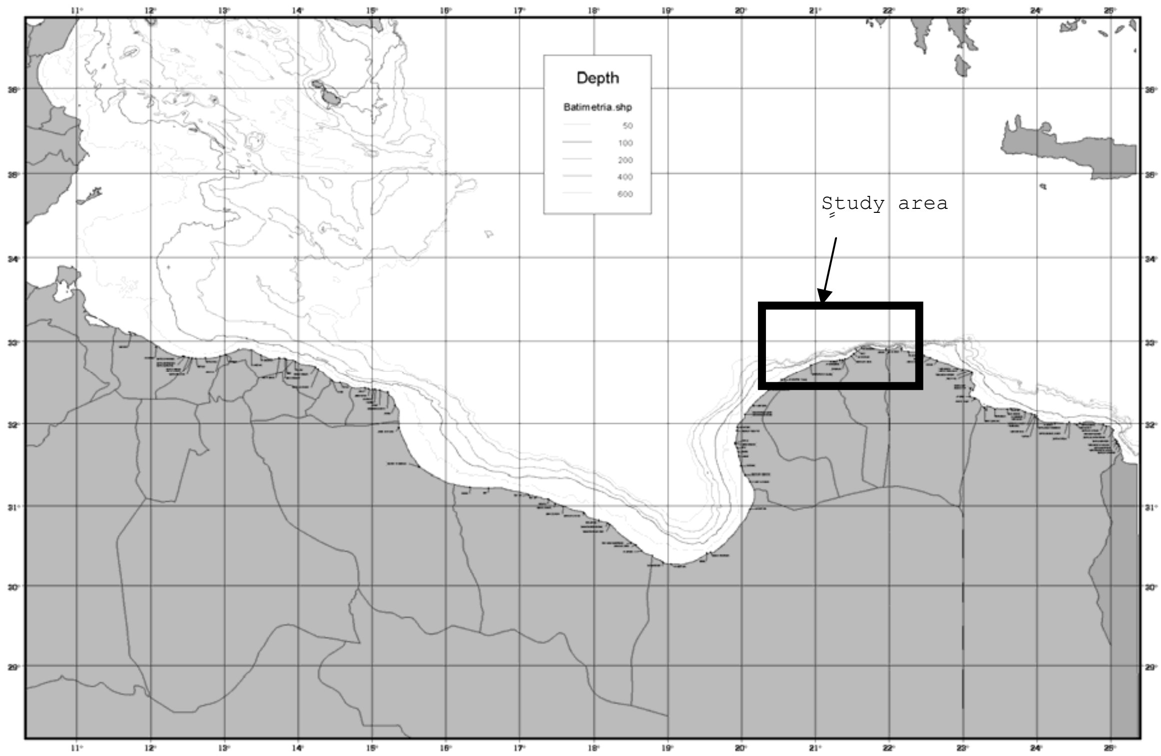

Fig. 1. Map of Libyan coasts showing the area studied (phase 4)

Phase of study/location	Total crawl tracks and nests (N)	Number of sites sampled	Sand beach (length) km	Coastline (Km)	Coordinates of sites	
2004 phase IV Total (and area limits)	(8) 15	8	26	210	32° 52´48N - 32° 46´42N	21° 32´48E - 20° 56´30E
Tolmitha (El-Gadri)	(1)	1	3	-	20° 56´30	32° 46´42
Ras-Elhabon	(1)	1	2	-	21° 20´36	32° 46´42
El-Hasi	(2)	1	5	-	21° 22´42	32° 47´00
El-Koria	(1) 4	1	6	-	21° 24´18	32° 47´18
Edess1	3	1	3	-	21° 29´24	32° 49´36
Edess2	1	1	3	-	21° 32´18	32° 50´54
Kashem-Elkalib	5	1	2	-	21° 32´48	32° 52´48
Musrata (Aman coast)	(3) 3	1	2	-	14° 52´42	32° 20´48

Tab. 1. Loggerhead turtle nesting activity in surveyed area from Tolmetha to Tubruq (numbers in brackets denote nests)

DISCUSSION

Numerous researchers agreed upon the existence of *Caretta caretta* along the Libyan coasts and with large nesting numbers. The findings of this comprehensive study as well as other researchers' studies conducted in the natural protectorates shores at Al-Kuf Valley confirm this fact.

The high number of nesting marine turtles on the Libyan shores is in part explained by the facts that sandy beaches are still conserving their natural condition, that turtles are not subject to intentional catching and that turtle meat is not eaten.

The density of the tracks logged in the four phases were not convergent, as they ranged from zero in some shores and frequently reached 5.8/km in Abu El Frais shore in Phase I and 4.4/km in Phase II. The threats to marine turtles are much diversified. For instance, turtles at sea are caught in different kinds of fishing nets, such as Tunara (fisheries for tuna fish). There are also some fisheries for sharks which use gill nets called "Khanaga" in which marine turtles are caught. What increases the number of entangled turtles in these two types of fisheries is the coincidence of the tuna fishing season (June) and the shark fishing season (February – June) with the season of turtle reproduction and of their approaching to shores.

The occupation of Libya of the longest shore in the south of the Mediterranean enables it to have a special importance as far as turtle nesting activity is concerned. This four-phase study supports also this fact and urges us to increase the surveillance of nesting sites especially those having high nesting density.

A protection program for important nesting shores, such as Ayn El Ghazalah, Al-Kuf, Abu Frais, El-Gbeba (west Sirt) and Farwa island, is needed to preserve and develop the stock of these endangered marine turtles, which are threatened with extinction. This programme needs also to foresee for more surveys especially in new sites.

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CONSERVATION PROJECT OF SEA TURTLES IN PATOK (ALBANIA)

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ABSTRACT

During the period 2002 - 2004 we have studied 382 individuals of Loggerhead turtle (*Caretta caretta*) and 8 individuals of Green turtle (*Chelonia mydas*), caught in fishing gear. Most of the turtles were caught at the fishing area of Patok, and few at the fishing areas of Durres and Divjaka. From the 382 individuals, 12 were dead (all *C. caretta*), 3 had a posterior flipper missing and 4 had a hook in their oesophagus. We have tagged 234 turtles: 2 *C. caretta* in 2002, 196 *C. caretta* and 2 *C. mydas* in 2003, 31 *C. caretta* and 3 *C. mydas* in 2004. All sea turtles observed were carrying various epibionts (Algae, Crustacea, Isopoda, Mollusca). Further, in the context of the project, we have undertaken activities aiming to raise the level of education and awareness of fishermen and other stakeholders regarding the protection and preservation of sea turtles.

INTRODUCTION

There are three species of sea turtles in Albania: Loggerhead *Caretta caretta* is the most common visitor in the Adriatic and Ionian Seas**,** Green turtle *Chelonia mydas* is very rare (caught for the first time in the Albanian seaside-Patok in May 2003), and Leatherback *Dermochelys coriacea* is occasional species in the Adriatic and Ionian Sea. According to Fromhold (1959) another sea turtle, the hawksbill turtle *Eretmochelys imbricata***,** is observed in Albania, but this species is very exceptionally met in the Mediterranean Sea (Gasc et al. 1997).

Publications on sea turtles in Albania are scarce (Zeko and Puzanov 1960, Haxhiu 1981, 1985, 1997, 1998 and Haxhiu and S. Oruci 1998). They talk about sporadic cases of observations and concern mainly the geographic distribution of the species in Albania. Most of the studies were made during the period 2002-2004. The results of 3 years of observations in many coastal areas of Albania, (mainly in Rodon Bay-Patok) are presented in the present paper in order to document information on the number, state, etc. of sea turtles.

From 2002 to 2004 we studied 382 loggerhead turtles (*Caretta caretta*) and 8 green turtles (*Chelonia mydas*), caught in fishing gear. We measured 354 turtles and tagged 234 of them. All sea turtles observed were carrying various epibionts (Algae, Crustacea, Isopoda, Mollusca, Polychaeta).

Sea turtles in Albania are threatened by many factors (Haxhiu 1995) but it is very likely that the main factor remains the harmful human attitude explained by the low level of public awareness.

In this report we talk about the educational campaigns undertaken in the recent years in Albania in order to protect and preserve the sea turtles.

METHODS

This work is based on field observations made in the years 2002-2004 in the course of numerous expeditions in many coastal areas of Albania, mainly in Rodon Bay-Patok (Fig.1). During these extensive surveys of the coastal areas, a considerable number of sea turtles were found caught in fishing gear. All the sea turtle caught in fishing gear were studied, measured and some of them were tagged. Considerable data were gathered by interviews organised with fishing specialists and fishermen. We collaborated with fishermen, especially in Patok, Durres and in the Divjaka area. The fishermen phoned us any time they caught a new specimen of sea turtle in their gear. We undertook activities aiming at raising the level of education and awareness of fishermen and other stakeholders regarding the protection and preservation of sea turtles.

Fig. 1. Map of Albania showing some of the most important fishing harbours and the location of Rodoni bay –Patok (⟶)

RESULTS AND DISCUSSION

During the period 2002-2004 we studied 382 specimens of Loggerhead turtle *Caretta caretta* and 8 *Chelonia mydas* caught in fishing gear. From 354 caught and measured specimens of *Caretta caretta*, 7 of them were caught in the fishing zone of Divjaka, 21 in the fishing zone of Durres and 329 were caught in the fishing zone of Patok. 13 other individuals were recorded (not measured) by the fishermen from the fishing zone of Saranda, Vlora and Velipoja. 12 specimens were also found dead.

From 382 individuals, 3 had a posterior flipper missing, 4 had a hook in their oesophagus, and some of them had wounds, mainly on their carapace. From the measurements of 354 specimens of *Caretta caretta* results that 111 specimens belong to the SCCL 20-50 cm group, 243 specimens belong to the SCCL 50-90 cm group (SCCL = Standard Curved Carapace Length) (Fig 5). More detailed data on individuals measured are given in Fig. 2, 3 and 4.

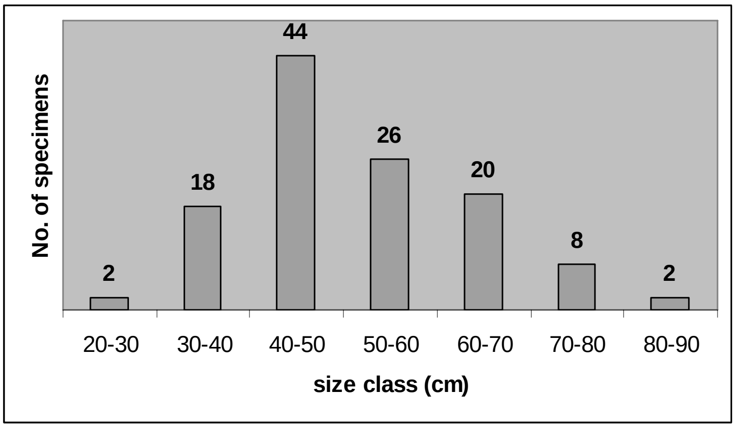

Fig. 2. Size frequency distribution of *Caretta caretta* measured in 2002

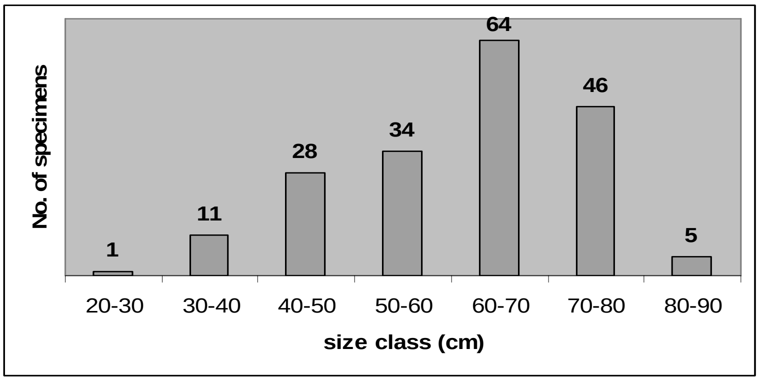

Fig. 3. Size frequency distribution of *Caretta caretta* measured in 2003

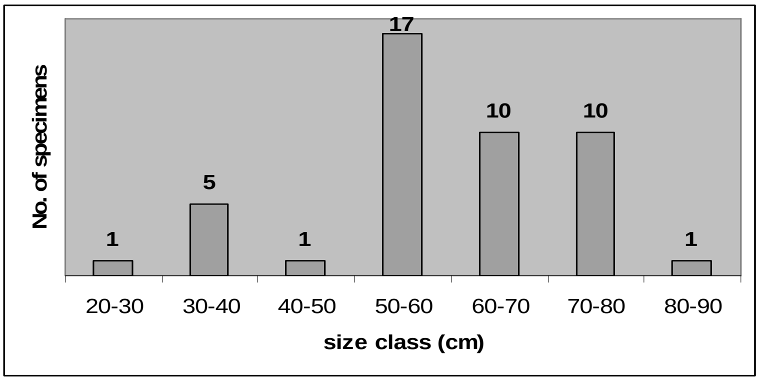

Fig. 4. Size frequency distribution of *Caretta caretta* measured in 2004

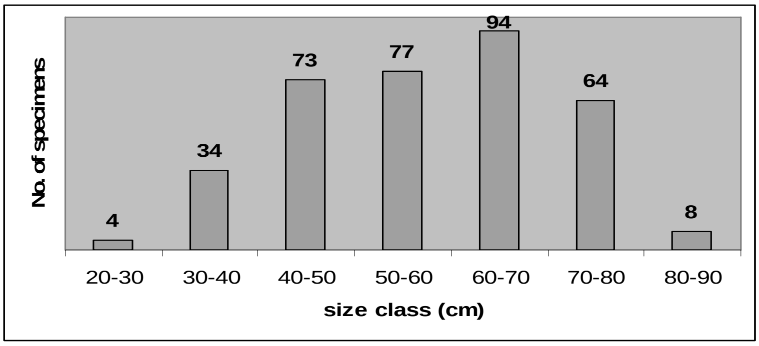

Fig. 5. Size frequency distribution of *Caretta caretta* measured from 2002-2004

Most of the specimens (179) of *Caretta caretta* were female, 97 male and 81 not identified. 228 *Caretta caretta* were tagged by applying light blue plastic tags on the front flippers. One flipper was tagged. All *Chelonia mydas* (8 specimens) were caught in the fishing zone of Patok. From the measurements results that 5 specimens belonged to the SCCL 27-39 cm group and only 1 specimen was larger, with a SCCL of 67 cm. One of them was female and the other 5 not identified. Of the 8 specimens of *Chelonia mydas*, 6 were tagged while the other 2 were caught and released by the fishermen in the Patok area.

Patok is a very interesting zone, as three rivers flow there: Mati, Droja and Ishmi River. Ishmi River is the most polluted in Albania. Maybe this fact is the reason that crabs (especially *Carcinus sp.)* are abundant in this area. Crabs are the main food for *Caretta caretta,* and for this reason they migrate to this area. We took pictures of *Caretta caretta* tagged in Greece and Italy.

All the specimens of *Caretta caretta* observed were carrying various epibionts: Algae, *Enteromorpha sp*.; Mollusca, Bivalvia: *Mytilus galloprovincialis* very rare; Polychaeta, Serpulidae: *Serpula sp*.; Crustacea, Cirripedia, Lepadidae: *Lepas sp.* (very rare), Balanidae:

Balanus sp. (abundant) and Isopoda. We did not observe epibionts on the 6 specimens of *Chelonia mydas* caught in fishing gear.

All the sea turtles studied by us were caught by three kinds of fishing gear: Fishing gear used near the shore at 2-3 m depth (Albanian name: rrjeta ngjitese); Fishing gear used in depth of 6 m or Stavnik (Russian name). Stavnik is good fishing gear for the sea turtles because they remain healthy there for a long time. Fishing gear used in depth 20-50 m (called Tartakoce). This fishing gear is dangerous for the sea turtles.

During resent years, we worked on issues of public education, having the fishermen as our specific target group. Open discussions, seminars, workshops and different publications, such as booklets, leaflets and posters were used for this work. A number of posters were given to the captains of fishing boats, fishermen, pupils and other stakeholders.

The presence of children, pupils, students and fishermen during the tagging process and during the liberation of some marine turtles in the sea was very important in raising public awareness. The role of the media, that frequently transmitted sequences from our fieldwork, was also very important in raising public awareness in sea turtle conservation in Albania.

ACKNOWLEDGMENTS

We thank the Ministry of Environment of Albania and GEF (UNDP) for financial support for this study. We thank, the fishing specialists, the fishermen, the pupils, the students and the media that collaborated and helped in this study for the protection and preservation of sea turtles in Albania. We also thank the Committee of the Second Mediterranean Conference on Marine Turtles that gave us this nice opportunity to present and publish the results of our conservation project.

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NEW SATELLITE RELAY DATA LOGGERS REVEAL FLEXIBLE DIVING STRATEGIES OF LOGGERHEAD TURTLES

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While we are only beginning to understand sea turtle migration routes in the Mediterranean, we are still far from knowing their behaviour outside the nesting season. Recent work using satellite transmitters revealed sea turtle behaviour, after they leave the nesting beaches and during the overwintering period. However, information on diving behaviour was usually derived from measuring the intervals that the transmitter was immersed or from depth histograms. We used a new Satellite Relay Data Logger (SRDL) on a 52 kg loggerhead turtle (*Caretta caretta*) to investigate its depth utilisation in the open sea and also to determine the duration of dormant winter dives. The SRDL functioned for 201 days recording a total of 1952 dives while the turtle moved along the south-western coast of Italy, crossed the Ionian Sea, and finally arrived at its overwintering ground in the South of the Peloponnese Peninsula (Greece). Some turtles have previously been shown circling in the Ionian Sea, probably feeding. This is supported by our new data showing that diving activity in the Ionian Sea was strongly diurnal with repeated long dives to depths between 30 and 60 m. During winter quiescence we obtained the first records of up to 7 hours long dives. Calculations of available oxygen stores and metabolic rates suggest different diving strategies where the turtle may have become anaerobic during deep foraging dives but remained aerobic throughout the winter dormancy.

PRELIMINARY FINDINGS ON THE INTERACTION BETWEEN MARINE TURTLES AND FISHERIES IN SYRIA

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INTRODUCTION

Interviewing fishermen is not such a difficult thing and can be a valuable exercise. Meeting with the fishermen is however not enough; to get the information required one must be a psychological expert. Unless you can act like the fishermen, observing their character and psychology, getting to their level, the interviews can be failures receiving wrong or superficial information.

Selecting the fishermen to interview plays a major role. It should be done carefully with a big group, taking age, experience and authority into consideration. It is also important to learn of the various fishing groups in the area and to befriend them all, so none are ostracised.

Meeting with a fisherman or his group (3-4 people) may take a week to achieve successful results. Once they get accustomed to you they are more willing to provide the true information being sought – generally one must show hospitality to the fishermen and alcoholic drinks help! It is a protracted process, but is the best way to obtain accurate and true information from fishermen that is not known or easily observed. In addition, once they come to regard you as a friend, they become more responsive to your ideas and suggestions. They may change their thoughts and habits without hesitation to those which you propose.

“Why do you protect the turtles?”, “How will protecting the turtles benefit me?” and “How can I avoid damage to my nets from turtles?” are some of the questions the fishermen ask and when they receive convincing answers the majority of them respond to reason as they have learned something that was not previously known to them.

This presentation of this project is important in that it concerns the relationship between fishermen and turtles in an area that has an important nesting beach and also important feeding areas.

The Syrian coast of 183km can be generally divided into two parts namely rocky with some short sandy parts from north of Lattakia to the Turkish border and sandy with some short rocky parts from south of Lattakia to the Lebanese border.

In general the coastal waters are not productive (the average yearly catch was only 1961 tonnes at Lattakia for 2000-2003). There are however over 1950 recreational and small fishing boats in addition to commercial vessels, oil tankers and military ships.

The coast is punctuated with villages, towns and cities, all generally within 5-10km of each other, thus there is a high human presence all along the coast and human-turtle interaction is common.

Surveys at Lattakia in 2004 proved that Syria has a regionally important nesting beach for the endangered green turtle but it also brought to light significant numbers of turtles stranded for various reasons and this provided the rational for starting the current project.

METHODS

From the Summer of 2004 fishing ports and coastal villages from the Turkish border in the north to Jableh further south (covering approximately 80km of coast) was regularly visited in order to enumerate the number and kind of boats present and to interview fishermen for information concerning their interaction with sea turtles.

RESULTS

A total of nine locations with fishing activity were visited and 960 boats recorded. The main results and observations are summarised in Tab. 1. The smallest area (Um Al-toyour) had only 10 boats whereas Al-azhari, a large port north of Lattakia had 383. Between 1 and 38 fishermen were interviewed at each port and the summary of observations and the number of fishermen interviewed are presented in Tab. 2.

Port / site	Number of recreational boats	Number of fishing boats	Total
Al-badrouseih	12	10	22
Ras Al-bassit	26	84	110
Um Al-toyour	5	5	10
Wadi Kandeel	4	8	12
Berj Eslam	6	68	74
Ibn Hani	35	48	83
Al-azhari	68	315	383
Al-kassab	12	38	50
Jableh	36	180	216
Total	204	756	960

Tab.1. Number of fishing and recreational boats per community in the northern part of the Syrian coast, 2004

In some instances fishermen expressed that they valued a kilo of fish over the lives of many turtles and would batter turtles when they encounter them in their nets. Still others indicated that they would injure turtles, leaving them bleeding as they thought that this would make other turtles leave the area.

Direct consumption of turtles is also a problem. Some fishermen drink turtle blood as they believe it is a kind of cancer treatment and they then sell the meat to be consumed (Tab. 2).

Port / site	Fishermen interviews	Importance of the site for marine turtles
Al-badrouseih	1	Sandy/rocky beach. Touristic place. Turtles present in summer and winter for feeding. Low level nesting
Ras Al-bassit	8	Sandy/rocky beach. Turtles present in winter for feeding & summer for low level nesting
Um Al-toyour	1	Sandy/rocky beach. Turtles present in summer. Little nesting.
Wadi Kandeel	2	Sandy/rocky beach. Turtles present in summer. Little nesting.
Berj Eslam	3	Rocky. Turtles present in summer. No nesting weak interaction.
Ibn Hani	12	Archaeological and touristic port, about 6,000 years old. "MAJOR" feeding area, strong interaction with fisheries. People consume turtle meat and blood.
Al-azhari	38	Main port. Turtles present year round for feeding. No nesting. Very strong interaction with fisheries. Fishermen consume turtle meat and blood.
Al-kassab	3	Just south of Lattakia. No nesting. Turtles present only in summer. Strong interaction with fisheries. People consume turtle meat and blood.
Jableh	4	No nesting. Turtles present only in summer. Strong interaction with fisheries. People consume turtle meat and blood.
Total	72	

Tab. 2. Summary of observations and the number of fishermen interviewed per community in the northern part of the Syrian coast, 2004

DISCUSSION

The information obtained from fishermen indicates there is cause for concern for marine turtle populations in Syria with turtles being maimed and killed for both malicious purposes and consumption. It is hard to quantify the level of take, but as the green turtle is critically endangered in the Mediterranean, it is likely that fisheries interaction in Syria is having a significant negative impact on its populations.

The work presented here, concerning having interviews and discussions with fishermen, is part of an ongoing project aimed at raising awareness and sensitising the fishermen to be more respectful to marine turtles and hence reduce the negative impact of fisheries. Fishermen are the main stakeholders, and from their interaction with turtles, they know a lot about turtle ecology; something that would otherwise take years of hard research to reproduce. Consequently their understanding and co-operation is imperative for the proper protection of the animals.

ACKNOWLEDGEMENTS

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NESTING ACTIVITY OF THE LOGGERHEAD TURTLE *CARETTA CARETTA* IN TUNISIA

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INTRODUCTION

Three marine turtle species are observed in Tunisian waters. The green turtle *Chelonia mydas* is rare, the leatherback *Dermochelys coriacea* is regularly observed (Bradai and El Abed 1998) and the loggerhead *Caretta caretta* is common and reproduces on some beaches (Laurent et al. 1990, Bradai 1995).

