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Sea turtles in the Mediterranean

Distribution, threats and conservation priorities

Edited by Paolo Casale and Dimitris Margaritoulis

IUCN-SSC MARINE TURTLE SPECIALIST GROUP

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IUCN-SSC Marine Turtle Specialist Group
Mediterranean Region

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Publications Services
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Switzerland
Tel +41 22 999 0000
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PREFACE

In the last three decades the interest in sea turtles in the Mediterranean has continuously increased, motivated mainly by the conservation concern on these animals and specifically by the need of adequate knowledge about their threats and the biological and ecological parameters relevant for their conservation. Nowadays, many groups are carrying on valuable conservation and research activities on sea turtles in most Mediterranean countries.

However, while a regional approach is fundamental for wide ranging animals as sea turtles, the number of countries, the different languages and also the number of people involved represent an intrinsic additional difficulty for the diffusion of information and for large-scale actions in this area.

For this reason, reviews on a regional scale (e.g. Groombridge, 1990[a]; Margaritoulis et al., 2003[b]) proved to be particularly important for people working in and outside the Mediterranean.

The Marine Turtle Specialist Group (IUCN/SSC) created a successful regional network among members working in most countries, contributing to the necessary exchange of information and favoring personal contacts and partnerships.

Among such initiatives, in April 2006, taking advantage of the 26th Annual Symposium on Sea Turtle Biology and Conservation, the first one in the Mediterranean (Island of Crete, Greece), several MTSG members from different Mediterranean countries organized a special session providing country-by-country updates about sea turtle conservation issues in each country. As a follow-up of this initiative, a more formal, comprehensive, and certainly ambitious task was undertaken: a country-by-country report including basic information about turtle occurrence, threats, conservation status and perspectives. Part of this information is usually not available in scientific papers which describe only specific results. Nonetheless, this different information can provide a more comprehensive picture of what is going on in a country/area and may favor the diffusion of successful models and of lessons learned, and ultimately it may favor cooperation. For this reason, this report is organized in chapters for each country/area which have the same structure (standard topic sections). In this way the information is focused on specific topics and is easy to find and to compare, but at the same time chapters can provide much descriptive information, including some representative pictures.

In addition, an Overview section summarizes the main aspects, and for most topics it helps the reader finding where a specific information is provided in detail.

The structure of the chapters, decided upon by all authors, is described below, as a guide to the reader on where to find the information sought within a country/area.

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This report is the result of a considerable amount of voluntary work by a large number of extremely motivated persons believing in information sharing and collaboration as fundamental approaches for the conservation of sea turtles. Therefore, we firstly thank all the authors for their tremendous efforts. We also thank M. Aksissou, M. Aureggi, C. Carreras, B. Godley, A. Rees, J. Tomas, and O. Turkozan who acted as reviewers of the contributions, C. Campana, W. Fuller, M. Godfrey, A. Panagopoulou, A. Rees, T. Riggall, and M. Tiwari for English revision, and B. Hutchinson for the covers layout and for the constant assistance.

Paolo Casale and Dimitris Margaritoulis
Editors

2 April 2010

[a] Groombridge, 1990. Marine turtles in the Mediterranean: distribution, population status, conservation. Report to the Council of Europe, Environment Conservation and Management Division, Nature and Environment Series No. 48.

[b] Margaritoulis, D., Argano, R., Baran, I., Bentivegna, F., Bradai, M. N., Caminas, J. A., Casale, P., De Metrio, G., Demetropoulos, A., Gerosa, G., Godley, B. J., Haddoud, D. A., Houghton, J., Laurent, L., Lazar, B., 2003. Loggerhead turtles in the Mediterranean Sea: Present knowledge and conservation perspectives, in: Bolten, A.B., Witherington, B.E. (Eds), Loggerhead Sea Turtles: Smithsonian Books, Washington DC, pp. 175-198.

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[1]Department of Animal and Human Biology, University of Rome 1 'La Sapienza', viale dell'Università 32, 00185 Roma, Italy (E-mail: paolo.casale@tiscali.it), [2]WWF Mediterranean Turtle Programme c/o WWF Italy, via Po 25c 00198 Roma, Italy, [3]ARCHELON, the Sea Turtle Protection Society of Greece, Solomou 57, GR-10432 Athens (E-mail: margaritoulis@archelon.gr; aliki@archelon.gr; arees@seaturtle.org), [4]Department of Biology, Faculty of Science, PO Box 2121, Tetouan 93002, Morocco (E-mail: aksissou@yahoo.fr), [5]Naucrates, Colle tenne 04010 Giulianello di Cori (LT) Italy (E-mail: naucrates12@tiscali.it), [6]National Institute of Sea Sciences and Technologies, P.O. Box 1035, 3018 Sfax, Tunisia (E-mail: mednejmeddine.bradai@instm.rnrt.tn), [7]Marine Turtle Research Group, Centre for Ecology and Conservation, University of Exeter, Cornwall Campus, Penryn, TR10 9EZ, UK (E-mail: A.C.Broderick@exeter.ac.uk; B.J.Godley@exeter.ac.uk), [8]Estación Biológica de Doñana, CSIC, Apdo. 1056, E-41013, Sevilla, Spain (E-mail: carlos_c_h@hotmail.com), [9]Cyprus Wildlife Society, P.O. Box 24281, Nicosia 1703, Cyprus (E-mail: andrecws@logos.cy.net), [10]Faculty of Agricultural Science and Technology, European University of Lefke (E-mail: wfuller@seaturtle.org), [11]Society for the Protection of Turtles, [12]16, Eshton Terrace, Clitheroe, Lancashire, BB7 1BQ, UK (E-mail: fglen1@hotmail), [13]Sea Turtle Project, NC Wildlife Resources Commission, 1507 Ann St., Beaufort, NC 28516 USA, [14]Department of Fisheries and Marine Research, Ministry of Agriculture Natural Resources and Environment, Bethlehem 101, Nicosia 1416, Cyprus (E-mail: mhadjichristoforou@dfmr.moa.gov.cy), [15]Libyan Seaturtle Program (LibSTP), Environment General Authority, P.O.Box 13973 Tripoli-Libya (E-mail: abdhamza@gmail.com), [16]Tirana University, Museum of Natural Sciences, Rr. Kavajes 132, Tirana, Albania (E-mail: idrizhaxhiu@yahoo.com), [17]Fisheries Department, Directorate of Agriculture, P.O. Box 4 Latakia, Syria (E-mail: mohammadjony@gmail.com), [18]Sfax Faculty of Sciences, P.O. Box 802, Sfax 3018, Tunisia (E-mail: imed.jribi@fss.rnu.tn), [19]Pamukkale University, Faculty of Science and Arts, Department of Biology, Denizli, Turkey (E-mail: caretta@pau.edu.tr), [20]POBox 19, Sour, Lebanon (E-mail: monahabiba@gmail.com), [21]'ministry of environment and natural resources' (E-mail: hkuset@yahoo.com), [22]Department of Zoology, Croatian Natural History Museum, Demetrova 1, HR-10000 Zagreb, Croatia, [23]Blue World Institute of Marine Research and Conservation, Kaštel 24, HR-51551 Veli Lošinj, Croatia, [24]Department of Biology, Faculty of Science, University of Zagreb. 6 Roosevelt Sq., HR-10000 Zagreb, Croatia (E-mail: bojan.lazar@hpm.hr), [25]Sea turtle conservation project, Sea Turtle Rescue Center, Israel National Nature and Parks Authority, Michmoret 40297 Israel (E-mail: yaniv@npa.org.il), [26]Orca, Triq id-Dwiemes Zejtun, Malta (E-mail: mifsud.carmen@gmail.com), [27]Friends of the Environment, [28]Nature Conservation Egypt, [29]MEDASSET, 34 Street 106, Hadayek El Maadi, Cairo, Egypt (E-mail: mnada@egypt.care.org), [30]Laboratoire IMAGES, Université de Perpignan Via Domitia, and Réseau Tortues Marines de Méditerranée française, 52 avenue Paul Alduy, F-66860 PERPIGNAN cedex 9 (France) (E-mail: oliver@univ-perp.fr), [31]Marine Sciences Laboratory, fac. Agr. Tishreen University, P.O. Box 1408 Latakia, Syria (e-mail: adibsaad@scs-net.org), [32]NOAA-NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA

92037 USA, [33]Cavanilles Institute of Biodiversity and Evolutionary Biology, University of Valencia, Aptdo. 22085, E-46071 Valencia, Spain (E-mail: jesus.tomas@uv.es), [34]Adnan Menders University, Faculty of Science and Arts, Department of Biology, Aydin, Turkey (E-mail: turkozan@adu.edu.tr), [35]Aquarium Piran, Kidričevo nadbrežje 4, SI-3600 Piran, Slovenia

1. General remarks

The Mediterranean Sea is a virtually enclosed basin connected to the Atlantic through the 14 kilometre-wide Strait of Gibraltar. It is bordered by 46,000 km of coastline, of which a significant stretch belongs to the islands of the basin. It is surrounded by 21 countries with different cultures. In all, about 150 million people permanently live on the Mediterranean coast. It is adversely affected by intensive fishing activities (Sacchi, 2008) and by severe and increasing mass tourism (in 2005, 246 million international tourists visited the Mediterranean states, i.e. 30.5% of global international tourism; UNEP MAP, 2009).

Three species of sea turtles frequent the Mediterranean: the leatherback turtle (*Dermochelys coriacea*), the green turtle (*Chelonia mydas*), and the loggerhead turtle (*Caretta caretta*). Only the last two breed in the basin and their Mediterranean populations have only a limited gene flow with those of the Atlantic (Encalada et al., 1996; Laurent et al., 1998). This said, large numbers of Atlantic loggerhead turtles enter the Mediterranean and share foraging habitats with Mediterranean Sea individuals (see 2.1.2.).

In the Mediterranean, severe exploitation of sea turtles occurred from the 1920s to the early 1970s by fisheries specifically targeting turtles off the coast of (what are now) Israel and Palestine, and Iskenderun Bay in Turkey (Hornell, 1935; Sella, 1982). Historically, turtles from these areas were sold to the United Kingdom and Egypt for consumption (Sella, 1982). Currently, international trade is not a conservation threat for marine turtles in the Mediterranean. Specific national and international legislations aimed at protecting turtles in the Mediterranean has resulted in relatively little take of eggs and/or adult females at nesting beaches, and reduced intentional harvest of turtles at sea, although these threats are still relevant in some cases.

This review summarizes, as much as possible, the main points described in the individual chapters, in an attempt to present an overall regional picture.

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

There has been no recorded nesting in the Eastern Adriatic (Albania, Bosnia and Herzegovina, Croatia, Montenegro, Slovenia), Algeria and Morocco (although occasional nesting cannot be ruled out, especially in the past), whereas nesting has not been recorded recently in Malta. In several countries, nesting is considered rare, scattered or sporadic, at least at the present time. Today, most clutches are laid in Greece, Turkey, Cyprus, and Libya (Table 1; Fig. 1) (Margaritoulis et al., 2003; this report). In the entire Mediterranean, the average number of documented nests, as provided by the individual chapters of this report, is over 7200/yr. It should be taken into consideration that number of nests reported from Libya concern only the surveyed tracts of coast, while the total number of nests remains unknown. Fig. 1 shows “major” nesting sites, here arbitrarily defined as sites averaging ≥ 50 nests per year. It is worth mentioning that the Mediterranean hosts the northernmost record for a loggerhead turtle nest worldwide (France; Sénégas et al., 2008).

Genetic analyses suggest a population substructure with reduced gene flow among groups of rookeries such as Greece, Cyprus, Turkey, and Israel (Carreras et al., 2007). However, it is likely that other genetically differentiated units will be recognized with a larger rookery sampling and more specific genetic markers.

2.1.2. Marine areas

Loggerhead turtles practically occur in all marine areas of the Mediterranean (Table 2). With the exception of aerial surveys off the coasts of Spain (see Chapter on Spain), data on relative abundance of turtles in different areas come from fishery bycatch data (2.3.2.1.). The highest density of loggerhead turtles appears to occur in the westernmost part of the Mediterranean (from the Alboran Sea to the Balearic Islands), the Sicily Strait, the Ionian Sea, and the wide continental shelves in the north Adriatic, off Tunisia-Libya, Egypt, and off southeast coast of Turkey.

The Mediterranean is also frequented by individuals from the Atlantic. First suggested by Argano and Baldari (1983), this was directly observed through tag returns (Manzella et al., 1988; Bolten et al., 1992). Molecular markers indicate that Atlantic turtles are abundant in the western Mediterranean, in some cases more abundant than Mediterranean ones, and that they venture at least as far as the Sicily Strait, Tunisian continental shelf and the Ionian Sea (Laurent et al., 1998; Carreras et al., 2006; Casale et al., 2008), while other areas in the eastern basin have not been investigated yet.

2.2. Past distribution and abundance

Trend analyses based on systematically collected data are not available, while heterogeneous information reported in the individual chapters is summarized in Table 3. Information on long term trends (decades) when available is anecdotal and suggest a general decline. More recent trends, based both on anecdotal and survey data, suggest decreasing, stable, and increasing trends in different areas.

2.3. Threats

2.3.1. Terrestrial Habitats

Coastal development and non-human predation appear to be the main threats, occurring in most countries with nesting sites, followed by beach restructuring and human exploitation (direct take of eggs or nesting females) (Table 1). Among other threats, erosion and debris are common.

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

Incidental catch occurs practically everywhere (Table 2), as expected from the distribution of loggerheads and fishing effort. A recent review of sea turtle bycatch in the Mediterranean (Casale, 2008) estimated over 150,000 captures per year (all species, sizes, and origin combined) within the basin (over 50,000 by pelagic longlines, 40,000 by trawls, 35,000 by demersal longlines, and 30,000 by set nets), and in excess of 50,000 deaths per year.

2.3.2.2. Intentional killing and exploitation

Intentional killing, especially after capture at sea, is still relatively widespread in the Mediterranean (Table 2). It is particularly significant in Egypt and Greece, whereas in some countries it is considered to be low and in other countries it occurs at undetermined levels.

2.3.2.3. Other threats

Potential threats such as boat strikes and pollution are reported from most of the countries (Table 2). Dynamite fishing, an illegal practice, is also considered as a threat in several countries.

3. *Chelonia mydas*

3.1. Present distribution and abundance

3.1.1. Nesting sites

Most clutches are laid in Turkey, Cyprus, and Syria (Table 1; Fig. 2). For the Mediterranean, the average number of documented nests is over 1500/yr. Fig. 2 shows “major” nesting sites, here arbitrarily defined as sites averaging > 40 nests per year.

3.1.2. Marine areas

Green turtles frequent mostly the Levantine basin (Turkey, Syria, Cyprus, Lebanon, Israel, Egypt) as well as having foraging areas in Greece and Libya (Table 2). Some green turtles can be occasionally found in the Adriatic Sea (Italy, Croatia, and Albania), in Tunisia and very rarely in Malta and the western basin.

3.2. Past distribution and abundance

The paucity of historical information makes it impossible to discern trends in the recent period (Table 3). However, historic accounts of large-scale sea turtle harvests (e.g. Sella, 1982), presumably targeting green turtles, would indicate occurrence of higher numbers in the past than the current estimate for the region.

3.3. Threats

See 2.3. and Tables 1 and 2.

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

The leatherback turtle has been recorded from almost every area and country in the Mediterranean, but available data suggest that specimens concentrate in specific areas, probably for trophic reasons, like the Tyrrhenian and Aegean Seas and the area around the Sicily strait (Margaritoulis, 1986; Casale et al., 2003; Bradai et al., 2004). Nesting is absent or exceptional (Lescure et al., 1989; Laurent et al., 1999), therefore, the leatherbacks found in the region are likely to be of Atlantic origin. Documented carapace lengths range from 112-190 cm (n=83; Casale et al., 2003) indicating that only large juveniles and adults frequent the basin, probably because small juveniles are restricted to tropical waters (Eckert, 2002). There are no records of small juveniles in the Atlantic as far north as the Straits of Gibraltar, which would be their entry point into the Mediterranean. In general, it seems that individuals enter the basin in small numbers. Average longline catch rates in the Mediterranean (0.0025 turtles/1000 hooks; reviewed by Casale et al. (2003)) are 60-200 times lower than those observed in the Atlantic (about 0.14-0.5 turtles/1000 hooks, according to the bait used; Watson et al., 2005). Moreover, a review of the years 1520-2001 reported only 411 records in the Mediterranean (Casale et al., 2003).

4.2. Past distribution and abundance

Data not available.

4.3. Threats

Most records from the region concern individuals incidentally caught in fishing gear, particularly set or drift nets (see Casale et al. (2003) for a review). Thus, by-catch probably represents the main threat in the Mediterranean. Other threats may include collision with boats and ingestion of plastic material (Casale et al., 2003), although data are too incomplete to draw solid conclusions.

5. Other species

Two other species of sea turtles have been occasionally reported in the Mediterranean. Hawksbill turtles (*Eretmochelys imbricata*) from Albania, France (Mediterranean), Malta, and Tunisia, and Kemp's ridley turtles (*Lepidochelys kempii*) France, Malta, and Spain.

See specific chapters for details.

6. Conservation status

Much effort is allocated to sea turtle conservation in the region, by NGOs, governments, research institutes, and individuals.

A regional Action Plan for the conservation of sea turtles in the Mediterranean was developed within the framework of the Barcelona Convention in 1989 and updated in 1999 and 2007 (UNEP MAP RAC/SPA, 2007). Parties to this Protocol, which include all Mediterranean countries, are asked to report on its implementation in their country every 2 years.

WWF also developed an Action Plan (WWF, 2005).

There are several international conventions and supranational agreements which protect sea turtles in the Mediterranean region:

<u>African Convention on the Conservation of Nature and Natural Resources (1968)</u>

All marine turtle species are listed in Class A of the Convention.

Article 8, 1, a.

Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (1973)
Under the Convention, parties must strictly regulate trade in species listed in its appendices and particularly Appendix I, where all marine turtle species are listed.

Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) (1976)
Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean. This protocol indicates species and habitats protection requirements that parties must incorporate into national legal frameworks. Obligations are particularly strong for species in the *List of Endangered or Threatened Species* (Annex II of the Protocol), which includes 5 marine turtle species: *Caretta caretta, Chelonia mydas, Dermochelys coriacea, Eretmochelys imbricata, Lepidochelys kempii*.

Convention on the Conservation of European Wildlife and Natural Habitats – Bern Convention (1979)
Five marine turtle species (*Caretta caretta, Chelonia mydas, Dermochelys coriacea, Eretmochelys imbricata, Lepidochelys kempii*) are listed in Appendix II (strictly protected fauna species).

Convention on the Conservation of Migratory Species of Wild Animals (CMS) – Bonn Convention (1979)
Six marine turtle species (*Caretta caretta, Chelonia mydas, Dermochelys coriacea, Eretmochelys imbricata, Lepidochelys kempii, Lepidochelys olivacea*) are included in Appendix I of the Convention, which lists endangered migratory species.

Convention on Biological Diversity (CBD) (1992)
The Convention calls on parties to conserve biological diversity by several measures; e.g. by establishing a system of areas which are protected or where special measures are taken, to manage biological resources, to promote the protection of ecosystems and the maintenance of viable populations of species, and to promote the recovery of threatened species.

Habitats Directive (1992)
This is an instrument of the European Union to protect, manage and where appropriate restore to a favorable conservation status, in its natural range, biodiversity and to set up a coherent ecological network of special areas of conservation set up under the title of Natura 2000 (composed of sites hosting areas of the natural habitat types listed in Annex I and habitat of the species listed in Annex II). Five marine turtle species (*Caretta caretta, Chelonia mydas, Dermochelys coriacea, Eretmochelys imbricata, Lepidochelys kempii*) are listed in Annex IV (Animal and Plant species of Community interest in need of strict protection). Two species (*Caretta caretta* and *Chelonia mydas*) are also listed as priority species under Annex II of the directive. The conservation of the species in Annex II requires the designation of special areas of conservation.

Adoption of these conventions by Mediterranean countries as well as national laws protecting sea turtles and their habitats are summarized in Table 4.

7. Conservation needs

Most individual chapters include a list of conservation needs. Although these range from general to very specific, some broad observations can be made. One observation is that although generally there seems to be adequate legislation, appropriate implementation and enforcement are generally insufficient. Another conservation need is adequate management and mitigation of threats at sea; a common recommendation is the establishment of MPAs (Marine Protected Areas), which obviously will also include Marine and Terrestrial (e.g. for nesting beaches) Natura 2000 sites. Furthermore, there is a need for more active participation by governments in the strategic planning and drafting of national Action Plans for marine turtles.

8. Miscellaneous

The following additional information is included in the following chapters.

Libya. Rescue Centres, Stranding Networks, Genetic Studies.

Spain. Sea turtles as communities, Natural predation at sea, Juvenile sex ratio.

9. Institutions and organizations involved in conservation, management, and research

In the country chapters there are descriptions of national, public and private organizations pertinent to sea turtle research and conservation per country. Below we present the organizations that have an overall Mediterranean identity and function.

9.1. Public

UNEP's Regional Activity Centre for Specially Protected Areas (RAC/SPA), based in Tunis, is responsible for the elaboration and coordination of the Action Plan for the Conservation of Marine Turtles in the Mediterranean, under the framework of the Barcelona Convention, to which all Mediterranean countries (and the European Union) are signatories. The National focal point for this protocol, from each country attends the national focal points meeting which is scheduled every 2 years. Furthermore RAC/SPA organizes, when needed technical meetings and training for parties to this protocol. Recommendations and decisions endorsed by the NFP meetings of the SPA and Biodiversity Protocol are then passed to the MAP Focal Point meetings. These in turn decide as to what is to be proposed to the Contracting Party meetings, the decisions and recommendations of which are binding on all the Contracting Parties that have ratified the Convention's Specially Protected Areas and Biological Diversity in the Mediterranean Protocol (see Article 3. General Obligations of the Protocol).

9.2. Private

Although not a legal body, the IUCN's Marine Turtle Specialist Group (MTSG) includes members from nearly every country in the Mediterranean. Membership lasts for four years and members may be reappointed by the Chair(s) of the MTSG. The principal functions of the MTSG are to provide expert opinion, particularly on Red Lists, and consultation to governments and international bodies.

10. Resources available about marine turtle research and conservation

The country chapters contain a great diversity of national resources for marine turtle research and conservation. These include websites, research publications and field reports, educational material, newsletters, field stations and volunteer camps, public awareness and information stations, rescue centres and first-aid stations and stranding networks.

Additionally, we report below some of the most well-known supra-national resources pertaining to marine turtles in the Mediterranean (and also in a global context).

Mailing lists (list servers) and web resources

- MedTurtle is a regional List Server (to subscribe contact arees@seaturtle.org; the archive can be found at www.seaturtle.org/gforum/gforum.cgi?forum=26).
- Mediterranean section at the Marine Turtle Specialist Group (IUCN/SSC) web site (http://www.iucn-mtsg.org/regions/med/).
- Euro Turtle (for details please see MEDASSET's resources in the chapter on Greece).
- CTURTLE. A global List Server providing communication among subscribers who are interested in sea turtle research and conservation. In order to subscribe please see instructions at http://accstr.ufl.edu/cturtle.html.

- seaturtle.org provides a global home for material related to marine turtles including research results, project reports and maps of turtles tracked using satellite telemetry etc. It also serves as portal for other sites on the world-wide web.
- Sea Turtle Tag Inventory at http://accstr.ufl.edu/taginv.html. Its primary purpose is to avoid duplication of tag codes and to assist in reporting turtle recaptures when only the tag code has been recorded. Most of the tag codes used in the Mediterranean are registered in this facility. It is maintained by the Archie Carr Center for Sea Turtle Research (ACCSTR).
- Marine Turtle DNA Sequence Patterns http://accstr.ufl.edu/genetics.html. It facilitates genetic studies by listing DNA sequence patterns and thus eliminates sequence duplication. It is maintained by the Archie Carr Center for Sea Turtle Research (ACCSTR).
- Marine Turtle Newsletter. This quarterly newsletter is freely available as both hardcopy and PDF from www.seaturtle.org/mtn. The MTN is an outlet for information on sea turtles, including research papers, meeting reports, editorials, book reviews, current news items and recent publications related to sea turtles.

Technical Manuals

- Demetropoulos A. and M. Hadjichristophorou. 1995. Manual of Marine Turtle Conservation in the Mediterranean. UNEP, RAC/SPA, IUCN, CWS, MANRE/Fisheries Department, Cyprus. 62 pp.
- Demetropoulos A. and M. Hadjichristophorou. 2008. Conservation Practices. Addendum 1 to the 1995 Manual of Marine Turtle Conservation in the Mediterranean. UNEP, RAC/SPA, IUCN, CWS, MANRE/Fisheries Department, Cyprus. 22 pp.
- Gerosa, G. 1996. Manual on Marine Turtle Tagging in the Mediterranean. UNEP, RAC/SPA. Tunis. 48 pp. Available in English, French and Arabic.
- Gerosa, G. and P. Casale. 1999. Interaction of Marine Turtles with Fisheries in the Mediterranean. UNEP/MAP, RAC/SPA, Tunis. 59 pp.
- Gerosa, G and M. Aureggi. 2001. Sea Turtle Handling Guidebook for Fishermen. UNEP, RAC/SPA, Tunis.31 pp. Available in several languages. A Teaching Book on how to use this Guidebook is also available.

Information on the above manuals can be taken from RAC/SPA, Tunis, www.rac-spa.org

Books of Mediterranean interest

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Table 1. Summary of sea turtle nesting and related threats in the Mediterranean (see specific chapters for details). Threats are compiled only for those countries where nesting occurs. Nests/yr are not necessarily comparable, due to different monitoring periods, areas, and mean vs. median values. Blank spaces: not applicable or data not available. NR: No records of nests are known, either in case specific surveys have been carried out or not. Notes: *Countries without a dedicated chapter; (a) data from Laurent, 1990; (b) mean; (c) maximum value; (d) approximate value; (e) median of range of values.

	Caretta caretta			*Chelonia mydas*			Threats on land				
	Nesting	Nests/yr	Period	Nesting	Nests/yr	Period	Coastal development	Beach restructuring	Non human predation	Human exploitation	Other threats
Albania	NR			NR							
Algeria* (a)	NR			NR							
Bosnia and Herzegovina*	NR			NR							
Croatia	NR			NR							
Cyprus											
Region A	Yes	236 (b)	1993-2007	Yes	104 (b)	1993-2007	Yes	Yes	Yes	No	
Region B	Yes	458 (b)	2005-2008	Yes	48 (b)	1989-2008	Yes	Yes	Yes	No	Erosion, damming, offshore breakwater, debris.
Egypt	Yes	67	1998	Yes	7	1998	Yes	No	Yes	Yes	
France	Yes	1 (c)	2002, 2006	NR			Yes	Yes		No	Erosion.
Greece	Yes	3472 (b)	1984-2007	Yes	1	2007	Yes	Yes	Yes	No	Erosion, exotic vegetation, debris.
Israel	Yes	57 (b)	1993-2008	Yes	8 (b)	1993-2008	Yes		Yes		
Italy	Yes	10 (b)	2000-2004	NR			Yes	Yes	Yes	No	Erosion.
Lebanon	Yes	60 (d)	1997-2006	Yes	16 (c)		Yes	Yes	Yes		War (habitat destruction), erosion, storms, debris, grazing.
Libya	Yes	726 (b)	2006-2007	NR			Yes	Yes	Yes	Yes	
Malta	NR (nowadays)			NR							
Monaco*	NR			NR							
Montenegro*	NR			NR							
Morocco	NR			NR							
Slovenia	NR			NR							
Spain	Yes	1 (c)	1992-2007	NR			Yes	Yes	No	No	
Syria	Yes	17 (b)	2004-2009	Yes	163 (b)	2004-2009	No	No	Yes	Yes	Storms.
Tunisia	Yes	<15 (c)	1993-2008	NR			Yes	No	Yes	No	Sea grass debris
Turkey	Yes	2145 (e)		Yes	1252 (e)		Yes	Yes	Yes	No	Erosion, debris.

Table 2. Summary of sea turtle occurrence at sea and related threats in the Mediterranean (see specific chapters for details). BS: beach seine; BT: bottom trawl; DN: drift nets; LL; longline; MT: midwater trawl; PLL: pelagic longline; DLL: demersal longline; SN: set nets; St: Stavnik. Species: Cc, *Caretta caretta*; Cm, *Chelonia mydas*. Species with low occurrence are in brackets.

	Species	Threats at sea		
		Incidental catch	Intentional killing and/or exploitation	Other
Albania	Cc (Cm)	BT, SN, LL, St	No or Low	Predation, boat strikes, pollution, habitat destruction (trawlers)
Algeria* (a)	Cc	BT, PLL	Yes	
Bosnia and Herzegovina*	Cc (b)			
Croatia	Cc (Cm)	BT, SN, LL	No	Pollution, boat strikes
Cyprus				
Region A	Cm, Cc	LL, SN	Yes	Boat strikes
Region B	Cm, Cc	SN, LL	Yes (Low) (c)	
Egypt	Cc, Cm	BT, LL, SN	Yes (High)	Pollution
France	Cc (Cm)	SN, BT, PLL	No or Low	Boat strikes
Greece	Cc, Cm	BT, PLL, SN, BS	Yes (High) (c)	Boat strikes, pollution, dynamite fishing, predation
Israel	Cc, Cm	DLL, BT, SN	Yes (Low)	Pollution, boat strikes
Italy	Cc	BT, MT, PLL, DLL, SN	Yes	Boat strikes
Lebanon	Cc (b) Cm (b)			Dynamite fishing, pollution
Libya	Cc, Cm	BT, PLL, SN	Yes (Low)	Pollution, dynamite fishing
Malta	Cc	PLL	No	Boat strikes, pollution
Monaco*	Cc (b)			
Montenegro*	Cc (b)			
Morocco	Cc	DN, LL, BT	Yes (Low)	Pollution, boat strikes
Slovenia	Cc	BT, SN	No	Pollution, boat strikes
Spain	Cc	PLL, BT, SN, DN	No	Pollution, boat strikes
Syria	Cc, Cm	Yes	Yes	Dynamite fishing, boat strikes
Tunisia	Cc	BT, PLL, DLL	Yes	Pollution
Turkey	Cc, Cm	BT, MT	Yes	Pollution, boat strikes

*Countries without a dedicated chapter; (a) data from Laurent, 1990; (b) data not available, but assumed from the general range of the species; (c) intentional killing only. Blank spaces: data not available.

Table 3. Summary of insights on Long term (decades) and Recent (years) sea turtle trends as abundance at sea (S) or number of nests (N) in the Mediterranean (see specific chapters for details). This information should be regarded with caution since it is often based on anecdotic data.

		Caretta caretta		*Chelonia mydas*	
		Long term	Recent	Long term	Recent
Albania		Increased (S)	Increasing (S)		
Algeria*					
Bosnia and Herzegovina*					
Croatia			Decreasing (S)		
Cyprus					
	Region A		Stable (N)		Stable (N)
	Region B	Decreased (N,S)	Increasing (N)	Decreased (N,S)	Stable (N)
Egypt		Decreased (N,S)	Decreasing (S,N)		Decreasing (S)
France					
Greece		Decreased (N,S)	Stable (N)		
Israel		Decreased (N)	Increasing (N)	Decreased (N,S)	Stable (N)
Italy		Decreased (N)	Decreasing (S)		
Lebanon					
Libya					
Malta		Decreased (N,S)			
Monaco*					
Montenegro*					
Morocco					
Slovenia					
Spain					
Syria				Decreased (N) (a)	Increasing (S) (a)
Tunisia					
Turkey					

*Countries without a dedicated chapter. Blank spaces: data not available; (a) it is uncertain which species the information refers to.

Table 4. Summary of international conventions and national laws protecting sea turtles in the Mediterranean (see specific chapters for details).

	International Conventions						Habitats Directive (EU)	National Law
	Barcelona Conv.	CBD	CMS	CITES	African Conv.	Bern Conv.		
Albania	X	X	X	X		X		
Algeria*	X	X	X	X	X			n/a
Bosnia and Herzegovina*	X	X						n/a
Croatia	X	X	X	X		X		X
Cyprus	X	X	X	X		X	X	X
Egypt	X	X	X	X	X			X
France	X	X	X	X		X	X	X
Greece	X	X	X	X		X	X	X
Israel	X	X	X	X				X
Italy	X	X	X	X		X	X	X
Lebanon	X	X						X
Libya	X	X	X	X	X			X
Malta	X	X	X	X		X	X	X
Monaco*	X	X	X	X		X		n/a
Montenegro*	X	X		X		X		n/a
Morocco	X	X	X	X	X	X		X
Slovenia	X	X	X	X		X	X	X
Spain	X	X	X	X		X	X	X
Syria	X	X	X	X				
Tunisia	X	X	X	X	X	X		X
Turkey	X	X		X		X		X

*Countries without a dedicated chapter. X: presence of legislation; blank spaces: absence of legislation; n/a: unknown. CBD: Convention on Biological Diversity; CMS: Convention on the Conservation of Migratory Species of Wild Animals; CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora (see section 6).

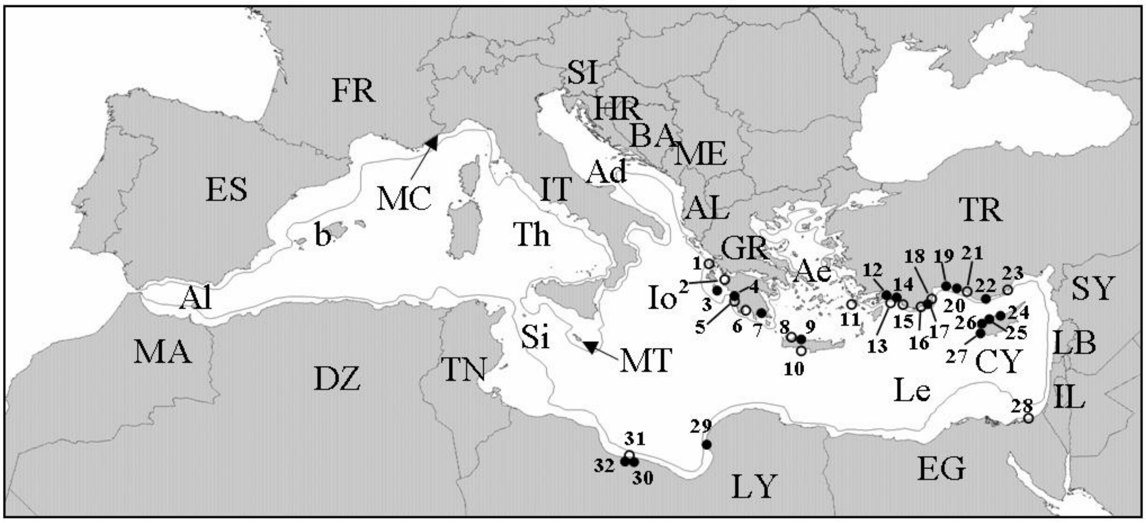

Fig. 1. Major nesting sites (≥50 nests/yr) of *Caretta caretta* in the Mediterranean (based on country chapters): 1, Lefkas Isl; 2, Kotychi; 3, Zakynthos Isl.; 4, Kyparissia Bay; 5, Beaches adjacent to Kyparissia town; 6, Koroni; 7, Lakonikos Bay; 8, Bay of Chania; 9, Rethymno; 10, Bay of Messara; 11, Kos Isl.; 12, Dalyan; 13, Dalaman; 14, Fethiye; 15, Patara; 16, Kale; 17, Finike-Kumluca; 18, Çıralı; 19, Belek; 20, Kızılot; 21, Demirtaş; 22, Anamur; 23, Göksu Delta; 24, Alagadi; 25, Morphou Bay; 26, Chrysochou Bay; 27, Lara/Toxeftra; 28, Areash; 29, Al-Mteafla; 30, Al- Ghbeba; 31, Al-thalateen; 32, Al-Arbaeen. Closed circles: >100 nests/yr; open circles: 50-100 nests/yr. The 200-m bathymetry line is shown. Country codes according to the International Organization for Standardization (ISO). AL: Albania; DZ: Algeria; BA: Bosnia and Herzegovina; HR: Croatia; CY: Cyprus; EG: Egypt; FR: France; GR: Greece; IL: Israel; IT: Italy; LB: Lebanon; LY: Libya; MT: Malta; MC: Monaco; ME: Montenegro; MA: Morocco; SI: Slovenia; ES: Spain; SY: Syria; TN: Tunisia; TR: Turkey. Ad: Adriatic; Ae: Aegean; Al: Alboran Sea; Io: Ionian; Le: Levantine basin; Si: Sicily strait; Th: Thyrrenian; b: Balearic.

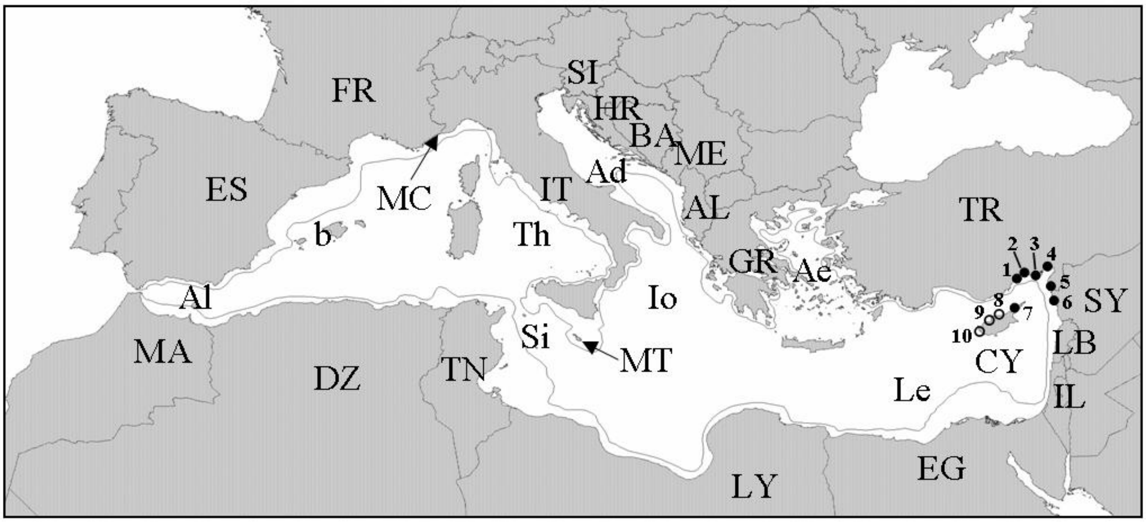

Fig. 2. Major nesting sites (>40 nests/yr) of *Chelonia mydas* in the Mediterranean (based on country chapters and on Kasparek et al., 2001): 1, Alata; 2, Kazanlı; 3, Akyatan; 4, Sugözü; 5, Samandağ; 6, Latakia; 7, North karpaz; 8, Alagadi; 9, Morphou Bay; 10, Lara/Toxeftra. Closed circles: >100 nests/yr; open circles: 40-100 nests/yr. Symbols and abbreviations as in Fig. 1.

ALBANIA

Idriz HAXHIU

Tirana University, Museum of Natural Sciences, Rr. Kavajes 132, Tirana, Albania
E-mail: idrizhaxhiu@yahoo.com

1. General remarks

The Albanian coastline has a total length of 476 km facing both the Adriatic and Ionian Seas (Fig. 1).

All three species of marine turtle (*C. caretta, C. mydas and D. coriacea*) documented from Albanian offshore waters are exhibited in the Museum of Natural Sciences in Tirana. According to Frommhold (1959) one other species of marine turtle, the Hawksbill *Eretmochelys imbricata,* has been observed in Albania.

Studies and publications on sea turtles in Albania are scarce (Zeko and Puzanov 1960; Haxhiu 1981, 1985, 1997, 1998; Haxhiu and Oruci, 1998). They concern sporadic observations and descritpive geographic distributions of turtles in Albania. Focused studies have been carried out between 2002 and 2006. The results of these 5 years of observations in coastal Albania (mainly in Rodoni Bay) are presented in this chapter.

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

No confirmed nesting by *C. caretta* on the Albanian coast has been recorded, although monitoring effort has been limited.

Potential nesting sites on both the Ionian and Adriatic coastal areas include beaches at Krorza (Fig. 2), Borshi, Palasa, Orikumi, and Narta, and near the mouth of the Semani and Shkumbini Rivers, and along Lalzi Bay.

On 14 July 2004, at about 11:45 PM, a barking dog alerted fishermen at Orikumi to a recently emerged *C. caretta*. The turtle was tied to a boat in shallow water, and the following day the turtle was slaughtered. Her oviducts reportedly were found to contain more than 100 mature, white eggs. The carapace of this *C. caretta* is on display in the town of Orikumi.

2.1.2. Marine areas

The Loggerhead turtle **(***Caretta caretta*) is distributed in both the Ionian and the Adriatic Sea. Throughout Albanian coastal waters, these turtles are incidentally captured in fishing nets, from both the sea bottom and shallow areas. The presence of loggerheads (*C. caretta*) in the extremely shallow Patok and Butrinti lagoons is interesting.

In the spring and summer *C. caretta* enter these shallow areas (1 – 10 m in depth), from late April until October (Fig. 3), apparently in concert with the rise of the marine water temperature. During the winter seasons, loggerheads are usually observed in waters that are 10-50 m deep, and are accidentally caught in trawl nets and in fishing gear used along the sea bottom.

C. caretta is trapped in fishing nets in both the Ionian and Adriatic Sea, but incidental capture seems to be more common in the Adriatic. Studies from the last 5 years show that *C. caretta* is mainly distributed at the mouths of several Albanian rivers, particularly those bringing the greatest pollution to the sea. These rivers are the Drini, Mati, Ishmi, Shkumbini, and Semani. The species is also commonly found in Drini Bay and Rodoni Bay.

The burgeoning abundance of marine turtles in Rodoni Bay is associated with the biological imbalance associated with the pollution from the Ishmi River. The Ishmi watershed includes the most populated and most heavily industrialized area of Albania.

The organic pollution of the Ishmi river mouth has resulted in a great increase of crabs *Carcinus mediterraneus*, jellyfish *Risostomo pulmo* and cuttlefish *Sepia officinalis*, which are principal prey items for *C. caretta.*

The most recent studies (Haxhiu and Rumano, 2006) carried out in Rodoni Bay document 710 individuals of *C. caretta* accidentally entangled in fishing nets. All turtles were examined, and nearly half of them (308) were tagged before release. In addition to the marine turtles measured during theses studies (476 specimens of *C. caretta*), more sightings have been reported by the fishermen of Rodoni Bay.

Sea turtles were allocated into size-classes (defined in increments of 10 cm) based upon their curved carapace length (CCL (White, 2007) (Fig. 4). The measurements of 476 specimens of *C. caretta*, caught during 2002-2006 show that 331 (69.5 %) belong to the CCL 50 - 99 cm group, 145 (30.5%) belong to the CCL 20 - 50 cm group.

The number of marine turtles in Patok Lagoon, an inland arm of Rodoni Bay, is much larger than further south in the fishing areas adjacent to Durrësi or Divjaka.

Some specimens captured at Patok had tags indicating previous presence in Greece and Italy.

The majority of C. *caretta* observed bore various epibionts (both flora and fauna). The heaviest growth of epibiontic flora and fauna (Figs. 5 to 9) was found on turtles missing a hind limb.

The carapaces of a few *C. caretta* were enitrely clean.

In the course of examining various C. *caretta* individuals at Patok, we have observed remnants of crab shells in excrement remaining within the cloaca. The feeding by *C. caretta* on crabs is further suggested by the influx of large numbers of turtles into Patok, mainly during the warm seasons. Crabs are an annoyance to fishermen at Patok, who instead of removing them from their nets usually kill them with a wooden club. The intentional killing of crabs likely reduces total food availability for *C. caretta*.

The seasonal occurrence of large numbers of marine turtles in Rodoni Bay and its inland lagoon at Patok suggest seasonal mirgration of *C. caretta* in the central Mediterranean. Specimens of *C. caretta* tagged in Patok have been caught incidentally in fishermen's nets or found dead elsewhere along the Albanian coast. One tagged specimen was found dead in Greece. Data on marine turtles during the winter in Albanian waters are lacking, but their accidental capture by bottom trawling in the winter months demonstrates that *C. caretta* can over winter here. No data exist on the mating of loggerhead turtles in Albanian offshore waters.

2.2. Past distribution and abundance

From anecdotal reports by elderly fishermen in coastal areas including Shëngjini, Rodoni Bay, Durrësi (Muzhel), Divjaka, Vlora, and Saranda, incidental capture of marine turtles by trawling has occurred for as long as anyone could remember. Around Patok, veteran fishermen report that marine turtles have never before been as numerous as in the present day. Similar reports were provided by elderly fishermen in Vlora and Saranda.

2.3. Threats

Marine turtles are threatened by a variety of anthropogenic factors which influence directly and indirectly their populations in Albania. The primary threats are fishing activities (including the illegal use of dynamite) and pollution.

2.3.1. Terrestrial Habitats

Although nesting has not been documented, potential nesting habitats face possible threats. Coastal development has increased drastically in the last two decades. Thousands of houses have been erected without building permits in coastal areas, with many building placed on the beach. In Durrës, Golem, and Saranda, serious environmental impacts have resulted from the illegal activities of construction firms. In recent years, Albanian beaches have become badly polluted by urban waste, most visibly at the mouth of rivers (e.g. Buna, Drini, Ishmi, Erzeni, Shkumbini, Semani, and Vjosa). The removal of beach sand for construction occurs but the extent has not been documented. Upland and beach erosion have become disturbing phenomena in recent years. In northern Albania, at Velipoja in Drini Bay, the sea has penetrated inland about 200 m - 400 m covering hundreds km square of coastal areas, likely the result of incorrect forestry and hydrological practices in and along the Drini and Mati riverbeds and their tributaries. Dozens of hectares of coastal woodlands have been submerged in places like Velipoja, Kune - Vain, Patok.

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

Marine turtles commonly are incidentally entangled in fishing nets, and also are sometimes hooked.

<u>Trawl</u>.

The most widely used nets are either for surface trawling or bottom trawling. Bottom trawling nets move along the bottom sea at depths of 10m-50m. Turtles captured in these submerged nets may perish from asphyxiation as the nets remain submerged as long as 4 hours, during which time the turtles cannot reach the surface to breathe.

<u>Drifting longline</u>.

In Albania, longlining occurs mostly in shallow waters, but this kind of fishing is not common in Albania.

<u>Set nets</u>.

Fixed nets are commonly used along the beach at a depth of 1-4 m, particularly at river deltas and in lagoons on the Adriatic. In July 2002, seven set nets at the Ishmi delta were responsible for the accidental capture of 29 *C. caretta* turtles. There are cases of marine turtle mortality in fixed nets.

<u>Bottom longlines</u>.

Fishing with hooks is not widespread in Albanian waters, although the use of fishing with hooks has been increasing in recent years. Adequate data are lacking on the number of marine turtles caught by hooks. However there have been various observations of marine turtles with fishing line in the mouth (Fig. 10) or in the cloaca (Fig. 11), including dead turtles presumed to have died after being hooked. Hooks pose an emerging threat to marine turtles in Albania.

<u>Other Gear</u>.

0-7 loggerhead turtles per day were caught in Patok by coastal nets and Stavnik (see section 8).

2.3.2.2. Intentional killing and exploitation

Sea turtles are not commonly slaughtered in Albania, nor are they killed for research purposes. There has never been commerce in marine turtles or parts thereof in Albania. There have been sporadic reports of marine turtles having been consumed locally according to fishermen in Saranda, Vlora, Durrësi and Patok but consumption of turtle meat is not an Albanian tradition.. Turtles are not killed for revenge, superstition, or out of antagonism.

In recent years the practice of embalming and mounting dead marine turtles for display on the walls of restaurants or hotels, to make them more attractive for clients, has been noted (Fig. 12 and 13). A few specimens of *C. caretta* have been briefly confined in freshwater ponds in some hotels (Vlora, Tirana and Laç) before invariably dying.

2.3.2.3. Other threats

Although there are no data on the predation upon marine turtles by other animals in Albanian waters, during 2006 an unprecedented number of sharks were observed in Durrësi and Rodoni Bays. Possibly this shark ‘population explosion’ was brought about by the increase in marine turtles feeding in these areas. We have found several marine turtles lacking a rear flipper or bearing marks attributable to shark teeth on their shell (Fig. 14).

Boats and other marine vessels may strike marine turtles with their hulls or propellers. Vessel refuse or discarded gear may also harm turtles.

Bottom trawling damages the sea floor habitat.

Dynamite fishing has declined sharply in the past 15 last years throughout coastal Albania. Dynamite fishermen risk prosecution by the authorities and significantly, are often denounced by other fishermen.

Offshore oil exploration is very harmful to all marine biota. Albanian harbors (Shëngjini, Durrësi, Vlora, Saranda) are fouled with petrol runoff. The Semani River drains the oil-producing area of Muzeqe and thus contributes to pollution of the southern Adriatic.

Extensive seaside construction during the last decade in some areas of Albanian coast has threatened offshore areas and their marine life. Biodiversity has surely suffered from pollution caused during construction, and from subsequent human activities. Whereas some creatures become scarce, others such as crabs have become more numerous at Patok and Divjaka, for example. Severe pollution may be the cause of the presence of numerous dead crabs near the mouths of the Semani and Ishmi Rivers.

Beaches near the mouth of Ishmi river are badly impacted by solid waste (Fig. 15) whereas organic compounds in the seawater are so concentrated that the hulls of boats as well as ropes and fishing nets become thickly covered with algae. Likewise, the originally "clean" shells of some C. *caretta* tagged only a month previously usually bear heavy algae (Fig. 16).

Besides organic compounds, hydrocarbons are also washed into the sea by certain rivers such as the Semani.

3. *Chelonia mydas*

3.1. Present distribution and abundance

3.1.1. Nesting sites

There is no evidence of *C. mydas* nesting in Albania.

3.1.2. Marine areas

A green turtle, *Chelonia mydas*, was captured in Albanian waters by fishermen in Patok lagoon in July 2003. Since then some 15 additional specimens have been caught (Haxhiu and Rumano, 2006). All were juveniles measuring less than 50 cm in length. Possibly these specimens arrived in Rodoni Bay along with migrating *C. caretta*. In contrast to loggerheads, all green turtles except one lacked epibionts.

3.2. Past distribution and abundance

Data not available.

3.3. Threats

3.3.1. Terrestrial Habitats

Not applicable, because this species does not nest in this area.

3.3.2 Marine Habitats

3.3.2.1 Incidental catch

All *Chelonia mydas* (16 specimens) were incidental caught by Stavnik (see section 8).

3.3.2.2. Intentional killing and exploitation

Data not available.

3.3.2.3. Other threats

Data not available.

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

A female 133.5 cm CCL was caught in 1960 (Zeko and Puzanoi, 1960), was preserved and is now on display in the Museum of Natural Sciences (Haxhiu, 1995) in Tirana (Fig. 17). In May 2004 an individual with the carapace longer than 1 m was captured in a net set at the mouth of the Drini River.

4.2. Past distribution and abundance

Data not available.

4.3. Threats

Data not available.

5. Other species

Gasc et al. (1997) reported that one of seven hawksbills turtles (*Eretmochelys imbricata*) documented from the Mediterranean was captured off Albania.

6. Conservation status

There are no specific laws for the protection of marine turtles, although Albania supports and is a signatory of international conventions that protect turtles.

- 1971 UNESCO Convention on Wetlands of international Importance especially as Waterfowl Habitat, as amended by the 1982 Paris Protocol and the 1987 Amendments (The Ramsar Convention). - Albania acceded in 29.02.1996
- 1973 UNEP Convention on International Trade in Endangered Species of Wild Fauna and Flora, as amended in 1979. - Albania acceded by Law no. 9021, date 06.03.2003
- 1979 Council of Europe Convention on the Conservation of European wildlife and natural habitats (The Bern Convention). - Ratified by Law no. 8294, date 02.03.1998
- 1979 UNEP Convention on the Conservation of Migratory Species of Wild Animals (The Bonn Convention). - Accession by Law No. 8692, date 16.11.2000

The protection of marine turtles in Albania presents many challenges. There is no strict prohibition on take whatsoever, contributing to their threatened status. Scientific research with marine turtles has been limited and discontinuous. Cooperation with fishermen to protect marine turtles is limited and far from universal in coastal areas.

Public education and awareness of sea turtle conservation is an important conservation activity. Publications, such as booklets, leaflets and posters were produced aimed at public education.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 and participation of school children, university students and fishermen (Fig. 18) during the tagging and release process of sea turtles is important, as well as the meetings with fishermen’s community.

Photos showing sea turtles are powerful method for raising awareness: members of the public, especially children, often want to keep sea turtle photos as a souvenir.

7. Conservation needs

More measures for the future study and protection of marine turtles in Albania are needed, some of which include:

- Establishment of a national organization with trained specialists devoted to the study and protection of marine turtles.
- Increased funding and equipment for marine turtle protection, currently almost non-existent.
- Cooperation among all coastal fishermen with regard to marine turtle conservation.
- Education of fishermen regarding safer fishing gear, raising their general level of awareness of the plight of marine turtles, and support for them, including compensation when their nets have been damaged by marine turtles.
- Establishment of a salt-water aquarium at Patok for the rehabilitation and display of wounded marine turtles.
- Decrease littoral pollution, especially near the mouths of rivers.
- A continuous tagging program.
- Publication and circulation of bulletins about marine turtle protection.
- Engagement of students, particularly of biology students, in academic studies concerning marine turtle protection (licensing of game wardens experienced in handling marine turtles).
- Information on marine turtle conservation spread through mass media.
- Regional (international) participation and sponsorhip of marine turtle conservation in Albania.

8. Miscellaneous

Some fishermen believe marine turtles to be supernatural creatures, and the majority of fishermen consider the entangling of marine turtles in their nets to be a misfortune.

Coastal people are generally indifferent to marine turtles.

The term "turtle" is sometimes used disparagingly to denote a lazy person.

Stavnik – a valuable “new” fishing gear for conservation of marine biodiversity

The Stavnik is a type of fishing weir that came to Albania from the Soviet Union in 1956. Its use was limited in the Ionian and Adriatic seas before 1990, and no stavniks were employed between 1990-2003. Since 2003, more stavniks have been deployed, with 16 being erected in Albanian waters. The newer ones have been manufactured in Albania based upon the original Russian design. The Stavnik is a wall constructed of nets fixed on poles using a 6 mm diameter wire passing from the first pole to the others. One pole is 5 – 8 m long, and driven into the sea bottom to a depth of about 0.5 m (Fig. 19).This fishing method is used mostly from April to August.The catch is 80-150 kg per day but sometime this is 800-1400 kg.The species trapped inside of the Stavnik are: *Rhisostomo pulmo* (Abundant), *Octopus vulgaris* (Rare), *Sepia officinalis* (Abundant), *Loligo vulgaris* (Abundant), *Carcinus mediteraneus* (Abundant), *Squilla mantis* (Abundant), *Monachus monacus* (Very Rare; caught in 1962 near the border of Greece), *Caretta caretta* (Abundant; 0-7 per day caught in Patok by Coastal Nets and Stavnik), *Chelonia mydas* (Very Rare) and about 50 fish species.

In Albania trawl is the most widely used fishing gear. Trawling is done with a wide, large net that is pulled across the sea bottom (10 – 50 m) by fishing boats. During the process of trawling (3-4 hours), animals which are pulled in are submitted to a terrible pressure inside the net basket. In this situation many animals die and others are badly wounded. The use of this type of gear not only damages the marine animals but also destroys the sea bottom and abyssal habitats.

The Stavnik is a valuable alternative fishing gear for the conservation of marine biodiversity.

Species trapped in Stavnik gear are not damaged, but fall passively into the gear chambers where there is sufficient space for swimming and avoiding injury.

After the removal of the target fish by the fishermen, the other animals are released by the fishermen back into the sea.

The advantages of using the Stavnik are:

- Biodiversity protection
- No damage to habitats and sea bottom.
- No loss of life or injury to any marine animal entering the Stavnik.
- No disturbance to marine wildlife.
- Stavniks are generally placed far from the seashore, which minimizes impacts fo fish reproduction.
- Relatively easy to use and requires minimal fuel or energy.

In light of the terrible loss of marine life as by-catch from most conventional fishing methods, it is very important that the Stavnik is widely implemented as fishing gear throughout the Mediterranean region and elsewhere. Experts in the construction and installation of the Stavnik wherever needed can be found in Albania.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

There are no specific institutions in Albania devoted to the management and scientific research of marine turtles. The Museum of Natural Sciences, University of Tirana, has a specialist who studies Albanian herpetofauna including marine turtles.

Small projects for monitoring and conservation of important sea turtle feeding grounds have been sponsored by the Albanian Environmental Ministry during 2004-2006, directed and successfully carried out by the author.

9.2. Private

From 2002-2005, the Albanian Herpetofauna Society (NGO) ran three modest study projects regarding marine turtles, the first of their kind in Albania. These focused on the study of the marine turtles which occur in Rodoni Bay, and to some extent in other Albanian coastal areas (Divjaka, Vlora, Saranda). Moreover, the study paid special attention to the protection of marine turtles.

10 Resources available about marine turtle research and conservation

Albanian Biologists have been conducting research and monitoring projects on sea turtles in the Adriatic and Ionian Seas for about 10 years, with a focus on taxonomic, bioecologic and etiologic data. Data collected on the biology and conservation of sea turtles in Albania have been presented at several national and international conferences, and some papers have been publishedAdditionally, booklets, leaflets and posters aimed at raising public awareness and support of sea turtle conservation have been distributed.

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Figure 1. Albanian coast. The arrow shows Patok area.

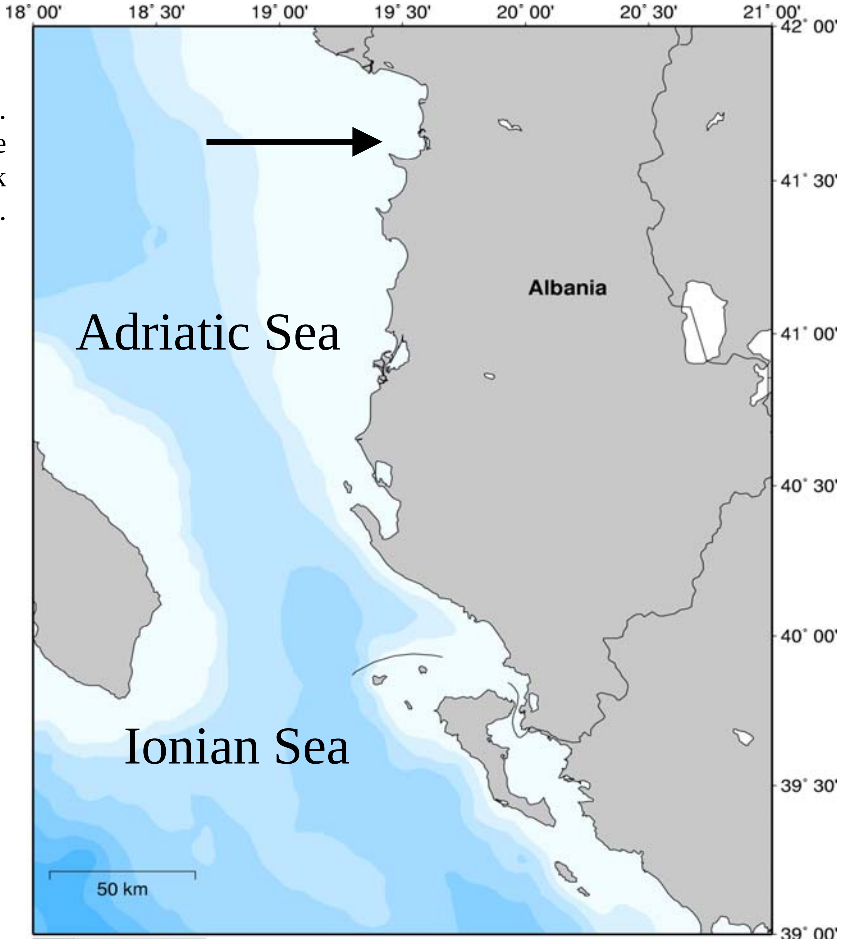


Figure 2. Krorza beach.

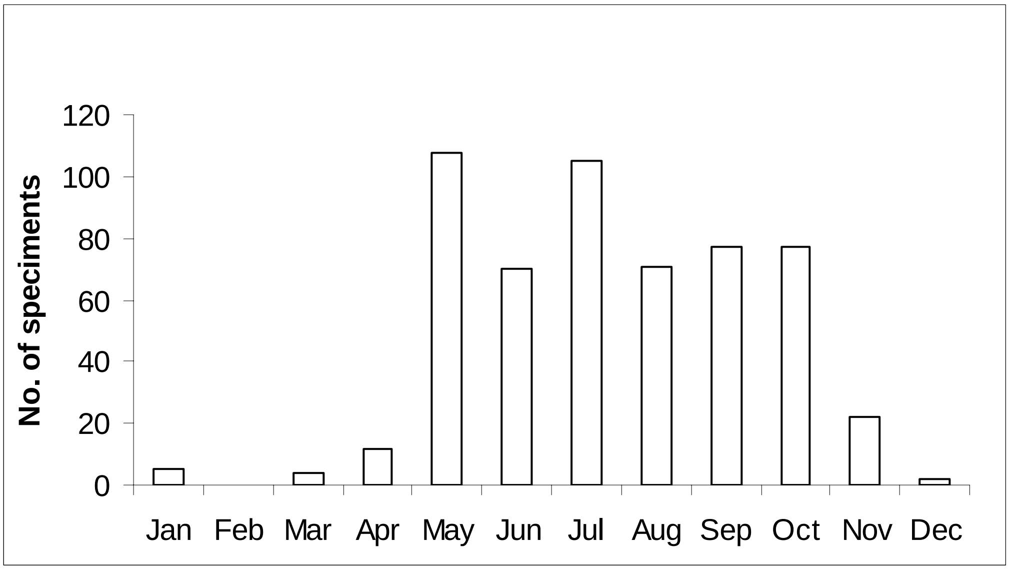


Figure 3. Seasonal distribution of *C. caretta* collected in Rodoni Bay (patok) in the period 2002-2006.

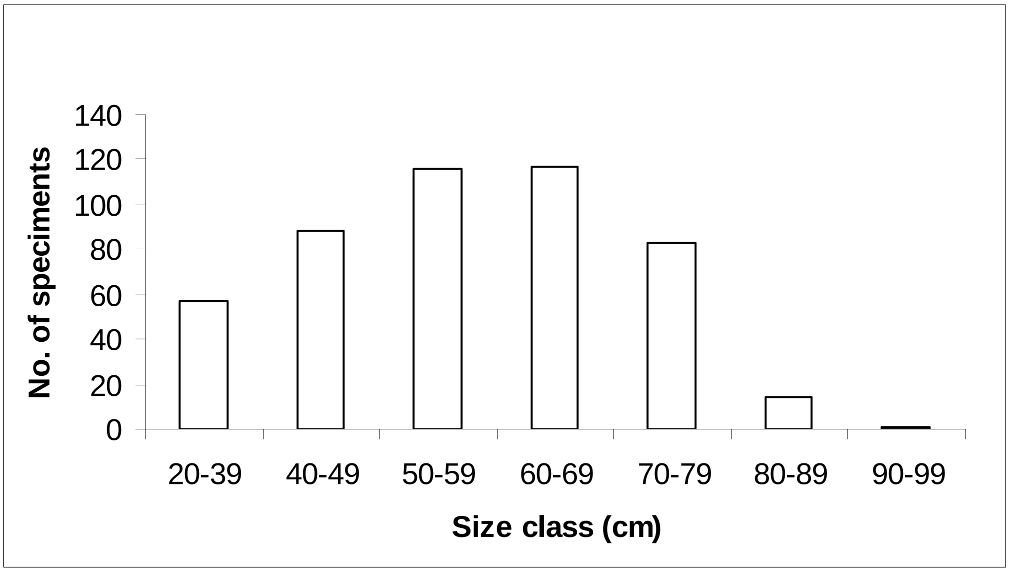


Figure 4. Size frequency (Curved Carapace Length) of 476 loggerhead turtles measured in Patok in the period 2002-2006.

Figure 5.
C. caretta with different algae (Photo: I. Haxhiu).

Figure 6.
C. caretta with barnacles (Crustacea) (Photo: I. Haxhiu).

Figure 7.
C. caretta with *Mytilus galloprovincialis* (Bivalvia) (Photo: I. Haxhiu).

Figure 8.
C. caretta with isopods (Crustacea) in the cloaca (Photo: I. Haxhiu).

Figure 9.
C. caretta with *Serpula sp* (Polychaeta) (Photo: I. Haxhiu).

Figure 10.
C. caretta with fishing line in the mouth (Photo: I. Haxhiu).

Figure 11.
C. caretta with fishing line in the cloaca (Photo: I. Haxhiu).

Figure12.
Mounted *C. caretta* in a restaurant in Patok (Photo: I. Haxhiu).

Figure13.
Mounted *C. caretta* in a restaurant in Saranda (Photo: I. Haxhiu).

Figure 14.
Wounded in *C. caretta* carapace, possibly bitten by a shark (Photo: I. Haxhiu).

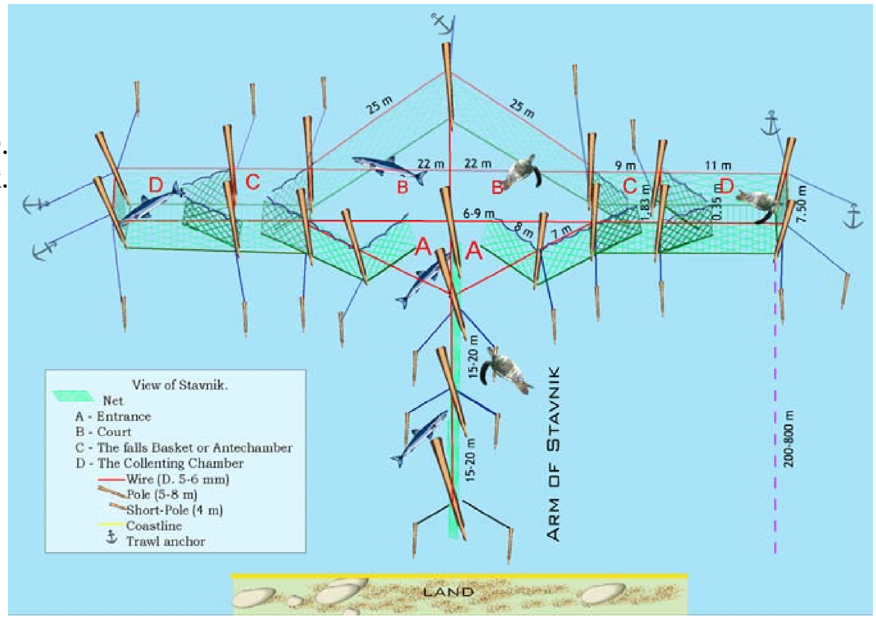
Figure 15.
Pollution at the mouth of Ishmi's river (Patok) (Photo: I. Haxhiu).

Figure 16.
C. caretta covered with algae (*Enteromorpha sp)* (Photo: I. Haxhiu).

Figure 17.
D. coriacea displayed in the Museum of Natural Sciences,Tirane (Photo: F. Osmani).

Figure 18.
Release of some *C. caretta* by fishermen of Godulla (Photo: I. Haxhiu).

Figure19.
The Stavnik.



CROATIA

Bojan LAZAR

Department of Biology, Faculty of Science, University of Zagreb. 6 Roosevelt Sq., HR-10000 Zagreb, Croatia, Department of Zoology, Croatian Natural History Museum, Demetrova 1, HR-10000 Zagreb, Croatia, and Blue World Institute of Marine Research and Conservation, Kaštel 24, HR-51551 Veli Lošinj, Croatia (E-mail: bojan.lazar@hpm.hr)

1. General remarks

With 1777 km of the mainland coastline, Croatian Adriatic coast accounts for the most of the eastern Adriatic mainland coastline(about 75%), which is shared with Montenegro (coastline length: 293 km, or 12% of the total eastern Adriatic coastline), Albania (Adriatic coastline: about 250 km, or 10%), Slovenia (44 km, or 2%), and Bosnia and Herzegovina (21 km, or about 1% of the total eastern Adriatic coastline; Bertić, 1987). Opposite to its western (Italian) part, the eastern Adriatic coast is one of the most indented in the Mediterranean, comprising of 1185 islands and islets, only 47 of which are being inhabited. If all islands and islets are included, the total Croatian coastline length is 5,835 km, while the Croatian Adriatic surface area accounts for about 33,200 km^2 (Central Bureau of Statistics of Republic of Croatia, 2005).

The Adriatic Sea is an elongated basin (139,000 km^2) of the eastern Mediterranean, extending for about 800 km in the European continent. On its southern side the Adriatic Sea is connected to the Mediterranean through the narrow (70 km) Strait of Otrant, with a sill depth of about 800 m. Oceanographically, the Adriatic can be divided into the three major sub-basins which differ in physical characteristics: the northern sub-basin, the central sub-basin and the southern sub-basin (Fig. 1). The shallow northern Adriatic (max. depth < 100 m) comprises the whole coast of Slovenia and northern part of Croatian coast, extending northward from the Zadar (Croatia) – Ancona (Italy) line. The central part [between the Zadar - Ancona line in the north and the Dubrovnik (Croatia) – Monte Gargano, (Italy) line in the south] includes middle Croatian coast and the whole coast of Bosnia and Herzegovina. The central sub-basin also includes the Jabuka Trench (max. depth 270 m), and is separated by the Palagruža Sill (130 m) from the deepest southern Adriatic (southward from the Dubrovnik – Monte Gargano line; max. depth 1270 m). Coasts of this sub-basin are mostly shared by Montenegro and Albania, with only a small part belonging to Croatia.

Overall, the most of the northern and the central Adriatic are below 200 m in depth. Average surface temperatures of the eastern Adriatic oscillate between 21 – 25 ˚C in the summer (August) and 8 – 13 ˚C in the winter (February), which defines Adriatic as a temperate warm sea (Cushman-Roisin et al., 2001; Supić and Orlić, 1992).

The first published notice on sea turtles in the eastern Adriatic date form the middle 19th century, and was related to the loggerhead turtle, *Caretta caretta* (Erber, 1864). Until the end of the 19th century three species were recorded for the eastern Adriatic marine fauna: loggerhead turtle (*C. caretta*), green turtle (*Chelonia mydas*) and leatherback turtle (*Dermochelys coriacea*; review by Lazar and Tvrtković, 1995). However, all published information was related to the sporadic records of individual specimens.

Systematic and continuous research project on sea turtles in the eastern Adriatic Sea, the *Adriatic Marine Turtle Research and Conservation Program* (AMTP), was launched by Department of Zoology, Croatian Natural History Museum (CNHM) in 1993, in cooperation with research institutes, museums and aquariums in Croatia and Slovenia. Today, research and conservation activities are carried out in collaboration with several institutions, coordinated by CNHM.

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

Due to its reproductive needs, loggerhead turtle could be considered as the only marine turtle species with possible individual nesting in the eastern Adriatic Sea, similarly to the nesting case recorded for the Italian Adriatic coast (Basso, 1996). The beach survey carried out along 960 km of the southern Croatian coast (including islands) showed the low number of physically suitable beaches (only five beaches, with a total length of 1,040 m), with different level of anthropogenic impact (Lazar et al., 1997). No sea turtle tracks or nesting activity were recorded. However, irregular presence of typical sea turtle tracks on two beaches on the Mljet Island was reported by local inhabitants (Lazar et al., 2000), and a small juvenile (15 cm in the carapace length) was found washed ashore (Lipej et al., 1987).

In conclusion, most of the Croatian Adriatic coast is unsuitable for loggerhead nesting. Observation of turtle's tracks and physical suitability of sandy beaches on the southern part of the Mljet Island point out the possibility of individual, exceptional nesting events. Interaction of temperature condition ranging in the bottom values for natural egg development, low number and small beaches may explain the lack of regular nesting activities (Lazar et al., 2000).

2.1.2. Marine areas

The Adriatic Sea, along with the Gulf of Gabès in Tunisia, constitutes one of the two most extensive shallow regions in the Mediterranean basin. A wide continental shelf in the northern and the central Adriatic Sea, with an area of about 102,000 km² and depths of less than 200 m (Cushman-Roisin et al., 2001), together with rich benthic communities (Gamulin-Brida, 1967; Kollmann and Stachowitsch, 2001) and temperature regimes (Supić and Orlić, 1992) make this region one of the key neritic feeding habitats for loggerheads in the Mediterranean, shared by juveniles and adults (Lazar and Tvrtković, 2003; Margaritoulis et al., 2003). Size-class analyses and dietary studies showed recruitment of the northern Adriatic by small juveniles (min. CCL = 25.0 cm), suggesting an early ontogenetic habitat shift to neritic habitats (Lazar et al., 2008a). Diet composition analyses of 52 loggerheads (mean CCL: 41.2 ± 9.9 cm) emphasized Anthozoa, Mollusca and Crustacea as the major prey taxa (Lazar et al., 2006a). Analyses of the exclusive species and the preferential species found in the diet pointed out at the community of coastal detritic bottom and the biocoenosis of coastal terrigenous ooze as favourable benthic feeding grounds (Lazar et al., 2002).

Tag returns data showed that on the adult female level, most of the loggerheads in eastern Adriatic belong to the Greek nesting population (94%; Lazar et al., 2004a), with most of the recoveries (about 82%) coming from the shallow (<100 m) northern sub-basin. This region also contains the highest number of tag recoveries of females from Greek nesting sites in the entire Mediterranean (Margaritoulis et al., 2003). In regard to juveniles, genetic (mtDNA) analyses showed the presence of eight haplotypes: two which are shared by Atlantic and Mediterranean populations (Cc-A2 and Cc-A3), four endemic to Mediterranean (Cc-A6, Cc-A26, Cc-A29 and Cc-A32) and two new ones, not yet identified on the nesting beaches (Lazar et al., 2008b). As revealed by the mixed stock analyses, juvenile loggerheads in the Adriatic almost exclusively belong to the regional (Mediterranean) nesting populations, predominantly to the Greek nesting stock (Lazar, unpublished data), and form the Ionian-Adriatic Management Unit (Lazar et al., 2004a).

Beside its importance as a feeding ground, high bycatch of loggerheads in bottom trawls during the winter also indicates the role of Adriatic as a wintering habitat (Lazar and Tvrtković, 1995, 2003;

Casale et al., 2004), with trawl bycatch rates (CPUE) increasing from the western (Italian) part towards its eastern coasts (Casale et al., 2004). Temporal and spatial distribution analysis showed that loggerheads are not homogeneously distributed along the eastern Adriatic costs between the warm (May - October) and the cold period (November – April). During the warm period, loggerheads are present along the whole coast. However, during the cold period there are major temperature differences between the northern and the central eastern Adriatic sub-basins. In the northernmost parts, the sea temperature may drop even to 8 °C, which is within the cold-stunning temperatures for loggerheads (Spotila et al., 1997). This temperature drop most likely triggers seasonal wintering movements from the northernmost regions towards south, to areas with the sea temperature above 11-12 °C. These areas seem to be situated southern of about 45°N and constitute over-wintering habitats (Lazar et al., 2003). With the increase of sea temperature in April/May turtles become more active, and a part of the overwintering populations return back to foraging and developmental habitats in the northern Adriatic. This seasonal movement model is supported by the lack of loggerhead records in Slovenian waters during the winter (Lazar et al., 2003), and by tag returns data from the northern Adriatic (Lazar and Žiža, personal data). Furthermore, despite the existence of seasonal north-south movements, repeated tag recoveries in the northern Adriatic have also pointed out on the site fidelity of loggerheads for Adriatic neritic feeding habitats (Lazar et al., 2004a; Casale et al., 2007).

2.2. Past distribution and abundance

All historical records refer to findings of individual specimens (see review by Lazar and Tvrtković, 1995), so no quantified data about the past distribution are available. However, narrative information from the end of the 19th century describes loggerheads as "*not rare, often caught by fishermen, and sometimes specimens weighed even more than 100 kg*" (Kolombatović, 1881, 1882). Despite such historical records, until the launch of AMTP, general public, and even biologists, considered loggerheads as rare and exceptional visitors. Similarly, no information on population trend exists, but according to professional fishermen opinion, the number of turtles caught or seen decreased during the 1980 – 1990 period (Lazar and Tvrtković, 1995).

2.3. Threats

2.3.1. Terrestrial Habitats

As nesting was never confirmed on Croatian coast, it is not possible to talk about specific threats to nesting habitats and nesting females. However, based upon physical characteristics, five beaches have potential to host nests. Due to ecological characteristics, these beaches represent rare and valuable habitats in Croatia.

Coastal development and heavy touristic impact is present on all five beaches physically suitable for loggerhead nesting. The heaviest touristic exploitation has been recorded at the Pržina Beach (Korčula Island) and the Šunj Beach (Lopud Island; Fig. 1). Until 1990, three remained beaches on the Mljet Island were almost without any touristic infrastructure, due to the presence of military base (Lazar et al., 2000). However, massive touristic development and illegal building are strongly visible today.

According to the unconfirmed interview in one Croatian newspaper, turtle eggs were used in the past for domestic consumption on the Mljet Island. However, this was never mentioned when interviewing local inhabitants during the beach survey project (Lazar et al., 1997), so this information is questionable.

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

Fisheries bycatch is surely the major threat to loggerheads in the eastern Adriatic. Based on the interviews with professional fishermen, bottom trawl bycatch was conservatively estimated at a minimum of 2,500 captures per year, with much higher bycatch rate in the northern *vs.* central and southern sub-basins (10 turtles/year/vessel *vs.* 3-4 turtles/year/vessel, respectively; Lazar and Tvrtković, 1995). However, on-board trawl bycatch monitoring program that is in place in the Croatian northern Adriatic waters confirms suspicion by Casale et al. (2004a) that CPUE is likely higher than the originally reported by fishermen (Lazar, personal data). The peak of bottom trawl bycatch occurs in the “cold” (winter) season, in waters with the sea temperature >11-12 °C (Lazar et al., 2003). It should be noted that the bycatch rates (CPUE) increase for about 10 folds from the colder western Adriatic (Italy) towards east (Casale et al., 2004), which additionally indicates an important role of Croatian waters as a wintering habitat for loggerheads.

Direct mortality in bottom trawls seems to be relatively low (12.5%, Lazar et al., 2003), but higher than in its western waters (9.4%, Casale et al., 2004), most likely due to longer haul duration (mean duration in Croatia: 367 ± 57 min, Lazar et al., 2007a; mean duration in Italy: 111 ± 45 min, Casale et al., 2004). No information on delayed mortality exists so far, but if the haul duration is considered, it is likely that the potential trawl mortality might be even higher than 43% as recorded in the western Adriatic (Casale et al., 2004).

Another fishery with concerning impact on loggerheads in the eastern Adriatic is the gill net (static net) fishery. Based upon interviews with professional gillnet fishermen and data on the incidental capture of individual turtles in the northern Adriatic (Slovenia and Croatia) in 2000-2005, gill net bycatch was conservatively estimated at 658 captures/year, with direct mortality of 74.7%. This estimate was based upon the number of exclusive gillnetters only. However, if the CPUE of exclusive gillnetters is also extrapolated to multifunctional vessels, total gill net bycatch may potentially be as high as 4,038 captures/year, suggesting a significant conservation concern for loggerheads in the northern Adriatic (Lazar et al., 2006b). CPUE of 3-layers trammel nets was 3-4 folds higher than of the 1-layer gillnets, and the gillnet bycatch was significantly associated with the warm period of year (May-October).

No quantitative data exists on interactions of other fisheries with loggerheads in eastern Adriatic, but several turtles were found with a longline hook in their digestive tract.

2.3.2.2. Intentional killing and exploitation

Marine turtles' meat was included on a price-list of some unpublished statistical reports between 1895 and 1987, whilst carapaces were used for taxidermy and often had a decorative purpose in restaurants along the coast (Lazar and Tvrtković, 1995). After the legal protection in 1995 and public awareness campaigns carried out by AMTP in the past decade, intentional killing is today absent or negligible.

2.3.2.3. Other threats

Although it is difficult to link marine pollution with direct mortality of sea turtles, it may impact the health status and, consequently, viability of resident populations. Marine debris was found in 35.2% of loggerheads, with plastic being prevalent debris type, recorded in 24.1% out of 54 turtles examined (Buršić et al., 2008). Ecotoxicological studies pointed out on high Hg and Cd tissue burdens, which are the highest ever recorded among all sea turtle species worldwide (Hg in kidney and pectoral muscles), or the highest recorded in Mediterranean loggerheads (renal Cd; Lazar et al., 2007b). Likewise, concentrations of some organochlorine contaminants in the fat tissue of loggerheads from the eastern Adriatic (PCB-153, PCB-138 and PCB-118) are higher than recorded in the western Adriatic, but still lower than in loggerheads from other parts of Mediterranean (Lazar et al., *in review*). However, despite possible sub-lethal effects, there is no clear evidence that pollution has directly caused death of any turtle.

Cases of boat strikes have also been recorded, leading to the injuries of carapace, extremities (limbs) and head, whilst one loggerhead has been euthanized due to severe polytraumatic traumas (Lazar, personal data). However, mortality due to boat strikes has not yet been quantified.

3. *Chelonia mydas*

3.1. Present distribution and abundance

3.1.1. Nesting sites

No nesting has ever been recorded.

3.1.2. Marine areas

Although it nests in the Mediterranean, the green turtle is the species with the lowest number of documented records in the Adriatic, even when compared to leatherback turtle. Detailed review on the presence of green turtle in the Adriatic was recently provided by Lazar et al. (2004b). The majority of Adriatic records refer to juveniles with a carapace length of 28-40 cm, recovered in the southern sub-basin. It is therefore suggested that this region may contain pelagic habitats for the species (Lazar et al., 2004b).

3.2. Past distribution and abundance

Data not available.

3.3. Threats

3.3.1. Terrestrial Habitats

Not applicable, because this species does not nest in this area.

3.3.2 Marine Habitats

3.3.2.1 Incidental catch

During 15 years of AMTP activities, only one out of more than 100 turtles handled was a green turtle (Lazar et al., 2004b). This turtle was, however, captured dead in the gill net, and reported by the fisherman as a loggerhead turtle. Although fishery bycatch most likely have only limited impact on the regional nesting populations due to the low occurrence of green turtles in Croatian waters, two things should be considered: first, majority of Croatian fishermen do not distinguish green from loggerhead turtle, and second, the most of AMTP activities are carried out in the northern Adriatic, resulting in much lower research effort in the southern sub-basin. Hence it is possible that the number of green turtle records and bycatch frequency may be underestimated.

3.3.2.2. Intentional killing and exploitation

Not an issue due to the low occurrence of the species in Croatian waters.

3.3.2.3. Other threats

Not an issue due to the low occurrence of the species in Croatian waters.

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

Recent review of the occurrence of leatherbacks in the eastern Adriatic suggested that the southern Adriatic Sea may be potentially relevant as a summer foraging habitat for leatherbacks within the Mediterranean (Lazar et al., 2008c), as it seems to be an important habitat for other large pelagic vertebrates (e.g. Cuvier's beaked whale; Holcer et al., 2007) or their oceanic developmental stages, like for green and loggerhead sea turtles (Lazar et al., 2004b; Casale et al., 2005). Adriatic leatherback findings were all distributed between July and December, with a peak in the summer (83.3%), whilst size-class analysis showed that all turtles were large immatures and adults of both sexes. Immigrations into the Mediterranean and Adriatic Sea thus take place in large juvenile and/or adult stage, most likely for trophic reasons (Casale et al., 2003).

4.2. Past distribution and abundance

Data not available.

4.3. Threats

4.3.1. Incidental catch

The most of eastern Adriatic leatherback records (61.5%) derived from incidental capture in fisheries, mostly from gillnets. Though only one capture resulted in direct dead, gillnets seems to be a dominant threat to leatherbacks in the eastern Adriatic (Lazar et al., 2008c).

