INSTM RAC/SPA MAP UNEP CMS BERN CONVENTION IUCN/SSC Marine Turtle Specialist Group Mediterranean Region

PROCEEDINGS OF THIRD MEDITERRANEAN CONFERENCE ON MARINE TURTLES

YASSMINE HAMMAMET, TUNISIA
20-23 OCTOBER 2008

EDITORS:

MOHAMED NEJMEDDINE BRADAI
&
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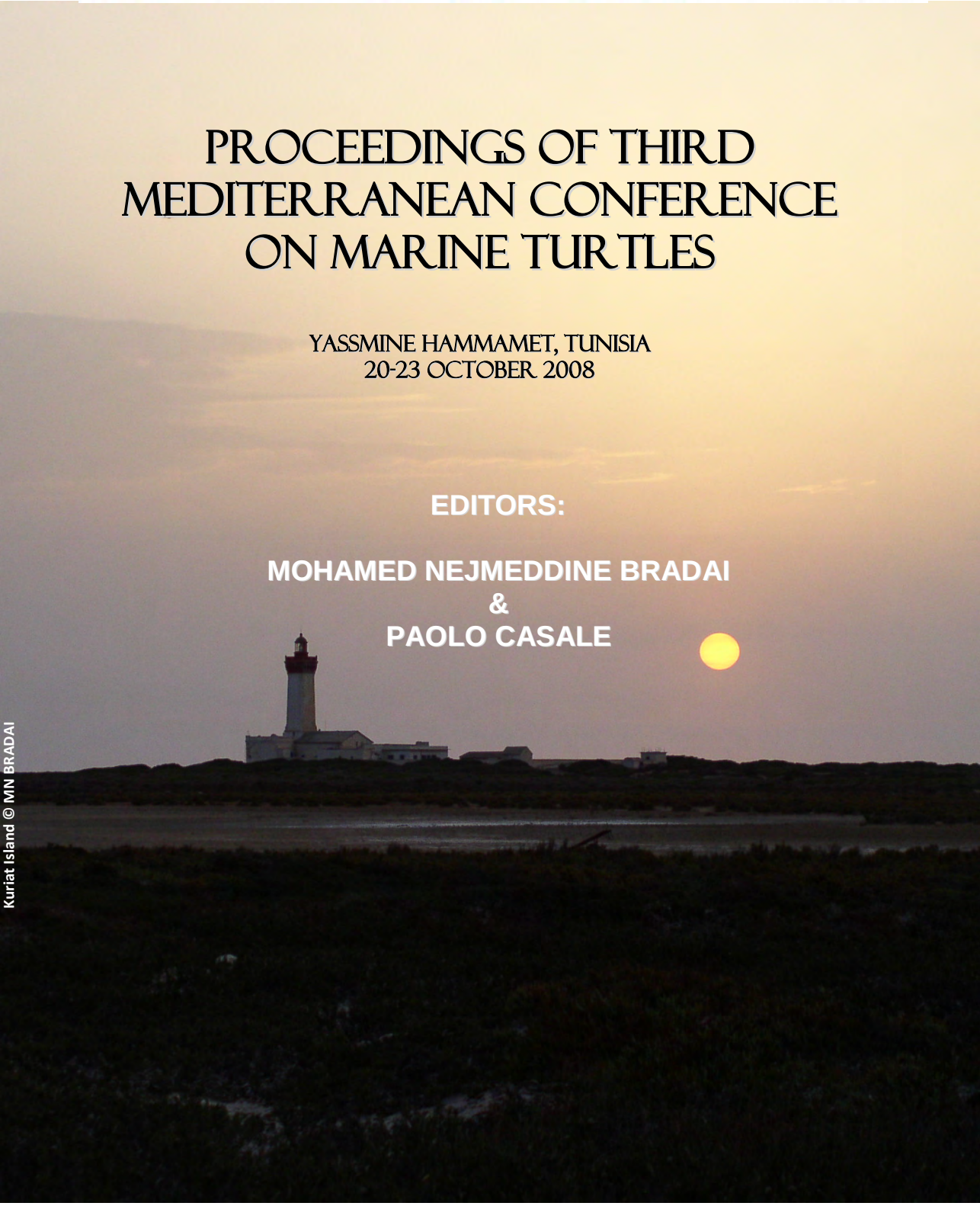

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BARCELONA CONVENTION - BERN CONVENTION - BONN CONVENTION (CMS)
TUNISIA„ 2012

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Preface

The Mediterranean Conference on Marine Turtles was born following discussions taken place in various fora regarding the possibility of organizing a pan-Mediterranean marine turtle conference that would allow scientist and conservation community working in the Mediterranean to express their views and knowledge on this taxon.

Its main objective is to give the opportunity to marine turtle scientists and conservationists working in the Mediterranean to share the most recent scientific and technical knowledge and management experience on Mediterranean marine turtle biology and conservation issues. It also aims to provide a platform for raising the awareness of decision-makers and the general public about the most urgent problems facing marine turtles in the Mediterranean region.

The Mediterranean Conference is a joint initiative by the secretariats of the three international conventions pertaining to the conservation of marine turtles in the Mediterranean, namely the Barcelona convention (RAC/SPA), the Bern convention and the Bonn convention (CMS), with the scientific support of the IUCN/SSC's Marine Turtle Specialist Group.

A first Mediterranean Conference intended to be the first of a series of regularly convened events on the subject on a regular basis was held in Rome from 24 to 28 October 2001. In the addition of the three mentioned convention, the Italian Government, through the Ministry of the Environment and the ex-ICRAM, made a financial and logistic contribution to the organising of the Conference. The Conference was attended by about 140 participants from Mediterranean countries and from outside the region.

The second conference took place in Kemer (Turkey) from 4 to 7 May 2005. It was locally hosted by the Ministry of Environment & Forestry and facilitated by WWF-Turkey. 177 participants from 20 countries were registered.

During this second conference, with the aim to develop a mechanism which would facilitate the smooth continuation of this important regional event in the next years, it was decided that at each conference, the country of the next conference should be decided as well as a Chairperson, who will undertake all responsibilities of coordination in decision-making and of the timely implementation of the conference. A nomination committee was constituted to nominate the chairperson of the fourth conference. As a provisional procedure, a proposal to have the third conference in Tunisia under the Chairmanship of myself Mohamed Nejmeddine Bradai was readily accepted. The chairperson of the fourth conference nominated during the third conference in Tunisia is Mme Flegra Bentivegna, stazione Zoologica Anton Dohrn, Napoli, Italy. The fourth conference will take place in Italy.

The third conference was organised by the INSTM (Institut National des Sciences et Technologies de la Mer, Tunisia) in collaboration with the Regional Activity Centre for

Specially Protected Areas (RAC/SPA). The Conference was attended by about 80 participants from Mediterranean countries and from outside the region, and had 53 contributions (27 Oral presentations and 26 Posters), five keynote presentations, and three thematic workshops.

The general subject of the conference was "Biology and conservation of Marine turtle in the Mediterranean". The scientific and programme committee classified the manuscript submitted to five thematic sessions:

- ✓ Marine areas (Main topics covered: Behavior, Ecology, Population dynamics and structure, pollution, boat strikes, climate change).
- ✓ Management and Conservation measures (Main topics covered: networks, inter- and supranational legal instruments; awareness; management)
- ✓ Anatomy, Physiology, Health (Main topics covered: Anatomy, Physiology, Health, Veterinary + Paleontology, evolution).
- ✓ Nesting beaches (Main topics covered: Behavior, Ecology, Population dynamics and structure (e.g. primary sex ratio, trends), habitat destruction; chemical and light pollution; predation; climate change)
- ✓ Fisheries (Main topics covered: fishery interactions)

Many organizations, institutions, committees were involved in the organization of the conference. For this I would like to thank firstly the Secretariats of Barcelona, Bonn and Bern conventions for the financial support, the IUCN/SSC's Marine Turtle Specialist Group for the scientific support and the members of the Scientific & Programme Committee for the work devoted to the successful scientific programming of the Conference, the Invited Speakers (Brendan GOLDEY, Selina HEPPELL, Andreas DEMETROPOULOS, Dimitris MARGARITOULIS, Paolo CASALE, Bojan LAZAR) and Aliki PANAGOPOULOU for the paper language reviewing.

My sincere thanks also go to the local organizing committee, the National Institute of Marine Sciences and Technologies (INSTM) and the RAC/SPA stuff and particularly Atef OUERGUI for support and all facilities.

Prossimo appuntamento in Italia

Mohamed Nejmeddine Bradai
President of the Third Mediterranean Conference on Marine Turtles

Table of Contents

About the Conference

The **Third Mediterranean Conference on Marine Turtles** is a joint initiative of the following organizations:

- ✓ Secretariat of the Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention, 1976), Protocol on Specially Protected Areas and Biological Diversity (SPA &BD, 1995).
- ✓ Secretariat of the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention, 1979).
- ✓ Secretariat of the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention,1982).
- ✓ The IUCN's Marine Turtle Specialist Group, Mediterranean Region.

The conference is organised by the INSTM (Institut National des Sciences et Technologies de la Mer, Tunisia) in collaboration with the Regional Activity Centre for Specially Protected Areas (RAC/SPA).

Steering Committee

Mohamed Nejmeddine BRADAI (President of the Conference)
Marco BARBIERI (CMS)
Eladio FERNANDEZ-GALIANO (Bern Convention)
Abderrahmen GANNOUN (Barcelona Convention)
Dimitris MARGARITOULIS (Regional co-chair of the IUCN's Marine Turtle Specialist Group)
Ridha MRABET (Host Committee representative)
Atef OUERGHI (RAC/SPA)

Scientific & Programme Committee

Paolo CASALE (Coordinator)
Flegra BENTIVEGNA
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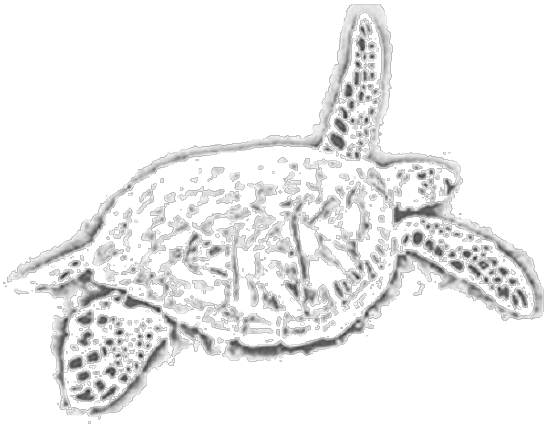


KEY-NOTES PRESENTATIONS

AUTHORS:

Brendan GODLEY
Selina HEPPELL
Dimitris MARGARITOULIS & Paolo CASALE
Andreas DEMETROPOULOS
Bojan LAZAR, Selina HEPPELL & Melissa L. SNOVER

SATELLITE TRACKING MEDITERRANEAN SEA TURTLES: WHAT HAS IT TOLD US SO FAR AND HOW COULD IT HELP IN THE FUTURE?

Brendan GODLEY

Centre for Ecology & Conservation, School of Biosciences, University of Exeter, Cornwall Campus, TR10 9EZ, UK

The use of satellite tracking for the fundamental and applied study of marine turtles began in the 1980s but has undergone rapid growth in recent years. I will present a thorough review of how the technique has been used thus far in the Mediterranean; highlighting the key fundamental and applied insights that have been afforded into the behaviour and ecology of both loggerhead (*Caretta caretta*) and green turtles (*Chelonia mydas*). I will outline what I think key gaps in our knowledge that might be quite easily bridged using this technique and overview the complementary high-tech tools that might be used more extensively in the future. Finally, I will discuss why the use of the technique has increased so markedly over time and point out key areas of concern that should be addressed by our community.

MODELS AS TOOLS FOR CONSERVATION: DECIPHERING THE "BLACK BOX"

Selina HEPPELL

Department of Fisheries and Wildlife, Oregon State University, Corvallis, USA

Quantitative analysis and models can be powerful tools for conservation, because they can indicate the most critical problems to address and convince governments to act. Population models have been developed for many species to help scientists and managers understand how their activities will benefit a population over the long term. Unfortunately, models are not always easy to interpret and biologists may not fully understand their value and limitations. In the United States and Australia, population analyses have been used to assess the status of marine mammals and sea turtles and to explore the potential effects of management. These models have had direct effects on fisheries laws and conservation efforts. I will review examples of trend analysis, extinction risk, and life cycle sensitivity analysis. The data required to construct population models depends on the complexity of the model and the management question that is asked. I will focus on the assumptions of these models and how the results can benefit decision-making.

UPDATE ON RESEARCH AND CONSERVATION OF MARINE TURTLES IN THE MEDITERRANEAN: SUCCESSES AND FAILURES

Dimitris MARGARITOULIS & Paolo CASALE

IUCN's MTSG Regional Co-Chairs for Mediterranean

A brief history of sea turtle research and conservation in the Mediterranean is presented through pioneer projects and figures, some of which have triggered a new generation of sea turtle workers to emerge and remain on the scene. Following a period of "cocooning", with its apparent drawbacks, the efforts to instigate "regional cooperation" are stressed. Exemplary milestones in research and conservation, bearing a national or regional importance, are described. On the other hand, serious gaps and deficiencies are identified which may comprise a road-list for the future.

MTSG - MEDITERRANEAN REGIONAL GREEN TURTLE ASSESSMENT: A PRESENTATION OF THE DRAFT ASSESSMENT

Andreas DEMETROPOULOS

Cyprus Wildlife Society, P.O. Box 24281, Nicosia 1703, Cyprus

The draft Assessment is based on two diverse sets of data:

- Data on nesting. Much of the beach monitoring started in the 1990s.
- Catch data and information from fisheries. As green turtles were specifically fished for, they had a commercial value and appear in official statistics.

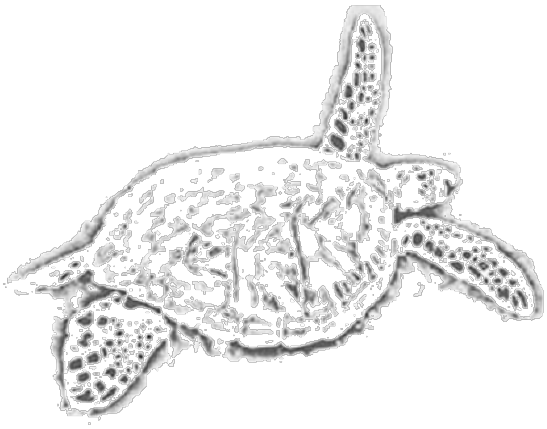
Nesting data were kindly provided by a number of people. These data reflect the nesting situation and the present population and trend. The baseline for these data, time wise, is sequential to the heavy exploitation of the population, between about 1919 and the 1970s. Any trend based on the nesting data, therefore, reflects the dynamics of the remaining green turtle population and its future, not its past.
Exploitation levels provide information, which is valuable in assessing the population three generations back, and comparing it to the present population, estimated from nesting data, as foreseen by the IUCN criteria for red-listing assessments. From 1962 to 1992, catch data appear in the FAO Fishery Statistics, as provided by National Fishery Administrations in Turkey, for 1962 to 1984 and for 1973 to 1992 in Egypt. These data are corroborated and supplemented by other information, some historical and some the outcome of a fact-finding survey. Historical information on turtle catches prior to 1934 is available for Palestine, while Igal Sella, in Israel, in 1982 provides data from a fact finding survey of the trade in turtles in the Eastern Mediterranean, with records for Palestine, spanning back to 1919 and in Turkey to 1952.

REGIONAL RED LIST ASSESSMENT OF LOGGERHEAD SEA TURTLE *CARETTA CARETTA* IN THE MEDITERRANEAN SEA

Bojan LAZAR[1], Selina HEPPELL[2] & Melissa L. SNOVER[3]

[1]Department of Zoology, Croatian Natural History Museum, Zagreb, Croatia and *Blue World* Institute of Marine Research and Conservation, Veli Losinj, Croatia
[2]Department of Fisheries and Wildlife, Oregon State University, Corvallis, USA
[3]NOAA/NMFS/Pacific Islands Fisheries Science Center, Honolulu, USA

The IUCN Red List Categories and Criteria were originally developed for classifying species at high risk of extinction at the global level. However, global Red List Categories may fail to adequately assess the extinction risk of populations at the smaller geographical scale, e.g. at regional, national or local levels. Following the Guidelines for Application of IUCN Red List Criteria at Regional Levels, we analyzed time series of loggerhead sea turtle nesting data from nine selected index sites in Greece, Turkey, Cyprus and Israel for trend and variance. We then performed quantitative analyses of quasi-extinction risk over a 100 year time horizon, using a Population Viability Analysis that is based upon a diffusion model. We applied two-year running sum of nests to provide a closer estimate of risk based on the number of nesting female while reducing some of the variance that is due to individual remigration interval. Our extinction risk calculation and Red List category assignment is based on the proportion of replicate simulations that cross pre-set threshold values, following IUCN criteria, and incorporating analysis of existing threats to the population and its habitats.



SESSION 1:

MARINE AREAS

CHAIRS:

Jesus TOMAS
&
Oguz TURKOZAN

MOVEMENTS OF JUVENILE LOGGERHEAD TURTLES ACCIDENTALLY CAUGHT BY FISHERMEN IN THE LIBYAN SEA

Flegra BENTIVEGNA[1], Abdulmaula HAMZA[2], Al Mokhtar SAIED[2], Hisham ELGHMATI[3], Ehab ELSHARIF[3], Graeme C. HAYS[4] & Sandra HOCHSCHEID[1]

[1] Stazione Zoologica Anton Dohrn, Napoli, Italy
[2] Environment General Authority (EGA)- Marine Conservation section, Tripoli, Libya
[3] Marine Biology Research Centre, Tajura, Libya
[4] University of Wales Swansea, U.K.

Libya has the longest coastline among the African bordering countries of the Mediterranean and it is known to be visited by both green and loggerhead turtles either during winter or as a stop-over on their migrations. However, only loggerheads nest in this region. We used satellite telemetry to investigate the movements and behaviour of turtles found in neritic Libyan waters. Three loggerhead turtles which were accidentally caught by bottom trawl were equipped with satellite transmitters and released close to their respective capture sites. Turtle 1 parted from Tajura, east of Tripoli (32.897°N, 13.35°E) and went straight to the north towards Sicily where it remained for one year circling in deep waters of the Ionian sea. Turtle 2 remained for one month in the Misurata area (32.375°N, 15.095°E) and moved then to shallow waters in the offshore area 120 km east of the Gulf of Gabes (Tunisia). Turtle 3 always remained in the Misurata area. Tracking periods for turtles 1, 2 and 3 lasted 359, 197 and 101 days respectively. Preliminary mtDNA analysis indicates that turtle 1 originated from the Atlantic while the other turtles carried a haplotype characteristic of the Mediterranean nesting populations. This might explain the difference in the turtles behaviour, since Atlantic turtles are believed to remain in the oceanic life stage and not to recruit to neritic foraging grounds in the Mediterranean. These results suggest that there is a separation in habitat use in similar sized late juvenile loggerhead turtles due to their native origins.

NEW DATA ON THE OCCURRENCE OF LEATHERBACK TURTLES, *DERMOCHELYS CORIACEA*, IN THE EASTERN ADRIATIC SEA

Bojan LAZAR[1], Lovrenc LIPEJ[2], Drasko HOLCER[1], Vladimir ONOFRI[3], Valter ZIZA[4], Pero TUTMAN[5], Esmeralda MARCELJA[6] & Nikola TVRTKOVIC[7]

[1] Department of Zoology, Croatian Natural History Museum, Zagreb, Croatia and Blue World Institute of Marine Research and Conservation, Veli Lošinj, Croatia
[2] Marine Biology Station, National Institute of Biology, Piran, Slovenia
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[4] Aquarium Piran, Piran, Slovenia
[5] Institute of Oceanography and Fisheries, Split, Croatia
[6] Developmental – Research Center for Mariculture, University of Dubrovnik, Ston, Croatia
[7] Department of Zoology, Croatian Natural History Museum, Zagreb, Croatia

We review the occurrence of leatherback turtle (Dermochelys coriacea) in the eastern Adriatic Sea based upon museum collections and published literature, and present six new records. Eight out of 13 records (61.5%) derived from fisheries bycatch, with gillnets being a dominant threat to leatherbacks in the study region. Findings were concentrated between July and September, with a peak in the summer. In total, 30 leatherback records exist for the entire Adriatic Sea. The specimens for which data on the size were available were all large immatures and adults. Most of the turtles (70.4%) were found in the summer, in the oceanic zone of the southern Adriatic (63.3%). The number of records in this sub-basin represents 4.5% of the recorded specimens in the entire Mediterranean. Comparing that percentage to the extent of the area relative to Mediterranean, the occurrence of the leatherback recorded in the southern Adriatic is up to 1.5 fold higher of that of the entire Mediterranean Sea. That suggests possible relevance of the southern Adriatic Sea as a summer foraging habitat for leatherbacks within the Mediterranean. Bycatch estimates for the Mediterranean and critically endangered status of the species, coupled with lack of data on the natal origin of the populations emphasize the need for systematic monitoring and data collection in the entire region.

COMPARATIVE STUDY OF FEEDING ECOLOGY OF THE LOGGERHEAD SEA TURTLE (*CARETTA CARETTA*) AND ASSOCIATED THREATS

Jesús TOMÁS[1], Elodie MAISON[2], Francisco J. AZNAR[2], Carmen BLANCO[2], María A. RADUÁN[2], Brendan GODLEY[1] & Juan A. RAGA[2]

[1]Centre for Ecology and Conservation, School of Biosciences, University of Exeter, Cornwall Campus, Penryn TR10 9EZ, UK.
[2]Instituto Cavanilles de Biodiversidad y Biología Evolutiva, Universidad de Valencia. Apdo. 22085, E-46071, Valencia, SPAIN.

