Sea turtles in the Mediterranean Region

MTSG Regional Report 2020

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REGIONAL OVERVIEW

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General remarks

The Marine Turtle Specialist Groups Regional Reporting initiative aims to gather information from all all Regional Management Units (RMUs) updating on the current status and knowledge for all sea turtle populations (RMUs) in such a manner that it is presented in a standardized form and made available to the public. In the case of the Mediterranean Region, which is the focus of the present report it is essentially an update of the previous reports, published in 2010 (http://iucn-mtsg.org/publications/med-report/) and 2018 (https://www.iucn-mtsg.org/regional-reports).

The Mediterranean Sea is a semi-enclosed sea connected with the Atlantic Ocean through the Straight of Gibraltar and the Red Sea via the Suez Canal. It has a coastline of 46,000 km and is surrounded by 21 countries. Three species of sea turtle frequent the Mediterranean: loggerheads (*Caretta caretta*), greens (*Chelonia mydas*) and leatherbacks (*Dermochelys coriacea*). There are also occasional encounters of olive and Kemp's ridleys (*Lepidochelys olivacea* and *Lepidochelys kempii*). Loggerheads and greens are the only two species with established populations in the region, belonging to 2 separate RMUs (CC- Med and CM- Med). The region is also visited by loggerheads from the North Atlantic and and North-east Atlantic RMUs (Casale et al., 2018) and by green turtles from the East Atlantic RMU. Leatherback turtles are rare, but regular visitors as they enter the Mediterranean through the Strait of Gibraltar in search of food (DC-ATL, not known which Atlantic RMU).

The current report presents updated data following the guidelines provided by the MTSG Co-Chairs, where each country/Territory is represented as an independent chapter structured according to a predetermined outline and a standard spreadsheet of tables. All data presented originate from published sources – no anecdotal reports are included. Published data are those that have already appeared in any type of material that can be cited (including gray literature, internal reports in any language, etc.).

A total of 22 Mediterranean countries/territories have been identified and included in this Report. For 3 countries/territories the provided information was updated in 2018 or 2019 (Table 2). Cyprus is represented as a single chapter consisting of region A and region B. All other countries are referred to information included in the first Mediterranean report (2010) (http://iucn-mtsg.org/publications/med-report/).

Table 2. Overview of Mediterranean Country Chapters and Information submitted

Country	Country abbreviations used in Table 1	YEAR OF UPDATE
Albania	AL	2020
Algeria	AG	2020
Bosnia & Herzegovina	BH	2020
Croatia	HR	2020
Cyprus		
Region A	CY_A	2020
Region B	CY_B	2019
Egypt	EG	2020
France	FR	2020
Greece	GR	2019
Israel	IL	2018
Italy	IT	2020
Lebanon	LB	2020
Libya	LY	2020
Malta	MT	2020
Monaco	MC	2020
Montenegro	MG	2020
Morocco	MA	2020
Slovenia	SI	2020
Spain	ES	2020
Syria	SY	2020
Tunisia	TN	2020
Turkey	TR	2020

1. RMU: Loggerhead turtle (*Caretta caretta*) Mediterranean

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

Nesting activity is concentrated in the Eastern Mediterranean basin with Greece, Turkey and Cyprus exhibiting the highest levels of nesting. Libya is probably a site of high levels of nesting activity (Hamza, 2010; Casale et al. 2018), however most of its 1,450 km coastline of mostly sandy beaches has not yet been fully assessed. Secondary nesting sites are found in Tunisia and Israel, while there are no recent reports on other countries where some nesting is known to occur such as Lebanon, and Egypt. In recent years, loggerhead turtles are consistently exhibiting low levels of nesting activity at locations in the western Mediterranean basin (Spain, Italy as per the present report, but also France and Malta).

1.1.2. Marine areas

Loggerhead turtles can be encountered throughout the entire Mediterranean region. The highest density of loggerhead turtles appears to occur in the westernmost part of the Mediterranean Sea (from the Alboran Sea to the Balearic Islands), the Sicily Straight, the Ionian sea, the Gulf of Gabès in Tunisia, the Adriatic Sea, and the south-east coast of Turkey. Juvenile loggerheads originating from the Atlantic rookeries mostly remain within the westernmost part of the Mediterranean.

1.2. Other biological data

Age at sexual maturity for loggerheads has been estimated at 21-34 years. Average clutch size is 110 eggs and mean hatching success ranges between 56 and 86%. A comrehensive review including all most recent research on loggerhead and green turtles is included in Casale et al. (2018).

1.3. Threats

1.3.1. Nesting sites

Coastal development and associated activies as well as non-human predation continue to persist as threats at all countries where nesting occurs (Table 1).

1.3.2. Marine habitats

The negative impact of the incidental capture of turtles in fishing gear persists as a highly important threat, with recent studies estimating total annual number of captures to 132,000 resulting in 44,000 deaths per year for all gear combined. Intentional killings of turtes are reported for all countries that submitted updated reports, highlinghting the probably significant impact of small-scale fisheries. Boat strikes, marine debris pollution and chemical pollutants constitute additional threats (Table 1).

1.3.3. Other threats

Climate change is a potential threat to sea turtle populations that has not yet been fully assessed. A more detailed analysis containing the most updated information is included in review paper (Casale et al., 2018).

1.4. Conservation

<u>Protection status</u>

All sea turtle species are protected throughout the Mediterranean region. For more details, see country chapters and the Med Turtle report published in 2010 (Casale and Margaritoulis, eds.).

Monitoring and conservation projects occur in most countries throughout the Mediterranean. Conservation projects typically involve monitoring of nesting activity (53 sites representing 41% of the total nesting effort reported annually), mitigation of threats at terrestrial and marine habitats, education programs, collaborative projects with fisheries. More information is provided at individual chapters within this report and at the Med Turtle report published in 2010 (Casale and Margaritoulis, eds.).

2. RMU: Green turtle (*Chelonia mydas*) Mediterranean

2.1. Distribution, abundance, trends

2.1.1. Nesting sites

Most clutches are deposited in Turkey, Cyprus and Syria(Table 1).

2.1.2. Marine areas

Green turtles occupy mostly the Levantine basin (Turkey, Syria, Cyprus, Lebanon, Israel, Egypt) and are known to have developmental habitats in Albania and Greece (Casale et al., 2018).

<u>Past distribution and abundance</u>

The green turtle populations of the Mediterranean are thought to be decimated as the result of exploitation during the first half of the 20th century (Casale et al., 2018). Monitoring studies show an upward trend in nesting activity (Table 1).

2.2. Other biological data

See Table 1. Age at sexual maturity for remains unknown for green turtle populations in the Mediterranean. A comrehensive review including all most recent research on loggerhead and green turtles is included in review paper (Casale et al., 2018).

2.3. Threats

Green turtles share the same threats with loggerhead turtles (Table 1).

2.4. Conservation

Monitoring and conservation projects occur in all countries with green turtle nesting activity (except for Syria where their conservation status is unknown). Conservation projects typically involve monitoring of nesting activity, mitigation of threats at terrestrial and marine habitats, education programs, collaborative projects with fisheries. More information is provided at individual chapters within this report and at the Med Turtle report published in 2010 (Casale and Margaritoulis, eds.).

<u>Protection Status</u>

All sea turtle species are protected throughout the Mediterranean region. For more details, see country chapters and the Med Turtle report published in 2010 (Casale and Margaritoulis, eds.).

<u>Conservation Priorities</u>

A comprehensive list on conservation priorities is provided in the comprehensive review (Casale et al., 2018)

3. RMU: Leatherback Turtle (*Dermochelys coriacea*) Atlantic (unknown)

3.1. Distribution, abundance, trends

Leatherback turtles encountered in the Mediterranean originate from the Atlantic RMUs. Leatherback encounters are reported in almost every Mediterranean country (Table 1). They constitute a rare, but regular visitor to the region, where they enter presumably in search of food. There are no estimates on numbers of individuals entering the Mediterranean and most encounters are documented as bycatch.

<u>Past distribution and abundance</u>

No data available

3.2. Threats

Leatherback turtles do not have any terrestrial habitats in the region. However they share the same threats as loggerhead and green turtle populations, especially the negative impact resulting from their incidental capture in fishing gear.

4. Other species

Kemp’s (*Lepidochelys kempii*) and olive ridleys (*Lepidochelys olivacea*) very occasionally enter the Mediterranean (Table 1).

Conservation and research priorities, available resources

A review paper on the current status and conservation of sea turtles (Casale et al., 2018) includes comprehensive information about knowledge gaps, research and conservation priorities of the Mediterranean. For more detailed information, please see individual chapters in this report, and the Mediterranean Report published in 2010 (Casale and Margaritoulis, 2010). The Report includes a comprehensive list of resources available to all stakeholders involved in sea turtle research and conservation.

References

Casale P. and Margaritoulis D. (eds), 2010. Sea Turtles in the Mediterranean. Distribution, threats and conservation priorities. Gland. Switzerland, IUCN, 294p.

Casale P., Broderick A.C., Camiñas J.A., Cardona L., Carreras C, Demetropoulos A, Fuller W.J., Godley B.J., Hochscheid S., Kask Y., Lazar B., Margaritoulis D., Panagopoulou A., Rees A.F., Tomás J., Turkozan O. 2018. REVIEW: Mediterranean sea turtles: current knowledge and priorities for conservation and research. Endangered Species Research, 36: 229–267.

Hamza, 2010. Libya, In Sea Turtles in the Mediterranean. Distribution, threats and conservation priorities (Casale P. and Margaritoulis D. (eds), 2010). Gland. Switzerland, IUCN, 159-188.

Table 1. Summary of key biological and conservation data for sea turte Regional Management Units (RMUs) in the Mediterranean region, extracted from Tables 1 of individual country chapters.

RMU	CC-MED	Country Chapters	CM-MED	Country Chapters	DC-ATL	Country Chapters	CC-ATL NW	Country Chapters
Occurrence								
Nesting sites	Y	AL, DZ, CY A, CY B, EG, FR, GR, IL, IT, LB, LY, MT, ES, SY, TN, TR	Y	CY_A, CY_B, EG, IL, LB, SY, TR	N		Y	ES
Pelagic foraging grounds	Y	AL, BA, BH, HR, EG, FR, GR, IL, IT, MT, ES, SY, TR	Y	AL, BA, EG, FR, IL, IT, MT, ES, SY, TR	JA	AG, IT, ES	J	ES, IT
Benthic foraging grounds	Y	AL, BA, BH,HR, CY_A, EG, FR, GR, IL, IT, LY, MA, SI,	Y	AL, BA, HR, CY_A, CY_B, EG, GR, IL, LY, SY, TR	Y	TR	J	ES, IT

		ES, SY, TN, TR						
Key biological data								
Nests/yr: recent average (range of years)	5712(a)	AL,CY_A, CY_B, EG, IL, IT, LB, LY, MT, ES, SY, TN, TR	2821	CY_A, CY_B, EG, IL, LB, SY, TR	n/a		1-3	ES
Nests/yr: recent order of magnitude					n/a			
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	30	CY_A, CY_B, GR, LB, LY, TN, TR	14	CY_A, CY_B, SY, TR	n/a		0	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	142	CY_A, EG, GR, IT, LB, LY, MT, SY, TN, TR	70	CY_A, EG, IL, LB, SY, TR	n/a		0	
Nests/yr at "major" sites: recent average (range of years)	4567	CY_A, CY_B, LB, LY, TN, TR	2445	CY_A, SY, TR	n/a		n/a	

Nests/yr at "minor" sites: recent average (range of years)	866	CY_A, CY_B, IL, IT, LB, LY, MT, SY, TN, TR	206	CY_A, IL, LB, SY, TR	n/a		n/a	
Total length of nesting sites (km)	906	CY_A, CY_B, IL, IT, LB, LY, MT, SY, TN, TR	431	CY_A, IL, LB, SY, TR	n/a		n/a	
Nesting females / yr	1853	CY_A, CY_B, EG, ES, TN, TR	824	CY_A, TR	n/a		1-2	ES
Nests / female season (N)	1.79	CY_A, TN, TR	3	CY_A	n/a		n/a	
Female remigration interval (yrs) (N)	2.33	CY_A, IT, TN	3	CY_A	n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	0.37 - 0.94	CY_A, IL, LY, TR	0.56-0.93	CY_A, IL, TR	n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	0.52 - 0.69	CR, IT, SL, TN	n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	0.4 - 0.83	IT, TN	0.42	CY_A	n/a		n/a	
Min adult size, CCL or SCL (cm)	60 CCL	CY_A, CY_B, FR, GR, IL, IT, LB, LY, TN, TR	65 SCL	CY_A, IL, LB, SY, TR	n/a		n/a	

Age at maturity (yrs)	21 - 34	IT (FOR ALL)	n/a		n/a		n/a		
Clutch size (n eggs) (N)	87.2	CY_A, GR, IL, IT, LY, MT, TN, TR	112	CY_A, SY, TR	n/a		n/a		
Emergence success (hatchlings/egg) (N)	0.56-0.86	CY_A, GR, IL, IT, LB, LY, MT, TN, TR	0.70-0.80	CY_A, LB, SY, TR	n/a		n/a		
Nesting success (Nests/ Tot emergence tracks) (N)	0.26-0.47	CY_A, GR, IL, IT, LB, TR	0.29-0.37	CY_A, LB, TR	n/a		n/a		
Trends									
Recent trends (last 20 yrs) at nesting sites (range of years)	stable or Up, only EG down	CY_A, CY_B, EG, GR, IL, MT, TN, TR	1 stable (SY), 3 up (CY_A, CY_B, IL), 1 down (EG)	CCY_A, Y_B, EG, IL, SY	n/a		n/a		
Recent trends (last 20 yrs) at foraging grounds (range of years)	STABLE/UP	CY_A, IT, MT, TN, TR	UP	TR	n/a		Y	ES	

Oldest documented abundance: nests/yr (range of years)	Y	CY_A, CY_B, SY, TR	Y	CY_A, CY_B, SY	n/a		n/a	
Published studies								
Growth rates	Y	CY_A, GR, IT	Y	CY_A	N		N	
Genetics	Y	AL; CR; CY_A, EG, GR, IT, LY, MT, ES, SI, TN, TR	Y	CY_A, EG, IL, ES, TR	N		Y	IT, ES
Stocks defined by genetic markers	Y	AL, CR, CY_A, EG, ES, GR, IT, LY, SI, TN, TR	Y	EG	N		Y	ES
Remote tracking (satellite or other)	Y	AL, HR, CY_A, FR, GR, IL, IT, LB, LY, MT, SI, ES, TN, TR	Y	CY_A, IL, LB, LY, SY, TR	N		Y	IT, ES
Survival rates	Y	CY_A, IT, ES	Y	CY_A,	N		Y	SP
Population dynamics	Y	CY_A, GR, IT, MT, TR	Y	AL, CY_A,	N		N	

				GR, IL, TR				
Foraging ecology (diet or isotopes)	Y	HR, CY_A, FR, GR, IT, LY, SI, ES	Y	CR, CY_A, ES, GR, TN	Y	TN	Y	SP
Capture-Mark-Recapture	Y	HR, CY_A, EG, GR, IT, SI, ES	Y	CY_A, EG,	N		Y	SP
Threats								
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, SN, DLL, ST, MT, OTH)	AG, CY_A, CY_B, FR, GR, IT, IL, MA, ES, TN, TR	Y (SN, DLL, PLL, ST, MT, OTH	CY_A, CY_B, GR, FR, IL, IT, ES, TR	Y (PLL, DN, SN, ST, MT)	FR, GR, IL, IT, MA, TR	Y (PLL; SN)	AG, SP, IT
Bycatch: presence of industrial fisheries?	Y (PLL, SN, BT, ST, MT, PT)	AG, GR, IL, IT, MA, ES, TN, TR	Y (SN, BT, DLL, ST, MT)	BH, GR, IL, IT, TN, TR	Y (PLL, DN, SN, ST, MT)	GR, IL, IT, MA, ES	Y	AG, SP, IT
Bycatch: quantified?	Y	CY_A, FR, GR, IL, IT, MA, ES, TN, TR	Y	CY_A, FR, IL, ES, TR	Y	FR, MA, ES	Y, 6060 (Mean PLL); 500 (BT)	SP

Take. Intentional killing or exploitation of turtles	Y	CY_B, GR, IT, MA, TN	Y	CY_B, GR, FR,	n/a	ALL	N	
Take. Egg poaching	N	CY_B, GR, IT, IL, MA, ES, TN, TR	N		n/a	ALL	N	
Coastal Development. Nesting habitat degradation	Y	AG, CY_A, CY_B, GR, IL, IT, TN, TR	Y	CY_A, CY_B, IL, TR	n/a	ALL	N	
Coastal Development. Photopollution	Y	AG, CY_A, CY_B, FR, GR, IL, IT, TN, TR	Y	CY_A, CY_B, IL, TR	n/a	ALL	N	
Coastal Development. Boat strikes	Y	AG, CY_A, FR, IL, IT, TN	Y	CY_A, CY_B, IL, TR	n/a	ALL	Y	SP
Egg predation	Y	CY_A, IT	Y	CY_A, CY_B, TR	n/a	ALL	N	
Pollution (debris, chemical)	Y	AG, CY_A, FR, IL, IT, TN	Y	CY_A, IL, TR	n/a	ALL	Y	SP
Pathogens	Y	FR, IT, TN	n/a		n/a	ALL	Y	SP

Climate change	Y	AG, CY_A, DZ, FR,	Y	CY_A, TR	n/a	ALL	N	
Foraging habitat degradation	Y	FR, IL	Y	IL	n/a	ALL	N	
Other	Y (see text)	DZ, FR, IL, TN	Y	FR, IL	n/a	ALL	N	
							0	
Long-term projects (>5yrs)							0	
Monitoring at nesting sites (period: range of years)	Y (1985-ongoing)	CY_A, IL, TN	Y (1978-)	CY_A, CY_B, IL, TR	n/a	ALL	N	
Number of index nesting sites	1 - 5, 11	CY_A (11), IL, IT, TN, TR	17	CY_A, IL, TR	n/a	ALL	N	
Monitoring at foraging sites (period: range of years)	Y (2000-ongoing)	GR, ES, TR	n/a	ALL	n/a	ALL	Y	SP
							0	
Conservation							0	
Protection under national law	Y	AG, CY_A, CY_B, DZ, GR, FR, IL, IT, MA, ES, TN, TR	Y	ALL	Y	ALL	Y	SP, IT
Number of protected nesting sites (habitat preservation) (% nests)	53 (41%)	CY_A, CY_B, GR, IL, IT, TN, TR	45 (90%)	CY_A, CY_B, TR	0	ALL	N	

Number of Marine Areas with mitigation of threats	5	AG, CY_A, CY_B, TR	3	CY_A, CY_B, TR	0	ALL	N	
N of long-term conservation projects (period: range of years)	14 (1978-)	CY_A, CY_B, GR, IL IT, TN	9	CY_A, CY_B, TR	0	ALL	N	
In-situ nest protection (eg cages)	Y	CY_A, CY_B, GR, IT, TN, TR	Y	CY_A, CY_B, TR	n/a	ALL	N	
Hatcheries	Y	CY_B, ES	Y	CY_B	n/a	ALL	Y	SP
Head-starting	Y	CY_B, ES	Y	CY_B	n/a	ALL	Y	SP
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y	IT, ES, TN, TR	Y	ES, TR	Y	ES	Y	SP
By-catch: onboard best practices	Y	GR, FR, IT, ES, TN, TR	Y	ES, FR, TR	Y	ES	Y	SP
By-catch: spatio-temporal closures/reduction	Y	CY_B, TN	Y	CY_B	n/a	ALL	N	
Other	Y (see text)	DZ, TR	N	ALL	n/a	ALL	N	

Table 1. (cont.)

RMU	CC-ATL NE	Country Chapters	CM-E ATL		LC-ATL*	Country Chapters	LO-ATL E*	Country Chapters
Occurrence								

Nesting sites	N		N		N		N	
Pelagic foraging grounds	Y	ES	Y	ES	Y	ES	Y	ES
Benthic foraging grounds	n/a		N		N		N	
Key biological data								
Nests/yr: recent average (range of years)	n/a		n/a		n/a		n/a	
Nests/yr: recent order of magnitude	n/a		n/a		n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a		n/a		n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a		n/a		n/a		n/a	

Nests/yr at "major" sites: recent average (range of years)	n/a		n/a		n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	n/a		n/a		n/a		n/a	
Total length of nesting sites (km)	n/a		n/a		n/a		n/a	
Nesting females / yr	n/a		n/a		n/a		n/a	
Nests / female season (N)	n/a		n/a		n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a		n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a		n/a		n/a	
Min adult size, CCL or SCL (cm)	n/a		n/a		n/a		n/a	
Age at maturity (yrs)	n/a		n/a		n/a		n/a	
Clutch size (n eggs) (N)	n/a		n/a		n/a		n/a	

Emergence success (hatchlings/egg) (N)	n/a		n/a		n/a		n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a		n/a		n/a	
Trends								
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a		n/a		N		N	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a		N		N	
Oldest documented abundance: nests/yr (range of years)	n/a		n/a		N		N	
Published studies								
Growth rates	N		N		N		N	
Genetics	N		Y	ES	Y	ES	Y	ES
Stocks defined by genetic markers	Y	ES	N		N		N	

Remote tracking (satellite or other)	Y	ES	N		N		N	
Survival rates	Y	ES	N		N		N	
Population dynamics	N		N		N		N	
Foraging ecology (diet or isotopes)	N		Y	ES	N		N	
Capture-Mark-Recapture	N		N		N		N	
Threats								
Bycatch: presence of small scale / artisanal fisheries?	n/a		Y (PLL)	ES	Y	ES	N	
Bycatch: presence of industrial fisheries?	n/a		N		Y	ES	Y	ES
Bycatch: quantified?	n/a		Y	ES	Y	ES	Y	ES
Take. Intentional killing or exploitation of turtles	n/a		N		N		N	

Take. Egg poaching	n/a		N		N		N	
Coastal Development. Nesting habitat degradation	n/a		N		N		N	
Coastal Development. Photopollution	n/a		N		N		N	
Coastal Development. Boat strikes	n/a		N		N		N	
Egg predation	n/a		N		N		N	
Pollution (debris, chemical)	n/a		N		N		N	
Pathogens	n/a		N		N		N	
Climate change	n/a		N		N		N	
Foraging habitat degradation	n/a		N		N		N	
Other	n/a		N		N		N	
	n/a							
Long-term projects (>5yrs)	n/a							
Monitoring at nesting sites (period: range of years)	n/a		N		N		N	
Number of index nesting sites	n/a		N		N		N	
Monitoring at foraging sites (period: range of years)	n/a		N					
	n/a							

Conservation	n/a							
Protection under national law	n/a		Y	ES	Y	ES	Y	ES
Number of protected nesting sites (habitat preservation) (% nests)	n/a		N		N		N	
Number of Marine Areas with mitigation of threats	n/a		N		N		N	
N of long-term conservation projects (period: range of years)	n/a		N		N		N	
In-situ nest protection (eg cages)	n/a		N		N		N	
Hatcheries	n/a		N		N		N	
Head-starting	n/a		N		N		N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a		Y	ES	Y	ES	Y	ES
By-catch: onboard best practices	n/a		Y	ES	Y	ES	Y	ES
By-catch: spatio-temporal closures/reduction	n/a		N		N		N	
Other	n/a		N		N		N	

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1. RMU: Loggerhead Turtle (*Caretta caretta*) Mediterranean

1.1 Distribution, abundance, trends

1.1.1 Nesting sites

Nesting of loggerhead turtle has just recently being reported for the Adriatic coast of Albania (6, 13, 16). Areas like Krorez, Borsh, Palase, Orikum, Narte, beaches near the mouth of Semani and Shkumbini Rivers, and Lalzi Bay were proposed as potential nesting sites in Albania (3, 13, 16). The anecdotal reports, the continuous presence of the female loggerheads in Albanian waters (1, 6, 8, 10, 20, 22, 23) and the new haplotypes found by mitochondrial DNA analysis in turtles foraging at Drini Bay (25) were an important stimulus on searching for nesting activities in Albania which was finally confirmed with the presence of hatchlings reported emerging from a small beach at Kepi i Rodonit in 2017 and a nest located in 2018 at Divjake (13, 16). Nesting of the loggerhead in Albania is a sporadic event and seems to happen almost along the entire country, from Drini Bay to Vlora Bay, and with no proper nesting sites (13, 16). This finding shifts the border of nesting known so far from northeast Ionian (Greece) to southeast Adriatic (Albania).

1.1.2 Marine areas

The presence of the loggerhead turtle in both Adriatic and Ionian sea has been observed through bycatch and strandings. The marine areas with the highest concentration of the sea turtles are Drini bay, Durres, Divjake and Vlora Bay (1, 3, 6, 7, 10, 12, 15, 17, 19, 20, 21, 22, 23).

Drini bay is the major foraging area in Albania where a high presence of the juvenile and sub-adult loggerhead turtles is reported (1, 3, 6, 7, 8, 10, 15, 19, 20, 21, 22, 23, 24) confirming once again the bay as an important development habitat for the loggerhead turtle. The presence of turtles in the bay is not equally distributed, the southern part of it seems to be more preferred by turtles (15, 19) and it is suggested to be linked with the presence of the invertebrates in this area affected by the rivers (3, 5, 15) and the presence of the Shengjini port in the northeast part of it. The CCL range of the turtles is 32-95cm CCL (1, 10, 15) while the presence of the adult turtles observed during the period April-October by a long term study (15) suggests the area as a foraging ground for the adult females in their non-reproductive period and those nesting in the nearby areas. Presence of the adult males with soft plastron, females with swollen cloacae, and with bite marks in the back of the neck indicating a possible courtship happened in the area, and suggesting the usage of the bay as a mating area by the adult loggerhead turtles (15, 21). A slitely higher proportion of adult female loggerheads (54.4%) is found for Drini bay during the period April-October, which might be even higher during the non-reproductive period, suggested by a decrease of the frequency of bycatch for adult females after May (15) and the data collected by the satellite tracking (18, 19). Drini Bay is a foraging area with an almost balanced sex ratio of adult loggerhead turtles during the hot season (15). The capture-mark-recapture data (1, 6, 14, 15, 22), bycatch during the winter time (1, 3) and data collected through satellite tracking (19) show a presence of the turtles in the bay for an extended period. Tracking has shown that loggerhead turtles use Drini Bay as a seasonal summer foraging site (19) and as an overwintering site (18, 19). Male maturity size is reported to be same as for other Mediterranean sites, the binomial distribution is clear for the class >75cm (CCL) (15).

Vlora bay is another foraging area for the loggerhead turtle. The bycatch of turtles here is lower compared to the Drini bay, but seems to occur mainly during the hot season (1, 10, 17).

The presence of the loggerhead turtle have been reported by bycatch or strandings even in other marine areas in Albania, but this mainly in the areas where there are found the river deltas like the ones of Shkumbini and Semani (1, 3, 10).

1.2 Other biological data

Please see table 1.

1.3 Threats

The nesting of the loggerhead turtle in Albania is a recent finding and seems to be sporadic so the main threat for the turtles is the bycatch. Turtle mortality is attributed to incidental bycatch in trawlers, gillnets, longlines and another problem is the illegally-performed fishing operations and usage of explosive substances (1, 5, 6, 10, 22) before 2013. Traps known as stavniks, which are the fishing gear yearly monitored and the main provider of the turtles studied in Albania, seems to not have any impact on the turtle health or cause any damage to them except for limiting their movement (3, 8, 22, 23). Boat strike is another cause of damages and mortality (1, 6, 22).

Chemical and solid waste pollution is a threat for the loggerheads in the Drini bay. The pollution is caused by the flows of Ishmi river and plastic brought to the bay causes mortality to the turtles (3, 5, 22) Usage of the embalmed turtles as a touristic attraction by restaurants is observed along the coast, but it is not a common finding (3, 5).

No proper nesting sites are known so far for Albania except for scattered nesting happening along the Adriatic coast. Coastal development is the main threat for these nests, especially in Divjake where according to a new development plan new touristic attractions will be established. Curiosity of people is another threat to be mentioned. Nesting of the loggerhead is not a common thing and local community and tourists tend to be way too curious about the eggs and the turtles.

1.4 Conservation

National laws for the conservation of the wild fauna and habitats and international conventions ratified by Albania ensure a protection of the sea turtles (Tab. 3). An Action Plan for the Conservation of the Sea Turtles and their Habitats in Albania adopted through a Ministerial Order is being implemented since 2012. Several projects have been implemented since 2002 by Herpetofauna Albanian Society and most of them are focused to the Drini bay. The involvement of the state institutions in the mitigation of threats is still low, and most projects are focused on awareness raise and best practices on handling and releasing the bycaught turtles (1, 6, 22).

1.5 Research

Knowledge gaps

The knowledge about the presence of both juvenile and adult loggerhead turtles at Drini Bay needs further investigations and to be complemented with information on movement patterns, genetics, time of residency, spatial distribution, juveniles sex ratio, feeding ecology and behavior.