4.3.2. Intentional killing and exploitation

The first three leatherbacks recorded in the eastern Adriatic were all killed and preserved for collections of natural history museums in Croatia (see Lazar et al., 2008b for a review). Nowadays, intentional killing is not an issue; quite contrary, every time when leatherback was captured alive, fishermen tried to release it and they reported the findings to AMTP.

4.3.3. Other threats

Not an issue due to the low occurrence of the species in Croatian waters.

5. Other species

No other species have been recorded in the Croatian waters.

6. Conservation status

Since1995, three sea turtle species recorded in Croatian waters, namely the loggerhead, the green and the leatherback turtle have been legally protected (Nature Protection Act, OG No. 162/03), with loggerhead and green turtle being included in the Red Book of Amphibians and Reptiles of Croatia (Janev Hutinec et al., 2006). As a candidate for EU membership, Croatia is also obligated to protect the species listed in the Habitat Directive, which also includes sea turtles.

In addition, Croatia is also a party of the following international conventions relevant for sea turtle conservation:

- Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention)
- Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA and Biodiversity Protocol)
- Convention on Biological Diversity (CBD)
- Convention on the Conservation of Migratory Species of Wild Animals (CMS) – Bonn Convention
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Convention on the Conservation of European Wildlife and Natural Habitats – Bern Convention.

7. Conservation needs

In the past 15 years of the implementation of AMTP a vast amount of scientific information on biology of loggerheads and the role of Adriatic Sea as the critical marine habitat of the Mediterranean importance have been collected. Although conservation of sea turtles is listed as a high priority in the National Strategy and Action Plan for the Protection of Biological and Landscape Diversity adopted by Croatian National Parliament in 1999, and despite obligations following ratification of international treaties, responsible state authorities failed to draw and implement any conservation strategy at the national level. Opposite to the National Strategy and following plans (Radović and Jelenić, 2003), all conservation and education activities so far have been designed and implemented by the staff and institutions involved in AMTP, without any initiative from the responsible state institutions. Hence (i) active, responsible involvement of the state authorities and stakeholders, along with (ii) allocation of necessary funds are the main perquisite for implementation of any successful conservation measures it the future.

As said above, fisheries bycatch is the major threat to loggerheads in Croatia, as well as in the whole Adriatic Sea, with direct impact on the Greek nesting population (Margaritoulis et al., 2003; Lazar et al., 2004a, 2008b;). But beside mortality, some fisheries (e.g. bottom trawling) are causing additional impacts on sea turtles. First, bottom trawling in wintering habitats may have disruptive effect on most likely torpid/inactive turtles; still no information is available how this may affect physiology and survival of over-wintering loggerheads. Second, bottom trawling is a destructive fishing technique, which alters benthic communities used by turtles as feeding habitats.

Therefore, conservation should be planned at several and parallel levels. First, there is an urgent need to reduce post-release mortality of turtles, especially in bottom trawls. This may be achieved by means of a wide awareness campaign providing fishermen with correct turtle handling procedures (Gerosa and Aureggi, 2001). Such campaign can be implemented on the short-time scale, but it would require (i) coordinated action of several state institutions at the national level and (ii) setting of a national stranding network as the crucial perquisite. The State Institute for Nature Protection of Croatia, in cooperation with UNEP MAP-RAC/SPA, has published the booklet by Gerosa and Aureggi (2001) in Croatian language, but they failed to organize educational campaign that should be linked with its distribution, so this valuable educational tool was never disseminated to fishermen.

Second set of measures include reduction of the fishing effort through (i) better enforcement of the existing fishing legislative, particularly for gill nets, and (ii) seasonal and/or spatial closures, if determined as necessary. This set of conservation measures would require active involvement of different state authorities and stakeholders, more time and certain changes in the existing legislatives. But in order to do so, some additional, specific conservation – orientated research is urgently needed. This primarily includes studies on the habitat use and behaviour, and validation of bycatch data through on-board observer program.

8. Miscellaneous

None.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

- Department of Zoology, Croatian Natural History Museum (research, conservation, education)
- Department of Biology, Faculty of Sciences, University of Zagreb (research, conservation)
- Centre for Marine Research, “Rudjer Boskovic” Institute (research)
- Institute of Oceanography and Fisheries (research)
- Institute of Marine and Coastal Research, University of Dubrovnik (rescue, research)
- Institute for Medical Research (research)
- State Institute for Nature Conservation (conservation, policy)
- State Directorate for Nature Protection, Ministry of Culture (conservation, policy)

9.2. Private

- Aquarium Pula (rescue, rehabilitation)
- *Blue World* Institute of Marine Research and Conservation (research, rescue, education)
- *Natura* – Society for the Nature Conservation of Croatia (education)

10 Resources available about marine turtle research and conservation

None.

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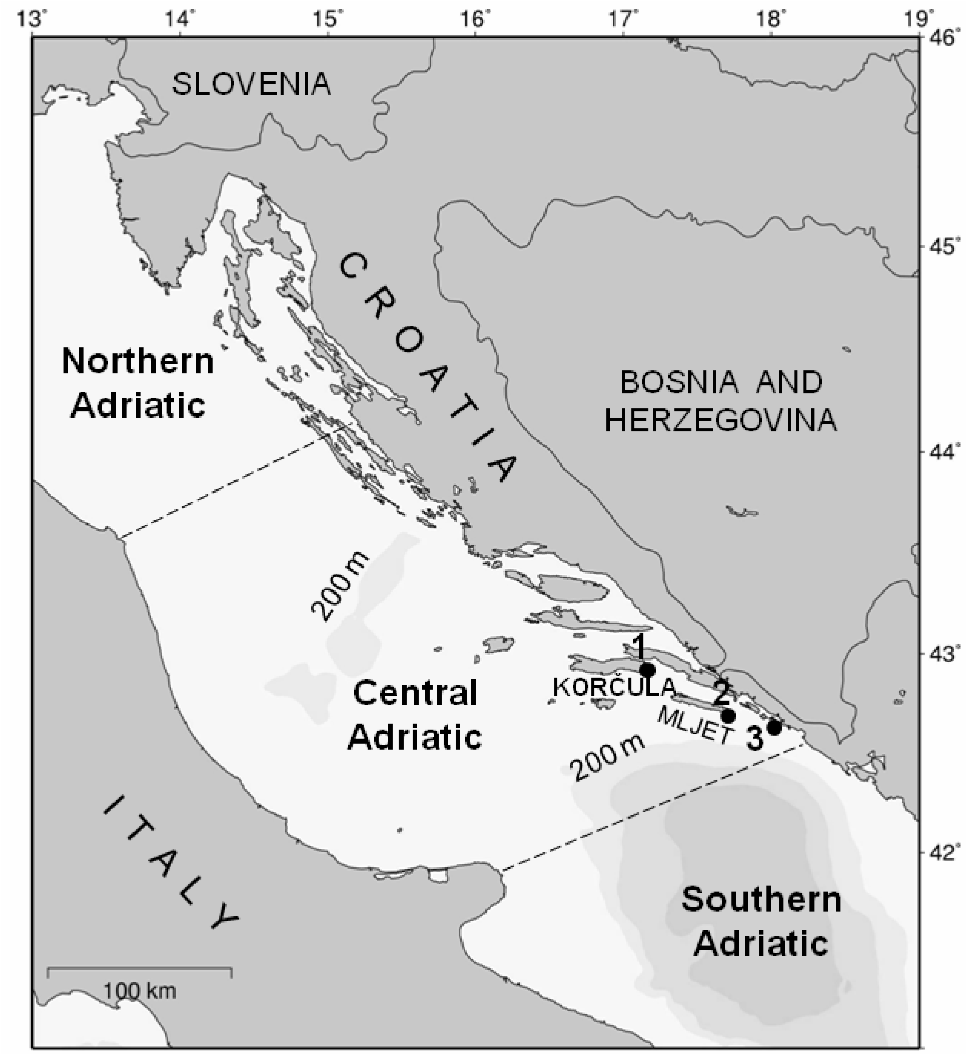

Figure 1. The Adriatic Sea, with division into the three sub-basins and 200 m isobath (beaches physically suitable for loggerhead nesting: 1 – Pržina Beach, Korčula Island; 2 – Saplunara Beach and Blace Beach, Mljet Island; 3 – Šunj Beach, Lopud Islet; according to Lazar et al., 1997, 2000).

CYPRUS

Editorial note.

The two regions (A and B) of the island of Cyprus (as defined in Fig. 1) will be treated separately in the next two sub-chapters. However, the sub-chapter Region B does not cover the coastal tracts of the British sovereign military bases, where some nesting has been recorded (MacLean et al., 1998; Downie, 2003; Rogers, 2008).

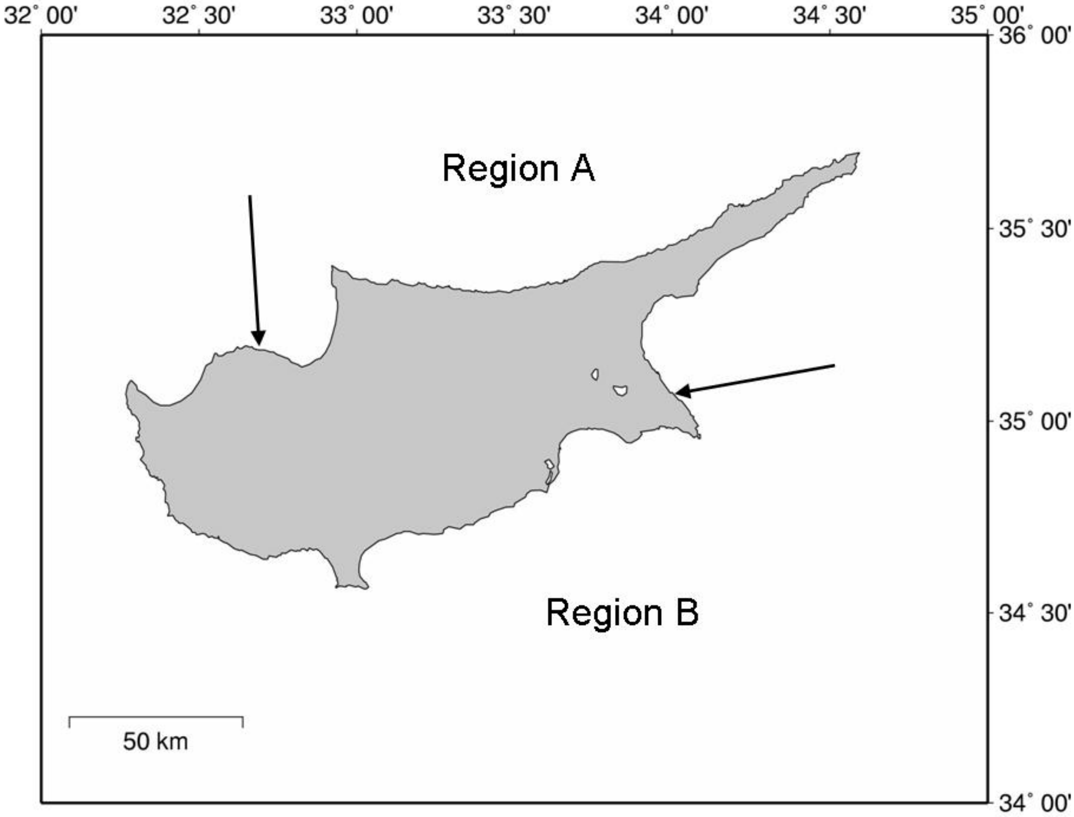

Figure 1. Cyprus island. The tracts of the coast included in Region A and B are shown by the arrows.

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CYPRUS - REGION A

Wayne J. FULLER[1,2,3], Annette C. BRODERICK[2], Fiona GLEN[4], Hasibe KUSETOĞULLARI[5], Brendan J. GODLEY[6]

[1]Faculty of Agricultural Science and Technology, European University of Lefke (E-mail: wfuller@seaturtle.org), [2]Marine Turtle Research Group, Centre for Ecology and Conservation, University of Exeter (E-mail: A.C.Broderick@exeter.ac.uk), [3]Society for the Protection of Turtles, [4](E-mail: fglen1@hotmail), [5]'ministry of environment and natural resources' (hkuset@yahoo.com), [6]Marine Turtle Research Group, Centre for Ecology and Conservation, University of Exeter (E-mail: B.J.Godley@exeter.ac.uk)

1. General remarks

Two species of marine turtle are found nesting, foraging and over-wintering around the coast of Region A, these are the loggerhead turtle (*Caretta caretta*) and the green turtle (*Chelonia mydas*). The first assessments on the nesting of turtles in this region were carried out in 1988 (Groombridge, 1988, 1990; Groombridge and Whitmore, 1989). These surveys estimated that the annual nesting population was between 25-50 *C. mydas* and 50-75 *C. caretta*. A local NGO, The Society for the Protection of Turtles received local recognition in 1990 and, in conjunction with the responsible bodies for Environmental Protection, coordinates relevant research and conservation activities. Systematic monitoring began in 1992, cataloguing a total of 88 beaches which showed signs of turtle nesting activity (Godley and Broderick, 1992; Broderick and Godley, 1996). It has been estimated that this region supports approximately 30% of green turtle nesting and 10% of loggerhead nesting of the entire Mediterranean (Broderick et al., 2002). At Alagadi Beach (Alakati beach) (35°33'N, 33°47'E), intensive night-time monitoring has been on-going since 1992, including the use of both flipper and PIT tags (Broderick and Godley, 1999; Godley et al., 1999) allowing detailed information to be gathered on the reproductive strategies of individual females. The results of this study are detailed in Broderick et al. (2003) and summary data presented here (Fig. 1).

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

Loggerhead nesting is found on nearly all the sandy beaches around the entire coastline; from Magosa bay (Famagusta bay) in the east to Guzelyurt Bay (Morphou bay) in the west (Zone 5; Fig. 2). The three sites which have been found to support the greatest amount (ca. 40%) of loggerhead turtle nesting in the region are Alagadi Beach (Alakati) (beaches 76-77: 17.3%), Akdeniz (Ayia Irini) (beach 85: 12.4%), Tatlisu (Akanthou) (beach 71: 10.3%). Summary data for the zones subject to the most consistent monitoring are given in Table 1.

Loggerhead turtles nesting at Alagadi Beach (Alakati beach) range in curved carapace length from 63-87 cm (mean = 73.6 cm, SD = 4.6 cm, n = 159; 1992-2000; Fig. 1a), typically lay 1.9 clutches (SD = 1.2, n = 168; 1995-2000; Fig. 1b) of 73 eggs (SD = 16, range 28-144, n=229; 1993-2000; Fig. 1c) breeding every 2 years (IQ range = 2-3, range 1-6, n = 44; 1992-2000; Fig. 1d; Broderick et al., 2003).

2.1.2. Marine areas

There is a great paucity in the information regarding the marine areas utilised by loggerhead turtles around the region although preliminary information on the behaviour of inter-nesting females has been ascertained using time depth loggers (Houghton et al., 2002), satellite transmitters and light based geolocation loggers (Godley et al., 2003, Fuller et al., 2008). Additional information from turtle strandings, fisher interviews and other anecdotal reports suggest that the region supports unquantified stocks of differing age classes (Godley et al., 1997, 1998a,b). Satellite tracking of post-nesting loggerhead turtles from beaches on the north coast has shown that they have a wide geographical distribution. Some individuals have remained along the coast of Cyprus, whereas others have travelled as far as Tunisia. The majority, however, have been shown as residing along the North African coast (Godley et al., 2003; Broderick et al., 2007; Fig 3).

2.2. Past distribution and abundance

Whilst the number of loggerhead turtles nesting at Alagadi Beach (Alakati beach) has declined over the past 15 years, around the entire coast numbers appear to be stable, with significant increases at some locations (Fuller, 2008).

2.3. Threats

Since it is difficult to identify species-specific threats, this section concerns both *Caretta caretta* and *Chelonia mydas.*

2.3.1. Terrestrial Habitats

2.3.1.1. Coastal development

This has become an increasing problem in recent times. The drive to provide more beach front tourist hotels and properties is becoming a problematic issue, with some beaches suffering as a result. Infrastructural improvements, such as new road building schemes, have led to the destruction of one nesting beach (beach 75, constituting about 1% of the total loggerhead nesting) and some severe damage to other beaches and associated dune systems, which in turn has led to extensive localised terrestrial erosion (beach 77).

2.3.1.2. Beach restructuring

There have been some localised attempts at beach restructuring. One of the early problems faced was the removal of large quantities of sand from Alagadi beach (Alakati beach). This has since been stopped however it does happen on a small scale at some other locations.

2.3.1.3. Non human predation

This currently constitutes the single most important threat to marine turtle reproductive success in the region, with predation by feral dogs and foxes constituting as much as 38% of clutches laid in a single year along the entire coastline of the region for both species (mean 17.7%, range 8-38%). This has been greatly reduced by nest screening at many sites. It seems that loggerhead nests are more likely to be predated by dogs and foxes, however, there is a great amount of annual variation between species, beaches and years.

We have also recorded numerous invertebrates infesting loggerhead turtle clutches (Broderick and Hancock, 1997). Whilst some species are known to attack viable eggs, the majority are likely to infest moribund eggs, thus not posing a major threat to clutch success at current levels (McGowan et al., 2001a,b). Lower levels of infestation recorded in green turtle clutches are likely a result of their greater depth. Ghost crab predation also occurs, however, this is not thought to be significant. Bird predation mainly happens after a clutch has been dug up by dogs or foxes. Occasionally, birds will take hatchlings that have emerged during daylight hours, again this is not thought to be significant.

2.3.1.4. Human exploitation

There are no reported recent incidences of the deliberate exploitation of turtle eggs, meat, carapace etc in the region. There is some historical evidence from archaeological sites, where turtle carapaces and bones have been discovered around Neolithic habitations, suggesting some low level exploitation.

2.3.1.5. Other threats

Climate Change. An extremely female biased hatchling sex ratio (c.90% female) is already thought to exist for both species breeding in the region. This, together with future predicted rises in global temperatures raises concerns for the future of marine turtles in the region (Broderick et al., 2000; Godley et al., 2001a,b; Reece et al., 2002; Fuller, 2008). With only a 2˚C rise in mean nest temperature, almost complete feminisation could occur. In addition to this, higher incubation temperatures which exceed the thermal tolerance for embryonic development are likely to increase the level of embryo/hatchling mortility.

2.3.2 Marine Habitats

Due to the oceanic currents around Cyprus, ocean-borne litter, has been a significant problem at some locations (see Figs. 4 and 5), this however, has been considerably improved in recent years with annual organised beach cleaning campaigns.

2.3.2.1 Incidental catch

Although fishing is at a relatively low level in the region, there is considerable incidental catch by artisanal fisherman. The fishing effort is relatively constant throughout the year; however, there appears to be a greater number of individuals caught during the summer months. It is estimated that there are approximately 180 fishing vessels using a combination of longlines and gill/trammel nets in the region. It is estimated that the median number of turtles captured by fishermen is 4 turtles/year/boat, with a 10% mortality rate (Godley et al., 1998a,b). It is difficult to state if there is a species difference in the capture rates between loggerhead and green turtles as most fishermen when questioned could not distinguish between the two species.

2.3.2.2. Intentional killing and exploitation

There is limited evidence that killings are carried out by fishermen, who believe turtles damage their nests and eat their catch (Godley et al., 1998a,b).

2.3.2.3. Other threats

Boat strike. The increased levels of tourism have led to a greater use of the marine habitat. Speedboats and Jet Skis are becoming more numerous every year and with this an increased likelihood of physical injury from boat or Jet Ski strikes. There have been a few boat strikes reported in recent years, particularly in the Girne (Kyrenia) area. However, this may not be a hotspot just reporting bias due to the fact that the turtle project base is close to Girne (Kyrenia).

3. *Chelonia mydas*

3.1. Present distribution and abundance

The green turtle (*Chelonia mydas*) is globally endangered and until recently green turtles in the Mediterranean Sea were considered a relatively discrete population from those of the wider Atlantic Ocean (Bowen et al., 1992). However, currently this is not the case and the critically endangered status has been reduced to endangered inline with the wider Atlantic population (Mast et al., 2006).

3.1.1. Nesting sites

The nesting of green turtles has been recorded around the Region A, but at fewer sites than loggerhead turtles (Fig. 6). The main nesting areas are North Karpaz (beaches 51-56), Alagadi (Alakati) (73-77), South Karpaz (32-33, 34-35, 38-39 and 45-46) and the West Coast (82-84) (Zone 5;.Fig. 2). This constitutes nine different sites which account for 81-93.9% of all recorded nesting for this species along the coast of the region, and whilst not significant, a general downward trend has been recorded in green turtle nesting over the past 15 years; summary data for the zones subject to the most consistent monitoring are given in Table 1. These data are in preparation for publication elsewhere.

As in most other green turtle populations world-wide, there is large inter-annual variation in the number of clutches laid in the region, thought to be related to the low trophic status of this species (Broderick et al., 2001). At Alagadi Beach (Alakati beach), individual females typically lay fewer clutches in poor breeding years (Broderick et al., 2003). Green turtles nesting at Alagadi Beach (Alakati beach) ranged in CCL from 77-106 cm (mean = 91.54, SD = 6.3 cm, n = 92; 1992-2000; Fig. 1a) laying on average three clutches (SD = 1.4, n = 97; 1995-2000; Fig. 1b) of 115 eggs (SD = 27, range 51-199, n = 277; 1993-2000; Fig. 1c) every three years (IQ = 2-3, range 2-6, n = 46; 1992-2000; Fig. 1d; Broderick et al., 2003).

3.1.2. Marine areas

There is little information regarding the marine areas utilised by green turtles around the coast of the region, however there are extensive sea grass beds to provide suitable foraging around the coastline. Information from strandings, fisher interviews and other anecdotal reports suggest that the region supports unquantified stocks of differing age classes (Godley et al., 1998a,b). Preliminary information on the behaviour of inter-nesting females has been ascertained using time depth loggers (Hochscheid et al., 1999; Glen et al., 2001; Hays et al., 2002a,b,), satellite transmitters and light based geolocation loggers (Godley et al., 2002; Fuller et al., 2008). Observations have been made of mating green turtles off the coast, and in one season females were observed on the nesting beach with males still attached (Broderick and Godley, 1997).

From satellite tracking studies, adult female green turtles which nest on the coast of the region have key over-wintering/foraging grounds in Libya and Turkey (Fig 7; Godley et al., 2002; Broderick et al., 2007). There is however, little knowledge on the population numbers and structure for green turtles around this coastline.

3.2. Past distribution and abundance

Although not significant, a general downward trend has been recorded in green turtle nesting over the past 15 years (see 3.1.1.).

3.3. Threats

Since it is difficult to identify species-specific threats, they are reported in section 2.3 for both *Caretta caretta* and *Chelonia mydas*.

4. *Dermochelys coriacea*

Data not available.

5. Other species

Data not available.

6. Conservation status

Systematic monitoring began in 1992, cataloguing a total of 88 beaches which showed signs of turtle nesting activity (Godley and Broderick, 1992; Broderick and Godley, 1996). It has been estimated that Region A supports approximately 30% of green turtle nesting and 10 % of loggerhead nesting of the entire Mediterranean (Broderick et al., 2002).

Under local legislation it is illegal to disturb, harm, and capture loggerhead and green turtles. To date there are a total of four protected sites around the coast of Region A, these have been designated Special Protected Areas by the local authorities. One of these, Alagadi Beach (Alakati beach) has the greatest number of loggerhead nests of any site. The other protected sites are Karpaz Peninsula (including beaches 40-56), South Karpaz (beaches 30-39) and Akdeniz (Ayia Irini) (beaches 81-85). These areas contain the third and fifth most important green turtle nesting areas in the entire Mediterranean (Kasparek et al., 2001) along with all other major nesting beaches for green turtles. One other major nesting site (Tatlisu (Akanthou) beach number 71) for loggerhead turtles is still under consideration.

7. Conservation needs

There is an urgent requirement for the designation of more protected areas combined with greater enforcement of the current legislation. There is also the necessity for more financial and manpower resources to be allocated to conservation in general. Currently, there are moves afoot to propose more protected sites (Karpaz peninsula, West coast beaches (Zone 5;.Fig. 2) and some more north coast beaches);

however, this is dependent on the agreement of "ministers". Another urgent requirement is the need for a conclusive and cohesive coastal zone management plan, in order to conserve and protect constituent ecosystems. Research needs to include a thorough assessment of the local population found inhabiting the waters of the region, together with an extensive survey and mapping of all major sea grass beds. Continued monitoring and nest protection of the major nesting areas is required.

8. Miscellaneous

None.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

Currently in the region there is a Nature Protection Section within the responsible bodies for Environmental Protection, under the control of the 'ministry of environment and natural resources'. This Nature Protection Section is severely undermanned and under funded. However, during the past 17 years they have been actively involved with turtle conservation and education. In recent years staff have made regular school visits to give information about turtles and nature in general. For the last 10 years they have carried out turtle conservation work in the Karpaz region (Zones 2 and 3).

9.2. Private

A local NGO, The Society for the Protection of Turtles (SPOT) received official recognition in 1990 and, in conjunction with the responsible bodies for Environmental Protection, coordinates relevant research and conservation activities, standardised throughout the region. This NGO has worked closely with local public bodies, the Marine Turtle Research Group currently based at Exeter University and many international researchers. This NGO has been one of the most active NGOs in the region. Their lobbying managed to secure the first Specially Protected Area designation for nature in the region (Alagadi beach (Alakati beach)), and since this more have been added. Of particular importance for green turtles the Ronnas Bay and Ayios Philon area on the Karpaz peninsula. In conjunction with the Marine Turtle Conservation Project over 4000 people partake in an organised turtle watch or hatchling release each season. This constitutes a valuable tourist attraction in giving turtles and their conservation a tangible value in the economy.

10 Resources available about marine turtle research and conservation

A report is produced annually together with frequent newspaper, magazine, radio and television articles. During the nesting season a weekly turtle diary is written in a national newspaper, informing people of things that have happened over the past week and informing people of any special events coming up.

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All this work would not have been possible without the help of numerous individuals in Cyprus. However, there are a few key individuals without whom the successes this monitoring and conservation work has achieved would not be possible. Three of them are the founder members of SPOT. Kutlay Keco: whose generosity has saved the conservation project thousands of pounds during its 17 years. Also, with his incredible influence at many different levels has smoothed the way for the day to day running of the conservation effort. The late Major Ian Bell and his wife Celia, whose dedication, generosity and organisational skills have played a huge part in how the turtle conservation in the region is carried out. Another important Cypriot is Savas Kalfaoglu who works for the responsible bodies for Environmental Protection and particularly in the early years was an invaluable member of the project team. A big vote of thanks to all of our sponsors over the years and in particular to Cyprus Turkish Airlines, Turkcell, British High Commission, UN. Finally, to all of those that are not mentioned here, but have helped out in so many different ways a very big thanks to you all.

Table 1. Breakdown of the total and mean turtle activity between zones 1,4 and 5 and species between the years 1993-2007. FCA - false crawl attempt; this is where a female turtle attempts to nest but returns to the sea without depositing her eggs. FCU: false crawl 'U' turn; this is when the female returns to the sea without attempting to nest. ES%: emergence success, calculated as Nests+FCA+FCU/Nests*100. HS%: hatch success; this is the number of hatched nests divided by the total nests.

			Mean/Year					
Species	**Zone**	**Length(km)**	**Nests**	**FCA**	**FCU**	**HS%**	**ES%**	**Nests km^{-1}**
C.caretta	1	8.2	41	63	49	60.6	27	5.0
	4	4.6	123	136	95	62.6	34	26.8
	5	7.2	72	118	103	59.5	24	10.0
C.mydas	1	8.2	1	1	1	50.0	25	0.1
	4	4.6	61	72	89	79.9	37	13.4
	5	7.2	42	56	48	52.9	29	5.9

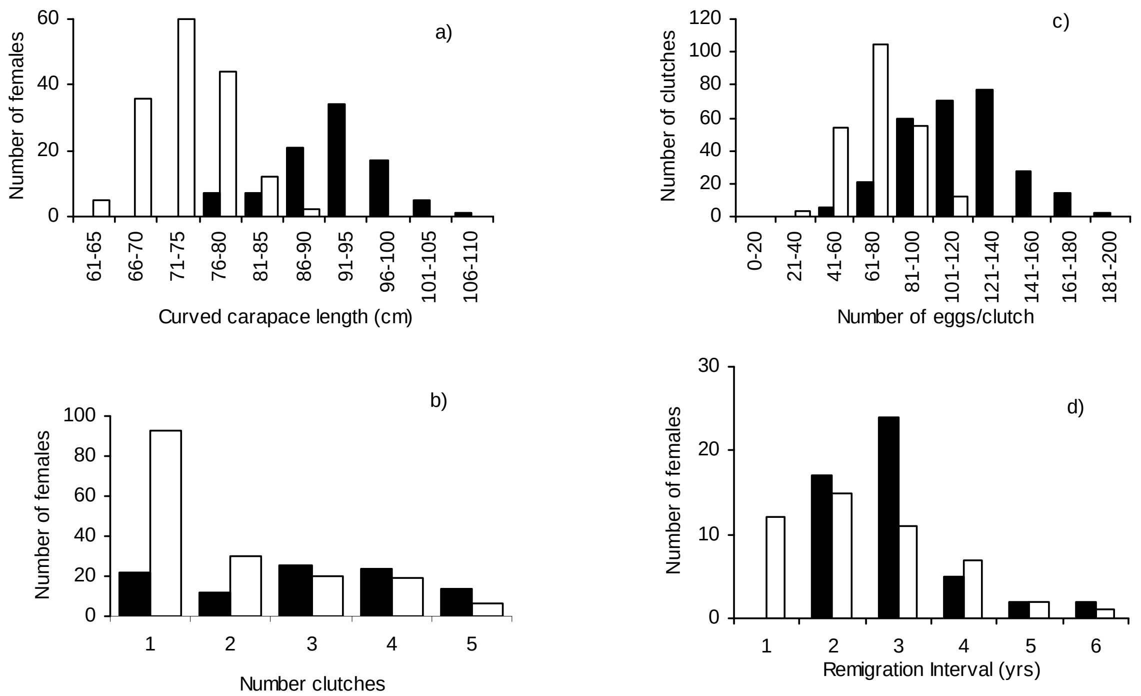

Figure 1. Frequency distributions of a) curved carapace length of females b) clutch frequency, c) clutch size, d) remigration intervals during the years 1993-2000. Shaded: green turtles; Unshaded: loggerhead turtles (Broderick et al., 2003)

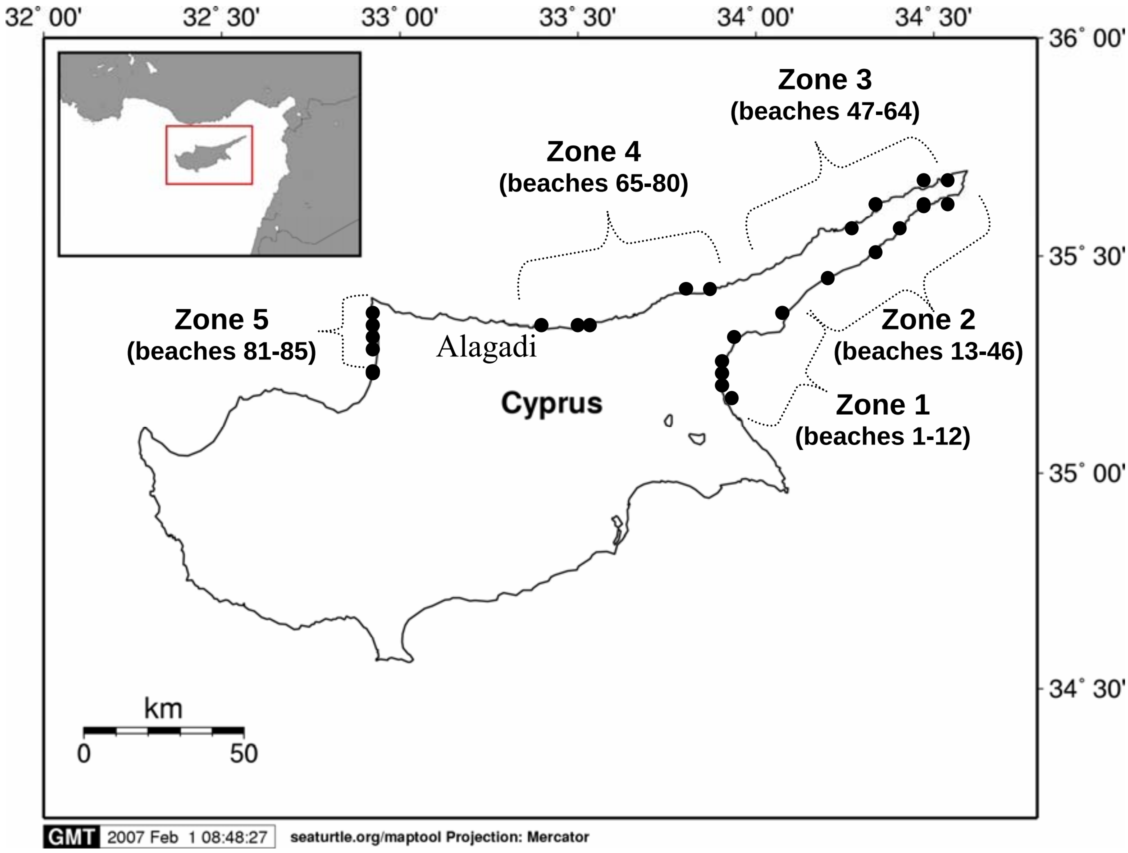

Figure 2. Map of survey zones and the beaches which have experienced loggerhead turtle (*Caretta caretta*) nesting since 1992 (●). Beach numbers in parentheses are those found in Godley and Broderick (1992). Data from Zones 2 and 3 have been gathered by the responsible bodies for Environmental Protection since 1997.

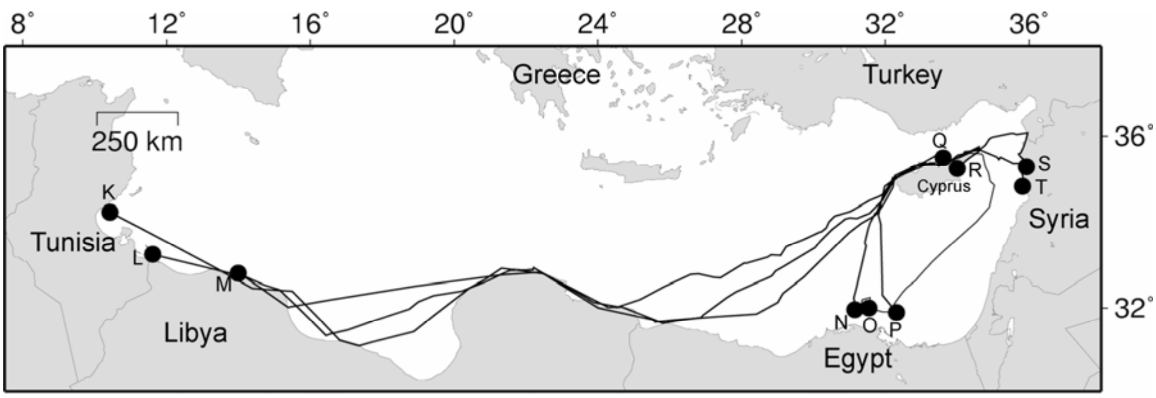

Figure 3. Migratory corridors and foraging grounds of ten female loggerhead turtles K-T from Cyprus to their foraging sites (1998-2005). Filled circles show endpoints (Broderick et al., 2007).

Figure 4.
Ronnas Bay during the early 1990's. (Photo: Marine Turtle Research Group, University of Exeter).

Figure 5.
Green turtle nesting amongst the beach litter. (Photo: Marine Turtle Research Group, University of Exeter).

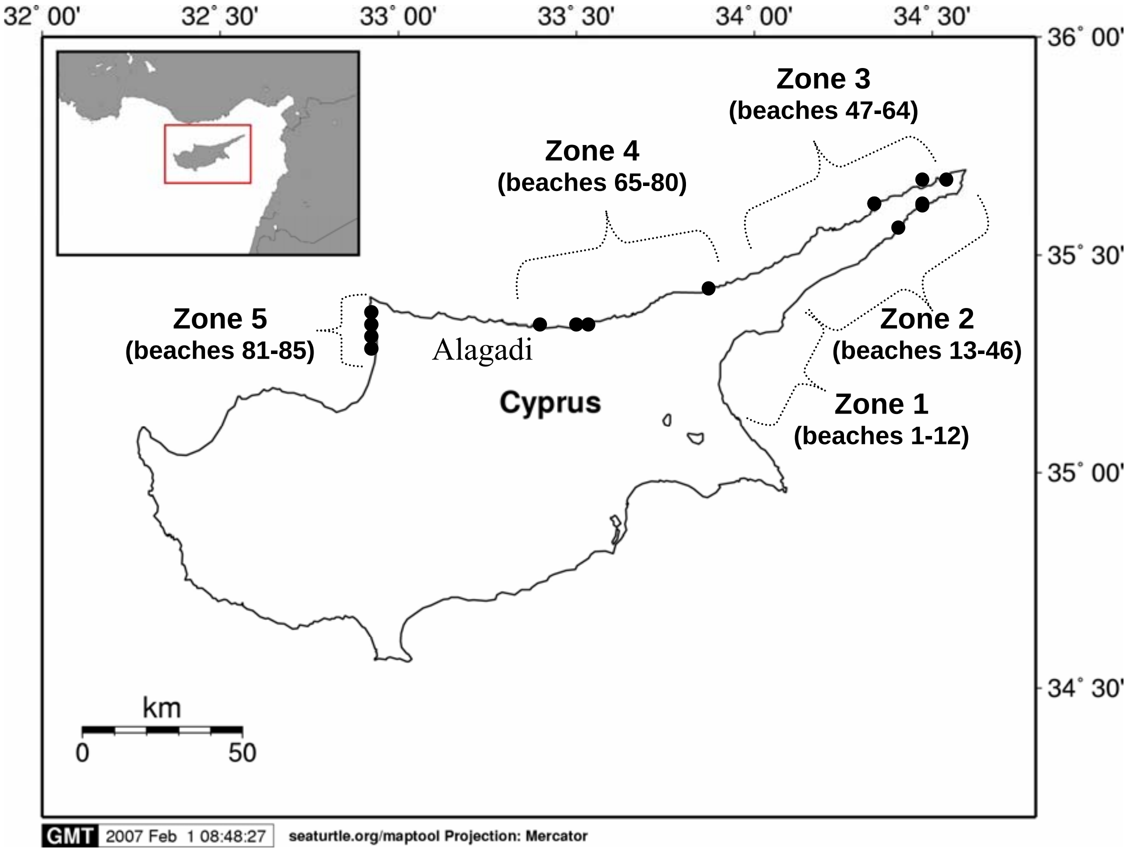

Figure 6. Map of survey zones and the beaches which have experienced green turtle (*Chelonia mydas*) nesting since 1992 (●). Beach numbers in parentheses are those found in Godley and Broderick (1992). Data from Zones 2 and 3 have been gathered by the the responsible bodies for Environmental Protection since 1997.

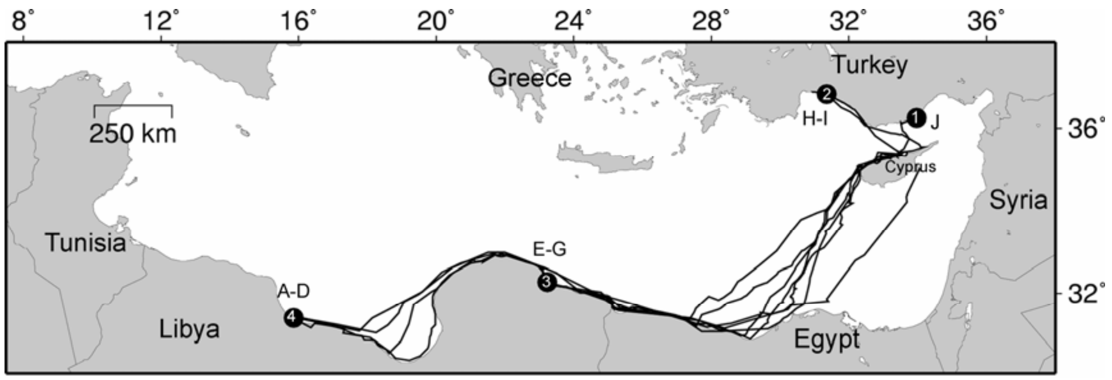

Figure 7. Migratory corridors and foraging grounds of ten female green turtles A-J, tracked from Cyprus to their foraging sites (1998-2005). Filled circles show endpoints, and numbers refer to number of females tracked to that location (Broderick et al., 2007).

CYPRUS – REGION B

Andreas DEMETROPOULOS[1] and Myroula HADJICHRISTOPHOROU[2]

[1]Cyprus Wildlife Society, P.O. Box 24281, Nicosia 1703, Cyprus (E-mail: andrecws@logos.cy.net), [2]Department of Fisheries and Marine Research, Ministry of Agriculture Natural Resources and Environment, Bethlehem 101, Nicosia 1416, Cyprus, (E-mail: mhadjichristoforou@dfmr.moa.gov.cy)

1. General remarks

The first turtle nesting surveys in Cyprus were undertaken in 1976 and 1977. Actual conservation activities started in 1978, with the setting up of the Lara Turtle Station on the west coast of the island (Fig. 1). Conservation activities continued without interruption since then (Demetropoulos, 1976-1989; Demetropoulos and Hadjichristophorou, 2004. Hadjichristophorou and Demetropoulos 1990-2007). The Cyprus Turtle Conservation Project which was set up then, is a government project and is implemented by the Department of Fisheries and Marine Research (DFMR). The Cyprus Wildlife Society (CWS) has been helping the DFMR with the project since 1989. This project covers all the beaches in the part of the island that is under government control (Demetropoulos and Hadjichristophorou, 2004).

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

There are two main nesting areas for this turtle (Fig. 1). The surf swept beaches on the west coast of the island and the more sheltered beaches in Chrysochou Bay, which is the main nesting area for loggerhead turtles. There is also regular, significant nesting of loggerheads in a couple of other beaches and scattered or occasional nesting on most other beaches.

West Coast. There are five main nesting beaches on the west coast, with Green and Loggerhead nesting on the same beaches. These are in the Lara/Toxeftra Turtle Reserve (Fig. 2), which covers 10 km of coastline as well as the adjacent sea. The total beach length in this area is about 5 km. There is also some nesting on other beaches on the west coast outside the Reserve, on Potima beach and in Coral Bay. All beaches are monitored and all the nests are protected, inside and outside the reserve.

Chrysochou Bay. There are eight main beaches in this bay, on which there is loggerhead nesting. There is nesting in about 12 km of beach. About 10km of these beaches are in the new Natura 2000 site, which has a total length of 11 km.

Some nesting also takes place in a number of other beaches in the area. All beaches are monitored and all nests are protected

It was estimated that up to 2004 the loggerhead population was about 300 females (Demetropoulos and Hadjichristophorou, 2004). The present situation is being reassessed (see 2.2).

2.1.2. Marine areas

No major loggerhead feeding or wintering grounds have been identified. Mating grounds are mainly just off the nesting beaches, especially in Chrysochou Bay.

The information available is insufficient for reliable conclusions to be drawn on any key migratory paths, in the context of the new RAC/SPA (UNEP/MAP) Action Plan for the conservation of Mediterranean marine turtles (RAC/SPA (UNEP/MAP), 2007).

2.2. Past distribution and abundance

There is little information on past distribution and numbers of loggerhead turtles before the last 30 years. Some nesting beaches have since been lost to urbanisation, recreation and tourism. Apart from this, the only major change that has been noted in the last 30 years has been the substantial increase in the number of nests noted in the last three years in Chrysochou Bay and in the last four years on the west coast (see 6 and Fig. 3). However what was the loggerhead population nesting on the island three generations back, as required by IUCN for their red-listing assessments, can only be the subject of conjuncture, as this would date back to the end of the 19th century and there are no sources of data to quantify this.

Old fishermen and the toponomy of one area, Chelones, on the east of the island, provide indications that turtles were more frequent in the past. The small size turtles of the present generation nesting in Cyprus are also signs of a heavily exploited population, which can safely be assumed to have been larger than what it is today.

The nesting population and trend in loggerhead nesting (Fig. 3) is commented upon elsewhere (see 2.1.1 and 6)

2.3. Threats

2.3.1. Terrestrial Habitats

2.3.1.1. Coastal development

Coastal development with some associated photo-pollution and water sports, together with the related human presence on the beaches, at night in particular, are the main problems on one beach in the western end of Chrysochou Bay (Asprokremmos beach). Offshore breakwaters are also planned for the central part of the bay (outside the Polis- Yialia Natura 2000 site) and these may have an impact on part of a nesting beach. With the declaration of a large part of the area into a Natura 2000 site and the pending management measures, these threats are expected to be at least partly mitigated. Driving on the beaches is also a significant threat in this area especially on a couple of beaches. Mechanical beach cleaning has so far been a minor and local problem on two limited sections of beach in Chrysochou Bay.

Coastal constructions with some associated photo-pollution and water sports are the main problems on one beach in the western end of Chrysochou Bay, together with the related human presence on the beaches, at night in particular.

In the Lara/Toxeftra Reserve, on the west coast, there has been no coastal development and photopollution is very limited. Human presence on the beaches at night is strictly controlled as is driving on the beaches, though some problems still exist with driving, though on a much reduced scale, on two of the beaches. There is no mechanical beach cleaning in the Lara/Toxeftra Reserve area. On two beaches on the west coast, outside the Reserve, in the Coral Bay area, tourism has reached such levels that all nests have to be relocated to the Reserve area, to a “hatchery” on the beach.

2.3.1.3. Non human predation

Fox predation was the major problem and, before the protection of nests with cages, predation reached 80% on some beaches. Now all nests are protected against foxes with cages and predation is limited to less that 5%. Ghost crabs are also a minor predator on a small number of beaches.

2.3.1.4. Human exploitation

There is no human exploitation of eggs and no turtles are killed for exploitation purposes.

2.3.1.5. Other threats

<u>Erosion</u> was largely caused by sand extraction which has now stopped. Beaches are now reaching new equilibriums, though no doubt there are residual effects. The <u>damming</u> of rivers may pose problems of supply of material for beaches in the more remote future, which may act synergistically with sea level rise in impacting beaches. Tourism pressure for sandy beaches has lead to the construction of <u>offshore breakwaters</u> in many areas around the island and there is pressure now for the construction of such breakwaters off some beaches in Chrysochou Bay.

The real effect of debris on the nesting beaches is minimal and is mainly limited to wood and some large objects washed up on the beaches by the prevailing westerly winds. Manual beach clean ups of nesting beaches, mainly in the turtle reserve area on the west coast, are carried out in the nesting season. The west coast is the area getting most of the debris from the open sea due to the prevailing westerly winds. The Chrysochou Bay beaches are impacted more by what beach users leave behind and by what the small boat users in the bay are jettisoning.

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

The main problems are associated with bottom set nets (trammel nets). Mortality from incidental catches in such nets is estimated from strandings, which are mainly in Chrysochou Bay where much fishing with small boats takes place. Strandings of loggerheads are mainly of adults and both male and female turtles are washed up in more or less equal numbers. About 10 turtles per year are usually washed up.

More intensive monitoring in recent years probably results in a false increasing trend. Long-lining for swordfish, a potential threat, has practically stopped in Cyprus due to a significant drop in catches, stemming no doubt from overexploitation of resources (not all due to the local fishery). Some tuna long lining is now taking place seasonally, mainly in May/June. Incidental catches on these long lines is currently being investigated.

2.3.2.2. Intentional killing and exploitation

Deliberate killing is now very limited and is caused by the occasional fisherman who had his nets damaged by a turtle. There may be 1-2 turtles (of both species) killed this way every year, though none were found since 2006. Again this information comes from our strandings records. There is no killing for trade or for personal use, though in the past hanging of dried carapaces on walls for decoration was fairly widespread in fish restaurants on the coast

2.3.2.3. Other threats

There is no evidence of other threats. For instance, none of the dead turtles (green and loggerhead) that have been recorded in recent years had any evidence of a boat strike. Practically all drown in fishing nets and the occasional one by being caught on a long line.

3. *Chelonia mydas*

3.1. Present distribution and abundance

3.1.1. Nesting sites

There are two main nesting areas for turtles (Fig. 1). The surf swept beaches on the west coast of the island and the more sheltered beaches in Chrysochou Bay, which is the main nesting area for loggerhead turtles. Green turtles nest only exclusively on the west coast beaches.

West coast. There are five main green turtle nesting beaches on the west coast. The total beach length is about 5 km (in 10 km of coastline). These beaches are in the Lara/Toxeftra Turtle Reserve (Fig. 2). There is also some nesting in a couple of beaches outside the Reserve, at Potima beach and at the Paphos airport beach on the south west coast. There is also some nesting on Asprokremmos beach in Chrysochou Bay and occasional nesting on the other beaches in Chrysochou Bay. All beaches are monitored and all the nests are protected, inside and outside the reserve.

The green turtle nesting population has been estimated to be around 100 females. Over 100 adult green turtles have been tagged since 1980.

3.1.2. Marine areas

There is an important foraging area for juvenile, sub adult and adult green turtles in Chrysochou Bay. They are found there throughout the year. They feed in the *Cymodocea* and *Posidonia* beds in the bay. Juveniles and sub-adults have been noted in the area, in relatively large numbers, in the last 10-15 years in particular. This is confirmed by fishermen and by the stranding records in this area.

The information available is insufficient for reliable conclusions to be drawn on any key migratory paths, in the context of the new RAC/SPA (UNEP/MAP) Action Plan for the conservation of Mediterranean marine turtles (RAC/SPA (UNEP/MAP), 2007).

3.2. Past distribution and abundance

Old fishermen and the toponomy of one area, Chelones, on the east of the island, provide indications that turtles were more frequent in the past. The small size turtles of the present generation nesting in Cyprus are also signs of a heavily exploited population, which can safely be assumed to have been larger than what it is today.

Past distribution of green turtles in the specific area (west and south coast of Cyprus) is largely unknown, but at least one nesting beach on the west coast (Potima), which was monitored from 1978, was degraded due to sand extraction in the early 1980s. This beach has since shown some signs of establishing a new sand equilibrium and some nesting has been noted there in the last couple of years. Urbanisation, tourism etc have caused problems in other areas such as Ayia Napa (now a very intensive tourist resort) where green turtle nesting has ceased since about 1980, while disturbance on Asprokremmos beach in the western part of Chrysochou Bay is likely to have affected green turtle nesting on this beach.

As already mentioned the green turtle population nesting in the area (west coast) has been estimated to be around 100 females. There are very large fluctuations in nest numbers and no clear trend is emerging from the nesting data (Fig. 5).

3.3. Threats

3.3.1. Terrestrial Habitats

3.3.1.1. Coastal development

In the Lara/Toxeftra Reserve, on the west coast, there has been no coastal development and photopollution is very limited. Human presence on the beaches at night is strictly controlled as is driving on the beaches, though some problems still exist with driving, though on a much reduced scale, on two of the beaches. There is no mechanical beach cleaning in the Lara/Toxeftra Reserve area.

Coastal development and constructions with some associated photopollution and water sports, together with the related human presence on the beach, at night in particular, are the main problems in one beach in the western end of Chrysochou Bay (the Asprokremmos beach), where there is some limited green turtle nesting. Driving on this beach is also a problem Part of this beach is going to be included in the proposals for a new a Natura 2000 site (the Akamas site) allowing for the introduction of some management measures on this part of the beach. With the declaration of a large part of Chrysochou Bay into a Natura 2000 site (the Polis – Yialia site) and the pending management measures, some of the threats mentioned above are expected to be at least partly mitigated in this part of the Bay, which however has only sporadic green turtle nesting.

3.3.1.2. Beach restructuring

See 2.3.1.2.

3.3.1.3. Non human predation

See 2.3.1.3 on fox predation.

3.3.1.4. Human exploitation

There is no human exploitation of eggs and no adults are killed for exploitation purposes.

3.3.1.5. Other threats

<u>Erosion</u> was largely caused by sand extraction which has now stopped. Any beaches affected are now reaching new equilibriums, though no doubt there are residual effects.

The real effect of <u>debris</u> on the nesting beaches is minimal and is mainly limited to wood and some large objects washed up on the beaches by the prevailing westerly winds. Manual beach clean ups of nesting beaches are carried out in the nesting season. (see also 2.3.1.5)

3.3.2 Marine Habitats

3.3.2.1 Incidental catch

The main problems are associated with bottom set nets (trammel nets). Mortality from incidental catches in such nets is estimated from strandings, which are mainly in Chrysochou Bay where much fishing with small boats takes place.

Strandings of green turtles are largely of juveniles and sub-adults (30 to 60 cm) but some adults are also found dead on beaches. About 20-30 juveniles and sub-adults a year were found dead in 2006-2007 in Chrysochou Bay mainly. They are often found in the summer months when fishing is more intensive in this bay. Following changes in the fishing regime, forbidding "sport" fishermen from using fishing nets and other professional gear, there was a very significant drop in strandings of juvenile and sub-adult green turtles in Chrysochou Bay in 2008. Nonetheless other possible explanations for this drop are also being investigated.

More intensive monitoring in recent years probably results in a false increasing trend. Long-lining for swordfish, a potential threat, has practically stopped in Cyprus due to a significant drop in catches, stemming no doubt from overexploitation of resources (not all due to the local fishery). Some tuna long lining is now taking place seasonally, mainly in May/June. Incidental catches on these long lines is currently being investigated.

3.3.2.2. Intentional killing and exploitation

See 2.3.2.2.

3.3.2.3. Other threats

See 2.3.2.3.

4. *Dermochelys coriacea*

There have been a few records of incidental catches of leatherbacks in Cyprus, mainly on long lines and trammel net, but these turtles are very rare in the region.

5. Other species

None

6. Conservation status

Turtles in Cyprus are protected mainly by the provisions of the fisheries legislation. Since joining the European Union turtles are also protected under the provisions of the EU Habitats Directive and Law 153(I)/2003 for the Conservation and Management of Nature and Wildlife which transposes this Directive into national law. This law has provisions for the conservation of species and habitats listed in the annexes. Both turtle species are included inter alia in Annex II of the Directive.

Cyprus has ratified inter alia the Barcelona Convention and its Biodiversity Protocol, the Bern and Bonn Conventions and CITES, all of which have provisions for turtle conservation.

The legal protection of turtles in Cyprus is analysed below in greater detail.

<u>Species conservation.</u>

Turtles and their eggs have been protected under the fisheries legislation since 1971 (Fisheries Law, CAP135 and amendments and the Fisheries Regulations enacted on the basis of this law). The killing, pursuing, catching, buying, selling or possessing of a turtle or attempting to do any of these is prohibited, as is the buying or selling or possession of any turtle egg or turtle part or derivative.

<u>Habitat conservation.</u>

West coast.

In 1989 habitat protection was given to the main nesting area on the west coast of the island on the basis of the Fisheries Law and Regulations. A 10 km stretch of coastline was declared, on the basis of the above legislation, as a turtle reserve. This was the Lara/Toxeftra Turtle Reserve. It includes the coastline and the adjacent sea area, down to the 20 metre isobath (about 1-1.5 km distance from the coast). The Reserve includes the 5 main Green turtle nesting beaches, which also support loggerhead nesting. The management regulations are in the Law. These foresee that the public is not allowed to:

- Stay on the beaches or the coastal area at night
- Drive any vehicle on a beach or tolerate such action

- Place any umbrella, caravan, tent etc., in the Protected Area
- Use or anchor a boat or tolerate such action (to the 20m isobath),
- Fish, except with a rod and line (to the 20m isobath)

Chrysochou Bay.

In 2002 the Polis/Limni was declared on the basis of the Town and Country Planning legislation as a “Shore for Ecological Protection”. Its provisions include: no permits for the commercial use of beaches; no breakwaters or marinas and restrictions for the adjacent area regarding lights.

In 2005 the Polis/Limni area was extended to include the Yialia area and the whole area was proposed to the European Commission as a “Natura 2000” site on the basis of the EU Habitats Directive. It was accepted as an SCI in 2008. The site includes an 11 km stretch of coastline (65-200 m wide) and the adjoining sea area down to the 50m isobath. The management regulations are at their final stage of adoption at the time of writing.

Enforcement.

The Fisheries legislation is implemented by the Department of Fisheries and Marine Research (DFMR) and its Inspectorate Service, which has offices and patrol boats in all the coastal towns. The management measures foreseen in the law are very largely implemented and are very effective.

The management plans for all “Natura 2000” sites are being elaborated and law implementation and enforcement is partly in place already. Licensing and law enforcement on the basis of this law is the responsibility of the Environment Service of the Ministry of Agriculture Natural Resources and Environment, in cooperation with the DFMR in the marine/coastal sites. Licensing and law enforcement on the basis of the Fisheries legislation remains the responsibility of the DFMR.

Conservation efforts.

Conservation activities started in 1978, after earlier surveys, with the setting up of the Lara Turtle station. They continued without interruption since then. The main initial aim was to protect nests and hatchlings from predation by foxes. The turtle conservation project is a government project and is implemented by the Department of Fisheries and Marine Research (DFMR). The Cyprus Wildlife Society helps with the project. The project covers all the nesting beaches that are in the part of the island that is under government control.

The main aims of the project now are:

- Protecting and managing the nesting beaches and the adjacent sea
- Protecting nesting females on the nesting beaches and adjacent sea during nesting
- Protecting eggs and hatchlings from predation - and from human activities
- Protecting turtles at sea
- Monitoring the turtle population and nesting activity in Cyprus
- Raising public awareness in turtle conservation

The project evolved with time. Head-starting (Fig. 6) was experimented with for many years, until the mid 1990s when it was stopped pending results. A small rescue centre now operates as needed at Meneou, where DFMR has its mariculture research station

Conservation methods used.

In the Lara-Toxeftra Reserve and on the Polis/Limni/Yialia beaches as well as on practically all other beaches that have any nesting, all nests are protected *in situ*, i.e., where the eggs were laid, by placing open, self releasing, aluminium (non magnetic) cages over them (Fig. 7). 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. Such distortion may interference with imprinting mechanisms affecting orientation and navigation. These cages have been used in the Cyprus Turtle Conservation Project since 1995. Since then studies have confirmed the assumptions made on the distortion of the magnetic field in the area of the egg chamber by the use of magnetic material for cages (Irwin et al., 2004). The cages used allow hatchlings to escape to the sea, as soon as they emerge from the sand, but prevent foxes from getting at the nest.

The minimum of intervention is aimed for, at all stages of conservation. A "hatchery" is used for a small number of nests (ca. 10-20) that cannot be adequately protected where they were laid. Loggerhead nests are relocated there mainly from two tourist beach on the west coast (Coral Bay). The hatchery is a fenced off part of the beach. No green nests are relocated to the hatchery at Lara, as there is no green turtle nesting on the Coral Bay beaches.

The conservation practices used are the ones described in the Manual for Marine Turtle Conservation in the Mediterranean (Demetropoulos and Hadjichristophorou, 1995) and its 2008 Addendum 1 (Demetropoulos and Hadjichristophorou, 2008). The conservation practices used have evolved during the life of the project with the experience and knowledge gained. Part of the work carried out in the project is focused on the mitigation of the impact of tourism development on turtle nesting beaches. The recommended strategies and actions are outlined by Demetropoulos (2003)

Inter alia the following are also practiced:

Nests laid too near the sea, which will obviously be inundated by waves, are relocated higher up the same beach. About 5% of the nests are relocated up the beach.

The egg chamber is located with an aluminium rod or a stick, when the nests are fresh. No digging to locate or verify the presence of eggs takes place. Nests are dug up only after the end of hatchling emergence from the nest, so as to check on what happened in the nest.

Though tagging is not a conservation measure, it is mentioned here, as it may endanger turtles. Turtles may for example be disturbed if approached at the wrong time, preventing nesting, while inappropriate tags and tagging may endanger turtles, restricting flipper growth and mobility and may also cause increased risks of entanglement in trammel nets. The UNEP/MAP tagging recommendations were adopted mainly with the above in mind. These tagging recommendations are followed in the project. Blue Dalton Jumbo tags are used in adults and the smaller Rototags are used in smaller turtles (over 30cm). Turtles are usually double tagged on the trailing end of the front flippers, at the distal end of the flipper.

Achievements.

It is estimated that through predation control and relocations more than four times as many hatchlings reach the sea every year than would have done if nests were not protected.

There have been significant increases in the number of loggerhead nests laid in the last three years in Chrysochou Bay and in the last four years on the west coast and, in both cases this increase continued also in 2009, though the final 2009 data are not available as yet. This is deemed to be the result of a combination of factors and does not necessarily reflect increases in the number of nesting turtles in Chrysochou Bay at least. Nor does it necessarily reflect the success of conservation measures, though this is likely, in part at least, on the west coast where the large increases are difficult to justify in terms of more clutches per turtle due to high sea temperatures. Increases in nest numbers may be due, in part at least, to the hydrography of the area and the high sea temperature regime noted in the last 3-4 years in the coastal waters in the area and in Chrysochou Bay in particular (Demetropoulos and Hadjichristophorou, 2008).

The nesting females in the project area are generally very young and it is deemed that the population may be recovering from the heavy exploitation of turtles that took place in the past in the east Mediterranean, though this was primarily aimed at green turtles. This small size of nesting loggerhead turtles and the scarcity of older/larger turtles are indications of this. These are characteristic of all heavily exploited populations and are familiar to fishery scientists working on population dynamics.

Unlike the recent changes in nesting in the loggerhead turtles, there has been no recent increasing trend in green turtle nesting. Though green turtle nesting is well known to fluctuate widely from year to year, in terms of nest numbers, it has been noted that these fluctuations are even wider in the last few years (Fig. 5). The slight increasing trend in nest numbers, based on the 1989-2007 data, may be due, in part, to more thorough monitoring in recent years.

7. Conservation needs

What is pending is the adoption of effective management regulations for the "Natura 2000" site in Chrysochou Bay. The land boundaries of this area in particular are causing some concern in relation to the management of the nesting beaches in this area.

What is also pending is the setting up of the "Natura 2000" site for the Akamas peninsula, which is expected to safeguard the hinterland behind the Lara/Toxeftra Reserve.

8. Miscellaneous

None.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

The Department of Fisheries and Marine Research (DFMR), of the Ministry of Agriculture Natural Resources and Environment, is the only government organisation that is involved in actual turtle conservation, management, monitoring and research. It has been the sole actor in all these since 1971 when the first law protecting these species was enacted. It implements, in the field, the Cyprus Turtle Conservation Project, with professional assistance from the Cyprus Wildlife Society. This includes assistance in all aspects of turtle conservation.

The Environment Service of MANRE is now involved in the preparation of the management plans for the Natura 2000 sites, along with the DFMR on the marine/coastal sites.

9.2. Private

The Cyprus Wildlife Society (CWS) is the only NGO that is doing regular work in the field on turtle conservation in Cyprus. It has been working in this field since 1989, organising and undertaking, every year, practical, hands on, training courses in turtle conservation for RAC/SPA (UNEP/MAP) sponsored scientists. These courses are undertaken in cooperation with the Department of Fisheries and Marine Research (DFMR). The CWS also helps the DFMR with the implementation of the Cyprus Turtle Conservation Project in the field, with nest protection, monitoring etc. The assistance is mainly with professional experienced biologists working in the field. The CWS was also instrumental in preparing and publishing the Turtle Conservation Manual and its 2008 Addendum. The CWS does all its work with its own resources. It is also involved in raising public awareness, education and training. It has published posters, postcards etc.

10 Resources available about marine turtle research and conservation

See:
http://www.moa.gov.cy/moa/dfmr/dfmr.nsf/DMLSea_en/DMLSea_en?OpenDocument

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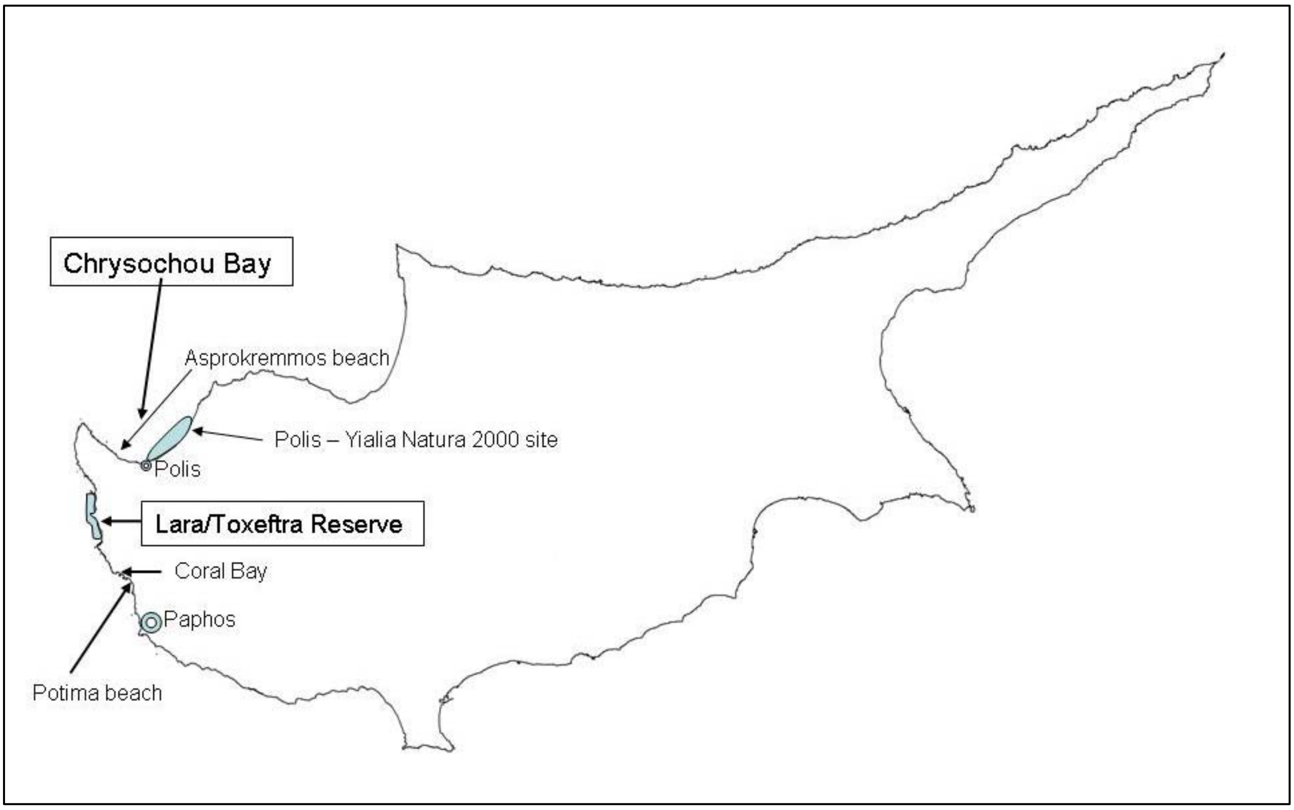

Figure 1. Map of Cyprus with main nesting sites on the West Coast and in Chrysochou Bay.

Figure 2. Lara beach (Photo: A. Demetropoulos).

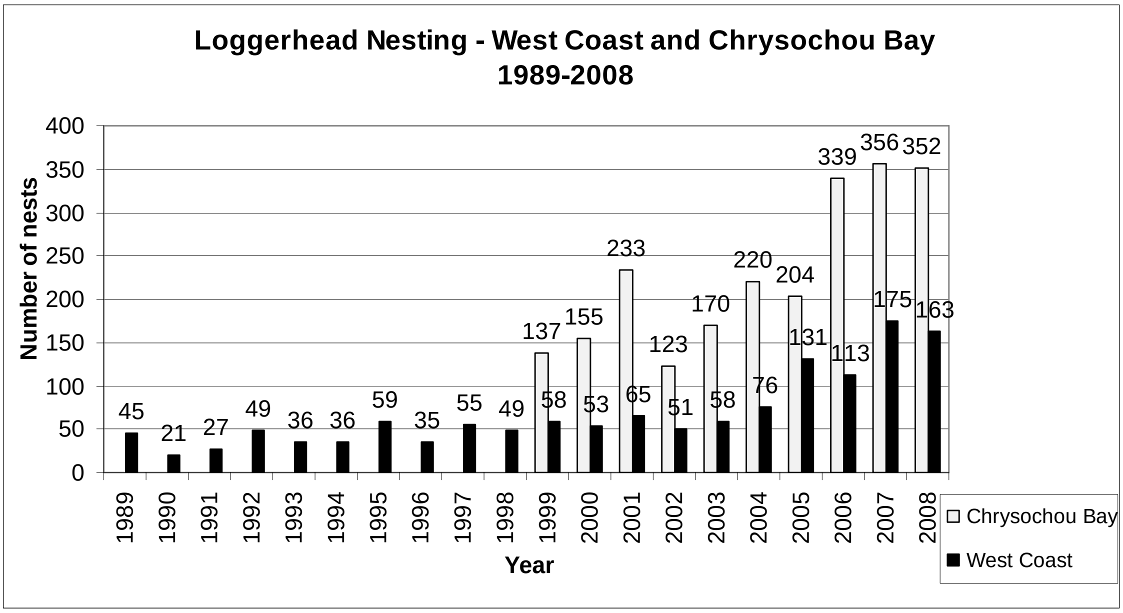

Figure 3. Loggerhead nesting on the West Coast and Chrysochou Bay, 1989 – 2008. The nesting data for Chrysochou Bay prior to 1999 are not compatible with the data for 1999-2008 and are not included. (Sources: Demetropoulos, 1989. Demetropoulos and Hadjichristophorou, 2009. Hadjichristophorou and Demetropoulos, 1990-2007. Demetropoulos and Hadjichristophorou - unpublished data).

Figure 4.
Sand extraction in 1982 at one of the Chrysochou Bay beaches. This had residual effects (Photo: A. Demetropoulos).

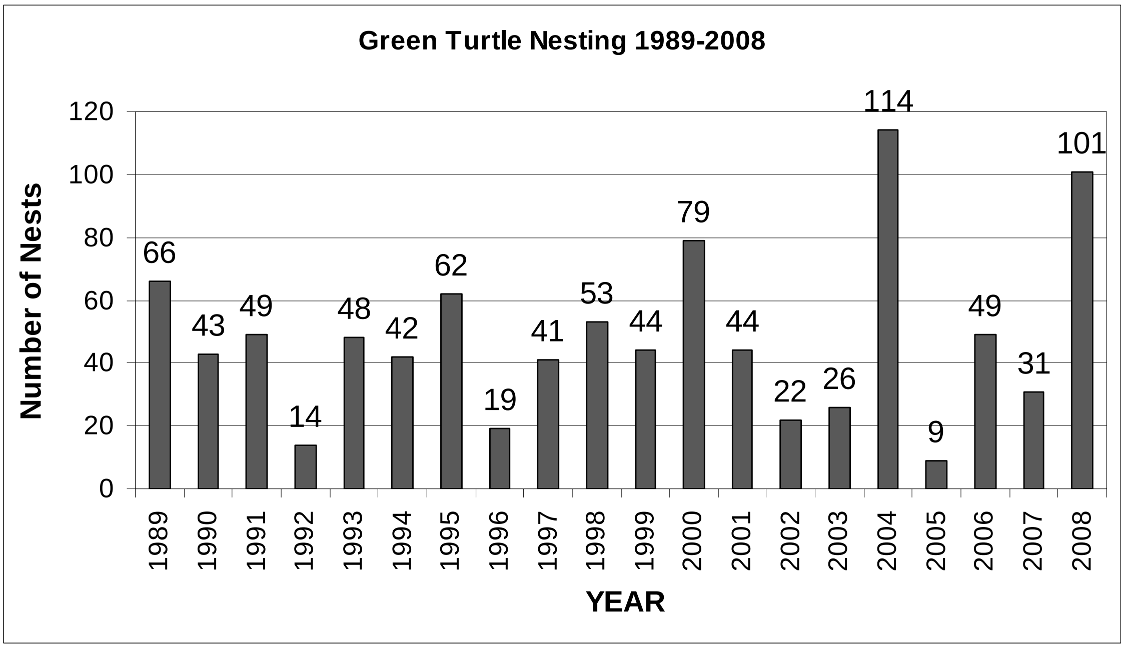

Figure 5. Green Turtle Nesting on the West Coast, 1989-2007. (Sources: Demetropoulos, 1989. Demetropoulos and Hadjichristophorou, 2009. Hadjichristophorou and Demetropoulos, 1990-2007. Demetropoulos and Hadjichristophorou, Unpublished data.).

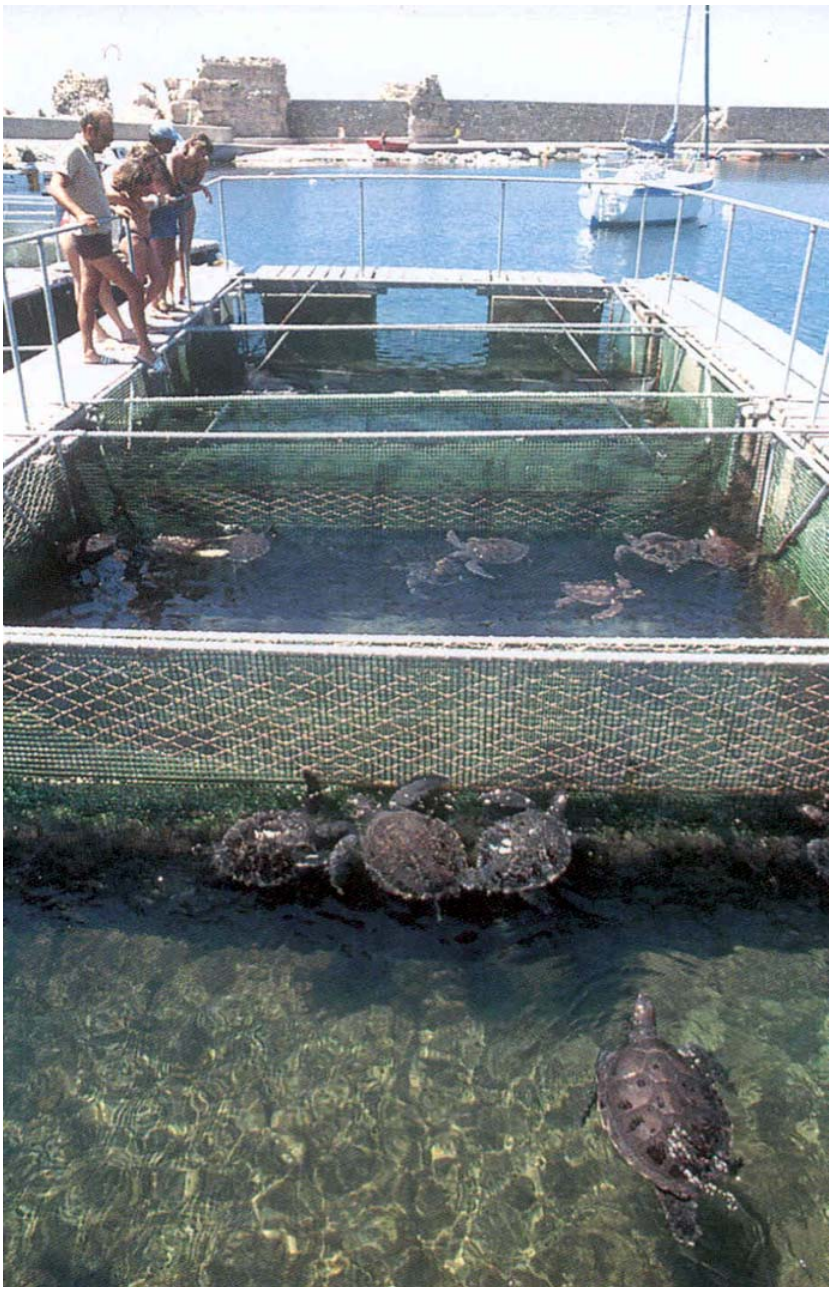

Figure 6.
Head-starting programme (see section 6) (Photo: A. Demetropoulos).

Figure 7.
In situ protection of nests in Limni beach (see section 6) (Photo: A. Demetropoulos).

EGYPT

Mohamed NADA[1,2,3] and Paolo CASALE[4]

[1]Friends of the Environment, [2]Nature Conservation Egypt, [3]MEDASSET, 34 Street 106, Hadayek El Maadi, Cairo, Egypt (E-mail: mnada@egypt.care.org), [4]WWF Mediterranean Turtle Programme c/o WWF Italy, via Po 25c 00198 Roma, Italy (E-mail: p.casale@wwf.it)

1. General remarks

All the three marine turtle species occurring in the Mediterranean also regularly occur in the Egyptian Mediterranean waters. These include *Caretta caretta* (loggerhead turtle); *Chelonia mydas* (green turtle); and *Dermochelys coriacea* (leatherback turtle). Among a sample of 54 carcasses found along the entire Mediterranean coast of Egypt during a single survey in 1998, 38 (70%) were loggerhead turtles, 8 (15%) green turtles, 1 (2%) leatherback turtles and 7 (13%) unidentified (Clarke et al., 2000). Accordingly, Nada (2001) found that 15% of turtles on sell in the fish market of Alexandria in 1998-1999 were green turtles, while the others were loggerhead turtles.

Loggerhead and green turtles nest in the Egyptian Mediterranean coast, although Egypt does not host important nesting sites, at least not at present time.

The Egyptian Mediterranean coast can be divided into three regions: western, central and eastern (Fig. 1).

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

Two studies investigated turtle nesting along the Mediterranean coast of Egypt. The first survey covered the western coastline between Alexandria and El Salum (Kasparek, 1993), while the second survey covered the entire coastline (Clarke et al., 2000). Both surveys concluded that nesting in the western region (west to Alexandria) does occur but in lower numbers compared to other areas in the Mediterranean, with the nests randomly scattered along the coastline. According to 23 fishermen interviewed in the western region (Nada and Casale, 2008), 87% mentioned that they observed at least one turtle nesting in the past ten years, while 56 % in the last 3 years. As for the last nesting season (summer 2006), only two fishermen observed turtles nesting in the western region. One mentioned that he saw a loggerhead nesting in July near the Sidi Barani city, while the second saw another loggerhead nesting approximately 5 kilometers west to El Salum. According to these fishermen, only loggerhead turtles nest in this region.

As for the area from Alexandria to Port Said, no evidence was found to suggest that nesting occurs in the area, probably because the soil has high mud/silt content and might have rendered these beaches unsuitable as nesting sites (Clarke et al., 2000). According to all the 157 fishermen interviewed by Nada and Casale (2008) no nesting was seen in the central region during the past ten years.

Most loggerhead turtle emergence tracks (n = 93) were observed in 1998 in the eastern region (from Port Said to Rhafa), of which 67 of these tracks were suspected to be actual nests (Clarke et al., 2000). The main nesting area along this coast is a 22 km stretch of sandy coastline located west of Areash city, of which 8 km of this beach lies within the boundaries of the Zaranik protected area (Clarke et al., 2000).

2.1.2. Marine areas

Egypt probably hosts important foraging

areas for loggerhead turtles. A strong indication of this is represented by the high by-catch levels (see 2.3.2.1.). Moreover, in the area between Alexandria and Port Said the highest density of dead loggerhead turtle strandings was observed, suggesting that turtles congregate here to feed on the inshore continental shelf (Clarke et al., 2000).

Genetic markers indicate that loggerhead turtles frequenting Egyptian waters originated from multiple rookeries, such as those in Turkey, Cyprus and Greece (Casale et al., 2008). Direct evidence of connection at least with the Cyprus rookeries come from fishermen who found turtles with flipper tags (Nada and Casale, 2008) and from satellite tracking of nesting females (Broderick et al 2007).

2.2. Past distribution and abundance

In the summer of 2007, 219 fishermen located in 15 coastal cities along the Mediterranean coast were interviewed, most of them (89%) stated that the number of turtles was decreasing; 8.2% stated they had not notice any change; and only 2.7% stated that turtles were increasing (Nada and Casale, 2008). Since Nada (2001) found that 85% of turtles in the market were *Caretta caretta*, it is thought that this trend is almost certainly related to this species.

While it seems that no nesting occurs at present time in Alexandria and its central regions (see 2.1.1.), three fishermen in Alexandria stated that a few turtles used to nest in Alexandrian beaches over thirty years ago (Nada and Casale, 2008).

2.3. Threats

2.3.1. Terrestrial Habitats

2.3.1.1. Coastal development

According to Clarke et al. (2000), the main nesting beach along the entire Egyptian Mediterranean coast, is a 22 km stretch of sandy coastline located west of Areash city, of which 8 km of this beach lies within the boundaries of the Zaranik protected area, a biosphere reserve. Their survey noted that beach development and tourism is a major threat to this beach as a result of the rapidly expanding resort of Areash, which has already engulfed a part of the most important nesting area. Nada and Casale (2008) found that the pressure on this beach is increasing, which is significantly impacting on the number of nesting recorded every year. The impact of tourism on marine turtle nesting is coupled with the lack of financial and human resources allocated to the Zaranik protected area. This makes the conservation of marine turtles inside and outside the protected area a significantly challenging.

As for the western region of the Egyptian Mediterranean coast, the rapid beach development in the past decade does not constitute a major threat as there is very limited evidence of nesting along the western coast and these incidence were scattered and not confined to specific beaches.

2.3.1.2. Beach restructuring

Not relevant in the main nesting site.

2.3.1.3. Non human predation

In the area with the highest nesting activity, Simms et al. (2002) observed a high predation level by ghost crabs (*Ocypode* sp.), with levels on different beaches ranging between 45-99%.

2.3.1.4. Human exploitation

Clarke et al. (2000) reported egg collection in the eastern region, and Nada and Casale (2008) found that this practice was still continuing in 2007. Local people do not depend on the eggs as a source of income and they do not trade in eggs, but they consider them as a free meal. Some of them eat eggs as they believe eggs to be a general tonic and aphrodisiac.

2.3.1.5. Other threats

Data not available.

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

From fleet data and catch rates reported by fishermen, the total number of captures by different fishing gear was recently estimated to be over 5000 per year, most captures were by trawlers or longliners (Nada and Casale, 2008). Fishermen also reported that some of the caught turtles are dead and the incidence of mortality is particularly high in longlines and gillnets. Artisanal fishermen using small gillnets also reported cases of by-catch and mortality. Interviews carried out by Laurent et al. (1996) also reported a mortality rate among turtles captured by trawlers of 0-10%.

Interestingly, by-catch is perceived by 219 fishermen interviewed as the main cause of turtle decline (48.4%), followed by intentional killing and human consumption (27.4%), then pollution (21.9%) and finally beach development 2.7% (Nada and Casale, 2008).

Almost all fishermen interviewed stated that they do not intentionally aim for sea turtles and they just found them in their nets or hooks accidentally. In a few cases, fishermen in Alexandria argued that if a turtle was spotted swimming near the surface, they might consider jumping from their boats to catch it.

2.3.2.2. Intentional killing and exploitation

Egypt is renowned for being one of the earliest markets to trade in marine turtles, principally in the fish markets of Alexandria. Old reports were reviewed by Laurent et al. (1996) as follows. The sale of both loggerhead and green turtles in the fish markets along the Mediterranean coast (Alexandria, Abou Keer, Brullos, Port Said, Domiat) has occurred at least since the beginning of the 20th century (Flower, 1933). Probably most of these turtles were captured in the waters of Cyprus, Turkey and Palestine, and then transported to Egypt and finally on to Europe. It is not sure if at those times consumption of turtles in Egypt was due to local people or Europeans living in Egypt. However, at least since the 1970s in some places (especially Alexandria) turtle consumption has become a tradition.

More recently, turtle consumption was observed in several cities, especially Alexandria (Laurent et al., 1996; Venizelos and Nada, 2000).

Three surveys aimed at specifically assessing the size of the trade in Alexandrian fish markets (especially Anfoushi fish market) and to document local community customs and traditions which were associated with turtle consumption (Nada, 2001, 2003, 2005).