We describe the diet of 64 *Caretta caretta* , (CCL range: 32-79cm) stranded along the coast of Valencian Community (Spain, Western Mediterranean) between 1995 and 2006 with another dataset from 54 loggerhead turtles previously sampled following fisheries by-catch. We found a high variety of prey taxa and species in both categories, including more than 30 new dietary records. In the stranded turtles pelagic tunicates were the predominant prey (70.3% occurrence). By-caught turtles were exploiting preferably discarded fish from trawl fisheries (57.4% occurrence), although pelagic tunicates were also important (35.2% occurrence, mean = 41.2 and SD = 239.1 prey items/turtle). Other groups found in both categories were crustaceans (17.2 vs. 51.9%), gastropods and bivalves (35.9 vs. 25.9%), and cephalopods (29.7 vs. 20.4%). Dietary differences may be explained by the different sampling origin and characteristics. High occurrence of marine debris, mainly plastics, were found in the stranded (83.4 %) and in the by-caught turtles (79.6%). When we compare our results with other studies carried out in the Western Mediterranean and further afield, we find a strong heterogeneity in the results highlighting the generalist and low selective feeding behaviour of the species. We can conclude that in the Western Mediterranean, early and late juvenile loggerheads feed mainly on floating or slow-moving prey items in the water column and close to the surface, although some benthic feeding exist and locally can be important. However, this feeding strategy make the turtles highly vulnerable to meet anthropogenic threats such as fisheries interaction and debris ingestion.

SOME DATA ON MARINE TURTLES STRANDING IN TUNISIAN COAST

Sami KARAA[1, 2], Imed JRIBI[1], Abderahmen BOUAIN[1] & Mohamed Nejmeddine BRADAI[2]

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[2]National Institute of Sea Sciences and Technologies, P.O. Box 1035, 3018 Sfax, Tunisia

ABSTRACT

Stranded animals represent a mine of information concerning their biology and ecology. Since the lunching of the National Stranding network on marine turtles and cetacean in 2004 in the entire Tunisian coast, 278 stranded turtles was examined from which 258 were recorded in the coast of the Gulf of Gabes (South Tunisia).

The most stranded turtles were loggerhead (96.76% of stranding data) whereas only four green turtles (1.43%) and two leatherback turtles (0.71%) were recorded. Our results show that stranded turtles were mainly juveniles (74.5 %). The most probable causes of stranding assigned to longline (6%) and boat collision (4%). However, bottom trawl seems to have also an important impact on loggerhead turtle in the area according to stranding data.

KEYWORDS: Gulf of Gabes, stranding turtles, fisheries impact.

INTRODUCTION

Marine turtle populations are globally considered in negative trend. Their mortality is linked to both natural and anthropogenic causes. In Tunisia, causes of marine turtle mortality are associated mainly to the interaction with fisheries (Jribi *et al.*, 2007; 2008). Within the framework of the national stranding network of marine turtles and Cetacean started in 2004, stranded marine turtle were recorded in Tunisian coasts and especially in the Gulf of Gabes (figure 1). These records allow the collection of amount of biological and ecological data and to determine causes of mortality.

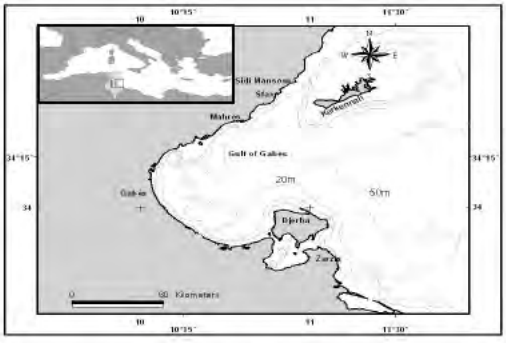

Figure 1: Gulf of Gabes

MATERIAL AND METHODS

Stranding network is organized in groups of 4-5 members attending to stranding reported by zone. Information's on stranding sea turtles were collected mainly by beaches prospecting and following indications of the coast guards, fisheries authority and NGOS. The causes of mortality were determined by external inspection, radiography and necropsy of the carcasses. Several tissues were sampled for mainly genetic studies, humerus and epibionts were collected for studies including genetic analyses and growth rates.

RESULTS AND DISCUSSION

From 2004 to 2007, 278 stranded turtles have been recorded a long the Tunisian coasts. The majority were loggerhead *Caretta caretta* (96,76%), which is the most common species in Tunisian waters and also nest on some beaches (Bradai., 1995). The number of green and leatherback turtles recorded was respectively four (1,43%) and two (0,71%) confirming their status as rare species. Only two turtles were unidentified given their advanced state of decomposition.

Most of stranding data were recorded in the Gulf of Gabes (258 cases registered). Only 14 and 6 cases were recorded respectively in the center and in the north of Tunisia. The gulf of Gabes has been also reported as feeding and wintering ground for Mediterranean loggerhead turtles (Argano *et al*, 1992; Laurent *et* Lescure, 1994; Margaritoulis *et al*, 2003).

The analysis of seasonal distribution of the stranding in the Gulf of Gabes shows that most strandings occurred during the period between May and June. The increasing of fishing activity in this period seems to be a potential cause of mortality. The oceanic conditions produce nearshore currents could facilitate drifting turtle's carcasses.

Despite the necropsies and external examination, cause of stranding was not possible to be identified in 90% of the cases, due to the bad state of the turtles. Hook ingestion was assigned as the cause of 6% of strandings, while a collision with boats was it to 4% of the cases. It is important to indicate that other fishing gears (particularly trawler and gillnet) which create a significant mortality and generally didn't leave a visible traces on stranded turtles (Jribi., 2003; Echoukhi comm. pers).

The mean CCL n-t (Curved Carapace Length notch to tip) of stranded turtles was 59,91 (SD = 29,69; Range: 28 – 98,5; n = 214; Figure 2). This distribution shows a dominance of juvenile individuals in the area, although some adult sized turtles (according Margaritoulis et al., 2003) were recorded.

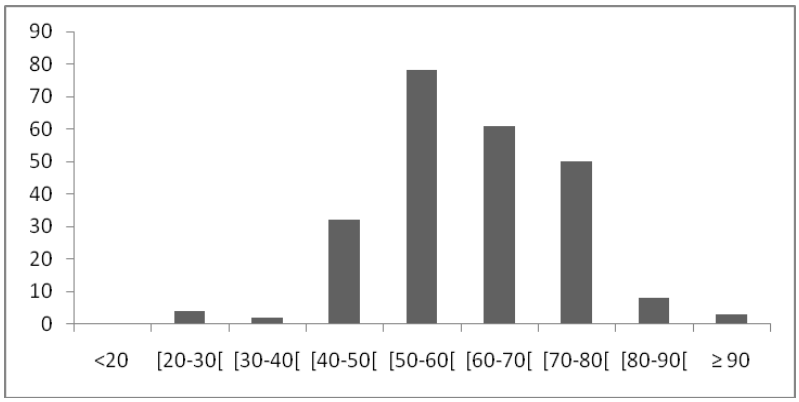

Figure 2: Size class distribution of stranded loggerhead in the Gulf of Gabes from 2004 to 2007

CONCLUSION

Three sea turtles species were known to strand in Tunisian coasts: loggerhead turtles (*Caretta caretta*), green (*Chelonia mydas*) and leatherback turtles (*Dermochelys coriacea*). The first one was the most predominant species (96.76% of stranding data).

The stranding occurs mainly in the Gulf of Gabes where loggerhead is commun. This area is considered in fact as a feeding and wintering area for Mediterranean loggerhead turtles. The stranded turtles are composed mainly of juveniles (74.5 %).

The main causes of mortality are longline and boat collision. However according to stranding data in the area, gillnet and the bottom trawl seems to have also an important impact on loggerhead turtle.

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MITOCHONDRIAL DNA CHARACTERIZATION OF LOGGERHEAD TURTLES FROM TUNISIAN NESTING AND FORAGING GROUNDS: PRELIMINARY RESULTS

Olfa CHAIEB[1,2], Fulvio MAFFUCCI[3], Ali ELOUAER[1], Noureddine CHATTI[2], Mohamed Nejmeddine BRADAI[1], Khaled SAID[2] & Flegra BENTIVEGNA[3]

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3 : Stazione Zoologica Anton Dohrn, Villa Communale Napoli, Italy

ABSTRACT

In the last decade genetic studies have contributed to deepen our understanding of loggerhead sea turtle population structure and dispersal in the Mediterranean Sea. However there are still some ambiguities due to the paucity of data from several nesting sites and foraging grounds within this basin. In this study we present the preliminary results of the genetic survey of the Tunisian nesting beaches and of the adjoining neritic foraging grounds. The analysis of a 380 bp of the mitochondrial DNA control region of 11 nests from different nesting females revealed only 2 haplotypes. The most common Mediterranean haplotype CC-A2 was observed in 90% of the samples. Only one individual exhibited the haplotype CC-44 previously found only on an Atlantic foraging ground, the Indian River Lagoon Florida. Four distinct haplotypes were detected in the samples from the foraging ground (N=35) of which 3 have previously been reported from both Mediterranean and Atlantic nesting beaches (CC-A2= 88.6%, CC-A3 = 2.8% and CC-A10 =2.8%). The rest of the samples (5.7%) exhibited an endemic Atlantic haplotype CC-A1. Mixed stock analysis of the foraging samples estimated a high Atlantic contribution (20.3%) suggesting that a proportion of the Atlantic juveniles which forage in the Mediterranean Sea utilize also the neritic areas along Tunisian coasts.

KEY WORDS

Caretta caretta, Mitochondrial DNA, Genetic structure, Tunisia, Mediterranean

INTRODUCTION

Located at the physical bottleneck connecting the western with the eastern side of the Mediterranean Sea, Tunisia hosts one of the most important foraging and overwintering ground for the loggerhead turtle in this basin (Zbinden et al 2007, Gerosa and Casale 1999). Moreover a small but regular nesting activity is reported along the coasts of the Kuriat Islands on the eastern side of the country in the Ionian Sea. Unfortunately there is a complete lack of data on the genetic make-up of the nesting population, and only little information is available on the demographic structure of Tunisian loggerhead turtle foraging aggregations. Laurent et al. (1998), analysing a limited number of individuals accidentally caught by

trawlers in the south concluded that Tunisian neritic habitats are utilized exclusively by Mediterranean loggerhead turtles. More recent genetic surveys of the Mediterranean foraging aggregations revealed deep genetic structuring within the western Mediterranean. The North-African coast and the Gimnesies Islands resulted to be inhabited mainly by turtles of an Atlantic origin, whereas the foraging grounds off the European shore of the western Mediterranean were utilized mainly by individuals from the local rookeries (Carreras et al 2006). In this work, we present the preliminary result of the large genetic survey of Tunisian nesting and foraging ground that the Institut National des Sciences et Technologies de la Mer started in 2007 with the collaboration of the Stazione Zoologica Anton Dohrn of Naples, Italy.

MATERIALS AND METHODS

Nest samples (N=11) were collected from Kuriat Islands from different nesting females during the nesting seasons of 2002 to 2006. Samples of the neritic foraging population (N=35) were collected between 2000 and 2006. Whole genomic DNA was isolated and a fragment of the mitochondrial DNA control region was amplified. Sequences were aligned and compared with previously described loggerhead haplotypes (http://accstr.ufl.edu/). Assessment of loggerhead stock composition in Tunisian coasts was carried out by a hierarchical Bayesian approach as implemented in the program BAYES (Pella and Masuda 2001). Haplotypes frequencies of the potential source populations (nesting rookeries) were obtained from Laurent et al. (1998), Encalada et al. (1998) and Carreras et al. (2007) and nesting population sizes from Margaritoulis et al. (2003) and Ehrhart et al. (2003) (see table1). Haplotype (h) and nucleotide diversities (π) were calculated by using program Arlequin v.2.0.1 (Schneider, 2000).

RESULTS

Two different haplotypes were found in the 11 nests (h= 0.182920 +/- 0.1436; π= 0.000483 +/- 0.000757). The vast majority of the individuals exhibited the most common Mediterranean haplotype CC-A2 (90%) while the other haplotype, CC-A44, found in a single individual, has previously been reported only in the Indian River Lagoon foraging ground, Florida (Reece et al. 2006). Four different haplotypes were detected at foraging ground. One of these haplotypes was specific to Atlantic rookeries (Table1). As expected haplotype and nucleotide diversity of the foraging population was much higher (h= 0.2168 +/- 0.0909; π=0.0005662 +/- 0.003580). Mixed stock analysis indicated that Tunisian waters are utilised mainly by Mediterranean loggerhead turtle populations with an Atlantic contribution estimated at 20.3%.

DISCUSSION AND CONCLUSION

Because of the small number of samples analysed we can not draw any definitive conclusion on the genetic make-up of the Tunisian nesting population. Our finding of a new haplotype, CC-A44, suggests that the Tunisian population may be genetically distinct from the other Mediterranean rookeries but this must be proved by further analysis. Although haplotype CC-A44 has already been found in the Indian River Lagoon foraging ground, Florida, this is unlikely to represent an evidence of a contribution of the tiny Tunisian population to the Atlantic stock.

The genetic analysis of samples from the foraging aggregation revealed for the first time, the presence of Atlantic juveniles along the Tunisian coasts. However both the individuals carrying the Atlantic haplotype were sampled on the northern coasts which are under the direct influence of the Atlantic surface currents entering from Gibraltar. This may lead to a genetic differentiation of the loggerhead turtle foraging aggregations along the Tunisian coasts with an higher proportion of Atlantic juveniles in north than in south of Tunisia. This could explain the difference with the previous study carried out by Laurent et al. (1998) who sampled individuals only from the south. However, because of the small number of individuals analysed it was not possible to test statistically the difference between the northern and the southern samples which were analysed together in the subsequent mixed stock analysis. The Atlantic contribution in this neritic area estimated at 20.3% was relatively higher than that previously reported for an other neritic Mediterranean foraging ground along Southern Italian coasts (7%, Maffucci et al. 2006). This percentage was much lower than that calculated by Laurent (1998) for the western and eastern oceanic habitats (45% and 47% respectively). More samples are under study to confirm our preliminary results.

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Table1 : Source nesting populations

	Cc-A1	Cc-A2	Cc-A3	Cc-A5	Cc-A6	Cc-A7	Cc-A8	Cc-A9	Cc-A10	Cc-A11	Cc-A14	Cc-A20	Cc-A29	Cc-A32	Cc-A44	Total	Rookery size
S.Florida	52	45	4	1		3				1	2	1				109	67100
NEF-NC	104	1														105	6200
Mexico		11	2				1	1	5							20	1800
Greece		82			5				1					1		89	3051
Turkey		19	13													32	1366
Cyprus		35														35	572
Israel		17											3			20	33
Present study																	
Nesting		10													1	11	
Foraging	2	31	1						1							35	

AN OVERVIEW OF YEARS 2003-2007 OF THE DATA COLLECTED ON STRANDED AND BY-CATCHED LOGGERHEAD TURTLES (CARETTA CARETTA) OF THE NORTH WESTERN ADRIATIC SEA

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The northwestern Adriatic sea is a very important feeding area for the Mediterranean loggerhead sea turtles, as highlighted in the literature. It is also known that they use this zone during summer and winter as well (as proven by incidental captures during January-March).
The turtles were found through the collaboration with the local fishermen-accidentally captured, stranded or floating at sea, in the area between the Sacca di Goro and the Reno River, Northwestern Adriatic sea (Italy).
This study puts together all the data collected on these incidents during the years 2003-2007, presenting an overview of the sea turtles recovered in this region. The healthy turtles were tagged (Monel 681 tags) and released.
A total of 319 turtles were sampled (mean = 63.8 individuals/year); 227 of these were found dead, stranded on shore or floating at sea; 82 were accidentally captured by midwater or bottom trawl, hooks, gillnets. 57 turtles were tagged and released.
A study of individuals with carapace length >70cm (CLM) (28% of the total), reveals a slight predominance of feamles (34% as sopposed to 28% male), the sex having been determined by the CCL and external charateristic in males.
The percentage of turtles found tagged over the total of animals recovered is 2%, taking into account that only 15% of animals captured and released were tagged.
The midwater pair trawl seems to be the fishing gear that captures the highest number of individuals as compared to the bottom trawl. Captures from these two fishing gears showed a similar trend, with a maximum number of captures occuring in July.

REPRODUCTIVE PATTERS AND ROUTES OF ADULT MALE LOGGERHEAD TURTLES IN THE MEDITERRANEAN: INSIGHTS FROM SATELLITE TRACKING

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The continental shelf between Italy and Tunisia is known to be an important foraging ground for loggerhead turtles from several nesting sites, and individual adult females nesting in Greece have been tracked up to that area through flipper or satellite tagging. However, turtles from other Mediterranean nesting sites probably frequent this foraging area too, and these sites and migratory routes can be identified by satellite tracking adult turtles. To this aim, five adult males incidentally caught by trawlers in this area were released from Lampedusa, Italy, in October-November 2006-2007 with a satellite transmitter and tracked for a period of 81-301 days. Two of them routed to the Libyan coast, one to Greece, while two showed no migration. Although based on a small sample, these findings suggest (i) an important link between Libyan nesting sites and the foraging area between Italy and Tunisia; (ii) that the western Libyan coast represents an important migratory corridor; (iii) that adult males might not reproduce every year, unless mating occurs also in foraging grounds distant from nesting sites.

DIET OF LOGGERHEADS STRANDED ALONG THE MEDITERRANEAN COAST OF MOROCCO

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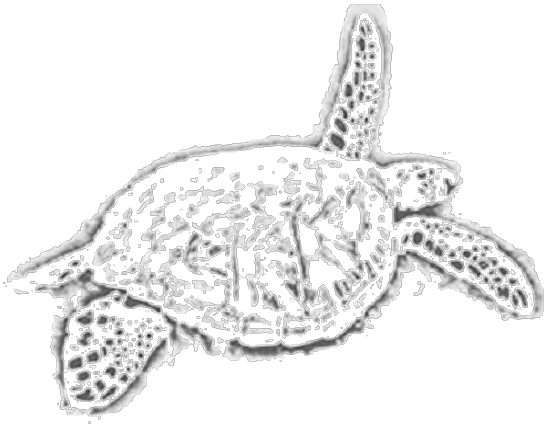
This study evaluated and analyzed the gut contents of 20 loggerheads stranded along the northern coast of Morocco since 2003 to determine their diet. Shellfish, pelagic and benthic fish, molluscs, and annelids were most commonly found; plastic and wood were also found. The consumption of the benthic preys in great quantity by these loggerheads proves that the habitat use is benthic. This result is confirmed by the presence of sand and vase in all the stranded sea turtles. These loggerheads, in majority sub-adults (mean CCL = 60 cm), generally use a benthic habitat in the area. We analyzed the percentages of occurrence of the various diet items consumed by the turtles. The Crustacean accounts for 50% in weight of the intestinal contents. *Polubius henslowii* represents 76% among Crustaceans intestinal contents. This crab is present in the Canary Islands, the Moroccan coasts, the Straits of Gibraltar and the Western Mediterranean; this indicates that stranded loggerheads generally come from these areas. This information may help to identify the foraging areas of loggerheads along the West Mediterranean coast of Morocco.



SESSION 2:

MANAGEMENT AND CONSERVATION MEASURES

CHAIRS:

Andreas DEMETROPOULOS
&
Aliki PANAGOPOULOU

TWO IN ONE: A PROPOSAL FOR THE CREATION OF A NEW MARINE PARK, COMBINING THE TWO MOST IMPORTANT NESTING AREAS IN GREECE

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ABSTRACT

Greece holds about 60% of all loggerhead nests made within the monitored areas in the entire Mediterranean Sea. The most important nesting areas in Greece are found in Laganas Bay on Zakynthos Island and Kyparissia Bay in western Peloponnesus. These two nesting areas, lying 70 km apart, host 63% of all loggerhead nests made annually in Greece and 37% of the ones made in the Mediterranean. Concerning conservation, Laganas Bay enjoys adequate protection by means of a National Marine Park, established in 1999, covering a terrestrial part of 4,500 ha and a marine part of about 9,000 ha. Kyparissia Bay, besides being an important nesting area, contains also a diversity of exceptional natural, anthropogenic and archaeological features, which have led to the designation of four NATURA 2000 sites along the Bay. However, the “NATURA 2000" status bears little significance to conservation because the only provision foreseen is the obligation for elaboration of Environmental Impact Assessments for construction works above a certain magnitude. Herein the creation of a combined new Marine Park is proposed, to incorporate these two important areas into one management unit, and thus assist in the long-term, sound conservation of this natural asset of Greece. The new extensive National Marine Park will be unique in the Mediterranean and will definitely extend the boundaries of sea turtle conservation.

INTRODUCTION

ARCHELON’s long-term monitoring projects have documented precisely the main nesting areas of the loggerhead turtle in Greece. Greece holds about 60% of all loggerhead nests made within the monitored areas in the Mediterranean Sea (Margaritoulis et al. 2003). The “major” nesting aggregations in Greece are found in the following areas (in descending order of nesting level): Zakynthos (Laganas Bay), Kyparissia Bay, Rethymno, Lakonikos and Bay of Chania (Margaritoulis et al. 2003). Of these, only Zakynthos has been granted a specific protection status. After a long and intense campaign by several NGOs and pressure towards the Greek government by the Council of Europe (Bern Convention) and the European Union (EU), the Zakynthos nesting and inter-nesting habitats were eventually assigned the status of a National Marine Park in 1999 (Dimopoulos 2001). The other four “major” nesting areas are only included in the Natura 2000 network in the context of the EU’s Habitats Directive (Dimopoulos et al. 2003). However, the “Natura 2000" status bears little significance to conservation because the only provision

foreseen is the obligation for elaboration of Environmental Impact Assessments for construction works above a certain magnitude.