The confirmation of the nesting manifests the need for further studies regarding findings of the abundance and recurrence of nesting, hatching success and sex ratio, threats, and especially with all the changes foreseen within the global warming/climate change scenario, the possible effects this might have in the nesting of loggerhead turtle in Albania.

2. RMU: Green Turtle (Chelonia mydas) Mediterranean

2.1 Distribution, abundance, trends

2.1.1 Nesting sites

Green turtle does not nest in Albania.

2.1.2 Marine areas

The presence of the green turtle in both Adriatic and Ionian Sea has been observed through bycatch and strandings, but with a lower intensity compared to the loggerhead turtle (1, 2, 3, 5, 6, 7, 8, 9, 10, 12, 14, 17, 22) with annual bycatch 2.6 turtles per year (14).

Drini bay and the area around Cape of Rodon is the area were most of the bycatch of the green turtle occurs in Albania (12, 14, Fig.1). The CCL range of the turtles reported from this area is 22.5-79.5 suggesting the Drini bay as both an oceanic and neritic habitat for the specimen while the role as a nursery habitat for those hatchlings dispersed to the area is not excluded (14). The presence of both juvenile and sub-adult turtles within the bay is related to the food recourses. Within the same area there is a high presence of invertebrates and seagrass meadows of *Cimodocea nodosa* thus depending on their life-stage green turtles can feed on animal, seagrass or mixed diet. The high bycatch frequency of the green turtles in Drini bay compared to other areas and during the hot season compared to the cold one seems to be directly related to the presence of the stavniks, since this is the only area using this fishing gear.

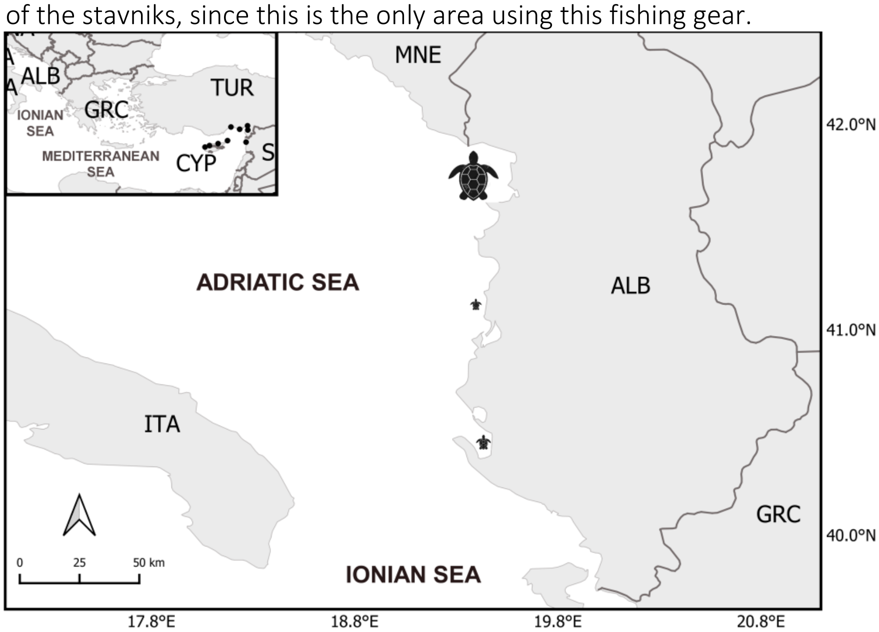

Fig. 1 Bycatch location of green turtles. Turtle size reflects the bycatch frequency. Black circles represent green turtle nesting sites in the Mediterranean.

Vlora bay and the area in front of the delta of Shkumbini river are other areas with green turtle encounters (14, 17). The Vlora bay is suggested as a possible oceanic and neritic habitat for the green turtles reaching Adriatic.

2.2 Other biological data

See table 1.

2.3 Threats
The main threat for the green turtles is the bycatch. Green turtle mortality is attributed to incidental bycatch in gillnets and boat strikes (14).

2.4 Conservation
National laws for the conservation of the wild fauna and habitats and international conventions ratified by Albania ensure a protection of the sea turtles (Tab. 3).

2.5 Research
Knowledge gaps

The knowledge about the presence of green turtles in southeast Adriatic needs further investigations and to be complemented with information on movement patterns, genetics, time and spatial distribution, feeding ecology and behavior and the possible effect the global warming/climate change might have in the presence of the green turtle in Albania.

3. RMU: Leatherback Turtle (*Dermochelys coriacea*) Atlantic (unknown)
3.1 Distribution, abundance, trends
3.1.1 Nesting sites
Leatherback turtle does not nest in Albania.

3.1.2 Marine areas
The leatherback turtle has been encountered only in Adriatic coast of Albania. All the turtles are bycaught during the hot season in the stavniks of the Drini bay, of which the last two in 2016 and 2017 (1, 3, 6, 26).

3.2 Other biological data
No other biological data is available except for all the turtles were large juveniles and for one of them the gender was reveled after the necropsy, it was a female (3, 26).

3.3 Threats
No data.

3.4 Conservation
No specific conservation measures for the specimen; protection status is the same for all sea turtles.

3.5 Research
Knowledge gaps

Studies regarding the origin of the turtles visiting the area are lacking.

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Table 1. Main biology and conservation aspects of marine turtle Regional Management Units (RMU) occurring in Albania.

RMU	CC-MED	Ref #	CM-MED	Ref #	DC-UNKNOWN	Ref #
Occurrence						
Nesting sites	Y	6, 13, 16	n/a		n/a	
Pelagic foraging grounds	JA	1, 3, 6, 7, 8, 9, 10, 17, 19, 21, 22, 23, 24	J	2, 3, 12, 14, 17, 22	J	1, 6, ,26
Benthic foraging grounds	JA	1, 3, 6, 7, 8, 9, 10, 15, 17, 19, 21, 22, 23, 24	J	2, 3, 12, 14, 17, 22	n/a	
Key biological data						
Nests/yr: recent average (range of years)	1 (2017-2018)	13, 16	n/a		n/a	
Nests/yr: recent order of magnitude	1		n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a		n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a		n/a		n/a	
Nests/yr at "major" sites: recent average (range of years)	n/a		n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	n/a		n/a		n/a	
Total length of nesting sites (km)	n/a		n/a		n/a	
Nesting females / yr	n/a		n/a		n/a	

Nests / female season (N)	n/a		n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a		n/a	
Min adult size, CCL or SCL (cm)	n/a		n/a		n/a	
Age at maturity (yrs)	n/a		n/a		n/a	
Clutch size (n eggs) (N)	n/a		n/a		n/a	
Emergence success (hatchlings/egg) (N)	n/a		n/a		n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a		n/a	
Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a		n/a		n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a		n/a	
Oldest documented abundance: nests/yr (range of years)	n/a		n/a		n/a	
Published studies						
Growth rates	N		N		N	
Genetics	Y	25	N		N	
Stocks defined by genetic markers	Y	25	N		N	
Remote tracking (satellite or other)	Y	19	N		N	
Survival rates	N		N		N	
Population dynamics	N		Y	14	N	
Foraging ecology (diet or isotopes)	N		N		N	
Capture-Mark-Recapture	N		N		N	
Threats						

Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, SN, DN)	1, 5, 10, 6, 22	Y (SN)	5, 14	n/a	
Bycatch: presence of industrial fisheries?	Y (PLL, DLL, MT, PT)	1, 5, 10, 6, 22	Y (MT)	5, 14	n/a	
Bycatch: quantified?	N		N		N	
Take. Intentional killing or exploitation of turtles	n/a		n/a		n/a	
Take. Egg poaching	n/a		n/a		n/a	
Coastal Development. Nesting habitat degradation	n/a		n/a		n/a	
Coastal Development. Photopollution	n/a		n/a		n/a	
Coastal Development. Boat strikes	Y	6	Y	14	n/a	
Egg predation	N		n/a		n/a	
Pollution (debris, chemical)	Y	3, 5, 22	N		n/a	
Pathogens	N		n/a		n/a	
Climate change	N		n/a		n/a	
Foraging habitat degradation	N		n/a		n/a	
Other	N		N		N	
Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	n/a		n/a		n/a	
Number of index nesting sites	n/a		n/a		n/a	
Monitoring at foraging sites (period: range of years)	Y (2002-2020)		Y (2002-2020)		n/a	
Conservation						
Protection under national law	Y		Y		Y	
Number of protected nesting sites (habitat preservation) (% nests)	n/a		n/a		n/a	
Number of Marine Areas with mitigation of threats	n/a		n/a		n/a	
N of long-term conservation projects (period: range of years)	>1 (2002-2020)		>1 (2002-2020)		n/a	
In-situ nest protection (eg cages)	N		n/a		n/a	
Hatcheries	n/a		n/a		n/a	
Head-starting	n/a		n/a		n/a	

By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a		n/a		n/a	
By-catch: onboard best practices	Y	1, 6, 22	Y	1, 6, 22	n/a	
By-catch: spatio-temporal closures/reduction	N		n/a		n/a	
Other	N		N		N	

Table 2. The information on the potential sea turtle nesting beaches in Albania

RMU / Nesting beach name	**Index site**	**Nests/yr: recent average (range of years)**	**Crawls/yr: recent average (range of years)**	**Western limit**		**Eastern limit**		**Central point**		**Length (km)**	**% Monitored**	**Reference #**	**Monitoring Level (1-2)**	**Monitoring Protocol (A-F)**
CC-NW IND				Long	Lat	Long	Lat	Long	Lat					
Divjake	N	1 (2018)	2 (2018)					40,984908	19,46315			13, 16		A
Kepi i Rodonit	N	1 (2017)						41,566006	19,460745			13, 16		A

Table 3. International conventions protecting marine turtles İn Albania.

International Conventions	**Signed**	**Binding**	**Compliance measured and reported**	**Species**	**Conservation actions**	**Relevance to sea turtles**
Bern Convention	Y	Y		CC, CM		y
Bonn Convention	Y	Y		CC, CM		y
CITES	Y	Y		CC, CM, DC		y
Barcelona Convention (&its 6 protocols)	Y	Y		CC, CM		y

ALGERIA

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RMU: Loggerhead turtle (*Caretta caretta*) Mediterranean

1.1. Distribution, abundance, trends

The Algerian coast covers 1622 km of the southwest Mediterranean coastline from the Moroccan to the Tunisian borders, of which approximately 180 km in the Alboran Sea. The Algerian coastline is characterised by narrow shelf with extended rocky bottom and its western part is under Alboran Sea conditions that are under directly influenced by Atlantic current (23). This coastline presents a variety of habitats, from the dominant rocky shores, sometimes with high cliffs, to sandy beaches and dunes in most of the. The beaches occupy a large part of the Algerian coast, of which, the largest ones are located on the eastern part of the country.

The presence of the sea turtle on the Algerian coast has been regularly reported since the end of the eighteenth century to date (1-16, Boutiba, 1992, Bouderbala 2007). Indeed, two species of sea turtles regularly strand, (alive or dead), or are accidentally caught in Algerian waters, including approximatively 69.8% loggerhead turtles (*Caretta caretta*) and 28,6% leatherback turtles (*Dermochelys coriacea*) (16). This situation is accentuated by the proximity of the feeding zone located in the Alboran Sea and Algerian basin (12, 17-19).

Apart from a few old reports by fishermen of the presence of sea turtle tracks on beaches on the east coast of the country during the summer season, no nesting was reported until 2017. During this year, a *Caretta caretta* nest was detected for the first time in Algeria on the beach of Tamanart in the eastern part of Algeria (15). This second nest reported on the southern coasts of the western Mediterranean basin after that reported in Zouara (Tunisia) in 2016 near the Algerian-Tunisian border by (20), asks us about the real potential for nesting sea turtles in this southern part of the western Mediterranean.

Moreover, the sporadic nests recorded in the western Mediterranean regions since the 2000s, And which is a response to rising temperatures (21), assumes that nesting possibilities may exist on the southern coast of the western basin and precisely in Algeria. In this context, the Algerian authorities, in collaboration with The Regional Activity Center for Specially Protected Areas (RAC/SPA), undertook since 2017, the implementation of the Action Plan for the Conservation of Mediterranean Marine Turtle, through an ambitious beaches temperatures monitoring program to look for potential nesting areas for marine turtles, to better protect them in the future.

1.1.1. Nesting Sites

See Table 1.

1.1.2. Marine Areas

See Table 1.

1.2. Other Biological Data

See Table 1.

1.3. Threats

In Algeria, sea turtles are threatened as in the whole Mediterranean basin by (i) negative interactions with industrial and artisanal fishing (pelagic nets, longlines, trawls), (ii) macro-waste which often causes mortalities by ingestion or entanglement, (iii) heavy maritime traffic (Collusion), (iv) chemical pollution (heavy metals, hydrocarbons and microplastics), (v) exploitation for the shell trade (decorative object), and finally (vi) the loss of habitats (nesting sites) caused by littoralization and over-frequentation of beaches, especially during nesting periods. This situation has brought the Algerian authorities to integrate the three marine turtle species (*Caretta caretta*, *Dermochelys coriacea* and *Chelonia mydas*) into the list of protected animal species since 2012 (JORADP, 2012). In this context, the Algerian Ministry of the Environment, in collaboration with the Regional Activity Center for Specially Protected Areas (SPA/RAC), have undertaken since 2017, the implementation of the Action Plan for the conservation of Mediterranean sea turtle, through an ambitious program to monitor the temperatures of the beaches along the coast and the surveillance of the beaches in the east of the country likely to harbor nests of sea turtles.

Moreover, the sporadic nests recorded in the western Mediterranean regions since the 2000s, And which is a response to rising temperatures (21), assumes that nesting possibilities may exist on the southern coast of the western basin and precisely in Algeria. In this context, the Algerian authorities, in collaboration with The Regional Activity Center for Specially Protected Areas (RAC/SPA), undertook since 2017, the implementation of the Action Plan for the Conservation of Mediterranean Marine Turtle, through an ambitious beaches temperatures monitoring program to look for potential nesting areas for marine turtles, to better protect them in the future.

1.3.1. Nesting sites

See Table 1.

1.3.2. Marine Areas

See Table 1.

1.4. Conservation

See Table 2.

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Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Algeria.

TOPIC	REGIONAL MANAGEMENT UNIT					
	CC-MED	Ref #	CM-MED	Ref #	DC-ATL?	Ref #
Occurrence						
Nesting sites	Y		N		N	
Pelagic foraging grounds	Y	1,2,3,4,5,6,7,8,9, 10,11,12,13,14,15,16, 18, 19	N		Y	16
Benthic foraging grounds	Y		N		Y	
Key biological data						
Nests/yr: recent average (range of years)	n/a		n/a		n/a	
Nests/yr: recent order of magnitude	n/a		n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a		n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a		n/a		n/a	
Nests/yr at "major" sites: recent average (range of years)	n/a		n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	n/a		n/a		n/a	
Total length of nesting sites (km)	n/a		n/a		n/a	
Nesting females / yr	n/a		n/a		n/a	
Nests / female season (N)	n/a		n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a		n/a	
Min adult size, CCL or SCL (cm)	n/a		n/a		n/a	

Age at maturity (yrs)	n/a		n/a		n/a	
Clutch size (n eggs) (N)	n/a		n/a		n/a	
Emergence success (hatchlings/egg) (N)	n/a		n/a		n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a		n/a	
Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a		n/a		n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a		n/a	
Oldest documented abundance: nests/yr (range of years)	n/a		n/a		n/a	
Published studies						
Growth rates	N		N		N	
Genetics	N		N		N	
Stocks defined by genetic markers	N		N		N	
Remote tracking (satellite or other)	N		N		N	
Survival rates	N		N		N	
Population dynamics	N		N		N	
Foraging ecology (diet or isotopes)	N		N		N	
Capture-Mark-Recapture	N		N		N	
Threats						
Bycatch: presence of small scale / artisanal fisheries?	Y	13,17	n/a		Y	13, 17
Bycatch: presence of industrial fisheries?	Y		n/a		Y	
Bycatch: quantified?	N		N		N	
Take. Intentional killing or exploitation of turtles	N		N		n/a	
Take. Egg poaching	N		n/a		n/a	

Coastal Development. Nesting habitat degradation	Y		n/a		n/a	
Coastal Development. Photopollution	Y		n/a		n/a	
Coastal Development. Boat strikes	Y		n/a		n/a	
Egg predation	n/a		n/a		n/a	
Pollution (debris, chemical)	Y		n/a		n/a	
Pathogens	n/a		n/a		n/a	
Climate change	Y	21	n/a		n/a	
Foraging habitat degradation	n/a		n/a		n/a	
Other	Y	22	n/a		n/a	
Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	N		n/a		n/a	
Number of index nesting sites	N		n/a		n/a	
Monitoring at foraging sites (period: range of years)	N		n/a		n/a	
Conservation						
Protection under national law	Y	21	n/a		n/a	
Number of protected nesting sites (habitat preservation) (% nests)	N		n/a		n/a	
Number of Marine Areas with mitigation of threats	1		n/a		n/a	
N of long-term conservation projects (period: range of years)	n/a		n/a		n/a	
In-situ nest protection (eg cages)	N		n/a		n/a	
Hatcheries	N		n/a		n/a	
Head-starting	N		n/a		n/a	
By-catch: fishing gear modifications (eg, TED, circle hooks)	N		n/a		n/a	
By-catch: onboard best practices	N		n/a		n/a	
By-catch: spatio-temporal closures/reduction	N		n/a		n/a	
Other	N		n/a		n/a	

Table 2. International conventions protecting sea turtles and signed by Algeria.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
CITES	Y	N	Y	CC, CM, DC	Y	Y
SPA/BD (Convention on Biological Diversity)	Y	N	Y	CC, CM, DC	Y	Y

BOSNIA AND HERZEGOVINA

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General remarks

So far, Bosnia and Herzegovina never had a monitoring of sea turtle's species. Some individual researchers spotted two species in B&H territorial waters, but they did not register any nesting sites. The registered species are: *Caretta caretta* (Linnaeus, 1758). and *Dermochelys coriacea* (Vandelli, 1761).

1. RMU: Loggerhead Turtle (Caretta caretta) Mediterranean

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

Absence of possible nesting sites is maybe due to the B&H coastline composition. Most of the coastline is rocky and composed of large to medium sized rock boulders which is not so suitable for sea turtle nesting.

1.1.2. Marine Areas (MPA)

See Table 1.

1.2. Other biological data

Almost all biological data about sea turtles in B&H are made upon single site records made by individual researchers. The latest record was made by the herpetological society „Atra", where they documented the presence of Caretta caretta (Linnaeus, 1758).

1.3. Threats

The main threats in the B&H area are:

1. Fast urbanization of coastal area (invasion of tourist capacities);
2. Ingestion of plastics or marine debris;
3. Constructions planes for the harbour in B&H.

1.4. Conservation

Even if B&H signed and ratify Barcelona, Berne and CMS, the sea turtles were not listed in the recent issue of the Red list of fauna of FB&H (1). Other marine species are also not listed in the Red list of FB&H even if B&H signed the above mentioned Conventions, which is a serious problem which must be resolved in the following Red List update. Technically, sea turtles are not legally protected in B&H.
So far, B&H does not have any MPA. Federal Ministry of environment and tourism launched a project in which the first MPA will be proclaimed. They done an environment evaluation and now this project is in phase of determine the boundaries of future MPA.
First of all, B&H need to legally protect the species by list them in the Red list of fauna. After that, B&H needs to conduct specialized scientific monitoring programme for the species to record their numbers and areal, and to develop conservation plan for the confirmed species. Serious lack of technical and human capacities may be the problem for the future conservation actions.

2. RMU: Leatherback Turtle (*Dermochelys coriacea*) Atlantic

2.1. Distribution, abundance, trends

The latest record was made by the herpetological society „Atra“, where they documented the presence of *Dermochelys coriacea* (Vandelli, 1761) in Neum-Klek bay and Malostonski Bay. Latest documented record was made in Klek, Croatia a town bordering B&H waters where a dead individual of *Dermochelys coriacea* (Vandelli, 1761) was found (2). Lack of serious scientific and long-term monitoring of sea turtles is a serious problem in B&H.

2.2. Other biological data

Not Applicable

2.3. Threats

As in 1.3 above

2.4. Conservation

As in 1.4 above

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Bosnia & Herzegovina.

	REGIONAL MANAGEMENT UNIT					
TOPIC	CC-MED	Ref #	CM-MED	Ref #	DC-ATL	Ref #
Occurrence						
Nesting sites	N		N		n/a	
Pelagic foraging grounds	A	1	N		n/a	
Benthic foraging grounds	A	1	N		n/a	
Key biological data						
Nests/yr: recent average (range of years)	n/a		n/a		n/a	
Nests/yr: recent order of magnitude	n/a		n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a		n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a		n/a		n/a	
Nests/yr at "major" sites: recent average (range of years)	n/a		n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	n/a		n/a		n/a	
Total length of nesting sites (km)	n/a		n/a		n/a	
Nesting females / yr	n/a		n/a		n/a	
Nests / female season (N)	n/a		n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a		n/a	
Min adult size, CCL or SCL (cm)	n/a		n/a		n/a	
Age at maturity (yrs)	n/a		n/a		n/a	
Clutch size (n eggs) (N)	n/a		n/a		n/a	

Emergence success (hatchlings/egg) (N)	n/a		n/a		n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a		n/a	
Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	Unknown		Unknown		n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	Unknown		Unknown		n/a	
Oldest documented abundance: nests/yr (range of years)	n/a		n/a		n/a	
Published studies						
Growth rates	n/a	n/a	N		N	
Genetics	n/a	n/a	N		N	
Stocks defined by genetic markers	n/a	n/a	N		N	
Remote tracking (satellite or other)	n/a	n/a	N		N	
Survival rates	n/a	n/a	N		N	
Population dynamics	n/a	n/a	N		N	
Foraging ecology (diet or isotopes)	n/a	n/a	N		N	
Capture-Mark-Recapture	n/a	n/a	N		N	
Threats						
Bycatch: presence of small scale / artisanal fisheries?	n/a		N		n/a	
Bycatch: presence of industrial fisheries?	n/a		Y		n/a	
Bycatch: quantified?	n/a		N		n/a	
Take. Intentional killing or exploitation of turtles	n/a		n/a		n/a	
Take. Egg poaching	n/a		n/a		n/a	

Coastal Development. Nesting habitat degradation	n/a		n/a		n/a	
Coastal Development. Photopollution	n/a		n/a		n/a	
Coastal Development. Boat strikes	n/a		n/a		n/a	
Egg predation	n/a		n/a		n/a	
Pollution (debris, chemical)	n/a		n/a		n/a	
Pathogens	n/a		n/a		n/a	
Climate change	n/a		n/a		n/a	
Foraging habitat degradation	n/a		n/a		n/a	
Other	n/a		n/a		n/a	
Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	Absent		n/a		n/a	
Number of index nesting sites	n/a		n/a		n/a	
Monitoring at foraging sites (period: range of years)	n/a		n/a		n/a	
Conservation						
Protection under national law	N		N		N	
Number of protected nesting sites (habitat preservation) (% nests)	0		0		0	
Number of Marine Areas with mitigation of threats	0		0		0	
N of long-term conservation projects (period: range of years)	0		0		0	
In-situ nest protection (eg cages)	N		N		N	
Hatcheries	N		N		N	
Head-starting	N		N		N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	N		N		N	
By-catch: onboard best practices	N		N		N	
By-catch: spatio-temporal closures/reduction	N		N		N	
Other	N		N		N	

Table 2. International conventions protecting sea turtles and signed by Bosnia and Herzegovina.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Barcelona convention	Y	Y	Y	CM, CC	N	N
Convention on the Conversation of Migratory species of Wild Animals	Y	Y	Y	CC, CM, DC	N	N
Berne Convention	Y		Y	ALL	N	N

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CROATIA

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Table 1. Biological and conservation information about sea turtle Regional Management Units in Croatia.

RMU	CC-MED	Ref #	CM-MED	Ref #
Occurrence				
Nesting sites	N		N	
Pelagic foraging grounds	Y	1,2	N	
Benthic foraging grounds	Y	1, 2, 3, 4, 5	Y	15, 16
Key biological data				
Nests/yr: recent average (range of years)	n/a		n/a	
Nests/yr: recent order of magnitude	n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a		n/a	
Nests/yr at "major" sites: recent average (range of years)	n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	n/a		n/a	
Total length of nesting sites (km)	n/a		n/a	
Nesting females / yr	n/a		n/a	
Nests / female season (N)	n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	57.9% (N = 57)	6	n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a	
Min adult size, CCL or SCL (cm)	n/a		n/a	
Age at maturity (yrs)	n/a		n/a	
Clutch size (n eggs) (N)	n/a		n/a	
Emergence success (hatchlings/egg) (N)	n/a		n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a	

Trends				
Recent trends (last 20 yrs) at nesting sites (range of years)	N		N	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a	
Oldest documented abundance: nests/yr (range of years)	N		N	
Published studies				
Growth rates	N		N	
Genetics	Y	7	N	
Stocks defined by genetic markers	Y	7	N	
Remote tracking (satellite or other)	Y	8, 9	N	
Survival rates	N		N	
Population dynamics	N		N	
Foraging ecology (diet or isotopes)	Y	4, 5, 10	Y	16
Capture-Mark-Recapture	Y	11	N	
Threats				
Bycatch: presence of small scale / artisanal fisheries?	Y (SN, MT,PT)		Y (SN, MT,PT)	
Bycatch: presence of industrial fisheries?	Y (MT,PT)		Y (MT,PT)	
Bycatch: quantified?	Y	1, 4, 12	N	
Take. Intentional killing or exploitation of turtles	N		N	
Take. Egg poaching	N		N	
Coastal Development. Nesting habitat degradation	N		N	
Coastal Development. Photopollution	N		N	
Coastal Development. Boat strikes	n/a		n/a	

Egg predation	N		N	
Pollution (debris, chemical)	Y	13, 14	n/a	
Pathogens	n/a		n/a	
Climate change	n/a		n/a	
Foraging habitat degradation	n/a		n/a	
Other	n/a		n/a	
Long-term projects (>5yrs)				
Monitoring at nesting sites (period: range of years)	N		N	
Number of index nesting sites	n/a		n/a	
Monitoring at foraging sites (period: range of years)	n/a		n/a	
Conservation				
Protection under national law	Y		Y	
Number of protected nesting sites (habitat preservation) (% nests)	n/a		n/a	
Number of Marine Areas with mitigation of threats	0		0	
N of long-term conservation projects (period: range of years)	2 (1995/2012-ongoing)	T4.1 & T4.2/T4.3	2 (1995/2012-ongoing)	T4.1 & T4.2/T4.3
In-situ nest protection (eg cages)	N		N	
Hatcheries	N		N	
Head-starting	N		N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y		Y	
By-catch: onboard best practices	Y		Y	
By-catch: spatio-temporal closures/reduction	N		N	
Other	n/a		n/a	

Table 4. Projects and databases relevant to sea turtle Regional Management Units in Croatia.

#	RMU	Country	Region / Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/Private
T4.1	CC-MED CM-MED	Croatia	Northeastern Adriatic Sea	Adriatic Marine Turtle Program	Marine habitat use, GSM telemetry, movements, bycatch, gill nets, LED lights, in-water population density, conservation, education	1995	ongoing	Croatian Natural History Museum / University of Pula	Public
T4.2	CC-MED CM-MED	Croatia	Northeastern Adriatic Sea	NETCET-Network for the Conservation of Cetaceans and Sea Turtles in the Adriatic	Marine habitat use, satellite telemetry, movements, bycatch, aerial survey, critical habitats, conservation, education	2012	2015	Blue World Institute of Marine Research and Conservation	NGO
T4.3	CC-MED CM-MED	Slovenia	Northeastern Adriatic Sea	LIFE EUROTURTLES-Collective actions for improving the conservation status of the eu sea turtle populations	Marine habitat use, GSM telemetry, movements, bycatch, gill nets, LED lights, in-water population density, conservation, education	2016	ongoing	Croatian Natural History Museum	Public

Table 4. (cont.)

