



7TH MEDITERRANEAN CONFERENCE ON MARINE TURTLES TETOUAN/ MOROCCO 2022

BOOK OF ABSTRACT



7th MEDITERRANEAN CONFERENCE ON
MARINE TURTLES
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BOOK OF ABSTRACT

Sea Turtles Conservation After the Pandemic

Book of Abstract

7th Mediterranean Conference on Marine Turtles,
Tetouan, Morocco 2022

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Sözbilen, D., Kabadayıoğulları, K., Pari, S., Angelini, V., Lombardi Moraes, K., Jribi, I. Nejmeddine Bradai, M., Boussellaa, W., Mallat, H., Chaieb, O., Cheikhsbou, A., Ben Naila, I., Haxhiu, I., Kolitari, J., Çurri, A., Casale, P & Kaska, Y.

PLENERY SESSIONS



7th MEDITERRANEAN CONFERENCE ON
MARINE TURTLES
TETOUAN-MOROCCO
18-21 OCTOBER 2022



PLENARY SESSION 1

SEA TURTLES CONSERVATION IN THE WORLD

Earl Possardt**U.S. Fish & Wildlife Service**

Dr. Earl Possardt obtained undergraduate and graduate degrees in Wildlife Biology from the University of Connecticut and University of Connecticut respectively. He just recently retired from a 44 year career with the U.S. Fish & Wildlife Service where he served in the National Wildlife Refuge System, Endangered Species program and for the last 24 years in its international program. While he started his career with U.S. Fish & Wildlife Service conducting research with sea birds in Alaska one summer in 1976, his real passion has always been reptiles and he eventually established himself as the coordinator for sea turtle conservation programs in the southeastern U.S. and since 1998 has directed and coordinated the U.S. Fish & Wildlife Service's international program which has grown from supporting a handful of conservation projects focused in Mexico and Costa Rica to over 45 projects in over 30 countries in every region of the world.

PLENARY SESSION 2

SEA TURTLES IN THE MEDITERRANEAN: PERSONAL REFLECTIONS

Dimitris Margaritoulis**Archelon, Greece**

A dedicated naturalist, he discovered on the island of Zakynthos, Greece, the largest nesting aggregation of loggerhead turtles in the Mediterranean and since then (1977) works on conservation and research of sea turtles in Greece. He founded (1983) the non-governmental organization Sea Turtle Protection Society of Greece (now ARCHELON), which established long-term monitoring projects at the main nesting areas of Greece, and through its pioneer activities on public awareness and environmental education as well as on turtles' rehabilitation became a model NGO in the region. He represented Greece, under authorization of the government, in several international meetings. Took active part in the elaboration of the Action Plan for the Conservation of Marine Turtles in the Mediterranean (1989,

Nicosia, Cyprus) and its subsequent revision (1998, Arta, Greece), under the auspices of UNEP/MAP. In 1993, he was invited in the Executive Committee of the IUCN's Marine Turtle Specialist Group (MTSG) and participated in the elaboration of the MTSG's Global Strategy for the Conservation of Marine Turtles (Mexico, June 1994). In March 1999 became the first MTSG's Regional Chair for Mediterranean, a position that held until 2010 when he was succeeded by Paolo Casale (his co-chair since 2006). He increased Mediterranean participation in the MTSG by enlisting members from many countries and elevated Mediterranean as an independent region in the global scene. In 2001, he initiated the "Mediterranean Meetings", in the context of the Annual Sea Turtle Symposia, which bring together Mediterranean scientists to discuss regional matters and augment collaborations. He contributed actively in the organization and implementation of the triennial Mediterranean Conference on Marine Turtles, in cooperation with the Barcelona Convention, the Bern Convention and the Convention for Migratory Species (CMS). In 2002, he was elected in the Board of Directors of the International Sea Turtle Society (ISTS), and from 2005 to 2006 became its President. In 2006 he organized the 26th Annual Sea Turtle Symposium in Greece (Island of Crete, 3-8 April 2006) which hosted about 700 sea turtle workers from 76 countries around the world. For his long-standing work with sea turtles, he received several awards, among them the Athens Academy Award and the ISTS's Life Time Achievement Award. He participated in many congresses, conferences and authored (& co-authored) many publications on marine turtles. He also served as a reviewer in several scientific journals.



SESSION 1: THREATS

ORAL PRESENTATIONS



ORAL PRESENTATIONS
SESSION 1: THREATS

EFFECT OF THE SYRIAN CRISIS ON MARINE TURTLE NESTING HABITAT WITH A FOCUS ON AL-SHKAIFAT-SNAWBAR (LATAKIA) BEACH (SYRIA)

A.Saad¹, A. Soliman²

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2-Faculty of Sciences, Tartus University, Tartus, Syria

It is regrettable to say that the conditions of sea turtles in Syria have deteriorated due to the crisis and the ongoing war since 2011, especially since 2018, for the following reasons: 1- The impossibility of carrying out night time beach patrols during the breeding season, as were undertaken prior to the crisis, due to the deterioration of the security situation on the one hand, and the lack of fuel on the other hand 2. The most important sea turtle nesting beach in Syria (Al-Shkaifat-Snawbar, south of Latakia) has been widely exposed to sand theft and dredging, which has deprived sea turtles of their nesting grounds. Unfortunately, and the very sad thing is that some violators of the law took advantage of the government's preoccupation with combating terrorism and weak oversight, and they stole sand in an organized and large-scale manner using bulldozers and trucks over the past two years, and despite our strong objection to this behaviour and despite our filing a complaint with government agencies, these criminals

have not been truly deterred. It is likely that they are supported by their kinship with some of the ruling authorities, and thus the best sandy beach in Syria suitable for nesting sea turtles, especially the green turtle, has been destroyed. We present here some sad pictures of the beach, which was rendered bare of sand. These pictures were taken during August of last year (2021), compared to the pictures of nests on this beach during the years 2017 and 2018. Despite the crisis, during the 2021 season, we managed to survey beaches for nesting activity south of Tartus to the Lebanese border, and they were few in number. The establishment of a tourist complex on part of the beach (20 km south of Tartus) is thought to have impacted the nesting activity. Between Tartous and the Lebanese border we found 26 nests including 18 loggerhead turtle nests and 8 green turtle nests. There were an additional, 14 tracks indicating that the turtles come out of the sea, but they do not deposit their eggs on every occasion.

ORAL PRESENTATIONS
SESSION 1: THREATS

A FIVE-YEAR MONITORING OF MARINE LITTER INGESTION IN DEAD LOGGERHEAD TURTLES IN TUNISIA (2017 – 2021)

Chaieb Olfa¹, Elhili Hedia², Bradai Mohamed Nejmeddine¹

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2-Centre National de Veille Zoosanitaire- Tunisia

The seven extant sea turtle species are impacted by marine litter worldwide. The loggerhead sea turtle, *Caretta caretta*, is used as bioindicator to monitor marine litter in the Mediterranean and European marine seas. In this study, we analysed stranding events of loggerhead turtles found along Tunisian coasts to investigate marine litter ingestion, using the INDICIT/SPARAC protocol. A total of 158 dead individuals with CCL ranging from 91 to 28 cm were necropsied from 2017 to 2021.

Overall, 29.7% of the turtles had ingested mesoplastics composed mainly of sheet category. The mean mass of 0.35 g was reported by turtle. Temporal and regional variations were assessed, comparing the north, centre and southern coasts and the difference between years. This long-term monitoring of plastic ingestion indicator would be necessary in contributing to the achievement of the Good marine Environmental Status (GES).

MARINE TURTLE BYCATCH IN THE GULF OF GABES SURFACE LONGLINE FISHERY (TUNISIA)

Mohamed Nejmeddine Bradai¹, Sami Karaa¹, Imed Jribi², Béchir Saidi¹, Samira Enajjar¹ and Lobna Ben Nakhla³

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In the frame of ACCOBAMS-GFCM Project on mitigating interactions between endangered marine species and fishing, developed with the collaboration of the UNEP-MAP-SPA/RAC and a substantial financial support from the MAVA foundation, we execute a pilot action on mitigating bycatch and depredation of elasmobranchs, sea turtles and cetaceans in surface and bottom longline fisheries operating in the gulf of Gabes. In this note we focus on surface longline fishery targeting swordfish primarily to better understand bycatch of sea turtles in southern of Tunisia and to experiment circle hooks (C) effect on reducing bycatch. This study was based on 34 fishing trips totaling 96 fishing days (96 sets) deploying 116500 J hooks between June and September 2016 and 2017. In order to evaluate the efficiency of some measures to reduce bycatch, we evaluated the effect of hooks shape (circle hook) during 9 experimental trips

(22 fishing sets) conducted during the same fishing season with the same bait. 10200 hooks were deployed (5100 J intercalated with 5100 C). During the surveys, 1251 vertebrates, including Swordfish, other teleost, sharks, seabirds and sea turtles were captured. Among them 29 loggerhead turtles and 2 leatherback turtles were caught at respective catch rates of 0.25 T / 1000h and 0.02 T / 1000h. All leatherbacks were captured alive. The direct mortality of the loggerhead turtle (caused directly by hook or wire) was estimated at 3.44% (one turtle); all the turtles caught were subadults. During experimentation of circle hooks effect, 14 loggerheads and 2 leatherbacks were captured. Analyses showed No significant difference in either the number of turtles caught or the mortality rate with the two kinds of hooks.

MANAGING BYCATCH DATA GAPS OF MARINE TURTLES FROM THE MEDITERRANEAN SEA IN COLLABORATION WITH ICCAT.

J.A. Camiñas¹, J.C. Báez², F. Poisson³, A. Domingo⁴

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Fisheries targeting tuna and tuna-like fisheries are managed by five Regional Fisheries Management Organizations (RFMOs). The area of competence of the International Commission for the Conservation of Atlantic Tuna (ICCAT) includes the Atlantic Ocean and the Mediterranean Sea. One of the tasks of ICCAT is the conservation of resources associated to the fisheries it manages, including longline, gillnet, purse seine, etc. High levels of sea turtle bycatch have been reported in several tuna fisheries including some fisheries operating in the Mediterranean Sea. There is another RFMO in the Mediterranean Sea, namely the General Fisheries Commission for the Mediterranean and the Black Sea (GFCM) who is responsible for the management of non-tuna fisheries. Although most of the Mediterranean countries are members of both OROPs sea turtles bycatch data to these OROPs remains largely unreported. In the course of previous works by experts of ICCAT member states with the Ecosystems and Bycatch Subcommittee to assess the impact of ICCAT's fisheries on sea turtles, gaps on bycatch data from Mediterranean countries have been detected.

To complete the existing information supported by the two mentioned RFMOs in the Mediterranean, we reviewed the information provided by the regional reports of IUCN's Marine Turtles Specialists Group for the Mediterranean Sea which include useful data on bycatch from most Mediterranean countries. The Mediterranean Sea was analysed with the purpose of including this region in the global review launched by ICCAT including non-tuna fisheries interacting with sea turtles in its area of competence. The data sources of the three organisations were reviewed to improve and elaborate a single database on bycatch in the Mediterranean Sea useful for the three organisations and for others involved in the conservation of the marine turtles in the Mediterranean Sea. The management measures, including the obligations by the contracting parties, implemented by ICCAT and GFCM to monitor and reduce the sea turtle bycatch in the fisheries within their competence area to improve the conservation of sea turtles were also reviewed.

ON BOARD OF AN INTERNATIONAL COLLABORATIVE WORK: ASSESSMENT OF THE IMPACT OF TUNA FISHERIES ON SEA TURTLES BYCATCH IN THE MEDITERRANEAN SEA

Baez J.C.1, Camiñas J.A.2, Coelho R.3, Domingo A.4, Hanke A.5, Jiménez S.6, Kerwath S.7, Macias D.8, Miller P.9, Niemeyer F.10, Ortiz de Urbina J.11, Parker D.12, Poisson F.13, Ramos M.L.14, Sabarros P.15, Sales G.16, Taylor N.17

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In the Mediterranean Sea there is an important fisheries ground area targeting tuna and swordfishes, and overlapping with an important feeding area for loggerhead juveniles, mainly coming from both the Atlantic and Mediterranean spawning beaches. Due to the spatial overlap between longline fishing grounds and loggerhead distribution, in the early 2000s, an estimated minimum of 60,000 loggerhead sea turtles were caught as bycatch in longline fisheries throughout the Mediterranean Sea. However, despite this obvious conservation problem, there are still many knowledge gaps. In 2018, collaborative work began to assess the impact of tuna fleets (longliners and purse seiners) on sea turtles in the Atlantic and Indian Oceans from a fully scientific perspective. Researchers participating in the Regional Atlantic and Indian Tuna Fisheries Management Organizations (ie T-RFMO ICCAT and IOTC) carry out this work. In this context, one of the group's objectives is to carry out a study of similar characteristics in the

Mediterranean Sea. The short-term objective of this process is to determine the spatio-temporal trends of sea turtle bycatch in tuna fisheries in the Mediterranean Sea. The stated secondary objectives include 1) conducting a literature review of the interaction of sea turtles with other non-ICCAT fisheries, to allow contextualization of the impact of tuna fisheries within a more regional framework; 2) Review the information available on the status of sea turtle populations in the Mediterranean Sea; and 3) Identify information gaps. For this purpose, i) the densities of sea turtles, ii) the distribution of incidental catches of sea turtles in tuna fisheries, and iii) the situation of the populations affected by these fisheries would be considered. This communication presents some conclusions of the research group, and a call is made to potential collaborators who are interested in joining this collaborative initiative between the scientists of the RFMO-T.

UNDERSTANDING THE BYCATCH THREAT: CHARACTERISING BEHAVIOURAL PATTERNS, SPATIAL UTILISATION AND CATCH COMPOSITION OF A SMALL-SCALE FISHERY TO IDENTIFY KEY AREAS OF CONFLICT WITH MARINE TURTLES

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Globally, small-scale fisheries (SSFs) play important roles in employment and food security. However, information on their spatial distribution and practices are often insufficient, precluding effective management of ecological impacts. This is the case in the eastern Mediterranean basin, where, despite concerns being raised regarding the magnitude of bycatch in SSFs over two decades ago and increasing reports of other negative ecological impacts, a poor understanding of the fishery persists. The island of Cyprus hosts both resident foraging and nesting populations of green and loggerhead turtles that overlap nearshore fishing areas, with estimates of at least 2700 marine turtle deaths annually in the SSF. To address this knowledge gap, we characterised the SSF fleet of North Cyprus through a combination of onboard observations, fisher self-reporting and vessel tracking to provide the first comprehensive overview of the

fishery including the array of gears deployed, catch composition, bycatch rates by métier and spatial footprint of the fishery. This multidisciplinary approach revealed that the SSF demonstrates highly diverse, mixed species catches and seasonality of gear types used to target them. Operating metrics such as soak time and set depth, among others, were generally consistent across different regions but varied greatly between individual fishing trips, which were broadly conducted overnight or during crepuscular periods. Fleet size and number of fishers have been steadily increasing with time. As the first detailed understanding of this fishery's operating behaviours, this research identifies potential opportunities to mitigate practices that are the most detrimental to vulnerable megafauna, such as marine turtle populations, and improve overall regulation of SSFs.

COLLABORATION WITH FISHERMEN - LESSONS FROM MOROCCO

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Studies on bycatch began in Morocco in 2000. Training workshops were carried out in several ports and landing stations. Fishermen collaborate and provide important data. Prior to 2012, there were interactions with the driftnet. Currently, with the elimination of the drifting gillnet, there are few interactions with the seine and the

trawl. However, measures to protect sea turtles are still necessary, such as reducing the duration of fishing and the use of TEDs. Observers at sea state that inshore fishing has an interaction of less than 5% with respect to the number of trips. Artisanal fishing does not exceed 1% of interactions in relation to the number of trips.

Backtrack modelling for the management of the risk of sea turtle entanglement in ghost gear

Sagarminaga, R., March, D., Segura, N., Moure, B & Sanchez, A.



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POST-NESTING DISPERSAL OF ADULT FEMALE LOGGERHEAD TURTLES THAT NESTED IN KYPARISSIA BAY, GREECE.

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We tracked a total of 21 adult female loggerhead turtles nesting on the core nesting area in south Kyparissia Bay (2018, N = 9; 2019, N = 12). Twenty of these turtles were tracked after completion of their breeding season and into their post-nesting migrations. A preliminary analysis revealed that the turtles migrated into widely different areas. Seven (35%) moved to the Tunisian plateau, 4 (20%) to the northern Adriatic, and 2 (10%) each to the northern Ionian and the Aegean. However, a novel finding was that 5 (25%) turtles migrated into the western Mediterranean. The turtles displayed two main foraging strategies. Turtles that foraged close to shore established generally well-defined foraging locations whereas turtles that remained in deep waters continuously moved across large expanses of habitat. The continuously moving epipelagic turtles were smaller (mean SCL = 72.9 cm, N = 9) than those with restricted home ranges (mean SCL = 78.6 cm, N = 8). These vagrant turtles comprised all those that migrated

into the western Mediterranean and all but two of the Tunisian plateau turtles. The finding of so many epipelagic foraging turtles, including 25% that migrated into the western Mediterranean, contrasts with the findings from the breeding population of Zakynthos where no female turtles from a sample of 34 migrated into the west. The contrast in foraging strategy / destination between the two populations may be contributing to the differing population trajectories between the two sites, where the Zakynthos population is relatively stable and the Kyparissia population is experiencing a dramatic increase. The implications of these findings require further investigation in order to identify additional potential conservation measures. Acknowledgements: This action was funded under the Conservation of Sea Turtles in the Mediterranean project financed by the MAVA foundation. We thank all the ARCHELON staff, field leaders and volunteers that helped make this a successful action.

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BASIN-WIDE ESTIMATES OF LOGGERHEAD TURTLE DENSITY IN THE MEDITERRANEAN SEA DERIVED FROM LINE TRANSECT SURVEYS.

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Loggerhead turtles are a globally vulnerable species of marine turtle. Broad-scale patterns of distribution and abundance can provide regional managers a tool to effectively conserve and manage this species at basin and sub-basin scales. In this study, combined aerial and shipboard line transect survey data collected between 2003 and 2018 were used to estimate density and abundance throughout the Mediterranean Sea. Approximately 230,000 linear kilometers of survey effort, from seven different surveying organizations were incorporated into a generalized additive model to relate loggerhead density on survey segments to environmental conditions. Two spatial density models estimating loggerhead density, abundance, and distribution were generated – one a long-term annual average covering 2003-2018 and another covering the summer of 2018, when a basin-wide aerial survey, the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area Survey Initiative, was performed. Both models were adjusted for availability bias using dive data from

loggerhead turtles tagged with time depth recorders. Mean abundance for the long-term average model was estimated as 1,201,845 (CV=0.22). The summer 2018 abundance estimate was 789,244 turtles and covered a smaller area than the long-term average. These estimates represent the first basin-wide estimates of abundance for loggerhead turtles in the Mediterranean not based on demographic models. Both models predicted similar distributions, with denser areas predicted in the northern Adriatic Sea, central Mediterranean basin, Tyrrhenian Sea, and south of the Balearic Islands. Lower densities were predicted in the eastern Mediterranean Sea and the Aegean Sea. The highest density areas generally did not coincide with previously established adult loggerhead turtle foraging areas, which are typically neritic, leading us to believe the models are predominantly predicting oceanic distributions, where most of the survey effort occurred. Juvenile loggerhead turtles are predominantly

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oceanic and comprise most of the population, but care must be taken when using these models as they may not accurately predict distribution of neritic foraging areas, where subadult and adult loggerheads can often be

found. Despite this limitation, these models represent a major step forward for conservation planning and understanding basin-wide distribution and abundance patterns of this species.

GREEN (CHELONIA MYDAS) AND LOGGERHEAD (CARETTA CARETTA) HABITAT USE OF THE MOST ENVIRONMENTALLY EXTREME SEA TURTLE FEEDING GROUND IN THE MEDITERRANEAN BASIN

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Studies of feeding grounds are vital to understanding the ecology and conservation issues of sea turtles. The hypersaline, lake Bardawil, of North Sinai has recently been recognized as being a major feeding ground for sea turtles in the Mediterranean Sea. The objective of this research was to examine if the environmental variables (salinity, dissolved oxygen, and depth), distance to nearest Mediterranean inlet, and food availability (zooplankton and phytoplankton density) differed between areas according to species richness (green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) turtles, single species, no species) and between areas in which loggerhead and green turtles were observed and not observed.

Our results highlight the importance of environmental factors determining the distribution of endangered sea turtles as areas with high sea turtle richness had lower salinity, higher dissolved oxygen, were deeper and located closer to the nearest Mediterranean inlet. Our results support the suggestion that since the creation of the man-made inlets from the Mediterranean Sea, the environmental conditions of the hypersaline lake Bardawil have become less severe and more suitable for sea turtles as a feeding ground. The conservation of this biologically valuable lake will require active management to protect it from the increasing anthropogenic threats that will encroach upon the lake in the next decade.

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HABITAT USE OF MEDITERRANEAN GREEN TURTLES: NEW TRACKING OF JUVENILES AND ADULTS FROM CYPRUS

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Green turtle clutch counts are showing pleasing increases. Yet tracking and stable isotope analysis from Cyprus suggests that the contribution of foraging sites to nesting cohorts is dominated by Lake Bardawil, with other foraging sites performing less well. This man-made habitat became colonised by foraging green turtles during the past half-century. Fisheries bycatch of green turtles is an ongoing threat which maybe undermining the suitability of foraging habitats around the island of Cyprus and in the rest of the Eastern Mediterranean. To advise on fisheries restrictions such as targeted use of bycatch reduction technology or spatial or temporal closures, an understanding of spatiotemporal patterns of habitat use are required. Meanwhile, tracking of nesting females from the Karpaz peninsula, a major rookery for Mediterranean green turtles, has been called for as a research priority, to understand their foraging areas. To determine the detailed habitat use of developing green turtles in foraging areas we deployed 13 ARGOS-linked data loggers on small (mean CCLmin: 44.5cm) juvenile green turtles caught in set nets off the north coast of Cyprus and in Famagusta Bay on the east coast of the island. These devices recorded GPS locations while eight (four in each of the two study areas) also recorded

dive data. To understand foraging site contribution to adult nesting cohorts, we deployed a further 19 ARGOS transmitters on adult turtles nesting in the Karpaz peninsula. Juvenile turtles in Cyprus foraging habitats typically exhibited bi-zonal habitat use with diel changes: diving in shallow, near shore waters (1 – 30 m) during the daytime and deeper waters (30 – 60 m) further offshore during the night. In Famagusta Bay, most shallow dives occurred between 1 – 10 m whereas on the north coast, shallow dives were deeper, at 10-20 m. This pattern of habitat use puts the species in direct conflict with siganid trammel netters, who specifically soak their gears overnight in shallow waters 0 – 30 m. Three of the juvenile turtles died during the 1656 tracking days suggesting an annual mortality rate of 0.66 which is not likely to be sustainable for green turtles developing in Cyprus foraging habitats. Meanwhile, 74% of adult females tracked from the Karpaz peninsula migrated into Lake Bardawil, supporting a concerning and increasing dependence on this heavily managed site for the recovery of the population. We discuss the spatial scales over which our study turtles operated and make suggestions for bycatch research and mitigation measures based on observed turtle behaviour.



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IS THE STRAIT OF GIBRALTAR A BARRIER FOR THE DISPERSAL OF LOGGERHEAD TURTLE NESTING?

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Global climate change is affecting the distribution and conservation status of many endangered species. Sea turtles are especially sensitive to climate change and many populations are already dispersing their nesting habitats to cooler areas. Increased temperatures affect the survival and fitness of the embryo, as well as sex determination. Warmer temperatures reduce or stop male production. Dispersal of sea turtles to cooler areas to nest has been identified in several populations. For example, the Mediterranean loggerhead sea turtle is colonizing the central Mediterranean and, more recently, the western Mediterranean, where they find cooler beaches that

can guarantee successful reproduction for decades to come. The westernmost nest of this population was found in 2020 in Fuengirola, east of the Strait of Gibraltar. If the warming of the nesting beaches continues, the dispersion of this population of turtles towards colder areas could be extremely important. In this study, we evaluated the quality of sea and beaches for loggerhead turtle nesting in the Alboran Sea and the Gulf of Gibraltar and Cadiz, to understand the viability of loggerhead turtle nesting in the coming decades and under various scenarios of global warming.

ASSESSING EGGS, EMBRYOS AND HATCHLINGS FOR IMPACTS OF CLIMATE CHANGE

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The predicted impacts of climate change on sea turtle eggs, embryos, and hatchlings include reduced egg fertilisation, increased embryo and in-nest hatchling mortality, and heat stress in embryos and in-nest hatchling. While these parameters have been the focus of studies to date, the inconsistency in methods of study and reporting of findings makes it challenging to compare temporal and spatial variations in findings. In this presentation, I will review:

- methods and resources for isolating and identifying early embryonic tissue to determine egg fertilisation rates;
 - methods and resources for assessing embryo developmental stage at mortality;
 - indicators of heat stress in embryos and hatchlings. to assist researchers in field and laboratory studies.
- INCOMPLETE ABSTRACT; TO BE FINISHED BEFORE SUBMISSION DEADLINE.

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IMPORTANT FINDINGS AFTER 38-YEARS OF MONITORING THE LOGGERHEAD POPULATION NESTING AT ZAKYNTHOS, GREECE

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Laganas Bay in Zakynthos hosts a large nesting aggregation of loggerhead turtles in the Mediterranean. ARCHELON initiated in 1984 a long-term programme containing annual nest counts and assessment of the main reproductive parameters. We present these data and the associated trends over 38 years (1984-2021). The nesting habitat, encompassing six separate beaches of 5.5 km total length, exhibits a high nesting density considered the highest in the Mediterranean. Nest numbers showed intense inter-annual variability but no significant long-term trend. Nesting increased on some public-accessed beaches, while decreased on a remote beach, Sekania, previously holding >50% of nesting in the bay. Changes among beaches are attributed to management actions by the National Marine Park of Zakynthos, established in 1999, improving conditions for sea turtles, while indicating that the previously recorded high nesting density on Sekania was rather atypical. The date of the first hatched nest, recorded precisely over

38 years, shifted significantly towards earlier dates, indicating a possible phenological change due to global warming. Clutch size, as well as body size of nesting turtles, decreased significantly over time. Hatching success, hatchling emergence success and in-nest hatchling mortality showed increasing trends. The annual number of viable hatchlings decreased, albeit not significantly, a possible result of the decreased clutch size. Incubation lengths, a proxy of incubation temperatures, showed declining trends on all six beaches with a consequent suggested increase of female primary sex ratios. Continuation of this long-term monitoring programme will provide further insights in the reproductive traits of this regionally important loggerhead population. We thank the thousands of field assistants and volunteers without whom the implementation of this programme could not have happened.

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An emerging loggerhead turtle nesting ground in Campania, SW Italy: nesting phenology and reproductive success during the period 2013 – 2021

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A REVIEW ON LOGGERHEAD NESTING ACTIVITY IN THE WESTERN MEDITERRANEAN: ARE TURTLES EXPANDING THEIR NESTING RANGE?

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Sea turtle nests in the western Mediterranean have been reported since the early 1990s but they have always been single sporadic events widely scattered over the coasts bordering the basin. However, since the 2010s reports of nesting activity have been increasing and, at least in some areas, new nesting sites seem to be emerging. Here we compile information on nesting activity from four countries surrounding the Western Mediterranean and collected data on loggerhead turtle nests between 2010 and 2020 to provide an exhaustive overview on the phenomenon of emerging new nest sites for loggerhead turtles.

The number of recorded nests has increased drastically since 2013 from 1-3 nests/year to a record number of 84 registered in 2020. While this increase may partly be explained by grown awareness and reporting by citizens, there is no doubt of an upward trend in nesting activity. The nests are unevenly distributed over the coasts of Spain, France, Italy and Tunisia with most nests occurring on the coasts of the Tyrrhenian Sea. A hotspot analysis identified beaches in SW Italy, SE Sardinia and NW Tunisia with statistically significant clustering of nests. Within these

hotspots four beaches had nests regularly identified at least four out of the five last years, three in the Cilento Park (SW Italy) and one in Tunisia. Despite not showing hotspots yet, nesting events are increasing rapidly in Spain since 2014. Metadata for the nests were also collected and analysed and show mostly correspondence to nesting phenology of Eastern Mediterranean rookeries, and mean hatching success of naturally incubating, non-relocated nests was 66%, although there was variability across the region. Also mean incubation durations varied between countries but some of the inferred sex ratios indicate sufficient female offspring production

to foster future colonization of some sites. Unfortunately, these beaches are already under high tourist pressure and subject to intense coastal development, so that females have a hard time to select a suitable site to lay their eggs, nests are destroyed by mechanical beach levelling and emerging hatchlings are disorientated by artificial lights. Thus, while this study shows that we are already witnessing an ongoing new colonisation process in loggerhead turtles, it also calls for urgent proactive conservation actions to mitigate these threats and allow the turtles to establish new nesting colonies.

