BOOK OF ABSTRACTS

4TH MEDITERRANEAN CONFERENCE ON

MARINE TURTLES

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

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

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Foreword

The marine turtles Mediterranean Conference takes place every three years in a Mediterranean country differing every time. It is supported and promoted by the Secretariats of the three most important International Conventions, namely the Barcelona (RAC/SPA), Bern and Bonn (CMS) Conventions, deeply involved in Mediterranean sea turtles conservation issues.
During the 3th Mediterranean Conference, which was held in Tunisia in 2008, the Stazione Zoologica Anton Dohrn of Naples (Italy), the oldest Research Institute of the world, was selected by the Nomination Committee to host and organise the 4th Mediterranean Conference on marine turtles, for 2011. In that occasion I was chosen as Chairman of the Conference.
Both the prestigious Research Institute I'm representing and myself feel honoured and grateful for this appointment because our 30 year commitment in the fields of marine turtles research and conservation has been deservedly recognised.
The RAC/SPA Organisation (Regional Activity Centre for Specially Protected Areas), as the main responsible body for the implementation of the Barcelona Convention Conservation Programme, has been appointed as the main coordinator of the Conference organisation.

The Mediterranean Conference is meant to be a sharing moment of experiences, outcomes achieved and knowledge acquired from Mediterranean people deeply and daily committed in sea turtles research and protection issues. Since its first edition, in 2001, the Conference has tried to make its variegated number of attendees comprehend that, in order to fight any threat affecting marine turtles, it is absolutely necessary to work in strong cooperation and overcome both political and geographical obstacles.

The Mediterranean sea is very small. It even appears like a small lake when observed by the satellite. As in a big arena, it hosts different ethnic groups, languages, cultures and traditions, which in the past gradually learnt to know each other, sometimes even fighting, and share their knowledge and background. Therefore, as in the past, our realities need to start communicate again by drawing any diverse disciplines and cultures to a common platform. The Mediterranean sea has to be used as our common tool to achieve that.
To that purpose, sea turtles living in the Mediterranean have to be considered as the most significant reference model because during their whole life these animals cross the Mediterranean sea far and wide without caring of frontiers or geographical limits.

The 4th edition of the Mediterranean Conference will be focusing on the progress and successes achieved over the past few years in the field of Mediterranean sea turtles behaviour and biology knowledge, being at the same time a stimulus and linkage for the new generations of researchers and young people involved in conservation that will soon replace us in the fight against sea turtles extinction. It is already clear that we can prevent and limit the loss of this precious natural re-

source and suggest adequate conservation strategies only by working on solid scientific bases and adopting common methodologies.

The leading theme of the Conference is the Turtle Odyssey, which is inspired by the Ulysses long journey across the Mediterranean sea.
As Ulysses in the Homeric poem, who was forced to overcome several obstacles and dangers and even hide his own identity before finally reaching his home in Ithaca, sea turtles constantly "sail" in more and more hazardous waters seriously threatening their survival.

Therefore, on the basis of what above underlined, the Conference will be divided into 5 sessions:

- Threats;
- Veterinary Medicine and Turtle Health.
- Breeding Biology and Movements;
- Anatomy, Physiology, Behaviour and Genetic Session;
- Habitat Management and Conservation Measures;

Key-note speakers will introduce each one of the said sessions.
Besides the main programme, three workshops, round-table discussions and thematic meeting will take place.

In conclusion, I would like to thank the Italian Ministry for Environment, Territory and Sea, for giving us its patronage, the Barcelona, Bonn and Bern Conventions Secretariats for their economical support, the Campania Region, Department for Environmental Policy – Ecology, the University of Naples "Federico II".
Further, I wish to convey a special acknowledgment to the President of the Stazione Zoologica Anton Dohrn of Naples, who supported and encouraged the organisation of the Conference, as well as to the co-ordinator and the members of the Scientific Programme Committee, Valentina Mauriello for the abstract language reviewing and Gianluca Treglia for the support on web site.

Last but not least, I would like to address a special thanks to our sponsor, Carpisa Kuvera Ltd, for its very generous contribution and Daniela Crocco for the Conference management and planning at Carpisa Conference Centre.

Time has come, everything is ready for this huge event. I really wish everything will meet your expectations and your stay will be as pleasant as possible. I further hope the outcomes resulting from this meeting days will give a strong and concrete contribution to the sea turtles knowledge and conservation. I want to finally express to all of you a warm and sincere welcome to the beautiful city of Naples.

Flegra Bentivegna
President of the fourth Mediterranean Conference on Marine Turtles

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Insights into sea turtle biology through stable isotopes

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The use of stable isotopes has become a standard technique in ecology through the past decade, with stable isotopes of carbon and nitrogen standing as the most popular tracers, as they can be used in most contexts. Sulphur and oxygen can also be useful to address some specific questions and lead has produced some promising results, whereas hydrogen stable isotopes are probably useless in most marine contexts. The relative abundance of stable isotopes, or stable isotope ratio, is usually expressed in the ∂ notation (i.e. ∂13C, ∂15N, ∂18O…), with higher values reflecting a higher relative abundance of the heavier isotope. The use of stable isotopes as tracers in ecology relies on the assumption that the isotope ratio of a particular element in the body of an animal reflects the relative abundance of those isotopes in the animal's diet. As a consequence, most authors use stable isotope ratios for dietary studies, although fractionation factors are needed to turn stable isotope ratios into estimates of prey contribution to the diet. These corrections factors are needed because enzymes often differ in their affinity for molecules carrying heavy and light isotopes and hence stable isotope ratios in consumers are often slightly different from the stable isotope ratios in their diets. Turnover rate is another critical piece of information that should be incorporated into stable isotope analysis, as it is species and tissue dependent and varies from weeks to years. Tissues integrate dietary information accordingly and hence tissue selection will depend on the time window to be explored, with serum and plasma preferred for inferring diet just before sampling and bone preferred for inferring diet during several years. Fractionation factors and turnover rates have been experimentally calculated for the skin, carapace scutes, whole blood, and blood components of some sea turtle species, but nothing is known for other tissues, although published data about other ectothermic vertebrates can be used as proxies. Keratinous tissues are stable once synthesised and hence the stable isotope ratio of carapace scutes does not change through time. This property has been used to reconstruct the ontogeny of diet in sea turtles, by analyzing the ratios of stable isotopes in overlapping layers of keratin of different age. Stable isotopes can also be used as habitat tracers, because the ∂13C of phytoplankton is usually lower that the ∂13C of benthic macrophytes, the value of the ∂15N is higher than elsewhere in coastal regions receiving massive amounts of sewage, and the ∂34S value is lower in coastal lagoons with anoxic sediments than in other habitats. As a consequence, turtles with a similar diet but with contrasting values of these parameters are likely to use different habitats. Nevertheless, inferences about habitat use based on stable isotopes rely heavily on a careful reconstruction of the isotopic landscape, or isoscape, through the analysis of stable isotope ratios in potential prey and other indicator species.

Loggerhead sea turtles (*Caretta caretta*) are not the only jellyfish consumers in the Mediterranean

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The proliferation of gelatinous plankton in several heavily fished regions has been suggested to be the consequence of reduced predator abundance due to overfishing. Loggerhead sea turtles (Caretta caretta) have been identified as the main jellyfish consumers in the Mediterranean and the high levels of bycatch of this species have been suggested to trigger a trophic cascade leading to increased abundance of gelatinous plankton in the basin. However, information about the actual relevance of gelatinous plankton in the diet of loggerhead sea turtles in the Mediterranena is scarce, as these preys are easily overlooked in sotmach contents analysis. Furthermore, nothing is known about the relevance of gelatinous plankton in the diet of other pelagic predators. Stable carbon and nitrogen isotopes were used to test the hypothesis that loggerhead sea turtles are the main jellyfish consumers in the western Mediterranean and to identify other potential consumers of gelatinous plankton. Samples from potential preys (salps, jellyfish, pelagic crustaceans, small pelagic fish and squids) and pelagic apex predators, including loggerhead sea turtles, where collected in the western Mediterranean in 2007. The feasible contribution of the potential preys to the diet of the apex predators considered was calculated by means of SIAR, a Bayesian mixing model. The results strongly supported a major role of gelatinous plankton in the diet of loggerhead sea turtles in the oceanic stage but not for loggerhead sea turtles in the neritic stage. Furthermore, jellyplankton was identified as a major prey for ocean sunfish (Mola mola), bluefin tuna (Thunnus thynnus), little tunny (Euthynnus alletteratus), swordfish (Xiphias gladius) and spearfish (Tetrapturus belone). In contrast, stable isotope ratios ruled out any relevant consumption of gelatinous plankton by bluefish (Pomatomus saltatrix), blue shark (Prionace glauca), leerfish (Lichia amia), bonito (Sarda sarda), and striped dolphin (Stenella caeruleoalba), all of which primarily relied on fish and squid. As a consequence, the jellyvorous guild in the Mediterranean integrates two specialists (ocean sunfish and loggerhead sea turtles in the oceanic stage) and several opportunists (bluefin tuna, little tunny, spearfish, and swordfish). Given the large number of potential consumers of jellyplankton inhabiting the western Mediterranean, it is unlikely that jellyfish outbreaks in the region can be attributed just to the decline of loggerhead sea turtles or that of any other single apex predator. Instead, jellyfish outbreaks could be the consequence of a general reduction of apex predators due to overfishing, although outbreaks are known to be also tightly linked to climatic variability.

Satellite telemetry and stable isotopes: a tool to investigate migratory connectivity in loggerhead turtles

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Loggerhead nest numbers in Florida, home to 90% of loggerhead nesting in the southeastern U.S., have been declining since 1998 for unknown reasons. One hypothesis proposed for the decline is a change in foraging that could lead ultimately to a change in reproductive parameters. We investigated the link between foraging ecology and reproduction and assessed the effectiveness of stable isotopes to trace foraging ecology and migratory routes. Such information is needed to develop appropriate management strategies for the recovery of this threatened species. Fourteen loggerheads nesting at the Archie Carr National Wildlife Refuge (Florida, USA) were fitted with satellite tags and tissue samples were collected for carbon and nitrogen stable isotope analysis. An additional fifty-seven nesting females were sampled only for stable isotope analysis. Morphometric measurements and reproductive parameters were collected for each female. Telemetry identified three major migratory pathways and associated foraging areas: (1) a seasonal continental shelf-constrained North-South migratory pattern between Virginia and North Carolina, (2) a year-round residency in southern Atlantic foraging areas and (3) a residency in the waters adjacent to the breeding area. The majority of the individuals we tracked moved north, demonstrating for the first time that the Mid- and South Atlantic Bights are an extremely important foraging ground for the Peninsular Florida Recovery Unit. Both 13C and 15N signatures differed among groups associated with foraging areas. Post-hoc analysis revealed that each migratory group differed in 13C, while 15N differed only in loggerheads of southern foraging areas. No tracked females left the continental shelf, suggesting that isotopic differences among females may not be attributed to a neritic/oceanic strategy. On the contrary, we found a North-South latitudinal gradient in 13C isotopic values, with northern individuals being the most 13C depleted and southern samples the most 13C enriched. This indicates that a latitudinal gradient may play a relevant role in explaining differences in isotopic signatures among females nesting at the Carr Refuge. Untracked females followed the same isotopic pattern observed in the satellite-tagged loggerheads suggesting that stable isotopes can be used to infer foraging areas of untracked individuals. We also investigated the relationship between fitness parameters and foraging strategies in order to assess potential carry over effects. Females did not differ in body size or reproductive parameters among migratory groups suggesting that the use of geographically distinct foraging areas does not affect female reproductive output. Stable isotopes hold great promise when used as intrinsic markers to trace foraging habits and migratory connections, but several assumptions still need to be tested to interpret isotopic patterns found in the marine realm. Our results suggest that stable isotope analysis can be used to infer foraging strategies and residence areas for loggerheads nesting on the Florida's east coast in lieu of more expensive satellite telemetry. We suggest using stable isotopes to assign turtles to foraging regions, allowing population-level estimates of reproductive parameters among foraging areas.

The grey swimming crab *Liocarcinus vernalis* (Risso, 1816): a new important prey of loggerhead sea turtles *Caretta caretta* in the central Tyrrhenian sea

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The number of invertebrates and fish eaten by loggerhead sea turtles Caretta caretta in neritic habitats is astounding. They constitute the central topic of the feeding ecology of the most carnivorous generalist bottom feeder among marine turtles. However most of the known loggerhead food items must be considered as "occasional" since they are small-sized species which are ingested accidentally and at low frequencies. Previous studies have shown that in each geographic region the prey of loggerheads is dominated by a preferred species that is abundant in the feeding habitat and easy to catch. Within the Tyrrhenian Sea near shore soft bottoms of the Campania region (southern Italy) are used as feeding grounds by loggerhead turtles. Here we report on a new "dominant" food item in the diet of Mediterranean loggerheads: the grey swimming crab Liocarcinus vernalis (Risso, 1816). This species is a very common portunidae crab, endemic in the Mediterranean Sea and closely associated with sandy environments of 0 to 20 m depth. We present part of the results of a 11-years feeding ecology investigation (1996-2006) carried out on 144 loggerhead turtles (curved carapace length (CCL): 37.3 to 84.0 cm) found stranded along the Campanian coasts. In the analysed digestive tract contents a total of 75 animal taxa were found (56 species and 19 genera). Liocarcinus vernalis resulted the most important food resource in the diet occurring in 72% of the turtles and representing 34% of the food material's total dry weight. We were interested in investigating which role the crab plays in the foraging strategy of the Central Tyrrhenian turtle aggregation. For this purpose, we analysed the temporal variations in the occurrence of the crab in the turtles' diet also in function of the different turtles sizes and age classes. These results showed that neritic juvenile loggerheads (CCL: 41 to 69 cm) feed primarily on Liocarcinus vernalis during summer, with maximum peak in June. Based on direct observations made in the wild on this crab species, we propose a strategy used by Caretta caretta to locate Liocarcinus vernalis in the sandy bottom. The persisting dominance of Liocarcinus vernalis in the diet of loggerhead turtles in Campanian waters indicates that the local turtles are quite the specialist foragers whose presence may be closely linked with the abundance of the crabs. Future investigations are planned to verify this possible prey-predator interaction.

Diving behaviour of juvenile loggerhead turtles (*Caretta caretta*) in captivity and in a natural bay

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Loggerhead turtles (Caretta caretta) spend the first decade of their life offshore. But data that characterize their behaviour during the oceanic phase have been few. It is unknown in particular how juveniles use their habitat while resting, swimming, diving and feeding. We reared 6 loggerhead hatchlings in the laboratory during the first 2 years of development. Through visual observations and time depth recorders (TDRs) we recorded the turtles' activity and diving behaviour in captivity and in a closed natural bay at three different periods of their life, at 3, 13 and 19 months of age. During all periods the behaviour of the juveniles in captivity was always monitored. At an age of 13 months the same group of turtles was placed for the first time in a 900 m2 area at sea which was enclosed with a 130 m long and 6 m deep aquaculture net. Both in captivity and in the natural bay loggerhead juveniles had positive buoyancy and preferred to swim and rest at the surface. But comparison between captivity and the natural bay put two different behaviours in evidence. In captivity the turtles spent less than 10% of the time in submersion, reaching the bottom of the tank only to feed. In the bay loggerhead juveniles spent up to 50% of the time in submersion near the surface at a depth of 30 cm. We hypothesized that they preferred to swim and to explore the bay at this depth because the cost of transport was lower. As in captivity, they rested at the surface, but against the expectations, they also fed near the surface finding food themselves. Despite growing up in captivity, the young turtles were able to dive and swim at different depths reaching 5.6 m and showing mainly V and W shaped dives. This proved that turtles reared in captivity were capable of diving deeper than the depths of their holding tanks. Despite their positive buoyancy they explored the space at their disposal improving their diving ability and buoyancy regulation. The results showed that observations of juvenile marine turtles in a closed natural bay not only allow studying their first years of development, but can enforce hatchling rearing programs giving them the possibility to test the natural habitat before release.

Variability in movement patterns of immature Mediterranean loggerheads

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Despite the recent progress in sea turtle life cycle understanding, thanks to satellite telemetry, the juvenile phases, namely the movements and the general at-sea behaviour of immature turtles, are still poorly studied. As for Mediterranean loggerheads, the available data on their distribution and movements are rather scarce and mainly based upon tag and by-catch analyses. Yet, recently satellite tracking has started to provide useful information in this respect. The purpose of this study was to investigate the at-sea behaviour of juvenile and sub-adult loggerheads by satellite tracking in various regions of the central Mediterranean sea, in order to compare the movement patterns displayed in different geographical areas and ecological conditions. The movement of sixteen late juvenile loggerheads (CCL between 47 and 87 cm) started to be monitored after their release, along three Italian marine zones, including the Northern Adriatic sea (including the Slovenian and Croatian side), the Northern Tyrrhenian sea and the Sicily Channel, around the Island of Lampedusa. All the turtles had been accidentally fished in the same region of release and recovered in different rescue centres. Those turtles were followed for periods of variable length (up to 451 days), during which they remained within the Central Mediterranean basin, most of them covering large distances, up to over 7500 km. The turtles, which had been tracked, displayed a number of different behavioural patterns as prolonged residence in fixed neritic locations, seasonal migrations towards southern regions, wandering circuitous movements over large neritic and oceanic areas, overwintering behaviour at high and low latitudes, with long-lasting dives. By combining location data with remotely-sensed oceanographic information, it has been possible to prove the main role of sea surface temperature (and, to a lesser extent, of chlorophyll concentration) in determining the kind and extent of turtle movements and behaviour. The reconstructed movements have confirmed the importance of the Gulf of Gabès and the North Adriatic sea as optimal foraging grounds for juvenile and sub-adult loggerheads in the Mediterranean Sea. Despite the fact that the North Adriatic sea is the coldest area in the Mediterranean, loggerheads may reside here also during the winter, although many tracked turtles did migrate southward as the cold season approached. According to these findings, other foraging areas have proved to be currently used by juveniles, such as the northern Tyrrhenian Sea, the Gulf of Naples or the Ionian Sea. In these cases, turtles mostly frequented the coastal shelf, that is the only neritic habitat available to them in these areas.

Importance of the Mediterranean sea for a third loggerhead RMU from the North Eastern Atlantic

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Loggerhead turtles from two Regional Management Units (RMU) have been previously found in the Mediterranean Sea. Firstly, the Mediterranean RMU that nests into the Eastern and Central Mediterranean and feed along the whole Mediterranean Sea and more rarely in the North-Eastern Atlantic. Secondly, juveniles and few adults from the North Western Atlantic RMU that are often found feeding in the South Western Mediterranean. However, no data was available about the presence in the Mediterranean of loggerheads from the Western African coast. Recent genetic studies have demonstrated the reproductive isolation of loggerheads that nest in Cape Verde that constitute the RMU of the North Eastern Atlantic. Population pairwise comparisons of mtDNA data have revealed significant differences between Cape Verde and all previously sequenced Atlantic and Mediterranean rookeries (F_{ST} = 0.745; $P<0.000$). Thus, this molecular differentiation permits the discrimination of the origin of most of loggerheads among the three RMU. The "many-to-many" rookery-centric approach revealed that juvenile turtles born in Cape Verde distribute mainly in Eastern Atlantic and South Western Mediterranean waters, with presence in Azores, Canary Islands, Madeira, Andalusia, Gimnesies and Pitiüses. More than 30 % of Capeverdian juvenile loggerheads could be feeding during long periods in South Western Mediterranean waters. Previous studies found that genetic structuring in the Mediterranean could be explained by the pattern of sea surface currents and water masses, where the foraging grounds off the North-African coast and the Gimnesies Islands are shown to be inhabited mainly by turtles from Western Atlantic nesting stocks. Our results corroborate this hypothesis, as juveniles from Cape Verde distribute in the Mediterranean exclusively in the feeding grounds surrounded by Atlantic currents. These results indicate a high diversity of loggerheads that inhabit in the Mediterranean Sea and highlight the responsibility of the European Union on the conservation of loggerheads from the three mentioned RMUs on their whole distribution area.

The genetic structure of the Mediterranean green sea turtle (*Chelonia mydas*) population

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The majority of the Mediterranean green sea turtle population is concentrated in the eastern basin. This population is highly threatened by extinction due to massive hunting and anthropogenic impacts during the last century, and is considered to be critically endangered. Only few hundreds of nesting females are left in the Mediterranean rookeries. High conservation efforts are taking place to save the specie from extinction. Revealing the genetic structure of the population will enhance our management programs and enable better conservation. A great deal of effort has been invested in the attempt to characterize the genetic variability of sea turtle populations worldwide. So far, the common haplotyping system has been based on sequence analysis of a segment of the mitochondrial DNA (mtDNA) control region (D-loop) as an indicator. This method indicates that genetic variability is practically nonexistent in the Mediterranean sea-turtle population. A singular common haplotype, CM-A13, was observed in all but three individuals out of hundreds of samples. In this study a new method of genetic characterization has been applied, based on a unique pattern within the mtDNA that consists of short tandem repeats (STRs) with varying numbers of copies. It was with this new haplotyping system that we have analyzed nesting turtles from the coasts of Israel, Turkey and Cyprus, and stranded green turtles found on the Israeli Mediterranean coastline. The analysis of Israel's turtle samples using the new method revealed ten different haplotypes, whereas a sum of thirty four different haplotypes were found from all samples analyzed in this study, representing most of the green sea turtle population of the Eastern Mediterranean basin. An in-depth and broader understanding of the genetic structure would prove to be doubtlessly valuable. Mapping out the phylogepgraphic structure may enable further insights to understanding aspects such as breeding habits, migration and nesting patterns in sea turtles along the coastline of Israel and the entire Mediterranean. Such data will also assist if needed, with planning of future breeding stocks, by maintaining a genetic variability to ensure survival of the green sea turtle.

Mitochondrial genetic diversity and dispersal pattern of loggerhead turtle from the Libyan nesting population

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Located in the southern part of the Mediterranean sea, Libya possesses more than 1,000 km of sandy, pristine coastline, that are suitable for loggerhead turtle nesting. Although earliest available records date back to late 1970's it was only in 1995 that monitoring of nesting effort along the Libyan coasts begun. In 2005 the Environmental General Authority with support of the Regional Activity Center for Specially Protected Areas launched the Libyan Sea Turtle Program (LibSTP) aiming to improve the conservation status of loggerhead turtle in the country. Efforts to manage and monitor this population require information on the level of genetic diversity within the population and its relatedness to adjoin Mediterranean nesting units. This information can improve our capacity to depict the demographic composition of Mediterranean foraging grounds by applying mixed stock analysis methods. Here we examine mitochondrial diversity in adult females from two nesting locations along the Libyan coasts, Misurata (n=14) and Sirte (n=35), using available mtDNA control region primers which increase the length of the amplified segment from the normally analysed 380 bp to ~800 bp. The two sites resulted genetically distinct (Φ_{ST}=0.13 p-value=0.02, Exact p-value=0.01) and population differentiation was found also in pair wise comparison with Calabria, the only Mediterranean nesting unit for which frequency distribution of the longer mtDNA fragment was available (Φ_{ST}=0.62 p-value=0.00, Exact p-value=0.00 and Φ_{ST}=0.34 p-value=0.00, Exact p-value=0,00 for Sirte and Misurata respectively). Although more data from Misurata are desirable, collectively these results support the existence of at least two management units in Libya and suggest a fine scale homing behaviour of loggerhead nesting females in the Mediterranean sea as already hypothesised by previous studies. Because of the paucity of data for the longer sequence from other source populations as well as feeding areas in the Mediterranean sea we used information from the short mtDNA fragment to investigate the dispersion pattern of Libyan loggerhead turtles. The two Libyan nesting site were pulled together since no genetic differentiation was revealed by the shorter fragment and this new information was used to reanalyze data from 4 oceanic and 6 neritic developmental habitats in the Mediterranean and Atlantic regions by applying the "many-to-many" mixed stock approach. "Rookery-centric" estimates suggested that turtles from the Libyan population preferentially remain in the Eastern Mediterranean pelagic habitat (44%) during the oceanic phase coherently with a strong influence of the complex surface circulation pattern characteristic of this area on early juvenile dispersion. Then they distribute in all Mediterranean neritic habitats although their abundance varies from 27% estimated for the Gulf of Gabes to 9% in the North Central Adriatic foraging ground suggesting a sort of juvenile phylopatry. These results must be viewed with caution because of the inherent caveats of the analysis. Information from other nesting beaches as well as foraging areas with the longer mtDNA fragment will probably result in more accurate evaluation of loggerhead turtle dispersal pattern in the Mediterranean sea.