#	Collaboration with	Reports / Information material	Current Sponsors	Primary Contact (name and Email)	Other Contacts (name and Email)
T4.1	Blue World Institute of Marine Research and Conservation			Dr. Bojan Lazar (bojan.lazar@unipu.hr; bojan.lazar@hpm.hr)	Dr. Drasko Holcer (drasko.holcer@blue-world.org)
T4.2	Croatian Natural History Museum	www.netcet.eu	EU-CBC/IPA Adriatic Programme	Dr. Drasko Holcer (drasko.holcer@blue-world.org)	Dr. Peter Mackelworth (peter.mackelwort@blue-world.com)
T4.3	Blue World Institute of Marine Research and Conservation	https://www.euroturtles.eu/	EU LIFE Ionaian-Adriatic Programme	Dr. Drasko Holcer (drasko.holcer@hpm.hr)	Dr. Peter Mackelworth (peter.mackelwort@blue-world.com)

CYPRUS - REGION A

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General remarks

Two species of marine turtle are found nesting, foraging and over-wintering around the coast of northern Cyprus, these are the loggerhead turtle (*Caretta caretta*) and the green turtle (*Chelonia mydas*). Early assessments on the nesting of turtles in the northern part of Cyprus were performed in 1988 [1]. Early estimates calculated that the annual nesting population ranged between 25-50 *C. mydas* and 50-75 *C. caretta*. In 1990 a local NGO, The Society for the Protection of Turtles received official recognition and in conjunction with the Department of Environmental Protection, began a process of coordinating research and conservation activities in the northern part of Cyprus. Systematic monitoring began in 1992, numbering and cataloguing a total of 88 beaches which showed signs of turtle nesting activity [2, 3]. It is estimated that the northern part of Cyprus supports approximately 30% of green turtle nesting and 10% of loggerhead nesting of the entire Mediterranean [4]. Alagadi Beach, which hold significant nesting levels for both species (35°33'N, 33°47'E) is a site for intensive night-time monitoring where beach patrols are performed throughout the night at regular intervals so as to intercept all nesting female turtles. All nesting females are fitted with both flipper and PIT tags [5, 6, 80] allowing detailed individual information to be gathered on female reproductive strategies for over 20 years [7].

1. RMU: Loggerhead Turtle (*Caretta caretta*) Mediterranean

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

Over 80 beaches have been identified as supporting varying levels of loggerhead turtle nesting. The first extensive assessment of turtle nesting in northern Cyprus was performed by academics and students from Glasgow University [2, 8]. These nesting beaches can be found around the entire coastline; from Famagusta bay in the east to Morphou bay in the west (Fig. 1 a, c). Northern Cyprus supports approximately 555 nests/year from almost 50 nesting sites (both major and minor, see Table 2 for details). Eleven index sites have been monitored consistently over the past 27 years [3] and average 228.7 nests/yr (Table 2), accounting for >40% of all loggerhead nesting in northern Cyprus. A significant positive nesting trend has been experienced at these index sites over the past 27 years (r^2 = 0.4, p=0.0002, Fig. 2), with the most significant increase seen at those beaches on the west coast. In terms of total nests, the most important site for loggerhead turtles is Alagadi beach (58.4 nests/yr), three other index beaches (Monster, Tatlisu and West beaches total 119.1 nests/yr) form part of the other major nesting beaches. Interestingly, the three remaining beaches which make up the seven major nesting sites are all relatively new additions to our beach monitoring protocol (Monster north, Secret and Guzelyali beaches total 132.9 nests/yr, see Table 2 for details).

1.1.2. Marine areas

In comparison to nesting beaches, there is a great paucity in the information regarding the marine areas utilized by loggerhead turtles around the coast of the northern part of Cyprus, although preliminary information on the behaviour of inter-nesting females has been ascertained using time depth loggers [9], satellite transmitters and light-based geolocation loggers [10, 11]. Turtle strandings, fisher interviews and other anecdotal reports suggest that the northern part of Cyprus supports unquantified and potentially significant stocks of differing age classes [12–14]. Satellite tracking of post-nesting loggerhead turtles from the northern part of Cyprus has shown that they have a wide geographical distribution. Some individuals have remained along the coast of Cyprus, whereas others have travelled as far as Tunisia. The majority, however, have been shown as residing and utilizing the North African coast lines of Egypt, Libya and Tunisia [10, 11, 15, 16] (Fig 3).

1.2. Other biological data

Loggerhead turtles nesting at Alagadi beach range in curved carapace length from 63-87 cm (mean = 73.6 cm, SD = 4.6 cm, n = 159; 1992-2000), typically lay 1.9 clutches (SD = 1.2, n = 168; 1995-2000) of 73 eggs (SD = 16, range 28-144, n=229; 1993-2000) breeding every 2 years (IQ range = 2-3, range 1-6, n = 44; 1992-2000) [7]. Hatchling emergence success from 50 clutches at Alagadi beach ranged between 78-79% for the years 1997-98 [17], however, there is considerable temporal and inter and intra beach variability. Female emergence success is 30% across all beaches for the years 1993-2012 (see Table 1 for details). In any population study information on key demographic parameters are required. Under the current climate warming threats, hatchling sex ratios are an important feature in determining the likely threats from predicted future increased temperatures. Loggerhead turtle sex ratios are extremely biased at approximately 89% female (628 clutches) [18]. Unfortunately at this moment in time we do not have existing estimates of juvenile or adult sex ratios.

Annual mean growth rates of adult nesting females 0.36 cm/yr^{-1} CCL, n = 39 and 0.51 cm/ yr^{-1} CCW, n = 38. Growth rate estimates for males, juveniles and sub-adults does not currently exist [7]. A limited amount of published dietary and trophic information exists, with prey items primarily consisting of Molluscan and Crustacean species [12, 19].

As section 1.3-1.5 are not species-specific and to eliminate unnecessary repetition, these sections will cover both species *Caretta caretta* and *Chelonia mydas.*

1.3. Threats

1.3.1. Nesting sites

Coastal development

This issue has escalated in recent years with the drive to provide an increasing number of beach front tourist hotels, facilities and properties, with some nesting beaches on the north coast suffering as a result (Fig 4; beaches 69, 73-74). Lighting and night-time activities on nesting beaches has impacted both nesting females and emerging hatchlings at some sites. Infrastructural improvements, such as new road building schemes, have led to the destruction of one nesting beach (beach 75, constituting about 1% of the total loggerhead nesting) and some severe damage to other beaches and associated dune systems, which in turn has led to extensive localised terrestrial erosion (beach 77). Increasing popular use of ATV's, has also led to an increase in reports of vehicles driving on beaches. All the above related issues have led to an increase in disturbance levels and reduced nesting at some sites. These issues highlight the need for a continued presence and campaigning regarding the local issues affecting sea turtles.

Beach restructuring

There have been some localised attempts at beach restructuring. During the early 1990's the removal of large quantities of sand from Alagadi beach was a major issue. This has since been stopped, however, it does continue to happen on a very small scale at some other remote locations.

Non-human predation

This currently constitutes the single most important threat to marine turtle reproductive success in the northern part of Cyprus, with predation by feral dogs and foxes constituting as much as 38% of clutches laid in a single year along the entire coastline of the northern part of Cyprus for both species (mean 17.7%, range 8-38%). Since the mid 1990's this has been greatly reduced by through the extremely intensive nest screening program at all monitored sites. Loggerhead nests due to their inferior levels of nest camouflaging and shallower depths are more likely to be predated by dogs and foxes, however, there is a great amount of inter-annual variation between species, beaches and years. We have also recorded numerous invertebrates infesting loggerhead turtle clutches [20]. Whilst some species are known to attack viable eggs, the majority are likely to infest moribund eggs, thus not posing a major threat to clutch success at current levels [21]. Lower levels of infestation in green turtle clutches is likely to be a result of their greater depth. Ghost crab predation also occurs, however, this is not thought to be significant. Bird predation mainly happens after the integrity of nest has been destroyed by dogs or foxes. Occasionally, birds will take hatchlings that have emerged during daylight hours, again this is not thought to be significant.

Human exploitation

There are no reported recent incidences of the deliberate exploitation of turtle eggs, meat, carapace etc in the northern part of Cyprus. There is some historical evidence from archaeological sites, where turtle carapaces and bones have been discovered around Neolithic habitations, suggesting some low level exploitation [22].

Other threats

Predicted increases in global temperatures are likely to negatively impact an already extremely female biased hatchling sex ratio (c.90% female) which is currently thought to exist for both species breeding in the northern part of Cyprus [18, 23–28]. With only a 2˚C rise in mean nest temperature, almost complete feminisation will occur. In addition to this, higher incubation temperatures which exceed the thermal tolerance for embryonic development are likely to increase the level of embryo/hatchling mortality [27].

1.3.2. Marine areas

Due to the oceanic currents around Cyprus, the deposition of ocean-borne litter on the beaches of Cyprus has been a significant problem at some locations, this however, has been considerably improved in recent years with annual organised beach cleaning campaigns. Marine debris is thought to pose a significant threat to all life stages of sea turtles through entanglement and ingestion.

Incidental catch

Although all fishing is artisanal (no trawling is permitted) in the northern part of Cyprus, there is considerable incidental catch by artisanal fishermen [13, 14]. The fishing effort is relatively constant throughout the year; however, there appears to be a greater number of individuals caught during the summer months. It is estimated that there are approximately 215–300 active vessels using a combination of longlines and gill/trammel nets. It is estimated as many as a 1000 turtles may be caught annually by this fishery with an estimated mortality rate of 60% [14]. From the examination of carcasses there does not appear to be a species specific difference in the numbers effected [14]. From fisher surveys turtle bycatch is higher during the summer months, with most turtles captured in bottom set nets and occasionally on longlines [14].

Intentional killing and exploitation

There is limited evidence that killings are carried out by fishermen, who believe turtles damage their nets and eat or destroy their catch [13]. This we hope will have lessened since the introduction of fisher outreach activities.

Other threats

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

1.4. Conservation (both *Caretta caretta* and *Chelonia mydas* covered)

Protection status

Under local legislation it is illegal to disturb, harm, and capture loggerhead and green turtles. To date there are a total of five protected sites around the coast of the northern part of Cyprus, these have been designated Special Protected Areas by the local authorities. One of these, Alagadi Beach has the greatest number of loggerhead nests of any site. The other protected sites include Karpaz Peninsula (beaches 40-56), South Karpaz (beaches 30-39) Tatlisu (beaches 69-72) and Akdeniz (beaches 81-85). These areas contain the third and fifth most important green turtle nesting areas in the entire Mediterranean [29] along with all other major nesting beaches for green turtles.

Conservation priorities

There is an urgent requirement for the designation of more protected areas combined with greater enforcement of the current legislation. There is also the necessity for more financial and manpower resources to be allocated to conservation in general. Currently, there are moves afoot to propose more protected, however, this is dependent on the agreement of government ministers. Another urgent requirement is the need for a conclusive and cohesive coastal zone management plan, in order to conserve and protect constituent ecosystems. Research needs to include a thorough assessment of the local population found inhabiting the water around the northern part of Cyprus, together with an extensive survey and mapping of all major sea grass beds. Continued monitoring, awareness raising, and nest protection of all major nesting areas is essential in maintaining and continuing the current positive trends being seen in both nesting populations.

Institutions and organizations involved in conservation, management, and research

Governmental

Currently in the northern part of Cyprus there is a Nature Protection Section within the Department of Environment, under the control of the Ministry for Natural Resources and Environment. This Nature Protection Section is severely undermanned and underfunded. However, during the past 25 years they have been actively involved with turtle conservation and education. In recent years staff have made regular school visits to give information about turtles and nature in general. For approximately the past 17 years they carried out turtle conservation work in the Karpaz region.

Non-Governmental

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

1.5. Research

Knowledge gaps

As with many turtle conservation projects, detailed knowledge of the at sea distribution, behaviour, population size and demographic profile of the resident turtle populations is lacking or at best poorly understood. Additionally, precise knowledge of key life history parameters such as Growth rates, Age at Sexual Maturity (ASM) and Size at Sexual Maturity (SSM) are required in order to provide more accurate population models. A thorough assessment on the effects of marine pollution (heavy metal, plastics, marine debris, etc.) on all life stages of sea turtles.

Existing but unpublished data that should be urgently published

Currently, much data exists on, individual female fecundity, the effects of marine plastics, post maturation growth rates which may provide answers to some of the questions highlighted under *Knowledge gaps*.

2. RMU: Green turtle (*Chelonia mydas*) Mediterranean

2.1. Distribution, abundance, trends

The green turtle (*Chelonia mydas*) is globally endangered and until recently green turtles in the Mediterranean Sea were considered a relatively discrete population from those of the wider Atlantic Ocean [30]. However, currently this is not the case and the critically endangered status has been reduced to endangered in line with the wider Atlantic population. Hopefully with the publication of ongoing genetic research using higher resolution molecular markers a more accurate population assessment of genetic relatedness can be made. Within the Mediterranean the green turtle is principally found in the eastern basin with Cyprus continuing to be a significant breeding location for the Mediterranean population. Many of the nesting beaches in recent years showing significant increases in nest numbers [3, 31]. Also, encouragingly this increased level of nesting is strongly correlated with the proportion new breeders in the nesting cohort and is hopefully a sign of a population in recovery [31].

2.1.1. Nesting sites

The nesting of green turtles has been recorded around the coast of the northern part of Cyprus, but at fewer sites than loggerhead turtles (Fig. 6). The six major nesting sites are found in the following areas: North Karpaz (beaches 51-56), Alagadi (76-77), South Karpaz (39, 45-46) and the West Coast (83-84) (see Table 2). The major sites constitute 71% of all recorded nesting for this species along the coast of the northern part of Cyprus. Eleven index sites have been monitored consistently over the past 27 years [3] and average 168.8 nests/yr, accounting for 33% of all green turtle nesting in northern Cyprus. A significant positive nesting trend has been experienced at these index sites over the past 27 years ($r^2 = 0.3$, $p = 0.0035$,) although the major increase in nest numbers has occurred after 2010 [31] (see Fig. 5).

2.1.2. Marine areas

There is a paucity of detailed information regarding the marine areas utilised by green turtles around the coast of the northern part of Cyprus. However, extensive sea grass beds exist around the coastline, which would provide suitable foraging sites. Information garnered from turtle strandings, fisher interviews and other anecdotal reports suggest that the northern part of Cyprus supports unquantified stocks of differing age classes [13, 32]. Preliminary information on the behaviour of inter-nesting females has been ascertained using time depth loggers [33–35], satellite transmitters and light-based geolocation loggers [10, 36, 37].

From satellite tracking and recent stable isotope studies, adult female green turtles which nest on the coast of the northern part of Cyprus have elucidated key migratory corridors, over-wintering/foraging grounds in Egypt, Libya and Turkey [15, 36, 38, 39] (Fig. 6). There is, however, little knowledge on the population numbers and structure for green turtles around the coast of the northern part of Cyprus. Observations have been made of mating green turtles off the coast, and on a few very rare occasions females were observed on the nesting beach with males still attached [40, 41]. The opportunistic satellite tracking of one of these male turtles showed it visiting several different green turtle rookeries in Cyprus and Turkey [40].

2.2. Other biological data

As in most other green turtle populations world-wide, there is large inter-annual variation in the number of clutches laid in Cyprus, thought to be related to the low trophic status of this species [42]. At Alagadi Beach, individual females typically lay fewer clutches in poor breeding years [7]. Green turtles nesting at Alagadi beach ranged in CCL from 77-106 cm (mean = 91.54, SD = 6.3 cm, n = 92; 1992-2000) laying on average three clutches (SD = 1.4, n = 97; 1995-2000) of 115 eggs (SD = 27, range 51-199, n = 277; 1993-2000) every three years (IQ = 2-3, range 2-6, n = 46; 1992-2000; [7]). Reproductive adult sex ratios have been estimated at 1: 1.4 (female:male) in paternity genetic studies [40], with hatchling sex ratios being extremely female biased (c. 90%) [27].

2.3. Threats

(See previous section 1.3, as species specific threats are the same or difficult to separate).

2.4. Conservation

(See previous section 1.4, as species conservation measures are the same or difficult to separate).

2.5. Research

(See previous section 1.5, as species specific threats are the same or difficult to separate).

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Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Cyprus – Region A.

TOPIC	RMU			
	CC-MED	**Ref #**	**CM-MED**	**Ref #**
Occurrence				
Nesting sites	Y	[2, 3]	Y	[2, 3, 37]
Pelagic foraging grounds	n/a		n/a	
Benthic foraging grounds	Y	[16]	Y	[37]
Key biological data				
Nests/yr: recent average (range of years)	555.8 (5-27 yrs)	PS	512.4 (5-27 yrs)	PS
Nests/yr: recent order of magnitude	500-1000	PS	500-1000	PS
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	7	PS	6	PS
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	47	PS	42	PS
Nests/yr at "major" sites: recent average (range of years)	310.5	PS	361.5	PS
Nests/yr at "minor" sites: recent average (range of years)	245.4	PS	150.9	PS
Total length of nesting sites (km)	44.6	[2]	42	[2]

Nesting females / yr	293	PS	170	PS
Nests / female season (N)	1.9	[4, 7]	3	[4, 7]
Female remigration interval (yrs) (N)	2	[7]	3	[7]
Sex ratio: Hatchlings (F / Tot) (N)	0.89 (628 clutches)	[18]	0.90 (67 clutches)	[27]
Sex ratio: Immatures (F / Tot) (N)	na		na	
Sex ratio: Adults (F / Tot) (N)	na		1:1.4 (20F:28M)	[40]
Min adult size, CCL or SCL (cm)	63 (CCL)	[7]	77 (CCL)	[7]
Age at maturity (yrs)	na		na	
Clutch size (n eggs) (N)	73 (229)	[7]	115 (277)	[7]
Emergence success (hatchlings/egg) (N)	78.2-79.2% (50)	[17]	70.2-73.8% (38)	[17]
Nesting success (Nests/ Tot emergence tracks) (N)	30% (5650/18806)	PS	29.2	PS
Trends				
Recent trends (last 20 yrs) at nesting sites (range of years)	Positive	PS	Positive	PS, [31]

Recent trends (last 20 yrs) at foraging grounds (range of years)	na		na	
Oldest documented abundance: nests/yr (range of years)	519 (1994)	[8]	461 (1994)	[8]
Published studies				
Growth rates	Y	[7]	Y	[7]
Genetics	Y	[43, 44]	Y	[28, 40, 45, 73-4]
Stocks defined by genetic markers	Y	[43, 44]	N	[73-74]
Remote tracking (satellite or other)	Y	[10, 11, 15],[16]	Y	[10], [15], [36, 38]
Survival rates	Y	77	Y	77
Population dynamics	Y	[27]	Y	[27, 31]
Foraging ecology (diet or isotopes)	Y	[12, 19]	Y	[19, 38]
Capture-Mark-Recapture	Y	[5]	Y	[5]
Threats				
Bycatch: presence of small scale / artisanal fisheries?	Y	[13, 16, 17, 32]	Y	[13, 17, 32]

Bycatch: presence of industrial fisheries?	na		na	
Bycatch: quantified?	Y	[13, 16, 17, 32]	Y	[13, 17, 32]
Take. Intentional killing or exploitation of turtles	N		N	
Take. Egg poaching	N		N	
Coastal Development. Nesting habitat degradation	Y	[3]	Y	[3]
Coastal Development. Photopollution	Y	[3]	Y	[3]
Coastal Development. Boat strikes	Y	[3]	Y	[3]
Egg predation	Y	[3, 46]	Y	[3, 21]
Pollution (debris, chemical)	Y	[3, 75]	Y	[3, 75]
Pathogens	N		N	
Climate change	Y	[18]	Y	[40]
Foraging habitat degradation	N		N	
Other	N		N	
Long-term projects (>5yrs)				

Monitoring at nesting sites (period: range of years)	1993-2019	PS	1993-2019	PS
Number of index nesting sites	11	PS	11	PS
Monitoring at foraging sites (period: range of years)	na		na	
Conservation				
Protection under national law	Y	PS	Y	PS
Number of protected nesting sites (habitat preservation) (% nests)	40 (c.75%)	PS	40 (c.90%)	PS
Number of Marine Areas with mitigation of threats	1	47-71	1	47-71
N of long-term conservation projects (period: range of years)	1 (1992 to date)	47-71	1 (1992 to date)	47-71
In-situ nest protection (eg cages)	Y		Y	
Hatcheries	N		N	
Head-starting	N		N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	N		N	
By-catch: onboard best practices	N		N	

By-catch: spatio-temporal closures/reduction	N		N	
Other	N		N	

Table 2: Main nesting beaches of sea turtle Regional Management Units (RMU) occurring in Cyprus – Region A

RMU / Nesting beach name (number)	Index site	Nests/yr: recent average (range of years)	Central point Long (+)/Lat (+)		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
CC -MED									
Alagadi (76-77)	Y	58.4 (1993-2019)	33.486	35.333	1.70	100	47-72, 76, 78-79	1	B
Monster North (new)		43.3 (2013-2019)	32.939	35.289	2.10	100	47-72, 76, 78-79	1	B
Monster (85)	Y	47.8 (1995-2019)	32.938	35.279	3.00	100	47-72, 76, 78-79	1	B
Guzelyali (new)		47.5 (2008-2019)	33.090	35.353	0.90	100	47-72, 76, 78-79	1	B
Tatlisu (71)	Y	37.4 (1993-2019)	33.835	35.412	0.26	100	47-72, 76, 78-79	1	B
Secret (new)		42.1 (2013-2019)	32.940	35.306	0.35	100	47-72, 76, 78-79	1	B
West 1 & 2 (83-84)	Y	33.9 (1993-2019)	32.936	35.333	2.17	100	47-72, 76, 78-79	1	B
Ronnas (52-56)		11.8 (1993-95, 98-99, 08, 2017-19)	34.333	35.600	2.41	100	47-72, 76, 78-79	1	B
Bogaz Military (9)		15.0 (1993-99, 2001-2007)	33.972	35.324	0.96	100	47-72, 76, 78-79	1	B

Golden Beach 1 & 2 (45-46)		13.4 (1993-95, 98-99, 2008, 2017-19)	34.536	35.639	4.09	100	47-72, 76, 78-79	1	B
Kaplica (69)	Y	13.0 (1993-2019)	33.899	35.425	0.79	100	47-72, 76, 78-79	1	B
753 Meter beach (16)		11.9 (1993-1999, 2019)	34.176	35.444	0.75	100	47-72, 76, 78-79	1	B
Kantara (70)	Y	13.0 (1993-2019)	33.863	35.416	0.13	100	47-72, 76, 78-79	1	B
Big Beach (24)		11.1 (1993-1999, 2018-19)	34.241	35.467	2.11	100	47-72, 76, 78-79	1	B
Cyprus Gdns (6)		11.8 (1993-99, 2001-2007)	33.920	35.274	1.69	100	47-72, 76, 78-79	1	B
Esentepe 1 & 2 (73-74)	Y	11.5 (1993-2019)	33.595	35.353	0.53	100	47-72, 76, 78-79	1	B
Message in a Bottle (82a)	Y	10.2 (1993-2019)	32.923	35.367	0.80	100	47-72, 76, 78-79	1	B
Istanbul (5)		7.6 (1993-99, 2001-2007)	33.913	35.262	1.19	100	47-72, 76, 78-79	1	B
Long Beach II (4)		7.3 (1993-99, 2001-2007)	33.904	35.252	2.21	100	47-72, 76, 78-79	1	B
Second Last (28)		6.4 (1993-99)	34.282	35.480	0.74	100	47-72, 76, 78-79	1	B
Aydins (59)		5.0 (1993-96, 1999, 2018-19)	34.201	35.556	0.59	100	47-72, 76, 78-79	1	B
Very Big Beach (25)		5.4 (1993-99, 2018-19)	34.257	35.473	2.50	100	47-72, 76, 78-79	1	B
Bafra (11)		5.5 (1993-99, 2002-2007)	34.078	35.364	2.12	100	47-72, 76, 78-79	1	B
First Beach (13)		4.6 (1993-99, 2018-19)	34.147	35.424	0.25	100	47-72, 76, 78-79	1	B
New Beach West (62)		5.3 (1993-99)	34.171	35.548	0.41	100	47-72, 76, 78-79	1	B

Doune (50)		4.4 (1993-95, 1998-99, 2017-19)	34.409	35.636	0.29	100	47-72, 76, 78-79	1	B
Greenfields II (30)		4.6 (1993-99, 2017-19)	34.341	35.524	0.35	100	47-72, 76, 78-79	1	B
Dolphin (38)		4.8 (1993-99, 2008, 2017-19)	34.387	35.548	0.82	100	47-72, 76, 78-79	1	B
Smalls (new)		4.6 (2013-2019)	33.794	35.412	0.10	100	47-72, 76, 78-79	1	B
Ruined Village (51)		4.0 (1993-95,1998-99, 2008, 2017-19)	34.221	35.375	0.83	100	47-72, 76, 78-79	1	B
Lost (82b)	Y	4.9 (1993-2019)	32.923	35.358	0.15	100	47-72, 76, 78-79	1	B
Dipkarpaz Sth (39)		4.0 (1993-99, 2017-19)	34.421	35.643	0.40	100	47-72, 76, 78-79	1	B
Balalan (new)		3.3 (2013-2019)	34.398	35.555	0.10	100	47-72, 76, 78-79	1	B
Bumpy (21)		3.7 (1993-99)	34.189	35.446	0.32	100	47-72, 76, 78-79	1	B
Greenfields I (31)		2.4(1993-99, 2017-19)	34.345	35.526	0.60	100	47-72, 76, 78-79	1	B
One Goat (48)		2.0 (1993-95, 1998-99, 2017-19)	34.421	35.643	0.46	100	47-72, 76, 78-79	1	B
Malibu (58)		2.9 (1993-99)	34.216	35.555	0.30	100	47-72, 76, 78-79	1	B
Yeni Erenkoy Bel Plaj (60)		2.9 (1993-99)	34.194	35.556	0.72	100	47-72, 76, 78-79	1	B
Thyme (49)		3.5 (1993-95, 1998-99, 2017-19)	34.413	35.639	0.31	100	47-72, 76, 78-79	1	B
Small Harbour (29)		2.4 (1993-95, 1998-99)	34.295	35.488	0.16	100	47-72, 76, 78-79	1	B
Military (75)	Y	1.6 (1993-2019)	33.580	35.350	0.93	100	47-72, 76, 78-79	1	B

Tatlisu Belediya (72)	Y	1.7 (1993-2019)	33.820	35.412	0.16	100	47-72, 76, 78-79	1	B	
Melons 2 (34)		1.9 (1993-99, 2017-19)	34.364	35.537	0.49	100	47-72, 76, 78-79	1	B	
Wolf 1 (33)		1.5 (1993-99, 2017-19)	34.358	35.535	0.30	100	47-72, 76, 78-79	1	B	
Wolf 2 (32)		1.2 (1993-99, 2017-19)	34.356	35.534	0.24	100	47-72, 76, 78-79	1	B	
Melons 1 (35)		1.5 (1993-99, 2017-19)	34.368	35.539	0.25	100	47-72, 76, 78-79	1	B	
Cove 4 (20)		0.5 (1993-95, 97, 99, 2019)	34.183	35.444	0.06	100	47-72, 76, 78-79	1	B	
Cove 3 (19)		0.3 (1993-95, 97, 99, 2019)	34.183	35.444	0.06	100	47-72, 76, 78-79	1	B	
Cove 1 (17)		0.2 (1993-95, 97, 99, 2019)	34.183	35.444	0.21	100	47-72, 76, 78-79	1	B	
CM-MED										
Ronnas (52-56)		137.9 (1993-95, 98-99, 2008, 2017-19)	34.333	35.600	2.41	100	47-72, 76, 78-79	1	B	
Alagadi (76-77)	Y	99.0 (1993-2019)	33.486	35.333	1.70	100	47-72, 76, 78-79	1	B	
Ruined Village (51)		51.8 (1993-95, 98-99, 2008, 2017-19)	34.221	35.375	0.83	100	47-72, 76, 78-79	1	B	
Golden Beach 1 & 2 (45-46)		25.5 (1993-95, 98-99, 2008, 2017-19)	34.536	35.639	4.09	100	47-72, 76, 78-79	1	B	
West 1 & 2 (83-84)	Y	22.3 (1993-2019)	32.936	35.333	2.17	100	47-72, 76, 78-79	1	B	
Message in a Bottle (82a)	Y	15.3 (1993-2019)	32.923	35.367	0.80	100	47-72, 76, 78-79	1	B	
Lost (82b)	Y	14.6 (1993-2019)	32.923	35.358	0.15	100	47-72, 76, 78-79	1	B	

Dolphin (38)		18.6 (1993-99, 2008, 2017-19)	34.387	35.548	0.82	100	47-72, 76, 78-79	1	B
Dipkarpaz Sth (39)		24.9 (1993-99, 2008, 2017-19)	34.421	35.643	0.40	100	47-72, 76, 78-79	1	B
Esentepe 1 & 2 (73-74)	Y	10.6 (1993-2019)	33.595	35.353	0.53	100	47-72, 76, 78-79	1	B
Secret (new)		7.1 (2013-2019)	32.940	35.306	0.35	100	47-72, 76, 78-79	1	B
Guzelyali (new)		0.9 (2008-2019)	33.090	35.353	0.90	100	47-72, 76, 78-79	1	B
Monster North (new)		6.7 (2013-2019)	32.939	35.289	2.10	100	47-72, 76, 78-79	1	B
Melons 1 (35)		9.2 (1993-99, 2017-19)	34.368	35.539	0.25	100	47-72, 76, 78-79	1	B
Aydins (59)		5.3 (1993-96, 1999, 2018-19)	34.201	35.556	0.59	100	47-72, 76, 78-79	1	B
Melons 2 (34)		9.5 (1993-99, 2017-19)	34.364	35.537	0.49	100	47-72, 76, 78-79	1	B
Doune (50)		6.1 (1993-95, 1998-99, 2017-19)	34.409	35.636	0.29	100	47-72, 76, 78-79	1	B
Thyme (49)		7.3 (1993-95, 1998-99, 2017-19)	34.413	35.639	0.31	100	47-72, 76, 78-79	1	B
One Goat (48)		3.0 (1993-95, 1998-99, 2017-19)	34.421	35.643	0.46	100	47-72, 76, 78-79	1	B
Monster (85)	Y	3.8 (1993-2019)	32.938	35.279	3.00	100	47-72, 76, 78-79	1	B
New Beach West (62)		3.3 (1993-99)	34.171	35.548	0.41	100	47-72, 76, 78-79	1	B
Wolf 2 (32)		6.6 (1993-99, 2017-19)	34.356	35.534	0.24	100	47-72, 76, 78-79	1	B
Wolf 1 (33)		5.5 (1993-99, 2017-19)	34.358	35.535	0.30	100	47-72, 76, 78-79	1	B