The first of these surveys (Nada, 2001) was conducted over a six-month period, from the beginning of December 1998 until the end of May 1999. Sea turtles were mainly slaughtered on Friday and Sunday mornings when there were enough customers present. Fishmongers interviewed mentioned that these two days are known as the days on which turtles are sold, and customers gather together to share the turtle meatbetween them. Turtles were offered for sale in one shop called El Hag Hosni and Sons. He mentioned that sea turtle trade was considered a family tradition, in addition to their normal business, which is dealing in fish and shrimps. In his shop, turtles were placed on their backs directly on the stall counter or on the ground. Some turtles were injured from biting each other as a result of the stress. Fish mongers mentioned that in some occasions, some turtles would be kept in the market for more than three weeks. Some of the observed turtles were severely dehydrated and emaciated.

The turtles were slaughtered by the cutting of the throat , in accordance with the Islamic way. The carapace is separated from the plastron by a knife, most of the meat is found in the area around the flippers, the digestive tract is removed and the head is separated. Green turtle meat was more expensive than loggerhead because the consumers prefer its taste. Average price of one kilogram of turtle meat was about 15 Egyptian pounds (nearly 3.5 USD), and varied according to the turtle species and its availability in the market.

Customers seeking turtlemeat were predominantly from the local community (Anfoushi) and resided around the fish market, which is the traditional fishing community of Alexandria. This community is proud of having its own cultural identity, distinct accent, customs, traditions, and personality. Among these customs is their distinctive habit of consuming meat and blood of marine turtles’.

During interviews with the customers

they mentioned that members of the fishermen community are the only ones capable of preparing turtle meat in Alexandria. They mentioned that they have a special way of preparing it; it is served either as a soup or cut up into to small pieces and cooked with rice in an oven. They mentioned that human hands must not touch the turtle meat because this makes the meat unpalatable . It is believed that the green turtle taste is much better because it feeds on sea grass, while the loggerhead, eats crabs, shrimps and jellyfish. One fishmonger mentioned that a leatherback was once captured and brought to the fish market. After slaughtering it, customers reported that its taste was unpalatable.

In addition to meat, blood is also consumed in Anfoushi. During the time of slaughter, blood consumers, who were not necessarily seeking turtle's meat, gathered together in the early morning to get a cup of fresh blood. Most of them were young women who believe that turtle blood will make them gain weight (it is traditional in this area that thin women are not attractive), also some women believed that the blood would make them more fertile. Fewer men drank turtle blood believing it to be an aphrodisiac and general tonic.

To overcome the taste of blood, several customers were seen to eat fruits, like orange or banana, while drinking the blood. On some occasions, young girls seemed not very willing to drink the blood. However, family members encouraged and/or push them to do so. Selling blood was considered as non significant source of income to fishmongers and they were not particularly interested in selling it. The price of a cup of blood was one Egyptian pound (about 0.25 USD).

From this field research, there was no evidence to backup Goodmans' argument (in Groombridge, 1990) that consumption of turtle meat was related only to Coptic communities. Findings from these interviews and the group discussions with both Moslems and Coptics from the local communities confirmed Kasparek's (1993) finding which stated that both Moslems and Coptic Christians consumed turtle meat.

Fishmongers and community members of the Anfoushi area argued that blood consumption had declined rapidly in the past ten years as a result of increased education and awareness. Interviews with different stakeholders in the Anfoushi area confirmed this and religious leaders added that this topic was covered several times in their weekly preachings.

An average of about six turtles per week were seen on display for sale, with a total of 135 turtles over the 6 months period. The number tended to increase gradually from December until it reached its maximum during the month of May. Throughout this period, both loggerhead and green turtles were seen in the fish market, with the majority 85% being loggerhead. It should be noted that this number did not include turtles that were slaughtered during the non official slaughtering time. It also did not include the number of turtles that was slaughtered on board or outside of the fish market. It was estimated that the overall number of turtles slaughtered during this period would range from 350 to 500 turtles.

Fishmongers and fishermen indicated that the number of turtles captured increased dramatically during summer time. Consequently, the number offered for sale in the fish market could reach 18 to 25 turtles per week during that time.

A second survey (Nada, 2005) assessed the difference in knowledge and attitude of three major groups. The first group was fishermen and fishmongers in the fish market of Anfoushi. The second group was members of the local community who are illiterate or have not completed their primary education. Finally, the third group was educated citizens residing within the local community in Anfoushi, which included university students, teachers and school students.

The main findings of this research were that: when asked if they had a craving to consume marine turtle meat, 81.3% of the first group, 39.7% of the second group, and 6% of the third group responded that they would; when asked if they knew that marine turtles were considered as an endangered species, 25% of the first group, 8.8% of the second group and 46.2% of the third group knew that; when asked about their knowledge on the illegally of trading marine turtles 26.6% of the first group, 8.8% of the second and 14.9% the third group knew that the trade was illegal.

As for their knowledge about the Islamic religion, 20.3% of the first group, 13.2% of the second group and 65.7% of the third group were aware that consuming marine turtles blood is prohibited by religion; when asked about the relationship between marine turtles and jellyfish, 51.6% of the first group, 5.9% of the second group and 31.4% of the third group knew that turtles feed on jellyfish; when asked about their perception regarding the importance of conserving marine turtles, 73.4% of the first group, 26.5% of the second group and 85% of the third group stated that they would think it is important to conserve them.

Reviewing these data, it could be argued that the main consumers of turtle meat were fishermen, fishmongers and uneducated members. The data emphasizes that education plays an important role in the people's knowledge regarding the status of marine turtles as an endangered species, as well as turtle predation on jellyfish. During the interviews, fishermen and fishmongers believed that it is important to save marine turtles from extinction because they were a source of income to some of them and provided a free meal to fishermen during their fishing trips. On the other hand, most of the educated people believed that conserving marine turtles will contribute to the preservation of the balance between different species in the food chain and thus ensuring an improved environmental health of their surrounding ecosystem.

A third complementary research was conducted to determine the willingness of fishermen and fishmongers, turtle meat consumers, and children to stop consuming marine turtle meat and to document their rational for change (Nada, 2003). The research examined the impact of five messages to the different target groups. These messages were: the importance of saving the sea turtles for biodiversity; the legislation preventing sea turtle trade; Islamic and Christian stand point related to killing an endangered species and blood consumption; the relationship between the sea turtles and jellyfish, and its effect on tourism; and the hazards of drinking turtle blood on human health.

Findings from this research illustrated that 53.3% of the fishermen and the fishmongers 66% of the turtle consumers and 85.7% of the children was willing to stop the consumption of marine turtles. As for the fishermen and fishmongers who stated that they will be willing to change their attitude towards turtle meat and blood consumption, were convinced by the religious point of view and/or the consequences of illegal trading. On the other hand, the reason behind the unwillingness to change revolved mainly around their dependence on it as source of income and considering it as a traditional meal.

As for the motivation to change by those who consumed turtles' meat and blood it was to a great extent resulting from religion and to some extent the hazards which may result from consuming sea turtle blood. Those who were unwilling to change argued that its meat is palatable to them and they also see it as part of their local traditions.

With respect to the motivation of school children, their motivation was driven by the importance of the marine turtles to biodiversity, the religious point of view, and the relation between the jellyfish and the sea turtle. Those who were unwilling to change their attitude argued that the taste of turtle meat is good.

The last study on turtle consumption (Nada and Casale, 2008) investigated intentional killings along the entire Mediterranean coast of Egypt. Results revealed that the enforcement of laws in the past few years had resulted in stopping the open sale of turtles in one market of Alexandria. However, in this area turtles are still traded through the black market while in another market of Alexandria, sea turtles are still openly traded. So, although the recent enforcement has probably reduced the total number of turtles traded, it has not stopped the trade completely. This survey also revealed that the most important cause of turtle death is represented by fishermen killing turtles directly on board. These turtles are usually consumed during fishing trips, and if not, only the meat is landed (to fishermen families or black market), so easily escaping police controls.

Hence, laws and their enforcement produced only apparent positive results (i.e. if only open trade in some markets is considered) but the main factors of turtle killing were unaffected and sea turtles are still slaughtered in large numbers. This habit is particularly common in Alexandria, with 77% of fishermen declaring turtle consumption, but it also occurs in other regions (0-15%). Given the high number of turtles caught in Egypt and in particular in Alexandria, it is likely that several hundreds of turtles are slaughtered annually.

Although fishermen appreciate turtles as a free meal in a context of general poverty, cultural factors are the main drivers for turtle consumption. While in regions like Alexandria the central and the eastern ones, tradition plays an important role favoring consumption or no consumption, in the western region some additional reasons for not consuming turtles exist, like respecting the ecosystem and life, and trust in community (non-governmental) authorities. As a result of this no fishermen declared turtle consumption in this region.

2.3.2.3. Other threats

A survey along the Egyptian Mediterranean coast (Clarke et al., 2000) concluded that the entire coastline is polluted, and the most polluted areas were in the western region were the classification of these beaches were ranked between `moderately’, ‘heavily' or `very heavily' polluted. None of the nesting beaches on the eastern region were as severely polluted as those in the western region. Beaches were polluted with non-biodegradable debris, such as plastic, rubber and nylon. Also most beaches were also found to be polluted to different degrees with oil and tar.

Fishermen and fishmongers in Alexandria, said that plastic bags were often found in stomach and digestive tracks of turtles, in particular of *Caretta caretta* (Nada and Casale, 2008) and such evidence was directly observed by M. Nada.

3. *Chelonia mydas*

3.1. Present distribution and abundance

3.1.1. Nesting sites

In 1998, only the eastern region (from Port Said to Rhafa) showed any evidence of green turtle nesting activity (n =8) , and 7 of these tracks were suspected to be actual nests (Clarke et al., 2000). The main nesting area along this coast is a 22 km stretch of sandy coastline located west of Areash city, of which 8 km of this beach lies within the boundaries of the Zaranik protected area (Clarke et al., 2000). This is the same area important for loggerhead turtle nesting (see 2.1.1.).

3.1.2. Marine areas

Most of the green turtles found washed up dead in 1998 by Clarke et al. (2000) were in the eastern region (from Port Said to Rhafa), suggesting that waters in front of this coast are the most frequented by this species, for trophic or reproductive reasons (3.1.1.).

Egypt probably hosts important foraging areas or migratory corridors, as suggested by satellite-tracked nesting turtles from northern Cyprus (Godley et al., 2002; Broderick et al., 2007) and Syria (Rees et al., in press).

This is supported by the high by-catch level (2.3.2.1.), even though Nada (2001) found only 15% of turtles in the market being green turtles.

3.2. Past distribution and abundance

Since Nada (2001) found only 15% of turtles in the market being green turtles it is uncertain if the trend reported by fishermen (2.2) can be applied to green turtles too. However, during the 2007 survey several persons stated that green turtles were becoming increasingly difficult to find (for meat consumption) (Nada and Casale, 2008).

3.3. Threats

3.3.1. Terrestrial Habitats

See 2.3.1.

3.3.2 Marine Habitats

Information presented in 2.3.2. concerns both *Caretta caretta* and *Chelonia mydas*, though it should be considered that the former is the most abundant species.

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

Leatherback turtles are known by fishermen, so they frequent Egyptian waters, though this is the rarest among the sea turtles species occurring in Egypt (Nada and Casale, 2008). Only one dead leatherback turtle stranded was found (in the eastern region) during the 1998 survey by Clarke et al. (2000) while another carcass was found in 2007 by Nada and Casale (2008) in the western region.

4.2. Past distribution and abundance

Data not available.

4.3. Threats

4.3.1. Incidental catch

Data not available.

4.3.2. Intentional killing and exploitation

Probably intentional killing is not common, at least not for consumption. Nada and Casale (2008) reported that one fishmonger mentioned that a leatherback was once captured and brought to the fish market. After slaughtering it, customers complained that its taste was unpalatable.

4.3.3. Other threats

Data not available.

5. Other species

No other sea turtle species are reported from Mediterranean Egypt.

6. Conservation status

Egypt is a signatory to four International Conventions that include the protection of marine turtles. These include:

- "The African convention on the Conservation of Nature and Natural Resources" (Algeria, 1968). All marine turtles are listed in class A of the Annex to this Convention for total protection.
- The "Migratory Species Convention" (Bonn, 1979), all Mediterranean marine turtle species are included in both Appendix I and II. According to Article III of the Convention, parties, including Egypt, are obliged to prohibit the taking of animals listed in Appendix I. Parties to this Convention also have the obligation to endeavor to conclude agreements for the conservation of migratory species listed in Appendix II, including marine turtles.
- In the "Convention of International Trade in Endangered Species of Wild Fauna and Flora" (Washington, 1973), known as CITES, all marine turtles found in the Mediterranean are listed in Appendix I. Accordingly, taking the turtles from the sea without a permit is banned. Furthermore, all domestic trade of species listed in the CITES Appendix I, and therefore the marine turtles and their products, is prohibited.
- The framework of the "Barcelona Convention" (Barcelona, 1976), in Genoa during 9-13 September 1985, parties, including Egypt, agreed to protect Mediterranean marine turtles as a "priority target". (The Genoa Declaration).
- Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA and Biodiversity Protocol) Date adopted: 10 June 1995 (Barcelona, Spain). Date entered into force: 12 December 1999 - replacing the Protocol concerning Mediterranean Specially Protected Areas adopted on 3 April 1982 (Geneva, Switzerland), entered into force on 23 March 1986.

Along the lines of this international commitment to conserving marine turtles, a series of national laws were drawn up during the 1980s and early 1990s, in order to demonstrate the importance of conserving these species. These laws included the following:

- Law 53/1966: the Agricultural law. This law was not the first law with provisions for the protection of wildlife; however it superseded previous laws that addressed the matter. The law provided provisions that aim at protecting endangered reptiles, mammals and birds.
- Law 102/1983 for Natural

protectorates, establishing the legal framework for the creation and management of protected areas. The law specified conditions under which a protected area, either inland or marine, could be established. The law designated the EEAA as the governmental body responsible for the selection and management of protected areas.

- Law 124/1983 on catching fish and other marine creatures. The law regulates harvesting of fish and other aquatic organisms in marine and inland waters, as well as aquaculture. It specifies standards for fishing methods, bans certain illegal techniques, and establishes a licensing system for fishing and aquaculture. The provisions of this law are implemented by the General Authority for the Development of Fisheries Resources of the Ministry of Agriculture.
- Minister of Agriculture Decree 1403/1990 which provides protection of 14 reptiles including turtles (the green turtles only).
- Environmental Law 4/1994: this law is the most significant law of all the legislations concerned with the conservation of the environment in Egypt. Although the law was largely devoted to pollution issues, article 28 address the hunting of wildlife. This article states that “killing, capturing, transportation, selling, nest destruction and display of an endangered species either dead or alive is prohibited when Egypt is signatory to an International Convention”. The Egyptian Environmental Affairs Agency was designated as the governmental body concerned with the implementation of this law.

In 1999, only 17 fishermen and fishmongers in the Alexandria fish market out of a sample of 64 individuals (26.6%) were aware that the trade in marine turtles is illegal (Nada, 2001). In 2007 Nada and Casale (2008) found that the percentage of fishermen and fishmongers who are aware of the illegality of trading in marine turtles have increased to 79% of the fishermen and 85% of the fishmongers. In addition, most of the fishermen and the fishmongers in Alexandria stated that the law is being enforced and they would not risk bringing caught sea turtles to the landing sites, trading it in the fish market or in public.

Similarly, a high number (89%) of police officers inspecting the landing sites were aware that the Egyptian law is prohibiting the trade and consumption of sea turtles. They also affirmed that they received strict instructions from the Egyptian government that these laws should be enforced.

During interviews with several governmental officials, it was clear that the recent focus on conserving the marine turtles could be attributed to a diverse set of factors that are mutually reinforcing. These factors included establishment of Egyptian Environmental Affairs Agency and its branch in Alexandria; international pressures on Egypt to conserve these species; pressures from national non governmental organizations; and enhanced capacity of a group of governmental officials regarding the importance of conserving marine turtles.

Although it is evident that the government of Egypt took significant steps to prevent the illegal trade of marine turtles in fish markets, Nada and Casale (2008) found that black market is in place and fishermen in most cases consume turtles on board of their ships, and if not, only the meat is landed to escape police control. Hence, laws and their enforcement produced only apparent positive results (i.e. if only open trade in some markets is considered) but the main factors of turtle killing were unaffected and sea turtles are still slaughtered in large numbers.

Almost all the researches that were conducted to assess the status and threats facing marine turtles in Egypt, as well as the advocacy campaigns to stop the illegal trade in Alexandria’s fish market, were driven and lead by foreign academic and/or international NGOs. However, in the last ten years, some initiatives started to emerge from Egyptian governmental institutions, NGOs, universities and research centers.

7. Conservation needs

On the basis of the present knowledge,

the following conservation priorities can be identified (Nada and Casale, 2008):

- Reduce sea turtle killing in Alexandria, basically by changing the present sea turtle position and role in the local communities culture. Turtle-based ecotourism, education campaigns, involvement of marginalized fishermen, and enforcement could contribute to this aim.
- Reduce sea turtle killing in other areas.
- Reduce sea turtle bycatch, through testing and implementing gear modifications or other fishery management measures.
- Reduce the anthropogenic impact on turtle nesting, through legal protection, enforcement, management and involvement of stakeholders.
- Monitor turtle occurrence and threats, through long-term research projects focused on conservation-related aspects.

8. Miscellaneous

None.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

The Egyptian Environmental Affairs Agency (EEAA; www.eeaa.gov.eg/English/main/about.asp) is the governmental body mandated to formulate environmental policies; preparing necessary plans for environmental protection; and promoting relations between Egypt and other States, as well as Regional and International Organizations. The EEAA is also mandated to insure the implementation of Egypt's environmental Law (law 4/1994). In addition, a prime responsibility of the EEAA is to declare and manage protected areas in Egypt.

In the past five years, the EEAA took several steps to conserve marine turtles. Among the key endeavors was coordinating with the environmental department and the police authority of Alexandria to insure the prevention of the illegal trade of marine turtles. In addition, monitoring nesting activities in El Zaranik protected area and undertaking awareness campaign to stop egg poaching by local communities.

9.2. Private

The Mediterranean Association to Save the Sea Turtles (MEDASSET-UK) took the lead on exploring the status of marine turtles nesting in the western region of the Egyptian Mediterranean coast. It was also among the first NGOs to contact different governmental institutions in Egypt and urging them to adhere to Egypt's commitment to conserve marine turtles and their habitat, demonstrated in the ratification of aforementioned conventions. MEDASSET in association with the Friends of the Environment Association in Alexandria undertook a long-term awareness campaign that targeted different segments of the fishermen communities in Alexandria, with specific focus on those residing in El Anfoushi area. MEDASSET and Friends of the Environment also conducted series of socio-economic researches to acquire a more holistic understanding of the factors that are impacting on fishermen perception towards turtles' conservation.

In 2000, Darwin Initiative for the Survival of Species concluded a three years survey that aimed at assessing the status of marine turtles nesting along the Egyptian Mediterranean coast and major threats. The project also undertook awareness activities to some local communities along the coast.

The Darwin Initiative for the Survival of Species organized a workshop on Marine Turtle Biology and Conservation in the Mediterranean, with the participation of several governmental administrators in the year 2001 (for more information: http://www.seaturtle.org/mtn/archives/mtn92/mtn92p15.shtml).

WWF commissioned a research in 1996 to assess the impact of trawling activities on marine turtles in Egypt, Tunisia and Turkey. In addition, in 2007, another research was commissioned by WWF to assess the status of marine turtles along the Egyptian Mediterranean coast and major threats.

10 Resources available about marine turtle research and conservation

Research papers commissioned by MEDASSET could be found at: http://www.medasset.org/pub_db/Search_results.asp?search=egypt

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Fig. 1 was prepared with Maptool (seaturtle.org).

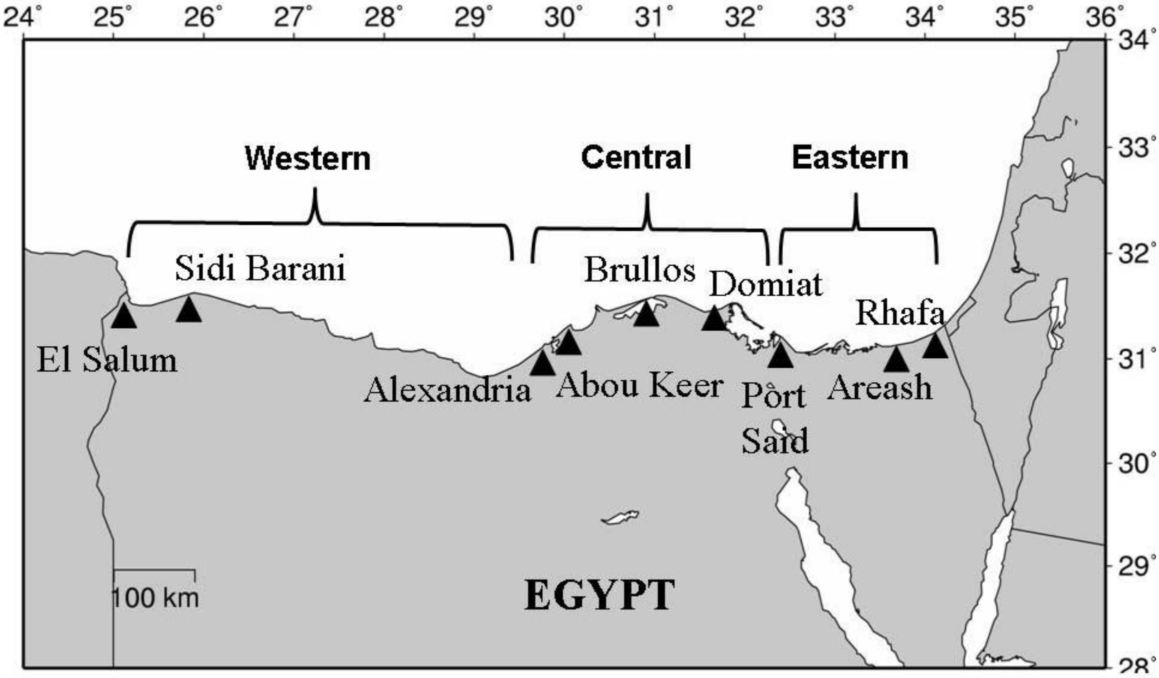

Figure 1. Mediterranean coast of Egypt. Regions (western, central, eastern) and places cited in the text are shown.

Figure 2.
Green turtle displayed in front of a fish restaurant in the Anfoushi area (Photo: M. Nada).

Figure 3.
Green turtle on sale in the black market in El Max (Photo: P. Casale).

FRANCE

Guy OLIVER

Laboratoire IMAGES, Université de Perpignan Via Domitia,
and
Réseau Tortues Marines de Méditerranée française,
52 avenue Paul Alduy, F-66860 PERPIGNAN cedex 9 (France) (E-mail: oliver@univ-perp.fr)

1. General remarks

Five Marine Turtle species which have been reported in the Mediterranean Sea, have been also observed on French Mediterranean coasts and in surrounding waters: the loggerhead turtle *Caretta caretta*, the green turtle *Chelonia mydas*, the leatherback turtle *Dermochelys coriacea*, the Kemp's ridley turtle, *Lepidochelys kempii* and the hawksbill turtle *Eretmochelys imbricata*. However some of these are very uncommon (*Dermochelys coriacea*) or exceptional (*Lepidochelys kempii* and *Eretmochelys imbricata*).

Guillaume Rondelet (1554, 1558) described and illustrated the loggerhead turtle as "De Testudine corticata" and the leatherback turtle from a specimen stranded at Frontignan (Hérault), near Sète (Hérault) as "De Testudine coriacea sive Mercurii".

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

Nesting was reported on Corsica Island in 1923, 1928 and 1932 (Testa in litt. in Delaugerre, 1988) but no physical evidence has been preserved. Subsequently, Delaugerre (1988) compiled information showing a probability that *Caretta* had nested on the eastern Corsican coast in the past.

At the end of November 2002, remains of a nest that was probably naturally destroyed by sea, were found at Palombaggia "Plage des Lumières", near Porto-Vecchio (South Corsica) (Fig. 1). A complete egg, dissected by Roger Bour at the National Museum of Natural History of Paris, contained one fully developed embryo nearly ready to hatch (Delaugerre and Cesarini, 2004) and the nest also contained empty shells that were possibly already-hatched eggs.

In mid-July 2006, another loggerhead nesting event was reported in Saint-Tropez on Var coast (Fig. 1). It is an exceptional event, recorded for the first time on the French Mediterranean coast and representing the northernmost nesting event in the Mediterranean (Oliver, 2006; Sénégas et al., 2008).

This nest was laid a few meters from the water line on a very gently sloping beach (Fig. 2). Due to inundation by rain and high sea levels,, by mid-September the eggs were removed and put under artificial incubation,. Ultimately none of them hatched, although some embryos had reached a developmental stage near hatching.

2.1.2. Marine areas

The loggerhead sea turtle (*Caretta caretta*) has been observed all along the French Mediterranean coastline (Fig. 1) and is encountered all year round (Oliver, unpublished). However, its presence follows a seasonal cycle during which numbers are more abundant from May to September (77% of annual captures) and particularly from June to August (58% of annual captures).

The marine environment along the French Mediterranean coast seems to be used as a feeding area and probably a movement zone during their migration as demonstrated by Camiñas and de la Serna (1995).

2.2. Past distribution and abundance

Data not available.

2.3. Threats

2.3.1. Terrestrial Habitats

2.3.1.1. Coastal development

Languedoc-Roussillon coasts extend to 218 km. Following I.G.N. maps (I.G.N., 1990a-c), 92 km, that is 42% of the coast, is urbanized (not including harbours and campings).

Provence and Riviera coasts extend 757 km. Today, 198 inventoried development sites (harbours, airport, artificial beaches, dams, etc.) occupy 123 km or 16,2% of this coastline; this percentage rises to 25,2% in the Alpes-Maritimes department and up to 21,8% in the Bouches-du-Rhône department (Meinez et al., 1990).

Resort developments reach down to the edge of the beach and seafronts are generally highly illuminated.

2.3.1.2. Beach restructuring

Sandy coasts, particularly those of the Camargue and Languedoc-Roussillon are actively eroding. Some beaches are, more or less regularly, repaired with loads of sand which is often carried away again by storms and it is necessary to repeat the same operation again in following years.

The majority of coastal cities clean their beaches with heavy machinery which plough sand to a depth of about 30 cm.

2.3.1.3. Non human predation

Data not available.

2.3.1.4. Human exploitation

None, given the low number of nests.

2.3.1.5. Other threats

Many beaches are subject to erosion and have cliffs that present an obstacle for females. In Camargue, urbanization and lighting are limited on the seafront.

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

Incidental captures represent 38% of whole recorded specimens: bottom trawl (26%), meshing nets (34%), drifting longline (20%), unidentified fishing gears (20%). Alive specimens found in fishing gears represent 78% of incidental captures in these traps (Oliver, unpublished).

2.3.2.2. Intentional killing and exploitation

According to Delaugerre (1988), loggerhead were traditionally eaten by Bonifacio area fishermen (South Corsica) on Saint Erasm’s day (June 2nd) until the 1960’s

2.3.2.3. Other threats

In some cases, boat propeller strikes have been identified. No other threats are known.

3. *Chelonia mydas*

3.1. Present distribution and abundance

3.1.1. Nesting sites

No nesting sites are known on the French Mediterranean coasts.

3.1.2. Marine areas

On Mediterranean French coasts, the Green Turtle (*Chelonia mydas*) is very rare: only 5 catches have been reported (Fig. 3). The first observation goes back to 1979 (Fretey, 1987) and 4 subsequent catches have been reported since this year (Laurent, 1991; Laurent et al., 1998; Oliver, unpublished).

3.2. Past distribution and abundance

Data not available.

3.3. Threats

3.3.1. Terrestrial Habitats

Not applicable, because this species does not nest in this area.

3.3.2 Marine Habitats
3.3.2.1 Incidental catch

These five observations correspond to incidental captures: 2 were caught by fishing line, and 3 by nets of unknown type, one of them in Thau lagoon (Hérault) (Pigno, obs.).

3.3.2.2. Intentional killing and exploitation

Data not available.

3.3.2.3. Other threats

Data not available.

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

The leatherback turtle (*Dermochelys coriacea*) has been observed all along the French Mediterranean coastline (Fig. 4). Its frequency and abundance are quite limited: nearly 1 specimen every two years. There have been 41 dated catches (Oliver, 1986; Duron-Dufrenne, 1986; Delaugerre, 1988; Delaugerre, 1992; Laurent et al., 1998; Oliver, unpublished).

This species has been reported between May and December: 85% of sightings have been between these two months and 78% between June and September (Oliver, unpublished).

4.2. Past distribution and abundance

Data not available.

4.3. Threats

4.3.1. Incidental catch

Fishing gear involved in leatherback incidental captures are: bottom trawl (3 cases), meshing nets (2 cases), tuna net (1 case) and drifting longline (1 case), however the type of fishing gear is unknown in 15 cases (Oliver, unpublished).

4.3.2. Intentional killing and exploitation

Data not available.

4.3.3. Other threats

Data not available.

5. Other species

Mourgue (1909) reported a female hawksbill turtle (*Eretmochelys imbricata*) which had been caught with fishing-line in Marseille bay. Laurent and Lescure (1991) reported the presence of this species in the French Mediterranean waters after three specimens were captured between 1960 and 1988 (one in a drifting net and one in a meshing net).

One Kemp’s ridley turtle (*Lepidochelys kempii*) was incidentally captured in meshing-net during summer 2001 off Valras-Plage (Hérault) (Oliver and Pigno, 2005) (Fig. 5).

6. Conservation status

French legislation concerning Marine Turtles includes the October 14th 2005 decree which established the list of marine turtle species protected. In addition, quartering law n° 96-1139 from December 26th 1996 applies to the disposal of marine turtle carcasses, after a scientific examination. In addition to these French-specific laws, there are international documents ratified by France: C.I.T.E.S. (applicable in European Union though communal settlement n° 338/97 from December 9th 1977), Bonn Convention, Bern Convention, Barcelona Convention, Directive Habitat.

7. Conservation needs

Professional fishermen are the principal providers of individuals for a rescue center. Coordination of the transfer of live animals from fishing boats to the rescue center could allow the rehabilitation of more individuals. On the other hand, methods or devices for reducing incidental capture at sea can protect marine turtles present in the area; but their number is low and the cost would be high.

8. Miscellaneous

None.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

The French Ministry in charge of Environment, Nature and Landscape Direction started an Action Plan for the Conservation of Marine Turtles in 1993.

Port-Cros National Park takes part in the rescue of Marine Turtles when it is necessary.

"The National Agency for Hunting and Wild Fauna" (Office national de la Chasse et de la Faune sauvage, or O.N.C.F.S.) is entrusted with environment policy. Several agents of this office participate by collecting data and observations.

9.2. Private

The «French Mediterranean Marine Turtles network» (Réseau Tortues marines de Méditerranée française, or R.T.M.M.F.) constitutes a specialised group of the S.H.F. (Société Herpétologique de France); it is linked to the "National Strandings Network" (Réseau National d'Echouages or R.N.E.) and G.T.M.F. (Groupe Tortues marines France). This network collects data on events concerning Marine Turtles on French Mediterranean coasts.

Some aquariums, such as those of Banyuls-sur-Mer (Pyrénées-Orientales), Agde (Hérault) or Institute Paul Ricard (Embiez Island, Var), participate in the rescue network when it is necessary. The Aquarium of Oceanographic Museum of Monaco (Monaco Principality) also collaborates with the French Mediterranean marine turtle network.

At Le Grau-du-Roi (Hérault), a Rescue Center (CESTMED : Centre d'Étude et de sauvetage des tortues de Méditerranée), specially dedicated to marine turtles, was approved by an official decree (June 18th, 2007). Their close relationships with professional fishermen, have allowed them to collect several specimens incidentally captured and to rehabilitate and release them.

10 Resources available about marine turtle research and conservation

Websites:

- www.portcrosparcnational.fr [Choose: "L'accueil"; after: "Actualités" and see: "Le Parc et le réseau tortues marines de Méditerranée française".
- www.cestmed.org

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12. Acknowledgements

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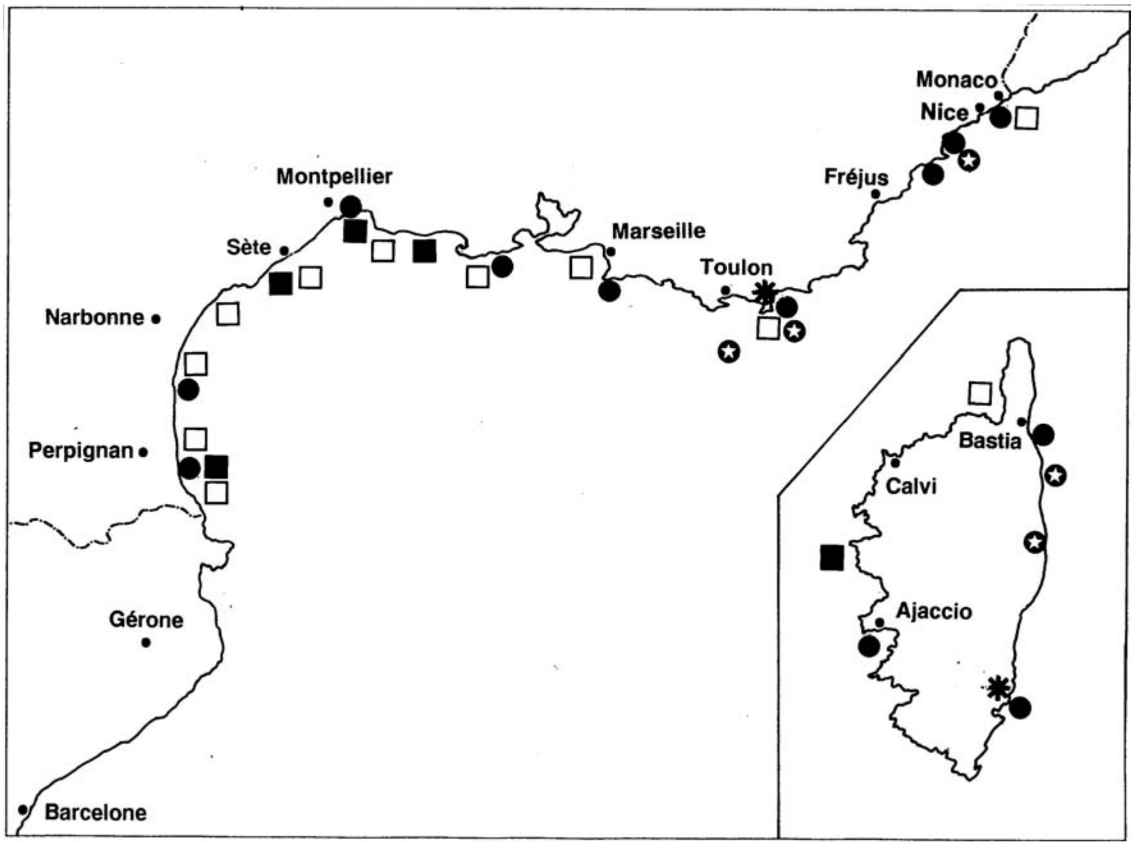

Figure 1. Location of the observations of loggerhead turtles (*Caretta caretta*) on the French Mediterranean coasts. Full squares: incidental captures (death). Empty squares: incidental captures (alive). Full circle: stranding. Circle with star: sighting. Asterisks: nests. Each symbol represents one or more specimens.

Figure 2. Site (fence on the right) of a loggerhead turtle nest (*Caretta caretta*) in Saint-Tropez (Var, France) (Photo: G. Oliver).

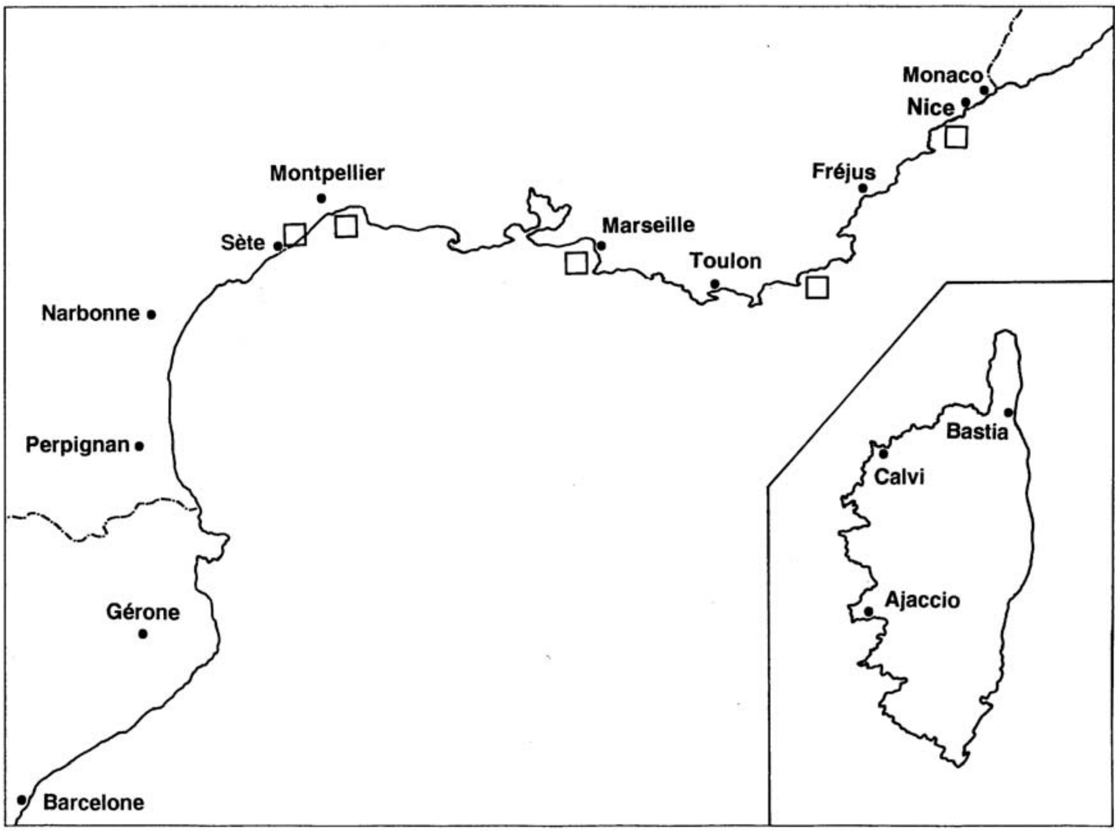

Figure 3. Location of the observations of green turtles (*Chelonia mydas*) on the French Mediterranean coasts. Symbols as in Fig. 1.

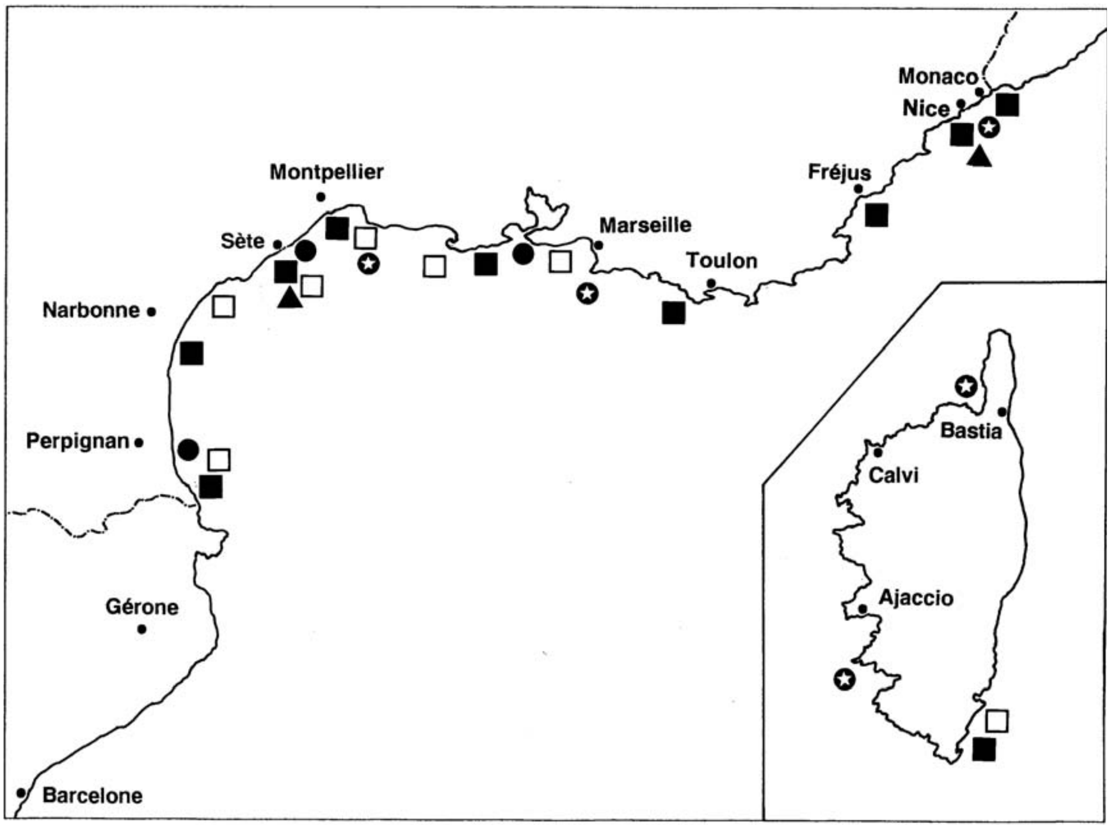

Figure 4. Location of the observations of leatherback turtles (*Dermochelys coriacea*), on the French Mediterranean coasts. Symbols as in Fig. 1.

Figure 5.
Kemp's ridley turtle (*Lepidochelys kempii*) captured in 2001 in front of Valras (Hérault, France) (Photo: G. Oliver).

GREECE

Dimitris MARGARITOULIS[1] and Aliki PANAGOPOULOU[2]

ARCHELON, the Sea Turtle Protection Society of Greece, Solomou 57, GR-10432 Athens,
E-mail: [1] margaritoulis@archelon.gr; [2] aliki@archelon.gr

1. General remarks

All three species of sea turtles known to frequent the Mediterranean Sea are found in Greece. The loggerhead turtle (*Caretta caretta*) is the most abundant while several of its main nesting aggregations are located in Greece. Less common is the green turtle (*Chelonia mydas*) whose regional population is estimated to have been decimated due to past exploitation in the eastern Mediterranean with no known nesting sites in Greece. Finally the leatherback turtle (*Dermochelys coriacea*) can only be considered a visitor from the Atlantic, since it occurs in low numbers in Greece without nesting in the Mediterranean.

First documentation of nesting of *Caretta caretta* in Greece has been recorded in 1977 on Zakynthos Island (Margaritoulis, 1982); systematic tagging started at Zakynthos in 1982 and standardized beach monitoring, continued unfailingly until today (2008), was initiated at Zakynthos and Kyparissia Bay in 1984.

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

After the discovery of the most important nesting area (Laganas Bay in Zakynthos) in 1977 (Fig. 1), beach surveys along the coasts of Peloponnesus revealed the nesting areas of Kyparissia Bay (Fig. 2), Lakonikos Bay, Romanos, Koroni (Fig. 3) and Kotychi. The foundation of the Sea Turtle Protection Society of Greece (now ARCHELON) in 1983 was followed by the onset of long-term standardized monitoring projects mainly at Zakynthos, Kyparissia Bay and Lakonikos Bay.

Further, a systematic long-range survey, conducted by ARCHELON during 1989-1992 along parts of the Greek coastline, not surveyed before, provided the opportunity to discover new nesting areas and determine the extent of loggerhead nesting in Greece. Through this survey, two important nesting sites were revealed on the island of Crete (Rethymno and Bay of Chania) as well as many other sites with lower nesting concentrations (Margaritoulis et al., 1995; unpublished data).

The overall results of the above surveys showed that regular nesting of loggerhead turtles in Greece is distributed at the Ionian Islands, western mainland Greece, western and southern Peloponnesus, southeastern Peloponnesus, Island of Crete as well as on the islands of Kos and Rhodes in the Dodecanese archipelago. Although in the Ionian Sea nesting occurs almost up to the northern boundaries of Greece, no regular nesting has been found in the central or the northern Aegean Sea. The latter has been also confirmed by another survey conducted in 1991 along the coasts of northern Aegean (Kasparek, 1994).

Following long-term data the nesting areas in Greece have been ranked as “Major”, “Moderate” and “Diffused” areas (Margaritoulis, 2000). “Major” nesting areas are those hosting an average of more than 100 nests/season and a nesting density over 6 nests/km/season. Five areas in Greece fulfill the requirements for “major” areas: Laganas Bay (Zakynthos Island), Kyparissia Bay (western Peloponnesus), Rethymno (Crete Island), Lakonikos Bay (southern Peloponnesus) and the Bay of Chania (Crete Island) (Margaritoulis, 2000). The above locations represent 71.5% of the total nesting activity in Greece and are monitored each season by ARCHELON through a systematic and standardized long-term monitoring project (Table 1).

"Moderate" nesting areas have an average of between 20 and 100 nests per season. These areas represent 13.5% of the total activity, while three of these (Bay of Messara, Koroni, Kefalonia Island) are also regularly monitored (Table 2). Finally, taking into account the "diffuse" nesting (estimated at 15% on total nesting) that takes place along the 16,000 km of Greek coastline, the overall number of loggerhead nests in Greece ranges from 5,319 to 2,132 with an average of 3,472 nests/season (Table 3).

The importance of Zakynthos, concentrating about 36% of the total nesting activity in Greece in only 5.5 km of beach, with an average nesting density of 226 nests/km/season), should be emphasized. On the average 54% of the total number of Zakynthos nests are laid on the 650-m long Sekania beach (Fig. 4), which is among the most densely nested loggerhead beaches in the world, with an average nesting density of 1,033 nests/km/season (and at times exceeding 1,500 nests/km/season). Further, one of Zakynthos beaches, the 370-m long Marathonissi beach, which hosts only 9.4% of the total number of nests at Zakynthos, produces almost exclusively male hatchlings because of lower sand temperatures (Margaritoulis, 2005; Zbinden et al., 2007a). This finding emphasizes the importance not only of beaches with high nesting levels (like Sekania) but also of beaches with other characteristics, very important to the nesting population but more difficult to be assessed.

2.1.2. Marine areas

Loggerhead turtles are found practically everywhere in the Greek seas. Concentration areas leading to possible marine habitats can be assessed either by frequency of strandings, tag recoveries and/or incidental catch in fisheries.

Collection and analysis of the above type of data yielded concentration of turtles at the following marine areas: Ionian Sea (north of Zakynthos), Zakynthos Island and western Peloponnesus (including Kyparissia Bay), Amvrakikos Bay, Messiniakos Bay, Argolikos Bay, Lakonikos Bay, Saronikos Bay, Island of Crete, southeastern Aegean Sea (including Kos and Rhodes), northern Aegean Sea (including Thracian Sea). The above marine areas are frequented by turtles throughout the year and therefore may well be foraging and/or wintering areas (Margaritoulis et al., 1995; Margaritoulis and Teneketzis, 2003; Panagopoulos et al., 2003; Rees and Margaritoulis, 2006).

Laganas Bay at Zakynthos is an important marine area for turtles as it comprises the main inter-nesting area of the female population nesting at Zakynthos (Zbinden et al., 2007b) but is also a courtship and mating area, with several types of solitary and social behaviours of both male and female turtles (Schofield et al., 2006). Also, the Gulf of Argostoli in Kefalonia Island can be considered a summer foraging area of large sized loggerheads (White, 2006).

In western mainland Greece, in-water field surveys have confirmed Amvrakikos Bay to be an important foraging ground for loggerhead turtles. Although it has not been yet possible to estimate the size and structure of the population frequenting the Bay, it seems that this comprises mainly of sub-adult to adult sized turtles, mostly males. Additionally, the capture of previously tagged turtles suggests that Amvrakikos Bay is a foraging habitat linking at least three major nesting areas in Greece (Zakynthos, Kyparissia Bay and Rethymno) (Rees and Margaritoulis, 2006). Further, a loggerhead turtle (SCL: 70 cm) captured in Amvrakikos Bay on 13 May and equipped with a satellite transmitter started a directed move on 29 June towards eastern Mediterranean, reaching the Syrian coast on 14 August; then moved to the Mediterranean coast of Turkey where it remained until 4 July the following year (end of transmissions). It may be possible that this turtle belonged to a nesting colony outside Greece and used Amvrakikos Bay as a foraging area (Rees and Margaritoulis, in press).

Post nesting movements of loggerheads, tagged while nesting in Greece, show a wide dispersion in the eastern and central Mediterranean basin, with marked clusters of tag recoveries at the Gulf of Gabès and the Adriatic Sea (Fig. 5). These areas are considered primary foraging and/or wintering areas for adult female loggerheads nesting in Greece. These foraging areas of loggerhead turtles nesting in Greece have been confirmed also by satellite tracking (Zbinden et al., in press).

Table 1. The "major" nesting areas in Greece and their nesting potential (from Margaritoulis et al. (2003a) with inclusion of unpublished data).

Nesting Area	Maximum number of nests/season	Minimum number of nests/season	Average number of nests/season	Number of monitoring seasons (years)
Zakynthos (Laganas Bay)	2,018	833	1,244	24 (1984-2007)
Kyparissia Bay	927	286	621	24 (1984-2007)
Rethymno	516	166	324	18 (1990-2007)
Lakonikos Bay	288	107	197	16 (1992-2007)
Bay of Chania*	192	45	94	16 (1992-2007)
TOTAL	3,941	1,437	2,480	

*Bay of Chania was within the 100 nests/season limit until 2005. However, it is still included in the "major" category with the hope that the nesting level will increase in future seasons.

Table 2. The "moderate" nesting areas in Greece and their nesting potential (from Margaritoulis et al. (2003a) with inclusion of unpublished data).

Nesting Area	Maximum number of nests/season	Minimum number of nests/season	Average number of nests/season	Number of monitoring seasons (years)
Bay of Messara	80	15	51	15 (1993-2007)
Beaches adjacent to Kyparissia town (not included in data of Kyparissia Bay)	68	60	64	2 (1989, 1998)
Ipirus Coast *	40	40	40	1 (1990)
Kefalonia Isl. (Mounda beach)	45	17	29	6 (1993-98)
Kerkyra Isl. (Corfu) *	20	20	20	1 (1990)
Koroni	66	35	50	13 (1995-2007)
Kos Isl. *	60	60	60	1 (1991)
Kotychi	80	32	50	3 (1986, 1989, 1995)
Lefkas Isl.*	50	50	50	1 (1990)
Rhodes Isl.	21	9	15	2 (1988-89)
Romanos	30	17	22	3 (1989, 1998-99)
Southeastern Peloponnesus (incl. Kythira Isl.) *	20	20	20	1 (1990)
TOTAL	580	375	471	

*Number of nests was estimated after 3 one-off surveys within the nesting season.

Table 3. Estimation of total nesting activity in Greece.

Category of nesting	Maximum number of nests/season	Minimum number of nests/season	Average number of nests/season
In “major” areas (>100 nests/season)	3,941	1,437	2,480
In areas with “moderate” nesting (20<x<100 nests/season)	580	375	471
“Diffuse” nesting (15% of total)	798	320	521
TOTAL	5,319	2,132	3,472

2.2. Past distribution and abundance

There are several anecdotic stories on the abundance of sea turtles in Greece. A fisherman reports that during the Second World War he used to fish turtles in southern Evoikos Bay and transport them to Athens for the Italian troops stationed in Athens who considered them a delicacy. Old people at Zakynthos say that many years ago certain beaches of Zakynthos were becoming “black” in August from the large number of hatchlings. On Crete old people remember that as children they used to dig up nests and play with the eggs. The President of Fishermen Association of Rethymno (Mr Ch. Tsountanis) testified in 2006 that in the last years he observes less turtles at sea than before. In Kefalonia Island local people say that there were more turtles in the past (Sutherland, 1987), and suggest a rapid drop in nesting frequency over the last 40 years (Stringell et al., 1996).

2.3. Threats

Human activities impact sea turtles in a number of different ways. They can directly impact the individual at any of its life stages: nesting female; incubating egg in nest; emerged hatchling on the beach or at sea; juvenile and adult at sea.

2.3.1. Terrestrial Habitats

2.3.1.1. Coastal development

A major threat faced by loggerhead turtles in Greece is loss of nesting habitat due to tourism development, booming since the 1970’s. The nesting beaches of Laganas Bay on Zakynthos and Crete are particularly susceptible to this threat, with several other areas becoming increasingly vulnerable to future development projects.

Coastal development has led to an expansion of hotels, bars, restaurants and houses along the beach. In many cases, these constructions are built on the dune systems affecting an originally flexible and adjustable coastal system. Dunes provide natural sediment reservoirs, which guarantee the maintenance of sandy beaches in a much wider coastal zone. If major parts of dunes are locked up under hard constructions such as buildings, parking places or roads, beaches may disappear through erosion, leading to a permanent loss of nesting habitat for turtles.

More specifically, terrestrial habitats of loggerhead turtles in Greece face the following threats, stemming from coastal development and tourism:

<u>Zakynthos Island (Ionian Sea).</u>

The nesting habitat extends along six discreet beaches, totalling 5.5 km in length, within Laganas Bay (southern part of the island). A description of the nesting beaches is found in Margaritoulis (2005).

Human presence affecting all beaches (with exception of Sekania beach) by disturbing (illegally) turtles at night, and trampling along nesting zones. However, this has been reduced in the last years due to effective wardening.

Coastal constructions in the form of walls, buildings, and various makeshift constructions mainly made in the past, but few also at present, have perturbed the natural physical characteristics of Daphni, East Laganas and Kalamaki beaches.

Artificial lighting of Laganas village and lights from the airport (behind East Laganas beach) affect the nesting beaches of Marathonissi, East Laganas and Kalamaki.

Vehicular traffic (motorbikes and cars) is still observed on the East Laganas and Kalamaki beaches.

Horse-riding (as a tourist attraction) is still seen on the dunes behind East Laganas beach.

Beach furniture (umbrellas, sun beds) and recreation boats (canoes, sea-bicycles) left on the beach, sometimes surpassing the permitted quota, occupy crucial nesting space at East Laganas, Kalamaki (Fig. 6) and Gerakas.

<u>Kyparissia Bay (western Peloponnesus).</u>

Nesting occurs along 44 km of continuous beach with low developmental level. However, 85% of nesting concentrates at the southernmost 9.5 km, which is considered the core nesting area (Margaritoulis and Rees, 2001). Threats noted below refer to the core nesting area, divided to four beach sectors (O, A, B, C).

Human presence, by means of trampling, affects strongly Kalonero beach (Sector O), which is the southernmost part of the core nesting area, and moderately other beach parts with vehicular access.

Coastal constructions by means of seasonal makeshift beach bars and opening of rough roads through the dunes have become a major concern, as these open up prospects for development.

Artificial lights (public and private) affect strongly Kalonero beach and to a lesser extent beach parts with nearby houses. Car headlights from the national road connecting Patras to Kyparissia town affect Vounaki beach (Sector A), where the road approaches the beach.

Vehicular traffic along the entire beach length, mainly with tractors and 4WD cars, is very common.

Beach furniture (umbrellas and sun beds) impacts moderately only Kalonero beach.

A large part of the coastal area at Agiannakis beach (Sector B) is rumoured to have been sold to developers in order to build a tourist installation.

<u>Rethymno (northern coast of Crete Island).</u>

Nesting occurs eastwards of the town of Rethymno, along several beaches, totalling about 12 km in length. The entire area, besides some very small parts, is almost fully developed.

Intense human presence on the entire area affects strongly the beach by trampling and, during the night, by directly disturbing turtles.

Coastal constructions (walls, buildings, makeshift beach bars), across the entire area, have caused severe disturbance to physical characteristics of the beach and a long-term beach erosion by flattening and stabilizing the dunes behind the beach (especially at sectors Sfakaki and Skaletta).

The beaches are usually cleaned before the beginning of the nesting season, which coincides with the opening of the tourist season. Sometimes, however, beach cleaning is done, with heavy machinery vehicles, after the beginning of nesting.

Artificial lighting affects strongly the entire area. Today very few and very small parts of the beach can be found with no severe light pollution.

Beach furniture (umbrellas and sun beds) affect strongly the entire area by taking up nesting space.

<u>Lakonikos Bay (southern Peloponnesus).</u>

The nesting habitat extents along several beaches, totalling 23 km in length, and its developmental status ranges from almost deserted (Evrotas beach) to moderately developed (Mavrovouni beach). Therefore the threats noted below are mostly confined to short parts of the entire area.

Artificial lighting affects relatively a small part of Selinitsa and Mavrovouni beaches.

Vehicular traffic affects a small part of the area.

Beach furniture (umbrellas and sun beds) affects partly Mavrovouni beach.

Beach cleaning, by mechanized vehicles, is sometimes done after the beginning of nesting (at Mavrovouni beach).

Bay of Chania (northern coast of Crete Island).

Nesting occurs west of the town of Chania, along several beach sectors, totalling about 14.5 km in length. The eastern sectors are almost fully developed mainly with tourist installations. The westernmost sectors are rapidly developing, with several smaller or larger tourist operations being built along the entire length of the coast.

Human presence affects the greater part of the area, mainly by trampling.

A diversity of coastal constructions (walls, buildings, beach bars, roads) is found across the entire area.

Beach cleaning is usually effected before the nesting season; but sometimes is done (with heavy machinery equipment) after the beginning of nesting.

Artificial lighting affects strongly the greater part of the area.

Vehicular traffic impacts moderately the westernmost beach sectors.

Beach furniture (umbrellas and sun beds) affect strongly a great part of the nesting area by taking up nesting space (Fig. 7).

Bay of Messara (southern coast of Crete Island).

Nesting extends along 8 km of beach, divided in four sectors with varying status of development. The southernmost sector (Komos beach, Sector A) is an archaeological site protected by the Archaeological Department. Kalamaki village (at Sector B) and the northernmost end of the beach (Kokkinos Pyrgos) are the most developed, backed by beach roads and several small scale hotels and tavernas. A large part of Tymbaki beach (Sector D) is undeveloped due to the fact that they are within a limited-access military area.

Human presence affects part of the area by trampling and occasional beach parties at night, especially in Komos beach.

Illegal camping observed behind Komos beach.

Coastal constructions (walls, buildings, makeshift beach bars, roads) are noted in parts of the area, especially in Kokkinos Pyrgos, Tymbaki and Kalamaki.

Artificial lighting affects Kokkinos Pyrgos, Tymbaki (incl. parts of the military area) and Kalamaki.

Vehicular traffic occurs along several parts of the area.

Beach furniture (umbrellas and sun beds) affect moderately part of the nesting area in Komos, Kalamaki, and Tymbaki.

Beach cleaning, by mechanized vehicles, is sometimes done after the beginning of nesting.

Koroni (SW Peloponnesus).

Nesting occurs mainly along the 2.7 km Zanga-Memi beach with varying developmental status, mainly in the form of houses and occasional tavernas.

Human presence affects parts of the beach (through trampling).

Artificial lighting affects beach parts, close to houses and tavernas.

Vehicular traffic is moderately affecting the entire beach.

Beach furniture (umbrellas and sun beds) affect part of the nesting area.

Kefalonia Island (Ionian Sea).

Nesting concentrates mainly along the 2.8 km Mounda beach (divided in two sectors Kaminia and Potamakia) at the SE part of the island.

Human presence affects a great part of the beach (mainly through trampling).

Artificial lighting of nearby hotels and car headlights affect part of the beach.

Vehicular traffic along the beach is frequently observed.

Beach furniture (umbrellas and sun beds) affect part of the nesting area.

2.3.1.2. Beach restructuring

Construction of groins, set at sea perpendicularly to beach along Chania nesting area, supposed to reduce “natural” erosion, have accelerated the rate of beach erosion (see also 2.3.1.5).

Beach armouring has been noted in front of some coastal hotels at Rethymno. Also “sand berg” practice (i.e. making of sand walls to protect sea side part of properties during winter then evening out the sand just before tourist season), has been noted mainly at Rethymno.

Sand mining has been noted, mainly in the past, along Kyparissia Bay, Lakonikos Bay, Bay of Chania and Bay of Messara.

2.3.1.3. Non human predation

Zakynthos.

Predation of turtle eggs by plants, mainly by tamarisk trees, has been recorded at the western end of the East Laganas beach. Small-scale predation on eggs and hatchlings occurs on all beaches (mainly by rats, martens, crows, dogs and sea gulls). In 1992, about 2% of hatchlings that emerged at Sekania were taken on their way to the sea by rats, martens and sea gulls (Charalambides and Katsoupas, 1994). However, in the last few years, the number of sea gulls on Sekania beach has increased, due to a nearby landfill site, and this is currently under investigation (see Section 6, Nest Management and Predation Control).

Kyparissia Bay.

Egg and hatchling predation, mainly by red foxes (*Vulpes vulpes*) and dogs, is substantial. During 1987, about 48% of nests were disturbed by mammal predators (Margaritoulis, 1988), while in 1984 and 1989 depredation of nests reached 57% and 62% respectively (Margaritoulis et al., 1996a); also secondary predation (after the opening of nests by primary predators) occurs by martens, rats, crows and sea gulls (Margaritoulis, 1988).

Rethymno.

Negligible egg and hatchling predation by dogs, martens and ghost crabs.

Lakonikos Bay.

Substantial egg and on-shore hatchling predation is observed mainly by foxes and feral dogs, and to a lesser extent by jackals (*Canis aureus*). Secondary predation of eggs is effected by martens, rats, crows, and sea gulls. During the nesting seasons of 1997 and of 1998 about 40% of the non-protected nests were depredated (most of them partly).

Bay of Chania.

Negligible egg and hatchling predation by dogs and martens. Also by tamarisk trees (negligible).

Bay of Messara.

Negligible egg and hatchling predation by dogs, martens and ghost crabs; secondary predation by rats, sea gulls (also negligible).

Koroni.

Substantial egg and hatchling predation by red foxes and feral dogs; secondary predation by martens, rats and sea gulls. Predation rate of nests is considered to be very high (about 65% in 2000 when no protection measures were taken); however, with protection measures (screening of nests) in place, it is reduced to about 20% (average over 5 seasons) (Margaritoulis and Rees, 2006).

Kefalonia Island.

Although that about 30% of nests were dug up by dogs during 1986 and 1987 (Sutherland, 1987), no incidents of nest and on-shore hatchling predation were recorded in 1996 (Stringell et al., 1996) and in 1997 (Houghton et al., 1997). Some incidents of nest predation by martens are considered negligible.

Romanos.

About 10% of nests were depredated during the 1998 nesting season. Nest predators are red foxes and feral dogs.

2.3.1.4. Human exploitation

There is no human exploitation of sea turtles in Greece, because of tradition. However, few instances of taking of eggs from marked nests, by non-Greeks, have been noted (e.g. at Romanos).

2.3.1.5. Other threats

Beach erosion is a general problem in Greece. Many beaches are eroding because of destruction of dunes (by stabilizing or removing sand) and disruption of natural processes by various constructions at sea (e.g. piers) and damming of rivers that cut off sedimentation.

Intense erosion is observed at Lakonikos Bay (along Evrotas beach) and northern Crete (Bay of Chania and Rethymno) (Fig. 8). Beach erosion at Lakonikos Bay is probably caused by construction of small dams along Evrotas river, which prevent transport of sediments to the sea.

Beach erosion in the Bay of Chania is caused from coastal constructions (ports at

Kolymbari and Platanias, groins at Platanias and Aghia Marina), and the removal of sediments from Tavronitis river bed by construction companies. Also, intense sand extraction is reported to have occurred during the 50's through the 70's.

Beach erosion is also observed in the Bay of Messara, caused from coastal constructions at the northernmost beach sector (harbour at Kokkinos Pyrgos and a beach road). Sand extractions also used to take place from within the military base, but this has discontinued.

Soil from eroded hill sides, behind the beach, impacts the nesting beach of Sekania at Zakynthos. This eroded soil (mostly clay), transported by rain and deposited over the beach sand, changes its physical properties and impacts directly nesting and hatching success rates. Further it increases vegetation encroachment and in the long-term may cause restriction of the area suitable for nesting. This problem becomes more severe after brush fires, very common in Greece during the summer (see also sections 6 and 9.2).

Planting of exotic vegetation (*Tamarix* sp., palm trees) is observed in Zakynthos, Lakonikos Bay, Rethymno, and Bay of Chania.

Predominant summery strong winds towards the beach cause heavy surf at Rethymno, Bay of Chania and Kyparissia Bay.

Sea-borne debris is frequently accumulated on the nesting beaches of Zakynthos, Kyparissia Bay, Rethymno, Lakonikos Bay, Bay of Chania and Bay of Messara.

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

The extent of fisheries interactions with turtles in Greece has not been fully assessed. The associated mortality is also not known. From a sample of 226 injured turtles admitted to ARCHELON's Rescue Centre in Glyfada (Fig. 9), in the period 1994-2000, it was found that 80% of these turtles bore injuries (incl. hook ingestion) attributed to fisheries interaction (Panagopoulos et al., 2003). However, from circumstantial evidence, it has been understood that each gear has a different impact to turtles. Also the fishing area and season of the year play a role on the impact of a particular gear.

Some nesting areas have a continuous fishing pressure with a diversity of fishing gears, e.g. Lakonikos Bay, which features also a foraging area for both loggerhead and green turtles.

Bottom trawls in Greece do not seem to catch many turtles. This is the case probably because most bottom trawlers in Greece fish in waters deeper than where turtles forage. Through an on-board observer project, conducted in 2000, it was estimated that the annual number of turtles caught in the Thracian Sea (northern Aegean) ranged from 0 to 418 and at the Ionian Sea from 0 to 448. Both estimates are of low accuracy because only one turtle was caught at each area (the one in the Ionian Sea was a green turtle!); both turtles were captured alive in depths of less than 50 m (Margaritoulis et al., 2003b). The usual practice of trawl fishermen in Greece is to release immediately captured turtles by throwing them overboard.

Drifting longline seems to be responsible for a high number of turtle captures. An on-board observer project, conducted in 1999 and 2000, produced a maximum estimation of 5,880 turtles/year as captured by the long-line fishery of Greece and a direct mortality of 5% (Kapantagakis and Lioudakis, 2006). Turtles captured in long lines are usually released by fishermen by cutting the branch line, without hauling the turtle onboard. Thus, in most cases released turtles have to survive with an ingested hook and a part of a nylon line.

Set nets: (together with bottom long lines) are operated by numerous and widespread small-scale and artisan fishermen widely distributed all over Greece. The so-called "small-scale fisheries" of Greece comprises of more than 17,000 registered vessels, which operate close to the shore throughout the year. Although there are no specific data on turtle captures by these gears, circumstantial evidence suggests that set nets cause accumulatively the highest incidental turtle catch (and associated mortality) in Greece (Panagopoulou et al., 2008). Also, captures in this gear draw the highest number of intentional killings or attempts at it (see also section 2.3.2.2).

Beach seines are gradually withdrawing from Greek fisheries (licences are not renewed) but they still hasve a heavy toll on sea turtles, especially in some areas. For instance, in Lakonikos Bay from a total of 112 loggerheads, captured in a diversity of fishing gear, 67% were caught in beach seines (Margaritoulis and Teneketzis, 2003). In Amvrakikos Bay, where beach seines are since the end of 1970s totally banned, fishermen report that when they were fishing with beach seines they used to capture many turtles.

2.3.2.2. Intentional killing and exploitation

In Greece, many of turtle deaths are attributed to intentional killings or attempts at it after capture in fishing gear. From a sample of 226 injured turtles (of which 96.5% were loggerheads) admitted to

ARCHELON's Rescue Centre in Glyfada, over 34% bore injuries attributed intentionally and presumably after capture in fishing gear (Panagopoulos et al., 2003). A subsequent investigation to a bigger sample (n = 469) raised the percentage of intentionally injured turtles to 41.6%. Circumstantial evidence suggests that the majority of the intentionally inflicted injuries are caused by small-scale fishermen using mainly set-nets. Main reasons for such behaviour on the part of fisherman are anger for gear damage, antagonism (because of dwindling fish stocks), to keep turtles away from their fishing areas, and also superstition (turtles will bring them "bad luck") (Panagopoulou et al., 2008).

Foreign crew members working on fishing vessels in Greece, mainly on trawlers, might consume occasionally captured turtles (Panou et al., 1999). Also, there are some cases of fishermen killing turtles (captured incidentally in their gear) to take their shell for using it as decoration either at their homes or sell it to others for the same reason.

2.3.2.3. Other threats

Boat strikes.

At the inter-nesting area, where there is an aggregation of turtles in the water, a severe threat is caused by speed boats which very often hit swimming and basking turtles. At Zakynthos, boat-strikes at the inter-nesting area of Laganas Bay were a major problem before the establishment of the protected zones (Venizelos, 1993). Today there are still incidents caused by boats not following the set speed limit of 6 knots (Fig. 10). Turtle-watching by tourist boats (Fig. 11) at the inter-nesting area, although a compatible activity, needs to be further controlled to avoid over-stressing the turtles. At Rethymno and Bay of Chania motorized sea sports cause disturbance and several incidents of collisions with turtles at the inter-nesting area. Numerous nesting turtles in Kefalonia have had signs of boat strikes (Stringell et al., 1996).

Pollution.

A landfill site at Zakynthos, near Kalamaki and Sekania beaches, creates at times a polluted outflow in Laganas Bay. Southern Kyparissia Bay receives domestic effluents from the town of Kyparissia (lacking biological treatment). Few turtles were brought to ARCHELON's Rescue Centre partly covered with tar; so oil pollution at sea does not seem a major problem for sea turtles.

Dynamite fishing.

Used to be noted frequently in Zakynthos, Kyparissia Bay and Rethymno but in the last few years has ceased to a large extent.

Predation at sea.

At the inter-nesting area, eight adult and sub-adult turtles (5 males and 3 females) were predated by monk seals (*Monachus monachus*) during one season (1994), thought to be caused by depleted fish stocks during that year (Margaritoulis et al., 1996b).

Debris.

Routine necropsies done at ARCHELON's Rescue Centre very often reveal plastics in loggerheads, but this does not seem to be the main cause of death.

Power plant entrapment.

A loggerhead turtle was sucked in by the waterway of the state power plant station at Keratsini (close to Piraeus port). The turtle was eventually “fished out” by a local fisherman in collaboration with the Coast Guard.

3. *Chelonia mydas*

3.1. Present distribution and abundance

3.1.1. Nesting sites

There are no regular nesting areas in Greece. In 2007 a green turtle nested in Rethymno, northern Crete, within the boundaries of the loggerhead nesting beach. Although the actual nesting was not observed, identification was done through the hatchlings, during the post-hatch excavation routine by ARCHELON volunteers.

3.1.2. Marine areas

Chelonia mydas is found regularly in Greek seas, but it is much less common than *Caretta caretta*. From a sample of 226 injured sea turtles admitted to ARCHELON’s Rescue Centre in Glyfada, 3.5% were identified as *Chelonia mydas* (Panagopoulos et al., 2003). However, a local concentration has been discovered in Lakonikos Bay, southern Peloponnesus, where the percentage of green turtles captured or stranded in the Bay comprise about 40% of all turtles captured or stranded in the same area (Margaritoulis and Teneketzis, 2003). Because of their small size (average CCL: 36.4 cm) Lakonikos Bay is considered a developmental habitat of *Chelonia mydas*. Further, stranding data indicate more frequent presence of adult green turtles in southeastern Aegean (especially the waters around Rhodes Island).

3.2. Past distribution and abundance

There are no data or anecdotic information.

3.3. Threats

3.3.1. Terrestrial Habitats

Not applicable, because the species does not nest in this area.

3.3.2 Marine Habitats

It is believed that the same threats impacting loggerheads at sea are valid in general for *Chelonia mydas*. Of course there are differentiations on the area, and the season of the year.

3.3.2.1 Incidental catch

As it was said in section 2.3.2 the extent of fisheries interactions with turtles, and associated mortalities, in Greece is not fully assessed. Because of the not-so-common occurrence of *Chelonia mydas* it is less known than *Caretta caretta* how the various fishing gear impact this turtle species.

<u>Bottom trawlers.</u> It is interesting to note that the only turtle caught by a bottom trawler in the course of an on-board observer project in 2000 was a green turtle (Margaritoulis et al., 2003b). However, in Lakonikos Bay with a mixed population of *Caretta caretta* (60%) and *Chelonia mydas* (40%) bottom trawlers caught much less green turtles than loggerheads (Margaritoulis and Teneketzis, 2003).

<u>Drifting longline.</u> It seems improbable to be caught in drifting longlines.

<u>Set nets.</u> In an area with 40% green turtles and 60% loggerheads (Lakonikos Bay), about 30% of the turtles caught in set nets were green turtles (Margaritoulis and Teneketzis, 2003).

<u>Bottom longline</u>: It seems improbable to be caught in bottom longlines (see also Margaritoulis and Teneketzis, 2003).

<u>Beach seines.</u> Although this gear is gradually withdrawing from Greek fisheries (licences are not renewed) it still has a heavy toll on sea turtles, especially in some areas. For instance, in Lakonikos Bay from a total of 76 green turtles, captured in a diversity of fishing gear, 84.2% were caught in beach seines (Margaritoulis and Teneketzis, 2003).

3.3.2.2. Intentional killing and exploitation

See 2.3.2.2.

3.3.2.3. Other threats

It is understood that certain threats, described in the section of the loggerhead turtle (2.3.2.3.), will also affect *Chelonia mydas*.

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

As a visitor species in the Mediterranean from the Atlantic it is also found in the Greek seas but not often. From February 1982 until November 1984 (34 months) eleven specimens were recorded along the Greek coastline (Margaritoulis, 1986). Further, in the period 1992-2000 five leatherbacks were identified among the 1,080 turtles reported as stranded through the ARCHELON's Stranding Network (Panagopoulos et al., 2003).

No specific marine areas are known, besides that the 11 specimens recorded in the period 1982-1984 were all reported in the Aegean Sea (including Pagasitikos Bay and Bay of Corinth), all northwards of 38º (Margaritoulis, 1986).

4.2. Past distribution and abundance

There are no available data, neither anecdotic information.

4.3. Threats

It is believed that the same threats impacting loggerheads and green turtles at sea, are valid in general for *Dermochelys coriacea*. Of course there are differentiations on the area, and the season of the year.

4.3.1. Incidental catch

Most of leatherbacks recorded in Greece were captured in fishing nets (mostly set nets). Few were found entangled in long lines (see also Kapantagakis and Lioudakis, 2006).

4.3.2. Intentional killing and exploitation

From the 11 leatherbacks, recorded in the period 1982-84, three were killed by fishermen after capture in set nets; also in three cases the carapace (and in two cases also the plastron) were taken as a souvenir by the fishermen or local residents (Margaritoulis, 1986)

4.3.3. Other threats

Not many data available. A necropsy of a leatherback at ARCHELON's Rescue Centre revealed 9.82 sq.m. of plastic sheet in the intestine (ARCHELON, unpublished data).

5. Other species

No other species of marine turtles are known to have been recorded in Greece.

6. Conservation status

Legislation and Regulations

Protection of marine turtles, as threatened species, is provided in Greece under several legislative acts, some of which are listed below:

- Presidential Decree No 617 (Gov. Gazette 163A/18-7-1980) prohibits fishing of sea turtles, destruction of eggs and collection of hatchlings.
- Presidential Decree No 67 (Gov. Gazette 23A/30-1-1981 and 43A/18-2-1981) declares *Caretta caretta*, *Chelonia mydas* and *Dermochelys coriacea* as protected species and prohibits killing, mutilation, trade, capture, possession, etc.
- Law 2055 (Gov. Gazette 105/30, June 1992) ratifies the Convention for International Trade on the Endangered Species (CITES), which includes sea turtles.
- Law 1335/1983 ratifies the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), in which sea turtles are included under Appendix II (strictly protected fauna species).
- The Convention of Migratory Species (CMS or Bonn Convention), ratified by an EC Regulation for the European

Union Member-States.
- The Protocol on Special Protection Areas of the Barcelona Convention, ratified in Greece by the law 1634/1986 (Government Gazette A104).
- The Habitats Directive (92/43) of the European Union. *Caretta caretta* and *Chelonia mydas* are listed as priority species under Annex II. Further, *Caretta caretta*, *Chelonia mydas* and *Dermochelys coriacea* are included in Annex IV as species requiring strict protection.

Site-specific legislation for protecting the nesting and inter-nesting habitats of *Caretta caretta* at Zakynthos has been activated, through various legislative acts, since 1984. However, these acts were not enforced effectively, because of local reactions and lack of adequate political will. Eventually most of these legislative acts were incorporated in the enabling Presidential Decree of the National Marine Park, issued at the end of 1999. The National Marine Park of Zakynthos (NMPZ) imposes regulations on land, including the six nesting beaches, and at sea, covering the entire marine area of the Bay of Laganas, which is considered the inter-nesting area (Dimopoulos, 2001). In 2000 the Management Agency of the Park was established with a 10-member board into which ARCHELON and WWF-Greece have one joint seat, representing the environmental NGOs. The Management Agency interrupted its operation from 2004 until August 2005 because of financial constraints. During this period ARCHELON tried to have increased presence on the nesting beaches to compensate the lack of wardening (Margaritoulis and Dimopoulos, 2004).

The purchase, by WWF-Greece in 1994, of the land behind the very important Sekania beach (hosting more than 50% of the total number of nests at Zakynthos) has been a crucial act in the establishment of the NMPZ and its subsequent operation. Now Sekania beach features as the strictly protected core area of the nesting habitat, with WWF-Greece taking measures against brush fires and subsequent soil erosion from the slopes towards the beach (see also Sections 2.3.1.5 and 9.2).

The nesting area of Kyparissia Bay is included entirely in NATURA 2000 Network (created under the Habitats Directive). The other three “major” nesting sites (i.e. Rethymno, Lakonikos Bay, Bay of Chania) are partly included in this network. Further, the “moderate” nesting areas of Kotychi, Bay of Messaras and Mounda beach in Kefalonia are also included in the NATURA 2000 network.

It should be noted that the inclusion of a site to the NATURA 2000 network implies only the restriction that Environmental Impact Assessments, necessary for construction works within the site, should get the approval of the central Ministry of Environment (instead of regional or prefectural bodies if outside the network).

Amvrakikos Bay, which includes a foraging area of sea turtles, is additionally a protected Ramsar site (as a wetland), it features a Management Agency, and there is a recent Joint Ministerial Decision to elevate its status to a National Park.

Efforts and achievements

<u>A. Nest management and predation control.</u>

ARCHELON: Fencing of nests mainly against (1) predation in Kyparissia Bay (Fig. 12), Lakonikos Bay, and Koroni, (2) pedestrian and vehicular traffic in Rethymno, Bay of Chania, Bay of Messara, Koroni, and Zakynthos (in cooperation with the NMPZ). Shading of nests to reduce hatchling disorientation due to artificial lighting is effected in Zakynthos, Kyparissia Bay, Rethymno, Bay of Chania, Bay of Messara.

NMPZ: Protection of nests at Zakynthos against pedestrian traffic (in cooperation with ARCHELON). Investigation to assess, and if necessary to mitigate, predation rate on hatchlings by sea gulls at Sekania beach (in cooperation with ARCHELON and the Hellenic Ornithological Society).

<u>B. Public awareness (addressed to various target groups).</u>

Targeting “beach users” and visitors

ARCHELON: Distribution of live information and printed material (through information outlets at vantage points, close to the nesting beaches, and presentations at tourist facilities) are currently effected at Kyparissia Bay, Rethymno, Lakonikos Bay,

Bay of Chania, Bay of Messara (Fig. 13), and Koroni. The same are also effected at Zakynthos with inclusion of informative talks on turtle-spotting boats operating lawfully in Laganas Bay (in co-operation with the Management Agency of the NMPZ).

NMPZ: Beach wardening and patrolling at sea. Signposting at the terrestrial and marine area of the Park. Operation of a small museum and information station off Daphni beach. Distribution of informative material.

Targeting the tourist industry

ARCHELON: Strong co-operation has been evolved with some large tour operators, especially on the Island of Crete (e.g. TUI, TUI Nordic, Hotelplan, Apollo, PURE CRETE). These tour operators have produced leaflets informing their clientele on the plight of sea turtles and recommended turtle-friendly behaviour at nesting sites. It is estimated that about 2.5 million tourists received this information from 1998 until 2002, prior or upon their arrival on Crete (Panagopoulou, 2006). As a result of this co-operation, associated hotel managers are taking a diversity of turtle-friendly measures in the area in front of their hotels and support the work of ARCHELON. Some of these measures include collection of beach furniture at night, reducing or cutting-off bright lights, instigating turtle-friendly behaviour to hotel personnel associated with beach cleaning and water sports. A major hotel chain on Crete that has been involved in such measures is GRECOTEL (Valerga and Panagopoulou, 2006).

Targeting fishermen

ARCHELON: Specialized projects at specific areas (e.g. Lakonikos Bay); visits to "hot spot" fishing ports; participation at fishermen meetings; distribution of informative material.

MEDASSET: Translation of RAC/SPA booklet on handling of incidentally captured turtles and dissemination of it through Fisheries Departments.

Targeting schoolchildren

ARCHELON: Sensitisation of schoolchildren at Rescue Centre in Glyfada (about 12,000 children per annum) (Fig. 14) and at ARCHELON's Environmental Stations in Kyparissia Bay and Rethymno. Creation and lending to schools of portable environmental education kits (Kremezi-Margaritouli, 1992). Creation and distribution of educational games, posters and booklets (see Section 10).

MEDASSET: Euro Turtle; various campaigns involving children (see Section 9.2).

NMPZ: Environmental education activities in Zakynthos.

Targeting general public (nationwide)

ARCHELON: Regular publicity of activities and events related to marine turtles.

MEDASSET: Publicity through mass media.

NMPZ: Publicity of its activities.

WWF Greece: Includes frequently sea turtles at its nature-conservation campaigns.

<u>C. Beach Management</u>

Beach Management at Zakynthos is effected by the Management Agency of the Park. Management is implemented as described in the Presidential Decree designating the protection status for the area, which includes specific management measures. However it must be noted that as yet, there is no specific Management Plan for the nesting beaches, as required by the existing legislation.

A pilot project to restore dunes has been undertaken by ARCHELON in Lakonikos Bay, in cooperation with local authorities, during 1997 by installing sand-trapping fences and planting native dune vegetation to stabilise the accumulated sand (Irvine et al., 2002). A similar project has been undertaken by ARCHELON in Kotychi-Strophilia, north of Kyparissia Bay in western Peloponnesus (Koutsodendris et al., 2006).

Management Plans (MPs) for the nesting areas on Crete (Rethymno, Bay of Chania, Bay of Messara), Lakonikos Bay and Kyparissia Bay were elaborated by ARCHELON in the course of LIFE-Nature projects aiming in establishing protected areas (Irvine et al., 1998; Irvine et al., 2000).

The MPs define the sectors which should be strictly protected and provide guidelines for “turtle- friendly” development outside them. They also suggest regulations to minimize human disturbance on various aspects (e.g. lights, beach furniture). Persistent lobbying has resulted to implement parts of the MP of Crete in cooperation with local communities and authorities (Panagopoulou and Dimopoulos, 2003). However, these MPs and associated measures are still not included in any legislation.

The MP of Kyparissia Bay has been incorporated into a so-called Special Environmental Study (SES), a formal instrument foreseen by the Greek Law in order an area to become a protected area, which includes a draft Presidential Decree depicting the recommended protection status and associated measures for the area. This also has not been implemented by the Greek government. Pressure is currently exercised to assign Kyparissia Bay a specific protected status.

An Action Plan for the conservation of sea turtles in Greece has been elaborated by ARCHELON, and has been forwarded to competent authorities and agencies for comments/deliberations.