The uniqueness of Libya in the genetic structure of loggerhead sea turtles (*Caretta caretta*) in the Mediterranean Sea

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Previous studies have addressed the genetic structure of loggerhead sea turtle (Caretta caretta) populations in the Mediterranean through the sampling of nesting beaches in the European and Middle Eastern shores. However, little is known about North African beaches. To fill this gap, we amplified a long mtDNA D-loop fragment (815 bp) from 196 dead hatchlings from the traditionally sampled nesting grounds of the Mediterranean (Israel, Lebanon, Turkey, Cyprus, Crete and Western Greece) including a robust sampling set from Libya. In addition, we considered previously published data from Calabria in the analysis to cover a wider geographical area. The results obtained highlighted Libya as a unique rookery, important because of its high genetic richness and diversity. The use of long fragments allowed the detection of major significant pairwise genetic differences (Exact test; FDR $p < 0.013$), mainly between Libya and the rest of populations, not detectable with short fragments. This was also supported by a Principal Coordinate Analysis (PCA) based on genetic distances between locations (Φ_{ST}), in which three main genetic groups could be defined: Libya, Calabria and the other rookeries, these latter ones showing too low a degree of differentiation to be classified as separate units. Furthermore, the widely-spread short haplotype CC-A2 split into three different new long haplotypes, one of them only present in Libya and Israel and another exclusive from Libya. This makes Libya the population with the highest haplotype ($h = 0.70 \pm 0.05$) and nucleotide ($\Phi_{ST} = 0.002 \pm 0.001$) diversities of all the Mediterranean nesting grounds analysed to date. Finally, a coalescent approach also allowed inferring historical processes on rookeries establishment of C. caretta during the colonisation of the Mediterranean Sea. Overall, we believe Libya and the use of long fragments on genetic studies should be considered in future conservation and management plans to protect this endangered species.

BREEDING BIOLOGY AND MOVEMENTS
ORAL PRESENTATIONS

Keynote presentation

What a large scale DNA project tells us about marine turtles and the people who protect them

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NC Wildlife Resources Commission

Advances in molecular techniques have made it possible to get maternal DNA from the shell of an egg collected the day after laying, thus providing a genetic "fingerprint" or tag for individual females. This innovation could potentially allow for a complete census of reproductive females if eggshell samples were collected from all nests laid within a known subpopulation, thereby providing accurate information on clutch frequency, beach fidelity, and remigration intervals. With this goal, a large-scale egg-sampling project was instituted in North Carolina, South Carolina and Georgia, which comprise the northern Management Unit for loggerheads in the eastern USA. The total coastline for these three states is >1100 km, and nesting occurs along the entire length. More than 95% of this available nesting habitat is patrolled daily by volunteers and cooperators, as part of the nest protection program, thus an infrastructure was available for collection of a single eggshell from every freshly laid nest in this subpopulation. Large-scale sample collection was initiated in the 2010 nesting season, and the results to date are highly informative. However, there has been reticence and even some resistance by some volunteers or cooperators to participate in this project, based on their understanding of sea turtle conservation. Sampling continues in 2011 and is scheduled for 2012, and the results of this project reveal not only details concerning reproductive attributes of loggerheads and but also some of the commonly held beliefs of sea turtle conservation volunteers.

A new system to analyze the recorded temperature of marine turtles nests

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Marine turtles nests temperatures have been recorded for more than 40 years. However, data analysis methods often seem to be hampered by a lack of knowledge on the temperature effects on embryos. In order to get such data, incubation at constant temperature is generally necessary even if logistically difficult or impossible in many cases. To this end, we have developed a system to model the growth of the embryo by focusing on its temperature-dependent growth. The parameters are fitted from field-gathered data: nest temperature and incubation length. We have modeled the growth of the embryo that is based on Gompertz equation with the instantaneous growth rate depending on incubation temperature at each time step. We fitted the parameters describing instantaneous growth rate dependency to temperature by using maximum likelihood with identity link to mass of embryo. The methodology was tested on Caretta caretta nests, which were monitored in Libya and Turkey. According to these data, it is possible to observe a curve of instantaneous growth rate upon incubation temperature. This rate reaches its maximum level at 32°C and decreases at lower temperatures (lower metabolic rate) as well as at higher temperatures (sub-lethal effect of high temperatures).

Spatial variations of loggerhead hatchling sex ratio along the eastern and western loggerhead turtle nesting beaches (Dalyan and Goksu delta) in Turkey

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Loggerhead nest and sand temperatures were recorded in the beaches of Dalyan and Goksu delta during the 2010 nesting season, from the end of May, approximately, till mid August. The majority of the nests was recorded in June and July, being the peak nesting season. The sex ratio of dead hatchlings and embryos was determined by gonad observation while for the other hatchlings it was estimated by measuring the nest temperature and analyzing the incubation duration as well as the period of emergences asynchrony. Sand and air temperatures were not directly related to nest temperatures. Air temperatures were warmer on eastern beaches while nest temperatures did not change accordingly. Sand temperatures were much more variable according to sandy, shady and stony areas. The sex ratio of hatchlings obtained from dead hatchlings showed remarkable differences between beaches zones and nest depths. Dead hatchlings collected from the first and last nest emergences were also different in sex ratio with a higher number of females in the emergences occurred during the first night and a higher number of males in the last night emergences. On Dalyan beach, the most western loggerhead nesting beach in Turkey, the temperature of 24 nests was analyzed, the temperature of 16 nests during the middle third of the incubation period measured more than the pivotal temperature (~29 oC), in which numbers of male and female hatchlings are equal to each other. The overall sex ratio was 61% females on Dalyan beach. The temperature of one green and 10 loggerhead turtle nests was recorded on Goksu delta, the most eastern loggerhead nesting beach in Turkey. Temperatures of the middle third of the incubation period were analyzed. Temperatures of 10 nests during the middle third of the incubation period were more than pivotal and 81% of the hatchlings were calculated as females. Sand temperatures at nest depths were also recorded in order to set up Hatchery sites and it was observed that they were warmer further inland than those closer to the sea. In this study, we found that the western nesting beaches of Turkey produced more male hatchlings while the beaches towards the east had a relatively high proportion of female hatchlings. Dalyan beach is an important nesting ground not only in terms of annual nest number but also in terms of relatively high proportion of male hatchlings.

West Sirte nesting sites (Libya) produce more female loggerhead marine turtles

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Marine turtle sex determination is controlled mainly by incubation temperature. The increase in nest temperature (producing more females) may affect the sex ratio of a certain population, which would have many implications on sustaining that population and could determine the trend of population future. Hatchling's sex ratio was estimated at five nesting beaches west of Sirte (Libya). Nest Temperature and humidity levels of 14 loggerhead marine turtle (Caretta caretta) nests were monitored using electronic data loggers, during July-September 2009. Sex ratio was estimated using two methods, the incubation duration and the nest mean temperature during the middle third of the incubation period. The results showed a female dominated sex ratio in all sites, with a percentage of female of 86.2 depending on incubation duration and 69.2 when estimations are based on mean temperature. These findings support the reported highly female-skewed sex ratios in the Mediterranean region and elsewhere. However, as this research started almost one month after season start due to logistical causes, these results provide first clues on sex ratio in Libya, more nesting beaches needs to be studied for the entire duration of the incubation period. Such information would be very crucial to understand future trends of population structure, and the effect of increasing nest temperature on long term survival of marine turtle population in Libya. This work was part of cooperation between Libyan Seaturtle Program LibSTP, UNEP-MAP/RACSPA and the University of Sfax, Tunisia.

Sea surface temperature determines the loggerhead turtle, *Caretta caretta*, nesting period in Kuriat islands (Tunisia)

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Marine turtles face a number of threats. Some of them, namely fisheries bycatch, are very well known but the consequences of others are still uncertain. Being an ectotherm, the life background of marine turtles is highly dependent on temperature at various life-stage. Temperature fluctuations and, thus, the global warming have a significant impact on eggs incubation, sex ratio and, likely, on nesting phenology. The complex relationship between these factors is still poorly understood. Kuriat Islands, in Tunisia, is the first nesting site for the loggerhead turtle Caretta caretta and is located at 35° 48'05" N, 11°02'05"E. Here, nesting activity has been studied for 14 years. A statistical model has been used to describe the phenology of the nesting process. We examined the relationship between the sea surface temperature, at various spatial and time scale, and the modelled date of the beginning of the nesting season. A strong relationship was found with the sea surface temperature in wintering sites close to the Kuriat Islands.

10 years of satellite tracking marine turtles in the Mediterranean: review on a multi-national project

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Over the past decades satellite telemetry has become extremely popular in the study of marine turtle movements and it is often used not only for scientific reasons but has also become a means of attracting public attention and raising awareness towards the critical status of these charismatic marine reptiles. Despite numerous satellite tracking projects in the Mediterranean there are some important biases that indicate substantial gaps in the knowledge of some species and life stages. In fact, the current Action Plan for the Conservation of Mediterranean Marine Turtles highlights the need to focus research efforts on, amongst others, the identification of mating, feeding and wintering areas and key migration passages. This aim has been pursued by the collaborative project between the Stazione Zoologica Anton Dohrn and the RAC/SPA since 2001 by applying satellite tags to turtles in regions that have received less attention previously. Here we present a summary of these tracking data obtained for loggerhead turtles of different life stages and sex, and how the results have so far helped to deepen our knowledge on marine turtle behaviour, ecology and conservation needs. A total of 15 loggerhead turtles were equipped with different models of satellite transmitters, some of which delivered positions only and some revealed also diving patterns. Of these turtles most were females (10), while two were males and for three the sex could not be determined. Turtles were either found on their nesting beach (n=7), rescued from fisheries bycatch (n=6) or were released after a long rehabilitation period in captivity (n=2). Partners from four countries collaborated in this project: Libya (8 turtles), Malta (n=2), Tunisia (n=4) and Turkey (n=1). Signal transmission was relatively successful for all deployments with an average tracking duration of 239 days (range 17 to 404) and a mean transmission rate of 1.5 locations per day (range 0.1 to 6). Displacements of turtles varied from those that did not move from the release point (max displacement: 54 km) to those undertaking long journeys (up to 2967 km). Of the main results to mention are those that highlighted the importance of the Tunisian Plateau as foraging and overwintering habitat for both male and female turtles; proved the existence of a migratory corridor along the Libyan-Tunisian coast; provided evidence that overwintering turtles continue to breathe also during quiescent periods; demonstrated that turtles use the water surface to absorb solar radiation, rest and recover from deep and long dives; and finally, that showed how turtles re-conquered their natural habitat and behaviour despite long captivity periods and physical handicaps. In addition the releases of turtles with satellite transmitters have always attracted a large public and received great media interest, which helped considerably to spread the news about the turtle conservation projects in the respective countries. In conclusion, this tracking project succeeded in answering basic biologic questions about marine turtles and proved successful model collaboration among Mediterranean countries in their common effort to better understand and protect these endangered animals.

Loggerhead sea turtles (*Caretta caretta*) nesting in Rethymno, Greece, show a preference for the waters adjacent to reproduction site during the interesting period

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Rethymno, situated on the northern coast of Crete, hosts the third largest nesting aggregation of loggerhead sea turtles in Greece and one of the largest in the Mediterranean. ARCHELON has been running conservation projects in Rethymno since 1990 consisting of monitoring and nest protection, public awareness campaigns and promoting of management measures to ensure the long-term viability of the nesting habitat that has been included in the NATURA 2000 Network. However, by comparison, relatively little is known about this population's behavior at sea. From a conservation standpoint this information is important since mortality at sea due to interactions with small-scale fisheries and boat collisions can render terrestrial conservation efforts invalid, and can lead to steeper population declines. The purpose of this study is to determine how Rethymno female loggerheads use the near-shore marine habitat during the inter-nesting period. This information will be useful for the compilation of management measures for the marine section of the protected site. Our field season took place in Rethymno during the 2010 nesting season (June-August). Work was conducted during night surveys when the beach is patrolled for nesting females. After egg-laying was complete, an ultrasound would be performed to assess whether the female would return to lay another clutch, thus determining if it was suitable for our interesting study. After confirming the presence of enlarged ovarian follicles, we proceeded with attaching a VHF radio transmitter (Telonics, MOD-050) and a time-depth recorder (LOTEK LAT 1100 series) on the trailing margin of the carapace. Daily observations for signals emitted by radio transmitters in specific listening locations showed whether females prefer to remain close to the nesting area. The time-depth recorders were retrieved when the turtles were again observed on the beach, at which time detailed diving and submergence records were downloaded. A total of 8 females were tagged during 2010 and we were able to get regular radio signals from 5 individuals. These observations indicate a preference for a specific marine area within 2 km of the shore which warrants further research. Three of the time-depth recorders were retrieved and the data were analysed to determine diving patterns. An initial overview shows that females may dive as deep as 67 m in the nearby shallow waters, although approximately 80% of the dives were less than 5 m deep. The longest dive recorded was 48 minutes, although 70% of the dives lasted less than 10 minutes. The longest and deepest dives occurred during the 3-4 days before the female was due to return to nest, suggesting a shift in behavior during that period. This paper will be discussing these results and will include our detailed findings as revealed by the on-going data analysis.

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HABITAT MANAGEMENT AND CONSERVATION MEASURES
ORAL PRESENTATIONS

Keynote presentation

MEDASSET's approach to sea turtle conservation: bridging gaps in the Mediterranean

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The organisation's aim since its official constitution in 1988 was to get involved in research and conservation projects throughout the Mediterranean, especially where research had never or sparsely been carried out before; and where little or no commitment to sea turtle conservation was known. Awareness raising, education, capacity building and lobbying complimented the organisation's conservation and research goals. Immediate research result announcements and open-access publications became one of MEDASSET's "trademarks"!

Over 8.000 km. of Mediterranean coastline were surveyed for potential or known nesting sites including Sardinia, the NE Aegean mainland and islands in Greece, the shores of Turkey, Egypt, Libya, Syria and Lebanon. Nesting was recorded for the first time in Lebanon, Syria and on parts of Libya and Egypt: this provided useful information for coastal habitat management plans, thus making an important contribution towards legal frameworks protecting sea turtles, especially in Egypt and Greece.

The first research on incidental catches of turtles in surface long line fisheries in the Greek Ionian Sea, "stavnike" traps in the Adriatic Sea in Albania, and the launch of the first satellite tracking project of turtles in Albania, complemented our marine research projects.

With only 300-500 female Chelonia mydas green turtles remaining in the Mediterranean, this species remains the organisation's research and conservation priority. Lobbying and international campaigns helped towards the establishment of the Zakynthos National Marine Park (ZNMP) and the "Save Patara" campaign in Turkey has so far prevented further development on the nesting beach. The Kazanli (Turkey) worldwide campaign, after several thousand tons of toxic waste were released into the sea in front of the green turtle nesting beach, resulted in the government initiating the neutralisation of the toxic "time bomb" of over 1.5 million tons of hazardous toxic waste, from the soda chrome factory, that is sitting on the beach. Recent campaigns for fisheries interaction in Episkopi Bay (Cyprus) and the protection of nesting beaches in South Kyparissia (Peloponnese, Greece), Fethiye and Patara (Turkey), are in full development.

MEDASSET's activities have been backed by the European Commission (EC), UNEP's Mediterranean Action Plan (MAP), the Regional Activity Center for Specially Protected Areas of MAP (RAC/SPA), the Global Environment Facility (GEF), and are further supported by national and international funding NGOs, sponsorships, fund raising, etc.

Collaborative sea turtle research and rehabilitation between the Stazione Zoologica Anton Dohrn, Italy and Taiwan

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Faculties from Stazione Zoologica Anton Dohrn (SZN) were invited by the National Science Council (NSC), Republic of China to visit Taiwan to attend a "Taiwan and Italy Conference on Marine Biology" between the SZN and National Taiwan Ocean University in May 2009. An agreement was signed by the two institutes to enhance research co-operation between the two nations. With the funding provided by the NSC, a two-year bi-lateral international research project on sea turtle behaviour was carried out from August 2010, with two main objectives. First, to compare the migratory behaviours of loggerheads between two different oceanographic regimes (i.e. the Pacific Ocean vs. Mediterranean). Second, to facilitate cooperation between the two institutes on sea turtle research and rehabilitation. The SZN is famous for its sea turtle rehabilitation and biological research in Italy, and the Institute of Marine Biology is the only institute that has carried out sea turtle biology research in Taiwan. This collaborative project allows us to carry out a cross-regional cooperation on sea turtle conservation. Satellite telemetry was carried out on a by-caught loggerhead from Eastern Taiwan on 28 February 2011. The turtle travelled southward along the coast, across the Taiwan Strait, then moved south along the coast of Mainland China. This track data will be compared with those of by-caught loggerheads in the Mediterranean. In January 2011, students and the faculty from the sea turtle research group of the Institute of Marine Biology visited the SZN and exchanged information during a workshop. Several agreements were subsequently achieved, including a joint publication, assistance to establish sea turtle rehabilitation centre in Taiwan, and a visit to the nesting sites to gain more knowledge on the nesting ecology of turtles in Taiwan. Mutual benefits from both institutes will promote both research and conservation actions of sea turtle populations.

Investigating marine turtle bycatch in artisinal fisheries of Cyprus

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Logistical challenges associated with data collection from numerous, diverse and diffusely distributed vessels, have repeatedly been implicated as the main factor leading to the lack of robust studies of bycatch in the artisanal fishing sector. The complex community-based structures of these fisheries, also hinder their understanding, driving marginalisation and disregard by governments, who lack the information needed to implement long-term sustainability plans. It has been speculated that artisanal fisheries could equal or even exceed the contribution of industrialised fisheries to global bycatch of marine megavertebrates. Here we describe a multidisciplinary study to gain insights into marine turtle bycatch in the artisanal fisheries in Cyprus, a region which has been demonstrated as highly important for marine turtles. This work includes: 1. A comprehensive harbour survey of number of vessels. 2. Data gathering through participatory fisher workshops around the coast to allow an assessment of gears deployed, spatiotemporal patterns of fishing and estimates of bycatch. 3. Year round beach monitoring for stranded turtles with associated necropsy. We discuss our preliminary results and plans for future work, including possible steps that might be taken to mitigate negative impacts. Data gathered from 28% of vessels in our study region through questionnaire surveys held at workshops indicates annual marine turtle bycatch to be in the region of 850 turtles per year (median IQR=500-1650). Most fishers deploy bottom-set gill nets >1km in length and many use long lines of hundreds, sometimes thousands of hooks. Bottom-set gill nets were implicated by 96% of fishers (n=57) as the main cause of bycatch though longline entanglements were responsible for some strandings. Of 57 stranded turtles reported between November 1st 2009 and October 31st 2010, 40% were Chelonia mydas, 53% were Caretta caretta (n=57) and for 7% the species was not identified. Of C. mydas the majority (95%) were juveniles, but for C. caretta 39% were potentially breeding adults. Our stranding data implicates Cyprus as a foraging site for juvenile green and loggerhead turtles and together with our anthropological survey suggest bycatch rates that may be unsustainable for Mediterranean populations of both species. Possible mitigation could include a reduction of overnight setting of nets and the development of protected areas based on the results of current marine turtle and fishing vessel telemetry studies, the aim of which is to determine those neritic areas that are important to turtles and which are of highest overlap with fisheries. We are currently trialling pingers which may be applicable as a means of buffering economic losses of mitigation, as dolphin depredation and associated net damages are currently limiting the profitability of gill net fishing.

Audiovisual 3D stereoscopic technology as an awareness instrument for sea turtle and marine environment conservation

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The high-tech media tools, which are based on screen interaction systems, have been recently playing an even more central role in the process of cognitive education of new generations of students. Since the beginning of the 90s, children and teenagers have grown up totally submerged in an environment marked by the influence of several high-tech instruments and multimedia services such as, besides TV, computers, play station games and software, Ipod and the Internet, all provided with a screen and demanding the primary cognitive activity of watching and observing. This type of influence, supported by different researches and studies, has developed a population of students, better defined as "TV audience", that is able to follow, comprehend and memorise even more images, contents and visual emotions instead of resorting to the traditional educational patterns. Within this context, the potential of an audiovisual 3D stereoscopic technology has been experimented as educational-teaching tool aimed at raising the public awareness on the knowledge and conservation of the Mediterranean marine environment and its sensitive species, particularly sea turtles. The idea of such a project originates from the visible and extraordinary outcomes, which have followed the adoption of the above mentioned technology in several environmental education activities realised in collaboration with the Association Expomed. Therefore, the introduction of an audiovisual 3D stereoscopic instrument for educational purposes has proven successful. Since 2009, several underwater documentaries and 3D films have been realised and displayed in many primary schools of Rome involving over 15.000 students, from 8 up to 14 years old, as part of an educational experiment conducted by biologists, in collaboration with Expomed. Through this approach the audience has been projected into the film simulating a real immersion and the direct observation of sea turtles and their marine habitat. In this way, the strong emotional impact was translated into attention, interest, fun and curiosity over the mentioned topic, as well as into a significant increase in knowledge and awareness on conservation issues. The immediate outcomes have driven to one year extension of this experience in primary schools. Finally, the educational potential of this technology, besides creating environmental education instruments, open great scenarios for the realisation of teaching tools affecting and fostering the existing conservation programmes on sea turtles and their Mediterranean marine environment. Moreover, the application and development of such a medial technology, which guarantees an experience of "immersion", might also be oriented towards the production and diffusion of more effective instruments addressed to a bigger audience, to promote and develop the current advocacy activities on the above mentioned delicate issues.

A decade of monitoring, conservation and awareness by a local team in South Lebanon

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The beaches of El Mansouri and El Koliala, which are located on the south coast of Lebanon, have been regularly monitored (each year) by a Lebanese team over the last decade. The monitoring effort has been enforced by the application of conservation strategies, such as individual nest protection, nest relocation, rubbish removal and public awareness. The nesting population is mainly composed of Caretta caretta, in addition to low levels of nesting by Chelonia mydas. The total number of nests found on the beaches from 2002 and 2010 (min 33, max 81), reflects the natural life cycle of sea turtles and the variable trends recorded across the whole Mediterranean region. The application of individual nest protection provided an effective protection technique against excavation by foxes and dogs. Nest relocation was initially applied to avoid nest flooding during incubation, whereas in the last two seasons it was necessary to avoid human interference. This was due to the sudden use of the beaches by local people during the day (recreation and artisanal fishing) and patrolling by soldiers during the night. The relocation of nests to alternative sites on the same beach resulted in a good hatching success rate. As on most of Mediterranean beaches, rubbish on the beach represents one of the main threats for marine animals. Hence, a regular rubbish removal programme was established to clear a suitable nesting habitat for sea turtles on the two monitored beaches. Socio-economic issues are priorities in South Lebanon, in particular after Israeli occupation and recent war. The local community and authorities, as well as the government, are not available to provide support to the monitoring campaign through the provision of man power, funds or other means. Despite these limitations, the area was locally declared “Hima” in 2006, which is a traditional system of community-based natural and human resource management. A decade of operation by the conservation programme highlights that the priority would be to declare the nesting site a national protected area, which could be managed and protected by laws and regulations. Ultimately, long term monitoring and conservation effort requires national and international support to be able to continue with success. In this particular area, support and collaboration with the military, international and national authorities might help to avoid irreversible damage and negative impact to the nesting environment.

Record nest numbers and increased incidence of neophyte turtles in Kyparissia bay: positive results from long term nest protection?

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The 44 km beach at Kyparissia Bay, western Peloponnesus of Greece, hosts the second largest loggerhead turtle nesting aggregation in the Mediterranean. About 84% of nests occur along the southernmost 9.5 km of the Bay, which is considered as the core area. About 8 km of the core area (Sectors A, B, C) has been monitored every year since 1984, with seasonal night-time tagging activity (since 1982) in sections of the core area. Turtles with old tags or scars attributed to lost tags are considered as remigrants, and turtles with no tags or scars as neophytes. Protection measures have been gradually introduced since 1987, as nests were subject to high rates of mammal predation (about 50%) and inundation by the sea (about 30%). In-situ nest fencing and relocation to safer sites have been applied with a varying intensity over the years, depending on human resources. However, since 1989 the majority of nests were protected in most of the core area. The minimum age at maturity for Mediterranean loggerheads is calculated to be 15-16 years. Hence, intensive nest protection starting in the late 1980s should therefore result in higher numbers of nesting turtles and nests in recent years. Is this the case? Over the 27-year period (1984-2010), nesting effort in sectors A through C ranged from 174 to 741 nests per year. However, in the last 5 years (2006-2010) there has been a considerable increase in nest numbers. The record number of nests occurred in 2010 and the three years previous to that were also some of the highest on record. Annual population growth rate between 1984 and 2005 is estimated at 0.9%. However, when the most recent years are included it increases to 1.6%. Through the 1980s to 1992 the percentage of neophyte turtles reduced from 100% to 50% as existing members of the population were tagged. This level stabilised at about 40% until 2002 when it bottomed out at just under 30% for two years. Subsequently the levels have increased, and the percentage of neophytes has been over 60% in three of the last 5 years. An increase in the number of neophyte turtles may indicate an increase in the number of turtles recruiting to the population. Our data tentatively indicate that recent increases in nest numbers may be associated with long-term nest protection efforts. However, a number of other factors may have also led to these results including the absence of saturation tagging, particular environmental and oceanographic driven conditions and increased at-sea survivorship. The indicated positive documented trend, potentially resulting from ARCHELON's conservation efforts in Kyparissia Bay, make us hopeful that similar activities carried out since the early 1990s at Rethymno, Island of Crete, may reverse the population decline that we have recently recorded there. We thank all field assistants and the many hundred volunteers without whom the above long-term work would not happen.