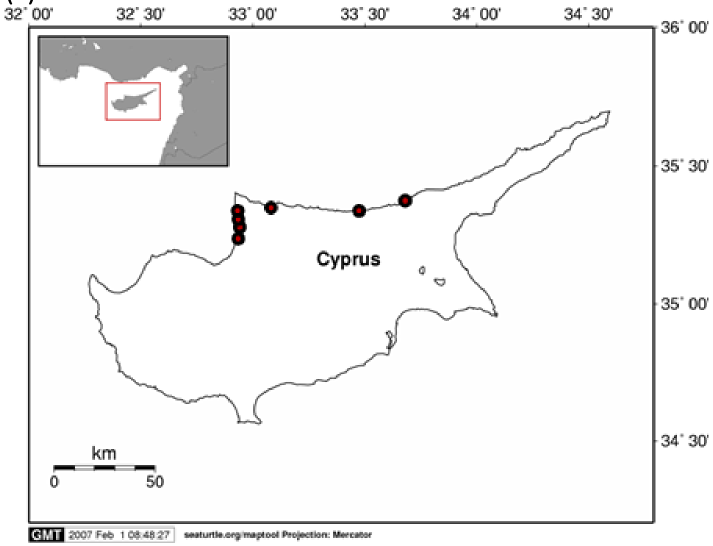
Balalan (new)		1.1 (2013-2019)	34.398	35.555	0.10	100	47-72, 76, 78-79	1	B
Military (75)	Y	1.2 (1993-2019)	33.580	35.350	0.93	100	47-72, 76, 78-79	1	B
Big Beach (24)		1.8 (1993-99, 2018-19)	34.241	35.467	2.11	100	47-72, 76, 78-79	1	B
First Beach (13)		1.3 (1993-99, 2018-19)	34.147	35.424	0.25	100	47-72, 76, 78-79	1	B
Kaplica (69)	Y	1.3 (1993-2019)	33.899	35.425	0.79	100	47-72, 76, 78-79	1	B
Tatlisu (71)	Y	1.5 (1993-2019)	33.835	35.412	0.26	100	47-72, 76, 78-79	1	B
Small Harbour (29)		1.2 (1993-95, 1998-99)	34.295	35.488	0.16	100	47-72, 76, 78-79	1	B
753 Meter beach (16)		0.9 (1993-99, 2019)	34.176	35.444	0.75	100	47-72, 76, 78-79	1	B
Greenfields I (31)		0.9 (1993-99, 2017-19)	34.345	35.526	0.60	100	47-72, 76, 78-79	1	B
Yeni Erenkoy Bel Plaj (60)		0.9 (1993-99)	34.194	35.556	0.72	100	47-72, 76, 78-79	1	B
Bumpy (21)		0.6 (1993-99)	34.189	35.446	0.32	100	47-72, 76, 78-79	1	B
Greenfields II (30)		0.3 (1993-99, 2017-19)	34.341	35.524	0.35	100	47-72, 76, 78-79	1	B
Cove 4 (20)		0.3 (1993-95, 97, 99, 2019)	34.183	35.444	0.06	100	47-72, 76, 78-79	1	B
Bogaz Military (9)		0.3 (1993-99, 2001-2007)	33.972	35.324	0.96	100	47-72, 76, 78-79	1	B
Second Last (28)		0.3 (1993-99)	34.282	35.480	0.74	100	47-72, 76, 78-79	1	B
Bafra (11)		0.2 (1993-99, 2002-2007)	34.078	35.364	2.12	100	47-72, 76, 78-79	1	B

Cyprus Gdns (6)		0.2 (1993-99, 2001-2007)	33.920	35.274	1.69	100	47-72, 76, 78-79	1	B
Malibu (58)		0.1 (1993-99)	34.216	35.555	0.30	100	47-72, 76, 78-79	1	B
Very Big Beach (25)		0.2 (1993-99, 2018-19)	34.257	35.473	2.50	100	47-72, 76, 78-79	1	B
Kantara (70)	Y	0.2 (1993-2019)	33.863	35.416	0.13	100	47-72, 76, 78-79	1	B
Istanbul (5)		0.1 (1993-99, 2001-2007)	33.913	35.262	1.19	100	47-72, 76, 78-79	1	B
Cove 1 (17)		0.0 (1993-95, 97, 99, 2019)	34.183	35.444	0.06	100	47-72, 76, 78-79	1	B
Cove 3 (19)		0.0 (1993-95, 97, 99, 2019)	34.183	35.444	0.21	100	47-72, 76, 78-79	1	B
Long Beach II (4)		0.0 (1993-99, 2001-2007)	33.904	35.252	2.21	100	47-72, 76, 78-79	1	B
Smalls (new)		0.0 (2013-2017, 2018-19)	33.794	35.412	0.10	100	47-72, 76, 78-79	1	B
Tatlisu Belediya (72)	Y	0 (1993-2019)	33.820	35.412	0.16	100	47-72, 76, 78-79	1	B

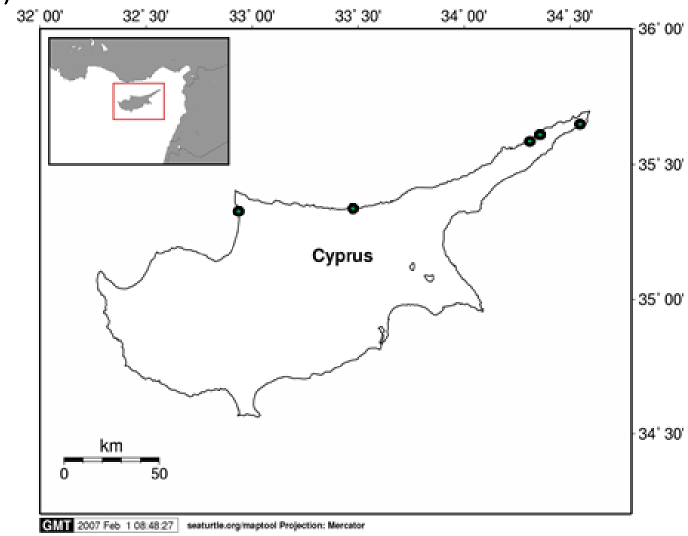
Table 3: Sea turtle conservation projects in Cyprus – Region A

RMU	Country	Region / Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/Private	Collaboration with	Reports / Information	Current	Primary Contact (name and Email)	Other Contacts	Database	REF
CM-MED & CC-MED	Cyprus	Mediterranean	Marine Turtle Conservation Project	Caretta caretta, Chelonia mydas, Nestings, Conservation	1992	continuing	Exeter University, UK	Public	Society for the Protection of Turtles	See Refs	NA	Prof. Annette Broderick (A.C.Broderick@Exeter.ac.uk)	Assoc Prof Dr Wayne J Fuller	no	47-76, 78-79

(a)



(b)



(c)

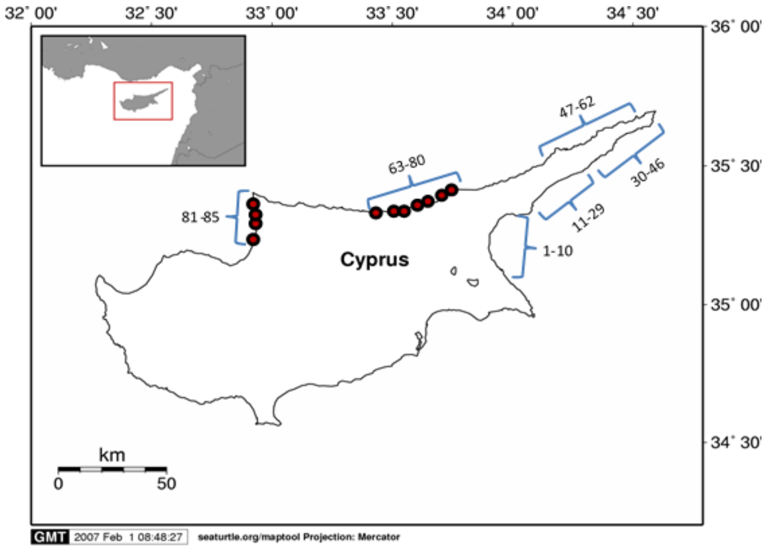


Figure 1. Map of loggerhead turtle (a) and green turtle (b) major nesting areas, together with minor nesting locations for both species and beach numbering as per Godley & Broderick 1992, together with eleven index beaches (c).

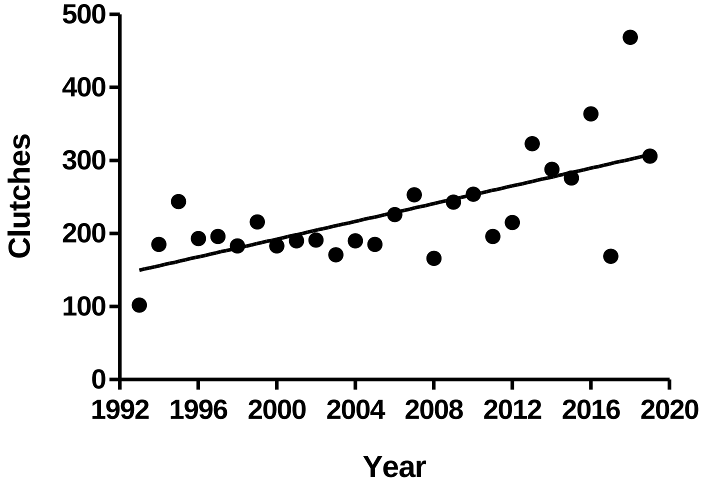


Figure 2. Loggerhead turtle nesting abundance (1993-2019) and positive linear trend (solid line) at eleven index sites in northern Cyprus.

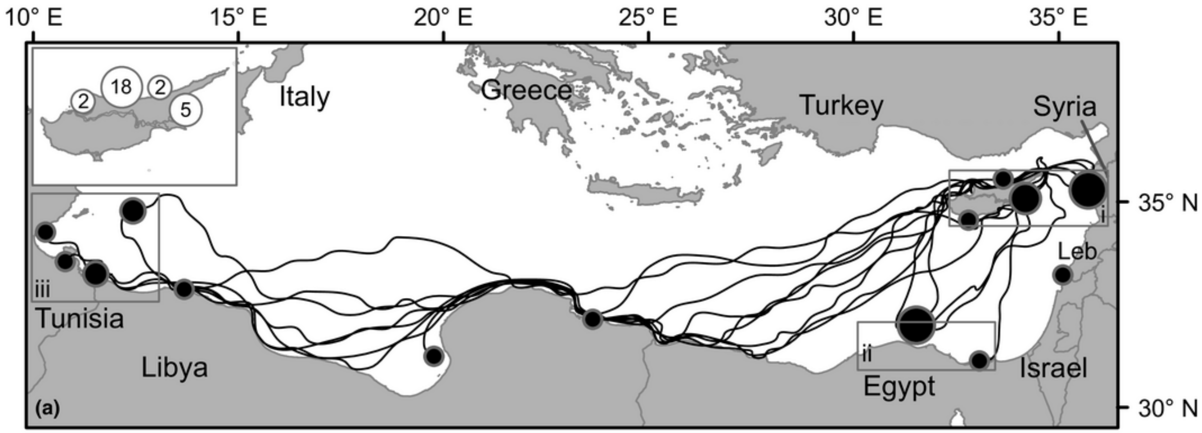


Figure 3. Loggerhead turtle migration routes (n=24) and final locations of residence by turtles that made post-nesting migrations directly from North Cyprus (see insert box for deployment sites. Map taken from Snape et al 2016). Black circles are scaled to the number of individuals residing in each area (1–4).

Figure 4. Beachside developments and activities impacting turtle nesting beaches.

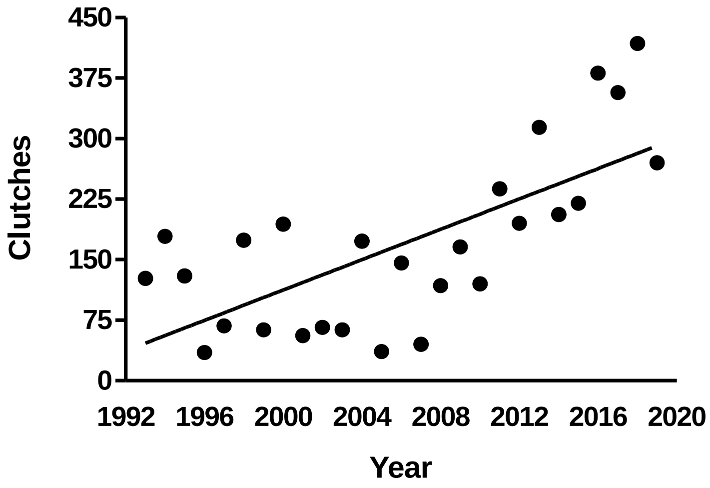


Figure 5. Green turtle nesting abundance (1993-2019) and positive linear trend (solid line) at eleven index sites in northern Cyprus.

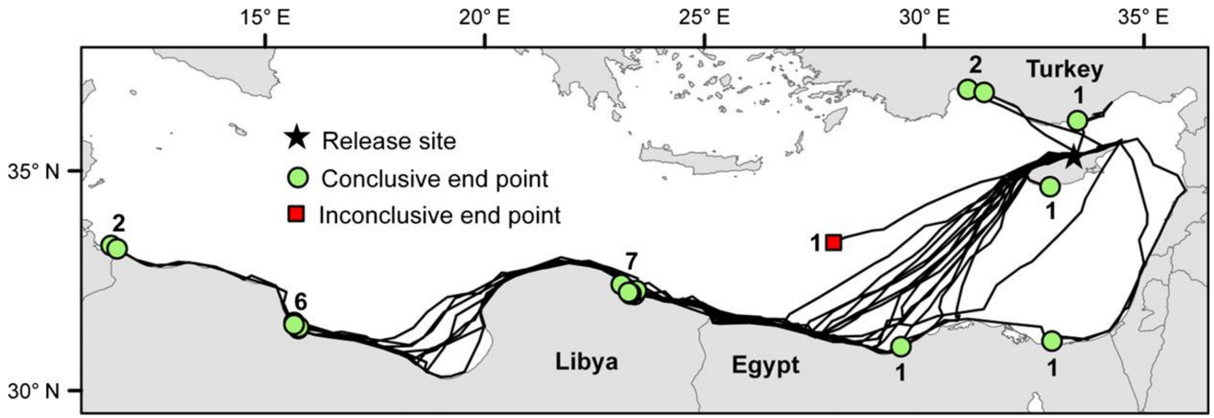


Figure 6. Green turtle migration routes and final locations of residence (n=21) of female turtles satellite tagged and tracked from Alagadi beach northern Cyprus. Numbers at final destinations indicate the number of individuals who have been tracked to that specific location (Map taken from Stokes et al 2015).

CYPRUS - REGION B

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General remarks

The first turtle nesting surveys in Cyprus were undertaken in 1976 and 1977. Actual conservation activities started in 1978, with the setting up of the Lara Turtle Station on the west coast of the island (Fig. 1). Conservation activities continued without interruption since then (Demetropoulos, 1976-1989; Hadjichristophorou and Demetropoulos 1990-2007), Demetropoulos and Hadjichristophorou, 2010, Demetropoulos et al 2015. The Cyprus Turtle Conservation Project which was set up in 1978 is a government project and is implemented by the Department of Fisheries and Marine Research (DFMR). The Cyprus Wildlife Society (CWS) has been helping the DFMR with the project since 1989 and has been implementing it on behalf of the DFMR since 2010. This project covers all the beaches in the part of the island that is under government control (Demetropoulos and Hadjichristophorou, 2004). About 80% of all loggerhead nesting and more than 90% of all Green turtle nesting takes place in two protected area one on the West Coast and one in Chrysochou Bay.

1. RMU: Loggerhead Turtle (Caretta caretta) Mediterranean

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

There are two main nesting areas for turtles (Fig. 1). The surf swept beaches on the West Coast of the island and the more sheltered beaches in Chrysochou Bay, which is the main nesting area for loggerhead turtles. There is also regular, significant nesting of loggerheads in a 3-4 other beaches and scattered or occasional nesting on most other beaches.

West Coast. There are five main nesting beaches on the west coast, with Green and Loggerhead nesting on the same beaches. These are in the Lara/Toxeftra Turtle Reserve (Fig. 2), which covers 10 km of coastline as well as the adjacent sea. The total beach length in this area is about 3.5km. There is also some nesting on other beaches on the west coast outside the Reserve, at Helios beach and in the Coral Bay beaches. All beaches are monitored and all the nests are protected, inside and outside the reserve.

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

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

It was estimated that up to 2006 the loggerhead population was about 300 females. The present situation (2010-2015) is being reassessed and it is deemed to be about 900 females (see also 2.2).

1.1.2. Marine areas

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

The information available is insufficient for reliable conclusions to be drawn on any key migratory paths, from this Region, in the context of the RAC/SPA (UNEP/MAP) Action Plan for the conservation of Mediterranean marine turtles (RAC/SPA (UNEP/MAP), 2007). But see also 3.1.2.

Past distribution and abundance

In the Lara/Toxeftra Reserve, on the There is little information on past distribution and numbers of loggerhead turtles before the last 40 years (Fig. 3). Some nesting beaches have since been lost to urbanisation, recreation and tourism. Apart from this, the only major change that has been noted in the last 40 years has been the substantial increase in the number of nests noted since 2006 in Chrysochou Bay and since 2005 on the West Coast (see Chapter 6). However what was the loggerhead population nesting on the island three generations back, can only be the subject of conjuncture, as this would date back to the beginning of the 20th century and there are only a few sources of data to quantify this.

Old fishermen and the toponomy of one area, Chelones, on the north-east coast of the island, provide indications that turtles were more frequent in the past. The small size turtles of the present generation nesting in Cyprus, compared for example with those nesting in Greece, (Margaritoulis et al) are also signs of a heavily exploited population, which can safely be assumed to have been larger than what it is today.

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

1.2. Other biological data

Please see Table 1.

1.3. Threats

1.3.1. Nesting sites

<u>Coastal development</u>

Coastal development and constructions and the associated photo-pollution are the main problems in Chrysochou Bay, together with the related human presence and disturbance on the beaches. With the declaration of a large part of this bay into a Natura 2000 site and the pending management measures, these threats are hoped to be at least largely mitigated. Driving on the beaches is also a significant threat in this area especially on a couple of beaches. Mechanical beach cleaning has so far been a minor and local problem on a couple of beaches in Chrysochou Bay.

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

In the Lara/Toxeftra Reserve on the west coast, there has been no coastal development and photopollution is very limited. Human presence on the beaches at night is strictly controlled as is driving on the beaches, though some problems still exist with driving, albeit on a reduced scale, on two of the beaches. There is no mechanical beach cleaning in the Lara/Toxeftra Reserve area. On two beaches on the West Coast, outside the Reserve, in the Coral Bay area, tourism had reached such levels that all nests (about 10-20) had to be relocated every year to the Reserve area, to a “hatchery” on the beach.

<u>Beach restructuring</u>

Sand extraction from some beaches in Chrysochou Bay (Fig. 4), mainly in the late 1970s and early 1980s, has caused problems of beach erosion. This has also caused problems on a couple of beaches on the west coast. Sand extraction from beaches has since then been very strictly controlled, though the impact of massive sand extraction has left its impact on some beaches. There are no problems with beach armouring, nourishment or sand extraction on the West Coast nesting beaches. Potima beach on the west coast has however been impacted by past sand extraction and part of it has been armoured to protect the coastal road behind it. One other beach in the Reserve area (Toxeftra) has also been impacted by past, illegal, sand extraction dating back to the 1990’s.

<u>Non-human predation</u>

Fox predation was the major problem and, before the protection of nests with cages, predation reached 80% on some beaches. Now all nests are protected against foxes with cages and predation is limited to about 10%, depending on the beach. Ghost crabs are also a minor predator on a small number of beaches.

<u>Human exploitation</u>

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

Other threats

Erosion was largely caused by sand extraction which has now stopped. Beaches are now reaching new equilibriums, though no doubt there are residual effects. The damming of rivers may pose problems of supply of material for beaches in the years to come. This may act synergistically with sea level rise in impacting beaches. Tourism pressure for sandy beaches has also led to the construction of breakwaters in many areas around the island irrespective of any erosion issues. There is pressure now for the construction of such breakwaters off some beaches in Chrysochou Bay. Some new breakwaters started being constructed 2-3 years ago in this bay, just west of Polis town, at the western end of the NATURA 2000 Polis-Gialia site, which was set up for turtle conservation purposes. More are planned for the same area.

The real effect of debris on the nesting beaches is minimal and is mainly limited to wood and some large objects washed up on the beaches by the prevailing westerly winds. Manual beach clean ups of nesting beaches, mainly in the turtle reserve area on the west coast, are carried out in the nesting season. The west coast is the area getting much but not all of its debris from the open sea due to the prevailing westerly winds. The Chrysochou Bay beaches are impacted more by what beach users leave behind and by what the small boat users in the bay are jettisoning.

1.3.2. Marine areas

Incidental catch

The main problems are associated with bottom set nets (trammel nets). Mortality from incidental catches in such nets is estimated from strandings, which are mainly in Chrysochou Bay, where much fishing with small boats takes place in summer but also and to a lesser degree, off the West Coast. Significant strandings are also taking place east of Limassol. Strandings of loggerheads are mainly of adults and both male and female turtles are washed up in more or less equal numbers. About 15-20 loggerhead turtles per year are usually washed up on the West Coast and in Chrysochou Bay and a similar number are washed up on the coast of the island east Limassol.

The increases in the population of this turtle in the waters of the island in recent years, has inevitably resulted in more turtles being caught in fishing nets. More intensive monitoring in recent years has also probably added to these numbers. Long-lining for swordfish, a potential threat, has practically stopped in Cyprus due to a significant drop in catches, stemming no doubt from overexploitation of resources (not all due to the local fishery). Some tuna long lining is now taking place seasonally, mainly in May/June and may be having an impact also.

Intentional killing and exploitation

On the West Coast and in Chrysochou Bay deliberate killing is now very limited. There may be 1-2 turtles (of both species) killed this way every year in these areas. Deliberate killing is a bit more widespread in the areas east of Limassol and Larnaca where there are more fishermen. Again this information comes from our strandings records. There is no killing for trade or for personal use, though in the past hanging of dried carapaces on walls, for decoration, was fairly widespread in fish restaurants on the coast

Other threats

There is no evidence of any other significant threats. For instance, only 1-2 of the dead turtles (green and loggerhead) that have been recorded in recent years, had evidence of a boat strike. Practically all drown in fishing nets and the occasional one by being caught on a long line. There has been little evidence of deaths from the ingestion of large pieces of plastic, such as loss of weight and inability to dive in live turtles.

2. RMU: Green turtle (*Chelonia mydas*) Mediterranean

2.1. Distribution, abundance, trends

2.1.1. Nesting sites

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

West coast: There are five main green turtle nesting beaches on the west coast and one small one. The total beach length is about 3.5 km (in 10 km of coastline). These beaches are in the Lara/Toxeftra

Turtle Reserve (Fig. 2). They are Toxeftra, Ayii Phanentes (AP), South Lara Bay (L2), Lara (W) and North Lara Bay (L1) and Karavopetres (K). There is also some nesting in a couple of beaches outside the Reserve. The Potima beach and the Paphos airport beach, on the south end of the west coast. Nesting at the Potima beach seems to have practically stopped and the occasional green turtle now nests at the Helios beach, a bit further south. There is also some nesting on Asprokremmos beach in Chrysochou Bay and occasional nesting on the other beaches in this bay. All beaches are monitored and all the nests are protected, inside and outside the two turtle reserves.
The green turtle nesting population has also been estimated on the basis of recent nest numbers (2010-2015) to be over 100 females compared to about 50, which was the previous long term average up to 2010. Well over 100 adult green turtles were tagged since 1980.

2.1.2. Marine areas
There is an important foraging area for juvenile, sub-adult and adult green turtles in Chrysochou Bay. These are found there throughout the year. They feed mainly on the *Cymodocea nodosa* and the larger turtles also feed to a degree on *Posidonia.* Juveniles and sub-adults have been noted in the area, in increasing numbers in the last 10-20 years in particular. This is confirmed by our own observations, those by fishermen and by the stranding records in this area. Other foraging areas are being investigated.
The information available is still insufficient for reliable conclusions to be drawn on any key migratory paths from the West Coast nesting turtles, in the context of the RAC/SPA (UNEP/MAP) Action Plan for the Conservation of Mediterranean Marine Turtles (RAC/SPA (UNEP/MAP) - 2007).
Past distribution and abundance
Past distribution of green turtles in the specific area (west and south coast of Cyprus) is partly unknown, but at least one nesting beach on the west coast (Potima), which is monitored since 1978, was degraded due to sand extraction in the early 1980s. New beach armouring in the last few years have impacted this beach and have stopped its recovery, though there were signs of a new sand equilibrium being reached. Urbanisation, tourism etc. have caused problems in other areas such as Ayia Napa (now a very intensive tourist resort) where green turtle nesting has ceased since about 1980, while disturbance on Asprokremmos beach in the western part of Chrysochou Bay has affected green turtle nesting on this beach. (see also 2.2)
As already mentioned the green turtle nesting in the area (West Coast and Chrysochou Bay) has now risen to around 100 females. Though there were large fluctuations in nesting numbers over the years, the older nesting data on green turtles nesting can be found in Fig. 3.1.1 and Fig 5).

2.2. Other biological data
Please see Table 1.

2.3. Threats
2.3.1. Nesting sites
<u>Coastal development</u>
In the Lara/Toxeftra Reserve, on the west coast, there has been no coastal development and photopollution is very limited. Human presence on the beaches at night is strictly controlled as is driving on the beaches, though some problems still exist with driving, albeit on a much reduced scale, on two of the beaches. There is no mechanical beach cleaning in the Lara/Toxeftra Reserve area.
Coastal development and constructions with some associated photo-pollution and water sports are the main problems in one beach in the western end of Chrysochou Bay, where there is still some green turtle nesting. The drop in nesting on this beach is associated with the related human presence on that beach, at night in particular. Driving is also a problem in this beach.
With the declaration of a large part of Chrysochou Bay into a Natura 2000 site and the pending management measures, these threats were expected to be, at least largely, mitigated. Delays in deciding on and in implementing management measures however are now causing problems.
<u>Beach restructuring</u>
As for *Caretta caretta*.