Some nesting beaches, mainly on Crete and Peloponnesus, have benefited as to their management by the “Blue Flag Programme”. This is an international awards scheme coordinated by the Foundation for Environmental Education (FEE). Beaches and marinas complying with a strict set of criteria including environmental protection measures and environmental awareness activities are awarded the “Blue Flag”. This award needs to be renewed each year and can be revoked if the awardee fails to comply with these criteria. ARCHELON in cooperation with the Hellenic Society for the Protection of Nature, which administers the “Blue Flag” programme in Greece, have developed a set of beach management prerequisites concerning sea turtles.

Effectiveness of existing regulations

Legislative regulations exist only at Zakynthos, within the boundaries of the NMPZ. The Park was founded in 1999 and its Management Agency in 2000 (Dimopoulos, 2001; Dimopoulos et al., 2003). The establishment of the NMPZ and the associated Management Agency (the first of its kind in Greece) were a major breakthrough in protecting the most important nesting habitat for *Caretta caretta* in the Mediterranean. ARCHELON and WWF-Greece are jointly represented, since the Park’s creation, on the Management Board of the NMPZ. Further ARCHELON continues the long-term monitoring and public awareness work, through agreements with the Management Agency of the Park.

From the outset ARCHELON has expressed its support and made positive contributions to ensure the success of the Management Agency. Despite the lack of experience concerning the operation of management agencies in Greece, the Zakynthos Management Agency has made a genuine effort to establish itself locally and proceed with its institutionalised objectives (Katselidis and Pandis, 2008).

In April 2004 the NMPZ employees had to go on strike due to the lack of funding and political support from the Ministry of Environment. As a result, all the nesting beaches (apart from Sekania, where an ARCHELON team was based) were not properly patrolled and safeguarded, while various violations constituted a daily occurrence not only on the nesting grounds but also within the Bay.

Following pressure by NGOs and by European Union, the Ministry of Environment re-activated the Park in August 2005 by appointing a new President and providing the necessary funds. However, until 20 August 2005, vehicular traffic and uncontrolled visitation on the beaches, and increase of beach furniture constituted a daily phenomenon. Undoubtedly, 2004 and 2005 were the worst seasons for the nesting beaches in Laganas Bay since the establishment of the Park.

Since its re-activation the primary focus of the Management Agency has been the improvement of the situation in Daphni by coming to terms with its land owners, several of which had built illegal houses and other constructions behind or on the nesting beach (Sourbes et al., 2008). The apparent aim of the Agency was to acquire control in this area, involving in the process local owners, in view of the expressed unwillingness of the state to demolish the illegal constructions.

During the 2006 and 2007 seasons the situation at Zakynthos was more or less as follows:

- Control of vehicular access was implemented on all protected beaches (the ones that could be reached by vehicles) by newly constructed or repaired vehicle barriers mounted at major beach entrances.
- Wardening was effectively applied on all protected beaches, with the exception of Sekania beach. Increased patrolling was also effected within the Bay to enforce maritime regulations.
- Control of beach furniture (umbrellas, sun beds) was attempted by the Agency by providing distinctive furniture carrying the Park’s logo. The enforcement of the legal quotas was greatly improved and the legal sun beds were either stacked at the back of the beach or leant against each other to reduce the area they were taking up.
- Increased signposting was done at the major entrances of the nesting beaches as well as on roads crossing the boundaries of the Park.
- An additional restriction on vessels in the northern part of the Bay has been imposed for the exclusive use of NMPZ-endorsed Turtle-Spotting Boats.

During 2008 the situation on the nesting beaches was further improved. However, the management of the marine area of the Park needs more patrolling to reduce cases of regulation infringements.

7. Conservation needs

Caretta caretta

A Management Plan for Zakynthos nesting areas, based on long-term conservation goals, should be drafted and duly adopted by the government.

All other “major” nesting areas in Greece (Kyparissia Bay, Rethymno, Lakonikos Bay, Bay of Chania) should be given specific protective status (by means of explicit legislation). Since these “major” areas (or parts of them) are all included in the NATURA 2000 network, competent Management Agencies should be established. These Management Agencies will undertake actions, in cooperation with competent NGOs, to mitigate the described threats, taking advantage of the preparatory work already done (e.g. Management Plans drafted by ARCHELON).

Fishing regulations or directives should be issued concerning post-release handling procedures. Intensive public awareness programme to stop intentional killings after capture, mainly in set-nets. Investigation on the possibility of providing compensation to set net fishermen on damages caused by turtles.

The Action Plan for the Conservation of Marine Turtles, elaborated by ARCHELON and under deliberation process by the competent agencies, should be adopted by the government.

Chelonia mydas

Extend existing NATURA 2000 site in Lakonikos Bay to include the marine area in front of the loggerhead nesting beach, identified as an important developmental habitat of *Chelonia mydas*.

Regulate fishing methods and gear in Lakonikos Bay (important developmental habitat of *Chelonia mydas*).

Public awareness program to induce voluntary handling of green turtles captured.

Dermochelys coriacea

Post-capture handling procedures should be recommended or imposed to fisheries.

8. Miscellaneous

None.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

Ministry of Agriculture (MoA). Responsible for legislative protection of threatened species; national authority of CITES. The Department of Fisheries, within the MoA, is the authority responsible for fisheries and the issuing of appropriate fisheries regulations.

Ministry of Environment. Responsible of legislative protection of habitats; foundation of protected areas and associated Management Agencies; operation of Management Agencies.

Ministry of Merchant Marine. Through its Coast Guard department is responsible for the enforcement of protection and fisheries regulations at sea.

Ministry of Finances. Hellenic Public Real Estate Corporation; Hellenic Public Land Department: Responsible for the management and commercial use (rentals, long-term leases, sales) of beaches (winter high wave line) and state lands.

Management Agency of the NMPZ. Responsible for the management of the National Marine Park of Zakynthos.

9.2. Private

ARCHELON, the Sea Turtle Protection Society of Greece, was founded in 1983. The primary objectives are (i) the long term protection of sea turtles and their habitats (ii) the scientific study of sea turtles towards their effective conservation, (iii) the promotion of creation, and participation in their management, of protected areas for sea turtles on land and at sea, and (iv) the relevant education and sensitisation of authorities, local communities and the general public. It conducts long-term projects covering many nesting areas in Greece by standardized beach monitoring and tagging. ARCHELON elaborated Management Plans for nesting areas on Crete (Rethymno, Bay of Chania, Bay of Messara), Kyparissia Bay and Lakonikos Bay in the course of LIFE-Nature projects co-funded by the European Union. Also undertakes and/or supports specific research projects in cooperation with Universities. It also expanded its mandate by undertaking work at sea both nationwide, through the European Marine Turtle Project (Laurent et al., 2001) and a LIFE-Nature project “Reduction of mortality of *Caretta caretta* in the Greek seas”, as well as with projects-at-sea in specific areas (e.g. Lakonikos Bay, Amvrakikos Bay). It also conducts public awareness activities both at nesting beaches (since 1986 at Zakynthos) and nationwide. Also, it carries out long-term educational work at schools (since 1985 and by creating in 1990 the first portable environmental kit in Greece) and recently at ARCHELON’s Sea Turtle Rescue Centre at Glyfada (visited by about 20,000 people per year, in cooperation with the local Municipality. Further, it conducts lobbying on government, EU and supra-national agencies, organizations and institutions. ARCHELON worked very hard for the creation of the National Marine Park of Zakynthos and in 1992, in close cooperation with Greenpeace, WWF Greece, and the Zakynthian Ecological Movement, submitted to the Greek government important technical proposals, which had the consent of the majority of the local communities and relevant agencies (Dimopoulos et al., 2003). ARCHELON is a Partner to the Mediterranean Action Plan (MAP) of UNEP and Member to the European Union of Coastal Conservation (EUCC).

MEDASSET, founded in 1988, is an international charity working for the study and conservation of sea turtles and their habitats throughout the Mediterranean, through scientific research, environmental education, political lobbying and raising public awareness. The organization is a Partner to the Mediterranean Action Plan (MAP) of UNEP and a Permanent Observer-member of the Bern Convention (Council of Europe).

- In Greece, MEDASSET lobbies the Government for the implementation of an effective system of strict protection for the loggerhead sea turtle in Zakynthos through a variety of channels that include international and national campaigns- press releases and announcements to media; letters and reports to the Government; annual reports to the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention); paper/poster/oral presentations at International Sea Turtle Symposiums and Conferences.
- MEDASSET's 'Small Garbage' Campaign has been ongoing since 1999 and has played a role as an umbrella campaign to a variety of initiatives such

as awareness raising leaflets, school visits, beach clean-ups, press releases, web activities.
- In collaboration with the Travel Foundation and Marine Conservation Society, MEDASSET has translated, subtitled and produced the 8 min 'Turtles in Trouble' animation in Greek on responsible tourism on sea turtle nesting beaches.
- MEDASSET's award winning (8th Mediterranean Honourific Award Winner, MIO ESCDE & Mediterrania-cie) Creative Learning and Awareness Raising Programme "Niretta the Caretta" has been carried out in schools and appeared at a variety of public events and environmental awareness-raising forums.

WWF-Greece. At an initial proposal of ARCHELON, WWF-Greece acquired about 33 hectares of private land behind Sekania beach at Zakynthos to protect it from development (Charalambides and Katsoupas, 1994). The purchase was completed in 1994 following a very successful international campaign to collect the necessary matching funds (the initial funds were provided by EU through the funding instrument ACNAT). After the land's purchase, WWF was hiring local guards for Sekania (mostly before the establishment of the NMPZ and during the non-operation years of the Park). Also, WWF-Greece is taking measures against soil erosion from the steep hills, usually following brush fires, which may degrade sand quality and influence negatively turtle nesting and egg incubation (Catsadorakis et al., 2008).

Katelios Group for Research and Protection of Marine and Terrestrial Life. A local group working for the protection of marine turtles on Kefalonia Island, Ionian Sea. They work both in the field (beach monitoring and tagging) as well as on education and raising awareness locally, including the local fishermen. They also do lobbying, towards the government and EU for the conservation of the nesting area of Mounda (southeastern Kefalonia).

10. Resources available about marine turtle research and conservation

NMPZ's Resources:

Publications:
- Leaflet addressed to "beach users"
- Leaflet depicting code of conduct while at sea
- Website : www.nmp-zak.org

Infrastructure: Museum/Information Station off Daphni beach. Seasonal information stations in other areas of Zakynthos.

ARCHELON's Resources:

Newsletters and websites: A 3-monthly newsletter in Greek (ARCHELON ischyros) and a 4-monthly in English (TurtleTracks). It also serves a website which is frequently updated (www.archelon.gr). Newsletters and publications can be downloaded in pdf format from this website.

Publications:
- Turtle Facts (booklet with current facts about marine turtles with emphasis in Greece; in Greek, English, German)
- Colouring Book (for children of primary-school age; in Greek, English, German, Swedish)
- Caretta Book (for teenagers; in Greek, English, German)
- Educational Poster of Turtle Species in Greece (in Greek)
- Booklet on Fishermen and Turtles (layman's report, outcome of a LIFE-Nature project; in Greek)
- Caretta (interactive CD-Rom; in Greek, English, German)
- DVD "Our Wealth is the Richness of the Sea" (on the interaction of Fishermen with Turtles; in Greek with subtitles in English)
- DVD "The ARCHELON Bubble" (in English with subtitles in Greek) by Lefteris Fylaktos
- Portable educational kits: The Turtle Briefcase; Life on the Coast; Fishermen and Turtles (all in Greek).
- Educational games: On Turtle's Back, Marine Voyages (in Greek and in English)

Infrastructure:
- ARCHELON's Rescue Centre at Glyfada

- Environmental Education Station of Agiannaki (Kyparissia Bay)
- Environmental Education Station of Evrotas (Lakonikos Bay)
- Environmental Education Station of Pangalohori (Rethymno)
- First Aid Station of Amvrakikos Bay (Kopraina)
- First Aid Station of Pangalohori (Rethymno)
- Seasonal Information Stations in Zakynthos (Gerakas, Kalamaki), Kyparissia Bay (Kalonero, Elaia), Rethymno, Lakonikos Bay (Mavrovouni), Bay of Chania, Bay of Messara (Matala), Koroni.
- Portable Exhibition (on marine turtles and on their interaction with fisheries)

MEDASSET's Resources

- EuroTurtle (http://www.euroturtle.org) is a Mediterranean Sea Turtle Biology & Conservation web site for Science and Education and is currently being updated, to be launched in June.
- MEDASSET's website (http://www.medasset.gr)
- Sea Turtle Resource Library
- Publications
- RAC/SPA's "Sea Turtle Handling Guide for Fishermen" in Greek and Albanian.
- "Turtles in Trouble" DVD subtitled in Greek
- "The Mediterranean Sea: A Source of Life" in Greek (English and Arabic)
- "Turtle Dives" newsletter in Greek and English

WWF-Greece's Resources

WWF-Greece includes regularly articles and news on marine turtles at Zakynthos in its newsletter Panda, issued monthly in Greek, as well as on its website http://www.wwf.gr. Information on marine turtles is also included within several leaflets.

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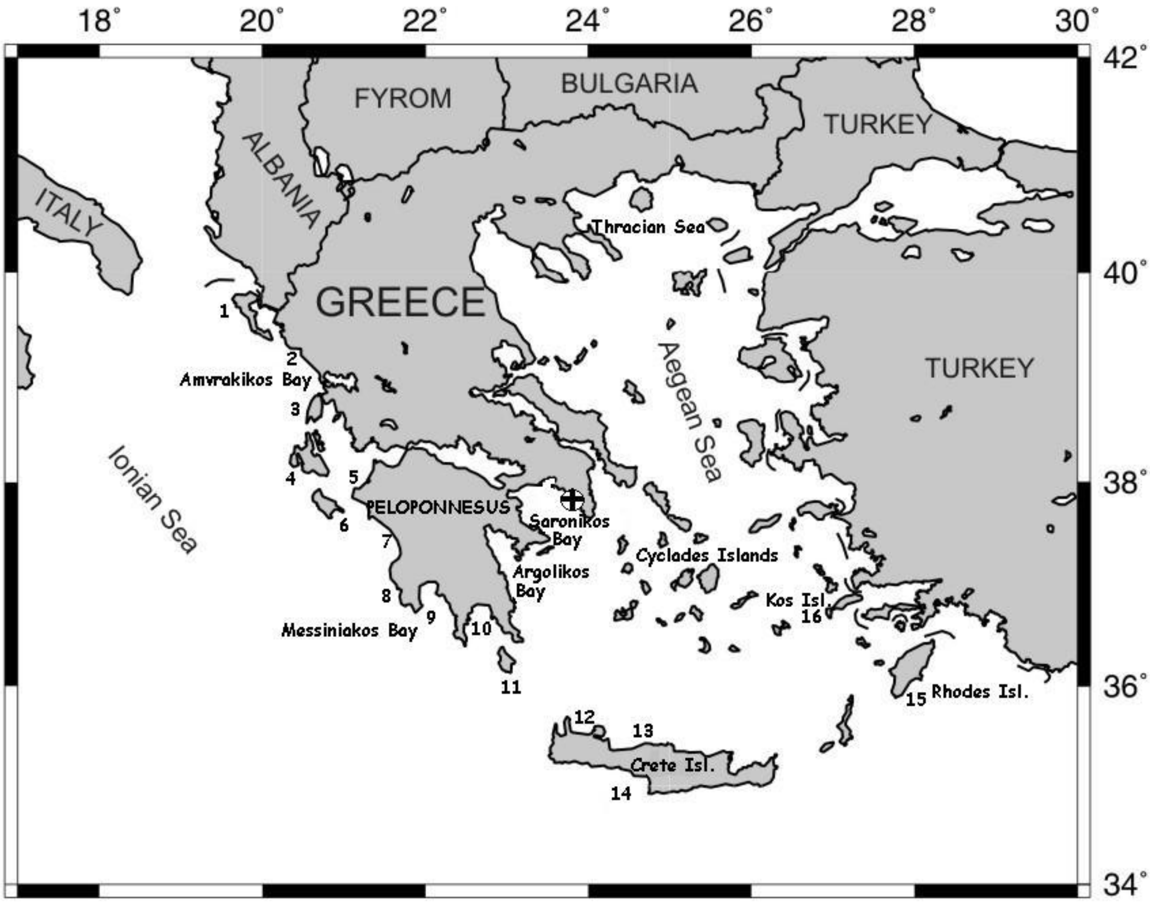

Figure 1. Map of Greece showing major localities mentioned in the text. Numbers indicate nesting areas (1: Kerkyra Isl., 2: Ipirus coast, 3: Lefkas Isl., 4: Kefalonia Isl., 5: Kotychi, 6: Zakynthos Isl., 7: Kyparissia Bay, 8: Romanos, 9: Koroni, 10: Lakonikos Bay, 11: Kythira Isl., 12: Bay of Chania, 13: Rethymno, 14: Bay of Messara, 15: Rhodes Isl., 16: Kos Isl.). Cross shows the position of ARCHELON's Sea Turtle Rescue Centre in Glyfada (close to Athens). Map drawn by MapTool of seaturtle.org.

Figure 2.
Kyparissia Bay still features pristine beach sectors (Photo: ARCHELON/ D.Margaritoulis).

Figure 3.
The nesting beach at Koroni, southwestern Peloponnesus (Photo: ARCHELON/ D.Margaritoulis).

Figure 4.
Sekania beach at Zakynthos is one of the densiest nested loggerhead beaches worldwide (Photo: ARCHELON).

Figure 5. Post nesting movements of loggerhead turtles tagged in Greece (Zakynthos and Kyparissia Bay) from 1982 to 2004. From a total of about 3,200 tagged females, 129 (4.0%) have been recovered at distances longer than 150 km from the respective nesting area. Of the recovered individuals, 43%were found in the Adriatic Sea and 28% in the Gulf of Gabès. Arrows are indicative and do not suggest migratory routes (figure and legend from Margaritoulis et al., 2007).

Figure 6. Sometimes beach furniture exceeds legal quota, foreseen in the Marine Park's regulations (Kalamaki, Zakynthos) (Photo: ARCHELON).

Figure 7.
Caged nests behind beach furniture in the Bay of Chania, Crete (Photo: ARCHELON).

Figure 8.
Severe beach erosion in northern Crete threatens nesting beaches (Photo: ARCHELON).

Figure 9.
ARCHELON's Rescue Centre at Glyfada (close to Athens) has a tank capacity of about 50 injured turtles (Photo: ARCHELON/ D.Margaritoulis).

Figure 10.
Speed boats may kill turtles especially in aggregation areas as those found in Laganas Bay, Zakynthos (Photo: ARCHELON).

Figure 11.
Turtle-spotting boats in Laganas Bay, a compatible activity controlled by the Park, provides income to many locals (Photo: ARCHELON).

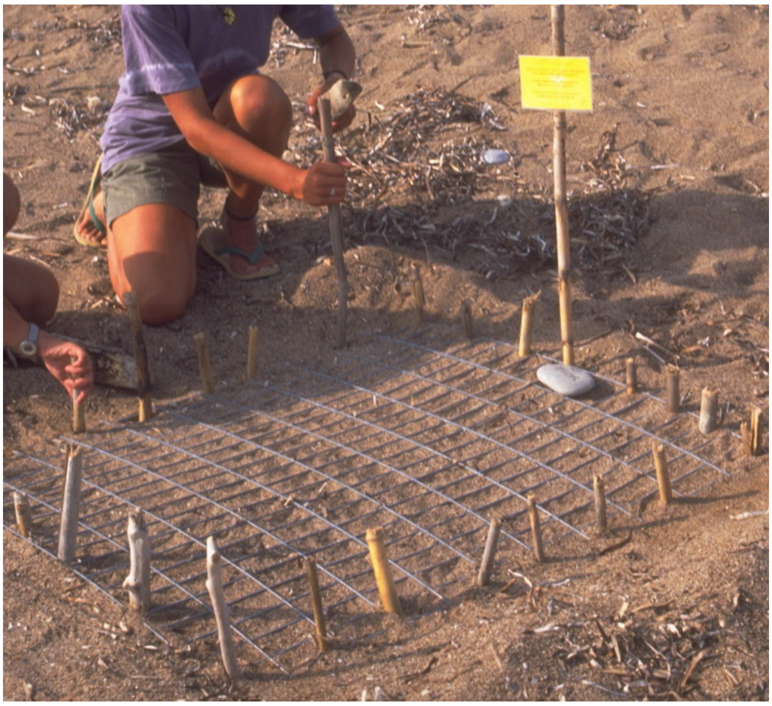

Figure 12.
All nests in southern Kyparissia Bay are fenced against mammal predation (Photo: ARCHELON/ D.Margaritoulis).

Figure 13.
Seasonal information station in the Bay of Messara, Crete (Photo: ARCHELON/D.Margaritoulis).

Figure 14.
Schoolchildren at ARCHELON's Rescue Centre (Photo: ARCHELON).

ISRAEL

Yaniv LEVY

Sea turtle conservation project, Sea Turtle Rescue Center,
Israel National Nature and Parks Authority
Michmoret 40297 Israel
E-mail: yaniv@npa.org.il

1. General remarks

The following information includes data collected by the Israel Nature and Parks Authority (NPA) teams. The first sea turtle records are from 1954, while those collected by the author within his work in the Nature and Parks Authority are since 1999.

Only information from the Mediterranean coast of Israel is included (and not the Gulf of Eilat in the Red Sea).

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

Distribution of nests (both *Caretta caretta* and *Chelonia mydas*) along the coast of Israel is shown in Fig. 1. The sea turtle population size was estimated by using calculations (Gerrodette and Taylor, 1999) based on the number of nests (Fig. 2). With the assumption of two nests on average per female (Broderick et al., 2002), the estimation of the breeding female population of the loggerhead sea turtle in Israel is between 12 to 80 a year (Median: 49.5). Since on the average a female breeds every two years, the median is multiplied (49.5*2=99) and so the estimated number of loggerhead nesting females in total is around one hundred (Levy, 2005). During the years 1993-2008, there were 57 nests on average per year.

2.1.2. Marine areas

Sea turtles are abundant at sea in front of Israel coast all year round; wounded and dead turtles stranded are reported through the year. However, there seems to be a seasonal segregation according to size classes. Stranded early juveniles (5-20 cm CCL) are more frequent from January to April. Later in the year, during the nesting season, there is an increase of stranded turtles and incidental captured reported by fishermen. It seems reasonably to believe that there are few feeding grounds (known by fishermen) but yet, research has not been done in this subject.

Table 1 reports mating observations which occurred from February to July.

Table 1: Reports of mating of *Caretta caretta* and unknown Cheloniidae species on the Israel coastal waters.

Date	Species	Water depth (m)	Distance from the shore (m)	Location
17/05/2004	*Caretta caretta*	7	800-1000	Haifa
19/05/2004	*Caretta caretta*	7	2400	Haifa
24/05/2005	*Caretta caretta*	60	2000	Haifa
28/04/1999	*Cheloniidae*	3		Kyriat Hayim
01/05/1999	*Cheloniidae*	4	30	Haifa
02/05/1999	*Cheloniidae*		50	Kyriat Hayim

2.2. Past distribution and abundance

See also section 3.2.

It can be estimated that from the 1950s the breeding population decreased in a magnitude of one to two.

The time period when organized data exist about the sea turtle populations in Israel is relatively short (about 20 years) (Fig. 2). By the existing data it seems that the loggerhead nesting population is small but relatively stable and showing an increase of nests in the last years.

Extinction may occur because of a threat by stochastic process resulting from their small population size. Although uncertain, the variation of the nesting individuals' size, may point out a small recruitment of young nesting turtles to the loggerhead population.

The change in number of loggerhead nests during the years are pointing to a possibility of a 4-5 year cycle in the highest records of nests (Levy, 2005).

2.3. Threats

2.3.1. Terrestrial Habitats

There is no quantitative estimation, but there are evidences of injuries in turtles due to changes in the beach condition and human activity in beaches. These causes damage the nesting conditions, and interrupt nesting success. Concerning the latter, there is a connection between a low nesting success in beaches in the center of Israel and the intensity of human activity.

Fig. 3 summarizes the impact of natural and anthropogenic factors on nests and hatchlings.

2.3.1.1. Coastal development

In Israeli beaches the sand is defined as a collection of quartz grains that their size is between 62 to 2,000 micron. The sand, which originates from central Africa, is transferred by the Nile to the Mediterranean Sea, and is carried by south to north coastal currents along Israeli shores (Rosen, 2000). The sand transportation model by Emery and Neev (1960) is based on the facts that the undisturbed sea surface, wind blowing distance, and the strongest wave activity west to Israel's coast is located in azimuth 282°. In addition, the shoreline is concave and its direction gradually changes from north east – south west in the south of Israel to north – south in the north. Currents and waves arriving from azimuth 282° to the shore in the north of Israel will cause the sand to be carried south. Currents and waves from the same direction in the south of Israel will cause sand carrying to the north. According to Emery and Neev (1960), the estimated meeting point is in the Tel Aviv area.

The sand transportation balance in Israel shores has changed significantly during the last century; from a positive sand balance some decades ago, to a negative balance today. Contributing to the decrease in sand were the construction of the Aswan Dam completed in 1965 (Rosen, 2000), a massive sand mining in the beaches, and the construction of coastal structures invading the sea (Golik and Rosen, 1999).

On Israeli shores, about 50 coastal structures influence the sand transportation processes. Most of the damage is in the entrapment of the sand south to the structures, and prevention of its transportation in its natural course to the north. The lack of sediments is compensated by beach erosion, a fact that erodes the beaches north to the structures, which causes a decrease in nesting habitats. The sand entrapment also affects the size of the transported particles. The transportation distance of the larger particles is smaller and as a result the portion of thin particles in the northern beaches increases (IEB, 1999). A different sand structure cause a change in the sand albedo, which results in sex ratio alteration (see section 8.).

Out of the prominent coastal structures it is important to mention the marinas. The Hertzelya Marina (Fig. 4) was completed in 1992 and was the second of three marinas (Ashkelon, Hertzelya and Ashdod) erected so far. Also, 11 possible sites were approved for building marinas or additional harbors (National Outline Plan 13, 1983). The marina caused changes in the sand transportation and in the beach structure (Tzvieli and Klein, 1998).

It is possible to find a connection between the building of harbors and breakwaters and the increase of unsuitable nesting sites for sea turtles in Israel. The above mentioned structures cause changes in sand transportation (Tzvieli and Klein, 1998) followed by beach narrowing and an increase in the soil water content in the remaining beach strip. For example, in the Beit Yanay area, it was discovered that during 80 years (1918-2000), the beach retreated in an average rate of 20 cm a year (Tzvieli and Klein, 2002). An obvious example for beach narrowing exists also in the Sidna – Ali Beach (Hertzelya). This beach that used to be wide and comfortable for nesting turned in its majority to a rocky and stony beach unfit for nesting.

Another important factor for hatching success is the water content in the sand. The greater the distance from the waterline, the less water content is to be found in the sand on the surface. Loggerhead sea turtles nest at a distance where the sand is relatively dry at the surface (Dodd, 1988). Thus, narrowing of the beach can damage traditional nesting sites (Lutcavage et al., 1997).

In the places where sand is left, the beach is totally exposed to the surf and its water content is higher than the one allowing turtle embryos' development.

2.3.1.2. Beach restructuring

No data.

2.3.1.3. Non human predation

See Fig. 3.

2.3.1.4. Human exploitation

No data.

2.3.1.5. Other threats

No data.

2.3.2 Marine Habitats

All data concerning injured sea turtles (alive and dead) are collected by the Israeli Sea Turtle Rescue Center in Mevo'ot Yam – Mikhmoret (Nature and Parks Authority).

Every year, dozens (20-100) dead young and adult loggerhead and green sea turtles are stranded ashore in Israel. The monthly distribution of dead sea turtles shows an increase in the turtles' death during breeding season. There is not a definite explanation for this; it might have to do with turtles' activity near the shores in this season, and so increasing the chances for their exposure to human threats.

During the years 2006-2007, around 40 injured young and adult loggerheads stranded ashore. Above 50% of the injuries in loggerheads are from different fishing methods (Y. Levy, unpublished data). About 30% of both species are impacted by different infections. Above 65% of the injured turtles treated in the Israeli Sea Turtle Rescue Center are released back to sea after rehabilitation.

In the past, sea turtle populations in the Israeli coast numbered thousands, while and today they number only several dozens (see 2.2). The reasons for the extinction of these species are identical to the international threats, ranging from natural causes to human threats such as fishing and habitat damage. It is important to mention the damage in the beaches as a result of coastal development and tourist structures.

During the years 1981-2004, 720 dead sea turtles that arrived to the Israel shore were recorded (Fig. 5). It was not possible to identify the cause of death, except for a few cases where an external injury was recognized (for example from a boat's propeller).

Most injured loggerhead sea turtles (55%) are found from January to April, while most dead turtles are stranded ashore a couple of months later. Sub-adult and adult sea turtles were found dead during the nesting season and the increase and decrease in mortality is correlated to the pick of the nesting season (Fig. 6). It also might be possible that the relatively high rate of the number of turtles getting hurt during the winter and the spring has to do with temperature drop and winter storms, followed by an increase in diseases. An examination of all the data about 104 injured loggerhead turtles in Israel shores during the years 1999-2004 (juvenile and adult) (Table 2) shows that most stranding causes are of natural origin. The major natural cause is getting carried to shore during storms. This factor influences juvenile turtles (carapace length smaller than 20 cm) (Y. Levy, unpublished data).

Only about 2% of all impacted turtles' injury causes can be defined as diseases; however, it cannot be excluded that some of those stranding events are caused by effects of pollution on the turtles. About 40% of turtles get injured from human activity connected with fishing, boating and pollution.

A major impact cause (59%) was natural disturbance and storms. The storms mostly affected young turtles (smaller than 14 cm CCL, median=7), which made 92% of all turtles impacted by storms (n=62). It is important to mention that the storm is usually the reason for the stranding of weak turtles ashore; but, not necessarily the reason for the turtles' weakness. The impact causes in young sea turtles can mostly origin from diseases, predators, hunger, cold-stunning, etc'. But, diagnosing the exact factor is difficult.

Table 2. Causes of *Caretta caretta* strandings in Israel in the period 1999-2005. Natural causes are marked with an asterisk.

Causes of stranding	All individuals (%)	Adults and subadults (%)
Storm & weakness*	59.6	0.0
Disease*	1.9	4.8
Static long-liner	12.5	31.0
Entanglement	7.7	19.0
Trawler bycatch	4.8	11.9
Fishing net	3.8	9.5
Swallowed debris	2.9	7.1
Propelled hit	2.9	7.1
Illegal possession	1.9	4.8
Power station filter	1.9	4.8
Total	100.0	100.0
N total	104	42

2.3.2.1 Incidental catch

When examining the injury causes in stranded sub-adult turtles (from two years) or adults, it is found that the main factor for *C. caretta* injury is fishing with its variable methods (52%) and the major impact (31%) is from static long-liners (Table 2).

Along the Israel coast there are 30 trawlers, 394 sea vessels engaged in coastal fishing, and 35 sea vessels engaged with pelagic sea fishing (Snovski, 2004). By oral reports from fishermen engaged with the above mentioned fishing methods it seems that over 200 adult sea turtles are by-caught each year, about 80% of the captures are released back to the sea alive. But, their survival chances decrease because of a deterioration in their health condition as a result of entrapment (e.g., pulmonary edema, wounds from hooks in the esophagus, etc.).

According to fishermen, approximately a fifth of the caught turtles are dead. Turtles that died by drowning and were thrown back to the water are stranded ashore without any external marks from the impact. The number of turtles that are transferred by fishermen to the Israel Sea Turtle Rescue Center is very low (approximately 5%).

2.3.2.2. Intentional killing and exploitation

No data.

2.3.2.3. Other threats

Cases of entanglement (Fig. 7), debris ingestion, boat strike, and entrapment in power station filters are reported among strandings (Table 2).

3. *Chelonia mydas*

3.1. Present distribution and abundance

3.1.1. Nesting sites

Distribution of nests (both *Caretta caretta* and *Chelonia mydas*) along the coast of Israel is shown in Fig. 1. The green sea turtle populations' size was estimated by using calculations based on the number of nests (Fig. 2) (Gerrodette and Taylor, 1999) as 16 adults (7 males and 9 females). During the years 1993-2008, there were 8 nests on average per year.

3.1.2. Marine areas

See 2.1.2 and Table 3.

Table 3. Reports of mating observations of *Chelonia mydas* and unknown Cheloniidae species on the Israel coastal waters.

Date	Species	Water depth (m)	Distance from the shore (m)	Location
24/02/2004	*Chelonia mydas*		100	Ashkelon
04/05/2004	*Chelonia mydas*	5	70-100	Achziv
20/05/2004	*Chelonia mydas*	5	100-300	Natanya
04/07/2004	*Chelonia mydas*	20	1000	Mikhmoret
24/04/1999	*Chelonia mydas*	6	200	Haifa
28/04/1999	*Cheloniidae*	3		Kyriat Hayim
01/05/1999	*Cheloniidae*	4	30	Haifa
02/05/1999	*Cheloniidae*		50	Kyriat Hayim

3.2. Past distribution and abundance

From a perspective of about 80 years of sea turtle reports in Israel's coastline (starting in 1935; Hornell, 1935), a drastic decrease is noticeable in the number of turtles at sea and at nesting beaches. The British fishing department in 1935, reported a massive hunt of about 2,000 green sea turtles each year from the "Watermelon Harbor" (Mikhmoret) and all the way to Acre (Hornell, 1935). Yigal Sella reports that in the 1950s about 200 sea turtle nests (loggerhead and green) were observed each year in a beach segment of only about 15 km, between Nahariya and Rosh Haniqra, with a density of about 15 nests/km (Sella 1979). The annual nests average in the years 1985-2004 in the same area is less than 7 loggerhead nests, and less than one green sea turtle nest, which means about 0.3 sea turtle nests/km.

It can be estimated that from the 1950s the breeding population decreased in a magnitude of one to two, assuming that the above findings show evidence for processes that happened in the Israeli coast.

The time period when organized data exist about the sea turtle populations in Israel is relatively short (about 20 years). By the existing data it seems that the green sea turtle nesting population is small but relatively stable along the studied period.

Extinction may occur because of stochastic processes resulting from their small population size.

Although uncertain, the variation of the nesting individuals' size, may point out a trend of aging in the green sea turtle breeding population. If so, the chances of continuous breeding of this species in Israel are low.

3.3. Threats

3.3.1. Terrestrial Habitats

See section 2.3.1.

3.3.1.1. Coastal development

See section 2.3.1.1.

3.3.1.2. Beach restructuring

No data.

3.3.1.3. Non human predation

No data.

3.3.1.4. Human exploitation

No data.

3.3.1.5. Other threats

No data.

3.3.2 Marine Habitats

See also section 2.3.2.

During the years 2006-2007, around 10 injured young and adult green turtles were stranded ashore. Above 30% of the injuries in green turtles are from different fishing methods (Y. Levy, unpublished data). About 30% of turtles are impacted by different infections.

During the years 1981-2004, 206 dead green turtles that arrived to the Israeli shore were recorded (Fig. 5). It was not possible to identify the cause of death, except for a few cases where an external injury was recognized (for example from a boat's propeller).

Most turtles are found in from January to April, while most dead turtles are stranded ashore a couple of months later. Sub-adult and adult sea turtles were found dead during the nesting season and the increase and decrease in mortality is correlated to the pick of the nesting season (Fig. 6). It also might be possible that the relatively high rate of the number of turtles getting hurt during the winter and the spring has to do with temperature drop and winter storms, followed by an increase in diseases.

The major natural cause is getting carried to shore during storms. This factor influences juvenile turtles (carapace length smaller than 20 cm) (Y. Levy, unpublished data).

The stranding cause was identified 33% of the green sea turtles (n=20) (Table 4).

The mostly vegetarian green sea turtle (from 3-5 years of age) does not get hurt from static long-liners fishing (Table 4), in contrast to the loggerhead turtle (see 2.3.2).

Table 4. Causes of *Chelonia mydas* strandings in Israel in the period 1999-2005. Natural causes are marked with an asterisk.

Causes of stranding	All individuals (%)	Adults and subadults (%)
Storm & weakness*	20.0	0.0
Disease*	20.0	25.0
Entanglement	15.0	18.8
Fishing net	15.0	18.8
Illegal possession	5.0	6.3
Tar	15.0	18.8
Brutal injury by men	10.0	12.5
Total	100.0	100.0
N total	20	16

3.3.2.1 Incidental catch

Based on fishermen's reports about a green sea turtle entrapment in shrimps' fishing's trawl nets, it seems that the turtles and the shrimps share common feeding areas.

3.3.2.2. Intentional killing and exploitation

Evidence of intentional killing come from stranding records (Table 4).

3.3.2.3. Other threats

Cases of entanglement and tars are reported among strandings (Table 4).

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

Sporadic occurrences of up to two observations per year are recorded regularly (stranded ashore, caught in fishing gear or observed alive at sea).

4.2. Past distribution and abundance

No data.

4.3. Threats

4.3.1. Incidental catch

In 2001, a live leatherback got caught in trawlers net, and the turtle eventually died for debris ingestion (see 4.3.3.).

In another case, the cause of death was due to entanglement in a static long-line (Fig. 8).

4.3.2. Intentional killing and exploitation

No data.

4.3.3. Other threats

Four leatherback necropsies revealed plastics in the digestive system.

In 2001, a live leatherback got caught in trawlers net and the turtle was rushed into the rescue center (Levy et al, 2005), unfortunately after five days of intensive care the turtle died. The necropsy revealed blockage in the digestive tract by plastic bags that probably was the cause of death, three other necropsies preformed to 3 different individuals but the results were similar, blockage in the digestion system was probably the cause of death.

5. Other species

There is no evidence of other sea turtle species occurring along the Mediterranean coast.

6. Conservation status

Israel is obligated to the following legislations and regulations:

- Barcelona convention – Protection on the marine and coastal environment of the Mediterranean sea – Action plan to protect the sea turtles (1989, 1999) RAC/SPA.
- Bonn convention (CMS): protection and conservation of migrating species.
- Ramsar Convention for the protection of wetlands.
- CBD – Convention on Biodiversity

National legislations:

- National parks and Nature reserves law 1998, Registrations on protected species (Fig. 4)
- Wildlife conservation law 1955
- Sea Turtle fishing restrictions 1963

Sea turtle conservation in Israel is carried out by the Nature and Parks Authority. This activity began in the 1980s, but there are observations and reports about dead sea turtles and nesting since the end of the 1950s (Sella, 1979; computerized observations archive, Nature and Parks Authority).

In 1979, the Nature and Parks Authority began to undertake surveys for nests detection in the shores of the Western Galilee and Carmel beach (Sella, 1979). In 1992 an administration plan was created (Meir and Kuller, 1993), which included frequent surveys in nesting season, and finding and relocating nests.

Until 1993, nesting survey effort along the Israel coastline was inconsistent. At first, the observations mostly focused on the Carmel beach and Western Galilee (Sella, 1979). Additional efforts have been made in different beaches, but the surveys were not thorough in all beaches, and did not occur on a daily basis. Since 1993, nesting survey efforts in all shores are identical, and the surveys during nesting season are done each day along all accessible beaches (except Israel Defense Forces bases and some of the declared public beaches between Hertzelya and Rishon L'tzion) (Fig. 9). NPA rangers became more and more professional in finding nests during the years, both from gaining local experience and from a RAC/SPA course in Cyprus under the guidance of A. Demetropoulos. It is possible that as a result of lack of skill in finding nests in the earlier years, nesting emergences have been considered as false crawls.

Distinguishing between *Caretta caretta* and *Chelonia mydas* nests was done by the species' physical characteristics (Pritchard and Mortimer, 1999).

Since 1993, during the nesting period (mid May till the end of August), in the first two weeks of the breeding season, May 15th-31st, the Israeli shores were patrolled twice to three times a week. Starting June 1st till August 15th the beaches were patrolled daily. From August 15th till the end of the month, patrolling took place twice a week. Since nesting occurs at night, surveys were done with first light. The surveys were completed by and with the help of Nature and Parks Authority rangers, who were trained for this task. Most of the Israel coastline is not suitable for turtles' nests as the beaches are disturbed by artificial lights, 4X4 vehicles and other human interruptions. Nests that were found there were dug and relocated to the nearest hatchery.

In the hatcheries the clutches are kept until the emergence of the hatchlings, which are released to the sea in a supervised manner. Since then, every year, tens of clutches are relocated to the hatcheries, and thousands of hatchlings are released to sea under supervision (during the years 1993-2007, average of 3,119 loggerhead sea turtles, and 566 green sea turtles every year; Kuller, 2002).

When relocating a nest to a hatchery, measurements of the eggs' location are taking place in order to restore them in the artificial nest dug in the hatchery. The order of actions includes measurement of the distance between the surface and the top egg, moving the eggs to a cooler cushioned with sand from the nest, measurement of the location of the bottom egg in relation to the surface, and measurement of the egg chamber diameter.

The eggs were transferred to the hatcheries in the end of the beach patrol (within 3-6 hours).

Along the Israel coast there are six hatcheries (from south to north):

- Ziqim: nests from Ashkelon and south until the border with the Gaza Strip.
- Nitzanim: nests from Tel Aviv and south until Ashkelon.
- Gador: some of the nests between Hadera Stream and Hertzelya.
- Habonim: nests between Atlit and Hadera Stream estuary.
- Atlit: nests between Haifa and Atlit.
- Bezet: nests from the Western Galilee (Fig. 10).

The hatcheries are fenced (Fig. 10), and each nest in protected with an aluminum net for protection from predators (Kuller, 2003).

At the end of the incubation period, the nests were checked several times a day. The checking frequency increased towards the forecasted date of the turtles' emergence. In Gador and Bezet hatcheries there was a constant presence of volunteers and of the author near the nests during nighttime. When emergences occurred, the number of emerging turtles and the time of emergence were recorded. In the other hatcheries, a night check and a morning check took place, and the number of hatchlings in each nest was recorded. The hatchlings in the hatcheries were released by removing the protecting net, and their progression to sea was done under supervision (to prevent predators and injuries).

About three days after the first emergence, the nest is excavated, its content is checked, and the number of living hatchlings that did not emerge, the number of dead hatchlings and the number of eggs that did not hatch are recorded. Turtles found alive in the nest are immediately sent to sea or during the following hours.

In 2004, the *C. caretta* eggs were incubated in the hatcheries in the beach, subject to the natural conditions at that beach, where the water content in the soil varied from 0.8% to 3.2%. Hatching success of *C. caretta* in the above mentioned water content in the soil was high and varied from 73% to 94% (n= 73). From the soil water content perspective, there is no reason for the significant difference in the nesting success between the two turtle species in Israel (see section 8.).

Soil water content examination in 26 sites in different areas on the Israeli coastline (from Gaza to Bezet) showed that in 88% of the sites the soil water content (0.7%-7.7%) was fit for *C. caretta* nesting (nest depth of about 50 cm), and in about 73% of the sites it was fit for *C. mydas* nesting (nest depth of about 80 cm).

In 1999, the Nature and Parks Authority founded the Israeli Sea Turtle Rescue Center in Mevo'ot Yam (Mikhmoret), directed by the author. The center's goals are to collect data in all the fields concerned with sea turtle biology, to find nests and relocate them to hatcheries, to collect injured turtles and investigate causes of injuries, to heal and take care of injured turtles, their rehabilitation and release to sea, to collect dead turtles and investigate about mortality factors.

Data collected include body size and diagnosis of the impact cause in stranded turtles and in turtles captured by fishermen. The nature of injury is documented. In sea turtles captured by fishermen, the method of entrapment is recorded (fishing method – gill nets, static long-liners, trawlers). In stranded sea turtles (alive or dead) external injury factors are recorded (for example injury from a boat's propeller, ropes marks, nets, tar). If there is no external mark or an injury, an necropsy is carried out, and in living turtles an additional investigation is done including X-rays or an endoscopy procedure for foreign bodies identification in the digestive system (hooks, garbage). Sometimes it is necessary to consult with an expert veterinarian in Israel or abroad.

Each year, up to 50 injured turtles get treated. Rehabilitation percentage is above 65%; the rehabilitated turtles are tagged and returned to the sea.

In addition, the Israeli Sea Turtle Rescue Center is active in public awareness.

In September 2002, the Israeli Sea Turtle Rescue Center launched a "Green Project" that its goal is creating a breeding stock of green sea turtles (Fig. 11). This is because of an actual threat that the local population of this species along Israeli shores will become extinct (Levy, 2005). Within the program, 28 hatchlings that emerged in Israeli beaches were collected and transferred to the rescue center, where they are kept in tanks. When they will reach sexual maturity (in a fastened growth in captivity it is estimated that they will sexual mature within 10 years), they will be transferred to large fenced pools for breeding purpose. It is expected that nesting will take place on the pool's edges in an artificial beach. The eggs will be relocated to a hatchery.

Because of the long life span of sea turtles, the project's results are not expected until after 30 to 50 years from now.

7. Conservation needs

Sea turtle conservation demands continuous monitoring, collection and completion of knowledge. This includes:

- The extent of overlapping of the feeding and mating areas with fishing zones.
- The survival of juveniles and adults in their different life stages
- Genetic clarification of the origin of the turtles stranded ashore in Israel.
- Since a haplotype so far known to be unique to Israel has been discovered, it is vital to make special efforts to conserve the only site where it was found (Sharon Beach National Park and Poleg Stream Nature Reserve – between Ga'ash and Poleg).
- In order to verify the sex ratio estimation in hatchlings, more in-depth research concerning sex ratio should be made, including an examination of gonad histology.The research results may support our preservation efforts of nesting sites in the south coastal plain of Israel.
- Information about the extent of imprinting of the hatchlings that emerge in Israel to the beaches where they emerged.
- An action plan to deal with sand erosion and the narrowing of the coasts.

In order to protect the sea turtle populations in Israel, the conservation management plan that is applied so far has to proceed together with further research, declaration of more marine and coastal nature reserves and further efforts in public awareness.

8. Miscellaneous

Nests and hatchery production.

Between the years 1993 and 2007, 845 *C. caretta* nests have been recorded; most of the clutches were relocated to hatcheries in different sites along the Israeli coast (Nature and Parks Authority). A total of 46,780 hatched from the relocated clutches and were released to sea (Fig. 12). From 93 relocated nests of *C. mydas*, 7,913 hatchlings were released to sea.

Body size.

Data concerning the turtles' body size can help indicate the age of the turtles in the breeding population.. Without direct data about the body size of the nesting females, their size can be estimated by the tracks width and the number of eggs (Hays, 2001). Analysis of tracks width in a period of 20 years indicates a relatively stable body size in both species.

Polulation genetics.

The genetic characterization was accomplished by analyzing the mitochondrial DNA and the nucleotide DNA (Carreras et al., 2007), in the evolutionary biology lab in Barcelona University. The material sent for the analysis included 20 embryo tissues collected by the author from different nests. In the years 2002-2004, skin and muscle tissues of undeveloped embryos or dead hatchlings were collected (Table 5).

The joint research with Dr. Cardona indicated two haplotypes (CC-A2, CC-A29). One of the haplotypes (CC-A29) is unique from Israel, and today is known only from a narrow beach segment between Ga'ash Beach and the Poleg estuary. The fact that only three samples contained this unique haplotype indicates its relative rarity. Two dead turtles with this haplotype have been found in the past on the Spanish coast, but only following this research, their breeding location has been found with a high likelihood (Y. Levy, unpublished data). The second haplotype is common to Israel and to four other Mediterranean countries (Greece – including Crete, Cyprus, Lebanon, and Turkey).

Table 5. Locations, dates and haplotype identification of *Caretta caretta* DNA samples from dead embryos and hatchlings collected in nests along 100 km beach in the center of Israel, (between Tel Aviv and Haifa).

UTM East	UTM North	Nesting site	date	Sample Number	Haplotype
6719	5749	Natanya	5.8.02	121	CC-A2
6722	5758	South Natanya	9.8.02	92	CC-A2
6675	5591	South to Hertzelia marina	16.8.02	81	CC-A2
6675	5591	South to Hertzelia marina	16.8.02	82	CC-A2
6694	5657	Shfaym	15.8.02	122	CC-A2
6694	5657	Shfaym	18.8.02	117	CC-A2
6718	5748	Natanya	18.8.02	114	CC-A2
6743	5855	Beit-Yanai	18.8.02	128	CC-A2
6820	6220	Megadim	21.8.03	126	CC-A2
6718	5748	Natanya-Argaman beach	23.8.03	87	CC-A2
6774	5994	Kisseri	23.8.03	89	CC-A2
6858	6009	Jaser a Zarka	25.8.03	111	CC-A2
6306	6159	Neve Yam	12.8.03	125	Extraction failed
6740	5843	Beit Yanay - south	27.8.03	110	CC-A2
6296	6120	Habonim	17.8.01	79	CC-A2
6829	6336	Haifa-North Shikmona	26.7.03	124	CC-A2
6823	6233	Megadim	4.8.02	120	CC-A2
6706	5701	HaSharon NR	5.9.02	123	CC-A29
6706	5697	HaSharon NR	10.9.03	97	CC-A29
6574	5659	HaSharon NR Ga'ash	11.9.03	103	CC-A29

Nesting season.

Nesting season in Israel takes place from mid May till the end of August for *C. caretta* and from June till mid August for *C. mydas*. The nesting peak for both species (*C. caretta* and *C. mydas*) occurs in the period from mid June till mid July.

Nesting density.

Nesting density in Israel is 2.8 nests per kilometer (Y. Levy, unpublished data).

Nesting success.

The mean nesting success for loggerhead sea turtles in Israel for the period 1993-2007 is approximately 50%.

The nesting success of *C. caretta* in Israel varies in different areas. The beach with the highest nesting success (81%) is from the south Mediterranean coast, and includes Gaza Beach until about two kilometers south of Ashdod. The beach with the lowest nesting success percentage (28%) is the segment from Shfaim to Givat Olga.

It is possible that the increase in false crawls starting in 1999 in the area to the north of the Hertzelya Marina (Y. Levy, unpublished data) has to do with the significant narrowing of the beach strip in this area (Tzvieli and Klein, 1998). The remaining beach is more exposed to the waves' motion and the water content in the soil is higher. Today the nesting success in this area is the lowest on the Israeli coast (28%). Additional factors for false crawls have to do with direct interruptions to turtle activities, such as human activity and vehicles on the beaches.

C. mydas eggs were incubated where the water content varied from 1.4% to 3.2%, resulting in a hatching percentage which varied from 9% to 94% (small sampling; the low value results from the waves reaching the nest. N=14).

During 2004, the green sea turtle nesting success in Israel varied in the different areas between 39% to 59%, except for the area from Ashdod to the Rishon L'tzion sand dunes (14%) and the area from the Rishon L'tzion sand dunes to Shfaim (100%). But, these data summarize an activity that happened in one year only, and probably of one female in each area, so it is difficult to estimate a trend with this population. In addition, the lack of stability in nesting success might origin from the dry sand – green sea turtles need to dig a deep nest, which is challenging when the water content in the soil is too low (Y. Levy, unpublished data).

<u>Sand temperature, incubation duration and primary sex ratio.</u>

The environmental conditions in Israeli beaches are fit for loggerhead and green sea turtle nesting.

Examining the Israeli shoreline from north to south, it is expected to have high albedo values in the south because of sand with a brighter color. Therefore, there is a higher soil temperature in the north (higher absorption), and a lower temperature in the south (higher reflection). Thus, a shorter incubation period is expected in the north in relation to the south of Israel. This results in a higher production of females in the north.

Indeed, nest chamber sand temperature for *C. caretta* (30-50 cm) is lower in the south of Israel (Fig. 13) in comparison to the north (Fig. 14), thus resulting in longer incubation time (58 and 52 days, respectively) (Levy, 2005).

This is important in the hatchling sex ratio determination. It should be emphasized that nests are artificial – nests relocated to hatcheries. The existing data indicated a higher male percentage in the hatchlings from the south of the country, based on pivotal incubation period of 56.6 days above which more males than females are developed. The conclusive estimation is that the male:female ratio in hatchlings developed in Israeli beaches is 1:1.75. From this point of view, sea turtle breeding in Israel is important, since in other Mediterranean beaches about which data exists, the gender ratio is significantly female biased (Levy, 2005).

In Israeli beaches, the sex ratio estimation derived from incubation duration in relation to pivotal incubation period in *C. mydas* (according to values obtained from Broderik et al., 2000), supports the development of more females (a majority greater than 55% of females).

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

Israel Nature and Parks Authority - conservation, management, and research.

9.2. Private

Underwater Observatory Marine Park in Eilat – public relations

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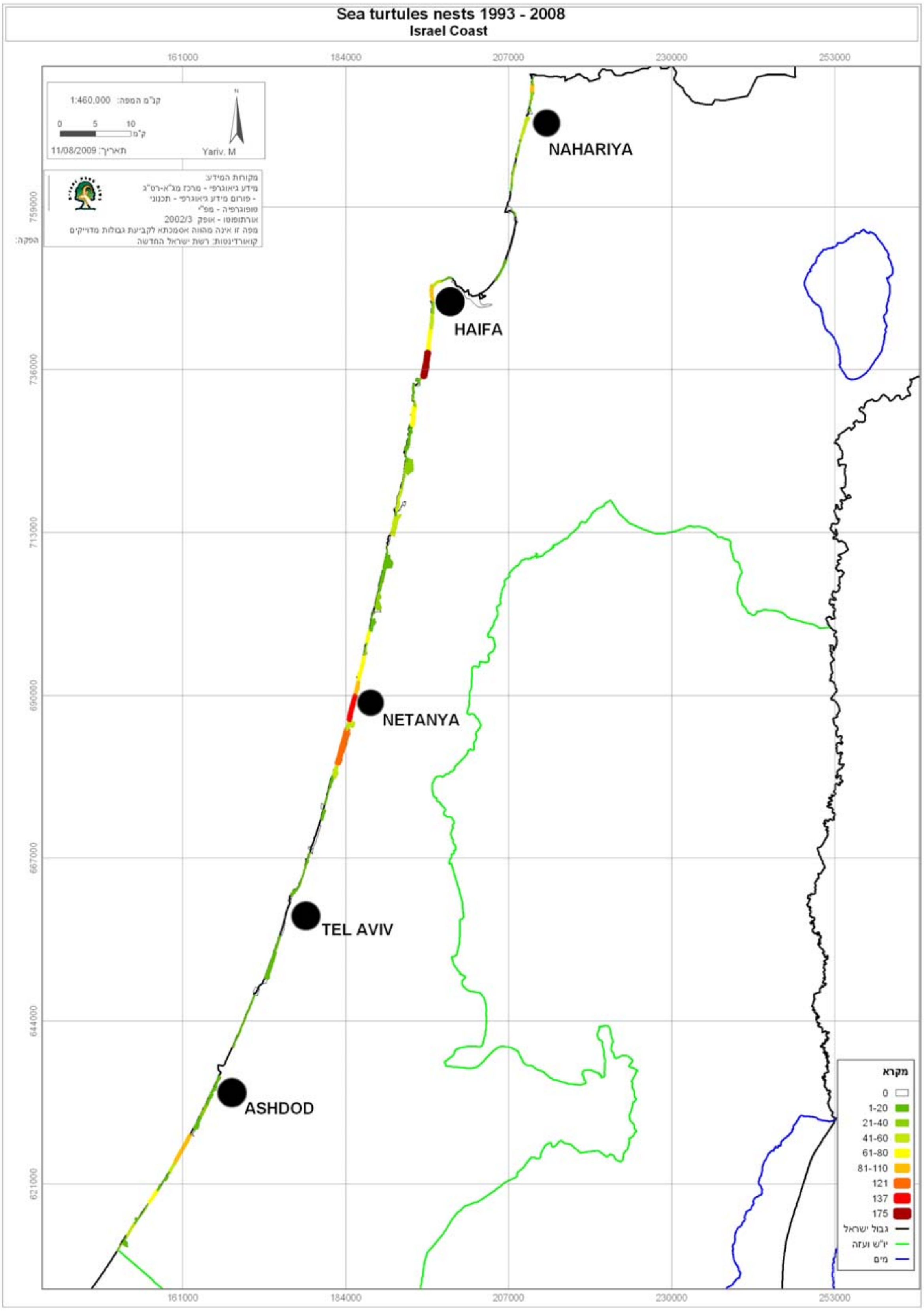

Figure 1. Israel's nesting sites from data collected by the Nature and Parks Authority during the years 1993-2008 (GIS department-Nature and Parks Authority).

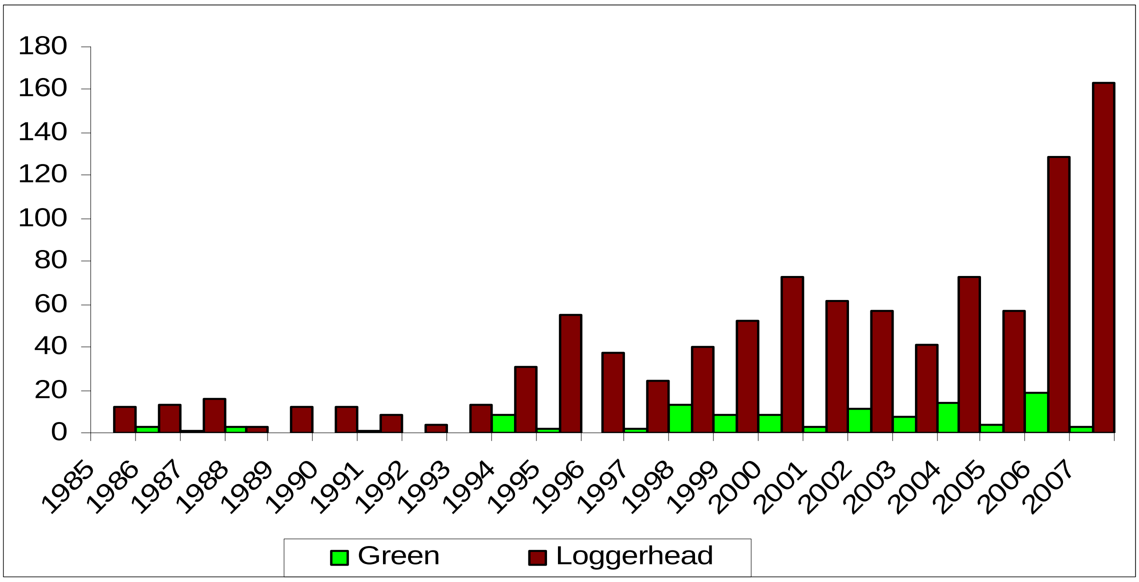

Figure 2. Number of nests of the loggerhead (*Caretta caretta*) and the green turtle (*Chelonia mydas*) recorded along the Israeli coast during the period 1985-2007 (Y. Levy, unpublished data).

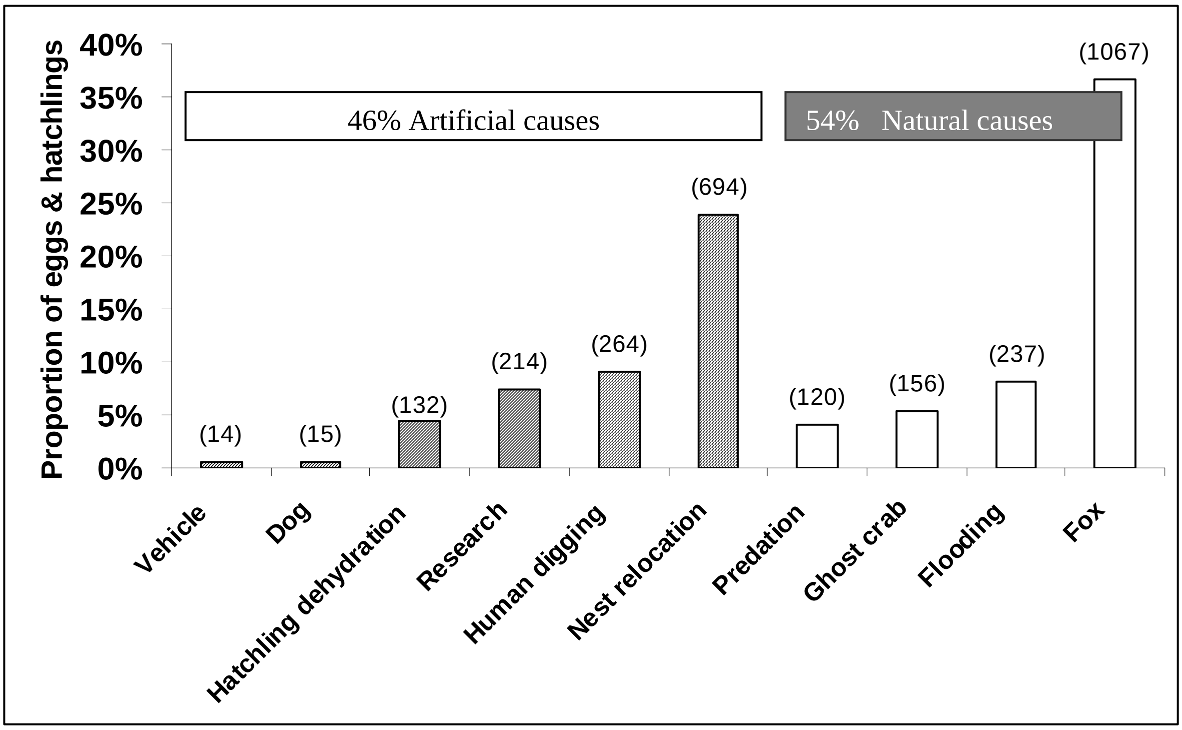

Figure 3. Proportion of eggs + hatchlings of *Caretta caretta* that were impacted by natural and man-made factors (1985-2004, n=2,913)

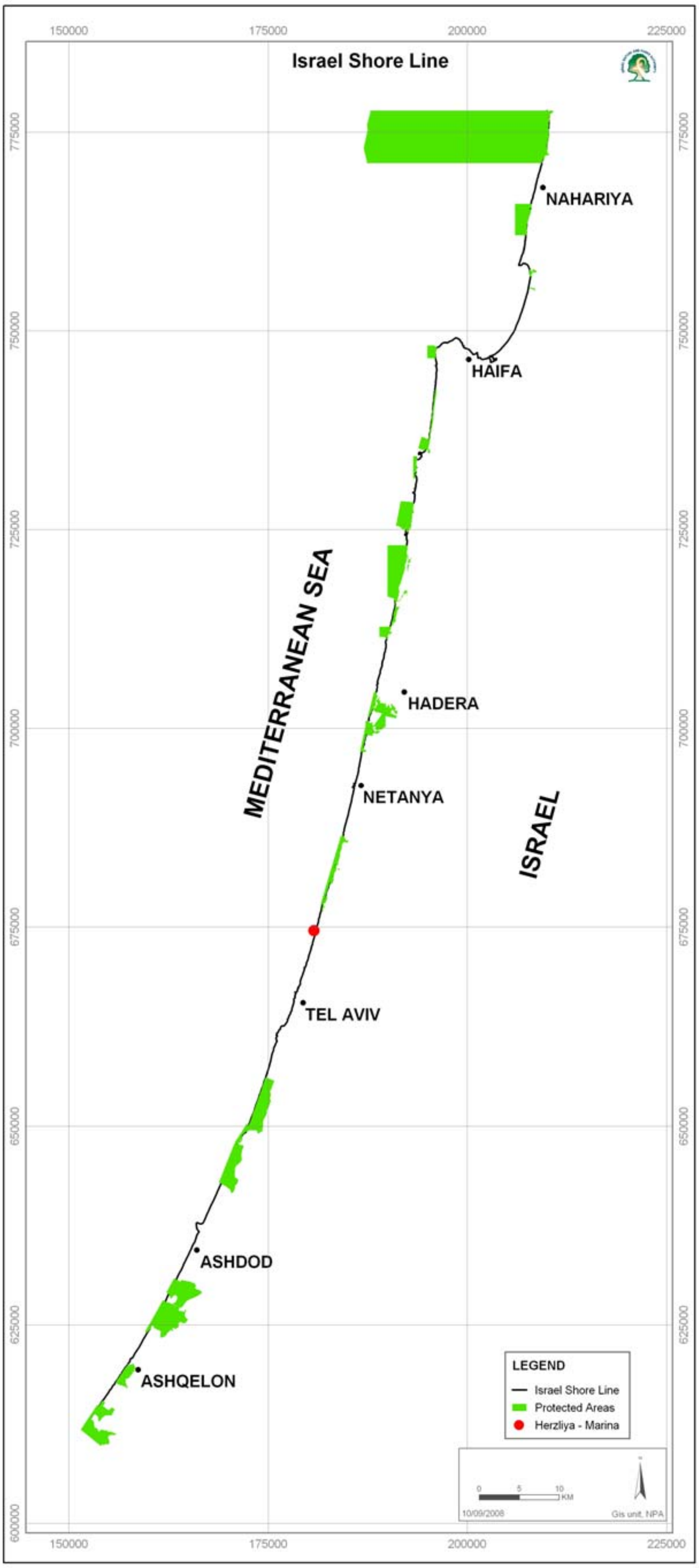

Figure 4. Israel Mediterranean coastal map and the marine protected areas (GIS department-Nature and Parks Authority).

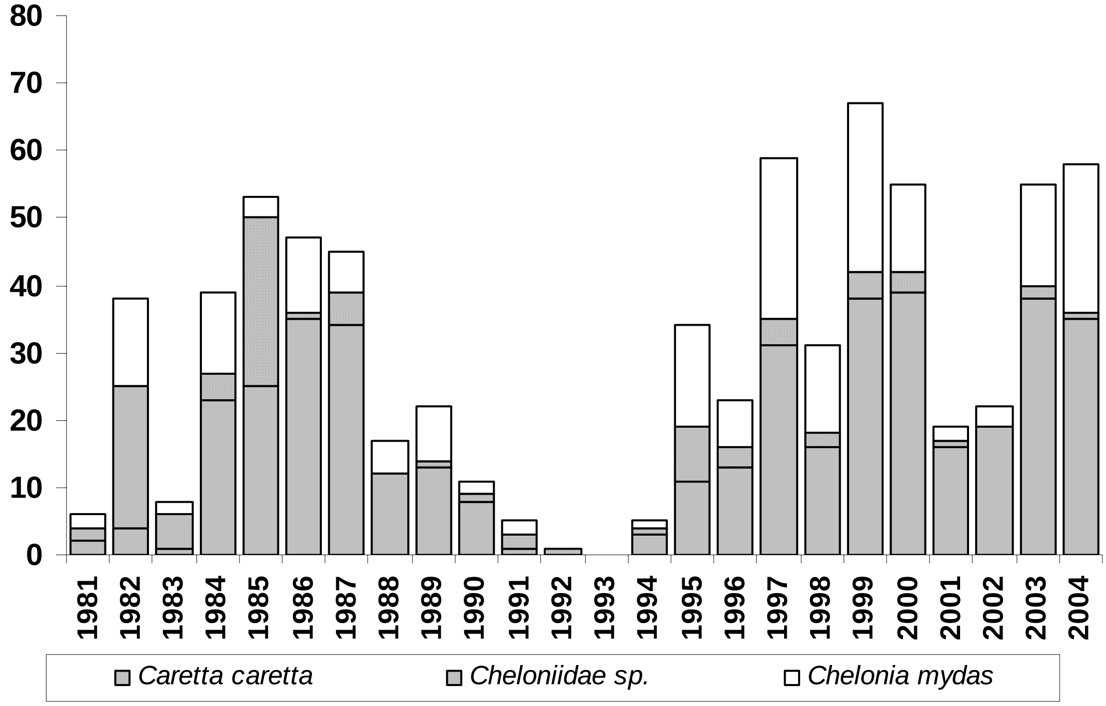

Figure 5. Yearly distribution of dead *Caretta caretta* (n=417), *Chelonia mydas* (n=206) and unidentified *Cheloniidae* (n=97) stranded ashore along the Israeli coast (1981-2004)

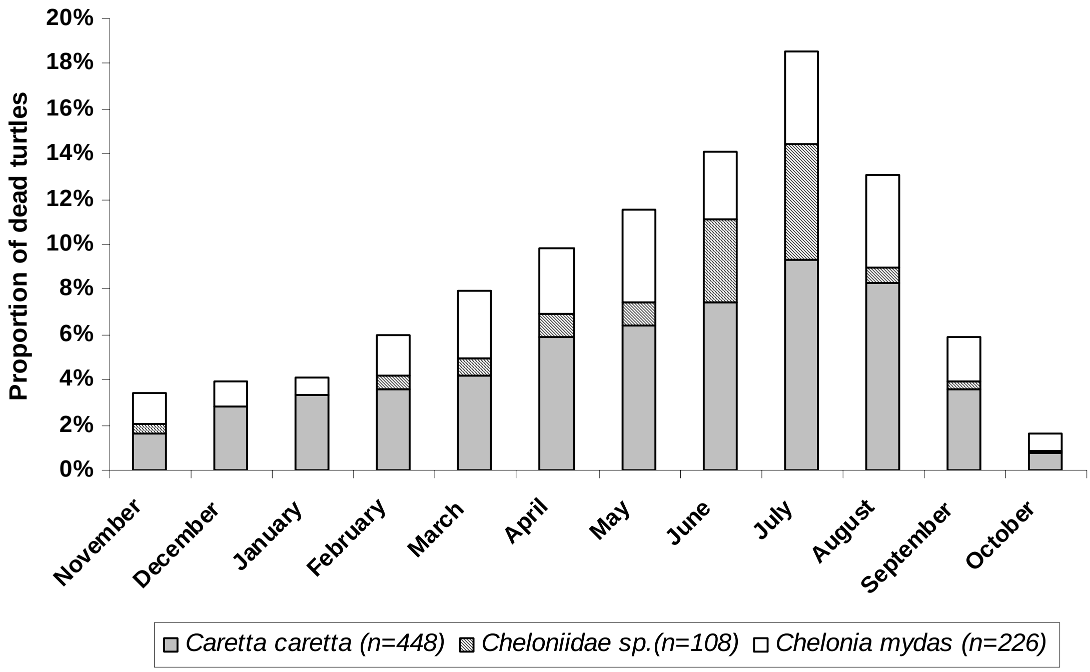

Figure 6. Proportion (%) of monthly distribution dead (stranded ashore) or trapped turtles of *Caretta caretta* and *Chelonia mydas* along the Israeli coastline (1952-2004)

Figure 7.
A stranded juvenile loggerhead entangled in a plastic sack. The turtle suffering from a friction in the humerus, was released after medical care and rehabilitation in The Israeli Sea Turtle Rescue Center (Photo: Y. Levy).

Figure 8.
Leatherback turtle stranded dead after entanglement with a static long-line (Photo: Y. Levy).

Figure 9.
Israel's Mediterranean coast is distinctive in a strip of a sandy shoreline followed by a kurkar ridge (Photo: Y. Levy).

Figure 10. Bezet hatchery, The Nature and Parks Authority ranger is looking for hatchlings. August 2005 (Photo: Y. Levy).

Figure 11.
The future breeding stock of green sea turtles
(Photo: Y. Levy).

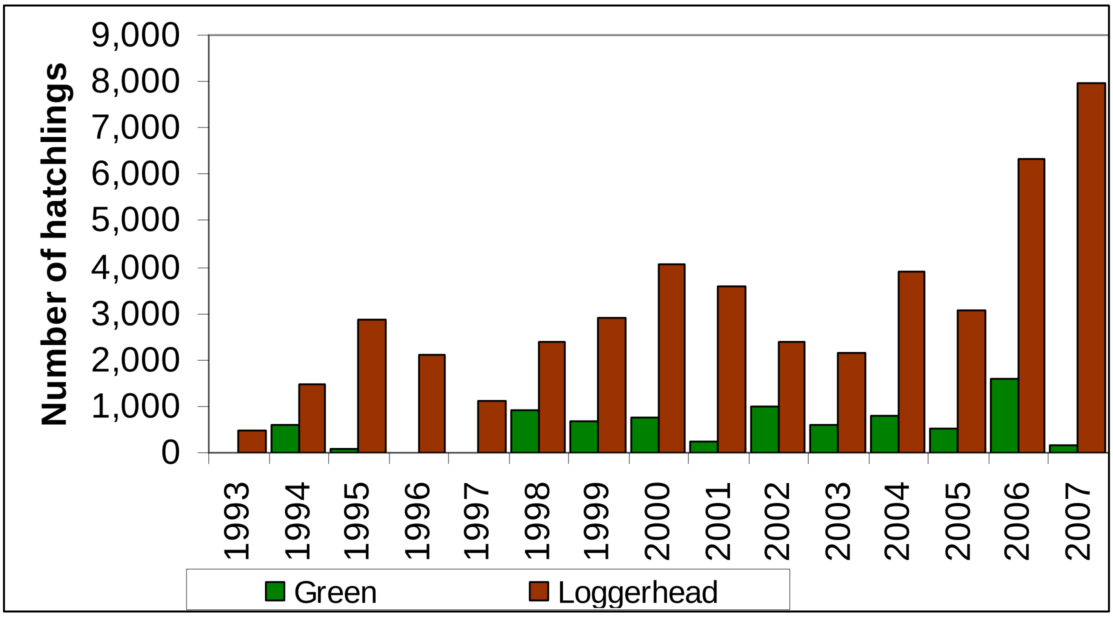

Figure 12. Annual number of hatchlings recorded from clutches incubated in hatcheries (Nature and Parks Authority) for the period of 1993-2007.

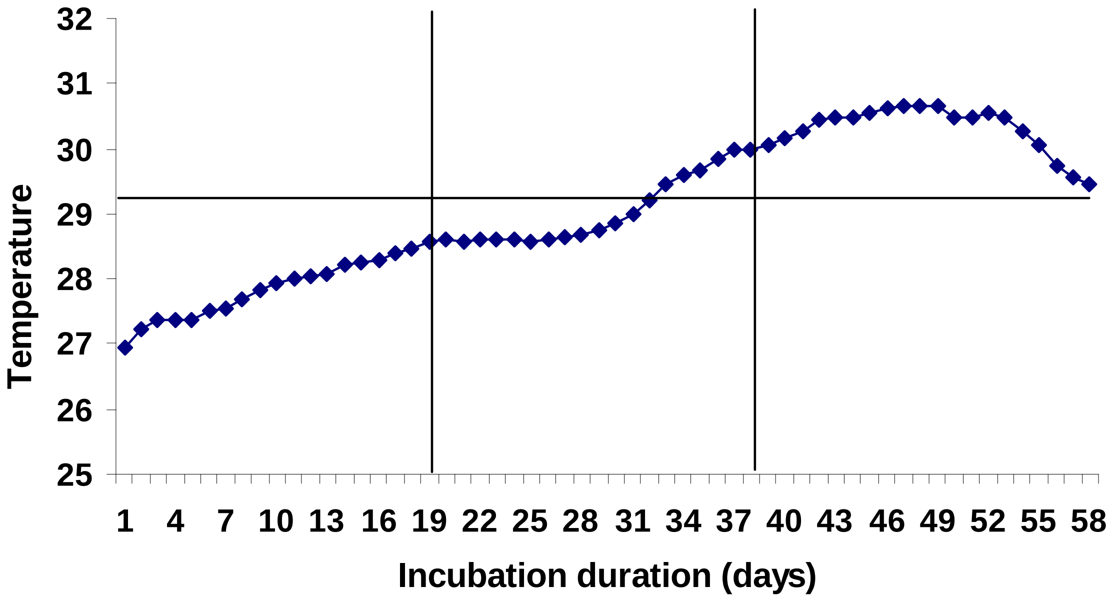

Figure 13. Daily average of a nest temperature in a hatchery located in southern Israel (Ziqim, southern coastal plain, year 2004). Horizontal line indicates pivotal incubation temperature based on a research done in Greece (Rees et al 2004). Vertical lines divide the incubation period to thirds.

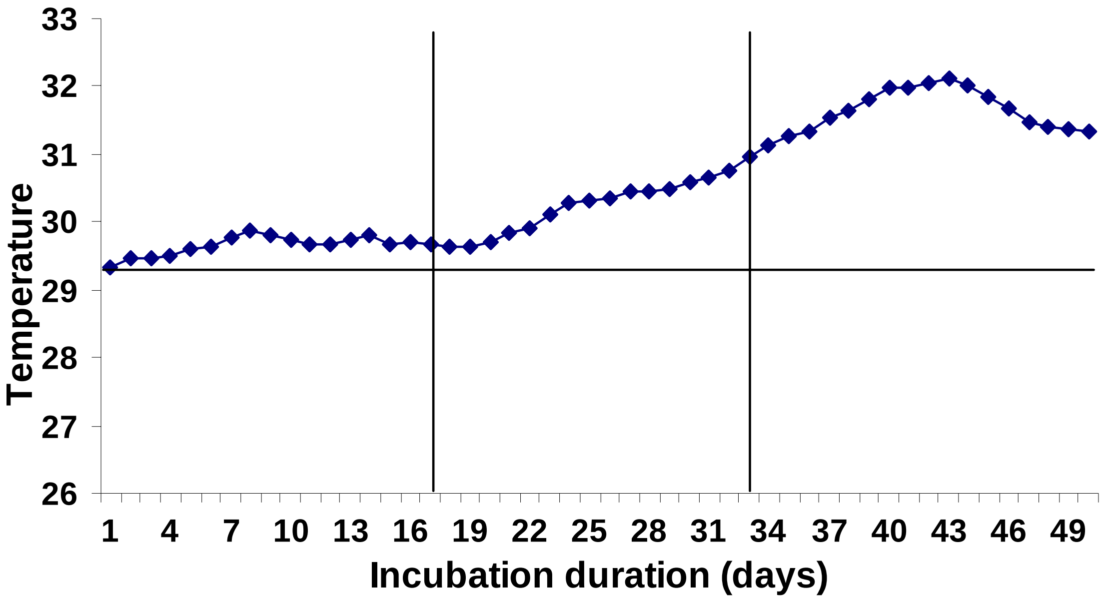

Figure 14. Daily average of a nest temperature in a hatchery located in northern Israel (Atlit, year 2004). Horizontal line indicates pivotal incubation temperature based on a research done in Greece (Rees et al 2004). Vertical lines divide the incubation period to thirds.

ITALY

Paolo CASALE

Department of Animal and Human Biology, University of Rome 1 “La Sapienza”, Viale dell’Università 32, 00185 Roma, Italy; WWF Italy, Via Po 25c 00198 Roma, Italy
(E-mail: paolo.casale@tiscali.it)

1. General remarks

Italy consists of a large peninsula in the middle of the Mediterranean and two large islands (Sardinia and Sicily) and many smaller islands, with an overall coastline of over 7000 km (Fig. 1).

While nesting activity is negligible when compared to other Mediterranean countries, turtles occur in high numbers in the Italian waters. In fact, most of the seas surrounding Italy are among the most important areas for loggerhead turtles in the Mediterranean (Margaritoulis et al., 2003; Casale et al., 2007a), and the Tyrrhenian coast represents one of the areas with the highest number of the few leatherback turtles recorded in the Mediterranean (Casale et al., 2003).

Because of the high fishing effort by its fleets, Italy has an important impact on sea turtle populations at the Mediterranean level. Unfortunately, so far no measures have been implemented at a national scale to mitigate this impact.

This report does not intend to provide a complete review of all the many articles, congress papers, and reports produced about turtles in Italy (reviewed by Mingozzi et al., 2008), but to give an overview of the main issues, referring to other reviews whenever possible.

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

Nesting activity in Italy has recently been reviewed by Mingozzi et al. (2007). For the 40-year period 1965-2004, this study listed records of “more than 143-144 nests”, with most occurring in the period 1985-2004, and with a maximum of 17 documented nests in a single year. In the 5-yr period 2000-2004 (when better monitoring is assumed) a total of 49 nests have been recorded, with an average of 10 nests per year. However, after taking into account the limited spatial coverage of constant monitoring efforts, Mingozzi et al. (2007) suggested that 30-40 nests might be laid in Italy annually. Recent intensive surveys of a total of 175 km of sandy beaches on the Ionian coast of south Calabria (Fig. 2) showed that it hosted half of the documented nests laid in all of Italy during the same period (Mingozzi et al., 2007).

Raw data from this review allow us to calculate the average annual nest density for the areas and periods of constant monitoring. Linosa: 16.3 nests/yr*km (1994-2004; 18 nests; 100 m); Lampedusa: 14.7 nests/yr*km (1990-2004; 33 nests; 150 m) (Pelagian islands); “Costa dei Gelsomini” (southern Calabria): 0.2 nests/yr*km (2000-2004; 17 nests; 16.5 km). Turtles nest on only one beach in Lampedusa (“Isola dei conigli” beach) (Fig. 3) and on only one beach in Linosa (“Pozzolana di ponente” beach) (Fig. 4).

Other nesting areas documented with lower nesting frequency are the wider Ionian coast of southern Calabria and the southern coast of Sicily. Few nesting events have also been reported from the south Adriatic coast of Puglia, Basilicata, Campania, and Sardinia (Mingozzi et al., 2007) (Fig. 1).

In conclusion, even the beaches with the highest nesting density (Pelagian islands) host very few nests per year (2.2 and 1.6 nests/yr in Lampedusa and Linosa respectively). Along the rest of the Italian coast, nesting occurs mainly in the southern part (central Mediterranean and Ionian Sea) although nests are rare and scattered, rather than concentrated in specific "nesting sites".

2.1.2. Marine areas

Italy lies in the centre of the Mediterranean, and the surrounding marine areas are among the most frequented by turtles in the basin (Margaritoulis et al., 2003; Casale et al., 2007a).

The north Adriatic Sea is an important developmental area for juveniles. Incidental captures (Casale et al., 2004; Vallini et al., 2003) and strandings (Affronte and Scaravelli, 2001) indicate that turtles occur in high numbers in this area. The occurrence of very small turtles (<40 cm and even < 20 cm; Affronte and Scaravelli, 2001) is not expected in shallow waters (< 100 m, and < 50 m in the northernmost part), since they are supposed to frequent open waters. However, the capture of small individuals by bottom trawlers (capturing turtles close to the sea bottom) (min: 29.5 cm CCL; Casale et al., 2004) and the evidence that small individuals on the other side of the Adriatic (Croatia) feed on benthic preys (min: 25 cm CCL; Lazar et al., 2008) suggest that in the north Adriatic even small turtles use the benthic trophic resources of these areas. Tag returns show that adult females nesting in Greece also frequent the Italian side of the north Adriatic (Argano et al., 1992), although most tag returns are from the Croatian side (Lazar et al., 2004a).

For their movements along the Adriatic, turtles seem to take advantage of the counter-clockwise current pattern: the Italian coast would be a migratory pathway for turtles moving southwards (Vallini et al., 2006).

Stranding data show a higher occurrence of small turtles on the south Adriatic-Ionian coasts than in other Italian areas, suggesting that this area is a developmental habitat for small turtles in the oceanic phase (Casale et al., 2005a). This is further supported by high catch rates by drifting longline in the Ionian (Deflorio et al., 2005) and by tag returns (Casale et al., 2007a). Genetic studies showed that this area is frequented by turtles from at least Greece, Turkey, and the Atlantic (Carreras et al., 2006; Maffucci et al., 2006).

In the central Mediterranean, the high catch rates observed in drifting longlines (fishing in oceanic areas) and in bottom trawlers (fishing in neritic areas) indicate a high occurrence of turtles both in the northern oceanic and in the southern neritic areas (Casale et al., 2007b). Comparison of these catch rates with those from other areas around Italy (Tables 1, 2) suggests that this is the area with the highest turtle occurrence. Tag returns showed that the southern neritic area is an important developmental area (Casale et al., 2007a) and a foraging ground for some of the adult females nesting in Greece (Margaritoulis et al., 2003) and possibly also for some of the Greek juveniles. Genetic markers revealed that this area is frequented by turtles from other Mediterranean rookeries, such as Cyprus and Turkey and also by Atlantic turtles (Casale et al., 2008a).

The northern oceanic area is frequented by both Mediterranean and Atlantic turtles (Laurent et al., 1998). As in the north Adriatic (see above), data on both capture by bottom trawlers (min: 22 cm CCL; Casale et al., 2007b) and diet (Casale et al., 2008b) indicate that in the central Mediterranean turtles recruit to neritic habitats at a small size.