The nesting activity of *Caretta caretta* was detected for the first time in 1988 in Kuriat islands (Laurent et al. 1990). Actually this site, which consists of two small islands: Little Kuriat (Kuria Sgira) and the larger Great Kuriat (Kuria Kbira) (35° 48'05''N/ 11° 02'05''E) represents the most important nesting site of *Caretta caretta* in Tunisia (Bradai 2000, Jribi 2003, Jribi et al. 2001a, 2001b, 2002a, 2002b). The beaches of both islands have been the object of monitoring since 1997, to count and protect nests, nesting females and hatchlings and determine reproductive parameters. A full-time encampment usually takes place from the beginning of June to the end of August. Numerous short visits are made in May to detect any early nesting and in September and October to excavate late hatching nests. Surveys are also made in other beaches in search of nesting activities.

MATERIAL AND METHODS

On Great Kuriat, beaches were patrolled throughout the night and any females observed were tagged with blue plastic Duo-tags (RAC/SPA) and morphometric measurements were taken after laying. All nests recorded were protected by metal cages, which served to facilitate awareness in the general public. In Little Kuriat and the other beaches, monitoring visits were made once or twice a week. After the excavation of hatched nests it was possible to calculate: clutch size, fertility rate (percentage of fertile eggs), hatching success (percentage of eggs hatched), emergence success (percentage of hatchlings emerged) and gather hatchling morphometrics.

RESULTS AND DISCUSSION

The number of nests deposited varies from year to year. However, nesting activity is regularly observed on Great Kuriat Island (Fig.1). On other sites such as Little Kuriat and Chebba, no nesting took place since 1997. The year 2004 represents an exceptional year: the number of nests deposited on the great Kuriat is the highest since the beginning of our monitoring while nesting on little Kuriat and Chebba was again observed. Other sites especially in the south Tunisian coasts may hold nesting activities and need prospecting surveys in future (Fig. 2).

The results of nesting activities during the eight years of monitoring on Great Kuriat (Tab.1) show high hatching and emergence rates. It also confirms that this site is suitable for nesting activity (Hirth 1980). It also reveals the effectiveness of the protecting efforts, which consist of the protection of nests, avoiding their stamping and disturbance, and the public awareness made on site.

A total of 10 nesting females were tagged and they had a SCCL (Standard Curved Carapace Length) average of 77.7cm (range: 70-81; SD: 4.62) and CCW (Curved Carapace width) average of 67.4cm (range: 63-69; SD: 2.32). This low number of females is the result of:

- The coming of nesting females is rare and scattered;
- The difficulty of controlling all the site of Great Kuriat.

Following emergence, we examined a sample of 627 hatchlings. The average length (MSCL) was 4.13 cm (range: 3.15-5, SD=0.17) and the average width (SCW) was 3.21cm (range: 2.6-4, SD=0.19). The scutes were typical for this species and are uniform.

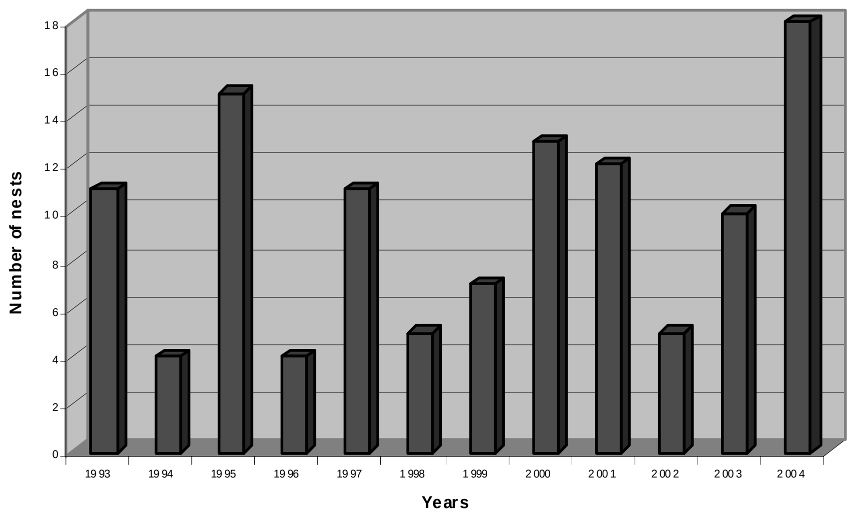

Fig. 1. The annual number of nests on the Great Kuriat

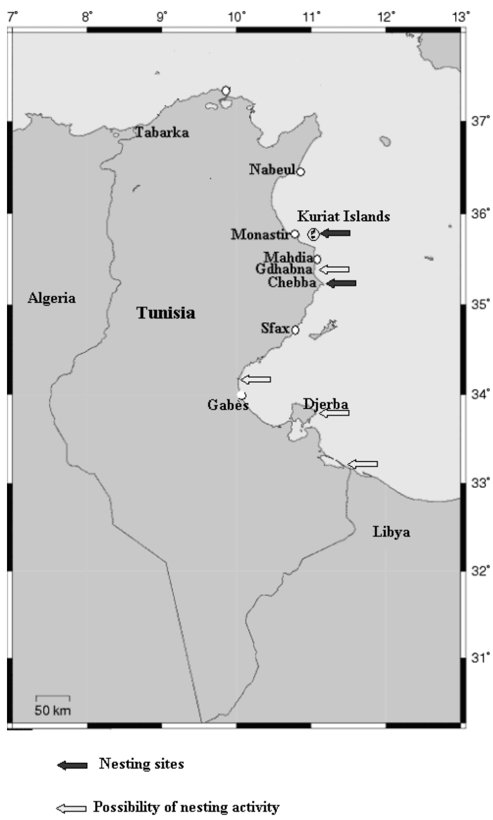

Fig. 2. Nesting sites in Tunisia

Year	Number of Eggs	Hatched eggs	Unhatched eggs			Hatchling dead in egg	Hatchling dead in nest	Fertility rate (%)	Hatching rate (%)	Emergency rate (%)
			Infertile	fertile						
				Early	Late					
Total 8 years	6,798	4,802	948	525	410	126	86			
Annual average	849.75	600.25	118.5	65.625	51.25	15.75	10.75	87.66	73.53	70.07

Tab. 1. Statistics of nesting during 8 years of monitoring in Great Kuriat

CONCLUSION

Protection efforts of marine turtles in Tunisia gave good results: On one hand, the restoration of certain nesting sites such us Little Kuriat and Chebba and on the other hand the increasing number of nests on the Great Kuriat which may lead to recruitment of new nesting females. It is, then, very important to continue our surveys on Kuriat islands and to enlarge them to cover other beaches in the south of Tunisia. However, we should develop other research subjects such us the interaction with fisheries, which seems to be the most important cause of actual mortality.

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NEST TEMPERATURES AND SEX RATIO VARIATIONS AMONG THE HATCHLINGS AND EMBRYOS OF LOGGERHEAD TURTLES ON DALAMAN BEACH, TURKEY

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INTRODUCTION

Many reptiles have no sex chromosomes. Sexual differentiation of sea turtle hatchlings is determined by egg incubation temperature, usually during the middle third of development (Yntema and Mrosovsky 1980, Janzen and Paukstis 1991, Mrosovsky 1994, Kaska et al. 1998). Temperature-dependent sex determination has been the subject of a number of studies (review in Mrosovsky 1994). When eggs are incubated at constant temperatures, there is a narrow range of temperatures around which ca. 50 % of each sex will be produced; wider ranges above this temperature produce females and below this threshold produce males (Bull 1980). The temperature at which an equal sex ratio is produced has been termed the pivotal temperature (Yntema and Mrosovsky 1980, Mrosovsky and Pieau 1991). The hatchling sex ratio depends on the proportion of embryonic development that occurs above and below the pivotal temperature during TSP. The sex ratio estimations on sea turtles were reviewed recently by Freedberg and Wade (2001).

The population survival of sea turtles depends on the sufficient production of both sexes. Estimates of the sex ratio have been obtained by combining the nesting distribution with the sexing of sampled hatchlings from different times during the season, from pivotal incubation durations and nest temperature of a nest during the middle third of the incubation period (Standora and Spotila 1985, Mrosovsky 1994, Marcovaldi et al. 1997, Kaska et al. 1998, Godley et al. 2001a).

It is known that sex determination in sea turtles is temperature dependant and this phenomenon is called temperature depend sex determination. Sex ratios of loggerhead turtles in the Mediterranean have been studied especially during the last few years. Kaska et al. (1998) found a mean sex ratio of 81.6 % females in loggerhead clutches laid over the 1995 and 1996 nesting seasons. Godley et al. (2001a, b) reported very short incubation durations for loggerhead turtles in Cyprus, implying warm, feminising conditions (89-99 % females based on incubation durations and mean incubation temperatures). The pivotal temperatures in studies of loggerhead turtles all cluster within one degree of 29 °C (Mrosovsky 1994, Marcovaldi et al. 1997). Mrosovsky et al. (2002) reported recently the pivotal temperature for loggerhead turtles in the Mediterranean (by using two clutches from Greece) as 29.3 ^{o}C and the pivotal incubation duration as 52.6 days. For the eastern Mediterranean, Kaska et al. (1998) used mean temperatures in the middle third of incubation to indicate a pivotal temperature just below 29 °C and the pivotal incubation duration later calculated as 59.9 d, close to the values of 59.3 and 61.7 d for Brazil and the USA, respectively. These data indicate that the physiology of Mediterranean loggerhead turtles is quite similar to that of conspecifics in the Americas with respect to thermal influences on sexual differentiation. Mrosovsky et al. (2002) reported also that hatchling sex ratio on some Mediterranean beaches is female biased but probably varies within this region. We, therefore, aimed to investigate the sex ratio of hatchlings on Dalaman beach, where there was no similar study done before.

MATERIALS AND METHODS

Temperature was measured using “Tiny talk” temperature recorders (Orion Components (Chichester) Ltd., UK). The device fits within a 35 mm film case. The accuracy of the device was tested under laboratory conditions against a standard mercury thermometer, and they were found to have a mean resolution of 0.35°C (min. 0.3°C, max. 0.4°C) for temperatures between 4°C and 50°C. They were launched by computer for a recording period of 60 days with readings taken at 90 min. intervals. This gave 16 readings per day. They were placed at one (either top or bottom) or two (any two levels) of the nest, during the oviposition or after excavating the nest in the morning of laying (approximately 10 hours after oviposition).Temperature data were offloaded to a computer and the gonads of the sacrificed hatchlings were dissected and preserved in Bouin’s solution for sex determination. The gonads were cut in half transversely and one half was embedded in paraffin wax, sectioned at 8-10 µm from the middle of the gonad, and stained with the Periodic Acid Schiff reaction (PAS) and Harris’ haematoxylin. Sex designation was based on the development of the cortical and medullary regions and the presence or absence of seminiferous tubules (Yntema and Mrosovsky 1980). The middle third of the incubation period was calculated from the total incubation period, from the night of laying to the day of first hatching. The temperature data were analysed as Mean temp. 2/3 period = 0.0716 percent female + 25.114 as the formula obtained from Kaska et al. (1998).

RESULTS AND DISCUSSION

A total of 34 nest temperatures were recorded (8-12-14 for the years 2002-4 respectively). By analyzing the nest temperatures during the middle third of the incubation period, the mean temperatures during this period ranged from 28.4 to 31.9°C. The sex ratios were estimated between 46% and 95% with a mean of 76% females by using the temperature data.

The mean sex ratios were obtained as 85% females (n=190) by histological examination of the gonads of dead hatchlings and embryos. The majority of the embryonic mortalities were found at early (6-7) and late (>26) stages. When these embryonic mortalities were compared in terms of depths, the highest percentages (45%) were found at middle levels and bottoms (35%) of the nests and less (20 %) mortalities at top levels. When the sex ratio of dead hatchlings and embryos was compared between the different levels, a 94% female sex ratio was obtained at the top level but only 64 % at the mid and bottom levels. The temporal and spatial sex ratio variations were also studied.

The nesting season started in mid May and continued until August. The hatching season started in July and continued until the first few weeks of the October, but there were no samples collected in October. Although our sample sizes were not high, we divided these hatchlings for every two weeks (from the begging of the July to the end of September) periods for the hatching season, there were statistical differences between the percentages of the both sexes produced during these periods (x^2=11.39; df=5; $P<0.05$), there were slight increases in the male percentages at the beginning and the end of hatching seasons compared to the middle hatching season.

The temperatures of nests close to the sea may be cooler, and therefore may be potentially producing more males, nests further inland may be exposed to warmer temperature conditions, and therefore producing more females. The relocation of nests to a safer area (or hatchery) may increase the hatching success, but the nature sex ratio and the sex ratio after the relocation might be different. The investigations of sex ratios are becoming important due to global warming and the relocation of nests. Since nearly all the natural sex ratios are highly female dominated, production of both sexes may be necessary in the future, since an endangered species can only be conserved by the presence of both sexes in nature. If we have more unfertile eggs in the future or if we are getting 100% female hatchlings from the beach, we may have to think of producing male hatchlings.

Sex ratio estimations and their biological and ecological implications are clearly a complex issue. There is an intricate interplay between nest location, nest depth, nest temperature, duration of hatching, selective predation and other mortalities within and outside the nest, along with changing conditions from year to year and from beach to beach.

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THE NESTING POPULATION AND SPATIAL DISTRIBUTION OF LOGGERHEAD SEA TURTLES NESTS ON DALAMAN BEACH, TURKEY

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INTRODUCTION

Sea turtles are one of the examples for a species diminishing in numbers due to degradation of the living and nesting habitats, incidental catches and pollution. Two species of marine turtle, *Chelonia mydas* (green turtle) and *Caretta caretta* (loggerhead turtle), are known to nest in the Mediterranean (Groombridge 1990). The nesting sites of sea turtles are being heavily used and destroyed by people especially during the last 25-30 years. The major nesting beaches identified for *C. caretta* were in Greece and Turkey, with smaller numbers recorded in Cyprus, Libya, Egypt, Syria, Tunisia, Israel and Italy (Broderick et al. 2002).

Dalaman beach is one of 13 key Turkish nesting sites for loggerhead turtles. Assessing the population size of sea turtles is a difficult task, particularly in those species that occupy different habitats during their life cycle and migrate large distances (Broderick et al. 2002). In 1988, a total of 69 nests, 73 nests in 1997 and 69 nests in 1998 were recorded (Baran and Kasparek 1989, Yerli and Demirayak 1996, Yerli and Canbolat 1998). We aimed to find out the population size of the sea turtles nesting on Dalaman beach, which was not investigated previously on a continuous basis.

MATERIALS AND METHODS

Dalaman beach is approximately 10.3 km in length and was examined during the breeding seasons of 2002-4. The beach consists of four subsections. The first subsection, 1.8 km in length, starts from Sarigerme hill and extends to the mouth of Sarisu stream. Behind this zone, there are three big tourist hotels (Aldiana, Magic Life, and Iber), and there are also water-sports facilities on the beach. Sun beds and umbrellas cover nearly the entire beach. The second subsection, 1.9 km in length, starts from Sarisu stream and extends to Dalaman River. There is a large wetland with small creeks behind the beach. There is also a camping site and a small restaurant near Sarisu stream. The third subsection is located between the Dalaman and Tersakan rivers. The length of this subsection is approximately 4.5 km. The Dalaman International Airport, a wetland, and agricultural fields are located behind the beach. The last subsection starts from Tersakan River and extends to Hodul hill. This beach has mainly beach rocks, therefore, not many turtle activities occur on this zone.

The beaches were measured with a tape measure and marked with numbered wooden posts at 500 m intervals, running parallel to the beach. This was to allow accurate positioning of turtle activity and egg chamber by measuring to nearby posts. The nest was recorded when a track led to an area of disturbed sand where digging and covering had occurred. All the nests were left in situ. False crawls were recorded in one of two ways: when some digging in the sand, if only slight, occurred but no covering was apparent (i.e., an attempt to dig a body pit and/or egg chamber by the female) or when a turtle made no nesting or digging attempts but simply crawled on the beach and went back to the sea. Species identification was possible using the criteria of track and nest pit morphology (Groombridge 1990). The beaches were patrolled from 21.00 to 02.00 and early in the morning from 06.00 to 11.00, to record any turtle activity.

All the activities from the previous night were accepted and evaluated as the next day's activity. The positions of the nests were also recorded by GPS. Depending on the number of volunteers available, daily night and morning patrols were provided by three groups consisting of 2-3 people on each beach. Half of the in situ nests, under threat from land predators such as foxes (*Vulpes vulpes*), were screened with a metal grid (72 x 72 cm) with a mesh opening of 9 cm placed over the nest at a depth of 20 cm from the surface over the center of the egg chamber. During night patrols, each encountered turtle - following oviposition or while returning to the water – was measured and tagged with monel tags on the right front flipper. Carapace lengths and widths (straight), from nuchal notch to caudal tip and widest point of carapace, were measured, in cm, using wooden callipers. During morning patrols, the shape and pattern of tracks were noted and those tracks that resulted in nests were marked. The nest locations were confirmed with probes and then marked. Tracks with no nests were counted as non-nesting emergences. Some nests were considered to be threatened by tidal inundation. These nests that were within 7 m of the sea were relocated further inland on the beach. Relocation of the nests always occurred within the first 24 hours after laying. The incubation period was calculated from the length of the time from oviposition to first hatchling emergence.

During the hatching season, the tracks of each hatchling coming from control nests were counted, and thus, the total numbers of hatchlings reaching the sea were determined. When tracks were interrupted by tracks of predators such as foxes, dogs, birds, or crabs, we assumed that the hatchlings were destroyed by those predators. All destroyed hatchlings and eggshells were also counted, and disposed of elsewhere. All undamaged eggs were replaced in their original nests after predation. After 8 or 10 days from the first emergence of the hatchlings, nests were opened, and checked for the number of retained hatchlings, empty eggshells, undeveloped eggs, and dead-in-egg embryos. Undeveloped eggs and dead embryos were identified according to Kaska and Downie (1999). The total numbers of eggs in the clutch were calculated as the sum of empty eggshells (Ee), unfertilized eggs (Ue), dead-in-egg embryos (DiEE), and depredated embryos (PE). Also, hatching success rate (HSR) was calculated as: HSR=Ee/(Ee+Ue + DiEE+PE)*100. Hatching success was the percentage of eggs that produced hatchlings. This was ascertained by counting hatched eggshells (fragmented eggshells were pieced together to represent one egg). Incubation duration was defined as the number of days from the date of egg deposition to the date of first hatching.

RESULTS AND DISCUSSION

During this study, a total of 39 animals were measured and 37 new females tagged. We were able to tag 11 females in 2002, 8 in 2003 and 19 in 2004. Only one of them was tagged previously on Fethiye beach in 1993. We found one stranded dead animal.

During the entire study period, a total of 1293 loggerhead turtle emergences were found on Dalaman beach and only 325 (25%) of them resulted in nests (Table 1). The peak nesting seasons were June and July. This result is parallel to the general pattern of nesting success in the Mediterranean (Groombridge 1990). The majority of nests were concentrated between 10 and 45 meters from sea, but non-nesting emergences were irregularly distributed up to 60 meters from sea. The majority of the nests (91 %) were found between 10 and 35 meters. These patterns were almost the same for all years. From the total data, it emerges that one of four emergences resulted in a nest on Dalaman beach. Nonetheless there was no nesting on the first 1.5 km zone, the nesting success was very low (10-15 %) in some regions (i.e., at 5.5; 6; 7 and 7.5 kms) and very high (nearly 50%) in some regions (at 2.5 and 3.5 kms). The distribution and fate of the nests together with hatching success were investigated and the locations of nests were marked on maps together with beach-back structures. The reasons of the dense nests and low nesting zones were investigated. The sand blockage of breakwater, beach rocks, photo pollutions from hotels and airport and water sports were found to be the main reasons for low nesting percentages.

		May	June	July	August	Total
2002	Nests	7	60	33	3	103
	Tracks	15	91	135	5	245
	Total emergences	22	151	168	8	348
	Nesting success rate (%)	32	40	20	38	30
2003	Nests	8	54	43	7	112
	Tracks	6	136	171	35	348
	Total emergences	14	190	214	42	460
	Nesting success rate (%)	57	28	20	17	24
2004	Nests	1	56	46	7	110
	Tracks	4	174	152	45	375
	Total emergences	5	230	198	52	485
	Nesting success rate (%)	20	24	23	13	23
Total	Nests	16	170	122	17	325
	Tracks	25	401	458	85	968
	Total emergences	41	571	580	102	1,293
	Nesting success rate (%)	39	30	21	17	25

Tab. 1. The number of emergences and their nesting success on Dalaman beach

The mean incubation period of these nests was 48 days (max: 62, min: 42). The hatching success was 65 % in the first year and this increased to 71 and 78 % in the second and third years, by relocating and screening the nests. The numbers of nests relocated were 6, 15 and 21 and the numbers of nests screened were 54, 45 and 60 for the years of 2002, 2003 and 2004 respectively. The main reasons for the low hatching success were nest predation and embryonic mortalities due to different reasons. The fates of the eggs during the study period are presented in Table 2. The majority (26 %) of the dead embryos were found at the early stages (6-16). These mortalities were compared according to the levels of presence in nest chamber as top, middle and bottom. There were statistically significant differences between stages 17 and 30 of dead embryos at different levels (x^2=63, 17, df =26, P<0.001). The embryonic mortalities were higher at the middle levels (45 %) and decreased towards to the bottom (35%) and top (20 %) levels. The embryonic mortalities were slightly higher at late stages embryos (after stage of 25) in all nests. The hatching and emergence success were higher in relocated nests and there were also less embryonic mortalities in relocated nests.

The heaviest impacts from invertebrates on loggerhead turtle nests were from *Pimelia sp.* (Tenebrionidae, Coleoptera). 24 (36.3 %) out of 66 randomly selected loggerhead hatched nests in 2002 and 20 (33.89%) out of 59 randomly selected nests in 2003 were affected by these larvae. *Pimelia* sp larval damage was recorded in 188 (10.6 %) out of 1773 eggs and only in 2 (0.28 %) hatchlings in 2002 and in 159 (9.8%) out of 1622 eggs in 2003. As this can be seen from these results, these insects primarily damage eggs and dead hatchlings and should not be taken as primarily predators for live hatchlings but may be accepted as decomposers of dead hatchlings and eggs.

	2002	2003	2004	Total
Nests	103	112	110	325
Numbers of predated nests	33	49	8	90
Unfertilized eggs	419	176	137	732
Dead embryos	1,337	662	1,364	3,363
Predated eggs	888	1,564	473	2,925
Total eggs	7,526	8,159	8,833	24,045
Hatchlings	4,882	5,757	6,859	17,498
Numbers of hatchlings reaching sea	4,682	5,656	6,739	17,077
Hatchlings predated by foxes	39	18	18	75
Hatchlings predated by crabs	22	15	16	53
Hatchlings predated by birds	1	3	6	10
Wrong direction-photo pollution	14	11	15	40
Hard surface	92	29	35	156
Plant root	12	5	5	22
Nests with stone (pebble)	20	20	25	65
Total dead embryos	200	101	120	421

Tab. 2. The fates of the eggs on Dalaman beach during the years of 2002-4

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MARINE TURTLE NESTING IN LEBANON

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A complete re-survey of the Lebanese Mediterranean coast was conducted in 2004, aiming both at assessing the current status of coastal habitats and the nesting potential for marine turtles. Sandy beaches in southern Lebanon tend to be longer, while the beaches in the other parts of the country are mostly relatively short and narrow. This factor together with tourist and other development means that the overall nesting potential for marine turtles is mostly in the south. Nesting status on Palm Island off Tripoli remains to be re-assessed. El-Mansouri beach in southern Lebanon, which has been monitored yearly by MEDASSET since 2001, is the most important nesting beach in the country. During the 2004 survey it was found that significant nesting also occurs at El-Aabbassiye/El-Bourgheliye beach, which is the only beach in Lebanon with significant sand dunes. Marine turtle nesting included nine nests of the critically endangered green turtle (*Chelonia mydas*). In the Tyre Coast Nature Reserve nine loggerhead (*Caretta caretta*) nests were found. The 2004 project in Lebanon was a joint effort by the Lebanese Ministry of Environment, MEDASSET, MedWetCoast and the EU funded MSC project. It included awareness building amongst the local population who use the beaches for recreation. Future conservation efforts should include the El-Aabbassiye/El-Bourgheliye beach and should cover the marine turtle nesting grounds and also rehabilitation of rare and endangered coastal habitats.