Non human predation
See above on fox predation.
Human exploitation
There is no human exploitation of eggs and no adults are killed for exploitation purposes.
Other threats
Erosion was largely caused by sand extraction, which has now stopped. Any beaches affected are now reaching new equilibriums, though no doubt there are residual effects.
The real effect of debris on the nesting beaches is minimal and is mainly limited to driftwood and some large objects washed up on the beaches by the prevailing westerly winds. Manual beach clean-ups of nesting beaches are carried out in the nesting season. (see also 2.3.1.5)

2.3.2. Marine areas

Incidental catches
The main problems are associated with bottom set nets (trammel nets). Mortality from incidental catches in such nets is estimated from strandings, which are frequent in Chrysochou Bay where much fishing with small boats takes place.
Strandings of green turtles are largely of juveniles and sub-adults (30 to 60 cm) on the Chrysochou Bay beaches, with the occasional adult also found there. About 20-30 green turtle juveniles and sub-adults a year were found dead over the last two years, in Chrysochou Bay and the West Coast. They are often found in the summer months when fishing is more intensive in this bay.
The large increases in the number of juvenile green turtles in the area in recent years, have also inevitably resulted in more incidental catches.
However, more intensive monitoring in recent years may have also resulted in a somewhat exaggerated increasing trend in strandings. Long-lining for swordfish, a potential threat, has practically stopped in Cyprus due to a significant drop in catches, stemming no doubt from overexploitation of resources (not all due to the local fishery). Some tuna long lining is now taking place seasonally, mainly in May/June (see also 2.3.2.1)
Intentional killing and exploitation
as for *Caretta caretta*
Other threats
as for *Caretta caretta*

3. RMU: Leatherback turtle (*Dermochelys coriacea*) Atlantic (unknown)

There have been a few records of incidental catches of leatherbacks in Cyprus, mainly on long lines and trammel net, but these turtles are very rare in the region and no further information is provided.
Conservation status
Turtles in Cyprus are protected mainly by the provisions of the fisheries legislation which, in addition to the sea, covers the nesting beaches also. Since joining the European Union turtles are also protected under the provisions of the EU Habitats Directive and Law 153(I)/2003 for the Conservation and Management of Nature and Wildlife which transposes this Directive into National Law. This law has provisions for the conservation of species and habitats listed in the annexes. Both turtle species are included in Annex II and IV of the Directive.
Cyprus has ratified inter alia the Barcelona Convention and its Biodiversity Protocol, the Bern and Bonn Conventions and CITES, all of which have provisions for turtle conservation.
The legal protection of turtles in Cyprus is analysed below in greater detail
Species conservation
Turtles and their eggs have been protected under the fisheries legislation since 1971 (Fisheries Law, CAP135 and amendments and the Fisheries Regulations enacted on the basis of this law). The killing, pursuing, catching, buying, selling or possessing of a turtle or attempting to do any of these is prohibited, as is the buying or selling or possession of any turtle egg or turtle part or derivative.
Habitat conservation
West Coast
In 1989 habitat protection was given to the main nesting area on the west coast of the island on the basis of the Fisheries Law and Regulations. A 10 km stretch of coastline was declared, on the basis of

the above legislation, as a turtle reserve. This was the Lara/Toxeftra Turtle Reserve. It includes the coastline and the adjacent sea area, down to the 20 metre isobath (about 1-1.5 km distance from the coast). The Reserve includes the 5 main Green turtle nesting beaches, which also support loggerhead nesting. The management regulations are in the Law. These foresee that the public is not allowed to:

Stay on the beaches or the coastal area at night

Drive any vehicle on a beach or tolerate such action

Place any umbrella, caravan, tent etc., in the Protected Area

Use or anchor a boat or tolerate such action (to the 20m isobath),

Fish, except with a rod and line (to the 20m isobath)

In 2011 the Turtle Reserve Area, all the beaches north of the Lara/Toxeftra Reserve, all the hinterland to the north coast together with the sea area to the 50m isobath, were declared as a part of the Akamas NATURA 2000 site. The Lara/Toxeftra Management Regulations continue in any case to be in force.

<u>Chrysochou Bay</u>

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

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

<u>Enforcement</u>

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

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

<u>Conservation efforts</u>

Conservation activities started in 1978, after surveys in 1976 and 1977, with the setting up of the Lara Turtle station. Conservation continued without interruption since then. The main initial aim was to protect nests and hatchlings from predation by foxes. The Turtle Conservation Project is a government project and is implemented by the Department of Fisheries and Marine Research (DFMR). The Cyprus Wildlife Society has been helping with the project for decades and has been implementing it since 2010 on the basis of an agreement with the DFMR. The project covers all the nesting beaches that are in the part of the island that is under government control.

The main aims of the project now are:

Protecting and managing the nesting beaches and the adjacent sea

Protecting nesting females on the nesting beaches and adjacent sea during nesting

Protecting eggs and hatchlings from predation - and from human activities

Protecting turtles at sea

Monitoring the turtle population and nesting activity in Cyprus

Raising public awareness in turtle conservation

The project evolved with time. Head- starting (Fig. 6) was experimented with for many years, until the mid-1990s, when it was put on hold pending results. A Rescue Centre now operates at Meneou, in DFMR's Mariculture Research Station.

<u>Conservation methods used</u>

In the Lara-Toxeftra Reserve and on the Polis/Limni/Yialia beaches as well as on practically all other beaches that have any nesting, all nests are protected *in situ*, i.e., where the eggs were laid, by placing open, self-releasing, aluminium (non-magnetic) cages over them (Fig. 2 and 7). Non-magnetic material is used for the cages so as not to risk unintended behavioural consequences by distorting the magnetic

field in the area of the nest. Such distortion may interference with imprinting mechanisms affecting orientation and navigation. These cages have been used in the Cyprus Turtle Conservation Project since 1995, after years of experimentation and evolution in cage design. Since then studies have confirmed the assumptions made on the distortion of the magnetic field in the area of the egg chamber by the use of magnetic material for cages (Irwin et al., 2004). The cages used allow hatchlings to escape to the sea, as soon as they emerge from the sand, but prevent foxes from getting at the nest.
The minimum of intervention is aimed for, at all stages of conservation. A "hatchery" is now used for a small number of nests (ca. 10-20) that cannot be adequately protected where they were laid. Loggerhead nests are relocated there mainly from a couple of tourist beach on the West Coast (Coral Bay/Helios beaches). The hatchery is a fenced off part of the beach. Very few green nests are relocated to the hatchery at Lara, as there is little or no green turtle nesting on the Coral Bay area.
The conservation practices used are the ones described in the Manual for Marine Turtle Conservation in the Mediterranean (Demetropoulos and Hadjichristophorou, 1995) and its 2008 Addendum 1 on Conservation Practices (Demetropoulos and Hadjichristophorou, 2008). The conservation practices used, have evolved during the life of the project with the experience and knowledge gained. Part of the work carried out in the project is focused on the mitigation of the impact of tourism development on turtle nesting beaches. The recommended strategies and actions are outlined by Demetropoulos (2003).
Inter alia the following are also practiced:
Nests laid too near the sea, which will obviously be inundated by waves, are relocated higher up the same beach. About 5% of the nests are usually relocated up the beach
The egg chamber is located with an aluminium rod or a stick, when the nests are fresh.
No digging to locate or verify the presence of eggs takes place. Nests are dug up a few days after the end of hatchling emergence from the nest, so as to check on what happened in the nest.
Though tagging is not a conservation measure, it is mentioned here, as it may endanger turtles. Turtles may for example be disturbed if approached at the wrong time, preventing nesting, while inappropriate tags and tagging may endanger turtles, restricting flipper growth and mobility and may also cause increased risks of entanglement in trammel nets. The UNEP/MAP tagging recommendations were adopted mainly with the above in mind. These tagging recommendations are followed in the project. Blue Dalton Jumbo tags are used in adults and the smaller Rototags are used in smaller turtles (over 30cm). Turtles are usually double tagged on the trailing end of the front flippers, at the distal end of the flipper.
<u>Achievements</u>
It is estimated that through predation control and relocations more than four times as many hatchlings reach the sea every year than would have done if nests were not protected.
There have been significant increases in the number of loggerhead clutches of eggs (nests) in Chrysochou Bay since 2006 and since 2005 on the West coast, with larger increases between 2010 and 2015 and after. This is deemed to be the result of a combination of factors, including the success of conservation measures. The coincidence of the onset of nest increases (2005/2006) and the calculated number of years a loggerhead turtle requires to reach maturity (about 20 – 25 years) and to start nesting, after conservation measures are implemented, is a very good indication as to the likelihood that there is a valid cause–effect connection. Fluctuations in nest numbers from year to year are normal and these may also be influenced by climate change issues. Fluctuations in nest numbers on the West Coast of the island in particular, may be due, in part at least, to the hydrography of the area with a cold/hot water front frequently moving up and down the coast (Demetropoulos and Hadjichristophorou, 2008).
The nesting loggerhead females in the project area are generally young and it is deemed that the population may be recovering from the heavy exploitation of turtles that took place in the past in the east Mediterranean, though this was primarily aimed at green turtles. This relatively small size of nesting loggerhead turtles, compared to those nesting in Greece, for example and the scarcity of older/larger turtles may be indications of this. These are characteristic of all heavily exploited populations and are familiar to fishery scientists working on population dynamics. Mediterranean loggerhead turtles are of course known to be generally smaller than the Atlantic ones.

Unlike the increases that started in 2005/2006 in nesting in the loggerhead turtles, increases in green turtle nesting did not start until 2012 and continued, peaking, so far, in 2016 and reflecting no doubt the longer period (by six years) required by the green turtle to mature and to start nesting. (Fig. 5),

Conservation needs

What is pending is the adoption of effective management regulations for the "Natura 2000" site in Chrysochou Bay. The land boundaries of this area in particular are causing some concern in relation to the management of the nesting beaches in this area, while pressures exerted towards the commercialization of several beaches in this bay are increasing.

What is also pending is the finalizing of the setting up of the "Natura 2000" site for the wider Akamas peninsula, which is hoped, will safeguard the hinterland behind the Lara/Toxeftra Reserve. Pressures exist here also, in spite of the declaration of the area as an SCI on the basis of the Habitats Directive, in 2011.

Miscellaneous

None

Institutions and organizations involved in conservation, management, and research

Public

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

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

Private

The Cyprus Wildlife Society (CWS) is the only NGO that is doing regular work in the field on turtle conservation in Cyprus. It has been helping the DFMR with the implementation of the Cyprus Turtle Conservation Project, mainly since 1989, with nest protection, monitoring etc, (Demetropoulos and Hadjichristophorou, 2004) and has been implementing it on behalf of the DFMR since 2010. Professional experienced biologists and technicians are used. The DFMR has to a large degree been financing the project.

The CWS was also instrumental in preparing and publishing the Turtle Conservation Manual and its 2008 Addendum on Conservation Practices. The CWS prior to 2010 did all its work with its own resources. It is also involved in raising public awareness, education and training. It has published posters, postcards etc. Since 1989 it has also been organising and undertaking, every year, practical, hands on, training courses in turtle conservation for RAC/SPA (UNEP/MAP) sponsored scientists and more recently for Council of Europe trainees. These courses are undertaken in cooperation with the Department of Fisheries and Marine Research (DFMR) but are not financed by it. The courses are provided free by the Society.

10 Resources available about marine turtle research and conservation

http://www.moa.gov.cy/moa/dfmr/dfmr.nsf/page13_en/page13_en?OpenDocument

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Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Cyprus –Region B.

	CYPRUS: MED C. caretta		CYPRUS: MED *Chelonia mydas*	
RMU	**CC-MED**	Ref #	**CM-MED**	Ref #
Occurrence				
Nesting sites	Y	5,6,7	Y	5,7
Pelagic foraging grounds	N	N	N	N
Benthic foraging grounds	N	N	Y	5,7
Key biological data				
Nests/yr: recent average (range of years)	911 (2010-2015)	5	101 (2010-2015)	5
Nests/yr: recent order of magnitude	658-1163	5	54-154	5
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	2	5	1	5
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	857 (2010-2015)	5	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	54 (2010-2015)	5	n/a	n/a
Total length of nesting sites (km)	13,5	5	n/a	n/a
Nesting females / yr	450?	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a
Sex ratio: Hatchlings (F / Tot) (N)	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	60 CCL	6	n/a	n/a

Age at maturity (yrs)	na	n/a	n/a	n/a
Clutch size (n eggs) (N)	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	n/a	n/a	n/a	n/a
Trends				
Recent trends (last 20 yrs) at nesting sites (range of years)	Up (1995-2015)	5	Up (1995-2015)	5
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	177 (1978 - 2004)	5,6	50 (1978 - 2004)	5
Published studies				
Growth rates	N		N	
Genetics	N		N	
Stocks defined by genetic markers	N		N	
Remote tracking (satellite or other)	N		N	
Survival rates	N		N	
Population dynamics	N		N	
Foraging ecology (diet or isotopes)	N		N	
Capture-Mark-Recapture	N		N	
Threats				
Bycatch: presence of small scale / artisanal fisheries?	Y (SN, DLL, PLL)	5	Y (SN, DLL, PLL)	5
Bycatch: presence of industrial fisheries?	N		N	
Bycatch: quantified?	N		N	
Take. Intentional killing or exploitation of turtles	Y	5	Y	5
Take. Egg poaching	N		N	

Coastal Development. Nesting habitat degradation	Y	5	Y	5
Coastal Development. Photopollution	Y	5	Y	5
Coastal Development. Boat strikes	Y	5	Y	5
Egg predation	Y	5	Y	5
Pollution (debris, chemical)	n/a		n/a	
Pathogens	n/a		n/a	
Climate change	n/a		n/a	
Foraging habitat degradation	n/a		n/a	
Other	n/a		n/a	
Long-term projects (>5yrs)				
Monitoring at nesting sites (period: range of years)	Y (1978 - ongoing)	5	Y (1978 - ongoing)	5
Number of index nesting sites	N		N	
Monitoring at foraging sites (period: range of years)	N		N	
Conservation				
Protection under national law	Y	7	Y	7
Number of protected nesting sites (habitat preservation) (% nests)	2 (80%)	5, 7	2 (>90%)	5, 7
Number of Marine Areas with mitigation of threats	1	5, 7	1	5, 7
N of long-term conservation projects (period: range of years)	2 (1978-2017)	5	2 (1978-2017)	5
In-situ nest protection (eg cages)	Y	5, 7, 9	Y	5, 7, 9
Hatcheries	1	5	1	5
Head-starting	1*	7	1*	7
By-catch: fishing gear modifications (eg, TED, circle hooks)	N	N	N	N
By-catch: onboard best practices	N	N	N	N
By-catch: spatio-temporal closures/reduction	Y	7	Y	7
Other	N	N	N	N

Table 2. The nesting beaches of Cyprus- Region B.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
CC-MED				Long	Lat	Long	Lat	Long	Lat					
West Coast (Lara/Toxeftra Turtle Reserve)	N	237 (2010-2015)	n.a					34,954225	32,303533	3,5	100%	5		
Chrysochou Bay	N	621 (2010-2015)	n.a					35,036700	32,426400	11	100%	5		
CM-MED														
West Coast (Lara/Toxeftra Turtle Reserve)	N	111 (2010 - 2016)	n.a					34,954225	32,303533	3,5	100%	5		

Table 3. The conventions signed by Cyprus-Region B.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Bern Convention	Y	Y	Y	CM, CC		
Barcelona Conventtion	Y	y		CM, CC		SPAMI
CBD	Y	Y		ALL		
CITES	Y	Y		ALL		
Habitats Directive	Y	Y	Y	CM, CC		NATURA SITES etc
Bonn Convention	Y	Y		ALL		

Figure 1.

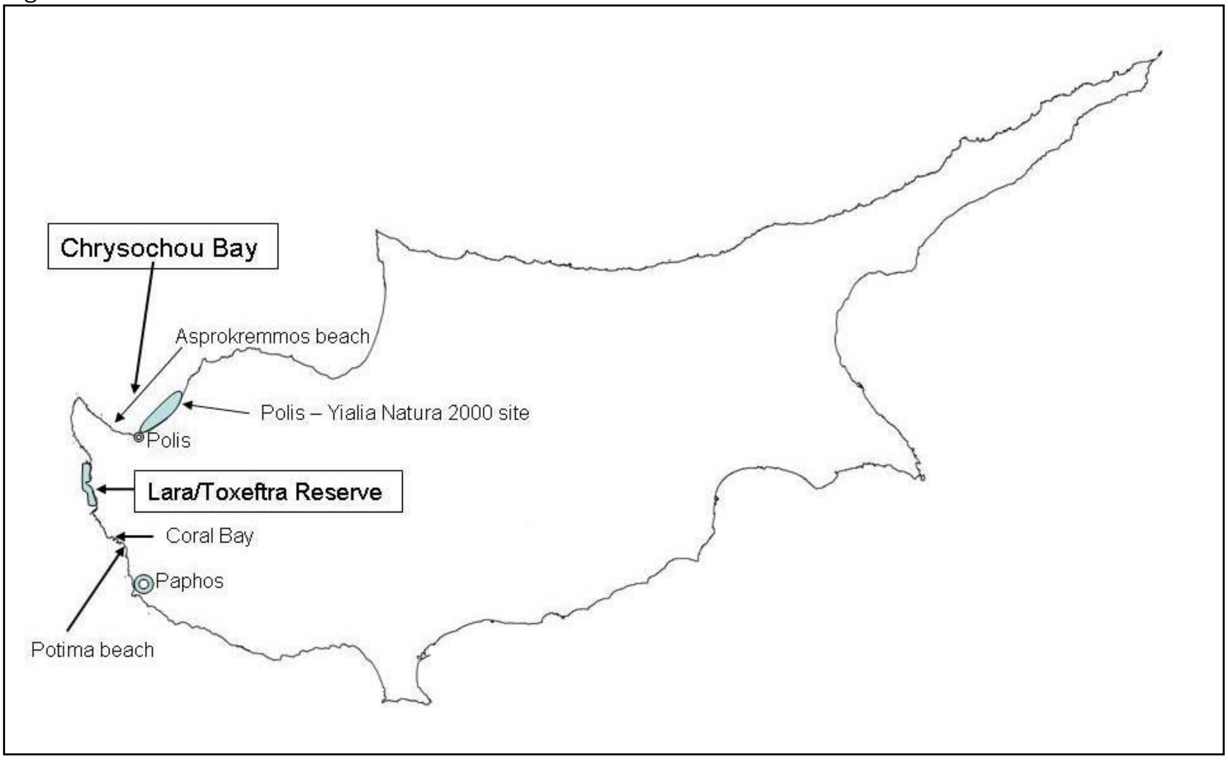

Figure 1. Map of Cyprus with main nesting sites on the West Coast and in Chrysochou Bay.

Figure 2. Lara beach with protective cages for nests (Photo: A. Demetropoulos).

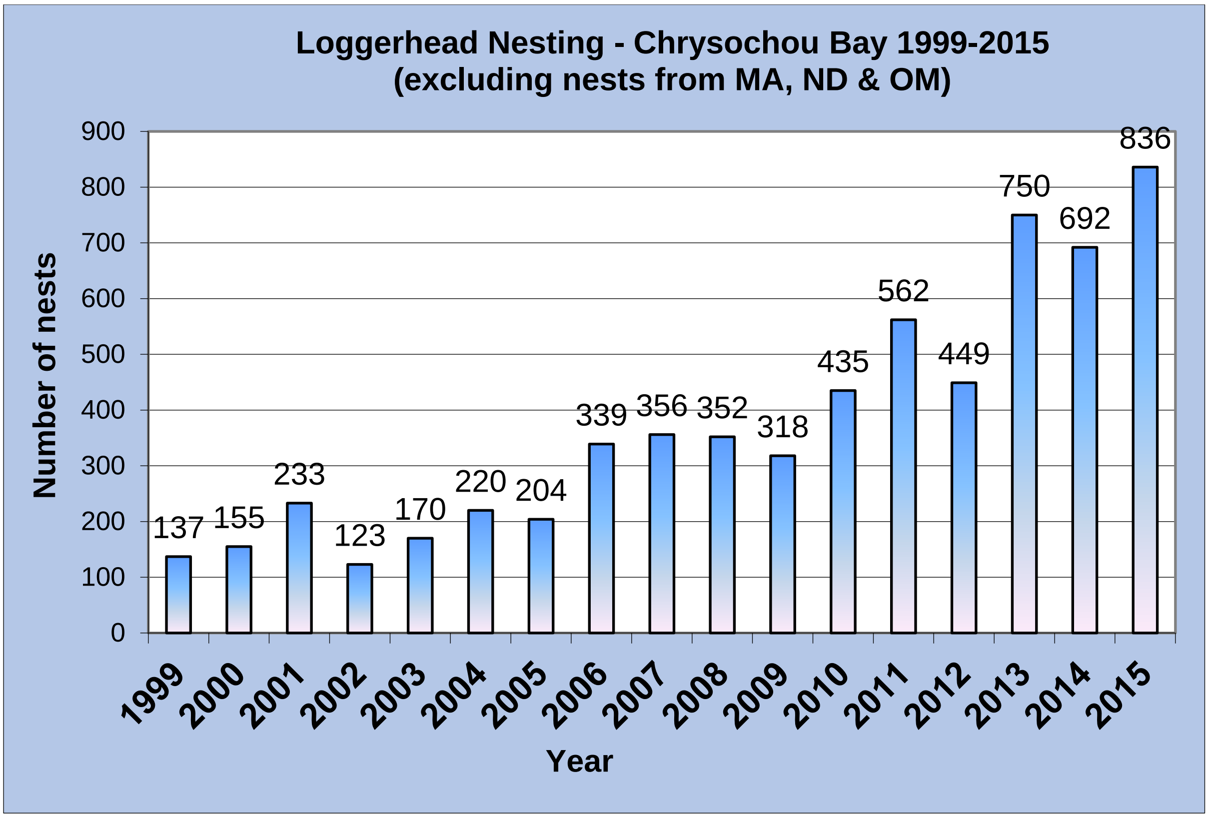

Figure 3. Loggerhead nesting in Chrysochou Bay, 1999-2015. (Sources: Demetropoulos 1989. Demetropoulos and Hadjichristophorou 2009. Hadjichristophorou and Demetropoulos 1990-2007. Demetropoulos and Hadjichristophorou unpublished data. Demetropoulos et al 2015.

Figure 4. Past sand extraction at Chrysochou Bay (Photo: A. Demetropoulos).

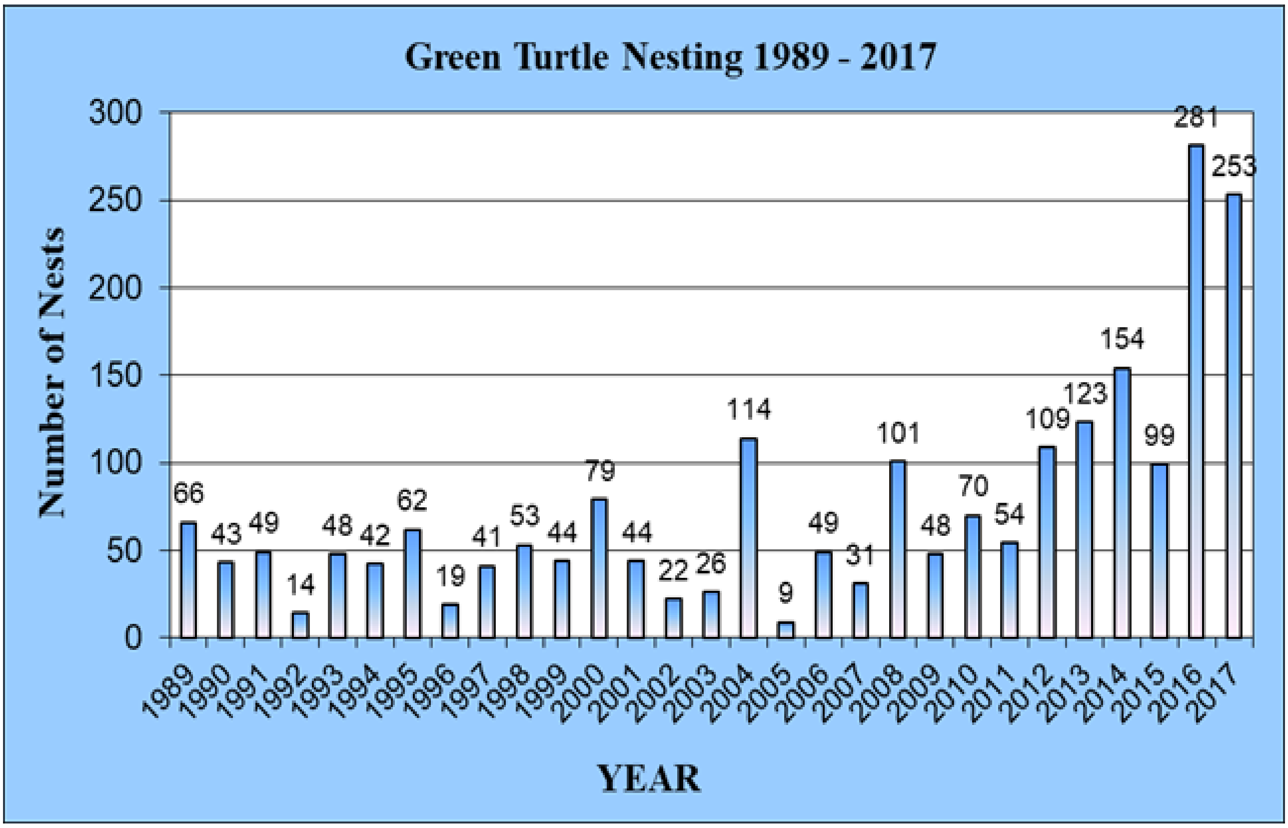

Figure 5. Green Turtle Nesting on the West Coast, 1989-2007. (Sources: Demetropoulos, 1989. Demetropoulos and Hadjichristophorou, 2009. Hadjichristophorou and Demetropoulos, 1990-2007. Demetropoulos and Hadjichristophorou, Unpublished data. Demetropoulos et al 2015)

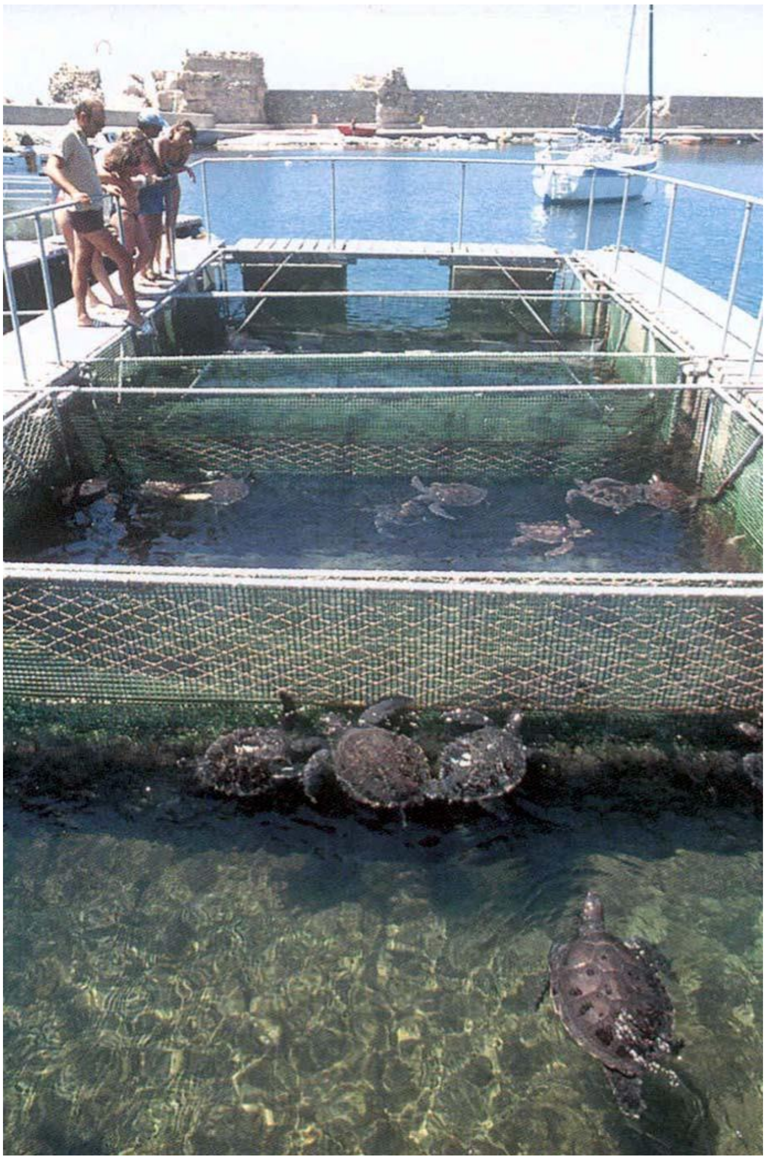

Figure 6. Head-starting was experimented with in the past (Photo: A. Demetropoulos).

EGYPT

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Introduction

Marine turtles considered as the oldest reptiles in the world and arose in the Cretaceous period, migratory species that utilize both terrestrial and aquatic habitat during its life cycle. Marine turtles have a significant role and ecological importance as it always says "Healthy Marine ecosystem needs Marine Turtles", they also have cultural and tourism values as well.

There are seven species around the world belonging to *Cheloniidae* and *Dermochelyidae* and all of them listed on the on the International Union for Conservation of Nature (IUCN) Red List for Endangered Flora and Fauna. Three out of these seven exist in Mediterranean region the Loggerhead turtle (*Caretta caretta*) and the Green turtle (*Chelonia mydas*) that nest on some beaches and the Leatherback turtle (*Dermochelys coriacea*) which is recorded regularly as visited species in the Mediterranean with nearly no nesting activity.

The same as in most Mediterranean countries, all the three marine turtle species occurring in the Mediterranean are regularly present along the Egyptian Mediterranean coast, were the Loggerhead turtle (*Caretta caretta*) and the Green turtle (*Chelonia mydas*) breed and nesting, while the Leatherback turtle (*Dermochelys coriacea*) has been recorded for stranding and by-catch with no nesting activity (Clarke *et al*. 2000; Nada and Casale2008; Nada *et al*. 2013; Rabia and Attum 2015). The Egyptian Mediterranean Coast is considered as an important foraging grounds and migratory corridors from/to multiple nesting areas for both loggerhead and green turtle (Laurent *et al*. 1996; Clarke *et al*. 2000; Broderick *et al*. 2007; Rees *et al*. 2008; Nada and Casale 2011; Nada *et al*. 2013; Schofield *et al*. 2013; Stokes *et al*. 2015; Snape *et al*. 2016).