The western Mediterranean (Tyrrhenian) side of Italy is frequented by loggerhead turtles too, with evidence of at least some neritic feeding areas (e.g. Gulf of Naples; Bentivegna et al., 2003). However, stranding records (Centro Studi Cetacei, 2000, 2002a, b, 2004a, b; WWF Italia et al, 2004, 2005, 2006) show that this area is less frequented than the other areas. It is probably frequented by turtles from at least Greece, Atlantic, and Turkey, listed in the order of relative contributions (Carreras et al., 2006).

The Strait of Sicily and the Strait of Messina are obligatory pathways between the western and the eastern Mediterranean, as also directly observed through satellite tracking (Bentivegna, 2002).

2.2. Past distribution and abundance

Although data for rigorous comparisons are not available, there are indications of more nesting activity in the past than at present. Doderlain (1881) wrote that "many individuals" laid eggs in Sicily and its islands, and some old fishermen narrated reliable stories about turtle reproduction in south Sicily to Argano (1979). Taking into account that human presence on the beaches, and consequently the chances of encountering a nesting female, was probably lower then than what it is today, such anecdotes suggests that nesting was not a rare event as it is nowadays. In Lampedusa (one of the few remaining nesting sites; 2.1.1.) the elders refer to a higher nesting activity in the past, also on beaches with no nesting activity at present (Casale, unpublished data).

Interviews with fishermen from Lampedusa suggest that sea turtle abundance in the surrounding marine area is declining (Casale et al., 2007b).

2.3. Threats

2.3.1. Terrestrial Habitats

As explained above (2.1.1.) nesting activity in Italy is low and it is difficult to identify specific nesting sites along coasts with rare and scattered nesting. For this reason, threats for the remaining few nesting sites are few too, whereas a wider range of threats affect the Italian coasts which have the potential to host nests.

2.3.1.1. Coastal development

General coastal development (human presence, coastal construction, pollution, artificial lighting, beach cleaning, vehicles driving on the beach) might be one of the causes for the probable reduction of nesting activity in Italy (see 2.2.), and is further threatening the coastal tracts that could support nesting activity.

At the two nesting sites in the Pelagian islands (Lampedusa and Linosa) human presence has been restricted to the daylight hours (thereby minimizing disturbance to the night time nesting activity). However, although it is restricted by law to daylight hours, human presence (up to 2000 persons/day on the small Isola dei conigli beach, Lampedusa) and related activities (digging for umbrella, shadows, walking, etc.) may affect nests if they are not adequately protected (Balletto et al., 2003). Other factors (coastal construction, pollution, artificial lighting, beach cleaning, vehicles driving on the beach) are not an issue because of the legal protection of these areas (see 2.4.).

2.3.1.2. Beach restructuring

See 2.3.1.

2.3.1.3. Non human predation

Di Palma (1978) reported that rats and seagulls preyed on hatchlings in Lampedusa, and this is still an issue today, although the few nests in Lampedusa and Linosa (see 2.1.1.) are protected against rats and feral dogs by cages (Balletto et al., 2003) and the release of hatchlings by dedicated personnel probably limits seagull predation, at least on the beach.

2.3.1.4. Human exploitation

Given the paucity of information about nesting activity in the past, it is uncertain if egg collection or female harvest occurred in the past, but it is certainly not a conservation issue today.

2.3.1.5. Other threats

One of the most important nesting beaches (Pozzolana di Ponente, Linosa; see 2.1.1.) is affected by erosion, which is a reason for concern given the small size of this beach (ca. 103 m long and max. 11 m wide; Fig. 4) (Balletto et al., 2003).

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

Italy has one of the largest fishing fleets in the Mediterranean, with several types of fishing gear used, and represents a major threat to sea turtles on a regional scale (Casale, 2008). At present, sea turtles are incidentally caught by basically five types of fishing gear: bottom and midwater trawl, pelagic and demersal longline, and set nets. An additional problem in estimating total number of captures is the uncertainty in the total fishing effort, due to an important illegal fishing activity (e.g. Cambiè et al., in press).

Bottom trawl is used on the wide continental shelves in the north Adriatic and central Mediterranean. In the north Adriatic, captures were conservatively estimated at 4300/yr, with a potential mortality (including comatose turtles which eventually drown if released in this condition) as high as 43% (Casale et al., 2004). The inexact number of Italian trawlers fishing in the central Mediterranean makes fishing effort even more uncertain than in the north Adriatic. However, on the basis of available information, Casale et al. (2007b) estimate at least 4000 captures/yr in this area. No estimation of mortality is available at present; however, indirect observations and insights suggest it may be significant (Casale et al., 2007b).

Mid-water trawl is used only in the northernmost part of the Adriatic Sea. This gear targets pelagic fish, but given the very shallow waters of the north Adriatic, the net may be very close to the sea bottom and may catch benthic animals (Casale et al., 2004). For this reason, turtle catch rate might vary much according to the bottom depth. Casale et al. (2004) estimated at least 161 captures/yr, but higher catch rates and total annual catches may occur in specific areas (Vallini et al., 2000).

Pelagic longline is used in deep waters such as the south Adriatic, Ionian, central Mediterranean, and Tyrrhenian. In the Ionian Sea, Deflorio et al. (2005) estimated 1100-4400 captures/yr and Cambiè et al. (2008) 500 captures/yr, while a conservative estimate for the central Mediterranean is 2100 captures/yr (Casale et al., 2007b).

No estimates are available for the Tyrrhenian. However, on the basis of catch rates reported by Guglielmi et al. (2000) (Table 2), interactions may occur at least in the southern part, while in the northern part (Ligurian Sea) it seems to be negligible (Orsi Relini et al., 1999). Generally, mortality rate induced by pelagic longlines is unknown because of the many parameters involved and the difficulty of monitoring turtles after the capture without veterinary treatment. Deflorio et al. (2005) observed no mortality at gear retrieval in a sample of 190 turtles, whereas Guglielmi et al. (2000) reported that 12% of 83 turtles were dead or almost dead at gear retrieval. Observations from a turtle rescue center indicate that the overall (long-term) mortality may be much higher than 30% (Casale et al., 2008c).

A preliminary investigation on demersal longline in the central Mediterranean indicates that this fishing gear may capture high numbers of turtles (250 captures/yr by the Lampedusa fleet alone) (Casale et al., 2007b). This fishing gear is suspected of high mortality rates because a captured turtle cannot surface to breath.

Indirect capture-mark-recapture results suggest that the set net fishery may capture many turtles and cause a very high mortality due to the prolonged forced apnea induced by this fishing gear (Casale et al., 2005b).

Table 1. Standard turtle catch rates by Italian bottom trawlers in different areas.

Area	Std Catch Rate	Source
Central Mediterranean	0.0274-0.0893	Casale et al., 2007b
North-East Adriatic	0.0548	Casale et al., 2004
North-West Adriatic	0.0037	Casale et al., 2004

Table 2. Standard turtle catch rates by Italian pelagic longliners targeting swordfish in different areas.

Area	Hook Shape, length (cm)	Turtles/1000 Hooks	Source
Strait of Sicily	J – 8.1	0.977	Casale et al., 2007b
North Ionian	J – 8-9	0.128	Deflorio et al., 2005
South Ionian	J –5-7	0.446	Deflorio et al., 2005
Thyrrenian	J – 9	0.255	Guglielmi et al., 2000
South Med.	J – 9	0.154	Guglielmi et al., 2000

2.3.2.2. Intentional killing and exploitation

In the past, some of the turtles incidentally caught in fishing gear were landed for the meat or for the carapace (De Metrio and Megalofonou, 1988; Basso, 1992). Nowadays, thanks also to the legal protection of these species, intentional killing for trade is absent or negligible. However, meat consumption onboard may take place in some cases, especially by foreign crews who support this tradition.

In circumstances where it may be economically convenient, turtles may be killed for recovering expensive hooks (Casale and Cannavò, 2003).

2.3.2.3. Other threats

Boat strikes are an important source of mortality at the national level as indicated by 4% of the dead stranded turtles with evidence of boat strikes (Casale et al., in press), especially in some areas with high maritime traffic, like the Gulf of Naples, Tyrrhenian Sea where boat strikes are responsible for 28% of the injured turtles (Bentivegna and Paglialonga, 1998).

Although the effect of pollution at a population level is still not understood, heavy metals (Storelli et al. 1998a,b; Storelli and Marcotrigiano, 2000a; Fonti et al., 2003), trace elements (Storelli et al., 2005), Chlorobiphenyls, HCB, and organochlorine pesticides (Storelli and Marcotrigiano, 2000b) have been detected in tissues of turtles found along the Italian coasts.

3. *Chelonia mydas*

3.1. Present distribution and abundance

3.1.1. Nesting sites

No green turtle nesting has ever been recorded in Italy.

3.1.2. Marine areas

Just a few green turtles have been recorded in Italian waters. The Adriatic is the most frequented area (Lazar et al., 2004b), but individuals have also been found in the other marine areas, including the Tyrrhenian (Centro Studi Cetacei 2000, 2002a, b, 2004a, b).

3.2. Past distribution and abundance

Data not available.

3.3. Threats

3.3.1. Terrestrial Habitats

Not applicable, because the species does not nest in this area.

3.3.2 Marine Habitats

3.3.2.1 Incidental catch

Deflorio et al. (2005) observed two green turtles captured by drifting longline in the Ionian Sea out of a total of 200 sea turtles, whereas no green turtles were among the 85 turtles captured by longliners in the south Adriatic, Ionian, Central Mediterranean, and Tyrrhenian (Guglielmi et al., 2000). No green turtles were observed among the turtles captured by bottom trawlers in the north Adriatic (Casale et al., 2004) and in the Gulf of Gabes (Casale et al., 2007b).

On this basis, it seems that the Italian fishing fleets of drifting longline and bottom trawl have a limited impact on the Mediterranean green turtle population due to the low occurrence of the species in Italian waters (see 3.1.2.).

3.3.2.2. Intentional killing and exploitation

Not an issue because of the low occurrence of the species in Italian waters (see 3.1.2.).

3.3.2.3. Other threats

Unknown, but probably not important, due to the low occurrence of the species in Italian waters (see 3.1.2.).

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

Relatively few individuals (less than 200) have been recorded from Italy, with the highest occurrence in the Tyrrhenian and the lowest occurrence in the Adriatic (Casale et al., 2003). Only adults and large juveniles enter the Mediterranean, and since they do not reproduce in this basin, their distribution around Italy is probably due to trophic reasons (Casale et al., 2003).

4.2. Past distribution and abundance

Data not available.

4.3. Threats

4.3.1. Incidental catch

Available records show that interaction with fishing gear, especially longlines and driftnets, is a major cause of mortality (Casale et al., 2003).

Three leatherback turtles were observed among the 85 sea turtles captured by longliners in the south Adriatic, Ionian, Central Mediterranean, and Tyrrhenian (Guglielmi et al., 2000). No leatherback was observed among the 200 turtles captured by drifting longline in the Ionian Sea (Deflorio et al., 2005).

4.3.2. Intentional killing and exploitation

Not an issue because of the low occurrence of the species in Italian waters (see 4.1.2.).

4.3.3. Other threats

Due to the low number of records, limited information is available on threats other than fishing gear. However, collision with boats seems to be significant, and also perhaps plastic ingestion (Casale et al., 2003).

5. Other species

A *Lepidochelys kempii* was found in Sicily (Tyrrhenian Sea) in 2009 (Insacco and Spadola, in press). No other sea turtle species are known from Italian waters.

6. Conservation status

Since 1980, capturing or keeping a sea turtle is forbidden by national law: Ministry Decrees 21/05/1980 and 30/05/1989 (Ministero Marina Mercantile); Law 25/08/1988 n. 381. This has been effective in eliminating (or reducing dramatically) local trade or personal use for consumption (see 2.3.2.2).

Italy is a member of the European Union and is a party of the following international conventions relevant for sea turtle conservation:

- Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention)
- Convention on Biological Diversity (CBD)
- Convention on the Conservation of Migratory Species of Wild Animals (CMS) – Bonn Convention
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Convention on the Conservation of European Wildlife and Natural Habitats – Bern Convention

As a member of the EU, Italy must protect the species listed in the Habitat Directive (including sea turtles).

Since 1996 and 2000, the two most important nesting sites (Lampedusa and Linosa; see 2.1.1.) are included in Natural Reserves. New buildings are forbidden and in Lampedusa human access is restricted to daylight hours and activities are regulated. Generally, these measures are effective in protecting these nesting sites.

There are no other specific regulations for the conservation of sea turtles.

Except for the prohibition of capturing or keeping turtles (see also 2.3.2.2.), which is obviously ineffective to prevent incidental catch in fishing gear, no measure with potential effects at a population level has been undertaken so far.

The protection of the nesting sites at the Pelagian islands was valuable and necessary, and the protection of the Calabrian coast, recently discovered to host regular nesting (see 2.1.1.), would be highly desirable and valuable in the long-term for guaranteeing suitable beaches, also in the context of possible scenarios due to climate change. However, at present such measures are unlikely to affect population growth, due to the few nests laid (see 2.1.1.) in comparison to the entire Mediterranean (5000/yr documented, plus a large number, possibly 1000, in Libya, plus scattered nests; Margaritoulis et al., 2003; Laurent et al., 1999).

In conclusion, at present there are no measures in place that are effective to reduce the only threat in Italy which is impacting turtle populations: the incidental catch in fishing gear.

7. Conservation needs

Considering what is reported above (2.3.2.1 and 6), reducing the impact of fishing is necessary and urgent. The following two specific conservation priorities have been identified (Casale et al., 2004; Casale et al., 2007b):

- reduce post-release mortality of turtles caught by drifting longlines and especially by trawls through an awareness campaign that provides fishermen with correct turtle handling procedures (e.g. Gerosa and Aureggi, 2001);
- reduce the number of turtles captured by drifting longlines through a technical modification of the gear (e.g. large circle hooks; deep hooks); however, these must be tested in the Italian fisheries before implementation.

Moreover, the number of captures may also be reduced throughreduction of high illegal fishing (e.g. Cambiè et al., in press) and through the enforcement of existent fishing regulations.

Regarding conservation-oriented research, priority should be given to issues assessing potentially important aspects such as the number of turtles caught by bottom longlines and mortality rates caused by trawlers in the central Mediterranean (Casale et al., 2007b), and tosuggestions for appropriate conservation measures.

Finally, tracts of coast with scattered but regular nesting should be safeguarded (Mingozzi et al., 2007).

8. Miscellaneous

None.

9. Institutions and organizations involved in conservation, management, and research

Many institutions, organizations, and even individuals carry out some activity related to sea turtles in Italy. A list of the groups with the highest levels of activity and regular sea turtle work is tentatively provided below, but should not be considered as a comprehensive listing.

9.1. Public

Aquarium of Livorno (rescue, rehabilitation)
Marine Biology Lab. of Bari (rescue, rehabilitation, research)
Marine Reserve of Capo Rizzuto (rescue, rehabilitation)
Natural History Museum of Calimera (rescue, rehabilitation)
Stazione Zoologica Napoli (rescue, rehabilitation, veterinary, research, education)
University of Bari (different teams) (veterinary, research, education)
University of Bologna (veterinary, research)
University of Calabria (research)
University of Pisa (research)
University of Rome 1 (research)
University of Torino (research)

9.2. Private

Associazione Pro-Natura Salento (rescue, rehabilitation)
ARCHE’ (rescue, rehabilitation, research,

education)
Centro Studi Cetacei (rescue, rehabilitation, research)
Centro Turistico Studentesco (rescue, rehabilitation, research, education)
Circolo Velico Lucano (rescue, rehabilitation)
Fondazione Cetacea (rescue, rehabilitation, research, education)
Sicily Wildlife Fund (rescue, rehabilitation)
WWF Italy (rescue, rehabilitation, research, education)

10 Resources available about marine turtle research and conservation

Listserv about sea turtles in Italy: itart@yahoogroups.com

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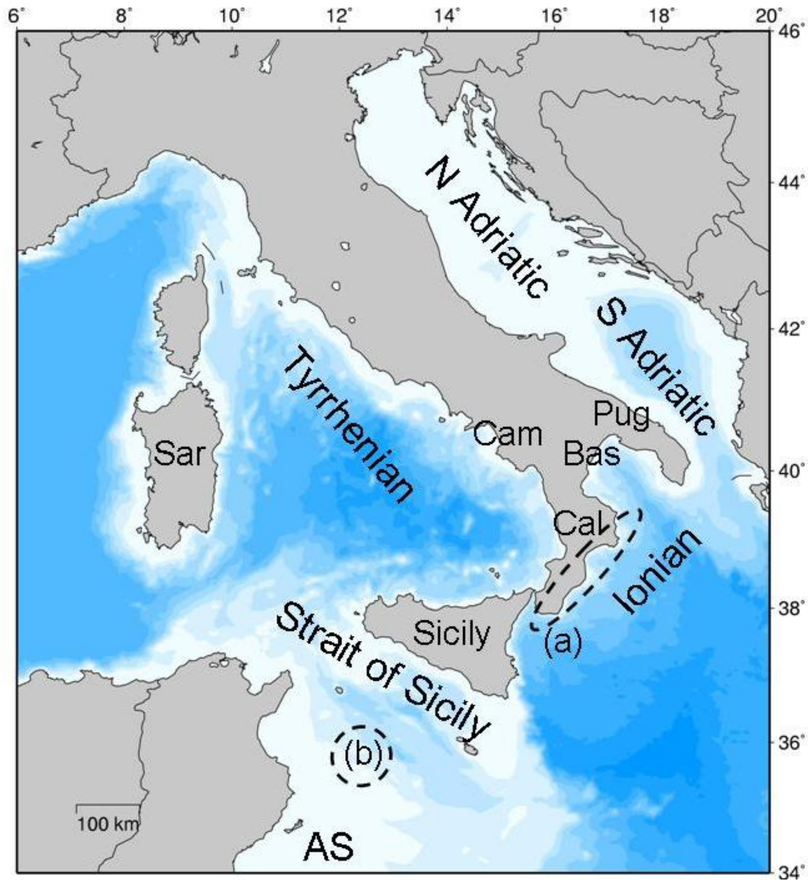

Figure 1.
Turtle marine areas and nesting sites in Italy. AS: African Shelf. Bas: Basilicata; Cal: Calabria; Cam: Campania; Pug: Puglia; Sar: Sardinia. North Adriatic and AS are neritic habitats while the others are predominantly oceanic habitats. Main nesting sites are shown (from Mingozzi et al., 2007): (a) Pelagian islands (Lampedusa and Linosa), (b) Calabria.

Figure 2.
Marinella di Bruzzano, one of the nesting beaches on the Ionian coast of Calabria. (Photo: A. Mingozzi).

Figure 3.
Isola dei conigli [rabbit island] beach, Lampedusa island. (Photo: P. Casale).

Figure 4.
Pozzolana di ponente beach, Linosa island. (Photo: G. Abbate & L. Cattarino).

LEBANON

Monica AUREGGI and Mona KHALIL[2]

[1]Naucrates, Colle tenne 04010 Giulianello di Cori (LT) Italy, E-mail: naucrates12@tiscali.it,
[2]POBox 19, Sour, Lebanon, E-mail: monahabiba@gmail.com

1. General remarks

Lebanon has a stretch of about 200 km of coast where several major towns, including Beirut, Tripoli and Sour (Tyre) are located (Fig. 1.). The coast is under enormous economic pressure due to human settlements and activities. In addition, the recent war has resulted in human, economic and natural loss in the country. Even though human development dominates along most of the coast, there are sites where flora and fauna remain in their natural habitat and such sites host endangered species. An example of such a case is sea turtles emerging to lay their eggs at a few sites along the coast.

Long sandy beaches are almost absent from the Lebanese coast. According to a recent survey (Kasparek, 2004), conducted before the 2006 war, the longest beach is to the north of Sour (El Aabbassiye and El-Bourgheliye), followed by the beach to the south of Sour, which is protected as the Tyre Coast Nature Reserve (Fig. 1). All other beaches are relatively small, usually not exceeding a few hundred meters in length, and are also often very narrow. Sand dunes are almost non-existent along the Lebanese coast: the only area which can be characterized as having an area of sand dunes of a significant size is situated to the north of Sour. In addition, rudiments of sand dunes are often found in the very narrow belt between the sandy beaches and agricultural land.

Recent genetic analysis shows that genetic variability of the loggerhead sea turtle in the eastern Mediterranean will be preserved only if all nesting sites are preserved, and that the survival of the small populations of Israel and Lebanon depends on the conservation of the rookeries of Crete and Cyprus (Carreras et al, 2007). Thus, international conservation at regional level is extremely important for the survival of the local nesting population.

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

Part of the Lebanese coast has been monitored carefully on a regular basis, thus providing a complete data set, such as number of nests per year. The other part of the coast was monitored sporadically thus providing an estimate of nest numbers that would need to be confirmed by further field research. In addition, the fact that sea turtle nesting may occur irregularly at places which are not suitable for nesting (i.e. developed beaches, etc) has to be considered.

Even though the available data has been collected using different methodologies and refers to different nesting sites, a general view of the importance of each nesting site is indicated in Table 1.

The combined nesting effort at all of Lebanon's nesting beaches falls within the range found by Margaritoulis et al. (2003) of 21 to100 *Caretta caretta* nests per season (Table 1). As far as number of nests per year, at the present state of knowledge the most important nesting beach is El Mansouri and El Koliala (Fig. 2; Table 1)

Table 1. Estimation of annual *Caretta caretta* nesting effort in Lebanon. EA: El Aabbassiye and El-Bourgheliye ; EM: El Mansouri and El Koliala; TCNR: Tyre Coast Nature Reserve. Min – Max: range of number of nests per season.

Beach	Length (m)	Seasons	Survey type	Range Nests/yr Min – Max
Palm Island	200	1997-98-99-00	Not known	3[6]-36[6]
EA	1670	05/04/2002	daily*	4[3] – 10[1]
TCNR	1714	2004-05	daily	0[1] – 9[2]
EM	1400	2002-03-04-05-06	daily	33[4] – 67[5]
Total	4984			40 - 122

[1]Cross and Bell, 2006; [2]Aureggi et al, 2005; [3]Newbury et al., 2002; [4]St John et al., 2004; [5]Khalil et al., 2006; [6]Kasparek, 2004. *For the first year of monitoring surveys were conducted weekly, but since 2004 they have been done daily.

2.1.2. Marine areas

Data not available.

2.2. Past distribution and abundance

Data not available. As monitoring programmes started only recently (2001), the information does not provide reliable trend data for the country.

2.3. Threats

2.3.1. Terrestrial Habitats

2.3.1.1. Coastal development

Coastal development is particularly spread along the northern coast of the country, transforming the beaches to unsuitable nesting sites for sea turtles. Due to the recent wars, the southern part of the country was not the focus of economic development and therefore less human impact on the beaches is found. However, the impact from military operations should be evaluated.

Sun loungers, chairs, cabanas, umbrellas, canoes, small boats, etc., are all physical obstacles which deter nesting attempts, interfere with egg incubation and hatchlings crawling to the sea, and are found on most of developed beaches in the northern part of the country and within Tyre Coast Nature Reserve. Aborted nesting attempts in close proximity to these obstacles was observed in 2004 (Aureggi, unpublished data).

Vehicular tracks are a major threat on most beaches, including the southern part.

2.3.1.2. Beach restructuring

Sand mining is conducted in the northern part of the coast to facilitate development, whereas in the south it is practiced at a smaller scale.

2.3.1.3. Non human predation

Feral dogs and foxes are the major natural predators observed in the southern beaches, attacking eggs buried in the sand and destroying nests (Aureggi et al., 2005)

Ghost crabs are predators which attack hatchlings prior to, or during, emergence or whilst they crawl to the sea threatening hatching emergences at El Mansouri beach (Khalil et al., in press).

2.3.1.4. Human exploitation

Data not available.

2.3.1.5. Other threats

The war in Lebanon certainly represents a threat to the nesting habitats, in particular in the southern region of the country. Some of the beaches were used for military operations both during and after the conflict, probably affecting the nesting environment. A post war assessment is needed in order to estimate the damage.

Natural beach erosion is reported as a threat in El Mansouri where intense nesting activity is reported resulting in a high nest density along the 1.4 km of stretch of this beach (Khalil et al., in press).

Marine turtle nests close to the tide line risk inundation, which may reduce hatching success rates. Sea storm may reach and flood turtle nests and alter their hatching success.

Debris on the beach is one of the greatest threat on all the nesting sites in Lebanon. Large amounts of debris (e.g., plastic, glass, hospital waste, tar balls, etc.) deposited on nesting beaches arrive via the sea. Layers of debris were found in the sand at different depths. Visitors also dispose of waste on nesting beaches.

Animal grazing on the beach could negatively influence sand characteristics, altering sand composition and dune vegetation, and was often observed on nesting sites in the south (Aureggi et al, 2005).

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

Data not available.

2.3.2.2. Intentional killing and exploitation

Data not available.

2.3.2.3. Other threats

Dynamite fishing is often observed in south Lebanon near nesting beaches (Khalil et al., in press).

Chemical contamination of the sea from sewage, agricultural runoff, pesticides, solvents and petroleum, occurs along the coast, but in unknown quantities and needs to be estimated. In particular the impact of the recent run off of from the oil spill near Beirut during the 2006 war (Fig. 3) should be estimated.

3. *Chelonia mydas*

3.1. Present distribution and abundance

Until recently, data on the nesting effort of *Chelonia* in Lebanon was unavailable due to an absence of beach surveys. Although long term seasonal monitoring in south Lebanon is urgently needed, and could provide higher figures, the available data, which is incomplete and represents an underestimate, shows a total nesting effort in south Lebanon of between 0 and 16 nests per year (Cross and Bell, 2006).

3.1.1. Nesting sites

Surveys started only recently and therefore do not allow any conclusions to be drawn on the presence of *Chelonia* along the Lebanese coast.

The only continuous data set is provided for El Mansouri where, during five years of monitoring, the total number of nests of *Chelonia* varied between 0 and 9 nests per season, showing that few adults are probably utilizing the beach for nesting.

It is evident from the beach description conducted in 2004 (Kasparek, 2004) that sandy beaches with dunes suitable for green turtle nesting are nearly non-existent in the country and therefore only few nests are found.

3.1.2. Marine areas

Data not available.

3.2. Past distribution and abundance

Data not available.

3.3. Threats

Same as for *Caretta caretta*: see 2.3.

4. *Dermochelys coriacea*

On 20 April 2006 a leatherback turtle was caught by a fishing net in Tripoli, near Palm Island. The specimen was tagged and released into the sea (email to Medturtle mailing list, 24/04/06).

5. Other species

No other sea turtle species are reported from Lebanon.

6. Conservation status

At national level marine turtles are protected through: Ministerial Decision issued by the Ministry of Agriculture banning the fishing of whales, monk seals and marine turtles (Decision No. 125/1, 1999); Code of Environment (Law 444, 2002); regulations within Protected Areas (Tyre Coast Nature Reserve and Palm Islands Nature Reserve).

Lebanon is a contracting party to UNEP/MAP (1975), which attempts to protect the Mediterranean in an environmentally sustainable way.

Lebanon signed and ratified the Mediterranean Action Plan (UNEP) in 1975, the Barcelona Convention and protocols, and the revised Action Plan for the conservation of marine turtles (1999).

The organization MEDASSETT initiated the first sea turtle survey in the country in 2001, supporting and encouraging conservation work related with the nesting population.

In 2004 and 2005 most of the surveys concerning sea turtle nesting population were conducted within the framework of a joint effort by the MSC Project funded by the EU, the MedWet-Coast Project funded by the French GEF, the Ministry of Environment, UNEP's Regional Activity Centre Specially Protected Area (RAC SPA), and Mediterranean Association to Save Sea Turtles (MEDASSET).

Unfortunately, the 2006 war created difficulties to the continuation of conservation work. Despite this, monitoring campaigns are carried out in El Mansouri together with awareness programmes in the area.

7. Conservation needs

Taking into consideration that the country is recovering from the recent war (2006), Lebanon sea turtle nesting sites need to have enforced and implemented management plans in order to apply existing regulations concerning the nesting population.

The southern part of the country also corresponds with the less developed area, destroyed and ruined by the war but still without tourism development along the coast. It is therefore of primary importance to exercise protection and management more effectively in this region. In particular, El Mansouri should be urgently included among the National Park areas and El Aabbassiye and El-Bourgheliye desperately needs to be recognized as a critical sea turtle nesting habitat.

The impact of the recent war on nesting beaches should be estimated in order to assess the beach status according to the needs of sea turtle nesting behaviour.

Sand dune protection and restoration of damaged and degraded areas should be considered as a priority action. Sand dunes are an integral part of sedimentary coastlines, acting as a vast natural sediment bank and defence structures.

Awareness campaigns are needed in order to involve local people and to provide knowledge about how natural resources could be a source of income in developing sustainable tourism schemes.

Long term monitoring programmes should be encouraged in order to collect data to compile a trend over time and apply suitable conservation strategies. Training should be conducted among officials of protected areas and among local people.

Information on the fishing effort and its impact on sea turtles is urgently required to assess this threat in the marine environment.

International cooperation with NGOs, institutions, governments, etc., should be encouraged to enhance information exchange and collaboration.

8. Miscellaneous

None.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

- Tyre Coast Nature Reserve (TCNR) – is responsible for the Tyre nesting beaches. They conducted monitoring programmes in 2004 and 2005 with the assistance of MEDASSETT.
- Palm Island Nature Reserve – chair:

Ghassam Ramadan-Jaridi, PhD.
- University of Balamand, Environmental Unit, Dr. Manal Nader .
- Ministry of Environment, Beirut – oversee all nature reserves in Lebanon.
- Ministry of Agriculture – issued a ministerial decision to protect sea turtles.

9.2. Private
- Local NGOs organize awareness campaigns or produce awareness materials such as posters and leaflets which are sporadically distributed.
- MSC Project: Management Support Consultancy Project funded by the EU, the MedWet-Coast Project funded by the French GEF, and MEDASSET was carried out in 2004.
- Mona KHALIL and Habiba SYED are responsible for the monitoring programme at El Mansouri and El Koliala beach and have been since 2001.

10. Resources available about marine turtle research and conservation

None.

11. Literature cited

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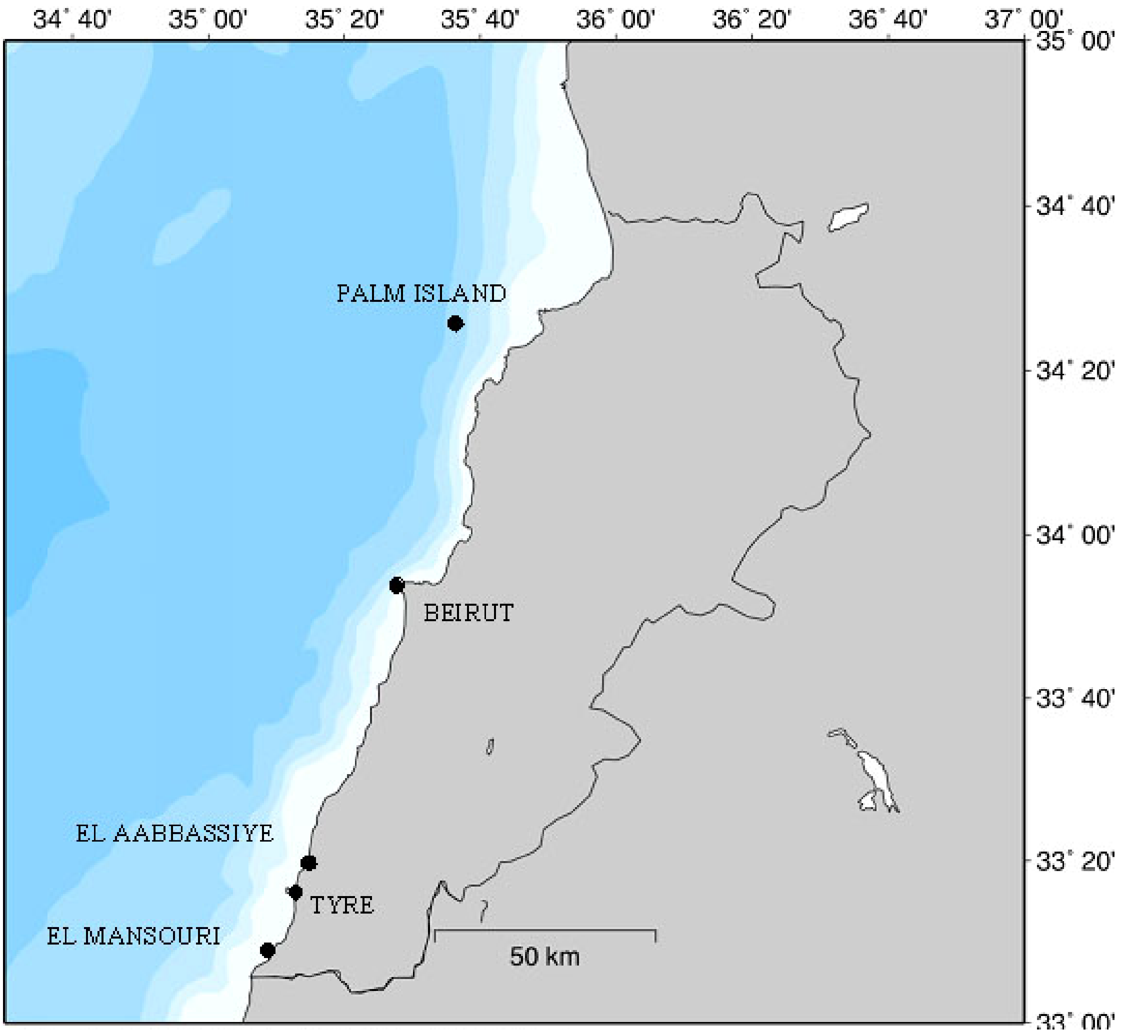

Figure 1. Map of Lebanon.

Figure 2.
El Mansouri beach, 2001
(Photo: M. Khalil).

Figure 3.
Oil spill in Beirut, 2006
(Photo: M. Khalil).

LIBYA

Abdulmaula HAMZA

Libyan Seaturtle Program (LibSTP), Environment General Authority, P.O.Box 13973 Tripoli-Libya (E-mail: abdhamza@gmail.com)

1. General remarks

The three species of sea turtles reported from Libyan waters are: the green turtle *Chelonia mydas*, the leatherback turtle *Dermochelys coriacea* which is irregularly and rarely observed at sea, and the loggerhead turtle *Caretta caretta*, which is the only reported nesting species along the Libyan coast (Schleich, 1987, Laurent et al., 1997, 1999).

The coast extends for approximately 2000 km (Fig. 1). Most of this coastline is still in a pristine condition; not only due to the limited human activities, but because of the underdeveloped nature of the Libyan fishing industry, compared to its neighbouring countries (Laurent et al., 1995). The continental shelf in the western region is a continuation of the eastern fraction of the Gulf of Gabes, and is characterised by sandy or muddy substrate, whereas in the central and eastern region, the continental shelf is narrow and almost absent in Cyrenaica, and the substrate is rocky ((Abulogma and Elgzeri, 1997).

Tidal movements are relatively limited and insignificant, with the exception of the coast between Zwara and Ras Ajdir towards the Tunisian border, due to its proximity to the Gulf of Gabes (Howege and Hamza, 2002).

The Gulf of Sirte's coastal area and some shallow bays of Cyrenaica (Bay of Bumba and Ain Alghazala), are characterised by immense meadows of *Posidonia oceanica*, and due to limited fishing activity, are among the most important nesting grounds for loggerhead turtles in Libya and potentially among the best in the Mediterranean in terms of nest counts

However, threats posed by high canine (Res Foxs and Jackals) predation levels which were observed by Laurent et al., 1995, 1997, increases the need for conservation measures to be put into place at certain important nesting sites.

2. *Caretta caretta*

2.1. Present distribution and abundance

Studies on distribution and abundance were mainly dealt with nesting sites identification and assessing their relative importance, based on track and nesting densities, first with single surveys (Laurent et al., 1997, 1999) and later with daily or weekly surveys (Hamza and Ghmati, 2006; Hamza, 2007; Saied et al., 2008). However these surveyed areas only cover 34% of the whole length of Libya's sandy beaches (1089 km)

2.1.1. Nesting sites

A few publications have reported the nesting activity of sea turtles in Libya. The earliest available records date back to late 1970's and early 1980's during the field studies to establish the Kouf National Park (KNP) northeast of Cyrenaica (Herbert, 1979; Armsby, 1980). Further information was published on the herpetofauna of KNP, this included details on loggerhead sea turtle nesting density and predation levels on adult females and hatchlings by canine predators (Schleich, 1987). The nesting of loggerhead turtles starts during the last week of May and ends between late July and early August (Laurent et al., 1999) although there were a few nests laid in September during 2005 season (Hamza and Ghmati, 2006).

Table 1. Beach length, nest counts and nesting density for 28 loggerhead turtle nesting beaches along the Libyan coastline Beaches are ranked basing on 2006 and 2007 data only. Collection of more data could alter this ranking as density and number of nests vary between years. More data will be needed to evaluate the relative importance of each of those sites. NS: not surveyed; D: daily; W: weekly.

	Nesting site	Province	Length (Km)	Nests 2006	Nests 2007	Mean Nesting density (nests/km)	Survey frequency
1	Al- Gbeba	Gulf of Sirte	5.67	139	154	25.84	D
2	Al-Metefla	Benghazi	4.5	(16)*	104	23.1	W
3	Ain Ghazala1	Tobruk	1.4	NS	26	18.57	W
4	Al-thalateen	Gulf of Sirte	5	66	80	14.6	D
5	Al-Arbaeen	Gulf of Sirte	8.54	154	84	13.93	W
6	Al Malfa	Misratah	1.5	3	37	13.33	W
7	West Camp sirt	Gulf of Sirte	2.5	NS	25	10	W
8	Ain Ghazala2	Tobruk	1.3	NS	10	7.69	W
9	Banans	Al Jabal Alakhdar - KNP	2	10	18	7	W
10	Abulfraes	Tobruk	1.4	NS	9	6.43	W
11	Elogla	Al Jabal Alakhdar	3.9	4	30	4.36	W
12	Al-Gwezat	Misratah	5.49	13	33	4.19	W
13	Jarjaruma	Al Jabal Alakhdar - KNP	3.3	5	22	4.09	W
14	Al Arar	Misratah	6	7	37	3.67	W
15	Semeda	Misratah	9.42	14	54	3.61	W
16	Ogla misrata	Misratah	0.95	4	2	3.16	W
17	Elmahbula	Misratah	5.32	10	22	3.01	W
18	Marzuga	Misratah	5.46	8	17	2.29	W
19	Al Hasi	Al Jabal Alakhdar- KNP	2.8	4	8	2.14	W
20	Bagasa	Benghazi	4	NS	6	1.5	W
21	Almjarin	Misratah	17.7	29	22	1.44	W
22	Ramel Khaieb	Misratah	8.11	6	11	1.05	W
23	Shat habib	Benghazi	15	NS	14	0.93	W
24	Errgeta	Benghazi	7	10	2	0.86	W
25	El Mrekeb	Misratah	4.8	2	6	0.83	W
26	Buretma	Misratah	5.87	5	4	0.77	W
27	El Khowada	Misratah	10.9	10	2	0.55	W
28	Surrah	Misratah	4.84	1	2	0.31	W
	Total		154.67	520	841	4.69	

*Data of 2006 was not included in calculations, as it was incomplete.

However, it was only with the beach surveys in 1995-1998 that the importance of Libya as nesting ground was highlighted. These surveys were organized and funded by several national and international organizations (Mediterranean Association for saving sea turtles (MEDASSET), Technical Centre for Environmental Protection TCEP (now the Environment General Authority, EGA), United Nations Environment Program-Mediterranean Action Plan-Regional Activity Centre for

Specially Protected Areas UNEP-MAP-RAC/SPA, Marine Biology Research Centre MBRC and World Wide Fund for Nature WWF); these surveys have identified several important nesting sites, and concluded that Libyan coast is one of the main nesting grounds of loggerhead turtles in the Mediterranean (Laurent et al., 1997; Laurent et al., 1999). The launching of the Libyan Sea Turtle Program (LibSTP) in July 2005 by EGA, was the latest movement towards studying and protecting sea turtles in Libya. This program aims to:

- assess the annual number of sea turtle nests laid on Libyan coast, by continuous monitoring of selected sites.
- study sea turtles in their different nesting, foraging and wintering habitats.
- provide capacity building for volunteers, biologists and conservationists from Libya and from other Mediterranean countries in future.
- raise public awareness on the importance of sea turtles as part of the Libyan Mediterranean marine biodiversity.

The program is coordinated and funded by the EGA, and in 2005-2006 was partially supported by UNEP-MAP-RAC/SPA.

From the available literature and the last three years personal observations, it appears that loggerhead nesting is mainly concentrated in four coastal sub-regions: the sandy beaches of the Gulf of Sirte (Gulf of Sidra) with a total length of more than 800 km, beaches located to the south and the north-east of Benghazi; on certain beaches of Aljabal Alakhdar (Cyrenaica), which are shorter and intersected with rocky formations, and at the area of Derna-Tubrok. The following rating of nesting beaches is set according to data collected during the nesting seasons of 2006 and 2007.

Al-Gbeba beach (Fig. 2) is located about 20 km west of Sirte (31°13 098'N - 16°23 123'E and 31°13.427'N - 16°19.862'E). and is 5.67 km in length, with a narrow beach (50-100 m wide), sand gradually increases in elevation up to 3 meters above sea level at the sand dune area, that separates the beach from a long dry marsh area (Sebkha), flooded in winter. Plant coverage does not exceed 25%, and is composed of sand dune plant communities mixed with small shrubs, and then an area of salt tolerant plant communities (*Salicornium* and *Arthrocnenum* sp.) dominates the periphery Sebkha zone. The beach is used for recreation by local people.

139 nests were reported in 2006 and 154 in 2007, mean nesting density were 25.84 nests/km, with an average of 147 nests/season (Table 1.

Al-Metefla beach is located 100 km south of Benghazi (one of western Cyrenaica nesting sites), with 4.5 km of a low lying sandy beach, containing moderate plant cover of mixed sand dunes and halophytic vegetation. The first monitoring of this site was during the 2006 season, when partial surveys (July-August months)reported a total of 16 nests. Here only 2007 data were considered as it represents data a complete nesting season, with total nesting density of 23.1 nest/km (Table 1).

Predation by foxes and some poaching represent the main threats to turtle nests.

Ain Ghazala 1 beach is a sandy beach located to the north-eastern side of Ain Ghazala lagoon and is about 60 km west of Tobruk.The beach measures approximately 1.4 km in length and is bordered by medium rocky formations and is not easily accessible from land due to rocky formations. An important nesting site, with high canine predation (Laurent et al., 1995). The site was surveyed weekly during the 2007 nesting season from late June to mid August. A nesting density of 18.57 nests/km was recorded (Table 1). Natural predation by foxes and jackals has exceeded 85% (Hamza et al., 2007), therefore conservation measures are urgently required. At this beach the first loggerhead (LY0002) was tagged in August 2008 with inconel flipper tags.

Al-Thalateen beach (Fig. 3) is located approximately 28 km west of Sirte (31°13 429'N - 16°19 860'E and 31°13.666'N -

16°19.473'E) and is separated from the Al Ghbeba site by a 200 m rocky formation (known locally as Gharnata beach). The beach is 5 km long and between 100-200 m wide. Some parts of this beach are 4 m above the sea level. The middle area of this beach is used by local inhabitants for recreational bathing, especially at the weekends. A small landing site with a few boats is also present. The western edge of the site is disturbed by the human activities of the nearby village (i.e. bathing, grazing and some waste dispose).

In 2006, 66 nests were reported and in 2007 there were 80 nests recorded, with a nesting densities of 13.2 nests/km and 16 nests/km respectively (Table 1).

Al-Arbaeen beach is located at approximately 37 km west of Sirte (31°15 195'N - 16°07 218'E and 31°14.012'N - 16°13.737'E). The total beach length is 8.54 km, with a width of 150-300 m, with a less dense shrub community and notably a greater density of sand-dune floral communities. This is possibly due to lower level of human disturbance compared to the other two sites of Sirte. The beach separates the sea from a lower salt marsh zone (Sebkha), with its typical halophytic communities of *Arthrocnenum* and *Salicornium* sp.

2.1.2. Marine areas

The coastline of Libya extends for approximately 2000 km, and includes a wide diversity of coastal and marine habitats. These coastal habitats are which mostly in near-pristine condition, and due to the very limited fishing industry, compared with neighbouring countries (Laurent et al., 1999) allows Libya to be an important Mediterranean country for sea turtle populations, during their nesting and/or foraging and wintering periods. Although to fully assess this important furtherstudies on turtles are required in order to fully assess the contribution of Libyan waters in sustaining sea turtle populations.

However, few studies has addressed sea turtles in marine habitats; some research efforts using satellite telemetry for both green and loggerhead sea turtles, showed a noticeable tendency of many tracked individuals towards Libyan waters, especially during autumn and winter (Bentivegna, 2002). Warmer water seems to drive turtles to spend these non-breeding periods near Libya, as it is the most southern limit of the Mediterranean and in close contact with the Sahara desert fringe. There has also been reported fidelity in loggerheads and green turtles nesting in northern Cyprus to Egyptian and Libyan marine areas, as shown by satellite tracking (Broderick et al., 2006)

During spring 2006, with the support of RAC/SPA and the zoological station in Naples, , three loggerhead turtles caught by fishermen from Libya, were rehabilitated and later equipped with satellite transmitters.

Two satellite tagged females remained near Libyan coast of Misrata to Sirte and possibly had nested there, while one male (Tajura) left directly to Sicilian coast, where it got entangled in fishing gear and later released, when it then moved to the south part of Adriatic sea (Fig. 2). Differences in habitat use were noticed from tracking data, The two tagged females (of Mediterranean haplotype) remained in coastal zone, whereas the male (of Atlantic haplotype) used deeper and colder waters in the north Mediterranean (Bentivegna et al., 2008).

Feeding is thought to be confined to shallow areas of the Gulf of Bumba and the nearby Ain Al Ghazala lagoon (northeast Libya), the eastern limits of the Gulf of Gabes in the west, and in particular the area of Farwa lagoon (Broderick et al., 2006; Hamza, pers. observ.).

Ain Al Ghazala is an important mating site during the pre-nesting period (April-early May): mating turtles were observed in several occasions during these months (Hamza, pers. observ.).

2.2. Past distribution and abundance

Sea turtles in Libya have been used by Libyans inhabiting coastal cities for many centuries; carapaces were traditionally used as baby cradle, and for ornamental purposes in their houses. Unfortunately very little information is available on historic background of nesting activity. Old fishermen in Tripoli confirmed that nesting activity occurs at many sites, even near the centre of Tripoli, on the sandy coasts of Tajoura (Hamza, unpubl. data); in fact during 2006 season, information confirmed that nesting occurred on this beach, which had a high number of bathers during July (Hamza, pers. observ.). Scientific research on sea turtles in Libya is relatively recent; observations were made during late seventies and the eighties by several researchers along the coastline in Kouf National Park, during the extensive surveys to establish the park (Herbert, 1979; Armsby, 1980; Schleich, 1987). These reports focused on the area of Kouf only, and reported the numbers of nests, track densities, canine predation, and standings of loggerheads.

2.3. Threats

2.3.1. Terrestrial Habitats

2.3.1.1. Coastal development

Human presence and coastal construction.

Along the coastal area the population density is about 50 persons per square km in the two northern regions of Tripolitania and Cyrenaica, but falls to less than one person per sq. km elsewhere. Ninety percent of the human population live in less than 10% of the area which is primarily along the coast. More than half the population is urban, mostly concentrated in the two largest cities, Tripoli and Benghazi. The remaining coast is characterised with vast areas of beaches with very scarce or no development.

During the last 5 years national planning and opening of the country to foreign investors, and the resulting planned intensification of tourism may threaten inportant nesting sites, unless urgent steps to minimise the effects of construction and human presence on nesting populations, are to be taken by national and local authorities.

Pollution.

Most of the "known" nesting beaches are located in areas with limited human activity; however, many of these sites are receiving large amounts of solid wastes, either land based or by marine currents from other countries. A survey in Al Gbeba (west of Sirte) found that more than 30% of these waste were brought in from the sea (the Gulf of Sirte includes the southernmost point of the Mediterranean). Furthermore, plastic bags, cans and bottles left by bathers constitute an important part of waste too.

Wastewater pollution is also a concern, as many treatment plants have become old and lack regular maintenance. The beaches around Benghazi and some Tripoli beaches are severely affected by this type of pollution. Wastewater pollution can be found at most of the nesting beaches.

Oil pollution is a major threat to nesting beaches in Libya, being a major oil exporter; many nesting sites are nearby oil exporting terminals, especially those in the gulf of Sirte and near Tobruk. Ballast water emptied by foreign oil tankers in the open sea, forms tar balls which move gradually by surface currents, and settle on the coast. Tar balls are a major pollutant at some sites.

Artificial lighting.

As most important nesting sites are located away from human settlements, and in addition tourism is still not highly developed, the problem of artificial lighting on beaches is up to now of minor concern.

Beach cleaning.

Very limited beach cleaning is evident, mainly in bathing beaches around east and west of Tripoli. This activity is still new in Libya, and most recreational beaches laboring persons to manually clean the beaches.

Vehicle driving.

The open ended, unprotected beaches attract many 4X4 vehicle drivers each summer, which coincides with the nesting season. The most affected beaches during the last three season’s are: Beaches of Misratah-Bowerat Lahsun area (NW Gulf of Sirte), where fishermen and bathers have to pass several kilometers to reach seasonal landing sites. To a limited extent vehicles also pose a problem in beaches south of Benghazi.

2.3.1.2. Beach restructuring

Many nesting sites (especially in Cyrenaica) have recently suffered from unsustainable sand mining activities, most of which are illegal. The problem of sand mining was not a noticeable problem until the last 4-5 years. Due to local economy decentralization policy all Shabiyates (Governorates) were called to utilize their own natural resources for development, and the active building in the country, which caused the construction industry to use more and more sand from the Shabiyat resources. Many nesting sites such as Kouf National Park were illegally sand mined and other beaches near Benghazi, Tolmitah, Derna and Toubruk also suffered from these unsustainable practices. The problem reach national level when EGA reported many of these illegal actors to the police for investigation. Some of them were stopped by a special committee formed by the General peoples committee (First ministry) but some are still illegally active. Further local and national coordination will be needed to tackle this problem. Sea turtle nesting was one legal instrument used to stop these illegal practices at many sites.

2.3.1.3. Non human predation

Evidence of canine predation (foxes and jackals) on eggs and nesting females were mentioned by several authors (Schleich, 1987; Laurent et al., 1995). The levels of predation in Libya are considered high ranging from 50-80% at some nesting sites (Laurent et al., 1999). Predation is mainly by the red fox and occasionally by jackals and stray dogs. During the 2005 season a reptile predator of eggs (*Varanus* sp.) was reported from Al Gbeba near Sirte. Furthermore ghost crabs are also active predators on eggs and hatchlings at many sites (Hamza and Ghmati, 2006).

2.3.1.4. Human exploitation

Meat and egg consumption is rare, as many Libyan fishers respect sea turtles and consider them a bad omen if they are caught and eaten. However, occasionally turtles may be caught in fishing nets and the flesh is consumed mainly by foreign fishermen. In recent years (1995 onwards), egg poaching has become more intensive in certain areas, mainly because of the mythical belief that they help in treating human fertility disorders. The practice was first noticed in the western region (Tripoli to Tunisian boarder) during the 1998 surveys as a local tradition (Laurent et al., 1999), which may explain the recent decline of nesting activity in this area.

Egg poaching and illegal trading were also reported in Misuratah and Sirte it was claimed for medicinal uses. This phenomenon was reported from the Gulf of Sirte (3 sites) beaches during 2005-2007 seasons, with over 12.5% of nests being poached in 2005 (Hamza and Ghmati, 2006). One of LibSTP objectives in awareness raising activities is to limit the poaching of turtle eggs. Measures were taken by EGA during the nesting seasons to monitor fish markets for illegal turtle/egg trading. These activities included articles in local and national newspapers, live radio interviews and audience discussions , several TV interviews with conservationists and physicians aimed to show how dangerous the consumption of sea turtle eggs is on human health and the species future.

2.3.1.5. Other threats

Data not available.

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

Laurent et al. (1995) emphasized incidental captures of sea turtles by bottom and drifting longlines, trammel nets and gillnets, but the numbers appeared to be low (Camiñas, 2004), mainly due to the small number of fishing units in Libya compared with its neighbouring countries (Lambeuf et al., 2000).

Studies on interaction of fisheries with sea turtles are limited and mostly done as observations during other studies (e.g. by MBRC Tuna fishing observers scheme). More effort is needed to quantify the actual contribution of fishing gears on turtle bycatch. A questionnaire of 100 artisanal fishermen in 5 landing sites along the coast in 2000 revealed that an average of 2.4 turtles/boat/year were caught (Hamza, unpubl. data). The issue of quantifying mortality rates caused by different fishing gears is a national priority.

2.3.2.2. Intentional killing and exploitation

It seems not common for fisherman to kill turtles: none of 100 fishermen questioned in 1999-2000 claimed that they ever killed a turtle intentionally (Hamza, unpubl. data).

While turtle flesh consumption is not a common practice in Libyan fishing communities, observations of foreigner fishermen working in Libya indicate the occasional consumption of turtle meat onboard their vessel, as it is strictly illegal to bring a turtle or any part of it to the port.

2.3.2.3. Other threats

Pollution.

As a major oil exporter, and located in the passage of oil tankers from Middle East to Europe, Libya is susceptible to marine oil pollution. So far no major leakages that harm the marine life, including sea turtles, have been reported. All oil companies have an emergency plans, and mitigation strategy in case of offshore accidents. They coordinate with EGA, MBRC and the national authority of combating disasters (formed recently).

Dynamite fishing.

As in most Mediterranean countries, the problem of dynamite fishing is presentand practised illegally all year around (Hamza et al., 2006). The authority's have campaigned from time to time to control the spread of this harmful practice, but this still yields limited results. Dynamite fishing in Libya uses dynamite from World War II mine fields, that still exist in many parts of Libyan Desert (programs of mine clearance is limited due to lack of maps of many of these minefields). The presence of such practices poses a threat to the whole marine ecosystem, and introducing alternative fishing methods should be a priority for local and national environmental institutes.

The region between Misratah till the Egyptian border hosts less than one third of Libya's artisanal fishing fleet (Lambeuf et al., 2000), however, more research will be needed to quantify impacts of this practice on the marine environment and ecosystem. Socio-economic studies also urgently should address this problem, to seek possible solutions.

Oil exploration.

During the last three years important areas of Libyan waters were opened for oil exploration by National Oil Corporation (NOC), for national and international oil firms. By law No. 15/2003 on protection and improvement of the environment, all activities that might have an impact on the environment on land and/or at sea are requested to prepare and present an Environment Impact Assessment study to EGA and NOC's Environmental office prior granting the permission to work by EGA, the EIA's are mostly well prepared, but the monitoring of actual application of every single mitigation measure of that plan are largely weak.

3. *Chelonia mydas*

3.1. Present distribution and abundance

3.1.1. Nesting sites

The green turtle has not reported as nesting in Libya; surveys of Libyan beaches have failed to identify any green turtle tracks (Laurent et al., 1997). It is worth mentioning that there is an availability of nesting habitats along the coast, which makes nesting a future possibility.

3.1.2. Marine areas

The juveniles of green turtles are frequently recorded in Libyan coastal waters. The first record was in 1992 at Ain al Ghazalah (Hadoud and El Gomati, 1996). Since then, several other surveys have found juvenile green turtle in Ain al Ghazalah lagoon (Laurent et al., 1995) and along the coast between Sirte and Misratah (Hadoud and El Gomati, 1996). This suggests that Libya may represent an important feeding ground for juvenile green turtles coming from nesting populations in the Eastern Mediterranean. This might explain why adult green turtles shows long over-wintering stays near the Libyan coast (during their post-nesting movements; Godley et al., 2002).

3.2. Past distribution and abundance

Data not available.

3.3. Threats

3.3.1. Terrestrial Habitats

Not applicable, because the species does not nest in this area.

3.3.2 Marine Habitats

3.3.2.1 Incidental catch

The proportion of green turtles caught by different fishing gear is unknown. However, given the current information available through questioning fishers, this proportion seems to be lower than the total loggerhead bycatch (Hamza, unpubl. data).

3.3.2.2. Intentional killing and exploitation

No available information on a specific targeting of green turtles by intentional killing or exploitation in Libya, however some fishers (mainly foreigners) stated that green turtle flesh is more palatable than the other species.

3.3.2.3. Other threats

Threats concerning loggerheads (2.3.2.3.) are valid for green turtle too.

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

The leatherback turtle is occasionally observed in Libya waters, as bycatch (one specimens was observed off Tajura coast in 1996, then died at rehabilitation facility at the Marine Biology Research Centre, it was then taxidermied at MBRC museum), No nesting of this species is known in Libya.

4.2. Past distribution and abundance

Except for the mention in one Mediterranean review (Capra, 1949), no other information was found on the historic presence of this species in Libya. Old fishermen can recognise this species apart from loggerhead and green turtles. The leatherback turtle used to be called 'Khanfusa' which means “the beetle” by local fishermen in Tripolitania area (Hamza, pers. observ.).

4.3. Threats

4.3.1. Incidental catch

Fishermen tell that this species is seldom caught, and mainly during winter months (Hamza, pers. observ.).

4.3.2. Intentional killing and exploitation

Data not available.

4.3.3. Other threats

Data not available.

5. Other species

No other sea turtle species are reported from Libya.

6. Conservation status

A national Action Plan was prepared under the supervision of the Regional Activity Centre for Specially protected Areas (Hamza, 2002), however this first action plan in need of revision after 10 years, in order to update objectives for the next phase.

By law, each activity that might cause any destruction or disturbance to the environment or its elements must be assessed using an Environmental Impact Assessment procedure (EIA). EGA has put safety and mitigation measures for the marine environment and its living elements as a primary priority in evaluation of any project EIA. Any impact assessment has to be prepared and presented for comments to the EGA before the granting of any exploration or working permits.

Mitigation measures are set at oil terminals to tackle and minimise any threat of oil pollution accidents on marine wildlife. EGA, the Marine Biology Research Centre, the National Board of Disaster control and the National Oil Corporation are in contact regarding this issue.

<u>National legislation</u>

- The law on the protection and improvement of the environment No 15/2003 stating that all endangered species (marine or terrestrial), and protected areas should be established to maintain biodiversity and secure a sustainable use of natural resources. The law also specifies certain measures to combat marine pollution.

- The Law no. 14/1989 on exploitation of marine wealth also specifies a whole chapter on establishment and management of marine protected areas, for sustaining marine biodiversity elements of Libyan maritime territories. However this chapter needs to be elaborated and developed in the form of national Law on Marine protected Areas.
- Sea turtles protection is included in the decree of the Secretariat of Agriculture No. 453/1993 stating that "*All species of turtles and tortoises are protected by law in Libya*" furthermore it states that "*Any use of these species or its products (skin, eggs, flesh) is banned by law in Libya*" and "*Any violation to these articles, will be persecuted with legal system according to Hunting Law no.28 of 1968*". These paragraphs are still in need of development to include habitat protection (terrestrial and marine), and to update the hunting and fishing laws.

International legislation

Libya has ratified several regional and international conventions dealing with marine conservation. Many activities involving marine conservation in Libya are in the framework of implementation of those conventions, including the establishment of the Libyan Sea Turtle Program in 2005.

Table 2 summarizes the position of Libya towards these conventions.

Table 2. Conventions ratified by Libya and including turtle protection.

Convention	Adoption	Ratification
The Convention on Wetlands of International Importance, especially as Waterfowl Habitat	1971	2000
The World Heritage Convention	1972	1978
the Convention on International Trade in Endangered Species of Wild Fauna and Flora	1973	2003
The African Convention on the Conservation of Nature and Natural Resources (Algiers Convention)	1968	1969
Barcelona Convention for Protection against Pollution in the Mediterranean Sea	1976	1979
The Convention on the Conservation of Migratory Species of Wild Animals(CMS)	1979	2002
Specially Protected Areas and Biodiversity Protocol (1995) and its Annexes (amendment)	1995	1995
Convention on Biological Diversity	1992	2001
the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS)	2001	2002

7. Conservation needs

- The effectiveness of legal protection of sea turtles needs to be enforced, and the drafting of a new comprehensive legal instrument for sea turtle protection at nesting sites (protected areas) and at sea is an urgent priority.
- Establish a network of Marine and Coastal protected Areas, with special emphasis to protect nesting beaches.
- Strengthening capacity building programs in the protection and studying of sea turtles.
- Develop a program to study the interaction of Libyan fisheries with sea turtles.
- Develop a project to study and quantify the level and impact of dynamite fishing.
- Establish a national stranding network

for sea turtles and other endangered marine species.

- Develop the present partnership ties between Libyan institutes with regional and International organisations.

8. Miscellaneous

Rescue centres.

The Marine Biology Research Centre is nominated by Libyan authorities to conduct sea turtle rescue activities. To date more than 15 loggerhead turtles were treated, rehabilitated and released back to the sea. It's important to stress here the need to undertake the following steps: designate a special unit for the rescue centre; conduct capacity building activities for veterinary staff and finally make the rescue centre accessible to fishermen, school children and the general public.

Stranding network.

Currently no stranding network operates in Libya. Information on stranded sea turtles is either received by MBRC or EGA. There is little coordination between them in dealing with this issue. A national stranding network stays a national priorityand requires effort to enforce it.

Genetic studies.

The first Genetic analyses of sea turtle from Libya, was conducted within a Mediterranean study where a specific haplotype "A1" was found in 7 samples, furthermore haplotype "A5" is suggested to represent an endemic population in Libya (Laurent et. al., 1998).

More recently analyses of loggerhead hatchling tissues samples (n = 9), from Algbeba during 2006 season, has been conducted in collaboration with Barcelona University. Preliminary results showed that Libya is genetically different from other Mediterranean nesting areas and have an exclusive haploype (CC-A26). Hence, Libya is an isolated independent management unit (Carlos Carreras, personal comm.).

These findings shows the need of comperhensive study of sea turtle genetics in Libya. Currently LibSTP has collected more samples for this purpose and results will appear in the second half of 2009.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

- Libyan Sea Turtle Program (managed and funded by EGA) – duties mentioned in section 2.1.1.
- Marine Biology Research Centre (Rescue, nesting surveys, education, Protected areas).
- Universities (Student volunteers)

9.2. Private

There is no specific NGO dealing with turtles but some NGOs related to environment, like the National Movement of Libyan Scouts have helped actively in 2005 surveys and in organising workshops and lecture talks, where LibSTP personnel had been invited to present their experiences and discuss issues of sea turtle conservation.

10 Resources available about marine turtle research and conservation

1. Two technical reports by Laurent et al. (1995, 1999) on the coastal survey of nesting activity.
2. One technical report (Arabic) by Haddoud and Gomati for 1996 survey of Sirt-Misuratah area.
3. Annual reports (Arabic) by Hamza et al., on monitoring of nesting sites in: Sirte, Benghazi, Misuratah, Albayda and Tobruk (all 2007) except Sirte (2005-2007), Misuratah (2006-2007).
4. Two articles (in Arabic) at Al-beeah bulletin of the EGA.
5. Several recorded lectures, talks and voice records.

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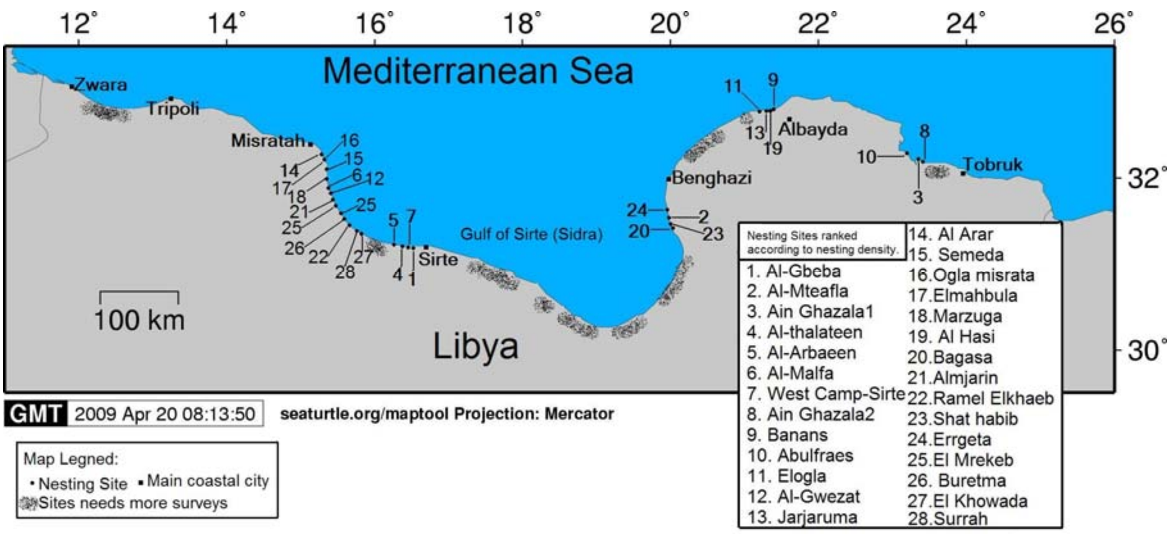

Figure.1. Map of Libyan coast showing known loggerhead sea turtle nesting sites.

Figure 2.
Al Gbeba Beach
(Photo: EGA-LibSTP).

Figure 3.
Al Thalateen Beach
(Photo: EGA-LibSTP).

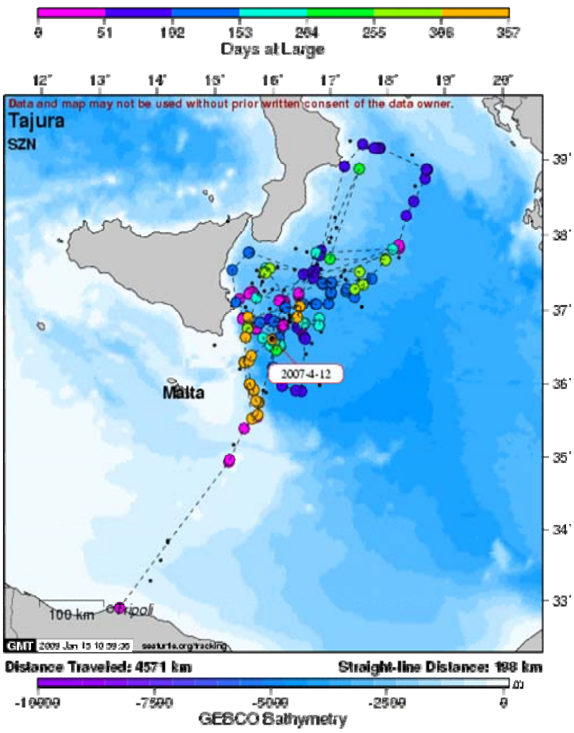

Figure 4.
Tracking routes of "Tajura" loggerhead sea turtle released from Libya.

Figure 5. Hatchery on Al Gbeba beach (Photo: EGA-LibSTP).

MALTA

Carmen MIFSUD

Orca, Triq id-Dwiemes, Zejtun, E-mail: mifsud.carmen@gmail.com

1. General remarks

The Maltese archipelago is a group of small, low islands located in the Central Mediterranean region at a distance of 96 km from Sicily and about 290 km from the Tunisian coast. The archipelago is made up of three main inhabited islands: Malta, *Ghawdex* or Gozo and *Kemmuna* or Comino, together with several uninhabited islets (Fig. 1), and with an overall total area of about 315 km^2 only, with highest point being of 253 m above sea level (Table 1).

The islands are situated on a shallow shelf, the Malta-Ragusa Rise, part of the submarine ridge, which extends from the Ragusa Peninsula of Sicily southwards to the African coast of Tripoli and Libya. Generally the archipelago is characterised by a southwest to northeast inclination, with the north-eastern sides of the main islands gently sloping, and the western and southern coastlines essentially characterised by steep cliffs.

Geologically, the islands are composed almost entirely of marine sedimentary rocks, mainly limestone of Oligo-Miocene age, capped by minor Quaternary deposits of terrestrial or lacustrine origin. Local soils, being calcareous, are basic. No mountains occur in the Maltese Islands, and no true rivers are to be found, except for the rain-dependant seasonal valley watercourses and the very rare perennial springs.

An important aspect to be kept in mind in connection with the Maltese Islands is their very small size and enormous population density. The population of the Maltese Islands was in the year 2001 at 394,648 individuals, with population density of over 1,200 persons/km^2 (Mallia et al., 2002), implying that Malta ranks third amongst nation States in its population density, after the Singapore and the Principality of Monaco 5. Such a high population density is augmented further by tourist arrivals, which are currently three times the resident population (currently over 1.2 million annually). These cause further pressures on the few resources available. Such overpopulation, brought about by insularity (which limits internal and external mobility) and the small land area of the archipelago, has led to various problems, of which the environmental aspect is one of the most obvious. Many areas are becoming increasingly disturbed and degraded, with the consequent loss of biodiversity. Waste management, air and water pollution, coastal zone management and sustainable landand sea-use also become increasingly important issues, as do any issues of minor importance for other countries.

Being in the very centre of the Mediterranean, the Maltese biota has affinities with all parts of the Mediterranean and thus one can find elements of western, eastern, North African and Sicilian affinity, although the closest affinities remain with Hyblean Sicily (for more information see: Lanfranco, 1993; Schembri et al., 1999, 2002). Various species with a western distribution have their limit of distribution in the Maltese waters and vice-versa with respect to eastern Mediterranean taxa.

The presence of marine turtles, off the Maltese Islands was probably first reported by Gulia (1890) who was the first naturalist to report not only the presence but also nesting of the loggerhead turtle in the Maltese Islands.

Five species have been recorded from Maltese waters; *Caretta caretta, Dermochelys coriacea, Chelonia mydas, Eretmochelys imbricata,* and *Lepidochelys kempi* (Brongersma and Carr, 1983). *C. caretta* remains relatively common, *D.*

coriacea has been recorded on several occasions particularly between the 1970s and 1980s (Lanfranco, 1983, Gramentz, 1989), whilst *C. mydas, E. imbricatsa* and *L, kempii* are known from single records (Brongersma and Carr, 1983; Gramentz, 1988).

The results presented in this chapter therefore detail, to the best of our knowledge, the status of sea turtles in Malta from foundation work that will be built upon in the coming years.

Table 1. Physical and demographical data concerning Malta. Source: National Statistic Office; Mallia et al., 2002.

	Max Length (km)	Area (km^2)	Perimeter (km)	Population (2001)	Pop. Density (km^{-2})
Malta (a)	27	246.50	193.32	363,799	1,476
Gozo	14	65.79	53.74	30,842	469
Comino	2.7	2.87	14.68	7 (b)	2.4
Other (c)	-	0.21	8.26	-	-

(a) The data for the island of Malta also includes *Il-gzira ta' Fort Manwel* or Manoel Island, an island located east of Malta, which is now connected to the mainland via a land bridge, thus forming an integral part of the island of Malta. (b) The population of Comino is quite small, and the data in the table is based on the number of persons registered on the 1996 Electoral Register. The number of residents on Comino has declined dramatically in the last 50 years, when the majority of the Comino residents migrated towards mainland Malta and Gozo for practical reasons. Nevertheless, this figure underestimates the number and impact of workers and tourists employed or utilising the Comino tourist facilities (including the Comino Hotel). (c) This includes all the uninhabited minor islets and rocks around the coastline, and include important biodiversity spots as *Il-Gzejjer ta' San Pawl* or *Selmunett* (the St. Paul's Islands Nature Reserve) (10.1ha), *Kemmunett* or Cominotto (9.9ha), *Filfla* or Filfola [the Filfla Nature Reserve] (2.0 ha) and *Hagret il-General* (the Fungus Rock Nature Reserve) (0.7 ha), most of which characterised by endemic taxa.

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

Sandy beaches, hence potential nesting sites, in the Maltese Islands only amount to about 2.5 % of the whole coastline and hence potential nesting sites are already quite limited geographically. Furthermore, turtles do not nest any longer in the Maltese Islands, although they did so in the past (see 2.2.)

2.1.2. Marine areas

Although the loggerhead turtle is found probably relatively commonly in Maltese waters, possibly all year round (from the strandings and incidental captures numbers by fishermen), unfortunately, the actual current distribution and abundance is not known, in view of the lack of scientific data

available at the moment. The limited data that exists is based on sightings by fishermen and other sea-users, who occasionally report such sightings in particular when they encounter large aggregates of seemingly migrating turtles in particular times of the year. Although, some scientists and researchers including local ones, are currently trying to gather data on distribution and abundance.

Turtles are not infrequently observed basking at the surface or beneath palm leaves used for fishing floats (Balzan in Groombridge, 1994). Some loggerhead specimens tagged on Zakynthos, Greece (Margaritoulis, 1988; Mifsud,et al., 2009a) and Italy (Mifsud et al., 2009a) have been recaptured in Maltese waters, whilst other tagged here have been found in Spain (Mifsud et al., 2009a).

Stranding events and turtles landed by fishers show that such turtles are usually large juveniles, whereas small pelagic juveniles and adults are less frequent. This can be shown from an average spectrum of a database taken from 1999-2002 of 19 stranded turtles, the average Curved Carapace Length is 49.7 cm (range: 34-70) and Curved Carapace Width is 42.2 cm (range: 25-66).

Larger size-classed turtles have been caught in long line fisheries, however, and smaller individuals have also been either caught incidentally or entrapped in the pipelines of reverse osmosis plants or disabled and found with crude oil pollution adhered to their body (Fig. 2).

From the speculation by fishermen on the number of turtles sighted or incidentally captured there might be an indication that the area off Filfla or in areas nearby (on South-West, South Coast of Malta) may be an important foraging ground. However this has yet to be verified, as sightings are mostly speculative and no clear numbers have been given by such fishermen.

Although we still have no scientific confirmation for the current numbers of foraging turtles, Groombrdige (1994), recounts that relatively large numbers of foraging *Caretta* used to occur in the Maltese waters. Today as recounted above quite a number of turtles are incidentally captured by fishermen or strandinded around the Maltese Islands.

Today, some fishermen report incidental captures on long-lining amounting to as much as 10-15 (or at times even more) turtles per long line trips (see 2.3.2.1).

Regarding migratory pathways, it is to be stated that some released specimens, mostly after treatment and rehabilitation, were either recaptured in Malta or in other countries in the Mediterranean. There are at least four encounters of such recaptured specimens either tagged in Malta or elsewhere and recaptured or vice versa.

One specimen tagged in Malta was found in the western Mediterranean, Spain (Mifsud et. al., 2009a) suggesting possible migration routes from the central parts of the Mediterranean to the western regions, turtles tagged in eastern parts migrating to central regions were also found e.g. a turtle tagged in Zakynthos and Peloponnesus, between 1982-87 was found in Malta in March 1988 (Margaritoulis, 1988; Mifsud et al., 2009a). 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 is no longer carried out in the Maltese Islands (Baldacchino and Schemrbi, 2002; Mifsud et al., 2009b). A further case of a recaptured turtle in Malta which was tagged in Italy (Mifsud et al., 2009a) also postulates some movements towards the south central regions.

In 2008, through the help of RAC/SPA and Istituto Zoologico di Napoli, the Malta Environment and Planning Authority together with the Veterinary Resources and Fisheries Control and Conservation Division released 2 rehabilitated turtles (one actually with a missing limb) were released with satellite tags and their migration route can be followed on http://www.seaturtle.org/tracking/index.shtml?project_id=358.

2.2. Past distribution and abundance

Caretta caretta formerly also used nest in the Maltese Islands, mainly in Gozo and probably also in Comino (Stevens, pers. comm.). Moreover, according to Despott (1915), such nesting had been known to occur in unfrequented beaches, suggesting that such nesting was probably minor, possibly irregular and that Gozo was not the only site (Groombridge, 1994). Nesting sites were abandoned following development and disturbance from tourism probably after 1910-1940 (Savona Ventura in Lanfranco and Schembri, 1989). The last recorded nesting occurred in the early 1940's according to (Balzan, in litt. 22nd August 1988; Lanfranco, in litt., July 1988; Baldacchino in litt. 11th August 1988, in Groombridge, 1994).

However, Deidun and Schembri (2005) reported of an encounter with a person who reported nesting at Ir-Ramla tal-Mixquqa (Golden Bay, North-West Malta) in Malta in 1960. This occurred at a time when the beach was still dark in the evenings and generator light was only used when necessary. There were also some other unverified statements by fishermen of possible nesting in Ghajn Tuffieha (North-West Malta) (Stevens, pers. comm). Some local fisherman also state that they used to capture specimens when they came up to nest at Santa Marija in Comino (Stevens, pers. comm.), which could be minor and irregular nesting sites.

Gramentz (1989) postulates that the beach at Ramla l-Hamra (situated on the North coast of Gozo) represent a former rookery. However, we are still not sure of the authenticity of this site, as it has never been reported as the actual site of such nesting in the 'historic' literature and may have been a postulation in view of the size of this beach in Gozo, which is some 300 m long and 20-50 m wide. Although Gulia (1890) refers to nesting, he only makes a general reference with regards to such nesting on sandy beaches whilst Despott (1915) does not specifically mention this place but rather mentions "unfrequented sandy beaches especially in Gozo". In fact being one of the larger beaches in Gozo, Ramla l-Hamra is surely not an unfrequented beach. Hence this creates some further confusion with regards to the real situation of this nesting site. Later, other authors (Bonett, 1982) quoted this as the actual site of nesting, mentioning only Despott (1930a) and Gulia (1890), which in reality, as described above, never particularly mentioned this site.

No available literature exits on the size of the former nesting populations (Mifsud & Baldacchino, 2002). In view of size of the actual nests, again, nothing is historically listed, although Deidun and Schembri (2005) quotes that his source had taken between 50-100 eggs for consumption (although he was fairly sure that it was closer to 100 then to 50) from the nest, following deposition by the female.

According to Despott (1915) and many other authors (Bonett, 1982; Gramentz, 1989; Baldacchino and Schembri, 2002; Mifsud et al., 2006, 2009a,b,c) loggerhead turtles were common around Malta in that period. Groombridge (1994) stated that relatively large numbers of foraging loggerheads used to occur in Maltese waters; highest numbers reported between June and September, coincident with maximum fishing activity for swordfish, tuna and dolphin fish (Groombridge, 1994).

Bonnett (1982) recounts that in his visits to the local fish market at Valletta he used to encounter many specimens and there seems to be quite a large number of adults or nearly adults, unlike the situation today where mostly sub-adults are encountered. Bonnett in fact quotes many specimens in the 70-80 cms range. Such turtles may have been adults.

2.3. Threats

Although in the past direct exploitation took place (2.3.2.2.) after legal protection, enforcement and awareness campaigns (6.) nowadays the main threat is represented mostly by incidental capture (2.3.2.1.) Hence incidental capture nearly exclusively through long-line fishing is the current biggest threat.

2.3.1. Terrestrial Habitats

Since no nesting takes place nowadays in the Maltese Islands, this section reports past impact on nesting sites or current threats to potential ones.

2.3.1.1. Coastal development

The Maltese sites which in the past were known to host nesting episodes have been lost to nesting due to the high anthropogenic activities and the amount of development which has occurred in the last 60-90 years (Mifsud & Baldacchino, 2002).

The tourist industry also contributes to the construction of tourist developments along or near to the potential egg laying beaches (although one cannot apply this strictly and directly to the Maltese Islands). Alteration in coastal features has also led to loss of many special habitats like sand dunes and sandy beaches. Sandy beaches in the Maltese Islands are already very much degraded due to the intense beach use both by the locals and the tourists.

The past nesting sites (2.2.) were lost following a number of threats but probably and primarily due to coastal construction and the associated impact of artificial light on such nesting sites.

One also cannot exclude the impact from barbeques which are frequently held on such sandy beaches, apart from concerts and beach parties and the like which continue to make other impacts like noise, apart from the lightening effects.

Moreover, nowadays, the most popular

sandy beaches are subject to beach cleaning nearly every morning (quite early before 8:00am) and this is mostly carried out mechanically.

2.3.1.2. Beach restructuring

In the past years there have been numerous proposals to reclaim sandy beaches by depositing sand material or by using dredged sediment material form other places.

In fact, such beach reclamation or what they are sometimes called "beach nourishment" have been carried out in several beaches around the Maltese Islands. According to Axiak *et. al.* (1999), such endeavours need to be accurately studied before any decision is taken, in view of possibilities of waste of time and sand from coastal erosion if the natural factors have not been adequately studied and over long periods of time. Moreover, another threat is posed from reclamation by the use of dredged sediment from local ports and creeks, which would obviously be more prone to contamination by pesticides, hydrocarbons, heavy metals and the like.

Due to the dearth of accurate knowledge about where historic nesting used to occur, such beach reclamation proposals would be very difficult to refuse on historic nesting grounds.

2.3.1.3. Non human predation

Not applicable.

2.3.1.4. Human exploitation

As discussed above, in the description given by Deidun and Schembri (2005), the person who was recounting his story specified that after collection of the eggs they also consumed the turtle which had just laid the eggs.

We have no other 'official' records of the amount of such egg consumption, however many fishermen recount that they used to search and look for such deposited eggs in that period (Stevens, pers. comm.).

2.3.1.5. Other threats

Erosion of the local beaches has already been mentioned above (2.1.1 and 2.3.1.2). Thus, as described above, most of the few sandy beaches that exist also face erosion (Axiak and Sammut, 2002). Moreover, such sandy beaches are located in pocket areas between headlands and there is evidence that most of these beaches are at present exposed to significant erosional processes (Axiak et al., 1999).

Although marine litter on beaches and in various other inshore sea bottoms is often reported to be significantly high, this will not be further discussed here in view of the fact that nesting does not occur any longer in the Maltese Islands.

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

Since the loggerhead turtle is relatively common in Maltese waters, probably year-around off the Maltese Islands (from the strandings or incidental captures by fishermen) but with the highest concentrations in Spring-Summer, incidental captures of such turtles is also quite frequent.

An estimated 1000-2000 loggerheads were caught annually in the past around the 1990s (Balzan, Zghazagh ghall-ambjent, in litt). Gramentz (1988) has estimated that 2000-3000 loggerheads were caught on the longline hooks during the swordfish season (spring-summer) around the Maltese Islands.

The highest numbers are generally reported between June and September, which coincides with the maximum activity for swordfish, tuna and dolphin fish (Balzan, in Groombridge, 1994). Although Bonett (1982) argues that this may be due to the time where there is more concentration on fishing, good weather allows more fishing then in other times of the year and it is possible that in this time the animals are migrating through the Maltese coastal waters making the number of specimens available larger then at other times of the year.

At one village, Gramentz (1989) bought, tagged and released 101 loggerheads during one summer. If these various estimates are accurate, mortality is around 15%-50% of the total catch.

Incidental catch at that time was also on the increase as the use of trawlers were on the increase (Balzan, in litt.), which is not the case any longer, since we rarely have any landings occurring by trawling fishermen.

In Malta, we are also recently and frequently finding many stranded turtles or turtles which are landed by fishermen which have injuries in their limbs produced by nylon lines which, though cut by the fishermen to release the turtle, are generally left quite long resulting in encircling the turtle's limbs and eventual debilitation of such a limb or severe other damage. In fact on several occasions the Rehabilitation centre have had to operate to either amputate or try to save such severed limbs and whose cause is usually the long nylon lines left dangling when the turtle was cut from the main line, probably in an effort by the fishermen in question, with the intention of saving such turtles.

No other present documented information currently exists on the effect of other type of gear.

2.3.2.2. Intentional killing and exploitation

Intentional captures used to occur quite frequently in the past either for human consumption or for artisanal products made with marine turtles.