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TEMPORAL ANALYSIS OF CARETTA CARETTA NEST TEMPERATURE & HATCHLING GENDER RATIO ON IZTUZU BEACH, TURKEY

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Marine turtles like many other reptile species lack genetic sex determination (GSD), instead sex determination relies on incubation temperature during a critical thermosensitive period (TSP). The internal temperature of Loggerhead sea turtle (*Caretta caretta*) nests has been recorded on Iztuzu beach, Türkiye, were measured using “tiny talk” dataloggers (Orion Components Ltd, Chichester, UK). These data loggers were placed in the centre of the nest’s egg chamber (ca 44cm depth) during or the morning after ovipositioning (n = 527). Devices were set to record once per hour indefinitely and hence recorded the internal nest temperature until the first hatchlings emerged from nest. The average internal nest temperature during the middle third of incubation, was then used as a proxy for predicted gender ratio. To avoid seasonal sampling bias, data used for inter annual comparison were binned so that incubation (and hence TSP) mid-point was between June 1st and July 15th, for which all years contained sufficient data. The mean male percentage over all study years, including all data was 25.72537%±23.30694. Average internal nest temperature (and hence male proportion) varied significantly more at lower temperatures (Pearsons correlation of standard deviation of temperatures and mean temperatures, $t = -10.729$, $p < 0.05$, $cor = 0.4420254$. Mean

incubation duration for the full study period was 53.94677±7.7.490503 s.d. days (range 31 – 77 days). These results show the primary sex ratio for hatchling *Caretta caretta* at Iztuzu beach, despite significant interannual variability has been heavily feminised during the last 10 years. In addition, climatic variables were modelled with internal nest temperatures to explore the importance of SST and air temperature during TSP. Internal nest temperature and air temperature significantly correlated ($df = 495$, $p\text{-value} < 2e-16$), the fitted gam had an r-value of 0.622, indicating the relationship is relatively strong, explaining 62.7% of deviance. Internal nest temperature and SST also significantly correlated ($df = 495$, $p\text{-value} < 2e-16$), the fitted glm had an r-value of 0.589, indicating the relationship is stronger than that with air temperature. Despite increasing numbers of nesting females at Iztuzu beach, the need to offer further protection is pressing. The importance of this rookery to the overall health of the *C.caretta* population of the Eastern Mediterranean cannot be overstated and while it is unclear if further protective measures are required currently, the projections made by the current study suggest that artificial shading or relocation programmes may become a necessity in the near future to prevent total feminization of the population.

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MORE ACCURATE AND REALISTIC TECHNIQUE FOR SEX RATIO ESTIMATION: A CASE STUDY ON GREEN TURTLE (CHELONIA MYDAS)

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Temperature-dependent sex determination, which results in female development in high temperatures and male development in low temperatures, is a common phenomenon for all sea turtles. Identification of hatchlings sex ratios is problematic because hatchlings sacrifice would be unethical. Also, using temperature data-loggers for a representative number can be costly and using dead hatchlings to histological examination can be inadequate for statistical analyze. For this method, firstly increase the histological sample size by grouping the nests according to the incubation duration (ID)-based instead of nest-based, so more accurate pivotal ID could be calculated (54,3 days). Secondly, determine the sample sizes we need to represent the accurate ID for the season [50 (SD= 2.6367, ME=0.6456) and 71

(SD= 2.4494, ME=0.6456) for each year] nests, respectively. Finally, regression equation (%female=331.2 – 5.181ID) found in ID-based model ($R^2=0.864$) was used for estimation of seasonal sex ratio. In this study, sex ratios (%female) of were estimated 61,5% and 76.5% by nest temperature (n=12), 60.3% and 62.1% by histological examination (n=188), 54.9% and 56.5% by ID (n=196). Among the variables for sex ratio estimation the ID represent the more accurate coverage of the seasons. It is possible to fail to reach the number necessary to make an accurate assessment. Therefore, it could be possible to increase the histological sample size by grouping the nests according to the ID. This technique can lead more accurate estimation on sex ratio of hatchlings by increasing sample size.

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FIRST HATCHLINGS TO THE CAPTIVE GREEN TURTLES BREEDING GROUP A NEW CONSERVATION MANAGEMENT PROGRAM FOR SEA TURTLES

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The green sea turtle is globally endangered. The contemporary small turtle population breeding along Israel's Med. coastline is only a remnant of a much larger population, which suffered a massive decline during the 1930's. During 1985 – 2002, the mean number of nests was only 3.5 nests per year. Active management was vital for the population survival. Therefore, the Israel Nature & Parks Authority decided to establish an ex-situ breeding group. The objectives are to hold a permanent group of breeding turtles in captivity, that will lay eggs in an artificial beach located in proximity to the water pools where they reside. The nest contents will then be relocated into existing hatcheries in protected nature reserves along the coast. The hatchlings will crawl to sea immediately after immergence, significantly increasing the number of offspring arriving at sea every season. Mating in the breeding group will be planned under consideration of the Mediterranean population genetic structure. In 2002, thirty hatchlings were collected from the Israeli coastline, to start the breeding group. In the following years, additional 15 rehabilitated turtles with disabilities and therefore with a low survival rate and decreased chances for

reproduction in the wild, were added to the group.. In order to allow the reproduction process, a special facility was built. First signs of mating were spotted as early as 2011, but due to delays in completion of the construction, males and females were separated until the special tanks with artificial nesting beach were ready. In May 2019, the turtles were transferred to the new breeding center and started mating and nesting. 18 nests were laid (1,227 eggs) and relocated into hatcheries along Israel's coast. A total of 105 turtles have hatched. Since this was the first reproduction season in the new facility, a few technical issues have caused the low rate of hatching. We see those first hatchlings as a great success of the project. We can reasonably assume that in the following years we will be able to increase the reproduction, relying on scientific studies conducted in the breeding group. We are only at the beginning of a long road but this year we received a proof of concept, for the project success, while establishing a facility suitable for research, tourism and increasing public awareness of marine conservation.



SESSION 4: PATHOLOGY & HEALTH

ORAL PRESENTATIONS



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SEVERE PNEUMOCELOMA CAUSED BY FISHING LINE CROSSING THE DIGESTIVE CANAL IN FOUR LOGGERHEADS (CARETTA CARETTA).

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In last six years 143 loggerhead turtles presenting severe digestive tract lesions caused by ingestion of fishing line were admitted to the Sea Turtle Clinic of the University of Bari's Department of Veterinary Medicine. For 4 of them a very severe pneumoceloma was concurrently found. After a clinical evaluation, the leakage of a fishing line from the cloaca was evident and radiographic examinations revealed the presence of a hook piercing the wall of the cervical esophagus. In Addition, a severe pneumoceloma determined the crushing of both lungs dorsally, against the inner surface of the carapace. The overdistension of the ligaments between the liver, the lungs, and the digestive canal was clearly highlighted by the radiographic contrast caused by the abundant gas in the coelomic cavity; additionally, the intestine appeared pulled in the center of the coelomic cavity due to the tension of the fishing line. An endoscopy of the coelomic cavity through the left inguinal fossa was performed during multiple surgeries to remove foreign bodies from the esophagus and intestine. This revealed in all 4 cases a rupture of the left lung in correspondence of the insertion point of the pneumocolic

ligament, wich was completely detached. The lesion was covered by extensive granulation tissue in 2 cases, which had closed the lung rupture; however, in the other 2 cases, there was evidence of anesthetic mixture leaking during ventilation. An esophagogastric tube was implanted after removal of the foreign body to guarantee appropriate feeding during recuperation. Weekly radiological tests were undertaken in the postoperative term to confirm the condition of the pneumoceloma, pending full spontaneous healing of the pulmonary rupture. Between 20 and 50 days after surgery 2 or 3 centesis of the coelomic cavity for air aspiration was performed to accelerate pneumoceloma reduction. Within 4 to 6 months of surgery, all 4 turtles had recovered from their pneumoceloma and were released back into the wild. Endoscopic evidence and tests on carcasses simulating what can happen when a linear foreign body is dragged across the intestine lead us to believe that if a fishing line is ingested and crosses the entire intestine, the lung can rupture due to detachment of the pneumocolic ligament and subsequent pneumoceloma, which is a rare but serious complication.

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SURGICAL REPAIR OF MULTIPLE HUMERAL FRACTURES IN A CARETTA CARETTA: CLINICAL, RADIOGRAPHIC AND HISTOMORPHOMETRIC ASSESSMENTS

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Sea turtle limb fractures and their treatment are poorly investigated in the literature, and they are still largely unstudied in terms of bone tissue repair. Some information has been reported about the repair process in some terrestrial reptiles, showing very long repair times and the formation of a larger quantity of fibrous callus unifying tissue as compared to the bone repair processes that occur in mammals. The present study describes the surgical treatment of multiple humeral fractures, consisting of a detachment of the distal humeral epiphysis, compatible with a type II Salter-Harris, and a fracture of the transverse diaphysis in a Caretta caretta. Radiological follow-up was carried out until the turtle was released into the sea. Three months after the release, the turtle was caught on a hook and fished up dead from a depth of 40 meters. To determine the evolution of bone repair, the right humerus was removed for histological

and histomorphometric analyses. As a control, also the left humerus, which had never been fractured, was removed, and processed with the same procedure. Two years after the surgery, radiographic follow-up showed a better filling of the fracture line and further remodeling of the stump margins. Our histomorphometrical data showed an elevated bone formation exclusively at the proximal and distal levels of the fracture gap, whereas the intermediate levels were characterized by a greater extension of cartilage. The coexistence of bone, cartilage and fibrous tissue suggests that both direct and indirect osteogenic processes take part in the repair processes. A substantial difference from bone repair processes in mammals was the constant presence of a wide medullary cavity. This case study provides a better basic understanding of the repair tissue in marine turtles and may lead to some guidance concerning the need of surgery.

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THE LEADING CAUSE OF DEATH OF TRAWLED TURTLES: DROWNING OR GAS EMBOLISM, THAT IS THE QUESTION

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International trade in turtles is no longer a conservation issue in the Mediterranean, but many turtles are by-caught by fishing gears targeting other species. Incidental captures of sea turtles in fishing gear contribute significantly to the mortality of sea turtles in the Mediterranean. According to several studies, direct mortality due to trawling depends on tow duration and hence to the submergence time. Drowning can result when turtles have been held underwater after capture in fishing gear. More recently loggerhead turtles entrapped during fishing trawls or in gillnets have been found to develop gas embolism (GE) which may lead to severe organ injury and even mortality. Between January 2016 and December 2021, 1445 loggerhead sea turtles incidentally captured (bycaught) in trawls were admitted to the Sea Turtles Clinic (STC) at the Department of Veterinary Medicine in Bari (Italy) for veterinary evaluation after having been taken to the local Adriatic Sea turtle rescue centre (World Wildlife Fund, WWF, Molfetta). The duration from surfacing (time of capture on fishing boat) until the animal arrived at the STC ranged from 5 to 7 h. Turtles were mainly incidentally captured (bycaught) in trawls in the winter months, with the highest incidence in December and January. We evaluated all the turtles bycaught both live and dead. Immediately upon admission, physical and radiographic examinations of each turtle were performed. All radiographs were assessed to evaluate

signs of drowning, characterized by interstitial and peribronchial thickening, and the presence of GE within the cardiovascular system. In all turtles with radiographic signs of GE, we evaluated and listed the cardiovascular sites (CAS) where the gas was clearly detectable. The main objective of the study was to evaluate the percentage of animals that died from GE and/or drowning to understand the definitive cause of death in trawled turtles. Of 1445 trawled turtles, 540 (37.4%) showed radiographic signs of systemic GE of variable severity, of which 147 (27.2%) also showed radiographic signs of drowning. Of the 540 subjects with signs of GE, 102 (19%) died and of the 147 turtles with GE and signs of drowning, 67 (65%) died. By contrast, of the 905/1445 (62.6%) turtles without radiographic signs of GE, 30 (3.3%) showed radiographic signs of drowning, however, none died. We found 14 CAS where gas could be detected. In the univariate analysis, radiographic drowning signs of GE-affected turtles emerged as a statistically significant factor for increased risk of death. However, in the multivariable analysis, radiographic drowning signs were not a risk factor for death, while the number of the CAS (>12/14) and the presence of GE in the left atrium and sinus venosus/right atrium were the only risk factors. According to the data it can be deduced that trawled sea turtles rarely undergo drowning without also suffering from GE and that mortality is closely associated with the presence of

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drowning contextually to GE. Specifically, we can therefore hypothesise that the turtles probably first undergo severe GE involving the heart then subsequently drown. We therefore hypothesise that the

leading cause of death of turtles caught in trawling gear is severe undiagnosed GE and not water aspiration associated with forced submergence.

THE PARASITE COPEPOD BALAENOPHILUS MANATORUM IN DEBILITATED SEA TURTLES HATCHLINGS

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Balenophilus manatorum (Copepoda: Harpacticoida) is an ectoparasite of sea turtles, which feeds on the soft alfa keratin of turtles' skin, occasionally causing erosive to ulcerative lesions especially in immunosuppressed animals. During summer, events of mass stranding of small loggerhead turtle juveniles along Northwestern Adriatic coast have been registered in the past years, suffering from variable degrees of Debilitating Turtle Syndrome (DTS). In this survey, we studied the occurrence of B. manatorum in Caretta caretta rescued along the NW Adriatic coast and studied its relation with DTS. Clinical examination (size, body condition score [BCS], percentage of body covered by barnacles and standard hematologic examination) was performed at arrival at the CESTHA Rescue Center. Parasites were isolated from 19 animals through careful washing and brushing of the turtles' skin in tap water, and successive observation of flushes at the stereomicroscope. Scanning electron microscopy was performed on a subsample to confirm the identification of the copepods. Molecular analyses were performed as well on pools of parasites using published protocols for the COX1 gene of

Harpacticoida. Difference in prevalence and intensity of infection in DTS and non-DTS groups was statistically evaluated. Ten out of 19 turtles were classified as affected by DTS, all small juveniles, having different degrees of anaemia (PCV 8-20%) and massive skin coverage by the barnacle Platylepas sp. (50-90% body surface), as well as reduced BCS. Higher prevalence (100% vs 45%, $p=0.01$) and intensity of infection (mean intensity 137 vs 102, $p=0.04$) by B. manatorum were reported in the DTS group. Two sequences of good quality were obtained and a maximum similarity of 85% with other Harpacticoida was retrieved from their alignment in GenBank. Though the presence of massive coverage by barnacles prevented the evaluation of skin lesions due to B. manatorum, we hypothesize that this parasite may represent a secondary pathogen in DTS-affected turtles. Infection by B. manatorum should not go overlooked especially in most debilitated animals and repeated fresh water baths should be taken into consideration to reduce parasitic burden on the turtles.



SESSION 5: ANATOMY, PHYSIOLOGY & GENETICS

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SEA TURTLE COLONIZATION UNDER GLOBAL WARMING: FEMALES NEEDED TO SUCCEED

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The loggerhead sea turtle (*Caretta caretta*) is particularly sensitive to climate change due to temperature sex determination, increasing hatchling mortality and the potential constraints to colonize new areas due to philopatry. Previous studies have described an incipient colonization process in the Western Mediterranean, but the rapid increase of sporadic nests in recent years needs assessing the reasons of this acceleration. From 8 nests laid between 2016 and 2019 in Spain, we sequenced one sample per nest for a fragment of the mtDNA D-Loop region revealing a mixed origin of the nesting females, from both Mediterranean and Atlantic nesting areas. We genotyped 45 hatchlings of the same nests using a 2bRAD technique. By using parentage analysis, we detected a minimum of 7 females and 9 males, one mother per nest except for two nests that were laid by the same female 213 Km apart within the same season. In addition, 50% of the nests presented multiple paternity, which increases genetic

diversity. On the nesting events. Additionally, we gathered information about clutch size, hatching success and incubation duration to estimate the percentage of female offspring. The rates of estimated female offspring have been increasing, with an average of 42.1% and reaching the highest values in recent years being highly dependent of the beach conditions. Overall, our results suggest that the analysed nests are the result of single colonisation events rather than being laid by returning females. Thus, the recent raised number of nests may be caused by the increase of turtles in the populations of origin and an earlier sexual maturation due to global warming. However, the high percentage of offspring females in recent nests indicate the potential of having future returning individuals when reaching maturity. Our results allow defining the current state of the potential colonization although the detection of remigrants is needed to confirm the establishment of the nesting population.

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PLASMA HORMONE LEVELS AND BLOOD BIOCHEMISTRY IN THE GREEN TURTLE *CHELONIA MYDAS* REARED UNDER CAPTIVITY AS A TOOL TO PREDICT MATING AND OVIPOSITION

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Circulating estradiol (E2), Testosterone (T) and progesterone (P4) levels and blood chemistry were monitored in green turtles *Chelonia mydas* during continuous seasons in the Israel sea turtle breeding facility. Female presented consistent E2 profiles from year to year, a rise from January to June with a peak towards the end of April, oviposition females had higher levels. P4 levels in females were high in April (mating) and higher towards the start of June due to oviposition, females that presented levels above 1ng/ml had successful oviposition (8 females). T profiles were high at the onset of vitellogenesis towards November and again, high during April. Males T levels elevated levels from June to November, and decreased from January to April. P4 levels were high in males during April probably due to mating and higher towards November due to interaction with the females in the tank. Male E2 levels were high toward April due to mating and again in November. Metabolites and Electrolytes

levels and Gamma-Glutamyl transferase (GGT) were elevated toward November only in nesting females. We were able to predict which females will undergo oviposition with a specific profile of P4 showing elevation in levels from February toward June. This will allow us in the future to selectively couple mating pairs we desire to ensure that the Mediterranean population genetic variability is maintained. Clutches per female were between 2 to 6, and 25 in total. Averagely females laid 91 ± 7 eggs (range 39-139 eggs) per nest with emergence rate of ~10% (0–58%). Overall same trend in circulating steroid levels over the years in males and females, reaching oviposition only when a certain threshold was achieved. We believe that the similarity at the facility to that in the wild contributed to the breeding success and will lead the way for implementation of more captive breeding programs to assist the recovery of endangered species, in addition to the existing conservation programs.

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Population genomics and adaptation of the Mediterranean loggerhead nesting turtles

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MOLECULAR METHODOLOGY FOR ASSESSING THE MEDITERRANEAN GREEN TURTLE POPULATIONS AND MONITORING THE ISRAELI BREEDING STOCK.

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The threatened green turtle population of the Mediterranean has been monitored in the past two decades by molecular means, mainly the genetic variation of the mtDNA control region. A new method of haplotypic determination enabled an international collaboration identifying four management units in the region's population. However, since this approach ignores the male contribution to the population variability, we had to develop a nuclear-based DNA typing. RAD-sequencing of 350 Mediterranean green turtles, including the members of the Israeli breeding stock, yielded about 30,000 informative SNPs.

This vast amount of genetic variation enabled calculating the genetic distance between any two individuals, identifying relatives like siblings and half siblings. We were able to identify each nesting female in the Israeli coast in the past decade, thus covering all the local female contribution to the Israeli population. Identifying the male contribution requires a specially developed algorithm. We have already used our findings for paternity determination of hatchlings in the breeding stock and selection of new recruits to the breeding stock, based on their genetic polymorphism contribution.



SESSION 6: OUTREACH, CONSERVATION & MANAGEMENT

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SESSION 6: Outreach, Conservation & management

AN ACTION PLAN FOR THE PROTECTION OF TURTLES IN GREECE: PRIORITIES, ACTIONS, OUTLOOK

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Sea turtles as a flagship species symbolize the value of protecting nature and its biodiversity. In this context, an Action Plan (AP) for turtles promotes the peaceful coexistence of humans with nature. APs are valuable tools including actions and measures to for the conservation of species and/or habitat types, reversing declines where they are observed. Under both Greek and European Union legislation, Greece is required to establish action plans for priority species and habitat types, to secure the conservation of biodiversity within its territory. Within this framework, loggerhead turtles (*Caretta caretta*) were selected as one of the first species to have an AP for their long-term protection. The AP for *C. caretta* was compiled as part of an EU co-funded LIFE-Nature project (LIFE Euroturtles), supported by the Ministry of Environment & Energy that committed to partially fund its implementation via LIFE-IP 4 NATURA, and was officially adopted as a Joint Ministerial Decree in August 2021. The best available science was used,

incorporating guidelines from the Action Plan for the Conservation of Mediterranean Marine Turtles (RAC/SPA, 2008) and considering experience from APs implemented in other countries. The AP has a six-year duration and focuses on *C. caretta*, although its actions benefit both *Chelonia mydas* and *Dermochelys coriacea* that frequent the Greek waters. Its main goal is to improve the conservation status of sea turtles in Greece through the recovery of their populations and the improvement of their terrestrial and marine habitats in the country. To achieve is goal, actions in the AP aim to maintain and increase present levels of nesting, to improve conditions within critical terrestrial and marine habitats for the species by managing threats, to expand scientific knowledge, and to empower all stakeholders to work towards the long-term protection of the species. Here we will present rationale, priorities, main actions of the AP and outlook for the future.

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MOBILE APPLICATION “ETURTLE “FOR SEA TURTLE CONSERVATION THROUGH CITIZEN SCIENCE

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Currently, loss of the biodiversity is among the most urgent environmental problems to deal with. Its monitoring become a priority in conservation issues. For this, novel methods and approaches are now available to complement, or in some cases replace, classical monitoring methodologies. Implementation of digital monitoring tools has been developed aiming to augment biodiversity monitoring programs, covering larger areas and time periods and economizing both human capital and natural resources. Mediterranean Sea turtles are threatened (critically endangered, endangered or vulnerable), needing more care. For this purpose, Life Med Turtles project is using innovative Android Mobile Application named eTurtle to improve data collection and biodiversity awareness. The application was launched in 2018 and

is freely available in 11 languages for Android. This application, available for fishers, scientists and volunteer observers, provides information about Sea turtle observations at sea (bycatch, floating...), nesting sites and stranded. From June 2022, 1615 observations were accessible from the app's home screen of which 1398 were reported in the Mediterranean, among them 630 in the Tunisian coasts (598 *Caretta caretta*, 2 *Chelonia mydas*, 9 *Dermochelys coriacea* and 21 unknown species). Among all sea turtle observations in Tunisian coasts, 489 are dead stranded animals measuring between 50 and 70 cm CCL. This project seeks to involve all Mediterranean countries in this monitoring to develop a large citizen science database.

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LIVING WITH POPCORN NESTING: MANAGEMENT, MONITORING AND OUTREACH LESSONS FROM NESTING EVENTS IN THE WESTERN MEDITERRANEAN

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The western Mediterranean is experiencing an increasing nesting activity of the loggerhead sea turtle (*Caretta caretta*) that is thought to be a response to global warming. The number of nesting events has raised during the last years, challenging the countries that are experiencing sporadic marine turtle nesting for first time and lack knowledge and resources to coexist with this ‘popcorn’ nesting. Here we present the major lessons obtained from two projects in the region: the COMING project, to use Marine Protected Areas as focus points for coordinated monitoring and management of the new nesting events, and the Nidos-Caretta project, that conducted a pilot test in Catalonia region for an integrated management and monitoring of the nesting events. Both projects had in common the integration of three basic pillars: management, research and outreach. A) The projects aimed to improve the management skills of the authorities and affected stakeholders by developing international, national and regional protocols

adapted to the particularities of these nesting events. The protocols provided standardized procedures for nesting management and monitoring but also described the network of stakeholders and their responsibilities and included flowcharts of action for an efficient response. B) Monitoring and research was also a fundamental part of the projects for understanding the characteristics and peculiarities of these emerging nesting areas by using a multidisciplinary approach. C) Outreach aimed to inform the citizenship, to minimise negative impacts to the nesting females and hatchlings and to develop a network to facilitate the detection of nesting events through citizen science. As a result of this integrated approach, our region has taken firm steps towards a sustainable coexistence between ‘popcorn’ nesting and human activity. Finally, this experience can be very valuable for other regions that are also experiencing emerging colonisation scenarios.

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OBJECTIVE METHOD FOR QUANTIFYING CHANGES TO ECOTOURISM VIEWING INTENSITY ON LOGGERHEAD SEA TURTLES DURING THE COVID-19 PANDEMIC USING A SOCIAL MEDIA-BASED MODEL

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The recent COVID-19 pandemic resulted in an unprecedented disruption of tourism globally, including the Mediterranean. Consequently, ecotouristic activities in wildlife hotspots were significantly reduced, particularly during 2020 and 2021 summers. Laganas Bay in the southern part of Zakynthos Island, Greece, is one such hotspot, supporting large numbers of loggerhead sea turtles (*Caretta caretta*). Around 300 and 100 adult females and males migrate to the bay to breed each summer, in addition to about 40 juvenile and adult males that are present year-round. Turtles are subjected to intense viewing pressure, both via organised boat tours and independent swimming/snorkelling. During the pandemic, international airport arrivals (May-October) in 2020 and 2021 dropped by 76% and 43%, respectively, compared to “normal” (i.e. 2019 season). Here, we developed a modular stochastic model to quantify changes to ecotouristic viewing pressure on turtles objectively via social media images, taking uncertainty into account. We compared social media entries of uniquely identified sea turtles (photo-identification) on Zakynthos for the pandemic impacted years (2020 and 2021) to a

normal tourism year (2019) (n = 2646 entries in total). Pressure was calculated based on the number of times individual turtles appeared in social media in pre-defined time windows, allowing us to account for the influence of time-dependent variables (e.g. number of people with access to social media). We found that, at the season scale (184 days), pressure from boat observations was 75% and 50% lower in 2020 and 2021, respectively, compared to 2019. Evaluation by month showed that tourism pressure was noticeably lower during June of the two pandemic years (98% and 71% lower compared to 2019), but the reduction on pressure was less pronounced in August (66% and 43% lower compared to 2019). At the scale of individual animals, we confirmed that certain turtles, particularly residents, were subject to disproportionately high pressure during certain time periods despite lower tourism activity. In conclusion, this study showed that even though the overall tourism pressure on sea turtles declined during the pandemic, it varied significantly depending on the turtles (juvenile/adult, male/female, resident/migrant) and time period of the touristic season.

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HOW CITIZEN SCIENCES USING SOCIAL MEDIA HELPED TO COLLECT DATA ON MARINE TURTLE STRANDINGS IN TUNISIA.

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Citizen science initiatives are gaining traction as a cost-effective way to improve data gathering and contribute to citizen education and environmental protection. In the Mediterranean region, three species of sea turtles are observed (Loggerhead, Green and Leatherback turtles) which are protected by international conventions and national laws. Interest in sea turtles in the Mediterranean has grown steadily over the last four decades, mainly thanks to conservation concerns, in particular, the need to have adequate knowledge concerning the threats they face as well as the biological and ecological parameters that are relevant to their conservation. To support the conservation efforts, most Mediterranean countries have implemented monitoring and conservation initiatives in order to locate concentration regions, nesting and feeding locations and causes of mortality. In Tunisia, a new citizen sciences initiative was born in April 2020 during the COVID pandemic through a Facebook group called “TunSea” in order to fill the gap between the scientific community and the general public. TunSea is a Tunisian citizen sciences platform that promotes innovative marine educational initiatives, information regional, and and worldwide marine sciences. Over 37,000 people have joined the group since its inception. TunSea has established itself as Tunisia's go-to

resource for participatory marine science. This group has grown in popularity in a short period of time, bringing together decision-makers, scientists, and other stakeholders such as fishermen, aquaculture workers, and sea users. The group was established for the purpose of information sharing about marine species and marine sciences, discussions about marine conservation, observations and reports of particular species and events, and many others... Sea turtles were among the species that gained most attention in the TunSea group. Several images of sea turtles (stranded dead or alive) were uploaded inquiring about their identification or presence in a region of the Tunisian coast in order to seek professional opinion on the reasons of death. Since the inception of this Facebook page, over 300 images of stranded sea turtles have been shared by various segments of Tunisian society. Information gathered from the group's images allowed us to estimate: the number of strandings every year (99% loggerhead, 1% leatherback) the spatio-temporal distribution of strandings as well as the reasons of death whenever it was possible. These findings are not only important for a better knowledge of the biology and the ecology of these threatened species, but they also encourage us repeat this experience with other species and follow the “TunSea” initiative with other sciences that need direct observation in the field.

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AN ENVIRONMENTAL EDUCATION PROGRAM AT THE LARGEST NESTING SITE OF LOGGERHEADS IN THE MEDITERRANEAN

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Since 1985, ARCHELON, the Sea Turtle Protection Society of Greece operates an Environmental Education Program in Greece. In 2001 the Environmental Centre of Agiannakis (ECA) was established at Kyparissia Bay which hosts the largest nesting aggregation of loggerheads in the Mediterranean and features an extensive sand dune system with coastal pine forest. The ECA's educational program (EP) is designed to increase environmental awareness among residents and visitors. Here, we see the ECA as a tool to increase understanding among local communities on the significance and the ecological value of the environment that they live in. The EP aims to teach ways to preserve what is valuable, like the sea turtles that we use as a flagship species. The EP runs every year from May until October and welcomes students of all ages. Here students learn through interactive exhibits about the evolution of life on earth and the local natural and cultural environment. One challenge to the efficacy of raising awareness about sea turtles is allowing

people interact with sea turtles in their natural setting with minimum disturbance. Here we introduce the students to a sea turtle's life cycle by showing them the in-situ protected nests, where we have talks and Q & A sessions, educational games and organized group activities. All the above are taking place at the pristine coastal environment thus we are able to demonstrate the challenges of sea turtle conservation as part of a complex natural environment. In the 19 years before the COVID-19 pandemic (2001-2019) the ECA hosted more than 200 school groups with 7,500 students and teachers having participated in educational activities. In 2022 schools were able once again to visit the station and 290 students experienced again the EP. Through the ECA we have managed to interact with the future generations in the area and help them understand nature and the interdependence of humans and non-human organisms in a creative and inclusive way.

ORAL PRESENTATIONS
SESSION 6: Outreach, Conservation & management

ORAL PRESENTATIONS
SESSION 6: Outreach, Conservation & management

USING RESOLUTION XIII-24 OF THE RAMSAR CONVENTION IN THE MEDITERRANEAN SEA AS A TOOL FOR THE CONSERVATION OF MARINE TURTLE HABITAT

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In November 2018, at the COP XIII of the Ramsar Convention, a resolution presented by France and Senegal on the coastal habitats of marine turtles up to 6 meters deep in the sea was adopted. This concerns 12 habitat types: nesting, embryonic development, basking, mating, interbreeding, nursery, frenzy,

development, feeding, marine resting, cleaning, wintering. A publication by the authors inventories these habitats in existing coastal Ramsar sites and makes recommendations for designating other sites important for the life cycle of marine turtles, including in the Mediterranean Sea.

A well-connected network for sea turtles monitoring in south mediterranean countries

Ben Nakhla, L., Attia, K & Limam, A.