Egypt committed to conserve marine turtles in its national waters through the ratification of the Barcelona Convention (signed on10th June 1995 and ratifiedon11th February 2000), the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (1995) and its annexes, adopted the Action Plan for the Conservation of Sea turtles in the Mediterranean and its related updates (UNEP-MAP SPA/RAC, 2007, 2013), its national laws and regulations, as well as the National Action Plan (NAP) for the Conservation of Marine Turtles in the Egyptian Mediterranean Coast in 2017 (Jiribi and Abdelwarith, 2017), that was established in the context of the implementation of the action Plan for the Conservation of Sea turtles in the Mediterranean elaborated by the Regional Activity Centre for Specially Protected Area (SPA/RAC).

Recently, there were many efforts to establish the National Action Plan for the Conservation of Marine Turtles in the Egyptian Mediterranean Coast, then programmes for monitoring and tagging were planned to be implemented under the National Action Plan (Jiribi and Abdelwarith, 2017 and Abdelwarith, 2018). In addition, collect samples from both Loggerhead and Green turtles towards establishing tissue bank for marine turtles in Egypt, adopting a protocol for genetic analysis, and prioritize points for scientific research programme as well (Naguib *et al*., 2018).

Since the adoption of the action plan for the conservation of Egyptian Mediterranean marine turtles at the national level, the Egyptian Environmental Affairs Agency has implemented many activities and measures that support the conservation and management of marine turtles at the national level and coordination with all national and regional bodies, especially the Regional Activity Center for Private

Protected Areas (SPA / RAC). The beaches survey of the Egyptian Mediterranean coast is considered one of the most important activities that took place during the recent period, which was implemented in a limited manner in light of the lack of implementation of such a survey more than 20 years ago.
Several beach surveys have been implemented and linked with stakeholders' inputs to identify and evaluate the presence of sea turtles on the Egyptian coast, mainly, for nesting and to what extent these beaches are still suitable to continue and host new nests. These surveys implemented mainly with the support of the Regional Activity Center for Specially Protected Areas (SPA/ RAC) through the conservation of marine turtle MAVA funded project.

1. RMU: Loggerhead turtle (*Caretta caretta*) - Mediterranean

1.1 Distribution, abundance and trends

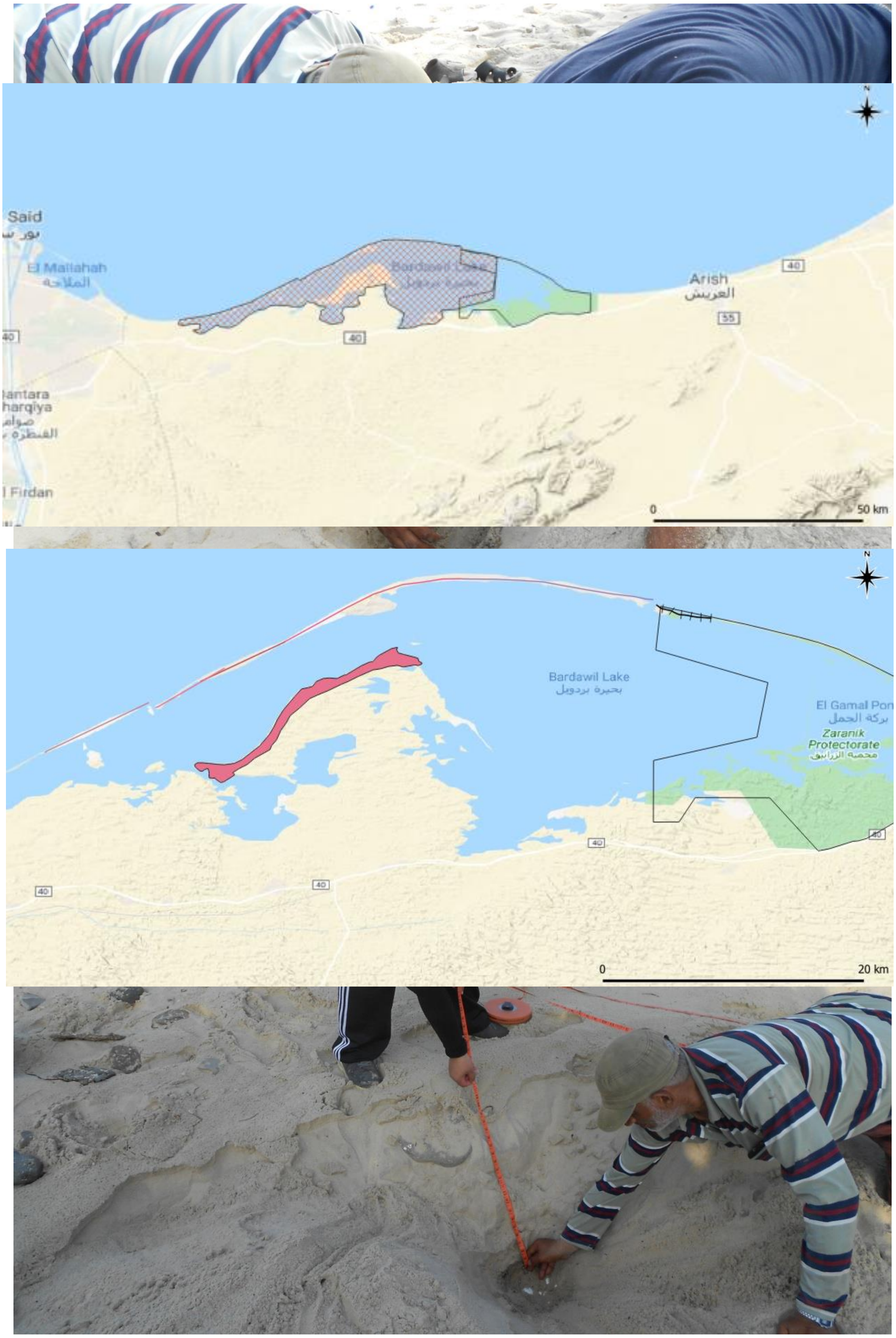
1.1.1. Nesting Sites

The Egyptian Mediterranean coast divided into 4 sectors: (A) El-Sallum to Matrouh, (B) Matrouh to western Alexandria, (C) Alexandria to Port Said, (D) North Sinai. The available data till 2016 indicates to, (i) nests for loggerhead were identified in El Salloum Sector (Kasparek,1993a,b), (ii) low nesting activity occurs in Matrouh - Alexandria sector, (iii) No evidence indicates nesting activity in Alexandria - Port Said sector, and (iv) the nests numbers of North Sinai sector as results of survey carried out in 2012 (Loggerhead N=66) which shows a similarly with nests recorded in 1998 (Loggerhead nests N=67) (Clarke *et al*., 2000; Campbell *et al*., 2001, Rabia and Attum, 2015). Clarke *et al*., 2000 and Campbell *et al*., 2001, concluded that nesting population did not exceed 20 females/year (93 tracks, 20 nests in 1998; 60 tracks, 27 nests in 1999; 79 tracks, 37 nests in 2000) (Nada *et al*., 2013).
During 2018, a new nest was recorded in the km 142 at the Rexos Hotel area within Sector B "from Matrouh to western Alexandria". It was considered as a new active nesting site.
As well as, one stranded loggerhead turtles has been recorded in El-Salloum MPA (sector A).

» Group 1: eastern Mediterranean coast from North Sinai to El-Burullous
» Group 2: western part from El-Salloum to Alexandria.

The survey of 2019, aimed to cover the areas that were visited in 2018, and to survey new areas covering approximately 50-60% of the total length of the Egyptian Mediterranean coast.
The first group covered the eastern region of the Egyptian Mediterranean coast (North Sinai coast including the parts of Bardawil Lake, Port Said and Kafr El Sheikh Governorates). The second group, concerned with covering the area from the middle of the Nile Delta in east to the city of El-Salloum in the west.
along the Egyptian Mediterranean coast, several cases of live stranded marine turtles were recorded by the national network.

In North Sinai (El-Bardawil Lake) about 59.94 km from Lake Bardawil coast line were covered. Three nests were recorded and tissue samples were collected for isotopes and genetics analyses.



From 15 to 20 years ago, El-Deeba village (Ezbet Shalabi El-Rudi), according to the local community, marine turtle used to come to this area to lay eggs for many years, however, due to the tourism and leisure activities (hotels and resorts)..

During season 2019, the following activities were carried out:

- Monitoring programme performed in Lake Bardawil, Port Said, Baltim, Matrouh, and Salloum.
- 3 Nests were recorded.
- Record the birds hunting activity of migratory birds by coastal nets, and determination its effect and interaction with the nesting areas of marine turtles. it was seemed to be non significant effect on nesting sites of marine turtles.

The survey work for the western coastal and the Delta region implemented as follows:

1. The first section of survey area starting from Salloum westward on the Egyptian-Libyan border to Marsa Matrouh city with a total distance of 218 kilometers divided into 9 sites:
   - Salloum City
   - Salloum Bay.
   - Salloum - Baqbaq
   - Baqbaq- Sidi Barani
   - The city of Sidi Barani
   - Sidi Barani - Al Nigila
   - Al Nigila
   - Al Mathani
   - The city of Marsa Matrouh
2. The second section of survey area, starting from the borders of the city of Marsa Matrouh to the outskirts of Alexandria with a total distance of 280 km (in addition to Abu Qir Bay 60 km Abu Qir Bay 60 km) divided into 8 sites:
   - Marsa Matrouh City - Bagoush
   - Bagoush - Dabaa

- Dabaa - Sidi Abdel Rahman
- Sidi Abdel Rahman - El Alamein
- El Alamein –Al Hammam
- Al Hammam– Alexandria
- Alexandria city
- Abu Qir Bay

3. A third section of survey area (Delta) - the range between the two branches of the River Nile and extends from the city of Rashid in the west to the city of Port Said in the east a total distance of 220 kilometers divided into 4 sites:
    - Rashid - Baltim
    - Baltim - Gamasa
    - Gamasa - Ras El Bar and Damietta
    - Damietta - Port Said

1.1.2. Marine areas

As in the previous literature foraging area exists were benthic habitats were found in the Nile delta (sector c); indicated either by incidental captures in bottom trawlers (Laurent *et al.* 1996) or with satellite transmitters from Cyprus and Syria (Broderick *et al.* 2007 and Rees *et al.,* 2008).

During establishing the National Action Plan for the conservation of marine turtles in Mediterranean Coast of Egypt in 2017, a survey had been done along Egyptian Mediterranean Coast starting from Port Said to El-Salloum. Interviews with Fishermen and local communities support that sector c and d (the region from north Sinai to Alexandria) offer foraging habitat for loggerhead turtles, as well as some observations by fishermen and local communities in El-Salloum.

1.2. Other biological data

See Table 1.

1.3. Threats

Marine turtles facing threats all the time, starting from females who are coming to lay their eggs, or the new hatchlings after they emerging from their nests and/or on their way to the sea; even when it's do their way to the sea they are facing many different threats. The most serious current threats facing marine turtles in Egyptian Mediterranean coast are:

<u>Interaction with Fisheries</u>

There is no directed fishery that targets marine turtles in Egypt. Most fishermen stated that they do not intentionally aim for sea turtles and they just found them in their nets or hooks accidentally. In a few cases, the fishermen of Alexandria do catch turtles swimming on the surface near their boats (Nada and Casale, 2010; Boura *et al*., 2016).

In 2012, in Bardawil Lake north Sinai, there was an incident were some turtles stranded and might have been died due to natural factors (low energy level and buoyancy), excessive salinity level, algal blooms, and /or interaction with fishing gears which seems to be one of the big reasons. The majority was Loggerhead then green and only one leatherback were identified (Nada *et al.,* 2013). A survey were organized by Nada *et al*. (2013) to 1) Determine the minimum number of dead sea turtles that were found during the surveys, 2) Assimilate and present available information about the sex, species and size of stranded turtles, 3) Define time span of deaths to provide insight on whether this was mass mortality case or not, 4) Provide information on possible cause of death; by analysis of stranding datasheets and photographic evidence. 23 loggerhead turtles were recorded.

<u>Intentional killing and trade</u>

The consumption of turtles in Alexandrian has been recorded since 1970s, which might be introduced behaviour from Europeans living in Egypt at that time (Boura *et al*., 2016, Jiribi and Abdelwarith, 2017),

where sea turtles consumption becomes a tradition especially in Alexandria then Damietta and Port Said either for consumption or trade (Nada and Casale, 2010, Jiribi and Abdelwarith, 2017). However, in Youth and new generations it was clear that their tendency toward consuming blood or meat of sea turtles declined, because of medical or religious reasons, and some others for the sake of conserving sea turtles (during the survey that has been done in 2017 for the preparation of the National Action Plan). Furthermore, in the western part of Egyptian Mediterranean coast (sector a and b) this behaviour is almost absent, were they respecting the ecosystem and life, and trust in the community authorities. Thus, no fishermen declared turtles' consumption in this region (Jiribi and Abdelwarith, 2017).
The subject of illegal trade and intentional killing of marine turtles in Egypt and particularly in Alexandria, was investigated for several years by MEDASSET (Mediterranean Association to Save Sea Turtle) (Nada, 2001; Nada, 2003; Nada and Casale, 2008; Nada and Casale, 2011; Venizelos and Kallonas. 1999; Venizelos and Nada, 2000 and Boura *et al*., 2016). The recent enforcement of law has probably reduced the total number of turtles traded but it has not stopped the trade completely which continues in the black market (Jiribi and Abdelwarith, 2017). In 2019, a decision was issued banning the handling or consumption of marine turtles.

Unplanned coastal development
The extensive urbanization of the coastline, especially in areas with sandy beaches, constitutes a serious threat. Many areas near nesting beaches are occupied by marinas and other kind of infrastructure where in summer vacation where beaches of the Egyptian Mediterranean coasts became crowded by millions of visitors, which coinciding with the nesting season. The western part of the Egyptian Mediterranean coast is heavily developed for tourism and the sea defense constructions on the Nile Delta beaches seems to deter nesting where physical alteration of nesting beaches and environment occurred. Beachfront developments are likely to impact and degrade important nesting beaches in Egypt (Campbell *et al*., 2001, Jiribi and Abdelwarith, 2017).

Pollution
The Egyptian coastline is polluted with non-biodegradable debris such as plastics, rubber and oil tar (Clarke *et al*., 2000), with no records for sea turtles affected by oil spills along Egyptian Mediterranean Coast. This might cause deterioration of the critical habitats for the life cycle of marine turtles, such as nesting, feeding and wintering areas, including key migration passages (Jiribi and Abdelwarith, 2017).

Human exploitation for consumption or for production of artefacts
There was evidence that some nests were raided by human for eggs in northern Sinai (Clarke *et al*., 2000), also, Nada and Casale (2008) found that this practice was still continuing in 2007. Generally, the consumption of sea turtles eggs was for usage on tiny scale and not for trade. There was couple of observations for using carapace of dead sea turtles in production of artefacts for good luck and by asking those who had them they said it was a gift from their great grandparents.

Predation
The new hatching of marine turtles is facing too many types of predation; for example, Ghost crabs and dogs preying on hatchlings were reported on nesting beaches in Egypt. This predation presents a massive threat to the turtle population; the mean of the different estimates of predation is 66.6%, which can be taken as the level of predation along the entire Mediterranean coast of Egypt (Simms *et al*., 1997).

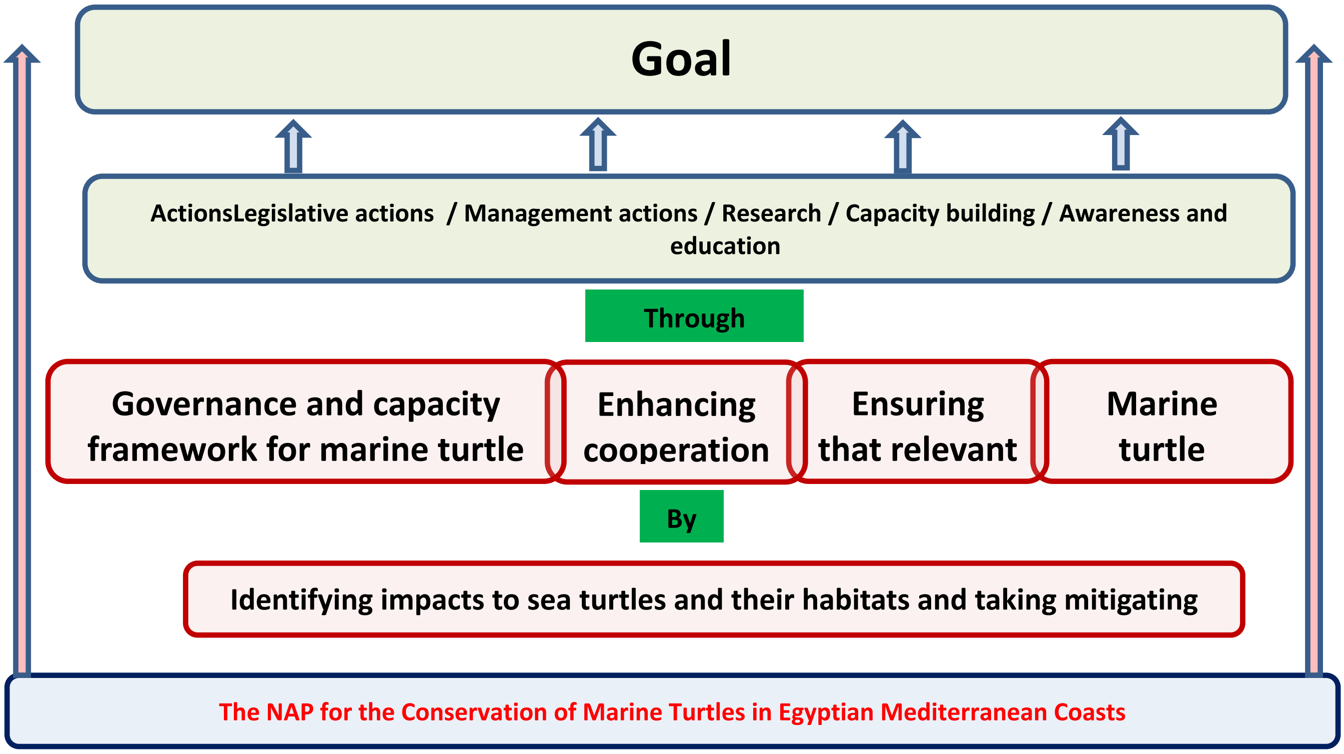
1.4. Conservation

Recent activities to conserve the Marine Turtles:
Numerous efforts have been made at the national level to protect sea turtles along the Egyptian Mediterranean coasts; the most important of these was preparation of the National Action Plan for the Conservation of Marine Turtles in the Egyptian Mediterranean Coast.

The National Plan of Action for the Protection of Sea Turtles on the Mediterranean Coast in Egypt

The NAP was prepared based on field survey in 2017 and through concentration meetings with the main stakeholders (sea users, professionals, fishermen, administrators, researchers, NGOs) held during January 2017 from Port Said to Salloum. This NAP was adopted in 2017.

The following diagram represents the main goal of the Egyptian Plan of Action for the Protection of Mediterranean Sea Turtles, the main activities necessary for the implementation of the NAP and achievement of the appropriate conservation status for Marine Turtles on the Egyptian Mediterranean coasts (Abdelwarith, 2018).



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In the frame of the implementation of the National Plan of Action for the Protection of Sea Turtles on the Mediterranean Coast in Egypt, that was adopted in 2017, and through the project of monitoring and conservation of marine turtle nesting areas which funded by MAVA and SPA / RAC, coordination were done with all relevant stakeholders (Nature Conservation Sector, Universities, Research Centers, Scouts, civil society associations and volunteers) to establish a national team concerned with the conservation and monitoring of marine turtles and nesting areas on the Egyptian Mediterranean coast. The following activities were carried out: 1) Establishing the National Team, 2) capacity building and public awareness, 3) field monitoring and rehabilitation, 4) follow-up of releasing campaigns, as follows:

Establishing the National Team:

In the context of the implementation of the national action plan the national team for monitoring of marine turtles has been established, with the participation of relevant stakeholders (MPA Managers, Research centers "NIOF & GERC", Academic and Universities Professionals, GAFRD, Marine Scout, NGOs, etc.).

Capacity Building and public awareness:

A national training was taken place, on principles of; (a) marine turtles' biology (b) methods of monitoring, c) requirements for fieldwork, d) scientific research; e) sampling and data analysis. in order

to they have capacities to be involved in consecutive training sessions and workshops as ToT for the subgroups and exchange experience along Egyptian Mediterranean Coast.
Following that, many of training courses have been carried out by the national experts in order to support the national team from other relevant and public bodies such as fishermen associations, civil society, MPA Researchers, volunteers, veterinarians, etc. as following:

Ashtoum El-Gamel MPA - Port Said Governorate

In cooperation with the team of Ashtoum El-Gamel MPA, training was held for the researchers, scouts, Faculty of science - Suez Canal University. Ashtoum El-Gamel PA has significant importance due to its direct location on Mediterranean coast and international maritime corridor (Suez Canal).

El-Burllous MPA - Kafr El-Sheikh Governorate

The El-Burllous MPA training was held in , with participation of relevant stakeholders. Kafr EL-Sheikh governorate has the one of the biggest fishing fleet on the Mediterranean. In addition to implementing consecutive workshops with a group of fishermen to raise their awareness on the importance of protection and conservation of marine turtles.

Meeting with Fishermen Association in Kafr El-Sheikh Governorate

Alexandria Governorate

Due to the great importance of Alexandria due to the presence of the largest gathering of fishermen and the largest markets for the trade of illegal sea turtles in Egypt, a number of actors have been integrated, such as: 1) the Marine scouts in Alexandria, 2) the representative of the Directorate of Education, 3) From Alexandria (independent team), in order to emphasize the importance of raising public awareness, especially for students belonging to the families of fishermen, and reducing fishing and illegal trade sea turtles in Alexandria.

Matrouh Governorate

A meeting was held with the leaders of the Marine Scouts in Matruh Governorate, with the aim of finding mechanisms to coordinate fieldwork between scout leaders and representatives of the National Team for the Conservation and Control of Sea Turtles along the Mediterranean coastline, especially in the areas previously registered with the departure of sea turtles such as Sidi Abdel Rahman The area from Foca to Matrouh.

Monitoring and rehabilitation

Civil society and specialists are working together to protect marine turtles and work to report their presence in the markets or pet dealers, then they are dealt with to ensure that they in good health until they are released back into their natural habitat in collaboration with the official relevant agencies.

1.5. Research

Launching the tagging programme

As part of establishing marine turtle’s registry and tagging programme, SPA/RAC provided tagging marks and applicators. Many tagged marine turtles “Chelonia mydas” in Ashtoum El-Gamil PA, El-Burllous PA, and Alexandria, where, the national team released them after rehabilitation process, with floating and eat normally. In addition, many other turtles were released through the efforts of civil society.

2. RMU: Green turtle (*Chelonia mydas*) - Mediterranean

2.1 Distribution, abundance and trends

2.1.1 Nesting Sites

See 1.1.1 for general description about surveys.

The available data till 2016 indicates the nests numbers of North Sinai sector as results of survey carried out in 2012 (Green Turtle N=7) shows a similarly with nests recorded in 1998 (Green turtles N=7) (Clarke *et al*., 2000; Campbell *et al*., 2001, Rabia and Attum, 2015). Clarke *et al*., 2000 and Campbell *et al*., 2001, concluded that green turtle nesting occurs on an occasional basis (8 nests in 1988; 2 in 1999; 10 in 2000) (Nada *et al*., 2013

At North Sinai “sector D” limited field surveys were taken place for the Northern boundary of El-Bardawil Lake, along 60 and recorded the following:

- 3 stranded green turtles
- 2 green turtles during the night on the beach
- 1 recent nest after emerging the hatchling

During season 2019, the following activities were carried out:

- Monitoring programme performed in Lake Bardawil, Port Said, Baltim, Matrouh, and Salloum.
- 1 Nest was recorded.

In *North Sinai (El-Bardawil Lake)* about 59.94 km from Lake Bardawil coast line were covered. One nest was recorded and samples were collected for isotopes and genetics analyses.
From 15 to 20 years ago, El-Deeba village (Ezbet Shalabi El-Rudi), according to the local community, marine turtle used to come to this area to lay eggs for many years, however, due to the tourism and leisure activities (hotels and resorts).

2.1.2. Marine areas

As in the previous literature foraging area exists were benthic habitats were found in the Nile delta (sector c); indicated either by incidental captures in bottom trawlers (Laurent *et al.* 1996) or with satellite transmitters from Cyprus and Syria (Broderick *et al.* 2007 and Rees *et al.,* 2008).
During establishing the National Action Plan for the conservation of marine turtles in Mediterranean Coast of Egypt in 2017, a survey had been done along Egyptian Mediterranean Coast starting from Port Said to El-Salloum. Interviews with Fishermen and local communities support that sector c and d (the region from north Sinai to Alexandria) offer foraging habitat for green turtles .

2.2. Other biological data

See Table 1.

2.3. Threats

See 1.3 for general descriptions.

Interaction with Fisheries

There is no directed fishery that targets marine turtles in Egypt. Most fishermen stated that they do not intentionally aim for sea turtles and they just found them in their nets or hooks accidentally. In a few cases, the fishermen of Alexandria do catch turtles swimming on the surface near their boats (Nada and Casale, 2010; Boura *et al*., 2016).
In 2012, in Bardawil Lake north Sinai, there was an incident were some turtles stranded and might have been died due to natural factors (low energy level and buoyancy), excessive salinity level, algal blooms, and /or interaction with fishing gears which seems to be one of the big reasons. The majority was Loggerhead then green and only one leatherback were identified (Nada *et al.,* 2013). A survey were organized by Nada *et al*. (2013) to 1) Determine the minimum number of dead sea turtles that were found during the surveys, 2) Assimilate and present available information about the sex, species and size of stranded turtles, 3) Define time span of deaths to provide insight on whether this was mass mortality case or not, 4) Provide information on possible cause of death; by analysis of stranding datasheets and photographic evidence. 8 green turtles (7 dead and 1 alive) were recorded.

Intentional killing and trade

See 1.3.

Unplanned coastal development

See 1.3.

Pollution

See 1.3.

Human exploitation for consumption or for production of artefacts

See 1.3.

Predation

See 1.3.

2.4. Conservation

See 1.4

2.5. Research

See 1.5.

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Table 1. Biological and conservation information about sea turtle Regional Management Units in Egypt (Mediterranean side).

RMU	CC-MED	Ref #	CM-MED	Ref #	DC-ATL?	Ref #
Occurrence						
Nesting sites	Y	1, 6, 8, 10, and PS	Y	1, 6, 8, 10, and PS	N	2
Pelagic foraging grounds	Y	6	Y	6	n/a	
Benthic foraging grounds	Y	6	Y	6	n/a	
Key biological data						
Nests/yr: recent average (range of years)	66 (1998-2012)	1, 2, 10, and PS	7 (1998-2012)	1, 2, 10, and PS	n/a	
Nests/yr: recent order of magnitude	n/a		n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	37	8	10	8	n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	20	8	2	8	n/a	
Nests/yr at "major" sites: recent average (range of years)	n/a		n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	n/a		n/a		n/a	
Total length of nesting sites (km)	n/a		n/a		n/a	
Nesting females / yr	20	8	n/a		n/a	
Nests / female season (N)	n/a		n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a		n/a	
Min adult size, CCL or SCL (cm)	n/a				n/a	
Age at maturity (yrs)	n/a		n/a		n/a	

Clutch size (n eggs) (N)	n/a		n/a		n/a	
Emergence success (hatchlings/egg) (N)	n/a		n/a		n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a		n/a	
Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	Down (1998-2018)	7, 8, and PS	Down (1998-2018)	7, 8, and PS	N	
Recent trends (last 20 yrs) at foraging grounds (range of years)	Y	7	Y	7	n/a	
Oldest documented abundance: nests/yr (range of years)	n/a		n/a		n/a	
Published studies						
Growth rates	N	ENTER REF	N	ENTER REF	n/a	
Genetics	Y	9, and PS	Y	9, and PS	n/a	
Stocks defined by genetic markers	Y	9, and PS	Y	9, and PS	n/a	
Remote tracking (satellite or other)	N		N		n/a	
Survival rates	N		N		n/a	
Population dynamics	N		N		n/a	
Foraging ecology (diet or isotopes)	N		N		n/a	
Capture-Mark-Recapture	Y	PS	Y	PS	n/a	
Threats						
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, DLL, SN, MT)	4, 6, 7, and PS	Y (PLL, DLL, SN, MT)	4, 6, 7, and PS	Y	
Bycatch: presence of industrial fisheries?	n/a		n/a		n/a	
Bycatch: quantified?	n/a		n/a		n/a	
Take. Intentional killing or exploitation of turtles	Y	4, 6, 7, and PS	Y	4, 6, 7, and PS	n/a	

Take. Egg poaching	N	PS	N	PS	n/a	
Coastal Development. Nesting habitat degradation	Y	4, 6, 7, and PS	Y	4, 6, 7, and PS	n/a	
Coastal Development. Photopollution	Y	4, and PS	Y	4, and PS	n/a	
Coastal Development. Boat strikes	Y	4, 6, 7, and PS	Y	4, 6, 7, and PS	n/a	
Egg predation	N		N		n/a	
Pollution (debris, chemical)	Y	4, 6, 7, and PS	Y	4, 6, 7, and PS	n/a	
Pathogens	n/a		n/a		n/a	
Climate change	n/a		n/a		n/a	
Foraging habitat degradation	n/a		n/a		n/a	
Other						
Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	N		N		n/a	
Number of index nesting sites	n/a		n/a		n/a	
Monitoring at foraging sites (period: range of years)	N		N		n/a	
Conservation						
Protection under national law	Y	3	Y	3	Y	3
Number of protected nesting sites (habitat preservation) (% nests)	5 (more than 60%)	PS	5 (more than 60%)	PS	n/a	
Number of Marine Areas with mitigation of threats	5	PS	5	PS	n/a	
N of long-term conservation projects (period: range of years)	n/a		n/a		n/a	
In-situ nest protection (eg cages)	N		N		n/a	
Hatcheries	N		N		n/a	
Head-starting	N		N		n/a	
By-catch: fishing gear modifications (eg, TED, circle hooks)	N		N		n/a	
By-catch: onboard best practices	N		N		n/a	
By-catch: spatio-temporal closures/reduction	N		N		n/a	
Other	n/a		n/a		n/a	

FRANCE

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1. RMU: Loggerhead turtle (*Caretta caretta*) Mediterranean

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

No recognized nesting sites but four Loggerhead nests were recorded during these last ten years, two on the Provençal coast (St Tropez, 2006, 171 eggs; St Aygulf, 2016, 74 eggs), one on the coast of Languedoc (Maguelone, 2018, 60 eggs) and, last year, one in Corsica (Ghisonaccia, 2019; 120 eggs [21]) (Fig. 1). Moreover, several nesting attempts with nest remains have been observed on the Corsica coast (Porto Vecchio, 2002; San Nicolao, 2014; Cap Corse, 2016 [6, 19]).