MARINE TURTLE NESTING AT EL MANSOURI, SOUTH LEBANON

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INTRODUCTION

The importance of Lebanon's coasts for sea turtle nesting was discovered in 2001 when a first survey to assess nesting potential was undertaken (Demirayak et al. 2003) within the framework of MEDASSET's ongoing conservation programme in the Eastern Mediterranean. A further survey of the entire coast took place in 2004 (Kasparek 2004).

MEDASSET surveys at El Mansouri were conducted in 2002 (Newbury et al. 2002), 2003 (St John et al. 2004) and 2004 (Aureggi et al. 2005) as well as a preliminary monitoring programme at the Tyre Coast Nature Reserve (TCNR) in 2004 (Aureggi et al. 2005). Results show that there is sparse nesting along parts of the northern coast, scattered on several developed beaches, while southern nesting sites are more important both nationally and regionally.

Southern Lebanon has been under considerable socio-economic strain since the end of the Israeli occupation in 2000. Along a 20 km stretch of coast, near Tyre town, three assessed nesting sites have been deemed important for both Mediterranean nesting species, *Caretta caretta* (*Cc*) and *Chelonia mydas* (*Cm*): El Mansouri beach, El Abbassiyeh beach and Tyre Coast Nature Reserve (TCNR).

This paper reports on the results of the 2004 survey at El Mansouri in the context of findings from previous monitoring surveys. A training programme for local participants was also conducted.

METHODS

The study area (1.4 km) was first described in detail in 2002 (Newbury et al. 2002). The monitoring programme was conducted daily between 01-05 -04 and 30-09-04 by two people.

Each nest was examined to confirm the presence of eggs. A one-metre square metal grid with 8 x 10 cm mesh size was placed over the egg chamber of each nest. Each grid was secured at the four corners by metal pegs and covered with sand. The metal grid, not visible to beach users, was left until the nest hatched. Six nests considered threatened by natural inundation, agricultural run off or by tourist disturbance were relocated. On the first day of hatchling emergence, nests were excavated. Incubation success rate was assessed by determining hatching success (number of hatched eggs as a proportion of the number of eggs in the nest).

RESULTS

During the study period 109 emergences were recorded, of which 49 resulted in nests. The most frequent nesting species was *Cc* with 43 nests (87.8 %). *Cm*, with 6 nests, represented 12.2% of nesting effort. Spatial distribution of the 49 nests varied over the 6 sections of beach

(Fig.1), with a range of 0-30 nests in each section. Most nests were laid in Sector A (61.2 %) and in Sector F (24.5%).

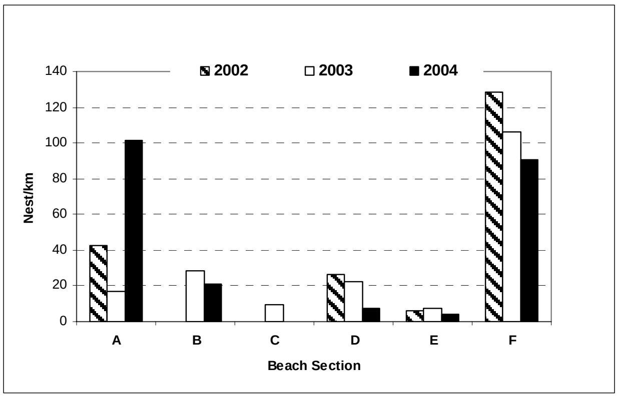
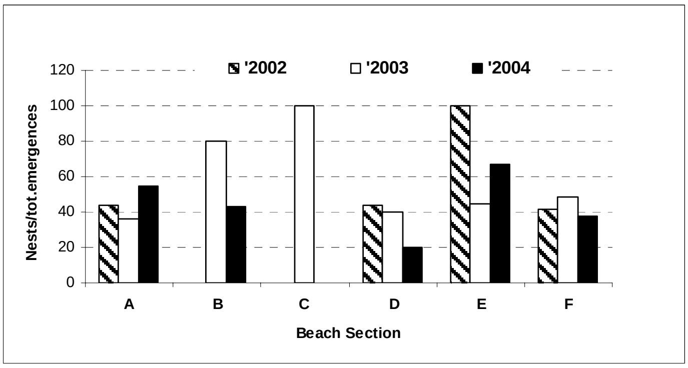


Fig. 1. Nesting density distribution. Data from 2002 (Newbury et al. 2002), 2003 (St John et al. 2003)

Total emergences resulting in nests varied from section to section, showing differences of nesting success rate, but a similar rate was recorded along the entire beach over the three years of the study (Fig. 2). The nesting success of emerging *Cc* on El Mansouri was on average 43.9% in 2004 (range 0 – 66.7%), 47.1% in 2003 (range 36.4 – 100%) and 40.2 % in 2002 (range 0 – 100%). Clutch size of *Cc* was on average 80 (N=43; range 30 –112) and 122 for *Cm* (N=5; range 105-143). The hatching success rate for *Cc* nests in situ was on average 67.2% (range 0 – 95.1; N=37), and 80.2% for relocated nests (range 60.6 – 91.7; N=6).

Fig. 2. Nesting success distribution. Data for 2002 (Newbury et al. 2002), 2003 (St John et al. 2003)



On the first day of hatching, 42.3 % of eggs hatched and emerged. During excavation 30.8 % of the total eggs were found hatched, with live hatchlings in the nest. *Cc* incubation time for nests in situ was on average 51 days (N=40; range 45 – 60) and 48 days for *Cm* (N=5, range 45 – 55).

DISCUSSION

Large annual fluctuations in the number of nests are not uncommon in loggerhead turtle populations in the Mediterranean (Margaritoulis and Rees 2001). However at El Mansouri the number of total nests per season did not fluctuate significantly between 2002 and 2004, being 37, 33 and 43 respectively. El Mansouri and other nesting sites within a 20 km stretch of coastline probably represent one nesting population, however according to available data, this beach provided the densest nesting of the entire 20km stretch (Aureggi et al. 2005). It is also the only beach where a three-year survey has been conducted.

Cc nesting density at El Mansouri was similar for the three years 2004, 2003, 2002 and was similar to Kizilot (Turkey), with 26.0 nests/km on the 5 km beach (Turkozan 2000).

Along the short stretch of beach, nest distribution was uneven. Sector A hosted most of the nests (*Cc* and *Cm*) in 2004. Both species showed a preference for this small stretch of the beach (236 m), which was not the case in previous seasons. On the contrary Sector F showed a decrease in number of nests. This shift could have been due to a more intensive use of the beach in the latter section, which is open to the public. Similar behaviour has been observed at Kazanli, Turkey, where the less frequented eastern part of the beach appears to offer more suitable conditions for nesting turtles (Aureggi 2001). Sector A is relatively quieter and the impact of light pollution at night lower in comparison with previous seasons (authors' observation).

In 2004 the total number of *Cc* emergences resulting in nests was similar to previous seasons, but in 2002 and 2003 the survey did not cover the entire season. This was higher than at nesting sites in Turkey, like Kizilot (31.9%) and Fethiye (26.4%) (Turkozan 2000).

Substantial differences in clutch size have been observed in *Cc* colonies throughout the Mediterranean (Margaritoulis et al. 2003), Lebanon clutch size is similar to that of Israel, Tunisia, Turkey and Cyprus whereas average size is smaller than in most Greek nesting sites. As in other Mediterranean nesting sites (Margaritoulis et al. 2003), incubation duration is short in Lebanon, suggesting a female-biased sex ratio in hatchlings (Godley et al. 2001). However data for only one season is available from Lebanon, which is insufficient to undertake proper statistical analysis.

Hatching success rate was higher for relocated nests than for *in situ* nests, as has also been reported at Kizilot in Turkey (Turkozan 2000), showing that applied conservation strategies to relocate nests were successful in El Mansouri. Furthermore, the fact that no nests (with the exception of one) were predated or disturbed by humans during egg incubation, demonstrates the success of individual nest protection strategies applied at the site. However, illegal fishing (with dynamite), tourism development and rubbish on the beaches remain common threats requiring urgent action on all Lebanese nesting beaches, including El Mansouri. Lack of awareness among local people also needs to be addressed.

For security reasons El Mansouri beach was not patrolled at night, so no assistance could be provided to emerging hatchlings. Because of this, nests were excavated on the day after first emergence, to avoid predator attacks on hatchlings over the following nights. Consequently a high percentage (30.8 % of the total number of eggs) of live hatchlings were found in each nest during excavation and released to crawl to the sea. Canid predation has been recorded on this beach (Demirayak et al. 2003) and the number of ghost crabs on the beach seems to increase during the hatching season, (authors' personal observation) threatening hatchling survival.

Southern Lebanon is the least developed part of the country and has been devastated by the war. There is little tourism development along the coast. Effective protection and management is essential in the region before these pristine beaches are overrun. It is a matter of priority that El Mansouri be given legal protection and defined as a National Park.

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SEXING OF JUVENILE LOGGERHEAD SEA TURTLES (*CARETTA CARETTA*): GONADAL MORPHOLOGY VS. HISTOLOGY

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Sea turtles exhibit sexual dimorphism only as adults, hence diagnosing the sex of hatchlings and juveniles requires the employment of different direct and indirect techniques which differ in the level of accuracy. With this study we therefore re-examined sex determination based upon gross morphology of reproductive organs of 99 juvenile loggerhead turtles, with the curved carapace length (CCL) ranging from 24.0-69.0 cm (mean: 41.8 cm; SD: 10.3) from the central and eastern Mediterranean, by histological analysis of gonads. All the cases in which the observer was unable to diagnose the sex from the gross morphology of the gonads, or where the sex determination differed between these two methods, were classified as incorrectly diagnosed sex. Overall, the sex was correctly diagnosed in 92.9% of the 99 cases. The highest error rate (33.3%) was found in juveniles with CCL = 20.0-29.9 cm (N = 9), which strongly influenced the sex ratio estimates (visual = 0.60; histology = 2.00). In turtles with CCL = 30.0-39.9 cm (N = 38) and 40.0-49.9 cm (N = 30), the error rates were 5.3 and 6.7%, respectively, and have not resulted in a significant difference in sex ratios between the methods. In large immatures (CCL = 50.0-69.9 cm, N = 22), sex determination equalled 100% by both methods. Our results show that gonadal morphology is good as a sexing method in larger juveniles; however in juveniles with CCL< 30 cm we strongly recommend verification of the results by histological examination of gonads.

HIGHLY FEMALE BIASED SEX RATIO IN LOGGERHEAD SEA TURTLE HATCHLINGS ESTIMATED FROM INCUBATION DURATION ALONG THE ISRAELI COASTLINE

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The Israeli National Nature & Parks Authority recorded nesting data of the loggerhead turtle *Caretta caretta* along the 190 km of Israel coastline over 9 full seasons (1996-2004). The method used to estimate the hatchlings sex ratio was through calculation of incubation duration and application of our data into concluded results of other localities. The validity of the results is therefore considered as an approximation. Long and short incubation durations imply low and high nest temperatures, respectively. In turtle species whose sex is determined by temperature males are produced at low temperatures and females at high temperatures. The results suggested that the hatchlings sex ratio is approximately 1:1.4 male to female (22.77:77.23). This female-biased sex ratio in Israel is similar to the one previously found for loggerheads in Cyprus. Male hatchlings are more likely to be produced from clutches laid at the beginning (May and June) and at the end (August) of the season, but due to small nesting activity in the beginning and end of season, the number of males is relatively small.

THE STJ: AN ADJUSTABLE BUOYANCY AID FOR SEA TURTLES

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Sea turtles are often brought to rehabilitation facilities with buoyancy disorders that result from excessive gas in the gastrointestinal tract, traumatic injury to the lung or morphological malformations (Campbell 1996). This condition may be temporary or chronic and requires prompt therapy. Weight belts are commonly used during veterinary treatment but they have same serious limitations. Often sea turtles encounter difficulties in equilibrating for the additional weight and their ability to float at the surface or submerge is strongly affected. We designed and produced a prototype for a “sea turtle jacket, STJ” which helps the turtle to regulate its position in the water column. Four inflatable air chambers guarantee the necessary buoyancy while another four weight pockets allow equilibrating the position of the animal. The STJ is fitted to the turtle by eight suspenders which attach to a central elastic ring and can be tightened with simple clips. This system enables us to fit the STJ to different sized sea turtles, obviously within a narrow size range. We tested the jacket on a loggerhead turtle that presented severe carapace abnormalities and floated vertically with the caudal part of its carapace above the surface. This animal was not responsive to other remedies and had drastically reduced its food intake and excretion rate. The turtle needed some time to get used to the shoulder straps, but after only few hours, it was able to submerge again. After an initial training period in the rehabilitation tank at the Turtle Point of the Stazione Zoologica we transferred the turtle to the Aquarium of Naples and released it into a big tank (2m deep and 6m long). No signs of stress were noticed and the animal was able to rest on the bottom and swim normally in a horizontal stable position. The food intake and excretion rate normalised with time. The STJ allowed us to improve the quality of life of a loggerhead turtle which can not be re-introduced into the wild.

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LOGGERHEAD NESTING IN RETHYMNO, ISLAND OF CRETE, GREECE: FIFTEEN-YEAR NESTING DATA (1990-2004) INDICATE A DECLINING POPULATION

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INTRODUCTION

The loggerhead sea turtle is considered an endangered species worldwide (Baille and Groombridge 1996) and is protected through international conventions, European Union directives (e.g. Habitats Directive 92/43) and national legislation. The main nesting areas in Greece are Laganas Bay (Zakynthos) and southern Kyparissia Bay, which are monitored annually under a standardized programme by ARCHELON since 1984. In the course of a rapid assessment study, during 1989, new nesting areas were discovered on the island of Crete (Margaritoulis et al. 1995); the most important of these, Rethymno, was included in the routine annual monitoring programme of ARCHELON in 1990.

STUDY SITE

Crete is the largest island in Greece and the fifth largest in the Mediterranean with a coastline length of about 1,000 km. Crete is characterised by a diversity of landscape, including high mountains, valleys, gorges and plains. The southern coast is generally precipitous while the northern is much gentler, thus attracting most of the development. Rethymno nesting beach stretches east of Rethymno town for about 12 km (Fig. 1), 10.8 km of which consist of suitable nesting ground. The development status of the area ranges from "full development" especially close to the town, to "low development" in some sectors, with hotels and pensions scattered along the entire area. Several beach sections, especially in front of hotels, are under heavy human use crowded with beach furniture and lit, during the night, by bright lights.

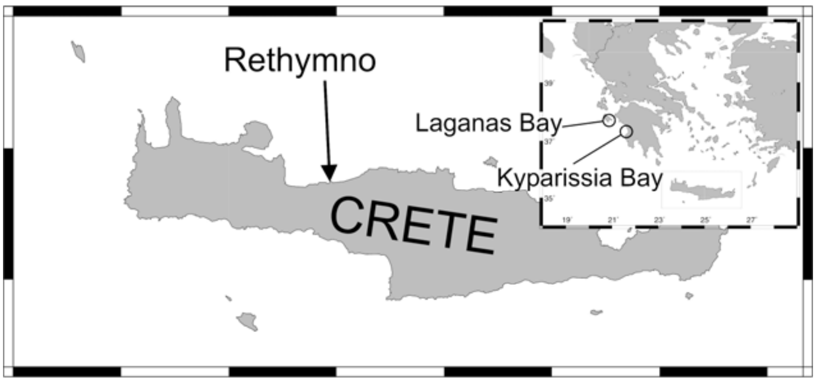

Fig. 1. Map of Greece showing Crete and approximate location of Rethymno nesting area

METHODS

Nesting activity (i.e., adult female emergences and nests) was assessed through daily beach surveys conducted early in the morning. Verification of nests was done through hand excavation of the sand until appearance of top eggs. All nests were marked and monitored until emergence of hatchlings.

RESULTS

The annual number of nests ranged from 248 to 516 with an average of 349.7 over the 15-year period (Fig. 2). Nesting density averaged 32.4 nests/km/season (range: 23.0 – 47.8 nests/km/season, N=15 seasons). The annual number of nests, over the monitored seasons, shows a downward trend which is highly significant (r^2=0.361, <0.05) (Fig. 2).

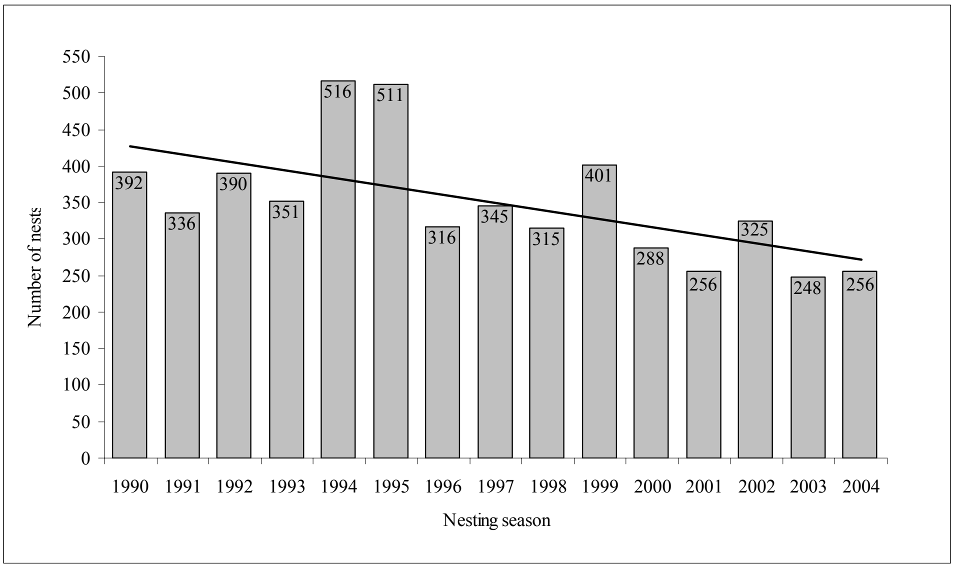

Fig. 2. Number of nests per season at Rethymno, over the period 1990-2004. The straight line above the bars shows the linear trend

DISCUSSION

The documented annual nesting effort of the Loggerhead Turtle in the Mediterranean averages about 5,000 nests (Margaritoulis et al. 2003). Of these, about 26% are made in the 5.5 km beaches of Laganas Bay (Margaritoulis 2005) and about 11% along 9.5 km in southern Kyparissia Bay (Margaritoulis and Rees 2001). In the same context, Rethymno concentrates about 7% of all documented loggerhead nests in the Mediterranean. Rethymno's average nesting level (more than 100 nests/season) and average nesting density (more than 6 nests/km/season) classify this area as a "major" nesting site in Greece (Margaritoulis 2000).

Although that nesting data at the two longest monitoring projects in Greece, i.e. Laganas Bay (Margaritoulis 2005) and southern Kyparissia Bay (Margaritoulis and Rees 2001), do not show any apparent trend, the downward evolution of nesting levels at Rethymno is alarming.

One would argue that the downward trend at Rethymno is only a temporary situation as the number of monitored seasons is not large enough to provide a full picture of the nesting population over the years. However, the high degree of adverse factors in Rethymno (see next section) indicate that the noted trend is most probably a real one. ARCHELON will continue monitoring Rethymno in order to further assess this trend.

CONSERVATION ASPECTS

Rethymno nesting area, when discovered in 1989, was already under severe tourist pressure, with several hotels in operation, many constructions under way, severe light pollution, etc. Further, it seems that human intervention has impacted beach-width as many buildings have covered parts of the high beach and the sand dunes, and various constructions at sea (e.g. groins) create substantial beach erosion in several cases. Narrowness of beach-width, combined with an increasing amount of beach furniture blocking the turtles' access to the back of the beach and concomitant seawater inundation, which is very frequent due to predominant northerly winds during summer, influence a great number of nests. Furthermore, light pollution has been responsible for increased hatchling mortality due to disorientation.

In an effort to mitigate these negative effects on a short-term basis, ARCHELON concentrates on protective measures on the beach by fencing and relocating threatened nests, and by shading hatching nests subjected to light disorientation. These are direct measures after a successful long process of involving the authorities, the tourist industry and the local people.

A large section of Rethymno nesting area has been included in the proposed sites for the Natura 2000 network of the Habitats Directive of European Commission (Dimopoulos et al. 2003). For the time being this provides only for Environmental Impact Assessments for any constructions within the site, which must be approved by the Ministry of Environment instead of the local authorities. A Management Plan was elaborated in 1997 by ARCHELON in the context of a LIFE–Nature project (Irvine et al. 1998). There is a continuous co-operation between ARCHELON and local communities to implement various aspects of this MP.

Further, an intense Public Awareness Programme is a permanent component of the conservation work in Rethymno. The general aim of this programme is to educate both tourists and locals about the loggerheads' presence and the conservation issues arising from human development and use of the nesting beaches. The aim is to point out the problems in the context of how the public could help solve them, in the hope that most problems could be avoided or substantially reduced by an informed public.

A special part of the project has been cooperation with the tourist sector. The long-term benefits of conservation for tourism were analysed to the interested parties, through presentations, personal contacts and the use of mass media. The target of ARCHELON is to show how many of the problems arising on the nesting beaches can be dealt with through low-cost solutions as described in the Management Plan. This would be of benefit to both parties since the long-term viability of the beaches as nesting sites can guarantee the quality of the tourist product in the future (Panagopoulou 2008).

ACKOWLEDGEMENTS

We are grateful to the many project leaders, field leaders, field assistants and hundreds of volunteers that worked in Rethymno nesting area over these years. We thank ARCHELON's office personnel for their support. Special thanks are due to the local authorities, the Prefecture of Rethymno, and the local municipalities for their cooperation and support. The project benefited greatly from the collaboration of the tourist sector, and especially from the Tourism Promotion Committee of Rethymno, TUI, HOTELPLAN, GRECOTEL. In the period 1995-97 the work at Rethymno was included in the LIFE-Nature project LIFE/A22/GR/1115/KRI. DM and AFR thank the conference organisers for funds to attend the conference and associated workshops. The map was made using MapTool, a free of charge service of SEATURLE.ORG.

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PRELIMINARY DATA ON STRANDED AND ON LANDED ACCIDENTALLY CAUGHT LOGGERHEAD TURTLES IN MALTA

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SUMMARY AND INTRODUCTION

Loggerhead turtles are relatively common in Malta and accidentally caught in significant numbers too, in particular in long line fisheries. Some fisherman, occasionally, land such accidentally caught turtles. These are then transferred to the recently available holding and rehabilitation facility at the Malta Centre for Fisheries Sciences at Torri San Lucjan, M'xlokk of the Fisheries Conservation and Control Division (FCCD). Most of these are eventually released after treatment and rehabilitation.

The database compiled from this incoming data, gives us indications of mortality numbers, numbers released and also hint at growth rates, thus helping to direct conservation efforts.

The Nature Protection Unit (NPU) together with the FCCD, started its tagging programme in 1991, through the assistance of the Regional Activity Center for Specially Protected Areas (RAC/SPA – UNEP/MAP) which also provided the tags.

Data is presented on the status of the loggerhead turtles in the Maltese Islands, and the first local attempt to describe the success rates of the initial endeavours of turtle rehabilitation. The incidence of landings of such injured specimens increased as a result of awareness campaigns aimed at fishermen.

METHODOLOGY

The data was collected by the authors as from 1991, with a gap between 1991 and 1997, during which no rehabilitation measures were as yet available, hence most turtles were released immediately. Dead specimens were sometimes stored in freezers for later examinations, post mortems and/or for sampling, some of them were buried for later extraction of the skeleton to be given to the Maltese Natural history Museum; All the live stranded or accidentally caught specimens were actually taken to the FCCD where they were taken care of and subsequently tagged just prior to release; those turtles which were not to be released were not tagged.