Sometimes marine turtles used to be killed because they are perceived as being harmful to the normal fishing activities. This naturally creates a reaction from fishermen who kill or persecute these marine reptiles.(Mifsud and Baldacchino, 2002)

Groombridge (1994) recounts that large numbers of loggerheads were caught at sea either as target species or as bycatch between August and November, and 500-600 loggerheads were killed every year and used as food by the majority of the population.

Fishermen also used to catch basking turtles with large hooks. Although Gramentz (1989) reports that turtles hooked on long-lines were usually thrown back after cutting the line, sometimes they were decapitated in order to save the hook. Moreover, Bonett (1982) recounts of encounters with some 92 specimens in the fish market at Valletta, from January to December 1981 in his 1 hour visits during the lunch break. This obviously presented only a fraction of those present since turtles were usually killed and sold early in the mornings.

Most of the Malta Agricultural and Fisheries Abstract records (for the 1959-1967 records for the catch of the years 1959-1966) at that time, also as highlighted by Gramentz (1989), were probably underestimations of the actual values, as dealers were often observed not to fill in the vouchers in order to get better profits. Argano (1979) estimated that 100-500 turtles were caught annually, however Gramentz (1989) like Groombridge (1994) argues that certainly 500-600 Loggerheads used to be killed every year in Malta, for meat, with carapaces being sold on weekends at the local markets and in souvenir shops.

Following the enactment of local legislation protecting turtles, some of the marine turtles hooked on long-lines are generally thrown back after cutting the line (Mifsud and Baldacchino, 2002; Mifsud et al., 2006, 2009a,b,c) In fact some of these turtles may later be found stranded on the beaches (sometimes with more then one hook and at times with nylon also coming out of the cloaca – pers., observations). Turtles are nowadays not fished purposely killed and decapitation is a practice which is probably not done any longer, in view of the illegality of the issue. The legal notice that the then Department of Environment had issued in 1992, also gave an incentive for fisherman to land the marine turtles since they would be remunerated for their lost fishing tackle.

2.3.2.3. Other threats

Developmental projects like marinas and private or commercial docks in inshore waters add more pressures on marine turtles populations through destruction or degradation of foraging habitats. The latter type of development also leads to increased boat traffic resulting in collision related injury or mortality of turtles. In fact we do have reports of some stranded turtles or sightings of turtles with smashed carapaces and/or heads. Fuelling facilities at marinas can also result in discharge of oil and gas into sensitive habitats.

We did find a number of turtles along these years, which had a severed limb or a limb which was greatly infected and damaged from the injuries resulting from nylon which got entangled in such limbs

A number of loggerhead turtles in Maltese water have been observed contaminated by tar (Gramentz, 1986) and with plastic and metal litter (Gramentz, 1988). Twenty out of 99 loggerheads examined in 1986 (after being caught accidentally on swordfish long-lines) were found to be contaminated, 17 of these with crude oil, and a few with discarded plastic or metal objects (Gramentz, 1988). The only plastics seen in the gut or faeces of the turtles examined were transparent or white (Gramentz, 1988). The effect of oil pollution is not known in detail, although small specimen can clearly be immobilised and exhausted by heavy contamination (Gramentz, 1988). Some turtles showed no external signs of oil pollution, but were seen to be contaminated after examination of the mouth cavity or faeces.

A great number of turtles are also found with several types of injuries related to either boat collisions or some form of attacks by other animals. This was also the case when Gramentz (1989) and Bonnett (1982) made some local studies and in which they found that several specimens had different types of injuries resulting from possible boat collisions. Recreational equipment such as jet skis also pose a danger due to collisions and harassment. Disturbance by vessels or other sea-crafts may also disrupt the normal behaviour of the marine turtles especially during mating, feeding or other delicate periods or phases;

We have also had at least 2 cases of entrainment and entrapment of juveniles and sub-adult marine turtles in either reverse osmosis plants or in cooling intake systems of costal power plant (Mifsud et al., 2009a,c) .

Depletion of the food resource caused by direct or indirect fishing activities is also a great threat. Most marine turtles depend upon algal beds, sea grasses and/or reef habitats for food refuge. The destruction of these habitats is widespread serious threat to the recovery of depleted marine turtle stocks. The general degradation of these habitats can be affected by eutrophication, sedimentation, chemical poisoning, collecting/gleaning, trampling and anchoring.

The recent burst in the aquaculture activities and tuna penning in the Maltese Islands may also have an impact directly or indirectly, on the costal phase of marine turtles.

3. *Chelonia mydas*

3.1. Present distribution and abundance

Although green turtles also occur in Malta, according to Groombridge (1994), Brongersma and Carr (1983) and Despott (1930a,b) this species is rare locally and known only from one record caught in 1929.

Although according to certain authors (e.g. Baldacchino and Schembri, 2002) it may be under-recorded by local fisherman due to its resemblance to the loggerhead turtle, since we have started our local turtle studies and since setting up the stranding network and the incentive for fishermen to land their turtles (at least nine years ago), no green turtles were ever encountered.

3.2. Past distribution and abundance

Data not available.

3.3. Threats

3.3.1. Terrestrial Habitats

Not applicable, because the species does not nest in this area.

3.3.2 Marine Habitats

3.3.2.1 Incidental catch

Data not available.

3.3.2.2. Intentional killing and exploitation

An interesting and unfortunate fact was that Despott (1930a,b) recounts that the flesh of the green turtle which was consumed by the people who bought it from the fishermen was stated to “be by far superior to that of our common turtle”.

This is a fact which may still be known by fishermen and hence may have an effect on our records in view of greater possibilities of illegal captures and consumption, although we don't really think this may be the case locally.

3.3.2.3. Other threats

Data not available.

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

The Leatherback has been recorded on several occasions with at least 12 records of either sightings or captures in the Maltese waters mostly in the period 1970-1980 (Lanfranco, 1977, Lanfranco, 1983; Gramentz, 1989; Baldacchino and Schembri, 1993).

These caught or sighted turtles occur from different places around or off the Maltese Islands. However, although statistically such data is very limited there were at least 2-3 occasions were such turtles were captured in the South zone (Zurrieq and Filfla area) (one was landed in the port of Zurrieq, with no details, however the landing site may point to a possibility of capture in that area).

4.2. Past distribution and abundance

Data not available.

4.3. Threats

Data not available.

5. Other species

An hawksbill turtle (*Eretmochelys imbricata*) was recorded in 1980 some five miles off the East of Gozo.

Malta can also boast of the first record of the kemp's Ridley (*Lepidochelys kempi*), in the Mediterranean. This was a specimen captured off the North-eastern Coast of Malta in 1929, one mile from the grand Harbour (Brongersma and Carr, 1983).

Despott (1930a) had errenously identified one kemp's Ridley turtle caught 1 n mile off the Grand Harbour of Valletta as *Chelonia mydas*. This specimen was stuffed and preserved and is presently at the Natural History Museum in Mdina.

Carr (1963) included Malta as a locality of the Kemp's Ridley in a distributional chart.

This specimen caught had a carapace length of 294 mm and its widest width is of 282 mm, with the width being approximately 96 % of the length.

Other records of this species were sightings attributed to Lampedusa. Specimens reported from the Mediterranean may have entered from the Red Sea through the Suez Canal.

6. Conservation status

International conventions.

Being a Party to the Barcelona Convention, which among its priority targets the protection of Mediterranean marine turtles (Genoa Declaration, September 1985), and also being a party to the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (Barcelona, 1995), Malta has thus a commitment for the conservation of marine turtles which are recorded in the Maltese territorial water. It is also in duty bound to contribute to their state of knowledge and conservation which will enable the Mediterranean population to maintain if not to increase its present status. Furthermore, Malta, has also adopted a series of action plans (which to date amount to four) amongst which there is the action plan for the conservation of Mediterranean marine turtle. Although these action plans are not legally binding they are regional strategies setting out priorities and activities to be undertaken by the contracting parties. These action plans summons for co-ordination of efforts between states of the region to ensure conservation and sustainable management of the concerned species in every Mediterranean area of their distribution

Furthermore, the conservation status of marine reptiles is affected by a number of international treaties, which Malta has accessed or ratified. A list of such treaties, which are directly or indirectly related to the protection of marine reptiles and/or their habitats, is given in Table 1.

The main problems for implementation of the Regional Action Plan for conserving Marine Turtles (UNEP/MAP), the Draft National Action Plan & the enforcement part of the legislation include:

- Lack of human resources including the difficulties of enforcement at sea and on land;
- Lack of adequate time to dedicate to the implementation; and
- Lack of financial resources.

Table 1. The status of Malta in relation to the main international treaties with relevant provisions on nature protection, in chronological order by date of adhesion (ratification or accession) by Malta. Pollution and waste treaties are excluded from this list, unless directly relevant to nature protection. Moreover treaties which are only relevant to a group of species e.g. bats unless indirectly linked to the conservation of turtles, are not reported here.

Treaty	Entered in force	Adhesion by Malta	Status
Convention for the Protection of the Mediterranean Sea against Pollution [Barcelona Convention]	16 February 1976	30 December 1977	Ratification
Convention concerning the Protection of the World Cultural and Natural Heritage [World Heritage Convention]	17 December 1975	14 November 1978	Accession
Protocol concerning Mediterranean Specially Protected Areas [SPA Protocol]	23 March 1986	11 January 1988	Ratification
The Convention on Wetland of International Importance especially as Waterfowl Habitats [Ramsar Convention]	1975	19 August 1988	Accession
Convention on International Trade in Endangered Species of Wild of Flora and Fauna [CITES]	1 July 1975	17 April 1989	Accession
United Nations Convention on the Law of the Sea [UNCLOS]	16 November 1994	20 May 1993	Ratification
Convention on the Conservation of European Wildlife and Natural Habitats [Bern Convention]	1 June 1982	26 November 1993	Accession
United Nations Framework Convention on Climate Change [UNFCCC]	21 March 1994	17 March 1994	Ratification
United Nations Convention to Combat Desertification in those Countries experiencing Serious Drought and/or Desertification, particularly in Africa [UNCCD]	26 December 1996	30 January 1998	Ratification
Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean	Not in Force	28 October 1999	Ratification

[Amended Barcelona Convention] Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean [SPABIM Protocol]	12 December 1999	28 October 1999	Ratification
United Nations Convention on Biological Diversity [CBD]	29 December 1993	12 December 2000	Ratification
Convention on the Conservation of Migratory Species of Wild Animals [Bonn Convention]	3 November 1983	13 February 2001	Accession
Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area [ACCOBAMS]	1 June 2001	13 February 2001	Ratification
Agreement on the Implementation of the Provisions of the United Nations Convention on the Law of the Sea relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks	11 December 2001	11 November 2001	Accession
European Landscape Convention [Florence Convention]	Not in Force	–	Signed
Convention on the Protection of the Environment through Criminal Law	Not in Force	–	–

<u>National legislation.</u>

Under the virtue of the powers vested in the Environment Protection Act 1991 (Act V of 1991 - in particular in sections 32 and 33), the ex-Environment Protection Department had issued Legal Notice 76 of 1992 – the Reptiles (Protection) Regulations -1992. This legal notice gives protection to the three most commonly occurring or visiting species.

Current Maltese regulations state that “No person shall pursue, take or attempt to take, kill or attempt to kill, possess, sell by any method, buy, exchange, import or export any species, or any part or derivative of such species, listed in the schedules of these regulations”. Moreover “any person who conspires or attempts or aids, abets, counsels or procures any other person to commit any of the above offences shall also be guilty of an offence”.

Persons who had in their possession specimens or the marine turtle’s carapace or other parts before the regulations came into force, had to register such specimens or parts with the Director responsible for Fisheries within three months from the publication of the regulations (11 August 1992). Today everybody who possesses a carapace or any other part of a marine turtle has to have the stamp of the Department of Fisheries to show legal possession.

Any marine turtle accidentally caught by fishermen during their normal fishing activities and landed at the fish market has to be surrendered immediately to the Director of Fisheries who shall dispose of it for scientific purposes only, and in such cases the fishermen shall be compensated for any loss of tackle fixed form time to time by the Director responsible for Fisheries. The last part is an incentive for fishermen to land any injured turtles so that they can be operated upon and rehabilitated (as the case may be) and more data can then be gathered on harmful gears and what fraction of the population it is affecting.

Only the Director responsible for the Environment may issue permits for the taking and keeping of any specimens listed in the schedule to the said Regulations for the protection of Maltese reptiles, and this is only issued for *bona fide* scientific studies or other similar purpose. These permits have to be renewed every calendar year.

Any person who possesses imported specimens, the import of which is subject to these or other Regulations, shall retain in his possession all permits certificates and licences relative to the import of that specimen. The Director responsible for the Environment may prohibit the importation of any species of reptiles that may endanger the biological identity of these waters or their territorial waters. Any person who commits an offence against these regulations shall on conviction be liable to either a fine of not less then Lm 25 for a first offence, and not more then Lm 100 for each subsequent offence, which fine shall in each case apply to each specimen. Three species of marine turtles are listed in the annexed schedule referred to in above: the loggerhead turtle (*Caretta caretta*) – Fekruna (Maltese name), the leatherback turtle (*Dermochelys coriacea*) - Fekruna s-sewda (Maltese name), and the green turtle (*Chelonia mydas*) – Fekruna l-Hadra (Maltese name).

Being an EU country, Malta also transposed the Habitats Directive (92/43EC) into local legislation through Legal Notice 311 of 2006. In particular this directive and its transposition, through the provisions of Annex II, requires the designation of Special Areas of Conservation, SAC's to aid conservation of the loggerhead turtle (and green turtle in the immediate future). Annex IV lists marine turtles amongst other animals and plants of community interest which are in need of strict protection.

Through the Enforcement (or Inspectorate) Section, the Environment Protection Directorate administers any contravention to the law of all the above regulations. Stranding events or illegal acts are reported by the public or other entities to this section on an emergency mobile phone. This mobile number is operated on a 24 hour service and cases are responded to immediately. Based upon the nature of the emergency, the necessary action is then taken. Injured or comatose marine turtles are generally taken to the rehabilitation centre at San Lucjan to be operated upon or for any other necessary treatment. This stranding networking is also run and assisted by local NGO's, Most of these incidentally caught turtles are nowadays landed and transferred to the recently available holding and rehabilitation facility at Malta centre of Fisheries Sciences at Torri San Lucjan Marsaxlokk, of the Veterinary, Fisheries Conservation and Control Division. Most of these turtles are released after treatment and rehabilitation (Mifsud et al., 2009a,b,c,d).

The negative impacts of man's activities on turtles were especially pronounced in the past, when the loggerhead was exploited as an item of food and for the ornamental value of its shell. However, following the publication of the regulations for the local protection of reptiles (including turtles) in 1992, (legal notice 76 of 1992) and relatively recent adherence to a number of regional and international conventions (Table 1), and also through communication, and public awareness campaigns, aided by the involvement of local NGOs, marine turtles are nowadays not caught intentionally any longer and its protected status is known by most of the general public.

<u>Stranding network.</u>

Through the Environment Protection Directorate personnel, also aided by local NGO's and the University of Malta, Malta has 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 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 beached 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.

<u>Public awareness campaigns.</u>

The Environment Protection Directorate over the years has issued a number of posters on reptiles (including marine turtles) and on their importance and their vulnerability. A number of publications like the Maltese Red Data Book (Schembri and Sultana, 1989), the Wildlife of the Maltese Islands (Sultana and Falzon, 1996) and others also highlight the vulnerability of turtles.

Other publications, like books on Maltese reptiles (Baldacchino and Schembri, 1993), Reptiles Amphibians and Mammals (Baldacchino and Schembri, 2002) and others also help to illustrate the vulnerable and threatened status of this reptiles as well as explaining their biology. Local NGOs like Nature Trust and BICREF also contribute significantly to these awareness campaigns. They also have produced a number of leaflets, stickers and other informative material on marine turtles. They also produced a leaflet for sea-users to track any sightings of aggregations or individuals with locations, duration of sighting and behaviours and with general information of distinguishing features for identification of three different species of marine turtles.

<u>Creation of a database on sighted or landed turtles.</u>

This draft database has been created by personnel from the Environment Protection Directorate and Veterinary Fisheries, Conservation and Control Division and reports landings made subsequent to the 1997 local legislations. The following data are reported in this database: length and width of Carapace(CCL and CCW), weight, date, species, area of sighting, tag number if any present, what happened with the turtle in question. All this information will also help in assessing the status of these reptiles in the Maltese Islands.

<u>Other indirect local conservation measures.</u>

Maltese legislation includes a number of laws designed to control marine pollution, which contribute to protect turtles habitats and further aids to their protection from eating debris.

Under the virtue of the powers vested by the Environment Protection Act 1991 (Act V of 1991), the Environment Protection Department has issued a number of legal notices concerning waste; e.g., Legal notice 128/97 –Deposit of waste and rubble (Fees) Regulations, 1997 which states that only inert material can only be dumped at sea by permission, some 1 nautical mile away form the grand harbour, at a spoil ground for dredges material, having a radius of about 350 metres and centred on Latitude 33° 55.1 N and Longitude 14° 34.0 E. This regulation contains, as an annex, a schedule listing hazardous waste and toxic or potentially toxic chemicals. Other local legislation was issued through the powers vested by the Environment Protection Act 2001 (Cap 435 of 2001).Other elements of pertinent national legislation include the Code of Police Laws (Chapter 10) Section 227, which decrees that: "no person shall leave in any harbour or on any wharf anything which may cause injury to public health, pose a nuisance, or throw anything into the waters of any harbour or into any part of the internal waters or of the territorial waters of Malta any rubbish or dirty liquid which may cause a nuisance".

Coastal waters are being routinely tested for a number for chemicals, and measures are adopted to reduce such chemicals. Some of these were co-ordinated through the ex-Pollution Control Co-ordinating Unit (PCCU) branch of the Environment Protection Directorate, to improve water quality, in particular concerning marine debris and organochlorines, heavy metals, and PCBs, which are known to be particularly harmful to marine reptiles.

International regulations governing indirect conservation efforts

Finally, Malta is a ratified member of MARPOL 73/78 (International Convention for the Prevention of Pollution from Ships, 1973 - as amended by the Protocol relating to the International Convention for the Prevention of Pollution by Ships). The Protocol 1 of MARPOL 73/78 has provisions concerning reports on incidents involving harmful substances and Protocol II on Arbitration. It has the following 5 annexes:

- Annex I: regulations for the prevention of pollution by oil (ratified by Malta);
- Annex II: regulations for the control of pollution by noxious substances in bulk (ratified by Malta);
- Annex III: regulations for the prevention of pollution by harmful substances carried by sea in packaged

form (ratified by Malta);
- Annex IV: regulations for the prevention of pollution from sewage by ships;
- Annex V: regulations for the prevention of pollution by garbage from ships.

7. Conservation needs

Nowadays, in Malta the most needed measure would be to carry out scientific surveys to know the status and distribution of the population which visit locally.

Following such surveys correlated with other hydrodynamic studies, one may potentially conclude on the most probable good foraging grounds and important migratory routes, if these exists and hence set the ball rolling to try and better conserve these areas through for example the setting up of Marine protected areas and/or Special Areas of Conservation (as defined in the Habitats Directive- 92/43/EC) in such zones.

Genetic studies are also needed in order to identify where these turtles are coming from, and since Malta is so strategically located such information is crucial.

More efforts also need to be put on the issue of incidental captures especially from long-lining which seems to be the biggest local threat. It may be the case to check out measures like circle hooks which have been introduced elsewhere. If these work in Malta, then more efforts should be given into perhaps changing some of the long-line fisheries to such hooks.

8. Miscellaneous

First aid, rescue and rehabilitation centre.

The Veterinary, Fisheries Conservation and Control Division (VRFCC) together with help from the Environment Protection Directorate of Malta Environment and Planning Authority, is responsible for a relatively small first aid and rescue centre for the rehabilitation of sick and injured turtles, at the premises of the Department, at Fort Saint Lucian, M'Xlokk. This centre periodically houses up to a maximum of 16 marine turtles, which are generally brought over by fishermen or by inspectors and other officials of the Environment Protection Directorate or NGOs. This centre through the assistance of dedicated personnel cure and rehabilitate these turtles. Most of the landed turtles are those caught incidentally on longlining and thus most of them require operations in order to remove the hook and/or hooks they have embedded. These turtles are then rehabilitated for the adequate time needed before releasing them again. Before release these turtles are tagged (see below). Release of the injured turtles greatly depends on how well the animal is recovering and how badly it was injured. Generally after three months of rehabilitation, most of the turtle which are recuperating quite well are released at sea. During the recovery time the marine turtles are fed and cleaned from external parasites frequently and their tanks are also cleaned every day or every other day. After operations they are also given antibiotics or vitamins according to necessity. This centre, through the expertise of the Veterinarian attending, also provides for necropsies of dead turtles. This helps also in identification of the possible causes of dead.

Tagging.

Malta started tagging turtles in 1991, with most of the turtles at that time being stranded specimens. Following the opening of the rehabilitation centre in 2001, fishers started landing incidentally caught turtles, which subsequent to rehabilitation were then tagged prior to release. Since then thirty-two turtles were tagged (data till 2004) and twenty eight turtles were released between 2002 and 2004 in mass release events (Mifsud et al., 2009a,b,c)

Malta had initially adopted the RAC/SPA plastic tagging system (Jumbo Tags) to mark marine turtles in order to increase the knowledge on their habits and lives. However, in view of recent guidelines issued by RAC/SPA, Malta is currently using rototags to tag such turtles. This system will also contribute to a regional knowledge on their status and if they have been fished more then once. This tagging system has a Malta name and a code number, which is specific to every turtle (each forelimb is tagged with same number). Nearly all the live turtles which are landed are tagged, normally after being fully recovered at the rehabilitation centre, if they are injured. After tagging they are the turtles are then left for three or four more days before eventual release, to recover from the wound inflicted by the tagging.

In 2008 satellite tags were used to tag two rehabilitated turtles.

Code of practice (COP) for stranded or landed turtles.

Although this is still at the initial phases, its actions may probably be incorporated into the cetacean COP and it is still functional in practical terms since it in the case of beached turtles the same guidelines as for that of the cetaceans COP, are followed.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

The Marine Ecosystems Team of the Ecosystems Unit of the Environment Protection Directorate of Malta Environment and Planning Authority:

First aid, rescue, and help for the rehabilitation Centre

- Tagging systems
- Stranding network
- Code of practice for beached or landed turtles
- Public awareness and education campaigns
- Creation of Database on landed turtles

At Malta Environment and Planning Authority (within the Ecosystems Management Team) a system has been set up to give permits to *bona fide* scientist and researchers and for such a permit we set out a number of conditions which have to be abided with. The applicant has to specify the kind of work envisaged and the methodology to be applied and is required to fill in a standard application form.

Permits are valid for one year and following review of the analysis submitted, decision is taken for renewal upon re-application by the contender.

This system is also set up since such studies also constitute a derogation of the Habitats Directive and Malta, like other EU countries have to report on the numbers and details of such derogations.

The Fisheries Control and Conservation Division (FCCD) of the Veterinary Affairs:

- Rehabilitation and care for the injured turtles
- Necropsies

9.2. Private

- Currently the Marine Rescue Team of Nature Trust (Malta) and Dr. Adriana Vella (University of Malta) have permits for handling of turtles.

The above entities also carry out lobbying and education especially to young people in schools and other endeavours.

10 Resources available about marine turtle research and conservation

Publications and papers are quoted in the reference list.

The Ecosystem Management Unit currently has most of the required equipment to attend to stranding events.

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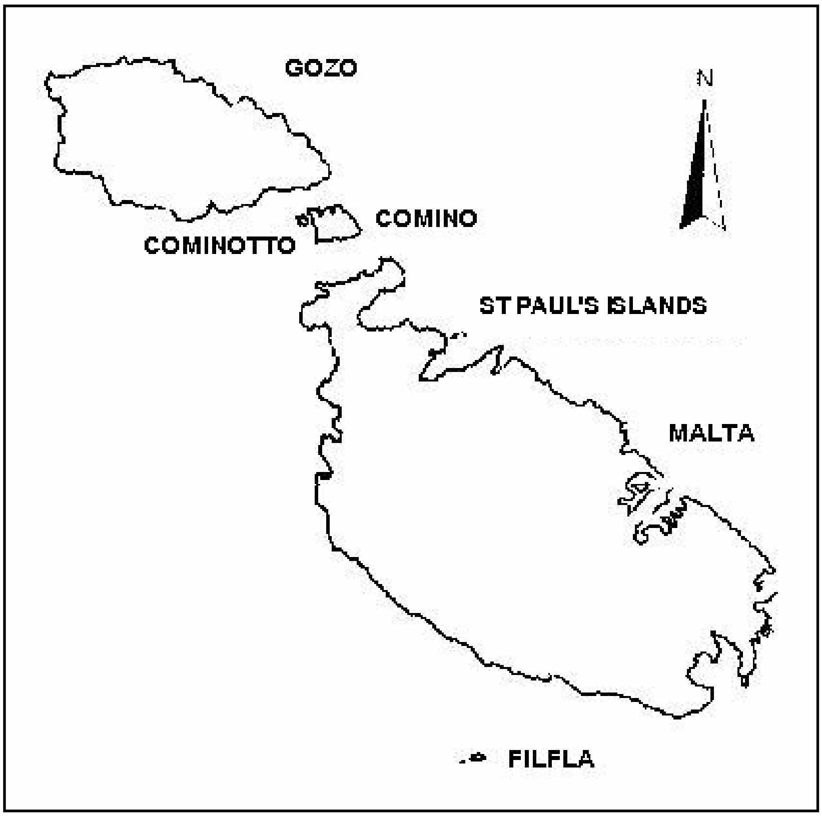

Figure 1.
The main Maltese Islands.

Figure 2.
A loggerhead turtle with crude oil, treated at the Rehabilitation Centre, San Lucjan, Malta (Photo: C. Sammut).

MOROCCO

Mustapha AKSISSOU[1], Manjula TIWARI[2], Wafae BENHARDOUZE[1] and Matthew H. GODFREY[3]

[1]Department of Biology, Faculty of Science, PO Box 2121, Tetouan 93002, Morocco (E-mail: aksissou@yahoo.fr), [2]NOAA-NMFS, Southwest Fisheries Science Center, 8604 La Jolla Shores Drive, La Jolla, CA 92037 USA. [3]Sea Turtle Project, NC Wildlife Resources Commission, 1507 Ann St., Beaufort, NC 28516 USA

1. General remarks

The Mediterranean coastline of Morocco stretches approximately over 490 km from Tangier in the west to the border with Algeria in the east (Fig. 1), with varying levels of human habitation and access to the coastline. To date, most of the effort in monitoring for sea turtle occurrences has been focused on the western end of the coastline, which is also more developed.

The status of sea turtles on the Mediterranean coast was largely unknown until the late 1980s, when the first systematic survey was completed (Laurent, 1990). Since then, efforts have been made to report on turtles that have been found stranded along the coast or that have been captured incidentally in fisheries. Plans to institute a consistent monitoring program and a national sea turtle network are in their infancy.

Two species of sea turtles regularly occur in the waters of Mediterranean Morocco: loggerheads (*Caretta caretta*) and leatherbacks (*Dermochelys coriacea*). This information is derived mainly from observations of turtles incidentally captured in fishing gear or turtles found stranded dead along the coast.

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

Laurent (1990) evaluated the possibility of sea turtle reproductive activity along the Mediterranean coast of Algeria and Morocco, and found no indications or signs of sea turtle nests. Benhardouze (2004) interviewed local residents, but no nesting was reported. The beach habitat may be unsuitable for nesting because the majority of Moroccan beaches are composed of rock; even the sandy beaches that do exist appear not to support any nesting (Laurent, 1990; Tiwari et al., 1999).

2.1.2. Marine areas

Morocco, at the western end of the Mediterranean and bounding the southern end of the Straits of Gibraltar can be regarded as the entry point for sea turtles from the Atlantic into the Mediterranean and vice versa (Brongersma, 1982). Studies of marine turtles in Morocco have been historically rare, likely related to the logistical challenge of studying turtles in the marine environment. Studies in the past decade or so have revealed that the Mediterranean coastal zone of Morocco is primarily used as foraging habitat by marine turtles (Gerosa and Casale, 1999). Silvani et al. (1999) reported bycatch of loggerheads and some leatherbacks in gillnets working off the coast of Morocco in the Straits of Gibraltar in the months of July and August during 1993-1994. Tudela et al. (2005) reported bycatch of loggerhead juvenile turtles in the Alborean Sea only in driftnets used by boats operating out of ports in Mediterranean Morocco; peak months for bycatch were December-March. Benhardouze (2004) reported bycatch of loggerhead juveniles in driftnets, seine nets and artisanal longlines, mostly in the months of September-January.

Observations of stranded turtles along the Mediterranean coast of Morocco reveal that both loggerheads and leatherbacks occur at various times of year (Amajoud, 2002; Ocaña et al., 2002; Ocaña and de los Rios, 2003; Benhardouze, 2004; de los Rios and Ocaña, 2006). On the basis of these results, both loggerheads and leatherbacks appear to occur in North Moroccan waters at all times of year. At the current time, it is not possible to discern seasonal trends in abundance, given that the abundance data available are linked to variable fisheries and monitoring efforts for beach-stranded turtles.

Based on data from bycatch and stranding observations, the Mediterranean coast of Morocco has long been assumed to be a feeding area for juvenile and sub-adult loggerheads. Laurent and Clobert (1992) recognized that this area of the Mediterranean would meet the habitat requirements for the developmental stage of loggerheads. Interestingly, recent data from satellite tracking revealed that larger juvenile loggerhead turtles (>57.0 cm CCL) preferentially spent time in waters off of Mediterranean Morocco (Eckert et al., 2008). Nevertheless, smaller loggerheads (<57.0 cm CCL) have been observed in Mediterranean Morocco, either as stranded animals or for sale in markets (Benhardouze, 2004; Benhardouze et al., 2004), suggesting that more research is needed to characterize the foraging population of loggerheads in Morocco.

2.2. Past distribution and abundance

There are few historical data available. The earliest record of a sea turtle comes from a photograph of a loggerhead turtle taken in the early twentieth century (Pontes and Avila, 1923). Laurent (1990) provided the first structured survey of sea turtle occurrences in Mediterranean Morocco, based on field visits in July-August 1989. No trend data are available, but these early publications document the occurrence of loggerheads in Morocco.

2.3. Threats

2.3.1. Terrestrial Habitats

Since no nesting sites have been identified in Mediterranean Morocco, no threats affect the species on land.

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

Incidental capture by drift gillnets, artisanal longlines, and trawlers is the primary threat facing turtles in Morocco.

A project on bycatch in 2003-2004 found that among the boats cooperating in the study, 85% of the turtles were caught in the driftnet fishery targeting the swordfish (*Xiphias gladius)*; artisanal longlines and seine nets were responsible for the other 15% (Benhardouze, 2004). Incidentally captured sea turtles are regularly reported as being released alive.

In a specific workshop in 2005 (see 6.), several fishermen explained that in their experience, April was the month of year with most turtle interactions, because that is when net-based fishing gear is most often employed.

The majority of the observed strandings occur in and around Tangier (the largest port in the area) where the fishing industry is most active. Incidentally captured sea turtles near Tangier are primarily juvenile and sub adult turtles (Fig. 2), probably captured while either migrating through the Straits of Gibraltar or actively foraging. Laurent (1990) estimated that 3,581 loggerheads are captured/yr by the driftnet swordfish fishery along the Moroccan Mediterranean. Data on bycatch estimates of sardine boats and trawlers are lacking.

2.3.2.2. Intentional killing and exploitation

Small sea turtles (CCL < 20.0 cm) were commonly offered for sale in the small markets of Martil (a coastal village near Tetouan) in the 1980s (Aksissou, pers. observ). This no longer occurs because of the prohibition of marine turtle fishing and the application of international conventions to protect threatened species. Laurent (1990) surveyed the towns of Nador, Al Hoceima and Tetouan on the Mediterranean coast, and described a network of trade in products from incidentally captured turtles. Principally, he described how sea turtle meat went to Spain and sea turtle carapaces were sold in bazaars and/or to passing tourists. Benhardouze (2004) investigated the use of sea turtles in northwest Morocco and a few fishermen admitted to eating turtle meat. A small percentage of fishermen (not exceeding 2%) mentioned consumption of turtle meat especially during the winter when fishing decreases (Aksissou, pers. comm.). Benhardouze (2004) did not observe meat for sale in the shops or markets, but 18 carapaces were observed for sale in artisanal shops (Fig. 3) or found on restaurant walls.

2.3.2.3. Other threats

Marine pollution may be a factor in strandings, primarily through the discharge of industrial and domestic wastewater and oil/petroleum from boats (Aksissou et al., 2006). Overall, the principal cause of strandings appears to be fisheries interactions, although boat strikes may also have an impact on loggerheads (Benhardouze, 2004).

3. *Chelonia mydas*

There are no known records of *Chelonia mydas* occurring in Mediterranean Morocco.

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

Leatherback strandings occur in Mediterranean Morocco, in and around Ceuta (De los Rios and Ocaña, 2006; Benhardouze and Aksissou, unpublished data).

4.2. Past distribution and abundance

Data not available.

4.3. Threats

4.3.1. Incidental catch

The incidental capture at sea of leatherbacks has been described by some fishermen, but far less frequently than loggerheads (Benhardouze, 2004).

4.3.2. Intentional killing and exploitation

Data not available.

4.3.3. Other threats

Data not available.

5. Other species

There are no records of other species of sea turtle from Mediterranean Morocco.

6. Conservation status

Morocco is a signatory of international conventions for the safeguarding and protection of threatened species. These conventions are as follows: Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention), Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention), African Convention on the Conservation of Nature and Natural Resources (Algiers Convention), Ramsar Convention, and the Convention on Biological Diversity (CBD). Morocco is also a signatory to the Memorandum of Abidjan, which is the Memorandum of Understanding Concerning Conservation Measures for Marine Turtles of the Atlantic Coast of Africa.

In an effort to reduce direct exploitation of marine turtles, the Moroccan government imposed a fine (500 Euros) for any infringement of the sea turtle protection regulations by fishermen in Moroccan ports. This appears to have made a considerable difference to the levels of turtle use by local fishermen. Drift gillnets appear to be the gear that has the most interaction with marine turtles in Morocco, and efforts are underway to replace this gear with other more flexible gears. However, this effort has met with resistance from the fishermen and their associations. In July 2008, a circle hook workshop was organized in Tangier to educate the fishermen about circle hook technology. Overall, more work is needed with more emphasis on developing alternative economic activities for these fishermen.

Regarding work on increasing awareness of fishermen and the data-gathering on interaction with fisheries, a workshop was held for 20 fishermen with the delegation of fisheries in November 2005 in Tangier. This workshop was part of a project entitled: Monitoring of sea turtle interaction with fisheries in the Kingdom of Morocco. Objectives of this workshop included raising awareness of sea turtles in Morocco and species identification, and providing suggestions on how to safely release incidentally captured turtles and how to treat injured turtles, and encouraging fishermen to participate in the project by collecting data on turtles they may incidentally capture (Benhardouze et al., 2006a); participating fishermen were provided with the necessary information and equipment to collect data. Representatives of the delegation of maritime fishing and ship owner associations from the port of Tangier were present and promised to request data collection from other fishermen. The children of the fishermen and some members of their families participated in a turtle drawing contest. Similar workshops have been or will be held in various locations around Morocco, to sensitize the fishermen to the conservation of marine turtles in Morocco and enlist their participation in data collection (for more information, see Benhardouze et al., 2006a, b, c).

Efforts are underway to establish a national sea turtle program that would institute regular monitoring for stranded turtles and also attempt to thoroughly document incidental capture in various fisheries.

7. Conservation needs

The conservation of marine turtles cannot be dissociated from the conservation of biodiversity in general, and the battle against pollution, the substitution of drift gillnets, the increased awareness of fishermen, and international co-operation are all needed for the protection of marine turtles in Moroccan waters.

Furthermore, the lack of standardized and regular monitoring both for stranded sturtles and fisheries interactions has made it challenging to interpret strandings data and evaluate the true impact of fisheries. The majority of stranded turtles in Mediterranean Morocco probably remain undiscovered and thus actual values of stranded turtles are underestimated. Therefore, any high rate of strandings reported in an area (as in Ocaña et al., 2002) likely does not reflect a hotspot for turtle mortality, but demonstrates a lack of effort in monitoring in other areas. The impact of fisheries will especially need increasing attention and vigilance as the port of Tangier plans to expand and increase its capacity. Additionally, public awareness programs are much needed and opportunities should be seized to highlight sea turtles and conservation activities locally. For instance, the release of a rehabilitated stranded loggerhead in 2004 during a public ceremony was used as an opportunity to increase public awareness regarding conservation of marine turtles in Morocco (Ourdani, 2004).

In 2008, an NGO, called ATOMM (see 9.2) was created to begin maximizing efforts for sea turtle research and conservation in Morocco.

Finally, the successful implementation of conservation measures requires the increased involvement of the government. Economic, social, cultural, and political aspects need to be addressed to successfully conserve marine turtles in Morocco.

8. Miscellaneous

None.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

- The Haut Commissariat aux Eaux et Forêts et à la Lutte Contre la Désertification is the national focal point of several conventions and international agreements (CMS, BERN, CITES, etc.). This department also has the role of managing wild fauna and its habitats in Morocco.

- Researchers from the Biology department of the Faculty of Science-Tetouan of Abdelmalek Essaadi University have been studying marine turtles since 2000. These studies address interactions with fisheries, strandings, and the use or sale of carapaces in markets.
- Mohamed V University's scientific institute collects data on sightings of marine turtles at sea.
- The National Institute of Halieutic Research (INRH) collects data on turtle strandings around its regional offices. Necropsies are also done to determine the cause of mortality.
- Other scientific institutions (e.g., Agronomic and Veterinary Institute Hassan II, Forest National Ecole Engineers) participate in some conservation and research projects on sea turtles.

9.2. Private

- Association de Protection des Tortues Marines au Maroc (ATOMM) was created in 2008 at the Abdelmalek Essaâdi University (Faculty of Science-Tetouan). This group focuses entirely on sea turtles and on all aspects of their research and conservation.
- Protective Company of the Animals and Nature "SPANA" Temara, Morocco. This group is dedicated to protecting all wildlife in Morocco.
- Association Arc en Ciel, Martil, Morocco. This group focuses on raising environmental awareness and coordinating beach clean-up efforts.

10 Resources available about marine turtle research and conservation

None.

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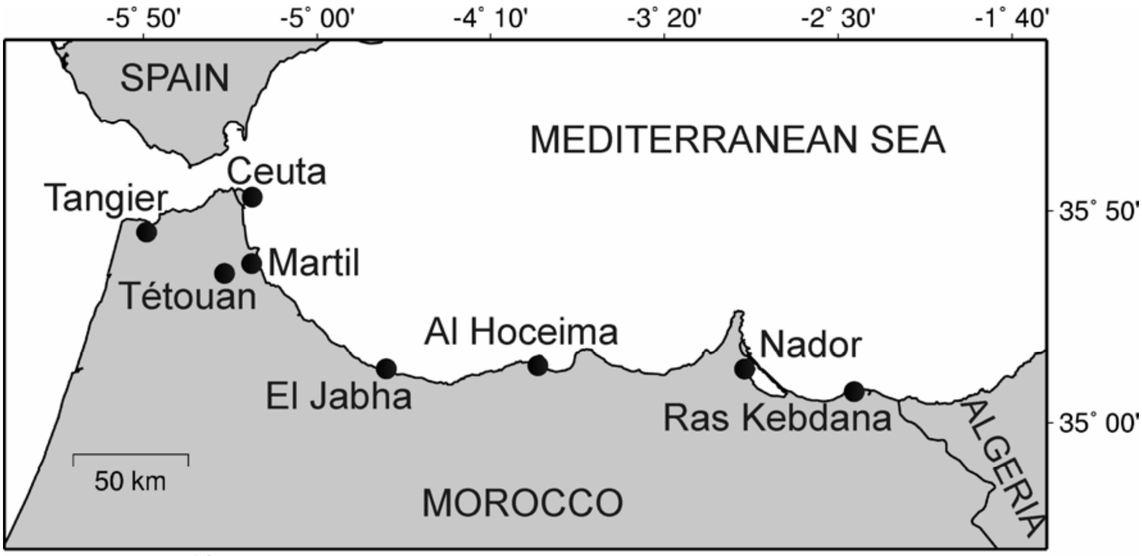

Figure 1: Mediterranean coast of Morocco, with principal cities and coastal ports highlighted.

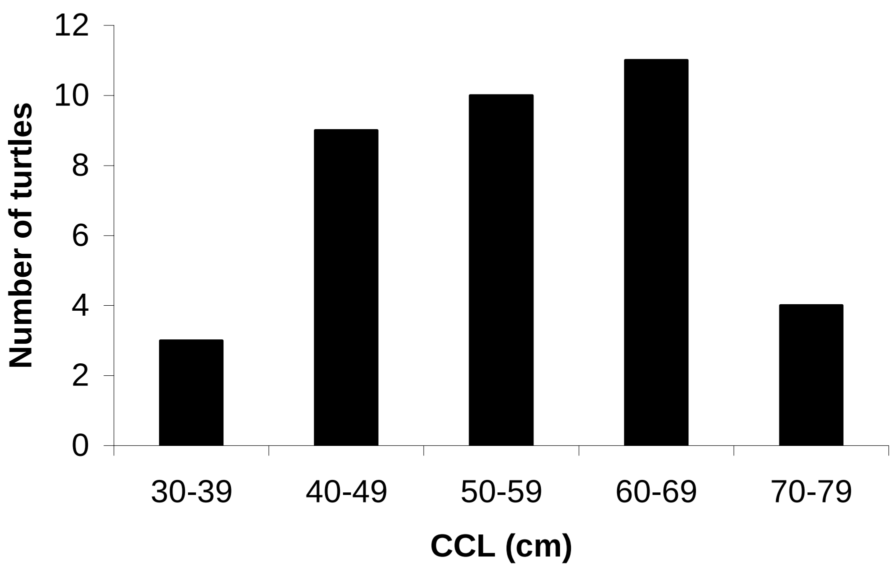

Figure 2: Size distribution (CCL in cm) of loggerheads accidentally captured around the port of Tangier (Benhardouze, 2004).

Figure 3. Loggerhead carapaces sold as guitars at Tetouan market (Photo: M. Aksissou).

SLOVENIA

Bojan LAZAR[1,2,3] and Valter ŽIŽA[4]

[1]Department of Zoology, Croatian Natural History Museum, Demetrova 1, HR-10000 Zagreb, Croatia, [2]Blue World Institute of Marine Research and Conservation, Kaštel 24, HR-51551 Veli Lošinj, Croatia, [2]Department of Biology, Faculty of Science, University of Zagreb. 6 Roosevelt Sq., HR-10000 Zagreb, Croatia (E-mail: bojan.lazar@hpm.hr), [4]Aquarium Piran, Kidričevo nadbrežje 4, SI-3600 Piran, Slovenia

1. General remarks

With a length of 44 km (Bertić, 1987), the Slovenian Adriatic coast accounts for about 2% of the eastern Adriatic mainland coastline. It is situated in the northernmost and the shallowest part of Adriatic belonging to the Gulf of Trieste region (< 50 m, Fig. 1), with heavily developed coast composed of rocks and without natural sandy beaches. Strong riverine inflow and shallowness result in drastic oscillations of sea temperatures, ranging between 6 ˚C in the winter and up to 27°C in the summer. Benthic communities of the Gulf of Trieste, formerly being characterised by suspension feeding organisms (the "O-R-M community"; Fedra et al., 1976), have been altered by major benthic mortality events and bottom trawling activities. That led to changes in community structure and immigrations of hermit crabs (mostly *Parguristes eremita*), which are today one of the dominant taxa (Kollmann and Stachowitsch, 2001).

Until recently, very little information existed on sea turtles in Slovenian Adriatic. Loggerhead turtle (*Caretta caretta*) was known to occur (Mršić, 1997; Kryštufek and Janžeković, 1999), but it was considered rare (Lipej et al., 2000). Systematic data collection and tagging of sea turtles in Slovenia was launched within the framework of a coordinated marine turtle tagging programme of UNEP MAP/RAC-SPA in 1995, but it was from 1998 that its implementation has intensified. This program was coordinated by the Institute for Nature Conservation of the Republic of Slovenia – Regional Department in Piran, and carried out by the Piran Aquarium in cooperation with the Marine Biology Station of the National Institute of Biology of Slovenia (Žiža et al., 2001). Presently, specific research projects are done in cooperation with the Croatian Natural History Museum, within the *Adriatic Marine Turtle Research and Conservation Program* (see the chapter on Croatia).

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

The coast is not suitable for loggerhead nesting.

2.1.2. Marine areas

Due to its shallow continental shelf, Slovenia primarily hosts neritic developmental habitats for juveniles (Žiža et al., 2001; Lazar et al., 2003) with only a small proportion of adults frequenting its waters. Yearly fluctuations of sea temperatures seem to be the key factor that determines a seasonal presence of loggerheads in Slovenia. With the exception of one dead stranded juvenile washed ashore in the winter, all existing 10-years records come from the warm period of the year (May – October). Hence, a spatio-temporal analysis defined Slovenian Adriatic waters as an exclusive summer feeding habitat (Lazar et al., 2003).

The mean CCL of juveniles (40.1 ± 10.3 cm, n = 73), and the minimum recorded size (20 cm CCL; Lazar and Žiža, personal data) suggest that Slovenian Adriatic is primarily recruited by small juveniles, with most of them belonging to the 30-40 cm CCL size class. Although such small turtles should theoretically still be in the oceanic life-stage (Bolten, 2003), diet composition analysis of 17 loggerheads with CCL < 40 cm (mean CCL = 33.9 ± 4.5 cm) pointed out on anemones (39.9% wet weight), crustaceans (23.4% w.w.) and molluscs (14.3% w.w.) as the major prey groups, with benthic taxa accounting for 87.6% of the diet (Lazar et al., 2008a). This study showed that loggerheads with CCL as small as 25 cm already recruit neritic zones, suggesting that Slovenian waters host transitional habitats for juveniles undergoing through the ontogenetic habitat shift (Lazar et al., 2008a). Three factors seem to shape the suitability of Slovenian waters as a summer transitional habitat for small juveniles: shallow continental shelf (< 50 m), prey availability (benthic communities dominated by hermit crabs) and favorable summer sea temperatures.

With the decrease of sea temperature loggerheads seem to undertake wintering migrations to the south. Although the existence of over-wintering habitats is known from the Croatian part of the Adriatic (Lazar et al., 2003), no loggerhead tagged in Slovenia has ever been recovered there (Lazar, unpublished data). It is therefore possible that some of small juveniles in the transitional phase shift back to the ocenic stage in the winter period, and spend this time in the warmer waters of southern Adriatic which are known to host oceanic developmental habitats (Casale et al., 2005). The existence of such transitional period characterized by shifting back and forth between the oceanic and neritic habitats is known for some loggerhead populations in the vicinity of seamounts, ocean banks and ridges that come close to the surface or around oceanic islands (Bolten, 2003). It seems that such transitions (shifts) also happen in juvenile loggerheads from Slovenian waters. Repeated recoveries of tagged turtles, although limited in number, suggest that juveniles return back to feeding habitats with the increase of sea temperature in May (Lazar and Žiža, unpublished data), supporting a theory on the site fidelity of loggerheads for foraging grounds (Lazar et al., 2004a; Casale et al., 2007).

Only a few tag recoveries of adult females exist for Slovenia, belonging to loggerheads nesting in Greece and Cyprus (Margaritoulis et al., 2003; Lazar et al., 2004a). Genetic analyses of juvenile loggerheads from the eastern Adriatic, which have also included samples from Slovenia, showed that they almost exclusively belong to the Mediterranean nesting populations, predominantly to the Greek nesting stock (Lazar et al., 2008b; Lazar, unpublished data), and form the Ionian-Adriatic Management Unit (Lazar et al., 2004a).

2.2. Past distribution and abundance

Data not available.

2.3. Threats

2.3.1. Terrestrial Habitats

Not applicable, because this species does not nest in this area.

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

The professional fishing fleet of Slovenia is relatively small. According to information from the Slovenian Directorate for Fisheries, the most of fishing vessels are registered as multifunctional vessels (70), followed by the exclusive gillnetters (26) and bottom trawls (20).

The peak of bottom trawl bycatch in the whole northern Adriatic area occurs in the winter (Lazar and Tvrtković, 1995; Lazar et al., 2003; Casale et al., 2004), when loggerheads are absent from Slovenian waters due to the thermal constrains (Spotila et al., 1997). Thus the yearly trawl bycatch rates in Slovenia are certainly lower than in the rest of the northern Adriatic, ranging between 3 – 5 turtles/year/vessel (Lazar and Žiža, unpublished data). Considering a small fleet size, low CPUE and low direct mortality in trawls (9.4 – 12.5%; Casale et al., 2004; Lazar et al., 2003, respectively), total take of loggerheads by Slovenian trawling fleet is low when compared to trawl bycatch of

Italian and Croatian fleets (Lazar and Tvrtković, 1995; Casale et al., 2004).

The fishery with the highest number of interactions with sea turtles in Slovenia is certainly the gillnet (static-net) fishery (Fig. 2). A survey carried out in the north-eastern Adriatic (Slovenia and Croatia) showed minimum bycatch of 658 captures/year, potentially ranging to 4038 captures/year if CPUE of exclusive gillnetters is extrapolated to multifunctional vessels (Lazar et al., 2006). With 26 vessels registered exclusively for gillnetting and CPUE of 2.81 turtles/year/vessel (Lazar et al., 2006), we estimate minimum gillnet bycatch of loggerheads in Slovenia at about 70 captures/year. If multifunctional vessels are considered, a potential gillnet bycatch may be as high as about 270 captures/year. Though most of multifunctional vessels use gillnets, their fishing effort is probably lower than of the exclusive gillnetters, most likely resulting in lower CPUE and lower bycatch rates. However, no information exists at present on the fishing effort of these vessels. All incidental captures in gill nets are coming from the warm period (May – October). In regard to mortality, gillnets are the most lethal fishing tool for sea turtles in the eastern Adriatic (direct mortality = 74.7%), affecting loggerheads with the mean CCL = 40.2 cm (Lazar et al., 2006). No information exists on interactions of other fisheries with loggerheads in Slovenia.

2.3.2.2. Intentional killing and exploitation

Intentional killing is absent or negligible.

2.3.2.3. Other threats

Several studies addressed the effects of marine pollution on loggerheads in the eastern Adriatic (e.g. ingestion of marine debris, heavy metal levels, organochlorine contaminants) and have included the samples from turtles found in Slovenia (Lazar et al., 2007; Lazar et al., *in review*; Buršić et al., 2008). Although the levels of some contaminants were considerably high (see chapter on Croatia), there is no clear evidence that pollution has directly caused death of any turtle.

A few dead stranded turtles were found with typical scares resulting from boat strikes and/or propeller injuries, but due to decomposition, it was not possible to determine whether these injuries were made post-mortem, or were the primary cause of death (Lazar and Žiža, unpublished data).

3. *Chelonia mydas*

No record of green sea turtle (*Chelonia mydas*) exists in Slovenia so far (Kryštufek and Janžeković, 1999; Lazar et al., 2004b).

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

The only data on leatherback sea turtles (*Dermochelys coriacea*) in Slovenia refer to two sightings of presumably the same animal with a carapace length of 170-180 cm in August 2001 (Lazar et al., 2008c). The species seems to be rare in Slovenian waters.

4.2. Past distribution and abundance

Data not available.

4.3. Threats

4.3.1. Incidental catch

Due to the low occurrence, no leatherback has ever been incidentally captured in Slovenian fisheries (Lazar et al., 2008c). However, intensive gillnet fishing represents a threat to all sea turtles frequenting Slovenian waters.

4.3.2. Intentional killing and exploitation

Intentional killing is not an issue. Moreover, fishermen tend to report sightings of this rare species.

4.3.3. Other threats

Not an issue due to the low occurrence of the species in Slovenian waters.

5. Other species

No other species have been recorded in Slovenian waters.

6. Conservation status

Both sea turtle species recorded in Slovenian waters, namely the loggerhead turtle and the leatherback turtle, are protected by the national legislative of Slovenia and are listed under Annex A of the Declaration on the Protection of Wild Animal Species of Slovenia. As an EU member, Slovenia is also obligated to protect the species listed in the Habitats Directive (92/43/EEC), which also includes sea turtles. Furthermore, Slovenia is also a party of the following international conventions relevant for sea turtle conservation:

- Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention)
- Convention on Biological Diversity (CBD)
- Convention on the Conservation of Migratory Species of Wild Animals (CMS) – Bonn Convention
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- Convention on the Conservation of European Wildlife and Natural Habitats – Bern Convention.

7. Conservation needs

Coastal gillnets present the major threat to loggerheads in Slovenia. Although temporal closures or just a reduction of the fishing effort in summer could be a solution of the bycatch problem in Slovenia, because of the short coastline and a small fleet, it is unrealistic to expect that such measures would have a significant impact on conservation of loggerheads in the Adriatic Sea. In order to be efficient, any conservation action should be internationally-coordinated and implemented by all countries hosting loggerhead feeding habitats in the northern Adriatic (Croatia, Italy and Slovenia). Moreover, any changes in fishing regulations that would aim to mitigate turtle bycatch only in Slovenia could have even an opposite effect. In the recent years, fishermen have been educated and highly sensitized about the problem of sea turtle conservation, and have intensively cooperated with researchers. Apart from being difficult to enforce at-sea, such changes in Slovenian fishing legislative could have a counter-effect in fishermen community, changing very positive attitude towards turtles present among fishermen at present into the hostility. Hence further education of fishermen on the procedures available to reduce post-release mortality and correct turtle handling (Gerosa and Aureggi, 2001), coupled with better enforcement of the existing fishing legislative, particularly for gillnetters, remain at present important conservation tools.

8. Miscellaneous

None.

9. Institutions and organizations involved in conservation, management, and research

9.1. Governmental

- Aquarium Piran, Piran (research, rescue, conservation, education)
- Marine Biology Station, National Institute of Biology, Piran (research)
- Institute for Nature Conservation of the Republic of Slovenia, Piran (conservation, education, policy)
- Ministry of the Environment and Spatial Planning, Ljubljana (policy).

9.2. Non-Governmental

- *Biocen* – Department for Ecological Research, Consultation and Education, Piran (research, education)
- *Morigenos* – Marine Mammal Research and Conservation Society, Ljubljana (research, education)

10 Resources available about marine turtle research and conservation

None.

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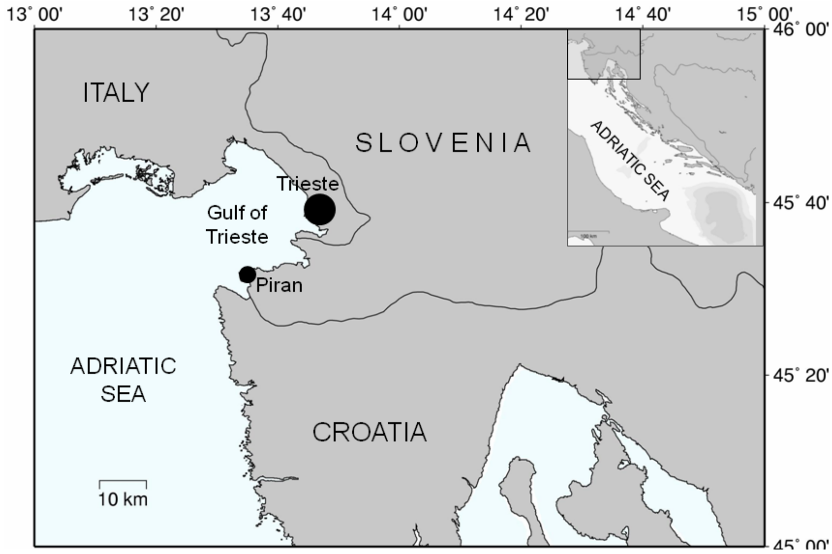

Figure 1.
Map of the Slovenian Adriatic coast.

Figure 2.
Typical professional gillnet vessel from Slovenia. The mean vessel length in the northern Adriatic is 7.6 m (Lazar et al., 2006) (Photo: B. Lazar).

SPAIN

Carlos CARRERAS[1] and Jesús TOMÁS[2]

[1]Estación Biológica de Doñana, CSIC, Apdo. 1056, E-41013, Sevilla, Spain (E-mail: carlos_c_h@hotmail.com), [2]Centre for Ecology and Conservation, University of Exeter, Cornwall Campus, Penryn TR10 9EZ, UK (E-mail: J.Tomas@exeter.ac.uk, jesus.tomas@uv.es)

1. General remarks

The first information on sea turtles from Spain was published two centuries ago (Boscá, 1877). There has been very little interest in turtle research in Spain, until recently when it has increased. Moving one century on from the first report, we find compiled information on 22 sea turtles stranded on the Spanish coast (Brongersma, 1972). In the last decades, interest in the biology and conservation of sea turtles has increased, in accordance with them being perceived increasingly as charismatic species. This interest has resulted in the creation and/or consolidation of research groups from universities, public administration, and NGOs dedicated to the research of these animals. The recent increase of interest in these species, by Spanish scientists and conservationists, has resulted in an important advance in knowledge, documented in an up-welling of scientific publications, PhD & Master Theses and reports (Fig. 1). In this chapter we collect a great deal of past and present information concerning biology and conservation of sea turtles in the Spanish Mediterranean and Atlantic adjoining waters.

Spain deserves special consideration in relation to conservation of sea turtles, based on three main reasons: (1) its geographical location between the Mediterranean Sea and the Atlantic Ocean, (2) the abundance and diversity of sea turtle populations and species (see below), and (3) the anthropogenic threats affecting these species in Spanish waters. The Mediterranean is an almost closed sea, with one only natural connection to the Atlantic located in the Gibraltar Strait, a passage with an approximate average of 12 km between Spain and Morocco and 8 km in the narrowest point. In these straits, the Atlantic waters enter into the Mediterranean as strong input surface currents while the Mediterranean waters leave the sea by the bottom (see section 2.1.2). The sea current pattern in the westernmost part of the Mediterranean, with currents coming either from the Atlantic or from the central and eastern Mediterranean (Millot, 1987; Millot, 1999; Fig. 2), may lead Atlantic and Mediterranean turtles to the Spanish Mediterranean waters and coasts, as will be explained below.

Spain is considered as a non-nesting, or exceptional nesting, country for the loggerhead sea turtle (*Caretta caretta*; Margaritoulis et al., 2003). However, this classification might be reconsidered according recent events (see section 2.1.1). Apart from the loggerhead, no nesting of other sea turtle species has been reported. Up to four species have been reported in the Spanish Mediterranean and the Atlantic adjoining waters, including the loggerhead sea turtle, the leatherback sea turtle (*Dermochelys coriacea*), the green sea turtle (*Chelonia mydas*) and the Kemp's ridley turtle (*Lepidochelys kempii*; see sections 2.5). A fifth species, the hawksbill turtle (*Eretmochelys imbricata*), has been reported elsewhere in different parts of the Atlantic Spanish coast. Of these records, two stranded hawksbills have been reported in Huelva province, in the Atlantic side of the Gibraltar Strait area (Mateo and Pleguezuelos, 2001; Camiñas, 2002; Bellido et al., 2006). This species has been reported previously in the western Mediterranean (Laurent and Lescure, 1991).

Although sea turtles seem to be relatively abundant in the Spanish Mediterranean (e.g., Gómez de Segura et al., 2006), a set of anthropogenic threats seriously affect these species in these waters. The most serious threat is incidental capture by fisheries, particularly the off-shore longline fishery (Camiñas et al., 2006, and references therein). Spain has one of the most important fishing fleets in the world, being the largest in the European Union and capturing over one million tons of target species annually (Mejuto et al., 2006). In particular, the Spanish longline fishing fleet operates throughout the western Mediterranean, and the number of annual captures of loggerhead turtles by this fleet has been estimated in the thousands (Laurent et al., 2001; Lewison et al., 2004; Mejuto et al., 2006 and references therein). However, other fisheries can have an important effect on sea turtle aggregations in the area and their impact on these species requires a deeper assessment. Apart from fisheries interaction, other major threats to sea turtles deserve consideration. All of the Spanish Mediterranean coast is considered as a tourism hotspot, receiving millions of people from the rest of Spain and European countries every summer. Moreover, in recent decades the human population has increased considerably in these coasts due to immigration from inland. The activities derived from tourism, the demographic pressure and the coastal development in the Spanish Mediterranean represent a significant set of threats for sea turtles, including more pollutants and litter spills to the sea (particularly in summer months), higher frequency of boat strikes, coastal alteration (including artificial light pollution), and the destruction of potential nesting areas (see section 2.3).

The loggerhead sea turtles present in Spain's Mediterranean waters have been reported coming from two different groups of populations, the Atlantic and the Mediterranean ones (Laurent et al., 1998; Carreras et al., 2004a, 2006a); hence, the existing threats in the area might have an important effect on both groups of populations. The increasing knowledge of sea turtle stocks present in the Spanish Mediterranean will contribute to the proposal of effective conservation measures in the near future, to face the major threats suffered by these species in this area.

2. *Caretta caretta*

2.1. Present distribution and abundance

All size classes of loggerhead sea turtle (*C. caretta*) are very common throughout the Spanish Mediterranean and the Atlantic adjoining waters, although nesting events are scarce in the area (see section 2.1.1). Hence, most of the loggerhead sea turtles in Spain are found in marine habitats (section 2.1.2.). Those turtles have been reported coming either from nesting areas in the Atlantic or the eastern Mediterranean and may remain in the western Mediterranean until they reach maturity (Carreras et al., 2006a). Although there is a lack of long term studies on trends in the area, and accurate abundance estimations have been performed only in some limited areas, at-sea studies (Gómez de Segura et al., 2003, 2006), and studies based on incidental catch by fisheries (Mejuto et al., 2006 and references therein), suggest the presence of tens of thousands loggerhead turtles in the Spanish Mediterranean waters throughout the year.

2.1.1. Nesting sites

The Spanish Mediterranean coast is not considered as a stable nesting habitat for any sea turtle species (Margaritoulis et al., 2003), although some nesting activity may have occurred in the past (see section 2.2). For the loggerhead turtle, Spain is classified as '*non-nesting or occasional*' (Margaritoulis et al., 2003; Margaritoulis, 2005). However, some recent reports lead us to suggest a slight change in this classification to '*sporadic nesting*'. First, a fully developed loggerhead embryo of 3.4 cm straight carapace length was found in the Delta of the Ebro River (Llorente et al., 1992/93; Fig. 3). No other nesting evidence was reported in the following 10 years until a loggerhead turtle was observed nesting in a beach of Vera, Almería (southeast Spain) in July 2001. Nest protection, 24h vigilance and nest study after hatching were carried out. An incubation period of 58 days, a clutch size of 97 eggs, and a 41.2% hatchling emergence success were reported (Tomás et al., 2002a). After this event, beach surveys were undertaken in Almería province beaches during the summers of 2002 and 2003, but no new nesting events were recorded there (Tomás et al., 2008a).

These two pieces of evidence alone could be considered as occasional events, according to the ten year interval. However, two successful nesting events of the species, with confirmed emergence of hatchlings, have been recorded in summer months of 2006, one of them in Valencia province (East Spain) and the second in Barcelona province (Northeast Spain; Tomás et al., 2008a; Fig. 3). Beach surveys were scheduled for summer 2007 in different regions - to our knowledge in Andalucía (South), Catalonia (Northeast) and Valencia Community (East Spain) - to detect further possible nesting events, but without success; some of these programmes included awareness and campaigns for turtle track recognition. However, the sea turtle nesting season in the Mediterranean (June-September; Margaritoulis et al., 2003) coincides with the tourist high season in the summer months. Tourism is massive in summer months throughout the Spanish Mediterranean littoral, and the human population increases considerably. Hence, the environmental consequences caused by tourist activities and by the demographic pressure (see section 2.3.1 for more details) would prevent the establishment of potential sea turtle nesting sites. Moreover, if sporadic nesting activity existed in some areas, the daily cleaning of many beaches for tourists by raking and smoothing the sand surface would eliminate any track of nesting events, making practically impossible the detection of the nests (Tomás et al., 2002a).

If no nesting activity has been reported in decades, the recent increase of reports deserves explanation. First, it is possible that there has been always a low level of undetected nesting in Spain, and the recent records reflect heightened awareness, both public and scientific, on the species. Second, these new nests could be either the consequence of lost or non-phylopatric turtles or perhaps reflect colonization from other nesting populations elsewhere. None the less, no potential explanation can be confirmed until the origin of the Spanish nesting females is determined (Tomás et al., 2008a). Genetic studies are in progress to determine the original populations of all the nesting loggerhead turtles found along the Spanish coast over the last decade. Further research, together with beach surveys, should be conducted in order to explore potential changes in breeding areas and nesting behaviours of the loggerhead sea turtle in the western Mediterranean coasts.

2.1.2. Marine areas

Abundance.

Some estimations on loggerhead turtle abundance in the Spanish Mediterranean have been inferred by opportunistic sampling from captures by long-line fishery (Camiñas and de la Serna, 1995; Camiñas et al., 2003). The single study on extensive estimation of loggerhead turtle abundance at sea in a wide area was conducted in the central Spanish Mediterranean, in an overall area of c. 32,000km^2 (Gómez de Segura et al., 2006; Fig. 5). Through aerial surveys, and using standard distance sampling methods applied to single animals, it was estimated an average surface density of 0.208 loggerheads km^{-2} (95% CI: 0.172–0.251), and a mean abundance of 6,653 turtles (95% CI: 5,514–8,027). After correction by the proportion of diving turtles, the absolute abundance increased to 18,954 turtles (95% CI: 6,679–53,783). Comparison with specific studies on aerial surveys over loggerhead turtle feeding grounds in and out from the Mediterranean showed that the density values estimated in Gómez de Segura et al. (2006) were at least one order of magnitude higher, with similar or lower coefficients of variation. Carreras et al. (2004b) conducted two aerial surveys off the Balearic Islands in March 2002 and September 2002, using the strip transect method. These authors estimated a surface density of 0.056 turtles km^{-2}. Gómez de Segura et al. (2006) suggested that those differences in loggerhead density found in close areas of the Spanish Mediterranean waters may be consequence of either differences in the methodology used and/or in the different bathymetry of the study areas (only continental shelf, in Carreras et al., 2004b). However, density estimated in a wide area of continental shelf in Gómez de Segura et al. (2006) was higher than that of Carreras et al. (2004b). These studies suggest that thousands (probably tens of thousands) of loggerhead turtles remain in, or visit, the Spanish Mediterranean waters every year.

Distribution.

There are very few historical reports of the presence of sea turtles in Spanish waters two centuries ago (Boscá, 1877) including the Mediterranean Spanish waters. However, it was not until the last decades of the 20th century when information about the regular presence of these animals was compiled, starting with the report of 22 stranded loggerhead sea turtles on the Spanish coasts (Brongesma, 1972). In the 1980s there were a few more reports, but always on a regional scale without considering the whole Spanish Mediterranean (Mayol et al., 1988; Pascual, 1985, 1989; Penas and Piñeiro, 1989). More complete studies were conducted during the 1990s based on stranding records (Camiñas, 1996a) or fisheries reports (Aguilar et al., 1995; Camiñas, 1988; Camiñas et al., 1992; Camiñas, 1995, 1996b) and demonstrate that the loggerhead sea turtle is a common visitor to the Spanish Mediterranean waters. The origin of all of the loggerhead sea turtles seen in this area was a matter of concern, as the absence of regular nesting in the area (see section 2.1.1) implied that most of them might originate far from the basin. The fact that individuals born in Atlantic nesting beaches might cross the Atlantic and arrive to the Mediterranean through the Gibraltar Strait, proposed by Carr (1987), has been proven by recaptures inside the Mediterranean of some individuals tagged in the Atlantic (Laurent, 1990a,b) and the use of genetic tools (Laurent et al., 1998). Moreover, Laurent et al. (1998) proposed that approximately 55% of juveniles in the western Mediterranean would be originally from Mediterranean nesting beaches, while 45% of the juveniles would come from Atlantic nesting beaches. The evidence of recapture in Cuban waters of turtles tagged and released in the western Mediterranean (Camiñas, 2004) showed that the return of Atlantic turtles to their original nesting beaches is also possible. The individuals from Mediterranean beaches possibly would use the Messina straits to reach the western basin (Bentivegna, 2002) although many animals are also found in the Sicily channel and hence the exact route is not yet known.

Stranding records in the Spanish Mediterranean coast show an apparent seasonal peak of abundance in summer (Tomás et al., 2003a; Tomás et al., 2008b) and the same was observed by fishermen interviewed in the Balearic Islands (Carreras et al., 2004b). This trend was also observed by reports of incidental catch of turtles on longlines and these results were used to propose a model of dispersion of loggerhead turtles in the Western Mediterranean (Camiñas and De la Serna, 1995). Under this model, sea turtles originating both in Atlantic and Mediterranean nesting beaches would increase their abundance during a spring migration into the Western Mediterranean, reaching a maximum abundance in July. During the following months, some turtles might move to the Alboran Sea, leaving the region at the end of the year. Other turtles might follow the Algerian current to the eastern Mediterranean during the autumn migration, and some few large turtles would remain during the winter around the Columbretes and Balearic Islands (Camiñas and De la Serna, 1995).

Recent satellite telemetry studies (Cardona et al., 2005; Revelles et al., 2007a) showed that during spring, turtles found in the Algerian basin do not show the expected northward preferred direction. All tagged turtles moved towards the Balearic Islands and the African coast, avoiding Spain's continental shelf and hence overlapping with major longline fishing areas. This result may help to explain the high catch rates of turtles by this type of fishing gear in the area. Additional telemetry studies (Revelles et al., 2007a) showed that the movements of a total of fifteen turtles tagged in the Algerian basin, exhibited neither latitudinal nor longitudinal seasonality all the year round. These authors only found a seasonal pattern in the time spent in the surface during daytime, probably associated to changes in feeding behaviour. Moreover, aerial surveys carried out along the coast of the Central Spanish Mediterranean (Gomez de Segura et al., 2003, 2006) found no seasonal differences in density and abundance of turtles. All of this evidence contradicts the bycatch-based migratory model proposed by Camiñas and De la Serna (1995) and linked evidence extracted from stranding records (Tomás et al., 2003a) and fishermen perception (Carreras et al., 2004b). Cardona et al. (2005) and Revelles et al. (2007a) argued that the methods that yield any seasonality are clearly influenced by fishing activity, that is clearly seasonal, hence biasing the results. Hence, the differences in catch rate detected during the year would be likely produced by differences in fishing effort, and will produce a higher mortality rate during summer, increasing stranding records in that season (Tomas et al., 2008b); then, migratory and distribution models based only on captures by fisheries and/or stranding data are not valid, and other sources of evidence is needed.

The western Mediterranean shows a complex hydrographic structure (Millot, 1999) with two clearly different water masses. Atlantic cold water enters through the Gibraltar Strait and moves eastward in the Algerian basin producing complex mesoscale structures in this area. On the other hand, Mediterranean salted warm water enters the western basin through the Messina Strait and flows northward following the European coast (Millot, 1999). Recent research has revealed that this current pattern directly influences the distribution of juvenile loggerhead turtles coming either from Atlantic or Mediterranean nesting beaches. Genetic studies (Carreras et al., 2006a) showed that the western Mediterranean feeding grounds dominated by Atlantic waters (i.e., Alboran Sea and Algerian Basin) are inhabited mainly by turtles born in Atlantic nesting beaches, while those feeding grounds dominated by Mediterranean waters (i.e. waters off East Spain, Northeast Spain and South France) are inhabited mainly by turtles born in eastern Mediterranean nesting beaches. The feeding grounds located in the areas were the two water masses met, i.e. the Central Spanish Mediterranean and south Balearic Islands, are inhabited by a mixture of turtles from both origins (Fig. 6). Telemetry studies (Cardona et al., 2005; Revelles et al., 2007a; Revelles et al., 2007b) agree with these genetic results, since turtles tagged in the Algerian basin, of Atlantic origin, were not tracked northward and their movements were a combination of passive dispersal and site fidelity to the water masses (Revelles et al., 2007b).

The Gibraltar Strait, a narrow passage of water between Europe and Africa and only 8 km wide at its narrowest point, deserves special attention for its hydrographic characteristics and strategic location. The surface water always flows eastward, generating strong currents, while the waters leave the Mediterranean deeper than 100m (Bryden et al., 1994; Tsimplis and Bryden, 2000; Delgado et al., 2001; Fig. 7).

Considering this structure, Revelles et al. (2007c) demonstrated that due to this hydrographic structure, the exchange of turtles across the Strait is asymmetric. Based on swimming capabilities analysed in captivity, loggerhead turtles smaller than 37 cm SCL (Straight Carapace Length) would not be able to swim against the surface currents in the Strait and be able to reach the Atlantic Ocean, while travel in the opposite direction is possible at any size as it is favoured by the currents. However, other evidence from tagging and recapture, or genetic analyses, showed that turtles usually leave the basin at a much larger size (>54.9 cm SCL; Revelles et al., 2007c). According to the growth model proposed by Bjorndal et al. (2000), if Atlantic loggerheads can arrive in the Mediterranean at a size of 20 cm SCL these turtles would remain in the basin for an average of 9.5 years (Revelles et al., 2007c). The reason of this permanence in the western Mediterranean may affect feeding or inhabiting preferences of the turtles. However, this permanence could be a consequence of other physical barriers present in the area (such as the Algerian current and circular eddies, Fig. 2) that may prevent the turtles arriving in the area of the Gibraltar Strait. This permanence would lead the turtles to be exposed to the anthropogenic threats in the area, increasing the impact of the nesting populations of their origin (see section 2.3.2).

Once in the western Mediterranean, the Atlantic juvenile loggerhead turtles seem to show a clear avoidance of the continental shelf (Cardona et al., 2005) and remain most of the time in oceanic waters (Cardona et al., 2005; Revelles et al., 2007a) in concordance with what would be expected for the habitat preference of juveniles during their pelagic phase, as reported in other areas (references in Bjorndal, 2003; Bolten 2003).

Some tagging programmes exist in Spain (Tomás et al., 2003a; Roca and Camiñas, 2000; Bertolero, 2003) with most of them using metal tags from the Spanish Ministry of Environment, although other passive tags (plastic tags, Monel tags, Inconel tags and internal transponders) have been used. A recent study collected data of recaptures from several of these tagging programmes (Revellés et al., 2008). This study also reveals limited exchange of immature loggerhead turtles between the northern and southern regions of the western Mediterranean.

Other evidence of the exploitation of pelagic habitats by large juvenile and adult-sized turtles is that these size classes appear to be more prevalent in bycatch of pelagic longline fishery in this area, according to stranding and incidental captures studies (Pont and Alegre, 2000; Camiñas and Valeiras, 2001; Tomás et al., 2008b). None the less, the distribution pattern of all size ranges of juvenile loggerhead turtles in the western Mediterranean can be strongly influenced by their feeding behaviour and dietary habits (see below). The results found may introduce alterations in the ontogenetic model of habitat use described by Bolten (2003).

Feeding.

Substantial research has been carried out into feeding of loggerheads in the Spanish Mediterranean (Tomás et al., 2001; Tomás et al., 2003b; Ocaña et al., 2005; Maison, 2006; Revelles et al., 2007d,e). However, one important gap on this research worldwide is the evaluation of selectiveness in the feeding behaviour of the species (Bjorndal, 2003). At species level, the feeding of loggerheads seems to be as generalists, according to the long list of prey species reported in the literature and the new additions to the list in every new study (e.g., Tomás et al., 2001). At local stocks level, the species seems to behave as an opportunist, feeding upon prey species according to their availability and abundance. If some potential prey species are particularly abundant in certain areas, in certain seasons, and are easy to catch, this can lead to an apparent spatial and seasonal specialisation. For instance, Ocaña et al. (2005) reported that in summer, loggerheads exploit almost exclusively the crab *Polybius henslowii* as a food resource, coinciding with the season in which this species form blooms in the waters around the Gibraltar Strait. The other feeding studies carried out in the Spanish Mediterranean, based on gut contents of relative large sample sizes, strongly support its generalist and opportunist feeding. Tomás et al. (2001; n = 54) reported prey of 47 different taxa of eight different phyla, 33 of them as new dietary records. A recent study, made also in the Central Spanish Mediterranean, reported prey from 48 different taxa (Maison 2006; n = 64), some of them not reported in Tomás et al. (2001). Revelles et al. (2007e; n = 19) also reported a high variety of prey species in turtles from the Balearic Islands.

However, gut content analyses are subjected to different caveats, and are unable to detect soft and easily digested prey species (Revelles et al., 2007e). Stable isotope analyses have revealed the importance of jellyfish in the diet of loggerheads in the waters around the Balearic Islands (Revelles et al., 2007d, e). Other soft floating pelagic species have been detected in these studies. The pelagic tunicates (pyrosomes and salps) were the most important prey group reported by Maison (2006), and one of the most important prey groups in Tomás et al. (2001) and Revellés et al (2007e). The importance of jelly plankton, including *Salpa* sp., in the diet of the loggerhead has been reported also on both sides of the Gibraltar Strait (Bellido et al., 2006). Furthermore, in this basin loggerhead turtles exploit food sources related to fisheries. Tomás et al. (2001) found that fish was the main prey group and demonstrated that fishes were acquired from fisheries' discards. Revelles et al. (2007e) reported also that longline bait is the most likely source of some important prey species found in their study.

The studies made in the Spanish Mediterranean, reveal that in these areas all ranges of juvenile loggerhead turtles, even larger ones close to adult sizes, feed mainly in the water column on floating or slow-moving species (i.e., jelly plankton), principally in open waters rather than in neritic habitats; although benthic invertebrates are also exploited as a food resource. In addition, loggerhead turtles feed in heavy fishing areas, apparently attracted by bait and discarded material. This food source is easy to obtain and highly nutritive, but this behaviour increases the risk of incidental catch and other anthropogenic threats (see section 2.3.2).

Migratory movements.

In addition to national tagging programmes, the existing stranding networks along the Spanish Mediterranean coast has facilitated the recapture of loggerhead turtles tagged by other Mediterranean tagging programmes (Tomás et al., 2003a; Casale et al., 2007). These recaptures provide evidence of movements and exchange of turtles between central and western Mediterranean basins.

As it has been commented, at least 15 loggerhead turtles have been tagged with satellite transmitters in waters off the Balearic Islands, and the tracks of the turtles also supports the segregation in basins between stocks and their fidelity to these basins (Cardona et al., 2005; Revellés et al., 2007b). Apart from these studies, two other juvenile loggerheads incidentally caught by Spanish fisheries were tagged with satellite-linked transmitters (PTTs) and released in the Atlantic side of the Gibraltar Strait (Cejudo et al., 2006). The movements recorded for these two turtles revealed transatlantic migration of the species, although transmission stopped at the middle of the Atlantic. Another 19 loggerhead turtles have been tracked using also Argos satellite tagging data from the Alboran sea (South Spain; Eckert et al., 2008). These authors also report transatlantic migration, including the first complete transmission across the Atlantic Ocean. These authors also report size-based variation in distribution and movements of the turtles through this method.

Size classes.

Marine habitats of the Spanish Mediterranean waters are visited by loggerhead turtles of all ranges of size, from early juvenile to, possibly, adult stage. Although no direct studies at sea have been carried out, studies based on strandings and incidental captures infer a dominance of middle and large juveniles in Spanish Mediterranean waters (Table 1).

Table 1. Size of loggerhead sea turtles recorded in stranding networks and research projects on incidental captures by fisheries along the Spanish Mediterranean coast. CCL: curved carapace length, SCL: straight carapace length; N: sample size.

Location	study type	method	mean ± SD (cm)	range (cm)	N	Reference
South	strandings	SCL	45.7	-	555	Bellido et al., 2006
South	captures	SCL	-	27.2-87	-	Camiñas, 2005
East Southeast	captures	SCL	47.4 ± 13.6	30-70	14	Camiñas, 1996b
East	strandings	CCL	53.6 ± 12.6	16-80.2	312	Tomás et al., 2008b
East Northeast	captures	CCL	49.4 ± 9	34-69	54	Tomás et al., 2001
Northeast	captures	SCL	45.8 ± 12.5	18-73	118	Pont and Alegre, 2000

2.2. Past distribution and abundance

Historical data on loggerhead sea turtle nesting on the Spanish Mediterranean coast are very scarce and limited to sporadic events. For instance, Salvador (1974) provides information of one nesting activity in the 19th century in Murcia province (Southeast Spain). Interviews with coastal habitants in some localities revealed that some nesting activity may have occurred in the 20th century (Pascual, 1985; Filella-Subira and Esteban-Guinea, 1992). However, according to the lack of published reports and to the source of the available information (oral transmission), it seems difficult to ascertain whether or not regular nesting in the Spanish coasts occurred in the past.

Concerning turtles at sea, most of data existing have been collected in recent decades, and always proceeding from indirect information, such as incidental captures by fisheries or strandings (Camiñas, 1988; Aguilar et al., 1993; Camiñas and De la Serna, 1995; Camiñas, 1996a). The first information concerning loggerhead distribution and abundance in the Spanish Mediterranean is quite recent and was extrapolated from incidental captures by longline fisheries (Camiñas and Valeiras, 2003 and references therein). However, data from captures by fisheries must also be taken as approximations, since they are heavily influenced by the seasonal variation in fishing effort or fishing areas (Gómez de Segura et al., 2006). To date, no national stranding networks exist to integrate data along the Spanish Mediterranean. Some regional or local stranding networks have provided data of records from the early 90s to date (Bertolero, 2003, Bellido et al., 2006; Tomás et al., 2008b). However, numbers and trends provided by these networks are subject to many caveats since they are dependant, to a great extent, on water currents, mortality rates and bycatch influenced by fishing effort (Gómez de Segura et al., 2006). Furthermore, the networks are always subjected to improvement, and are not always as efficient as they might be..

As commented before, the only at-sea estimations of density and abundance are quite recent (Cardona et al., 2005; Gómez de Segura et al., 2006). None the less, based on bycatch data (Camiñas, 2005 and references therein), it is reasonable to think that loggerhead turtles have been present in numbers in the thousands in Spanish Mediterranean waters in the past.

2.3. Threats

2.3.1. Terrestrial Habitats

No permanent loggerhead nesting beaches are located along the Spanish Mediterranean coast, although some sporadic nesting activity can occur in some parts of this coast, and impending research in the area may change the scene in the future (section 2.11). For this reason, it is important to summarise some potential threats that could affect sea turtle nesting activity on the Spanish coast. Furthermore, threats to terrestrial habitats have deleterious consequences on sea turtle stocks at sea.

2.3.1.1. Coastal development

In the last four decades, and particularly in the recent years, coastal development has increased dramatically in Spain. In some provinces, building covers more than 50% of the strip of the first 500m from coastline. Town planning and development, and the creation of marinas, extend along the Spanish coast. This increase is a consequence of the growing tourism industry and of immigration from inland to the coast. Tourism is one of the most important economic activities on the Spanish Mediterranean coast, which receives millions of people from the rest of Europe every summer, coinciding with the loggerhead nesting season in the Mediterranean. Tourist beaches are cleaned every morning in summer months, most of them with tracktors and lorries. If nesting activity is present, nests would be affected by this activity.

2.3.1.2. Beach restructuring

Development and creation of ports and marinas always causes loss of sand from beaches, therefore nourishment, and other beach restructuring actions are common activities in Spain’s Mediterranean beaches to keep them adequate for tourism.

2.3.1.3. Non human predation

Not applicable due to the very low nesting activity in Spain.

2.3.1.4. Human exploitation

There is no human exploitation in the few nesting events recorded recently. Lack of data on past human exploitation is linked to the lack of data on past nesting activity on the Spanish Mediterranean coast.

2.3.1.5. Other threats

Not applicable due to the very low nesting activity in Spain.