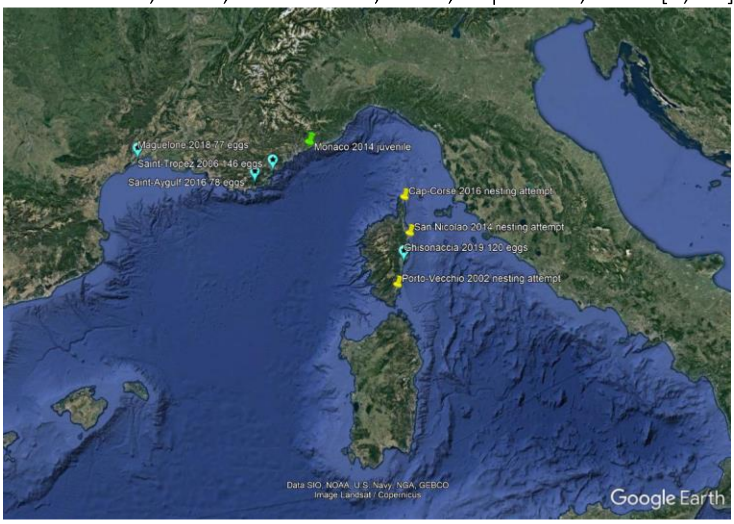


Fig. 1 [Nesting sites (blue pins) and attempts of nesting sites (yellow pins)]

1.1.2. Marine areas

The French Mediterranean waters lie from the French continental coast to South of the Corsica Mediterranean (Fig. 2). Most data on turtle occurrence and size derive from stranding data, fisheries by-catch data and at-sea observations collected by the French network RTMMF[1]. From 2007 to 2019 around 1986 marine turtles were observed either caught, stranded or observed at sea (annual average of 150 individuals; Table 5) [2, 14, 17, 20, 21]. *Caretta caretta* is the major species observed with 96% of identified individuals, followed by *Dermochelys coriacea* (3%) and *Chelonia mydas* (1%). Most turtles

[1] Réseau Tortues Marines de Méditerranée Française

observed at sea, not clearly identified (n = 403) were likely loggerhead sub-adults.

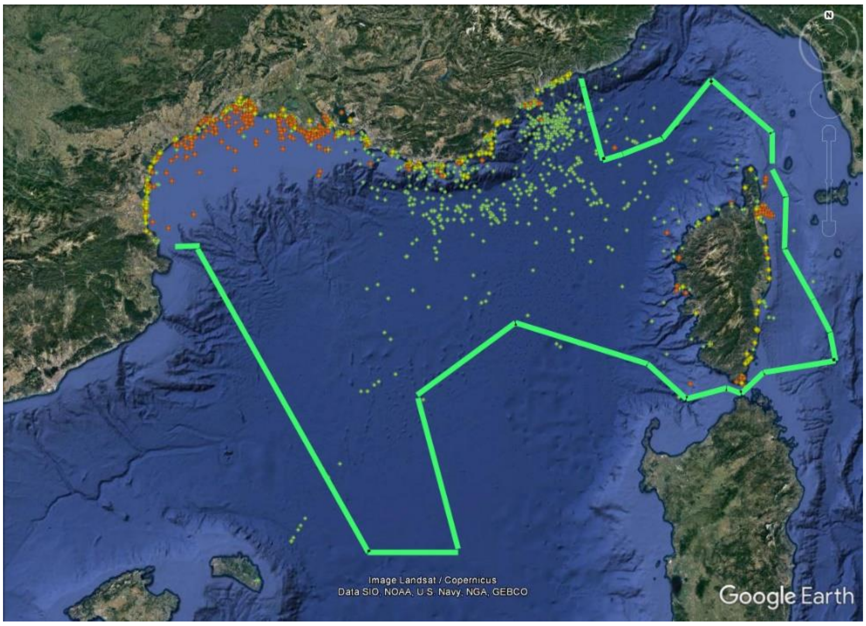


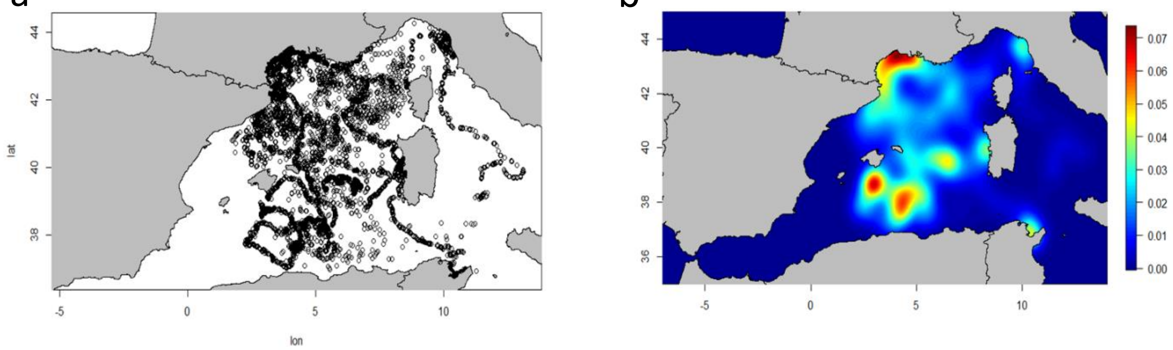
Fig. 2 [Distribution of *Caretta caretta* observations in French Mediterranean waters between 2007 and 2019 (green dots: Observations at sea; brown dots: captures; yellow dots: stranding; green line: limits of French EEZ)]

In addition to these data regularly collected by the RTMMF, 647 undetermined cheloniidae and 2 leatherbacks turtles were observed during aerial surveys in 2011, 2012, 2019 (SAMM) [16], in 2014, 2017 (Marineland Association) [2], and 2018 (ACCOBAMS) [17] (Table 5).

Moreover, the movements of 16 loggerhead turtles were tracked between 2008 and 2017 using telemetry techniques [Ref. 26, 27, 28, 29]. Satellite-transmitting archival tags were deployed on rescued turtles rehabilitated at the "Centre d' Etude et de Sauvegarde des Tortues marines de Méditerranée" , the Sea turtle Rescue Center (CESTMed[2] ; Grau du Roi). All these turtles measured between 54 and 65 cm (CCL) and were released in the Gulf of Lions.

The tracks and the kernel density estimation plot of 10-year (2008-2017) turtle space-use showed that all the loggerhead turtle remained in western Mediterranean (Fig 3a), but tended to move south towards Italy, Spain and even down to north Africa (Fig. 3).

a b



[2] Centre d'Etudes et de Sauvegarde des Tortues Marines de Méditerranée

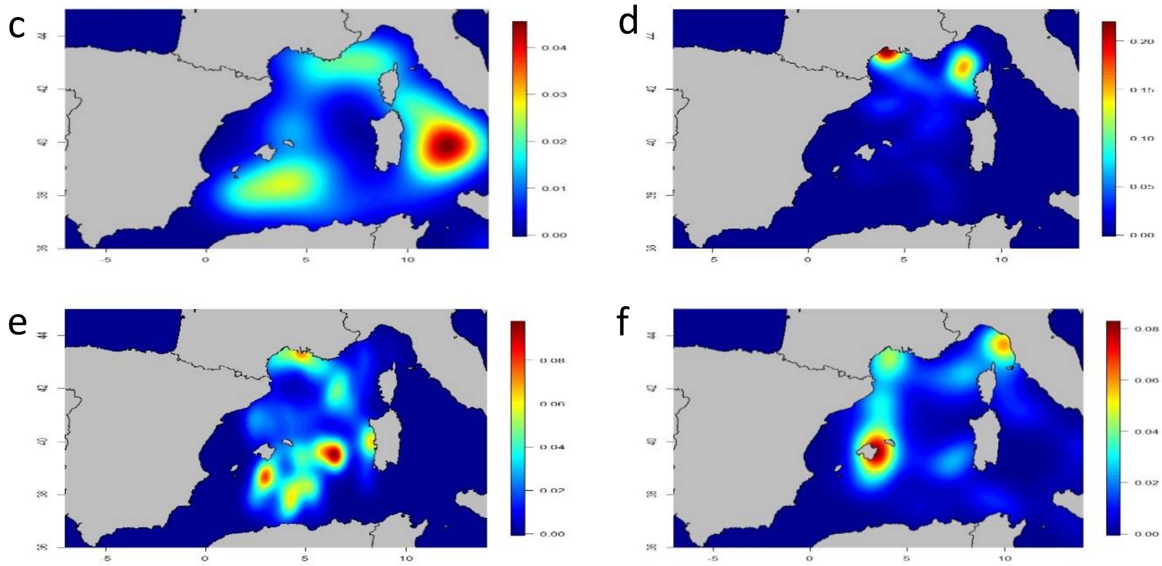


Fig. 3 [Movements and high space use areas occupied by 16 satellite-transmitting archival tagged loggerhead turtles between 2008 and 2017. (a) individual tracks and kernel density plot showing the major areas of prolonged residency for (b) entire dataset or combined per quarter (c) (January to March), (d) (April to June), (e) (July to September) or (f) (October to December) . These tags were funded within the scope of aregional programmes mainly led by CESTMed (Total foundation, Coca cola and other sponsors) and Ifremer (France Filière Pêche :FFP) during theSELPAL project conducted in close collaboration with commercial pelagic longliners from the Association Méditerranéenne des Organisations de Producteurs (AMOP)]

Interestingly, several individuals spent a significant time in lagunas off the French coast (étang de Berre, Leucate) and two turtles migrated to the Gulf of Oristano, an important area for mussel production. Densities of occurences were estimated based on data collected over the entire study period and aggregated by trimester [26, 27] (Fig. 3).
It is important to note that these preliminary results were obtained using turtles that had remained in captivity for variable periods of time (up to several month) before they were tagged and released.

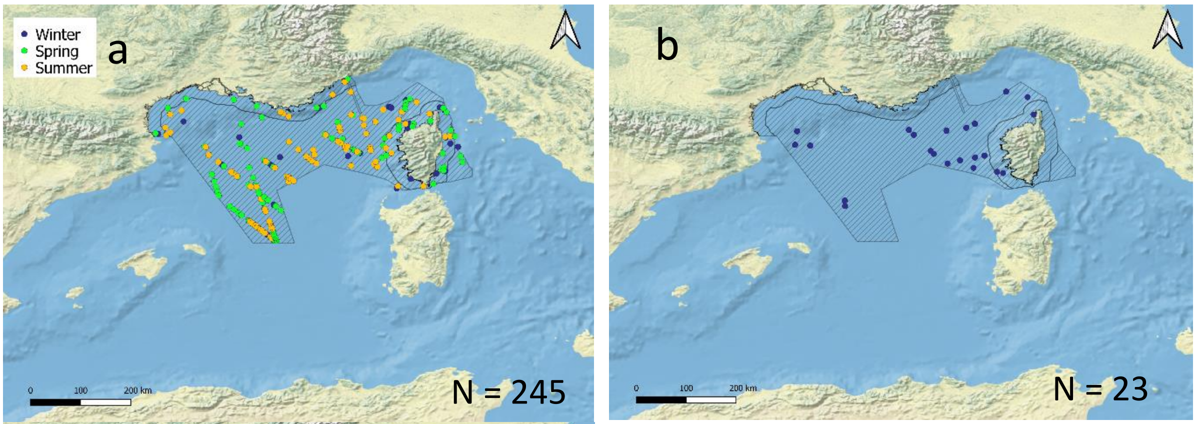
These data, along with stranding data, at sea observations and aerial surveys [16] suggest that the Loggerhead is present throughout the year long in French EEZ Mediterranean waters and occur all along French coasts (Table 6).

Digestive tract content analysis of dead specimens, satellite tracking and trawl by-catches *suggest that the continental shelf of the Gulf of Lions is an im*portant foraging and wintering area for sub-adult Loggerheads occurring in these waters. Other foraging areas are also suspected close to river mouths and lagoons of the Gulf of Lions and Corsica. Pelagic waters of Catalan Liguro-Provençal current could also be an important foraging area for juvenile loggerheads.

In addition, some individuals have been observed mating offshore in the eastern part of the Gulf of Lions.

While no migratory corridor has been clearly identified yet, preliminary genetic analyses of 99 blood and soft tissue samples from juveniles (including two turtles <10 cm and one embryo from the St Tropez 2006 nesting event) suggest that loggerheads entering the French EEZ may originate from three nesting areas: West Atlantic, East Atlantic and East Mediterranean [Ref. 30]. Overall, results from this study were difficult to interpret due to the low diversity of the genetic marker used (D-loop region of mitochondrial DNA). Therefore, complementary studies based on samples collected after 2015 will be needed to confirm the observed trends.

Attempts to estimate abundance were carried out based on aerial surveys over French EEZ waters (SAMM, 2011 -2012 and 2019, Fig. 4a&b; Marineland, 2014 and 2017)[Table 5] [Ref. 16] and recently in Mediterranean waters (ACCOBAMS Survey Initiative, 2018; Fig. 4c), [Table 5].



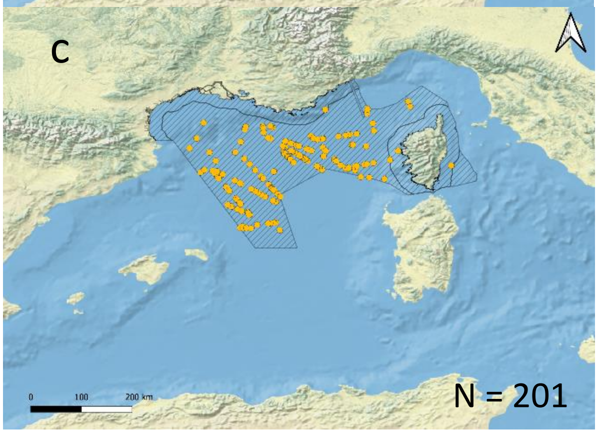
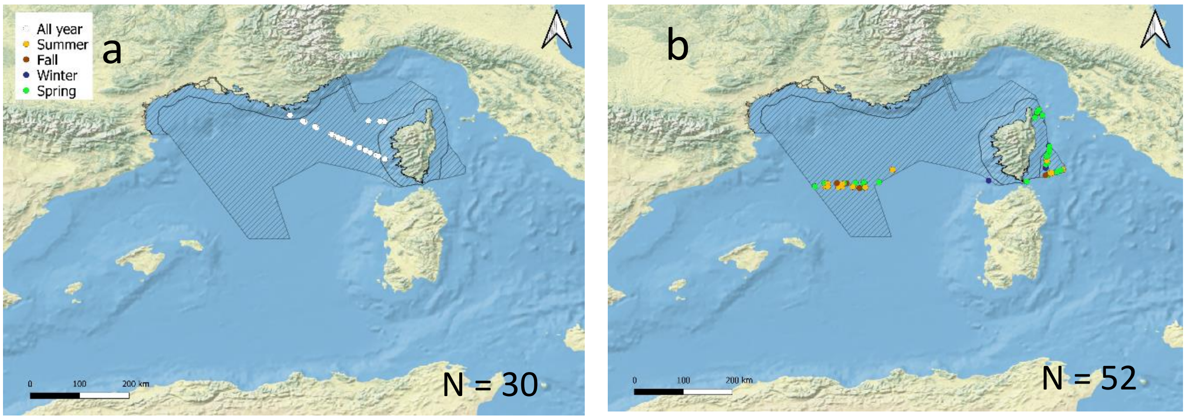


Fig. 4 [Chelonids (most likely loggerheads) sightings distribution from aerial surveys. The (a) SAMM 2011 – 2012 and (b) SAMM 2019 surveys were carried out within the french EEZ by the AAMP[3] and AFB[4], respectively. The (c) ACCOBAMS 2018 survey covered the EEZs of several Mediterranean countries. Only sightings from the french EEZ (hatched area) are represented]

In addition, sea turtle at-sea observation data were collected by observers onboard ferries in the French Mediterranean. These initiatives were carried out by French (EcoOcéan institut, 2011-2018, Fig. 5a) and Italian (ISPRA, 2013-2017, Fig. 5b and Centro Internazionale in Monitoraggio Ambientale - Fondazione CIMA, 2009-2018, Fig. 5c) institutes [Table 5] within the Fixed Line Transects Mediterranean monitoring Network (FLT Med Net; ISPRA 2016) [Ref. 31].



[3] Agence des Aires Marines Protégées
[4] Agence Française pour la Biodiversité

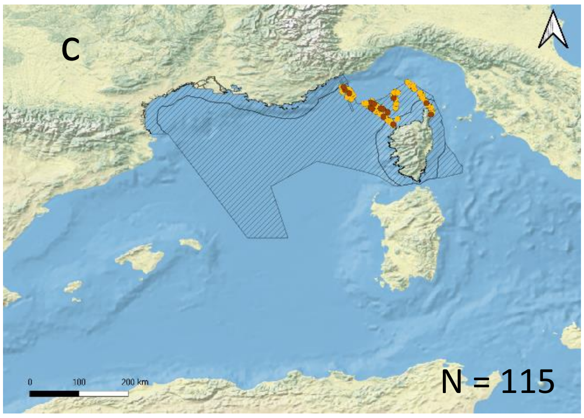


Fig. 5 [Loggerhead sightings distribution based on at-sea observations made by observers onboard ferries. Data collected by (a) EcoOcéan Institut between 2011 and 2018 in the french EEZ, and by (b) ISPRA and (c) the fondazione CIMA between 2013-2017 and 2009-2018, respectively. Only sightings from the french EEZ (hatched area) are represented]

While observations were recorded [Table 5], estimates of abundance or trends are not yet available.

1.2. Other biological data

72 % of measured loggerheads showed CCL between 35 and 65 cm [Tab. 7].

Sex determination is based on phenotypic characters for living specimens and tail length or gonads examination for dead turtles. Among 484 loggerheads examined between 2007 and 2019 (caught or stranded), 47 were Female, 19 Male and 418 unsexed individuals for which length was mainly less than 62 cm standard CCL.

1.3. Threats

1.3.1. Nesting sites

N/A

1.3.2. Marine areas

Given that the Gulf of Lions is potentially an important foraging and wintering area for Loggerheads, bycatch resulting from fishing activities is the most important threat in this area [Ref. 26]. Incidental capture is the main cause of identified mortality, with 34 captures per year on average and 7.3 deaths per year for all gear combined; gillnet and trammels are responsible for 51 % of mortality from all fishing techniques, followed by trawling (20 %). 63 % of trawl catches occur in winter time from November to end of January when trawlers are working in the wintering areas of the Gulf of Lions. Same seasonal patterns occur for turtles entangled in trap-net (fyke-net) set in shallow waters of lagoons. On the opposite, 68 % of catches by static nets occur from April to July (Table 6) [7, 8, 10].

After gillnetting, the second cause of loggerhead morbidity is vessel strikes, with three collisions per year resulting in two deaths per year. However, this number likely underestimates the real intensity of this pressure.

Entanglement of sea turtles is one of the main impacts of marine debris. Abandoned pieces of net are the most frequent material responsible for entanglement. Nevertheless, we find in our observations only 4 cases of loggerhead entangled in fishing materials (Table 8, e) [3, 4].

Ingestion of marine debris, which occurrence may reach 100% (Corsica) according to necropsy analysis, could be also an important cause of delayed morbidity and mortality but this remains difficult to evaluate to date [1, 5, 9, 11, 22].

1.4. Conservation

All sea turtle species and their habitats are protected by a national law (*Arrêté ministériel du 14 octobre 2005*) and France ratified the international conventions (Bern, Bonn, Barcelona, OSPAR) dedicated to environmental and species conservation, including sea turtle species. Furthermore, as European Member State, France is actively involved in the MSFD[5] and Habitats Directive monitoring

[5] Marine Strategy Framework Directive

and reporting processes. The Ministries and agencies in charge of fisheries and environment, as well as the national committee for fisheries, are involved in designing practical measures with NGOs. The permits procedure for operating on protected species is facilitated through a national scientific program (*Observatoire des Tortues Marines de France Métropolitaine*) which allows stranding networks to operate easily on the field (*Arrêté ministériel du 25 octobre 2016*). National funding has increased since the MSFD monitoring program has been launched.

At the moment, the main measures for conserving sea turtles in the French Mediterranean aim to mitigate bycatch, mostly through informing fishermen about onboard best practices to reduce post-release mortality, and rescue turtles in sea turtle rescue centers. Guidelines, technical sheets and a video have been designed and disseminated [Ref.23, 24, 25, 35]. In certain areas, the tight relationships with fishermen and their involvement in scientific programs (through collaborative and Participatory Action Research programs for instance) contribute to increase the chances of survival, since they feel included in conservation actions and are encouraged to bring back turtles to the rescue center. However, this effort should be extended to all the coastline. Mitigating the marine debris issue is one of the top priorities of the French State, and initiatives for cleaning the environment (ghost fishing gears, packaging) are encouraged through national calls for funding.

Since an increasing breeding activity has been observed on the French coastlines and nearby waters, it is recommended to pay a special attention to tracks on beaches. A program with sniffing dogs is currently under development for finding possible undetected nests. Furthermore, communication about the potential mounting of sea turtles on beaches has been initiated but should be developed.

1.5. Research

There is an important need to develop genetic analyses with the aim to determinate the origin of populations entering French Mediterranean waters, combined with skeleto-chronology analyses for assessing the age of individuals encountered in this area. These studies are planned to start in 2019-2020 as part of the MSFD monitoring program.

Knowledge on spatial and seasonal distribution obtained independently from fishery information is also urgently required in order to identify habitats and hot-spot areas. While around 25 satellite tags were used between 2003 and 2017 (Fig. 3; [Ref. 26]), a special effort on telemetry should be initiated. This would not only provide information of important habitats, but also inform management on by-catch reduction. For this purpose, aerial or sea survey should be carried out at the EEZ scale.

To help develop appropriate mitigating measures, knowledge on the intensity of by-catch due to various French fishing methods is also urgently needed; this study should be carried out based on the survey protocol adopted at the GFCM[6] level.

The work on interactions between sea turtles and marine debris initiated by France [Ref. 1, 5, 9, 11, 32, 33, 34] led to a European project INDICIT I (2017-2019) followed by INDICIT II (2019-2021), supporting MSFD and the regional sea conventions OSPAR and Barcelona. Data on diet and marine debris ingestion based on digestive contents collected in France and by the INDICIT consortium should be published soon.

2. RMU: Green turtle (*Chelonia mydas*) Mediterranean

2.1. Distribution, abundance, trends

2.1.1. Nesting sites

Not applicable. This RMU does not breed on the French coast.

2.1.2. Marine areas

This species is only occasionally found in Mediterranean French waters but can be seen all year long [12, 13]; only 26 Green turtles were observed between 1965 and 2019 with 3 stranded, 6 captured, and 17 observed at sea; 19 of them have been recorded between 2007 and 2019 (Fig. 6).

[6] General Fisheries Commission for the Mediterranean

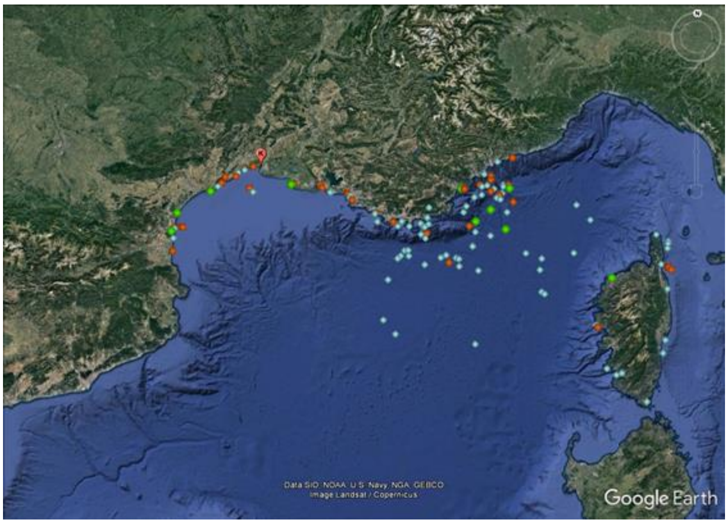


Fig. 6 [Distribution of observations of *Chelonia mydas* (green dots), *Dermochelys coriacea* (red dots), undetermined Cheloniidae (blue dots) and *Lepidochelys kempii* (red pin) between 2007 and 2019].

Their recorded CCL were between 31 to 50 cm.
No estimates of abundance or trends are available.

2.2. Other biological data

Only one male and 18 unsexed individuals were identified among the 19 green turtles recorded between 2007 and 2019.

2.3. Threats

2.3.1. Nesting sites

Not applicable

2.3.2. Marine areas

As for loggerhead, small scale coastal fishing is the main anthropic impacting activity (when Green turtles come near shore on seagrass beds) with 6 catches by coastal gill nets, 1 by longline and 1 by ghost net (trammel).

2.4. Conservation

Protection status in France is the same for all sea turtle species. No specific conservation measures have been developed.

2.5. Research

Tagging and genetic analyses could provide valuable information on the origin of green turtles coming into French waters.

3. RMU: Leatherback Turtle (*Dermochelys coriacea*) Atlantic (unknown)

3.1. Distribution, abundance, trends

3.1.1. Nesting sites

Not applicable (no nesting area in the Mediterranean Sea)

3.1.2. Marine areas

Leatherbacks can be observed in French Mediterranean waters all year long but in small numbers.
From 2007 at 2019, 45 Dc were observed at the rate of 3.5/year either caught [7], stranded [7], observed at sea [29] or during aerial survey [1] (Fig. 6).
Size recorded are between 142 and 190 cm CCLs.

3.2. Other biological data
No data

3.3. Threats
3.3.1. Nesting sites
Not applicable

3.3.2. Marine areas
Leatherbacks can be also affected by fishing activities, mainly through entanglement in surface long lining (6 with a mortality rate of 14% between 2007 and 2019).
Fatal injuries caused by vessel strikes were noted for two cases between 2007 and 2019.

3.4. Conservation
Protection status in France is the same for all sea turtle species. No specific conservation measures have been developed.

3.5. Research
Studies specifically focusing on the occurrence of Leatherback in Mediterranean waters are lacking. International tagging programs carried out on the two sides of the Atlantic may be useful.

4. Others
4.1. Kemp's turtle (*Lepidochelys kempii*) Atlantic (unknown)
Kemp's ridleys have been observed only twice in French Mediterranean waters (Fig. 6). The first one was caught in July 2001 [Ref.15]. The second Kemp's ridley was caught in the Gulf of Lions in July 2015 [18]. The turtle was freshly dead and had a CCL of 33.5 cm.
4.2. Hawksbill turtle (*Eretmochelys imbricata*) Atlantic (unknown)
Only five Hawksbill turtles were recorded in French Mediterranean waters between 37 and 44 cm of CCL, and since the last capture of one specimen in July 1989 there has been no more validated observation of this species until now.