SESSION 1: THREATS

POSTER PRESENTATIONS

POSTER PRESENTATIONS
SESSION 1: Threats

SPATIO-TEMPORAL ANALYSIS OF MARINE TURTLE STRANDINGS ON THE NORTHWEST COAST OF MOROCCO

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Marine turtle stranding data are a valuable source of information on population indicators, biological analyses and causes of mortality. In the present study, the species composition, Spatio-temporal distribution and potential mortality causes were analyzed based on data provided by the NHRI stranding network. Two species of sea turtles were present on the northwestern coasts of Morocco for five years (2016-2020), from Jebha to Larache. These species were the loggerhead turtle *Caretta caretta* (n=19) and the leatherback turtle *Dermochelys*

coriacea (n=5). Analysis of strandings from 2016 to 2020 (n = 24) shows that the relative frequency of strandings of these two species has decreased significantly, with a large number of strandings reported in the western Mediterranean (88% of reported cases). All stranding events showed no significant seasonal or monthly differences (p-value>0.05). In this study, 32% of all stranding events showed interactions with fishing.

THE RISKS AND THREATS ON THE TURTLES IN YEMEN

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Sea turtles in Yemeni waters are exposed to many continuous threats by humans, and this matter is becoming more dangerous today as a result of the decrease in their numbers in the Yemeni seas and the shores of coastal reserves. All species of sea turtles are endangered animals worldwide and are listed by the International Union for Conservation of Nature (IUCN). Any form of stalking them around the world is illegal. According to the 2014 Public Authority for Environmental Protection report.

Five species of turtles were recorded from the Yemeni water. Their nesting and breeding ground extends along the sandy shores of Yemen. These species are Green turtle - Hawksbill turtle - Loggerhead turtle - Leatherbacks turtle - Olive ridley. Yemen is a signatory to the Convention on International Trade in Endangered Species (CITES). Yemen ratified it in 1997, and sea turtles were included in the appendix to this convention. It is protected from international trade.

POSTER PRESENTATIONS
SESSION 1: Threats

INTERACTION ENTRE LES PECHERIES ET LES TORTUES MARINES AU PORT JEBHA

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In the Mediterranean, marine turtles are threatened by bycatch. Coastal fishing has resulted in many interactions with marine turtle populations. To study these interactions, surveys were conducted with 24 coastal fishermen during January and March 2021. A total of 42 sea turtles were incidentally caught in 2020, by 24 vessels according to the surveys at the port of Jebha. 28 turtles by bottom trawl and 14 by purse seine, of which 36 were loggerhead turtles, 5 were green turtles, and only one was a leatherback. Only one turtle was counted as dead, which was by trawl. However, purse seining has no lethal effect on marine turtles. The majority of these catches occurred in the

spring and summer. The turtles caught in the nets were mainly juveniles and subadults ranging in length from 50 - 100 cm. The majority of active fishermen are older than ten years (95.83%, n=23), of which 73.91% (n=17) stated that the number of catches of marine turtles has decreased compared to the past and 26.09% (n=6) stated that the incidental capture of marine turtles has increased. The majority of fishermen are older than 36 years. Most stated that fishing is the main source of living. 21 fishermen interviewed had been fishing for a period of between 5 and 30 years (87.5%, n=21).

POSTER PRESENTATIONS
SESSION 1: Threats

TURTLE EXCLUDER DEVICE (TED): PRELIMINARY RESULTS ON SEA TURTLE BYCATCH AND COMMERCIAL EFFICIENCY OF BOTTOM TRAWLERS IN THE GULF OF MANFREDONIA, ADRIATIC SEA

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One of the greatest threats to sea turtle conservation is represented by incidental catches due to fishing activities. Bottom trawlers are considered one of the most impacting fishing gears for sea turtle populations. Turtles mostly die for the forced apnea, therefore, reducing the time a turtle is retained in the trawl is essential to reduce both direct and delayed mortality. To this aim, turtle excluder devices have been adopted in many fisheries of the world but not yet in the Mediterranean where trawlers target multiple species of relatively large size resulting in a higher commercial loss. Given the key role fishermen play in sea turtle conservation and considering their reticence to change the gear traditionally used, it is crucial to determine the optimal gear configuration that can be both commercially efficient and turtle friendly. The LIFE MEDTURTLE project (cofounded by the LIFE instrument of the EU) aims to evaluate the efficiency of a recent type of TED in the Adriatic Sea, that represents an important

neritic foraging area for Mediterranean loggerhead turtles (*Caretta caretta*) and where a very high number of turtle catches by trawlers occurs. We tested TEDs on 2 trawlers in the Gulf of Manfredonia (South Adriatic). Data were collected by onboard observation while comparing the flexible TED with non-modified gears (case control study). Variables considered included the rate of sea turtle bycatch and the total catches of commercial, discard (species that have no commercial value and undersized or damaged individuals) and debris (both natural and anthropogenic). Preliminary results on two different trawlers equipped with top-opening TEDs showed an average commercial catch loss of 8% on 96 hauls in total. This seems promising regarding the potential use of this type of TED, but further adjustments will be explored and more data will be collected during the project.

POSTER PRESENTATIONS
SESSION 1: Threats

SINGLE-USE PLASTICS HIGHLY AFFECT LOGGERHEAD SEA TURTLES IN THE WESTERN MEDITERRANEAN SUB-REGION

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Caretta caretta is the most abundant sea turtle in the Mediterranean sea, and it is threatened by human activities during all its life stages. Litter pollution has become, in the last years, one of the main issues affecting all sea turtles recovered by Rescue Centres. A high percentage of the sea turtles accidentally by-caught in fishing gears, entangled in ghost nets, found at the sea surface, or washed ashore ingested marine litter objects before their recovering. Through the Marine Strategy Framework Directive (MSFD), great attention has been focused on this topic, and C. caretta was recently chosen by the European Commission as a bio-indicator for plastic pollution within the Mediterranean. Following the standardised MSFD protocol, we collected data to investigate further which items this species is more prone to ingest. Moreover, we integrated the Fourier Transform Infrared Spectroscopy (FTIR) analysis into this protocol, allowing us to determine each item's polymer type. The “Stranding Network”

of Lazio, managed by Regional Institutions in accordance with Coast Guard and volunteers, as well as the “Regional Network” of Sardinia, entirely made by Marine Protected Areas and National Parks, with the support of Vigilance Bodies, was able to recover all the injured or stranded loggerhead sea turtles. We analysed samples from 226 sea turtles from 2008 to 2017 in two areas of the western Mediterranean sub-region (Lazio and Sardinia). In the Lazio area, we found a frequency of occurrence of plastic ingestion of 78.33%, while in Sardinia, 41.79%. The analysis of the litter categories among all individuals highlights user-sheet prevalence (Use-She; 69.13%) and user-fragment plastics (Use-Fra; 20.84%). The polymer analysis showed a dominance of polyethylene (65.98%) and polypropylene (26.23%). These results show that single-use plastics represent the litter typology mainly ingested by loggerhead turtles in the Western Mediterranean sea.

POSTER PRESENTATIONS
SESSION 1: Threats

PLASTIC IN MARINE TURTLES: WHAT WE CAN LEARN FROM THE DEBRIS EXPELLED BY PATIENTS OF THE LAMPEDUSA SEA TURTLE RESCUE CENTER

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The plastic littered in the Mediterranean Sea is diverse. Currently scientific data show Marine Turtles consume different types of plastic, with a range of densities and colours. The aim of this study was researching into the proportion of plastics consumed by turtles rescued in the Lampedusa Turtle Rescue Center and whether there is a clear difference in the types they consume; by looking at the size, colour and flexibility of plastic passed through turtles in the recent years (2015-2022) of Lampedusa Turtle Rescue. This is limited to the Mediterranean due to the location of which the patients were brought to the centre. A considerable amount of hard plastic has been collected by feces or through turtles' digestive tract, and many pieces fragmented. Each piece of

plastic collected was analysed, measuring the width and length, as well as noting down the colour and determining the material type. The results were compared to find percentages of each colour and type and statistical tests determined whether there was a type and coloured plastic that was more prominent in the Mediterranean, or that had a higher likelihood of being consumed. This study would like to play a part in determining whether plastic consumption is a rising issue within the Mediterranean and whether there is a growing abundance of plastic, a probable future issue, that ideally, we should be researching from now.

THE GREEN SEA TURTLE (CHELONIA MYDAS) INGESTS LARGE AMOUNTS OF MARINE LITTER IN TURKEY'S WESTERN MEDITERRANEAN AND SOUTHERN AEGEAN COASTS

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Increasing marine pollution concerning researchers and threatens natural life. All sea turtles are known to ingest plastic waste in the seas. As a result of litter ingestion, it is common for individuals to lose their condition and even die. Therefore, sea turtle species are shown as a good indicator for monitoring pollution in the seas. Dead or injured stranded sea turtles are widely used to monitor pollution. In this study, marine litters in the digestive systems of stranded green sea turtle (*Chelonia mydas*) individuals on Turkey's western Mediterranean and southern Aegean coasts between 2020 and 2022 were investigated. Sea Turtle Research, Rescue and Rehabilitation Center (DEKAMER) collected stranded green sea turtles from the regions between İzmir, Aydın, Muğla, and Antalya through the rescue network of DEKAMER. Necropsies were performed on a total of 51 individuals. The esophagus, gut and intestine contents

were examined and recorded according to the type, size and amount of microplastic and macroplastics obtained. Marine litter occurrence rate in the digestive system of green sea turtles was 52.94%. In addition, 17.6% of the individuals ingested longlines. The common ingested litter types were plastic films and fibers. Our results show that green sea turtles in the study area are exposed to high levels of marine litter. Although there are no large river systems to carry waste in the study area, it indicates that the high rate of exposure of green sea turtles to litter creates pressure on all living things in the region, especially in these regions where tourism-related human influence is high. For this reason, new measures should be considered for both tourism activities and waste management of coastal settlements in the region.

THE ENTANGLEMENT OF SEA TURTLES IN ANTHROPOGENIC DEBRIS IN THE MOROCCAN MEDITERRANEAN

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Lost, abandoned or discarded fishing nets constitute a major threat to marine wildlife. Sea turtles are most affected by this problem. However, assessments of their impact on threatened sea turtles are largely lacking in the Moroccan Mediterranean. Here, we provide for the first time the record of sea turtle entanglement in the Moroccan Mediterranean. This study identified

15 cases of sea turtle entanglement in anthropogenic debris, including two species *Caretta caretta* (n= 3) and *Dermochelys coriacea* (n=2). The fishing activity is the main source of this type of litter, showing the importance of educating fishermen about the impacts of the release of this litter on marine fauna and especially on sea turtles.

POSTER PRESENTATIONS
SESSION 1: Threats

TEN YEARS OF MONITORING MARINE LITTER INGESTED BY SEA TURTLE (2011-2021): THE ITALIAN EXPERIENCE.

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The Marine Strategy Framework Directive (MSFD) requires European Member States (MS) to develop monitoring strategies that should lead to programmes of measures achieving or maintaining Good Environmental Status (GES) in European Seas. One of the criteria to be monitored is "The amount of litter and micro-litter ingested by marine animals is at a level that does not adversely affect the health of the species concerned". In 2011 Matiddi et al., proposed the sea turtle *Caretta caretta* as good indicator for monitoring marine litter ingestion by biota in the Mediterranean Sea, alike the *Fulmarus glacialis* for the North Sea. After a pilot action, the guidelines produced by Italy were incorporated in to the EU Guidance of Monitoring of Marine Litter in European Sea (Galgani et al., 2013). Matiddi et al., (2017), produced the first evaluation of possible GES scenarios collecting data from 110 turtles stranded along the Italian Western Mediterranean sub-region. Authors reported that, 27% of loggerheads had 1.3 g or more plastic in the stomach and 64% of loggerheads had more plastic grams than food remains (Foo) in the stomach,

considering a turtle with more plastic than food in the stomach as an animal in a bad health condition. These values cannot be considered as GES as the samples were collected all in the same region without comparison with data coming from an area considered pristine or near to pristine (Matiddi et al., 2019). At the meantime, Italy is collecting data on ingested litter enlarging the number of samples and the spatial coverage. Within the National Monitoring Programme, 916 stranded turtles were collected from 2011 to 2021. The 48% of sea turtles were found with ingested marine litter and 32% of these with more ingested litter than natural food remain. The average value of plastic ingested were of 2,36 gr. The analysis of the litter categories, among all individuals, highlights a prevalence of user-sheet (Use-She; 46%) and user-fragment plastics (Use-Fra; 25%). Data collected are fundamental to understand distance from GES and evaluate the strength of Programmes of measure. Moreover, this method will allow comparability of data among different countries.

POSTER PRESENTATIONS
SESSION 1: Threats

ASSESSING THE PRESENCE OF MARINE LITTER IN SEA TURTLES FROM THE GULF OF CÁDIZ AND THE ALBORAN SEA

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Marine litter is one of the top contaminants of concern that our world is facing. The presence of plastic and other debris in the marine environment is not limited to areas of high population density, but is manifested in the most remote places on the planet, from the open ocean to the Arctic and even in the great abyssal depths. Large accumulations of litter entanglement and ingestion by marine organisms are a visual part of this problem, which is accompanied by impacts at other ecosystem scales, sometimes with almost unpredictable consequences. In the present study we focused on understanding the impacts of litter on two species of sea turtles: *Caretta caretta* and *Dermochelys coriacea* predominant in the study areas: the Gulf of Cadiz and the Alboran Sea. In addition, both species are considered vulnerable species on the IUCN red list. The team was formed with the collaboration between marine scientists from the University of Cadiz specialized on marine litter and associated veterinarians whose expertise with these organisms relate the rehabilitation of stranded individuals as well

as post-mortem assessments. The team performed necropsies to the specimens and separated the digestive content to determine the presence of plastic in the digestive tract of the organisms. The processes involved the development of a protocol for the extraction of litter and microplastics that offered the opportunity to determine fragments as small as 200µm. Macro and mesoplastics were separated through visual inspection whereas microplastics (smaller than 5mm) where extracted after a 24h-digestion with KOH at 10%, 40°C. Each individual item was characterized through image processing with ImageJ software to determine its physical features and polymer types were assessed by using Fourier transform infrared spectrometer (FTIR). Preliminary results indicate the relative high presence of this contaminant in *C. caretta* and *D. coriacea* with non-acute effects detected at structural level, although its indirect link as a potential cause of death at physiological level is still unclear.

POSTER PRESENTATIONS
SESSION 1: Threats

IMPACTS OF CLIMATE CHANGE ON THE NESTING DISTRIBUTION OF CHELONIIDAE IN THE MEDITERRANEAN SEA

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Climate change is reshaping global ecosystems at an unprecedented rate, with major impacts on biodiversity. Many species are already responding by changing their phenology and distribution range, among other adaptations. Understanding how organisms can withstand change is key to identify priority conservation objectives. Marine ectotherms are being extremely impacted, in particular species whose biology and phenology are related to temperature, such as sea turtles. These depend on both marine and terrestrial environments and are influenced at the same time by changes occurring in both realms. We explored the changes of nesting grounds over the last years, focusing on loggerhead and green sea turtles (*Caretta caretta*, *Chelonia mydas*) in the Mediterranean Sea. We incorporated both terrestrial and marine variables into species distribution models (SDMs), and we projected the potential nesting distribution, across the Mediterranean basin, at present and under future greenhouse gas emissions (2000–2100). SDMs of both species (*C. caretta*: mean AUC = 0.919 ± 0.047 ;

C. mydas: mean AUC = 0.943 ± 0.020 ; p-value ≤ 0.001) highlighted a sharp increase over time in the western Mediterranean Sea, particularly, the worse the climate change scenario, the more suitable areas for *C. mydas* will increase. The most important predictors were anthropogenic variables, which negatively influence nesting probability, and sea surface temperature, with an increase up to a maximum probability of nesting around 24–25°C, but a rapid decrease at higher temperatures for loggerheads, and a constant stay for green turtles. The potential importance of the western Mediterranean beaches as possible nesting areas for sea turtles highlighted the relevance of proactive efforts to assist sea turtles' conservation during their range expansion, because as soon as they will expand, it will be necessary to focus on threats other than climate such as fishing effort, coastal development, erosion, and shorelines armoring.

POSTER PRESENTATIONS
SESSION 1: Threats

TWO DECADES OF MARINE LITTER INGESTION DATA EMPLOYING LIVE LOGGERHEAD SEA TURTLES RESCUED ALONG THE ITALIAN COAST

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Almost 10 years have passed since *Caretta caretta* (Linnaeus 1758) was included in the Marine Strategy Framework Directive (2008/56/EC) as a target species of the Mediterranean Sea Region for the monitoring of marine litter (ML) ingestion in biota. Gastrointestinal (GI) content analysis has remained the only official tool to assess the trend in the amount and composition of anthropogenic debris ingested by sea turtles. Although analysis of faecal samples collected from hospitalised specimens also represents an efficient and low-cost tool to study the ML pollution phenomenon, it still requires a common standardised protocol. The study aimed at assessing the ingestion of macro litter (>5mm) through the faecal analysis which was conducted on 411 loggerhead sea turtles in different life stages (mean CCL $\pm$ SD [Range]: 52.0 ± 14.9 [10.4–88.0] cm), rescued from 2000 to 2020 (excluding 2017) along three of the four sub-regions of the Mediterranean Sea (sensu MSFD). The percentage of animals that expelled ML during their hospitalisation period (Frequency of Occurrence, FO%) is 68.9%.

Due to the different number of representative specimens available for each sub-region, only samples from the Western Mediterranean were used to evaluate possible trends of occurrence over time. No clear trend emerged from the analysis of occurrence along the two decades of monitoring, with FO% ranging from 27% (2020) to 92% (2005). ML was detected with an average of 1.15 ± 0.12 grams and 10.19 ± 1.16 items per specimen. Among the ML categories identified in the samples, sheetlike items represented the most abundant plastic shape category for number (65%), and fragments were the most represented in terms of dry mass (39%). This work is the first to provide a long-time series of data on ML ingestion by loggerhead sea turtles through faecal analysis. The employment of live specimens allows the collection of data in rescue centres, providing more information on the ML issue, and offers the opportunity to evaluate the potential impact of litter ingestion on animal behaviour (e.g. buoyancy disorder).

POSTER PRESENTATIONS
SESSION 1: Threats

DISTRIBUTION OF LOGGERHEAD TURTLES AND FLOATING MACRO LITTER IN THE TYRRHENIAN OCEANIC REALM (WESTERN MEDITERRANEAN).

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The complex life history and high mobility of sea turtles make them vulnerable to marine litter pollution. Ingestion of and entanglement in the marine litter have become a critical threat for sea turtles worldwide, including loggerhead populations in the Mediterranean Sea. Oceanic turtles may be more at risk than neritic turtles due to their wider distribution, possible overlap with area of high litter abundance and feeding habits. In this study we present the first preliminary results of a four-year monitoring of sea turtles and floating marine macro litter in the Tyrrhenian Sea (western Mediterranean), using ferries as platform of observation. The activity was conducted along the Naples-Palermo (summer 2019, 2020, and 2021) and the Salerno-Palermo (winter and spring 2022) routes, as part of FLT monitoring network. Two trained observers were positioned on each side of the command deck and collected data on position, distance, life stage, and behaviour of the animals while a third observer collected data on all floating litter objects larger than 20 cm.

Over an effort of approximately 3000 Km (19 surveys 140 loggerhead turtles, primarily early and late juveniles, were sighted, and 912 anthropogenic litter items observed, 95% of which were plastics. The top-three identifiable categories included sheets, shopping bags, and bottles. The overall Kernel Density Estimate of turtles and marine litter suggests that the area between 50 and 150 km northeast of Palermo may have a higher likelihood of marine litter and turtle co-occurrences. Two turtles were reported entangled in FADs, and one interacted with a shopping bag. Although the monitoring of the area is still in its early stage, continued and repeated turtles and litter surveys will be performed over the next years within the LIFE CONCEPTU MARIS PROJECT (2022-2025), which will allow for a detailed examination of sea turtle exposure to litter and marine traffic in the Mediterranean offshore areas, thus contributing to appropriate mitigation strategies at the local and regional levels.

POSTER PRESENTATIONS
SESSION 1: Threats

SEA TURTLE INTERACTIONS WITH THE ARTISANAL FISHERIES IN BELYOUNECH (STRAIT OF GIBRALTAR)

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Bycatch is one of the most serious threats to sea turtles all around the world. In the Mediterranean the main species which are the loggerhead turtle, the green turtle and the leatherback turtle are classified as endangered, however bycatch still high. In this paper we focused on assessing interaction between sea turtles and the artisanal fisheries in Belyounech, situated in northern Morocco and overlooking the strait of Gibraltar. The survey was conducted with 20 fishermen. They were $41,5 \pm 12,8$ years old and their average experience was $18,4 \pm 11,9$ years. All fishermen claim to have seen a turtle at least once in their life. The loggerhead turtle and the green turtle are the most observed in the region throughout the

year. In spite of this, results showed a low interaction between artisanal fisheries and sea turtles. It is due to the use of selective gears (hook lines and bottom longlines), which had no impact on sea turtles. However, four cases of bycatch were identified and were due to the use of trammels; two turtles were released and two were already dead. Despite the enthusiasm and moral commitment expressed by fishermen for the protection and preservation of sea turtles. It remains essential to plan meetings and workshops in order to discuss the interest of the protection of this species, the laws and conventions that protect them, the incentives in case of collaboration in the protection, etc., as well we can help in reducing sea turtles bycatch.

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SESSION 1: Threats

MATERNAL TRANSFER OF MICROPLASTICS IN THE YOLK OF LOGGERHEAD SEA TURTLES (CARETTA CARETTA) EMBRYOS: EVIDENCE FROM AN ITALIAN PILOT STUDY.

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Considering its long life, trophic position and mobility, Loggerhead turtle *C. caretta* can accumulate pollutants along the trophic chain and overlarge areas in different aquatic compartments. Plastics and microplastics (MPs) accidentally ingested by loggerhead turtles have been usually associated with health status impairment and gastrointestinal damages in addition to impaired reproduction. However, a possible maternal transfer of MPs to the egg yolk and in turn to the embryo has not yet been proven. In this light, the aim of the present study was to investigate the occurrence of MPs in yolk and liver of unhatched embryos and to correlate their presence with embryo development impairment. To this purpose, 80 embryos that failed to hatch from two loggerhead sea turtle (*Caretta caretta*) nests (Rimigliano and Baratti) collected along the coast of the Tuscany region in August 2020, were analyzed. For each embryo biometric parameters including total and carapace length, total, yolk and liver weight were recorded in order to classify the embryonic developmental stages. Livers were divided in two portions: one for histological analysis and

the remaining for MPs analysis. Histological analysis of liver was performed to quantify melanomacrophages (MMs) and lipids. Chemical digestion, filtration and Raman spectroscopy analysis were performed separately on yolk and liver of each embryo to investigate the abundance, size, colour and polymer type of MPs. Results evidenced that: 1) all yolks analyzed showed MPs (mean value=0.63 MPs per gram of yolk for Baratti nest and 0.95 MPs per gram of yolk for Rimigliano nest); 2) in the liver the abundance of MPs was found higher than yolk (mean value=2.04 MPs per gram of liver for Baratti nest and 0.35 MPs/ gr of liver for Rimigliano nest); 3) the most abundant MPs polymers were Acrylonitrile butadiene styrene and PVC for Baratti and Polyethylene and PVC for Rimigliano 5) the number of MPs retrieved in the liver positively correlate with MMs density 6) the number of MPs in the yolk negatively correlate with the yolk weight. This pilot study evidenced for the first time, maternal transfer of MPs into the yolk, the absorption of MPs from yolk to liver during embryonic development, and the possible effects of MPs on yolk adsorption and in turn embryonic development.

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SEA TURTLE STRANDINGS AND NESTS IN THE NORTHERN ADRIATIC SEA: CONSERVATION AND MANAGEMENT CHALLENGES IN A CHANGING ENVIRONMENT.

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The northern Adriatic Sea is considered a foraging ground for juveniles, subadult, and mature female loggerhead sea turtles (Almpanidou et al., 2022). In 2020, a Natura 2000 Site of Community Interest was established to protect this species: "Adriatico Settentrionale Veneto – Delta del Po" (SCI IT3270025). Systematic data from 2016 to 2021 were collected to assess causes of death and population characteristics of dead stranded individuals. The analysis of the morphometric characteristics showed a consistent increase in the curved carapace length (CCL), and more stranded adult female individuals were recorded across the years. The analysis of the causes of death and the environmental factors showed seasonal stranding trends, although the decomposed carcasses often compromised post-mortem

investigations. Moreover, in 2021 two loggerhead sea turtle nests were recorded and monitored on the coastline of the Veneto Region in the Adriatic Sea, for the first time ever, representing the northernmost record worldwide. One nest was compromised by the presence of *Fusarium* spp., while the other recorded a significant hatching success rate. These data confirmed the northern Adriatic Sea as an emerging important area for this species opening new conservation challenges and scenarios for the management of local human activities, such as fisheries, ship traffic, and tourism, as well as climate change, which can impact the life cycle of marine turtles.

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INTERACTIONS BETWEEN FISHERIES AND SEA TURTLES IN JEBHA PORT

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Interactions between marine turtles and fisheries represent one of the most serious threats to marine turtle populations. Our study aims, on the one hand, to describe and analyze sea turtle interactions with fisheries, and on the other hand, to highlight the extent of bycatch of sea turtles. To achieve these objectives, our methodological choice fell on a quantitative method that relies on the use of a tool of data collection through the questionnaire. This questionnaire was conducted in 2021, aimed among 48 fishermen in the port of Jebha (30 of coastal fishing and 18 of artisanal fishing). The majority of fishermen (77.08%) stated that they had accidentally caught marine turtles, during all their professional seniority, of which the loggerhead turtle

(89.19%) was the species most captured. Moreover, the purse seine is the most threatening fishing gear for the marine turtles according to the fishermen (54.05%). Indeed, bottom-set nets (15.15%) are the fishing gears that cause more mortality among loggerhead turtles. In addition, all the fishermen surveyed (100%), the majority of which are older, claimed that the sea turtle population is declining. This data is the most worrying since marine turtles are threatened with extinction, and this would indicate a shifting baseline of ecological knowledge among generations. Improving fishing techniques, raising fishermen awareness, as well as the implementation of conservation measures for marine turtles remain the best solutions to avoid their bycatch.

RESULTS OF EXAMINATIONS OF STRANDED MARINE TURTLES ON THE NORTHERN COAST OF TUNISIA (2005-2021)

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This study describes the results of examinations of 54 sea turtles (50 *Caretta caretta* and 4 *Dermochelys coreacea*) stranded on the northern Tunisian coast from May 2005 to June 2021. Of these sea turtles only 23 were autopsied. Hook and monofilament ingestions were observed in 11 sea turtles associated with some lesions: enteritis, necrosis and even perforation. Few sea turtles had plastic debris in their digestive

tract. Most of this debris was in the intestines but without apparent lesions. Signs of entanglement with fishing gear were very little observed. Most turtles had epibionts attached to the carapace, plastron and skin. Finally, traumatic erosions and fractures of the carapace or plastron caused mainly by boats collisions were also rarely observed.

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OCCURRENCE OF MESO AND MICROPLASTICS IN MARINE TURTLE CARETTA CARETTA IN NORTHERN TUNISIA

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Plastic pollution has a direct and deadly effect on wildlife and on biodiversity. Thousands of seabirds and sea turtles, seals and other marine mammals are killed each year after ingesting or getting entangled in plastic waste. More than 700 species of marine animals have been found with traces of plastics in their digestive tracts. In the framework of COMMON MED-project, we examined in three compartment of the digestive tract (esophagus, stomach and gut) of 08 post-hatchling loggerhead *Caretta caretta* sea turtles stranded along the Tunisian coast. For each specimen total length (LT), CCLst, CCWst, CPL, sexe and weight are determined.

Necropsies revealed abundant numbers of plastic particules ranging from 4 to 154 mm in size (length). The largest particles are found in the stomach with an average size of 64 mm, followed by the intestines (43mm) and the smallest in the esophagus (8mm). Most particles (n = 61) were films (46.25%), fragments (28.57%) and filaments (14.25%) with transparent and white opaque being the dominant colours, the percentages of which are respectively 47.54% and 14.75%. Fourier transform infrared spectroscopy (FT-IR) of isolated particles showed a range of synthetic materials such as Polyethylene high density, polyethylene and polypropylene.

IMPACT OF CLIMATE CHANGE INDUCED SEA-LEVEL RISE ON A KEY NESTING HABITAT OF THE GREEN SEA TURTLE CHELONIA MYDAS

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Karpaz beaches of Northern Cyprus are one of the critical nesting habitats of green turtles in the Mediterranean. These beaches cover almost %20 of the overall nesting. Although threats to the species are reported as tourism and recreational activities and bycatch, as more focused research is in place on the impact of climate change on the spatial ecology of threatened species, the unpredicted impacts have been revealed recently. Hence considering the effect of climate change-induced sea-level rise to determine the lumpsum threat levels towards threatened species is an emerging way to ensure viable

populations. In the given context, the study aims to assess the impact of climate change induced sea-level rise on a critical nesting habitat of the Green Sea Turtle, the Karpaz beach in Northern Cyprus, for effective conservation planning of the species. Field survey data for the 2022 nesting season and a HiRes Digital Elevation Model derived from an RTK drone were used to conduct GIS analyses to determine the impacts of sea-level rise on the current and potential nests within the beach.

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ASSESSMENT OF LOGGERHEAD TURTLE BY-CATCH IN THE VALENCIA REGION, EAST SPAIN: RESULTS OF LIFE-MEDTURTLES PROJECT.

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One of the main objectives of the LIFE-MEDTURTLES project (LIFE18 NAT/IT/000103) is to reduce the mortality of sea turtles by-caught in fishing gears. To assess the perception of the fishers about this problem a series of interviews were held in the Valencia region (Western Mediterranean) to bottom trawling (n=148) and artisanal vessels (n= 119), accounting more than 50% of the fishing fleet, in autumn 2020. According to interviews, a sum of 116 loggerhead turtles were reported accidentally captured, 71 by bottom trawling, and 45 by artisanal vessels, from autumn 2019 to autumn 2020. This implies an average Catch per Unit of Effort (CPUE) of 0.041 loggerhead turtles in the region by both fisheries, 0.05 for bottom trawling and 0.032 for artisanal vessels. Considering a fishing effort of 2822.77 months, we estimated a minimum annual by-catch of 105.27 loggerhead turtles for bottom trawling and 106.57 for artisanal vessels.