RESULTS

Out of more then 50 turtles landed in the period from 2002-2004, 10 turtles died [~20%], some after a few days at the center, with an occasional incidence of post-operative death. Only 3-4 turtles died post an operation. Most of the turtles which died were either brought by fisherman in an advanced comatose stage or had several traumatic lesions probably caused by a propeller. Others may have died due to severe infections following the swallowing of hooks and complications in the gut (as showed by some postmortems).

An interesting event was the landing of a loggerhead turtle on the 15th October, 2002, which was in difficulty near Comino possibly because of some entanglement in nylon, although a number of long line hooks (as confirmed by an operation) were also later extracted; This turtle was quite particular in that it had 4 costal scutes on its carapace. This turtle was operated upon, on the 25th January 2003, but died some 20 days afterwards.

Thirty-two turtles were tagged and twenty eight turtles were released between 2002 and 2004 in two mass releases. 4 other individuals were released in single events prior to 2002.

The common seasons when fishermen mostly land turtles seem to be between June and October, whilst in December - February some fishermen fishing for swordfish also land a number of turtles.

Most of the landed turtles in January - March actually turtles entangled in drift nets or in pieces of nylon, or are hit by propellers (and for one turtle, the case was of disorientation in the output piping system of the reverse osmosis plants).

DISCUSSION AND CONCLUSION

The majority of specimens stranded or landed were actually juveniles, measuring less than 60 cm (CCL), however fishermen may be less reluctant to land bigger turtles and thus this data needs to be taken with caution.

Although tagging started in 1991, more frequent tagging was carried out after 2001, subsequent to some formal and informal campaigns carried out amongst fishermen by FCCD and amongst the general public by NPU, through the first mass release of turtles. This followed the setting up of the rehabilitation centre.

Although there is an occasional incidence of post-operative death, and though a few turtles which due to severe physical handicaps, have limit swimming abilities and have to remain at the centre, the incidence of rehabilitating turtles is quite good.

ACKNOWLEDGEMENTS

We are particularly grateful to dedicated personnel at the MCFS caring for the turtles at the centre and in particular to Mr. Charles Sammut. We would also like to show our appreciation to all officials who work at the Nature Protection Unit of the Malta Environment and Planning Authority and to volunteers within the NGO Nature Trust, for the care and attention they give to stranded marine turtles.

The first author is also indebted to the assistance of John Borg and Dimitris Margaritoulis for their interest and transmittal of numerous publications.

ANALYSIS OF TAGGING AND RECOVERING OF MARINE TURTLES IN MALTA

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INTRODUCTION

Here we present data regarding the recapture of turtles tagged in Malta and elsewhere and we try put forward possible postulations regarding movements and migration routes and possible inferences on ecology and growth. Unlike what happens in the Adriatic (Lipej et al. 2000, Ziza et al. 2003) where the major threat is through trawling or entrapment in other nets, the major local threat for turtles is accidental capture in long line fisheries. Landed turtles are rehabilitated at the Malta Centre for Fisheries Sciences (MCFS) at Torri San Lucjan, M'Xlokk. Released specimens, after treatment and rehabilitation, are sometimes recaptured in Malta or in other countries in the Mediterranean. Such recapture data can give insight even about the behaviour and ecology of these reptiles. There are at least four encounters of such recaptured specimens, tagged in Malta or elsewhere, and recaptured in Malta.

Some of the turtles actually have multiple hooks (necropsy analysis and operations, Gruppetta pers. comm.) and some accidentally caught specimens are generally released by the same fishermen through the cutting of the long line. Correct handling of data of such accidental captures, can thus contribute to substantial information which can lead to the understanding migratory movements and other ecological aspects.

METHODOLOGY

Prior episodes of selling of turtles (with annual captures of 2000-3000) at market places (Gramentz 1988) are non existent in Malta nowadays, as a result of legislation and related public awareness campaigns done by the Nature Protection Unit (NPU) and MCFS. The NPU together with the MCFS, started a tagging programme in 1991, however only one turtle was tagged then. At that time, due to the lack of a rehabilitation centre, most of the turtles which caught were released immediately. Bigger efforts and attention to tagging were given post 2001. Tagging was done through regional assistance by the Regional Activity Center for Specially Protected Areas (RAC/SPA – UNEP/MAP), which provided the blue plastic RAC/SPA tags.

All the live stranded or accidentally caught specimens are taken to the MCFS, where they are operated according to needs, then tagged and then given time to recover prior to release. Those turtles which were not to be released were not tagged. The creation of network of people working on turtles has further assisted us in tracing any recaptured tagged turtles and getting the relevant data much more quickly.

RESULTS

Thirty two turtles were tagged from 1991 to 2005, 4 specimens were found again. Twenty-eight turtles were released between 2002 and 2004 in two mass releases, and 4 other individuals were released in single events prior to 2002.

A turtle tagged in July 1997 (tag T 3500) was released on the same day from Ghajn Zejtuna, Malta and was recaptured again in September 2000, as a sub-adult, by a fisherman while fishing in the east of Gozo (Baldacchino and Schembri 2002). During this three-year period, the CCL increased by 16 cm, from 44 cm 60 cm. Unfortunately no other measurements were taken during the recapture and the fate of this turtle was not reported. Another injured turtle was found in July 2002, 200 miles south west of Malta, three swordfish hooks were then extracted and the turtle was then released in a mass release event on the 6th April 2004. It was then collected dead 3 miles off the Puebla de Farnala port in Spain on the 26th September, 2004 with peritonitis and intussusceptions, which were probably the cause of death (Toni Raga and Jesus Tomas pers. comm.). During this 5 month period the CCL increased by 4 cm and the CCW also increased by 4 cm. This turtle navigated a minimum distance of 1,340 Km (723.54 n miles) in 173 days (speed of 7.7 km/day), although it may also have died before and then drifted by currents to the site where it was found dead.

A tagged turtle was also found in the Maltese territorial waters in January 2002, displaying an Italian tag (Z 0491), which was then subsequently tagged also with a Maltese tag (T 3519). Details about such Italian tag are still being awaited. A turtle tagged in Zakynthos and Peloponnesus, between 1982-87 (Margaritoulis 1988) was found in Malta in March 1988.

DISCUSSION AND CONCLUSION

The specimen tagged in Malta which was found in the western Mediterranean also confirmed migration routes from the central parts of the Mediterranean to the western regions, although turtles tagged in eastern parts migrating to central regions were also found (Margaritoulis 1988). Previous reports of movements between the central and western parts are reported by Tomas et al. (2001). Movements between the eastern and the central basins have been well documented through tagging and recapture studies by Argano et al. (1992), Laurent and Lescure (1994) and Margaritoulis (1988).

Gut analysis of the turtle found dead in Spain, showed an accumulation of debris at the end of the intestine producing blockage. This turtle was at the Centre for rehabilitation for nearly two years and may have got accustomed to getting fed, checking ability to survive in the wild prior to release, may help further in these studies. However according to Margaritoulis (1988), turtles may actually survive for a number of days without food and thus the actual cause of death subsequent to rehabilitation cannot be entirely postulated. This turtle made quite a remarkable journey, even more remarkable then a similar one quoted by Tomas et al. (2001), wherein one turtle made a journey of at least 695 nautical miles in 394 days.

One of the turtles tagged and released in Malta was recaptured again in the Maltese Islands after a number of years, confirming movements to previously visited places even though nesting no longer takes place in the Maltese Islands. A further case of a recaptured turtle tagged in Italy also postulates some movements towards the south central regions. (Although the movements of this turtle were not known, and hence pointing to the importance of introducing systems like telemetry in Malta, which might have helped in tracing and confirming movements of such turtles). According to data from Zakynthos, turtles which nest there, then spread out in various directions, and sometimes are found also in Malta (Margaritoulis 1988).

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We are particularly grateful to dedicated personnel at the MCFS who care for the turtles at the centre and in particular to Mr. Charles Sammut for helping us to gather data and for his dedicated care with the turtles. We would also like to show our appreciation to all officials at the Nature Protection Unit of the MEPA and to volunteers working with Nature Trust, for their invaluable help with stranded marine turtles. The first author is also indebted to the assistance of John Borg, Dimitris Margaritoulis and Charles Galea for their interest and transmittal of numerous publications. The first author would also like to express her most sincere gratitude to the reviewers, of this manuscript, in particular Andreas Demetropoulos, for his patience and for his helpful suggestions and discussions on the subject.

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MARINE TURTLES IN MALTA: LEGAL FRAMEWORK, CONSERVATION EFFORTS AND STATUS UPDATE

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INTRODUCTION

Five species of marine turtles are recorded in the Maltese Islands. The Loggerhead Turtle is the most common; with the Green Turtle and the Leatherback turtle being relatively rare. Hawksbill and the Kemp's Ridley are also recorded. The negative impacts of man's activities were more pronounced in the past, mainly because of lack of public awareness, with accidental and sometimes even intentional capture through fisheries, being the chief threat in Maltese waters. Through the recent adherence to a number of regional and international conventions, the publication of local regulations, and public awareness campaigns, marine turtles are nowadays facing a much better future in Maltese waters. Tagging of these turtles as well as data gathered from stranding or accidental capture is also accruing our knowledge on these reptiles. The additional rehabilitation measures available today, the drawing up of a code of practice, the establishment of a data base, the drafting of a national plan of action for protecting turtles and the additional planned educational material will contribute to the desired protection strategy targeted towards more effective conservation of these marine reptiles.

SPECIES PRESENT INCLUDING RARE AND VAGRANT SPECIES

All five species of marine turtles recorded in the Mediterranean, have also been documented for the Maltese waters (Brongersma and Carr 1983). In the Maltese Islands the loggerhead turtle is relatively common, with highest numbers occurring between June and September (Groombridge 1990). The leatherback (*Dermochelys coriacea*) has been recorded on several occasions with at least 13 records of sightings in the Maltese waters mainly attributed to Gramentz (1989) from 1970-1980 and Lanfranco (1977, 1983) (also quoted in Baldacchino and Schembri 1993). The green turtle has been recorded once in the Maltese waters (Despott 1930 a, b) however, local fishermen may misidentify it due to its resemblance to the loggerhead turtle. The hawksbill (*Eretmochelys imbricata*) and the Kemp's ridley (*Lepidochelys kempi*) are known from a few records. The latter record is of a specimen captured off the north-eastern coast of Malta in 1929, one mile from the Grand Harbour (Brongersma and Carr 1983), whilst the former was recorded in 1980 some five miles off the East of Gozo (Vella Gaffiero pers. comm. in Gramentz (1989)).

STATUS OF TURTLES IN MALTA: NESTING AND THREATS

Caretta caretta is recorded to have formerly nested in very small numbers in the Maltese Islands, prior to 1940s (Balzan 1988, Lanfranco 1988, and Baldacchino 1988 in Groombringe (1990)). Nesting was probably irregular and quite minor, according to Groombringe (1990). Disturbance from sea crafts may pose quite a threat to marine turtles in the Maltese territorial waters. The high incidence of accidental catches of marine turtles during the fishing seasons, through the use of long lining mostly for the blue fin tuna (*Thunnus thynnus*) and the broadbill swordfish (*Xiphias gladius*), also have their toll during such fishing periods. Some fishermen (Mifsud pers. comm. with numerous fishermen) recount encounters or accidental captures of between 8-15 marine turtles per fishing episode. Furthermore, some marine turtles ingest multiple hooks either from the same line on which they are captured or else from previous incidents, which were not fatal. According to Despott (1915) large numbers of loggerhead turtles (*Caretta caretta*) are captured at sea between August and November. Before the publication of the Reptiles (Protection) Regulations (Legal Notice 76 of 1992), *Caretta caretta* used to be caught for food by locals. An estimated 1000 to 2000 loggerheads used to be caught annually (Groombridge 1990) with August and September being the months with the maximum fishing activity for swordfish, tuna and dolphin fish (Balzan in Groombridge 1994). Gramentz (1988) also estimated that 2000-3000 loggerhead turtles are caught on longline hooks during the swordfish season and that 500-600 loggerhead turtles were caught during that time and used as food or for souvenirs each year. Groombridge (1990) also estimated that mortality is around 15-50% of the total number of marine turtles caught. Sometimes carapaces were also sold as souvenirs for tourists. Before 1992 turtle meat was quite frequent in homes but less common in restaurants (Groombridge 1990). Presently loggerheads are still caught by fishermen, but, nowadays nearly all such captures are attributed to accidental captures mainly on the tuna, swordfish and dolphin fish long-lining. Incidental captures in trawling, which according to Balzan (in Groombridge (1990)) was on the increase in 1988, is nowadays apparently not such a big threat in view of the short trawl time and the small numbers of trawlers registered (Gruppetta pers. comm.). Corroborating this is the fact that very few comatose turtles are actually landed. Most of the accidentally caught turtles are usually thrown back after cutting the line. Today the lost hook and nylon are compensated for, when the turtle is handed in to the Fisheries Department, which proves an incentive for landing injured turtles, rather than disposing of them, or killing them. Loggerheads taken from Maltese waters have been examined by Gramentz (1986b, 1988) and found to be contaminated with tar and having swallowed other plastic and metal litter. Lately samples were taken of dead stranded turtles to investigate occurrences of heavy metals and the presence other pollutants, however we are still awaiting results.

CONSERVATION AND MANAGEMENT MEASURES IN MALTA

Malta is party to the Protocol for Specially Protected Areas and Biological Diversity in the Mediterranean, which has the protection of Mediterranean marine turtles as one of its priority targets. Such regional agreements or treaties oblige parties to take appropriate measures for the conservation of marine turtles. In the light of such obligations, the Fisheries Conservation and Control Division and the Nature Protection Unit of the Malta Environment and Planning Authority are also presently drafting a National Plan of Action for Conservation of Turtles with strategies, priorities and activities to be undertaken. Malta has also acceded to and/or ratified a number of other international treaties, which also provide for the further protection of marine turtles. The Reptiles (Protection) Regulations, mentioned above, which are published under the Environment Protection Act 1991 (Act V of 1991 - sections 32 and 33), protect the three most commonly occurring marine turtles in the Maltese territorial waters However following accession to the European Union, the EU Habitats Directive was transposed into national legislation, and published under Legal Notice 257 of 2003, and the latter give protection to all the species of marine turtles ever recorded in the Maltese Islands. Apart from prohibiting killing, attempts to kill and selling, even conspiring to do so will be considered as an offence. Specimens or other parts in the hands of persons prior to this legislation had to be registered.

Marine turtles accidentally caught by fishermen have to be surrendered immediately to the Director of Fisheries and eventually, at the discretion of the Director, the fishermen shall be compensated for any loss of tackle, this being an incentive for fishermen to land injured turtles for subsequent rehabilitation and data gathering. Permits for *bona fide* scientific studies can also be issued by the Director responsible for the Environment. Any person who commits an offence against these regulations shall on conviction be liable to a fine, which fine shall in each case apply to each specimen.

ENFORCEMENT, THE STRANDING NETWORK AND THE RESCUE AND REHABILITATION CENTRE

Through the Nature Protection Unit Inspectorate, the Environment Protection Directorate administers any contravention to the above regulations. Stranding of marine turtles or any illegal acts committed vis-à-vis marine turtles are reported by the public or other entities to the Inspectorate who are on call on a 24 hour basis. Based upon the nature of the emergency, necessary action is then taken. Injured turtles are generally taken to the rehabilitation centre, to be operated upon or for any other necessary treatment or rehabilitation. The Department of Fisheries and Aquaculture (Fisheries Conservation and Control Division) centre, in collaboration with the Environment Protection Directorate (EPD), run a relatively small rescue and rehabilitation facility at the Malta Centre for Fisheries Sciences at Torri San Lucjan, M'Xlokk for injured, or accidentally caught, marine turtles. This centre periodically houses up to a maximum of 20 marine turtles. Through the assistance and involvement of dedicated personnel, a number of marine turtles are cured and rehabilitated each year, after the necessary operations needed generally for the extraction of hooks. Before release they are usually tagged using tags provided by the Regional Activity Centre for the Protocol for Specially Protected Areas and Biodiversity in the Mediterranean (RAC/SPA). During recovery they are fed on cephalopods and subsequent to the operations, they are given antibiotics or vitamins according to necessity. Some necropsies are also carried out to help in identification of the possible causes of death. Subsequent to rehabilitation, most of the recovered turtles are then released in mass. Over the last three years more then 30 turtles have been released in such mass release events. In order to aid the smooth release a number of divers also help in this endeavour. The tags have a RAC/SPA code and a number, which is specific to every turtle (each forelimb is tagged with corresponding tags). The RAC/SPA tagging system is a regionally recognised scheme, although one of the major disadvantages is that the turtles' 'tagging origin' is not immediately recognised because of the lack of the country's name on the tag.

STRANDING NETWORK, OTHER CONSERVATION MEASURES AND PUBLIC AWARENESS

Through the Environment Protection Directorate personnel, we have a 24-hour system where persons encountering marine turtles can phone and immediate help will be summoned. The Armed Forces of Malta, the Malta Maritime Authority and/or the Administrative Law Enforcement Section generally provide a helping hand through provision of a sea-craft when needed. This network provides for recording sick, dead and injured turtles, which are either stranded or sighted at sea. This network also provides for help from veterinarians, biologists and other turtles experts as well as local NGO's and other volunteers. Although the code of practice (CoP) for beached or landed turtles is still at its initial phases, its actions are incorporated into the already existent and finalised cetacean COP. In the case of beached turtles the same general guidelines as that of the cetaceans COP are followed. Preparations are presently being made to launch a questionnaire regarding turtle interactions with fisheries. This questionnaire aims to collect more data on the type of fishing tackle used during the accidental capture of the turtles, the type of bait used, data on the type of boats used during such expeditions and finally data pertaining to the status of the turtle i.e. measurements, sex etc. Some data is already incoming through questions asked at the point of entry of landed turtles. Over the years a number of posters on reptiles (including marine turtles) have been issued by the Environment Protection Directorate, emphasising their importance and their vulnerability. A number of other publications also highlight the vulnerability of turtles. Other private publications, like books on Maltese reptiles (Baldacchino and Schembri 1993), Amfibji, Rettili, u Mammiferi (Baldacchino and Schembri 2002) and others also help to illustrate the vulnerable and threatened status of these reptiles as well as explaining their biology, which all contribute to an increase of public awareness. Presently the RAC-SPA booklet on the handling of marine turtles by fishermen is being translated into Maltese through financial aid by the same centre and is to be distributed to the general public and particularly to fishermen to increase public awareness for conservation. A demonstration session to fishermen is also planned. Local NGOs like Nature Trust also contribute significantly to these awareness campaigns. They have produced a number of leaflets, stickers and other informative material and a leaflet for sea-users to track any sightings, which also includes information on distinguishing features for the identification of three different species of marine turtles. A database for sighted or landed turtles has been created by personnel from the Environment Protection Directorate for reported sightings or landings made subsequent to the 1997 local legislation. Biometrics are also taken and are listed. This will help in assessing the status of these reptiles in the Maltese Islands.

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We are grateful for the dedicated care that the personnel at the Fisheries Conservation and Control Division give to the rehabilitation of turtles at the centre, in particular, to Mr. Charles Sammut who dedicates most of his time looking after these turtles and is so devoted and passionate that he gives each turtle a name, besides being able to recount each turtle's history from memory. We would also like to show our immense appreciation to all officials who work at the Nature Protection Unit of MEPA, for their help in the stranding network and to volunteers working with the NGO, Nature Trust, who all give their unfailing share of attention to stranded marine turtles. The first author is also indebted to the assistance of John Borg, Dimitris Margaritoulis and Charles Galea for their interest and transmittal of numerous publications. The first author would also like to express his most sincere gratitude to the reviewers, of this manuscript, in particular Andreas Demetropoulos, for his patience and for his helpful suggestions and discussions on the subject.

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PRELIMINARY DATA ON THE EPIBIONTS OF *CARETTA CARETTA* FROM MALTESE WATERS

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INTRODUCTION

The recent availability in 2001, of holding and rehabilitation facilities, at Malta Centre for Fisheries Sciences (MCFS) at Torri San Lucjan, M'Xlokk, for stranded turtles or those caught accidentally by fishers in Malta, has permitted a detailed study of individuals being rehabilitated, including data on epibionts.

Some preliminary results on such epibionts collected and identified from a few individuals of *Caretta caretta* are discussed here. The species of such epibionts, were cirripeds including *Chelonibia testudinaria* and the hirudinian *Ozobranchus margoi* (Figure 1). *Ozobranchus margoi* is a new record for Malta and not so common in the Mediterranean.

Observations on the density and distribution of these epibionts and occurrence preferences on the turtles' surface, as well as notes on their relation to the host's ecology, are given. Epibionts showed preference to different kinds of surfaces such as skin, scutes and epidermal plates as well as preference to anterior or posterior ends.

METHODS

Notes were taken of the position and quantities of any epibionts found. Epibionts were collected and put in formalin, with the exception of the leech which was refrigerated, then put in alcohol, to leave intact the diagnostic features. Pictures of turtles, with the epibionts, were taken from both dorsal and ventral view.

Four living specimens of loggerhead turtles, *Caretta caretta,* all with a smaller CCL than 65 cm, and most of which were immature specimens, were examined for epibionts.

Data could not be gathered for all specimens landed, in fact only 4 specimens were fully examined, since most of the other specimens which are landed actually get cleaned free from epibionts immediately at the centre; some of the data was actually taken from further examination of the photos taken, when the turtle was landed; Abrasions whilst on the boat deck could also have resulted in losses of epibionts.

The data presented are only preliminary and without doubt biased in view of small number of examined turtles.

RESULTS

Chelonibia testudinaria was the biggest barnacle encountered; some of the specimens were so big that they acted as another surface for the attachment of other barnacles of the same species or of *Lepas* sp. These were mostly found growing on the sides of the *Chelonibia* - One specimen was actually more then 4.8 mm long and 3.8 mm wide.

The anterior and middle region of the carapace seemed to be a more common place for settlement of *Chelonibia*, the 2nd and 3rd vertebral scutes, the 1st and 2nd marginal and the 2nd and 3rd costal scutes proved to be quite a common place for settlement of *Chelonibia*; One turtle whose carapace was overgrown with green algae, had quite a big number of *Chelonibia* and some of them even occurred between the 8-10th marginal scutes; This turtle was amongst the biggest turtles examined locally with a CCL of 58 cm and CCW of 60 cm.

Fig. 1. *Ozobranchus margoi* infestation shown in the damaged limb – Photo C. Sammut

A massive infestation of the ectoparasite *Ozobranchus margoi* (Hirudiinea class) was observed on one of the turtles and it probably also induced pathological effects. It was located around the cloacae region and under the folds of skin in the neck, but particularly (with several stages of the development of the leech present) on the left limb, which was severely cut nearly to the bone. It is normally found also on soft tissue between carapace and the plastron (Scaravelli et al. 2003). This leech is not so commonly reported since its occurrence is not so common, particularly in the Mediterranean (Scaravelli et al. 2003).

It was also evident from the specimens examined that the plastron was less frequently colonised with the exception of the anal scutes, on which generally some small (generally one on each side) *Chelonibia testudinaria* occurred - *Chelonibia* found on the plastron were smaller then those found on the carapace; another common place for *Chelonibia* was the soft parts of the neck and near the anal region, however *Chelonibia* found here were even smaller then those found on the plastron.

DISCUSSION AND CONCLUSION

The largest specimens of *Chelonibia* testudinaria occurred mostly on the carapace. The carapace seems to be more commonly colonised than the plastron.

Most of the turtles, which had a large number of barnacles or had quite large barnacles, actually had more than one hook in their bodies. Most such landed turtles, ending up at the rehabilitation centre, are generally a result of accidental captures. It may be tentatively concluded that such impairment may result in a slowing down of swimming, hence increasing the chance for attachment by such commensals.

Chelonibia found, seemed not to settle preferentially between the 3-6th marginal scutes, which may be due to the movements of the forelimbs which may sometimes touch the borders of the carapace (Gramentz 1988). Settlement by *Chelonibia* in the anterior and middle region of the carapace seemed to be more common, probably due to the type of hydrodynamism present on the turtle's surface whilst swimming. The turtle which had a large number of *Chelonibia* was one of the biggest ever found locally and was quite overgrown with green algae. It may be inferred that at an older age the turtle, which then has a decreased rate of growth, will become more susceptible to greater colonisation by such commensals; Also the algae may render the surface even more prone to further colonisation by barnacles.