THE NATIONAL MARINE PARK OF ZAKYNTHOS (NMPZ)

The NMPZ occupies a terrestrial area of about 4,500 ha on southern Zakynthos and the Islands of Strofadia (about 22 miles south of Zakynthos), and a marine area of about 9,000 ha covering the entire Laganas Bay, which is considered to be the critical inter-nesting habitat of the turtle population, plus an area outside the two promontories embracing the Bay. The Park discontinued its functioning from about April 2004 to August 2005, because of financial constraints. Its operation was resumed in August 2005 after the appointment of a new President and Management Board; now the Park seems to enjoy adequate governmental funding, political support and fruitful collaboration with ARCHELON and WWF Greece. Generally the Park's activities in the last few years can be judged as successful; however, more time is needed to establish locally a firmer position.

THE KYPARISSIA BAY

Extending for more than 45 km of almost continuous sandy beach, this Bay is very important for sea turtles, as well as for a number of other features. The nesting area, second only to Zakynthos, hosts annually an average of 580 nests (range: 286-927, N=15 seasons) (Margaritoulis et al. 2003). Furthermore the Bay features the largest sand dune area in Greece, which is backed by a rare coastal forest managed by the Forest Service. The rivers Alfeios and Neda, both known from Greek mythology, cut through the beach and flow into the Ionian Sea. Off-shore Kyparissia Bay there are extensive *Posidonia oceanica* beds and frequent sightings of cetaceans have been recorded. These important natural features have been described in the four Natura 2000 sites designated along the Bay. In addition the area includes several archaeological sites; among them the ancient site of Olympia, cradle of the Olympic Games, and the temple of Apollo at Fygaleia.

THE COMBINED NEW PARK

We hereby propose to combine the two areas into a large Marine Park (the Ionian Marine Park). The proposed Park will incorporate the existing area of the Zakynthos Park, and the entire Kyparissia Bay with its four designated Natura 2000 sites, the archaeological sites, and also the vast marine area in-between (Figure 1). The creation of the new Park will bring under protection status 63% of all turtle nests in Greece and 37% of all loggerhead nests made within monitored areas in the entire Mediterranean.

Figure 1. Indicative location of the proposed Ionian Marine Park.

The main objectives of the proposed Park would be:

- To protect the natural environment on land and at sea.
- To protect the marine and terrestrial habitats of loggerhead turtles
- To protect the dune ecosystem and the coastal forest along Kyparissia Bay
- To protect the archaeological sites within the boundaries of the Park
- To provide incentives for local people towards eco-tourism and sustainable development.

According to Greek law, a Specialized Environmental Study must be undertaken to define all natural, cultural and economic assets in this area and design the Ionian Marine Park's protection goals and mandate. The extensive National Marine Park will be unique in the Mediterranean and will definitely extend the boundaries of sea turtle conservation.

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CREATING AN EFFECTIVE SEA TURTLE STRANDING NETWORK: THE ROLE OF THE COAST GUARD IN GREECE

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ABSTRACT

In 1990, in response to an increasing number of sea turtles found dead or injured in Greece, the need to create a tool for systematic recording of sea turtle strandings nationwide led to the establishment of the Sea Turtle Stranding Network (STSN) by ARCHELON, the Sea Turtle Protection Society of Greece, in collaboration with the Ministry of Mercantile Marine, the authority responsible for the Greek Coast Guard. There are over 300 sea turtle strandings reported every year, and the STSN has evolved to include fishermen, fishermen associations, research institutes, other NGOs and individual citizens; however its backbone was and continues to be the Coast Guard. With 236 stations, they are able to respond to strandings occurring all along the 16,000 km of Greek coastline. Especially in the last two years (2006 – 2007) ARCHELON's collaboration with the Coast Guard has bloomed, with more than 74.7% or sea turtle strandings being reported through them. Through this co-operation, ARCHELON has been able to collect systematic and reliable information on turtles found dead or injured in Greece, which is subsequently used for the elaboration of conservation policies. The involvement of the Coast Guard remains as one of the few examples where the government demonstrates its commitment towards the protection of an endangered species in Greece.

THE SEA TURTLE STRANDING NETWORK

The Sea Turtle Stranding Network (STSN) was launched by ARCHELON in 1990 aiming to create a tool for the systematic recording of sea turtle strandings occurring in Greece (Panagopoulos et al., 2003). From 1992 onwards, the Ministry of Mercantile Marine, the authority responsible for the Greek Coast Guard, began its collaboration with ARCHELON by issuing a circular letter containing detailed information on the actions needed to be taken in case a sea turtle is found dead or injured. This collaboration quickly produced results by revealing a significant number of sea turtles found injured, leading to the establishment of the Sea Turtle Rescue Centre in 1994 in Glyfada, Attiki, by ARCHELON in co-operation with the local municipality (Kopsida et al., 2002). The circular letter was updated in 1999 to include the Rescue Centre information and the STSN has since continued to expand, with 2,736 sea turtles reported dead or injured between 1990 and 2007.

THE ROLE OF THE COAST GUARD

Since its inception in 1990, the STSN has evolved, including not only ARCHELON members, but also research institutes, other environmental organizations, fishermen and fishermen's associations, as well as concerned individuals (Panagopoulou et al., 2005). However, the backbone of the STSN was and continues to be the Coast Guard. With 236 stations throughout the Greek waters, it is the only authority able to respond to strandings occurring all along the 16,000 km of Greek coastline (nearly 1/3 of the whole Mediterranean). Once a sea turtle has been found dead or injured, the Coast Guard arrives on scene and records all the relevant information (species, biometric data, causes of injury if evident), which is later entered in the stranding sheet designed by ARCHELON. Where possible, in cases of dead turtles they have the regional veterinary conduct a necropsy to determine cause of death before organising the removal of the carcass and its burial in co-operation with the local municipality. If the turtle is found injured, in collaboration with ARCHELON, they organize the transportation of the animal to the Sea Turtle Rescue Centre for treatment and rehabilitation. Further, the Coast Guard are able to intervene in cases of turtles found dead or injured at sea or in cases of entrapment in lagoons, power plant waterways and other similar incidents reported in the past. They also participate in the release of some rehabilitated animals by providing the use of their patrol boats.

CONCLUSIONS – RESULTS

ARCHELON s collaboration with the Greek Coast Guard in relation to the STSN has continued to evolve since the issue of the first circular letter in 1992. In the last two years alone, 74.7% of the total number of sea turtle strandings was reported through Coast Guard stations throughout Greece. This information, added to that collected through the other STSN members, has been instrumental in ARCHELON re-evaluating and adapting its conservation priorities to deal with the issue of fisheries interactions with sea turtles, that are for the most part the reason behind the high numbers of turtles found dead or injured in the Greek waters each year. (Panagopoulos et al., 2003). In reaction to this information, ARCHELON has established the Sea Turtle Rescue Centre (1994), set up collaborative programmes with fishermen and elaborated a National Action Plan for the Conservation of Sea Turtles.

In conclusion, the involvement of the Greek Coast Guard remains as one of the few examples where the greek government demonstrates its commitment towards the protection of an endangered species in Greece.

ACKNOWLEDGEMENTS

Special thanks are due to all individual Coast Guard officers that have assisted in the operation of the Sea Turtle Stranding Network from 1992 to this day.

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MONITORING AND CONSERVATION OF IMPORTANT SEA TURTLE FORAGING GROUNDS IN THE PATOK AREA OF ALBANIA

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Research investigating the population dynamics of sea turtles began at Patok, Albania, in June 2008, where their presence has been known for several years; Professor Haxhiu has tagged turtles caught as bycatch since 2002. White et al. (2006) confirmed the distribution patterns of turtles in coastal waters by interviewing fishermen throughout Albania. The Patok project will investigate: reasons for the presence of large numbers of loggerheads in Gjiri i Drinit, possibly oceanography or food; consider habitat purpose (e.g. year-round or summer-only foraging, overwintering, or transient use by migrating animals); and identify instances of inter- and intra-annual site-fidelity by individual turtles. Captured turtles will be tagged prior to release, morphometric and photo-recognition studies will be undertaken (White, 2007).

Researchers from Tirana University will be trained in field techniques; and workshops undertaken with local fishermen; strong links will be developed with schools and other local stake-holders (capacity-building). The project will enable tertiary-level students to conduct fieldwork with turtles towards their diploma or PhD studies. Awareness-raising activities are planned, such as school visits and various media presentations. Conservation programmes will be developed by MEDASSET and ECAT (Tirana). A central tagging-database will be established for Albania; building on Haxhiu's previous work. Extensive artisanal fishing in the area (fish-traps, trawls, and longlines) means that turtles will be caught as bycatch; however, we aim through education to reduce mortality levels of captured turtles using RAC/SPA's Sea Turtle Handling Guide for Fishermen. Management plans will be passed to the Ministry of Environment, with recommendations for best fishing practices.

THE INVOLVEMENT OF YOUNG PEOPLE (8-18 YEARS) IN SEA TURTLE CONSERVATION: ARCHELON'S YOUTH ACTION GROUP "CHELONOPAREA"

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ARCHELON's projects are based on volunteerism. Volunteers should be older than 18 years of age. However, through ARCHELON's environmental education projects we have solicited strong interest and abilities also for younger ages. As a result, ARCHELON has long planned and now operates the "Youth action group" named "CHELONOPAREA". The aim of this project is to provide young people (aged 8-18) with the opportunity to be directly involved in sea turtle conservation; something which was not possible so far because of their young age.

The project's activities include special events designed only for the young people, but the members of this action group have also the opportunity to take part in:

- the ongoing public awareness programs of ARCHELON,
- the routine work at ARCHELON's Sea Turtle Rescue Centre work and releases of rehabilitated turtles,
- volunteering with their parents (family volunteering) at conservation field projects,
- ARCHELON's thematic youth camp at Lakonikos Bay, southern Peloponnesus, featuring a diversity of environmental activities which complement the conservation work conducted at the nesting beach.

"CHELONOPAREA" may have a significant impact upon the community through its members, their families and social environment, their school fellows and friends. Above all we feel that we are also preparing the new generation of volunteers for sea turtle conservation and the environment in general and we encourage them to be active citizens of the world.

PUBLIC AWARENESS PROGRAMME FOR SEA TURTLE CONSERVATION IN TUNISIA

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Sea Turtle conservation efforts will not be successful without public awareness and support. The Sea Turtle Rescue Centre of Tunisia created in 2004 has developed a programme to enhance public awareness and to emphasize personal responsibility for sea turtle conservation. The programme consisted of an educational policy which has been promoted by public conferences and scientific seminars, school and university meetings, field activities and training sessions organized in the rescue centre. During these activities conservation schemes were discussed and protection activities were analyzed. These awareness campaigns which took place throughout the years were strongly supported by the media. Eight conferences were conducted in schools and universities. Ten field activities were organized on different beaches and in ports along Tunisian coastlines. They were planned on the occasion of a local festivity to guarantee increased attendance of the local community, fishermen and tourists. Nine training sessions were held in the rescue centre for children. All these activities were characterized by a high public attendance and interest. Participative conservation schemes have been a successful strategy in achieving sustainable sea turtle protection in Tunisia. People have been particularly made aware of the existence of the rescue centre and of the importance to make contact when necessary. They have also understood the urgency of participating in the conservation programme and developing new levels of respect for their natural environment. These encouraging results need to be continued and more local authority support on a national scale is required for a better achievement of such awareness campaigns.

APPROACHING ENVIRONMENTAL EDUCATION AND AWARENESS CREATIVELY: 'NIRETTA THE CARETTA'

VENIZELOS Lily & Jenny IOANNOU

With environmental education established in the 1980s, late in the development of Greece's education system and still lacking to this day, it is essential for environmental non-governmental organisations to engage in activities targeted at schools, youth institutions and general public to help increase environmental consciousness. A new initiative by MEDASSET- the Mediterranean Association to Save the Sea Turtles, is the creative learning and awareness raising programme of "Niretta the Caretta", launched successfully in 2008. The programme follows the organisation's long running 'Small Garbage' campaign that has run for ten years and succeeded in raising awareness throughout Mediterranean countries about the effects of the small pieces of personal waste, casually discarded on beaches or directly into the sea that have devastating effects on the marine environment. The overall vision of the project is to give a fresh face to sea turtle conservation in Greece through the use of a creative and innovative approach. Appealing to children and the public alike, MEDASSET's "Niretta the Caretta" sea turtle mascot is effective in conveying environmental education messages in its immediacy and appeal. A partnership with the Hellenic Children's Museum in Athens is leading to the creation of Niretta's home, a space within the Museum that acts as the sea turtle's habitat in the Mediterranean. A range of pedagogical learning tools including wall illustrations and props are combined to create an environment which facilitates the process of learning and relates the value of coexistence between all species to the children.

KEY WORDS: marine turtles, environmental education, mascot

'SEA AND SAND' – SCIENCE-BASED MANAGEMENT OF THE LOGGERHEAD BREEDING POPULATION IN THE NATIONAL MARINE PARK OF ZAKYNTHOS

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The National Marine Park of Zakynthos (NMPZ) was established in 1999 to protect the reproductive marine and terrestrial habitats of the largest loggerhead sea turtle population in the Mediterranean. At the time protective legislation was 'precautionary-based'; hence scientific research was required to develop effective area management. Here we present the NMPZ scientific programme which focuses on (1) the NMPZ protected nesting beaches; (2) the NMPZ protected marine area, and (3) the breeding population pan-Mediterranean migratory routes and wintering/foraging areas. These parameters are critical to conserving and effectively managing the Zakynthos loggerhead population at the local and regional level.

INTEGRATING CONSERVATION MONITORING & SCIENTIFIC RESEARCH FOR EFFECTIVE MANAGEMENT OF THE LARGEST LOGGERHEAD ROOKERY IN THE MEDITERRANEAN

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The island of Zakynthos hosts the largest known loggerhead sea turtle (*Caretta caretta*) breeding area in the Mediterranean. Sea turtle nesting activity was first recorded in 1977. From the first researchers, the Sea Turtle Protection Society of Greece (now known as ARCHELON) was established in 1983, with the main objectives to protect and study sea turtles and their habitats. The long term nesting datasets of ARCHELON contributed to the delineation of protection zones and regulations during the 1980s and 1990s, which have been continued to be enforced by the Management Agency of the National Marine Park of Zakynthos (NMPZ) since its establishment in 2000. In subsequent years it was recognised that existing terrestrial and maritime protection measures and management needs required updating. Therefore, since 2006 the NMPZ has developed a science-based research programme to complement the ongoing baseline monitoring work of ARCHELON, which targets specific parameters considered to influence sea turtle activity, such as environmental and human-related factors. Here we present the development and future directions of the collaborative work of ARCHELON and the NMPZ towards the effective, sustainable, management of Zakynthos' loggerhead rookery.

BEFORE THE NATIONAL PARK (UNTIL 2000)

The primary objectives of ARCHELON since formation in 1983 have been (i) the long term protection of sea turtles and their habitats in Greece and the Mediterranean (ii) the scientific study of sea turtles towards effective protection, (iii) to promote the creation, and participate in the management, of protected areas for sea turtles, and (iv) to educate and develop awareness of authorities, local communities and the general public (Margaritoulis 2005). After Greece's entry into the European Union, strong pressure was placed by ARCHELON and other NGOs (including Greenpeace Greece, MEDASSET, WWF-Greece and the Zakynthian Ecological Movement) towards the formation of the NMPZ. Following a Special Environmental Study utilising long-term ARCHELON nesting data from which protected area

legislations were developed, the Presidential Decree for the NMPZ was signed in 1999, with the Management Agency forming in 2000 (Dimopoulos, 2001).

SINCE THE NATIONAL PARK (2000-2008)

Following the formation of the National Marine Park of Zakynthos, the role of the NGO ARCHELON has continued to develop. Within the framework of the NMPZ, ARCHELON has not only continued long-term monitoring activity of the nesting beaches through the dedicated work of hundreds of volunteers (Margaritoulis, 2005), but is integral towards providing assistance for NMPZ activities such as the beach wardening programme and providing public awareness and recording infractions of the law on the nesting beaches and on turtle-watching boats. Since the formation of the NMPZ, scientific studies in the maritime area (Schofield et al 2007; Zbinden et al 2007) and general observations by NMPZ staff, ARCHELON volunteers and other NGOs, have indicated the requirement for updating protection measures and protocols of the marine and terrestrial protected areas (Togridou et al 2006). As a direct result the NMPZ Management Agency has developed an intensive science-based research programme which complements the ongoing monitoring work of ARCHELON providing co-ordinated scientific data on environmental, human-use and turtle activity in the NMPZ protected area. The above NMPZ information can subsequently be applied towards developing effective management of the region. The NMPZ research programme could not have been realised without the long-term monitoring activities of ARCHELON on all nesting beaches and dedicated work of WWF-Greece to protect the natural environment of Sekania, the most densely nested beach in the Mediterranean.

CURRENT COLLABORATIONS (2008)

In 2008, the NMPZ and ARCHELON together developed several activities towards further improving our knowledge about sea turtles and the factors impacting them;

1. On the nesting beaches, complementary monitoring of nesting activity and nest protection activities were continued and jointly revised with detailed information being collected by both organisations in order to further improve protection in the future
2. The NMPZ initiated PIT tagging of male and female turtles in the marine area and on the nesting beaches, to complement long term external flipper tagging programme of female turtles on the nesting beaches by ARCHELON in an effort towards jointly determining breeding population numbers
3. On Sekania, the study of seagull predation and hatchling emergence rates, respectively by the NMPZ and ARCHELON, which was conducted intensively in 2008 as a co-ordinated effort to establish exact datasets
4. In the maritime zone, NMPZ research assistants and ARCHELON project members recorded turtle sightings and conducted public awareness work on turtle-watching

boats; towards a comprehensive NMPZ supervised study of turtle behaviour in the maritime area.

FUTURE DIRECTIONS (2008 ONWARDS)

The long term goal of the NMPZ and ARCHELON on Zakynthos is to protect the sea turtle population through managing its marine and terrestrial breeding habitats. In forthcoming years the NMPZ and ARCHELON will develop further joint studies to address specific issues that may arise. The combined input of both organisations towards positively addressing management issues is vital. The collaboration between ARCHELON and the NMPZ is one example of a network of co-operative activities that the NMPZ is involved in towards effectively protecting the marine and terrestrial breeding habitats of Zakynthos' loggerhead population.

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TURTLES AND TOURISTS: MONITORING AND MANAGING NESTING BEACH SPATIAL AREA USE IN THE NATIONAL MARINE PARK OF ZAKYNTHOS

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ABSTRACT

The National Marine Park of Zakynthos (NMPZ) protects the most densely nested loggerhead sea turtle beaches in the Mediterranean. Effective protection requires evidence-based data, hence the NMPZ established a scientific research programme to obtain standardised information on a range of sea turtle, environmental and anthropogenic parameters. Within the framework of this programme counts of beach visitor numbers and GPS based records of area use are collected. Here we assess how both humans and sea turtles utilise the nesting beaches and consider the implications for conservation management.

KEYWORDS

Evidence-based data, protected area management, GPS, GIS, nesting activity, integrated planning, visitor management

INTRODUCTION

Sea turtle nesting beaches provides a narrow but important window of opportunity for assessing reproduction and nesting biology. Essential information may be obtained through the standardised inventory of nesting habitat quality, nesting activity and nest distribution with habitat conditions. The successful selection of adequate management measures for effective turtle protection and conservation requires a complete study of all aspects related to nesting biology, through combining traditional census techniques with computerised databases, genetic analyses and GIS technology (Richardson 1999; Eagles et al 2002). Standard guidelines and criteria based on sound scientific research are essential in order for policy-makers and field workers to decide when and why to invoke one management option over another, how to effectively implement the chosen option, and how to evaluate success (Pullin et al. 2003; Sutherland 2004).

Zakynthos hosts an average of 1249 nests along 5.5 km of nesting beaches, and attracts over 700,000 tourists, each summer (Margaritoulis 2005; NMPZ & Archelon data). Since 2006 the National Marine Park of Zakynthos have developed a scientific research programme and visitor monitoring programme, in complement to the systematic monitoring of nesting activity by the NGO Archelon since 1983, in

order to obtain baseline evidence-based data on turtle, environmental and human-use parameters on its nesting beaches to develop effective management of the protected area. Here we assess the relative spatial area use of the nesting beaches by humans and turtles using GIS technology and consider the implications for protected area management.

MATERIAL & METHODS

Both NMPZ guards and research assistants collected information To objectively assess the impact of visitors on the nesting beaches (i) visitor number information (total per hour between 10:00 and 19:00 and total per day) was collected by the NMPZ guards and (ii) GPS spatial area use information of beach visitors (at peak time of day and week, June-August) and sea turtles was collected by NMPZ research personnel. Visitors are requested to only use the beach area within 5 m of the sea, and our GPS-based surveys of visitor area use investigated (i) to what extent visitors follow these guidelines (ii) to what extent nests overlap the zone of beach used by visitors. On the nesting beaches where beach furniture is permitted by day, all furniture was cleared each night, so turtle activity and area use was not impeded.

RESULTS AND DISCUSSION

Beach visitation peaked between 12:00 and 16:00 primarily in August. At Marathonisi (beach length 383 m) visitor numbers never exceeded the NMPZ designated limit (200 persons) at any one time. Visitor distribution was well managed by guards; with just four nests (out of 102; 4%) fringing the zone used by visitors indicated by GPS surveys. At Kalamaki (beach length 2789 m) despite there being no legal limit to beach numbers, visitors generally adhered to area use guidelines. Overall 17 nests fringed and one nest fell within (out of 154; 11.5%) the zone used by visitors (of which one nest was subsequently relocated). At Crystal (beach length 578 m) there was also no limit to visitor numbers, however just 11 nests (out of 102; 11%) fringed the area used by beach visitors (of which four were subsequently relocated). At Gerakas (beach length 594 m) visitor numbers exceeded the legal limit (350 persons at any one time) primarily in August (12% of time in daytime surveys). However spatial area use of visitors was well regulated; eight nests fringed and 5 nests (out of 92; 14%) fell within the zone used by visitors (of which five were subsequently relocated). Sekania was not subject to beach visitation and at Daphni the nests were primarily caged within the framework of an ongoing pilot study.