CPUE and minimum annual by-catch for each fishery were higher at Castellón (north Valencia region) fishing grounds, probably due to the wider continental shelf in that area with more vessels working at shallower depths used preferably by turtles for feeding and resting. Although 82% of reported loggerhead turtles were found alive, a high percentage of individuals (40%) were returned directly to the sea, and not handed over to the regional stranding network. All the interviewed fishers were informed about the best practices to handle by-caught sea turtles and about this rescue network, in order to increase the number of sea turtles taken to the rescue centres for their adequate recovery and to reduce mortality. This is key objective of LIFE-MEDTURTLES project, as well as others including fishing gear modification to reduce turtle by-catch. Hence, a continuous collaboration and awareness of fishers is a conservation management need in the area.

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THE LOGGERHEAD NESTING SITE IN CHEBBA (TUNISIA): AN AREA THREATENED BY ARTIFICIAL LIGHT POLLUTION

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Sea turtles, like most other living organisms, require regular intervals of natural diurnal and nocturnal light. Unfortunately, the increasing use of artificial light is representing a major threat to the majority of sea turtle population around the world. Thus effective management of lighting is critical in areas where industrial and touristic developments occur close to nesting habitats. The nesting beaches in Chebba (Tunisia) represent the second most important nesting beaches in the country after those of Kuriat islands. Accordingly,

the beaches namely “Essir” and “Sidi messaoud” are highly frequented and light polluted. The frequenting does not allow to detect nests, and lights attract hatchlings at the moment of the emergence as they end up crashed on the road by the beach if they are not rescued by visitors. Despite being considered as minor, nesting beaches of Chebba need to be protected. Recommendations are given which will enable protecting them because they can give an appreciable regional contribution, both in number of nests and in genetic diversity.

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STRANDINGS OF SEA TURTLES IN DJERBA: REVIEW OF THE YEAR 2021

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Data on strandings provide key information about life stages, seasonal distributions and geographic ranges of marine turtles. Strandings offer a source of biological material for population studies such as age determination, general health, threats, etc. Strandings can also provide preliminary information for conservation planning and management, such as the location of rehabilitation centres. Furthermore, adequate measures based on stranding records can be taken if the causes of injuries or deaths are mostly fishery-related. Sea turtle populations are globally considered in negative trend. Their mortality is linked to both natural and anthropogenic causes. In Tunisia, causes of sea turtle mortality are associated mainly to the interaction with fisheries (Echwikhi et al., 2014). The conservation of sea turtles on the Djerba island is one of the interests of the NGO: Association Jlij for the Marine Environment (AJEM). The AJEM's participation in the the project «Fishermen Engaged for Preserving Coastal Heritage in Libya and Tunisia», has made it possible to carry out many actions, including the monitoring of sea turtle strandings on the coasts of Djerba. The stranding study of sea turtles is done in coincidence with the research and monitoring of nesting sites on the coasts of the islands of Djerba conducted from June to September 2022. Three teams from AJEM association for monitoring strandings. Each group was equipped with the necessary logistics to occur in the event of stranding, or possible cases of incidental capture. These teams meet regularly for consultation and discussion. In addition to surveys on the ground, the monitoring is done through calls informing the association of the presence of a stranding. This work reports the results obtained between February and July 2021.

Ninety-eight stranded turtles were examined, the most stranded turtles were loggerhead (95% of stranding data) whereas only three leatherback turtles (two decomposed and one putrefied; 3%), one decomposed green turtles (1%) and one unidentified turtle (1%) were recorded. Regarding loggerhead sea turtles, the majority of strandings were juveniles (74.5%). Giving that most of the turtles were in poor condition, the causes of mortality could only be detected for 7 turtles (with 5 collisions, 1 entanglement and 1 turtle showing an interaction with longline fishing). However, gillnet fishing dedicated to sharks: “Kallabia” and “Guattatia” also seems to have a significant impact on loggerhead turtles in the area according to the distribution of strandings in the region. Three sea turtle's species were known to strand in Tunisian coasts: loggerhead turtles (*Caretta caretta*), green (*Chelonia mydas*) and leatherback turtles (*Dermochelys coriacea*). The first one was the most predominant species (95 % of stranding data). The Gulf of Gabes is considered in fact as a feeding and wintering area for Mediterranean loggerhead turtles. The stranded turtles are composed mainly of juveniles (74.5%). The main causes of mortality are longline and boat collision. However according to stranding data in the area, gillnet seems to have also an important impact on loggerhead turtle. Gillnet which create a significant mortality didn't leave a visible trace on stranded turtles. Other stranding is monitoring over longer time intervals accompanied by bycatch studies on sea turtles in Djerba are necessary to elucidate the habitats and causes of mortality of these chelonians.

PRELIMINARY DATA ON BYCATCH AND STRANDING OF MARINE TURTLES IN AL HOCEIMA, MOROCCO

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The Al Hoceima region in Morocco occupies a strategic biological position regarding the trajectory of migrating species. Bycatch and standing data in this area are still lacking. However, knowledge of the number of stranded individuals/species and the rate of bycatch/total catch for each fishing gear is essential to adopting more effective conservation strategies. Given this lack of information, monitoring of total and bycatch data was conducted from January to June 2021. Two different approaches were used in this study: on-board observation of longline, trawlers, and seiner vessels for bycatch rate and

monitoring of the turtles standing area through self-declaration by sensitized fishermen. The results showed the existence of two species. *Dermochelys Caracas* (Vandelli, 1761) (1 individual) was aground at Calabonita beach, and *Caretta Caretta* (Linnaeus, 1758) was captured from longliners (two individuals) and trawlers (three individuals). No individuals were reported in purse seiners. For the first time, preliminary data on the bycatch and standing of turtles in Al Hoceima have been determined and this information is vital to implement future conservation measures.

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A COMPARISON OF BOTH SIZE AND INJURY CLASSIFICATION BETWEEN CARETTA CARETTA SPECIMENS RESCUED FROM LAMPEDUSA AND SICILY BETWEEN 2016 TO 2021

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Fishing in the Mediterranean is one of the many anthropogenic threats *Caretta caretta* turtles are facing. Here we analyse the most significant threats and the different ages presented in turtles rescued offshore (Lampedusa) versus onshore (Sicily). Data were collected between 2016 and 2021 on 614 subjects. Among them, 442 were injured and required treatment. Statistical tests were performed: the Chi-squared test in order to compare injury prevalence, the Mann-Whitney test to compare size frequency. Injuries were classified into categories: flipper injuries, impact injuries, hook injuries, line injuries and combined hook and line injuries. CCL measurements were used to classify hatchlings, juveniles, subadults and adults. Comparing injury prevalence in the two different locations, a noticeable skew appears in favour of turtles found in Lampedusa. Those turtles had by far a notable difference in frequency compared to turtles rescued in Sicily for hooks without lines (96.10%), hooks with lines (95.52%), and collision injuries (89.47%). The classification of injury that had the least of a difference was lines without hooks (70.59% from Lampedusa, 29.41% from Sicily). Regarding the

differences in size distribution, there was a larger prevalence of more mature turtles rescued in Lampedusa: 95.18% of the subadults and 96.55% of the adults were rescued in Lampedusa. Interestingly, within the six years of data obtained, only three hatchlings were rescued – two in Lampedusa and one in Sicily. Lastly, 87.38% of the 103 juveniles rescued were recovered in Lampedusa. Whilst there is a skew in the results due to most turtles being recovered in Lampedusa, there is a notable difference in both estimated age and injury classifications. These disparities could be due to the differences in their mode of arrival. Typically, turtles rescued in Sicily have been stranded, whereas turtles rescued in Lampedusa are manually brought in or recovered through by-catch. The differences in size could indicate their movement patterns to and from nesting sites found around the Mediterranean. As Lampedusa is located closer to Tunisia, a country with a coastline rich in nesting sites, this could indicate the more mature turtles heading south whilst the smaller, younger turtles are found closer to Europe.

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STATE OF THE ART ON MARINE TURTLES IN TUNISIA AND ON THE SOURCES OF NUISANCE AFFECTING THESE SPECIES DURING THE SUMMER CAMPAIGN OF 2018

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The vulnerability of marine turtles to climate change and anthropogenic activities is a subject that has been addressed since the 1990s. We present here the abundance of the population of marine turtles present along the Tunisian coasts and waters and the different pressures affecting these populations by maps developed using QGIS software. The ACCOBAMS Initiative Survey project database, the MAVA project "Conservation of marine turtles in the Mediterranean region," the Copernicus database, and other bibliographic references of 2018, have been analyzed. Accordingly, the sources of nuisance on land and sea have increased over the last few years. As a result, the risk affecting sea turtles populations has grown and can be considered a source of concern for the scientific community. Moreover, solid wastes and the increased atmospheric and surface water temperature, maritime traffic, fishing activities (especially bycatch), light pollution, and chemical pollution are affecting the

Marine Turtles along the Mediterranean Sea, particularly in Tunisia waters. On the Tunisian coasts, we confirmed that the abundance of marine turtles is significant compared to other Mediterranean countries, prioritizing saving these species. However, fisheries are well developed along the Tunisian coastline and maritime traffic, which increases the probability of sea turtles death by bycatch or collision with the propellers of a boat. The same goes for plastic pollution, widespread along the coastline. According to the results, the central and southern areas of the Tunisian coast can shelter the marine turtles, while reducing the sources of nuisance applied to these turtles. From a protection and conservation point of view, the Gulf of Gabes is an area of significant importance for the Mediterranean marine turtles biologically and culturally.

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BYCATCH OF SEA TURTLES IN THE EGYPTIAN MEDITERRANEAN WATER - PILOT STUDY

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There are mainly three species of marine turtles, among seven known in the world, feed in the Mediterranean Sea and two species use the beaches of this basin to reproduce. They are the loggerhead turtle *Caretta caretta* (Cheloniidae), the most common turtle species that nests on many Mediterranean beaches, the green turtle *Chelonia mydas* (Cheloniidae), and the leatherback turtle *Dermochelys coriacea* (Dermochelyidae) which visit the Mediterranean basin from the Atlantic Ocean to feed. Like all extant species of the marine turtle species, the three species that found in the Mediterranean are classified are listed on the International Union for Conservation of Nature (IUCN) Red List for Endangered Flora and Fauna. The literatures indicate that there is no there is no fishery that targets marine turtles in Egypt directly. Most of the all fishermen stated that they do not intentionally aim for sea turtles and they just found them in their nets or hooks accidentally. some figures pointed to the total number of captures by different fishing gear was estimated to be 5278 per year and the most involved gears were trawls and longlines (Nada and Casale, 2008). While, Boura et al. (2016) also stated a catch rate of 4.06 unique turtle captures/vessel. However, the bycatch is one of the most important threats facing sea turtles in the Egyptian Mediterranean waters. The bycatch and the associated illegal turtle trade affect several marine turtle populations in the Mediterranean. In fact, some action have to be taken, In particular, intentional killing should be tackled through its cultural drivers, and measures to reduce bycatch mortality need to be tested and implemented. In this regards, and within the implementation of the national action plan for

conservation of the marine turtles in the Egyptian Mediterranean Waters, In this regards, and within the implementation of the national action plan for conservation of the marine turtles in the Egyptian Mediterranean Waters, a pilot survey has been made in collaboration between the Egyptian Environmental Affairs Agency (EEAA) and the General Authority for Fish Resources Development (GAFRD). This Survey aimed to assess the size of the bycatch and study the interaction of sea turtles and other marine mega fauna with fisheries. Over six months, data were collected by (120) questionnaires from the landing sites in Alexandria (El-Max and Abu Qir), Behyra (Madaya, and Rosetta), Damitta (Ezbet El-Borg), and from Port Said. As well as, (21) questionnaires on board of Fishing boats in Ezbet El-Borg, Madaya, and Rosetta. The data was gathered from various local fishing gear in random samples (Trowel, purse seines, long line, etc.). Many taxa recorded during 2022, and before as reported by fishermen including sea turtles, short-beak bottlenose dolphins, devil fish, etc. References: Boura, L., S. S. Abdullah and M.A. Nada (2016) New observations of sea turtle trade in Alexandria, Egypt. A report by MEDASSET-Mediterranean Association to Save the Sea Turtles. 27pp. Jribi, I. and Abdelwarith, M.S. (2017). The National Action Plan (NAP) for the Conservation of Marine Turtles in the Egyptian Mediterranean Coast. UNEP-MAP SPA/RAC, 58pp. Nada M. and P. Casale (2008) Marine turtles in the Mediterranean Egypt: threats and conservation priorities. WWF Italy, Rome.

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ASSESSING POST-RELEASE SURVIVAL OF LOGGERHEAD SEA TURTLES BYCAUGHT IN BOTTOM TRAWLS FOLLOWING ON-BOARD RECOVERY PROTOCOL

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Fisheries bycatch is the primary threat to sea turtles worldwide. Different methods are applied for bycatch reduction, from technological innovations and changes in fishing practices to reduction of fishing effort by spatio-temporal closures and banning some fisheries. All these approaches involve substantial costs and different levels of acceptance and compliance by the fishery industry. Recently, education of fishermen on recovery techniques for bycaught turtles has been introduced as an alternative conservation tool. This low-cost method based upon a simple recovery procedure for comatose turtles is widely used throughout the Mediterranean, but no study to date has evaluated its conservation success. We assessed post-release survival of wintering loggerhead turtles by-caught in a comatose

state in bottom trawls in the northern Adriatic Sea in February 2015. After application of the recovery protocol, 10 loggerhead turtles (47-74 cm CCL) were equipped with PTT ARGOS-linked satellite transmitters and released alive. One transmitter failed to send any information, while the remaining nine units provided location data for 131 to 541 days (mean $\pm$ SD: 237 $\pm$ 165 days), resulting in a minimum post-release survival rate of 90%. Our results suggest that the application of a simple and inexpensive recovery method is highly efficient in reducing sea turtle mortality in bottom trawls. This emphasizes the potential of educational programs directed on fishermen as a valuable tool for sea turtle conservation.

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FEEDING SEA TURTLES IN THE WILD: THE EXAMPLE OF LOGGERHEADS IN GREECE

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Greece hosts ~46% of the breeding population of loggerheads (*Caretta caretta*) in the Mediterranean, as well as important foraging habitats. In both breeding and foraging areas, the increased presence of marine turtles coincides with the touristic period. While accidental feeding of sea turtles occurs traditionally in ports through fishermen bycatch, in recent years intentional feeding increases. ARCHELON received a growing number of reports of intentional feeding practiced by coastal entrepreneurs or fishermen to attract turtles, so tourists can see them. Such incidents recorded in Zakynthos (2013-2018), Kefalonia (annually since 2012), Lakonia (2019-2020), Attica (2018-2019), Crete (2012 and 2021), Boiotia (2021) and Kastellorizo (2018-2019). Apart from the fact that sea turtles are fed with inappropriate food (e.g. fruits & vegetables), feeding appears to be linked with elevated levels of aggressiveness, with turtles biting or bumping (pinching) on swimmers. Presumably, the animals associate human presence with food, or feeding creates an artificial foraging ground, which the turtles perceive as high quality and being antagonistic over.

In Lakonia, 40 (in 2019) and 170 (in 2020) instances of trivial injuries were reported to the local hospital. In Kefalonia (in 2012) a girl was bitten by a turtle (regularly fed in the harbor). Similar incidents took place in Attica during 2018 and 2019, where about 5 swimmers were transferred for first aid. In Crete (Chersonissos) and in Boiotia (Korinthian Gulf) during 2021, approx. 7 and 5 cases were reported respectively. Direct observations in Zakynthos, showed elevated aggressive behavior among turtles fed by humans, while one turtle, repeatedly fed with tomatoes (2016 – 2017), reduced its natural sponge-foraging behavior and became more agitated. In order to minimize the negative effects, ARCHELON issued press releases to raise public awareness and cooperated with the Coast Guard in an effort to eliminate this practice. Some Coast Guard stations issued guidelines and accompanied ARCHELON to feeding spots to help explain that wild animals should not be treated as pets. This bad practice must stop, as it might cause problems to the normal behavior and health of turtles, as well as to the safety of people.

POSTER PRESENTATIONS
SESSION 1: Threats

THE BENEFITS OF IRON MESH IN REDUCING PREDATION OF LOGGERHEAD SEATURTLE'S NESTS IN AL-KHAMSEEN BEACH WEST OF SIRTE, LIBYA

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The study area (Al-Khamseen beach) extends to 10.55km in the western side of the Libyan city of Sirte on the Mediterranean. The area is mostly of long sandy beaches with few rocky crops and it is considered a high-nesting area for the loggerhead seaturtle (*Caretta caretta*). Being far from urban areas, and isolated by salt marches (Sebkha) from the main land and roads, this area is relatively isolated with little human presence during the year. In consequence, the area has an increasing presence of wild canine species such as foxes and jackals along with feral dogs which in return increases the predation on sea turtles nests. Also, in the south Mediterranean region, monitoring sea turtles nesting and predation is mostly opportunistic, short-termed, localised and linked to small initiatives or funding schemes. In the case of Libya, one can hardly find substantial information or literature on nesting and predation along the roughly 1990 km

coastline. In this paper, we present the results of 3 years joint effort by several researchers from Governmental Agencies and Libyan NGOs to install iron mesh on top of 40 loggerhead seaturtles nests to protect them from predation (17 nests in 2018 and 23 nests in 2018) while comparing the hatching success against data from 2017 (with no protection on nests) in the same area. The results show that nests were still being assaulted by canines despite the installation of the iron mesh. This would require more studies to further understand the predation behaviour and to find better mitigation measures to this issue. On the other hand, this study highlights the importance of protecting loggerhead sea turtles nesting sites, add more information about the predation issue, and re-emphasise the importance of the gulf of Sirte region to the nesting of the loggerhead sea turtle in the Mediterranean.

POSTER PRESENTATIONS
SESSION 1: Threats

THE BYCATCH RATE OF SEA TURTLE IN FISHING GEARS OF MEDITERRANEAN COAST OF MOROCCO

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This study addresses the information gaps by a descriptive analysis of multi-taxa Bycatch of vulnerable species in Moroccan Mediterranean area including marine turtles. The data were collected in the framework of the MedBycatch project. The key figures of the monitoring programme for the phase 1 (from March 2019 to March 2020) of the MedBycatch project are 15 observers, 909 days at sea observations (339 on-board trawlers, 246 on-board long liners and 324 on-board purse-seiners), 1890 questionnaires. Five loggerheads (*Caretta caretta*) with an estimated percentage of 2% were bycaught during the surveys. Other threatened species were also affected by bycatch, among them sharks and rays had the highest percentage with an estimated 95% of the total number of bycaught individuals. Approximately, 321 elasmobranchs observed to have been bycaught in the monitored gears, most of

them being deep-water sharks (Triakidae, Oxynotidae, Dalatidae). 12 *Delphinus delphis*, were also bycaught in purse seiners and zero bycatch of seabird. The bycatch rate of sharks and rays in the trawlers fishery made up more than 0.18%, common dolphins with 0.016 % and 0.006% for sea turtles and the benthic species with 0.005% and 0.001% respectively for sponges and corals. All leatherbacks were captured and released alive. Those estimates rates represent low rates in comparison to the quantities caught by the target fisheries. This research resulted in the development of the turtle excluder device (TED), which reduces the catch of sea turtles and other large animals including sharks, stingrays. This mitigation measure is being experimented for the Moroccan trawlers during the phase 2 of the work.

POSTER PRESENTATIONS
SESSION 1: Threats

PLASTIC SACKS BECOME A NEW AND MAJOR THREAT TO SEA TURTLES IN THEIR PELAGIC STAGE IN THE MEDITERRANEAN SEA

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Sea turtles are endangered marine reptiles, spending majority of life stages at sea. Habitats impacted by anthropogenic exploitation endanger populations often to the brink of extinction. During the post hatching to juvenile life stages, turtles occupy pelagic habitats, using floating materials or flora (e.g. Sargassum in the Atlantic Ocean) that create a passive transport method and a focal point of threats. The main conservation resources for populations worldwide are used for the prosperity of marine turtles' reproduction onshore, and although it is critical for recruitment, the fragile pelagic stage is not in the center of research and conservation attention. Numerous challenges are concerning long term work in pelagic transitory habitat, with small individuals whose movement depend on the currents, waves, and wind. These difficulties create a gap of knowledge regarding their passive migration distribution in the Mediterranean, the stage's exact duration, growth rates which vary between populations of the same species, diving patterns, nutrition and more. This research used Israel's Sea Turtle Rescue Center's (ISTRC) database to reveal month-specific growth rates of Loggerhead and Green

sea turtles, an average growth of 0.75 and 0.95 cm CCL (respectively) per month in their first two years of life in the Mediterranean. Our results point out that the most common threat (43.9%) to ISTRC juvenile turtles was entanglement in Polypropylene (PP) woven sacks, that are used in a variety of industries courtesy of their strength and resistance. The unraveled threads suggest sacks are being cut and thrown to sea intentionally, and the turtles presumably use them as their floating habitat, tangling their limbs and necks in the threads causing injuries and deaths. Most entanglements (76%) occurred between June and September. Hypothesizing sacks are presence only during summer, accentuate seasonal cargo or voyages. To our knowledge, our study reveals the first juvenile sea turtles' month-specific size-at-age growth rates, and this is the first record of weaved PP sacks as a major threat to the pelagic life stage. These results can contribute to the understanding of population dynamics, threats and medical implementations, and points out the importance of conservation manners for the pelagic stage.

POSTER PRESENTATIONS
SESSION 1: Threats

UNDERSTANDING MEDITERRANEAN MULTI-TAXA 'BYCATCH' OF VULNERABLE SPECIES & TESTING MITIGATION – A COLLABORATIVE APPROACH (THE MEDBYCATCH PROJECT)

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Consisting of 21 partners, the MAVA funded MedBycatch project, overall goal is to provide knowledge, skills and tools to reduce the impact of selected fishing gears, specifically the incidental capture of vulnerable species and habitats. The project also supports regional and national policy development aimed at promoting effective conservation measures and sustainable fisheries. Phase 1 (2017 – 2020) focussed on the establishment of national observer teams, led by National Focal Points for Morocco, Tunisia and Türkiye, for the harmonised collection of data. The GFCM/FAO protocol (Monitoring the incidental catch of vulnerable species in Mediterranean and Black Sea fisheries: Methodology for data collection) was applied for on-board observations, port-based questionnaires and fishers self-sampling, targeting trawl, longline, net and purse seine fishing gears. During Phase 2 (2020 – 2022), the project expanded to include Italy and Croatia, and continued the observer programme, but primarily focussed on the trialling of Bycatch Reduction Devices

(BRD) and supporting Bycatch National Strategies. In Phase 1, 50 observers completed in collaboration with fishers, 1,503 on-board observations and 5,392 port-based questionnaires. The data revealed, as analysed and presented by our NFP's that from all the individuals bycaught, elasmobranchs were the most commonly taxa recorded (av. 97.67%, n = 12,564), followed by sea turtles (av. 1.83%, n = 235), sea birds (av. 0.41%, n = 53) and marine mammals (av. 0.09%, n = 12). In Phase 2, BRD's are being trialled for the bottom trawlers in Morocco, Tunisia and Türkiye, with grids and/ or spatiotemporal measures; for longlines (pelagic and demersal) in Morocco, Italy, Tunisia and Türkiye with circle and J hooks and spatial-temporal fishing changes; for static nets in Croatia, Tunisia and Türkiye with fishing gear adaptations, spatial-temporal measures, Green LED and UV lights; and for purse seiners in Morocco with the use of pingers.

POSTER PRESENTATIONS
SESSION 1: Threats

SEA TURTLE BYCATCH BY DIFFERENT TYPES OF FISHERIES AROUND AGADIR, MOROCCO

Touaf.M

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The bycatch of sea turtle weather in industrial or artisanal fisheries has become a serious problem worldwide. Recently, bycatch has been increasingly receiving attention due to the significant impact it causes on these threatened species. So far, information on sea turtle bycatch around Agadir is limited. This study aims to assess sea turtle bycatch in industrial (longliners, purse-seiners and trawlers) and artisanal fisheries in Moroccan water especially around Agadir. Bycatch was examined by collecting information from fishermen on sea turtle bycatch through interview-based approach, fishermen were asked to answer detailed questionnaires in the

main port of Agadir, only one fisherman per vessel was interviewed mainly the captain. In all the interviews, fishermen were asked to consider sea turtle bycatch only during the previous fishing year 2021. Estimates obtained by the present results showed that the majority of sea turtles caught are loggerhead turtles, *Caretta caretta*, with only a low percentage of leatherback turtles, *Dermochelys coriacea*, during the year 2021. This study provided us general information about the status of sea turtle bycatch around Agadir revealing a widespread impact of fisheries on sea turtles.

POSTER PRESENTATIONS
SESSION 1: Threats**DEVELOPING IDENTIFICATION SONAR-BASED DEVICE AS A TOOL TO MITIGATE MARINE TURTLE CASUALTIES IN ANTHROPOGENIC IMPACTED ENVIRONMENT**Yaniv Levy^{1,2*}, Dror Kipnis³, Roei Diamant³

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The increase in marine anthropogenic activities, impacts endangered marine turtle by high acoustic intensities with both physical and behavioral impacts. Hence, there is a need for a device that can serve as a warning system, to alert the presence of sea turtles to stop or mitigate disturbance or detriment during marine operations. This type of device can be applied over vessels performing seismic surveys that may lead to the interruption of marine turtles' normal behaviors; within areas of sea water intake to desalination factories that can injure turtles; within the proximity of areas containing hot water from power plants where turtles aggregate; as well within ports and ship channels and dredging zones where turtles are abundant. Identification of sea turtles' presence in their natural habitat can also be an important tool for population monitoring and conservation. This study takes a first step towards such a goal, and offers an algorithm for detecting sea turtles by active acoustics. Abundant in coastal areas, sea turtles are affected by high-intensity acoustic anthropogenic sounds., we offer a clustering approach to serve as a

warning system for the existence of nearby sea turtles. We focus on the challenge of overcoming the low signal-to-clutter ratio (SCR) caused by reverberations from the seabed and the sea surface. Assuming that, due to low SCR, target reflections are received in groups, our detector applies clustering and classification to identify possible 'blobs' in the reflection pattern, and to classify them as either clutter or a target. Our clustering is based on geometrical and spectral constraints over the blob's member relations. In turn, the classification of identified blobs as either a target or clutter is based on features extracted from the reflection pattern. To this end, assuming reflections from a sea turtle are stable but include spectral diversity due to distortions within the turtle's body, we quantify the stability of the blob's members and their spectral entropy. We test our detector in both modeled simulations, and at sea, for the detection of sea turtles released after rehabilitation. The results show robustness to highly-fluctuating target intensity and ability to detect at low SCR.

POSTER PRESENTATIONS
SESSION 1: Threats**The Impact of Pre- and Post- Sars Cov 2 Lockdowns on the Predation of Loggerhead Sea Turtle (*Caretta caretta*) Nests at Dalyan Beach, Türkiye**

Sözbilen, D., Mathebula, Z., Çetin, G & Kaska, Y.



SESSION 2: At Sea Biology

POSTER PRESENTATIONS

WHY IS THE MEDITERRANEAN LOGGERHEAD TURTLE POPULATION NOT INCREASING LIKE THE EASTERN ATLANTIC ONE?

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The East Atlantic loggerhead turtle population (ATL) has multiplied its population size by 8.5 times in the last 4 seasons (2018-2021). However, the Mediterranean loggerhead population (MED) has not significantly increased in the same period. Both populations share some characteristics such as the important influence of the African continent or their smaller adult body size in comparison with other close populations. It is interesting and may be important to identify and understand the main differences between both populations to help understanding some of the causes that could be holding back the growth of the MED juveniles.

The dominant pelagic habitat of the juvenile stage showed by the Atlantic population is likely one of the major ecological differences. The colder environment and poorer pelagic diet of most of the ATL juveniles could slow down their growth rate, but could also significantly reduce their mortality by the lower pressure of fisheries and large predators. The global warming of the oceans, could be increasing the productivity of cold pelagic zones of the north and central Atlantic favouring the survival and growth of ATL juveniles, meanwhile the overheating of the Mediterranean could be negative for the MED juveniles.

SEA TURTLES IN LAKE BARDAWIL, EGYPT - SIZE DISTRIBUTION AND POPULATION STRUCTURE

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We investigated the size distribution, sex ratio, and proportion of sexually mature green (*Chelonia mydas*) and loggerhead (*Caretta caretta*) turtles in Lake Bardawil, a large coastal lagoon. During the study 30 green turtles (8 males, 4 females, and 18 juveniles/sub-adults) and 14 loggerheads (1 male, 8 females, and 5 sub-adults) were captured. Forty percent of the green and 64 % of loggerhead turtles were believed to be sexually mature. The

green turtles had a mean curved carapace length of 65.23 cm (15 – 100 cm range) and the loggerhead turtles 68.79 cm but with a much narrow range (60 - 80 cm) reflecting the absence of juveniles. This study provides evidence that Lake Bardawil is an important feeding and development area for green turtles and feeding area for loggerhead turtles and expands our knowledge of such important sites in the Mediterranean basin.

POSTER PRESENTATIONS
SESSION2: At Sea Biology

EVALUATION OF THE DIET PREFERENCES AND FEEDING ECOLOGY OF LOGGERHEAD TURTLES IN THE ADRIATIC AND THE TYRRHENIAN SEA

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The Adriatic Sea is an important foraging area for the loggerhead sea turtle (*Caretta caretta*) which is found in a wide range of habitats from neritic areas to the high sea, based on the life stage. The feeding habits are expected to change during the development and according to the use of the habitat. Based on the literature so far, this species is thought to spend the juvenile stage in the open sea feeding on pelagic species and shifting to more benthic species during the subadult and adult stages. We conducted dietary analysis on the gastroenteric content of the esophagus, stomach, and intestine in 100 loggerhead sea turtles (range of CCL: 19,2-107 cm) stranded and/or bycaught along the Adriatic coast of Abruzzo and Molise regions (Italy), and the Tyrrhenian coast of Lazio from 2019 to 2021. Prey items were identified based on the lowest taxonomic level to calculate the frequency of occurrence (FO). Information about the date and location of the stranding

or the capture was available, along with the sex, size, ingestion of litter (INDICIT protocol), and necroscopic data. Among the gastroenteric contents of *C. caretta* of the Adriatic Sea, the most abundant taxonomic group recorded was Arthropoda (FO 92%), followed by Mollusca (FO 65%) and fish (FO 33%). The results were different compared to the Tyrrhenian Sea where loggerhead turtles fed mostly on Mollusca (FO 85%), fish (FO 30%), and Arthropoda (FO 27%). Considering the rate of ingestion, the frequency of occurrence of litter in juveniles (CCL <59,9 cm) from the Tyrrhenian Sea is remarkably high (93%) as well as in the Adriatic Sea (47%). Surprisingly, both the samples from the Adriatic and the Tyrrhenian Sea showed early recruitment of juvenile individuals towards neritic areas based on the dietary analysis. Further studies should be conducted to assess the dynamics behind this behavior.