How loggerhead sea turtle conservation can benefit from Mediterranean Protected Areas networking: the case of the National Marine Park of Zakynthos within the MedPAN network

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The establishment of Mediterranean Marine Protected Areas (MPA) should contribute to the protection of the loggerhead sea turtle since integrated management of those Protected Areas constitutes the prerequisite for long term "favourable" status of conservation. The National Marine Park of Zakynthos was established in December 1999, aiming at the conservation of one the most important breeding area of loggerhead sea turtle in Mediterranean. Beyond the management of its own protected area, the N.M.P.Z. Management Agency intended to identify migrating routes of sea loggerhead turtles in order to support its conservation through its whole life cycle and not only the breeding one. In 2005, the NMPZ Management Agency contributed to the reactivation of the MedPAN Network, primarily created in 1990, which main objective is to improve the effectiveness of marine protected areas management in Mediterranean. Amongst the main means of actions promoted trough MedPAN operational framework, at least three may be considered as crucial in order to ensure the most integrated conservation of the whole life cycle of loggerhead sea turtle: 1. Setting up of scientific monitoring of the ecological condition of marine protected areas in the network, and promotion of scientific research programmes. 2. Promotion and coordination of exchanges between the members of the MedPAN network, and 3. Provision of support to the establishment of new marine and coastal protected areas in the Mediterranean area. The gathering and distribution of scientific information within the scope of integrated management should supply basic guidelines for managers in order to implement and evaluate actions for sea turtles conservation. For this purpose, an updated and interconnected MPA Data Base is being created, assessing the management effort undertaken in Mediterranean MPAs. Trough the correlation of data and obtaining the necessary information about loggerhead sea turtle wintering, breeding and foraging areas at least at the level of protected areas, managers will be allow to take action and provide the institutional players about immediate actions to be carried out. Such a case is representative of the N.M.P.Z. area which sea turtles seem mainly to use Croatia and Slovenia coast line as foraging and wintering area, according to information provided by tag recovering and satellite tracking. At least five managing authorities (National Marine Park of Zakynthos, Strunjan Nature Park, Brijuni National Park, Mljet National Park, Kornati National Park) and four Institutions (Slovenian Institute For Nature Conservation, Public Institution for Management of protected areas in Sibenik-Knin County, Lastovo Islands Nature Park Public Institution, Telascica Nature Park Public Institution) will be thus involved, sharing information concerning not only monitoring of the sea turtle but also sustainable tourism and fishing management. Furthermore, information should integrate immediate or latent threatens such as marine pollution, sea turtles illness and invasive species and afford quick actions to be carried out. The existence of a wintering area in the Gulf of Gabe's in Tunisia that sea turtles breeding in Zakynthos and Peloponisos area are also using, could give need to establish new marine and coastal protected area, based on information gathered trough the MedPAN network. In such a way, primary aims of the conservation of loggerhead sea turtle breeding in the NMPZ area should be fulfilled, covering anymore a very important segment of its life cycle.

THREATS
ORAL PRESENTATIONS

Keynote presentation

Getting organised: Regional Management Unit as a framework for prioritizing sea turtle research and conservation at multiple scales

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Given the imbalance between limited conservation resources and myriad, diverse conservation targets, robust yet flexible priority-setting frameworks are vital. Priority-setting is especially important for geographically widespread species with distinct populations subject to multiple threats (e.g. fisheries bycatch, direct take) that operate on different spatial and temporal scales. Marine turtles are widely distributed and exhibit intra-specific variations in population sizes and trends, as well as reproduction and morphology. However, current global extinction risk assessment frameworks do not assess conservation status of spatially and biologically distinct marine turtle Regional Management Units (RMUs), and thus do not capture variations in population trends, impacts of threats, or necessary conservation actions across individual populations. Thus, the IUCN/SSC Marine Turtle Specialist Group (MTSG) has worked to meet a two-fold challenge: 1) to define population units for assessments, and 2) to develop a system for assessing the conservation status of those population units. To address these challenges, the MTSG leadership convened the Burning Issues Working Group (MTSG-BI), of marine turtle experts from around the world who represented government agencies, nongovernmental organizations, and academic institutions. First, the MTSG-BI developed Regional Management Units (RMUs) (i.e., spatially explicit population segments defined by biogeographical data of marine turtle species) as the framework for defining population segments for assessments. Second, we developed a new assessment system that allowed us to evaluate, compare and organize marine turtle Regional Management Units (RMUs) according to population status and threats criteria. Because conservation priorities can vary widely (i.e., from avoiding imminent extinction to maintaining long-term monitoring efforts), we developed a 'conservation priorities portfolio' system using categories of paired risk and threats scores for all RMUs (n=58). We performed these assessments and rankings globally, by species, by ocean basin, and by recognized geopolitical bodies to identify patterns in risk, threats, and data gaps at multiple relevant scales. This process resulted in characterization of risk and threats to all marine turtle RMUs, including identification of the world's 11 most endangered (i.e., highest risk and threats scores) marine turtle RMUs. This system also highlighted important gaps in available information that is crucial to accurate conservation assessments. In this presentation, we will outline the MTSG-BI process and products, and present preliminary results of a global evaluation of fisheries bycatch impacts on marine turtle RMUs, to demonstrate the utility of RMUs as an assessment framework. Overall, the priority-setting approach developed through the MTSG-BI process can provide guidance for research and conservation priorities at multiple relevant scales, and should serve as a model for conservation status assessments and priority-setting for widespread, long-lived taxa.

Environmental impacts in Drini Bay: an important sea turtle foraging and developmental habitat in Albania

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During MEDASSET's (Mediterranean Association to Save the Sea Turtles) three-year study (2008-2010) at Drini Bay, 407 sea turtles were captured as fisheries bycatch (402 Caretta caretta, 5 Chelonia mydas). The project concluded that Drini Bay is a regionally and nationally important habitat that is used by sea turtles for foraging, as a refuge and as part of a key migratory corridor between the Ionian and Adriatic Seas. Drini Bay supports several artisanal fisheries, as well as a small trawling industry. Fisheries Regulations No.1 prohibits trawling within three nautical miles of the coast, or shallower than the 40-metre isobath. Trawlers are frequently observed fishing close to the beaches of Drini Bay. All of the study area was shallower than 47 metres. Nearshore trawling is not an isolated incident, but the common practice. Conversations with trawlermen suggest that turtles are captured in their nets, especially south of River Drini, but this is unquantified and not reported. A comprehensive bycatch assessment should be undertaken. In 2009, to determine coastal pollution in the area, a survey using quadrat-counts of debris (10 × 10 m quadrats) was conducted at eleven locations around the bay. All of the beaches in the 30-km bay were found littered with debris, mostly plastic; most of the waste enters the bay via the four main rivers. In 2010 water-sampling for micro-biological contaminants was conducted in several rivers that flow into the Adriatic Sea; all the river-water samples were 'bad or 'very bad' for faecal coli forms. Illegal dynamite use for fishing in Drini Bay was monitored throughout the three-year project. There were distinct changes in usage patterns during 2010: all explosions took place in the vicinity of Kepi Rodonit and the mouth of River Ishmi (i.e. the south-eastern corner of Drini Bay) whereas during 2008-9, dynamite was also used at Tales, but this site now has a small, yet successful, emerging tourism industry that may have curtailed dynamite-use there. The illegal use of dynamite for fishing in 2010 exceeded the total usage from the previous two years (540 charges in 2010, n = 24 days; 124 charges in 2008, n = 18 days; 57 charges in 2009, n = 15 days). Albania is an impoverished developing country that lacks infrastructure and resources: a particular nation-wide problem is waste management, including disposal of sewage. Nevertheless, another important factor is lack of awareness about the importance of sea turtles as a species and the need for environmental protection. Throughout the project researchers endeavoured to raise awareness among fishermen regarding the importance of this 'umbrella' species locally, nationally and regionally. Environmental education and awareness-raising, is probably the quickest way to improve the coastal zone; local residents could seek help from communities and prefectures, as well as national government. A national sea turtle management strategy, which includes the protection of Drini Bay, will be presented to the government in 2011.

Identifying local bycatch hotspots of loggerhead turtles: a new method applied off the Ionian Calabrian coast (Italy)

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Incidental captures by the longline fishery is recognized as a serious threat for loggerhead turtles Caretta caretta and the identification of persistent areas of high bycatch rates ("hotspots") could facilitate effective conservation planning. In this study a new method to determine the location and spatial structure of turtle bycatch hotspots in the drifting longline fishery is presented. These datasets are common and easy to record but their use represents a challenge because, for a drifting gear, the locations where the catches occur do not necessarily coincide with the places where they are found. Twenty-three longline sets were surveyed onboard during two fishing seasons, between June and August of 2007 (n=10) and 2010 (n=13), off the southern coast of Ionian Calabria (Italy). Data collected per each set included: number of hooks, position in the longline of each hook responsible of turtle capture and the coordinates of all buoys at the time of their deployment and their retrieval. In 2010 GPS loggers were also positioned on the first and the last buoy of each fishing set, in order to record the track of the drift. For each set the longline gear was mapped twice, during deployment and during retrieval. With GIS mapping software the polygons defining the effort area of each set were constructed by connecting the line of deployment of the gear with its retrieval through the track of the drift, which was approximated to a straight line. GPS data allowed us to evaluate that this simplification did not significantly change the effort area and permitted to use the same methodology for both years. To improve the accuracy in defining the bycatch area, each polygon was divided in sub-areas to which turtle captures were associated. The lines of the gear deployment and retrieval were thus divided in a number of equal segments defined by groups of 100 hooks. Each segment of deployment was connected to the corresponding segment of retrieval, in order to map the effort area described by the drift of 100 hooks. We associated to each sub-area its corresponding soak time (hr), size (km2), number of turtle caught and then we estimated the related bycatch density. We therefore created a grid with cell size 50x50 m overlapped to the surveyed area, assigning estimations of bycatch density and fishing effort to each cell, assuming an equal repartition of the values corresponding to each sub-area among all the cells included. When in a cell more than one sub-area overlapped, the values for that cell were the average value of bycatch density among the different sub-areas and the accumulated fishing effort. Two grid layers (bycatch density and fishing effort) per year were defined. To compare the estimates of bycatch density between the two years, values were normalized for each year. As a result, one bycatch hotspot common to both years was identified. The average bycatch density in this area was 0.24 (± 0.12 SD) and 0.10 (± 0.10 SD) turtles per km2 per day per 100 hooks during 2007 and 2010 respectively.

Southern Kyparissia bay at a crossroads: protect it now or forever hold its pieces

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The Bay of Kyparissia is the second most important nesting area for loggerhead sea turtles in the Mediterranean Sea. The Bay has a continuous beach length of 44 km, but about 84% of nesting activity occurs at the 9.5-km southernmost part of the Bay, between the rivers Arkadikos and Neda, which is considered the core area. A section of this beach is backed by the village of Kalo Nero. Away from the village, the top of the beach forms one of the most extensive sand dune systems in Greece, which is backed by seasonally cultivated fields and a coastal pinewood forest. ARCHELON works in Kyparissia Bay since 1982. All nests at the core area are located, marked, and protected against mammal predation and inundation. Locals and visitors are informed about the ecological importance of Kyparissia Bay at ARCHELON's Information Stations and during frequent presentations at local venues. Human-induced effects on the nesting activity were, in the past, relatively mild. Cultivated fields between the dunes and the forest and a few tavernas and small hotels at the beach front of Kalo Nero had a tolerable effect on nesting activity and hatching success. The core area became part of a Natura 2000 site and ARCHELON conducted a Life-Nature project for the implementation of a management plan for the protection of the natural environment and the sea turtle nesting activity. A disused railway station in the middle of the core area was renovated and became the Environmental Station of Agiannaki, which continues to contribute significantly to the operation of ARCHELON's field project and the effective public awareness for the historical and ecological importance of the Bay. With the completion of the Life-Nature project in 2003, ARCHELON submitted a Special Environmental Study, a Management Plan, and a draft Presidential Decree to the Ministry of Environment, which would then complete the process by submitting these to public consultation and legal scrutiny, and then issue a Presidential Decree for the environmental protection of this area. The Ministry did not take these steps, and southern Kyparissia Bay remains unprotected. A steady rise in tourism influx and investment interest in recent years, in combination with an apparent willingness of local authorities to allow the circumvention of general regulations and to avoid prosecuting violations against the environment result in its accelerated deterioration. An increasing number of tourism venues, municipal street lights, makeshift beach bars set on dunes, and beach furniture pollute the beach with noise and light and disrupt the nesting and hatching activities. Further, the construction of more roads reaching the sea, luxury homes, and a beach wall without appropriate permits continues unabated. While damage is already significant, it is not too late for the Bay of Kyparissia. Its legal protection is a critical step, but the effective promotion of sustainable development can partially recover the damage and satisfy the needs of the local community.

VETERINARY MEDICINE AND TURTLE HEALTH
ORAL PRESENTATIONS

Keynote presentation

Pathogens, pathology and epidemics prevention in Chelonians: a challenge for the new millennium

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Reptile medicine is one of the youngest disciplines in veterinary medicine. Despite the significant maturation that this new branch has undergone during the last few decades, several of its main areas are still a “work in process”. Among these, diagnostic of infectious diseases is dramatically calling for more attention. In a globalized world where pathogens can spread faster and far more efficiently than ever, diagnostic of infectious diseases could be an invaluable tool to detect epidemics at their dawn, limiting their potential devastating effect on wildlife, including sea-turtles. Additionally, the growing environmental threats might magnify the role of pathogens in the future, making the pathogen-exposure-detection of stringent actuality for sea-turtle conservation and well-being around the world. Nevertheless, the road towards the goal of discovery and characterization of potential sea-turtles’ pathogens and the development of diagnostic tests aimed to reveal the exposure to them is disseminated of many hurdles. Among others, the lack of baseline biological information and of funding has hampered for long time this research effort. Despite this, some seminal works performed in the past have demonstrated that this is a challenging but not an impossible task.

We will review the best-characterized pathologies caused by the known sea-turtles’ and other chelonians’ infectious agents, discussing the benefits but also the pitfalls of the diagnostic tests developed to detect these agents. Finally, we will highlight what we learned from these investigations, discussing how these data might help to provide better sea-turtle medicine, to prevent epidemics and to contribute to the conservation of sea-turtles for the generations to come.

At-sea rehabilitation and pre-release observations of rescued marine turtles: the Turtle Bay project

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After treatments in a Rescue centre, a recovered turtle should be prepared for its release. Therefore, it is necessary for the turtle to undergo a period of rehabilitation to assess its full recovery and a good health status. To guarantee an appropriate rehabilitation the Rescue Centre of the Stazione Zoologica Anton Dohrn in Napoli opened the "Turtle point" centre, which is dedicated exclusively to the rehabilitation of turtles patients. This new facility was equipped with large square tanks and an oval tank where the turtles' capability to fed and maintain buoyancy could be ascertained. However, for some individuals which had suffered severe injuries and underwent long treatment periods, the rehabilitation in shallow tanks did not allow to determine their actual swimming and diving ability. In fact, although the turtles in the Turtle point had more space to move than in the Rescue Centre, the water depth was still limited. To improve this pivotal aspect for marine turtles, in 2007 we had the opportunity to close a marine area of 900 m2 inside a small volcanic island where bathing and shipping is prohibited because it hosts a remand home. The area was used to rehabilitate some individuals which had been subjected to long treatment periods as well as to study some key aspects of their behaviour which are useful for the designing of programs for the re-introduction of wild species into their natural habitat. To evaluate the progress of rehabilitation we compared diving patterns and daily rhythms of 13 loggerhead turtles (Caretta caretta) introduced in the Turtle Bay with individuals kept in tanks. The observations were conducted during the summer months from 2007 to 2008 utilising time-depth recorders (TDR), attached to the turtles' carapace. TDR recordings extending over 3 to 12 days, showed two different diving patterns corresponding to the two environments considered. While turtles in captivity spent most of their time inactive on the bottom of the tank irrespective of day or night, turtles in the bay rarely came to rest in the first three days, indicating that turtles need to acclimate and familiarise with the new environment. After that they developed diurnal activity patterns, most of the swimming, exploring and feeding occurred during the day, while resting bouts were detected at night. Additional direct observations of the turtles in the Turtle Bay made both in and outside water revealed that: 1) the turtles began to forage on live preys present in the bay; 2) they showed territorial behaviour in the interaction with their conspecifics and 3) they tended to utilise primarily the zone closest to the open sea. Finally, the Turtle Bay Project consisted not only of the rehabilitation of marine turtles, but also for the inmates of the island's remand home, which were involved in the care and monitoring of the turtles through a specific environmental education program.

Laser therapy in sea turtles

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LASER (Light Amplification by Stimulated Emission of Radiation) is a powerful energy source obtained by the amplification of light waves through radiations. Biological effects of light in the frequency emitted by laser instruments (6-20 KHz) are well documented in medical literature and are the fundamentals of Low Level Laser Therapy (LLLT).

Proper laser light stimulation acts on the intracellular compartment mainly leading to mitochondrial activation and consequently impacting the cellular energy produced. Through cell reactivation, tissue damage secondary to multiple causes including inflammation, trauma, metabolic imbalance and degeneration, may be repaired, allowing the restoration of normal tissue architecture and organ function. Wound healing, affecting both soft and hard tissues, scar formation and oedema resolution occur in shorter periods when treated with laser therapy. This represents a significant reduction in recovery time, particularly welcome when dealing with critical patients as sea turtles may be.

Following laser therapy, first tissue changes include neovascularization, which is pivotal to provide the delivery of an appropriate amount of nutrients, distribution of inflammation mediators, and recruitment of monocytes.

This work describes 8 clinical cases in which LLLT has been a valuable aid in treating various injuries affecting the flippers, the ramphoteca, the shell, as well as bite and impact wounds. Different types of LLLT applications, progression of lesions healing and follow up are described for each case.

Investigation of some blood hormones in loggerhead sea turtle (*Caretta caretta*) and its possible usage in estimation of the sex

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We investigated steroid hormones concentrations (Testosterone (T), Estradiol (E2), Progesterone (Pro) and Corticosterone (B)) in healthy loggerhead turtles (Caretta caretta) caught from Iztuzu nesting beach and lagoons of Köycegiz – Dalyan Special Protection Area, and injured loggerhead turtles brought to the Sea Turtle Research, Rescue and Rehabilitation Centre (DEKAMER). Samples were collected from 23 Caretta caretta and two Chelonia mydas individuals between 2009 and 2010. Of the 23 C. caretta samples, 57% (n=13) were healthy turtles from Dalyan region, while 26% (n=6) were injured turtles from the same region and 17% (n=4) were injured turtles brought to DEKAMER from Mersin, Antalya/Kemer, Mugla/Fethiye ve Mugla/Bodrum. Two injured C. mydas were brought from Belek and Manavgat regions in Antalya. The hormone levels of the turtles were affected by their health conditions. We found that T and E2 levels were the most profoundly affected by health conditions. Plasma E2 and Pro levels were found to be higher (mean-E2-healthy = 127,50 ± 131,20 pg/ml; mean-E2-injured = 1039 ± 865 pg/ml and mean-Pro-healthy = 0,499 ± 1,267 ng/ml; mean-Pro-injured = 1,44 ± 3,29 ng/ml), T and B levels were found to be lower (mean-T-healthy = 2,53 ± 3,38 ng/ml; mean-T-injured = 1,06 ± 2,06 ng/ml and mean-B-healthy = 0,78 ± 1,73 ng/ml; mean-B-injured = 0,057 ± 0,047 ng/ml) in injured turtles. E2 levels were found dramatically high in injured turtles in both sexes and maturity conditions. There were no significant differences in T levels among sexes when injured turtles were included for statistical analysis. Thus, hormone levels of injured turtles were excluded from statistical analysis and only healthy turtles' hormone levels were evaluated. Healthy male and subadult turtles did not provide enough sample size for statistical analysis but, mean plasma T levels were higher in male turtles (mean-T-male = 4,86 ng/ml; mean-T-female = 1,84 ng/ml). Based on the results of this study, no significant differences were found between male and female injured turtles. Thus, we can claim that injured turtles are not showing appropriate models for sex ratio studies and should be excluded from sex ratio estimation studies. Nevertheless, T precursor Pro levels and T product E2 were higher, while plasma T levels were considerably low in injured turtles. It is thought that elevated E2 levels in injured turtles might be a physiological response to injury. B levels are higher in healthy turtles. Having a large proportion of nesting female turtles in healthy turtles group, thigh B levels can be related to mobilization of lipid, carbohydrate and protein reserves during ovarian development and yolk deposition. Environmental stressors can also affect plasma B levels of nesting females due to spending time on the land.

Comparision between left and right surgical approach through the soft tissues of the inguinal region in sea turtles

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The accidental capture of sea turtles with longline is a frequent event in the Mediterranean sea. Frequently hooks are located in oral cavity or oesophagus and surgical removal is relatively easy; whereas in many other cases hooks and especially lines are located in lower digestive tract, often causing severe damages, as serious injuries on the intestinal wall. Recently, effective surgical techniques have been proposed for hook and line extraction from different districts of digestive tract. The access to the coelomic cavity through the prefemoral soft tissues allows the removal of hooks and lines from the caudal portions of the digestive tract and it is often employed in conjunction with cervical or axillary approach, if one or more hooks are located in oesophagus or stomach and lines cross the entire digestive tract. In this study, the left inguinal approach is compared to the right one, and results are reported concerning 97 turtles treated by these routes for the extraction of foreign bodies from digestive tract. The surgical approach through soft tissues of the right inguinal region was performed in 63 turtles. In 23 cases a unique approach was used to remove hooks lodged in the lower digestive tract and lines extended through the entire digestive tract. In 40 cases this approach was performed together with cervical and left axillary surgical approaches, to remove hooks lodged in oesophagus or stomach, and lines crossing the lower digestive tract. The surgical approach through the soft tissues of the left inguinal region was performed in 34 turtles. This technique was employed as a single approach in 5 cases to remove hooks stopped in the pyloric portion of the stomach, and in 10 cases to remove lines crossing the entire digestive tract. In the remaining 19 cases the left inguinal approach was employed additionally to the cervical one, to remove hooks lodged in the oesophagus and lines extended through the entire digestive tract. To remove hooks located in the intestine, we chose the side closest to the site of the foreign body. To remove line crossing all the digestive tract, the choice of the side access was initially random, but experience showed how the right inguinal approach is to be preferred. Indeed, we tested how this approach allows the exteriorization of longer tracts of intestine, whereas with the left inguinal approach is often difficult to expose the tract between jejunum and ileum, because this portion is more subject than others to plication, intussusceptions and severe lacerations of walls, because of the major tensions that line induces there. To guarantee the survival of the patient, our direct experience show definitely how it is important to operate as soon as possible, in particular when it could be present a line in the digestive tract. The choice of the surgical approach appears crucial to solve life-threatening situations, in which lines cross the entire digestive tube.

Cranial fractures management in loggerhead turtles (*Caretta caretta*)

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Cranial injuries in sea turtles are mainly due to boat strikes and are a common occurrence in sea turtles referred to rescue centers. Unfortunately in very few cases it is possible to act promptly after an impact and many animals die. More commonly surviving turtles are evaluated hours or days after trauma making impossible to fully apply emergency medicine procedures. Nevertheless, even for those animals surviving a boat strike, head trauma should always be considered a life threatening condition and a careful assessment and a correct management of the injured patients are key factors for a successful recovery. Proper assessment of the severity of the lesions is only achieved by a thorough clinical examination combined with advanced diagnostic imaging. Treatment includes specific and supportive therapies and varies upon the degree of neurological lesions: some individuals are released after a short period while others need prolonged therapies and rehabilitation.