CONCLUSIONS

The NMPZ study indicated that on all assessed beaches visitor density generally remained aggregated near major entrances and hence amenities. The official sunbed zones permitted on Kalamaki, Crystal and Gerakas beaches were

designated based on precautionary data obtained from the NGO Archelon. The NMPZ scientific research programme supports that these areas are subject to lower levels of nesting success, and may be primarily due to environmental parameters (i.e. beach slope and moisture levels). Therefore tourist distribution should be managed based on access sites and amenities available. NMPZ research supports that on beaches (or areas of beach) frequented by visitors, nest caging serves as a valuable tool to delineate the boundary, improve protection of fringe nests and as a public awareness tool. The National Marine Park of Zakynthos will continue accumulating information on beach visitor and sea turtle spatial area use to further develop management protocols.

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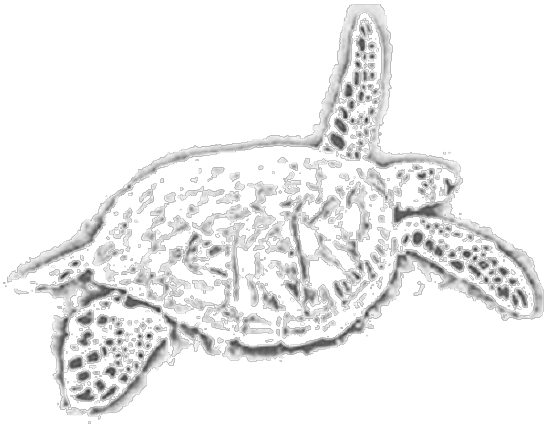

SESSION 3:

ANATOMY, PHYSIOLOGY, HEALTH

CHAIR:

Flegra BENTIVEGNA

FLOW CYTOMETRIC ANALYSIS OF LOGGERHEAD TURTLE (CARETTA CARETTA) PERIPHERAL BLOOD CELLS FROM NORTH ADRIATIC SEA

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While many of the physiological changes documented in turtle during stress still remain within the realm of experimental research, some have proven useful for quantifying stress, like changes in cortisol level, blood glucose etc. However, many other factors like genetic, developmental and environmental additionally influence physiological stress responses in turtles.

In this study, we analysed different populations of leukocytes and genomic DNA alternations as potential stress biomarkers by flow cytometry analyses. Blood samples were taken and compared from freshly captured eleven turtles and from the same specimens before their releasing. A significant increase of granulocytes was observed in two of eleven turtles. Flow cytometric analysis requires only interpase cells and it is therefore an attractive alternative to conventional cytogenetic by measuring DNA content deviation. Eight of eleven turtles showed normal DNA cell cycle: 90% cells in Go-G1 phase, 3% in S phase and 5% in G2-M phase.

Genomic DNA alterations (12.4 % cells in S phase, 6.5 % in G2M phase and 2.5% of cells in sub Go-G1 peak -apoptotic peak), were detected in two turtles, which indicate influence of possible action of infectious pathogens and/or anthropogenic contaminants. The positive correlation between granulocyte proliferation and genomic DNA alternation were observed in two turtles. However, before releasing, genomic DNA alternations or granulocyte proliferation was not observed.

Because immune proliferation or suppression have the potential to decrease survival of already threatened sea turtle population, it is important to understand the risk of stress on turtle general health and immune functions.

PRELIMINARY STUDY ON STRANDED SEA TURTLES ALONG THE NORTH COAST OF TUNISIA

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ABSTRACT

During the last three years, eleven cases of stranded turtles (three alive and eight dead) *Caretta caretta* have been observed along the north coast of Tunisia. The animals were examined, autopsies were performed on seven turtles that freshly died or that presented a moderate decomposition state and some tissues taken mainly from livers, spleens, kidneys and gonads were sampled for histological analysis. This technique helped us to familiarize with the normal structure of these organs. Livers, kidneys, muscles and sometimes hearts were sampled from these turtles for chemical analysis. The autopsies showed hooks in the digestive tract of six turtles generating some complications such as congestion necrosis, and cloacal prolepses. The preliminary chemical results obtained only from two turtles indicated that the levels of aliphatic hydrocarbon (nc_{10}-nc_{34}), Polycyclic Aromatic Hydrocarbon (PAH) and lead are very low. Mercury was found at high concentration only in the liver of one turtle. The organ distribution of cadmium and copper is similar to some bibliographic results and the high amounts of cadmium in the kidneys of the two turtles suggest the efficient detoxification and tolerance processes in this animal species.

KEY WORDS: Caretta caretta, Necropsy, Histology, Trace elements, Hydrocarbons

INTRODUCTION

For a long time, some strandings of marine turtles have been observed on the Tunisian coast specially in the south, and since three years ago, the National Institute of Sea Sciences and Technologies has set up a national net of three teams to supervise strandings of cetaceans and marine turtles in the north, the centre and the south. This was a good opportunity for the researchers to work on a national scale. This study aims to provide further information about the circumstance and the cause of the turtles' stranding at the north of Tunisia, the anatomo-pathology of some organs and also the distribution levels of some chemical compounds.

Material and Method

Stranding information, animal examination and tissues sampling

According to the questionnaire prepared before, we recorded all information about the circumstances of the stranding (the date, the person who declare it...), the animal data (the species, the mensuration, the sex.), the place of stranding (the nature of sediment, the position according to GPS) the tissue samples, and the internal lesions. When the animal was alive, it was taken in captivity, examined, treated, X-rayed and then it was transported to the rescue centre of Monastir; Whereas when the turtle was freshly dead or presented a moderate decomposition, it was autopsied, and some organ tissues were sampled for histopathology and chemical analysis. All the organs were examined to look for parasites and lesions. For histological analysis we used Formalin 10% to fix samples. For chemical analysis, we stored tissues (muscle, liver, kidney and sometimes the heart) at -20°C.

Histology

The paraffin embedded sections were sectioned at 5 µm, mounted on glass slides, and stained with hematoxilin and eosin.

Chemical analysis

Trace elements

The trace elements (Cd,Pb,Cu) concentrations were determined by atomic absorption spectrophotometry with graphite using methods described by UNEP/IAEA/FAO (1990). Mercury concentration was determined by the SAA in cold vapor, recording and processing by IAEA/UNEP (1984). The results are expressed in µg/g dry weight.

Aliphatic Hydocarbons (nC10-nC34) and Polycyclic Aromatic Hydrocarbons (PAH)

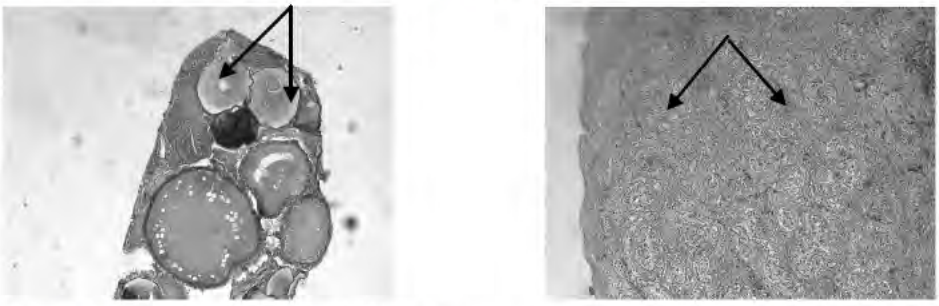
Analysis of hydrocarbons in marine organisms was performed according to the technique proposed by IAEA/MEL/MESL (1996). The results are expressed in µg/g dry weight.

RESULTS AND DISCUSSION

Two turtles stranded alive at Carthage; one had a hook thread in the anus and the other in the mouth. They were transported to the Monastir rescue centre after X-ray examination. All turtles autopsied showed a hook on the surface of the oesophagus except one stranded at Goulette which showed a hook thread obstructing the intestine in many sites causing congestion, necrosis and cloacal prolepses. Even the cases from Carthage showed anal prolepses, rolling intestine, many necrosis and important intestinal congestion.

HISTOLOGICAL RESULTS

Now, we are still at the stage of the recognition of the normal structures of some organs (liver, spleen, kidney, and gonad). When we will have a clear knowledge on the normal structures, we will attempt to study anomalies. Besides, the gonad's histological examination is the best method to confirm the sex when we have doubt or to determine sex in neonate (Ceriani and Wyneken, 2008) (Figure 1)



Ovary with follicles at different stages **estis with seminiferous tubules**

Figure 1. Histological sections of ovairy and testis

CHEMICAL RESULTS

The chemical analysis concerned only two turtles. The kidney exhibited high cadmium and lead concentrations (99,65 and 56,62 µg/g for Cd; 0,870 and 0,249 µg/g for Pb). With regard to copper and mercury, the first turtle was more affected in the liver while the other was more affected in the kidney. We also noticed a relatively high concentration of copper in the heart (10,09 µg/g). Similar organ distribution of cadmium and copper have been obtained in *Caretta caretta* from French Atlantic Coast (Caurant and *all.*, 1999) and from Mediterranean sea (Andreani and *all.*, 2008). Whereas, the trace element concentrations (Hg, Cu, Cd, Pb) were comparable within the Mediterranean sea (Caurant and *all.*, 1999; Maffuci and all, 2005 and Andreani and *all.*, 2008) and other ocean locations except for cadmium which is lower than those found in the Japan Sea (Sakai and *all*, 1995, 2000). Concentration of total Aliphatic and total Aromatic Hydrocarbons are low and don't signify the cause of death. Benzo(a) pyrène which represent an indicator of contamination with hydrocarbons were not found in all organs samples (Table 1).

Table 1. Distribution of some metal traces, Aliphatic hydrocarbon and Polycyclic Aromatic Hydrocarbon (PAH) in some organs

Place and date of the stranding	organs	Hg (µg/g)	Cd (µg/g)	Pb (µg/g)	Cu (µg/g)	Aliphatic hydrocarbon (nc_{10}-nc_{34}) ng/g	Polycyclic Aromatic Hydrocarbon (PAH) ng/g
12/07/06 Borj Cedria	muscle	0,018	2,30	0,230	4,00	2091,232	93,6
	liver	2,398	10,49	0,194	6,62	1147,200	66,93
	kidney	0,410	99,65	0,870	7,90	1519,247	105,66
02/02/07 Carthage	muscle	0,027	0,34	0,054	4,71	7326,927	55,90
	liver	0,171	2,86	0,085	12,50	680,121	345,96
	kidney	0,478	56,62	0,249	4,24	10678,440	552,73
	heart	0,023	1,06	0,199	10,09	-	-

CONCLUSION

This study provided us with important information about the biology and pathology of some stranded sea turtles and the distribution levels of some chemical compounds. Therefore, we have the obligation to continue theses investigations to increase our knowledge, improve the diagnostics for stranded sea turtles with regard to public health and to collect scientific material and data.

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THE TUNISIAN MARINE TURTLE RESCUE CENTRE: 4 YEARS ACTIVITY IN HELPING TURTLES

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National Institute of Sea Sciences and Technologies (INSTM)

Since it was created in 2004, the marine turtle rescue centre of Monastir (National Institute of Marine Sciences and Technology, Tunisia) is contributing to help the Mediterranean marine turtle population. In addition to 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. From 2004 to 2007, fifty-one *Caretta caretta* were admitted in the Centre: 19 turtles alive and 32 dead. The live turtles, mainly discovered by fishermen, were examined and received treatment appropriate to their health status. Essential problems included buoyancy abnormalities, pneumonia due to net capture and water swallowing (27 %), entanglements and strangulation injuries by nets and fishing line (27 %), ingestion of hooks (21 %), anorexia related to ingestion of plastic and solid waste (21 %), and internal haemorrhages (4 %). Ninety percent of suffering turtles received and treated in the Centre were healed and released in the sea. Only one fully blind turtle will probably have to be kept for a long period. The necropsy of dead turtles (32) was performed according to standard methods. It was shown that the causes of mortality were mainly related to hooks (47 %) and nets (40 %), while13 % died of unknown reasons.

METAL LEVELS IN THE TISSUES OF LOGGERHEAD TURTLE HATCHLINGS AND EMBRYOS ON DALAMAN BEACH, TURKEY

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Loggerhead sea turtles make 3-5 nests with two weeks intervals and prefer to nest on their natal beach. Because of these general characteristics of loggerhead nesting behaviour, we have investigated the metal levels in the eggshells, liver, muscle and yolk of the embryos (n= 35) and hatchlings (n= 55) found dead in the nests. Three to five samples from 20 nests were collected during the hatching season of 2007 on Dalaman beach, Turkey. These samples were air dried in the field and left in an oven until a constant weight was reached. The metal (Fe, Cu, Mn, Ni, Zn, Cr, Pb, As and Cd) concentrations were analysed by atomic absorption spectrometry. The mean values [±SE(Min-Max)] of metals found in the tissues were: Fe [455,3±65(33,8-4008,8)], Cu [6,1±0,8(0-36,4)], Mn [8,85±1,66(0-77,01)], Ni [21,01±2,46(0,76-97,9)], Zn [103,1±10,3(0-730,4)], Pb [1,47±0,29(0-16,63)], As [0,36±0,11(0-8,08)], Cd [0,28±0,09(0-6,83)] and Cr [0,38±0,09(0-3,93)]. Fe was highest in the eggshell and slightly lower in the muscle, liver and yolks. Cu and Zn were higher in the Muscle and liver. Mn and Ni were higher in the eggshells. The concentrations of Pb, Cr, As and Cd were quite low in all samples. The concentrations of these metals among the collected samples were temporally analysed by having 5 nests from every two weeks period in August and September. These values show that adults eliminate metals by transferring to the eggs and the amount of the transfer is slightly higher in pre-laid nests within the season.

AGE AT SIZE AND GROWTH RATES OF MEDITERRANEAN LOGGERHEAD SEA TURTLES (CARETTA CARETTA) IN THEIR FIRST YEARS OF LIFE

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Growth rate is a fundamental parameter to understand sea turtle population dynamics and is also important for the conservation of these threatened species. It can be influenced by both environmental and genetic factors, thus it can vary according to the area. Growth rates and age at size of loggerhead turtles (*Caretta caretta*) were estimated for the elusive first period of life, through length frequency data of 88 turtles ≤ 30 cm of Curved Carapace Length found in Italian waters and assumed to feed upon pelagic preys. Results indicate that this size range includes turtles in the first four years of life. Growth rates ranged from 12.8 cm/yr in the first six months of life to 3 cm/yr at age 2.5-3.5 years and these values and age at size are similar to those known from the Atlantic. The results also suggest a secondary increase of growth rates in larger turtles recruiting to neritic habitats, supporting a polyphasic growth pattern proposed for other populations and other sea turtle species. Given the difficulty in investigating growth patterns in this size class, these results will support future studies using different methods and size classes in order to understand an important aspect of sea turtle population dynamics.

THE TURTLE PROJECT AT "CENTRO REGIONALE RECUPERO FAUNA SELVATICA E TARTARUGHE MARINE" OF SICILIAN WILDLIFE FUND IN COMISO (RG)

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Sicily is considered to be strategic in biogeography for its central location and its role in the evolution of Mediterranean. Given the large amount of marine chelonians living around the island, its role in conservation and in scientific studies is relatively high.

The Sicilian regional government has regulated regional centres for wildlife by creating legislation and ratified the role of Comiso wildlife rescue centre with two decrees, in 2000 and 2006.

The centre works on rescue, hospitalisation and release of turtles all around the Sicilian coasts. It is also involved in monitoring of nesting activity, running conservation activities and in the musealisation of samples in collaboration with the local Natural History Museum.

The centre has 12 pools ranging from a few hundreds to 5000 liters, filled with sterilized and conditioned artificial sea water, a surgery room and separate services for food and analysis.

863 animals were collected from 1991 till 2007 (188 *C. caretta*, 3 *D. coriacea*, and 1 *C. mydas, fr* in the period 1991-1998; 322 *C.caretta* and another *C. mydas* in 1999-2002 and 348 *C.caretta* from 2003 to 2007); the trend for 2008 seems to be similar.

36% of the turtles died and 64% was released. 38% of the turtles derive from strandings and 62% directly from fishermen, with casualties distributed as: general stranding 35%, longline hooks 21%, gillnets entanglement 6%, bottom trawling 2%, direct capture 29%. Studies are growing on parasite, contaminats and biological traits with different cooperations. The number of volunteers and collaborators is increasing each year as the number of school classes.

PRELEMINARY STUDY ON EPIBIONT OF A SEA TURTLE *CARETTA CARETTA* (L.) FROM THE GULF OF GABES (TUNISIA)

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Among marine turtles, the loggerhead sea turtle *Caretta caretta* (Linnaeus, 1758) is known to be colonized by large and diverse communities of epibiont fauna and flora. This turtle species is common in the Mediterranean and reproduces also in Tunisia.

In the present work we study the composition of the epibiontic assemblage associated with *Caretta caretta* in order (1) to have some information about the epizoites of this turtle and (2) to gain better understanding on its behaviour, habitat preference within the gulf of Gabes and migration patterns.

Epibionts were collected on alive and stranded specimens by removing them carefully from the turtles. Samples were fixed and preserved in ethanol 70% until the laboratory where the species were identified and counted. Analyses revealed a variety of fauna and flora species: 19 species of crustaceans (cirripedia, amphipoda, isopoda and copepoda), 11 algae, 3 molluscs, 3 annelids, 2 foraminifera and one cnidaria species. The most frequent species were the barnacle *Chelonibia testidunaria* and the red algae of the genus *Ceramium*.

All epibiont species found in this study were mentioned in the north Mediterranean except for the two foraminifer's species. Moreover, crustaceans (mainly cirripedia) and annelids seem to be frequent on Mediterranean loggerheads.

Key-word: Epibionts, loggerhead turtle, Gulf of Gabes

INTESTINAL NECROSIS IN A LOGGERHEAD SEA TURTLE (*CARETTA CARETTA*)

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Post mortem examination of a juvenile loggerhead sea turtle (*Caretta caretta*) stranded in the Mahdia coast (Tunisia) revealed a fishing line in the small intestine. After histological analysis, we noticed severe necrotic enteritis, multiple haemorrhages and marked oedema of the intestinal submucosa. Besides that we revealed chronic myocarditis, PAS stained didn't show mycotic infection. Samples from internal organs (spleen, liver, intestine, and heart) and lesions were cultured in usual and selective medias. Phenotypic characterisation revealed the presence of Gram-negative and Gram-positive bacteria, including *Bacillus sp.*, *Salmonella sp*, *Aeromonas hydrophila*, *Proteus sp.* and *V. alginolyticus*. Many of these bacteria were considered as opportunists in marine environment. It can be transformed in pathogens when the immunity of the animals decreases. A traumatic lesion caused by the line can be a pathway of entry of these bacteria and necrosis signalled in small intestine and septicaemia.

Lethal injures were related to the effect of strangulation and traction produced by the line throughout the gastro-intestinal tract. The length of thread, the size, the location and the traction of the hook determine the chances of survival. The presence of a long monofilament line, and the traction applied to it could be harmful for this turtle.

INTRODUCTION

Loggerhead turtles are frequently captured by the different types of fishing gear: fishing lines, fishing net …. (Gallo *et al*., 2006, Jribi *et al*., 2008). Sometimes, fishermen throw them back into the sea, and regardless whether or not a hook is clasped in their digestive system. Fishing hooks may cause severe injuries especially in the esophagus which causes perforation or ulceration. Diagnostic techniques may include visual inspection radiology (X-rays) and endoscopy. Hook removal may be accomplished by hand, endoscope, or surgery. Although, plastic material cannot be detected by X-rays. Hooks of long line fisheries represent a great threat for sea turtles, causing thousands of deaths in the Western Mediterranean (Aguilar et al 1995). In this study, we report here the post-mortem findings of a stranded male loggerhead sea turtle (Caretta caretta).

MATERIALS AND METHODS

The post mortem examination were carried in center of rehabilitation for marine turtles in Monastir (Tunisia) using the protocol developed by Wolke and George (1981). For histopathologic analysis, the sample was individually fixed in 10% buffered formalin, and 4-µm-thick sections were cut from paraffin blocks and stained with hematoxylin-eosin,(HE). Selected samples from intestinal lesions were also stained with periodic acid schiff (PAS)). to determine if an opportunistic fungal isolate is causing infection Tissue samples from the intestine were cultured on TCS agar, TCBS agar, SS agar and sabouraud agar. Plates were incubated for 24-48h at 20 and 37°C. Diagnostic of principal bacteria was carried using api 20E and api 20NE (Biomèrieux).

RESULTS AND DISCUSSION

In March 2008, an adult male loggerhead sea turtle (Caretta caretta) was found floating off the coast of Mahdia Tunisia (Mediterranean Sea). The turtle had a hook anchored in the mouth and a traumatic injury in the jaw. The turtle weighed 41.8-kg and had a carapace length curved of 75.5 cm and the width curved of the carapace was 67.4 cm. Physical examination had revealed anorexia, lethargy, debilitation, and positive buoyancy, and non responsiveness to external stimuli; it had sunken eyes and tears on the level of the mouth. The animal died 2 weeks after being housed in the rehabilitation center of Monastir (Tunisia). At necropsy the turtle was cachectic; it had an injury from a hook which had been removed by the fishermen. The hook had caused a serious wound (4 cm) in the jaw which appeared healed. The liver was soft, dark, and showed severe passive congestion. The spleen was enlarged and friable. The duodenum was full of gas and green mucous fluid, the small intestine was firm and has became pleated and gathered around a linear foreign body. The foreign body was identified as a hook thread.

The digestive apparatus was empty. Some dark lesions were noted in the intestinal part. Thick yellow fibrin necrotic membrane covered the mucosa and were associated with Aeromonas hydrophila, Vibrio alginolyticus, Pseudomonas aeruginosa, Bacillus, and Salmonella spp. infections. Histologically, severe necrotic enteritis, multiple hemorrhages, and marked oedema of the intestinal submucosa, (fig.1).The PAS stain did not reveal any fungi. Other lesions observed were mild multifocal fibrinous myocarditis (fig 2). No histological lesions were present in other major organs.