POSTER PRESENTATIONS
SESSION2: At Sea Biology

RECORD OF TURTLE STRANDINGS ON TUZLA, AKYATAN, AĞYATAN AND YELKOMA BEACHES FROM 2019 TO 2022 YEARS, THE EASTERN MEDITERRANEAN COAST OF TURKEY

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The stranding data of marine turtles are provided key information about their life stages, seasonal distributions, and geographic ranges. This research is stranding data of loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and Nile soft-shelled turtle (*Trionyx triunguis*) turtles, which were collected from Tuzla, Akyatan, Ağyatan, and Yelkoma beaches in Cukurova Delta on the eastern Mediterranean coast of Turkey out of the nesting seasons between 2019 and 2022. A total of 122 strandings were recorded (113 *C. caretta*, 7 *C. mydas*, and 2 *T. triunguis*). The mean curved carapace length (CCL) of *C. caretta* was 66.15±5.11 cm (minimum:54.0, maximum 86.0 cm).

The mean curved carapace length (CCL) of *C. mydas* was 45.67±17.49 cm (minimum: 25.0, maximum: 68.0 cm). The mean curved carapace length (CCL) of *T. triunguis* was 59.50±2.12 cm (minimum: 58.0, maximum: 61.0 cm). Of the 113 *C. caretta*, 75.8% (n=75) were sub-adults (30-70 cm CCL), 24.2% (n=24) were adults (≥70 cm CCL). Of the 6 *C. mydas*, 33.3 % (n=2) were oceanic stage small juveniles (≤31.5 cm CCL), 66.67 % (n=4) were sub-adults (31.5-85 cm CCL). Our study contributes to the stranded data for both marine turtle species in the Mediterranean.

POSTER PRESENTATIONS
SESSION2: At Sea Biology

TAGGING AND TRACKING: SURVIVAL AND MOVEMENTS OF STRANDED AND BYCAUGHT LOGGERHEAD SEA TURTLES RECOVERED IN THE VALENCIA REGION (SPAIN, WESTERN MEDITERRANEAN).

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Marine turtles stranded and bycaught by fisheries in waters of the Valencia Region (East Spain) have been recorded by a well established stranding network since 1989. Passive tagging (flipper tags and PIT tags) has been applied to marine turtles recovered in local rescue centers since 1993. Tagging effort increased exponentially in the last decade thanks to awareness campaigns on fishermen, who bring bycaught turtles to ports for their recovery at rescue centers. Besides, about 20 of these turtles have been released with satellite transmitters attached. Moreover, the network has given the opportunity of recapturing turtles tagged elsewhere. Here we use all this information to provide estimation of survival probability and to describe the movements of the recovered turtles either within, inside or outside the western Mediterranean basin. A total of 519 loggerhead turtles (mean CCL= 43,2± 12,4 cm) were tagged and released by the network from 1993 to 2019. Of them, 43 were recaptured (3 more than once) either inside the same region, in neighboring Spanish regions, or in other parts of the western Mediterranean, with one turtle leaving the Mediterranean by the Gibraltar Straits. Recaptured turtles tagged out

of the Valencia Region were released from Catalonia, Balearic Islands, Italian waters, south France, Malta, and Florida (USA). A preliminary analysis of survival using a joint live-dead parameterization with software Mark yielded a 0.53 ($\pm$ 0.06 se) annual survival probability. Most of the recaptures came from the same study area, as suggested by a value of fidelity probability close to 1. The turtles leaving the region headed preferably northeast and east, with few turtles heading south; although these results may be biased by higher number of recaptures in areas with more rescue centers and stranding networks. Ongoing analyses on data from satellite tracked turtles will help us in better define both survival probability and turtle movements. Nonetheless, the recaptures of these turtles suggest complex dispersal movements in the basin. We also study the effect of turtle size and of bycatch fishing gear on survival probability and distance travelled by tagged turtles. Our results will help in the assessment to authorities for a better management of this species in the area.

POSTER PRESENTATIONS
SESSION2: At Sea Biology

THE KERKENNAH ISLANDS: AN IMPORTANT AREA FOR GREEN TURTLES CHELONIA MYDAS (LINNAEUS, 1758) IN TUNISIA

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The green turtle, *Chelonia mydas* (Linnaeus, 1758) is a circumglobal species distributed in tropical and sub-tropical waters. According to the International Union for Conservation of Nature (IUCN), this species is globally endangered while populations of Mediterranean green turtles haven't yet to be assessed. To this end, and for the purpose of conservation and management of these turtles, it is necessary to obtain reliable data on their distribution and on the threats they face. Current knowledge on the distribution and habitats of green sea turtles in the Mediterranean is largely concentrated on nesting beaches, most of which are located in Turkey and Cyprus. Much less is known about their foraging, wintering and developmental habitats. Post-nesting satellite tracking in Cyprus reveals a fidelity for feeding and wintering sites along the North African coasts, notably in the Gulf of Bomba and west

of Sirte in Libya. This work lists records of green turtles around the Kerkennah Islands (North-East of the Gulf of Gabès) during the period (2016 – 2022). In the frame of the "Life Med Turtles" project, coordinated by the Sfax Faculty of Sciences, collaboration was established with Kerkennah fishers to report sightings and bycatch of green turtles. The first results show that most of the turtles recorded were juveniles caught in shallow depths by fixed fisheries called "charfia". Moreover, we note a noticeable increase of the observations compared with those registered between 1987 and 2014 in the same area. The Kerkennah Islands could constitute a suitable area for green sea turtles in the Gulf of Gabès and in the Mediterranean.

POSTER PRESENTATIONS
SESSION2: At Sea Biology

STATUS OF THE GREEN TURTLE *CHELONIA MYDAS* LINNAEUS, 1758 IN THE SOUTH OF THE GULF OF GABES

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Sea turtles are a fundamental link in marine ecosystems. They help maintain the health of seagrass beds and coral reefs that benefit commercially valuable species such as shrimp, lobster, and tuna. Sea Turtles include seven extant species of marine reptiles of the Superfamily Chelonioidae and the Families Dermochelyidae and Cheloniidae. Three sea turtle species are observed in Tunisian waters. The green turtle, *Chelonia mydas* Linnaeus, 1758, is rare, the leatherback, *Dermochelys coriacea* (Vandelli, 1761), is regularly observed and the loggerhead, *Caretta caretta* (Linnaeus, 1758), is common and reproduces on some beaches. The documents of Bouchon Brandely and Berthoule (1890) and of De Fages and Ponzevera (1908) evoke the ancient presence of the green turtle. According to these authors, it would be located near Djerba but is very rarely observed and the name given to this species is also "Bouzegza". Blanc (1908, 1935) was the first author to report with certainty the presence of the green turtle in Tunisia; according to him it would be located in the Gulf of Gabes. Lawrent et al. (1990) mentioned 4 turtles captured in the Gulf of Gabes and one of them was tagged in Cyprus. Studies on the presence of green turtles in the southern Gulf of Gabes have taken on an upward rhythm since 2008 after the establishment of the stranding network since 2004 and following effort of many local NGOs such as the Ilij Association for the Marine Environment (AJEM). In this work, we collected data on detections of green turtles in the southern Gulf of Gabes (Djerba and Zarzis areas) since 2008. These data were obtained via (1) research work within the National Institute of Sciences and Technologies of the Sea (INSTM), (2) surveys carried out by the AJEM within the

framework of its project "Fishermen are of the Islands of Farwa in Libya and Djerba in Tunisia » financed by CEPF and (3) observations on board within the framework of the project « Interaction of sea turtles with gillnets in the island of Djerba » financed by Reford Foundation. Eight observations were collected between 2008 and 2021 (5 strandings and 3 accidental captures); these observations mainly concern subadult turtles (curved carapace length between 44 and 115 cm with an average length of 72.42 cm) mostly recorded during the summer season which coincides with the increase in coastal fishing effort, mainly trammel nets and gillnets. Surveys of the beaches carried out by the AJEM in July 2021 made it possible to find an attempt of green turtle lay. The green turtle nested only once in Tunisia in 2019 on the beach of Rejiche (central Tunisia). The south of the Gulf of Gabes, known by a wide continental shelf and by a high density of *Posidonia* and *Cymnodocea* meadows, would be a favourable habitat and a feeding area for green turtles in the Mediterranean. Despite this, the rarity of green turtles, an herbivorous species feeding mainly on marine phanerogams, would be a strange fact. The evolution of the status of the Green Turtle in Tunisia (fairly common at the beginning of the century to currently rare) could result from the massive exploitation of populations in the eastern Mediterranean in the 1920s and 1930s (Sella, 1982). The conservation efforts dedicated for these chelonians in the Mediterranean in recent years support their reappearance in the waters of Tunisia. Further survey efforts are needed in order to verify this fact in the region.

RECENT FINDINGS IMPLY INCREASING IMPORTANCE OF ADRIATIC SEA AS A DEVELOPMENTAL HABITAT FOR MEDITERRANEAN GREEN SEA TURTLES (*CHELONIA MYDAS*)

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We collected new findings of green sea turtles in Adriatic Sea obtained from fisherman, stranding networks and citizen science applications. In combination with literature review, we present 75 records of the species in Adriatic including 8 new. The number of records is generally low, but with an intriguing ten-fold increase since 2000. This may be a direct result of positive population trend at main nesting sites in Mediterranean and increased institutional capacity for sea turtle research and conservation in the past two decades. In addition, we assume that raising sea temperatures established recurring thermal corridors along Ionian-Adriatic developmental pathway corroborated by majority of records being small juvenile animals. With further warming due to climate change Adriatic Sea might be shifting towards suitable thermal environment for the species,

while also providing food sources for dietary ontogenetic shift: diverse planktonic and variety of benthic invertebrate communities, algal assemblages and sea grass meadows. Variety and abundance of food is also likely the reason for some turtles to stay during the seasonally unfavorable thermal conditions in winter. Lastly, our study highlights high interaction with fisheries in Adriatic. A large portion of the fleet of more than 10 000 vessels operating mostly in shallow and coastal areas, frequented by juvenile greens turtles, warrants a careful consideration in the future. Increased presence of the species is opening up opportunities to address the existing regionally specific knowledge gaps and poses new challenges to manage and conserve this charismatic sea turtle species in the changing Mediterranean Sea.



SESSION 3: Nesting Biology

POSTER PRESENTATIONS

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SESSION3: Nesting Biology

EVALUATION OF THE EFFECTS OF THE CAGING TOP AND SIDE CAGING ON SEA TURTLES NEST ON DALYAN BEACH, TURKIYE

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Sea turtles are known to spend most of their lives in the sea, only female sea turtles go back to the beach for nesting. One of the main threat to the nests are threatened by predators. This study is carried out on sea turtles nest against predator on Dalyan beach during the last nesting seasons of 2020-2021. There were top cages used for public awareness but there were screens, 1 meter square meshes with 7.2 cm grid sizes, used under the sand against predators. This was not enough to stop predators digging out from the sides of the cages. Later a vertical side cages, 1 m, 25 cm in depth with mesh size of 4 cm, were also applied to some nest where heavy predation occurs on the beaches. There were 1492 nests over the study period, of which 188 of them completely predated by foxes and badgers. A total of 224 nests were partially predated, some of them were still able to reached by the predators from

the top and some of predated, some of them were still able to reached by the predators from the top and some of them from the sides. We managed to protect the remaining 1080 nests. The results of top caging and side caging were compared both spatially and temporally. The predators were very active at the beginning of the nesting season and attacking majority of the nests but the predation rates were controlled with top and side cages with the increase of number of nests later in the season. A total of 14,692 eggs were predated despite of the caging. We discussed the predation rates and learning capacities of the predators. Usage of the side cages were found to be more effective than using only top cages. Further studies were needed in order to investigate the population sizes of the mammalian predators in the vicinity and establishment of hatcheries were also discussed.

POSTER PRESENTATIONS

SESSION3: Nesting Biology

Nesting of sea turtles along the Libyan coastline 2021

Saied, A & Glidan, A.

POSTER PRESENTATIONS

SESSION3: Nesting Biology

LOGGERHEAD TURTLE IN MCPA KURIAT

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The Kuriat Islands are two small uninhabited islands with almost no development, 2 km apart and located east-north-east of Cape Monastir-Tunis, about 16 km from the coast. These islands are in number of two islets, a small island or Conigliera island (Qûrya Essaghira) of about 70 ha and a larger island "Big Kuriat" (Qûrya El Kabira) of about 270 ha in area and a perimeter 6.9 km and about 2.5 km from the first (APAL/SCET-TUNISIE, 2000). The Kuriat Islands are one of the main nesting sites of the Loggerhead sea turtle « *Caretta caretta* » in the southern Mediterranean (Bradai, 2000; Jribi et al., 2001), and therefore constitute a vulnerable ecosystem. The nesting of *C. caretta* was highlighted for the first time in 1988, on the beach located between Ras Dimas and Mahdia and on the large Kuriat, then on the small Kuriat in 1993 and at Chebba in 1994, 1995 and 2000 (Bradai, 2000; Jribi et al., 2001). Currently, the beaches of the large Kuriat represent the most important site for nesting in Tunisia and are the subject with those of the small Kuriat of a monitoring, which began since 1997. Currently, this monitoring is done within the framework of a quadripartite agreement between four actors, the National Institute for the Sciences and Technologies of the Sea (INSTM), Coastal Protection and Planning Agency (APAL), Regional Activity Center for Specially Protected Areas (RAC/SPA) and the association Notre Grand Bleu (NGB). This monitoring is part of the implementation of the national program on the monitoring of marine and coastal biodiversity in Tunisia and the national action plan for the conservation of sea turtles. Tracking the nesting of Loggerhead Sea Turtles from the previous season 2021 lasted 104 days. Previous visits carried out to monitor the latest emergences on the large and small Kuriat until 02

October. The monitoring aims in addition to the determination of the eco-biological parameters of the nesting, the protection of the spawning site, the nesting females and the newborns as well as the awareness of the visitors of the islands. On the other hand, the monitoring team provides training sessions for students and national and international volunteers on the monitoring of the nesting site and various aspects of biodiversity. Night patrols in search of nesting females were carried out daily on all the beaches of Big and Small Kuriat are organized by the association Notre Grand Bleu (NGB) with the team of management unit, volunteers and interns. These nocturnal patrols, carried out on a daily basis, begin at nine o'clock in the evening until sunrise. A break of 15 to 20 minutes is taken at the start point, and similarly at the end point, before resuming the patrol. This approach was applied to ensure that the majority if not all of the nesting females on the site were encountered, and thus be able to mark them. Night patrols are carried out by three pairs (1 pair per zone) on a 3.07 km section, divided into 3 zones on the large Kuriat, and one or two pairs on a 1.14 km section divided into 2 zones on the small Kuriat. Once the spawning is finished, and before its return to the sea, the straight line measurement of the carapace (CCL) the curved width of the carapace (CCW), the marking, if necessary, and the taking of the samples are ensured for data collection. In the morning, surveys were also carried out in search of traces of females that went unnoticed during the night as well as the geolocation of the nest. Before the end of the incubation period, the protection of the nests of the sea turtles was reinforced by the

installation of a seat of short cane stakes, in order to direct the babies towards the sea, and to avoid their trampling on the case some of them go out during the day. At the end of the incubation period, the digging of the nest can be done if no sign of emergence has been observed, or if, on the other hand, the emergence has already happened for 2 to 4 days. The nests are then opened by the surveillance team, in order to help latecomers to reach the sea and to count the hatching parameters. The collection of this data then allowed us to determine the clutch sizes and the different fertility, hatching and emergence rates. From these calculations, it would be possible for us to make an estimate of the success of the incubation of the nests, and then be able to deduce the favorable conditions and identify the main threats for the females, the nests and the newborns on the MPCA Kuriat.

Climate change and coastal erosion are natural hazards that affect the loggerhead turtle nesting phenomenon on the Kuriat Islands. Thanks to the efforts of the team of eco-volunteers coordinated by the managers of the MCPA Kuriat and the effectiveness of the quadripartite agreement between the APAL, the SPA / RAC, the INSTM and NGB, the number of nests deposited the previous year, in addition to the two previous years (2019 and 2020), is higher than the figures recorded in previous years. The number of nests for the years 2021, 2020, 2019 and 2017 are respectively 46, 44.42 and 21 nests. Also, Fishermen become more and more included in the process of saving of the marine turtles which has been increased from 22 in 2016 to 40 in 2021.

POSTER PRESENTATIONS

SESSION3: Nesting Biology

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A NEWLY IDENTIFIED NESTING BEACH IN GREECE PRODUCING MALE LOGGERHEADS

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Greece hosts the largest reproductive aggregations of loggerhead sea turtles (*Caretta caretta*) in the Mediterranean Sea. Bearing in mind that most nesting beaches in the basin produce mainly female hatchlings, especially considering the effects of climate change, beaches which yield predominantly male hatchlings are of extreme importance at regional level. In this context, knowing the ratio of males to females, both for modelling and for determining the future success and survival of any sea turtle sub-population is crucial. ARCHELON initiated conservation efforts on Preveza beach in 2017, in the framework of the LIFE EUROTURTLES project, co-funded by the European Commission. This beach faces the Ionian Sea on the north side of the mouth of Amvrakikos Gulf (38.9561°N, 21.0222°E). It is currently the northernmost nesting site in Greece that ARCHELON monitors. The beach spans approximately 13 km from Kastrosykia in the north to Mytikas Cape in the south and it is predominantly west-facing. The main activities of ARCHELON include beach monitoring, nest protection and post-hatch excavation of nests. Also, since 2018, temperature loggers were placed during the

incubation period both in nests and in surrounding sand, to estimate the sex ratio of the hatchlings. Following the analysis of the temperature loggers' collected data, ARCHELON found that the nest temperatures were below the pivotal value (29.7 °C; where balanced sex ratio of hatchlings is produced) during most of the incubation period, suggesting the production of an overwhelming majority of male hatchlings. The value of this male-producing beach is enhanced not only because of global warming, but also by the fact that nesting levels seem to be increasing. Systematic monitoring of the beach started in 2017 with 3 recorded nests, followed by 8 in 2018, and 13 in 2019. The increasing nesting levels encourage the fact that Preveza could become a site with a larger nesting potential in the future. This is even more profound in relation to the warming of other nesting beaches which will produce increasingly female biased hatchling output whilst Preveza beach continues to produce males. We thank all ARCHELON volunteers who worked at this project.

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SESSION3: Nesting Biology

EFFECTS OF TEMPERATURE ON HATCHLINGS SEX RATIOS OF LOGGERHEAD TURTLE IN PATARA BEACH TURKEY

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Temperature-dependent sex determination (TSD) is a form of environmental sex determination, in which environmental factors determine sex determination. The loggerhead sea turtle, like all species of sea turtle, do not have heteromorphic sex chromosomes and sex determination is dependent on temperature. Differentiation of indeterminate gonads into ovaries or testes depends on the hatching temperature of the eggs during the thermosensitive period (TSP) of embryonic development, this is approximately the middle third of the hatching period in sand. For this reason, temperature monitoring at nesting beaches is important for monitoring sex ratios and conservation studies of these species. This study aims to determine the sexes of the hatchlings produced in Patara Beach in four years (2019-2022). Nest incubation temperatures were monitored with data

loggers, and sex ratios were estimated from the average incubation temperature during the middle third of incubation. In addition, dead hatchlings were collected and their gonads were histologically examined. As a result, the histological data validates the use of incubation temperature to estimate hatchling sex ratios. We found that Patara beach produced 15.4% males during our study period. In terms of months, male reproduction rates were calculated as 22.96% in June, 11.4% in July and 11.8% in August. It has been observed that nests made especially in the first quarter of the breeding season are capable of producing more male individuals. Considering the impact of global warming, this situation is of great importance for the continuation of the species with temperature-dependent sexes.

POSTER PRESENTATIONS

SESSION3: Nesting Biology

Environmental characterization of nesting sites of *Caretta caretta* L. 1758 along the Tuscan-Latium coastline

Pagli, D., Campana, I., Carrara, A., Tagliaferro, L., Poggioni, L & Papetti, L.

POSTER PRESENTATIONS

SESSION3: Nesting Biology

MONITORING OF LOGGERHEAD TURTLE POPULATION ON PATARA BEACHES, TÜRKİYE

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Patara beach is one of the most important and best protected nesting sites of Loggerhead turtles (*Caretta caretta*) in Turkey. Monitoring of population studies have been carried out on this beach for long period of time. The regular monitoring of the beach started in 1988 and we know that the sexual maturity age is somehow between 20-25 years. Here, we presented the last tree years loggerhead turtle's nesting data of Patara beach, and compared the previously published knowledge. We recorded 286 nests for 2019, 434 nests for 2020 and 316 nests for 2021 nesting seasons. The nest density per kilometer is calculated as 23.83 nest/km for 2019, 36.1 nest/km for 2020 and 26.33 nest/km for 2021. Screening of nests against mammalian species predation were carried out in order to protection of the nests and increase the hatching success. The high number success. The high number

of nests maintained in a region with high predation rates, such as Patara, indicates the importance of nightly studies and effective cage method. As a result of analyzing of data, a remarkable record of nest count increase occurred during the last 12 years. This population fluctuation cannot be explained with an increase in the population especially increasing numbers in the last 3 years. There are two possible explanations of these increases in the nest: the first, as a result of continuous monitoring and protection efforts since 1988, the population trend of loggerhead sea turtle increased with recruitment of new mothers that has started to lay eggs. The second, nesting females, that are use other beaches as a breeding site, could be contributed to Patara population.

POSTER PRESENTATIONS

SESSION3: Nesting Biology

THE SUITABILITY OF ALBANIAN COASTLINE TO SUPPORT VIABLE NESTING FOR LOGGERHEAD TURTLE (CARETTA CARETTA)

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This study aims to assess the suitability of Albanian beaches to support nesting activity of loggerhead turtle *Caretta caretta*. The survey was conducted during the summer period (June – September) of 2018 and 2019. Data were collected along transect lines (49 sites along 41 beaches in 2018, and 36 sites along 29 beaches in 2019) for elevation, compaction and anthropogenic activity up to a distance of 100m either side of the transect. Complementary data were also collected using a DJI Phantom 4 Pro, which was flown by automated pilot to create maps, generated using DroneDeploy software. An elevation toolkit used to measure the elevation of the beach above the sea line to calculate suitable areas for nesting. Drone flight missions were conducted at 34 sites each year (2018 & 2019), at a height of 30m to 50m and a total of 2.85km² coastline was mapped (max 0.232km², min 0.004km²). In order to evaluate the temperature conditions of the sand, and evaluate the potential impact of climate warming, sand temperature loggers

(model: Tinytag, Gemini data loggers) were placed at the start of surveying (May) at three beaches during 2018 and seven beaches during 2019 and were removed at the end of the surveying season (September-October). In total, the suitability of 57 sites across 43 beaches was assessed based on the selected parameters, and ranked as 'HIGH' (n = 20), 'MEDIUM' (n = 25) or 'LOW' (n = 12). One site was excluded, due to substrata type. Suitable beaches primarily occurred in the southern and northern most regions. Two emergences of sea turtles were documented in the northern region during the survey period; one non-nesting emergence and one nest (the first official nest in Albania). Based on previous evidence and the data collected during this survey, it indicates that the northern Adriatic region of Albania is more likely to experience sea turtle nesting activity. Recommendations for further research and conservation measures are proposed.

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SESSION3: Nesting Biology

NESTING SITE SELECTION AND APPLICATION OF DIFFERENT PROTECTION METHODS IN THE COASTAL AREA OF PATARA NESTING BEACH, TÜRKİYE

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The rise in sea levels will have a number of impacts including coastal flooding, the destruction of coastal wetlands, increased erosion of beaches. As well as the mammalian predation of the nests, beach erosion and the subsequent inundation are the main factors for the low hatching success of marine turtles at Patara, Türkiye. In this context, this study's goal was to assess if extensive beach management could be a more effective method of sea turtle conservation against to predation, inundation and nest losses by sand erosion in Patara beach. In order to prevent natural nest losses such as beach erosion, nests inundation and nest predation, and also human-caused nest losses as well as the detrimental consequences of nest management on sex ratios and hatching success, we define intensive beach

management as both extensive beach patrolling and proper nest relocations. The GPS coordinates and the distances from sea of the nests were measured and recorded between 2019-2022 nesting seasons. To determine core nesting areas on the beach we performed Kernel Density Estimation under ArcGIS program (v10.4). With the help of the kernel density estimation, we identified the regions that had the most nests over the course of four seasons and then identified the environmental factors that might have an impact on these regions' nesting habits. Our findings presented more information about the nesting site selection and prediction of areas to be nest relocation of marginal sea turtle populations and have implications for the protection and monitoring of nesting sites during reproduction seasons.

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FIRST RECORD OF THE LOGGERHEAD TURTLE CARETTA CARETTA NESTING IN DJERBA ISLAND (SOUTH OF TUNISIA)

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In Tunisia, the first indications of nesting sea turtles were mentioned for the first time in 1988 by the discovery of loggerhead turtles nesting on the beaches located between Ras Dimas and Mahdia (Middle of Tunisia) and in Kuriat islands. The Kuriat Islands, declared as a future marine and coastal protected area (MCPA), remain the most important and most regular nesting site of the loggerhead *Caretta caretta* in Tunisia. This site has been monitored since 1997 by the National Institute of Marine Sciences and Technologies (INSTM) with the close collaboration of the Coastal Protection and Planning Agency (APAL) and the Regional Activity Center for Specially Protected Areas (RAC/SPA). Currently, the Notre Grand bleu association contributes actively to monitoring the nesting of loggerhead turtles as co-manager of the site. Several recent observations and testimonies evoke the nesting of sea turtles on other Tunisian regions such as Nabeul, Kerkennah, Zarzis and especially in Chebba where nesting has been well documented. As part of the project «Fishermen Engaged for Preserving Coastal Heritage in Libya and Tunisia», financed by “CEPF” and implemented by the “AJEM association” from Tunisia and “BADO association” from Libya, prospections on the beaches of the Djerba island have been conducted and have for objectives : (1) the search for possible nesting sites, (2) measurement of the importance of the nesting activity of the sea turtle on (number of nests, success of hatching and success of emergence of hatchlings), (3) identification of problems that disturb this phenomena, (4) monitoring and protection of nests and (5) helping hatchlings to reach the sea. The island of Djerba has about twenty kilometers of sandy beaches suitable for nesting and located mainly at the eastern end of the island. Surveys of nesting sites were conducted in the beaches of Aghir,

Ras Rmal and Seguia during the period from June to October 2021. Three teams of three persons were placed on each site to monitor turtle nesting. Given the curfew situation in Tunisia, we were unable to carry out night patrols. Surveys were conducted early in the morning: first, the teams search turtle tracking and then they ensure the presence of eggs. At the end of incubation period and after hatchlings emerge, nests are opened to count hatched eggs, infertile eggs, unhatched fertile eggs (early mortality and late mortality), hatchlings dead in eggs and dead-in-nest hatchlings to determine clutch sizes and different fertility, hatch and emergence rates. Two loggerhead turtle nests were discovered in “Ras Rmal” and “Aghir” beaches in July 2021 (clutch sizes 131 and 73 respectively) for incubation periods respectively of 46 and 52 days. The hatching rates of Ras Rmal and Aghir nests are respectively 93.13% and 52.05% corresponding to emergence rates of 90.23% and 39.73% and fertility rates of 97.72 % and 84.94%. This is the first report of the nesting of the sea turtle *Caretta caretta* on the beaches of Djerba. These results confirm the need to update the nesting sites of loggerhead turtles on the Tunisian coasts. The island of Djerba would be a favorable area for the nesting of the loggerhead turtle *Caretta caretta* in Tunisia. However, this phenomenon encounters several constraints, including (1) the significant human frequentation (summer visitors and tourists) especially during the nesting period of the sea turtle and (2) the intense fishing activity around the island (fishing nets placed near shore interfere with nesting females and form barriers for hatchlings that may entangled in these nets after emergence).

POSTER PRESENTATIONS

SESSION3: Nesting Biology

MEDITERRANEAN SEA: CARETTA CARETTA NESTINGS AT HIGH LATITUDES, MINIMALLY INVASIVE APPROACH TO PROMOTE THEIR SURVIVAL

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In the Mediterranean Sea, the growing occurrence of sporadic nesting sites of *Caretta caretta* sea turtles at elevated latitudes, resulting from climate change, increasingly implies the need to seek adequate strategies to promote hatching success. Late nestings at high latitudes are subject to decreasing temperatures, with the displacement of the hatching date towards colder periods, at times incompatible with embryogenesis, also rendering them vulnerable to autumnal storms. The nesting which occurred on July 30, 2019, in Pesaro (PU), Italy, by the central Adriatic Sea and located at a latitude of 43°55'21" N, was the northernmost nesting site in the Mediterranean Sea. It offered the optimal conditions to experiment with an innovative, minimally invasive and sustainable strategy to promote incubation, the so-called “dome”, consisting in an igloo-shaped waterproof sheet covering the nest and aimed at protecting it against climatic adversities, in order to ensure more suitable incubation times. On the 67th day of incubation, the nesting site, at that moment left

exposed due to the imminent hatching phase, was flooded by a strong sea-storm surge. A prompt rescue operation was carried out, consisting in the collection and transfer of the entire content of the egg chamber to a nearby veterinary facility. Of the 69 elements found in the flooded nest, 33% were healthy hatchlings, 28% were non-embryonated eggs, 17% were damaged eggs, 13% were intact eggs, 7% were hatchlings in critical clinical conditions, and 2% were dead hatchlings. At the veterinary clinic, over a week, various artificial incubation management strategies were adopted depending on the stage of development. The survival rate of the embryonated eggs and hatchlings was 76%. In conclusion, our experience with the implementation of extraordinary measures to ensure successful hatchling survival, might prove useful for future conservation activities of nesting sites in extreme environmental conditions.