This paper describes 4 head trauma cases occurred in 4 Loggerhead turtles (Caretta caretta) over a period of 4 years and proposes an algorithm for sea turtles head trauma classification and management

Fisheries interaction lesions on sea turtles: WWF Lampedusa sea turtle rescue centre case history from 2003 to 2010

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In the Lampedusa Rescue Centre, each year a great number of animals accidently captured by longline, trawl-net and drift-net engines or found suffering adrift, are rescued. The purpose of this work was to analyze clinical data and surgically treatable lesions for the period ranging from January 2003 to December 2010.

For each subject the following was considered to verify the real interactions's degree: localization, kind and seriousness of lesions, capture method, fishing gear used.For each animal a health examination was drawn up in a clinic folder within general health condition, clinical and diagnostic procedures, type and location of the lesions, and therapeutic treatment used. Biometrical data, rescue modality, general health condition, lesions, mark of fisheries interaction and duration of hospitalization were related. The presence of external lesions was examined, an x-ray exam put into evidence the presence and the number and localization of hooks. From January 2003 and December 2010, 1496 turtles were rescued. 877 subjects were captured by trawl net, evidence of a good collaboration with this fishery. 294 were catch accidentally with longline, 310 subjects were found suffering adrift and manually rescued, the remain group stranded.

Our study shows as turtles with hooks fixture in the upper digestive tract (mouth and oesophagus) were mostly captured by longline and assisted directly by fishermen, while turtles with hooks in the lower digestive tract (stomach and intestine) were mostly found in trouble adrift and manually rescued, evidence of a past interaction with longline. This data confirm that very often, in case of accidentally capture by longline, turtles are released into the sea, just cutting the line. In this way the hook progress deeper, and line, when swallowed, causes foreign body injuries. The number of external injuries attributable to trawl net appears small compared with the great number of animals caught with this fishery system and conferred to the centre.

Few days after interaction with longline, surgery on turtles is almost always decisive. Otherwise, when animals are rescued highly weaken after a long period from interaction, surgery becomes complex. The importance of timely action is further confirmed by the different location of hooks and lines in relation to the time from ingestion. In the subjects accidentally caught by longline, hooks are mainly present in mouth or in oesophagus and lines come out from mouth. In turtles manually rescued hooks are generally located in the lower digestive tract and lines cross all intestinal canal, coming sometime out of cloaca.

In conclusion, longline and trawl net are both a dramatic menace for sea turtle conservation: damages caused by trawling do not allow many opportunities for treatments, but damages caused by longline can be largely resolved only with a well-timed action.

ANATOMY, BEHAVIOUR, PHYSIOLOGY AND GENETICS

POSTER PRESENTATIONS

Long-term monitoring of a loggerhead turtle foraging assemblage in Amvrakikos Gulf, NW Greece

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To fully understand demographics of marine turtle species we need to assess vital parameters such as growth rates, age at maturity, survivorship, reproductive output, migration and sex ratios of natural populations. It is only through our understanding of these factors that we may interpret the relative benefits of differing conservation measures and thus target actions in an effective manner. At-sea studies on marine turtle populations are rare compared to nesting beach studies, especially in the Mediterranean. Consequently we know less about the demographics of juveniles and males and females away from the breeding area than about nesting females. For this reason, at sea studies should be considered a priority area for marine turtle research in this region. Information from local fishers indicated Amvrakikos Gulf hosts significant numbers of loggerhead turtles. To address our lack of knowledge on this understudied segment of the population and obtain vital information specific to the area, ARCHELON initiated a research programme in 2002. Efforts have concentrated on flipper tagging and recording biometric data that include carapace and tail lengths of a sample of the population that are found in a limited region with water < 2m deep, but have also included satellite telemetry and tissue sampling. In a decade of research we have recorded over 270 individuals with numerous inter- and intra-annual recaptures, from which we are able to derive important insights into the biology and ecology of Mediterranean loggerheads. Herein we present our most recent findings and set out a planned future work. Turtles of the Gulf range in size from 46.2 to 91.5 cm SCL (mean=67.6, SD=8.1, N=273) covering the range from large juvenile to adult size classes and may indicate that Mediterranean loggerheads shift from pelagic to benthic existence at around 45-50 cm. Telemetry and tag recaptures have linked turtles in Amvrakikos Gulf with the three main nesting areas of Greece (Laganas Bay – Zakynthos, Kyparissia Bay - Peloponnese and Rethymno - Crete) in addition to coastal habitats of Syria and Turkey. Planned genetic analysis aims to determine relative contribution of the differing Mediterranean nesting populations to the foraging assemblage in the Gulf. Long-term residencies have been shown through turtles recaptured in the Gulf in four separate years, spanning eight years from initial capture. Initial growth rate results (< 3 cm year-1) showed the expected decrease with size, but more data are needed before robust rates can be presented. Observations indicated the onset of sexual dimorphism at around 65 cm SCL and assurance of sex, judged on tail length, possible from around 75 cm SCL. These values are useful data for determining sex ratios of other populations. Planned continuation of the mark-recapture study will add data to strengthen the value of current findings and whole-Gulf surveying (sponsored by the British Chelonia Group) will provide the first estimate of total population size within the Gulf.

Green turtle (*Chelonia mydas*) in the north western Adriatic Sea: two interesting cases

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Green turtles (*Chelonia mydas*) are very rare in the Adriatic Sea. This species has been recorded within the basin several times since 1830 but only one specimen was found in the Po River Delta in 1985. The number of green turtle populations living in the Adriatic Sea is low, with only two new cases recorded in 2009 and 2010 in the north western Adriatic Sea, respectively at Lido Nazioni and Porto Garibaldi (Ferrara, Italy). Unlike the second specimen, which was caught by a mid-water pair trawl, at 0.25 NM from the coastline, the first one was found stranded alive, but in desperate health conditions, with all the carapace and plastron scutes broken apparently by the impact. Unfortunately this animal died shortly after the recovery. Both the animals were juvenile species, with the carapace length measuring between 29.5 and 38.5 cm CCL. The range of carapace length, which has always been reported in literature, as for the Adriatic, was respected.

Satellite-telemetry reveals different behavioural patterns for three loggerhead turtles *Caretta caretta* tagged at a foraging ground in Albania

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During MEDASSET's (Mediterranean Association to Save the Sea Turtles) three-year study (2008-2010) of turtles captured as bycatch at an important foraging ground, Drini Bay, northern Albania, satellite transmitters (SPOT5, Wildlife Computers) were attached to three *Caretta caretta* so that their movements and habitat-use could be determined; they were released into Drini Bay on 12/09/2009. One turtle was an early-adult female (Shpresa), the other two were adolescent males (Guximtari & Patoku); Drini Bay hosts an unusually-high proportion of males (27%; 112/407 turtles). ARGOS was the data-provider; Web-pages were established (www.medasset.org & www.seaturtle.org), and both STAT & MapTool were utilised for data-presentation. Each turtle exhibited a different strategy during the first winter: the female remained in Drini Bay; one male (Guximtari) went north to Croatia (coastal foraging and offshore-onshore movement), returning to Albania in summer 2010; while Patoku went south and utilised an underwater ridge to the north of Corfu island (Greece) during the winter months; this ridge is likely to have extensive limestone caves and abundant foraging resources. Patoku also revealed the first timing for a remigration into Albanian waters: leaving Corfu in early-April 2010 and being recaptured in Drini Bay later that month. Indications are all three loggerheads used Drini Bay in two consecutive summers (2009 & 2010), signifying that the bay could be an important foraging ground and developmental habitat. In March 2011 Guximtari migrated southwards to Corfu and into the Ionian Sea; it is possible that Patoku and Shpresa may forage in Drini Bay for a third summer. As little is known of the marine ecology or distribution of turtles in Albania, transmitters were configured solely to provide locational data. Transmission anomalies were encountered in Drini Bay and northern Corfu; these limited the Class-accuracy for data from ARGOS; Shpresa was the most-affected, as she remained in Drini Bay: her transmitter appears to be up linking, but ARGOS has not provided an accurate location since April 2010. It is likely that if she migrated elsewhere then positional data would be received, especially from open sea areas. Likewise, no transmissions were received from Patoku in Drini Bay after November 2010.This extended study shows that loggerheads demonstrated intra-annual and inter-annual site-fidelity, and provided some insight into overwintering behaviour and habitat use, of importance is that two of the subjects are adolescent males, a life-stage for which little is known.

Influence of prolonged captivity on body proportions and growth rates in the loggerhead turtle, *Caretta caretta*

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Due to increasing human pressure on marine ecosystems, in recent years there has been a constant rise of the number of sea turtles which require specialized care in qualified rescue centres. Depending on both pathology and trauma suffered, time spent at the centre ranges from few days to several months. The prolonged captivity may affect the natural growth of animals due to the alteration of environmental parameters such as temperature, photoperiod, space availability, and food routine. Although loggerhead turtles' growth rates in captivity have been already studied, sample sizes are usually limited and authors have rarely taken into consideration how morphometric relationships vary during long rehabilitation periods or how size affects growth rates. In this study, we monitored the growth of 51 specimens of *Caretta caretta*, ranging in size from 8.6 cm to 63.9 cm, maintained for rehabilitation at the rescue centre of the Stazione Zoologica Anton Dohrn. All the individuals were evaluated in good condition by the veterinary at the arrival to the centre and were let to acclimatize to captivity for one month before starting the experimental period. Feeding and cleaning routine followed those commonly adopted by the rescue centre. Eight morphological parameters were measured at the beginning of the observation period and after an interval ranging from 6 to 7 months (standard curved carapace length, CCLst ; curved carapace width, CCW; curved plastron length, CPL; minimum straightline carapace length, SCLmin; straightline carapace width, SCW; maximum straigthline head length, HLmax; straighline head width, HW; body mass, Mb). Absolute growth rate (AGR), specific growth rate (SGR), and initial and final body index condition (IC) were calculated using the following equation: $AGR=Wt-W_0/t$; $SGR=Ln\ (Wt) - Ln\ (W_0)/t)$, where t = time elapsed between measurement, W_0 = measurement at the beginning of the interval and Wt = measurement at the end of the interval. $IC = W/CCLst^3$; Changes in body proportions were evaluated by comparing the allometric relationship between different morphometric parameters at the beginning and at the end of the study period using the equation y= bxa and estimating the coefficients a and b by non linear regression using a two- parameters power function. Changes in IC were evaluated by a paired t- test. No significant morphometric variations were found except for a slight increase in weight (t- value = -2.93; p – value = 0.005) due to the low level of activity of the turtles during the observation period. Absolute growth rates for the CCL exhibited similar trends to those reported in the literature for sea turtles. After a rapid drop between 10 and 30 cm of CCL, in which it decreased from 19 cm/year to 4 cm/year, the AGR cm/year increased again to reach a secondary peak around 50 cm of CCL. A hyperbolic decrease of specific growth rate in weight with respect to CCL was detected which highlighted the importance of the genetic growth program of this species which maximizes the growth in the first few years of life to reduce risk of predation.

Genetic characterization of the loggerhead turtle foraging population in the Gulf of Gabès (South Tunisia)

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Both Atlantic and Mediterranean loggerhead turtles feed and develop in the Mediterranean Sea. The Gulf of Gabès is one of the most extensively utilized neritic habitats in this basin. Large numbers of juvenile and adult loggerhead turtles concentrate on this vast shallow and sandy area, attracted by the abundance of food. In this study we determined the rookery origins of loggerhead turtles frequenting the Gulf of Gabès using a Bayesian mixed stock analysis program. We sequenced a 380 bp fragment of the mitochondrial DNA control region of 116 stranded and incidentally caught turtles over six years. We compared our sequences to those published for key nesting populations in the Atlantic and Mediterranean regions. Most of the individuals were juveniles and sub-adults (29.5 cm < CCL < 84 cm; mean CCL = 58.91 ± 10.98 cm). Six haplotypes previously reported from the Mediterranean were found: CC-A2, CC-A3, CC-A6, CC-A10, CC-A26 and CC-A28. Genetic diversity of the studied foraging population was among the smallest in the Mediterranean Sea. Bayesian analysis showed a high presence of Mediterranean loggerhead turtles which supports the importance of the Gulf of Gabès for the survival of local populations. The absence of Atlantic endemic haplotypes is probably related to the geomorphology of the studied area and to the sea surface currents which may help in maintaining Atlantic juveniles far from the Tunisian coasts. Since the Gulf of Gabès is one of the most exploited shallow habitats in the Mediterranean Sea with thousands of loggerhead turtles incidentally captured each year, specific management plans must be rapidly implemented to preserve the vulnerable Mediterranean population.

Preliminary data on genetic characterization of loggerhead turtles, *Caretta caretta*, in the Sardinian sea

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The loggerhead turtle, *Caretta caretta*, is a common inhabitant of the Sardinian waters, especially during the warmer months. Due to serious tourism exploitation, the presence of humans along the coast has drastically increased, exposing loggerhead turtles to higher risks of interaction with human activities. Sardinia is located at the centre of the western Mediterranean sea, which has proved to be visited by both Atlantic and Mediterranean juveniles. However, the proportion of turtles belonging to these different reproductive stocks was found to vary among different foraging areas as a consequence of sea surface currents, in proximity to nesting beaches, and the size class composition of the foraging aggregation. Here we are providing the preliminary outcomes of a still ongoing genetic survey on loggerhead turtles in Sardinian waters, with the aim to guarantee a better comprehension of the existing mixing patterns between local and Atlantic individuals in the western Mediterranean sea. These data will definitely permit an easier assessment of how human activity affects the smaller and vulnerable Mediterranean sea turtle population by increasing their mortality rate. Blood samples were taken from 26 accidentally caught or stranded individuals. Total genomic DNA was isolated by standard phenol–chloroform extraction and mtDNA control region sequences were amplified via polymerase chain reaction using primers TCR5 and TCR6. Products were sequenced in both directions. Control region sequences of 380 bp were aligned with published loggerhead mtDNA haplotypes and compared with haplotypes in the online haplotype registry, which is maintained by the Archie Carr Centre for Sea Turtle Research. Genetic differentiation between Sardinia and other Mediterranean loggerhead turtle foraging aggregations was verified with the exact test of population differentiation, computed with 100,000 steps in the Marcov Chain and 10,000 dememorisation steps, and with pairwise Φ_{st}, computed with 10,000 random permutations. Analysis of molecular variance (AMOVA) was performed to test the genetic structure among foraging populations in the Mediterranean sea and adjoin regions. The Tamura-Nei model of nucleotide substitutions, which was designed to monitor region sequences, was used in any test requiring sequence divergence estimates. Five distinct haplotypes were observed. The vast majority of individuals were classified as haplotype CC-A2 (73% relative frequency), as the most common mtDNA sequence found in the Atlantic and Mediterranean regions. A percentage of 11.5 individuals were carrying haplotype CC-A1, which is a sequence reported exclusively from the Atlantic rookeries, while 8% of them were classified as CC-A3, which is also shared between the Atlantic and Mediterranean rookeries. It was finally observed that two individuals were displaying, respectively, haplotypes CC-A6 and CC-A32, known to be reported only from the Greek nesting population. The AMOVA outcomes highlighted a significant genetic structure among loggerhead turtle foraging aggregations (F_{st}=0.207, p-value<0.01). Pairwise comparisons suggested that Sardinia is in an intermediate position between Mediterranean neritic and oceanic habitats. Given its geographical position, Sardinia hosts a proportion of Atlantic origin juveniles, which is higher than the one observed within the adjoining Italian neritic habitats. This could better explain the above mentioned argument. Further samples are under examination in order to apply mixed stock analysis programme.

Density and allometric relationships in humerus bones of loggerhead turtles

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Marine turtle evolution has prompted specific adaptations for a fully aquatic life. Structural modifications of the body include a reduction and re-shaping of the shell into a more streamlined profile, and the substantial transformation of the limbs into powerful paddlelike fore flippers and semi-rigid rudders as hind flippers. Specifically, the humerus bone of marine turtles was reorganized for aquatic flight and is flattened in cross section as well as in the proximodistal plane. Because growth marks are most evident in long bones and the relative easy extractability, humerus bones have been used in skeletochronological studies for age determination. The latter is an important step in defining the life history traits of marine turtle individuals and populations. However, skeletochronology is carried out on dead specimens and up to today there is no alternative method available that provides a noninvasive age estimate. The present results are part of a study aiming at defining a reliable age estimator via bone density. For this, humerus bones were extracted during necropsies of 74 loggerhead turtles that were found stranded dead on south Italian coasts between June 2009 and December 2010. Average curved carapace length (CCL) of turtles was 52.3 cm (min-max: 7 – 89 cm), but humeri of turtles < 11 cm (n = 6) were too small to be included in the density measurements and were thus excluded. Bones were cleaned from tissues, boiled and dried in air for storage. A series of 12 straight-line distance measurements was recorded from each humerus to determine allometric relationships in long bone growth which resulted isometric for all combinations of length parameters as well as in relation to CCL. This implies that humerus length is a good estimator for turtle size. Bone density was first determined using the Archimedes Principle with wet weights measured on an electronic balance [using the equation: $d = (A/A - B) \times P$, where A = humerus wet weight in air, B = humerus wet weight in water, A – B = weight of volume of water displaced by bone, P = density of distilled water of known temperature.] Bone density increased significantly with CCL ($r^2 = 41\%$, $F = 45.73$, $p < 0.001$). One-, 3-, 5-, and 10-mm cross sections of the humerus diaphysis were scanned with computed tomography (CT). Measured radiodensities in Hounsfield (HU) for all thickness categories were regressed with whole humerus densities, resulting in significant differences between the residual values of the various thicknesses ($F = 7.44$, $p < 0.001$) with the lowest residuals for 5-mm sections. As a final result, 74% of the variation in HU of 5-mm sections was explained by humerus densities ($F = 166.57$, $p < 0.001$) and 42% depended on the CCL ($F = 42.48$, $p < 0.001$). These relationships indicate that bone density increases with age and that it may be possible to derive age estimates from CT scans also on living individuals. A future examination of the same humerus bones using traditional skeletochronological techniques will be carried out to confirm the age-bone density relationship.

The sex ratio of juvenile loggerhead turtles from the Tyrrhenian Sea

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In the loggerhead turtle, temperatures experienced by developing embryos during the middle third of incubation determine offspring sex (temperature-dependent sex determination, TSD). This may result in 'extraordinary natal sex ratios' that differ significantly from a balanced sex ratio (1:1) predicted by Fisher's theory for sexually reproducing species. Over time, hatchling sex ratio varies according to naturally occurring environmental temperature fluctuations and estimates of gender proportion obtained from short-term assessments on single nesting beaches (e.g., over < I generation) may be misleading when considering the global population. Therefore it is important to investigate sex ratio also in juvenile and adult loggerhead turtle aggregations which are usually mixed stocks composed by individuals from several reproductive units belonging to different year cohorts. This information is indeed vital to develop hypotheses concerning population viability.

Here we determined sex ratio of the juvenile loggerhead turtle aggregation which utilize the central Tyrrhenian sea. Previous studies have shown that this area is frequented almost exclusively by individuals from Mediterranean nesting rookeries. 249 dead turtles, collected between 2000 and 2010, were sexed by direct examination of gonads. No association between year and sex ratio was observed (Chi-sq=4,478; df=9; p-value>0,05) and all individuals were pooled together for further analysis. The overall sex ratio was 1,4:1 (F:M), significantly different from an even sex ratio (Chi-sq=6,4257; df=1; p-value<0,05 after Yates correction). In order to assess possible age/size-dependent sex ratios two analysis were performed. First the sample was subdivided into 50 mm size classes of curved carapace length and tested for association of these categories with sex ratio; in the second sex ratio of each class was tested with the chis-quare test of equal proportion. In both cases there was not a significant association between age/size and sex ratio. Although tests results were not significant (Chi-Sq=6,124; df=9; p-value>0,05), inspection of the Chi-sq values showed that some categories contributed disproportionately to the overall Chi-sq value. Therefore we run again the analysis dividing the sample only into three arbitraries size classes: CCL<55 cm, 55 cm<CCL<75 cm, CCL>75 cm. Sex ratios were not significantly different (Chi-Sq=5,765; df=2; p-value=0,056). But applying Chi-square test of equal proportion with Yates correction it results that smaller size classes exhibited an even sex ratio (Chi-sq=0,32; df=1; p-value>0,05), while there was a bias towards females at the middle size class (sex ratio 1,74:1, Chi-sq=10,277027; df=1; p-value<0,01). Overall sex ratio of juveniles frequenting the Tyrrhenian sea was comparable to those reported from other Mediterranean foraging grounds but significantly less female-biased than estimated hatchlings sex ratio from major local nesting beaches. It has been suggested that male-biased immigration of Atlantic individuals may produce the observed scenario but results of genetic studies and the recent finding of a female skewed sex ratio of pelagic juvenile loggerheads in the Macaronesian waters, the most probable source population of Atlantic immigrants, cast serious doubts on it.

Our data demonstrate that there is a significant discrepancy between estimated hatchlings sex ratios and those observed in juvenile and adult aggregations and that it would be of the utmost importance to continue a comprehensive and long-term monitoring assessment of sex ratios on different size/age classes in order to ensure accuracy of population models.

Sea turtles in northern Albania: Key results of a three-year research project (2008-2010)

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During MEDASSET's three-year study (2008-2010) at Drini Bay, 407 sea turtles were recorded as fisheries bycatch (402 *Caretta caretta*, 5 *Chelonia mydas*) proving that the area is an important foraging ground in Albania. The majority (99%) were captured in two 'stavnike' fish-traps (fixed-location pound-nets). Turtles were allocated into size-classes based on their curved-carapace-length (Mean CCL=64.5 cm; SD=9.2 cm; range 30.0-84.5 cm). An unusually-high proportion (27%) of male turtles was recorded: adults (n=35); adolescents (n=77). Comparison of CCL size-class ranges showed a 12.5cm overlap between the smallest adult (CCL=68.5 cm) and the largest adolescent (CCL=81.0 cm); it is not known how many years of growth this represents. Three tail-measurements were used; with highly-significant differences for each when adults and adolescents were compared. By cross-referring size-class and tail data from the more-easily-recognisable males, short-tailed turtles were assumed to be female and categorised as: adult (CCL>70.0 cm); adolescent (CCL=60-70 cm). This enabled another 160 turtles to be classified (adult=53; adolescent=107); laparoscopy was unavailable. One disadvantage was that the sex of the smallest size-classes remained unclear; these could be juveniles of either sex. Drini Bay is thus used as a developmental habitat: 69% of the captured turtles are not yet mature (77 adolescent males, 107 'assumed adolescent' females and 98 uncategorised smaller animals). Inter-annual recaptures showed that turtles were at Drini in more than one year and also enabled incremental growth-rates to be calculated; these provided limited insight into the possible duration of adolescence and size at maturity. CCL growth-rates for 26 loggerheads ranged between 0.0-4.9 cm/yr (Mean=1.7; SD=1.4). Turtles migrating between the Ionian and Adriatic Seas will pass through either Albanian or Italian waters and may perhaps enter Drini Bay; however, none of the recaptured turtles had been tagged elsewhere (e.g. Greece or Croatia); and only one Albanian tag has been reported internationally (Libya 2010). Migrating green turtles (n=5) were captured occasionally in the area; including two adolescent male Chelonia mydas in 2010; these are new records for this life-stage in the Adriatic Sea; thus extending the known range for this species. Three loggerheads (two males and one female) were released with satellite-transmitters in order to monitor overwintering strategies during September 2009- September 2011; and samples were collected from 43 turtles (40 loggerheads; 3 greens) for DNA analysis in collaboration with Adnan Menderes University, Turkey. These findings may provide a better understanding of the life cycle and marine movements for turtles in the Mediterranean Sea and offer the basis for more comprehensive legislative measures to be enacted in the region, particularly for the protection of sea turtle migratory corridors.

Episkopi Bay, Southern Cyprus: increased number of strandings of dead *Chelonia mydas* reveal an important foraging ground for green turtles in the Mediterranean

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Episkopi Bay is on the South coast of Cyprus in the British SBA. It has a beach length of approximately 11km and it is a minor nesting area for *Chelonia* mydas and *Caretta caretta*. The annual average number of nests is 13. The bay also borders Akrotiri nesting beaches which are approximately 6km long and have an annual nesting level of 35-50 nests. The ratio of nesting C. mydas to C. caretta across both areas is approximately 1 to10.

Prior to 2008 SBA authorities made the following assumptions. Firstly, that turtle presence within the bay was limited to mating and nesting seasons and consisted largely of *C.caretta*. Secondly, that the number of turtles off Episkopi beaches at any time of year was negligible.