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

One of the main reasons explaining the development of sea turtle research and conservation in Spain is the importance of incidental captures produced by the Spanish fishing fleet. Spain is a country with large tradition in fishing activities, as it is demonstrated by its large fishing fleet and the variety of different types of fishing gear used, some of them exclusive to certain small areas. The Spanish drifting longline fleet that operates in the western Mediterranean seems to have the most important contributions to incidental captures for the species, since annual catch numbers run between a minimum of 650 turtles per year (Argano and Baldari, 1983) to 35,637 turtles per year (Aguilar et al., 1995). However, other types of fishing gear have not been deeply studied in the area in the past because of their low catches per unit of effort (CPUE) or because they are of very local use. Recent surveys demonstrate that gear such as trammel nets, or bottom trawls can produce significant numbers of captures. Research into these other fishing activities is in progress. The importance of these and other types of fishing gear on a local scale, and the geographic variation of their impact, demand a detailed study of each type of gear in each area. Integrated studies are also necessary to have a full evaluation of fisheries' impacts on sea turtle populations in the western Mediterranean. Following is information on the types of fishing gear with the most significant impacts on sea turtles in the Spanish Mediterranean.

<u>Drifting longline.</u>

Although the Spanish longline fishing fleet operates along the entire Mediterranean Spanish coast, most of the vessels harbour in Southwestern Spain (Camiñas, 2005). Despite the size of the fleet has decreasing in the last decades, it is estimated that more than 70 vessels are still on the official register, in addition to an unknown number of vessels that use other types of fishing gear, but that switch to drifting longline during summer months (Camiñas, 2005). The specific characteristics and size of the vessels are highly variable and the types of gear used also varies depending on the target species; thus the impact on juvenile sea turtles is also variable (Camiñas et al., 2006). Although the fleet operates in almost all the Mediterranean Spanish waters, from the Gibraltar Strait to waters off Catalonia, most of the fishing effort is concentrated to the south of the Balearic Islands, an area inhabited mainly by turtles originated in Atlantic nesting beaches (Fig. 6). Catch rates also have a high variance in time and space, and based on this variance a model of distribution of sea turtles in the western Mediterranean was proposed (Camiñas and De la Serna, 1995). Table 2 summarizes the longline annual catch rates recorded in the Spanish Mediterranean.

Mortality caused directly by fisheries seems to be slightly variable between the different longline gear used (Camiñas et al., 2006; Table 3). Pre-release mortality (i.e., turtles captured dead) in the western Mediterranean has been found to be very low, and most of the turtles are captured alive (Carreras et al., 2004b; Camiñas et al., 2006). However, as most of the turtles are released with the hook (Camiñas, 2005), or might be injured when hauled by fishermen after hooking, then it is necessary to consider also the post-release mortality (i.e., turtles captured and released that die as consequence of that capture); although there have been few assessments of post-release mortality. In the Mediterranean, Casale et al. (2008) proposed post-release mortality at >30% for the turtles captured by longline fisheries. Aguilar et al. (1995) proposed a mortality rate not higher than 50%. However, these numbers are difficult to evaluate as they imply the long term monitoring of the released animals without changing their chance of survival. To our knowledge, these numbers are currently under revision in the Spanish Mediterranean waters (Luis Cardona, University of Barcelona, pers. com.). Another point of interest is that turtle captures have been found to be related to the segment of the longline transect, but not the captures of target species. This has been explained as the segment with higher catch rates being retrieved from the sea during daylight time, possibly because loggerhead turtle use vision to locate bait (Báez et al., 2007a). Significant correlation has been found with the captures and the distance to the coast (Báez et al., 2007b).

De la Serna et al. (2004) reported a slight increase of fishing effort, a slight decrease of total captures of target species and a clear decrease in turtle bycatch rates for the period 1998-2001 in the Spanish longline fishing fleet. In addition, a modification of the longline fishing gear introduced in 2003 in the fleet resulted in a considerable reduction of mean number of hooks per vessel (Báez et al., 2006; Camiñas et al., 2006; Báez et al., 2007b). This is consistent with the general down-sizing of the whole Spanish fishing fleet and the reduction of captures of almost all fish species in recent years.

In summary, total annual captures have been estimated as varying from 1,953 to 23,886 turtles (Camiñas, 2005). Despite these data reported, standardized studies in peer reviewed publications are scarce and numbers, together with mortality rates, should be revised. However, there exists also the possibility that these fisheries will decline, perhaps due to overexploitation of target species in the area, before effective bycatch mitigation can be enacted.

Table 2. Annual catch numbers found in the literature for the loggerhead sea turtle by drifting longline fishery in the Spanish Mediterranean.

Year	Estimated total catch	Reference
1978	650-3,750	Argano & Baldari, 1983
1984	17,092	Camiñas, 2005
1985	20,326	Camiñas, 1986
1985	17,712	Mayol et al., 1988
1986	16,697	Camiñas, 1988
1987	16,315	Camiñas, 1988
1989	5,935-7,568	Mas and García, 1990
1989	15,339	Camiñas et al., 1992
1990	35,637	Aguilar et al., 1995
1991	22,225-23,637	Aguilar et al., 1995
1991	22,880	Mas and Aguilar, 1992
1992	4,363-6,620	Aguilar et al., 1993
1993	1,953	Camiñas, 1996b
1994	5,364	Camiñas, 1996b
1995	11,673	Camiñas 1996b

Table 3. Number of loggerhead turtles caught per 1000 hooks (CPUE) and direct mortality percentage observed in 6 different drifting longline gear types as described in Camiñas et al. (2006). BFT: Blue fin tuna; BFTr Blue fin tuna with roller; SWA: Swordfish vessels with less than 12m in length; SWB: Swordfish vessels wit length higher than 12 m; ALB: albacore.

Gear type	CPUE (turtles x 1000 hooks)	Direct mortality rate
BFT	1,41	1,74%
BFTr	1,06	1,85%
SWA	0,69	1,6%
SWB	0,74	0,54%
SWBr	1,36	4,24%
ALB	1,18	1,41%

Bottom Trawl.

The impact of bottom trawl fisheries on loggerhead sea turtles stocks are uneven along the Spanish coast, since turtle bycatch reported is not related to fishing effort. For instance, little impact has been reported in the Balearic Islands (captures = 13, 95% CI = 5-21 turtles during 2001; Carreras et al., 2004b) although this is one of the major fishing gears operating in the area. In contrast, it has been proven to be the major source of mortality in the north Spanish Mediterranean, especially in the area of the Ebro river Delta, with 270 (95% CI = 134-406) turtles caught in one year (Álvarez de Quevedo et al., 2006). Differences in depth where the trawlers operate due to continental shelf width could be the reason of such differences in turtle bycatch (Álvarez de Quevedo et al., 2006). It is possible that the impact of this and other fisheries will be underestimated in the Spanish Mediterranean, since there is an important lack of integrated assessment, and most of the available information comes only from vessel logbooks and occasional reports at a regional level (Tomás et al., 2008b).

Trammel nets.

The trammel net used by Spanish fishermen is less than 2m high and several miles in length, and it settles on the bottom on the sea floor using a line of leads at the bottom and a line of floaters at the top. Hence, the net is a barrier to the movements of the prey, which become trapped in the external nets and cross the central net forming a bag preventing them to escape.

A study combining fishermen interviews and onboard observations showed that the lobster trammel nets are a significant threat for sea turtles in the Balearic Islands, even more than drifting longline fisheries (Carreras et al., 2004b). For instance, in 2001 captures by this gear (196, 95% CI = 123-269) were higher than the captures by longline fleet (102; 95% CI = 93-111 captures) during the same period. The trammel nets are settled for several hours and hence turtles trapped in those nets can not breathe, resulting in a direct mortality close to 100%. However, the importance of lobster trammel net captures in the Balearic Islands is uneven between islands, as CPUE is much higher in some of them due to gear modifications and variation in fishing techniques (Carreras et al., 2004b). A recent study carried out in the northern Spanish Mediterranean showed that the trammel was the third cause of turtle bycatch (total captures = 65, 95% CI = 35-95, for one year period between 2003-2004; Álvarez de Quevedo et al., 2006) after bottom trawling and longline.

Drift nets.

This type of gear has been, and still is, used in the Alboran Sea and in the area of the Gibraltrar Strait. Although total captures are not so important as in other fisheries (Camiñas, 2005), the impact of this gear has to be evaluated since it may affect loggerhead turtles either from Mediterranean and Atlantic stocks.

2.3.2.2. Intentional killing and exploitation

No intentional killing or exploitation has been detected on Spanish Mediterranean coasts, although it is known that occasional meat was produced in the past in southern Balearic Islands and in the Columbretes archipelago using turtles incidentally captured by fishing gear (Carreras and Tomás, unpublished data).

2.3.2.3. Other threats

Debris.

Marine pollution is considered one of the main anthropogenic threats affecting sea turtles (Hutchinson and Simonds, 1991), and particularly the loggerhead sea turtle due to its habitat and feeding behaviour (Lutcavage et al., 1997). Pollutants and solid debris amounts are increasing in the Mediterranean, as a consequence of the growing population on its coasts; and the Spanish Mediterranean is not an exception. For instance, trawling surveys in the bottoms of the Valencia Gulf (east Spain) showed high amounts of solid debris, dominated by plastics (Ciri León et al., 2006). In addition, aerial surveys performed in the same waters (Gómez de Segura et al., 2006) revealed high amounts of floating debris, mainly plastics, and sometimes forming large patches (J. Tomás, pers. obs.).

In the Spanish Mediterranean, loggerhead turtles feed mainly in the water column on jelly plankton and many other floating or slow moving prey species (see section 2.1.2). This low selective feeding strategy makes loggerhead turtles highly vulnerable to debris ingestion, since they may consider solid debris as potential prey while feeding in the water column and at the surface (Tomás et al., 2002b). Some studies on gut contents report the presence and occurrence of different types of debris, with plastic being the most frequent and abundant type swallowed by turtles (Tomás et al., 2002b; Revelles et al., 2007e). However, only one includes quantification of debris (Tomás et al., 2002b). This study reports a high frequency of occurrence of marine debris, and particularly anthropogenic debris, but a low volume and number of items in most of the analyzed turtles.

The most important physical and chemical effects of debris ingestions on sea turtles include digestive track blockage, damage in intestine by pointy objects, and dietary dilution (Hutchinson and Simmonds, 1991; McCauly and Bjorndal, 1999). Since debris ingestion may not be lethal at low ingestion levels, small amounts of debris can cause both blockage and damage of intestines. Concerning dietary dilution, Tomás et al. (2002b) found that the amount of debris ingested increased proportionally to the volume of the turtles. These authors suggested that knowing whether the proportional ingestion of debris to the size produces the same detrimental effect, may depend on the existence among turtles of differences in their ability to compensate dietary dilution by increasing intakes. Pelagic loggerheads may have this ability limited because of their higher diluted diet, based on low-nutritive organisms, such as jellyfish or salps (McCauley and Bjorndal, 1999). According to feeding data reported in the area, debris ingestion should be considered a serious problem causing dietary dilution in loggerhead turtles in the Spanish Mediterranean.

Several authors suggested that active debris ingestion occurs by mistake due to its similarity to prey species, such as jellyfish (e.g., Gramentz, 1988, Plotkin et al., 1993). This hypothesis assumes some discrimination in shape and colour by turtles. However, rather than confusion the high variety of debris found, and the presence of some debris highly different from any prey species reported, supports the hypothesis of low discrimination (particularly on small items) in the feeding behaviour of the loggerhead in the western Mediterranean, which makes them more vulnerable to the threats derived from human activities (Tomás et al., 2003b).

Boat strikes.

Tomás et al. (2003c) reported that boat strikes accounted for the 4% of turtles stranded in the Valencian community (Central Spanish Mediterranean) between 1994 and 2001. Bellido et al. (2006) reported 4.3% of turtles stranded in south Spain for the period 1994-2004 due to hits of different origin, including boat strikes. Despite the low impact reported, due to the development of marinas and the increasing of marine traffic, these percentages may increase in the future.

Pollutants.

A study included in Bellido et al. (2006) analyzed a sample of 21 loggerheads for marine pollutant and heavy metal concentrations. Although the authors recognized that sample size is not large, interesting results are revealed. They found important accumulation of cadmium. In addition, they found a high variety of organochlorines, showing higher concentrations of DDT and some isomers of the HCH (Hexachlorociclohexan).

There are some reports of turtles with considerable detrimental effects caused by tar or oil (Tomás et al., 2003c; Bellido et al., 2006). However, as boat strikes, the frequency of occurrence is minimum compared to other anthropogenic threats in the Spanish Mediterranean.

3. *Chelonia mydas*

3.1. Present distribution and abundance

3.1.1. Nesting sites

Nesting of this species has never been recorded on the Spanish Mediterranean coast.

3.1.2. Marine areas

Very little information exists about the green sea turtle (*Chelonia mydas*) in the Spanish coasts and waters. To our knowledge, only a few individuals have been reported stranded or incidentally captured in the Spanish Mediterranean coasts and waters (Raga and Salinas, 1990; Bertolero, 2003). Another four individuals are reported from the Atlantic coast of southern Spain (Bellido et al., 2006). The green turtles reported from east and northeast Spain (Raga and Salinas, 1990; Bertolero, 2003, respectively) are supposed to be of Mediterranean origin, according to the migratory patterns and stock distribution proposed for *C. caretta* in the western Mediterranean by Carreras et al. (2006a). However, it can not be discounted that they came from some Atlantic beaches.

3.2. Past distribution and abundance

Data not available.

3.3. Threats

Not applicable due to low occurrence.

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

Leatherback turtles have been reported in the Spanish Mediterranean from a few decades ago (Pascual, 1985; Pérez et al., 1994). It is the second species in number of standings (references in Camiñas, 2005), although its numbers are quite far from the records for the loggerhead sea turtle. A global study considering stranding records of leatherbacks in the whole Mediterranean showed a west-east gradient with most records in the western basin that fit with a possible Atlantic origin of the individuals (Casale et al., 2003), although differences in monitoring effort among countries might bias the results.

Sporadic strandings have been reported on different parts of the Spanish Mediterranean coast (Camiñas, 2002; Tomás et al., 2003a). Seasonal strandings of this species have been reported on both sides of the Gibraltar Strait , in the Atlantic side from the Gulf of Cadis (Camiñas and Valeiras, 2003 and references therein) and in the Mediterranean side from the Spanish territory of Ceuta (northern African coast, García and Chamorro, 1984), including a massive stranding of 11 individuals in a small area in a short period. These authors reported that strandings coincide with the season of massive concentrations in “blooms” of jellyfish.

4.2. Past distribution and abundance

Data not available.

4.3. Threats

Data not available.

5. Other species

Before the 21st century there is only a single report of a Kemp’s ridley sea turtle

(*Lepidochelys kempii*) in the Mediterranean Sea. The whole Mediterranean, therefore, seems to be outside the range for this species, and its presence in this sea can be regarded as sporadic or incidental, despite the relative high number of sightings and strandings reported in the eastern Atlantic (references in Tomás and Raga, 2007; Witt et al., 2007). Since 2001, the number of *L. kempii* sightings in Mediterranean and adjoining Atlantic waters has increased (Tomás and Raga, 2007). To our knowledge, a total of 3 occurrences of *L. kempii* have been reported in the Spanish Mediterranean (2) or near the Gibraltar Strait (1). Of the first two turtles, one appeared in 2001, incidentally caught in coastal waters of Alicante province (east Spain; Tomás et al., 2003d) and the second in 2006, caught from land with a rod close to Valencia harbour (east Spain; Tomás and Raga, 2007). The third specimen was reported at the Cadiz Gulf (south Spain; Carreras et al., 2006b). All of these reported individuals were of juvenile size. To date, the only individual genetically analyzed was the one captured in 2001 in Valencia. The analysis of mtDNA revealed a perfect match with haplotype D typical of the species. Genetic analyses are in progress to confirm the specific identification of the other reports and to provide some insight about the origin of the specimens. This evidence altogether affords a new evaluation of the distribution of this species in the Mediterranean Sea. The reports of this species in the Mediterranean can be explained by current patterns, as for the Atlantic loggerhead turtles (see section 2.1.2). It is likely that new reports will be found of the species in the area, in the near future. According to the global conservation status of the species, and considering all these reports, the Kemp's ridley should be taken into account in all the conservation measures adopted for sea turtle conservation in the western Mediterranean (Tomás and Raga, 2007).

6. Conservation status

The loggerhead turtle is included in the National List of Threatened Species (*Catálogo Nacional de Especies Amenazadas*) as '*of special interest*' (Real Decreto 439/1990 de 30 de marzo; BOE 1982). Based on this decree, this species is protected throughout Spain's territory and seas (López-Jurado and Andreu, 1997, in Camiñas, 2002). The same decree includes other sea turtle species, such as the leatherback sea turtle, the green turtle, the hawksbill and the Kemp's ridley.

Other national laws that include the protection of the loggerhead and other sea turtles species are the law 4/1989 for the Conservation of Nature Areas, Fauna and Flora, and the decree Real Decreto 1997/1995 for the protection of Biodiversity through Habitat Conservation (Camiñas, 2005).

The information reported in this chapter suggests that the Spanish Mediterranean is inhabited, or visited, by thousands of loggerhead sea turtles every year. However, it appears that the number of incidental captures by Spanish, and foreign, fisheries in these waters is of a similar order of magnitude. However, the scarce information on past abundance and distribution, and the reduced number of standardized studies on turtle by-catch, make difficult to establish trends and a precise conservation status of the species in the area.

7. Conservation needs

Considering the status of marine turtles in the Spanish Mediterranean, and the impact of different threats described above, and considering also the recent nesting reports, as well as the general recommendations described in the Action Plan for the Conservation of Mediterranean sea turtles (Mediterranean Action Plan, 1998), a proposed set of needs necessary for sea turtle conservation in this area of the Mediterranean is listed below in a priority order (based on authors' insight and feelings).

a) Research and monitoring

- We consider as essential a standardized and integrated long term assessment of fisheries' impacts on sea turtles in the area, especially of those underrepresented in the scientific literature such as trawling or artisanal

fisheries. This assessment should include the precise numbers of captures, direct mortality and post-release mortality, as well as additional data on the biology of the species that provide insights into the mechanisms that lead to the interaction with the fisheries.
- At the same level, we call for the need for long term assessment and estimation of trends in abundance and distribution of sea turtles throughout Spanish Mediterranean waters.
- It is essential also for the assessment of detailed population parameters of early and late juvenile stages of the species in the area, considering as different units the turtles originating in the Atlantic and the ones originating in the Mediterranean.
- We also recommend beach surveys for nesting assessment, linked to the development of awareness campaigns on the topic, addressed to all stakeholders and tourists.

<u>b) Protection and management of the species and its habitats:</u>
- It is necessary for a significant reduction of impact of the different fisheries in the area through the reduction of captures and mortality by using mitigation measures and adequate fishing regulations.
- We found also important the evaluation and reinforcement of measures for protection and management of key Marine Protected Areas (MPA) according to sea turtle conservation. An example of this kind of evaluation can be found in Gómez de Segura et al. (2003). These authors estimated the absolute abundance and distribution of loggerhead sea turtle in the waters inside and outside the MPA of Columbretes Islands (east Spain) among different seasons, since the MPA is surrounded by a heavy trawl fishing area. They found high turtle density throughout the area studied, without differences between the inside and outside of the MPA. Hence, they concluded that the zone influenced by the MPA is higher than expected and that any plan of expansion of the MPA would benefit loggerhead turtle stocks in the area.
- We consider extremely urgent the adoption of measures for the reduction of pollutants and litter spills at sea. A greater control of both land-based and sea-based litter spills, plus cleaning measures of marine debris, particularly of plastic bags, must be intensive and generalized throughout the Spanish Mediterranean.

<u>c) Public awareness</u>
Awareness campaigns on the species, its biology and impact of anthropogenic threats should be undertaken and maintained in the long term with fishermen associations, marinas, the tourist sector, schools and the general public.

<u>d) Coordination</u>
We believe that the improvement of stranding networks and the coordination between them along the Spanish Mediterranean coast will put more exposure on the biology and the impact of the different threats suffered by the species in this area.
However, due to the needs of research and monitoring, conservation measures must be linked to the promotion, reinforcement and economic support of research activities. In addition, these measures should be flexible to new advances in the knowledge of the biology of these species in Spanish waters in the near future. Finally, due to the similarity of results among studies performed in the area (e.g. Revelles et al., 2007b; Eckert et al., 2008), it seems necessary for more collaborative and integrated research at a regional level. None the less, some specific measures not mentioned here could also be locally necessary.

8. Miscellaneous

<u>Sea turtles as communities</u>

Few studies have been undertaken on loggerhead parasitology, and most of them are restricted to faunistics (Bjorndal, 2003). To our knowledge, the single previous study on community structure of sea turtle parasites in the western Mediterranean revealed depauperated parasite communities, with low species richness, and limited exchange between individual turtles or between the species and other marine vertebrates (Aznar et al., 1998).

As a continuation of Aznar et al. (1998), a complete study on the parasites and epibionts of loggerhead sea turtles in the Spanish Mediterranean has been carried out recently (Badillo, 2007). This is the first complete study on epibiont and parasite communities in a large sample of loggerhead sea turtles in Spain and in the western Mediterranean basin. This study identifies 39 different taxa of epibionts, some of them as new records either for the Mediterranean and/or for sea turtles, including the proposal of a possible new species of parasite copepod of the genus *Balaenophilus*. Concerning parasites, this study records 10 helminth species, all of them obtained from the digestive tract and most of them specific from sea turtles, with the exception of digenids of Hemiuroidea spp and the nemathods of *Anisakis* sp Type I, both considered as accidental. This study also found that parasite communities remain constant in stocks of loggerhead turtles with different diets.

Another interesting result of this study was that *Balaenophilus* spp. could be considered as possible ectoparasites, based on gut contents of copepods of *this genus* (consisting in keratin and flat tissue similar to turtle epidermis) and analyses on histopathology on the turtles (Badillo et al., 2007).

There is also a similar scarcity of literature about epibiont flora on sea turtles. Báez et al. (2002) compiled the scant information with their own records to perform a check-list of epizootic algae species in Mediterranean loggerhead sea turtles. This list includes 7 different taxa, two of them being new algae records for *C. caretta*. In a previous study, Báez et al. (2001) reported the first record of the algae, *Polysiphonia carettia*, on the carapace of loggerhead turtles captured in the Mediterranean. These authors investigated the possibility of using *P. carettia* as a biological marker to distinguish the loggerheads that come from the Atlantic Ocean to those coming from the eastern Mediterranean Sea. Further research on this topic is in progress.

Natural threats and predation

No direct mortality has been detected by natural threats in the Spanish Mediterranean, but heavy colonization by parasites or epibionts can affect their immune system, making them more vulnerable to other threats. Turtles can be colonized by massive fixation of Balanidae larvae when they meet with blooms of these species. When these crustaceans grow they can affect turtles, either preventing the normal swimming, when covering the surface of the flippers, obstructing mouth, eyes or snout, or producing skin problems and secondary infections. These phenomena were reported in 2001 in south and southwest Spain (Bellido et al., 2006 and references therein).

In the bibliographic review undertaken for this chapter only one report of natural predation on sea turtles at sea was found in the area. Predation of loggerhead turtles by different species of sharks has been reported off the Balearic Islands (Morey et al., 2003). This type of predation was also observed directly in aerial surveys in waters off Alicante province, central Spanish Mediterranean (J. Tomás, pers. obs.).

Sex ratio

A sample of 104 loggerhead turtles, most of them juveniles, from the north western Mediterranean (Catalonia and Valencia regions) were sexed by gonad examination, and yielded 53.8% of females. This value was not significantly different from other Mediterranean areas (Casale et al., 2006).

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

In recent decades several research groups (most of them from public institutions) have increased their research on sea turtles. Some of the most important groups are placed at the University of Barcelona, the University of Valencia, the Research Institute *Estación Biológica de Doñana* (from the Council of Scientific Research, CSIC, of the Spanish Government) and the Centro Oceanográfico de Fuengirola, Málaga (Spanish Institute of Oceanography, IEO). Some research on sea turtles is also undertaken in other Spanish universities (Baleares, Murcia, etc.). In the east of Spain, the University of Valencia collaborates with public (local government) and private rescue centres with important tasks on rehabilitation of injured sea turtles and education. All these institutions are involved in education and conservation tasks with the support of the Spanish ministry of Environment and local and regional governments.

9.2. Private

The Spanish Herpetological Society (AHE) has increased its interest in sea turtle species in recent decades, with an important role on the standardization and coordination of sea turtle tagging activities together with the Spanish Ministry of Environment.

According to Lens et al. (2006), several stranding networks and organizations collect information on strandings along the Spanish coasts. Included here are the organizations that collect information on the Spanish Mediterranean coast and southern Spain: CRAM Foundation in Cataluña (North-East Spain), CREMA (Aula del Mar) in Andalucía (South Spain), GRAMPUS – SECEM and OCEANIDE in the Gulf of Cádiz (South Spain), PROMAR in the coasts of Almería (South Spain), GRAMM in the coast of Melilla (Noth Africa), CERCAM in the Balearic Archipelago MARINELAND Foundation also in the Balearic Islands, and The Cavanilles Insitute of the University of Valencia in the coasts of Valencia Community (as mentioned before). Most of these organizations collect information either for cetacean or sea turtle strandings, and some of them are currently providing important information on pathologies and veterinary treatment on by-caught sea turtles (e.g., Alegre et al., 2006). Most of these stranding networks receive public (local government) support and funding.

The work of the NGO Spanish Cetacean Society (GTTM-SEC) should also be noted. The SEC was leading the project LIFE-Nature/E/8610: "*Conservation of cetaceans and turtles in Murcia and Andalusia*" that started in 2002. This project has produced valuable information on biology and the conservation status of loggerhead sea turtle stocks inhabiting the waster of the south and south-east Spanish Mediterranean, Alboran Sea and the Gibraltar Strait. This project also included important activities of education and awareness for this species of sea turtle.

10. Resources available about marine turtle research and conservation

To the authors' knowledge, there are no specific publications, newsletters or web pages exclusively dedicated to sea turtle biology and conservation in Spain. However, the increase of interest into these species results in the increase of publications of papers about this topic in scientific journals edited in Spain, with (e.g., Scientia Marina) or without impact factor (Revista Española de Herpetología). Most of the institutions quoted in the previous section (9), such as CRAM Foundation (www.cram.org), the SEC (www.cetaceos.com) or Aula del Mar (www.auladelmar.info), include information on sea turtles in their respective web pages.

The present chapter aims to quote the most important works on Mediterranean sea turtle biology and conservation produced in Spain, and all of them are listed in the next section. When possible, it has been given preference to peer reviewed published work, but a lot of work on these species has been presented in national and international symposia on sea turtles and marine conservation. Authors encourage the reader to look in the abstract or proceedings books of these conferences for further information.

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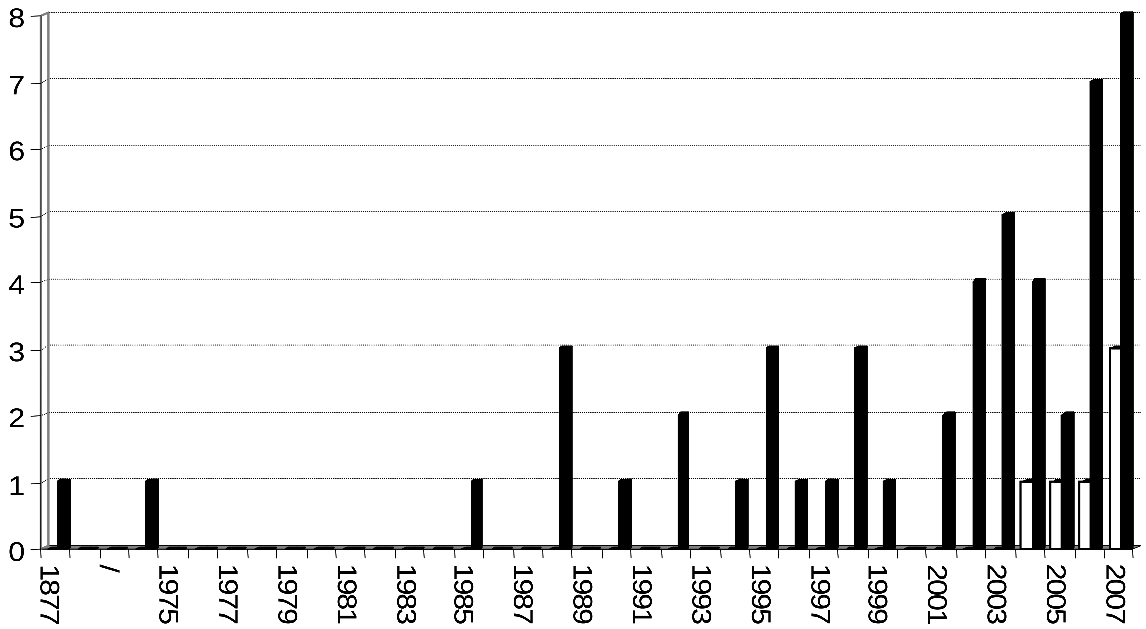

Figure 1. Annual number of PhD theses (white bars) and research papers (black bars) on sea turtle biology and conservation produced by Spanish researchers, according to our bibliographic research.

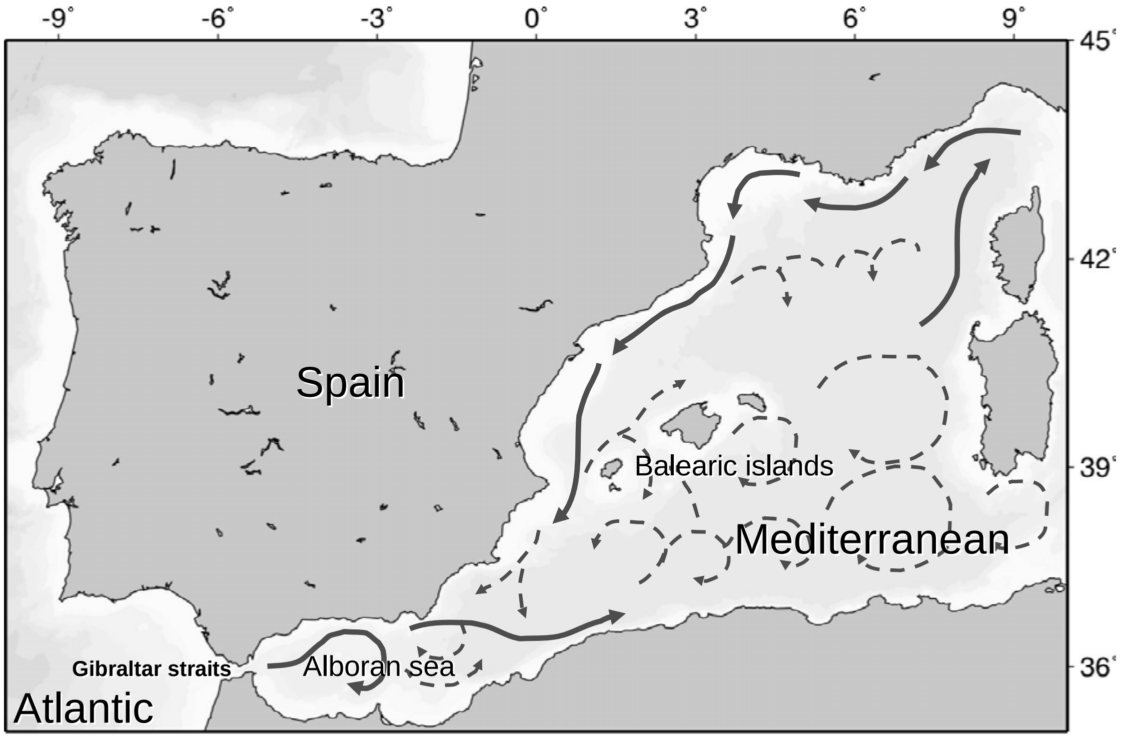

Figure 2. Map of the western Mediterranean showing the main surface currents according Millot (1987) and Millot (1999). Map source: Seaturtle.org/maptool.

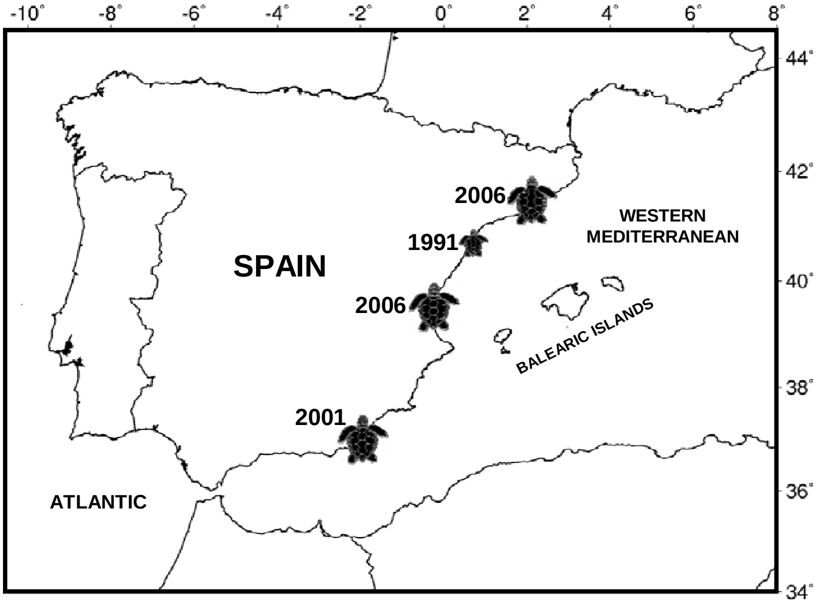

Figure 3. Location and year of the most recent reported nesting events of loggerhead sea turtles in Spain (modified from Tomas et al., 2008a, see text for details). Note that the small size of the 1991 record represents the finding of a dead hatchling, while the other three records are confirmed successful nests. Map source: Seaturtle.org/maptool.

Figure 4. Loggerhead nesting event in Valencia province (east Spain) in 2006: detection of the clutch thanks to the sand removal by heavy weaving after a storm. Note the eggs on the sand. (Photo: J. Tomas).

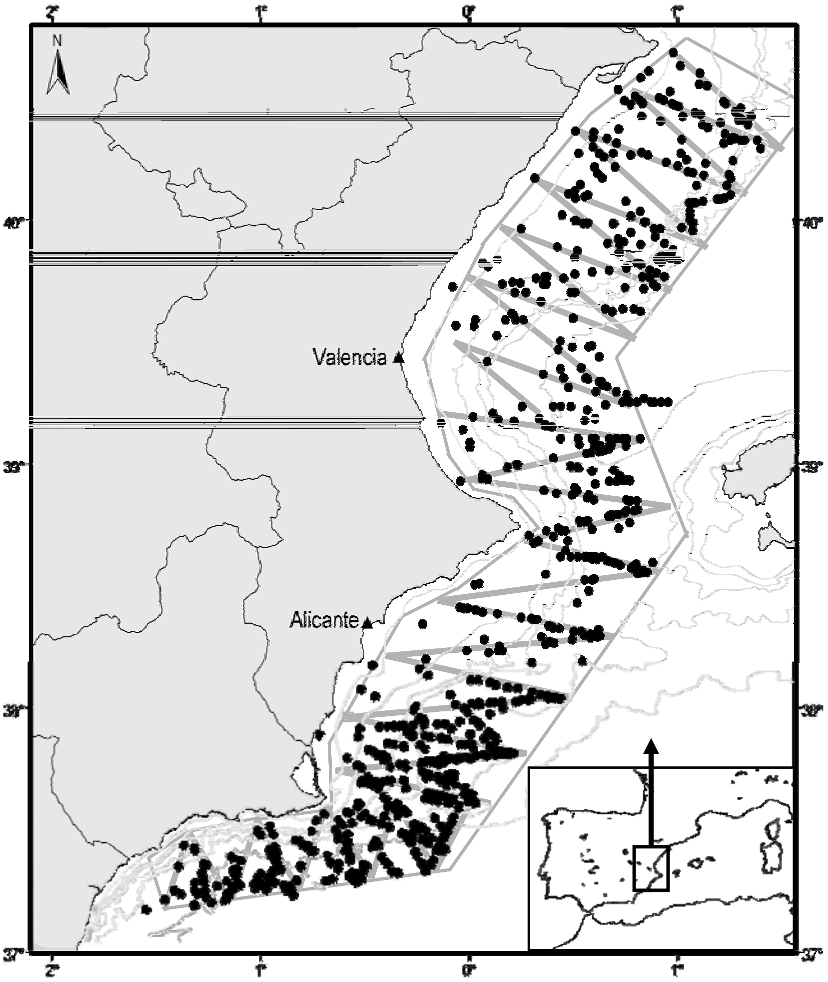

Figure 5.
Area surveyed and loggerhead turtle sightings (n = 770) recorded in aerial surveys during the period 2001-2003, modified from Gómez de Segura et al. (2006).

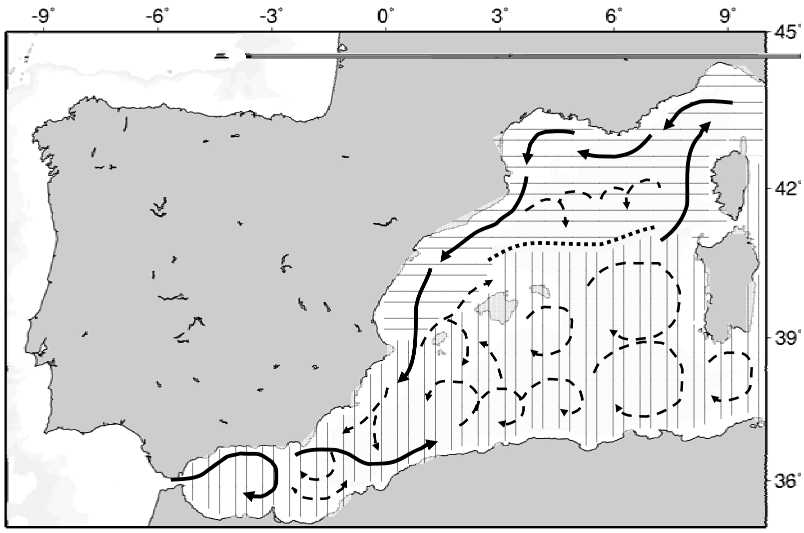

Figure 6. Distribution of juvenile loggerhead turtles in the western Mediterranean. Horizontal stripped area: feeding grounds inhabited mainly by turtles born in Mediterranean nesting beaches; vertical striped area: feeding grounds inhabited mainly by turtles of Atlantic origin. Solid arrows represent permanent currents while discontinuous arrows are temporal eddies (Millot, 1999). Dotted lines represents the front between the two hydrographic systems. Map: Seaturtle.org/maptool.

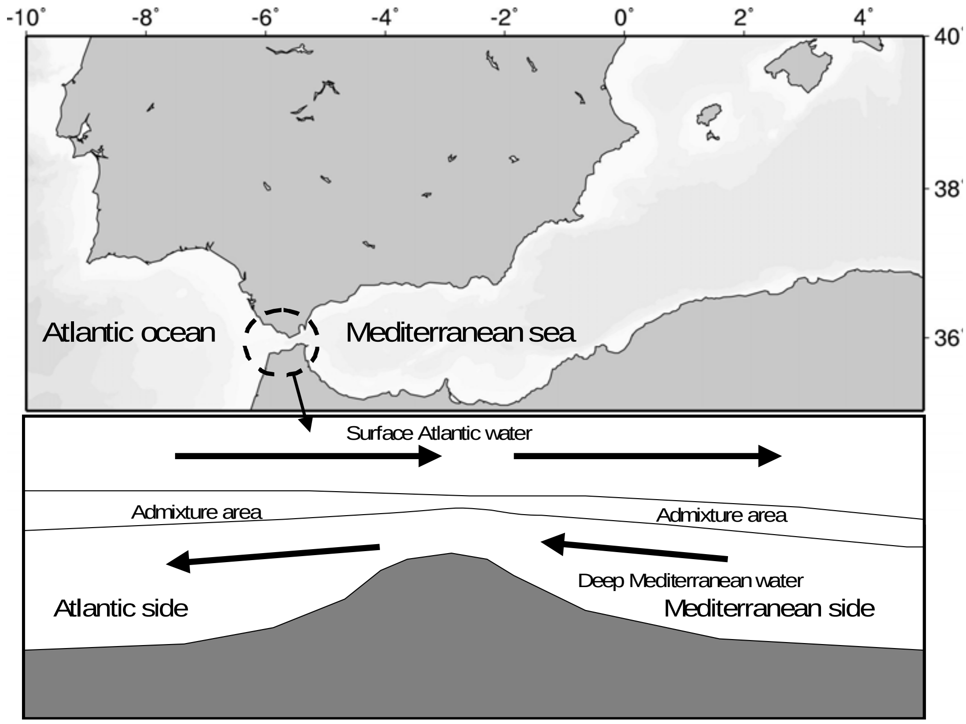

Figure 7. Hydrographyc transversal structure of the Gibraltar Strait at its narrowest point (dashed circle on map) with superficial entering water and deep outcoming water.

Figure 8. Some evidence of threats affecting sea turtles in the Spanish Mediterranean: longline fisheries (top-left), effect of a longline hook and line on the gut of a loggerhead turtle (top-right), boat strike on a loggerhead turtle (bottom-left), and a leatherback turtle stranded with clear evidence (see right flipper) of entanglement with fishing gear (bottom-right). (Photos: J. Tomas).

SYRIA

ALan F. REES[1], Adib SAAD[2], Mohammad JONY[3]

[1]ARCHELON, the Sea Turtle Protection Society of Greece, Solomou 57, GR104-32 Athens, Greece (e-mail: arees@seaturtle.org), [2]Marine Sciences Laboratory, fac. Agr. Tishreen University, P.O. Box 1408 Latakia, Syria (e-mail: adibsaad@scs-net.org), [3]Fisheries Department, Directorate of Agriculture, P.O. Box 4 Latakia, Syria (e-mail: mohammadjony@gmail.com)

1. General remarks

Syria has a coastline approximately 183 km in length and is comprised of rocky areas surrounding sandy beaches to the north of Latakia (approximately 60 km) with longer beaches interspersed with rocky areas to the south (approximately 120 km).

The presence of loggerhead and green sea turtles, off the coast of Syria, was first reported by Gruvel (1931) but nesting on the country's beaches was not indicated. The next turtle information to come out of Syria resulted from a rapid assessment survey in 1991 that identified low-level nesting concentrated on a beach south of Latakia City (Kasparek, 1995). Local researchers noted incidental turtle captures in beach seines (M. Ali and A. Saad, pers. observ. 2003) and also observed turtles stranded along the coast (Saad et al., 2003). In 2004 a more temporally extensive coastal survey was undertaken, primarily to better identify Syria's actual and potential nesting populations (Rees et al., 2008a). The location and names of the beaches surveyed in 2004 are shown in Fig. 1.

Beach surveys subsequent to 2004 have generally been undertaken to a weekly, or longer, schedule, except for the nesting beach at Latakia, which has received more concerted efforts. The long sandy coast south of Tartous remains incompletely surveyed but investigations indicate that this coastline is not appropriate, morphologically, for nesting as there is a long rocky outcrop at the front of the sandy beach that deters turtle from reaching the sandy section. The results presented in this chapter therefore detail, to the best of our knowledge, the population status of sea turtles in Syria from foundation work that will be built upon in the coming years.

2. *Caretta caretta*

2.1. Present distribution and abundance

Since loggerhead nesting was re-confirmed in 2004, repeated surveys have indicated that diffuse loggerhead nesting (*sensu* Margaritoulis, 2000) occurs along the entire sandy coast of Syria. No especially dense aggregations occur. Loggerheads are also known to occur year-round in coastal waters of the northern part of Syria at probably regionally-significant levels.

2.1.1. Nesting sites

Sandy beaches, hence potential nesting sites, from north to south are listed in Table 1. Initial surveys proved that Latakia beach is, nationally, the most important nesting site in terms of nest numbers. All data are preliminary and may be refined as further surveys reveal more accurate assessments of nesting levels.

2.1.2. Marine areas

Loggerhead turtles are present year-round in Syrian coastal waters. Stranding surveys along the northern part of the coast indicate that small pelagic juveniles are rare whereas adult and near adult sized turtles are more frequently encountered but still not common. There is possible temporal variation in size of turtles in Syria's coastal waters as the smaller turtles were recorded stranding in colder months (Jony and Rees, unpublished data)

Larger size-classed turtles have been caught in beach seines off the beach south of Latakia during the spring (M. Ali and Saad, unpublished data) indicating the area may be an important foraging ground prior to the summer nesting. Additionally, adult sized loggerhead turtles are frequently observed during the summer in the fishing ports of Al Azhari and Jablah (Fig. 1) where they eat on the fish parts discarded from trawl fishing boats Fig. 2).

Further indication of Syria's international importance as a marine foraging habitat for loggerheads is that two turtles from Cyprus, tracked by satellite, migrated to and remained in Syrian coastal waters after they had finished nesting (Broderick et al., 2007).

Table 1. Potential and actual nesting beaches for loggerhead turtles in Syria. Nest numbers from the period 2004 (Rees, Saad, Jony, unpublished) and 2005-2009 (Saad, unpublished).

Beach Name	Location	Approximate Beach Length (km)	Number of Nests Mean (range; N yrs)
Ras el Basit	35°51'55"N, 35°51'55"E	8.5	1 (0-2; 5)
Um Toyour	35°45'08"N, 35°50'43"E	2.5	0 (0-0; 1)
Wadi Kandil	35°43'20"N, 35°49'57"E	2	2 (0-4; 6)
Latakia	35°28'00"N, 35°51'45"E	12	11 (1-22; 6)
Banias (area)	35°12'40"N, 35°57'04"E	3	2 (0-4; 6)
Tartous (and south)	34°43'45"N, 35°56'10"E	22	1 (1-1; 1)*

* Although the coast is mainly sandy, a majority of the beach has a rocky shelf at the edge of the sea, rendering it unsuitable for nesting.

2.2. Past distribution and abundance

Due to lack of certainty as to which species of turtle were referred to, all historical information has been grouped in section 3.2 for green turtles.

2.3. Threats

For a description of threats occurring in Syria, see section 3.3.

3. *Chelonia mydas*

3.1. Present distribution and abundance

Green turtles have been shown to be the most numerous nesting species within the country with five nesting areas identified and one of these areas is of regional importance. Syria's coastal waters also host a sub-adult and juvenile foraging population that may be of regional importance.

3.1.1. Nesting sites

Since green turtle nesting was discovered in 2004, repeated surveys have indicated that Latakia beach hosts a regionally important rookery. This, together with the presence of lower frequency nesting at a few other beaches places Syria as the third most important country, after Turkey and Cyprus, for green turtle nesting in the Mediterranean.

Sandy beaches, hence potential nesting sites, from north to south are listed in Table 2. It can be seen that Latakia beach is nationally most important for green turtle nesting being one of the top ten nesting sites for green turtles in the Mediterranean (cf. Kasparek et al., 2001). A maximum of more than 10 nests per season has also been recorded at three other beaches.

3.1.2. Marine areas

Strandings and direct observations also indicate that the coastal waters of northern Syria host regionally significant year-round foraging grounds for a range of post-pelagic size classes of green turtles.

Green turtle strandings surveys have been undertaken along the northern coast and briefly along the southern coast in 2004

(Jony and Rees, pers. observ.). The strandings indicate that green turtles are present year-round in Syrian coastal waters and range from small juvenile up to adult sized individuals. Juvenile green turtles have been captured in beach seines during February off Latakia beach and have been seen in some density in the shallow waters near Berj Eslam and Ibn Hani / Côte D'azur. It is believed that the shallow coastal region to the north of Latakia is an important foraging area for green turtles in Syria.

Stranding results from Summer 2004 and winter 2004/5 indicate a large coastal population of green turtles that may display seasonality in the abundance of different size classes with the smaller sized turtles being most abundant mainly during the winter months (Saad et al., 2006; Jony and Rees, unpublished data).

Furthermore, there are strong indications that Syrian waters are important for the migratory pathway of green turtles from Turkey, as post-nesting migrations have been tracked by satellite from Turkey, in the north, through Syrian coastal waters to Lebanon, in the south where the turtles set up residency for an extended period (Godley, unpublished data). The transmitters did not last long enough to identify if this was an overwintering area or only a stopping off point en route to another location.

Telemetry of a nesting green turtle from Syria did not produce any internesting locations as the turtle had completed her last nest of the season and immediately headed south, travelling through sovereign waters of several states before the transmitter failed at the Egypt / Libya border (Rees et al., 2008b).

Table 2. Potential and actual nesting beaches for green turtles in Syria. Nest numbers from the period 2004 (Rees, Saad, Jony, unpublished) and 2005-2009 (Saad, unpublished).

Beach Name	Location	Approximate Beach Length (km)	Number of Nests Mean (range; N yrs)
Ras el Basit	35°51'55"N, 35°51'55"E	8.5	4 (0-11; 5)
Um Toyour	35°45'08"N, 35°50'43"E	2.5	3 (0-7; 3)
Wadi Kandil	35°43'20"N, 35°49'57"E	2	7 (1-13; 6)
Latakia	35°28'00"N, 35°51'45"E	12	140 (18-273; 6)
Banias (area)	35°12'40"N, 35°57'04"E	3	9 (1-15; 6)
Tartous (and south)	34°43'45"N, 35°56'10"E	22	0 (0-0; 1)

3.2. Past distribution and abundance

Fishermen and local residents have communicated that in the past they believe there were more turtles nesting on Syrian beaches and on beaches where now almost no nesting occurs e.g. Ras el Basit and Wadi Kandil. This includes areas of beach south of Tartous that are now unsuitable for nesting due to the presence of a rocky shelf at the beach front. However, some fishermen state that they are now encountering more turtles at sea than they were 10 years ago.

3.3. Threats

3.3.1. Terrestrial Habitats

3.3.1.1. Coastal development

Coastal development, especially for tourism, is limited in Syria and therefore the country avoids the problems that face the nesting turtles in some areas of Greece, Turkey and Cyprus. Some of the northern beaches, e.g. Ras el Basit (Fig. 3), have camping grounds, small hotels and chalets established behind the beach but others places such as the beach south of Latakia and the stretch of coast south or Tartous are relatively free from any development. The main nesting beach at Latakia is relatively undeveloped. Two areas of the beach are used as military firing ranges and most of the rest of the beach is backed by dunes and cultivated land.

In some areas (e.g. Latakia beach) farmers use the beach as a thoroughfare for driving their tractors. The passage of heavy vehicles kills nests that are crushed beneath the tyres and the deep ruts that are left in the beach trap hatchlings on their way to the sea (Jony and Rees, 2008).

The coast of Syria suffers greatly from the presence of sea-borne plastic and other waste. The preponderance of litter was noted during the rapid assessment survey in 1991 (Kasparek, 1995) and again during the more extended surveying of 2004 (Rees, pers. observ.; Fig. 4). This waste accumulates in some areas in such quantities as to cause hindrance to turtles wishing to come ashore to nest and subsequently for the emerged hatchlings struggling to reach the sea.

Light pollution is a serious problem along the southern part of Latakia beach. Many hatchlings are misorientated into the dunes and field behind the beach due to the high-levels of ambient light, in part caused by the illuminated main road that passes along the coast some distance away from the sea.

There is also pressure from the Ministry of Tourism to develop certain coastal areas, including Latakia Beach.

3.3.1.2. Beach restructuring

Some sand mining occurs in limited locations on Latakia beach, but there are no armouring or nourishment actions undertaken on the nesting beaches.

3.3.1.3. Non human predation

Egg and hatchling predation is a major concern at Latakia beach where many nests are exhumed by dogs and other canids and the eggs eaten. The nest spoils are then available to be depredated by smaller mammals and birds etc. A significant number of hatchlings, and possibly nests, are predated by ghost crabs (*Ocypode cursor*) which are abundant on the nesting beaches, probably sustained by the large amounts of rubbish that is continuously found there (Simms et al., 2002; Jony and Rees, 2008).

3.3.1.4. Human exploitation

No exploitation of turtle eggs is known in Syria (contrary to the observations of Kasparek, 1995) and there is no current commercial enterprise occurring for nesting turtle meat. However, deliberate, malicious, injury and killing of turtles while on or near the nesting beach has been observed on several occasions (three individuals during 2004 and four during 2006) with no consumption or other utilisation of the turtle taking place. Other turtle strandings have been found with their carapaces removed, having been collected as ornaments and curios (Jony and Rees, 2008).

One pertinent story, told by an old fisherman and confirmed by others, was that in the late 1950s and early 1960s one of Syria’s nobility would meet with the local fishermen and ask them to catch for him all the adult turtles nesting on the beach and take them to Latakia and place them in a holding pool, near the city port. From there, the turtles were gathered and shipped to Egypt every two weeks. The old fisherman said he and his friend did this for 3 years and were paid £1 (Syrian) for every turtle. He added that when delivering his turtles he saw many others in the holding pools (Communicated to M. Jony, 2007). It seems that at least for several years in the last century, there was high-level directed take of mature sea turtles from the nesting beaches fuelled by international demand for turtle meat.

3.3.1.5. Other threats

Storm waves during the summer months inundate a number of nests laid close to the sea, to the detriment of their hatching success. No other significant threats have been noted.

3.3.2 Marine Habitats

3.3.2.1 Incidental catch

In 2004, extensive surveying of fishermen at all coastal communities and ports along the northern coast of Syria was undertaken to assess their attitudes towards sea turtles and obtain information on fisheries interactions and hence deduce at-sea turtle population levels (Jony and Rees,

2009) and has since extended to cover the whole Syrian coast.

The interviews with fishermen indicated that sea turtles are well known throughout the area. Specific gear types and catch rate have not been reported but strong interaction with fisheries was reported at half the surveyed locations.

Additionally, as already mentioned, juvenile green turtles have been captured in beach seines during February off Latakia beach, with up to nine individuals getting caught in a single setting of a single net. Whilst under observation by researchers, all these turtles were returned to the sea unharmed by the fishermen, and hence if exploitation is not occurring, fishing using beach seines would not severely impact on Syria's turtle population.

It is thought that drift-net fishing taking place further from shore has a large impact on sea turtle populations through death by incidental capture and may be the reason for large numbers of dead stranded turtles that show no sign of injuries.

3.3.2.2. Intentional killing and exploitation

The previously mentioned survey found that green turtles are sometimes eaten if they have been captured by fishermen. Turtle blood is considered by some to be a cure for cancer and meat is an acceptable replacement for that of domesticated animals. Other turtles are deliberately injured and then left at sea as this is believed to make turtles leave the area. Some fishermen expressed that they value a kilo of fish over the lives of many turtles.

Additionally, stuffed turtles and preserved juvenile turtle carapaces (loggerhead and green), presumably of Syrian origin, are available in small quantities, for purchase in larger cities, as witnessed in Latakia and Damascus.

At least on one occasion, a juvenile green turtle has been captured and hung from the side of a tourist boat near Ibn Hani as an attraction for tourists (Fig. 5).

3.3.2.3. Other threats

The noted green turtle foraging area at Berj Eslam and Ibn Hani / Côte D'azur (Jony and Rees, pers. observ.) is unique in Syria as there is a large luxury hotel built on coastal land and the more affluent tourists to the area are able to hire jet skis and power boats to speed around in the sea. These speeding sea-goers must be having a negative impact on the foraging turtle population from direct impact with the individual animals and through general disturbance to the marine environment. This area also abuts onto the already established marine protected area of Ibn Hani into which numerous high-speed water vehicles from the nearby tourist facilities actively stray.

Explosions at sea, suggesting dynamite fishing, were regularly heard during the morning beach surveys in 2006 (Saad, unpublished data). Although this is illegal, enforcement of the law is difficult.

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

Leatherback turtles are infrequently encountered in Syria. The few leatherbacks that have been caught or sighted have been observed during the summer months and have been reported by fishermen from the port at Jablah. See Rees et al. (2004) for the first published record of a leatherback in Syrian waters.

4.2. Past distribution and abundance

Data not available.

4.3. Threats

4.3.1. Incidental catch

Fishing with trammel nets has been reported to be one source of incidental capture for leatherbacks (Rees et al., 2004), however, due to the apparently low-level presence of these turtles in Syria and the Eastern Mediterranean their incidental captures are rare and are not likely to have a significant negative impact on any breeding population.

4.3.2. Intentional killing and exploitation

Intentional killing may occur in Syria as the one leatherback known to be caught in recent years was brought to port to be exhibited to other fishermen with a plan to kill it, but the local port authorities insisted on its release back to the sea. No regular commercial exploitation of leatherbacks occurs due to the infrequency of captures.

4.3.3. Other threats

Marine threats, other than incidental capture in fishing gear, are possible at a low level, due to lack of animals, and are not quantified.

5. Other species

No other species of sea turtle have been recorded in Syria.

6. Conservation status

The following international conventions have been adopted by the Syrian government:

- The Convention on International Trade in Endangered Species (CITES) – 2003;
- The Convention on the Conservation of Migratory Species of Wild Animals (CMS, Bonn Convention) – 2003
- The Barcelona Convention – 1978 – in which Syria is a contracting party to UNEP/MAP through which an Action Plan for the protection of Marine Turtles has been elaborated.

There are currently no specific national laws to protect marine turtles in Syria, however they are included in general law 30 (1964) to protect aquatic life and general law 50 (2002) to protect the environment.

Field work for sea turtle research and conservation includes continued monitoring of Latakia beach to provide an estimate of nesting population levels and attempts to protect nests from predation using metal screens are underway.

Systematic surveys to record stranded turtles are being undertaken along the whole of the coast.

Nesting turtles and those caught and reported to local researchers are being tagged in order to obtain information on life-history traits of Syria's turtle populations.

Coast guards have been contacted and encouraged to advise fishermen not to catch sea turtles and those turtles that are incidentally captured should be released and that no nets should be set near the coast during nesting season which would prevent turtles reaching the beach.

Establishment of a protected area at Latakia is being actively sought to maintain and improve the conditions at the nesting beach and offshore waters. However it is facing strong opposition from certain sectors such as the Ministry for Tourism.

Existing public awareness actions include: Promotional TV spots and in national and Arabic environmental magazines declaring collective responsibility to protect sea turtles. In June 2007 a workshop was held by the High Institute for Marine Research and The General Establishment of Fisheries to promote the conservation of sea turtles.

7. Conservation needs

<u>Education, training and awareness activities for fishermen and coastal communities</u>

This are needed in order to reduce deliberate and accidental death and injury to captured turtles.

Sea turtles are affected directly and indirectly by fishing activity. It is important that efforts are made in the area to eliminate the use of dynamite. The most effective course of action from a sea turtle conservation perspective would be to ban fishing in the near-shore zone, especially during the nesting season. However, as many families in the area are dependent on fishing for their income, this would be difficult to enforce without financial compensation. Alternatively a comprehensive educational programme should be designed *and enacted* to outline handling techniques for turtles caught in nets as by-catch. This could be accompanied by an education programme for fishermen, which would encourage them to discuss and explore the concept of an ecologically healthy and diverse ecosystem. The importance of sea turtles within this system would be stressed. With the recently published Arabic version of the Sea Turtle Handling Guide for Fishermen by RAC/SPA there is enormous potential for developing such a programme.

Monitoring and research programmes

This are needed to accurately assess population levels and detect possible trends and changes.

More structured and systematic monitoring of Latakia beach for nesting and the greater coastline for stranded turtles would generate better understanding of the status of sea turtles in Syria through assessment of reproductive output and survivorship at sea.

Establish a monitoring programme on by-catch of marine turtles by Syrian fisheries; to accurately assess fisheries impacts on sea turtle populations and provide vital data on which targeted conservation measures can be scientifically based.

Develop a research and monitoring programme to assess at-sea populations of turtles in Syria; to more critically identify foraging and overwintering areas and assess the structure of these populations and their ecology. In this way critical habitats can be identified and protected and direct conservation activities can be focussed and more effective.

Further telemetry and tagging studies to obtain overwintering locations for green turtles that nest in Syria as strandings indicate that the majority do not remain there year-round, this would highlight the essential nature of regional marine turtle conservation strategies and initiatives and importance of collaborative projects.

Raising awareness on sea turtle status and conservation needs

Develop systematic public awareness projects (addressing stakeholders and the general public), structured in such a way that the objectives and target groups are clearly defined. Some of the main target groups involve local residents and tourists at nesting sites, local and national authorities, schoolchildren, fishermen, yachtsmen and other sea users. The establishment of such programmes could be triggered and assisted by appropriate regional initiatives.

Establish awareness campaigns and lobbying targeted at decision-makers.

Establish a rescue centre in Latakia that would adequately cope with rescue and rehabilitation of sea turtles in Syria; together with public exhibition and viewing facilities thus creating a major focal point for sea turtle conservation that can be expanded to encompass the marine environment, as it develops.

Improving legal status and law enforcement

Speed up procedures for enacting and enforcing legal texts granting protection to marine turtles.

Improved enforcement of protection at established marine protected areas where turtles are known to exist that would reduce negative human-turtle interactions of recreational and fishery origin.

And as a precautionary measure; establish bottom trawling restrictions in Syrian marine waters throughout the winter in areas where the sea is less than 50 m deep.

Overall

Local researchers and conservationists need to receive training and capacity building assistance. This will ensure their actions are properly directed, effective and that information gathered complies with international standards, thus facilitating accurate assessment of results and progress achieved.

8. Miscellaneous

None.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

- Ministry of Agriculture: A- General Establishment of Fisheries (GEF), Monitoring of nesting, Impact of fishing method and fishing gears on the sea turtles, education of fishermen about the importance and necessity of sea turtle conservation. B- Department of agriculture at Lattakia:, participation in the monitoring of sea turtle nesting
- Marine sciences Laboratory, Tishreen University: Monitoring of sea turtle nesting, and stranding, Interaction of

sea turtle with fisheries, (in collaboration with GEF). Contact: Abid Saad, adibsaa@scs-net.org

- Ministry of Local Administration and environment: Department of biodiversity and protected areas: National Focal Point, coordination with international instutions concerning research projects and establishment of coastal protect areas.

9.2. Private

Syrian society for Aquatic Environment protection (SSAEP): raising awareness of fishermen and public, nesting beach surveying and market surveys, monitoring of turtle movement by tagging. Contacts: adibsaad@scs-net.org, aliothman@scs-net.org, assep@aloola.sy, www.ssaep.jeeran.com

10 Resources available about marine turtle research and conservation

- www.seaturtlesinsyria.org: English language web-site describing the internationalisation of sea turtle conservation efforts in Syria and hosts news, images and scientific documents concerning work undertaken there. It is the intention that all English language scientific articles concerning sea turtles in Syria will be made available here.
- www.ssaep.jeeran.com: Arabic language web-site describing the activities of the Syrian society for aquatic environment protection, concerning: sea turtles, cetaceans, jellyfish, pollution of sea water and rivers, impact of fishing on the fish stock, sea turtles and cetaceans, etc.
- turtle.4eco.com: Arabic news and blog site covering sea turtles in Syria and further afield.
- Information leaflet prepared and distributed by SSAEP.

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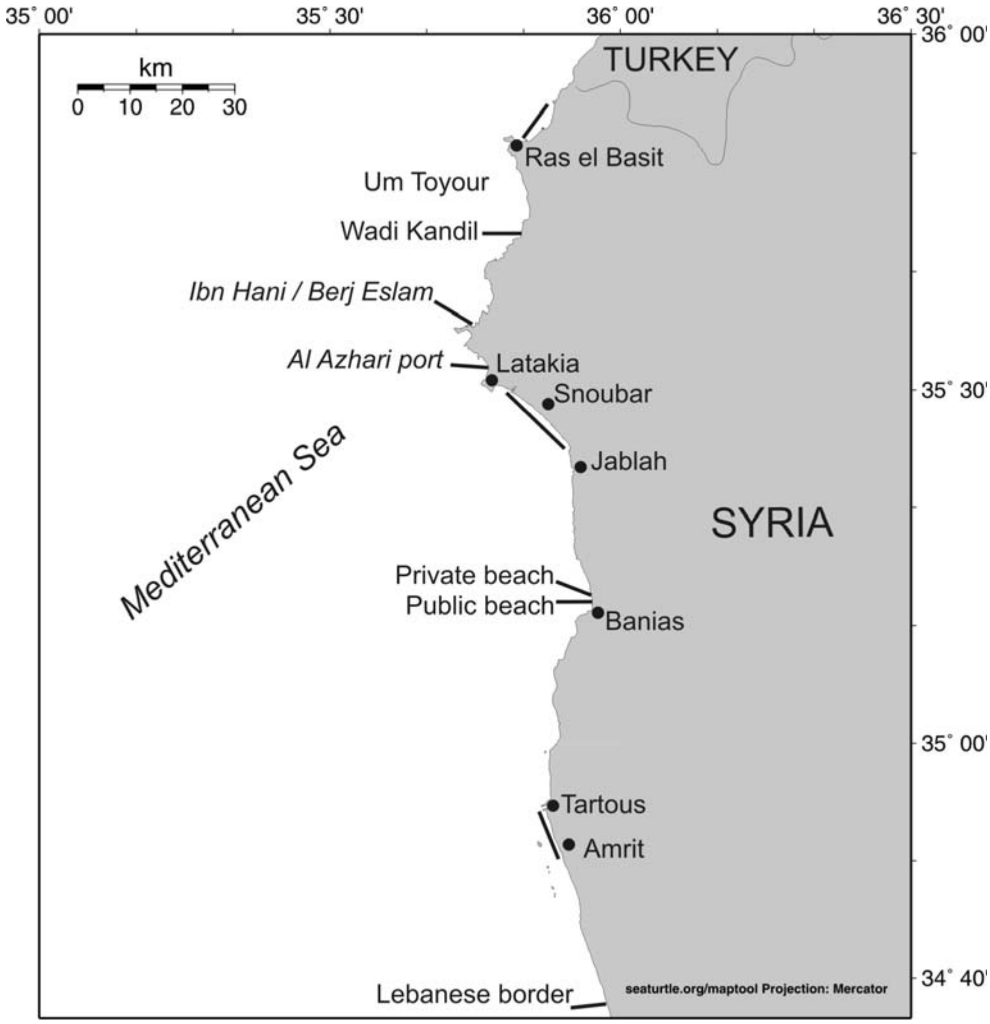

Figure 1. Locations of beaches surveyed for marine turtle nesting activity in 2004. Lines perpendicular to the coast indicate shorter stretches of beach whereas lines parallel to the coast indicate the lengths of beach surveyed.

Figure 2.
View of Al Azhari port where loggerheads are observed to feed on fish discarded from trawl boats (ALan F. Rees/ ARCHELON).

Figure 3.
Ras el Basit beach in the north of Syria. A very popular tourist destination on which a loggerhead track was seen in 2004 (ALan F. Rees/ ARCHELON).

Figure 4.
Latakia beach looking north towards Latakia City. This litter-strewn beach hosts one of the top ten nesting aggregations of green turtles in the Mediterranean (ALan F. Rees/ ARCHELON).

Figure 5.
Juvenile green turtle hung to attract tourists to a passenger-carrying pleasure boat (Mohammad Jony).

TUNISIA

Mohamed Nejmeddine BRADAI[1] and Imed JRIBI[2]

[1]National Institute of Sea Sciences and Technologies, P.O. Box 1035, 3018 Sfax, Tunisia (E-mail: mednejmeddine.bradai@instm.rnrt.tn), [2]Sfax Faculty of Sciences, P.O. Box 802, Sfax 3018, Tunisia (E-mail: imed.jribi@fss.rnu.tn)

1. General remarks

Three marine turtle species are observed in the Tunisian sea. The green turtle *Chelonia mydas* is rare, the leatherback turtle *Dermochelys coriacea* is regularly observed and the loggerhead *Caretta caretta* is common and reproduces on some beaches.

The Tunisian coast stretches to about 1250 km (Fig. 1). The northern coast is under the influence of the Atlantic current. The continental shelf there 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 at the level of the Gulf of Gabès.

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 Gabès presents hydro-dynamic, 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 Mediterranean oriental basin.

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

Nesting activity has been brought up many times in literature, but never based on precise information (Blanc, 1935; Knoepffler, 1962 ; Argano, 1979; Parent, 1981). The nesting of the loggerhead turtle (*Caretta caretta*) was first recorded in 1988 on the beach situated between Ras Dimas and Mahdia and on the island Great Kuriat (Laurent et al., 1990) which is considered as the most important nesting site in the country (Bradai, 1995a; Bradai, 1996; Jribi et al., 2002a, b; Jribi et al., 2006). Some nests were found on other beaches along the Tunisian coasts, such as Chebba (Ellouze, 1996), Zarzis, Hergla (Fig. 1), but nesting is not regularly observed. Only four nests were found in 2007 at Chebba, for example.

The Kuriat islands, which are considered the most important nesting site in Tunisia, (35° 48' 05" N, 11° 02' 05" E) lie 18 km from the coast of Monastir and consist of two small islands: Little Kuriat (Kuria Sgira) which is ca. 0.7 km^2 and Great Kuriat (Kuria Kbira) which is ca. 2.7 km^2. Little Kuriat has a total of 800 m of sandy beach situated in the north-eastern part of the island; the rest of the coastline is rocky or marshy. Almost one third of the Great Kuriat shoreline is rocky and large deposits of sea grass (*Posidonia oceanica)* detritus further restrict the accessible nesting sites particularly in the south and the south-western beaches. The principal nesting beach lies on the western coast and is almost 900 m in length.

Great Kuriat is a military zone so it is forbidden to be there at night, while Little Kuriat is highly frequented by tourists and plays host to hundreds of day trippers.

Nesting activity in Little Kuriat was reported for the first time in 1993, when 7 tracks leading to nests were detected (Bradai, 1993a). Further activity was also recorded in 1995 and 1996 (one nest each year) (Bradai 1995a, 1996).

From 1993 until 2008, the number of nests on Great Kuriat ranged from 4 to 22 (Fig. 2).

Over eleven consecutive nesting seasons we recorded mean clutch size of 87.85 eggs (range of means : 58.6-107.36 ; SD=12.77 ; n=11), which is similar to those recorded in Cyprus and Turkey, but less than those recorded in Greece (Margaritoulis et al., 2003). The hatching success and hatchling emergence success were 68% and 64% respectively, which reveals the suitability of the beaches of Great Kuriat.

Although most nesting of Mediterranean loggerhead turtles is localised in Greece, Cyprus, Turkey and Libya, “minor” nesting sites exist in other countries and their protection is desirable because they can give an appreciable contribution, both in number and in genetic diversity. We conclude that nesting numbers at Kuriat, although very small, are stable or increasing and, at least in the nesting sites, subject to high levels of protection.

In Little Kuriat, no nests were detected between 1997 and 2003, although 3 nests were recorded in 2004, 2 nests in 2005 and 7 in 2007. For this island the number of recorded nests can be considered as an underestimate, because some tracks may have been erased due to strong winds or heavy beach usage by tourists.

2.1.2. Marine areas

The Gulf of Gabès in the south of Tunisia is likely to be one of the most important areas for marine turtles in the whole Mediterranean.

The number of accidental captures suggests a high density of marine turtles in the region.

In fact, the Gulf of Gabès is considered an important wintering and a foraging area for marine turtles in the Mediterranean (Argano et al., 1990; Bradai, 1992; Gerosa and Casale, 1999; Laurent et al., 1990; Laurent and Lescure, 1994; Margaritoulis, 1988).

The high water temperatures in the region seem to attract turtles, especially in winter. Many turtles which were tagged in Greece and Italy have later been recorded in the Gulf of Gabès in winter (Margaritoulis, 1982; Jribi, 2003).

An adult male loggerhead turtle, *Caretta caretta*, which was accidentally caught in a bottom trawl in the Gulf of Gabès, Tunisia, on January 21st 2001, was then released from Monastir on the January 25th and tracked via satellite telemetry. The turtle maintained an eastward course for more than three weeks, during which it determinedly followed a relatively straight line covering, on average, 47.4 km per day. It appears that the turtle was moving along the isotherms and stayed within a narrow temperature range between 15 and 16.5°C.

At the end of February the turtle changed course again and moved towards Greece, at a reduced average travel speed of 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. Five months later the turtle had returned to the Gulf of Gabès. The water temperatures off the coasts of Tunisia were 27°C at the end of September (Fig. 3).

Some observations and minor studies show that *Caretta caretta* feed in winter in the Gulf of Gabès. Loggerhead turtles over-wintering in the Gulf of Gabès were found with full stomachs and intestines, confirming that they continue to feed during the cold period (Laurent and Lescure, 1994). Loggerhead turtles show a great capacity for long aerobic dives at low temperatures, which allowed them to rest in a dormant state for most of the time and keep energetic costs at a minimum, without truly hibernating (Hochscheid et al., 2007).

2.2. Past distribution and abundance

Since 1889, the loggerhead has been reported in the Gulf of Gabès (Servonet, 1889). It was mentioned also by Oliver (1896) at Tunis and Bizerta, Mayet (1903) and Seurat (1934) in the Gulf of Gabès, Mosauer (1934) at Sfax and by Blanc (1908, 1935) and Domergue (1966) off all Tunisian coasts. According to these authors, the loggerhead was very common in the Tunisian sea. Other papers mention, without specifying the species, the presence of marine turtles in great numbers; these were probably loggerheads. In this way, Bouchon and Berthoule (1890) wrote that the marine turtle is very common in Sousse waters. For Charcot (1924), in the Esquerquis banc (north of Bizerta) in June, marine turtles floated by in calm weather in considerable quantity.

More recently Argano (1979) and Parent (1981) confirmed the status of the loggerhead as a very common species. Laurent et al. (1990) also confirmed the same status.

Ancient data showed an abundance at sea in summer (Bouchon and Berthoule, 1890; Servonet, 1889). In contrast, Laurent et al. (1990) and Bradai (1992) indicated an abundance in winter, taking into account incidental capture by bottom trawlers. For Jribi et al. (2007), the winter, the spring and the summer were periods where catch rates are higher. This variety of abundance seems to be related to fishing activity. In fact trawling is a relatively recent fishing technique, which intensified from 1960. Moreover, the trawling period in the Gulf of Gabès varies from year to year, according to the shrimp campaign; shrimp is the most targeted species in the Gulf of Gabès.

2.3. Threats

2.3.1. Terrestrial Habitats

2.3.1.1. Coastal development

The island of Great Kuriat, which is the most important nesting site in Tunisia, is a military zone, so there is no construction or activity on beaches. However, on the island of Little Kuriat, which is 2 km away from Great Kuriat, the beaches are heavily used by humans and disturbance of the sand may have impeded detection of turtle tracks or nests.

In other areas where nesting activities were recorded, such as Chebba, Djerba and Zarzis, beaches are frequented by swimmers during the nesting period and much touristic activity has developed there.

2.3.1.2. Beach restructuring

Some beaches, known in the past to be nesting sites for the loggerhead turtle, were destroyed following tourism activities (hotels, campsites etc.).

2.3.1.3. Non human predation

Sea gulls *Larus cachinans*, common on the Kuriat islands, seem to engender predation of hatchlings, mainly of those emerged during daytime (Bradai, 1993a; Bradai, 1995b; Laurent et al., 1990).

2.3.1.4. Human exploitation

Fishermen reported that human exploitation occurred in the past on some ancient nesting beaches such as Chebba and Ras Dimass. Actually, since 1993 no human exploitation has occured in the Kuriat islands where nests are controlled by the INSTM researchers and especially since 1997, the date of the instauration of the monitoring of the site.

2.3.1.5. Other threats

On beaches of Great Kuriat, the large deposits of sea grass (*Posidonia oceanica)* detritus further restrict the accessibility of turtles to nesting sites, particularly in the south and the south-west. These deposits of *Posidonia* also hinder the return of hatchlings to the sea after emergence. However, the deposits constitute a natural protection of the island from waves and inundation.

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

Marine turtles, and especially the loggerhead (*Caretta caretta),* interact with numerous fisheries in Tunisia. The first data on turtle bycatch estimation were those of Argano (1979); an inquiry in 1978 in four fishing ports (Bizerta, Tunis, Sousse and Sfax) showed that 2000 to 3000 turtles were captured a year. Later, Laurent et al. (1990) estimated the annual incidental captures in Tunisia at 4000-5500 loggerheads; Sfax port contributed from 60 to 70 % of the total captures.

Following investigations done in 1991-

1992, an inquiry into fishermen along coasts between Monastir and the Libyan border showed that many types of fishing gear engender incidental catch of turtles: bottom and surface longlines, trammel nets, shark nets, purse seine. A boat using bottom longline engender the capture of a mean of 22.83 turtles per year, surface longline 12.56 (Bradai, 1993b; Bradai, 1995b) while a trawler captures 6 to 8 turtles per (Bradai, 1992).

Concerning bottom trawling, Bradai (1992) estimated annual captures and re-captures at about 2000-2500 turtles in the Gulf of Gabès for a fleet of 300 trawlers.

More recently, studies were carried out mainly in the zone of the Gulf of Gabès, a zone presumed to be a foraging zone and an important wintering area in the Mediterranean (Argano et al., 1990; Bradai et al., in press; Gerosa and Casale, 1999; Laurent et al., 1990; Laurent and Lescure, 1994 Margaritoulis, 1988).

The evaluation concerns two types of fishing gear which seem to have a very important interaction with marine turtles: bottom trawling and longlines. The following results concern these recent studies.

Bottom trawling.

The study was carried out during two years, 2001 and 2002, in the Gulf of Gabès. This study shows that trawlers have a large impact on sea turtles in the Gulf of Gabès (Jribi, 2003; Jribi et al., 2004; Jribi et al., 2007).

Marine turtles are captured throughout the year (Table 1). The winter, the spring and the summer are periods where the catch rates are highest, in contrast with the autumn where this rate is lower.

The total catch resulting from the fishing effort registered in the zone was estimated at 5458 ± 1652 (95% C.I). However, the direct and potential mortality were low and estimated respectively at 182 ± 55 and 91 ± 28 turtles (95% C.I).

Longlines.

During 2004 and 2005, studies were made in the zone of Zarzis (Gulf of Gabès) on board commercial bottom and surface longliners. Results (Table 2) show an important interaction with both types of longlines. Surface longlines appeared to have the highest catch rate per unit effort while the bottom longlines cause a higher total annual catch because its fishing effort is greater in the region (Echwikhi et al., 2006).

Table 1. Turtle catch rates by trawling in the Gulf of Gabès with 95% confidence intervals. h.d: headrope length /30.5m*duration /60min.

Year quarter	Turtles	Trips	Days	Hauls	h.d	Turtles/ trip	Turtles/ day	Turtles/ haul	Turtles/ h.d
Winter (Dec-Feb)	15	16	121	1256	2325.27	0.93750± 0.52076	0.12397± 0.07116	0.01194± 0.00601	0.00645± 0.00320
Spring (Mar-Mai)	22	22	143	1478	2633.27	1.00000± 0.51582	0.15385± 0.06824	0.01488± 0.00645	0.00835± 0.00356
Summer (Jun-mid-july)	9	7	45	476	922.24	1.28571± 1.33304	0.20000± 0.14741	0.01891± 0.01225	0.00976± 0.00648
Autumn (Sep-Nov)	14	28	188	2046	3601.1	0.5000±0. 23642	0.07447± 0.04043	0.00684± 0.00357	0.00389
Total	60	73	497	5256	9481.88	0.82192± 0.24878	0.12072± 0.03321	0.01142± 0.00292	0.00632

Sea turtles captured by surface longline (average: 58.5 cm Curved Carapace Length notch to tip; SD = 9.33; range = 38-72; n = 33) were significantly larger than those captured by bottom longline (average: 48.7 cm Curved Carapace Length notch to tip; SD = 6.7; range = 38.3-61; n = 24). The most important catch selectivity factor seems to be the hook size; hooks used for bottom longlines are smaller than hooks used for surface longlines.

2.3.2.2. Intentional killing and exploitation

The capture of loggerheads, *Caretta caretta,* in Tunisian fisheries is ancient. Many authors mentioned such a practice (Blanc, 1935; Bouchon and Berthoule, 1890; De Fages and Ponzevera, 1908; Gruvel, 1926; Monconduit, 1927; Servonet, 1889). Capture methods were not described, but it seems to be incidental in general, except for direct captures of turtles observed at the surface in calm weather (André, 1961; Servonet, 1989).

Turtles were considered in ancient fisheries as an exploitable species, but not targeted. These reptiles were mentioned, in fact, on the fished species lists and on the fishery statistics (Monconduit, 1927).

The main use of marine turtles in these periods was for food from their meat (Servonet, 1889). They were sold in fish markets of all maritime cities (Blanc, 1935). Carapaces were used as cradles for babies (André, 1961; Bradai, 1993b), and were also sold to tourists (Argano, 1979). This also occurred in 1989 (Laurent et al., 1998). Although selling of turtles in fish markets was stopped in 1990, a clandestine trade for local consumption was detected (Laurent et al., 1996) as well as occasional consumption by fishermen on board their vessels.

2.3.2.3. Other threats

In the frame of the stranding network, some cases of boat strikes were mentioned. In fact, from necropsy (80 cases) and external examination, causes of mortalities were classified as follows: 6% with hook ingestion, 4% with traces of collisions and 90% with non identified causes due to the bad state of stranded turtles.

Moreover, the necropsy of some stranded loggerheads showed the presence of plastic and nylon ropes in their guts.

Table 2. Turtle catch rates and mortalities by surface longline and bottom longline in the zone of Zarzis (Gulf of Gabès).

Fishing gear	Catch rates Turtles/1 000 hooks	Total captures (by year)	Mortality (%)
Surface longline	0.823	486.48	0
Bottom longline	0.278	732.89	12.5

3. *Chelonia mydas*

3.1. Present distribution and abundance

3.1.1. Nesting sites

No nesting sites of this species exist in Tunisia.

3.1.2. Marine areas

The presence of green turtles in Tunisian waters is rare.

At the beginning of the century, Blanc (1908) gave a description of the green turtle sometimes being captured in Tunisia and mainly in the Gulf of Gabès. Laurent et al. (1990) mentioned 4 turtles captured in the Gulf of Gabès, and one of them was tagged in Cyprus. Actually the green turtle was sometimes incidentally captured but this phenomenon is relatively rare. In the framework of the stranding network of marine turtles and cetaceans in Tunisian coasts established since 2004, three stranded green turtles were detected.

3.2. Past distribution and abundance

Data not available.

3.3. Threats

Not applicable because of the rarity of the species.

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

Tunisian coasts are frequented by both adults and large juveniles during all the year mostly in the Gulf of Gabès in summer and autumn (Bradai and El Abed, 1998; Bradai et al., 2003). This fact may be related both to the Atlantic surface currents entering the Mediterranean Sea and probably to the abundance of jellyfish along the Tunisian coasts (Bradai and El Abed, 1998).

The first mention of this species in Tunisia was given by Blanc (1908) concerning a specimen captured in 1907 in the Gulf of Tunis. Heldt (1933) synthesised captures and strandings of this species along Tunisian coasts. Five individuals were noted by this author from 1930 to 1933. Blanc (1935) underlined the rarity of this species in Tunisia. Later, Heldt (1950), Postel (1955) and Chakroun (1966) mentioned new captures. Other observations were also mentioned; a stranded specimen in Jerba in 1978 (Parent, 1981), three captures in 1983 (Hchaichi and Rais, 1985) and 9 individuals from 1985 to 1987 (Laurent et al., 1990).

In the past century a total of 42 specimens had been recorded in Tunisia, 17 of them in the ten-year period 1990-2001 (records collected by INSTM and partly reported by Bradai and El Abed (1998).

4.2. Past distribution and abundance

Data not available.

4.3. Threats

4.3.1. Incidental catch

Leatherbacks mentioned in this work were incidentally captured in coastal fishing gear like trammel net and driftnets in shallow waters. It should be mentioned that driftnets are now prohibited in Tunisia. Otherwise, two turtles of this pelagic species were caught by bottom trawler (Bradai and El Abed, 1998).

4.3.2. Intentional killing and exploitation

Exploitation and selling of turtles in fish markets were stopped in 1990.

4.3.3. Other threats

Data not available.