There is no means of verifying that the *O. margoi* infestation has actually led to the pathological condition the turtle mentioned above was found in. In fact to date this turtle is still recovering at the rehabilitation centre, since it still has not regained full use of this limb.

ACKNOWLEDGEMENTS

We are particularly grateful to dedicated personnel at the MCFS caring for the turtles at the centre, in particular, to Mr. Charles Sammut in helping us to gather the necessary data. We would also like to show our appreciation to all officials who work at the Nature Protection Unit of the Malta Environment and Planning Authority, and to volunteers working with the NGO, Nature Trust, who all give their unfailing share of attention to stranded marine turtles. The first author is also indebted to the assistance of John Borg, Dimitris Margaritoulis and Charles Galea for their interest and transmittal of numerous publications. The first author would also like to express his most sincere gratitude to the reviewers, of this manuscript, in particular Andreas Demetropoulos, for his patience and for his helpful suggestions and discussions on the subject.

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EXPLORING FISHERMEN'S ATTITUDES TOWARDS MARINE TURTLE CONSERVATION: WHY FISHERMEN BEHAVE THE WAY THEY DO

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INTRODUCTION

The Egyptian Mediterranean coasts are not considered a significant nesting site for marine turtles but are an important feeding and wintering area. Thus fisheries interaction and illegal trade/exploitation are seen as the main threats facing the marine turtle population in Egypt (Laurent et al. 1996, Venizelos and Nada 1999). Over the past few years the Egyptian government and civil society organisations have undertaken several conservation initiatives informing different sectors of the community about threats facing marine turtles, and enforcing existing laws banning illegal trade/exploitation of endangered species, including marine turtles. While these endeavours have had a notable impact on public trade in turtles in Alexandria's fish market, illegal trade is still practiced and a black market exists.

SCOPE AND METHODOLOGY

This paper explores how and, more importantly, why fishermen in Alexandria continue to trade and exploit marine turtles illegally despite conservation measures. The research relies on four methods for data gathering, namely desktop review, in-depth interviews with key informants, direct observation and a quantitative survey (with 127 fishermen). These different methodologies were used to ensure bias and limitations associated with one method would be compensated for by the strengths inherent in the others.

The research used the structured social psychology analytical framework of 'Planned Behaviour', which provided a useful insight into fishermen's decision-making processes and their conservation behaviour. As outlined in Beedell and Rehman (1999), the theory attempts to predict and understand behaviour by measuring the underlying determinants of that behaviour: attitudes, subjective norms and perceived behavioural control (see Figure 1). The main assumption of the theory is that people behave rationally, in accordance with the beliefs they hold and that a person's behaviour is a function of the information or beliefs that she/he has. The beliefs may be based on experience, fact, hearsay, or may be fallacious.

Ajzen (1985) identified three distinct types of belief that relate to: the effects or outcome of behaviour (termed 'behavioural beliefs' e.g. 'conserving marine turtles will decrease the probability of my children being stung by jellyfish'); social influences ('normative beliefs' 'religious leaders in my community will be upset if they know that I exploit marine turtles'); and factors that can make this behaviour easier or more difficult or even completely prevent it ('control beliefs' e.g. 'enforcing laws that prohibit the exploitation of endangered species thus discouraging me from illegally trading marine turtles'). All behavioural beliefs that influence a person, can be combined to form a belief based measure of 'Attitude', a positive or negative predisposition to behave in a certain way; the normative beliefs to form a 'subjective norm', a general measure of perceived social pressure to perform (or not perform) a behaviour; and, the control beliefs to form a measure of 'perceived behaviour control', an overall perception of how easy or difficult it is to behave in a certain way. When applying the theory, two measures of each belief are taken: one relates to how good or bad the effect of the behaviour is (outcome evaluation) and the other to the likelihood of the behaviour leading to this outcome (belief strength).

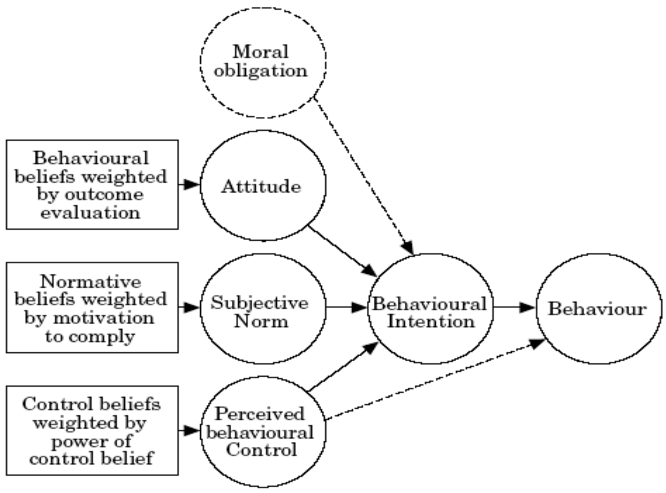

Fig. 1. Theory of planned behaviour

Behavioural Beliefs	Correlations
• Destroys my fishing equipment	0.39*
• Prevents me from enjoying a meal	0.29
• Turtle meat is a free meal for me	0.43 *
• Shows colleagues that I do care	0.21
• Conserves marine turtle population	0.24
• Protects my children against jellyfish stings	0.28
• Makes fishing physically uncomfortable	0.19
• Prevents me form taking a natural aphrodisiac	n.s
• Protects me from illness (blood consumption)	n.s
• Conserves this species for the next generation	0.26
• Denies me an additional source of income	0.57 *
• Conserves this resource for my community	0.19
• It is not my responsibility to conserve turtles	0.78 *

Box (1): Correlation between fishermen's behavioural beliefs and marine turtle conservation

Normative Beliefs	Correlations
• My children	0.17
• Community leaders	0.56 *
• Best friends	0.48 *
• Governmental officials	0.23
• My wife	0.56
• Other fishermen	0.29
• Religious leaders	0.50 *
• Media	0.24
• Fishermen's Co-Operative	n.s.
• Environmental NGOs (FEAA)	0.21

Box (2): Correlation between fishermen's normative beliefs and marine turtle conservation

Control Beliefs	Correlations
The stigma of killing a marine turtle	n.s.
The religious leader will be disappointed in me	0.46*
If I was arrested I would be punished	0.57*
My knowledge about conservation of turtles is limited	0.31
I am not involved in the decision making process	0.52*

Box (3): Correlation between fishermen's control beliefs and marine turtle conservation

MAIN FINDINGS AND DISCUSSION

From the analysis of fishermen responses, the most significant results are presented below:

A) Behavioural Beliefs: It was found that most of the fishermen interviewed did not have a positive attitude towards sea turtle conservation and responses were grouped into two main sets of behavioural beliefs.

Firstly, and most significantly, fishermen believe that it is not their responsibility, but the government's, to conserve sea turtles in Egypt. Although in theory they do have a stake in these resources, in reality they do not have the right even to discuss with the government decisions related to fishing practices and how it impacts on fishermen livelihoods. While national laws aiming to conserve endangered species exist and the government is paying increasing attention to the enforcement of these laws, most of the fishermen interviewed argued that most government institutions are corrupt and it is unjust that they enforce regulations that affect the livelihoods of poor fishermen.

Secondly, conserving sea turtles will negatively affect fishermen's livelihood (as turtles have a negative impact on fishing equipment, it prevents me from getting a free meal, and deprives me of an additional source of income). While all the fishermen stated that the trade/consumption of marine turtles does not represent a significant source of income, a considerable percentage welcomed it, citing the dire need for any additional source of income. One fisherman stated, "Conservation people like you have nice houses, eat three times a day and your kids go to school. If you were struggling to survive and achieve your basic household needs, your priorities in life would change."

While significant behavioural beliefs were not in favour of marine turtle conservation, some fishermen illustrated that there were positive elements to it (e.g. it shows colleagues that I do care, conserves marine turtle populations, and conserves this resource for my community (Box 1). The major factors/conditions identified among those who favoured turtle conservation were younger age group, higher education level, access to environmental information and fishing not being the main source of income. These results should be investigated in more depth through focused research and with a larger sample size.

B) Normative Beliefs: Studying the impacts of normative beliefs on fishermen's behavioural intentions is rarely done but offers a crucial entry point into marine turtle conservation. Such studies could lead to the development of awareness campaigns that might not target fishermen directly but would focus on those influencing them. This approach has been used by several non-governmental and governmental organisations but without being based on in-depth analysis.

Data from this research identifies community and religious leaders the most influential. Equally important, but rarely considered in the design of awareness campaigns, were fishermen spouses and friends. These findings suggest that future awareness campaigns could consider approaching community and religious leaders, social entrepreneurs in the fishing communities and fishermen's spouses through specially tailored training programmes. Fishermen's children were not found to play an important role in educating their fathers, at least within the fishermen community of Alexandria. Future research is needed to investigate in more depth these findings and examine them within different contexts.

The impact of awareness campaigns implemented by ENGOs directly targeting fishermen was brought into question by this research, as highlighted by one fisherman's response, "We really appreciate the enthusiasm and effort taken by Friends of the Environment (Environmental NGO in Alexandria), but I believe they come from a different culture. They don't understand how we live or the problems we face. They care more about sea turtles than anything else and don't realise that we face the dangers of the sea every morning and every pound we can earn really counts". These comments highlight the importance of partnering with local grassroots organisations as a more effective approach when targeting indigenous communities. It is, however, important to assess the image and organisational capacity of these groups. For instance, qualitative and quantitative data gathered throughout this research suggests that in Alexandria fishermen cooperatives are neither achievable nor effective.

C) Control Beliefs: The most common controlling belief identified was that fishermen were afraid of being caught while illegally trading/consuming turtles. This finding does not seem to be directly related to the lack of involvement of fishermen in resources management. However, fishermen argued during interviews and focus groups that they only complied willingly with regulations and laws governing marine resources that made sense to them and were in keeping with their customs and practices. When these preconditions do not exist, fishermen feel that they are forced to comply with these regulations and will try to find ways to avoid compliance. Involving fishermen in the design making process and co-management of resources will reflect positively on how they buy into the outcomes of the process.

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A NEW FORAGING AREA FOR *CARETTA CARETTA* IN THE MEDITERRANEAN SEA: THE CRAB *POLYBIUS HENSLOWII* (DECAPODA: BRACHYURA) AS A MAIN FOOD RESOURCE FROM NORTH WEST AFRICA

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We present data on the almost exclusive diet of the Loggerhead turtle *Caretta caretta* based on five years of intensive research on dead and live specimens from the South Bay of Ceuta (Spain), located across the Strait of Gibraltar, just within the first part of the Mediterranean Africa. At this foraging area, turtles of all stages and different origins, feed on the crab *Polybius henslowii*, which is not only particularly important in the Loggerhead´s diet, but in other predator´s diet, becoming essential for the whole marine ecosystem. In addition, recent data about the feeding ecology of the Loggerhead in the rest of the Moroccan coast is also presented, showing that the crab is also a very important food resource in these developmental areas. We also analyze some aspects of what kind of feeder the Loggerhead turtle is (specific, generalistic or opportunistic). Investigations on the biology, ecology, pathology, osteology and conservation are presented as well.

MARINE TURTLE NESTING SITE EVALUATION SURVEY, TURKEY 2003

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INTRODUCTION

The most important nesting beaches for *Caretta caretta* are in Turkey and Greece according to the long years of study on this species (Baran and Kasparek 1989, Margaritoulis 2000). These two countries are, to a lesser extent, followed by Cyprus (Broderick and Godley 1996), Egypt (Kasparek 1993, Clarke et al. 2000), Libya (Laurent et al. 1995), Tunisia (Laurent et al. 1990), Israel (Kuller 1999) and Syria (Kasparek 1995).

The nesting sites for *Chelonia mydas* are in Turkey, Lebanon, Israel, Egypt and Cyprus. There have been no records from central and western Mediterranean on nesting of this species in these regions (Kasparek et al. 2001).

The first detailed study covering all marine turtle nesting sites in Turkey was carried out by Baran and Kasparek in 1988 with the support of WWF (World Wide Fund for Nature). The most important 17 marine turtle nesting beaches for *Caretta caretta* and *Chelonia mydas* have been determined by the results of this study.

Another WWF supported study was carried out on all beaches in Turkey in 1994 (Yerli and Demirayak 1996). This study has covered all beaches in Turkey and continued during an entire breeding season. Potential nesting beaches for marine turtles have been determined by similar studies done by Yerli and Canbolat (1998) between 1996 and 1998, and by Yerli et al. (1998). The criteria used in the determination of the importance level of the beaches in Turkey have not been defined in the studies done up to date.

The major threats to marine turtle nesting sites due to unregulated human activities such as construction of second houses and hotels on the beaches and illegal sand mining continue to be the most serious problem faced. The ever developing fisheries industry has also become a major threat to marine turtles in the Mediterranean.

The studies on marine turtles in Turkey are usually scientific and they also include recommendations for public awareness and measures to be taken for the conservation of the species. Marine turtles have become a symbol for nature conservation in Turkey after a successful campaign supported by Turkish Society for the Conservation of Nature (DHKD) and various other national and international institutions against the construction of a big resort in Dalyan in 1986. In 1989, the conservation work, experience and studies done by universities and NGOs were evaluated during a series of meetings organized under the coordination of Ministry of Agriculture and Rural Affairs. The “Marine Turtle Monitoring and Evaluation Committee” was founded in 1990. The committee is coordinated by the Ministry of Environment and Forests according to the last re-organization of the government.

Turkey has signed international conventions and also developed its own national legislation for the conservation of marine turtles and their habitats. In spite of these efforts, marine turtle habitats are still under threat due to insufficient or inefficient conservation monitoring and evaluation programs.

METHODS

The study covers 17 officially designated marine turtle nesting beaches plus three candidate nesting sites (Cirali, Alata and Yumurtalık beaches), that have not yet been listed officially, along the Mediterranean coast of Turkey.

The study team consisted of nine people from WWF-Turkey, Adnan Menderes University and Dokuz Eylul University. The team worked as three 3-people groups between June 20th and July 12th 2003; The Western Mediterranean Group between Ekincik and Tekirova; The Middle Mediterranean Group between Belek and Goksu Delta; The Eastern Mediterranean Group between Alata and Samandag

The teams recorded data on standard data forms according to pre-determined method. The study consisted of two phases. The first phase was done during the day and data on the end points of the beaches, rivers and other physical structures, big building blocks, approximate area covered by parasols and chaise lounges on the beaches were collected by GPS. All potential and existing threats were recorded during this assessment of the beaches. The nests and tracks encountered were also recorded. The lighting conditions of the beach, human activities, whether the chaise lounges are collected, and other positive and negative human impacts on the beaches were recorded during the second phase and this was done during the night. The results from former studies were also gathered, as much as they were available, and data on nesting densities, tracks and nests are presented for every beach separately.

The 20 marine turtle nesting sites mentioned in the study are: Ekincik, Dalyan, Dalaman, Fethiye, Patara, Kale-Demre, Kumluca, Cirali, Tekirova, Belek, Kizilot, Demirtas, Gazipasa, Anamur, Goksu Delta, Alata, Kazanli, Akyatan, Yumurtalik, Samandag.

The final evaluation of the study was done with the synthesis of the results of a survey completed by team leaders. The importance of marine turtle nesting beaches was evaluated according to nesting densities (per km) and mean annual nest numbers until this study. With this study, for the first time a pointing system and additional criteria were employed for the determination of the importance of the beaches in terms of marine turtle nesting. The main threats posed on the beaches were assessed in the first part of the survey. The specialists have evaluated the situation of the beaches with the letters A, B and C according to the present severity of the threats. The overall evaluation of the threats was done and graded between 0 and 4 in the second part of the survey. After the overall evaluation of the threats to the beaches, developments and threats for the intervals of 1988 and 1994; 1994 and 1996 (or 1998); 1996 and 2003 were assessed.

For the time intervals used, the problems, recommendations and implementation of these recommendations, presented in the final reports of the studies of 1988, 1994 and 1996–1998, were taken as references. These three studies covered almost all nesting sites in Turkey.

Threats, measures taken, improvement or deterioration and conservation status of the beaches during past 15 years were taken into consideration for the grading by the experts. The experts evaluated only the areas on which they had confident information and experience and they did not evaluate areas with insufficient data and experience. Mean values of the data collected by the experts were calculated and evaluated according to total lengths of the beaches and development of the threats.

RESULTS

64% of all beaches are in bad condition and immediate measures must be taken for the conservation of these sites. 24% of the beaches are in reasonable condition and need only some improvements and rearrangements in terms of conservation measures, while 12% of the beaches are in good condition. None of the areas evaluated were found to be in very good condition. Similar results arise when this evaluation is done according to the total lengths of the beaches.

Results of planning-based evaluation of marine turtle nesting sites:

2003 Condition	Very good (0) … Very bad (4)	
Ekincik (1 km)	2.5	→
Dalyan (4.4 km)	1.0	←
Dalaman (10.1 km)	2.5	I
Fethiye (8.3 km)	2.5	→
Patara (10 km)	1.5	←
Kale (Demre)(8.5 km)	3.0	→
Kumluca (20.5 km)	3.0	→
Cirali (3.2 km)	1.5	→
Tekirova (3.7 km)	3.5	→
Belek (29.5 km)	3.0	→
Kizilot (16.2 km)	2.0	I
Demirtas (8.1 km)	1.5	I
Gazipasa (6.5 km)	2.5	I
Anamur (12.7 km)	2.5	I
Goksu Delta (28.7 km)	2.0	←
Alata (3 km)	2.0	
Kazanli (4.4 km)	3.0	←
Akyatan (21 km)	1.0	I
Yumurtalik (25.5 km)	2.0	→
Samandag (14.5 km)	3.0	I

→ Stands for a deterioration in the condition of the site since 1994
← Stands for an improvement in the condition of the site since 1994
I Stands for a stable condition since 1994

The problems such as sand mining in Belek, Kizilot, Anamur and Samandag, noise and light pollution from the airport in Dalaman, light pollution from restaurants and hotels in Fethiye Calis and recommendations for these are stressed in all reports since 1988. All examples indicate lack or insufficiency of the implementation of relevant legislation and violation of legal regulations.

Approximately 65% of all nesting beaches in Turkey were awarded with one or more conservation statuses within the last 15 years. Turkey signed and ratified the Bern and

Barcelona conventions and in 1996 the Convention on Biological Diversity. As relevant legislation has not been developed in accordance with these international conventions, most of the problems and threats to the nesting sites have not been resolved.

For the solution of the problems on the nesting beaches:
1. National legislation should be improved and implemented for the conservation of marine turtles and their habitats.
2. All development plans prepared for nesting sites should include scientifically determined conservation targets and sustainable use principles, and they should follow complete EIA procedures.
3. The threats posed to marine turtle nesting beaches should be monitored by local NGOs and volunteers.

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RELATIONSHIP BETWEEN GREEN TURTLE NESTS AND PHYSICAL CHARACTERISTICS OF NESTING SAND IN THE SAMANDAG (ANTAKYA) COAST, TURKEY

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This article presents the effects of physical characteristics of the nesting sand of Samandag Coast on green turtle's nest distribution and nesting density, in 2003 season. The first author worked as coastal geomorphologist, and second author worked as biologist in the project entitled "investigation of some physical and chemical parameters effects on green turtles' nest distribution, nesting density and sex differentiation in Samandag Coast". Topographical maps and aerial photos of Samandag coast from different dates were interpreted, afterwards field-check was conducted to investigate dynamics of the coast, and as well as to depict type of improper human activities. The Samandag nesting zone has largely been subject to coastal degradation by means of intensive sand excavations. Intensity of man-made depressions along the coast forced biologists to augment hatching success by relocating nests. In addition, the beach inclination has been reversed in many places, thus, preventing turtles from nesting. The prevailing winds from WSW create a distinct littoral drift to the NNW direction resulting in a longer nesting zone on the northern part of Asi Delta. Intensive nesting zone is located at both sides of river mouth at the mean 6-8% slope inclination, about 25 m distance from the coast. Grain size distribution of the most preferred nesting zone at nearby Asi mouth is heterogeneous; between 0 to 850 micrometer which reflects less sorted alluvium. In this zone, due to the abundance of 600-850 micrometer coarse sand, as well as the effect of fresh water, humidity and salt content of the sand are low, thus attracts nesting.

NETWORKING AMONG RESCUE CENTRES IN THE MEDITERRANEAN

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INTRODUCTION

ARCHELON established its Sea Turtle Rescue Centre in 1994 in co-operation with the Municipality of Glyfada, Athens. Its aims include the rehabilitation of turtles reported injured in Greece, as well as environmental education activities. Over 400 sea turtles have been treated at the Rescue Centre over the last ten years, 60% of which have been released back to their natural environment (Kopsida et al. 2002). There are currently several other rehabilitation facilities for sea turtles operating in the Mediterranean, in Italy, Spain, Croatia and Israel, while organisations or institutions in other countries intend to establish new ones.

The causes of injuries for the majority of sea turtles admitted in all Mediterranean Rescue Centres are similar and are usually the result of their accidental capture in fishing gear (UNEP RAC/SPA 1999). These include deliberate injuries inflicted on the head and/or the carapace, ingestion of fishing lines and hooks, and damages caused by entanglement to nets or fishing lines. Additionally, the Mediterranean region is a "closed" sea with apparently genetically isolated sea turtle populations (Bowen et al. 1992, Bowen et al. 1993, Laurent et al. 1993).

Yet there has been limited communication and interaction among Rescue Centres. As a result, experience acquired in each Rescue Centre is rarely made available to other rehabilitation facilities to improve treatment techniques and methods, efficiency of Stranding Networks, administration, infrastructure, etc. More importantly, each new facility has to "re-invent the wheel" for practically all aspects of their operation. This presentation will be analyzing the benefits of networking among the Mediterranean Rescue Centres and present the progress made so far in that direction.

DISCUSSION

A Network of Mediterranean Rescue Centres would be an ideal forum for exchange of information on rehabilitation methods and practices, protocols, organisation of stranding networks, administration, infrastructure, etc. Additionally the Network would be in a position to facilitate exchange and training of volunteers and personnel, as well as transportation of sea turtles to other facilities better equipped or more experienced in the particular type of injuries/ailments. Finally, the Network would provide comparable databases on the interaction of sea turtles with fisheries for the entire Mediterranean region, using stranding results and statistics and sea turtles admitted to the rehabilitation facilities. This information can then be disseminated to the public, the scientific community and decision makers and used for lobbying for the implementation of conservation measures across the region.

Co-operation of Mediterranean Rescue Centres in the context of a Network would have several benefits for the long term as well as the short term sea turtle conservation the region.

These include:

1. The quality of turtle rehabilitation can be significantly improved throughout the region by (a) increasing the percentage of turtles rehabilitated and (b) reducing the average time turtles spend under treatment.

2. Standardised and comparable databases and information can contribute to creating an even more accurate picture on the issue of the interaction of sea turtles with fisheries, as well as valuable information on the biology and behaviour of sea turtles at sea (e.g. foraging areas, migration patterns, etc.). As a result, conservation efforts in the region can be constantly re-adapted, optimising their efficiency for the protection of the species.

3. The Network can play a supportive role for Rescue Centres that will be established in the future, by providing experience, training, practical advice, etc. Combined with the available literature and guidelines the Rescue Centre can reach its full potential in less time.

THE MEDITERRANEAN WORKSHOP ON THE REHABILITATION OF INJURED SEA TURTLES

ARCHELON organised on 19-21 November, 2004 a Mediterranean Workshop on the Rehabilitation of Injured Sea Turtles. The Workshop was organized in co-operation with the Municipality of Glyfada in the context of a LIFE-NATURE Project co-funded by the European Commission aiming to reduce mortality of turtles at sea. Over 30 participants attended the workshop, including representatives from the MTSG and UNEP’s RAC/SPA. Other participants included experts from various Mediterranean rehabilitation facilities (WWF Italy, Fondazione Cetacea ONLUS, CTS – Ambiente "Mediterranean Gate" Rescue Centre, Ceuta and CRAM, Pula Aquarium, Israeli Rescue Centre, ARCHELON’s Rescue Centre, the Veterinary Department of Thessaloniki, and the Hydrobiological Station of Rhodos) and observers from DHKD, University of Pammukale, MEDASSET.