The origin of this opportunistic infection may be related to the presence of a hook thread in the intestine and to the immunosuppressive state of the turtle due to the traumatic lesions suffered, and other stress conditions associated with transportation or rehabilitation of these marine animals.

Foreign bodies in the digestive tract can harm the health of sea turtles both directly and indirectly. Plastics and other materials may block the digestive tract or cause local necrosis and ulceration (George 1997).

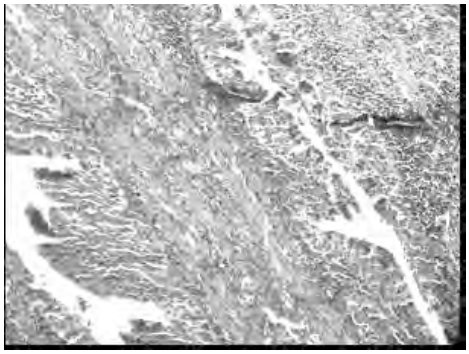

Fig. 1. *Caretta caretta*. Severe necrotic enteritis

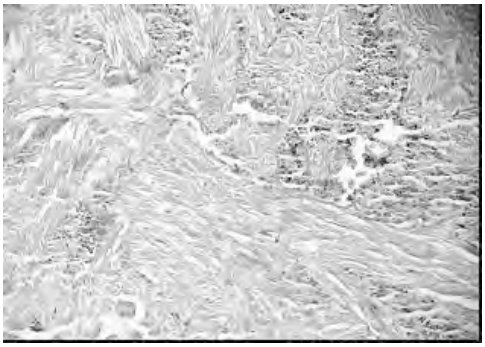

Fig. 2. *Caretta caretta*. Chronic myocarditis

Indirectly, indigested waste material may harm turtles by interfering with lipid metabolism (Schulman and Lutz, 1995), increasing intestinal transit time, or contributing to the accumulation of gas and uncontrollable floating (George, 1997). *Aeromonas hydrophila, Vibrio alginolyticus, Pseudomonas aeruginosa, Salmonella sp and Bacillus sp*, are common in turtles and are associated with ulcerative,,stomatitis-obstructive rhinitis-pneumonia complex (Glazebrook *et al.,* 1993). Many of these bacteria are opportunistic pathogens requiring predisposing factors to induce disease in sea turtles. Histological diagnosis of myocarditis was based on findings of myocite degeneration and necrosis increased number of chronic inflammatory cells. The enlarged spleen might be due to sustained antibody production at a high level. The cachectic status, shown by this turtle and the absence of digestive material in the gastrointestinal tract could have compromised the immunological system leading to severe intestinal necrosis.

CONCLUSION

This study clarifies the hook effects on the digestive system of loggerhead turtles, and demonstrates that the lethal effects are caused more by the traction of the line than by the hook itself.

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EPIBIONTS OF *CARETTA CARETTA* IN ITALIAN WATERS AND A STUDY ON PLANES MINUTUS ON LOGGEHEADS IN SICILY

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The paper summarizes information on epibionts of loggerhead turtles collected in the northern Adriatic Sea and in the Sicily channel. Barnacles and molluscs are the main hosted species. Number of barnacles and their distribution on carapace are not related to size and seem to be connected with sea region and physiolocal status of the turtle. Twenty-six *Planes minutus* crabs were collected on rescued loggerhead turtles from the southern Sicilian coast between 1995 and 2007. All except two crabs were adults. There were a few more females than males in the sample, 58% and 42% respectively. Among the collected animals there were seven couples of crabs of mixed gender and one couple of two males was found. In this couple one male was a small juvenile. Distribution by months underlines a strong concentration of crabs on turtles rescued during summer months. Few cases were present in spring and autumn, but 84% of the samples were found between May and August. By month crabs were found with the following relative percentage (in declining order): 25% in June, 25% in August, 21% in July, 13% in May, 13% in November, 8% in April and 4% in October.
More information on the epibiont community can help in understanding the ecological traits and movements of the loggerheads and further studies are actually ongoing.

EFFECT OF DIET CHANGES ON HEAVY METAL CONTENT IN LOGGERHEAD TURTLES

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Rescue centres have an important role in rehabilitation of sea turtles and represent a very important site where study the biology of these reptiles. This preliminary work reports on the evaluation of the variation of heavy metals body burden in sea turtles hospitalised in a rescue centre as a function of time of hospitalisation thanks to a change to a fish based diet. Metals (As, Se, Pb, Cd, Hg) were quantified in the blood of sea turtles by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES). Obtained data showed high levels of As and Se (4.03 ± 2.78 and 3.3 ±2.59 µg/ml of blood respectively) in the blood of sea turtles, while all other toxic metals were below or close to the limit of detection, and Hg was always below the limit. No strong statistical correlation was observed between time of hospitalisation and metal levels but a clear tendency to decrease in blood heavy metal content was found in housed animals. The shift in feeding habits induced with the hospitalisation to concentrate on low level contamination small pelagic fishes is probably involved in this trend. These preliminary data seem to confirm the importance of diet in determining heavy metals body burden, and witness the importance of blood as marker of recent exposure to pollutants.

KEYWORDS: *Caretta caretta*, heavy metals, time of hospitalisation

INTRODUCTION

Rescue centres are important for the rehabilitation of sea turtles as well as to investigate many particular aspect of their biology. During the hospitalisation the diet of loggerhead Caretta caretta, the most common species in Mediterranean centres, can be drastically changed, due to practical aspects. Indeed, turtles are maintained on a fish-based diet, because it is easier to obtain and at lower costs. Main species used for turtles feeding are herring that are supposed to have a lower metal body burden (Zaccaroni et al, 2008). Considering this, it can be supposed that long lasting hospitalisation could reduce heavy metal burden in sea turtles. The present work reports on the first data concerning heavy metal contents in the blood of hospitalised turtles in relation to the time of hospitalisation itself, in order to verify if diet changes could effectively reduce heavy metal burden, and to which extent.

MATERIALS AND METHODS

Loggerheads were all recovered at Sicilia Nature Fund Centre of Comiso, South Italy. From each animal present in the Centre at the beginning of the research (n=14, SCL range 26.5-76 cm; see table 1) blood was withdrawn from the jugular vein and immediately stored at -20°C for heavy metals analysis (As, Se, Pb, Cd, Hg), performed with a ICP-OES technique. Analytical data were subsequently correlated with information available for each turtle concerning length of hospitalisation.

RESULTS

Obtained data showed high levels of As and Se in the blood of sea turtles, while all other toxic metals were below or close to the limit of detection, and Hg and Pb were always below the limit.

No correlation was observed between time of hospitalisation and levels of detectable metals (As, Se and Cd); anyway, a certain trend could be observed towards reduction of heavy metal content of blood (figure 1); the data concerning the long time hospitalized animal was excluded). No correlation was observed as well between blood heavy metals content and carapace length, and no clear trend toward decreasing or increasing concentration with increasing dimensions was observed, with the only exception of Cd. In this case, a slight tendency in increasing concentration could be seen (Table 1).

Table 1: Heavy metal content in blood of hospitalised turtles. Time: time of hospitalization; SCL: Straight Carapace Length. Being always below the limit of detection, data concerning Pb and Hg are not reported.

Time (days)	SCL (cm)	Metal (mg/L)		
		As	Se	Cd
1	46	6,78	1,34	0,03
11	58	8,71	4,34	0,03
35	76	3,61	3,34	0,03
36	39,5	6,02	1,69	0,1
37	48	2,20	1,14	0,07
45	42,5	5,28	9,31	0,07
52	57	3,16	2,06	0,07
58	51	8,27	8,04	0,03
69	72	1,59	3,56	0,05
70	57	2,01	2,25	0,11
91	53	5,98	4,46	0,03
193	27,5	1,72	1,96	0,01
276	63	1,02	2,60	0,03
1353	26,5	0,10	0,11	0,05

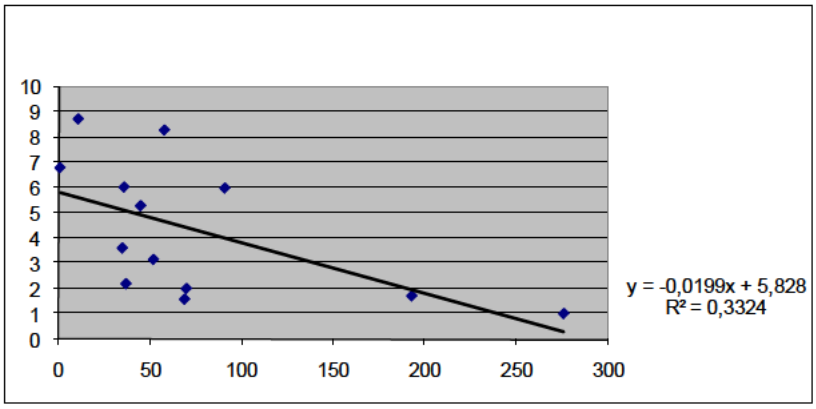

Figure 1- Arsenic concentrations in relation to hospitalization time. The value of the long time hospitalized animal (1353 days) was excluded from the graph.

DISCUSSION

Little information is available concerning heavy metal content in the blood of sea turtles (Day et al., 2005; Wang, 2001; Wang, 2005; Kenyon, 2001). None of these studies focuses on the variation of this burden during hospitalisation. This data could confirm the reduced ingestion of metals with diet in hospitalised turtles, when using, for example, herrings as food. Indeed, blood content is indicative of recent exposure to heavy metals, thus representing the amount of pollutants ingested with the diet and the "acute" risk of intoxication for the animals. Concerning Pb and Hg, the fact that these metals were never detectable in blood could be considered as a marker of low o neglible exposure to these pollutants, thus confirming the validity of blood as short term monitoring tool. Indeed, a monitoring of the same metals in blood of free ranging sea turtles from the same area showed detectable levels of Hg and Pb, witnessing an exposure to these contaminants in the wild (Zaccaroni et al., not published).

Also when correlation with SCL are considered, the lack of any correlation can be partially explained with the fact that blood has to be considered as a short term exposure tool. Anyway, the trend observed for Cd is in agreement with huge literature concerning an accumulation of the metal with age.

CONCLUSIONS

These preliminary data seem to confirm the importance of diet in determining As, Se and Cd body burden, and witness the importance of blood as marker of recent exposure to pollutants.

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CONTAMINANT LEVELS IN HATCHLINGS AND EGGSHELLS OF A LOGGERHEAD NEST FROM THE APULIAN COAST, SOUTHERN ITALY

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At the end of October 2007 a loggerhead nest at San Foca beach, near Lecce, Apulian region, Italy, hatched with a very high hatching success (77.36%, equivalent to 41 hatchlings out of 53 eggs). Aim of present research was to verify if metal contamination could have been responsible for the death of the animals and to monitor general exposure of the nest to these contaminants. The few dead hatchlings (n=3) and eggshell fragments (n= 10) which could be collected in the nest were stored at -20°C until analysis. Tissues (liver, muscle and yolk sac when available) and eggshells were homogenized and then microwave digested. Digested samples were finally analysed with Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES) for heavy metals analysis (As, Se, Pb, Cd, Hg). Due to small sample size, no statistical analysis was performed. Among analysed metals, As, Hg and Se only were detectable, while Cd was found in yolk sac content only (63 and 66 ng/g); Pb was never detected. As levels ranged between 693 and 2875 ng/g in eggshell and muscle respectively; Se presented the highest concentrations (range 2761-4966 ng/g). Hg was found at very low levels in all samples analysed, reaching the highest values in yolk sac content (364 and 402 ng/g). Data concerning As and Hg can be partially explained with the known lipophilicity of these pollutants, which accumulate in fatty tissues. Low levels observed are not to be considered responsible for the death of the hatchlings, which seem to have died by drowning.

HEAVY METAL MONITORING IN THE BLOOD OF *CARETTA CARETTA* FROM THE NORTHEN ADRIATIC SEA

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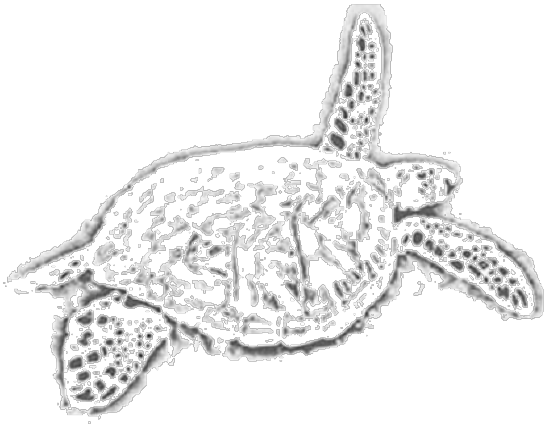
[2] A.R.C.H.E'., Onlus Research and Educational Activities for Chelonian Conservation, Ferrara, Italy

The present work reports on the monitoring of heavy metals (As, Se, Pb, Cd, Hg) in the blood of loggerhead turtles from the area of the delta Po River, Northwestern Adriatic Sea and evaluates the presence of correlations between heavy metals content and biometrics and gender. Blood was collected from caudal sinus of bycatched turtles and preserved at -20°C till analysis, which was performed by Inductively Coupled Plasma-Atomic Emission Spectroscopy (ICP-AES) for heavy metals analysis (As, Se, Pb, Cd, Hg). Obtained data showed high levels of As and Se (2.73 ± 0.28 µg/ml and 1.11 ± 0.157 µg/ml respectively) in blood of sea turtles, while all other toxic metals were below or close to the limit of detection. Positive correlations with CCL measurement were found for As ($r=0.4328$, $p=0.001$) and Hg ($r=0.3408$, $p=0.009$) only. When sex is considered, a difference between sexes was found for Pb only ($r=0.4374$, $p=0.012$), with adult males showing higher concentrations (0.111 ± 0.014 µg/ml vs 0.05 ± 0.014 µg/ml respectively). Mean metal concentrations are to be considered as very low and thus non-toxic. Considering gender, differences observed for Pb in adult subjects may be partially ascribed to the fact that females can expel contaminants with eggs. It has indeed been already proved that pollutants body burden in adult females is normally lower than that in adult males. Present work increases knowledge concerning heavy metals blood burden in sea turtles and confirms the importance of blood as marker of short-term exposure to contaminants.



SESSION 4:

NESTING BEACHES

CHAIRS:

Carlos CARRERAS
Abdulmaula HAMZA
&
Yakup KASKA

POPULATION GENETIC STRUCTURE OF LOGGERHEAD TURTLES, *CARETTA CARETTA* IN TURKEY BASED ON MTDNA SEQUENCES

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This study provides information on the population genetic structure of loggerhead turtles nesting on the Turkish coasts. We have analyzed mtDNA D-loop region sequences from 100 individuals belong to 17 nesting sites. In order to avoid pseudoreplications, the tissue samples were collected only from the clutches laid within a 10 day window. The sampling localities and samples sizes were as follows: Dalyan (n: 16), Dalaman (n: 8), Fethiye (n: 6), Patara (n: 2), Kale (n:4), Kumluca (n:8), Çıralı (n:8), Tekirova (n: 2), Belek (n: 8), Kızılot (n:4), Gazipaşa (n: 6), Anamur (n: 8), G�ksu Deltası (n: 6), Alata (n: 4), Akyatan (n: 4), Akyatan (n: 1) and Samandağ (n: 5). Approximately 860 bp of mtDNA D-loop region sequences was amplified with PCR using LCM15382 (5'- GCTTAACCCTAAAGCATTGG -3') and H950 (5'- GTCTCGGATTTAGGGGTTTG -3') primers and then sequenced. A total of four mtDNA haplotypes so called CC A2, CC A3, CC A13 and CC A43- two of which (CC A13 and CC A43) were new for the Mediterranean region - were determined. Previous genetic studies have shown that the frequency of Haplotype CC A3 was higher in the east part of the Turkey but in the present study this haplotype was represented with higher frequencies in the west part. The haplotype diversity ranged from 0.000 to 0.7333 and nucleotide diversity from 0.00000 to 0.001015.

SEX RATIOS OF LOGGERHEAD TURTLE HATCHLINGS ON DALAMAN BEACH, TURKEY: ANALYSES OF 6 YEARS DATA

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The nesting activities of loggerhead turtles, gonad samples from dead hatchlings and embryos and nest temperatures were recorded on Dalaman beach between 2002 and 2007. The air temperatures, nest temperatures, recorded with electronic temperature recorders, and incubation periods were analyzed. The sex ratio of dead hatchlings and embryos were determined by gonads observation and sex ratios for the other hatchlings were estimated by measuring temperatures of the nests and by analyzing the incubation durations and the period of emergences asynchrony. The sand temperatures were found to be lower close to the sea and showed an increase towards inland. The sex ratio obtained from dead hatchlings showed remarkable differences between the zones of the beaches perpendicular to the sea and nest depths, by having more females at the top levels and inland ones. The dead hatchlings collected from the first and last emergences of nests were also different in sex ratio by having higher sex ratio of females in the first night emergences and higher males in the last night emergences. The slightly higher proportion males are produced from the early laid and last laid nests. There were some slight differences in sex ratios among the years by analysing different methods but all the sex ratio of all years' estimations was skewed for the favor of females. The spatial and temporal variations of nests and their sex ratios were discussed under the possible effect of the nesting site preferences of adult females under possible effect of global warming.

POPULATION GENETIC STRUCTURE OF GREEN TURTLES, CHELONIA MYDAS, IN TURKEY AND NORTHERN CYPRUS BASED ON MTDNA SEQUENCES

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This study provides information on the genetic structure of green turtles population nesting on the Turkish and Northern Cyprus coasts. We have analyzed mtDNA D-loop region sequences of 161 individuals belonging to 6 nesting sites. In order to avoid pseudoreplications, the tissue samples were collected only from the clutches laid within a 10 days window. The sampling localities and samples sizes were as follows: Northern Cyprus (2002, n= 35), Yumurtalık (2006, n= 9), Kazanlı (2007, n= 21), Alata (2007, n= 5), Samandağ (2006 and 2007, n= 15) and Akyatan (2006 and 2007, n= 78). Approximately 900 bp of mtDNA D-loop region sequences were amplified with PCR using LCM15382 (5'- GCTTAACCCTAAAGCATTGG -3') and H950 (5'- GTCTCGGATTTAGGGGTTTG -3') primers and then sequenced. A total of six mtDNA haplotypes have been identified. Identified haplotypes are Cm-13 (N=154), Cm-14 (N=2), haplotype-e (N=1). Furthermore, three new haplotypes were described.

HOW DOES A WAR AFFECT A SEA TURTLE NESTING POPULATION

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El Mansouri & El Koliala beach (EM), have been regularly monitored and conservation strategies have been applied since the importance of South Lebanon as a sea turtle nesting site was highlighted. The results of the monitoring efforts conducted by the Lebanese team show that there is a nesting population, mainly of *Carretta caretta* with a minority of *Chelonia mydas* regularly emerging. Southern Lebanon has been under considerable socio-economic strain since the end of Israeli occupation in 2000 and the recent war (2006) has certainly created a peculiar situation in the country. In a short time the country has been dramatically hit and damaged. The local community and authority were not available to provide support to the monitoring campaign either with man power, funds or other. A part from an interruption during the war, the monitoring programme continued. Even though the total number of nests found on the beach (min 36-max 76) from 2002 and 2007 did not show a particular variation before, during and after the war, some problems emerged after the war. Individual nest protection was applied resulting in a successful technique until 2006. During the war, foxes probably found the beach as a safe area with food available and learned how to locate nests. Army bases, and therefore soldiers, were located near the beach causing an impact on the nesting habitat. An increased human presence created disturbance on the beach, particularly during the night, domestic dogs were present on the beach and sand was removed from it.

OLD TURTLES LAY MORE EGGS THAN THE YOUNGER ONES

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Kyparissia Bay is located in western Peloponnesus and comprises the second most important nesting area of loggerhead turtles in the Mediterranean with an annual average of 580 nests (over 15 seasons). Since 1982, an ongoing annual tagging project is conducted at Kyparissia Bay, during which the observed turtles at night are registered as “recruits” (new nesters) or “remigrants” (old nesters), depending on whether they bear tags from previous seasons or scars attributed to lost tags. Subsequently, the “new” turtles and the “scarred” turtles are tagged. Excluding the first two seasons (1982 and 1983) which had no “remigrants”, and also the 1990 season in which tagging personnel did not record the “scarred” turtles, the remaining 21 seasons (1984-2005, without 1990) gave the following results. The total number of observed turtles, during the 21 seasons, was 1,765. Of these, 859 (48.7%) turtles were registered as “recruits” and 906 (51.3%) as “remigrants”. Of the 859 “recruit” turtles, 655 (76.3%) were observed to lay only one nest during the season (single-nesters), and the 204 (23.7%) were observed (or estimated) as laying more than one nest during the season (multiple-nesters). Of the 906 “remigrant” turtles, 547 (60.4%) were documented as single-nesters and 359 (39.6%) as multiple-nesters. The overall result, despite the expected constraints of tagging intensity and site fixity which may cause a number of turtles to be unobserved, shows that the reproductively “older” turtles make generally more nests (and lay more eggs) than the reproductively “younger” turtles.

ESTIMATING HATCHLING SEX RATIOS OF LOGGERHEAD TURTLES FROM INCUBATION DURATION AND NEST TEMPERATURES AT KURIAT ISLAND, TUNISIA

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Hatchling sex ratios in the loggerhead turtle (*Caretta caretta*) were estimated at Kuriat islands during 2007 by using two methods: (1) incubation durations and (2) nest temperatures. Analysis concerned 11 nests deposited in the south part of the beach of great Kuriat where sand and nest temperatures were recorded with electronic temperature recorders throughout the nesting season. The incubation periods ranged from 53 to 62 days with a mean of 56.5 days, the mean temperature in the middle third of the incubation period ranged from 28.7 to 31.7°C. Based on these results, the sex ratios of hatchlings (% of females) at Kuriat islands were estimated at 75% by the first method and 85% by the second one. These results provide a highly female-skewed sex ratio in loggerhead turtles in the Mediterranean and elsewhere.