From 2008 onwards a number of specific factors caused us to question these assumptions. Firstly, there was a dramatic increase in the number of strandings of dead turtles and in particular of fresh strandings at Episkopi. Prior to 2008 the highest number recorded was six in 2007. In 2008 we recorded 21, rising to 26 in 2009 and, to 33 in 2010. Current flows in the area meant that the bodies could not have drifted from Akrotiri. Secondly, from July 2008 onwards the majority of strandings were juvenile *C.mydas*. Ten were recorded in 2008 rising to 20 in 2009 and to 21 in 2010. Clearly these were not part of a predominantly *C.caretta* nesting population. Finally, in 2009 necropsies performed on 11 of the strandings showed that all died as a result of fishing interaction and that at least 7 must have died locally.

Concerned by the stranding levels we decided that it was important to test the null hypothesis that there is no turtle population off Episkopi beaches. We wished to establish whether a local population existed which might merit special protection measures. To test the hypothesis we have conducted a one year population survey incorporating 16 low level aerial surveys along Akrotiri and Episkopi coastlines (approximate sea coverage 105km2). This has been supplemented by boat surveys and sighting forms distributed at beach outlets.

Flight data collected to date showed a mean surface count of 54. The range was from 27 to 115 with a standard deviation of 22.5. Turtles were mainly spotted in the Episkopi area. Boat surveys revealed main gathering areas above belts of cymodocea nodosa in 3-14m depth during summer months. The gatherings shifted west during the winter period and appeared to be predominantly *C.mydas* adults and juveniles. Survey forms completed during the period May to August reported average monthly sightings of approximately 40 turtles 100m to 1km offshore in water depth of 3-15m. Species identification was unreliable but sightings included a mix of juvenile and adult turtles.

Preliminary findings suggest that there is a year round turtle population off Episkopi and in particular, that it may be an important foraging area for *C.mydas*.

Genetic characterization of loggerhead turtle (*Caretta caretta*) stocks around Italy and Malta by using mitochondrial and nuclear markers

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We describe here the genetic composition of loggerhead aggregates in Italian and Maltese waters, by means of both maternal and biparental markers. Samples were collected from all the Italian and Maltese marine areas (Tyrrhenian, Ionian, North and South Adriatic, Central Mediterranean waters around Lampedusa and Malta). Tissues from a total of 268 individuals of *C.caretta* were collected both from stranded and bycaught animals (years 2001 to 2009), thanks to the collaboration with fishermen, public research institutions and sea turtle rescue centres. A short (380 bp) and a long (815bp) fragments of the mtDNA D-loop were sequenced. Measures of intra- and inter-population diversity were obtained using short sequences, for which a comparison with published data is possible. A new short haplotype and six new long haplotypes were identified. The analysis of longer fragments revealed new variants of the most common Mediterranean and Atlantic haplotypes (CC-A2 and CC-A1, respectively). When mitochondrial haplotype composition of our six groups was compared by the Analysis of Molecular Variance, no significant difference was found in pairwise comparisons (st always < 0.018). The higher gene diversity among our groups was found in the North-Adriatic (0.385). Overall, these values are in line with those previously reported for Italy and for the Central Mediterranean, and were lower than those of Western Mediterranean stocks. The same six dinucleotide microsatellites (Cc7, Cc141, Cm72, Cm84, Ccar176, Cc117) used to characterize Mediterranean nesting colonies were chosen as biparental markers. Moreover, a standardization of microsatellite alleles was undertaken to allow a precise comparison among groups. Our results are coherent with a high male-mediated gene flow in the Mediterranean, although further investigation on this aspect is needed. We can conclude that coastal waters around the Italian peninsula and Malta are mainly inhabited by individuals of Mediterranean origin, with sporadic entries also from the Atlantic.

An hotspot of mitochondrial genetic diversity among juvenile loggerhead turtles (*Caretta caretta*) aggregating offshore the southern coast of the Ionian Calabria (Italy)

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In the Mediterranean the annual number of sea turtle bycatch in pelagic longlines has been estimated to be above 57,000 and the Ionian Sea represents one of the fishing grounds with the highest risk of capture, with more than 4,000 turtle bycatches per year. In particular, off the southern coast of the Ionian Calabria (Italy) the accidental catch of 500 loggerhead turtles each year can be ascribed to the artisanal pelagic longline fleet. This fishing ground is located off the most important nesting site for *Caretta caretta* in Italy, for which a genetic uniqueness in the Mediterranean matrilinear framework was identified by a recent study. As in these waters adult reproductive females cohabit with small and large juveniles, there is an urgent need to identify the origin of the turtles impacted by longline fishery, in order to know which loggerhead populations are mostly affected by this activity. The presence at sea of specimens from the Calabrian colony and from other endangered Mediterranean rookeries could greatly increase the strategic importance of this area for the species conservation. Biopsies from loggerhead turtles were sampled during surveys (n=13) on board a commercial fishing vessel using pelagic longline during June-August 2010. Longline sets were deployed from 37º43' to 37º53' N and 16º02' to 16º32' E. A total of 23 biopsies were collected, 22 from turtles bycaught and one from a turtle sighted. All samples corresponded to juvenile turtles with a mean of 40.1 (± 11.71 SD) cm of curve carapace length notch to tip (CCLn-t). Genetic analysis of these individuals was carried out by sequencing 815 bp of the mitochondrial Control Region. Six different haplotypes were identified, one of which was never recorded before, and two are new extensions of known short haplotypes. The most frequent haplotype (CC-A2.1; 78%) is also the most common in the Mediterranean and among females nesting in the Calabrian colony (58%). Three haplotypes identify the likely origin of their carriers in the N-Atlantic (CC-A1.1) and Greece (CC-A6.1 and CC-A32.1), due to their geographical specificity. The provenance of another haplotype (CC-A3.1) is controversial, as it is shared by both Turkish and Atlantic nesting colonies. Haplotype diversity (0.395) is among the highest recorded so far for Mediterranean foraging stocks. In particular, only in western-Mediterranean stocks higher values were observed, due to the heavy income of Atlantic turtles, whereas foraging aggregates around Italy and eastern-Mediterranean countries host lower matrilinear diversities. Our results prompt to consider South-Ionian waters in front of Calabria an important foraging area for juvenile loggerhead turtles from Mediterranean rookeries, with sporadic presences also of specimens from the Atlantic. Moreover, it is to be considered that hatchlings and juveniles born in the endangered Calabrian colony probably exploit this area in an early stage of their development. Even if we have not found the specific Calabrian haplotype CC-A20.1, we cannot exclude that some of the individuals with haplotype CC-A2.1 came from the Calabrian rookery. Management actions addressed at the regulation of fishing activities in this area are thus necessary and urgent.

Morphology VS genetics: the hybrid origin of a sea turtle disproved by the DNA

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Inter-specific hybridization in sea turtles has been reported in the Atlantic but never documented in the Mediterranean. On August 2003 a young sea turtle was found stranded in Torre Faro (Messina), Sicily. It was in good general health conditions, showing some behavioural alterations that could be related to long captivity. Additionally, morphology and lepidosis, as well as measurements and coloration, showed different features in respect to typical loggerhead turtles (*Caretta caretta*). In order to assess whether the turtle could be the result of inter-specific hybridization, a double step procedure was carried out, which included morphometric evaluation and genetic typing. All morphometric traits were recorded and measurements were compared with standard values for sea turtles. Among the discrepancies observed, the main source of variation occurred in shape and coloration of the head, in beak profile (which resembled that of *Eretmochelys imbricata*) and in the anterior flips (which were similar to those of *Chelonia mydas*). Moreover, prefrontal scutes number could not be ascribed to any of the sea turtle species. Consequently, we speculated that it might be a hybrid between *C. caretta* and *E. imbricata* or *C. mydas*. We typed the turtle with species-specific DNA markers. In order to assess the maternal component, an 815 bp fragment of the mitochondrial DNA Control Region was sequenced with primers currently reported in the literature. Successively, three biparentally-inherited nuclear loci (Cmos, BDNF and R35) were analyzed to determine both the male and female component. These loci can be amplified with universal primers for marine turtles, and contain variable positions that specifically identify *C. caretta*, *C. mydas* and *E. imbricata* (i.e. the putative parents). The mitochondrial sequence was unequivocally from the loggerhead turtle C. caretta, and matched the most common Mediterranean haplotype CC-A2.1. Sequence profiles at the three nuclear loci revealed a biparental contribution from a single species, with no overlapping peaks in the discriminating nucleotide positions (i.e. those which distinguish loggerhead turtles from the other sea turtle species). Multispecies alignments at all loci confirmed that this individual is a *C. caretta*. We can thus exclude that this individual is a hybrid between two sea turtle species. Probably, the specimen is a loggerhead turtle born in a Mediterranean rookery, with morphological traits never recorded before for this species. This study highlights the importance of integrating different methodological approaches to understand reproductive animal biology. In particular, genetics is a valid tool in the identification of hybrids, and is capable to prove/disprove hypotheses based on morphology.

First record of a *Lepidochelys kempii* in the Adriatic Sea

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The Kemp's Ridley sea turtle, *Lepidochelys kempii*, lives in tropical and subtropical waters, in the western Atlantic Ocean. This species is considered as one of the most threatened sea turtles worldwide. In the Mediterranean Sea, on the contrary, *Lepidochelys kempii* occurs only sporadically. Before 2000, only one record, namely a specimen captured off Malta in 1929, was known while recently 4 specimens have been recorded in the Mediterranean basin: in France and Spain (2001), in Spain (2006) and in Italy (2009). No record exists for the Adriatic Sea. On 24 March 2010 a Kemp's Ridley sea turtle was caught alive by a bottom trawl net off Bellaria, in the Northwestern Adriatic Sea. This specimen measured 33 cm of Carapace Curved Length (31,5 cm SCL; 31,0 cm SCW) and it was hospitalised in the Sea Turtle Rescue Centre of the Fondazione Cetacea. Unfortunately the animal died after about 60 days. Necropsy showed muscle lesions characterised by pale yellow plaques "like diphtheroids" and small nodular heart lesions.

Analysis of stomach contents of loggerhead turtles stranded along the northwest coast of Morocco to determine foraging habitats

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The stomach contents of 20 loggerheads (CCL or Curved carapace length range = 33.8-80.6 cm) stranded along the coast of NW Morocco between 2002 and 2007 were analyzed. In particular, 2 adults (CCL>70 cm), 10 subadults (50 cm<CCL<70 cm) and 8 juveniles (CCL<50 cm) were examined. We believe that adults have CCL>70 cm because the sex is evident from this size. Subadults have CCL between 50 cm and 70 cm and juveniles have CCL<50 cm. Analyses of prey composition ingested by these loggerheads showed that the prey belonged primarily to three groups: crustaceans, mollusks and fish. The Henslow's swimming crab, Polybius henslowii, was the most common prey species in the loggerheads sampled (16 individuals). Pelagic fish consumed by the loggerheads could have been discarded from fishing boats suggesting that fishing activity, nutrition, and incidental mortality are correlated. Furthermore, detailed stomach content analyses have reported the following results: juvenile loggerheads used the pelagic habitat consuming pelagic fish and crustaceans; adults used the benthic habitat consuming benthic crustaceans and mollusks; sub-adults used both habitats in their transition phase consuming pelagic fish and benthic crustaceans.

Loggerhead turtles (*Caretta caretta*) foraging at Drini Bay in northern Albania: genetic characterization revealed two new haplotypes

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Sea turtles foraging in a nearshore habitat at Drini Bay, Northern Albania, were studied over three summers (2008-2010) by MEDASSET (Mediterranean Association to Save the Sea Turtles). The majority (99%) of turtles were incidentally captured in 'stavnike' fish-traps (a type of pound-net), and subsequently were measured and tagged. Furthermore, genetic sampling of selected individual turtles was undertaken in 2009-2010. DNA samples were collected from 40 loggerhead turtles. A total of 860 bp of mtDNA D-loop region were amplified with known protocols. The size of the mean curve carapace length of the turtles was 68.8 cm (SD = ± 10.3 cm; range = 32.0-84.5 cm; n = 40). Haplotype CC-A2.1 (93%) was the dominant haplotype in the region there was also a record of haplotype CC-A.2.8. Furthermore, 2 novel haplotypes were described (CC-A6.1 and CC-A10.4) Haplotype and nucleotide diversity were 0.14615 and 0.00017 respectively.

The first report on epizoic algae of loggerhead sea turtles, *Caretta caretta*, in the Gulf of Gabes-Tunisia

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Within the marine environment, any submerged surface is susceptible to be colonized by a variety of algae spores and larvae, which circulate in the water column. Organisms growing on the surface of a living creature may compose a complex assemblage known as a fouling community or epibionts. Sometimes the *Caretta caretta* species (Linnaeus, 1758) can turn into an 'ecosystem' itself because of the very rich fauna and flora that it supports as epizoic organisms. As far as we know, this is the first study on seaweeds growing on *C. caretta* to be carried out in the Southern Mediterranean Sea. This investigation provides a detailed list of 11 epizoic algae which have been found stranded or accidentally caught from the Southern Tunisia, on 31 loggerhead turtles (n = 25 and n = 6, respectively). Among these epibionts, the red algae *Polysiphonia carettia* was recorded only in the Blear Sea and frequently in the Gulf of Gabes showing eventually migration of turtles between the Atlantic Ocean and the Mediterranean sea.

Demographic composition of the Tunisian loggerhead foraging aggregation: does the analysis of a longer mtDNA segment provide additional information?

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Shallow habitats on the Tunisian continental shelf are amongst the most important foraging grounds for neritic juvenile and adult loggerhead turtles in the Mediterranean sea. Previous studies based on different approaches ranging from satellite telemetry to physical tagging or genetic surveys proved that several Mediterranean nesting units utilize this area but the demographic composition of this foraging aggregation is still not exactly quantified. In particular, genetic analysis have demonstrated that almost exclusively Mediterranean loggerhead turtles forage on Tunisian neritic habitats but because of the very low level of genetic variability they could not resolve what fraction of the individuals in the mixed stock comes from each local population. In this study we tested the utility of expanding the mtDNA segment analyzed particularly in splitting the most common previously described haplotype CC-A2. To this end we sequenced 700 bp of the mtDNA control region from 108 loggerhead turtles stranded or accidentally caught from the Gulf of Gabes (n = 108). The number of haplotypes and the standard diversity indices were obtained from both the long and short mtDNA segment. The analysis of 700 bp fragment allowed the detection of two variants of the most common CC-A2 haplotype, CC.A2.1 and CC-A2.9 occurring at different frequencies (56% and 27% respectively). Both have already been reported from the Mediterranean sea but up to date only CC-A2.1 was found in the Atlantic loggerhead turtle stock. Five individuals carried the Atlantic endemic haplotype CC-A1 which were assigned to two subtypes, CC.A1.1 (n = 3) and CC-A1.3 (n = 2), when using the longer segment. Haplotype diversity increased significantly from 0,3133 ± 0,0561 to 0,6099 ± 0,0395. In contrast nucleotide diversity did not rise at the same extent as already found in other molecular studies on marine turtles which compared the long and short mtDNA sequences. These results confirm that increasing the reading frame augments the numbers of haplotypes found in a loggerhead turtle stock and, more importantly, provide variants to the most common and widely shared. The usefulness of these improvements to resolve the demographic composition of the Tunisian foraging ground will strongly depend on how the different subtypes are distributed amongst the Mediterranean reproductive populations.

First data from a satellite-tracked *Lepidochelys kempii* in the Mediterranean

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Kemp's Ridley Turtle (*Lepidochelys kempii*) lives in tropical and subtropical seas, in the western Atlantic Ocean. Few specimens have been recorded in Mediterranean waters and, among them, one was found stranded in the Italian sea on 19 August 2009. It was found in Capo Peloro Messina (Italy) (38°16'00"N 15°39'08"E) by the local coastguards (Insacco & Spadola, 2010). The turtle was transferred to the Regional Wildlife Recovery and Sea Turtles Centre of the Wildlife Fund of Sicily, in Comiso (Ragusa), for appropriate treatment. Following a short rehabilitation and feeding phase, the turtle started to perform healthy conditions. It was then agreed to release the animal back to the sea and track its movements in order to support the theory according to which Kemp's Ridley species are present in the Mediterranean not only occasionally. Thanks to the Anton Dohrn Zoological Station of Naples, a Telonics TAM-4310 ARGOS transmitter was attached to the carapace of the turtle in the evening prior to its release. After the carapace cleaning and sandpapering, the transmitter was glued onto the scutes by applying a thin layer of Pure 2K epoxy (Powers Fasteners) and then secured laterally using HoldFast® epoxy putty (Aquarium Systems Inc.). Once the epoxy was dried, a final layer of Pure 2K epoxy was applied covering most of the parts of the transmitter as well as the first two central and costal scutes. The Kemp's Ridley turtle was released on 9 October 2010 and tracked for a period of 186 days, during which it travelled for 619 km. About 703 valid sites were reached, 47% of which in good quality (ARGOS location classes 1-3). Transmitter signals ended on 13 April 2011, probably due to low battery power. During all the time the turtle remained in the Ionian sea, spending 43 days in the Italian territorial waters and 15 days in Maltese waters and then moving eastwards, spending 126 days in Greek waters. It has been observed that the turtle had often travelled on a circular route, as if transported by eddies, or it remained in certain areas on purpose. The above mentioned information, which refers for the first time to this species in Mediterranean waters, proves that the Kemp's Ridley species could be able to pursue feeding and connection routes in our sea.

BREEDING BIOLOGY AND MOVEMENTS
POSTER PRESENTATIONS

Nesting activity and site fidelity of loggerhead turtles on Linosa island, in the Pelagian Archipelago (Italy)

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In this study we have observed and recorded the loggerhead females nesting activity and site fidelity on the black sandy pocket beach of Pozzolana di Ponente (about 100 meters), Linosa Island, in 2004 and 2010 seasons. A night beach monitoring was conducted every day, from June to mid-August, from 21.00 pm to 6.00 am, together with a discontinuous daylight monitoring activity. In particular, night nesting females were observed by using a night visor in order not to disturb the turtles. Each one of them has been identified with a metallic tag and new females were tagged for the first time when occurred. For each one of them, data on size (TCCL-CCW), false crawls, number of nests, clutch size interesting period, and remigration interval were collected. Any data on females, including tissue samples, was taken after eggs laying, not to interfere with the regular nesting activity. Four nesting females were recorded within seven seasons. Two of them have returned to nest with a regular remigration interval during the whole period. One of them, which is considered as the “oldest” female nesting on Pozzolana di Ponente, was tagged and recorded for the first time in 1996.

Sicily 2010 nest season: bad weather and good news

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The southern coast of Sicily is rarely choosen by loggerhead turtles for nesting. The "Centro Regionale Recupero Fauna Selvatica e Tartarughe Marine of Sicily Wildlife Fund in Comiso (Ragusa)" is in charge of sea turtles problems in Southern Sicily and making a conservation effort in the case of nesting along the coasts of the Island. Here we describe the nests recorded in 2010, the problematic weather and the success of the protection measures. The first date with a nesting female was 31st of July in S. Lorenzo, Marina di Noto (SR). At 22,30 a female of 98 cm CCL was found covering up a nest which contained 70 eggs. The nest was protected and surveyed until 15 October. At this date, after a long time of heavy rains and cold weather the nest was opened ensuring that all the embryos had died. The 1st August in Micenci close to Donnalucata (RG) a female emerged from the sea at 22,30 but was disturbed by numerous curious people, and thus returned to the sea. On the 14th August, again in Marina di Noto (SR) a nest was found at 4.00 in the morning just 12 m from the water and in peril to be inundated. Hence at 19.00, when nest temperature was equal to external one, 87 eggs were move close to a new nest site following an international translocation protocol. Also this nest was opened on the 15 October containing only dead embryos. The 5th of September in Contrada Picci in Avola (SR) the centre was called at 10.30 to intervene on a hatching nest. 16 hatchlings were found at the seashore too exhausted for the rough sea conditions and were hospitalized. Other 3 hatchlings were found in the nest together with 39 unhatched and 50 open eggs. The day after the hatchlings were released in the open sea. We also received a report that in Contrada Rais Gerbi in Finale di Pollina, close to Palermo at the holiday resort Valtur, tourists found a dozen of hatchlings on the 3rd of October, and released them to the sea, as documented by the photos and interviews collected. The nest was located and another 36 live hatchlings were found and helped to reach the sea. In the nest chamber a total of 103 eggs were detected. The cold humid weather that distinguished the late summer of 2010 did not permit a large recruitment from Sicilian nests but the work done served to save at least a small proportion of young loggerheads and to collect more information and materials.

Nesting of loggerhead sea turtle *Caretta caretta* along the Ionian coast of Calabria (Italy): evidence of different incubation duration in different areas

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Incubation duration is defined as the elapsed period (in days) from egg-laying until the emergence of the first hatchlings. Typically, incubation period decreases as incubation temperatures increase. Field studies have shown that several factors influence sand temperature on nesting beaches, including: latitudinal variation, seasonal temperature changes, shading by vegetation, sand colour, depth of the eggs and episodic events such as rainfall. In addition, several studies recorded an increase in temperature attributed to metabolic heat produced by developing embryos of sea turtles. Here we aimed to highlight the differences in incubation periods along the Ionian coast of Calabria (Southern Italy), the most important nesting ground of the loggerhead turtle in Italy. Two different sectors along the study area, about 50 km apart, were considered: i) a southern sector (S), including the main nesting area, and ii) a northern one (N), where magnitude of nesting activity was lower. In both sectors the same monitoring protocol for three nesting seasons (2008-2010) was applied. Only nests laid from mid-June to mid-July were taken into account. Incubation showed a mean duration of 46.6 days for S sector (n = 17 nests), and of 59.0 days for N sector (n = 5). We detected statistically significant difference (non-parametric Mann-Whitney permutation test for independent samples) between the two mean values. Such a result was probably due to differences in beach physical structure and exposure, as well as particle size and sand colour, or local climate. The shorter incubation period in sector S means higher mean of sand temperature and hence may imply unbalanced output in hatchlings sex ratio (more female production). However, other variables (e.g., clutch size, metabolic heating, sand compaction), not yet investigated, may influence the relationship between incubation duration and sex ratio. Therefore, further research is needed to assess the effects of such a difference in incubation duration on hatchlings sex ratio.

Temporal distribution of nests and nesting activity of loggerhead turtle on Dalaman beach: declining of the number of nests

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Any species conservation activity requires a deep understanding of population size, history and behavioural patterns of target species. The loggerhead sea turtle is an endangered species and its population size has been declining around the world. In Dalaman-Sarıgerme beach, which is known as one of the most important loggerhead breeding beaches in Turkey, conservation activities on loggerhead sea turtle populations started in 2002 breeding season and are still ongoing. In this study, nesting activity and distribution on Dalaman-Sarıgerme beach were investigated during 2009-2010 breeding seasons and compared with previous data. An average of 92 nests (ranging from 61 to 113 nests) were recorded during 2002-2008 nesting seasons. A total of 56 and 74 nests were registered in 2009 and 2010 breeding seasons as the lowest data since 2002. Within the examined nests, a number of 4542 and 5556 eggs were found respectively in 2009 and 2010 breeding seasons. According to this survey, 3698 (81.4%) and 3709 (66.8%) hatchings were recorded as successful data showing that the loggerhead population has decreased dramatically according to a damped oscillation in nest numbers. Secondly, we have checked the location of nests on the beach. According to this analysis, nest concentrations occurred mostly between Dalaman River and Taþ Stream. As displayed by data collected in the past nine years, female emergence and nesting activity seem to occur within the same undeveloped sections of the monitored beach. In addition, numbers of nests have been decreasing on Sarıgerme section (Section I and II), which has recently shown a certain level of development. According to these results, there is clear evidence that loggerhead turtles have been choosing undisturbed beach sites for nesting activity.