The aim of the workshop was to bring in contact sea turtle experts from the region in order to exchange experiences and expertise so that rehabilitation practices and the efficiency of stranding networks can be improved. Another important aim of the workshop was to explore the possibilities that rescue centres may provide for sea turtle conservation in the Mediterranean as well as the idea of creating a Network among Rehabilitation facilities.

The need for better communication and the opportunities that a Network of Mediterranean Rescue Centres can provide for sea turtles conservation in the region became apparent very early on in the discussion. Although everyone was in favour of networking among Mediterranean Rescue Centres, it was agreed as a first step that they should communicate electronically, without using a special listserv. The creation of a special webpage for communication was decided to be the best option.

The webpage will be hosted on a website not affiliated with any specific country or organisation (e.g. seaturtle.org, MTSG, etc.) and it will have a public and a password-restricted section for more “confidential” discussions. It will contain profiles of all the existing rescue centres and first aid stations in the Mediterranean. Vasilis Kouroutos of MEDASSET, Greece volunteered to be the webmaster of the page. The group also appointed an editing team: Flegra Bentivegna (Naples Aquarium), Paolo Casale (WWF Italy), Alvaro De Los Rios y Loshuertos

("Mediterranean Gate" Rescue Centre, Ceuta), Atef Ouerghi (RAC/SPA) and Alan Rees (Co-ordinator, ARCHELON).

The editing team are in the process of preparing Mediterranean Sea turtle rescue centre profiles to be included in the public section of the website. At the same time lists of publications concerning turtle rehabilitation matters are being compiled for inclusion at the webpage which is in the final stages of designing.

CONCLUSION

ARCHELON's Mediterranean Workshop on the Rehabilitation of injured sea turtles provided the perfect opportunity to explore the benefits and the possibilities of creating a Network of Rescue Centres operating in the region. Since there was consensus from the participants concerning its benefits for sea turtle conservation in the region, the first steps and decisions for its creation were taken. Hopefully, within the next few years, the results of this regional co-operation will begin to have an effect on the long-term protection of sea turtles.

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FIRST RECORD OF CONJOINED TWIN EMBRYO IN ITALY

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We report the first finding of a conjoined twin embryo of *Caretta caretta* in Italy. The twin embryo was found in 2002, in the execution of the EU-Life Project "*Caretta caretta*", during a post-hoc examination of the unhatched eggs of a nest at the Pozzolana di Ponente beach in Linosa island (Pelagie islands, South Italy, 35°51'N-12°51'E). Twinning has been occasionally described in many turtle species. Twinning is thought to be much rarer in sea turtles than in freshwater species, though differences in twinning rate between sea and freshwater turtles might be overestimated and be due to differences in the data collecting methods. In fact, in sea turtles, post hoc examination of unhatched eggs allows to find only those twins dead before hatching. Aberrant embryos as conjoined twin pairs usually die before pipping, most of them in the early stages of development. During the last decade of nest monitoring at the Pelagie islands, the two most important and long-term monitoring loggerhead nesting beaches in Italy, no twin embryos were found and no findings have been reported in literature. In this work, we give a complete morphometric description of the twin embryo, which reached an advanced developmental stage. We show photos and an x-ray photograph that shows the vertebral column and the overall skeletal organization.

AT-SEA EVALUATION OF ARTIFICIAL BAIT IMPACT ON LONGLINE TARGET AND BY-CATCH SPECIES

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In order to reduce loggerhead sea turtle by-catches without impacting negatively on swordfish (*Xiphias gladius*) catch size, we investigated the possibility (1) to reduce bait attractiveness, (2) to decrease the overall attractiveness of the fishing device, and (3) to utilize acoustic deterrents. Experiments were initially run at Cattolica “Delphynursery” in a round tank having a 10 m diameter, during the EU-Life Project *Caretta caretta*. Later on, artificial baits were tested in the Sicilian Sea thanks to the co-operation of local fishermen. The natural bait (*Scomber* spp.) smell proved to be an important component for the detection of bait by turtles. Our findings showed that smell-less artificial baits are generally unattractive for turtles. The impact of artificial baits on target and by-catch species was evaluated during at-sea tests with swordfish fisheries in the context of the EU-Life Project Del.Ta.

PREFERENTIAL POSITION OF CIRRIPEDS EPIBIONT ON SPECIMENS OF *CARETTA CARETTA* CAPTURED IN LINOSA AND LAMPEDUSA WATERS (PELAGIE ISLANDS, SICILY, ITALY)

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Presence and distribution of the cirripeds present on *Caretta caretta* specimen by-catches in the water surrounding the Pelagie Islands have been analysed to verify if they occupy a preferential position on the turtle and, should that be the case, if this position is species-specific. Loggerheads were taken in the First Aid Centre of Lampedusa and in the Marine Turtle Rescue Centre of Linosa in 2003-2004 during the EU-Projects "*Caretta caretta*" and "Del.Ta.". Cirripeds present on each turtle were mapped, sampled, identified, and counted. Turtles were measured and, if adults, were sexed. We found six species of Cirripeds: *Chelonibia testudinaria* (present on 11% of the 81 turtles examined), *Conchoderma virgatum* (62%), *Lepas anatifera* (22%), *Lepas hilli* (26%), *Platylepas hexastylos* (10%), and *Stomatolepas elegans* (2%). It was not possible to establish a connection between the presence of these epibionts and the size of the turtles. Nevertheless, the obtained data were sufficient to verify if the epibiont cirripeds of different species are distributed randomly or not. *Chelonibia testudinaria* is significantly more frequent on the carapace, *Conchoderma virgatum* on the forelimbs and hind limbs, *Lepas hilli* on the marginal and supracaudal scutes, *Platylepas hexastylos* on the plastron. Only *Lepas anatifera* shows a wide distribution, with emphasis however on the marginal scutes. It is possible to hypothesize that this species-specific position of these cirripeds on the turtle body is a strategy adopted to avoid coming into conflict because of the available space.

INTERNATIONAL MIGRATIONS OF NON-NESTING LOGGERHEAD TURTLES FROM GREECE TO TURKEY AND LIBYA

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INTRODUCTION AND METHODS

Migration and movements of turtles have traditionally been studied with mark-recapture programmes involving flipper tagging. However, results from this kind of study depend on third parties who must observe the turtle and tag, and subsequently notify the originating body. Hence tag recoveries can be biased by differences in tag recapture and reporting "effort" in different locations.

Until the year 1999, ARCHELON had tagged 2,868 loggerhead turtles at the main nesting sites of Zakynthos and Kyparissia Bay and from these only 100 were re-sighted at distances longer than 150km from the respective nesting areas (Margaritoulis et al. 2003). Tag returns indicate that the northern Adriatic and Gulf of Gabes are two of the most important foraging and overwintering sites for loggerheads nesting in Greece and that apparently very few turtles migrate to the southern and eastern parts of the Mediterranean (Margaritoulis et al. 2003).

Flipper tagging recoveries provide the observation locations of turtles and do not necessarily provide precise information whether the observation location was along a migratory route or at a residency area. However, when many tag recaptures are reported from the same area we can assume that this is a residence area and not sightings of numerous turtles *en route* to somewhere else.

To acquire a better knowledge on turtle migrations around the Mediterranean, ARCHELON initiated telemetry studies that could follow turtles along their migration routes using transmitters communicating with the Argos satellite system and data are managed using Satellite Tracking and Analysis Tool (STAT, Coyne and Godley 2005). To date, all transmitters have been deployed on non-nesting turtles. The tracks of the two international migrations of loggerheads from Greece are presented here.

The first turtle, "Luar", was captured in Amvrakikos Bay, which is bordered to the north by important RAMSAR designated wetlands and has extensive shallow areas with an abundance of foraging loggerheads (Rees and Margaritoulis 2006, 2008). The second turtle, "Toby", was found injured on Crete and sent to ARCHELON's Rescue Centre at Glyfada near Athens for rehabilitation. After over a year at the Rescue Centre it was released and tracked as part of the study of behaviour and movements of post-rehabilitated turtles. Upon his release, Toby had recovered normal behaviour, controlling his buoyancy and feeding freely and normally. Both turtles were probably juveniles; details on their sizes and other information are found in Tab 1.

Turtle	SCL (n-t)	Origin	Release date	Duration of transmitter operation
Luar	70.0cm	Amvrakikos Bay	13 May 2003	418 days
Toby	66.5cm	Chania, Crete	6 June 2004	77 days

Tab. 1. Turtle and transmitter summary

TURTLE MOVEMENTS

Luar remained within Amvrakikos Bay after its release until 29 June when it commenced its migration (Fig. 1). On 8 July it passed Zakynthos and next approached land when it passed by the westernmost part of Crete on 15 July. From there it continued eastwards for almost a month until it reached the coast of Syria on 14 August. The turtle then travelled north and west, following the coast of Turkey, until 9 September when it doubled back on itself. It made a final cycle around Antalya Bay, reaching its final destination of Finike Bay on 22 October where it stayed until the last transmission was received on 4 July 2004.

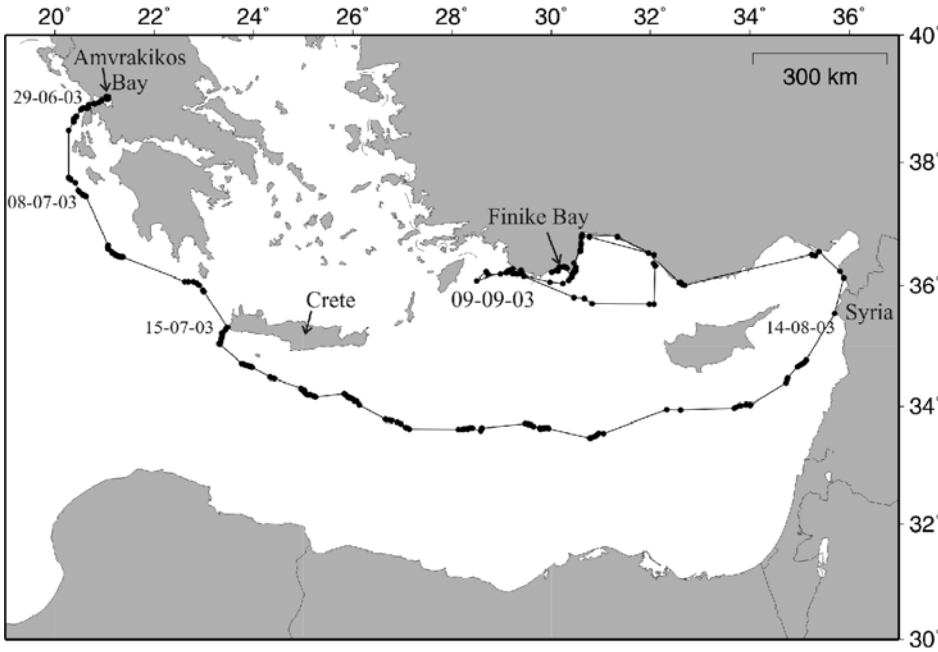

Fig. 1. Track of Luar's migration. Dates are for indicative purposes only

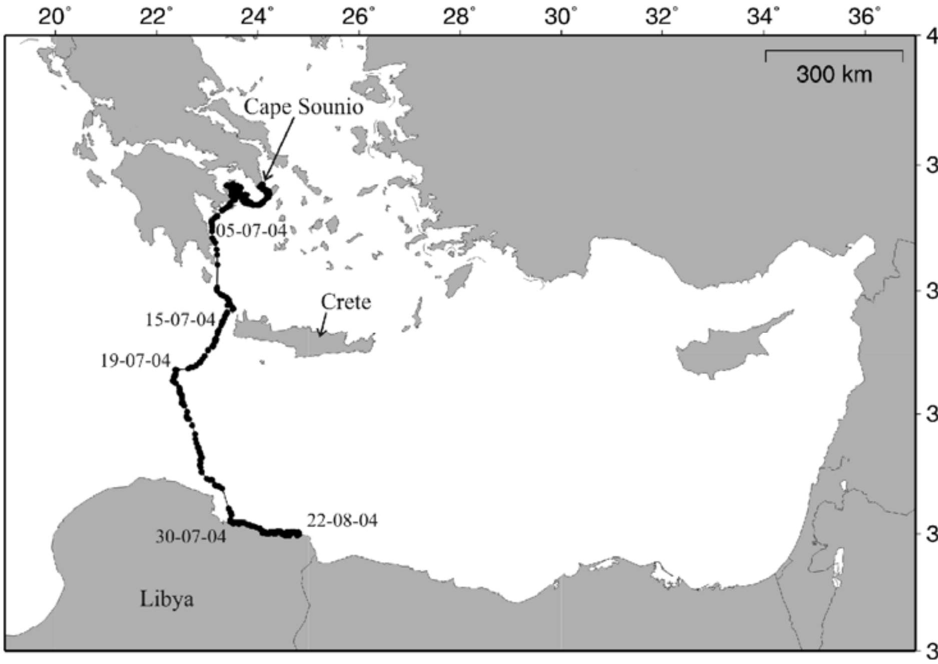

Fig. 2. Track of Toby's migration. Dates are for indicative purposes only

Toby was released at Cape Sounio and spent the majority of the next month in the Saronic Gulf (Fig. 2). On 5 July it started its migration south, passing along the east coast of the Peloponnesus. On 15 July it passed the westernmost part of Crete. On 19 July it made a distinct change from its south-westerly course to a south-south-easterly one. On 30 July the turtle reached Libya and travelled eastwards along the coast until the last transmission that was received on 22 August 2004.

DISCUSSION

The movements presented here show directed, non-random migrations. The kinked nature of Toby's track on its journey to Libya was probably caused by climatic or oceanographic features and warrants further investigation. Despite the migrations being obviously directed they do not represent the turtles taking the shortest routes from one residential neritic foraging area to another as shown by Toby's eastward journey along the Libyan coast and Luar's extensive travels from the Syrian coast to south west Turkey. Luar's migration is exceptionally complex as the turtle passed, in early September, through the area it was to finally settle in late October.

These tracks reinforce the fact that turtles, albeit juveniles, travel from Greece to the east and south Mediterranean, a broad area from which there have been very few tag recoveries from turtles nesting in Greece. Several reasons for this can be proposed.

1. Juvenile loggerhead turtles exhibit different migration and residency patterns to adults.

2. The turtles belonged to nesting colonies outside Greece and were returning to their maternal lands after a period in Greek waters.

3. Migrations by turtles found in Greece to the south and east region of the Mediterranean are more common than previously known due to lack of observation or reporting from these distant localities.

We hope to gain more understanding of the migratory behaviour and population structure of turtles found in Greece through deployment of further satellite transmitters, continued flipper tagging at the nesting beaches and Amvrakikos Bay and from genetic analysis of turtles encountered throughout Greece.

Irrespective of whether there is a biological difference in migrations for juvenile and nesting turtles or that the lack of tagged turtles sighted in the south and east of the Mediterranean basin is due to lack of reporting, it is clear that marine turtles found in Greek seas are long-distance travellers and to be fully protected require cooperative conservation efforts at an international level.

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MARINE TURTLE NESTING SURVEY, SYRIA 2004: DISCOVERY OF A “MAJOR” GREEN TURTLE NESTING AREA

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INTRODUCTION

Green turtle nesting in the Mediterranean is confined to the Eastern Basin with most nesting occurring in Turkey and Cyprus. Lower nesting levels have been recorded across the rest of the Levantine coast (Kasparek et al. 2001). The Mediterranean population has recently been classified as critically endangered in the IUCN Red Lists (ERASG 1996). Syria’s 183km coastline was briefly surveyed in 1991 and limited nesting (attributed to loggerheads) was found on 2 beaches at Lattakia and between Tartous and Lebanon (Kasparek 1995). No follow-up surveys were subsequently carried out to better quantify nesting levels.

In 2004, a two-month survey of the 12.5km beach south of Lattakia, that was shown to have most turtle tracks by Kasparek (1995), was undertaken to provide up to date and more comprehensive information on marine turtle nesting in Syria.

METHODS

From 30 June to 27 August (excluding 1, 7 & 31 July and 1 August) the 7.5km beach between North Jableh and Snowbar (35.428°N, 35.907°E to 35.467°N, 35.862°E) was surveyed on foot in the early morning for evidence of marine turtle nesting, nest hatching and events that may have affected the incubation of nests, such as inundation by storm waves or depredation. The adjoining 5km beach to the north, from Snowbar to the river Al Kabir Ash Shamali next to Lattakia, was surveyed weekly, a total of 10 times, as a continuation of the daily survey.

Emergence tracks from adult turtles were checked for species and evidence of nesting and the track recorded as either a nesting or non-nesting emergence. Nest identification was verified by locating the eggs of each nest; intermittently before 18 July and systematically from then on. Thus, after 17 July, only emergences where egg deposition was confirmed were recorded as nests.

Nesting species was determined by appearance of the track (Schroeder and Murphy 1999) and by maximum width of the track. In the eastern Mediterranean, loggerhead turtles are generally far smaller than green turtles (Broderick 1996) and hence their track widths are much narrower. Additionally, confirmation of species was made by identification of dead or live hatchlings or embryos from post-hatch excavation of nests.

Nests and suspected nests made after 30 June were marked with driftwood and items of litter found on the beach that were labelled with the date of egg-laying and the emergence number for that day.

After the emergence was assessed and records taken, each track was marked with parallel scuff lines above the high-wave level to identify that it had been registered (most important on the northern part of the beach that was surveyed weekly) and the region of track nearest the sea was obliterated by scuffing so as to not confuse the next day's observations.

Total number of nests was calculated in two ways: 1) from initial track assessment that did not include clutch identification and 2) by summing the number of nests proven by observation of eggs. The four ways eggs were observed were; a) nest excavation after hatching, b) clutch location after deposition, c) nest depredation and d) direct observation at egg-laying. Accuracy of nest numbers obtained only from track assessment was checked by comparing nesting success (the percentage of emergences that result in clutch deposition) for the period before and after 18 July when observation of eggs became mandatory to assign nest status to an emergence.

RESULTS

The number of green turtle nests in Lattakia determined from track inspection (and subsequent to 18 July through clutch location) was 104. Nesting success was 33.6% for the period prior to routine clutch location and 40.6% after. Assuming no significant seasonal changes in nesting success, nest determination from track observation can be considered an accurate (or somewhat conservative) method and hence the total number of nests laid was probably more. The number of nests determined through direct observation of eggs was 98; comprising 28 from excavation of hatched nests, 34 confirmed through locating the eggs after clutch deposition, 32 from predation activity and 4 nests observed being made. It should be noted that hatching (and predation) activity was expected to continue through the month of September into October and that the nests from the start of July had only just started to hatch prior to the end of fieldwork (late August) thus the number of nests determined by observation of eggs is considered a low estimate of the true number and corroborates the conservative nature of the 104-nest estimate.

Two main threats to nests and the emerged hatchlings were identified from the beach monitoring; these were canid predation, with 27% of the nests already depredated prior to the end of August and a large but un-quantified level of hatchling misorientation that resulted in many tens of hatchlings being lost in the dunes etc behind the beach. These misorientated hatchlings if they managed to finally orientate towards the sea at dawn had prolonged their time on land which wasted limited energy reserves and increased the chances of their being predated by canids, ghost crabs or birds.

Other threats identified included nest inundation by the sea, vehicles trampling nests and vehicle tracks and litter that hindered or blocked hatchlings' journeys to the sea.

DISCUSSION AND CONCLUSIONS

A recent review of green turtle nesting within the Mediterranean (Kasparek et al. 2001) assigned levels of importance to nesting areas. Those with a maximum of over 100 nests were considered of "major" importance. The results of this study revealed Syria to host one such population which, according to nesting levels presented in the review, ranks in the top ten green turtle nesting areas of the Mediterranean.

Green turtle nesting numbers show high inter-annual fluctuations (Kasparek et al. 2001) and hence subsequent surveys of this nesting beach, probably for many years, are essential to ascertain a more accurate estimation of the size of the nesting population in Syria and to identify any signs of population size trends. It is clear that this is an important area for green turtles in the Mediterranean and a unique one in Syria. On both a national and regional scale it warrants extensive conservation measures such as beach protection and nest management, to support the existing population and systematic monitoring and research to evaluate population status and conservation practices.

ACKNOWLEDGEMENTS

The project in Syria was made possible through support by the Marine Conservation Society Turtle Conservation Fund with additional support from the British Chelonia Group. AFR and MJ thank the conference organisers for funds to attend the conference and associated workshops.

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CLUTCH SIZE AND HATCHING SUCCESS OF GREEN TURTLE NESTS IN SYRIA DURING 2004

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INTRODUCTION

Marine turtle nesting on Syria's beaches was reported from a spot survey in 1991. Only the 12.5km beach south of Lattakia City (35.440°N 35.895°E) was shown to have nesting at any significant level, with over 20 tracks attributed to loggerheads recorded (Kasparek 1995). A full re-survey of this beach in 2004 confirmed the presence of a small population of nesting loggerhead turtles but also discovered a regionally important nesting population of green turtles (Rees et al. in press). Data presented here are a product of this nesting survey, when nest fates were recorded and post-hatch nest excavations were undertaken in addition to counting adult turtle tracks.

METHODS

The southernmost 7.5km of Lattakia beach was surveyed daily for marine turtle nesting or hatching activity and evidence of nest predation was recorded from June 30 to August 27, 2004 (excluding July 1, 7 & 31 and August 1), the adjoining 5km beach to the north was surveyed weekly, a total of 10 times, as a continuation of the daily survey.

Freshly made nests were marked with labelled sticks and stones to confirm the identity of nests observed through hatching or predation. Nests discovered for the first time through hatching or predation, were labelled in a similar manner.

Nest excavations were undertaken on the morning of the second day after hatching on the daily monitored beach and upon observation of hatching on the weekly monitored stretch of beach. Nests that had been depredated, determined by evidence of digging at the nest site with scattered egg fragments on the beach, were not excavated and do not contribute to the clutch size or hatching success data.

Clutch size was calculated by averaging the number of eggs counted per nest from post-hatch nest excavation. This value was supplemented with egg counts made from relocated nests that needed to be moved as they were situated too near to the sea and would be destroyed during periods of high waves. Yolkless eggs were omitted from egg counts and multi yolked eggs treated as single eggs as per Miller (1999).

Hatching success was calculated as the percentage of the total eggs in a clutch which hatched (including eggs that were associated with live or dead pipped hatchlings). Overall hatching success was calculated in two ways: 1) as the mean of the hatching successes from individual nests and 2) by summing together nest contents and treating all excavations as a single nest.

This second method removes the bias created by large or small clutches that have exceptionally low or high hatching success.

RESULTS AND DISCUSSION

Mean clutch size derived from nest excavation was 108 eggs (SD=25.1, 72-164, N=29) however this rose to 112 eggs (SD=26.4, 72-164, N=33) when four egg counts from nest relocation were added. Broderick et al. (2003) found that clutch size for green turtles on Cyprus increased throughout the season. The limited data presented here, support this as the four relocated nests were late season nests and all had clutch size above that of the excavated nests which were early season nests (Fig. 1). In both instances clutch size is within the range of annual variation in mean clutch size found on Cyprus (Broderick and Godley 1996) and Turkey (Yerli and Demirayak 1996).