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ASSESSMENT OF CARETTA CARETTA NESTING SITES ON TUNISIAN COASTS

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In addition to the two regular and known loggerhead-nesting sites on the eastern Tunisian coasts, namely Kuriat islands and Chebba beach, several testimonies and observations affirm the presence of other possible nesting sites. The project “Conservation of sea turtles in the Mediterranean region” coordinated by SPA/RAC and financially supported by MAVA aims, among other activities for Tunisia, to explore sandy beaches looking for new and potential sea turtles nesting sites. For this, surveys were carried out on the majority of sandy beaches on Tunisian coasts. Fact sheets on beach quality (granulometry, length, width...) and potential disturbance of the nesting activity have been filled. Detailed analyses of particle size, organic matter and pH were performed in the laboratory and a nesting indicator was used. Furthermore, interviews with beach users were conducted in

order to be informed about the presence of previous or recent nesting activities. Primarily results show that 24 sites were identified as nesting sites for the loggerhead turtle (where previous or current nests were detected) from which two on the northern coasts were not concerned by the phenomenon in the past. Moreover, the study of the quality of beaches patrolled indicates that the majority of them are favorable for nesting activity, which allows us to consider them as potential nesting sites. This study encourages us to continue the surveys on all the Mediterranean coasts and especially on the coasts of the western basin where nesting activity increases recently from one year to another in many Mediterranean countries. Global warming phenomenon and increase of observation efforts could be responsible of the extension of the nesting areas.

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SESSION3: Nesting Biology

CHALLENGES FACING NESTING OF MARINE TURTLES ON THE EGYPTIAN MEDITERRANEAN COASTLINE BY USING GIS TECHNIQUES

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The southern coast of the Mediterranean still has wilderness areas, especially in North African countries, this is back to the little development along the Mediterranean coast. It is also characterized by the most suitable habitat in the Mediterranean basin which attracts sea turtles to nest and forage. Therefore, over the last 10 years, conservation practitioners are investing resources towards conserve and protecting sea turtles and their critical habitats. This study will deal with the Egyptian Mediterranean coast which stretches to 995 km from west to east and is considered one of the important areas for sea turtles (*Caretta caretta* and *Chelonia mydas*) as migratory corridors and aims to investigate different threats and pressures that affect the survival of marine turtles and their habitats along the Egyptian Mediterranean coast by using GIS and high-resolution google earth maps. The study results showed a history of changes where approximately 40% of the total

coastline is still suitable for homing marine turtles and the rest of the total coastline revealed several destructions of sea turtle habitat due to coastal erosion, mass tourism, excessive touristic resorts, urban development, and climate changes. As well as the demand for land use for development activities such as fish farms, electric power, and mining industries. This study recommended that more efforts need to be taken towards the mainstreaming of the conservation and protection of the sea turtles' habitats within the developmental planning process and land use map, it needs to establish regulations to preserve sea turtles' habitats, also, take measures to use sea turtle nesting sites that overlapped with touristic developments as attracting sites under strict regulations. In addition to preparing management plans of species habitat in the North African countries.

POSTER PRESENTATIONS

SESSION3: Nesting Biology

HATCHLING MORPHOLOGY OF GREEN TURTLES IN TURKISH REPUBLIC OF NORTHERN CYPRUS

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Northern Cyprus is one of the most important nesting grounds for green turtles in the Mediterranean. There are plenty of studies on the conservation and management of sea turtles in the region. Hatchling morphology is a part of such studies since it provides direct information on the fitness of hatchlings. Data were collected during hatchling emergence from the north and south beaches of the Dip Karpaz, Northern Cyprus.

Morphometric measurements of the green turtle were taken from natural and relocated nests. We measured straight carapace length (SCL), width (SCW) and weight of the hatchlings using a digital scale (accuracy ± 0.1 g) and dial callipers with an accuracy of ± 0.01 mm, respectively. Scutes were examined concerning variation within the carapacial scute series and variation in the carapacial scute pattern.

POSTER PRESENTATIONS

SESSION3: Nesting Biology

REPRODUCTIVE ECOLOGY OF GREEN TURTLES, CHELONIA MYDAS, ON KARPAZ PENINSULA OF THE TURKISH REPUBLIC OF NORTHERN CYPRUS

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The beaches of the Karpaz Peninsula are one of the critical breeding habitats of green turtles in the Mediterranean. The mean nest numbers reported in previous studies cover almost %20 of the overall nesting activity. We, therefore, focused on seven nesting beaches on the peninsula and started our fieldwork on the 24th of May. A total of 1768 non-nesting emergence and 925 green turtle nests have been recorded so far. The GPS coordinates and distance of the nests to the

water line were measured using a tape measure. The fieldwork will be ended in late September, depending on the incubation duration of late nests. The nests will be excavated after hatchling emergence had completed. The content of the nests (empty eggshell, embryo, unhatched eggs) will be counted, and the clutch size of each nest will be determined.

POSTER PRESENTATIONS

SESSION3: Nesting Biology

LOGGERHEAD MISSING BOTH REAR FLIPPERS INSISTING TO LAY EGGS

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The involvement of rear flippers into the nesting procedure of loggerhead turtles is well known. But what if a female loggerhead is missing both rear flippers? ARCHELON, the Sea Turtle Protection Society in Greece monitors the main nesting beaches of Greece for the last 39 years, consecutively. ARCHELON's Lakonikos Bay project, in southeast Peloponnesus, comprises of about 23 km of beaches: Mavrovouni, Valtaki, Vathi, Selinita and Evrotas. We present here the case of a loggerhead missing both rear flippers, first observed by our team in July 2010 in Mavrovouni during an early morning non-nesting emergence. We called her "Stumpy" as her rear limbs were cut at about the ankle level and both flipper spades were missing. As a result, she was leaving very distinctive tracks on the sand. In June 2012 we met "Stumpy" again in Mavrovouni and this time we tagged her and helped her dig her nest. Post-hatch excavation revealed 155 eggs, with 45.2% hatching success. Most unhatched eggs had no embryos. Incubation duration: 46 days. In July 2019, we saw her again in Mavrovouni, still tagged, making some nesting attempts. Later in the season (1/8/2019) we recorded a "stumpy"

emergence with 3 nesting attempts in Mavrovouni. In 6/7/2020, during the morning survey in Mavrovouni, we found a clutch of 90 eggs exposed on the sand, only 5 meters from the sea. The inspection of tracks, the several emergences with "stumpy" tracks in Mavrovouni prior to this date, and the non-excavation of a complete egg chamber, suggested that this clutch belonged to "Stumpy". We prepared an artificial egg chamber where we placed the 88 eggs that were still intact and fenced it to protect it from predation. At least one hatchling emerged from this nest, reaching the sea on 20/8/2020. It is likely more hatched but went unnoticed by us because of the pebbles surrounding the nest as a result of inundation. Regrettably, the nest was completely predated on 28/8/2020. To our knowledge this is the first reported case in the Mediterranean of a loggerhead lacking both rear flippers to repeatedly attempt nesting. In addition, the outcome of this case validates the importance of monitoring the nesting beaches, so that we maximize the number of hatchlings recruited to the population every year.

POSTER PRESENTATIONS

SESSION3: Nesting Biology

CURRENT AND FUTURE SUITABILITY OF THE BALEARIC ISLANDS AS NESTING GROUNDS FOR LOGGERHEAD TURTLES

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Main nesting grounds of loggerhead turtles (*Caretta caretta*) in the Mediterranean are located in the eastern basin but sporadic nesting also occurs on the western side. As temperatures in the Mediterranean are increasing, it has been suggested that increasing of nesting toward western areas may occur as an effect of climate change although, nesting is still sporadic and scattered there. One of those locations with sporadic nesting is the Balearic Archipelago, Spain, where successful loggerhead turtle nesting events are being recorded since 2019. Here, we assess the suitability of the Balearic Islands as nesting grounds for loggerhead turtles under current conditions and future scenarios of climate change to the mid (+40 years) and end (+80 years) of the 21st century. We used a combination of air and sand temperatures on 19 beaches of the Balearic Islands to forecast nest temperatures and sex ratios. Current climatic conditions at the Balearic Island seem suitable for egg incubation during the peak of summer but cool conditions at the beginning and rain at

Nests on most beaches would experience temperatures above the development threshold but would predominantly produce male hatchlings under current and +40 years scenarios. Under the +80 years scenario, primary sex ratios would still be predominantly male when considering all beaches together. However, sex ratio at the warmest sites, where some nests have been recorded, would be similarly biased to females as those of well-established nesting populations in the eastern Mediterranean. Our results suggest that climatic conditions at the Balearic Islands could favor the production of male turtles over a long-time period. Other conditions, such as survival of hatchlings in the water, and nesting site fidelity will also be necessary for the establishment of nesting populations in new areas such as the Balearic Archipelago.

POSTER PRESENTATIONS

SESSION3: Nesting Biology

SURVIVAL, DISPERSAL STRATEGIES AND HABITAT SUITABILITY OF LOGGERHEAD SEA TURTLE (CARETTA CARETTA) POST-HATCHLINGS FROM SPANISH NESTS

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Loggerhead sea turtle nesting events are increasing in the western Mediterranean Sea, far from their usual nesting areas in Mediterranean and Atlantic basins. In accordance, the study of survival and dispersal behaviour towards potential development areas of loggerhead post-hatchlings from these western Mediterranean nests out of range seems to be crucial to comprehend this colonization process. Moreover, since 2014, several nests recorded in the Spanish Mediterranean coasts have been managed to enhance hatchlings survival. However, these management measures, like head-starting programmes, should be assessed in order to discuss their effectiveness. To fill this gap, we carried out survival estimates, investigated dispersal strategies, and modelled the species' habitat preferences based on data collected from 19 head-started loggerhead post-hatchlings released on the Spanish Mediterranean coast and satellite-tracked between 2016-2018 (mean tracking period 174 ± 95 days, ranging from 69 to 339 days).

Minimum daily survival probability was 99%, indicating great success of the head-starting program, at least in terms of short-term survival. Turtles dispersed over large areas and showed active swimming phases, since they were able to disperse by or against sea currents. Their dispersal routes were individual-based, although they consistently dispersed south-eastwards, especially during the coldest periods. For the first time we observed post-hatchlings from Spanish nests travelling through the Sicilian Channel to reach deep and warmer areas in the eastern Mediterranean basin. The species distribution model indicated that the most suitable areas for development and survival of studied loggerhead post-hatchlings during all year corresponded to the Ionian and Levant Seas. Therefore, these areas could presumably be developmental areas for the early life-stage of loggerhead turtle in the Mediterranean Sea, and conservation measures focused on this stage should be taken in them

POSTER PRESENTATIONS

SESSION3: Nesting Biology

THERMAL CONDITIONS OF GREEN TURTLES NESTS ON KARPAZ PENINSULA OF NORTHERN CYPRUS

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Climate change affects sea turtles as much as any other organism living on this planet. Researchers expect global temperatures to increase enormously in the following decades. It is known that a change in the temperature of a sea turtle nest would affect the sexual determination of the nest. Since high nest temperature results in a higher number of female turtles, it is expected to have an increased number of female hatchlings due to climate change. Aiming for long-term temperature monitoring, we deployed data loggers into the nests of green turtles during the 2022 nesting season. A total of 30 data loggers were located in randomly selected *Chelonia mydas* nests. The data logger

distribution covers both the peninsula's north and south beaches. With great care, we located the data logger in the nests the following day of laying, before 12 hours elapsed. We removed approximately 20 eggs from the clutch, placed the logger and reburied the eggs. We programmed the data loggers for 30 minutes intervals during the incubation duration of a nest. The results are expected to be collected by late September 2022. We aimed to present the thermal conditions of green turtle nests and provide baseline data for data modellers. Furthermore, the data collected is expected to enable us to understand the long-term effect of climate change on sea turtles

POSTER PRESENTATIONS

SESSION3: Nesting Biology

NESTING ACTIVITY OF MARINE TURTLES IN CYPRUS DURING THE 2016-2021 REPRODUCTIVE SEASONS

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The monitoring and protection of turtle nesting in Cyprus started in 1978. Turtle nest long term protection is deemed to be the main reason of the spectacular increases in nest numbers in Cyprus which can now be considered one of the main nesting rookeries in the Mediterranean. Field work is carried out from May to November encompassing the full nesting and hatching periods. Nests are protected from fox predation using aluminium cages and excavated after hatching for data collection. Here we present the reproductive data for six consecutive seasons (2016-2021) of a key nesting area of approximately 16 km length, located on the West Coast and in Chrysochou Bay where a total of 13 nesting beaches accounted for 84% and 96% of all nests laid in Cyprus for loggerhead turtles (*Caretta caretta*) and green turtles (*Chelonia mydas*) respectively. During these six nesting seasons a total of 8235 nests were found on these 13 beaches: 6639 loggerhead nests (average 1106.5 ± 271.6 SD, range 684-1429) and 1596 green nests (average 266 ± 72.6 SD, range 152-362). Nesting densities were overall 90.09 nests/km and 59.80 nests/km for loggerhead on the West Coast and Chrysochou Bay and

70.91 nest/km and 1.05 nests/km for green turtles on the West Coast and Chrysochou Bay respectively. The following reproductive parameters were calculated from a total of 3046 loggerhead and 1192 green excavated nests which were not predated, disturbed by predators or humans or inundated by the sea. The average number of eggs for all seasons was 76 (± 19.8 SD, range 1-158, n=918) on the West Coast and 74 (± 18.1 SD, range 1-177, n=2128) in Chrysochou Bay for loggerhead and 114 (± 25.4 SD, range 21-220, n=1118) on the West Coast and 110 (± 25.3 SD, range 42-158, n=74) in Chrysochou Bay for the green turtle. Hatchling emergence success was highly variable between and within beaches. Overall the emergence success for loggerhead turtles was 64% on the West Coast and 74% in Chrysochou Bay, while the overall emergence success for green turtle nests was 70% on the West Coast and 74% in Chrysochou Bay. Predation, disturbance from predators or people and inundation by the sea were the causes for hatching failure or reduction of hatching and emerging success for 20% of the all nests during the six year monitoring period.

POSTER PRESENTATIONS

SESSION3: Nesting Biology

Conservation of Loggerhead turtle nesting in Zwara, northwestern Libya

Dhan, S., Banana, E., Dhan, F & Abdulmaula, H.



SESSION 4: Pathology and Health

POSTER PRESENTATIONS

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SESSION 4: Pathology & Health

FIRST REPORT ON MARINE LEECH OZOBRANCHUS MARGOI PARASITIZING LOGGERHEAD TURTLE (CARETTA CARETTA) IN CYPRUS

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Leeches of the genus *Ozobranchus* are known to be permanent and exclusive ectoparasites of marine turtles. They feed on turtle blood and attach onto the turtle's skin, mainly around the cloaca, the head and the flippers. *Ozobranchus* spp. may cause severe skin and eye lesions and have been implicated as vectors of chelonid herpesvirus 5 (ChHV-5), associated with the development of fibropapillomatosis (FP), a neoplastic disease causing epithelial tumours in marine turtles. The species *Ozobranchus margoi* parasitises several species of marine turtles but it seems to be mostly associated with loggerhead turtles (*Caretta caretta*) in several parts of the world, including the Mediterranean Sea, where however its occurrence is not very common. Here, we report the finding of *O. margoi* parasitising two individuals of loggerhead turtles in Cyprus. Both individuals were found dead. The first was a male loggerhead stranded on 2013 on Potima beach, north of Paphos (CCL n-t 70 cm, CCW 64 cm) with several individuals of *O. margoi* around the cloaca. The second was a young adult or large subadult floating at sea in the waters near Paphos Harbour in 2017 (CCL n-t 60.5 cm, CCW 58.8 cm,

approximate weight 25 kg) with many leeches around the head and some by the cloaca and carapace. No obvious injuries were present and it was not possible to determine the cause of death or a correlation between the death and the presence of the parasites. Several specimens of leeches were collected and preserved in 90% ethanol. Identification of specimens was carried out by the mean of genetic barcoding with the amplification of the cytochrome c oxidase I (COI) gene and the comparison of the obtained sequences with barcodes on the BOLDSYSTEM (Barcode of Life Data System v4) (probability of placement as *Ozobranchus margoi* 99.8%). To our knowledge this is the first record of the marine leech *Ozobranchus margoi* from Cyprus waters and the first time DNA barcoding has been used for the identification of marine turtle leeches in the Mediterranean. DNA barcoding is a useful means to identify leeches to species level when it is not possible to analyse the morphological characteristics (because of degradation of specimens or the lack of mature specimens, i.e. only larval or cocoon stages are present).

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

FIRST CASE OF CYSTITIS OBSERVATION IN A LOGGERHEAD SEA TURTLE IN TUNISIA (SOUTHERN MEDITERRANEAN)

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Cystitis is a general term for any inflammation of the urinary bladder. This disease is rarely reported in sea turtles. This poster reports the first case cystitis observation in a loggerhead (*Caretta caretta* Testudines, Cheloniidae) in Tunisia. The subadult male turtle was found stranded alive at Sousse beach (central eastern tunisian coast). It was emaciated and showed a buoyancy disorder and anorexia. It died two weeks later in the sea turtle rescue centre of INSTM. The post mortem examination showed urinary calculus in the bladder, associated with

a fibrinous inflammation of the mucosa. Bacteriological analysis showed the presence of *Escherichia coli*, *staphylococcus*, *pseudomonas* sp and *vibrio alginolyticus*. The antibiogram performed for the isolated strains showed resistance to tetracycline (TET 30µ) and flumequine (FLUME 30µg). The antibiotic resistance in sea turtles should be further investigated in order to better protect public health.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

POTWORMS (ENCHYTRAEUS, ENCHYTRAEIDAE) IN LOGGERHEAD SEA TURTLE NESTS (CARETTA CARETTA) IN TUSCANY, ITALY

M. Schmelz¹, D. Pagli², D. Scaravelli³, L. Tagliaferro², L. Papetti², M. Klinth⁴ zucchini

Sea turtle eggs, laid in nests on beaches, are vulnerable to predators, parasites and scavengers, including invertebrates. Occasionally, oligochaetes have been reported from nests, often associated with high mortality of eggs. Recent finds of oligochaetes in degraded nests of the loggerhead sea turtle at a highly anthropized beach in Tuscany stirred interest in the species identity of this invader and its possible rôle in the degradation of the eggs, which at the time of sampling were infested with fungi and no longer viable. Specimens were fixed in ethanol and investigated light-microscopically. One of these specimens was further processed for DNA sequencing, and a fragment of the COI-barcoding gene was generated. Morphological study and DNA sequencing showed that the specimens belong to the *Enchytraeus albidus* complex, a group of species common worldwide on seashores, coarse sandy substrate and high content of organic matter. One species is also common in compost heaps. The two modes of

investigation further revealed that the specimens belong to an hitherto undescribed species of this group. Comparison of the DNA barcode sequence with published sequences showed that the same species had been found previously at a neighbouring sea shore site. It is therefore probably a local endemic. Species of *Enchytraeus* feed on bacteria, fungi and dead organic matter. Cases of predation or parasitism are unknown. Their soft-bodied mouth region lacks hard-bodied structures and is therefore not suitable for a predatory attack on healthy plants or animals. It is suggested here that these worms enter the nests only when the eggs are no longer viable, and that they contribute to their decomposition. This view is in line with the general knowledge on enchytraeid feeding strategies and would mean that enchytraeids are not a causal factor for the bad condition of sea turtle nests. They are rather attracted, as decomposers, by turtle nests already in decomposition.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

ENVIRONMENTAL POLLUTANTS (POLYCHLORINATED BIPHENYLS, ORGANOCHLORINE PESTICIDES AND TRACE ELEMENTS) IN LOGGERHEAD TURTLE EGGS FROM THE EMERGING NESTING SITES ALONG THE SOUTH-WESTERN COASTS OF ITALY, WESTERN MEDITERRANEAN SEA

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Caretta caretta is the most common sea turtle species in the Mediterranean Sea. It is threatened by the significant increase in marine pollution, both chemicals and plastic waste, to which it is exposed through food, water and sediments. The transfer of chemical pollutants from mothers to their offspring is of particular concern for sea turtle conservation because it may affect hatching success and embryonic development. In this study, the levels of six indicator polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs), and trace elements were measured in unhatched eggs of *C. caretta*. The eggs were collected during the 2021 nesting season at different sites along the Campanian coasts (Italy) that has recently emerged as one of the very few regular although minor nesting sites on the Western Mediterranean beaches. A total of 50 turtle nests were sampled to obtain a homogeneous pool of 3 whole unhatched eggs from each nest during final excavation. The concentrations of trace elements were

determined by inductively coupled plasma mass spectrometry (ICP-MS), while PCBs and OCPs were analyzed by high-resolution gas chromatography coupled with high-resolution mass spectrometry (HRGC-HRMS) and gas chromatography-mass spectrometry (GC-MS/MS), respectively. Trace element levels decreased in the following order: Sr > Zn > Fe > Ba > Mn > Cu > Se > As > Rb > Ga > Cr > Li > Ni > Bi > V > Pb > Hg > U > Co > Cd. The highly chlorinated PCBs (153, 138, and 180) contributed the most to the sum of PCBs. Contamination profiles of PCBs showed great similarity in unhatched eggs collected from the same beaches at different times during the nesting season. Levels of OCPs were below the limit of detection in all samples. Our results provide additional baseline data on chemical contaminants in *C. caretta* to evaluate maternal transfer of individual compounds based on their presence in eggs and to investigate whether contaminants might affect reproductive success in this species.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

First Detection of *Listeria monocytogenes* in stranded Loggerhead Sea Turtle (*Caretta caretta*) along the coast of Campania Region (Southern Italy)

Esposito, M.E., Paduano G., Iaccarino, D., Esposito, F. Di Nocera, degli Uberti, B., Amoroso, M.G & Fusco, G.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

NEW BACTERIAL PATHOGENS IN SEA TURTLE EGGS: VAGOCOCCUS HYDROPHILI AND IGNATZSCHINERIA LARVAE

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Turkey's Mediterranean beaches include twenty one officially designated nesting sites, which are used by loggerhead and green turtles. Among these sites, the Sugözü Beaches are an important nesting site for the green turtle, and the Göksu Delta is an important nesting site for the loggerhead turtle. In this study, we describe the first isolation of *Vagococcus hydrophili* (from loggerhead turtle) and *Ignatzschineria* larvae (from green turtle) from the infected sea turtle eggs. These isolates were identified by sequencing of 16S rRNA gene amplified with

universal primer pairs 27F and 1492R. Amplified genes were cloned, sequenced by Applied Biosystems, and identified by comparison with known the GenBank database by using the National Centre for Biotechnology Information (NCBI). These findings are important to evaluate the potential threat of these pathogens to nests of green and loggerhead turtle population in Turkey and to develop future conservation measures and treatment processes.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

ESSENTIAL OILS TREATMENT FOR CUTANEOUS FUSARIOSIS IN CAPTIVE LOGGERHEAD SEA TURTLES (CARETTA CARETTA): PRELIMINARY IN VIVO DATA

Segati S1, Marcer F2, D'Acunto S1, Brandi S1, Albonetti L1, Tentoni E3, Scozzoli M3, Danesi P4, Sgubin S4, Bacci B5, Marchiori E2

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Fusariosis is a mycotic disease caused by filamentous fungi of the genus *Fusarium*. Among marine animals, skin and pulmonary infections have been described in pinnipeds and several sea turtle species both free-ranging and in captivity. In the latter scenario, the risk of opportunistic infection is increased by the presence of fungal spores in the tanks and by immunosuppression due to stressful conditions. In most studies, *Fusarium solani* species complex is reported as the main etiological agent. In this study, we describe preliminary results of essential oil (EOs) as treatment for superficial fusariosis in loggerhead turtles hosted in the CESTHA rescue centre (Marina di Ravenna, Italy). Over the period December-March 2022, 11 juvenile and subadult loggerhead turtles, either newly admitted or already hosted in the centre, showed erosive to ulcerative superficial lesions on carapace, head and/or limbs, involving up to 50% of the body surface area. Infection due to *Fusarium* was confirmed by mycologic culture and histologic preparations of skin scrapings from lesions.

In order to reduce the fungal growth, a mixture of essential oils and herbal ingredients (GreenVet APA-CT®) was added in the tank water (45 ml per 1000 litres of tank water). As well, topical treatment of lesions was performed daily for 30 days, leaving animals out of water for a session of 30 minutes. After 30 days, 8/11 animals were clinically healed suggesting the treatment was effective for cutaneous fusariosis with no side effects observed. These preliminary results show the in vivo activity of EOs towards *Fusarium* sp. In vitro tests and molecular identification of *Fusarium* species involved in this outbreak are ongoing. The antifungal activities of EOs in a formulated mixture represent a promising alternative for the therapy of fusariosis, avoiding the toxicity of classical antifungal drugs. In order to limit the spread of fungal infection in rescue centres, prompt treatment of infected, entering animals and disinfection of tank filters and water is advisable.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

COMPARISON BETWEEN MINI-FLOTAC AND A CONVENTIONAL TECHNIQUE FOR THE DETECTION OF HELMINTH EGGS IN SEA TURTLE FECAL SAMPLES

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The copromicroscopic exam can represent an useful tool to define the composition of gastrointestinal parasite communities in wild populations as well as in hospitalized animals. In this study, the sensitivity of Mini-Flotac technique (MF) compared to a traditional sedimentation and flotation method (SF) is assessed, using the post mortem isolation of gastrointestinal helminths as a reference test. During necropsy helminths were collected from the digestive system of 51 stranded loggerheads and the parasites were counted and morphologically identified. Furthermore, fecal samples were stored in 5% formalin and copromicroscopic exam was performed by both MF and SF, using the same solution (density: 1.450). Concordance between the results of the two copromicroscopic methods was evaluated with k-value, and the sensitivity (Se) of each method assessed through the comparison with helminths isolation. Finally, the correlation among fecal egg counts (FEC) and helminth burden was calculated through Spearman's rank coefficient. An overall number of eight helminth taxa (six trematode and two nematode species), were collected from the

gastrointestinal system. Eggs referable to the same taxa were detected at copromicroscopic exams, in addition to eggs of cardiocirculatory flukes (Spirorchidae eggs type 1 and 3). Concordance among the two copromicroscopic techniques was good to excellent for the ten different taxa ($k=0.61-1.00$) and the Se for the different taxa was also similar (41-75% for SF, 45-75% for MF). Weak correlation was found between FEC and helminth burden for all taxa. MF method showed similar performances to SF technique in terms of sensitivity, proving at the same time faster to perform without specific lab supplies. In previous studies, in which MF was applied to sea turtle stool samples, Spirorchidae and nematode eggs had not been detected. Geographical differences in the epidemiology of these infections must be considered, nevertheless, the efficiency of different types of high-density solutions should also be further investigated. As a first assessment on the correlation between FEC and helminth burden, this study suggests to consider anti-helminthic treatments in rescued animals regardless of FEC for pathogenic species such as *S. sulcata*.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

CELLULAR CULTURES SETUP AND ECOTOXICOLOGICAL EXPOSURE TO BISPHENOLS IN CARETTA CARETTA

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Population of various marine species are threatened. In addition to natural threats such as viruses and bacteria, there are also numerous anthropogenic threats such as contaminants, litter, climate change, food depletion from over-fishing, bycatch, noise, shipping and collision. Moreover, the incidence of some diseases is closely related to the level of environmental pollution. For this reason, it is difficult to discern the effects of one threat from the others, since multiple threats act simultaneously. On top of these, a clinical veterinary approach as well as experimental studies are unfeasible for wild marine species such as *C.caretta*. Ethical and legal constraints on marine wild species, lead to the development and use of the in vitro test-system as cell-lines. According to the 3R Principal and in respect of the European regulations, in vitro methods represent a cost-effective methodology and a great opportunity to study and conduct researches about endangered species. In this study,

four primary cell-lines were prepared from loggerhead sea turtles. For the first time in *C. caretta*, a protocol to obtain cell cultures from hearth, kidney, spleen and thymus was defined, in addition to a protocol for the exposure (for 24-48 h) of the hearth cell-cultures to Bisphenols A, B, F and S at 5 different concentrations each (100 µg/ml, 10 µg/ml, 1 µg/ml, 0,1 µg/ml, 0,01 µg/ml). The different effects of bisphenols on the cell lineage were evaluated using a multidisciplinary approach including molecular biology and immunohistochemistry. In addition, spectroscopy techniques were used to highlight macromolecular changes in the treated cells such as FTIR and RAMAN. This study is key in getting a deeper understanding of the contaminants' effects on the loggerhead sea turtles' health status. Moreover, the approach and protocols described could be used for other marine wild species.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

HAEMATO-BIOCHEMICAL PARAMETERS IN A MEDITERRANEAN POPULATION OF CARETTA CARETTA RECOVERED FROM THE REHABILITATION CENTER "L. CAGNOLARO" PESCARA, ITALY

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The loggerhead sea turtle (*Caretta caretta*) - an endangered species in the Mediterranean Sea - is the subject of numerous studies, but published results on the blood and biochemical parameters of this species show wide ranges that are not useful for rehabilitation centers. The different methods for classifying the age of the animals, and the likely influence of temperature seasonal variations on the hematobiochemical parameters could be the basis of the wide variability. The present study aimed to assess the hematological and biochemical parameters of Mediterranean loggerhead sea turtles rehabilitated after being stranded or accidentally caught. From March 2016 to April 2022, the Regional Marine Animals Network of the Abruzzo and Molise regions intervened on a total of 886 sea turtles: 608 were dead and 240 were alive. Among the latter, 102 healthy individuals were selected and blood samples were taken. We compared the hematological values of the immature (IG) and mature group (MG) to investigate the laboratory parameters: packed cell volume