KEYWORDS: Kuriat islands, Sex ratio, incubation duration, temperature

INTRODUCTION

In sea turtle hatchlings, sexual differentiation is influenced by the temperature of the sand in which the eggs develop usually during the middle third of incubation duration: higher temperatures produce primarily female hatchlings and lower temperatures produce primarily male hatchlings. Several previous studies have used beach temperature data and incubation durations to estimate hatchling sex ratios (Marcovaldi et al., 1997; Kaska et al., 1998 and 2006; Mrosovsky et al., 2002). In general, these studies of loggerhead turtles have shown a conservative range of pivotal temperatures within about 1 degree of 29°C and indicate similar pivotal temperatures of loggerhead turtle populations in the Mediterranean and elsewhere (Kaska et al., 2006).

The aim of this study is to estimate the sex ratio of hatchlings hatched in Kuriat islands during the nesting season of 2007 by using two methods: the first one used was the mean temperature during the middle third of the incubation period based on study of Mrosovsky et al. (2002) and the second one used was the incubation period based on the study of Marcovaldi et al. (1997).

MATERIALS AND METHODS

Temperatures of sand and nests were measured using electronic temperature recorders. In the nest, the data logger was placed into the centre of clutch.

Additionally, a second one was buried in sand adjacent to the nest. In the sand, temperatures were recorded at three different depths (15; 30 and 45cm) during the whole period of nesting. To determine the effect of the distance of nests from the sea, temperatures were also recorded at different distance from the sea at 30cm depth during 48 hours.

Measuring the temperatures in both the nest and in the adjacent sand in one hand and at different distance from the sea in second hand permitted us to make all necessary corrections to the temperatures measured in the sand for the different nests during the whole period of nesting.

The incubation period correspond to the number of days from the eggs deposition to the first days of emergence.

RESULTS AND DISCUSSION

As to be expected, temperature variability decreased with increasing depth. The temperatures were usually higher in the nest than in the adjacent sand. During the middle third of the incubation period, the daily mean nest temperatures were 2°C (range: 1-2.9) greater than sand temperature. Information on the 11 analysed nests is presented in the Table 1.

Nest n°	Lay date	Emergence date	Depths (cm)		Clutch size	Emergence success	Distance to sea (m)	I D	T° TSP	Corrected T°	Sex ratio (%♀) from T°	Sex ratio (%♀) from ID
			T	B								
1	09 Jun	08 Aug	9	41	84	39.3	8.5	61	26.6	28.7	0	19
2	19 Jun	19 Aug	23	47	101	80.2	8.5	62	27.5	29.6	40	8
3	22 Jun	19 Aug	23	40	78	55.1	15.5	59	27.6	30.1	90	50
4	05 Jul	28 Aug	22	46	106	60.4	15	55	28.3	31.1	100	98
5	06 Jul	27 Aug	23	46	106	90.6	10	53	28.3	30.6	100	100
6	07 Jul	28 Aug	22	40	78	59.0	17	53	28.3	31.4	100	100
7	11 Jul	06 Sept	25	43	68	89.7	14	58	28.2	30.9	100	70
8	23 Jul	13 Sept	12	35	103	55.3	10	53	28.4	30.7	100	100
9	25 Jul	18 Sept	14	42	56	66.1	16	56	28.6	31.7	100	95
10	26 Jul	20 Sept	26	45	75	42.7	5,8	56	28.6	30.5	100	95
11	06 Aug	30 Sept	25	45	88	92.0	10	56	28.1	30.4	100	95
Mean			20.4	42.7	85.7	66.4	11.8	56.5	28.0	30.5	84.5	75.5

T:top, *B*:bottom, *ID*: incubation duration, *TSP*: thermosensitive period

Tab. 1: Estimating hatchlings sex ratio (%♀) of *Caretta caretta* in the Kuriat islands

Based on mean daily temperatures during the thermosensitive period, 8 of the 11 nests were predicted to produce 100% females and one 90% females. The two remaining nests were predicted to produce hatchlings with male-biased sex ratios. Based on incubation duration, 8 of the 11 nests were predicted to produce more

females. Among the remaining three nests, two were predicted to produce hatchlings with male-biased sex ratios and the third was predicted to produce hatchlings with a sex ratio of 1:1. The nests with male biased sex ratio were deposited at the beginning of the nesting season when the temperatures were relatively low. Comparison of the two methods indicates that sex ratios are not significantly different (Student test: P>0.05).

The report about the sex ratio for loggerhead sea turtles is generally female dominated (Kaska et al., 1998 and 2006; Marcovaldi et al., 1997; Mrosovsky et al., 2002). The present study estimates that Kuriat islands is also an area producing a female-biased sex ratio. Because of the knowledge about the sex ratios of hatchlings on different beaches is an important parameter for conservation measures, more research is needed on small beaches such as Kuriat islands in order to have enough females and males for the reproduction.

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THE EFFECT OF CLIMATE CONDITIONS ON GREEN TURTLE NESTING SUCCESS IN AKYATAN, TURKEY

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The aim of this study is to investigate the influence of climate conditions, mainly changing daily air temperature, on nesting success. The data were collected during the 2006 and 2007 reproduction seasons in Akyatan beach, Turkey. The meteorological data were supplied from Turkish State Meteorological Service. During the research, daily average temperature is chosen as a representative of climatic factors after proving that there is a statistically significant correlation between temperature, moisture and barometric pressure ($p<0.0001$). The regression analysis proved significant negative relationship between the average temperature and abundance of nests in Akyatan beach ($r=0.24$, $p<0.05$). Additionally, due to the strong correlation between climatic conditions, it is assumed that the number of nests also decreases with an increase on maximum and minimum temperature as well as humidity while an increase on the number of nests might be observed if the air pressure increases. A remarkable decrease, from 562 nests to 170, occurred on the abundance of nests between 2006 and 2007. However, this would probably be attributable to natural fluctuation of nest numbers over the years. Long term observations in relation to nest numbers and temperature will be carried out in Akyatan. Overall, we should bear in mind that these are initial findings. Thus, modelling as well as detail analysis for estimating the nesting success with regards to changing climatic conditions are on process. This study was realized within the framework of a collaboration protocol established between WWF-Turkey and the Ministry of Environment and Forestry's Regional Directorate located in Adana

A RECENTLY DISCOVERED POPULATION OF CARETTA CARETTA NESTING IN CALABRIA (SOUTHERN ITALY) HOSTS AN IMPORTANT QUOTA OF MEDITERRANEAN MATRILINEAR DIVERSITY

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We sequenced 815 bp of the mtDNA of loggerhead turtles from a recently described population nesting in Calabria (Southern Italy). Non-invasive sampling and detection of pseudoreplication were applied. Among the 38 resulting nests we found haplotypes CC-A2.1 (57.9%), CC-A20.1 (36.8%) and CC-A31.1 (5.3%). When compared to other colonies, Calabria hosted the highest intra-population genetic diversity, and contributed a previously unknown quota of the overall Mediterranean diversity. Analyses of population structure converged in showing a strong maternal isolation, consistent with the female natal homing behaviour. Furthermore, Calabria and Eastern Turkish nesting areas harboured far more diversity than expected based on their census sizes. Overall, the results question the simple model of a single colonization for the Mediterranean, suggesting recurrent founder effects, from sources yet to be identified in this sea or in the Atlantic.

INTRODUCTION

We report for the first time genetic data on the most abundant Italian nesting population (Mingozzi et al. 2007), by describing the mtDNA endowment of females, as reconstructed from their progeny. We address three fundamental questions i.e. i) whether or not it harbours qualitative and quantitative genetic peculiarities in the overall scenario of Mediterranean diversity, ii) whether or not the mtDNA pool of this population leads to a revision of the model for the colonization of the Mediterranean beaches, and iii) whether or not the genetics and other peculiarities of this population merit ad hoc conservation actions.

MATERIAL AND METHODS

The study area is located along the Ionian coast of Calabria, the southernmost part of the Italian peninsula. The monitoring period was 2000-2007. Each nest was identified by its location and date of deposition. Non invasive sampling consisted only in the collection of dead hatchlings and non-hatched eggs one week after hatching, without interfering with the nesting female at the time of deposition. We resequenced a fragment of 815 bp of the mtDNA, that could be entirely aligned with those produced by LaCasella et al. (2007).

RESULTS

We typed 71 individuals from 47 nests. The possibility that, among the nests sampled in the same year, two or more were laid by the same female, is a potential source of bias in the estimation of the mtDNA haplotype frequencies in the population. We then sought to search for instances of multiple depositions in our dataset. Overall, three criteria were used: geographical distance between nests, time interval between depositions and identity of inferred maternal mtDNA type. Nests residing within 5 km from each other and being laid at intervals of 13-16 days (Schroeder et al. 2003) and showing the same mtDNA type in their hatchlings, were considered with high likelihood of the same female. In order to examine whether the resulting series were still biased in favour of common or rare haplotypes, we performed three additional controls: first, we considered only years 2006 and 2007; second, we used a fixed 15-days window (Carreras et al. 2007); third we repeated the calculation on all years by using only the geographical distance and time interval criteria. We concluded that the combined use of three criteria to detect pseudoreplication within each of 5 years (2003-2007) enabled a stringent exclusion of repeated depositions, yet retaining the power to sample uncommon haplotypes, and did not significantly alter mtDNA haplotype frequencies. Among the 38 resulting nests we found haplotype CC-A2.1 (57.9%) and two other haplotypes never described in Mediterranean nesting grounds, CC-A20.1 (36.8%) and CC-A31.1 (5.3%). The latter two haplotypes differ for a single transition from CC-A2.1.

We then compared our data with those reported for the other Mediterranean nesting populations in the comparable subset of the sequence. In pairwise comparisons, two populations stand out as mostly differentiated, i.e. the Calabrian (Phi_st always > 0.16) and East Turkish (Phi_st always > 0.21). The presence, among the Mediterranean populations, of a basically ubiquitous haplotype at high frequencies (CC-A2) and of only two instances of haplotypes (CC-A3 and CC-A6) that are shared by no more than three populations lead to barely measurable migration rates.

When examining the relationship between mtDNA polymorphism and the size of the nesting colony, the Calabrian and East Turkish populations emerged for the relatively large Theta (pi) despite small number of nesting females.

DISCUSSION AND CONCLUSIONS

The data favour a model in which the genetic composition of the Calabrian and East Turkish nesting populations still carry the signature of the original foundation events by a presumably small number of founders, and the ensuing large variations in haplotype frequencies (founder effect). While it is possible that these foundation events occurred from within the Mediterranean, an Atlantic provenance should be also taken in due account.

Two aspects of the Calabrian population are relevant for its conservation in the Mediterranean. These are the location at the north-western edge of the breeding area, and the enhancement of the overall diversity of matrilines, contributed mainly by the remarkable frequency of CC-A20.1. Finally, waters off Calabria are certainly exposed to incoming of foraging males from the Atlantic (Maffucci et al. 2006). This nesting population may then act as a stepping stone for male-borne genes that are later exchanged in the rest of the Mediterranean and contribute to the preservation of viable amounts of genetic diversity.

Our findings prompt for the conservation of this site.

Sample composition and results of mtDNA typing after controlling for pseudoreplication.

Year n. nests typed (individuals typed) Instances of multiple depositions (depositions/female) mtDNA haplotypes in "independent" females Total n. of independent haplotypes

CC-A2.1 CCA20.1 CCA31.1

2000 1 (1) - 1 1

2001 1 (1) - 1 1

2002 1 (1) - 1 1

2003 5 (6) - 4 1 5

2004 4 (8) 1 (2) 1 2 3

2005 9 (12) 2 (2,2) 5 2 7

2006 8 (16) 3 (2,2,2)3 2 5

2007 18 (26) 3 (2,3) 8 6 1 15

Total 22 (57.9%) 14 (36.8%) 2 (5.3%) 38

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NESTING ACTIVITY OF LOGGERHEAD TURTLES, *CARETTA CARETTA*, IN KURIAT ISLAND, TUNISIA (2006- 2007)

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Among the three common sea turtles appearing in the Mediterranean, only the loggerhead Caretta caretta nests in Tunisia. Kuriat islands are relatively the most important nesting site in the country. The nesting season started at the beginning of June and ended at the middle of August for both years. A totals of 15 and 29 nests were recorded respectively in 2006 and 2007. In the great Kuriat, the mean clutch size was 92.1 in 2006 and 83 in 2007. The hatching success and the hatchling emergence success were respectively 69.6% and 68.4% in 2006 and 56.85% and 56.08% in 2007. The nesting site of the little Kuriat island seems to be disturbed.

INTRODUCTION

Only, the loggerhead turtle (Caretta caretta) and the green turtle (Chelonia mydas) are known to nest in the Mediterranean Sea (Groombridge, 1990; Kasparek et al., 2001; Margaritoulis et al., 2003). The major nesting beaches identified for the loggerhead were in Greece, Turkey, Cyprus and Libya, little nesting activities were recorded in Egypt, Syria, Lebanon, Tunisia and Italy (Margaritoulis et al., 2003). In Tunisia, the Great Kuriat represents actually the most important loggerhead nesting site. This little site was object of regular monitoring since 1997 (Bradai, 2000; Jribi et al., 2006). In this study, we give some data on the reproductive parameters of Caretta caretta in the Kuriat islands for 2006 and 2007.

MATERIEL AND METHODS

The Kuriat Islands (35° 48'05'' N, 11°02'05'' E) consist on mainly two islands: The Little Kuriat (Kuria Sgira) which ca. 0.7 Km2 and the Great Kuriat (Kuria Kbira) which ca. 2.7 Km2 in area. The most important nesting beach is situated in the west of the Great Kuriat.

A full time survey takes place yearly on Great Kuriat, from June to August with some daily visits in September and October. The night patrolling covers the beaches on Great Kuriat from 10:00 p.m. to 03:00 a.m. After females completed their nesting process, body measurements (Curved Carapace Length notch to tip: CCLn-t and Curved Carapace width: CCW) were taken and turtles were tagged. Morning patrols were also achieved in the two islands. All nests recorded were protected by metal cages, which served to facilitate awareness for general public. Nests were opened and checked after the hatchlings completed their emergence to

count empty eggshells, unfertilized eggs, dead embryos, dead hatchlings and live hatchlings. These data were used to estimate nesting parameters.

RESULTS AND DISCUSSION

The nesting season started at the beginning of June and ended at the middle of August, with mean incubation duration of 63.5 days. Generally, the females deposit their nests in June, mainly in July and exceptionally in August (Jribi *et al.,* 2006). Over 2006 and 2007, the monthly distribution of nests was 35.14 % in June, 62.16% in July and 2.7% in August. This situation is similar on the nesting beaches of Greece (Rees and Margaritoulis, 2005).

During the night patrolling, 6 females were tagged and measured. The mean CCLn-t was 77 cm (range: 72-82; N=6) and CCW was 64.83cm (range: 60-74; N=6). Only 3 females were observed twice, with mean inter-nesting interval of 16.33 days.

The mean clutch size was 86.68 eggs per nest (range: 55-125; N=37), in the Great Kuriat. This is similar to those recorded in Cyprus and Turkey but less than those recorded in Greece (Margaritoulis *et al.,* 2003). The hatchling success was 60.9% (range: 1.56 - 96.77; N= 37). The emergence success was 60% (range: 1.56 - 96.77; N= 37). These two rates are the lowest records since 1997. The high humidity on of the south part of the beach, where the half of nests was deposited, seems to be the major cause for this lower hatching and emergences success. Table 1 gives data on the reproductive parameters for both years considered in this study.

Season	2006	2007
Number of nests	15	22
Clutch size	65-118	55-125
Fertility rate (%)	82	78.31
Hatching success (%)	69.6	56.85
Emergence success (%)	68.4	56.08

Tab. 1: Some reproductive parameters in Great Kuriat

In the Little Kuriat, no nests were detected in 2006 and 7 nests were deposited in 2007. It's the highest number of nest recorded since 1993. The mean clutch size was 82.33 (range: 58-148; N= 6). The hatching success and the emergence success were 53.21% and 50.09% respectively. According to Hirth (1980), the nests seem to be disturbed and the beaches are not favorable for the nesting activity. The little Kuriat is, indeed, very frequented in the summer.

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EFFECTS OF NEST TEMPERATURE ON SEX RATIO OF THE LOGGERHEAD SEA TURTLE (*CARETTA CARETTA*) HATCHLINGS ON OLYMPOS-ÇIRALI BEACH, TURKEY

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In this study, hatching success and hatchling sex ratios of the loggerhead turtle (*Caretta caretta*) were estimated by placing electronic temperature recorders in 9 nests at Olympos-Çıralı beach during the nesting period of 2006. Over the season, the mean temperature in the middle third of the incubation period ranged from 28.9ºC to 31.9ºC, and incubation periods ranged from 42 to 60 days. The results of the temperature analyses and incubation periods suggested that Olympos-Çıralı has a relatively high proportion of female hatchlings (85%).

ZOOGEOGRAPHIC POLYMORPHISMS IN THE MITOCHONDRIAL DNA CONTROL REGION OF LOGGERHEAD AND GREEN TURTLES NESTING ON TURKISH BEACHES

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The genetic structures of loggerhead sea turtle (*Caretta caretta*) and green sea turtle (*Chelonia mydas*), nesting along the Turkish coast, were investigated by collecting tissues of brain, kidney, liver, heart, gonad and muscles from dead hatchlings and embryos. Tissues were collected on 11 beaches from 31 different dead hatchlings (14 *C. caretta* and 17 *C. mydas*) and preserved in absolute alcohol. These tissues were digested with Proteinase K and DNA's were carried with dextran blue. PCR was carried out by HDCMI and LTCMI which were specific for the control region of mtDNA and differences compared by restriction fragment length polymorphism (RFLP) analysis. *AluI, HindII, HindIII, HaeIII* and *SmaI* restriction enzymes were used for digestion in PCR-RFLP analyses. The *SmaI* and *HindIII* enzymes were not digested the mtDNA from both species. By looking at the digestion sites and length variations of the fragments, produced by the digestion of *AluI* and *HindII* enzymes, the polymorphisms in three *C. caretta* and two *C. mydas* specimens were determined on four different beaches of Turkey. These results of zoogeographic differences were discussed together with the population sizes of the different beaches in terms of the importance of the biological and genetical diversities of the sea turtle population on Turkish beaches.

Key Words: *Caretta caretta*, *Chelonia mydas*, mitochondrial DNA, Polymerase Chain Reaction.

A REFUGE FOR THE *CARETTA CARETTA* IN THE MEDITERRANEAN: CIRALI, TURKEY

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The Mediterranean is the leading tourist destination in the world. Tourism can be a major tool for economic development but can also have adverse effects on biodiversity, natural resources and local communities. Cirali beach (Antalya/Turkey) is 3.2 km in length and one of the major nesting sites for the endangered loggerhead turtle *Caretta caretta.*

An EU funded project, led by WWF-Turkey has been successfully implemented and Cirali now represents a good model of sustainable small scale tourism in the Mediterranean.

The local community has participated in many conservation activities during the turtle nesting seasons. Monitoring and conservation of the beach has been ensured both by WWF Turkey's staff and by local community.

Field surveys carried out since 1994 show the increasing trend in nest numbers since the start of conservation activities. In 1994 there were 34 nests; 105 were documented in 2007. However this increase on the nest numbers doesn't necessarily mean that sea turtle population is increasing.

Overall, effective protection and conservation management of marine turtle nesting beaches in touristic areas is a pressing issue and unfortunately finding the effective solution is not easy mainly because of the complex relationship between biology of turtle reproduction, nesting behaviour, socioeconomic factors and political interests. WWF-Turkey signed a 5-year protocol with the Regional Directorate of Ministry of Environment and Forestry in Antalya for long term monitoring and conservation of Cirali beach in 2007.

ESTIMATED SEX RATIO AND HATCHING SUCCESS IN LOGGERHEAD TURTLE, CARETTA CARETTA, NESTS AT FETHIYE, TURKEY

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Most of the turtles are males at lower incubation temperatures and females at higher temperatures but some turtle species produce females at high and low temperatures and males at intermediate temperature. There are many methodological approaches for the estimation of sex ratios. Validation of incubation duration as an index of the sex ratio of hatchling sea turtles is one of them. In this study we used the incubation durations of 499 nests laid between the 1995 and 2005 reproduction seasons. The pivotal temperature and incubation temperature at the middle third of incubation were estimated by using regression line approach for Fethiye beach. Another regression line was produced to estimate the percentage of females. We estimated the middle third of incubation temperature of eleven years for each of nests from the first linear regression equation and, % females were estimated by using second linear equation with estimated middle third of incubation temperatures. The error rate of estimated sex ratios (-1.16 and 1.10) was comparable with that of a previous study. The mean of estimated percentages of the females hatchlings was 72.27 (N=499) for eleven years. The mean percentage of females was higher in 1998, 2000, 2001, 2002, 2003 and 2004. There is significant positive relationship between hatching success (%) and estimated percentage of females (Spearman's Rho= 0.15 P= 0.001); between hatching success (%) and hatchlings that were able to reach the sea (%) (Spearman's Rho= 0.25 P= 0.000).

NESTING ACTIVITY AND CONSERVATION OF MARINE TURTLES IN THREE NESTING SITES WEST OF SIRTE (2006-2007 SEASONS)

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Nesting activity for loggerhead marine turtles *Caretta caretta* in three nesting sites (Al Ghbeba, Al Thalteen, and Al Arbaeen beaches) west of Sirte was conducted as daily prospection and *in situ* and *ex situ* protection for nests. Results showed an increase in nesting density at the three sites since 2005. Al Ghbeba is proved to be the most important nesting site in Libya so far with 8.8 nests/km in 2005, 18.5 nests/km in 2006 and 30.6 nests/km in 2007. Nesting activity, density, predation and poaching threats were reported and discussed. The program was funded by Environment General Authority of Libya and partially by UNEP/MAP-RAC/SPA.