Internesting movements and postnesting migrations of four loggerheads belonging to the major Italian rookery (Calabria, Southern Italy)

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The Southern coast of Ionian Calabria (Southern Italy) was recently recognized as the most important nesting ground for the loggerhead turtles *Caretta caretta* in Italy, accounting for about 70% of the total nesting events documented nationwide. However, no information is currently available about the at sea movements and migratory behaviour of this population, as well as the location of their feeding grounds. Furthermore, because beach patrolling activity only covers a portion of the potential nesting area, this may lead to an underestimation of the number of nests laid along the entire coastline. To fill these gaps, we relied on satellite tracking to reconstruct both the internesting and the postnesting movements of Calabrian females. The experiments, which constitute the first attempt to track turtles nesting in Italy, were conducted in 2009 and 2010 by equipping with Argos-linked satellite transmitters four females. The two turtles tracked in 2009 (named Zeffiria and Esperia) were monitored only during the postnesting migration, while the two 2010 turtles (Lacinia and Kalabria) were also followed during their last inter-nesting period. This made it possible to localize the last nests of the season of these two individuals, which were laid 4.25 km (Lacinia) and 0.60 km (Kalabria) away from the previous one. During the internesting period, both turtles did not remain in the waters close to the nesting beaches but performed long-distance movements in the oceanic areas south of the nesting beaches, moving for a maximum distance of 100 (Lacinia) and 160 km (Kalabria). Both turtles returned to the nesting area with a looping route. Three of the four tracked turtles migrated towards the continental shelf along the coast of Tunisia, where the two turtles monitored in 2010 have then been localised for several months while residing in spatially-limited foraging areas in the neritic environment. For the 2009 turtle (Esperia), anomalous diving data indicating no submergences were received a few days after its arrival in the waters around Djerba, Tunisia, and this led to hypothesise that it could had been captured by local fishermen. The second 2009 turtle (Zeffiria) remained throughout the tracking period in a large oceanic area offshore Southeastern Sicily, likely following an oceanic foraging strategy.

Satellite tracking reveals: loggerhead turtles nesting in Libya prefer to feed on the Tunisian plateau

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With 1,970 km, Libya's coastline is the longest of any African country bordering the Mediterranean and from recently initiated surveys it appears that Libya may host one of the biggest loggerhead turtle nesting colonies in the region. The adjacent waters are important foraging and overwintering grounds for both green and loggerhead turtles that migrate there after nesting farther to the east. We aimed at elucidating whether the local loggerhead turtles use the Libyan habitats as well or whether they migrate to distant foraging grounds elsewhere. In the summers of 2009 and 2010 five females (A – E) were equipped with ARGOS satellite transmitters after they finished nesting on beaches in the Gulf of Sirte. The females left their nesting area between 6 July and 2 August and moved in a westward direction along parallel routes either close to the coast (n = 3) or slightly offshore (50 km). They took between 11 and 19 days to arrive at the foraging grounds, travelling between 310 and 641 km at an average rate of 36 km/d. The foraging grounds were located on the Tunisian shelf and in the Gulf of Gabés area, and up to the Libyan-Tunisian boarder. For turtles B and D transmissions ceased as soon as they arrived at their apparent destination. This may be attributable to the turtles' death, although other unknown reasons may have caused the transmission failure. The other turtles remained in areas with a maximum radius of 18 km and ranging in seafloor depths mostly between 10 and 50 m and up to 100 m for turtle A. This foraging ground preferred by the Libyan turtles is also frequented by loggerhead turtles nesting in Greece, Israel, Northern Cyprus, Tunisia and Turkey. The occurrence of turtles from various rookeries throughout the Mediterranean not only highlights the importance of the Tunisian plateau as a foraging ground, but also calls for urgent conservation measures to reduce the demonstrated high mortality in fishery's bycatch. Our results indicated the location of potential key zones for fisheries regulations, where more than one turtle stayed within a small area.

An updated overview of the loggerhead sea turtle Caretta caretta nesting activity in Italy: further highlights on the effective monitoring potential value for turtle conservation

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Until 2000 no intensive monitoring on loggerhead sea turtle nesting localisation was conducted in Italy, in spite of several hundred kilometres of coastline potentially suitable as nesting grounds. As a result, nesting activity was believed to be confined almost exclusively to the Pelagian Islands, while being sporadic elsewhere. However, new projects to assess the nesting activity magnitude within some areas of the southern coastline have been carried out in the last 10 years. According to the said analysis, sea turtle nesting in Italy has to be considered as a regular phenomenon rather than just an occasional event. Here is an updated overview of 123 nests, which have been recorded throughout the country in the last six years (2005-2010). Nationally speaking, the southern Ionian coast of Calabria has proved to be the most significant nesting ground in Italy, followed by the Pelagian Islands, as second regular nesting areas, while the central coast of the Ionian sea, as well as the southern coast of Sicily, appear to be irregular grounds. Single nesting records were documented elsewhere in the country, namely along the southern Tyrrhenian coast, in Sardinia, and along the lower Adriatic coast. Annual and intensive monitoring programmes were performed by different research teams only on Pelagian Islands (two pocket beaches) and along the southern Ionian coast of Calabria (a coastline sector of about 36 km). Irregular and/or less intensive surveys were carried out along the following sites: a) the central and the northern Ionian coast (for a total of 102 km patrolled), b) some limited sectors (about 5 km) of the southern Sicilian coast; c) three sectors (on the whole 30 km) of the coastline of Campania (Tyrrhenian sea). As a matter of fact, annual monitoring efforts appear to be still insufficient in some potentially suitable coastal areas (e.g. in Sicily). Accordingly, nearly one third of the nests recorded were accidentally discovered. Therefore, the current figures may still underestimate the actual nesting activity magnitude in the country and threatened nesting sites may be left unprotected.

HABITAT MANAGEMENT AND CONSERVATION MEASURES
POSTER PRESENTATIONS

A successful model for conservation and habitat management in Dalyan beach, Turkey: it was reached the highest number of nests

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Dalyan beach is one of the most important nesting sites of Loggerhead turtles (*Caretta caretta*) in Turkey. Dalyan beach was designated as a Specially Protected Area by the Turkish Ministry of Environment and Forestry in 1988. Nesting activity and conservation actions were performed between 1 May and 30 September 2010. Out of 1005 emergences onto the nesting beach, 354 (35 %) resulted in successful nesting during the 2010 nesting season. Hatching success was calculated as 55.4%. There was a mean incubation period of 53 days (range 46-66) and a mean clutch size of 75.4 eggs (range 14-130). A total of 222 (63%) nests were screened against predation, with the screens being fixed with long metal hooks from the corners for additional safety. Overall, 133 nests were completely predated and 92 nests were partly predated, mainly by foxes. A total of 118 nests, comprising 10496 eggs, that did not have screening were predated. The main predator was red foxes in 216 nests, badgers in 8 nests and ghost crab in one nest. The highest number of nests was observed in the 2010 nesting season, in relation to nest numbers since 1988. In addition, based on conservation actions, the highest number of hatchlings reached the sea in 2010. While the observed predation rate seems to be higher than that documented in the literature, Dalyan beach demonstrates a very good example of coexistence of turtles and tourists.

Factors affecting the temporal distribution and hatching success of loggerhead turtle nests at Dalyan beach, Turkey

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The decline of sea turtle populations is increasingly becoming an international concern. The number of ecological problems has risen around the world. One major issue is nest site selection by sea turtles, which plays a fundamental role in the reproductive success of sea turtles. Nest site characterisation, such as distance to sea, distance to vegetation, nest diameter, and predator risk, have considerable effects on the temporal distribution of nests and their hatching success on beaches. In these respect, we investigated certain ecological variables of nests in relation to nest distribution and the effect on hatching success at Dalyan beach, Turkey, using data from the 2010 nesting season and from some previous years. The data were submitted to a multiple regression analysis at microhabitat scales to investigate the most important explanatory factors influencing hatching success. Consequently, we evaluated and interpreted the results in terms of sea turtle conservation and coastal management programs.

Positive and negative effects of the use of small circle hooks on sea turtle survival off the southern coast of Ionian Calabria (Italy)

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Research on the effects on small circle hooks are still limited, and this lack of data calls for additional studies, as there is evidence that these hooks could reduce the incidence of being swallowed by sea turtles. This appears to be of particular interest since small-scale longline fisheries, which usually employ relatively small J hooks, are often responsible for high sea turtle bycatch rates. Along the southern Ionian coast of Calabria (Italy), 500 bycatch events of loggerhead turtles *Caretta caretta* have been estimated to be caused by artisanal vessels using pelagic longline. For this reason, in 2010 we started the first experimentation on small-sized circle hooks at an artisanal longline fishery operating in this area to test: i) their effectiveness in reducing the incidental captures of loggerhead turtles and other non-target species, and ii) the possible change in the number of turtles hooked in body locations that are associated to higher post-release mortality, and iii) in the direct mortality rates between the two hooks types. Non-offset circle hooks 13/0 were alternated to J-style hooks N. 4 with a 10° offset along each set (n = 13) for a total of 4642 hooks that were directly checked. Catch rate and mean body size of target and non-target species, as well the hooking locations in the turtles caught per fishing set were compared between the J-style and circle hooks. For continuous variables, with normal distribution and equal variances, a one-way ANOVA was made; otherwise a non-parametric Kruskal-Wallis test was performed. In addition, as 26% (n = 6) of the hooked turtles were found dead, analysis of survival was also performed by using a generalised linear mixed model (GLMM), with the size of turtles (CCLn-t, cm) and the soak time (hr) being used as fixed and random factors, respectively. For both J-style and circle hooks the most captured species were loggerhead turtles and bluefin tuna, indicating that endangered species formed the most important part of total catch. No significant difference was found in the mean number of loggerhead turtles caught per fishing set ($p = 0.194$) between the two hook types. On the contrary the number of turtles hooked in body locations that are associated to high post-release mortality was significantly lower with circle hooks ($p = 0.048$). A significant difference was also registered in the mean size of turtles caught with respect to the hooks type (34.4 cm on circle hooks vs. 47.6 cm on J-style hooks) ($p = 0.008$). The GLMM indicated that the probability of surviving an incidental capture in pelagic longline increased significantly with the size of turtles, but that there was also a drastic decrease when soak time exceed 28 hours. In the study area, the soak time has gradually increased over recent years, and the use of small circle hooks could cause an increase in the direct mortality rates of small juvenile turtles, a fact that, at the moment, prevents us from considering the implementation of small circle hooks as an adequate bycatch mitigation strategy.

Teaching and training of new students necessary for scientific research of sea turtles in the future

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Scientific research and publications on sea turtles in Albania before 1995 are scarce, only becoming more numerous after this period. Albania is a small country and, therefore, the discipline of marine biology at universities in the country has been absent. Due to this shortage, since 2002 we have organised numerous visits for university students to interesting areas of the Albanian coast, such as Saranda, Vlora, Divjaka, Durres, Patoku (the most frequented) and Shengjin. During these excursions, numerous talks and lectures are conducted on various issues of marine biology, with a primary focus on the conservation and protection of sea turtles. About one hundred students have annually participated in these organised activities above, with the most interested students being the opportunity to conduct scientific research work within the framework of a Masters diploma. Overall, from 2006 to 2011, 9 masters' degrees have been realised that were led by Prof. Dr. Idriz Haxhiu. These theses have encompassed taxonomic, biological, ecological etc. issues, of Rodoni gulf's sea turtles and problems concerning the pollution the rivers that flow into the area. The quality of the diplomas has been very good. In addition to university students, we have educated school children all of age-groups about the protection and conservation of sea turtles, especially schools located near to Patok.

A preliminary investigation of the biology and status of juvenile *Chelonia mydas* in Lakonikos Bay, southern Peloponnese, Greece

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There is a severe lack of knowledge concerning the small and severely threatened *Chelonia mydas* metapopulation in the Mediterranean, which has received relatively little attention and inadequate protection due to the limited knowledge on local populations. This metapopulation constitutes an independent demographic unit, and due to female natal homing behaviour combined with the predicted extinction of Mediterranean sea turtles, not only would genetic variation of the species be lost, but the Mediterranean would not be recolonised in an ecologically relevant timescale. Especially for the area of Lakonikos Bay in Southern Peloponnese, Greece, very little of such research has been done and published. Because little is known about the Lakonikos population of *Chelonia mydas*, more data must first be collected to adequately protect this endangered species. A long-term study is proposed whereby several aspects of the biology of Lakonikos turtles will be investigated to develop a sound understanding of the correct conservation strategy for the species within this area. During the preliminary stages of the proposed study an attempt to locate and identify foraging populations of green turtles in the Lakonikos Bay area will be made through a systematic survey that will comprise the following elements: Questioning local sources i.e. fishermen; An aerial survey; A boat survey; Direct observation and; On board collection of data from fishing vessels. Collection of biometric data will include basic measurements (CCL, SCL, CCW, SCW, weight etc.), while blood samples will be taken for analysis comparable to the studies done by Labrada-Martagon et al. (2010). Additionally, photo ID, identification and monitoring epibionts and parasites (using processes outlined in Fuller et al. 2010), and a population census will be carried out. In the long-term, further data will be collected to build a better understanding of the status of the Chelonia mydas population in Lakonikos Bay. This includes the following: 1) A satellite telemetry study will facilitate the assessment of the migratory routes of juveniles from the feeding grounds and the location of core foraging habitats within the gulf. This knowledge will constitute the baseline to efficient protection of the marine lifestages. The aim is to attach 3 to 5 satellite tags on captured green turtles. 2) Dive patterns, length of time at what depths, implications for fishing practices. 3) Assess feeding habits, stomach contents. 4) Determine sex ratios of juvenile population in the feeding ground and blood sampling.5) Origins of green turtles from stable isotope analysis and DNA. 6) Identify heavy metals in sea turtles. The proposed study will contribute to a better understanding of relevant aspects about the conservation and biology of *Chelonia mydas* in general, as well as the Mediterranean metapopulation and their feeding grounds. Our study will be one of the first investigations to shed light on at-sea habitats of Mediterranean greens, and constitutes a major step in protecting the animals in these foraging habitats where they spend the majority of time and face enormous threats. The preliminary results of the study will be presented at the 4th Med Conference on Marine Turtles in Naples, Italy.

Fethiye sea turtles in trouble: MEDASSET campaigns for their conservation

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Tourism development and lack of enforcement of conservation measures are threatening Fethiye, a Specially Protected Area under the Barcelona Convention since 1988, and one of the 12 key *Caretta caretta* nesting beaches in Turkey. Since Baran & Kasparek's first assessment in 1988, threats to the nesting population have continuously increased, resulting in serious nesting decline since 1993: snack bars, dense rows of beach furniture, bright lights at night, sand removal, nearshore fishing and water sport activities, unrestricted vehicle access, illegible and damaged information signs and visitors roaming the beaches at night. Eight hundred acacia trees, an introduced species known for its extensive rooting, have been planted along a 150 metre stretch of the nesting beach. Moreover, Turkish Authorities are considering building a shipyard/drydock on one of Fethiye's beaches that would permanently and irrevocably destroy this key nesting area. Based on existing scientific evidence and a threat assessment, MEDASSET launched a campaign for the protection of Fethiye SPA. A short film "Turkey's Sea Turtles in Trouble" was produced in September 2009 showing the lack of protection in Fethiye. The film was made available on the internet and was presented at the 29th Bern Convention Standing Committee Meeting (2009), the 3rd Turkish National Sea Turtle Symposium in Mersin (Dec. 2009) and the 30th International Sea Turtle Symposium in India (April 2010). A complaint and three update reports were submitted to the Bern Convention. The issue was discussed at the Bern Convention Standing Committee Meeting in 2010, during which the Turkish Environmental Protection Agency for Special Areas informed of its plans to implement conservation measures in 2011. Campaign letters were forwarded to the Turkish Authorities, major international tour operators active in Fethiye and local hotels and bars that impact the beaches. Following the campaign, travel group TUI started developing guest and hotel guidelines for sea turtle protection in Turkey in collaboration with MEDASSET. Several recommendations including a list of conservation priorities have been provided by MEDASSET to the Turkish Authorities.

Management strategy for the conservation of sea turtles and their habitats in Albania

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Within its sea turtle conservation project throughout the Mediterranean, MEDASSET carried out research, local capacity building and awareness-raising from 2008 to 2010 through the project "Monitoring and Conservation of Important Sea Turtle Feeding Grounds in the Patok Area of Albania". Albania is a country in transition, a former communist country ruled under dictatorships and a regime of self-isolation for 56 years, which resulted in economic poverty. Its current gross domestic product remains the lowest per inhabitant among the current EU Member States. International aid and limited government and private funding are mainly streamlined towards combating poverty, corruption, lack of infrastructure and pollution, among others. Raising funds for this project was an uphill struggle, until UNEP/MAP, RAC/SPA and GEF/SGP came to the rescue. The challenges and limitations faced during the project led to an assessment of the factors that constrain sea turtle conservation in Albania, e.g.: lack of funding, basic infrastructure, research and rescue facilities, skills and expertise; absence of a culture of volunteerism; little public and stakeholder concern for sea turtles and the environment; the great potential and interest of biology students who participated in the project's training programme. Research confirmed that *Caretta caretta* and *Chelonia mydas* are present in Albanian waters, and that Drini Bay is as an important foraging area, a refuge and part of a key migratory corridor. Key threats were identified through surveys and systematic monitoring. An assessment of the legal and institutional framework was carried out and included: a review of existing legislation; identification of stakeholders at national and regional levels; meetings with relevant officials to record current responsibilities, positions and plans; evaluation of oversight and inspection procedures. All these elements were synthesised into a workable and enforceable protective strategy. Recommendations and a "Management Strategy for the Conservation of Sea Turtles & their Habitats" were drafted and submitted to the Albanian Authorities in 2011, to serve as a roadmap for the development of national sea turtle monitoring and protection. The Strategy is based on four objectives: a. the establishment of sea turtle conservation as a national priority, b. the monitoring of sea turtle populations and habitats, c. the identification and mitigation of threats, d. the identification and legal protection of critical habitats, and e. the creation of a functional network of protected areas. The action plan for the implementation of these objectives includes the establishment of a scientific consultative committee and a national authority responsible for sea turtle conservation; inter-institutional implementation of the strategy; education (at all levels), training and awareness raising; establishment of a Marine Science Institute; long-term monitoring of population trends; creation of an inspection and permit system, a national tagging database and a stranding network; development of veterinary skills on sea turtle care and rehabilitation and establishment of a Rescue Centre; monitoring and reduction of fisheries bycatch; pollution mitigation and waste management, etc.

Status and conservation of the loggerhead sea turtle (*Caretta caretta*) in the shallow waters of the Aeolian Archipelago (Sicily, Italy)

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Few studies have determined the fine-scale distribution of the loggerhead sea turtle (*Caretta caretta*) in the Mediterranean Sea. During its life cycle, this species uses different habitat types in different periods of its biological cycle. Since 2005, a conservation and monitoring project was implemented in the shallow waters around Filicudi Island (Aeolian Archipelago, Sicily, Italy) located in the Tirrenian Sea. Dedicated boat surveys using visual sampling were conducted during the summer periods in a study area of 400 km2. We used the MCP method and the Kernel distribution analysis (50% and 95% UD) to determine the distribution area of sighted individuals (ArcGis 9.2). We investigated the habitat structure selected by the turtles through multiple regression analysis. Most sighted individuals were juveniles and adults (80%), and were located in the shallow waters, particularly in the north-western shore of the island. This area is an optimal feeding and resting ground for the loggerhead sea turtles at these age classes. Most sighted individuals were rescued with injuries, mainly by longlines for tuna and sword fish fishery, and they were transported to the regional rescue centre of Comiso. The curved carapace length (CCL), the weight and the standard dimensions of rescued individuals were measured. Most rescued individuals were also found dead. The cause of death and the location of hooks in dead turtles were also assessed. The stomach contents of rescued and/or dead individuals were also analysed, to determine the diet of the turtles. We also analysed the database of the regional rescue centre of Comiso (Sicily, Italy) to gather information about the number of individuals that were rescued in the Aeolian Archipelago and the percentages of threats to rescued individuals. Fishing activities, marine traffic, increased pollution and the presence of plastic debris represent a serious threat to sea turtles. Data we gathered to underline the strong conservation importance of the Aeolian Archipelago for the conservation of the loggerhead sea turtle in the Mediterranean Sea.

Hatching success of natural vs. relocated nests of the loggerhead sea turtle *Caretta caretta* along the Ionian coast of Calabria, Italy

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Nest relocation is a management technique commonly used in sea turtle conservation programs to increase hatching success. Two different methods are normally used to perform this technique: nests could be relocated to another part of the same beach where they are less exposed to threats (in situ relocation), or nests could be relocated to another beach and placed in a hatchery (hatchery relocation). However, the use of this technique is controversial because it may be detrimental to hatchling success, hatchling fitness, or alter hatchling sex ratio. Therefore in relocated nests, hatching success is expected to be lower than in natural nests. We aimed to compare the hatching success of natural and relocated nests during a conservation project performed along the Ionian coast of Calabria (Southern Italy). Along this coastline (the most important nesting ground of the loggerhead turtle in Italy), 72 nests were laid from 2005 to 2010, 34 of which were relocated (in situ relocation) because of being placed: a) too close to the shoreline (less than 15 m); b) in an unfavourable substrate (i.e. presence of an important clay component which may prevented hatchlings emergence); c) on beaches with severe touristic pressure. Nest relocation was usually conducted at sunset or sunrise, from 12 to 24 hours after laying (in 2 cases 72 h later). Eggs were maintained in their original vertical orientation and position, to ensure the correctly embryo development. Both relocated and not relocated nests were monitored daily throughout their incubation period. Nest content was collected one week after the last emergence and examined to assess hatching success. We did not detect any statistically significant difference (ANOVA) in hatching success in natural vs. relocated nests. Therefore, in our study site, in situ relocation appeared an adequate management technique, as far as hatching success is concerned, to prevent the failure of nests exposed to hazards.

Monitoring of sea turtle nesting in Campania: awareness-raising actions of local communities of Pisciotta and Capaccio (Salerno)

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3. Environmental Education Center "La Primula " Regional Network INFEA

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The project began in 2009 and is still in progress; it is performed with the cooperation of INFEA Environmental Education Center " La Primula" in Pisciotta and "Torre Laura" in Capaccio, two towns of Cilento and Vallo di Diano National Park.

For the success of the project the most important activities carried out by the Environmental Education Centres were those about information and awareness amongst the local communities, promoting in particular initiatives aimed at protecting sea turtles and the coastal ecosystem, through the active participation of childrens, youth, adults and especially fishermen.

At the time we can notice a strengthening of the bond with the territory which has produced a strong awareness of the problem.

THREATS
POSTER PRESENTATIONS

Threats to the Cape Verde loggerhead rookery, the third most important origin for this species in the Mediterranean

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The North East Atlantic loggerhead RMU faces serious conservation threats on its nesting area. These include substantial illegal harvest of eggs and adult females on the beaches, along with the loss of both males and females in the surrounding ocean waters through harvest or incidental capture in fisheries. Furthermore, males are captured due to a belief in their aphrodisiacal powers of their parts. This RMU of the Eastern Atlantic has an extremely reduced nesting area that is only relevant in few kilometres of beaches of the island of Boa Vista, Cape Verde. Extensive monitoring of loggerhead nesting in this island demonstrated a globally significant population for the species. Through an extensive stratified monitoring programme across the island in the seasons 2007-2009, we estimated a total number of clutches of 13955, 12028 and 19950 in the three years, respectively. These levels are much higher than those suggested in previous studies which were more constrained in spatial coverage. Our findings indicate that Cape Verde constitutes the third largest nesting aggregation for this species in the world after the south-eastern USA and Oman. However, more than 80 % of the overall nests are deposited in less than 25 km of beaches with some sites demonstrating particularly high density of nests. This spatial concentration of nests facilitates targeted monitoring and conservation but increases the vulnerability to extinction by local threats or disasters. For example, consumption of sea turtle meat is a traditional practice in Cape Verde that continues despite national sea turtle protection laws. During 2007, it was estimated that about 1200 females were killed or captured around the island of Boa Vista representing around the 36 % of the nesting females per annum. Increasing beach protection and monitoring, ongoing educational programs and cooperative projects with local communities is urgently needed to save the only relevant loggerhead nesting aggregation in the Eastern Atlantic and the third most important source of loggerheads for the Mediterranean Sea. The cooperation on conservation of loggerhead nesting in Cape Verde of developed countries, especially those that are included in the distribution range of this RMU is urgently needed.