5. Other species

Baccar (in Groombridge, 1989) mentioned that four species have been reported in Tunisia, including the hawksbill turtle, *Eretmochelys imbricata*. Unfortunately, no detail was given on this mention.

6. Conservation status

In order to support conservation of *Caretta caretta*, a monitoring programme at Kuriat islands was launched in 1997 (Jribi et al., 2002a,b). The main objectives of the programme were: (a) to protect nesting sites, nesting females and hatchlings, and (b) to document the nesting activity.

Following the ratification of international conventions (Table 3), special attention has been paid by Tunisia to improve the national legislation on the matter. Firstly, the fisheries commissionership applied to regional delegates a circular note number 1155 of June 10, 1987, asking them to ensure forbidding the capture of marine turtles. Actually, the protection of these species is assured, since 1992, by a yearly decree of the agriculture minister relating to the organization of hunting. This decree stipulates that hunting, destruction, capture, sale, purchase, hawking and detention of marine turtles are prohibited at all times. The decree of the agriculture minister of 28 September 1995, relative to the organization of fishing, forbids the catch of marine turtles and the collection of eggs.

In addition, a marine turtle rescue centre was created in 2004 which is contributing to helping the Mediterranean marine turtle population. Apart from its principal role of rescuing turtles in difficulty, the centre also plays a role in public awareness and in the activities of the national stranding network.

The live turtles, mainly discovered by

fishermen, were examined and received appropriate treatment according to their health status. Problems were essentially: buoyancy abnormalities and pneumopathy due to net capture and water swallowing. 90% of suffering turtles received and treated in the Centre were healed and released in the sea.

The necropsy of dead turtles shows that the causes of mortality are related to hooks (47%), nets (40%) and unknown reasons(13%).

A national stranding network was launched in Tunisia in 2004. Results show that interactions with fisheries were the major source of death. Several tissue samples mainly for genetic studies, a number of humerui for growth studies and also some epibiont species were collected.

Table 3. International conventions ratified by Tunisia

Convention	Adoption	Ratification	Law n.
World Heritage	1972	1974	74 - 89 of the 11/12/74
CITES	1973	1974	74 - 12 of the 11/05/74
Algiers	1975	1976	76 - 91 of the 04/11/76
Barcelona	1976	1977	77 - 29 of the 25/05/77
CMS	1979	1986	86 - 63 of the 16/07/86
Bern	1979	1995	95 - 75 of the 07/08/95
SPA Protocol New SPA	1982	1983	83 - 44 of the 22/04/83
Protocol (1995) and its Annexes (amendment)	1995	1998	98 - 15 of the 23 /02/98
CBD	1992	1993	93 – 45 of the 03/05/93

7. Conservation needs

Although marine turtles are protected in Tunisia, a specific legislation for these species is recommended. Some other conservation actions are also recommended:

- Protection and management of known nesting, feeding and wintering areas. We quote the Kuriat islands as the most important nesting site and the Gulf of Gabès as a feeding and wintering area;
- Identifying possible nesting site as yet unknown;
- Encourage fishermen to collaborate with the rescue centre in Monastir in order to help turtles in difficulty;
- Regulate activities related to tourist use that affect the important nesting beaches such as Little Kuriat;
- Grant adequate protection to the Kuriat islands and strengthen the process of setting up the Kuriat islands National Marine Park;
- Assess the impact of artisanal fisheries on marine turtles;
- Assess sea turtle mortality caused by interactions with fisheries and determine relevant conservation measures;
- Establish a public awareness programmes for fishermen and coastal communities.

8. Miscellaneous

None.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

- National Institute on Marine Sciences and Technology (INSTM)
  - The INSTM assures the monitoring of Kuriat nesting beaches in collaboration with the RAC/SPA and APAL (Agency of Protection and Management of the Littoral)
  - manages the marine turtle rescue centre with collaboration of the APAL
  - manages the national stranding

network

- undertakes the teaching of marine turtle biology and of conservation in collaboration with the Sfax Faculty of Sciences in the frame of the doctorate school of the INSTM
- works in collaboration with the Sfax Faculty of Sciences on the interaction between marine turtles and fisheries, and bycatch

• Sfax Faculty of Sciences (FSS), University of Sfax.
• Agency of Protection and Management of the Littoral (APAL)

9.2. Private

There is no specific NGO dealing with turtles, but some NGOs related to the environment sometimes undertake activitie with marine turtles

10 Resources available about marine turtle research and conservation

None.

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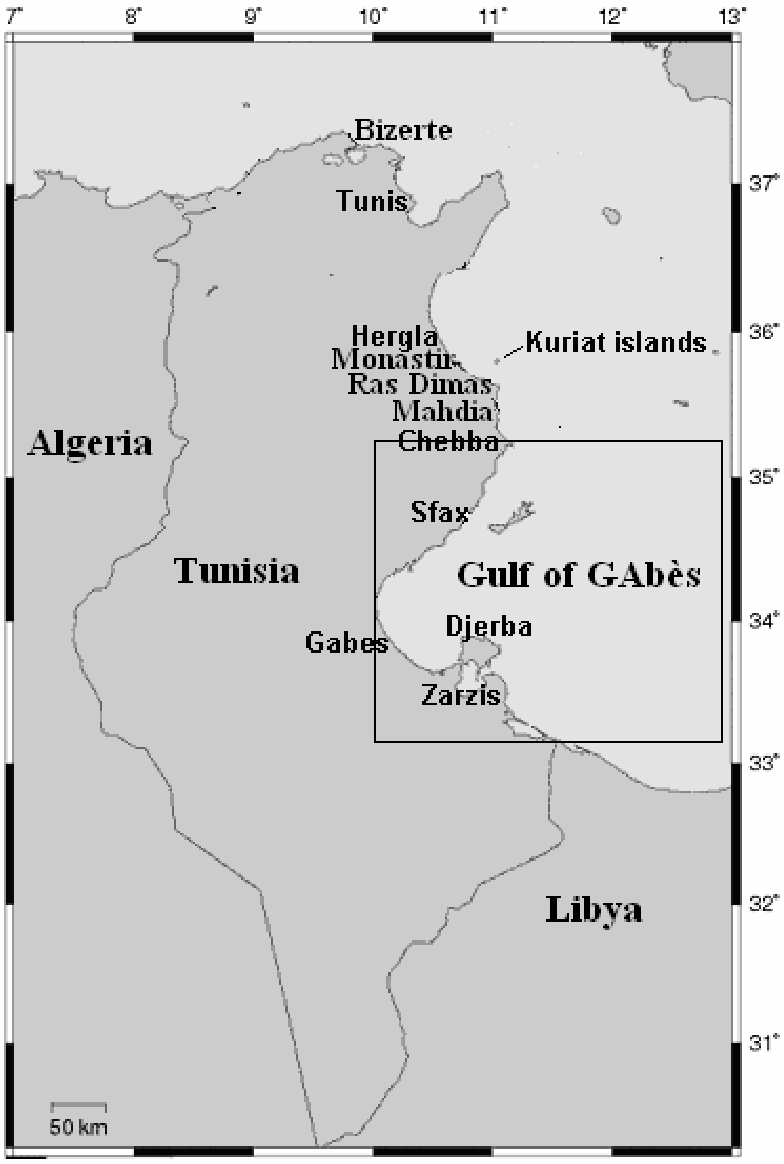

Figure 1.
Map of Tunisia. Kuriat Islands are the main nesting site. Some anecdotial nestings are sometimes observed(Kélibia, Chebba and Zarzis).

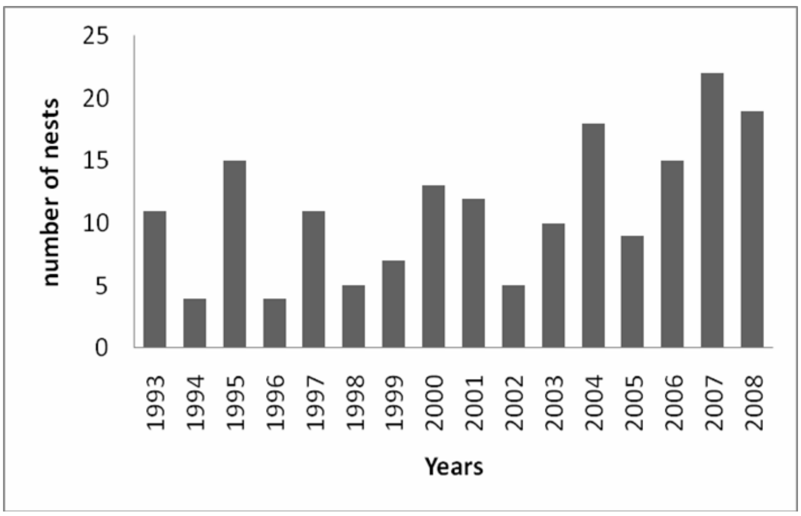

Figure 2.
Annual number of nests recorded over sixteen seasons (1993-2008) on Great Kuriat.

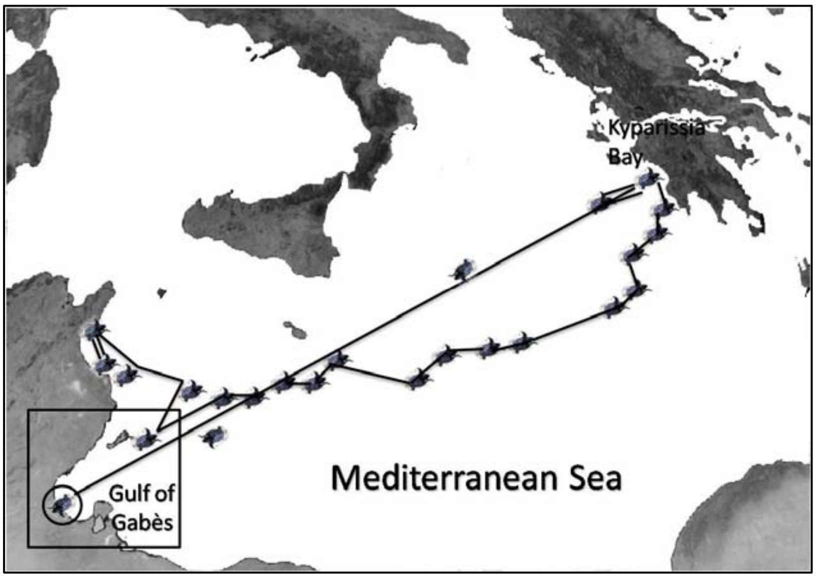

Figure 3
314 days telemetry monitoring of an adult male marine turtle moving between the Gulf of Gabès and Greece.

TURKEY

Oğuz TÜRKOZAN[1] and Yakup KASKA[2]

[1]Adnan Menders University, Faculty of Science and Arts, Department of Biology, Aydin, Turkey (E-mail: turkozan@adu.edu.tr); [2]Pamukkale University, Faculty of Science and Arts, Department of Biology, Denizli, Turkey (E-mail: caretta@pau.edu.tr)

1. General remarks

The Mediterranean coasts of Turkey are important nesting grounds for both loggerhead and green turtles (Groombridge, 1990). Turtle nesting mainly occurs in a region over a coast length of 2577 km, of which 606 km are beaches (Baran and Kasparek, 1989). Based on the nest numbers, Turkey holds the most important green turtle stocks (Kasparek et al., 2001) and the second most important loggerhead turtle stocks (Margaritoulis et al., 2003) in the Mediterranean. According to Laurent et al. (1998) Turkish loggerhead colonies are important management units due to significant divergence of mtDNA haplotype frequencies. Carreras et al. (2007) further confirmed this finding. The most recent study (Yılmaz et al., 2008) showed that Turkey has the highest haplotype diversity among other Mediterranean countries. The oldest known marine turtle study in Turkey is by Hathaway (1972). There is an increasing trend on marine turtle studies especially after 1988. The studies carried up to date covers all nesting sites and information on those nesting beaches are available. However, the real potential of some nesting beaches is still unknown either due to the lack of studies covering overall beaches or the whole breeding season. In spite of some regional studies (Oruç, 2001) the main information gap at present is the interaction of fisheries and marine turtles in Turkey. The overall mortality rate of capture turtle is still unknown.

The breeding season starts in early June and extends to early October. The peak nesting occurs in June or July depending on a beach and species. The hatching season usually starts after the second week of July. The research groups, therefore, start their monitoring programs on the beaches on 1st June and finish the season on 30th September.

2. *Caretta caretta*

2.1. Present distribution and abundance

2.1.1. Nesting sites

The first nesting records of *Caretta caretta* and *Chelonia mydas* from Turkey were published by Hathaway (1972). Later Başoğlu (1973) and Başoğlu and Baran (1982) gave information on the *C. caretta* carapace scutes at İzmir, Köyceğiz and Fethiye. Geldiay and Koray (1982), Geldiay et al. (1982) and Geldiay (1984) described marine turtle population on the Mediterranean coast of Turkey. Baran and Kasparek (1989) surveyed 2456 km of Turkish coastline between Kusadası in the Aegean region and Samandağı close to Syrian border for sea turtle nesting activity. They identified 17 important nesting grounds namely from west to east; Ekincik, Dalyan, Dalaman, Fethiye, Patara, Kumluca, Kale, Tekirova, Belek, Kızılot, Demirtaş, Gazipaşa, Anamur, Göksu Delta, Kazanlı, Akyatan and Samandağ. Later, Türkozan et al. (2003) reviewed loggerhead turtle nesting in Turkey and reported 20 loggerhead turtle nesting grounds in Turkey (Fig. 1). An additional nesting site was recorded near Mersin Province, namely Alata (Aymak et al., 2005) in all there are 21 nesting sites at present. Canbolat (2004), in his review, included Yumurtalık and Samandağ beaches in the nesting grounds of Turkey while these beaches have a potential of 1-3 nest per year while he excluded Ekincik beach (almost 12 nests per nesting season) and reported 19 loggerhead turtle nesting grounds in Turkey.

The average annual number of loggerheads throughout the Mediterranean reaches 5031 nests/season and of these 27.2% (1366 nests/season) occurs in Turkey (Margaritoulis et al., 2003). Türkozan et al. (2003) estimated 1267 (663-1991) loggerhead turtle nests per season throughout the Mediterranean coast of Turkey. Having reviewed the nesting beaches in the Mediterranean coast of Turkey, Canbolat (2004) estimated 2000 nests/year (1547-2485) for the loggerhead turtles. He also estimated the number of nesting females ranging from 500 to 800. There were some differences among reported data on the same beach on different seasons. This may be because of the nesting fluctuations between 'good' and 'bad' seasons. Based on project reports and mainly on other unpublished data and published sources Kaska et al. (2005a) estimated that there are 1360-2710 *Caretta caretta* nests on Turkish beaches. However, some sites along the Aegean and Mediterranean coasts were not monitored and some monitored nesting sites were studied only in part (not all the beach or not the whole nesting period), leading to underestimation of the nesting level. Under the light of the up-to-date information, it is likely that the real potential of the loggerhead turtle nesting beaches is still unknown. The reason for this information gap is the lack of regular surveys (covering overall beach and the whole breeding season) on certain nesting beaches which has estimated to have a larger potential and the small beaches nearby main nesting beaches not surveyed in all surveyed seasons. Based on the existing data (Table 1), the present estimates are far from the estimates of Canbolat (2004). The annual number of loggerhead turtle nests ranged from 769 and 3521 nests. It seems from the present data that Ağyatan and Yumurtalık beaches provide just a small contribution to the annual nest numbers of loggerhead turtles in Turkey.

Ekincik beach (Fig. 2).

Ekincik beach is the westernmost nesting site of the loggerhead turtles in Turkey. The beach was included among the seventeen nesting sites in 1988, after that, surprisingly, the area was declared as a "tourism investment area". Following this, several tourist facilities were built. The beach is now a "Specially Protected Area" (SPA) as part of the Köyceğiz-Dalyan Specially Protected Area. The beach is almost 1 km in length and half of the beach includes restaurants and hotels just behind the beach. At the beginning of nesting surveys in 1988, Baran and Kasparek (1989) ranked the beach as having a great nesting potential, as much as Dalyan, but under the light of following year's surveys, it was understood that the Ekincik beach does not possess the same potential as Dalyan in terms of nest number. Baran and Kasparek (1989) stated that this beach might serve as a bridge to the populations in Greece. The situation on the beach has significantly worsened since 1994 (Oruç et el. 2003).

Dalyan beach (Fig. 3).

Dalyan is one of the most important reproductive sites of the loggerhead turtle in Turkey. The beach is also used by the Nile Soft Shell turtles, *Trionyx triunguis*, for nesting. The reproduction of both endangered species on the same beach increases the importance of the beach. The Köyceğiz-Dalyan area was designated as a "Specially Protected Area" in 1988. Public access is not allowed on Dalyan beach from 19.00 to 08.00. Dalyan beach is one of the regularly and long-term surveyed beaches. Oruç et al (2003) reported that Dalyan beach is one of the nesting beaches for which conservation practices have been improving since 1994. The beach contributes 11.9% of the overall nesting efforts of loggerhead turtles in Turkey (Canbolat, 2004).

Dalaman beach (Fig. 4).

Dalaman beach is 10.4 km in length and bisected by Sarisu and Dalaman streams to the northwest and Tersakan Stream to the southwest. The hinterland of the beach is covered by a complex wetland. The Nile Soft Shell turtle, *Trionyx triunguis*, also uses the beach for nesting. Lake Sulphurous (Kükürtlü Gölü) is about 1 km away from the Dalaman airport and the beach. Near the lake, there is a hotel and the İncebel summer village. Dalaman Beach consists in four subsections. The first one, 1.8 km long, starts from Sarıgerme hill and extends to the mouth of Sarisu stream. Behind these zone three large hotel complexes occurs. There are also water-sports facilities on the beach. Sun beds and umbrellas cover nearly the entire beach. The mountains behind the hotels are covered by clusters of red pine forest. The second subsection, 1.9 km in long, starts from Sarısu 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 Sarısu 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, wetlands, and agricultural fields are located behind the beach. The last subsection starts from Tersakan River and extends to Hodul hill. This beach is mainly rocky; not many turtle activities take place here.

Table 1. Summary of nesting data for loggerhead and green turtles in Turkey.

Beach name	Length of the beach	Range of nests numbers	
		C. caretta	*C. mydas*
Ekincik	1	9-12	
Dalyan	4,7	57-330	
Dalaman	10.4	69-112	
Fethiye	8.3	72-191	
Patara	14	35-127	2-2
Kale	8.5	39-109	
Fenike	21	75-305	0-7
Çıralı	3.2	23-96	
Tekirova	3.7	4-23	
Belek	29.3	68-819	2-8
Kızılot	15.7	50-270	0-3
Demirtaş	7.8	41-137	
Gazipaşa	7	14-53	
Anamur	12.2	146-674	1-1
Göksu Delta	25.6	36-151	3-20
Alata	3	16-32	20-198
Kazanlı	4.5	2-26	73-403
Tuzla	25		4-9
Akyatan	22	3-31	108-735
Karataş	7		3-3
Ağyatan	8.5	2-2	0-3
Yelkoma	23.1		2-3
Sugözü	3.4		213-213
Yumurtalık	6	1-1	1-3
Samandağ	14.2	7-20	20-440
Total	289.1	769-3521	452-2051

Fethiye beach (Fig. 5).

Fethiye beach is 8 km in length and naturally divided into three subsections, namely Çalış, Yanıklar and Akgöl. The beach is designated as ''Specially Protected Area'' but the control of the beach during the nesting season is not as good as Dalyan beach. The beach is one of the long-term monitored beaches. The beach was suffering from the fox predation in the past (Türkozan, 2000) but fox predation suddenly finished for an unknown reason. The main threats on the beach are tourism development and sand extraction. According to Oruç et al. (2003) the beach has been deteriorating since 1994.

Patara Beach (Fig. 6).

Patara Beach is a complex ecosystem consisting of beach, a very large dune ecosystem and floodplain inland. The sediments of Eşençay River created the most important and largest dune ecosystem on the Turkish Mediterranean coast. The beach is divided by this river. Sand erosion and tourism are the main problems. The ancient city of Patara is an Archaeological Site. The beach and dunes are included in Patara SPA. Patara beach is 12.1 km long and bisected by Eşençay River. The beach has been monitored by different research groups since 1989. Some of these studies were concentrated only on 6.9 km of the beach where core nesting occurs. The main natural threats on the beach are predation, flooding due high tide and natural sand movements.

Kale-Demre beach.

Kale Beach lies between Beymelek lagoon and Kale town. The core nesting site is in front of the lagoon system. The agricultural runoff and the highway on the western part of the beach, sand extraction and lagoon fishing are the main threats for marine turtles. Unfortunately, Kale beach has no protection status. Beymelek lagoon is in the border of a governmental organization, Beymelek Aquaculture Production and Development Centre of the Ministry of Agriculture, and therefore well protected since unauthorized entrance to beach is impossible. Kale-Demre beach is almost 8.5 km in length and consists of 4 subsections namely, Çayağzı, Sülüklü beach, Taşdibi and Beymelek. The beach is one of the nesting beaches which we have insufficient information in comparison to other nesting beaches (Table 6). According to Oruç et al. (2003) the beach has been deteriorating since 1994.

Finike-Kumluca beach.

Finike-Kumluca Beach is located in the south of Kumluca town which settled on a fertile agricultural plain. A wide highway runs parallel to the sea along most of the beach (close to Finike town). Condominiums and secondary houses, local summer houses (Baraka) have been built. Kumluca beach has no protection status. The total length of the beach is 21 km. This is also one of the nesting beaches which we have insufficient information in comparison to other nesting beaches (Table 7). Oruç et al. (2003) recorded that the beach became worse since 1994. The beach contributes 11.3% of the total annul nesting efforts of loggerhead turtles in Turkey (Canbolat, 2004).

Çıralı beach (Fig. 7).

Çıralı beach is 3.2 km long and one of the regularly monitored beaches of Turkey since 1994. The beach was not included in the 17 marine turtle nesting area listed by Baran and Kasparek (1989). The beach work was first started by DHKD (The Nature Protection Organization) in 1994 with support of WWF. During 1997-2000, the project was supported by the LIFE program. In 2001, Ulupınar Environmental Protection, Development and Administration Cooperative were founded. Local people who are member of this cooperation have continued the marine turtle monitoring program. According to Oruç et al. (2003) the beach has been become worse since 1994.

Tekirova beach.

Tekirova Beach is almost completely covered with resorts according to South Antalya Tourism Development Plan. The main threats for turtles are lights from tourist facilities, and unregulated use of the beach during the day and night by visitors. Some parts of the beach are Natural Site. Tekirova beach is 3.7 km in length and was included in the list of 17 important nesting grounds (Baran and Kasparek, 1989). Unfortunately, the whole beach was almost covered with deck chairs and umbrellas and no place was left for turtle nesting. In Baran and Kasparek (1989) they mentioned the need of light screening. Oruç et al. (2003) proved that the situation is even worse and the beach has almost lost its marine turtle nesting site status.

Belek beach.

Belek Beach is situated between Aksu and Acısu Rivers east of Antalya. There are old stone pine forests which host a rich wildlife on the dunes behind the beach, followed by a wide fertile plain further inland. The area is over developed for tourism and the main problem is the wrong planning of the whole area according to east Antalya Tourism Development Plan. Some sections are under protection of Natural Site . The area around Acısu is a SPA. The total length of the beach is around 30 km. Regular data are available since 1994 (Table 9). However, since different length of the beach parts were studied it is impossible to understand the exact potential of the beach.

Kızılot beach.

Kızılot Beach is located further east of Antalya. The area of Titreyengöl, at the western part of the Kizilot beach, is completely covered by hotels. Photo pollution and sand extraction are the main threats for sea turtles. Kızılot Beach has no protection status. There are new hotels being built in recent years. The beach from Manavgat River to Alara River is around 15.7 km. in length. Canbolat (2004) reported that the beach supports 8.9% of the total loggerhead turtle nesting potential in Turkey and therefore, should be graded as first degree importance. Oruç et al. (2003) reported that the beach is stable since 1994. However, the personal observation of senior author in August 2007 proved that the beach has become worse since 2003. As in Belek beach different parts of the beach studied with different groups (Table 10). It is therefore difficult to comment on the real potential of the beach

Demirtas beach.

Demirtaş Beach is bisected by Sedre Creek. Rocky cliffs extended onto beach over its whole length. This cliff decreases the nesting attempts on the beach. Therefore, nests are mainly concentrated on both ends of the beach where the beach is more suitable for nesting. A highway runs parallel to the sea along the beach. The light from highway and the buildings are visible from the beach. Sand extraction is also another problem. This beach is a Natural Site. Oruç et al. (2003) reported that the beach conditions are stable since 1994.

Gazipasa beach.

Gazipaşa Beach is a Natural SIT area. Lights from the buildings are visible from the beach. Sand extraction is also a problem. The beach is 7 km long.

Anamur beach (Fig. 8).

Anamur Beach is situated between Anamur point in the south and Pullu in the north-east and bisected by Dragon River. Sand extraction, photo pollution and beach erosion are main threats for sea turtles. Anamorium and Mahmure Castle coasts are Archaeological SIT areas. The total length of the beach is 12.2 km. The beach supports 8.8% of the total loggerhead turtle nesting potential in Turkey (Canbolat, 2004). According to Oruç et al. (2003) the beach conditions are stable since 1994.

Göksu Delta beach (Fig. 9).

Göksu River created a peninsula extending to the Mediterranean south of Silifke town. The delta consists of a network of channels, wetland and Paradeniz and Akgöl lagoons on the southern tip where the Göksu River empties in to the Mediterranean. The area is quite protected. There is some evidence of pollution from Paper Factory, and secondary houses on the periphery of the delta are increasing in numbers. This beach is a Ramsar site and most of the delta lies in Göksu Delta SPA. The main problem on the beach is high tide line. Furthermore, golden jackals attack and kill adult females. The beach was studied by different research groups (Table 12). The total length of the beach is 37.8 km.

Alata beach.

Alata Beach is not included in the 17 important sea turtle nesting grounds of

Baran and Kasparek (1989) but holds both loggerhead and green turtle nests. However, green turtle nests are more abundant in comparison loggerhead nests. The beach was introduced as an important nesting site, for the first time by Aymak et al. (2005). The beach is located near Mersin Province. This area is well protected due to its location near the institution of Ministry of Agriculture. Alata Horticultural Research Institute established on 4 square kilometers land 35 km from Mersin. The area of Alata Horticultural Research Institute was declared as a 1st degree natural site in 09 Jan 2000, meaning that the site should be protected as it is and only scientific studies were allowed in this region..

Kazanlı beach (Fig. 10).

Kazanlı Beach is one of the most important sites for green turtles but also hold small amount of loggerhead turtle nests regularly (Table 14). Kazanlı beach is located 10 km east of Mersin at the western end of Çukurova Delta and the total length of the beach is about 4.5 km. The pollution caused by the nearby factories and beach erosion are the main threats. There are also rare occasions of sand extraction.

Akyatan beach (Fig. 11)

Akyatan Beach is located between Akyatan lagoon and the delta formed by Seyhan and Ceyhan Rivers. The area constitutes one of the largest dune ecosystems. Akyatan beach is the most important green turtle nesting area in the Mediterranean (Kasparek et al., 2001) but also holds loggerhead turtle nests (Table 15).

Ağyatan beach.

This beach is not used intensively by marine turtles. The length of the beach is approximately 8.5 km. Only two nests were recorded during 1996 nesting season (Yerli and Canbolat, 1998b). During 2006 nesting season a total of seven emergences were recorded with two resulting in nests (Türkozan et al., 2006).

Yumurtalık beach.

The length of the beach is almost 24.5 km. The area includes wide sand dunes with rich vegetation. Yerli and Canbolat (1998b) reported only one nest during 1996 nesting season. Similarly, Türkozan et al. (2006) also located only one nest. It seems that loggerhead nesting is very limited in this area.

Samandağ beach (Fig. 12).

Samandağ Beach was formed by the sediments of Asi River and is surrounded by headland. The total length of the beach is 14.2 km**.**

2.1.2. Marine areas

Nesting sites in Turkey are more or less well documented but marine areas important for sea turtles are far less studied in Turkey (Fig. 13). There is very limited information published on this issue. Therefore, this is one of the subjects the new generation marine turtle biologist should give priority to investigate.

According to Oruç (2006) Kadirga Cape, Karagelme Bay and Samucak Cape at Datca-Bozburun (Muğla) Specially Protected Area is a mating area for loggerhead turtles. She also emphasized the regular observation of this species near Kas-Kovan Island, Suluada and near Tekirova and suggested that these areas are probably feeding ground for this species. The area between Mersin and Iskenderun were reported as an important area for breeding, feeding and wintering of sea turtles. Oruc (2001) reported that most of the turtles (78.3%) were caught in trawl boats during winter, which is the sign of the existence of non-migrant marine turtles in the area.

Loggerhead turtles were observed and pictured many times by local people in the lagoon system of the Dalyan beach. There are also some individuals staying in the lagoon system during the winter. Only a single female was satellite tagged on Dalyan beach but results have not been presented yet (Canbolat, unpubl.). Three live juvenile loggerhead turtles, 10-30 cm in size, washed on a shore during the nesting season, one found on Göksu Delta beach and another two on Akyatan beach (Türkozan and Yılmaz unpubl. data)

2.2. Past distribution and abundance

It is not possible to give reliable estimations about the population size or trend of marine turtle populations in Turkey. There are only some fragmentary data available from the past.

Our knowledge about the past numbers comes from the fisheries statistics. Hathaway (1972) reported that 286,505 kg turtles were caught in all of Turkey in 1968 while 52,355 kg were taken in 1969. These statistics are difficult to read for turtles since individual weights vary from juvenile to adult. Furthermore, species were not identified. These are the only available data and no comparable data exist either former or subsequent years.

Number of nests comes from the study of Geldiay et al. (1982) for the first time. They reported 330 nests on the Dalyan beach during 1979 nesting season. The number of nests on Dalyan beach has never reached the same amount until now. Furthermore, the same researchers recorded nesting from Side and Alanya where nesting is ceased now.

The past distribution of nests on each beach is given as separate Tables (2-16).

<u>Dalyan Beach.</u>

Türkozan (2006) reported a mean of 194 nests on Dalyan beach during 19 consecutive years (1987-2005) (Table 2). There were also strong annual fluctuations in the number of nests, ranging from a minimum of 57 (in 1990) to a maximum of 286 (in 2002), a 401% difference. However, such a large fluctuation resulted from the different length of the beach studied. Recently, Türkozan (2006) reviewed the 19 years of nesting data and concluded that the numbers of nests have not shown an upward or downward trend and were not shown to differ significantly from a stable population. The 95% confidence intervals of these values are -2.7% to +6.7% per year.

<u>Dalaman Beach.</u>

The mean number of nests was 87 during 9 nesting seasons on Dalaman beach (Table 3). The mean nesting density was calculated as 8.7 nests/km. Oruç et al. (2003) reported that the status of the beach is the same as that in 1994. The beach was classified as the 2nd degree important site with 4% contribution (Canbolat, 2004).

<u>Fethiye Beach.</u>

The mean number of nest per year was 105 during 14 consecutive nesting seasons (Table 4). Both Türkozan (2006) and Ilgaz et al. (2007), with a different statistical approach proved that the nest numbers on Fethiye beach is decreasing. Based on 13 years nest numbers, Türkozan (2006) showed that the nests on this beach have been declining at 5% per year, on average. The 95% confidence intervals on this decline are -1.5% to -8.6% per year, which means that we are very confident that the nests on this beach are declining. The mean nesting density was calculated as 13 nests/km.

<u>Patara Beach.</u>

The annual mean nesting number was calculated as 72 nests with a nesting density of 6 nests/km for 15 nesting seasons (Table 5). In comparison to 1994, the beach has been improving naturally (Oruç et al., 2003). The beach was classified as a nesting beach of 2nd degree importance with 3.5% contribution to the national total (Canbolat, 2004).

<u>Kale-Demre Beach.</u>

See Table 6.

<u>Finike-Kumluca Beach.</u>

See Table 7.

<u>Çıralı Beach.</u>

The mean number of nests was calculated to be 49 nests/yr with a nesting density of 15 nests/km (Table 8) during 13 nesting seasons.

<u>Belek Beach.</u>

In 1979, Geldiay et al. (1982) recorded 240 nests in 16 km between Aksu and Acısu. Later, Baran and Kasparek (1989) surveyed the beach on different dates and recorded 226 nests. Belek beach is the most deteriorating beach among others (Oruç et al., 2003). Canbolat (2004) classified the beach as 1st degree importance with 27.9% contribution to the national total. See Table 9.

Kızılot Beach.

See Table 10.

Anamur Beach.

See Table 11.

Göksu Delta.

See Table 12.

Alata Beach.

Based on the data available (Table 13), the mean 25 nests/yr was calculated, with a mean nesting density of 8.3 nests/km during 4 nesting seasons.

Kazanlı Beach.

See Table 14.

Akyatan Beach.

See Table 15.

Samandağ Beach.

See Table 16.

Table 2. Numbers of loggerhead turtle nests nest on Dalyan beach (a: Geldiay et al., 1982; b: Canbolat, 1991; c: Erk'akan, 1993; d: Baran et al., 1992; e: Canbolat, 2004; f: Yerli and Demirayak, 1996; g: Baran et al., 1996; h: Ilgaz and Baran, 2001; i: Yerli and Canbolat, 1998a; j: Canbolat, 2001; k: Canbolat, 2006a; l: Canbolat, 2006a; m: Türkozan and Yilmaz, 2008; n: Canbolat et al., 2007; empty cells refers to lack of data).

Year	Number of nests	Length of beach studied (km)	Reference
1979	330	4.7	a
1988	146	4.2	b
1989	235	4.2	c
1990	57	4.2	d
1991	271	4.7	e
1992	217	4.7	e
1993	235	4.7	e
1994	86	4.7	f
1995			
1996	107	4.7	g
1997	135	4.7	h
1998	193	4.7	i
1999	276	4.7	e
2000	264	4.7	j
2001	197	4.7	J
2002	286	4.7	k
2003	232	4.7	l
2004	223	4.7	m
2005	221	4.7	m
2006	269	4.7	n

Table 3. Numbers of loggerhead turtle nests on Dalaman beach (a: Baran and Kasparek, 1989; b: Erk'akan et al., 1990; c: Yerli and Demirayak, 1996; d: Yerli et al., 1998; e: Kaska et al., 2005b; f: Erzin et al., 2006; g: Canbolat et al., 2007).

Year	Number of nests	Length of beach studied (km)	Reference
1988	110	10.4	a
1989	69		b
1994	73	7.2	c
1998	69		d
2002	103	10.4	e
2003	110	10.4	e
2004	112	10.4	e
2005	63	10.4	f
2006	73	10.4	g

Table 4: Numbers of loggerhead turtle nests on Fethiye beach (a: Türkozan and Baran, 1996; b: Baran and Türkozan, 1996; c: Türkozan, 2000; d:Yerli and Canbolat, 1998a; e: Türkozan, 2006; f: Ilgaz et al., 2007; g: Canbolat et al., 2007).

Year	Number of nests	Length of beach studied (km)	Reference
1993	118	8.3	a
1994	158	8.3	b
1995	191	8.3	c
1996	88	8.3	c
1997	95	8.3	c
1998	93	8.3	d
1999	100	8.3	e
2000	110	8.3	e
2001	114	8.3	e
2002	84	8.3	e
2003	106	8.3	e
2004	58	8.3	e
2005	80	8.3	f
2006	72	8.3	g

Table 5. Numbers of loggerhead turtle nests on Patara beach (a: Yerli, 1990; b:Baran et al., 1992; c: Kaska, 1993; d: Canbolat, 2004; e: Yerli and Demirayak, 1996; f: Baran et al., 1996; g: Taskin and Baran, 2001; h: Yerli and Canbolat, 1998a; i: Canbolat, 1999; j: Erdoğan et al., 2001; k: Öz et al., 2006; l: Selin, 2004; m: Türkozan and Kiremit, in prep.; n: Canbolat et al., 2007).

Years	Number of nests	Length of beach studied (km)	Reference
1989	93	6.7	a
1990	58	6.7	b
1991			
1992	52	6.7	c
1993	85	6.7	d
1994	33	6.7	e
1995			
1996	35	6.7	f
1997	52	6.7	g
1998	64	6.7	h
1999	79	6.7	i
2000	85	11.9	j
2001	53	9.9	k
2002	81	9.8	k
2003			
2004	72	6.9	l
2005	83	14	m
2006	127	12.1	n

Table 6. Numbers of loggerhead turtle nests on Kale-Demre beach (a: Yerli and Demirayak, 1996; b: Yerli et al., 1998; c: Ergene, 2006).

Years	Number of nests	Length of beach studied (km)	Reference
1994	39	2.2	a
1998	109	8.5	b
2006	52	8.5	c

Table 7. Numbers of loggerhead turtle nests on Finike-Kumluca beach (a: Geldiay et al., 1982; b: Baran et al., 1992; c: Yerli and Demirayak, 1996; d: Yerli et al., 1998; e: Oruç et al., 2003) * This nest number is recorded during one day monitoring.

Years	Number of nests	Length of beach studied (km)	Reference
1979	295		a
1988	148		b
1994	75	7.4	c
1998	305		d
2003	96*	21	e

Table 8. Numbers of loggerhead turtle nest on Cirali beach (a: Oruç et al., 2007).

Years	Number of nests	Length of beach studied (km)	Reference
1994	34	3.2	a
1995	37	3.2	a
1995	26	3.2	a
1997	29	3.2	a
1998	23	3.2	a
1999	39	3.2	a
2000	37	3.2	a
2001	61	3.2	a
2002	27	3.2	a
2003	89	3.2	a
2004	86	3.2	a
2005	58	3.2	a
2006	96	3.2	a

Table 9. Numbers of loggerhead turtle nests on Belek beach (a: Yerli and Demirayak, 1996; b: Whitmore, 1995; c: Sak and Baran, 2001; d: Canbolat, 2004; e: Canbolat et al., 2007; f: Selin, 2004; g: Taşkavak et al., 2006 *survey carried out between August 9 to September 9).

Years	Number of nests	Length of beach studied (km)	Reference
1994	68	7.2	a
1995	203	16.1*	b
1996	153	17	c
1997	168	17	c
1998	385	29.3	d
1999	612	29.3	d
2000	682	29.3	d
2001	645	29.3	e
2002	745	29.3	e
2003	737	29.3	e
2004	409	7.3	f
2005	433	7.3	g
2006	819	16	e

Table 10. Numbers of loggerhead turtle nests on Kizilot beach (a: Baran et al., 1992; b: Yerli and Demirayak, 1996; c: Türkozan, 2000; d: Yerli et al., 1998).

Years	Number of nests	Length of beach studied (km)	Reference
1990	143		a
1994	50	8.5	b
1996	125		c
1997	108		c
1998	270		d

Table 11. Numbers of loggerhead turtle nests on Anamur beach (a: Baran et al., 1992; b: Yerli and Demirayak, 1996; c: Yerli and Canbolat, 1998b; d: S. Ergene (Mersin Unv.) unpublished data)

Years	Number of nests	Length of beach studied (km)	Reference
1990	146	12	a
1994	195	4.1	b
1996	187	12	c
2006	674	12	d

Table 12. Numbers of loggerhead turtle nests on Goksu Delta beach (a: Von Piggelen-Strijbosch, 1993; b: Peters and Verhoven, 1992; c: Yerli and Demirayak, 1996; d: Glen et al., 1997; e: Yerli and Canbolat, 1998a; f: Selin, 2004; g: Taşkavak et al., 2006; h: Canbolat et al., 2007).

Years	Number of nests	Length of beach studied (km)	Reference
1991	117		a
1992	89		b
1994	36	10.5	c
1996	36		d
1998	94		e
2004	137	25.6	f
2005	151	25.6	g
2006	107	34.7	h

Table 13. Numbers of loggerhead turtle nests on Alata beach **(**a: Aymak et al., 2005; b: Ergene et al., 2006; c: S. Ergene pers. com.)

Years	Number of nests	Length of beach studied (km)	Reference
2002	27	3	a
2003	32	3	a
2004			
2005	26	3	b
2006	16	3	c

Table 14. Numbers of loggerhead turtle nests on Kazanlı beach (a: Baran et al., 1992; b: Yerli and Canbolat, 1998b; c: Aureggi, 2001; d: Baran et al., 2002; e: Elmaz and Kalay, 2006; f: S. Ergene, pers. com).

Years	Number of nests	Length of beach studied (km)	Reference
1990	2	-	a
1996	7	4	b
2001	26	4.5	c
2002	18	4.5	d
2004	7	4.5	e
2006	11	-	f

Table 15. Numbers of loggerhead turtle nests on Akyatan beach (a: Brown and McDonald, 1995; b: Yerli and Demirayak, 1996; c: Türkozan et al., 2007).

Years	Number of nests	Length of beach studied (km)	Reference
1992	3	9	a
1994	23	13	b
2006	31	22	c

Table 16. Numbers of loggerhead turtle nests on Samandağ beach (a: Yerli and Canbolat, 1998b; b: Yalçın, 2003; c: Özdilek Yalçın, 2007 d: B. Sönmez (Mustafa Kemal Univ. PhD student), unpubl. data).

Years	Number of nests	Length of beach studied (km)	Reference
1996	3	9	a
2001	20		b
2002	7	14	b
2003	20	14	c
2004	11	14	c
2005	15	14	c
2006	9		d

Nest numbers for other beaches.

Baran et al. (1994) monitored the Ekincik beach for two months regularly and detected only 13 emergences, of which only 9 resulted in nests. They reported that the beach structure, with large grains of sand and the layer under these large grains was very difficult to dig for nesting. Ilgaz et al. (2006) monitored Ekincik beach during the full breeding season and recorded 30 emergences with 12 resulting in nests.

During 1988 work (Baran and Kasparek, 1989), a total of 40 nests were recorded on different dates (Baran and Kasparek, 1989) on Tekirova Beach. In the same report, it was mentioned that Kinzelbach found 23 nests in two days. Yerli et al. (1998) reported 4 nests during 1998 nesting season. During the 2003 nesting season, the whole beach of Tekirova was monitored on foot and seen that the beach had almost lost its marine turtle nesting site status.

Baran and Kasparek (1989) recorded 41 nests in 7.4 km Demirtas Beach. During the 1996 nesting season 80 nests were recorded (Yerli and Canbolat, 1998b). During the 2006 nesting season 137 loggerhead turtle nests were identified in 7.8 km (Canbolat, 2006d).

Baran and Kasparek recorded 53 nests on Gazipaşa beach. 14 nests were recorded both in 1994 (Yerli and Demirayak, 1996) and 1996 (Yerli and Canbolat, 1998b).

2.3. Threats

2.3.1. Terrestrial Habitats

2.3.1.1. Coastal development

Human presence, coastal construction, pollution, artificial lighting and vehicle driving are the issues commonly seen at most of the nesting beaches. Public access is prohibited at night because of turtle nesting on Dalyan and Patara beaches. However, strict control measures have been applied only on Dalyan beach.

Contraction of new hotel complexes and secondary houses are another important problem. Most of the big holiday resorts cover the beach in front of their complexes with deck chairs and umbrellas.

Although the Kazanlı beach was used for nesting mainly by green turtles, the "accidental"' discharge of waste from the factory in 2001 interestingly coincided with a death of over 30 loggerheads that washed on Kazanlı shore (Aureggi, 2001). These stranded turtles as well as many others on other beaches were investigated in terms of the cause of mortality. A total of 65 stranded and two injured turtles were found along the south-western Mediterranean coast of Turkey during the monitoring program and the majority (n = 42) of the stranded ones were loggerhead turtles and the others (n = 23) were green sea turtles. The main causes of turtle mortalities were fishing-industry related injuries and drowning in trawl nets (Kaska et al., 2004).

2.3.1.2. Beach restructuring

Beach structuring activities mainly occur near the holiday villages. At some beaches, the holiday villages close both side of beach entrance with a fence for "security reasons". These resorts also use heavy machinery on the beach almost every day to smooth and arrange the beach sand. Unfortunately, for this aim they sometimes steal sand from different parts of the beaches. Sand mining activities also occurs in others part of Turkey. The biggest sand mining activities occurs in Belek and Kumluca beaches. Some parts of beaches have been designated as areas for beach volleyball, especially on the western coast.

2.3.1.3. Non human predation

At many sites around the Mediterranean, predation by mammals has been shown to be a major cause of egg and hatchling mortality. Similar results have also been recorded from Turkish beaches. Of the depredated eggs, 71.9% were destroyed by foxes and dogs on the Fethiye beach while this was 68.4% on Kızılot beach (Türkozan, 2000). On Dalyan beach, of the depredated eggs, 93% were destroyed by red foxes (*Vulpes vulpes*) while 7% were depredated by badgers (*Meles meles*) (Türkozan and Yılmaz, in press). Another problem recorded from certain loggerhead nesting beaches is invertebrate infestation (Baran et al., 2001; Türkozan et al., 2003). Between the years 1994 and 1997, 17.6% of the predated eggs were infested by coleopteran larvae, while 18.5 % were infested by coleopteran larvae on Kızılot beach (Türkozan et al., 2003). Another mammal species predating loggerhead turtle eggs is the golden jackal (*Canis aereus*). This species is mostly active on the eastern beaches where nests are mainly from green turtles. During 2006 nesting season 66% of the total egg number was predated by jackals on Akyatan beach (Türkozan et al., 2006). Most of the loggerhead turtle nests are predated by foxes since loggerhead nests are shallower in comparison to green turtle nests, which make the nest easy to find and dig up (Türkozan et al., 2006). The wild pig visits the nesting beaches but no predation by this species was reported until now. Yerli and Demirayak (1996) reported that an unconfirmed predator on Anamur beach may be by Egyptian mongoose (*Herpestes ichneumon*).

For the hatchlings, fox, crab, bird and strong sunlight and dehydration causes hatchling losses on nesting beaches. Assessing predation data from 3 seasons at Dalyan beach resulted in hatchling predation rates of 32.1% by foxes, 60.1% by crabs and 0.8% by bird predation. The main threat to the beach is natural predation by fox on the nests and hatchlings of the loggerhead turtles.

On Patara beach, during two seasons, of the predated hatchlings, 13% were predated by foxes and 82.2% by crabs. On Kızılot beach, of the predated hatchlings, 55.2% were predated by foxes, 4.5% by birds, and 11. 9% by dogs.

Predation by jackals was not limited to sea turtle nests and hatchlings. Van Piggelen (1992) reported that in 1991 jackals killed 4 female loggerheads coming ashore to nest. This report was further confirmed (Peters and Verhoeven, 1992; Selin, 2004; Akçınar et al., 2006). Three adult loggerhead turtles coming ashore to nest were killed by golden jackals (Peters and Verhoeven, 1992) and in 2004, 10 loggerhead turtles were killed by golden jackals.

The predation of hatchlings in the sea has also been reported (Türkecan and Yerli, 2007). This study reported that 4.8 % of the hatchlings (out of 62 hatchlings) were predated by the sea bass (*Dicentrarchus labrax*).

2.3.1.4. Human exploitation

Normally, turtle meat and turtle eggs are not eaten in Turkey. However, there is a wrong belief in some areas that turtle and/or tortoise meat is good for treating cancer. Furthermore, in Taşucu, Mersin Province, some people believe that stepping on turtle/tortoise blood heals eczema (Yerli and Demirayak, 1996). However, this does not mean there is a black market for meat and blood in Turkey. These are just personal activities reported in the past.

2.3.1.5. Other threats

Beach erosion is a serious problem for some nesting beaches. While this erosion occurs naturally in some areas, illegal sand extraction and artificial jetties also cause erosion and destroy nesting beaches. High tide line also causes nest flooding in certain beaches such as Patara and the Göksu Delta. A jetty of a factory in Kazanlı caused heavy beach erosion for years on an important section (K3) of the green turtle nesting beach.

Boat strikes have already been mentioned as one of the threats to marine turtles in Turkey. However, no data is available on its potential impact. In recent years, preliminary data collected by sea turtle research, rescue and rehabilitation centre at Dalyan beach showed evidence of boat strikes and propeller cuts. In 2009 the center reported four turtles (out of 11) with such an evidence.

Marine debris is also a big problem especially on the eastern coasts of Turkey.

The destruction of the eggs by plant roots is rarely reported on Turkish beaches.

Although not a large-scale activity, some people bury themselves in to the sand on the beach. These people believe that hot sand is good for many illnesses. However, such activities sometimes caused the destruction of a few nests by coincidence of burying themselves on or nearby a nest.

Samandağ beach is severely eroded because of illegal sand mining. Beach erosion and plastic pollution are the common problems. The beach needs an urgent rehabilitation actions to be able to ensure continued nesting site status in the future. On Kızılot beach, strong sunlight and dehydration caused 11.9% hatchlings to die. Strong sunlight and dehydration caused the death of 7% hatchlings on Dalyan beach (Türkozan et al., 2003).

2.3.2 Marine Habitats

2.3.2.1 Incidental catch

In 1995-1996 fishing season Oruç et al. (1996) carried out a preliminary research on the impact of fisheries on sea turtles between Mersin and Samandağ areas with 5 trawl boats. They reported 26 loggerheads trapped in the nets. Of the 26 turtles trapped in the net 42% were from 11-30 m depth.

In the following season (Oruç et al., 1997), 116 loggerheads were caught by 12 trawl boats. The size of turtles measured (N=82) was mostly (61%) 31-60 cm and 89% of the turtles (N=70) were caught at 11-30 m depths.

A survey carried out by Godley et al. (1998) between Alanya and Mersin concluded that fisherman in Turkey caught an estimated 2.5 turtles/boat/year mainly by bottom trawls.

2.3.2.2. Intentional killing and exploitation

From 1950-1970, sea turtle hunting was quite widespread on the eastern Mediterranean coast. In 1950's and 1960's a factory in Iskenderun bought harvested sea turtles from the local people for exporting to Central Europe (Baran and Kasparek, 1989). The turtles that were once being hunted for export have been under protection since 1973, following publication of the 1380th Water Products Circular regarding the law on water products, and therefore collecting and hunting sea turtles is forbidden in Turkey. Laurent et al. (1998) mentioned that large immature and adult stage loggerhead turtles from Turkish coasts had been harvested predominantly by Egyptian fisheries.

However, there are reports of adult turtle deaths after they become entangled in fishing nets. These deaths are both accidentally and intentionally caused by fishermen.

2.3.2.3. Other threats

Pollution in the sea mainly occurs in the eastern beaches of Turkey. Sources of pollution may originate from the sea, from rivers, from the beach or from nearby factories. These types of pollution are reported on Samandağ beach, the most eastern beach of Turkey (Özdilek et al., 2006). Özdilek et al (2006) reported that solid waste accumulation on beaches negatively affects green turtle hatchlings trying to reach the sea and the percentage of hatchlings reaching the sea was found to be negatively correlated with beach litter amount. Kazanlı is another example of factory-caused pollution. Due to the chemical waste of the Soda-chromium factory, the sea in this area is polluted and accidental discharge of waste has also been reported.

The major categories of potential pollutants having impact on marine turtles are solid debris, oil and tar. The heavy metal contaminants in eggshells, yolk and embryonic livers of loggerhead turtles (Kaska and Furness, 2001) and on stranded animals (Kaska et al., 2004) and nesting environment (Çelik et al., 2006) from Turkey have already been investigated. The contamination levels reported were found to be within the acceptable limits.

3. *Chelonia mydas*

3.1. Present distribution and abundance

3.1.1. Nesting sites

The green turtle is mostly confined to the eastern Mediterranean coasts of Turkey. However, there are also sporadic nesting records from the western beaches. Including these sporadic nesting sites, green turtles nest on 16 beaches in Turkey. Of these beaches, some holds important amount of nests namely, Alata, Kazanlı, Akyatan, Sugözü beaches and Samandağ. According to Kasparek et al. (2001) 78% of all green turtle nests in the Mediterranean concentrated at five nesting beaches, three of them in Turkey (Akyatan , Kazanlı and Samandağ) and two in Northern Cyprus (North Karpaz and Alagadi). However, the explorations of two new nesting sites, Sugözü beaches and Alata, should have changed the current status of green turtles in the Mediterranean. Kasparek et al. (2001) estimated 350-1750 clutches per year from which annual nesting population of 115 to 580 females has been estimated. Broderick et al. (2002) estimated 339-360 green turtles nesting annually at some sites in the Mediterranean. Canbolat (2004) estimated annual mean nest numbers of green turtles along the coast of Turkey as 648 (range: 391 - 910). He estimated 130 to 300 females nesting along the Turkish coastline. He also gave the overall nesting density as 19.2 nests/km for the green turtles of Turkey. Kaska et al. (2005a) estimated 700-1150 *Chelonia mydas* nests on Turkish beaches.

Recently, Bağda et al. (2008) identified 6 haplotypes from Turkey and Northern Cyprus, three of which were new haplotypes for the green turtles.

Under the light of this up-to-date information, it is likely that the real potential of the green turtle nesting beaches is still unknown. The reason for this information gap is the lack of regular surveys (covering overall beach and the whole breeding season) on certain nesting beaches which has estimated to have a larger potential. Based on existing data (Table 1), the present estimates are far from the estimates of Canbolat (2004). The annual number of green turtle nests ranged from 452 to 2051 nests. It seems from the present data that Tuzla, Karataş, Ağyatan, Yelkoma and Yumurtalık beaches give a small contribution to the annual nest numbers in Turkey.

<u>Patara beach.</u>

Erdoğan et al. (2001) recorded two green turtle nests from Patara beach for the first time. This is the only record of green turtle nest up to now. This beach is mainly used by loggerheads for nesting.

<u>Kumluca beach.</u>

This beach is one of the least studied beaches of Turkey. Yerli and Demirayak (1996) recorded 7 nests during 1994 nesting season. However, Yerli et al. (1998) found no nesting of green turtles. It seems that green turtles have used this beach sporadically.

<u>Belek beach.</u>

Green turtle nesting was first mentioned by Geldiay et al. (1981) but in a comprehensive survey in 1988, no nest of this species were recorded (Baran and Kasparek, 1989). Successive monitoring of the beach during different years located two to eight nests per annum (Table 17). The beach has been monitored regularly since 1994 to 2006, but green turtle nests were observed only during five nesting seasons.

Kızılot beach.

Kızılot beach is also one of the least studied beaches of Turkey. Kaska (1993) recorded three nests during 1990 nesting season. No nests were recorded during a 1994 survey (Yerli and Demirayak, 1996). While only one nest was recorded during 1998 nesting season (Yerli et al., 1998). It seems that either green turtles have used this beach sporadically or these results are due to the lack of regular surveys covering the whole beach.

Anamur beach.

The first green turtle nest was reported by Yerli and Demirayak (1996) during the 1994 nesting season. They located only one green turtle nest. The following studies found no green turtle nests in Anamur beach except one nest record in 2006 nesting season (S. Ergene unpubl. data).

Göksu Delta beach.

No green turtle nesting was reported during 1988 and 1994 surveys (Baran and Kasparek, 1989; Yerli and Demirayak, 1996). However, complete surveys have revealed green turtle nesting on this beach.

Alata beach.

Alata beach is first introduced as green turtle nesting area by Aymak et al. (2005). Based on the existing nest counts (Table 19) the mean number of nest is 188 with a nesting density of 39 nests/km.

Kazanlı beach.

This beach is designated as a Natural SIT area. The total length of the beach is about 4.5 km. Previous studies (Coley and Smart, 1992; Yerli and Demirayak, 1996) have divided the beach into four different sections (K1, K2, K3, K4) easily defined by obvious physical features.

- Kazanlı 1 (K1). This part of the beach is different from the rest of Kazanli area. It has a rather homogeneous aspect of fine sand and small dunes with quite rich Mediterranean dune vegetation. Towards the eastern end, the dunes are wider and the beach is more wild and natural. It was in fact declared as a Nature Site in October 1999.
- Kazanlı 2 (K2). This is the municipal stretch of the beach. One restaurant and two tea gardens are located on the beach and along them a line of cement benches has been placed. There is a recreational area for children and a football ground on the eastern part of this section. A wedding saloon is situated in the back of the football ground.
- Kazanlı 3 (K3). Strong erosion has removed most of the western part of the beach leaving a step of about 1-2 metres, with greenhouses behind. The eastern part of the beach, ending at the sewage canal of the village, is sandier but narrow.
- Kazanlı 4 (K4). Previous surveys refer to this section as the part in front of the Soda-Chrome Factory, with limited public access to the area. During the season 2001, free access was given to the sea turtle monitoring programme and therefore it was included in the study area. The beach was separated from (K3) by a jetty of stone blocks, which was removed in August 2001. There is a sheer cliff, approximately 3 metres high, with a road at the top surrounding the beach.

Green turtle nesting at this site was first mentioned by Geldiay and Koray (1982). The regional importance of this site was further confirmed by Baran and Kasparek (1989), According to Yerli and Demirayak (1996) Kazanlı beach is the most important green turtle nesting site in Turkey with 48 nests/km density. However, in the most recent assessment by Kasparek et al. (2001) proved that Kazanlı beach is the second important nesting ground after Akyatan in the Mediterranean based on relative annual contribution in number of nests.

Dog and crab predation are another two factors affecting the turtle population. There is also photo-pollution in some parts of the beach.

Tuzla beach.

Tuzla beach is located at the western edge of the Akyatan beach and is almost 25 km long. Baran and Kasparek (1989) recorded only turtle track without mentioning the species. It seems that the first nesting was reported by Langeveld and

Sarıgül (1990) with four nests. In the 1996 nesting season eight nests were found (Yerli and Canbolat, 1998b). Finally, during the 2006 nesting season a total of 11 emergences were recorded with nine resulting in nests (Türkozan et al., 2006).

Akyatan beach.

This is one of the pristine shores in Turkey and is almost inaccessible, creating an ideal refuge for wildlife. Access to Akyatan became more restricted after forestation efforts and, as a result, jackal and fox populations have exploded, making predation a major threat for sea turtle nests.

Green turtle nesting was first reported by Geldiay and Koray (1982). Following surveys with various methodologies, survey time and the length of the beach studied proved that the beach is very important for the green turtles. Yerli and Demirayak (1996) stated that Akyatan is the second most important nesting sites of green turtles in Turkey after Kazanlı with nesting density of 38 nests/km. However, in a review of green turtle nesting in the Mediterranean proved that Akyatan beach is the most important nesting site of green turtles in the eastern Mediterranean holding 45% of the nesting activity in the eastern Mediterranean (Kasparek et al., 2001). The beach is 22 km long and may hold up to 735 nests per season (Table 21). The whole beach was studied for the first time through the 2006 breeding season (Türkozan et al., 2007). The main threats on the beach are fox and golden jackal predation. However, local people sometimes use tractors on the beach and destroy the natural structure which affects hatchlings in negative way (Türkozan et al., 2007). Kasparek et al. (2001) mentioned the possible extension of tourism activities from Tuzla over the main nesting area.

Karataş beach.

Karataş beach is located at the eastern edge of the Akyatan beach. Baran and Kasparek (1989) recorded some tracks and a couple of nests during surveys on different dates on the beach. Geldiay reported the Karataş beach as an important nesting area but he probably referred to Akyatan beach (Baran and Kasparek, 1989).

Ağyatan beach.

Ağyatan beach is a large sandy beach 8.4 km long. Baran and Kasparek (1989) recorded three nests. Yerli and Canbolat (1998b) found two nests. During the 2006 nesting season no nest were recorded (Türkozan et al., 2006).

Yelkoma beach.

This is a sandy and remote beach, 23.1 km long. The name of the beach is found in many publications but most of the time it is included as part of Yumurtalık beach. Baran and Kasparek (1989) reported three nests. Yerli and Canbolat (1998b) recorded two nests in 1996. This beach is generally assessed as a part Yumurtalık beach.

Yumurtalık beach.

Yumurtalık beach is 24.5 km in length and is a part of Permanent Wildlife Reserve. Baran and Kasparek (1989) reported three nests. Türkozan et al. (2006) monitored the overall beach every 15th day during the 2006 breeding period but recorded only one nest.

Sugözü beaches.

This beach was introduced as a new nesting site of green turtles, for the first time, by Canbolat et al. (2005). This beach could also be taken under Yumurtalık. The beach consists of four small subsections with a total length of 3.4 km. In the 2004 nesting season, a total of 213 green turtle nests were recorded by Canbolat et al. (2005).

Samandağ beach.

Samandağ beach is the most eastern of the marine turtle nesting sites. The beach is 14 km long and consists of three subsections namely, Çevlik, Sehhızır and Meydan beaches. Sand mining and erosion are two main threats to the beach. Regular beach monitoring and conservation activities have been carried out since 2001 (Table 22) by the local university, Hatay Mustafa Kemal University, biology department.

3.1.2. Marine areas

The Gulf of İskenderun was first cited by Gruvel (1931), as given in Groombridge

(1990), as visited by turtles outside the nesting season. Stranded turtles found during a survey along the Turkish coasts (Baran and Kasparek, 1989) suggested that green turtles reside in shallow water adjacent to their nesting beaches along the Çukurova region coast. The presence of juveniles in the Çukurova area has been further confirmed (Oruç et al., 1997). In addition Yalçın-Özdilek and Aureggi (2006), based on strandings of juvenile green turtles on the beach, suggested that Samandağ area is probably a foraging ground for green turtles. It is highly probable that the Iskenderun Bay is a juvenile developmental area for green turtles.

Türkozan and Durmuş (2000) reported that Fethiye Bay might represent a feeding ground for juvenile green turtles.

Of the six adult females equipped with satellite transmitters in the Northern Cyprus, one migrated to Turkey. This turtle used the area between Antalya and Kızılot as foraging and wintering ground (Godley et al., 2002).

3.2. Past distribution and abundance

In 1980, Geldiay tagged 15 turtles at Kazanlı in two nights (Geldiay and Koray, 1982). In 1988, only 1-5 turtles were seen and tagged (Baran and Kasparek, 1989).

The nesting numbers are given below as separate tables for each beach monitored.

<u>Belek beach.</u>

Table 17. Numbers of green turtle nest on Belek beach (a: Yerli and Demirayak, 1996; b: Yerli et al., 1998; c: Canbolat, 2006b; d: Canbolat, 2006b; e: Selin, 2004; f: Taşkavak et al., 2006; g: Canbolat et al., 2007).

Years	Number of nests	Length of beach studied (km)	Reference
1994	4	7.2	a
1998	8	29.3	b
1999	2	29.3	c
2000	8	29.3	d
2004	3	7.2	e
2005	4	7.2	f
2006	1	29.3	g

<u>Göksu Delta.</u>

Table 18. Numbers of green turtle nests on Göksu Deltası beach (a: van Piggelen and Strijbosch, 1993; b: Yerli et al., 1998; c: Glen et al., 1997: d: Yerli and Canbolat, 1998b; e: Selin, 2004; f: Taşkavak et al., 2006; g: Canbolat et al., 2007).

Years	Number of nests	Length of beach studied (km)	Reference
1991	20		a
1992	14		b
1996	3		c
1998	12		d
2004	14	25.6	e
2005	3	25.6	f
2006	12		g

Alata beach.

Table 19. Numbers of green turtle nests on Alata beach (a: Aymak et al., 2005; b: Ergene et al., 2006; c: S. Ergene, pers. com., 2006).

Years	Number of nests	Length of beach studied (km)	Reference
2002	134	3	a
2003	121	3	a
2004	-	-	-
2005	20	3	b
2006	198	3	c

Kazanlı beach.

Table 20. Numbers of green turtle nests on Kazanlı beach (a: Baran and Kasparek, 1989; b: Baran et al., 1992; c: Durmuş, 1998; d: Yerli and Canbolat, 1998c; e: Aureggi, 2001; f: Baran et al., 2002; g: Elmaz and Kalay, 2006; h. S. Ergene, pers. com.).

Years	Number of nests	Length of beach studied (km)	Reference
1988	152		a
1990	74		b
1993	176		c
1994	216		c
1996	128	4	d
2000	111		
2001	73	4.5	e
2002	307	4.5	f
2004	403	4.5	g
2006	385		h

Akyatan beach.

Table 21. Numbers of green turtle nests on Akyatan beach (a: Baran and Kasparek, 1989; b: Whitmore, 1991; c: Brown and McDonald, 1995 ; d: Yerli and Demirayak, 1996; e: Gerosa et al., 1998; f: Yerli and Canbolat, 1998b; g: Aureggi et al., 2000; h: Oruç, 2001; Oruç et al., 2002; j: Türkozan et al., 2007).

Years	Number of nests	Survey period (days)	Length of beach studied (km)	Reference
1988	108	7		a
1991	210	3		b
1992	120		9	c
1994	496	81	13	d
1995	504	74		e
1996	179	84		f
1997	231	85		e
1998	735			g
2000	223	57	8	h
2001	159	81	6	i
2006	562	101	22	j

Samandağ beach.

Table 22. Numbers of green turtle nests on Samandağ beach (a: Baran and Kasparek, 1989; b: Yerli and Demirayak, 1996; c: Yerli and Canbolat, 1998b; d: Özdilek Yalçın, 2007; e: B. Sönmez, unpubl. data (Mustafa Kemal Univ.)).

Years	Number of nests	Length of beach studied (km)	Reference
1988	34		a
1994	124		b
1996	44	9	c
2001	20	4.1	d
2002	118	14	d
2003	126	14	d
2004	325	14	d
2005	16	14	d
2006	440	14	e

3.3. Threats

3.3.1. Terrestrial Habitats

3.3.1.1. Coastal development

The eastern Mediterranean beaches of Turkey are subject to high levels of pollution from marine debris. Most of this debris washes ashore at Akyatan and Samandağ.

There is an increasing demand for refined petroleum storage plants in the last five years, especially in the green turtle nesting region. Furthermore, coastal construction and pollution are other important threats for all beaches. In some parts, chemical discharge also threatens survival of the green turtle populations.

Kazanlı beach has suffered from considerable problems in the recent past; caused by expansion of greenhouses behind the beach and varied effects of the adjacent soda-chromium factory. For example, discharge of toxic waste into the sea was documented twice in 2001 (Kasparek et al., 2001), which would have affected more than just sea turtles, and a jetty has caused a significant amount of erosion to the core nesting area. The jetty has been removed but the beach has not yet replenished itself.

3.3.1.2. Beach restructuring

Sand mining and beach erosion are the most important problems facing green turtle nesting beaches. According to Kasparek et al. (2001) large parts of sand dunes in the Göksu Delta have been lost due to sand extraction. Oruç et al. (2003) also reported a large amount of sand extraction taking place on Samandağ beach. Beach erosion has also been reported from the core nesting subsection (K3) of Kazanlı beach by several researchers (Durmuş, 1998; Kasparek et al., 2001). Coastal construction also occurs on Samandağ and Kazanlı beaches.

3.3.1.3. Non human predation

The predation of green turtle nests by mammals (*Vulpes vulpes, Canis aureus* and *Canis familiaris*) is very common on nesting beaches (van Piggelen, 1991; Brown and McDonald, 1995; Aureggi et al., 1999; Türkozan et al., 2007). However, published data showing the details of nest or hatchling predation is limited in comparison to loggerhead nesting sites. Brown and McDonalds (1995) reported that 63.8% of green turtle nests were attacked by wild canids on Akyatan beach. During 1995 nesting season on Akyatan beach, 23.9% of the green turtle nests were depredated (Aureggi et al., 1999) by canids as well. The predation rate on Akyatan beach during 2006 nesting season was 14.0% for the eggs (Türkozan et al., 2007). The predation rate was reduced by placing wire meshes over the nests during the breeding season.

Of the hatchlings, 18% were depredated by either foxes or jackals on Akyatan beach during the 2006 breeding season (Türkozan et al., 2006). According to Peters and Verhoeven (1992) jackals have more impact on hatchling survival than on nests.

Jackal attacks are not only limited to

green turtle nests and hatchlings. During the 2004 nesting season, two adult females were killed on Göksu Delta beach (Akçınar et al., 2006)

3.3.1.4. Human exploitation

See 2.3.1.4

3.3.1.5. Other threats

Data not available.

3.3.2 Marine Habitats

3.3.2.1 Incidental catch

In the course of the trawling season in 1996, a total of 160 green turtles were captured between Mersin and Samandağ region and 61% of these turtles were captured at 11-20 m depth (Oruç et al., 1996). In the following year with 12 trawl boat, a total of 306 green turtles were captured from the same area (Oruç et al., 1997; Oruç, 2001). Of the 190 turtles measured during these captures 82% were 31-60 cm in size and 88% of the turtles (N=261) had been captured at 11-30 m depth.

Eight green turtle females washed ashore on Göksu Deltası with a CCL between 26 and 46 cm (Peters and Verhoeven, 1992). Yalçın-Özdilek and Aureggi (2006) recorded 22 green turtle strandings on Samandağ beach during 2002 breeding season with CCL ranging between 23.5 and 80 cm.

3.3.2.2. Intentional killing and exploitation

Although two species of sea turtles nest in Turkey, when it comes to mortality rates, exploitation etc., almost all the sea turtles are reported as loggerhead turtles. Therefore, the information given for loggerhead turtles (2.3.2.2.) more or less will be the same for green turtles as well. As already mentioned in the loggerhead turtle section, from 1950-1970, sea turtle hunting was quite widespread on the eastern Mediterranean coast. In the 1950's and 1960's a factory in Iskenderun bought harvested sea turtles from the local people for exporting to Central Europe (Baran and Kasparek, 1989). Since there are less loggerhead turtles than green turtles nesting in this region in recent years, it is more likely that majority of turtles caught were green turtles. The turtles that were once being hunted to be exported have been under protection since 1973 with the publication of the 1380th Water Products Circular regarding the law on water products.

In the past, turtle shells were used as cradles or used as decorations and souvenirs for tourists (Baran and Kasparek, 1989). Turkish people do not consume turtle meat. However, there are some extraordinary conditions they use turtles. There is a wrong belief in some areas that turtle meat is good for cancer treatment. Furthermore, in Taşucu, Mersin Province, some people believe that stepping on turtle blood heals eczema as well. There are also some records that the application of turtle blood is good for haemorrhoids and increases sexual power (Baran and Kasparek, 1989). Yerli and Demirayak (1996) reports killing of adults entangled in fishing net by fishermen.

3.3.2.3. Other threats

As it is already mentioned in the loggerhead section (2.3.2.3.), there is only one complete survey of the Mediterranean coast of Turkey and a total of 23 green sea turtle standings were reported. The main causes of turtle mortalities were fishing-industry related injuries and drowning in trawl nets (Kaska et al., 2004).

4. *Dermochelys coriacea*

4.1. Present distribution and abundance

The leatherback title has been irregularly recorded from the Aegean and Mediterranean seas of Turkey. The first actual record of leatherback turtle was from a fisherman in 1985 (Baran and Kasparek, 1989). Later, Oruç et al. (1996) reported that fishermen from Karataş and Yumurtalık occasionally observe leatherbacks in the sea. Moreover, an officer from the authority of the Ministry of Agriculture photographed a carcass of an adult leatherback turtle on the beach in the Straits of Hurma. Another leatherback turtle was caught by fishermen in the vicinity of Ören, Balıkesir Province, the Bay of Edremit, Aegean Sea (Baran et al., 1998). Taşkavak et al. (1998) reported a healthy individual again from the Aegean Sea, between Foça and Karaburun based on Prof. Dr.Şükran Cirik's personal observation. They also recorded another carcass from the Mediterranean Sea, in the vicinity of Anamur. More recently, a turtle that was originally tagged while nesting at Matura Beach (Trinidad) was found stranded on the most eastern basin of the Mediterranean (Sönmez et al., 2008).

4.2. Past distribution and abundance

Data not available.

4.3. Threats

Data not available.

5. Other species

No other sea turtle species have been reported from Turkey.

6. Conservation status

Turkey has been playing an important role for the conservation of marine turtles for a long time in the Mediterranean. As in other Mediterranean countries, there are some stories of successes during these conservation efforts as well as some unsuccessful results for the conservation of marine turtles. Regulations and laws are poorly enforced which permits local people to develop and illuminate the coast, thus causing problems for turtles. Turkey has national legislation for conservation of marine turtles. One act is the 1380th Water Products Circular regarding the law on water products and therefore the collecting and hunting of sea turtles is forbidden in Turkey. This is followed by the 2872nd Environment Law, the 3621st Coastal Law, the 2873rd National Park Law and the 2863rd Law of Protection of Natural and Cultural Beauties, all of which have been serving marine turtle conservation in Turkey. In addition to national laws, Turkey has been a part of some international conventions such as the Paris Declaration on the protection of the World Heritage of Cultural and Natural Diversities since 1983, the Barcelona Convention since 1988, the Bern Convention since 1984, Rio Convention since 1996, CITES since 1996.

The most well-known success story comes from Dalyan. Dalyan has served as a ”flagship beach” for the conservation of marine turtles in Turkey ever since an action of stopping a construction of a hotel complex on the beach in 1987. This is the start point of the marine turtle conservation in Turkey. Since that day, the understanding of conservation has been changed in the local communities as well. When conservation measures were first applied in Dalyan, the local people was quite angry due to imposed limitations. However, now they are very accepting of the turtles' presence and they know that the turtles are one of the most important species of Dalyan which indirectly provides them with an important source of income. The Köyceğiz-Dalyan area was designated as a “Specially Protected Area” in 1988. Public access is not allowed on Dalyan beach between 19:00 and 08:00. The existing wooden poles, extending through the beach at approximately 50 m intervals and 50 m away from the water line were used for the beach division. However, the main duty of these poles is keeping the day-time users not to use this area, which is identified as a core site for turtle nests. Beach guards control the beach 24 hours a day. The beach has been regularly monitored by scientists since 1987. This is a good example of both conservation and research activities.

Ekincik beach was included among the seventeen turtle nesting sites in 1988, after that, surprisingly, the area was declared as a ”tourism investment area”. Following this, several tourist facilities were built. The beach is now “Specially Protected Area” (SPA) as part of the Köyceğiz-Dalyan Specially Protected Area.

Dalaman beach is partly designated as Specially Protected Area and while some parts are under natural SIT status. Fethiye and Patara beaches are designated as ”Specially Protected Area” but the control of the beach during the nesting season is not as good as Dalyan beach. Some parts of Kale-Demre, Gazipaşa and Anamur beaches are under natural SIT status. Çıralı, Demirtaş, Alata and Kazanlı are also under 1st degree natural SIT status. Belek beach has been partly designated as SPA while some parts are under natural SIT status. Göksu Delta is a Ramsar site, Permanent Wildlife Reserve and SPA. Most parts are also under natural SIT protection. Akyatan lagoon is a Ramsar site, the forest is Permanent Wildlife Reserve and the beach is a Natural SIT area. Yumurtalık is a Nature Protection Area. There is no protection status on Samandag beach, but entrance to the southern section is forbidden at night due to its proximity to the Syrian border. Kumluca, Tekirova and Kızıot have no protection status. However, all nesting sites have been declared and listed as “marine turtle nesting sites” by Turkish Ministry of Environment and Forestry.

The Turkish Ministry of Environment and Forestry has been funding projects every year for turtle monitoring for almost all marine turtle nesting areas. However, these projects have been given to the researchers on an auction basis and annually. Instead of considering mainly the experience of the applicant research group, the lowest amount of money requested plays an important role for the decision about who will run the project. Another problem is that the duration of these projects is one year which means that researchers doing the scientific work could change every year. This hinders regular long-term beach monitoring programs and future planning by the scientists.

In spite of many national and international legislations and regulations, coastal developments, sand extraction, unplanned beach use, driving vehicles on the beach and beach lighting are the most important problems faced on the nesting beaches. Unfortunately, the implementation of the existing legislation is very poor on some nesting beaches. This is mainly a result of inaction from the local authorities.

Turkey is now trying to build a rehabilitation centre and first aid stations for marine turtles along the Mediterranean coast. Although it is a late attempt for a country with a 21 important nesting sites, it should be taken as a positive improvement for the conservation of marine turtles.

7. Conservation needs

In fact, Turkey has all legislations and regulations for the conservation of marine turtles. The only thing Turkey need is the strict control of implementation of these regulations and legislations. In addition, the turtle nesting beaches should be assigned to local universities for regular long-term population monitoring instead of on an annual auction basis.

In spite of a high nesting potential, the lack of first aid stations along the nesting coast and a rehabilitation centre for marine turtles is one of the most important needs. Furthermore, the lack of studies in marine areas, especially on the interaction of fisheries and marine turtles prevents us to estimate the real size of accidental catch resulting in mortality and injuries. Such a study would also provide immense knowledge on wintering and foraging areas together with genetic stock composition (Bowen et al., 1993; Encalada et al., 1998). All this better understanding of biological knowledge would provide better conservation and management for these species in Turkey. Sex ratio estimations from beaches is also providing a long-term conservation perspective as a highly female dominated sex ratio for both loggerhead and green turtles has been reported (Casale et al., 2000; Kaska et al., 2006).

Furthermore, all beaches should be regularly monitored along their whole coastal tract and for the entire nesting period, for at least three consecutive years. This will at least provide an idea about the status of some nesting beaches, which have never been investigated regularly in terms of either entire breeding season or the whole length of the beach.

8. Miscellaneous

None.

9. Institutions and organizations involved in conservation, management, and research

9.1. Public

The following universities have been

carrying out marine turtle research programs and education activities on different beaches of Turkey. In alphabetical order: Adnan Menderes University, Akdeniz University, Dokuz Eylül University, Hacettepe University, Hatay Mustafa Kemal University, Mersin University and Pamukkale University.

Ministry of Environment and Forestry, Wildlife Protection Department and Authority for the Specially Protected Areas financially supports the projects and manage the beaches according the recommendations coming from those universities working on the beaches. The "Marine Turtle Monitoring and Assessment Commission" was established in 1990 to coordinate marine turtle studies. The structure of this commission was consisting of scientific experts, NGO's and representatives from different governmental offices. Later on with the decision of Marine Turtle Monitoring and Assessment Commission, this commission was divided into three commissions on marine turtles, i.e. "Scientific Committee", "National Committee" and "Local Committee" Ministry of Environment and Forestry, Wildlife Protection Department organizes meetings at least once a year and call these commissions separately or together according to needs. Currently, the "scientific committee" consists of scientists from the universities, authorized people from the related governmental departments and two NGO's (WWF-Turkey and EKAD).

9.2. Private

<u>WWF-Turkey.</u>

The WWF-Turkey, which has been serving as The Nature Protection Organization in the past, is an effective organization for the protection of marine turtles in Turkey. They have supported and are still supporting many marine turtle projects in Turkey.

According to WWF-Turkey, the level of protection for marine turtle nesting sites is still far from adequate. Therefore, WWF aims for better protection and effective management of these turtle nesting sites. These areas are popular with tourists and human induced pressures on these sites continues to grow. Some of the important work WWF-Turkey carried out are listed below.

- Marine Turtle Nesting Site Evaluation Survey, Turkey 2003. The aim of the fieldwork was to determine the current status of the 17 nesting sites that were identified in 1988, by assessing the level of threats and preparing action plans and recommendations for the effective protection of marine turtle nesting sites in Turkey.
- First National Marine Turtle Symposium in Turkey. More than 150 participants attended the First National Marine Turtle Symposium in Turkey on 4-5 December 2003, in Istanbul. The Symposium, organized by WWF-Turkey with technical support of Ministry of Environment and Forestry, aimed to provide a review of marine turtle projects, distribute information on effective conservation techniques and showcase some examples of success stories.
- Sea Turtle Handling Guidebook for Fishermen. The UNEP Mediterranean Action Plan, Regional Activity Centre for Specially Protected Areas (RAC/SPA) "Sea Turtle Handling Guidebook for Fishermen" has been translated to Turkish, printed and distributed to all relevant parties by WWF- Turkey.

<u>Ekad.</u>

Academicians and volunteers working on environment founded EKAD in 2003. This NGO is predominantly carrying out marine turtle monitoring programs in Turkey. They have carried out conservation and research program for the last two years on several beaches Turkey.

10 Resources available about marine turtle research and conservation

<u>Newsletters:</u>

Kumsal: Published by WWF Turkey.

<u>Websites:</u>

Pamukkale University Sea Turtle Research Unit: http://caretta.pamukkale.edu.tr

Hacettepe University Sea Turtle Research Team: http://www.strt.hacettepe.edu.tr

Doğal Hayatı Koruma Vakfı-Wild World Foundation: http://www.dhkd.org

Çevre ve Orman Bakanlığı-Turkish Ministry of Environment and Forestry: http://www.cevreorman.gov.tr

Papers:

Proceedings of the First National Sea Turtle Symposium.

Proceedings of the Second National Sea Turtle Symposium (Kaska, 2008).

Sea Turtle Handling Guidebook for Fishermen (in Turkish) translated and published by WWF-Turkey.

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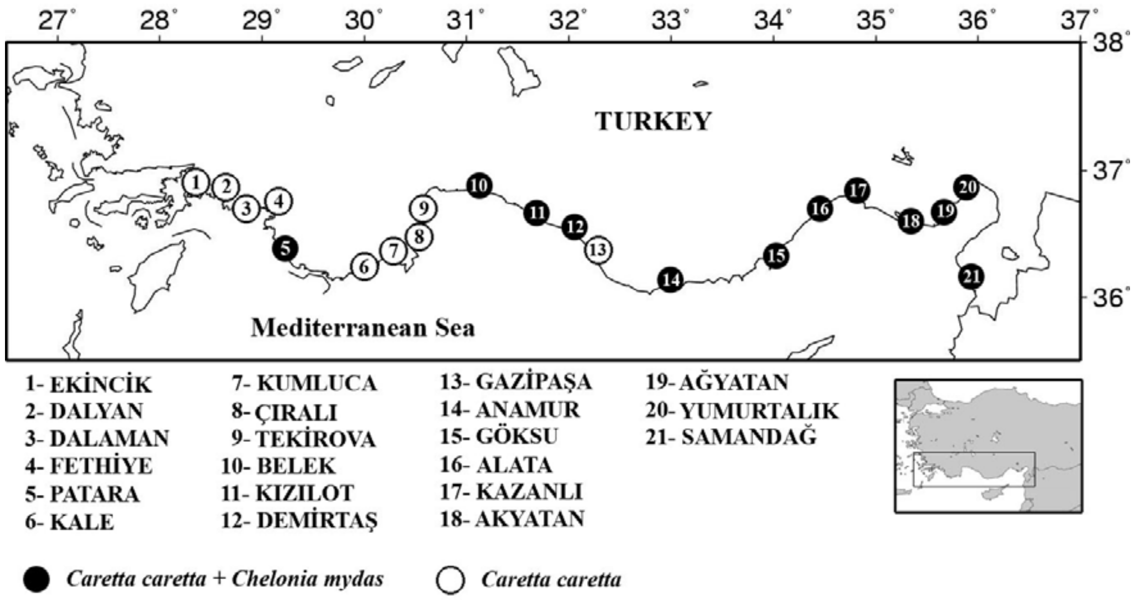

Figure 1. Nesting localities of loggerhead and green turtles in Turkey (map from MAPTOOL at seaturtle.org).

Figure 2.
Ekincik beach
(Photo: O. Turkozan).

Figure 3.
Dalyan beach
(Photo: O. Turkozan).

Figure 4.
Dalaman beach
(Photo: Y. Kaska).

Figure 5.
Fethiye beach
(Photo: O. Turkozan).

Figure 6.
Patara beach
(Photo: Y. Kaska).

Figure 7.
Çıralı beach
(Photo: O. Turkozan).

Figure 8.
Anamur beach
(Photo: O. Turkozan).

Figure 9.
Göksu Delta beach
(Photo: O. Turkozan).

Figure 10.
Kazanlı beach
(Photo: Y. Kaska).

Figure 11.
Akyatan beach
(Photo: O. Turkozan).

Figure 12.
Samandağ beach
(Photo: Y. Kaska).

Figure 13. Feeding and wintering sites of both loggerhead and green turtles in Turkey (map from WWF-Turkey).

INTERNATIONAL UNION
FOR CONSERVATION OF NATURE

WORLD HEADQUARTERS
Rue Mauverney 28
1196 Gland, Switzerland
mail@iucn.org
Tel +41 22 999 0000
Fax +41 22 999 0002
www.iucn.org