GEOLOGICAL PROPERTIES OF SOME SEA TURTLE NESTING BEACHES IN THE EASTERN MEDITERRANEAN

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Sand samples from five sea turtle nesting beaches (Alagadi, Kazanlı, Anamur, Bozyazı and Dalyan-İztuzu) in the eastern Mediterranean were collected and some geological properties were analysed. The compositions of sand samples were determined via stereo-microscope and found to originate from magmatic, sedimentary and metamorphic rocks. The densities and sizes of quartz, feldispat, garnet, magnesioferrit and mica minerals were determined and photographed. These minerals directly related the temperature profile of the beach, its moisture and salinity. The magnet mineral, like iron, high heat capacity and high resistive properties of mica minerals are directly related the temperature profile of the beach. The temperature dependent sex determination, natal homing hypothesis, nest site selection of sea turtles, the effects of temperature to the incubation period and geological properties of the beach sand were discussed with the spatial differences between these minerals and their quantities.

USING GIS IN GREEN TURTLE, CHELONIA MYDAS, NESTS

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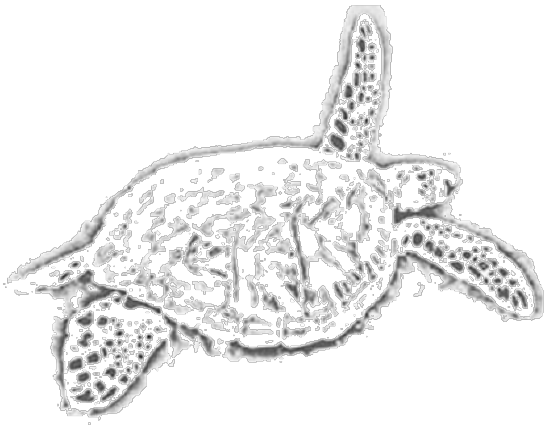
Akyatan beach, Turkey was investigated for the reproductive ecology of green turtles, *Chelonia mydas*, during 2006 and 2007 nesting seasons. Nest places were recorded with GPS nearest to 7 m. We used Dell Axim x51 and a GlobalSat GPS receiver to map the beach.

First the digital map was divided into two areas, vegetated and non-vegetated. Furthermore, we divided to beach into 11 sections with 1-km long polygons starting from eastern side of the beach and ending in the western side to examine the existence of the density dependent hatching success.

For both 2006 and 2007 green turtles preferred to nest in the vegetated areas. Hatching success was higher for both years when nests were located in the vegetation.

Nests were concentrated on certain areas of the beach. In 2006, a 1km area in the eastern side of the beach was preferred. In 2007, an area of middle of the beach was preferred.

Hatching success between 1km polygons for 2006 and 2007 were not statistically significant except or the 2006 nesting season when predated nests were not included. Certain areas were more successful than the others but no geographical pattern was determined.



SESSION 5:

FISHERY

CHAIR:

Paolo CASALE

TACKLING SEA TURTLE BYCACTH IN THE MEDITERRANEAN: STRATEGY OR FATALISM?

Paolo CASALE

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The high fishing effort in the Mediterranean represents a major threat to sea turtle populations of the basin, due to both mortality induced by the fishing gear alone and the intentional killing of captured turtles. A full understanding of this threat is difficult to achieve, however a large amount of data have been collected. A review of by-catch data from the Mediterranean is presented. Although with a high degree of uncertainty, the analysis of this information suggests that over 100,000 or even 200,000 captures per year may take place in the Mediterranean by trawlers, longliners and set netters, with possibly over 50,000 deaths per year by interaction alone, not including intentional killing which is probably more important than commonly thought. Although the lack of adequate information on population dynamics does not allow understanding how such a harvest may affects population growth, under a precautionary approach it should be assumed to be not sustainable. However, while this is generally assumed, and research effort is spent on this issue, measures developed in other regions or proposed in the Mediterranean delay to be tested and implemented on a regional scale. Measures and approaches to tackle the impact caused by the many small/artisanal vessels of the Mediterranean have not been investigated yet. Intentional killing remains a phenomenon difficult to remove. A new effective strategy should be urgently developed and implemented, probably at regional level and tackling the issue of ecosystem-based management of fisheries as a whole.

IUU FISHING IN THE IONIAN WATERS FACING THE MAIN ITALIAN NESTING GROUND OF Caretta caretta: IS THERE A PRAGMATIC SOLUTION?

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ABSTRACT

Illegal, unreported and unregulated (IUU) fishing is considered one of the most serious threats to the achievement of sustainable fisheries. In summer 2007, we began on a preliminary research on the characteristics of the fishing fleet that may impact the loggerhead turtle population in its main nesting ground in Italy (Ionian Calabria). We divided the fishing vessels that work in the study area in 1) permanent vessels (local ships that fish in the area all the year round), 2) seasonal vessels (non-local ships that fish in the area during the summer only). The permanent vessels were composed of 206 artisanal, 2 polyvalent and 326 recreational. The seasonal vessels were composed of 5 artisanal (surface longliners) and 8 polyvalent (illegal drift netters). Our results showed that 87% (n=179) of the artisanal permanent vessels were illegal, because they lacked a hull identification number . The fish catch and profit value, estimated as yearly average per boat, differed greatly between artisanal (4.2 tons and 4.458 Euro) and polyvalent (92.60 tons and 59.352 Euro) vessels. These differences cause a social conflict that increases during the summer, when the local artisanal boats compete spatially with the non-local polyvalent boats (drift netters). The fishing effort increases during the summer as number of vessels. The boats that join the local fleet use surface longline and drift nets. We recommend a better control of the illegal drift netters and the registration of the artisanal vessels, as an essential requisite to manage them and to guarantee the conservation of loggerhead turtles in the area.

KEY WORDS: Loggerhead turtles, artisanal boats, drift nets, longlines

INTRODUCTION

Loggerhead turtle Caretta caretta is included in the red list of threatened species of the IUCN (2001) (http://www.redlist.org). One of the main conservation problems of this species is connected with the incidental captures by longlines, and drift nets (today illegal) (Camiñas et al., 2006, De Metrio y Megalofonou, 1988). The Southern Ionian coast of Calabria between Capo dell'Armi (15°40'50''E, 37°57'12''N) and Capo Bruzzano (16°08''38'E, 38°01''52'N) was recently recognized as the most important Italian nesting site of C. caretta (Mingozzi et al., 2007). In summer 2007, we began a preliminary investigation of the characteristics of the fishing fleet that

was likely to influence the nesting population in our area. In this paper we focused on the description of the fleet in our study area.

MATERIALS AND METHODS

Census was done combining the information from the port authorities (n = 27, 25 artisanal and 2 polyvalent) and our data collected in the field, where every ship was catalogued by length. We divided the fleet in three sections, according to GFCM (www.gfcm.org) and Italian law: 1) artisanal vessels: length < 12 m and gross tons< 10 t; 2) polyvalent vessels: length > 12 m; 3) recreational vessels: used only occasionally, without an economical profit. The collection of technical and economical data was possible with specific interviews to the ship-owners, to obtain information about: a) technical data of the boat (length, gross ton, motor capacity, gears used by month etc.); b) costs data (fixed, variable and maintenance costs); c) production and profit data (kg landing by month). The interviews conducted (n = 50) represent the 18% of the artisanal boats, the 60% of the polyvalent boats and the 2% of the recreational boats.

RESULTS

We divided the fishing vessels in 1) permanent vessels (local ships that fish in the area all year long), 2) seasonal vessels (non-local ships that fish in the area only during the summer). The permanent vessels (n = 534) are divided in 206 artisanal, 2 polyvalent (purse seiners for small pelagics) and 326 recreational. The seasonal vessels (n = 13) are divided in: 5 artisanal (surface longliners) and 8 polyvalent (illegal drift netters). The artisanal sector is the most representative of the commercial fishing activity in the area in terms of number of boats. However the 87% of the artisanal permanent vessels are illegal, because they lack a registration number. On the contrary, all the seasonal vessels have a registration number. The technical and economical indicators of the fishing fleet are represented in Table1.

Table 1: Technical and economical indicators of the fleet fishing in the study area.

	INDICATORS*						
fishing unit	boat gross ton (t)	yearly fishing days per boat (n)	boat length (m)	yearly variable costs per boat (€)	yearly gasoline costs per boat (€)	yearly catch per boat (t)	yearly catch per gross ton (t)
artisanal	3.53	212	6.00	6799	3271	4.20	1.20
polyvalent	16.46	246	15.80	79974	37537	92.60	5.60
recreational	0.71	107	4.90	1388	568	0.60	0.84

* All the indicators represent the average

The technical and economical differences between the artisanal, polyvalent and recreational fishing boats are shown in Table 1. However, the three fleet sections have in common an increasing rate in the fishing days from spring to summer season (artisanal = + 46.3%, polyvalent = + 27.4% and recreational = +232.2%).

DISCUSSION AND CONCLUSIONS

The artisanal and polyvalent boats exploit economically the marine resources in the study area; however their profit value is very different, in order of magnitude. This difference causes a social conflict that increases during the summer season, when the local artisanals boats compete spatially with the non-local polyvalent boats (drift netters). The illegal condition of the artisanal fishermen, due to the absence of their vessels registration number, prevents them from opposing the predominance of the drift netters. The legalisation of the artisanal vessels should drive the local fishermen to develop a tangible opposition form to the illegal drift netters, which presence appears totally inappropriate for the turtle conservation in the study area. The fishing effort increases during the summer period in number of fishing days and number of vessels. The boats that join the local fleet in the summer period use surface longline and drift nets, which are the most impactant gears for the sea turtles. We recommend a better control of the illegal drift netters and the implementation of management measures toward the longliners (Cambiè *et al.,* 2008) to guarantee the conservation of Loggerhead turtles in the area.

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ASSESSEMENT OF MARINE TURTLE BY CATCH IN THE GILLNET FISHERY IN THE SOUTH OF TUNISIA

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ABSTRACT

The gillnets targeting elasmobranchs, mainly sharks and guitarfish, are artisanal nets used in the south of Tunisia in spring by depth no exceeding 40 m. These nets seem to interact heavily with marine turtles. The means Catch Per Unit Effort (CPUE) corresponding to the number of turtles/set and to the number of turtles/km^2 of gillnet/24 hours are respectively 0.882 (SD: 1,163) and 0.077 (SD: 0.057). Total captures was estimated at 540.88± 339.86 (95% C.I). The loggerheads captured are mainly juveniles (mean = 55.3 cm, SD=7.72; range = 46-73). The direct mortality was very high and reached 60% (n=9).

KEYWORDS: By catch, catch rate, gillnet fishery, *Caretta caretta*, Gulf of Gabès.

INTRODUCTION

Due to their ecology and feeding habits, marine turtles are often caught by several fishing gears (Jribi et al., 2007; Jribi et al., 2008; Caminas et al., 2006). Almost all studies were focused on large-scale commercial fisheries, mainly longlines and trawls. Other fisheries widely distributed in the Mediterranean such as gillnet fishery are still ignored.

This study aims to analyze preliminary data on the by catch of loggerhead sea turtles in coastal gillnets in the south of the Gulf of Gabès (fig.1.) which is considered as a foraging zone and an important wintering area for the loggerhead turtle, Caretta caretta, in the Mediterranean Sea.

MATERIALS AND METHODS

The investigation was carried out during the fishing season 2007 on board Tunisian commercial vessels operating with gillnets targeting mainly sharks and guitarfish. Data were collected by onboard observers in 17 fishing sets. These sets took place from April to June corresponding to the fishing campaign of these species. At the beginning and the end of each set, we recorded the date, geographic coordinates, bottom depth and number of turtles captured. Information about turtles included the species, the Curved Carapace Length notch to tip (CCLn-t) and the physical condition.

RESULTS AND DISCUSSION

A total of 15 sea turtles (all Loggerheads) were incidentally caught during 17 fishing sets (soak time = 862.56 h) which represents a catch rate of 0.882 turtle per set and 0.077± 0.057 turtle per Km2 of gillnet per 24 hours. The estimated average fishing efforts for gillnets fisheries fleet operating in the zone of study was 613 sets /year (Source DGPA: General Directorate of Fishing and Aquaculture).The total captures resulting from this fishing effort was estimated at 540.88± 339.86 (95% C.I).

Catch rates estimated suggest that there is a substantial interaction of sea turtles with gillnets fishery in the south of the Gulf of Gabès which is an area where a high density of marine turtles is suspected.

The captures registered by gillnets occurred in depths between 15 and 40 meters (fig. 1), these low fishing depths show the threat of this gear on sea turtles population generally concentrated in depths lesser than 50 m (Gerosa and Casale, 1999).

The mean carapace length (CCLn-t) of caught loggerheads was 55.3 cm (SD=7.72 cm; range = 46-73), most of these turtles were juveniles, only one large turtle had been captured (CCLn-t > 70 cm) (fig. 2).

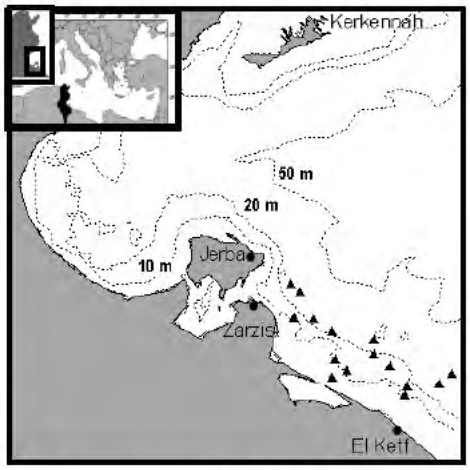

Fig. 1. The Gulf of Gabès:(▲) Locations of sets with turtles caught by gillnet fishery

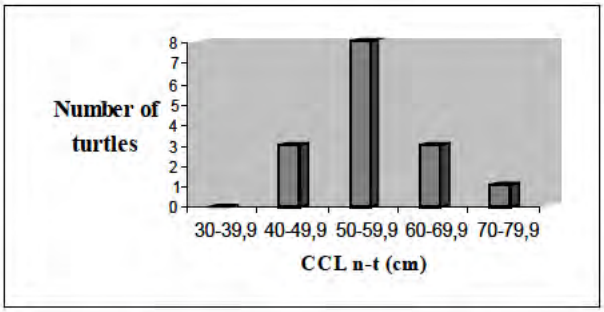

Fig. 2. Distribution of (CCLn-t) Frequencies of loggerhead turtles caught in study area (N=15)

The majority of loggerheads were death (60%), three turtles were found in a comatose state (20%) and three were in good conditions (20%). Consequently, the total direct and potential mortalities for the gillnet fisheries operating in the study area were estimated respectively at 324.528 ±203.916 and 108.176± 67.972.

The mortality rate registered exceed those recorded by trawlers (0.033) (Jribi et *al.*, 2007), pelagic longline (0.0) and benthic longline (0.125) (Jribi et *al.*, 2008) in the

study area. Considering this high mortality rate, it is quite possible that the cumulative lethal effect of small coastal gillnet fisheries could have a direct mortality level equivalent to that of larger commercial fisheries.

This study shows clearly that gillnets represent a the threat to the sea turtle population. These results and those of other artisanal fisheries, which must be more expected, should be taken in consideration in all strategies for conservation.

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CAPTURE OF SEA TURTLES IN FISHERIES AROUND TANGIER, MOROCCO

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The area of Tangier in northern Morocco represents an important crossing point of sea turtles between the Mediterranean and the Atlantic. With different fisheries operating in Tangier waters, the risk of incidental captures is potentially quite high. We conducted interviews with fishermen in order to obtain information on sea turtle bycatch in the Tangier fisheries. At some times of the year (April to September except July), sea turtles are at a high risk of incidental capture in the Moroccan driftnet fishery operating on the Mediterranean coast of Tangiers. 55 loggerheads and 8 leatherbacks were captured accidentally in 2006-2007 in this area by 10 fishermen. In the present study, we analyze the data to determine the size class of the captured population, the seasons of greater incidental capture, the mortality rate, and the fisheries with which greater interactions with sea turtles occur. The class most represented in the distribution of the frequencies of size of the sea turtles captured is between 50 and 70 cm CCL. Sea turtles are captured during all year, but especially in spring and the summer when the fishermen use driftnets. During winter and autumn, the rate of capture is less and the fishermen use longlines as fishing gear. 54 sea turtles captured were released alive and 9 loggerheads dead (mortality rate = 14.28%). The total number of turtles caught per year by the Tangier fishery is about 1000.

INTENTIONAL KILLING OF SEA TURTLES IN EGYPT: AN IMPORTANT THREAT TO MEDITERRANEAN POPULATIONS

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Sea turtles have been traded in Egypt for a long time, and to assess the present situation after protection, enforcement, and awareness campaigns in the last years, 445 persons, mostly fishermen and fishmongers, were interviewed along the Mediterranean coast. Most fishermen believe that turtle occurrence both at sea and at nesting beaches has dramatically declined in Egypt. The declared catch rates and the official fleet statistics, suggest that over 5000 turtles per year are captured by trawlers, longliners and set netters, and an important proportion of these turtles may die just as a consequence of the capture. However, mortality due to intentional killing is probably even more important: most fishermen from Alexandria and some of the fishermen from other regions admitted to killing and consuming turtles on board or occasionally landing the meat for their families or for sale. Turtles are no longer sold publicly in those Alexandria markets where regulations have been enforced, although they are still sold through the black market and even publicly in other Alexandria markets. Regulations and their enforcement can achieve just limited results, because onboard consumption, meat landing, and black markets are difficult to control. This situation represents a major threat to sea turtle populations nesting in other Mediterranean countries, so highlighting the need of regional cooperation, and actions aimed to remove the cultural drivers of turtle consumption and to mitigate bycatch mortality are deemed as necessary and urgent.

INCIDENTAL CAPTURE OF THE LOGGERHEAD TURTLE *Caretta caretta* BY SURFACE LONGLINE FISHING OFF THE MAIN ITALIAN NESTING GROUND.

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ABSTRACT

The Southern Ionian coast of Calabria between Capo dell'Armi and Capo Bruzzano is the main Italian nesting site of *C. caretta*. In summer 2007, we began on a preliminary study on the impact of swordfish longline on the loggerhead turtle population in this area. The observations were carried out from a single commercial fishing vessel. Out of 46 catches over 10 fishing events observed, 17 (36.9%) were by-catch of Loggerhead turtle. *Caretta caretta* was the second species, in terms of number, after *Xiphias gladius*. The R index (number of incidental catches/number of hooks^{-3}) (average 2.76) and the F index (number of incidental catches/number of fishing operations) (average 1.67) increased over the summer season. Almost all of the caught sea turtles (n=16, 94.1%) were hooked to squid baited hooks, contiguous to attracting lights. Out of the 16 turtles that were brought on board, 7 (43.8%) were found hooked on the floor of the mouth, 6 (37.5%) deep in the digestive track and 3 (18.8%) on the higher oesophagus. On average, the CSCL (curved standard carapace length) was 52.67 ± 8.07 SD cm (range: 40.0 - 66.0 cm, n=16). We estimated that 100 sea turtles were caught, during summer 2007, by each fishing unit using this gear and 500 by the whole fleet (n=5). We recommend technical changes in the surface longline (abandonment of the attracting lights, the use of less attractive bait for the turtles and the experimentation of circle hooks) and spatial and temporal restrictions on this fishing gear.

KEY WORDS: Loggerhead turtle, surface longline, by-catch.

INTRODUCTION

Loggerhead turtle Caretta caretta is included in the red list of threatened species of the IUCN (2001) (http://www.redlist.org). Drifting longlines are considered a major threat to endangered sea turtle populations worldwide. The Southern Ionian coast of Calabria between Capo dell'Armi (15°40'50''E, 37°57'12''N) and Capo Bruzzano (16°08'38''E, 38°01'52''N), was recently recognized as the most important Italian nesting site of C. caretta (Mingozzi et al. 2007). In summer 2007, we began a preliminary investigation of the characteristics of the fishing fleet in this nesting

area. In this paper we focused on the impact of the swordfish longline on the local Loggerhead turtle population.

MATERIALS AND METHODS

From June to August 2007, we monitored the fishing ground in front of the Calabrian nesting area between 3.5 to 17 miles off the coast, and between 200 and 2,000 m depth. The observations were carried out from a single commercial fishing vessel (8.9 m in length). As the catch per unit effort (CPUE) measure we used the index R (number of incidental catches/number of hooks-3) and the index F (number of incidental catches/number of fishing operations) (Camiñas et al., 2006). A total of 10 fishing events were monitored for an overall 5,960 hooks controlled directly. We collected data on effort (number of hooks) and fishing strategy (number of attracting lights, number of floats, and type of bait). During each fishing event we recorded a) the initial and final location of the fishing events, b) the veers; c) the sea turtle recovery points. For each collected turtle we measured the curved standard carapace length (CSCL) and we recorded the hook insertion point in the turtle body. The technical characteristics of the surface longline used in this study area are reported in Table 1.

Table 1: Technical features of the drifting surface longlines used in the study area.