Metal and Polycyclic Aromatic Hydrocarbons (PAH) distribution in loggerhead turtles (*Caretta caretta*) tissues

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Since industrialization, high quantities of chemical pollutants have been released into the sea seriously affecting the natural biological equilibrium and the aquatic animals health conditions, with particular reference to long living species including sea turtles, which are likely to accumulate organic and inorganic food, sediments and water contaminants within their tissues. In this study, the level of four types of metal traces, that is (Cadmium (Cd), mercury (Hg), lead (Pb), copper (Cu)) and Polycyclic Aromatic Hydrocarbons (PAH) was measured within the liver, kidney, muscle and heart samples of 5 loggerhead turtles, *Caretta caretta*, found stranded along the north Tunisian coast. Analysis were performed by using the Atomic Absorption Spectrometry for metal traces and the mass chromatography for PAH. According to the above mentioned analysis, muscles generally display the lowest level of metal and PAH concentrations, whereas kidneys and livers contain a greater number of these contaminants. Furthermore, bibliographic data have revealed that loggerhead sea turtles living in other Mediterranean marine areas display similar traces of metal concentrations in their tissues. In particular, it was observed that the kidney has the highest concentration in cadmium, lead and PAH, being the liver and the heart the organs with the highest concentration in copper and mercury, as for the liver uniquely. These preliminary data were obtained by examining the samples collected on Tunisian coasts. Further investigations that take into consideration, at the same time, all the biological and pathological factors, will be necessary in order to better describe the distribution of these pollutants in this endangered species

Activities of Sinis Rescue center in the Sardinian conservation network for marine protected species (marine turtles and marine mammals)

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The Regional Network for the monitoring, treatment and rehabilitation of endangered species (marine turtles and mammals) was instituted in 2005 by "Regione Autonoma della Sardegna". Different international conventions and directives currently deal with the protection of these species. In Sardinia the environment, including Marine Reserves as Marine Protected Areas (MPAs) and National Parks (NP), plays an important role in the field of marine conservation. Conservation and management of marine resources represent a priority both for the national interests and the marine reserve. The establishment of the Regional Network for Marine Wildlife conservation guaranteed a more effective intervention in a lot of situations. The Sardinian Regional Administration, in agreement with the Ministry of Environment (MATTM), decided to involve all the MPAs and the National Parks, which encouraged the project in order to act for the protected stranded species territorial need. The Regional Network is currently composed of the following seven nodes: "Tavolara – Punta Coda Cavallo" MPA, "Capo Carbonara" MPA, "Laguna di Nora" S. Margherita di Pula Municipality, "Penisola del Sinis – Isola di Mal di Ventre" MPA, "Capo Caccia – Isola Piana" MPA, "Arcipelago di la Maddalena" NP, "Isola dell'Asinara" MPA/NP. These areas are all equipped with rescue and rehabilitation and emergency centres. The Regional Network for Conservation represents an important agreement signed by the above mentioned institutions, the vigilance bodies, coastguards (Corpo Forestale e di Vigilanza Ambientale, Direzione Marittima della Capitaneria di Porto) and research institutes. Vigilance bodies are alerted through their emergency free numbers and activate the common procedure. Each reported specimen activates the Regional network to retrieve procedure. Qualified personnel, in collaboration with the vigilance, coordinates the retrieve procedure, which is different as for mammals or turtles, alive or dead. When a marine turtle is found alive the transfer to the Rescue Centre must be fast in order to be able to easily make a diagnosis. Therapy and rehabilitation are important recovery phases finalized to release. A tag with an alphanumeric code is applied to each turtles. Sometimes the Network supervises large animals retrieves and particular events (nesting). During these years, according to Regional Network, the Sinis Rescue Centre has worked on the monitoring and recovery of a great number of sea turtles and cetaceans. From 2001, 473 animals have been recorded of which 244 marine turtle and 229 marine mammals ,. Most of them have been retrieved alive (377), 139 were trapped in fishing gear. About one hundred of loggerhead turtles were tagged. Awareness activities on protected species have guaranteed the Network improvement, as well as the strong collaboration of citizens and fishermen has allowed continuous monitoring of the coastline. Through the creation of the Regional Network it has been possible to entrust the different actions according to their skills in order to act at different levels to a common aim.

Heavy metal exposition of loggerhead sea turtle juveniles from the Central Mediterranean areas: what carapace, nail and blood can tell us?

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The loggerhead turtle, Caretta caretta, is the most common sea turtle species in the Mediterranean sea. Listed as endangered by the IUCN Red List, its survival worldwide is threatened by incidental captures, urban development, habitat degradation, and the marine pollution.

Heavy metals are among the most dangerous marine pollutants. Although many of these elements are essential for physiological activities some are dangerous even at very low concentrations and all of them become extremely toxic above a threshold limit.

Heavy metals are persistent pollutants, which can bioaccumulate and biomagnificate affecting particularly those long-lived species at the top of the food-web, such as sea turtles. In recent years many studies have dealt with heavy metal contaminations in loggerhead turtles from the Mediterranean sea but all of them have analyzed element concentrations in tissue samples from dead animals. This poses some caveats for the extrapolation of an index of exposition to trace elements for a whole population in a specific area. In fact, dead specimen have often an already altered physiological status which, together with different levels of decomposition of the carcasses, may deeply affect tissue concentrations.

Therefore, it would be advisable to develop non invasive methods to monitor trace element exposition in live loggerhead turtle specimens. Here we describe the concentrations of trace metals (Cd, Pb, Cu) in samples of blood, keratin and nails obtained from 26 live specimens of Caretta caretta from Southern Italy, Central Mediterranean sea. These three tissues have been suggested to provide information on the short-term and medium-term exposition, to this class of pollutants.

Curved carapace length was measured using a flexible tape, to the nearest 0,5 cm ,in all specimen. Blood was sampled from the dorsal cervical sinus using a sterile Vacutainer®, while keratin was obtained from the most superficial layer of lateral and vertebral scutes of the carapace. Nails were sampled from the most external part and were cut by a nail-clipper. During the sampling period three animals died at the rescue centre and underwent necropsy. Kidney and liver samples were taken from all three individuals in order to compare metallic concentrations in known target organs with those found in blood, keratin and nails.

The possible use of keratin and nails as non-invasive and painless indicators of the medium-term trace metal exposition in live loggerhead turtle will be discussed.

Heavy metals and PCBs contents in Loggerhead turtle (*Caretta caretta*) in the Sicilian sea

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The purpose of this study is to evaluate levels of heavy metals and PCBs in specimens of the loggerhead turtle Caretta caretta in order to define whether the concentrations of these contaminants may produce serious pathological effects in the animals observed and whether strandings may be eventually caused by the intake of these contaminants. Analyses were performed on muscle samples taken from 43 specimens of Caretta caretta found in 25 coastal sites in Sicily. On all these samples, cadmium, lead and mercury concentrations were determined. Analyses of PCBs concentrations were carried out on 18 congeners. Results were subdivided into the main Sicilian geographical areas (Tyrrhenian Sea, Ionian Sea and Straits of Sicily) to correlate the mean values of contaminants to the geographical area concerned. The mean values recorded for heavy metals (mg/kg dry weight) were: Cadmium 0,09 ± 0,17; Lead 0,18 ± 0,07; Mercury 0,02 ± 0,01. The mean Cadmium concentration was about one third lower in the samples from the Strait of Sicily compared to the samples from the other two basins. Lead showed a higher concentration in samples taken from the Straits of Sicily; on the contrary, Mercury concentration is almost equal in the samples from the three geographical areas. The 18 PCBs indicator congeners (the analyses that the Italian Zooprofilattico Institutes determine to control contaminations by persistent organic compounds in matrices of animal origin), represent between 72 to 87 percent of the contamination of total PCBs. This study showed that polychlorinated biphenyls do not show high concentration levels in the tissues of Caretta caretta from Sicilian waters. In fact, the analysis of muscle samples revealed a mean concentrations of PCBs, expressed in ng/g fresh weight, always below 10 ng/g in the muscle, then at a level not detectable by the available scientific instruments. The very low concentrations of these toxic substances suggest that these kind of chemicals are not a toxicological risk for these marine reptiles. This can be explained mostly by the low trophic level of these species or even by the largest number of specimens from the Mediterranean areas where the presence of industrial waste discharges is minor.

Bycatch of Loggerhead Sea turtles in the Gulf of Gabes (South of Tunisia) in longline and gillnet fisheries

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Sea turtles are particularly vulnerable to over exploitation and slow to recover from large population declines. The expansion in fishing activities in coastal areas and in the high seas is believed to have contributed to these declines. In Tunisia, the Gulf of Gabes is an important wintering and feeding area for the loggerhead turtles in the Mediterranean Sea. This area contains an important fishing fleet using many kinds of gears. Among them pelagic longline and gillnet, operating during different seasons and targeting a wide variety of commercially important species. Bycatch of sea turtles data has been obtained from records taken by onboard observers during trips carried out during the 2007 and 2008 fishing seasons on-board fishing boats connected to the ports of Zarzis, Djerba and El Ketf located in the southern part of the Gulf of Gabès. Total capture were estimated to 437.086 (299.092-608.629) and to 443.6 (357.65- 501.25) resulting, respectively, from interaction with pelagic longline and with gillnet fisheries. These values show that these gears pose a high threat to loggerhead population in the Gulf of Gabes. The majority of turtles captured were juveniles and sub-adults sized between 50 and70 cm CCLn-t. The mortality rate was very high for gillnet resulting mainly from the long soak time. To reduce turtle bycatch, different mitigation measures including generic and specific solutions were involved. Awareness campaigns aimed at fishermen must be conducted in order to attend the goal.

Mapping elements distribution in the carapace of *Caretta caretta*: a pilot study

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The worldwide spread of major and trace elements in marine environments may seriously threat Caretta caretta health conditions. Unlike other sea turtles species, loggerhead turtles display a higher elements body burden, which could be explained by the variety of their diet habits. Loggerhead sea turtles are migratory and carnivorous species, and foraging can be the main source of exposure to these chemicals. The environmental fate of xenobiotics may be traced by analysing tissues and organs. The carapace, on the opposite, is the least investigated by the scientific community, although considerable amounts of some elements have been found accumulated in this hard tissue. Furthermore, there is a lack of knowledge on the baseline levels of those contaminants in this matrix. This study provides the analysis of As, Ca, Cd, Cr, Cu, Mg, Mn, Pb, Sb, U, V and Zn found in the carapace of a stranded individual living in the Mediterranean Sea (Sicily, Italy) as an attempt for the mapping elements distribution. About 30 specimens were accurately selected and sampled from different areas of the carapace. An acid assisted digestion of samples was carried out by means of a microwave oven equipped with a probe for temperature control. Elements quantification was performed by the Graphite Furnace Atomic Absorption Spectrometry (GF-AAS) as well as by the Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES) while 3D distribution of any element was explored by developing mapping algorithms with Mathworks Matlab 7.1 and related to growth rate and directions of the carapace. This novel approach enabled a temporal analysis of the element bioaccumulation. A different distribution for some of the analysed elements was observed. This approach will be applied to other carapaces in order to relate the above mentioned results to the characteristics of individuals found stranded in the same area.

Turtle stranding increase at Zakynthos: a case of major concern

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The Bay of Laganas, in Zakynthos, hosts the largest rookery of loggerheads in the Mediterranean, with an average of 1,294 nests per season. Since 1984, various legislative interventions have been attempted in order to protect the loggerhead reproductive habitat, even if with no adequate enforcement. Following pressure by the Bern Convention and the European Union, the National Marine Park of Zakynthos was established in 1999. Since 1984, ARCHELON has been conducting a systematic project aiming at the monitoring of nesting and hatching activities in Laganas Bay. In particular, within the last years, the said Society has worked in partnership with the Park. Field work, including daily beach surveys and turtles tagging, was carried out from roughly mid-May until mid-October. In addition, ARCHELON has developed a nationwide Sea Turtle Stranding Network, which reports turtles stranding through size measurements, type of injuries, health conditions, and fate of the carcass. In case of sea turtles found injured but still alive, they are transferred to the ARCHELON Rescue Centre, in Glyfada, which is close to Athens, for rehabilitation treatment. Thanks to the ARCHELON project in Zakynthos, skilled project members are available on site and, thus, able to perform detailed observations and obtain precise measurements of stranded turtles, sometimes working in joint collaboration with the wardens of the Park. During the period 2005-2010 a total of 128 turtles were found dead at Zakynthos, of which 89 (69.5%) within the boundaries of the Park. The annual number of dead turtles ranged from 6 to 37, showing a significant upward trend. In particular, death cause, which was registered in 61 cases, has been classified as: direct human impact (head injuries delivered on purpose) affecting 3 turtles (4.9%); indirect human impact (boat strikes) in 13 cases (21.3%); fisheries interaction in 19 turtles (31.1%); monk seal predation in 26 cases (42.6%). Within the same period 25 turtles, of which 18 specimens (72.0%) found in the Park, were recorded as injured but alive at Zakynthos and all transferred to the ARCHELON Rescue Centre. Secondly, injury cause, observed in 22 turtles, has been classified as: indirect human impact (boat strikes) in 2 cases (9.1%); natural causes, in 3 cases (13.6%); fisheries interaction, in 17 cases (77.3%). In total, 153 turtles were recorded as dead or injured; 151 (98.7%) of them were identified as loggerheads, 1 as green turtle, and 1 was not identifiable. Size distribution was also examined by classifying the dead turtles into juvenile (SCL<40cm) and subadult (SCL<65cm). Out of the 106 individuals that were measured, 6 (5.7%) were classified as juveniles, 33 (31.1%) as subadults and 67 (63.2%) as adults. The significant upward trend in the number of dead turtles recorded over the last 6 years at Zakynthos is to be considered as an alarming signal. Further, given that most of the dead specimens belong to the adult size class, the breeding population is currently under a strong pressure, which may not be sustainable in the long run. In conclusion, the Park should carefully consider this problem and take the necessary steps to mitigate the threats causing the above mentioned deaths. We thank all the ARCHELON assistants and volunteers working on the field, as well as the Park wardens, for their valuable help in recording turtle stranding.

Maternal transfer of metals to the eggs of loggerhead turtles and green turtles in Turkey

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Loggerhead and green turtles make 3-5 nests with two weeks intervals and prefer to nests on their natal beach. Because of these general characteristics of sea turtle nesting behaviour, we have investigated the metal levels in the eggshells of green turtles that collected on Akyatan beach and loggerhead turtle on Dalaman beach. Three to five samples were collected during the hatching season on both beaches. 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. Two readings from each specimen were taken and the averages of these values were calculated. The Fe, Cu, Mn, Ni and Cr were found to be statistically different between to species but no statistical differences found for Zn, Pb, As and Cd. The concentrations of Pb, Cr, As and Cd were quite low in all samples. These values show that adults eliminating metals by transferring to the egg shells and the amount of the transfer is slightly higher in pre-laid nests within the season when the samples were analysed temporally.

Loggerhead sea turtles bycatch with bottom trawls in the northeastern Adriatic Sea

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Sea turtles interaction with fisheries has always represented one of the most sever threats to sea turtles worldwide, affecting different size classes of animals depending on the fishing method as well as the areas/habitats where the fishing effort is placed. The northern Adriatic Sea hosts one of the most important neritic habitats for loggerhead sea turtles (Caretta caretta) in the Mediterranean and is considered as a bycatch hotspot in terms of trawl and gillnet fisheries, with catch rates ranging in thousands catches per year. In this study, bottom trawl loggerhead bycatch in the northeastern Adriatic Sea, namely in the territorial waters of Croatia and Slovenia, was deeply examined. The mean curved carapace length (CCL) of captured turtles was 54.0 ± 15.4 cm (ranging: 20.0 – 89.0 cm, N = 91), with the majority of animals (64.8%) belonging to larger size classes (¬> 50 cm CCL). Although bycatch occurred throughout the year, it was positively associated to the “cold season” (November-April, chi-sq. = 11.87, $p < 0.01$, d.f. = 1), reaching its peak in January-February season. Direct mortality was 7.5% (N = 93), whilst 18 loggerheads (19.4%) were captured in comatose health conditions, suggesting the total (potential) mortality of 26.9%. According to the different methods we have applied, there is evidence that the estimate for total bottom trawl loggerhead bycatch in the study region is of 2135 - 4334 captures per year.

Monitoring litter by sea turtles: An experimental protocol in the Mediterranean

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Marine litter, defined as any solid waste lost or discharged into the marine environment, has a widespread negative impact on marine wildlife including physiology-level effects, reduced fitness, changes in community structure, death caused by entanglement, nutrient dilution, obstruction of gut, and so on. Plastic pollution is one of the most enduring threats, due to its huge quantities and high resistance to degradation. The number of species affected counts in hundreds and includes marine mammals, seabirds, sea turtles, fish and benthic biota. Seabirds are among the most visibly affected oceanic animals and in particular, effects on Fulmar glacialis (Linnaeus,1761) have been studied in western Europe and a monitoring program using fulmar stomach analyses has been established.

Alike the fulmar in the North Sea and neighboring Atlantic waters, marine turtles have been proposed for the Marine Strategy Framework Directive as potential indicator species for marine litter monitoring in the Mediterranean and bordering marine areas.

Here we propose an experimental protocol, comparable to Fulmar's one, using Caretta caretta as indicator species.

Dead animals collected by fisherman, public authorities, or volunteers should be transported to an authorized laboratory for dissection. All relevant information regarding the location of finding, date, finder's personal details, turtle status and possibly reason of the death should be registered by specialized staff using common datasheet. The gastrointestinal tract must be divided into three sections: esophagus, stomach and intestine and particular attention must be paid to not mix the contents. These sections must be analyzed separately. The contents of each one must be drained using a sieve of 1mm mesh size and the overall weight recorded. Then the contents must be rinsed with cold water in the same sieve to remove smaller organic material. Once cleaned, all remaining items must be placed in petri-dishes for identification and sorting under stereo-microscope using the same categorization as in Fulmar protocol analysis: 1) plastics (industrial pellet or user plastic), 2) rubbish (other than plastic), 3) pollutants (industrial or chemical waste remains) and 4) natural non-food remains. For each of the above categories, found in the different parts of the gastrointestinal tract, incidence (presence/absence), abundance by number (count of number of items), and abundance by mass (weight of air-dry material) must be recorded.

Further details are possible, for example recording colors (number of items with the same color). Different items found could be photographed above a graph paper foil. Samples should be kept and stored for potential later detailed studies or alternative categorization.

VETERINARY MEDICINE AND TURTLE HEALTH
POSTER PRESENTATIONS

Marine turtles centre of Tunisia: rescue activities and awareness programme

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Since its foundation in 2004, the sea turtles rescue centre of Monastir has received 70 individuals of Caretta caretta stranded alive or accidentally caught. The type of injures and illnesses influence not only their survival but also their residence time in the centre. Only 10% of turtles arrived in satisfactory health conditions, about 45% presented chronic clinical signs: apathy, anorexia, lethargy, mycosis (mycosis is a disease, not a clinical sign) and buoyancy disorders, 40% had injuries caused mainly by fisherman devices (propeller, net, longline...) and the others have presented serious illnesses and deep wounds not easy to treat, leading often to mortality. During the last eight years of rescuing, the overall survival rate was only 55%. However, the rate has been much higher during the last few years. This difference could be due to the animal sanitary state and the number of turtles received in the centre. The dead turtles at the rescue centre (and turtles brought already dead) are routinely autopsied. Rehabilitated turtles are released into the wild. Before any release, certain strict criteria of health status are followed: cessation of any therapy for at least two weeks, easy-snorkelling, good appetite and regular weight increase. Releases are generally made on the beach in the presence of local people, fishermen and tourists. Awareness campaigns, organized in the centre, were also programmed in order to explain to children the biology of turtles and their fundamental role in the environment.

Sea Turtle Research and Rehabilitation Centre (DEKAMER), Dalyan, Mugla-Turkey

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The first sea turtle rescue centre (DEKAMER) in Turkey was established in 2008 and its activities during the first three years are explained. Despite having nesting and foraging grounds along the Mediterranean coast of Turkey, only one turtle rescue centre has been established following the RAC/SPA (Regional Activity Center/Special Protected Areas) guidelines in the year of 2008. A total of 27 injured turtles were received during the first two years. The main causes of injuries were related to the fishery activities such as hook ingestion, fishing line cut, propeller cuts and speed boat crashes. A large effort is made to increase public awareness because its importance to the overall goal of sea turtle protection is crucial to the survival of the species. An outreach program to the locals, students, tourists and tourist companies was created by DEKAMER. The center provided information to approximately 30.000 visitors annually. This centre provides medical treatments to injured and sick sea turtles and an efficient environmental education program as well. Transport of turtles to the Centre is easy since it is located adjacent to the sea and harbor. There is also an airport just 45 minutes drive-away in Dalaman. The center has the advantage of holding facilities close to a nesting beach. The volunteers working at the center have both the experience of helping the injured turtles and the protection of the nests and hatchlings on the beach especially during the summer period. The centre is open to both national and international collaborations.

Use of three-dimentional CT scan in politraumatized loggerheads (*Caretta caretta*)

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Objective: evaluation of three-dimensional CT scan sensibility and specificity for soft tissue and bone lesions diagnosis in politraumatised sea turtles (Caretta caretta), rescued near the coast of Sicily.

Study design: two sea turtles (Caretta caretta) with high impact trauma.

Methods: after emergency treatment, two turtles were anesthetized for total body helical CT scan. The computed tomography settings were manipulated to show soft tissue and skeletal structures. Multiplanar and three-dimentional reconstruction images were used for evaluation of complex vertebral fractures and the extent of soft tissue damage.

Results: in addition to the fractured carapace, three vertebral fractures were found in one case. No compression of the spinal cord was found. In the other case, despite the finding of a small lesion of the carapace, there was a focal coelomitis with large necrotic areas close the carapace damage.

Conclusion: The use of CT in trauma patients is well established in veterinary medicine. The ability to obtain multiplanar images and three-dimensional CT scans during the last generation, allows an accurate diagnosis of injury, which is difficult to evaluate with radiography or ultrasonography. This method can be advantageously used even in sea turtles.

"Turtle Hyde" - A case study of the complete recovery of a sea turtle with severe head trauma demonstrated by post-release monitoring

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A small juvenile loggerhead turtle (body mass 7.3 kg), was recovered in August 2007 by the "Osservatorio Faunistico Provinciale" of Brindisi, Adriatic Sea. The turtle had a serious head injury which had caused the loss of the right eye. The damage was probably due to an impact with a boat propeller. Because of its "two faces", depending on the side at which you looked at the turtle, it was named "Hyde" after the "The Strange Case of Dr Jekyll and Mr Hyde". Hyde was recovered and cured at the Marine Turtle Rescue Centre of the Stazione Zoologica Anton Dohrn. After the treatments were finished, it was rehabilitated in the biggest tank of the institute's public aquarium (10,000 m3) where it could freely swim and dive and search for food that was dispersed in the tank. After three years it had recovered completely from its injury and had manifested no problems with feeding. Thus it was decided that Hyde could return to the sea. A Telonics TAM-4410 ARGOS transmitter was attached to the carapace of the turtle in the evening prior to its release. After cleaning and sandpapering of the carapace the transmitter was glued onto the scutes by applying thin layer of Pure 2K epoxy (Powers Fasteners) and then secured laterally with HoldFast® epoxy putty (Aquarium Systems Inc.). When the epoxy was dry to the touch a final layer of Pure 2K epoxy was applied covering most parts of the transmitter and the first two central and lateral scutes. The turtle was released in Brindisi, close to where it was found originally, on 9 October 2010 and tracked for a total of 212 days during which it traveled 444 km. 490 valid locations were received, 35% of which were of good quality (ARGOS location classes 1-3). Transmissions were continuing at the time this abstract was written. After its release the turtle remained shortly in the Adriatic sea moving to Albania and staying there for 5 days. Then it entered the Ionian sea via the Strait of Otranto and engaged on a long round trip via Southern Italy, Sicily, Malta, Libya and back to Sicily. Overall, it spent 98 days in Italian territorial waters and 43 days in Maltese waters and 64 days in Libyan waters. These tracking results have shown that also a turtle with such a severe injury can be cured and re-introduced into the sea with success, proven by its ability to undergo long distance migration and take up the typical life style of a loggerhead turtle.

The activity of the Sea Turtle rehabilitation in the Regional Rescue Centre of Comiso (Sicily, Ragusa, Italy) in 10 years

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The Regional Wildlife Recovery and Sea Turtle Centre of the Wildlife Fund of Sicily, in Comiso (Ragusa) is a facility dedicated to rescuing sea turtles and to collecting information on marine reptiles and marine mammals. Located in the town of Comiso, the centre has a complete veterinarinary surgical unit and a series of pools of different capacity till 6000 litres, with separate circulation and water treatments; here the animals can be followed and cured. During the last 10 years, a total of 763 turtles arrived at the Centre. 4 species were recorded: Lepidochelys kempii (1, year 2009), Chelonia mydas (1, year 2005), Dermochelys coriacea (3, years 2000 and 2010) and 710 Caretta caretta. The number of loggerheads varies among years and it was more numerous in year 2007 and 2008. From year 2000 to 2010, C. caretta were collected 66, 48, 24, 38, 37, 35, 85, 116, 140, 88 and 86, respectively. During these years of activity, we were able to release the 72% of the hospitalised turtles. Of the total of the cases the 17% of the animals arrived dead or was found stranded. Among causes of hospitalisation, hooks and lines were close to 48% of the cases. Also hooks associated with fin necrosis and fractures were another 3,5%. Another high number of cases are related to gut occlusion with marine litter (28%). Hypotermia (6,5%), fin fractures (4%) or necrosis (5%) and other miscellaneous pathologies complete the scenario. All the activities were possible not only by the efforts of the staff of the centre, but mainly thanks to the volunteers of the Sicily Wildlife Fund Onlus and the support of the public by the Regional Government of Sicily – Regional Department of Agriculture and Forestry.