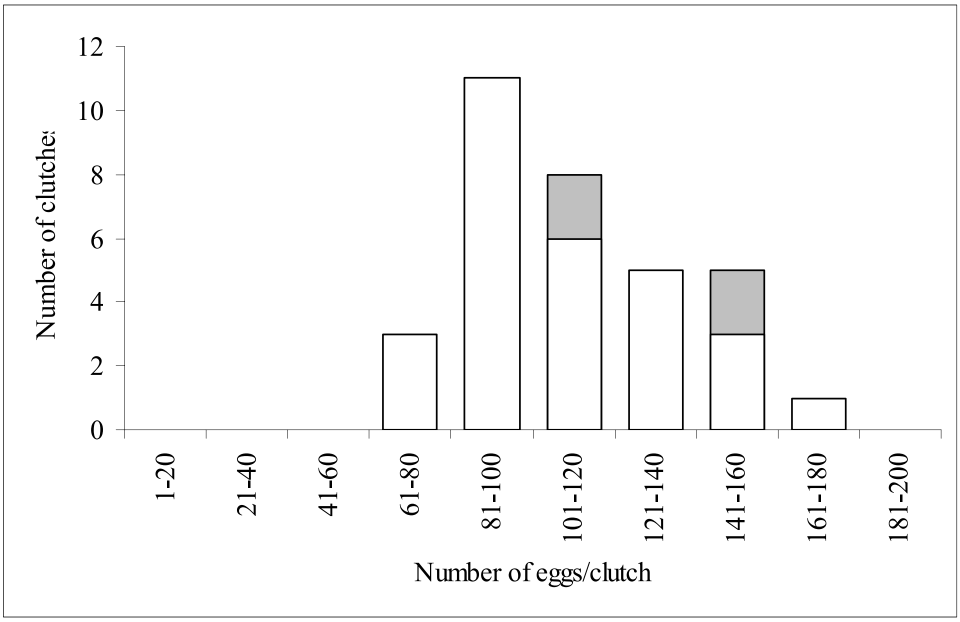

Fig. 1. Clutch size for green turtle nests in Syria, 2004. Shaded area are data derived from nest relocation (N=4), non shaded area are data from post-hatch nest excavation (N=29)

Overall hatching success for undisturbed nests was calculated to be 83.5 and 83.9% (for methods 1 and 2 respectively) which is in the lower range of yearly values for green turtle nests on Cyprus, as presented by Broderick and Godley (1996). This is probably due to a combination of the small sample size of the present dataset with one particular nest that had a hatching success of 40.2% (Fig. 2). Not all hatchlings had emerged from their nests; and on average 3.5% (SD=6.9, 0-37, N=29) of the eggs from each nest produced hatchlings that were present at excavation.

During the survey period 27% of the nests had been depredated by canid predators. This figure was expected to rise during the progress of the hatching season as nest predation normally occurs just before or during the hatching period and the maximum rate for green turtle nest predation was found to be August and September (Kaska 2000).

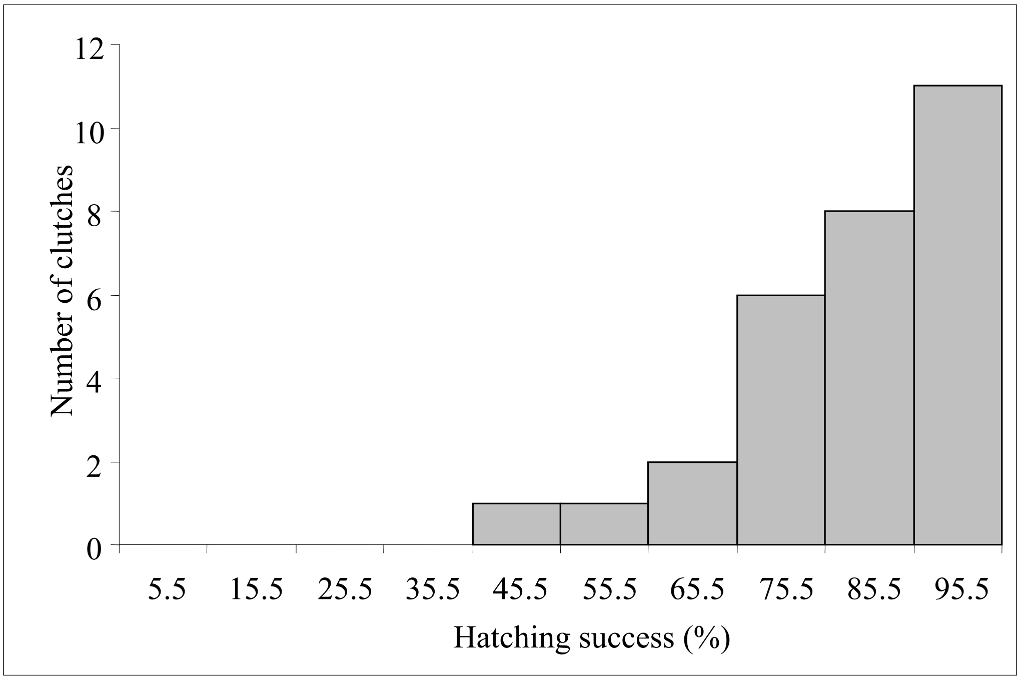

Fig. 2. Hatching success for green turtle nests in Syria, 2004 (N=29)

In addition to nest depredation other un-quantified important factors that affected hatchling survival in Syria were nest inundation by high waves and hatchling misorientation due to artificial lighting behind the nesting beach.

In conclusion, green turtle nests in Syria were found to be similar to those of the rookeries in Cyprus and Turkey with regard to clutch size and hatching success. The number of hatchlings that survive to reach the sea is estimated to be far lower than the 83% of hatched eggs. Hence nest management activities, such as nest screening to deter predators and nest relocation for those nests made at sub-optimal locations, would benefit the population. Increased hatchling production, would be one significant way to improve the survival chances in Syria for this critically endangered species.

ACKNOWLEDGEMENTS

The project in Syria was made possible through support by the Marine Conservation Society Turtle Conservation Fund with additional support from the British Chelonia Group. AFR and MJ thank the conference organisers for funds to attend the conference and associated workshops.

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INCUBATION CONDITIONS OF THE LOGGERHEAD SEA TURTLE *CARETTA CARETTA* IN KYPARISSIA BAY, GREECE

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Kyparissia Bay, western Peloponnesus, Greece represents numerically one of the most important nesting areas for the loggerhead sea turtle in the Mediterranean. This study was carried out during the nesting seasons of 2001 and 2002, and aimed to determine which of several potentially important environmental and biological variables were actually significantly related to hatching and emergence success. Several variables were entered as covariates into a General Linear Model, including nest temperature during the first, middle, and final thirds of incubation, nest location with respect to distance from the vegetation line, clutch size, nest depth, laying date and two sand parameters, mean particle size and sort coefficient. Whether or not a nest was inundated by seawater and whether or not a nest was relocated were included as factors in the model. Three mortality factors were identified which strongly influenced hatching and emergence success - the percentage of the total clutch containing no visible embryo, the percentage of visible dead embryos, and the percentage of hatchlings produced which died in the nest. Of the variables considered to be potentially important, temperatures experienced during the first and final thirds of incubation, nest depth, and whether or not a nest was inundated were significantly related to the three mortality factors. These variables were themselves related to laying date, the number of developing embryos and nest location. Results from this study suggest that sea turtles nesting in Kyparissia Bay have the potential to significantly influence the success of their clutch through choice of nest site, choice of nest depth and timing of reproduction.

TARTANET; A NETWORK FOR THE CONSERVATION OF SEA TURTLES IN ITALY

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In recent years conservation activities regarding *Caretta caretta*, have taken on a strategic aspect throughout the Mediterranean. In Italy certain local programmes have been able to stem or thwart certain specific threats, especially in reference to safeguarding nesting sites, but the conservation effort has been fragmentary and uncoordinated. The primary objective of this project is to implement an effective, nationwide and long-term conservation strategy by creating a network of centres along Italy's coasts. Central coordination, the implementation of common procedures and a common data base will strengthen the effectiveness of individual conservation efforts and ensure that treated turtles will be fully reintegrated into their natural, biological domain as soon as possible. The Centres will also acquire important biological data in order to monitor the results of specific conservation measures in order to update the action plan.

The above objectives will be achieved through a series of actions calling for:

- the establishment of 5 new recovery centres in hot spots
- the creation of a sea turtle network among the new centres and those already existing
- coordination and standardization of programmes and activities concerning *Caretta caretta*
- experimentation of systems to reduce accidental catch
- creation of a web portal regarding sea turtles
- creation of a package of programmes aimed at informing and training fishermen
- preparation of a national plan for reduced interaction with fishing activities
- creation of a programme of public-awareness measures.

MYCOFLORA OF LOGGERHEAD TURTLE, *CARETTA CARETTA*, NESTS AND EGGSHELLS AT FETHIYE (TURKEY)

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The aim of this study was to investigate the mycoflora of loggerhead turtle, *Caretta caretta*, nests and eggshells at Fethiye, Turkey. During the 2004 breeding season, after emergences of the hatchlings had completed, sand samples were collected from 15 nests and eggs from these nests were swabbed. These samples were refrigerated at 4^{o}C until analysis. Rose Bengal Chloraphenicol Agar was used for isolation, and then the mycoflora was sub-cultured onto suitable media. Fungi were counted and identified at genus level. As results, 10 genera were detected in the nests and eggshells: *Absidia* sp., *Aspergillus* sp., *Chrysosporium* sp., *Cladosporium* sp., *Cylindrocarpon* sp., *Emericella* sp., *Fusarium* sp., *Mucor* sp., *Penicillum* sp. and *Thielavia* sp.

THE SEA TURTLE STRANDINGS NETWORK IN THE VALENCIAN REGION (SPANISH MEDITERRANEAN)

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INTRODUCTION

The Valencian Community is a region located at the east of Spain composed by three provinces: Castellon, Valencia and Alicante, north to south. The coastline of this region extends for 419 km, from 40º31'N-0º31'E to 37º51'N-0º45'W. Since more than 10 years ago, there exists a stranding network in this region involving several public and private institutions, funded by the local government (Conselleria de Medio Ambiente de la Generalitat Valenciana) and coordinated by the University of Valencia. Public rescue centres and aquaria also collaborate in several tasks of the network.

Various human activities affect sea turtles in the western basin of the Mediterranean. The most serious threat is incidental captures by fisheries, particularly the off-shore long line fishery. The activities derived from tourism also represent a significant threat for sea turtles in the Spanish Mediterranean coastal waters. These activities result in the injuries or death of a large number of loggerheads each year. Consequently, these animals are often found as live or dead strandings. Here we present stranding data for loggerheads found in the Valencian Community (East Spain) from 1995 to 2004.

RESULTS

From 1995, a total of 488 turtle strandings have been counted along the coast of this region, with a mean of 48.8 ± 31.6 turtles (40.2 ± 17.2, excluding 2001) per year and a maximum of 61 turtles registered in 2004. A preliminary report on the stranding records of the Valencian Region (Spain) network was presented in the First Mediterranean Conference on Marine Turtles in 2001 (Tomas et al. 2003). That report showed a spectacular increase in the number of loggerhead strandings in 2001, probably due to an unusually large migration of turtles into the western Mediterranean. Three years latter, we confirm that the number of strandings has turned to the normal values, with a slight increase in the records, probably caused by the improvement of the functioning of the network, since no increases either in fishing effort or in other threats were detected.

Strandings occur frequently in summer time, during July and August. The importance of detected anthropogenic threats to sea turtles is discussed within the framework of the Valencia Region which is an area of highly developed tourism and fisheries activities.

The stranding network includes a tagging programme of live stranded turtles, recovered and released to the sea. A total of 102 loggerhead turtles have been tagged, with metal and /or plastic flipper tags, from 1995 to 2004 within the network. Tagged turtles from other countries have been also detected in the Valencian Community in this period. All recapture data show a complex variety of movements of subadult loggerheads between the westernmost part and the central part of the Mediterranean Sea.

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ADVANCES IN *CARETTA CARETTA* FEEDING ECOLOGY: STRANDINGS VERSUS INCIDENTAL CAPTURES

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INTRODUCTION

The present study analyses the gut content of 46 loggerhead sea turtles stranded on beaches of the Valencian coast (east Spain) between 1995 and 2004. Preliminary data have been presented previously (Tomas et al. 2003). Here we complete the study of turtles stranded in the Valencian Community, comparing the results with the ones obtained from the analyses of 54 loggerhead turtles seized in Barcelona in 1991, predictably captured at sea by fisheries in the Spanish Mediterranean (Tomas et al. 2001, 2002). The present work is of special interest since, first, the dietary composition can confirm the ecological conclusions extracted from the previous study of turtles captured at sea; and, second, the analysis of stranded individuals can relate directly anthropogenic threats to the feeding behaviour of this species.

METHODS

We present data of digestive tract contents of 46 subadult loggerhead turtles (curved carapace length (CCL) range: 32-79 cm) stranded along the Valencian Community coasts (east Spain, from 40º31'N/ 0º31'E to 37º51'N/ 0º45'W) from 1995 to date. Solid items including organic matter, debris and substratum were collected from the guts. The number of prey individuals and prey species were recorded. Prey groups were arranged based on taxonomic and abundance criteria. Prey identification was made to the lowest taxonomic level possible. The importance of the prey species was expressed by the frequency of occurrence and the number of individuals. We relate number of prey individuals and prey species to size and sex of the turtles. Debris ingestion was quantified in this sample by the frequency of occurrence of items longer than 1cm, and the measurement of wet volume to the nearest 0.5 ml.

Differences in feeding and debris ingestion between both samples (stranded versus incidentally captured) have been compared by parametric and non-parametric mean comparison tests depending on normality and homoscedastic conditions of the variables.

RESULTS AND DISCUSSION

Mean size of the stranded turtles (58.4 ± 11.6 cm) was higher than the ones studied in Tomas et al. (2001, 2002) (49.6 cm) ($t = 4.233$; $p < 0.001$). However, our sample covers a wider range, including from early juveniles to Mediterranean adult size turtles (see Margaritoulis et al. 2003). Food items appeared in 41 of the 46 turtles (91.3%). No relationship was found between turtle size or sex and either the number of prey individuals or the number of prey species per turtle ($p > 0.1$ in all cases), as occurred in Tomas et al. (2001).

Most of the stranded turtles died because of bad health condition, preventing them from normal feeding behaviour before their stranding, or due to anthropogenic causes related to feeding strategies, such as ingestions of longline hooks or debris. Therefore, we might expect stranded turtles to have, first, lower frequency of appearance and abundance of prey items and, second, more anthropogenic debris in their gut contents than those captured.

We identified a high variety of prey taxa in the stranded loggerheads. Six animal species, 2 algae and 1 seagrass are also cited in Tomas et al. (2001). Table 1 and Table 2 compare respectively the items (food and debris) found in the guts and the frequencies of appearance and number of the different prey groups and debris types of the two samples of turtles. Frequencies of appearance of food items were similar in both samples, except for fish, finding also a high variety of benthic and pelagic prey species in the stranded turtles. However, pelagic tunicates were more frequent and abundant ($U= 693.5$, $p< 0.001$) in the stranded ones. The frequency of occurrence and the mean number of debris items seem to be higher in the stranded turtles, though no significant differences have been found ($U= 1080$, $p> 0.1$). Mean volume of debris per turtle is smaller in the stranded turtles because volume of substratum was not considered here; nevertheless, significant differences were not found either ($U= 1013$; $p> 0.1$) (Tab. 1).

		Stranded	**Captured at sea** (Tomas et al. 2001, 2002)
Prey	Frequency of occurrence	89.1%	92.6%
	Mean No. individuals (± SD)	85.6 (± 294.5)	49.9 (± 240.5)
	Mean No. species (± SD)	3.4 (± 3.6)	3.9 (± 3.8)
Debris	Frequency of occurrence	82.6%	79.6%
	Mean No. items (± SD)	8.5 (± 10)	6.8 (± 10.6)
	Mean vol. (± SD)	11.2 (± 14.1)	13.5 (± 31.5)

Tab. 1. Comparison of prey and debris ingestion between both samples, the stranded turtles and the turtles captured at sea

The present study gives more evidence on the opportunistic feeding habits of this species. In Tomas et al. (2001), we stated that the importance of pelagic feeding in juvenile loggerheads was clearly substantiated by the presence of floating, discarded by-catch and the large number of pelagic tunicates found in the gut. The present study supports this importance of pelagic feeding, even in larger turtles from neritic habitats. Nevertheless, the importance of pelagic tunicates and the higher amounts of floating debris (Tab. 2) may be the result of feeding predominantly in the water column, since normal diving to capture benthic invertebrates can be limited by the bad health condition of the turtles.

Prey and Debris	Stranded		Captured at sea (Tomas et al. 2001; 2002)	
	%	mean ± SD	%	mean ± SD
Fish	30.4	0.4 ± 0.9	57.4	3.8 ± 6.4
Pelagic tunicates	71.7	80.7 ± 292.2	38.9	43.3 ± 239.2
Crustacea Decapoda	15.2	0.3 ± 1.1	51.9	1.17 ± 1.78
Cephalopoda	30.4	0.7 ± 1.3	20.4	0.5 ± 1.8
Gasteropoda & Bivalvia	21.7	1.7 ± 6.3	25.9	0.5 ± 1.1
Plastic	63	3.9 ± 5.1	59.8	4.1 ± 6.6
Tar	23.9	-	25.9	-
Wood	21.7	1.4 ± 4.6	18.6	1.3 ± 3.4
Styrofoam	10.9	0.1 ± 0.3	2.7	0.2 ± 0.4
Net fragments	28.3	0.4 ± 0.7	1.9	0.1 ± 0.4
Other floating debris	21.7	0.5 ± 1.2	1.6	0.1 ± 0.4

Tab. 2. Importance of the main prey groups and types of debris in both samples, the stranded turtles and the turtles captured at sea. %: Frequency of occurrence; mean ± SD: mean number and standard deviation of individuals (or items) per turtle

ACKNOWLEDGEMENTS

This work has been supported by the CACSA-UV agreement. We also thank the Environment Management Office of the Conselleria de Territori i Habitatge of the Generalitat Valenciana for their support. Thanks are given also to Akira Kanezaki and to the staff of the Marine Zoology Unit of the Cavanilles Research Institute of Biodiversity and Evolutionary Biology (University of Valencia), for their valuable help.

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REPRODUCTIVE ECOLOGY OF THE LOGGERHEAD TURTLE, *CARETTA CARETTA*, ON FETHIYE BEACH, TURKEY IN 2004

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ABSTRACT

In this study, the Fethiye beach (Yaniklar and Akgol subsection beaches) was examined during the 2004 breeding season. A total of 117 emergences were recorded with 33 (28.2%) resulting in nests. The nest density was 5.6 nests/km. A total of 2532 eggs were laid in 33 nests, with a mean clutch size of 76.7 (range: 54-107). These eggs produced 1752 (69.2 %) hatchlings and 1615 (92.2 %) of these hatchlings were able to reach the sea.

INTRODUCTION

Fethiye beach is one of 13 key Turkish nesting sites for loggerhead turtles (Baran and Kasparek 1989). The beach was one of the first three areas which were designated as a "Specially Protected Area" in the framework of the Barcelona Convention of 1988. Within the boundaries of that site, an "archaeological site" is situated. This area is also important because it is used as a feeding ground by juvenile green turtles (Turkozan and Durmus 2000). The continuity of the loggerhead turtle population studies at Fethiye beach, which have been carried out since 1993, underlines the status of this site and makes it a case study for Turkish beaches and conservation efforts. In order to conduct better planning concerning the protection of the sea turtle population of Fethiye Beach and to compensate for a deficiency in information on the status of the populations, the survey of Fethiye Beach was found to be beneficial. This paper aims at giving updated information about the population status of the Loggerhead turtle at Fethiye Beach, and includes the results of population monitoring.

MATERIAL AND METHODS

The beach is located in Fethiye Bay, Mugla Province, Turkey, and is approximately 8 km long (Figure 1). Three subsections were distinguished based on their features and on practical fieldwork considerations. However, the present work covers only two subsections, Yaniklar and Akgol. The Akgol beach subsection extends from Uzun Cape in the north to the mouth of Kargi stream in the south. It is approximately 1 km long and 50 m or more wide. The front of this beach consists of pebbles up to 2 cm in diameter. Behind this zone, the beach becomes much steeper and is composed of sand mixed with pebbles: sand is the dominant substrate at some places. Except for short stretches at both ends, this subsection is not suitable for nesting because a length of about 300-400 m is covered with pebbles. The hinterland here consists of farmland. The second subsection (Yaniklar) extends from the mouth of the Kargi stream to the hill called Calistepe. This beach is approximately 4.5 km long and its width varies between 50 m and 80 m. The first few meters of the beach gently slope up from the sea and consist of pebbles. Behind this zone, sand becomes the dominant substrate. The hinterland here is a large wetland, mostly covered by a forest which is partly inundated until June. Several small creeks enter the sea along this beach subsection.

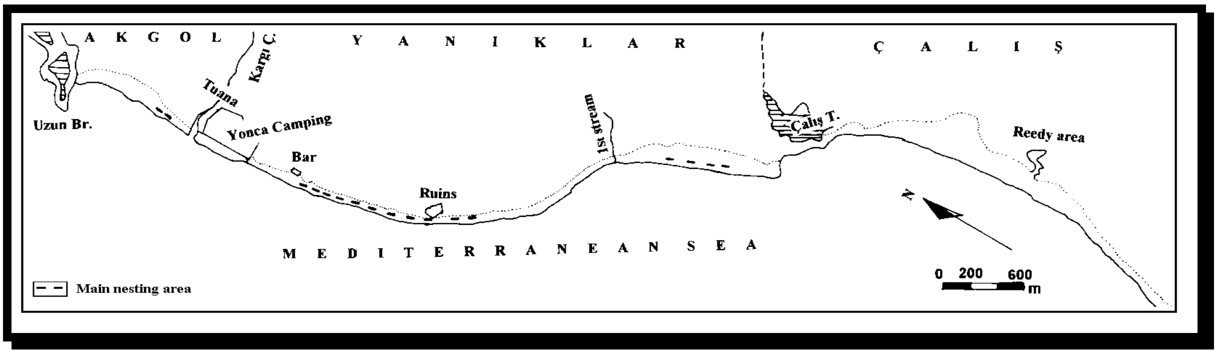

Fig. 1. Sketch map of Fethiye Beach

Our investigation was carried out without interruption between 17 June and 4 September 2004. The beach was patrolled every day. Night and morning patrols were carried out by two groups consisting of 3-4 persons each, depending on the number of personnel available. During night patrols, nesting and non-nesting females were measured and tagged. Turtles were tagged with metal tags on the right front flipper. After tagging, standard straight and curved carapace lengths and widths were measured in cm using tape and wooden callipers. These processes were applied to nesting females after they had completed the nesting process. During morning patrols, the shape and pattern of tracks were noted and those tracks that resulted in nests were marked. The nest locations were confirmed by probing with a metal stick and then marked. After this, the distance from the sea was measured. During the hatchling emergence season, once hatchling activity was observed, the nest was monitored constantly to increase the survivorship of hatchlings against predators. After 8-10 days from the first emergence of the hatchlings, the nests were opened and the number of empty eggshells, unfertilized eggs and embryos were determined. The depth and diameter of the egg chamber were measured with a steel meter during control openings.

RESULTS

A total of 117 emergences were recorded, with 33 (28.2%) resulting in nests. The distribution of nests and non-nesting emergences of *Caretta caretta* with respect to months are given in Figure 2. The distribution of 33 nests and 84 non-nesting emergences on Fethiye Beach is presented for each separate beach subsections in Table 1. The total number of eggs laid on the beaches, in 33 nests in 2004, was 2532. The natural hatching success and survival is given in Table 2.