(PCV), red blood cells (RBC) and white blood cells (WBC) counts from the lithium-heparin sample by the direct method burker chamber, platelets (PLT) count, differential count of WBC (WBC-diff) on blood smear with rapid Romanosky-type staining (Diff-Quick-DQ), maximum and minimum length diameters of RBC (respectively RBC-DMa and RBC-DMi) from blood smear, standard biochemical analyses from serum samples by automatic analyzer (ILAB650). Among all the results, there were not significant differences in the PCV and RBC parameters between the two groups taking into account only healthy individuals. However, significant differences were observed for RBC-DMa and RBC-DMi: RBCs were on average smaller in the IG (19.1 x 13.2 µm) than in the MG (20.1 x 14.1 µm). Other differences observed refers to the reproduction season. This study set new ranges for hematobiochemical studies we can be taken into account for further investigation.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

OVIDUCTS DETACHED DURING EGG-LAYING IN A LOGGERHEAD TURTLE

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ARCHELON monitors the 9.6km loggerhead turtle core nesting beach (*Caretta caretta*) on south Kyparissia Bay since 1984. All clutches are located, fenced against predation with metal grids and marked. In June 2021, a nest was located on Agiannakis sector, 27m from the sea. Initially it appeared to be normal, but when following the track, traces of blood were observed along the downward track. In the process of locating the egg chamber, the turtle's oviduct tubes were found below the surface of the sand. They were leading to the top eggs, located at a depth of 29cm. The oviducts were removed from the egg chamber, rinsed and examined. The oviducts totalled 6.5m in length, with the longest intact section being 4.8m. The tube's width varied from about 0.1cm to 5cm. Next to the oviducts, blood clots of 2-13cm in length were also observed. All but one 5cm clot were outside the oviducts. Since the eggs did not appear to be

affected by blood or tissue, we left the clutch in situ. To prevent egg predation, triggered by the oviduct's smell, additional metal grids were placed on the sides and in front of the nest. As a result, the nest was not predated during the 54 days of incubation. Post-hatch excavation revealed a significantly low hatching success, since only 9 out of 94 eggs were hatched. Two conjoined and 9 yolkless eggs were also observed. We believe that the oviducts were detached during egg-laying and subsequently cut into pieces by the turtle's nest-covering movements. The female loggerhead itself was never observed, and thus no speculation can be made on the turtle's health. Although, reproductive abnormalities such as prolapsed oviducts have been documented previously in loggerhead turtles we believe that this is the first documentation of oviducts that were detached during egg-laying.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

GRANULOMATOUS INFLAMMATORY PROCESSES DETECTED IN SEA TURTLES STRANDED ON THE VENETO COASTLINE

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Loggerhead turtles (*Caretta caretta*) are among the most threatened marine megafauna worldwide, because fishery-related incidental captures and infectious diseases. The northern Adriatic Sea supports a very valuable marine biodiversity, including sea turtles, and it is an important foraging and growing area for loggerhead turtles. Between 2018 and 2021, a total of 329 sea turtles were found stranded along the Veneto coastline and collected by the trained personnel of the Department of Biomedicine and Food Science of the University of Padua to monitor stranding trends and assess the causes of death. According to the decomposition code of the carcasses, 177 of them were analyzed by applying systematic and standardized post-mortem investigations (gross and histological examination). Among these, 10 cases of granulomatous inflammation processes were detected. In 4 animals,

one focal granuloma was detected in the ventral muscles of the neck; in one of these cases, the granuloma was surrounding a fishing hook. In the other 6 cases, multifocal granulomas were detected in the liver (2 animals), lungs (3 animals), and kidneys (1 animal). In all cases, microbiological swabs were performed, but the results were invalidated by the advanced decomposition status of the carcasses. In one of the granulomatous pneumonia cases, fungal hyphae were microscopically detected. These results underline the importance of performing comprehensive and standardized post-mortem analysis for the detection of pathological processes affecting these animals, to understand the anthropogenic impacts, but also the natural infectious diseases that threaten this species.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

SURGICAL AMPUTATION OF FLIPPER LACERATION IN A LOGGERHEAD, CARETTA CARETTA FROM TUNISIAN COASTS

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Sea turtles are exposed to many threats, from natural phenomena to anthropogenic factors. Very often, turtles are accidentally victims of fishing nets, getting serious damages in their fins that can develop in necrosis and mutilation of limbs. On April 28, 2022, a juvenile loggerhead turtle *Caretta caretta*, developing severe necrotizing inflammation of the full-thickness fins, was hospitalized at the first aid centre of the Sfax Faculty of Sciences created within the framework of the Life Med Turtles project co-financed by the EU. Faced with such therapeutic failure and the risk of super infection of the area concerned, the medical team opted for a surgical treatment which was crowned with success. The intervention consists of the ablation

of the limb at the level of the shoulder joint under loco-regional anesthesia after infiltration of the brachial plexus. A rotation flap, using the adjacent viable skin was used to cover the exposure. The complete amputation was well done and the turtle's activity was improved. The healing was successful and its muscles were not stiffening after being out of the water for a long time, with no infection spotted. Postoperative healing took place with success and the release of the turtle is possible. This is the first surgical remove of sea turtle flipper in the first aid centre of the Sfax faculty of Sciences (Tunisia) which supports that Single-amputee turtles can learn to compensate for their physical challenge and survive in the wild.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

PRESENCE OF PHTHALATE METABOLITES IN LIVERS OF LOGGERHEAD TURTLES (*CARETTA CARETTA*) FROM THE MEDITERRANEAN SEA (EAST SPAIN).

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Loggerhead turtles (*Caretta caretta*, L. 1758) in the Mediterranean Sea, face exposure to many contaminants that come from plastics, herbicides and other anthropogenic products. Phthalates are of concern due to their ubiquity and endocrine disruption potential. In this study, we analysed the concentration of 18 phthalate metabolites (PhMet) in liver from bycaught and stranded loggerhead turtles from the western Mediterranean (East Spain) for the period 2016-2021. Seven phthalate metabolites (mMP, PA, mEP, mBP, mHxP, mNP and mHepP) had detection rates $\geq 85\%$. However, metabolites mDeP (38.94 ng/g d.w.), PA (24.2 ng/g d.w.), mEHP (22.28 ng/g d.w.) and mHxP (20.27 ng/g d.w.) showed

the highest median concentrations. Median $\Sigma 5\text{PhMet}$ was negatively correlated with the size (curved carapace length) of the turtles ($r = -0.296$), with smaller turtles showing a tendency to display higher concentrations. No correlations were found between median concentrations and sex or sampling location. Finally, median concentration of phthalate metabolites was significantly different depending on the year of sampling, showing a steep increase in 2021. Here, we report for the first time concentrations of phthalate metabolites in marine turtles, a reliable method that will help to understand exposure to their parent compounds.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

HISTOLOGICAL ANALYSIS AND FOURIER TRANSFORM INFRARED MICROSCOPY IMAGING (FTIRI) APPLICATION TO CHARACTERIZE THE FOLLICULOGENESIS PROCESS IN LOGGERHEAD SEA TURTLES (*Caretta caretta*)

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Loggerhead sea turtles (*Caretta caretta*) living in the Mediterranean Sea, spend a long period in foraging areas where they store energy that can be later mobilized for reproduction. The reproductive season starts a long way before (8-9 months) the breeding season with the activation of physiological mechanisms that promote follicular growth. While the breeding season begins with the migration of adults from foraging sites to mating areas where males and females meet. Despite the reproductive biology and some features of endocrinology in sea turtles have been widely investigated, some aspects of gonadal maturation need to be clarified. Indeed, the steps of follicular development and the oocytes' biochemical composition at different maturation phases are still missing to complete the information on gonadic macroscopic characterization in both sexes. The present study aimed to characterize *Caretta caretta* folliculogenesis at the morphological and macromolecular level through the integration of histological and FTIRI analyses. Ovaries from *C. caretta*

specimen found stranded and examined by IZS AM from 2016 to 2022 along the Abruzzo coasts were sampled and histologically processed. The characterization of the folliculogenesis stages was performed following the description proposed for the hawksbill sea turtle *Eretmochelys imbricata*. The analysis of each sample was associated with the period of stranding and the value of curved carapace length (CCL) normally used to identify the maturity stage in sea turtles. The pattern of the main macromolecules' distribution in the follicles at each maturation stage, was described using FTIR-imaging analysis with a focus on the following structures, follicular cells, ooplasm, zona radiata, and yolk vesicles in vitellogenic oocytes. The results obtained in the present study represent a clear and comprehensive picture of the *C. caretta* folliculogenesis and suggested that the CCL-based method applied to determine the sexual maturity of sea turtles so far is not representative of the real gonadal maturity.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

FIRST REPORT OF SEPTICEMIC LISTERIOSIS IN SEA TURTLE (*CARETTA CARETTA*): STRAIN DETECTION AND SEQUENCING.

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This work describes the first case of *Listeria monocytogenes* (Lm) in a stranded loggerhead sea turtle (*Caretta caretta*) with a severe septicemic infection. Lm is a facultative ubiquitous bacteria distributed in various ecological niches. It is widespread within the environment, mainly in soil and decaying vegetation. In farm animals, wastewater and sewage are reported to be cause of rivers contamination with Lm explaining the circulation between water, plants, animals and humans. Although the number of reports on the prevalence of Lm in wild species is increasing, this is the first documented case of listeriosis in a sea turtle. An adult female *Caretta caretta* was rescued after being stranded alive along the coast of the Abruzzo region in summer 2021. Despite the efforts of the veterinarians at the recovery centre, the turtle was unresponsive and its clinical conditions lead to death in 6 days.

The carcass necropsy showed widespread organ lesions: yellow foci of necrosis in many organs, gastrointestinal erosions, pericarditis and granulomatous pneumonia. Lm and *Listeria* spp were detected and DNA was extracted for the next generation sequencing. Strain characterization showed that the isolated Lm belonged to serogroup IVb, CC388, ST388. This rare sequence type was mainly associated with clinical cases and only recently reported in wild animals. Although listeriosis is rarely reported as disease in reptiles, and even less in marine reptiles, it is a major concern because of its zoonotic potential. Sea turtles play an important role as indicators of the marine ecosystem health, for this reason a constant monitoring is essential for a better understanding of the spread of diseases, like listeriosis, especially in water ecosystem.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

ALLOMETRIC RELATIONSHIPS AND LATERALISATION OF AMPUTATIONS IN CARETTA CARETTA HOSTED IN THE LAMPEDUSA TURTLE RESCUE, SOUTH MEDITERRANEAN

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Data refer to turtles rescued in the Lampedusa Turtle Recovery Center from 2012 to 2021, for a total of 825 *Caretta caretta*. We used the R program for differences in mean weight of amputated and non-amputated turtles, for differential growth rates in the two groups using linear models. We used the chi-square test to analyze the lateralization of amputations, which age group is most affected, how and which age group interacts most with longline fishing. The results show amputated sea turtles weigh significantly less than non amputated ones, possibly due to lower feeding efficiency, but there is no differential growth between the two groups.

Laterality of events of amputations and constrictions is present and affects significantly right anterior flippers more than left ones. One reason could be related to the lateralization of the brain in these animals. Juveniles are more often rescued manually at sea, adults and sub-adults are recovered more often due to accidental catches, probably because juveniles are too small to interact with fishing; the sub-adult age group interacts more than other age groups with long lines (intended as animals rescued with hooks and lines), probably because adults by experience, and youngs by size, are less involved in this problem.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

ALLELIC VARIATION IN OOCYTE MATURATION FACTOR MOS (OOCYTE) AND RECOMBINATION ACTIVATING PROTEIN-2 (RAG-2) GENES AMONG CHELONIA MYDA AND CARETTA CARETTA POPULATIONS IN EGYPT

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The allele variation in Oocyte maturation factor Mos (Oocyte) and recombination activating protein 2 (Rag-2) genes were detected by real-time PCR among the *Chelonia myda* (Green sea turtle) and *Caretta caretta* (Loggerhead sea turtle) populations in Egypt. The data showed that the highest allelic frequencies were found in both green and loggerhead turtles in the Mediterranean populations. In the current study, the Mediterranean loggerhead sea

turtle population is characterized by high allele frequency for both Rag-2 and Oocyte genes. The Rag-2 results in the current study displayed a different pattern in the Mediterranean and the Red Sea green sea turtle populations. Those patterns might reflect their origin or their natal home. Further studies are needed to compare with other locations in the Mediterranean basin.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

SERRATIA MARCESCENS INFECTION OF A STRANDED LOGGERHEAD TURTLE (CARETTA CARETTA)

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Serratia marcescens, opportunistic and zoonotic bacteria, is often cause of nosocomial infections. A stranded juvenile loggerhead turtle (*Caretta caretta*) was recovered from Sicilian coasts on April 2022 and admitted at the National Reference Centre for Wellness, Monitoring and Diagnosis of Sea Turtle Disease (C.Re.Ta.M.) of the Istituto Zooprofilattico Sperimentale della Sicilia "A. Mirri", Italy. The subject showed ataxia, anorexia, the presence of a fishline exiting through the mouth and the cloaca and, at x-ray evaluation a hook was evidenced in the gastro-intestinal tract. Few hours after the admission, the turtle died and a necropsy was carried out. Congestion of organs of the celomatic cavity, pulmonary collapse, necrotic-haemorrhagic

enteritis was evidenced and samples of organs were collected for diagnostic purpose. A strain of *Serratia marcescens* was isolated from heart, spleen and intestine, and antibiotic resistance genes for antibiotic resistance were tested; resistance towards different antibiotic classes was evidenced. The injuries and the septicemic condition mined the health and the survival of this recovered subject. This study underlines the need for a continuous monitoring of potential pathogen bacteria, and their antibiotic resistance, in sea turtle admitted to rescue center.

POSTER PRESENTATIONS

SESSION 4: Pathology & Health

A REVIEW OF THE USE OF BACTERIOPHAGE THERAPY AS AN ALTERNATIVE TO ANTIMICROBIAL THERAPY IN SEA TURTLES

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Bacteriophage therapy was discovered in the early 1900's to control and remove bacteria in humans. However, since the discovery of antibiotics and its success in 1928, the interest in bacteriophage therapy declined over the last century. A bacteriophage is a naturally occurring virus that can specifically recognize and select pathogenic bacteria and kill them. Making use of these ubiquitous organisms may provide an efficacious alternative to antibiotics. A bacteriophage injects its DNA or RNA, depending on the type of bacteriophage, into the bacteria host, where new bacteriophages multiply and eventually lyse the host cell. Now, due to the rapid increase in antimicrobial resistant (AMR) organisms, and the problems associated, the importance of finding an alternative solution is essential. Due to the complexity of diagnosing sea turtles at a rehabilitation centre, and the lack of research into the microbiological specifics of turtles, broad spectrum antibiotics are unfortunately

still generally administered. Antibiotics can destroy the intestinal microflora which play an important role in the functioning of hind gut fermentation system and the extraction of the necessary nutrients. This imbalance can impact on sea turtles' overall health and lead to a multitude of problems. Some resistant microorganisms which are responsible for the dissemination of resistance genes have been found in turtles. This suggests that turtles act as reservoir species without having a known history of antimicrobial treatment. Therefore, the bacteriophage therapy on sea turtles may reduce the spread of AMR organisms. The purpose of this review is to introduce bacteriophage therapy; what it is, its history and how it works, collate the current literature on the use of this therapy on sea turtles, assess the efficacy, methodology, results and evaluate the potential use of bacteriophage therapy as a new way forward.

POSTER PRESENTATIONS

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CONSTRUCTION OF A WATERPROOF 3D SHIELD FOR A DEEP CARAPACE PENETRATING WOUND

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In rescue centers, traumatic carapace wounds are one of the most common findings in sea turtles, resulting in most cases from impact with boats and propeller cutting. Penetrating carapace wounds in chelonians often represent a therapeutic challenge, especially in aquatic species, in which the entry of water into the wound can favor bacterial and mycotic overinfections. In July 2020, a sub adult of *Caretta caretta* was found off the coast of Cervia (Ravenna), with an infected penetrating cut injury to the carapace and underlying tissues, involving the vertebral body of T7, which extended from the first right costal shield to the last left. Following clinical stabilization and collateral examinations, the presence of a fistula was highlighted, which penetrated beyond the lung tissue, extending to the coelomic space contralaterally. In parallel to the repeated surgical curettage of the wound and after the failure of waterproofing using traditional techniques, six prototypes of artificial carapaces were over time created through laser scanner technology and 3D printing, in order to isolate the wound from

water and maintain possible access from the top. Through a complete scan of the carapace and the wound, the most suitable anchor points for the artificial shell were identified. The models evolved based on: i) growth of the specimen; ii) progressive wound healing; iii) efficiency in keeping the wound dry but allowing dressing operations; iv) ergonomics. The artificial PLA shell were fixed to the turtle's carapace by means of a thixotropic bi-component epoxy glue, which allowed a stable fixing once dry. To further improve waterproofing, a layer of glue with very high resistance to humidity was added to the outer perimeter. The animal was then put back in the tank for the duration of the following hospitalization, having the advantage of preventing water from entering the wound. Deep carapace lesions are traditionally kept dry using petroleum gels, healing ointments or vacuum-assisted systems. The extraordinary nature of the clinical presentation required, in this case, the use of an innovative method that has been successfully tested and could be useful in similar cases of penetrating carapace wounds.



SESSION 5: Anatomy, Physiology and Genetics

POSTER PRESENTATIONS

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SESSION 5: Anatomy, physiology & Genetics

STABLE ISOTOPE ANALYSIS CONFIRMS THAT A LARGE LOGGERHEAD SEA TURTLE (CARETTA CARETTA) POPULATION RESIDENT AT THE OVERWINTERING SITE AND CONTRIBUTES TO THE NESTING POPULATION IN KÖYCEĞİZ-DALYAN SPECIALLY PROTECTED AREA, TÜRKİYE

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Stable Isotope Analysis (SIA) is a widely used tool to identify the characteristics of an organism's foraging area, its trophic position in the food web and connectivity between breeding sites and foraging areas of migratory species. Although SIA has been used for many years, the number of studies conducted in the Mediterranean is limited. Since the breeding aggregation facilitates tissue sampling from adults, it is a very common practice to predict the foraging and overwintering areas based on the breeding individual's stable isotope values in their tissues. Dalyan Beach in Köyceğiz-Dalyan Specially Protected Area (SPA) is an important indexed nesting beach for loggerhead sea turtle (*Caretta caretta*) throughout the Mediterranean. Studies carried out by Sea Turtle Research, Rescue and Rehabilitation Center (DEKAMER) in the last decade have indicated that this region can also be an important wintering and foraging area, and also contribute to the

breeding population of individuals overwintering in the region. Therefore, we aimed to determine the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ levels of the individuals residential in the wintering area and therefore the region, and contribution of overwintering individuals to the nesting populations. We collected 56 scute, 80 erythrocyte and 36 plasma samples from wintering individuals in Köyceğiz-Dalyan SPA, 18 scute, 53 erythrocyte and 22 plasma samples from nesting females at Dalyan and Belek beaches, and 13 scute, 28 erythrocyte and 16 plasma samples from stranded individuals between İzmir and Antalya. Our results showed that the $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ stable isotope values of wintering individuals in Köyceğiz-Dalyan SPA were significantly different from the other foraging areas in the Mediterranean. Our results also showed that wintering population is contributing to nesting population in sampled areas.

POSTER PRESENTATIONS

SESSION 5: Anatomy, physiology & Genetics

GAS EMBOLISM OCCURRENCE AFTER BYCATCH EVENTS IN NORTHERN ADRIATIC SEA: PRELIMINARY RESULTS

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Gas embolism (GE) is reported in sea turtles as a result of bycatch events. Together with hypoxia associated to forced submergence and/or water aspiration, decompression sickness (DS) is to be considered among factors leading turtles to death after bycatch, either acutely or post-release. Prolonged duration of forced submergence, higher fishing depth, faster ascent rates and cold temperatures are reported as factors enhancing the risk of developing GE for turtles caught in trawlers in the Southern Adriatic Sea. Diagnosis is accomplished through diagnostic imaging, which allows visualization of gas within circulatory system and its distribution. Though North-western Adriatic Sea is a well known hotspot for sea turtle bycatch, no studies are yet available on the occurrence of DS in the area. Thirty-six loggerhead turtles, received at CESTHA rescue centre (Ravenna, Italy) after bycatch in bottom trawlers between December 2020 and December 2021, were included in this study. Depth and duration of trawling and water temperature were registered for each event and their influence on occurrence of GE was statistically evaluated. All animals underwent X-rays examination within 2 hours upon admission, and presence and severity of GE was assessed as mild, moderate, or severe

depending on the vascular districts involved. GE was observed in 15/36 turtles and was classified as mild in 7/15 cases with small amounts of gas observed within renal vessels and partial involvement of renal portal veins, and moderate in 7/15, with gas filling renal portal vessels, margino-costal veins and occasionally external iliac and/or gastric or hepatic vessels. One case (1/15) was classified as moderate to severe for the presence of gas in the postcaval vein as well. No pathognomonic clinical signs of GE nor mortality events were registered. Only fishing depth was significantly correlated to occurrence of GE. These data report GE in sea turtles received after bycatch by bottom trawlers in the Northern Adriatic Sea, as predictable. Only mild and moderate cases were detected in this study, but the low number of animals involved make this study only preliminary. Further research is certainly needed to assess which percentage, if any, of mortality may be attributed to DS, with the ultimate scope of improving mitigation measures.

POSTER PRESENTATIONS

SESSION 5: Anatomy, physiology & Genetics

TO WHOM BELONGS THE GENOTYPE OF THE UMBILICAL CORD? EXPLORING NON-INVASIVE METHODS FOR SEA TURTLES

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Conservation genomics aims to obtain samples using the least invasive sampling methods to avoid damage to wild fauna without compromise the reliability of the results. Here, we describe a non-invasive sampling for genomic studies on loggerhead turtle (*Caretta caretta*) using umbilical cord samples from exhumed nests to explore the possible origin of the tissue, whether containing maternal or offspring DNA. Likewise, genomics allows obtaining high numbers of loci from small amounts of tissue, providing the opportunity to obtain an accurate genotyping unambiguously identifying even related individuals, and therefore, it is an excellent technique to test the origin of the DNA of this tissue. In this study, we use the 2bRAD high-throughput technique to genotype 4 samples from the same nest. We extracted DNA, and genotyped a blood sample from the nesting female, another

blood sample from one hatchling and the distal and proximal regions of its umbilical cord. The catalogue of loci was obtained with three different approximations: 1) using only the four samples with a de-novo polymorphic loci identification, 2) against a pseudogenome of loggerhead turtle (*Caretta caretta*) constructed with all the loci identified with a de-novo methodology in previous studies, and 3) using the green turtle (*Chelonia mydas*) genome as a reference. Our results allow assessing for the first time, the potential of the umbilical cord as a non-invasive method for obtaining genomic data, revealing to whom the umbilical cord genotype belongs. In summary, the different genotyping processes unveil which dataset is more useful to evaluate intraspecific genetic variability in related samples, when the reference genome of the species is not sequenced.

POSTER PRESENTATIONS

SESSION 5: Anatomy, physiology & Genetics

FILLING THE GAPS IN MIXED STOCK ANALYSES, THE ORIGIN OF MARINE TURTLES FORAGING IN KUŞADASI BAY, TURKEY

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Sea turtles are highly migratory species in which feeding and breeding sites can be very distant, while individuals from the same breeding areas can use different foraging grounds. Considering that sea turtles are species of conservation concern, it is essential to establish connections between foraging and nesting areas to link threats at seas to the affected populations. However, gaps in the knowledge of these connections may jeopardize management and conservation efforts. The eastern Mediterranean hosts nesting populations of loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles. Previous studies on the loggerhead turtle have determined the origin of individuals in most known foraging areas, although the studies on green turtle foraging areas are much scarce. The origin of turtles foraging the Aegean Sea has not been addressed for any of the two species, remaining a significant knowledge gap. Samples from both species were collected around Kuşadasi Bay from 2017 to 2021, a

foraging zone in the Aegean Sea inhabited by turtles all year round. We genotyped 44 samples of green turtles (*Chelonia mydas*), with sizes ranging from 16 to 149 cm CCL, using a pattern of four mitochondrial DNA (mtDNA) AT short tandem repeats (STRs) with varying copy numbers. We also genotyped 79 samples of loggerhead turtles (*Caretta caretta*), with sizes ranging from 60 to 115 cm CCL, using a segment of the mtDNA D-loop (control region). A Mixed Stock Analysis showed that turtles from both species come mainly from the Turkish nesting populations, with the loggerheads coming mostly from western beaches and the green turtles from easternmost beaches. These results are consistent with published satellite telemetry studies, stable isotope analysis, and hatchling dispersion modeling. This study highlights the importance of using genetic tools to identify the origin of sea turtles and delineate the migration routes within the Mediterranean.

POSTER PRESENTATIONS

SESSION 5: Anatomy, physiology & Genetics

GENETIC DIVERSITY OF LOGGERHEAD TURTLE (CARETTA CARETTA) ALONG THE CENTRAL-SOUTH TUNISIAN COAST (MONASTIR-GABÈS) BASED ON DNA MITOCHONDRIAL (D-LOOP).

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Loggerhead turtle (*Caretta caretta*) is an emblematic species of the marine biodiversity that is classified in the red list assessment of IUCN as vulnerable species globally and as least concern in the Mediterranean. Nesting areas of *C. caretta* are identified along the Tunisian coasts. We sampled blood or tissues from stranded or injured adults and new born turtles collected from Central to South Tunisian coast: Monastir (12 individuals), Mahdia (4 ind), Sfax (10 ind), Kerkennah (3 ind), Gabès (46 ind) to Djerba (2 ind). The D-loop (control region) from mtDNA was amplified (380 bp) from these 77 turtles to estimate their genetic identity. The comparison between our dataset of sequences with the short haplotypes list available in

Archie Carr Center for Sea Turtle Research (University of Florida) and the sequences available in GenBank database revealed that three Tunisian individuals from Gabès (3.89%) are closed with loggerheads studied in Colombia, but showed two specific deletions, confirming migration between Central West Atlantic ocean to South Tunisia coast. These sequences could allow to define a new haplotype. Three haplotypes most present in Mediterranean Sea were found: CCA-3.3 (found in 1 Sfax, 4 Gabès; 6.49%), CCA-26 (1 Djerba, 2 kerkennah, 2 Sfax, 1 Gabès; 7.79%) and CCA-2 found in 67.53% (52/77) Tunisian turtles. The other turtles (14.3%) presented some mutations which are not related to defined haplotypes.

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BONES AND SCUTES OF MEDITERRANEAN LOGGERHEADS FOUND IN FRENCH WATERS: WHAT CAN BE LEARNT FROM THESE GROWING STRUCTURES?

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Sea turtles have a complex life cycle and occupy a mosaic of habitats such as beaches, pelagic areas, oceanic gyres and neritic areas. The individuals are thus exposed to various and sometimes contrasting environmental conditions throughout their life cycle. Structures such as long bones and scutes can record information on these environmental conditions, through variations of growth rate and changes in their geochemical composition. This study was conducted on Mediterranean loggerheads turtles (*Caretta caretta*) collected in the French Mediterranean waters either stranded on the coastline or dead in rescue centres. We studied two types of growing structures, supracaudal scutes and humeri. To this end, we used

Sea turtles have a complex life cycle and occupy a mosaic of habitats such as beaches, pelagic areas, oceanic gyres and neritic areas. The individuals are thus exposed to various and sometimes contrasting environmental conditions throughout their life cycle. Structures such as long bones and scutes can record information on these environmental conditions, through variations of growth rate and changes in their geochemical composition. This study was conducted on Mediterranean loggerheads turtles (*Caretta caretta*) collected in the French Mediterranean waters either stranded on the coastline or dead in rescue centres. We studied two types of growing structures, supracaudal scutes and humeri. To this end, we used

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SESSION 5: Anatomy, physiology & Genetics

DEVELOPMENT OF SPECIFIC ENZYME-LINKED IMMUNOSORBENT ASSAY FOR DETERMINING FSH LEVELS IN GREEN SEA TURTLE (CHELONIA MYDAS), USING RECOMBINANT GONADOTROPIN.

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Detailed information on the nature and levels of circulating pituitary hormones and sex steroids is critical for understanding of the reproductive cycles. When working with threatened or endangered wildlife, the tools for obtaining reproductive data are limited. Since the development of specific Follicle-stimulating hormone (FSH) RIAs by Licht in early 1980, to date no specific enzyme-linked immunosorbent assay (ELISA) for turtle gonadotropins has been developed. FSH is involved in the regulation of essential reproductive processes in sea turtles such as gametogenesis and follicular growth. Recently we produced green sea turtle (*Chelonia mydas*) recombinant (r) FSH as single-chain polypeptides in the methylotrophic yeast *Pichia pastoris* expression. In this research a competitive ELISA for FSH levels in plasma samples of *C. mydas* was developed. rFSH $\beta\alpha$ was used for standards, rFSH β for coating and a specific antibody against FSH β . The sensitivity of the assay was 0.13 ng/ml and the intra-assay and inter-assay coefficients of variation were

5.54% and 13.52% respectively. Parallelism was observed between the linearized FSH standard curves and serial dilutions of *C. mydas*, Loggerhead Sea turtle (*Caretta caretta*) Hawks bill sea turtle (*Eretmochelys imbricate*) and African softshell turtle (*Trionyx triunguis*) plasma samples. Using the ELISA, we studied the FSH profiles of males and females during the reproductive cycle. Nesting females showed an increase in FSH levels from April to June during the nesting season, and another peak from September to November. Additionally, it was noticed that after the oviposition stage the FSH levels of the females remained relatively high opposed to the FSH levels of non-nested females that was relatively low. Overall, our findings increase our understanding of gonadotropins functions and their effects on the reproductive biology of green sea turtle and can be used to study other turtle species.

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ULTRASOUND IMAGING OF REPRODUCTIVE SYSTEM (OVARIES, EGGS AND TESTICLES) IN LOGGERHEADS (CARETTA CARETTA) IN ADRIATIC SEA (ITALY).