Technical Features	Measures
Size of hook (cm) (standard J hook)	6.5-7.5
Number of hooks	450-860
Main line length (km)	20.5-34.4
Branch line length (m)	8
Distance between branch line (m)	33-45
No. branch line between two floats	3-7
No. Floats	30-166
Distance between two floats (m)	132-360

RESULTS

Out of 46 catches over 10 fishing events observed (3 in June, 4 in July and 3 in August), 17 (36.9%) were by-catch of Loggerhead turtle. *Caretta caretta* was the second species, in terms of number, after *Xiphias gladius*. The index R (average 2.76) increased over the summer season: R (June) = 0.57; R (July) = 3.40 and R (August) = 4.30. The index F (average 1.67) also increased: F (June) = 0.33; F (July) = 2.00 and F (August) = 2.67. Our data show an increasing trend in CPUE from June to August. Almost all the caught sea turtles (*n* = 16, 94.1%) were hooked to squid baited hooks, contiguous to attracting lights. Out of the 16 turtles that were

brought on board, 7 (43.8%) were found hooked on the floor of the mouth, 6 (37.5%) deep in the digestive track and 3 (18.8%) on the higher oesophagus. On average, turtles CSCL was 52.67 ± 8.07SD cm (range: 40.0 - 66.0 cm). We estimated the total impact of this fishing gear on the local sea turtles population considering the total number of vessels using the same gear (n = 5) and the average number of days fishing per boat in summer (n = 20). Using the index F, we estimated that100 sea turtles were caught by every fishing unit and 500 by the whole fleet. According to the results on sea turtle survival rate with regard to the hook position on different parts of the animal body by Casale *et al.* (2008), we estimated that 46.5% (n = 232) of the caught specimens die after their release.

DISCUSSION AND CONCLUSIONS

The drifting surface longline for swordfish has a negative impact on the local Loggerhead turtle population in the study area. This conclusion is based on: a) C. caretta was the second most abundant fished species, in terms of catch number, after Xiphias gladius; b) the CPUE resulting from our observations was higher than the CPUE calculated by Deflorio et al., (2005) for the longlines of Sicilian vessels targeting Swordfish close to our study area; c) the average size (CSCL) of Loggerhead turtles caught in our samplings is typical of specimens that are closer to the sexual maturity than those reported by Deflorio et al. (op. cit.); d) the study area probably includes an important feeding ground for C. caretta; this area is also in front of the most important reproduction site for the species in Italy. Our results emphasized the need for urgent regulation on the longline fishing activity to reduce the mortality of Loggerhead turtles. This regulation should involve some technical changes such as the abandonment of the attracting lights, the use of less attractive bait for the turtles, and the experimentation of circle hooks. Other important management measures could be to better control the fishing vessels without licence and to create incentives to develop alternative economical activities connected with the eco-tourist industry.

ACKNOWLEDGEMENTS

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INTERACTION OF PELAGIC AND BENTHIC LONGLINE FISHERIES WITH LOGGERHEAD SEA TURTLE *CARETTA CARETTA* IN THE GULF OF GABÈS (SOUTH OF TUNISIA)

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ABSTRACT

The pelagic and benthic longline fisheries interact with sea turtles and results are ingestion of baited hooks and entanglement with fishing line. During 11 observed pelagic longline sets and 9 benthic longline sets, 12 and 8 loggerhead sea turtles were caught respectively. Catch rates were estimated at 1.437 turtles/1,000 hooks for surface longlines and at 0.633 turtles/1,000 hooks for bottom longlines. The total captures were estimated respectively at 702 ± 355.254 and 219.42 ± 152.053 (95% C.I).Captures affected juvenile and subadult size classes essentially. However turtles captured with pelagic longline were larger (mean =57.42 cm) than those captured by bottom longline (mean= 47.375 cm).

KEYWORDS: By catch, bottom longline, pelagic longline, Caretta caretta, Gulf of Gabès.

INTRODUCTION

Fishing activity has been identified as a significant source of mortality contributing to population declines in the Mediterranean Sea (Casale et al., 2007; Jribi et al., 2007). Pelagic and benthic longline targeting respectively swordfish and groupers are some of these fishing gears interacting with marine turtles (Jribi et al., 2008). In this study, we report the incidental capture of loggerhead sea turtles by both pelagic longline (PLL) and benthic longline (BLL) operating in the Gulf of Gabès. We provide data on sea turtle by catch obtained on fishing sets and analyze the parameters related to the two fishing gears.

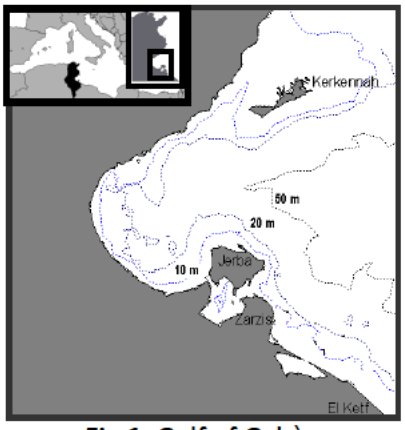

Fig.1. Gulf of Gabès

MATERIALS AND METHODS

For this assessment, we worked onboard commercial boats connected to the ports of Zarzis, Jerba and El Ketf located in the south of the Gulf of Gabès (fig.1). Data concerning 11 fishing sets for PLL targeting mainly swordfish and sharks and 9

fishing sets for BLL targeting mainly groupers were collected from June to September 2007 corresponding to the fishing campaign of targets species.

For each set we recorded the date, geographic coordinates, bottom depth, commercials catch, number of hooks and number of turtles captured. Information on caught turtles included the species, the Curved Carapace Length notch to tip (CCLn-t) and the physical condition of the animal.

RESULTS AND DISCUSSION

8350 hooks were deployed during 11 sets with PLL, 12 loggerhead turtles were caught, the catch rate was estimated at 1.437 turtles per 1000 hooks. Concerning BLL, 12620 hooks were deployed during 8 sets, 9 loggerheads were captured estimating the catch rate at 0.633 turtles per 1000 hooks. The estimated average fishing efforts for the PLL and BLL fleet operating in the area of study were respectively 351 and 192 trips/year (Source DGPA: General Directorate of Fishing and Aquaculture). The total captures resulting from these fishing efforts were estimated respectively at 702 ± 355.254 and 219.42 ± 152.053 (95% C.I). The two catch rates recorded indicate a substantial interaction of sea turtles with longline fisheries, the high density of marine turtles can be explained by the fact that the wider area of the Gulf of Gabès is considered as an important wintering and foraging area in the Mediterranean Sea.

The mean carapace lengths of loggerheads were 57.416 cm (SD=7.867; range= 42-68cm; n=12) for pelagic longline and 47.375 cm (SD=7.029; range= 42-62; n= 8) for bottom longline. Sea turtles captured by PLL were significantly larger than those captured by BLL, this difference is largely due to the larger hook size used in pelagic longline. According to Casale et al., (2005), all specimens caught by PLL and BLL were juveniles or subadults. Therefore both types of Longline appear to be selective fishing gears correlated to the size of captured turtles, as PLL catches especially large specimens and BLL smaller specimens.

Sea turtles were hooked or entangled in 75% of the sets. The majority of them were healthy (50%), three turtles were in a coma (15%), two were injured (10%) and five were dead (25%) (tab.1).The direct mortality provided in this study indicates clearly that BLL is much more harmful than PLL, this is understandable since PLL practically fishes close to the surface, so the animal is able to reach the surface to breath. For the BLL, the hooks are close to the bottom and the turtles captured are smaller; therefore they might not been able to reach the surface to breath especially when the gear is set deep.

Table 1. Physical conditions of captured turtles

Physical conditions	PLL	BLL	Total
Healthy	9	1	10
Comatose	0	3	3
Injured	2	3	5
Dead	1	1	2

Both types of longline seem to have a negative impact on sea turtles since the PLL induce a considerable catch rate and the BLL engender a non-negligible direct mortality.

For conservation and management, data concerning BLL should be considered, especially given the rarity of assessments on the impact of this specific gear on sea turtles.

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IS ÇARDAK LAGOON (ÇANAKKALE, TURKEY) POSSIBLE FORAGING HABITAT OF LOGGERHEAD TURTLE?

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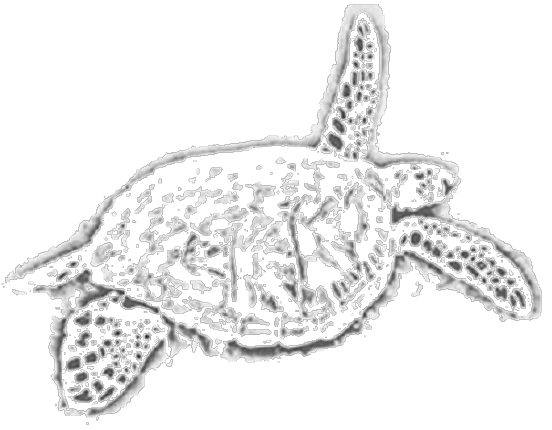
Caretta caretta is one the most common turtle species in the Mediterranean and generally feed on benthic fauna including human-caught fauna. Therefore, it is incidentally captured by fishermen. Sea turtle foraging habitats may be identified from the interaction with fishing activity in areas where sea turtles spend most of their time for feeding. There is no record on nesting and/or foraging habitats of sea turtles in Çanakkale Boğazı (Dardanelles) beaches; however, at least one loggerhead turtle is incidentally caught in Çardak lagoon every year. In this study the two-year fishing activities made by Kutlukbey Fisheries in the Çardak lagoon were assessed. The fish compositions caught fifteen days before and after of a loggerhead capture event were analyzed. It was determined that loggerhead turtles and two species of fish, *Diplodus puntazzo* (sharpsnout seabream) and *Diplodus annularis* (annular bream) were caught in Çardak lagoon at the same days. The fish assemblage assessments confirm that Çardak Lagoon is a possible foraging habitat for loggerhead turtles, especially during spring.

Key words: by-catch, foraging habitat, loggerhead.



CONFERENCE HIGHLIGHTS

SESSION 1: MARINE AREAS (CHAIRS: J. TOMAS, O. TURKOZAN).

The session included one invited key-note presentation, 5 oral presentations and 3 posters. In the key-note presentation, Dr. Brendan Godley talked about the use of satellite tracking for the studies on marine turtles in marine areas, from the 1980s till present time. Dr. Godley highlighted the insights afforded into the behaviour and ecology of loggerhead turtles and green turtles through the use of this technique worldwide and in a Mediterranean perspective, also proposing the key areas and gaps (such as the tagging of juvenile loggerhead and green turtles) deserving attention in future work, particularly in this sea.

According to Dr. Godley, satellite tracking highlights the importance of use of pelagic areas even for large juvenile and adult loggerhead turtles. In addition, these studies have permitted the identification of marked migratory routes and the fidelity of turtles to these routes and to foraging areas. Finally, Dr. Godley informed about the benefits of the tool STAT, hosted by the web seaturtle.org, for satellite data providing and analyses.

The information provided in this key-note talk was supported by two presentations in the session, the oral presentation from Dr. Sandra Hochscheid, and the poster presented by Paolo Casale, which reported male and female loggerheads tagged and released in the Central Mediterranean and Libya.

The importance of use of pelagic areas by *Caretta caretta* was also reported through studies on feeding presented by Dr. J. Tomás. This presentation and the poster presented by Wafae Benhardouze showed the variety of the diet of this species and its generalist and low selective feeding behaviour.

Bojan Lazar compiled the records of the leatherback turtle (*Dermochelys coriacea*) in the Adriatic sea, and suggested the relevance of the southern Adriatic as summer foraging habitat for this species.

Olaf Chaieb and collaborators presented the preliminary results of mtDNA characterization of loggerhead turtles from Tunisia nesting and foraging grounds. A total of 2 haplotypes, one of which were of Atlantic origin were recorded in 11 nest, while four haplotypes, one of which were endemic Atlactic haplotype, were reported from foraging habitats

Sami Karaa presented the data from a stranding network along the Tunisia coast, reporting major threats such as boat strikes and fisheries impact affecting loggerhead turtles in this area. Finally Carola Vallini provided in her poster more information on the interaction between fisheries and *C. caretta*, and highlighted the implication of fishermen in the marine turtle conservation since 1996 in the northwest Adriatic sea. Vallini reported that midwater trawlers is the fishery with higher number of captures, although bottom trawler causes 100% mortality.

The session has covered a wide group of subjects of concern in the study and conservation of Mediterranean marine turtles at sea, identifying the existing gaps and providing information on the tools and techniques to fill them.

SESSION 2: MANAGEMENT AND CONSERVATION MEASURES (CHAIRS: A. DEMETROPOULOS, A PANAGOPOULOU).

The Management and Conservation Session comprised of a total of 10 presentations, including keynote speech provided by Selina Heppel on population modeling. There were 7 oral presentations and 2 posters. The majority of papers presented at the session concerned management and conservation issues from Greece (5 orals and 2 posters). The remaining papers presented work in Albania (1 oral) and Tunisia (1 oral). On the other hand the session was diverse in terms of conservation issues and management tools covered. 5 presentations (3 oral, 2 posters) involved issues on the management of marine and terrestrial habitats for marine turtles, namely the Marine Park of Zakynthos and its possible expansion to include the nesting area of Kyparissia Bay and the marine area in between, and the Patok area in Albania. A second focal issue was environmental education and public awareness (3 orals) which included educational tools and an information campaign conducted in Tunisia. A final presentation involved the operation of the Greek National Stranding Network.

SESSION 3: ANATOMY, PHYSIOLOGY, HEALTH (CHAIR: F. BENTIVEGNA)

There were a total of four oral presentations and eight poster presentations in the Anatomy, Physiology & Health session. The oral presentations covered studies on metal levels in loggerhead turtles at various life stages, necropsy results and histological analysis of stranded dead turtles, rescue center activities in Tunisia and stress assessment in captured and hospitalized animals. The main results from the recovery of dead and alive turtles in Tunisia revealed that fishing, especially long-line, was the main impact on turtles followed by the ingestion of plastic debris. First results obtained from histological analysis were collected together with information on metal burden in loggerhead tissues which have the potential to contribute to the understanding the correlation between turtle diseases and environmental pollution. In this line another important pilot study showed that flow cytometric analysis of peripheral blood cells is a useful tool to assess stress levels in turtles through genomic DNA alterations and granulocyte proliferation. Finally, metal levels in loggerhead turtle eggs and embryos indicated that adult females eliminate metals to the eggs, especially to egg shells.

Metal elimination through eggs was also the topic of one poster, while two more further posters showed low non-toxic heavy metal levels in the blood of loggerhead turtles from the Adriatic sea and how variation in blood metal concentrations can be indicative of diet shifts. Two posters presented epibiont communities of loggerhead turtles in Tunisia and Sicily, and in particular the seasonal occurrence of the crab *Planes minutus*. Rescue Center activities in Comiso, Sicily, were demonstrated where 863 turtles, mostly loggerheads, were recovered between 1991 and 2007. In a necropsy of a dead loggerhead Gram-negative and Gram-positive bacteria as potential pathogenic agents were detected on tissue samples from the spleen, liver, heart and intestine. Finally, a study on age at size and growth rates during the first years of life in loggerhead turtles confirmed the polyphasic growth pattern already proposed for other turtle populations and species.

SESSION 4: NESTING BEACHES.
(CHAIRS: C. CARRERAS, A. HAMZA, Y. KASKA)

Six oral, two keynote and 10 poster presentations were given. The subjects of the presentations were mainly on the genetic diversity (4 presentations) of the both green and loggerhead turtles and sex ratio estimations (4 presentations) on the hatchlings produced. There were also nesting activity records from Libya, Tunisia and Turkey. The other topics covered by the presenters include the recording of Geographic Information System (GIS) in recording the turtle nests, climatic conditions of the nests and geological properties of nesting beaches, comparison of the clutch sizes between the young and older female turtles and effect of military war on Lebanon beaches. The most important results reported were the genetical diversity of both loggerhead and green turtles on Turkish beaches, by having 2 new haplotype for the Mediterranean and 2 new haplotype shared with Atlantic for loggerhead turtles and 3 new haplotypes one shared with Atlantic for green turtles. Due to the genetic diversity found on especially green turtles, they may not show precise nest site fidelity especially in the eastern Mediterranean. All the reported sex ratio by the 4 different studies showed that hatchlings produced on the beaches are female biased varying from 70-90 %, implying the effect of global warming.

The two keynote presentations were on the regional redlist assessments of both loggerhead and green turtles in the Mediterranean. This first regional assessment of sea turtles in the Mediterranean was established in previous Conference in Turkey and a group of MTSG Members were working on them since then.

SESSION 5: FISHERY (CHAIR: P. CASALE)

The Fishery session had 8 presentations (5 oral and 3 posters). One provided evidence through fishing data of a foraging area in Turkey. Two reported a high incidental catch by longlines in front of the most important nesting area in Italy and highlighted the problem of high illegal fishing by artisanal vessels. Two concerned turtle bycatch in gillnets, and pelagic and demersal longliners in Tunisia, with high number of turtles estimated to be caught by these fishing gear. A high number of captures per year was also estimated for vessels using driftnets and longlines and based in Tangier, Morocco. One presentation provided new information about turtle bycatch and intentional killing in Egypt, while another one reviewed the available data on turtle bycatch in the Mediterranean, highlighting gaps and priorities for conservation.

As a whole, presentations provided evidence of the importance for turtle conservation of artisanal vessels using set nets or demersal longlines, which are gear difficult to study and have received little attention till now. Intentional killing persists in the Mediterranean and in some areas can be very important. Finally, illegal or unreported fishing represents an unknown fishing effort inducing additional turtle captures.

WORKSHOP 1: SEA TURTLE MEDICINE: EXCHANGING EXPERIENCES BETWEEN MEDITERRANEAN RESCUE CENTERS (COORDINATORS: D. FREGGI, A. DI BELLO)

The aims of this workshop were: to share experiences between all people involved in Sea Turtles' care in the Mediterranean, to have a specific moment for exchange and comparison of ideas, improving medical administration, to establish together a network in order to share experiences and function as a better emergency organization.

D. Freggi (Italy) introduced some short presentations: M. Bradai (Tunisia), that focused on the role of rescue centers and the contribution that they can give to the conservation of marine turtles, P. Medina (Spain) described activities in CRAM and surgical approaches, S. Yalain Ozdilek (Turkey) illustrated a turtle project in her country, difficulties and perspectives to take care of injured turtles, P. Tsaros (Greece) explained activities in the Archelon center, focusing on some difficulties with therapies, K. Gobic Medica (Croatia) focused on medical administration difficulties and problems, A. Di Bello (Italy) described his activities in Lampedusa rescue center, illustrating new surgical techniques and emergency organisation.
M. L. Parga (Spain) led a common discussion between the 40 participants representing 29 groups from 10 countries in the Mediterranean. We compared the different techniques used in each country, and difficulties to find information about specific surgical techniques or medical administration. It is clear that there is a strong need for continuous communication among rescue center vets (a rescue center network where to share concerns or ask questions), but also the necessity to standardize handling and caring in rescue centers by specialized staff (training courses and workshops for veterinarians), and there was unanimous desire to meet again annually (to be considered in each official meeting on sea turtles).
The discussion was closed with the following proposals: to exchange specialists between rehabilitation centers, in order to share experiences; to determine a official protocol for handling, medical administration and emergency organization put together by specialist vets, in order to improve care; to establish a rescue center network, in order to communicate; to meet again scheduling this meeting in the next conference, in order to grow together. All of this can help to reduce costs of suffering for turtles, failure of energy and resources.

WORKSHOP 2: SEA TURLE BYCATCH IN THE MEDITERRANEAN: HOW TO FILL THE GAPS AND HOW TO MOVE FORWARD (COORDINATOR: P. CASALE)

The workshop had about 50 participants and began with a presentation by M. Bradai who introduced the GFCM and the results of the last meeting on bycatch on 15-16 September in Rome. A second presentation by M. Parga reported the recent results of a project to test changes in longline gear for reducing turtle capture, such as different bait, circle hooks, and deep hooks.

Then the participants discussed on the gaps in the process of implementing conservation measures to reduce the impact of the fisheries on turtles in the Mediterranean. There was a general consensus about the many suggestions provided that can be summarized as follows. There is the need for a shared strategy on the regional level, with the several actors having clearly defined roles. Firstly, scientists should provide additional information to fill gaps, for instance in biology and distribution, should provide clear suggestions ready to be implemented, and should communicate results to media other then the strictly scientific ones, so to raise the interest of the general public, as well as of decision makers and stakeholders. In this respect, it would be important that scientists provide data to RFMOs like GFCM at a constant basis, since GFCM may be an important actor for sea turtles conservation in the region. The general public can play an important role of market change if a certification system of fishery products that doesn't impact sea turtles is developed. The illegal or unreported fishing effort should be reduced. To investigate and implement conservation measures, the involvement of fishermen associations and individual fishermen is fundamental. NGOs can play a major role towards the implementation of available measures, with their capacity of public awareness and contacts with decision makers. In this respect, public bodies involved in sea turtle conservation should be informed by scientist, NGOs, etc. about the available measures, and the participation at Conference like the one on marine turtles in the Mediterranean should be pursued. In this respect, also the results of specific workshops like this could help and should be communicated.

WORKSHOP 3: PREDATION ON NESTS AND HATCHLINGS: IS IT A THREAT IN THE MEDITERRANEAN? ARE WE APPLYING THE RIGHT CONSERVATION STRATEGY? (COORDINATOR: M. AUREGGI)

A general overview of the topic of the workshop was presented by M. Aureggi, followed by a presentation concerning a case study in Turkey by A. Oruc.

The workshop focused on aspects related with predation on nesting beaches. Predation can decrease the amount of hatchlings that go safely into the ocean and therefore could negatively affect the contribution to the future generation. Participants from different countries brought their experiences and their opinions, enabling exchange of information and knowledge.

All participants agreed that predation has to be considered a threat to the survival of sea turtles and that conservation strategies have to be carefully applied. Predators species in the Mediterranean nesting grounds are similar and therefore similar conservation actions can be applied in different places. Individual nest protection is the most common technique used by different teams. The discussion covered general, technical and practical details providing the opportunity to exchange experiences and information. Another common strategy is the establishment of hatchery. It was emphasized and agreed that a good hatchery management plan has to be applied and overviewed before implementing it.

In the Mediterranean there are conservation projects that have been working since many years and projects that have recently started to work on sea turtles. The workshop was designed to facilitate communication on practical issues between projects in order to improve the application of conservation strategies.

INDEX TO AUTHORS