Tracking rehabilitated loggerheads from Sicily

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Spending a long time in rehabilitation facilities can interfere with the turtles' at-sea behaviour and ability to survive back in the wild. A project financed by the regional government of Sicily (Regional Department of Agriculture and Forestry – Division 11) and with the technical support of Ragusa Regional Wildlife Service was established to follow sea turtles rescued by the Centro Regionale Recupero Fauna Selvatica - Tartarughe Marine of the Wildlife Fund in Comiso (Ragusa). Two loggerheads were equipped with Argos-linked satellite transmitters (Telonics model A-2025B) glued by means of epoxy resins to the turtles' carapace. The turtles came from different backgrounds and had different injuries before they were brought to the "hospital". The first loggerhead was an adult male of 83 cm CCL called Ulisse. He was transported to the Turtle Recovery Centre in Comiso on 10 November 2007 with propeller injuries to the carapace and a hook in the throat, debilitated and very dehydrated. He recovered fully after 10 months, and at release he was 87 kg of weight. The second loggerhead, called Penelope, was a subadult of unknown gender of 64 cm CCL. It was found on 18 May 2008 with intestinal problems and dehydration. At release it was 47 kg. Both turtles were released at Sampieri (Ragusa) beach on 27 September 2008. Ulisse was followed for 329 days with a journey of 4181 km. Despite having spent so long time in the hospital facilities, Ulisse moved straight to Malta after release and then to the waters off the coast of Tunisia, where he presumably wintered. In May he first moved southward along the coast of Tunisia, then northward by passing through the Sicily Channel. In July, Ulisse followed the northern African coast to Algeria, where he remained by performing circuitous movements, probably to forage, until 22 August when the transmitter stopped emitting. Penelope travelled for 587 days covering 3628 km. Leaving the Sicilian coast, the turtle followed winter circulation in the Ionian sea and then again reached Sicilian waters where it spent the rest of the year foraging close to Ragusa coast. In the second part of the journey, Penelope moved westward and then crossed the southern Tyrrhenian Sea to reach the Naples Gulf where transmissions ended. Here, it is confirmed that released animals can have a very positive return to the wild after spending a long time in rehabilitation centres, providing a stronger support for the role and effectiveness of the conservation effort.

Methodology of medical treatments of external injuries of Sea Turtles

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The Rescue Centre of the Stazione Zoologica of Naples (Italy), a public research institute, has been working since 1983 for the recovery of sea turtles, especially loggerheads (Caretta caretta) which are the most common species of sea turtles in Italian waters.

Most of the injuries of rescued loggerhead turtles are caused by accidental capture in fishing gear and nets, and violent impacts with boats. All these factors can cause traumatic injuries of the head, carapace, neck and flippers.

In recent years, the number of turtles taken into the Rescue Centre that presented external injuries has increased greatly. We have concentrated our efforts on the cure of traumatic injuries, preparing a specific methodology of medical treatments.

Here we present several cases concerning loggerhead turtles that showed carapace fractures, deep neck and head injuries, severe flipper lesions, by indicating for each one of them the treatments, therapies and maintenance procedures carried out during the cure.

The results obtained, supported by photographic documentation of the several temporal phases, demonstrate that these kinds of damage need long times before a complete recovery is achieved and require a precise maintenance protocol. Thus it would be better for the animals in recovery to be held in good conditions so to avoid any source of stress that, as commonly known, can badly affect the injured animal's rehabilitation.

A case Debilitated Turtle Syndrome in the Northern Adriatic Sea

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The DTS, Debilitated Turtle Syndrome, has been described in 2003 by the Georgia Sea Turtle Center (Georgia, USA). This syndrome is usually observed in loggerhead turtles (Caretta caretta). A debilitated turtle is characterized by emaciation and presence ofsmall barnacles on the skin.

During the summer 2009, namely in August and September, a large number of small loggerhead turtles were found stranded or drifting in shallow water, along the Italian coast of the Adriatic Sea. A total of about 180 specimens were recorded, specifically along the Marche, Emilia-Romagna, Veneto and Friuli regions coast.

In this paper we refer to 77 loggerhead sea turtles recovered from Fondazione Cetacea and hosted in its Sea Turtle Rescue Centre, in Riccione.

All of the turtles were smaller than 25 cm curved carapace length and presented a wide part of the body covered in barnacles, in some cases up to 80-90% of the total body surface.

Causes of this phenomenon remain unknown, but several hypotheses were investigated and are presented in the paper.

Antimicrobial susceptibility of bacterial strains isolated from loggerhead sea turtles (*Caretta caretta*)

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In December 2010-April 2011, 24 loggerhead sea turtles (Caretta caretta) rescued by the WWF Sea Turtle Rescue Centre of Molfetta (Italy) after either fishing net entrapment, ingestion of hooks and lines, or cold stunning, were presented to the Clinics of the Faculty of Veterinary Medicine of Bari, Italy, for routine diagnostics. Samples were collected from the animals for bacterial investigations and evaluation of drug susceptibility of the bacterial flora. Amies transport swabs were collected from cloaca and from the oral cavity. The swabs were cultured on Columbia Blood agar and McConkey agar and incubated for 24-48 h at 37°C. Cloacal samples were also screened for salmonella, by using an enrichment procedure. The isolates were identified by Gram staining, oxidase test and api system 20E and 20NE. The strains were screened for antimicrobial susceptibility by means of Kirby-Bauer method, according to Clinical and laboratory Standards Institute guidelines, using the following drugs: ampicillin plus sulbactam, amoxicillin + clavulanic acid, ceftazidime, cefuroxime, doxycycline, gentamicin, norfloxacin and ciprofloxacin. Twenty-six bacterial strains were isolated and identified. All the isolates were found to be Gram negative. The predominant strains were classified as Aeromonas spp. (6 out of 26, 23%), Pseudomonas spp. (4/26, 15.4%), Vibrio spp. (4/26, 15.4%), Serratia spp. (4/26, 15.4%), Proteus spp. (2/26, 7.7%). Citrobacter spp., Alcaligenes spp., Kluyvera spp., Escherichia coli, Moraxella spp. were also identified. One strain was identified as Salmonella spp. The highest rates of resistance were detected to beta-lactams (amoxicillin + clavulanic acid 92.3%, ampicillin plus sulbactam 76.9%, cefuroxime, 50%). One isolate, belonging to Kluyvera genus, was found to be resistant to three different classes of antimicrobials (beta-lactams, doxycycline and gentamicin).

The detection of drug resistant bacteria in wild animals, such as sea turtles, raises questions inherent the origin of resistance. Moreover, since gram negative organisms can perform exchange of genetic material including also drug resistance genes, at different species or genus level, the bacterial flora of sea turtles may represent a potential source of drug resistance genes for pathogenic organisms throughout the marine environment.

An easy protocol for the maintenance and raring of hatchling *Caretta caretta* in captivity

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There is little information about the biology of sea turtle hatchling especially when they have reached the sea from the nesting beaches. Therefore, it is difficult to propose a protocol for growing them adequately in captivity. The Stazione Zoologica Anton Dohrn of Naples, which has been keeping sea turtles in captivity for rehabilitation and curative purpose since 1983, has hosted several groups of hatchling loggerhead turtles. The young turtles either hatched in an incubator or were not able to reach the sea or never emerged from the nest. The aim of this study was to identify the ideal parameters for the conditions of maintenance in captivity so that the turtles could grow as naturally as possible. Three groups of hatchlings were analyzed from 2008 to 2011. The first group, coming from Calabria in July 2008, consisted of seven turtles that got lost in the vegetation and never reached the sea (initial straight carapace length, SCL: 4.23 – 4.44 cm; initial body mass, Mb: 17.2 – 18.27 g). The second group, coming from Campania in September 2008, consisted of three turtles, which were trapped inside the nest (initial SCL: 4.23 – 4.30 cm; initial Mb: 15.48 – 15.89 g). The third group, coming from Calabria in November 2009, consisted of 22 turtles which hatched in captivity after the eggs were recovered from an unhatched nest and kept in an incubator (initial SCL: 3.96 – 4.41 cm; initial Mb 14.26 - 17,12 g). Since their arrival all turtles were periodically weighed, measured, controlled and returned into sea water in tanks of dimensions adequate to the size of each turtle. The maintenance protocol differed slightly for the three groups, particularly in the range of temperatures to which the groups of hatchlings were exposed during their permanence in the centre. In fact, group one and group two were kept at high temperatures (min-max: 20° - 26°C) also during the winter period, while the third group was exposed to naturally varying temperature regimes (15° - 26°). Although food was provided in the same quantities for all groups, the first and second group ingested more and grew more rapidly, reaching mean Mb of 3.13 kg and 3.43 kg, respectively, after their first 17 months of life. Individuals of the third group instead weighed on average only 0.773 kg at an age of 17 mo. The success in maintaining the hatchlings was shown by high survival rates of 95-100% in the three groups. In conclusion, analyzing the different techniques of maintenance, we identified a protocol that can be easily adapted to the reality of the rescue center and which resulted in the most natural growth of the young turtles.

Survey on the occurrence of Fusarium spp. in loggerhead sea turtles (*Caretta caretta*) with or without dermal lesions

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Dermatomycoses occur regularly in reptiles although they are often under diagnosed being lesions indistinguishable from those caused by bacterial infections at gross clinical examination. Mixed fungal and bacterial infections are also common, and it is oftentimes difficult establishing the primary cause of lesions. For instance, Fusarium species are soil-borne fungi worldwide distributed, which may infect plants, animals, and human beings and represent the second most frequent mould causing invasive fungal infections in immunosuppressed patients. Interestingly, Fusarium spp. are also commonly incriminated as pathogens in reptiles, and F. solani, F. oxysporum, F. verticilloides, and F. incarnatum have often been identified in cases of fusariomycosis. Again, cutaneous hyalohyphomycoses by F. solani have been reported in captive loggerhead sea turtles causing superficial or ulcerative lesions in immunosuppressed animals and fusariomycosis with necrotizing lesions on scales, carapace and plastron bones, osseous jaws and corneal ramphoteca. Since data on the occurrence of Fusarium spp. in sea turtles, with or without cutaneous lesions, are scarce, this study aimed at evaluating the occurrence of this particular mould in these animals.

From December 2010 to April 2011, 43 loggerhead sea turtles (Caretta caretta) were referred to the Faculty of Veterinary Medicine of Bari by the WWF Sea Turtle Rescue Centre of Molfetta (Italy) for routine diagnostics after rescue (fishing net entrapment, ingestion of hooks and lines, cold stunning). Skin scrapes were collected in each turtle from three anatomical sites (plastron, flipper, and carapace) for fungal culture. Fifteen animals (34.9%) yielded a positive culture for Fusarium spp. of which only 3 (20%) had no lesions. Conversely, 16 animals (37.2%) had lesions but Fusarium spp. was not isolated. Correct genus-level identification of Fusarium species is an important action to underpin correct treatment and infection control strategies. In this survey species of Fusarium other than F. solani have been identified and F. oxysporum and F. equiseti have also been isolated in animals with dermal lesions. The results of the present study showed a high rate of isolation of Fusarium spp. from dermal lesions in sea turtles and suggest that it could play a role in their occurrence.

Preliminary study on parasites in Loggerhead (*Caretta caretta*) turtles from the southern Tunisian waters

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The occurrence of parasites has been used not only to assess the health status of their hosts, but also as an important tool to understand aspects of the biology of the host, namely their migratory behaviour, distribution and feeding ecology. The presence of parasitic agents on the loggerhead sea turtle in the Gulf of Gabes (South of Tunisia) was performed on five stranded and two accidentally caught animals between 2005 and 2010; three helminthic species were found in the intestine (one digenean trematode and two nematodes) and two species of ectoparasites (one herpacticoid copepod and one annelid) were recorded in different locations of the body. The parasitological findings here described are consistent with previous reports from loggerheads in the Mediterranean. Further studies appear necessary to outline the parasitic fauna of the Loggerhead turtles from the gulf of Gabes as an important foraging and wintering area in the Mediterranean Sea.

Evaluation of the best diet for the rehabilitation of sick or injured loggerhead turtle, *Caretta caretta*, in a recirculating holding system

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Due to the intensify of human pressure on the marine environment there has been, in the recent years, a step increase in the number of loggerhead turtles found in difficulties or injured because of accidental capture in fishing gears, boat collisions or debris ingestion which are brought to rescue center for specialized treatments. These facilities have grown in sophistication from the simple static water holding tanks to modern recirculating systems with complex water treatment apparatus. The maintenance of adequate water quality parameters has been, in fact, recognized as one of the fundamental factors affecting the rate of recovery of hospitalized turtles. Therefore the selection of the appropriate diet must take into consideration not only the physiological requirements of the animals but also the quality and quantity of waste produced that must be filtered by the system.

In this study we compared the three different diets, composed by fresh food items easily available on the fish market, in order to select the optimal combination of food for the rehabilitation of loggerhead turtle in a recirculating holding system.

Six animals of comparable size and in good physical condition were selected among those in rehabilitation at the Turtle point of Stazione Zoologica Anton Dohrn of Naples. Two diets were composed by just one food item, respectively fresh anchovies and frozen squids. A third diet was a mix of 50% fresh anchovies, 25% fresh shrimps, 25% frozen squids. All diets were supplemented with vitamins (Aquavits by International Zoo Veterinary Group). Food portion were selected on the bases of turtle's weight. Animals were acclimatised to the new diet in the first month of the experimental period. Size, weight and blood parameters were evaluated each three weeks for the next six months. Gastrointestinal transit times were assessed, in a duplicate tests, by providing in sequence plastic balls of four different colours during eight food administrations. Waste were characterized on the basis of the texture in two categories: solid and soft.

The different diets did not affected significantly blood biochemical profile, complete blood count and plasma proteins. This is probably related to the relative short experimental period. Absolute growth rates in CCL varied considerably among the individuals although those feed with the mix diet exhibited the relative higher values. Transit times were strongly affected by the kind of diet as well as the waste's texture. Animals feed with the mix diet exhibited the shorter transit time and the highest occurrence of solid waste. Squid were retain into the gastrointestinal system up to 30 days and produced liquid faeces.

Collectively these results demonstrate that the mixed diet offer the best benefit for the rehabilitation of loggerhead turtle in a recirculating holding system since it provide the best growth rate and waste that can be easily removed by a simple mechanical filtration reducing he biological load of the filtration unit.

Detection of erythrophagocytosis in loggerhead's blood

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The phagocytosis of red blood cells (RBCs) is due to changes on the erythrocyte surface: specific modifications of RBC membrane components, alteration of surface molecules, loss of RBC membrane phospholipid asymmetry and irreversible oxidative damage of SH groups. In man erythrophagocytosis by neutrophils and monocytes is detectable in the autoimmune hemolytic anemia associated with paroxysmal cold hemoglobinuria and has been observed in some patients manifesting clonal hematopoietic malignancies with myelodysplasia. Phagocytosis by macrophages is a highly conserved phenomenon among vertebrates and it has been postulated that the pathophysiology of erythrophagocytosis may likewise be similar in reptiles and mammals. In Caretta caretta the heterophils, analogous to the mammalian neutrophils, can phagocyte both parasitized and normal-appearing erythrocytes. On circulating blood smears stained with MGG-stained smears of circulating Caretta blood demonstrated that 4-51% of the heterophils were emitting pseudopodia that made contact with erythrocytes and that others had progressively encircled individual erythrocytes. These are mature erythrocytes containing a typical inclusion body, recognized as Heinz body. Moreover, teardrop-shaped RBCs were also identified in the blood films suggesting that the phagocytosing cell aspirates or selectively removes the inclusion body from the erythrocyte and permits the resultant dacrocyte to remain in the circulation. A comparable phenomenon, the pitting function of the spleen, is well know in man. In this case the phagocytic cells of the spleen remove remnants of DNA (Jolly bodies) from denucleated erythrocytes and allow them to persist in circulation. This pitting results in a efficient removal of the inclusion bodies contained in RBC cytoplasm by releasing dacryocytes into circulation. The positivity to ALP MPO and CAE reactions also confirmed that the loggerhead's phagocyting cells are heterophils. In conclusion loggerhead's erythrophagocytosis is a defense mechanism allowing both the complete degradation of infected/parasitized erythrocytes and the pitting of the inclusion body and the release of an healthy erythrocyte into circulation

A novel intramuscular injectable combination for anaesthesia in loggerhead turtles (*Caretta caretta*)

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Anaesthesia in sea turtles is required for selected diagnostic procedures (imaging, endoscopy), minor or major surgical procedures and, in very few cases, for clinical examination and therapeutic administration. Long distance transportation may also require sedation.

For induction and short non invasive procedures intravenous propofol is widely used and it is considered the drug of chioce. Surgical anesthesia can then been achieved by administering oxygen and an inhalant anesthetic gas after tracheal intubation. Analgesics are then added to control pain.

We investigated a mixture of medetomidine, ketamine, midazolam and butorphanol injected intramuscolary in 8 Loggerhead turtles (Caretta caretta) both as anesthesia inductor and as for surgical anesthesia.

The main advantages of this combination are the avoidance of intravenous injection, the possibility to be partially reversed with atipamezole, and the analgesic effects. Different depths, and lengths of anesthesia can then be achieved balancing the amount of each drug making this protocol very useful and reliable from sedation to surgical anesthesia. The combination is also particularly useful in those situations where inhalant anesthesia is not available.

For each animal induction time, duration of anesthesia, reflexes, pain perception, heart rate and recovery time are reported and discussed.

Investigation of some blood physiological parameters of loggerhead sea turtles (*Caretta caretta*) in Turkey

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We investigated physiologic blood parameters of healthy loggerhead turtles (Caretta caretta), caught from Iztuzu nesting beach and lagoons of Köycegiz – Dalyan Special Protection Area - and injured loggerhead turtles brought to the Sea Turtle Research, Rescue and Rehabilitation Centre (DEKAMER). Blood cells including erythrocytes, monocytes, lymphocytes, heterophils, eosinophils, basophils and thrombocytes were identified morphologically and blood cells counts were performed both on healthy and injured turtles. Samples were collected from 23 Caretta caretta and two Chelonia mydas individuals between 2009 and 2010. Of the 23 C. caretta samples, 57% (n=13) were healthy turtles from Dalyan region, 26% (n=6) were injured turtles from the same region and 17% (n=4) were injured turtles brought to DEKAMER from Mersin, Antalya/Kemer, Mugla/Fethiye ve Mugla/Bodrum. Two injured C. mydas were brought from Belek and Manavgat regions in Antalya. The results of biochemical analysis were investigated according to turtles' sex, maturity and health condition, respectively. Sex affects plasma concentration of cholesterol (Chol), triglyceride (Trig), urea, creatinine, lactate dehydrogenase (LDH), potassium (K), phosphorous (P) and magnesium (Mg). Plasma Chol and Trig levels were considerably high in the healthy group of turtles with a large proportion of nesting females. Females have considerably high LDH levels. Nesting requires more energy and muscle activity on land. LDH levels might be altered due to high physical activity. K levels were also high in females, which may be the result of high nesting effort on land. Urea levels were the lowest in female turtles. All altered plasma biochemical values except urea can be explained by increasing physical effort due to nesting activity of female C. caretta. Health condition alters plasma levels of iron (Fe), sodium (Na), potassium (K), chloride (Cl) and magnesium (Mg) and all the parameters were found very low in injured turtles. While Fe low levels might be consistent, among other causes, with blood losses and feeding deficiency, low levels of Na, K, Cl and Mg are consistent with a lack of physiological control of homeostasis in injured turtles. Additionally, haematological blood cell counts were investigated in six C. caretta (n=3 injured, n=3 healthy). An increasing number of white blood cell (WBC) was observed in injured turtles compared to those found in the healthy ones (mean-WBC-healthy = 10,93 K/µL, mean-WBC-injured = 22,1 K/µL). Is this significant? Physiological blood parameters are extremely important to determine the sex ratio of wild sub-adult sea turtles and understand sea turtle physiology. Physiological researches are also necessary to establish more effective medical treatment for injured sea turtles. The results of this study can be used for injured sea turtles' medical treatment and include reference values for future studies.

Predation on nests and hatchlings (Part II): is it a threat in the Mediterranean? Are we applying the right conservation strategies?

Monica Aureggi, Andreas Demetropoulos, Myroula Hadjichristophorou

This workshop would be a follow up of the first part presented and discussed in Tunisia in 2008. Even though this was scheduled in the morning of the last day, there were many participants who actively contributed to the workshop. Participants from different countries brought their experiences and their opinions, enabling exchange of information and knowledge.The audience 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.The workshop will discuss different case studies and take into consideration different predators, species, places, etc and different conservation strategies that are commonly applied to nests.In the Mediterranean there are conservation projects that have been working for many years and projects that have recently started to work on sea turtles. The workshop is designed to facilitate communication on practical issues between projects in order to improve the application of conservation strategies.

Sea turtle by catch in the Mediterranean

Paolo Casale, Mohamed N. Bradai, Bojan Lazar

Mortality due to capture by fishing gear is an important threat to sea turtle populations in the Mediterranean, both for mortality directly caused by the capture and for intentional killing driven by antagonistic or consumption reasons. A large amount of information is available for the Mediterranean, more than for other regions. Current information indicates that in addition to large industrial vessels, also the artisanal/small scale fishery represents an important cause of mortality, possibly even the more important than the former. In spite of all this information, little is being implemented to mitigate this threat, in part for lack of measures and in part for inaction.The workshop aims to bring together people working on or interested in sea turtle by-catch and will deal with (i) definition and status of the small-scale fishery in the Mediterranean, (ii) evaluation of by-catch and fishing mortality in the Mediterranean, especially in small-scale fisheries: approaches and data collection methods, (iii) experiences aimed to reduce or avoid impact on marine turtle species and implementation of mitigating measures, (iv) current key limitations to act and how to overcome them, (v) key actors not currently involved and how to approach them, (vi) possible value of large cooperative initiatives.Part of the workshop will be allocated to invited presentations or presentations of particular interests proposed by participants, while most of the workshop will be dedicated to discussion.Participation of representatives of relevant organizations will be sought.Any suggestion for the agenda or key persons/organizations to invite is welcome.Please contact the workshop co-chairs for suggestions or if you want to contribute with a presentation.

Nesting Beach Monitoring Data

Brain P.Wallace, Aliki Panagopoulou

Nesting beach monitoring has been the most widely implemented tool used by those involved in sea turtle research and is an important component of any attempt to assess the status of sea turtle populations. Beach surveys range from very structured and standardized sampling to less intensive sampling spanning part of a single season or conducted irregularly across seasons. While nesting surveys are so widely used, there is high variability in the methods and analyses used which hampers our ability to make any meaningful assessment of the status of nesting populations. This, combined with the fact that nesting females only represent a portion of the total population, may lead to false assumptions on the true population status and therefore declines may remain unobserved until it is too late to take any action to prevent their collapse. To address this issue, The State of the World's Turtles Initiative (SWOT) has recently delivered the Minimum Data Standards for Nesting Beach Monitoring (http://seaturtlestatus.org/data/standards. In the Mediterranean several nesting beach monitoring programs are conducted in Greece, Turkey, Cyprus, Libya, Lebanon, Israel and Italy, with approximately 7,200 loggerhead and 1,500 green turtle nests being documented every year. At the same time, due to constraints such as available resources and accessibility to specific sites the exact nesting effort in the region remains unknown for some areas/countries such as Libya, meaning that nesting female population assessments are incomplete. The 4th Mediterranean Conference presents an excellent opportunity to discuss some of the SWOT Minimum Data Standards for Monitoring in a regional context. This workshop aims to find a regional "Gold Standard", where protocols applied and datasets collected for analyses will be sufficient to adequately identify and monitor nesting populations, while trends in nesting activity will be detected thus providing valuable insights onto the robustness of sea turtle populations.

Future release of captive-born sea turtles for restocking of wild populations: visions and options

Sidonie Catteau, Manuel Garcia Hartmann

Sea turtles are subject to many threats and internationally protected by law, and many organisations worldwide aim to protect and restore populations of endangered sea turtles to healthy conditions.

One possible option to support this aim could be the restocking of wild populations with captive-born individuals. Such undertaking has been carried out and proven successful in a number of other wildlife species, but requires careful evaluation.

This 'roundtable discussion' was planned to bring together interested parties, organisations and scientists, to discuss their visions and the options currently available for the potential future release of captive-born sea turtles, with a special focus on Europe. The "IUCN/SSC Guidelines For Re-Introductions" was used as a starting point for this discussion.