Ciccarelli, Stefano (1); Franchini, Delia (1); Paci, Serena (1); Valastro, Carmela (1); Freggi, Daniela (2); Salvemini, Pasquale (3); Bellomo, Davide (1); Di Bello, Antonio (1)

1: University of Bari "Aldo Moro", Italy; 2: Lampedusa Turtle Rescue, Italy; 3: WWF Molfetta Rescue Center, Italy

Reproductive anatomy of male and female loggerhead sea turtles (*Caretta caretta*) has been difficult to study. The main method for evaluation of the coelomic cavity in both adult and juvenile sea turtles is celioscopy. In this preliminary study, ultrasound scans were performed in 80 subjects of *Caretta caretta*, admitted to the Sea Turtles Clinic (STC) at the Department of Veterinary Medicine in Bari (Italy) for veterinary evaluation, with a curved carapace length (CCL) greater than 65 cm in the period between September 2020 and March 2022. All turtles examined were placed in dorsal recumbency on foam mattress. The ultrasound was performed through the right and left inguinal fossae and the cranial pole of the kidney was identified as a landmark to identify the oviduct and the ovary in female and testicles in male. Preliminary results showed that subjects with a curved carapace length (CCL) less than 70 cm presented no follicular development and only the oviduct could be identified with values ranging from 2 to 5 mm. On the other hand, in sea turtles > 73 cm of CCL it was possible to

identify large vitellogenic follicles (from 18 to 25 mm in diameter). In adult male the total ranges for the length of the testicles were 5–11 cm with a width of 3–6 cm. Ultrasonography showed advantages because is non-invasive and did not require anesthesia. By evaluating ovarian and testicles morphology without laparoscopy approach, this non-invasive technique allows to monitor the reproductive season of these animals in order to accurately study their reproduction. Accurate measurements of follicles, eggs and testicles allow a turtle's reproductive status to be monitored at frequent intervals but only follicles larger than 3 mm in diameter could be measured. This would limit the use of ultrasonography in large immature female or male sea turtles where ovarian maturation is not complete. Moreover, the positioning of the sea turtle is essential to have a good visualization of the oviduct and other genital structures that may be hidden by the intestinal tract or urinary bladder. Further investigation are needed to relate the size of the follicles and testes to hormonal parameters.

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SHORT TANDEM REPEATS(STR) OF MT DNA OF GREEN TURTLE NESTS MAY OFFER INSIGHTS INTO WESTWARD SHIFT OF GREEN TURTLE NESTING

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Herbivorous green turtles in the Mediterranean Sea are generally distributed in the Eastern basin. In recent years, a few nests have been discovered in more westerly locations (Göcek, Turkey and Tunisia). Elaboration of the mtDNA control region is not very useful for understanding population structure in Mediterranean green turtles. The 'AT' repeat region in the 3' end of the control region of the mitochondrial DNA holds more promise, as it contains four different Short Tandem Repeats (STR) separated by short spacers. We analysed 235 samples (hatchlings and stranded and turtles under rehabilitation) from Turkey, 29 from Cyprus, 1 from Tunisia and 3 from Lebanon to make a total 268 samples. Data suggest the nest in Tunisia might have a linkage with a turtle nesting in Cyprus and eastern Turkey,

whereas the nest in western Turkey probably originated from turtle nesting on Turkish beaches. The results were analysed and compared with the literature. Westward expansion of green turtles in the Mediterranean could be driven by a number of factors including increasing population size and shifting sea grass distribution. The western beaches could become cooler nesting sites and expansion of nesting to these sites could in part constitute adaptation of climate change. Nests recorded at the western locations were at what is considered the end of the nesting season and activities may have been under taken on the way to migration to foraging areas. Results are contextualised with previous satellite-tracking and stable-isotope results.



SESSION 6: Outreach, Conservation and Management

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THE SEA TURTLES STRANDING NETWORK: AN IMPORTANT TOOL TO EVALUATE THE THREATS ON SEA TURTLES IN THE LEBANESE WATERS

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1-Tyre Coast Nature Reserve-TCNR, Lebanon (Lebanese Republic)/ 2The Specially Protected Areas Regional Activity Centre (SPA/RAC)- Tunisia Republic

The two marine turtles species, the loggerheads (*Caretta caretta*) and the greens (*Chelonia mydas*), frequent the Lebanese waters. Based on the data collected from the national sea turtles stranding network established along the Lebanese coast in 2019, a total of 202 records were analyzed for the period 2019-2021. The analyses of the records showed that sea turtles

along the Lebanese coast are affected mainly by boat traffic with 54.5 %, fishing activities with 32.8 %, and marine pollution, including marine litter with 12.7%. From a monitoring and protection point of view, data collected from stranding incidents must be maintained on an ongoing basis, building a robust database to reduce the pressures on sea turtles in the Lebanese waters.

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THE MEDTURTLE BULLETIN - A NEW PUBLICATION DEDICATED TO SEA TURTLES OF THE MEDITERRANEAN

ALan F Rees

Turtles from Above

After 12 months of planning and processing the first Issue of the MedTurtle Bulletin (MTB) was published in May 2022. It contained articles submitted from Spain, Greece, Tunisia and Turkey and an account of the IUCN-SSC Marine Turtle Specialist Group from its inception in 1999 through to present day. The plan is for the MTB to be published on a six-monthly basis, but in press articles will be made available in between publication dates so that time sensitive

information can be published in a peer reviewed format with a very short latency.

The MTB will not be access if it is not supported by the community submitting scientific articles and records, opinion pieces, announcements etc. This proposed poster presentation has the purpose of raising the profile of the MTB and give me an opportunity to meet with potential authors in a time and place dedicated to discussion on the continued success of the newsletter

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LEVERAGING TECHNOLOGY TO STRENGTHEN CONSERVATION

Tsirigoti A.1; Naasan Aga - Spyridopoulou R. 2; Giovos I. 2; Rae V. 1; Touloupaki E.1

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SEAlly© is a mobile application launched in 2019 by MEDASSET and iSea under the financial programme of the Greek Green Fund and the support of Softweb. The application is a citizen science technology tool, which can deliver to the scientific community valuable data about sea turtle, shark and batoid observations. SEAlly© is the first mobile application that allows multi-taxa recording and consists of a comprehensive Mediterranean species list for all taxa. Its “target group” are fishers, port authorities, divers, sailing community and all sea users interested in the conservation of marine ecosystems. All recordings are validated by the SEAlly© team before uploaded to the app’s map. The user apart from the occurrence can provide information about the behavior, the state, the gender, the size and the if the animal was bycaught, making the application’s use broader with potential to be used as a management tool. Furthermore, the app provides open access data to its users as every published record has all the

aforementioned information available. Since its inception, the app has been developed further to include batoid species observations (2021) and as of 2022 is now available in 4 languages; English, Greek, Arabic and Turkish, expanding its reach across the Mediterranean region. To date, 247 observations have been reported by 89 registered users, of which 79% (n= 197) have been validated from 82 contributors and uploaded to the App’s map. In total 17 species have been recorded, three sea turtles, 10 shark species and four batoids, with 25.9% listed between Vulnerable to Critical on the IUCN Red List with decreasing population trends. Unsurprisingly, the most commonly reported taxa are sea turtles (88.3%, n=218) with 83.9% (n=183) recordings validated, followed sharks (7.7% n=19), with 33.3% (n= 6) recordings validated, and recently added, batoids (4.0%, n=10), with 80% (n= 8) validated.

POSTER PRESENTATIONS

SESSION 6: Outreach, Conservation & Management

"CARAPACE RACE": SNEAKING AWARENESS & AND INFORMATION INTO PURE ENJOYMENT

Stamatiou A.1,2

1, MEDASSET; 2, Chios Nature

This poster introduces “CARAPACE RACE”, a new and highly interactive game developed for use in either outreach educational work or at facilities such as aquaria or rescue centres that host school groups. Using a large, (2m x 2.5m) playing mat and a cast of 3D characters, players must each help their turtle avoid threats, find food and grow as she progresses along the pathway of her life cycle. Each loggerhead will encounter dangers and opportunities, finally arriving at a nesting beach as an adult to lay her own eggs. Turtles gain or lose ping pong ball eggs along the way and the Winner is whichever turtle has the most with her when she reaches the nesting beach! The concept provides for an adult leader or “animateur” who adjudicates disputes, explains the way things work, and maintains order - because in the battle to collect more eggs or place a threat in an opponent’s path, young players can get a bit over-excited! 42 different “Chance Cards” provide

opportunities to affect the outcome of the game while dropping nuggets of additional knowledge about sea turtles into the experience. (We like to think of this as “stealth learning”). The physical engagement the game offers is an important element of it. Players get to handle not only their own sea turtle but also a ghost crab, seagull, shark, octopus, hermit crab, jellyfish, and squid. They will also see some of the competing turtles become literally entangled in fishing gear, making the experience very real. They’ll have to make decisions about whether to use a precious “Chance Card” to free a struggling turtle or let her carry on unaided. Suspense and the power to influence outcomes engages the emotions, resulting in a thoroughly memorable experience. MEDASSET launched the game in Greece in 2018 and continues to use it during its educational outreach work. Our poster will fully illustrate it in use and provide images of some of its details.

POSTER PRESENTATIONS

SESSION 6: Outreach, Conservation & Management

AN EFFECTIVE TOOL IN MARINE TURTLE CONSERVATION STUDIES: CITIZEN SCIENCE

Ayşe Oruç 1, Nilüfer Araç 1, Ebrucan Kalecik 1

Marine and Wildlife Program, WWF-Turkiye (Dogal Hayati Koruma Vakfi), İstiklal Caddesi 136, Beyoglu, İstanbul, Türkiye

Citizen science is an important tool for democratizing science and promoting the goal of universal and equitable access to scientific data and information. Data generated by citizen science groups have become an increasingly important source for scientists, applied users and those pursuing the 2030 Agenda for Sustainable Development (Sherbinin et al., 2021). Today, providing data entry from different groups, evaluation of information and photographs on social media, and providing data to civil society's species conservation efforts are becoming increasingly important. Citizen science is also becoming an important tool for raising awareness. Local knowledge of coastal communities is also a valuable

resource for citizen science. Evaluation results provide data for decision-making institutions and public information. With this study, more than 100 data and photos on the conservation of marine turtles published in the press and social media between 2018-2021 and the data obtained from the Mobile Phone Application prepared within the scope of Conservation of Marine Turtles in the Mediterranean Region and MedBycatch projects were evaluated. Data and photographs from volunteers, fishers, citizens from different professions were recorded in a database, and evaluations were made after checking their reliability. The results show that citizen science contributes to meaningful results in marine turtle conservation.

POSTER PRESENTATIONS

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USING SOCIAL MEDIA FOR THE CONSERVATION OF SEA TURTLES IN THE MOROCCAN MEDITERRANEAN

Bilal Mghili and Mustapha Aksissou

LESCB, URL-CNRST N° 18, Abdelmalek Essaadi University, Faculty of Sciences, Tetouan, Morocco

Over the past decade, social media has offered a new window for opportunistic data collection. Social media allows individuals to share photos, videos and opinions with the world. In this study, social media was used to assess sea turtle strandings along the Moroccan Mediterranean between 2016 and 2022. A total of 69 stranded turtles were recorded. Among these, 54 (78.27%) of them were *Caretta caretta*, 12 (17.39%) *Dermochelys coriacea* and 3 individuals (4.34%) were unidentified. Strandings were more numerous in summer, which

coincides with the fishing effort near the Moroccan coast. Our findings indicate that fisheries bycatch and boat strikes are the major threats to sea turtles in Moroccan waters. We have also recorded cases of release of sea turtles by Moroccan fishermen, showing the degree of awareness of these fishermen towards these threatened species. In this study, we demonstrated the usefulness of social media as a resource for monitoring the stranding and conservation of sea turtles along the Moroccan Mediterranean.

POSTER PRESENTATIONS

SESSION 6: Outreach, Conservation & Management

Lampedusa hosting the first sub regional training by SPA/RAC: how to implement networking and rehab skills among rescue centers

[Roldi, C.](#), Zucchini, M & Freggi, D.

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COMPARING VULNERABILITY TO CLIMATE CHANGE DRIVEN SEA-LEVEL RISE OF MAJOR LOGGERHEAD NESTING SITES IN GREECE USING DRONES

[G.,Chalkias](#), [A. Panagopoulou](#)¹, [A. F. Rees](#)², [B. J. Godley](#)², [K. Anderson](#)³

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The study of coastal topography is crucial for monitoring nesting habitats and developing effective conservation strategies, especially under the influence of climate change (CC). High-resolution 2D and 3D mapping products can reveal habitat degradation (e.g.land use change) and inform conservation (e.g.vegetation height as a barrier to artificial light pollution). Here, we developed a methodology to survey coastal sites and produce digital surface models (DSMs) using structure-from-motion photogrammetry to estimate the impact of CC driven sea level rise (SLR) on nesting beaches. SLR poses a serious threat to sea turtles as it can reduce hatching success due to nest inundation and in time cause the loss of nesting habitat, especially if coastal zone planning has been poor. As a study system, we chose two major nesting areas for loggerheads in the Mediterranean (Rethymno, 10.8km, heavily urbanised coastline, 275 nests/yr; Kyparissia bay, 9.5 km, rural setting, 1,400 nests/yr). We flew a quadcopter drone at

45m and collected photographs on a double grid flying pattern. We took photos with a 75% overlap, camera aperture at f/5.6, shutter speed at 1/640s, and ISO-100. To improve model reconstruction, we used two camera angles, nadir and 75° off nadir. To improve the spatial accuracy of the DSM we placed ground control points (GCPs), in an offset (zigzag) pattern every 75m. For all the GCPs we measured their position at centimeter level relative accuracy. To do so we used the Emlid ReachRS+ unit which is a low-cost Global Navigation Satellite System receiver. Here we present the first results of our study that provides a straightforward methodology to estimate the SLR impact on nesting habitats and provides conservation practitioners with a low-cost and efficient method to map and monitor nesting sites and produce visually attractive products that can be useful in engaging stakeholders in debates regarding the impacts of CC and planning decisions, now and in the future.

POSTER PRESENTATIONS

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LIFE MEDTURTLES - COLLECTIVE ACTIONS FOR IMPROVING THE CONSERVATION STATUS OF THE EU SEA TURTLE POPULATIONS: BORDERING AREAS.

Giulia Baldi¹, Valeria Angelini², Wiem Boussellaa⁴, Mohamed Nejmeddine Bradai⁴, Anxhela Çurri⁵, Idriz Haxhiu⁵, Mar Izquier-Serrano³, Imed Jribi⁴, Yakup Kaska⁶, Jerina Kolutari⁵, Kamyla Lombardi Moraes², Paolo Luschi¹, Hamed Mallat⁴, Raúl Míguez-Lozano³, Sauro Pari², Ohiana Revuelta³, Doğan Sözbilen⁶, Jesus Tomas³, Paolo Casale¹

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The loggerhead turtle (*Caretta caretta*) and green turtle (*Chelonia mydas*) populations in the Mediterranean Sea are affected by anthropogenic threats in different countries and their conservation needs an international approach. The project LIFE MEDTURTLE (co-funded by the LIFE instrument of the EU) carries out conservation actions in Albania, Italy, Spain, Tunisia and Turkey, and is a geographical expansion of the previous project LIFE EUROTURTLES. At foraging sites turtles are mainly threatened by incidental captures in fishing gears and modifications such as Turtle Excluder Devices (TEDs) for bottom trawlers and Light-Emitting Diodes (LEDs) in set nets, as well as assessment of on-board best practices, will help reduce bycatch and consequent mortality. Bycatch location communicated by fishers, aerial surveys with drones, and remote tracking will synergically help to identify hot-spot areas, whose

knowledge is necessary to implement conservation actions (e.g. communication to fishermen). Early detection and protection of nests in new suitable nesting sites will increase the success of sea turtle clutches and hatchling survival, thus helping compensate vulnerability of extant nesting populations to climate change. Upgrading rescue facilities and networks will increase sea turtle rehabilitation capacities, reducing the number of turtles dying from anthropogenic factors (e.g. fishing, collision with boats) and facilitating awareness campaigns. Identification and removal of ghost gears, together with placement of bins in several harbours will reduce turtles' mortality and contribute to raise awareness of the anthropogenic impacts. All the above actions will promote sensibilization of public and fishermen at local and national levels whenever possible, promoting Mediterranean sea turtle populations as a common heritage.

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LOGGERHEAD TURTLES HEAD-STARTING PILOT PROJECT: LEARNING THROUGH COORDINATED MANAGEMENT BETWEEN DIFFERENT RESCUE CENTERS IN SPAIN

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In the last decade, nesting events of loggerhead sea turtles (*Caretta caretta*) in the western Mediterranean coast have shifted from sporadic to regular due to global warming. In Spain, several head-starting programmes have been developed, allowing valuable post-hatchling data collection, increasing scientific knowledge of the ongoing nesting colonization throughout the animal identification, satellite tracking or genetic analyses. However, methodologies used in these experiences were not homogeneous, making difficult the comparison between results in order to elucidate the best practices assuring well-being, health, and the adequate development of the head-starters. During the 2021 nesting season, 5 nests were detected in the Catalan coast and 85 hatchlings were distributed among 4 different rescue centers, carrying out a controlled rearing for 11 months. The project goal was to promote knowledge transfer among centers, as well as to analyze and standardize the best head-starting practices

to be able to observe whether the genetic origin of the nests, the incubation method or the animal handling in different centers, influence their growth, survival, and behavior. For its execution, a fixed procedure on animals feeding and environmental conditions were agreed, establishing a common protocol for all the different centers. This collaboration not only helped to identify best practices for head-starting programs but also facilitated the resolution of difficulties efficiently when questions or problems arose. Results showed no differences between the hatchling's growth according to genetic origin, incubation method or center's handling. However, it seems to be differences among hatchling survival according to their genetic origin. Nevertheless, further studies under complete homogeneous conditions between facilities are needed to determinate the effect of nest origin or incubation on the post-hatchling characteristics, health and fitness.

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TUNISIA FIRST AID SEA TURTLE CENTRE: FIRST RESULTS, CONSERVATION ACTIVITIES AND SCIENTIFIC PERSPECTIVES

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The Gulf of Gabès is a hotspot for marine turtles. It is considered, indeed, as an important wintering and feeding area in the Mediterranean. The anthropic activities that exist in this gulf are considered as threats for these threatened species. In order to mitigate the anthropic impact on marine turtles in the Gulf of Gabès, a first aid centre for marine turtles has been created within the Faculty of Sciences of Sfax within the framework of the Life MedTurtles project co-financed by the EU. Forty-one sea turtles, including thirty-seven loggerhead turtles (*Caretta caretta*), and four green turtles (*Chelonia mydas*) have been hospitalized in the first aid centre since April 2021, of which thirty-one have been released and returned to

the sea after being marked with metal tags. During this time and to better understand the biology, ecology and behaviour of this species, measurements were taken and samples were collected from each sea turtle. Training sessions on marine turtle conservation have been carried out as an effective method of sensitizing the different social groups that have visited the centre, (students, school children, researchers, international volunteers). The turtles received in the centre for care and rehabilitation are also used to develop research activities. Greater efforts to improve the conditions in the centre should be made in order to accommodate more sea turtles.

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THE PRECIOUS ROLE OF FISHERMEN IN SEA TURTLE CONSERVATION: THE CASE OF LAMPEDUSA, SOUTH MEDITERRANEAN SEA

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Since its establishment over 30 years ago, Lampedusa Turtle Rescue has helped with the rescue and rehabilitation of around 6000 sea turtles. One of the main conservation efforts of the Rescue Centre, especially in the last decade, is the active education of fishermen in the local community about the threats that their fishing activities pose to sea turtles. To determine whether the divulgation of key information to fishermen has had any positive impact on the turtles arriving at the Rescue Centre, we chose to assemble and analyse the patient information collected from 2013 to 2021. During this 9 year period, Lampedusa Turtle Rescue received 801 turtles, 513 (64%) of which resulted from bycatch. X-rays performed on intake revealed that 53.6% of turtles arriving at the rescue centre had a hook, the majority of which were in the oesophagus, and many were located in the mouth. More concerningly, 46.3% turtles

also arrived with a fishing line visible from either the mouth or cloaca. Fishing lines are one of the major threats to sea turtles as once ingested, they can cause irreparable and fatal damage to the intestines. The data showed that in 2013, 68.8% of the turtles arriving with a hook required surgical intervention to remove it. However, in 2021 following 9 years of hard work by volunteers at Lampedusa Turtle Rescue to educate fishermen about how to minimise harm caused to sea turtles following accidental capture, the percentage of turtles with hooks requiring surgical removal decreased to only 33.8%. This is a positive decrease as reduced need for invasive surgery, even when performed by a specialist veterinarian, hugely decreases the stress experienced by the turtle and often decreases the duration of time spent at the rescue centre before release.

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PRESERVING ECOSYSTEM FUNCTION & CLIMATE RESILIENCY THROUGH ENHANCED MARINE TURTLE POPULATIONS IN THE MEDITERRANEAN

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The Mediterranean is rapidly changing. As temperatures increase 20% faster than the global average, predicated conditions threaten the ability of ecosystems, biodiversity, and marine turtles, to deliver essential ecosystem services and co-benefits that support livelihoods and perform crucial functional roles for the benefit of the region. Marine turtles are sentinel indicators of climate change and are under mounting direct and indirect threats. Increasing temperatures are predicted to have disastrous consequences for marine turtles through disrupted sex ratios, reducing hatching success to close to 0%, inhibiting successful foraging, reducing, and shifting nesting areas, and increasing pathogenic risk. Moreover, it is estimated that over 132,000 individuals are captured as by-catch, with over 44,000 mortalities, each year with nesting female estimates being as low as 800 and 1,800 for Mediterranean green and loggerhead turtles, respectively. Marine turtles - even at diminished population levels - play important ecological and socio-economic roles in the Mediterranean. Area-based and ecosystem-based management measures are vital instruments for the Mediterranean region for protecting and increasing the adaptive ability of marine populations, biodiversity, and ecosystems to resist climate anomalies. To address the impacts faced by marine turtles, from local, direct pressures such as bycatch and reduced nesting grounds, to ecosystem pressures and climate change, effective conservation strategies for ecosystem adaptation and increased resiliency, strong protection and improved monitoring and intervention mechanisms are required to protect, maintain, and

enhance populations. The MedPartnership created within the MAVA Marine Turtle project, Conservation of Marine Turtles in the Mediterranean Region, has developed a 3-year project to protect and enhance critical ecosystems to conserve marine turtles and safeguard livelihoods and co-benefits in a changing Mediterranean. As well as to support the identification of Important Marine Turtle Areas (IMTA), encourage regional and national legislation, and strengthen and expand the already established, active and strong partnership. The project will result in the advancement of monitoring practices and reporting, build technical capacities, and improve the management and protection of nesting sites, while continuing to drive the communication and awareness for the conservation of marine turtles and resilience to climate change impacts in the Mediterranean. The oral 60-minute presentation of this new project will amass marine turtle experts, conservationists, practitioners, and key stakeholder from throughout the Mediterranean, representing the project's Partnership. Throughout the session, an introduction to the project will be delivered alongside the achievements and advancement made during its respective first two phases. First-hand accounts from the Partnership through case studies and examples of implementation, as well as the critical need for this project, will be contextualised. The aim of the oral presentation will be to highlight the project and its next steps for the enhancement of marine turtles in the Mediterranean.

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MAVA FUNDED PROJECT: PAN-MEDITERRANEAN SYNERGY FOR SEA TURTLES' CONSERVATION

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Within the project "Conservation of Sea Turtles in the Mediterranean Region (phases I & II)", funded by MAVA Fondation pour la Nature, ARCHELON conducted the activity of placing satellite transmitters on loggerhead sea turtles (*Caretta caretta*) in Greece. In particular, transmitters were placed on 29 nesting females in the breeding area of Kyparissia Bay and on 7 males in the foraging habitat of Amvrakikos Gulf, with the aim of investigating their movements and migrations in the Mediterranean basin. The findings of the activity showed a wide distribution in the Mediterranean. The tagged turtles roamed a large part of the Mediterranean and came close to the coasts of Spain, France, Malta, Italy, Montenegro, Albania, Turkey, Libya, Tunisia, Algeria, while one of them almost reached Morocco. The highly migratory behavior of marine turtles highlights that international synergies are essential, in order to achieve effective protection of the species in the Mediterranean. This need is greatly served by this project, in which participate nine (9) direct partners from different countries, i.e. the Regional Activity Centre for Specially Protected Areas (SPA/RAC) as the

coordinating beneficiary, ARCHELON, DEKAMER, MEDASSET, MedPAN, National Marine Park of Zakynthos (NMPZ), WWF Greece, WWF NA and WWF Turkey. In addition, the partnership benefits from numerous international, national and local partners: IUCN's Marine Turtle Specialist Group (IUCN MTSG), Egyptian Environmental Affairs Agency (EEAA), Ministries of Environment (Algeria, Lebanon, Libya, Morocco), the Coastal Protection and Development Agency (APAL), NGO Notre Grand Bleu and the National Institute of Marine Sciences and Technologies (INSTM) in Tunisia, Herpetological Association of Spain (AHE), and the Regional Administration for Protected Areas in Korca (RAPA) in Albania. The activities of the project started to be implemented in 2017 and will terminate in October 2022, in 13 countries of the basin. It is expected that the strong collaborative efforts of project partners, acting at regional, national and local level, will bring successful results and prove once more that synergies are key to the long-term conservation of sea turtles.

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BUILDING STRONG AND MAINTAINING COLLABORATIONS BETWEEN OBSERVERS AND THE FISHING COMMUNITY

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The incidental capture of sea turtles during fishing operations is widely acknowledged as the most significant threat to sea turtles today. In order to effectively address this threat, the involvement and collaboration with fishers is essential for awareness raising and training, the collection of valid data and the application of bycatch reduction tools. Forming trust and mutual benefits have been identified as key factors in establishing any relations between researchers and fishers, which has not always been easy. Through the MAVA funded, “Understanding Mediterranean Multi-Taxa Bycatch of Vulnerable Species and testing Mitigation – A Collaborative Approach” (MedBycatch), the overall goal is to provide knowledge, skills and tools to reduce the impact of selected fishing gears, specifically the incidental capture of vulnerable species and habitats. The forming of strong relations between fishers and observers is essential for the project to achieve its goal. Since the inception of the observer programme in

2018, observers have successfully collaborated with fishers to complete more than 3,600 on-board observations and over 12,100 port-based questionnaires across five Mediterranean countries. Funded under the MAVA Foundation’s ‘Learning and Sharing Grant’ scheme, fishers and observers involved in the above programme shared their experiences and knowledge via organised National workshops and questionnaires. In total, 60 fishers and 43 observers from three countries provided their feedback for (1) their participation (the issues and the successes) and (2) their recommendations on how to build trust and maintain strong relations. From their valuable feedback, key points were identified for building strong collaborations in how an observer should conduct themselves, how to approach fishers, expectations for conducting on-board observations and port-based questionnaires, and how to sustain collaborations even after the surveying has ended.

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ZOOARCHAEOLOGY AS A COMPLEMENT TO SEA TURTLE RESEARCH AND CONSERVATION IN THE MEDITERRANEAN

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Sea turtle remains have been found at coastal archaeological sites throughout the Levant, and in the Aegean. Presence of sea turtle bones dating up to ~5000 years before present raises interesting zooarchaeological research avenues into ancient turtle exploitation, however the remains themselves can also be viewed as archives of biological information. The often highly fragmented nature of the bones, requires that novel molecular tools be capitalised on. By applying methods such as protein fingerprinting and ancient population genetics, we can understand more about the species distribution or connectivity in the past. Stable Isotope

Analysis of bone collagen can inform us about any diet changes between past and present. By leveraging the potential for multidisciplinary research of this kind, we can gain a long-term perspective on the plasticity of Mediterranean sea turtles through time. This baseline information could help predict resilience to anthropogenic threats to some extent. In particular the geographic areas utilised by sea turtles throughout millenia can be identified. This contribution explores how bioarchaeological methods can complement or even inform aspects of sea turtle conservation biology. Every bone has a story to tell.

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CONTRIBUTION TO SEA TURTLE RESCUE FACILITIES OF LIFE MEDTURTLES PROJECT

Doğan Sözbilen 1 Koray Kabadayıoğulları1 Sauro Pari 2 Valeria Angelini 2 Kamyla Lombardi Moraes 2 Imed Jribi 3 Mohamed Nejmeddine Bradai 3 Wiem Boussellaa 3 Hamed Mallat 3 Olfa Chaieb4 Ali cheikhsboui3 Idriss Ben Naila3 Idriz Haxhiu 5 Jerina Kolutari 5 Anxhela Çurri 5 Paolo Casale 6 Yakup Kaska 1

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The rehabilitation facilities are important part of the sea turtle conservation as not only contribution to the population but important part of the public awareness. Those rehabilitation facilities are far better in the European countries than non-European ones. The migratory species such as sea turtles can only be protected by collaboration of countries in the region. The project LIFE MEDTURTLE (co-funded by the LIFE instrument of the EU) is one of the first EU project supported both European (Italy, Spain) and non-European countries (Albania, Tunisia and Turkey). The rescue facilities were presented as the baseline (2019) and the improvements received by the end of 2021. The facilities were gained infrastructure improvements (new tanks, solar panels...etc) as well as the medical support. This upgrading rescue facilities and networks were increased sea turtle rehabilitation capacity, reducing the number of turtles dying from anthropogenic factors (e.g. fishing, collision with boats) and facilitating awareness campaigns. In Albania, Patok Sea Turtle Research and First Aid Center were

transformed into a rescue center. In Italy the Rescue Centre in Riccione were improved and will be created a first aid center. In Tunisia, the Rescue Centre in Monastir were improved and created a first aid center in Sfax. In Turkey, the Rescue Centre (DEKAMER) in Dalyan were improved and will be established two first aid and information centers as to support Rescue/stranding Network. There were 13 turtles at the beginning of the year at RC of project partners. The total number of injured turtles were reached to 246 at the end of second year and majority of these turtles admitted to RC in the second year was 210 (86% of the turtles were admitted to the RCs) and 139 (56%) of them successfully rehabilitated. Mortalities are inevitable and there were 50 turtles died at RC in the second year. The cause of injuries and rehabilitation durations were compared among the four countries and the EU contribution to the non-European countries for the protection of migratory sea turtles were presented.