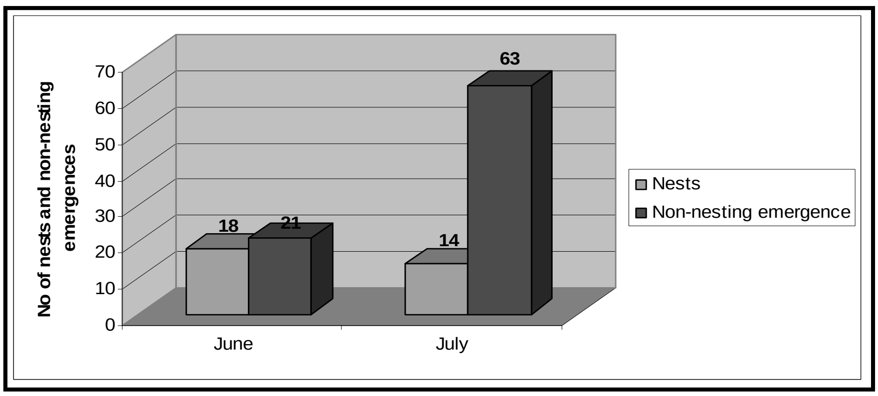

Fig. 2. Distribution of nests and non-nesting emergences of *Caretta caretta* with respect to months

	Yanıklar	Akgol	Overall
Number of nest	22	11	33
Number of non-nesting emergence	70	14	84
Total emergence	92	25	117
Nest ratio (%)	23.91	44	28.2
Non-nesting emergence ratio (%)	76.09	56	71.8

Tab. 1. Distribution of nests and non-nesting emergences on subsection beaches

	33 Nests	%
Total number of eggs	2532	-
Unfertilized or infected eggs	19 ±0.2	0.77
Number of death embryo	760 ±3.17	30.01
Hatchlings	1752 ±4.25	69.2
Those that could not reach sea	137 ±2.56	7.81
Those that could reach sea	1615 ±4.57	92.18

Tab. 2. Natural hatching success and survival on Fethiye beach

A total of 5 females were tagged and measured during the breeding season. The nest density was 4.58 nests/km in Yaniklar, 11 nests/km in Akgol, whereas the non-nesting emergence density was 14.58 per km in Yaniklar, 14 per km in Akgol. The overall nest density 5.68 nests/km and overall non-nesting emergence density was 14.48 per km. The average distance of 27 nests from the sea was 15.89 m (min: 7.00 m. Max: 51.3 m ±1.56). The mean diameter of the chambers was found to be 20.4 cm (min: 16 max: 23 ±0.35) and the mean depth 45.5 cm (min: 29 max: 58 ±1.2). The mean incubation duration was 54.8 (45-66 days, n=14).

CONCLUSION

The nesting percentage of the emergences at various *C. caretta* nesting beaches of Turkey have been reported as 52.15% in Patara (Erdogan et al. 2001), 36.4% in Dalyan (Ilgaz and Baran 2001) and 31.9% in Kizilot (Turkozan 2000). The present value of nesting percentage for Fethiye beach is lower than the Patara, Dalyan and Kizilot beaches.

The mean clutch size was 76.7 eggs on Fethiye beach. It was 87.5 eggs in Patara (Erdogan et al. 2001), 81 eggs in Dalyan (Ilgaz and Baran 2001) and 82 eggs in Israel (Silberstein and Dmiel 1991), 70 eggs in northern Cyprus (Broderick and Godley 1996). As can be seen, the clutch size in our study area was smaller than Patara, Dalyan and Israel, but higher than northern Cyprus.

The mean incubation period was 54.8 days, whereas it was 52.4 days in Dalyan, 51.8 days in northern Cyprus (Ilgaz and Baran 2001), 54.8 days in Patara (Erdogan et al. 2001) and 54.9 days in Greece (Kefalonia) (Houghton and Hays 2002).

The nest density at Fethiye was 5.6 nests/km. The nesting density elsewhere in Turkey was reported as 28.7 nests/km in Dalyan (Ilgaz and Baran 2001), 7.4 nests/km in Patara (Taskın and Baran 2001), and 26 nests/km in the Kizilot (Turkozan 2000).

The number of hatchlings reaching the sea was 92.18% on Fethiye Beach whereas it was 90.6% in Dalyan, 55.5% in northern Cyprus (Ilgaz and Baran 2001) and 54.7% in Patara (Erdogan et al. 2001). Unfortunately, the number of nests in 2004 breeding season reached its minimum value since 1993 (Figure 3).

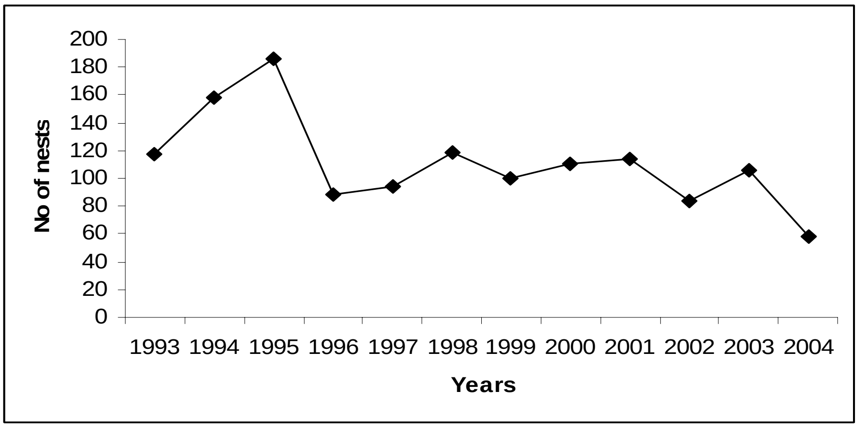

Fig. 3. Trend of nesting during 1993-2004 on Fethiye beach

Based on nesting data over a 12-year period (1993-2004), it was reported that this points to a negative population trend of the loggerhead turtle population at Fethiye beach, Turkey (unpubl. data). The main reason for this decline can be attributed to sand extraction and increased beach lighting. Furthermore, although ''Youth Camping'' was removed from the beach, the beach kiosk extended its function and paid no attention to the warnings of the working group and located their deck chairs just 2 m from the water line. Furthermore, Tuana Holiday Village was organising beach tours by 4x4 scooters on the beach. As in previous years the fishing activities in front of the nesting beach continued and increased.

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ENVIRONMENTAL AWARENESS AND EDUCATION: KEYS TO CONSERVATION

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INTRODUCTION

Environmental education and awareness are recognized keystones of any successful conservation initiative. As we become increasingly aware of the importance of a regional and more holistic approach to marine turtle conservation, we need to acknowledge that it may no longer be enough for the target audience simply to understand the basic life history and conservation status of sea turtles. There is a need for a more comprehensive understanding of the world that turtles inhabit (Ranger 2003). This Paper examines the practicalities and ethos of 4 successful environmental education projects as a guide to success.

SMALL GARBAGE, THE DEADLY ILLUSION

By "Small Garbage", we mean all the small and large objects discarded as litter on beaches or directly into the sea, and those that end up on the beaches and the coast, after being dumped elsewhere, all of which have devastating effects on the marine environment and on mankind (Venizelos 2004a). In an effort to make children and the general public aware of and sensitive to the problem, MEDASSET started an international environmental education project in 1996, entitled "Small Garbage", the Deadly Illusion, which continues with great success to date. Thousands of leaflets have been produced in Greek and English and distributed around the world. Talks and Slide Show presentations have been given in universities and schools around Europe.

One of the most common and destructive substances, which constitutes some 75% of all 'recreational' waste found on beaches, is plastic. It accumulates in the animal's gut and although the animal feels full, in reality it is dying of starvation. (Venizelos and Smith 1998). Worldwide over a million birds and 100,000 sea mammals and sea turtles die every year from swallowing or being trapped in rubbish, especially plastic (Marine Conservation Society 2003). Research has shown that marine species choose their food according to its colour, shape and size. They are deceived by the various sizes, shapes and colours of plastic, and eat it (Venizelos and Smith 1998). Of 54 *Caretta caretta* sea turtles recently seized by the Spanish authorities, 42 (77.8%) were found to have rubbish in their digestive tract (Tomas et al. 2000).

In Greece, the 'Small Garbage' project has been used several times as part of the school curriculum in both primary and secondary schools, and in 2003 it was sponsored by the Greek Ministry of Environment. Implementation of the project in classrooms, addressing children and their parents, gives special emphasis to the effects of "small garbage" on the marine environment. With talks and slide presentations, educational material is distributed and awareness and project orientated activities are carried out on beaches. Because it is presented to students in a simple, vivid and precise manner, it has been a great success (Venizelos 2004a). Following the talk and slide presentation, the students are taken to the nearest beach, where they are separated into groups, and given the right equipment to start collecting "small garbage", together with a form to list quantities of the various items. Later, they are encouraged to dig a big hole in the sand, and bury a dated message in a glass bottle explaining their project and about pollution, for future generations to find (Time capsule!). Then to write a message to the world, in the sand, using a stick. The "Small Garbage" campaign reached the Andaman and Nicobar Islands in 1999, when WWF India wrote that "Operation CAP", Campaign Against Plastic Waste on the islands, in large measure owed its success to the information and support provided by MEDASSET (Kumar 1999).

EUROTURTLE

EuroTurtle, a Mediterranean sea turtle Biology & Conservation web site for Science and Education, is the result of collaboration between the University of Exeter, Kings College, Taunton and MEDASSET. Set up in January 1997, the site was the first in Europe to be exclusively devoted to the conservation and biology of Mediterranean sea turtles (Poland and Baggot 1999). EuroTurtle, which is comprised of 2 sections, Conservation and Education, contains overviews of all sea turtle species, a section on the threats to turtles in the Mediterranean (e.g. tourism), identification keys and even an adventure game involving a loggerhead turtle on a Greek island. The 'Useful weblinks' page is interactive and the visitors can suggest links. There is also a dedicated 'Feedback Page' (Poland et al. 2000). The site, which is rich in high quality graphics, work sheets, diagrams and on-line activities, has grown in size and popularity. In 2001 a major site redesign was carried out by the Telematics Centre at The University of Exeter, ensuring simplicity of navigation and consistency of style and operation. To achieve this it collated ideas from groups that had used the original EuroTurtle site (Poland and Prosser 2003).

News of more than 150,700 (2003 – 134,000) visits, an average of 412 (2003 – 369) per day, and over 2,399,000 (2003 – 1,370,000) hits on the website during 2004 demonstrates its success (Venizelos 2004b). The site has been recommended by several international educational institutions as one of the top six environmental education websites and has received thousands of emails, mostly from teachers and students. There have also been a significant number of enquiries from the international media. The majority of responses have been highly complimentary, some providing constructive feedback on site improvements.

THE MEDITERRANEAN SEA, A SOURCE OF LIFE

In 2003 MEDASSET produced "The Mediterranean Sea, A Source of Life". This is an original and unique Environmental Education Kit for free dissemination to schools and youth groups. The pack is aimed at teachers, parents and group leaders of 6-12 year old children (Venizelos et al. 2003). The 50 page Kit was published within the framework of MEDASSET's educational programme, portraying the richness of the region's natural environment, the threats it is facing as well as the multi-cultural inheritance of the Mediterranean peoples in educationally innovative ways. Two thousand Greek language Kits for donation to Greek schools and one thousand in English have been produced for distribution throughout the Mediterranean and worldwide. With the financial assistance of UNEP/MAP it has been adapted to the appropriate culture and ecology, and translated into Arabic. With funds from the Stavros Niarchos Foundation, UNEP/MAP and RAC/SPA, the Arabic version is now being printed. In contrast to some environmental education initiatives, this package focuses exclusively on the Mediterranean region in order to engage users in a critical assessment of the role and value of its cultural and environmental heritage. This project has thus moved the goalposts and effectively illustrated how to bring a regional and inclusive aspect to environmental education. In short, this pack is not just about saving turtles, it is about fostering an understanding and appreciation of the Mediterranean as a living resource, thereby achieving a better understanding of the world (Ranger 2003). Famous names worldwide have praised the Kit, and it won recognition in the form of the '3rd Mediterranean Honorific Award' from Mediterrania (Centre D'Iniciatives Ecològiques). The pack includes: Maps, Fact sheets, Activity sheets for 6-9 and 10-12 year old children, and an Educators' Guideline Booklet with evaluation sheet and bibliography.

SEA TURTLE HANDLING GUIDEBOOK FOR FISHERMEN

Fisheries are a major threat to the survival of endangered sea turtles in the Mediterranean. Many thousands are caught by or get entangled in fishing gear each year. Sea turtle strategies for marine conservation recognise professional fishermen as the central factor. UNEP's Mediterranean Action Plan (MAP) includes as a Priority, the banning of exploitation and the minimization of incidental catch (UNEP 1998: Annex III, page 2, point 8). In line with this strategy the RAC/SPA MAP Sea Turtle Handling Guidebook for Fishermen is meant to provide the tools suggested by turtle experts and conservationists (Gerosa and Aureggi 2001a). With funding by the UNEP/MAP, Regional Activity Centre for Specially Protected Areas (RAC/SPA) "The Sea Turtle Handling Guide for Fishermen" (Gerosa and Aureggi 2001b), has now been adapted and translated into Greek by MEDASSET. The Greek Ministry of Merchant Marine and The Ministry of Environment are helping with the distribution. The Ministry of Agriculture and Fisheries were so impressed that they have had 4,000 extra copies printed for distribution all over Greece. The waterproof guide, for use on fishing boats, provides simple and practical advice with illustrations to enable fishermen to deal with those turtles unfortunate enough to get caught. It is designed to allow fisherman to find the right page easily and there is a glossary, and space for notes. One purpose of the Guidebook is to enable an assessment to be made of the state of health of the turtle to establish whether the animal is dead, inactive, injured or healthy, thus increasing the chance of saving it. The Guide has already been produced by RAC/SPA in English, French, Croatian and Turkish, while Spanish, Arabic Slovenian and Maltese editions are in preparation.

CONCLUSION

Over 20 years' experience has taught us that for an environmental awareness/education project to be successful certain "essentials" will have to be considered. These are: collaboration; logical progression; the use of positive language appropriate to the targeted audience; to keep it short and stick to the point, or people get bored; to only attempt that which can be achieved; illustrations should complement the text giving a visually attractive whole; to supplement, but not to duplicate others' efforts; to suggest, but not to seem to "preach" or "teach"; to try not to be exclusive towards persons or groups; in personal contact, to use all the senses (hearing, sight, touch and smell); to make it like a game, which carries people through; and to seek end user feedback about the final draft project.

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PRELIMINARY STUDY ON SAND AND GREEN TURTLE NEST TEMPERATURES AND SEX RATIO OF HATCHLINGS ON SAMANDAG BEACH, TURKEY

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Samandag Beach, which is important for nesting activity of endangered green turtles, is located at the most eastern part of the Mediterranean in Turkey. The sand and nest temperature were investigated in Samandag Beach, which is about 14 km in length, during the 2003 nesting season. Sand temperatures were measured periodically by using electronic temperature recorders in different beach locations including *Chelonia mydas* nests at different depths. Various data such as distance from sea, river, vegetation, and road (if there was) were also recorded. In total, 6 *Chelonia mydas* nest temperatures were recorded. It was observed that the sand temperature was high near the sea and a little decreased (0.4 - 0.8 ^{o}C) at the back. Mean incubation temperature was measured between 29.4 and 31.4 ^{o}C. Temperature data and histological examination of the gonads of dead hatchlings suggest a female dominated sex ratio on Samandag Beach.

THE EFFECTS OF SOME ELEMENTS (Ca, Mg AND Cr) ON NESTING ACTIVITY OF GREEN TURTLES IN SAMANDAG BEACH, TURKEY

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Samandag Beach is one of the most important nesting habitats of *Chelonia mydas* (L., 1758) which is an endangered species. Some elements (Ca, Mg and Cr) were analyzed in sand samples which were collected from Samandag Beach. A total of 150 sand samples were collected mainly from three types of locations: near the nest chambers, the adult's track and non-track (one location every 2 km randomly); and also from three levels in each location: surface, 30 cm deep and 80 cm deep. The metal concentrations were digested by using hydrofluoric acid and analyzed by using ICP-AES. Some biological data about nesting activity such as nest density and nesting success also were monitored in 2003 nesting season. The mean concentrations of the elements of [Ca], [Mg] and [Cr] in whole sand samples were measured as 278.0 ppm ± 121.97, 317.0 ppm ± 9.92 and 5.39 ppm ± 1.38 respectively. It was observed that [Ca], [Mg] had a significantly positive correlation with nesting success ($r = 0.717$ for [Ca] and $r = 0.672$ for [Mg]; $p<0.001$). Also [Cr] was observed as having a positive correlation ($r = 0.760$; $p<0.001$) with nest density.

COMPARISON OF THE HATCHLINGS OF NATURAL AND HATCHERY NESTS OF LOGGERHEAD TURTLES (*CARETTA CARETTA*) ON DALYAN BEACH, TURKEY

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In this study, the hatchlings of 34 natural (734 hatchlings) and 49 hatchery (1188 hatchlings) nests were compared in terms of some measurements (SCL, SCW and weight) and carapace scute deviations. The vertebral, costal and marginal series were the most variable and the supracaudal scutes were almost stable for the hatchlings. The most common scute pattern observed in natural nests was 12 (62.53 %) pairs of marginals, 5 (92.10 %) pairs of costals, 5 (91.96%) vertebrals, 2 (100 %) supracaudals and a single nuchal (95.23 %). The most common scute pattern observed in hatchery nests was 12 (57.07 %) pairs of marginals, 5 (93.94 %) pairs of costals, 5 (88.22 %) vertebrals, 2 (100 %) supracaudals and a single nuchal (98.48 %). The mean SCL and SCW of the hatchlings in natural nests was 40.48 ± 1.60 (range= 33.54-43.62) mm and 31.73±1.38 (range 25.20-36.46) mm respectively. The mean weight was 14.81±1.76 (range=8.70-18.90) g in natural nests. The mean SCL and SCW in hatcheries was 40.39±1.34 (range=35.60-44.48) mm and 31.48±1.10 (27.50-34.60) mm respectively. The mean weight was 14.51±1.41 (range=9.60-18.40) g. The SCW of the hatchlings in hatcheries was smaller than that of natural nests (ANOVA F= 19.65, $p<0.001$). The weight of the hatchlings in nests in hatcheries was also smaller than in natural nests (ANOVA F= 16.77, $p<0.001$). The scute deviation percentages were higher in hatchery nests. This difference was supported statistically as well (Chi-square test, $p<0.05$).

POST-NESTING MOVEMENTS OF LOGGERHEAD SEA TURTLES FROM A MAJOR MEDITERRANEAN NESTING AREA ASSESSED BY SATELLITE TELEMETRY

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The Bay of Laganas on the Greek island of Zakynthos hosts the by far largest known nesting aggregation of loggerhead sea turtles (*Caretta caretta*) in the Mediterranean. Monitoring and conservation efforts have been focussing on the land based stages, while knowledge on habitat use at sea is only fragmentary. Some foraging areas have been identified through tag-returns from flipper tagging. One of the major drawbacks of this method is however that it only renders information on two point of the migration. On the Mediterranean scale, information on migration routes for loggerhead sea turtles only exists from minor nesting areas or rehabilitated individuals. We started to fill this gap by satellite tracking three post-nesting turtles from Zakynthos in 2004. All three turtles nested again after transmitter attachment, which allowed for inferences about habitat utilisation during the inter-nesting interval. They were successfully tracked to their foraging habitats, where they occupied restricted, well-defined patches. Two individuals settled down in the Adriatic Sea, whereas the third moved to the Western Mediterranean to stop its migration in a previously unconfirmed foraging ground off Tunisia. Two individuals that were still transmitting at the time, moved south during autumn: One individual left the Italian coast to move close to Corfu, while the other turtle moved into the Gulf of Gabes (Tunisia). This exemplifies that utilization and thus appropriate protection of at sea habitats is very complex. Even this very small sample size allowed to critically evaluate hypotheses on habitat utilisation put forward based on tag-returns.

LOGGERHEAD SEA TURTLE HATCHLING SEX RATIOS FROM ZAKYNTHOS: SMALL-SCALE DIFFERENCES MIGHT BE CRUCIAL FOR THE MEDITERRANEAN METAPOPULATION

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Sex determination in sea turtles is temperature-dependent with cold temperatures producing males and warm temperatures females. This mechanism raises concerns in view of global warming. We estimated hatchling sex ratios in the nesting aggregation of loggerhead sea turtles (*Caretta caretta*) of the Greek island of Zakynthos (composed of six distinct nesting beaches) to investigate whether the individual beaches produce different sex ratios and to judge the importance of this largest Mediterranean nesting aggregation for the metapopulation. Estimates of hatchling sex ratios were obtained by clutch incubation duration and sand temperature profiles in 2003. In addition, we measured temperature within clutches to determine whether metabolic heating is likely to affect sex ratios. Clear-cut differences in estimated hatchling sex ratios were found between two groups of beaches. The overall hatchling sex ratio of Zakynthos was estimated at 75% females. Through a correlation of air with sand temperatures, we inferred a rough estimate of hatchling sex ratios during the past 20 years. We conclude that high conservation priority should be given to the beaches producing a male-biased sex ratio. They seem to buffer the overall hatchling sex ratio of Zakynthos from the effect of climate warming. Since it is unlikely that any other major Mediterranean nesting aggregation produces a high number of male hatchlings, we hypothesize that the male loggerheads produced on Zakynthos are of great importance to the entire metapopulation.

HIGHLIGHTS OF THE CONFERENCE

Session 1: Networking and Social Issues

The main points underlined were:

- the importance of public awareness for the sea turtle conservation, in order to avoid threats such as direct consumption of turtles (still occurring in some countries of the Mediterranean) or environmental loss. The awareness must be carried out on all target groups, from local people to national authorities and using the media.
- the importance of recording/studying turtle strandings for assessing threats at sea. In order to improve the actions and studies on strandings, it has been of special relevance the creation and first steps of networking among sea turtle rescue centres in Mediterranean countries. Such a network would let the exchanging of expertise and the sharing of information between members improving the quality of their tasks. In addition, this network can be a good body to influence policy makers, leading to a more efficient conservation of sea turtles in the Mediterranean.

Session 2: Turtles at Sea

- Sea turtles are marine animals spending all life at sea, with just an exceptional, though fundamental, presence at land. However, traditionally most of the research and conservation activity is carried out at land.
- Fortunately, this disequilibrium is rapidly changing, as shown by the number of oral and poster presentations dealing with turtles at sea in this conference. These studies are contributing to understand where, when and how, turtles of different origin go and distribute in the Mediterranean.
- The classic flipper tagging still provides useful insights, though satellite telemetry can clarify aspects otherwise impossible to investigate, and new tracking devices are promising.
- Other studies on turtles-at-sea improve our knowledge on the threats the Mediterranean populations are facing, providing further evidence of the importance of fishery interactions but also on other factors like boat strikes.

Session 3: Nesting Populations

- The improving knowledge is showing that the importance of nesting beach is not only associated with the number of nests. For instance genetics and sex ratios should be taken into consideration.
- There is a need of detailed research for the discovery of new possible nesting sites in the eastern Mediterranean.
- There is a need to protect the already identified nesting sites.

Session 4: Ecology and Ecophysiology

- On sex-ratio and eggs incubation:
    - o temporal and spatial sex-ratio variation in the loggerhead nests to be considered during nest relocation activities.

  - concerning the global warming phenomenon, a high conservation priority should be given to the beaches producing a male biased sex-ratio.
- On the physical characteristic of the nesting beaches:
  - Coastal degradation decreases the success of the nesting activity.
- In addition to the classic assessment of the nesting effort, several ecological factors were studied. In the same way the development of stranding networks and sea turtle rescue centres allowed the development of epibiont study and feeding ecology. The stranding studies should be encouraged.

Session 5: Management and Conservation

The session highlighted the following:

- what is conservation and what is not. Monitoring, tagging etc are not conservation measures. Their aims are to provide information on which to base conservation policy and actions. So far conservation measures have focussed mainly on beaches not at sea.
- The need to apply up-to–date knowledge and techniques in turtle conservation projects on nesting beaches, relating *inter alia* to predation, was stressed. It includes issues such as:
  - The use of non-magnetic material for protective cages or grills for protecting nest.
  - Protection nests *in situ* wherever possible (implies that beaches need to be protected).
  - Disturbing nests and hatching process as little as possible during the efforts to protect the nests (no digging for locating chambers, no digging up hatched nests in less than 3 days after hatching).
  - Predator population control.
- The value of training for conservation was emphasized as this would minimize the risks to turtles.
- The progress made in passing legislation protecting and managing critical areas for turtle conservation and more so the willingness in implementing such legislation was reviewed for a number of countries (Cyprus, Malta, Turkey).
- Raising public awareness and education issues were presented and discussed. They were deemed as prerequisites to effective conservation. The channels and modalities used need to be appropriate to target groups.

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