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Acronyms

AAMP Agence des aires marines protégées (now called Office français pour la Biodiversité)
ACCOBAMS Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area
AFB Agence Française pour la Biodiversité (now called Office français pour la Biodiversité)
AMOP Association Méditerranéenne des Organisations de Producteurs
CESTMed Centre d'Etude et de Sauvegarde des Tortues marines de Méditerranée
CIMA foundation Centro Internazionale in Monitoraggio Ambientale
EEZ Exclusive Economic Zone
FLT Med Net Fixed Line Transects Mediterranean monitoring Network
GFCM General Fisheries Commission for the Mediterranean
INDICIT European project "Implementation Of Indicators Of Marine Litter On Sea Turtles And Biota In Regional Sea Conventions And Marine Strategy Framework Directive Areas"
ISPRA Istituto Superiore per la Protezione e la Ricerca Ambientale
MNHN Muséum national d'Histoire Naturelle
MSFD Marine Strategy Framework Directive
RMU Regional Management Unit
RTMMF Réseau Tortues Marines de Méditerranée Française
SAMM campaign "Suivi aérien de la Mégafaune marine"
SELPAL research project "Sélectivité Palangre"
SHF Société Herpétologique de France
TED Turtle Excluder Device

Table 1: Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in France.

TOPIC	REGIONAL MANAGEMENT UNIT					
	CC-MED	Ref #	**CM-MED**	Ref #	**DC-ATL**	Ref #
Occurrence						
Nesting sites	Y		N		n/a	
Pelagic foraging grounds	JA		Y		n/a	
Benthic foraging grounds	Y	14, 20	n/a		n/a	
Key biological data						
Nests/yr: recent average (range of years)	n/a		n/a		n/a	
Nests/yr: recent order of magnitude	n/a		n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a		n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a		n/a		n/a	

Nests/yr at "major" sites: recent average (range of years)	n/a		n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	n/a		n/a		n/a	
Total length of nesting sites (km)	n/a		n/a		n/a	
Nesting females / yr	n/a		n/a		n/a	
Nests / female season (N)	n/a		n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a		n/a	
Min adult size, CCL or SCL (cm)	72 CCL		n/a		n/a	
Age at maturity (yrs)	n/a		n/a		n/a	
Clutch size (n eggs) (N)	n/a		n/a		n/a	
Emergence success (hatchlings/egg) (N)	n/a		n/a		n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a		n/a	
Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	n/a	n/a		n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a		n/a	

Oldest documented abundance: nests/yr (range of years)			n/a		n/a	
Published studies						
Growth rates	N		N		N	
Genetics	N		N		N	
Stocks defined by genetic markers	N		N		N	
Remote tracking (satellite or other)	Y		N		N	
Survival rates	N		N		N	
Population dynamics	N		N		N	
Foraging ecology (diet or isotopes)	Y		N		N	
Capture-Mark-Recapture	N		N		N	
Threats						
Bycatch: presence of small scale / artisanal fisheries?	Y (PLS,GND, GNT, OTB)	7, 8, 10	Y (PLS,GND, GNT, OTB)		Y (PLS, GND, GNT)	
Bycatch: presence of industrial fisheries?	N		N		N	
Bycatch: quantified?	Y		Y		Y (PLS, GND, GNT)	
Take. Intentional killing or	N		N		N	

exploitation of turtles						
Take. Egg poaching	n/a		n/a		n/a	
Coastal Development. Nesting habitat degradation	n/a		n/a		n/a	
Coastal Development. Photopollution	Y		n/a		n/a	
Coastal Development. Boat strOkes	Y		Y		Y	
Egg predation	n/a		n/a		n/a	
Pollution (debris, chemical)	y	1, 3, 4,5,11	n/a		n/a	
Pathogens	Y		n/a		n/a	
Climate change	Y		n/a		n/a	
Foraging habitat degradation	y		n/a		n/a	
Other	Y (see text)		Y (see text)		N	
Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	n/a		n/a		n/a	
Number of index nesting sites	n/a		n/a		n/a	
Monitoring at foraging sites (period: range of years)	n/a		n/a		n/a	
Conservation						
Protection under national law	Y		Y		Y	

Number of protected nesting sites (habitat preservation) (% nests)	n/a	n/a	n/a	n/a	n/a	
Number of Marine Areas with mitigation of threats	0		0		0	
N of long-term conservation projects (period: range of years)					0	
In-situ nest protection (eg cages)	n/a		n/a		n/a	
Hatcheries	n/a		n/a		n/a	
Head-starting	N		N		N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	N		N		N	
By-catch: onboard best practices	Y	7, 8,10,23, 24,25	Y		n/a	
By-catch: spatio-temporal closures/reduction	N	N	N	N	N	
Other	Y (see text)	Y (see text)	Y (see text)	Y (see text)	Y (see text)	

Table 5. Annual number of sea turtles recorded per type of observation from 2007 to 2019

Cc	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average	%	
Captured	18	25	17	20	42	29	12	41	42	63	75	43	18	34	32%	445
Stranded	20	5	6	8	9	13	6	14	14	26	38	29	17	16	15%	205
Obs. at sea	13	5	19	14	70	4	62	108	57	94	174	72	106	61	58%	798
Total	51	35	42	42	121	46	80	163	113	183	287	144	141	106		1448
Ferry (EcoOcean)					3				6	9	5	7		-	-	30
Ferry (ISPRA)							6	12	10	10	14			-	-	52
Ferry (CIMA)			47	16	3	0	7	9	11	6	9	7		-	-	115
Total ferry obs.			47	16	6	0	13	21	27	25	28	14				197
Dc	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average	%	
Captured	0	0	0	0	0	0	0	0	0	6	1	0	0	1	16%	7
Stranded	0	0	1	1	0	0	0	0	0	3	0	2	0	1	16%	7
Obs. at sea	2	0	1	1	0	2	2	3	1	11	6	2	0	2	70%	31
Total	2	0	1	2	0	2	2	3	1	20	7	4	0	3		44
Ferry (EcoOcean)					0				0	0	0	0				0

Ferry (ISPRA)							0		0	0	0					0
Ferry (CIMA)			0	0	0	0	0	0	0	0	0	0				0
Total ferry obs.			0	0	0	0	0	0	0	0	0	0				0
Cm	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average	%	26169
Captured								2				0		-	-	2
Stranded				1			1		1			0		-	-	3
Obs. at sea	0	0	0	1	0	0	1	2	0	1	3	1	4	1		13
Total	0	0	0	2	0	0	2	4	1	1	3	1	4	1	99%	18
Ferry (EcoOcean)					1				0	0	0	0				1
Ferry (ISPRA)							0		0	0	0					0
Ferry (CIMA)			0	0	0	0	0	0	0	0	0	0				0
Total ferry obs.			0	0	1	0	0	0	0	0	0	0				1
Cheloniidae	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average	%	
Captured (RTMMF) nd			1							4	3					8
Stranded (RTMMF) nd		2	2	2	1					4	3	2				16
Obs. at sea (RTMMF) nd	15	2	164	8	1	22	20	2		26	56	32	31	32		379

Aerial surveys (SAMM)					18	363							23	-	-	404
Aerial surveys (ASI/ACCOBAMS)												201		-	-	201
Aerial surveys (MarineLand)			17					10		3	12			-	-	42
Dc	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average	%	
Aerial surveys (SAMM)					0	0							0	-	-	0
Aerial surveys (ASI/ACCOBAMS)												1		-	-	1
Aerial surveys (MarineLand)											1			-	-	1

Table 6. Monthly distribution of loggerhead number par type of observation from 2007 to 2019

Cc	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Au**	**Spt**	**Oct**	**Nov**	**Dec**	**Total**
Captured	24	9	16	47	48	99	32	25	25	37	56	27	**445**
Stranded	9	4	10	24	18	51	36	19	7	13	11	3	**205**
Obs at sea	1	1	5	17	62	113	212	223	109	47	3	5	**798**
Total	34	14	31	88	128	263	280	267	141	97	70	35	**1448**

Table 7. Distribution of CCL in cm for loggerhead from 2007 to 2019

<20	**20-25**	**25-30**	**30-35**	**35-40**	**40-45**	**45-50**	**50-55**	**55-60**	**60-65**	**65-70**	**70-75**	**75-80**	**80-85**	**>85**	**Total**
1	4	11	50	95	82	65	46	48	60	37	27	13	5	4	548

Table 8. Monthly distribution of catch of loggerhead per type of fishing gear from 2007 to 2019 (Ent : entrapment in abandoned piece of fishing gears)

Month	Trawl	Gillnet & trammel	Longline	Trapnet	Others . gears	Ent	Co	Po	Total
Jan	21	1		1	1		2	1	24
Feb	6	1		1	1				9
Mar	10	3	2		1	1	3	1	17
Apr	19	22	1		5	3	2	1	50
May	10	26	8		4	1	3		49
Jun	5	66	10		18	6	9	1	105
Jul	3	20	5		4		13	1	32
Au	5	18			2	5	5	1	30
Sep	2	12	6		5		2		25
Oct	14	14	6		3	2	2	1	39
Nov	42	11			3		2	1	56
Dec	20	4	1		2	1	2		28
Total	**157**	**198**	**39**	**2**	**49**	**19**	**45**	**8**	**464**
mortality	**19**	**49**	**7**	**2**	**10**	**8**	**27**	**3**	**125**
Mortality rate/interaction	**12%**	**25%**	**18%**	**100%**	**20%**	**42%**	**60%**	**38%**	
Total Mortality rate	15%	39%	6%	2%	8%	6%	22%	2%	

Table 9. Mortality per type of interaction and per species (2007- 2019)

interactions	Cc	Cm	Dc	Nd	Total

Fishing *	95			1	96
Collisions	27		2	3	32
Pollution	3				3
Nd	192	4	8	26	230
Total	317	4	10	30	361

* including entrapment in loss fishing materials

Table 3. International conventions protecting sea turtles and signed by France.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Barcelona Convention	y	y	y	CM, CC, DC	to assess and control marine pollutionto ensure sustainable management of natural marine and coastal resources;to integrate the environment in social and economic development;to protect the marine environment and coastal zones through prevention and reduction of pollution, and as far as possible, elimination of pollution, whether land or sea-based;to protect the natural and cultural heritage;	Specific Action Plan for the conservation of Mediterranean Marine Turtles with objectives: Development, implementation and enforcement of legislation;•Protection and effective management of nesting areas (include adjacent sea);• Protection and management of feeding, wintering and mating areas and keymigration passages;•Minimization of incidental catches and elimination of intentional killings.• Restoration of degraded nesting beaches

Convention on Biological Diversity	y	y	y	AL	a) Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity;(b) Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity;(c) Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use;(d) Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings;(e) Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas;(f) Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies;(g) Establish or maintain means to regulate,	

					manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse environmental impacts that could affect the conservation and 107sustainable use of biological diversity, taking also into account the risks to human health;(h) Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species;(i) Endeavour to provide the conditions needed for compatibility between present uses and the conservation of biological diversity and the sustainable use of its components;(j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge,	

					innovations and practices;(k) Develop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations;(l) Where a significant adverse effect on biological diversity has been determined pursuant to Article 7, regulate or manage the relevant processes and categories of activities; and(m) Cooperate in providing financial and other support for in-situ conservation outlined in subparagraphs (a) to (l) above, particularly to developing countries.	
Convention on the	y	y	y			

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Conservation of Migratory Species of Wild Animals						
Convention on International Trade in Endangered Species of Wild Fauna and Flora	y	y	y	CC, CM, DC, EI, Ek		
Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)	y	y	y		promote national conservation policiespromote measures against pollutionpromote educational and informative measuresco-ordinate efforts to protect migratory speciesestablish legislative and administrative measures	

Table 4. Sea turtle conservation projects in France

#	RMU	Country	Region / Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/Private	Collaboration with	Reports / Information material	Current Sponsors	Primary Contact (name and Email)
T4.1	CC-Mediterranean, CC-Atlantic Northeast, CC-Atlantic Northwest	France, Italy, Spain, Greece, Portugal, Turkey, Tunisia	EU, BARCELONA AND OSPAR CONVENTIONS	INDICIT (Implementation Of The Indicator Of Marine Litter On Sea Turtles And Biota In Regional Sea Conventions And Marine Strategy Framework Directive Areas)	marine litter, bio-indicator, marine strategy framework directive	01/02/2017	01/02/2019	CNRS-EPHE, Center of functional and evolutionary ecology, Montpellier, France	Public	CNR-IAMC (IT), DEKAMER (TR), FRCT (PT), HCMR (GR), IMAR (PT), INSTM (TN), ISPRA (IT), MNHN (FR), ULPGC (ES), UNIVERSITY OF VALENCIA (ES), SZN (IT)	https://indicit-europa.eu/	EU	coordination@indicit-europa.eu

T4.2	CC-Mediterranean, CC-Atlantic Northeast, CC-Atlantic Northwest	France	France MAINLAND	OBSERVATOIRE DES TORTUES MARINES DE France METROPOLITAINE	stranding, species occurrence and distribution, rescue, anthropogenic impacts, observers, samples storage, tagging, training	Museum National d'Histoire naturelle	SHF RTMMF, Aquarium La Rochelle RTMAE, OFB French office for biodiversity	http://gtmf.mnhn.fr/25-oct-2016-arrete-donnant-subdelegation-au-mnhn-pour-lobservatoire-des-tortues-marines-en-france-metropolitaine/	claro@mnhn.fr

GREECE

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1. RMU: Loggerhead Turtle (*Caretta caretta*) Mediterranean

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

Following the criteria set in Table 1, six nesting areas in Greece have a nesting potential of >20 nests/yr AND a nesting density of >10 nests/km/yr. These areas are Laganas Bay (Zakynthos Island), southern Kyparissia Bay, Rethymno, Koroni, Kefalonia, and the beaches "adjacent to Kyparissia town". In addition, twelve nesting areas in Greece have <20 nests/yr OR <10nests/km/yr. These areas are Lakonikos Bay, northern Kyparissia Bay, Chania, Messaras Bay, Kos Island, Lefkas Island, Romanos, Kerkyra Island, Ipirus coast, SE Peloponnese, Kotychi and Rhodes Island.

The nesting areas of Laganas Bay, Kyparissia Bay, Bay of Chania, Rethymno and Messaras Bay, Lakonikos Bay and Koroni are monitored by ARCHELON through a systematic and standardized long-term project (Fig. 1). In addition, Mounda beach in Kefalonia is monitored by the local group "Katelios", supervised by ARCHELON. Nest counts since 1984 in Zakynthos, southern Kyparissia Bay and Mounda are the oldest in the Mediterranean. Besides Mounda and Lakonikos Bay, all other areas are index sites.

Considering trends of annual nest counts, a downward trend is evident in the areas of Rethymno and Chania, and to a lesser extend in Laganas Bay, while in southern Kyparissia Bay there has been a dramatic increase of nests, in the last few years, rendering this area to host today the largest nesting loggerhead aggregation in the Mediterranean. Nevertheless, it is estimated that the total annual number of nests in Greece is considered more or less stable.

Analysis of expanded mtDNA sequences has assigned in the Mediterranean seven independent Management Units (MUs), of which two concern loggerhead populations nesting in western Greece (i.e. Zakynthos, Kyparissia, Lakonikos) and on Crete (i.e. Rethymno) (108).

Figure 1. Map of Greece showing the main nesting areas monitored by ARCHELON
1) Laganas Bay; 2) Kyparissia Bay; 3) Koroni; 4) Lakonikos Bay; 5) Chania; 6) Rethymno; 7) Messaras Bay.

1.1.2.Marine areas

Preliminary analyses of strandings, tag recoveries and/or incidental catch in fisheries yielded turtle concentrations at the following marine areas: Ionian Sea (including Zakynthos, Kyparissia Bay, Amvrakikos Bay), SE Peloponnese (including Messiniakos Bay, Lakonikos Bay, Argolikos Bay), Island of Crete, SE Aegean Sea (incl. Rhodes and Kos), northern Aegean Sea. The above marine areas are frequented by turtles throughout the year and therefore may well be foraging and/or wintering areas (20, 22, 38, 57, 58, 59, 60, 61, 62, 64, 114, 115).

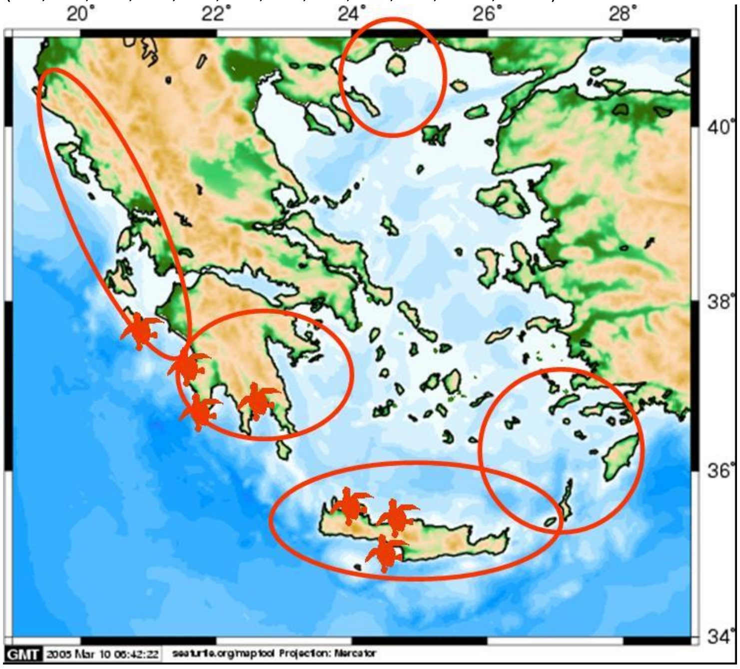

Figure 2. Map showing approximate marine areas, where many turtles are reported as bycaught or stranded. Red turtles indicate main nesting areas.

The marine area of Laganas Bay at Zakynthos is an important marine area for turtles as it comprises the main inter-nesting area of the female population nesting at Zakynthos (21) but is also a courtship and mating area, with several types of solitary and social behaviours of both male and female turtles (116). Adult loggerheads in Laganas Bay were observed using fish-cleaning stations (117) and also were seen foraging during the breeding season (116). In Laganas Bay, an overall balanced operational sex ratio was suggested (40), while males were using multiple breeding sites during the breeding season (16). Females in Laganas Bay show an intense male avoidance (116) while genetic analyses reveal the highest multiple paternity for this population globally (21, 118). In Laganas Bay, female loggerheads use a home range of about 10.2 km^2 while males a smaller one of about 5.2 km^2 (30).

Another important marine area is Amvrakikos Bay, western Greece, where a long-term study, incl. satellite telemetry, capture-mark-recapture work and genetics, revealed that the Bay constitutes an important neritic foraging habitat of a remarkable loggerhead population comprising mainly of large juveniles and adult-sized turtles, mostly males. Growth rates have been calculated as <2.7 cm/yr decreasing with increased body size. Flipper tagging and genetics have linked this population to nesting areas in Greece, with the majority associated with Zakynthos. Telemetry has shown long-term residency in the Bay and one female migrated to Turkey where she probably nested. MtDNA mixed stock analysis indicated that 82% of the loggerheads in Amvrakikos Bay originate from Greek nesting beaches with lesser contribution from Turkey, Cyprus and Libya (19, 20, 22, 25, 38).

A marine area deserving further research is Mesolonghi lagoon (38.32^0 N; 21.37^0 E), where 7 turtles, equipped with satellite transmitters, displayed various behaviours, one of them migrated 1800 km in Algerian waters in the western Mediterranean (25).

Tag recoveries from turtles flipper-tagged while nesting in Greece show a wide dispersion in the Mediterranean basin, with concentrations at the Gulf of Gabès, the Ionian Sea, the Adriatic Sea and the Aegean Sea (4, 11, 13, 14). These areas are considered primary foraging and/or wintering areas for adult female loggerheads nesting in Greece (see Fig. 5 in Margaritoulis and Panagopoulou, 2010). These foraging areas have been also confirmed later by satellite tracking (16, 17, 18, 21).

Simulations of particle distribution indicate that hatchlings from Greece disperse mainly in the Ionian Sea, south-central Mediterranean and in the Adriatic Sea (106) rendering these areas as possible nursery areas.

1.2. Other biological data

Please see Table 1.

1.3. Threats

1.3.1.Nesting sites

Threats of nesting sites have been thoroughly described by Margaritoulis & Panagopoulou (2010). Specifically, threats at nesting beaches concerning coastal development and associated recreational activities leading to degradation, photo pollution, beach restructuring, non-human predation of eggs and hatchlings, beach erosion because of human actions, planting of exotic vegetation, and sea-borne debris have been analysed in detail per nesting area (4). To this we can add recent studies on egg infestation by invertebrates (112), and on possible impacts of temperature rise and sea level rise because of climate change (89-96, 100).
Some site-specific threats are discussed under the section 1.4. (Conservation) below.
A major threat in the form of a building plan along the southern Kyparissia Bay has been deterred by activating the Bern Convention and the European Union (10).

1.3.2.Marine areas

By-catch and associated mortalities in various fishing gears as well as intentional killings, boat strikes and disturbances at sea from turtle watching in Laganas Bay, detailed in Margaritoulis & Panagopoulou (4), are still valid.
Predation of adult loggerheads by monk seals has been intensified at Zakynthos during the nesting season of 2010 when 21 adult loggerheads have been predated (72). Nevertheless, in 2011 predations were much reduced, probably because an individual male seal, thought to have effected most predations, was found dead.

1.4. Conservation

Conservation status, concerning marine turtles and their habitats, under both national laws and ratified supra-national conventions have been described in detail in the previous MTSG report (4). Most of nesting areas with regular nesting are designated as Sites of Community Importance (SCI's) at the EU's NATURA 2000 network of protected areas and in some areas this includes also the marine area in front of the nesting beach. Recently, more nesting areas as well as marine areas, thought to be used as inter-nesting and foraging/overwintering areas, have been included in the NATURA 2000 network either through expansion of existing NATURA sites or through the establishment of new ones. Further, management bodies of the above NATURA 2000 sites have been designated either anew or through reconstructing of existing management bodies. It should be noted that except for Laganas Bay in Zakynthos and the pending legislation on the protection status of southern Kyparissia Bay (see below), most of these sites continue to remain without a designated conservation status as dictated by the existing Greek environmental legislation and are therefore remain extremely vulnerable to existing anthropogenic pressures.
Laganas Bay jn Zakynthos, with the status of a National Marine Park, continues to have problems of inadequate wardening and poor enforcement of regulations mainly due to limited governmental funding. During the 2017 nesting season lack of sufficient wardening resulted in high numbers of violations both on land and at sea. Specifically, ARCHELON recorded 68,047 violations regarding removal of beach furniture, which compared to 2016 season (29,040 violations) yields an increase of about 134%! Further, 653 violations of legislation were recorded by ARCHELON within the protected marine area. Of these, 486 incidents were boats breaching the speed limit of 6 knots. It is worth to note that in 2017 nesting season 8 turtles were found dead because of a boat strike. Regarding the turtle watching activity in the marine area of Laganas Bay, ARCHELON recorded in the 2017 nesting season 2,090 incidents of non-compliance to the set guidelines. Other illegal activities, such as building and road constructions, continue in the wider area of the Marine Park. Despite recommendations by

the Council of Europe since 1987, no action has been taken for the removal of illegal buildings at Daphni, now operating as businesses. Moreover, within the boundaries of the Park operates an overused landfill site, which is a permanent toxic pollution threat to both the nearby nesting beaches and the marine area.
In 2012 a specific developmental threat at the southern part of Kyparissia Bay, a Natura 2000 protected site, resulted in the EC taking Greece to the European Court of Justice for not complying with its nature conservation obligations. As a result, the Greek authorities, following also recommendations from the Bern Convention, issued a Presidential Decree, now at its final consultation stage, for the legislative protection of the area and especially of its core nesting area (10).

Impacts of litter on marine turtles and entanglement

Due to its extended distribution in the Mediterranean, the loggerhead turtle was proposed as a bio-indicator of marine litter impacts by the EU's Marine Strategy Framework Directive (MSFD). The projects INDICIT and MEDLITTER investigate the implementation of indicators of litter impacts on sea turtles and marine biota in general. Many partners from several Mediterranean countries participate in it. The Hellenic Marine Research Centre (HMRC) is a partner to these projects, with ARCHELON and MEDASSET participating as subcontractors.

1.5. Research

<u>Key knowledge gaps</u>

1. Interaction with fisheries: update of existing data on other gears.
2. Overwintering and foraging areas of adults in Greece; developmental habitats for juveniles in Greece; post-hatch migratory routes ("the lost years")
3. Mitigation measures to reduce interaction with fishing gears
4. Impacts of climate change on biotic and abiotic parameters (gas exchange, humidity, temperature) affecting hatching success and hatchling survival on nesting sites;
5. Impacts of climate change on sea turtle nesting phenology
6. Marine debris impacts on sea turtles (including ingestion of plastics, ghost gear, microplastics)
7. Impacts of heavy metal discharges on sea turtles.
8.

2. RMU: Green turtle (*Chelonia mydas*) Mediterranean

2.1. Distribution, abundance, trends

2.1.1. Nesting sites

No nestings of green turtles have been recorded in Greece, besides an exceptional nesting on the loggerhead nesting area of Rethymno (island of Crete) in 2007, representing the westernmost nesting record of *Chelonia mydas* in the Mediterranean (4).

2.1.2. Marine areas

There is increased presence of small juvenile green turtles (average CCL: 36.4cm) in Lakonikos Bay (50, 53, 55, 86) feeding on the sea grass *Cymodocea nodosa* (86). Stranding data indicate the presence of adult green turtles in the eastern Aegean Sea, especially around Rhodes Island (4, 114).

2.2. Other biological data

2.3. Threats

2.3.1. Nesting sites

Not applicable

2.3.2. Marine areas

By-catch in various fishing gears, intentional killings (4).

2.4. Conservation

The marine area in Lakonikos Bay, featuring a relatively large percentage of *Chelonia mydas* has been recently included in the NATURA 2000 Network.

2.5. Research

Key knowledge gaps

Investigate population size, origin and growth of juvenile green turtles in Lakonikos Bay.

3. RMU: Leatherback turtle (*Dermochelys coriacea*) Atlantic (unknown)

3.1. Distribution, abundance, trends

3.1.1. Nesting sites

Not applicable

3.1.2. Marine areas

No specific marine areas are known (10)

3.2. Other biological data

3.3. Threats

3.3.1. Nesting sites

Not applicable

3.3.2. Marine areas

By-catch in fishing gears, ingestion of plastics, intentional killings (4).

3.4. Conservation

3.5. Research

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Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Greece.

RMU	CC-MED	Ref #	CM-MED	Ref #	DC-ATL	Ref #
Occurrence						
Nesting sites	Y	4, 11	N	4	N	4
Pelagic foraging grounds	J	29, 101, 106	n/a	n/a	A	62, 77, 102, 103
Benthic foraging grounds	JA	11, 13, 14, 18, 19, 23, 26, 29, 30, 32, 38, 52, 53, 55, 58, 88, 101, 106	J	50, 53, 55, 86, 87	n/a	n/a
Key biological data						
Nests/yr: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr: recent order of magnitude	n/a	n/a	n/a	n/a	n/a	n/a
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	6	2, 3, 4, 5, 6, 7, 8, 9, 10, 11	n/a	n/a	n/a	n/a
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	12	1, 4, 7, 9, 11, 12	n/a	n/a	n/a	n/a
Nests/yr at "major" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a
Nests/yr at "minor" sites: recent average (range of years)	n/a	n/a	n/a	n/a	n/a	n/a
Total length of nesting sites (km)	n/a	n/a	n/a	n/a	n/a	n/a
Nesting females / yr	n/a	n/a	n/a	n/a	n/a	n/a
Nests / female season (N)	n/a	n/a	n/a	n/a	n/a	n/a
Female remigration interval (yrs) (N)	n/a	n/a	n/a	n/a	n/a	n/a

Sex ratio: Hatchlings (F / Tot) (N)	Y	5, 6, 35, 36, 37, 41, 109	n/a	n/a	n/a	n/a
Sex ratio: Immatures (F / Tot) (N)	n/a	n/a	n/a	n/a	n/a	n/a
Sex ratio: Adults (F / Tot) (N)	Y	38, 40, 93, 110	n/a	n/a	n/a	n/a
Min adult size, CCL or SCL (cm)	63.5 SCL	11	n/a	n/a	n/a	n/a
Age at maturity (yrs)	n/a	n/a	n/a	n/a	n/a	n/a
Clutch size (n eggs) (N)	106.7 (4017 clutches)-116.5 (5972 clutches)	5, 6	n/a	n/a	n/a	n/a
Emergence success (hatchlings/egg) (N)	0.67 (5972 clutches)-0.69 (4017 clutches)	5, 6	n/a	n/a	n/a	n/a
Nesting success (Nests/ Tot emergence tracks) (N)	0.26 (31665 nests)	5, 6	n/a	n/a	n/a	n/a
Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	Stable (2000-2010)	4	n/a	n/a	n/a	n/a
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	n/a	n/a	n/a	n/a	n/a
Oldest documented abundance: nests/yr (range of years)	n/a	n/a	n/a	n/a	n/a	n/a
Published studies						
Growth rates	Y	38	N	n/a	N	n/a
Genetics	Y	19, 42-49, 108, 118	N	n/a	N	n/a
Stocks defined by genetic markers	Y	42, 46, 48, 49, 108	N	n/a	N	n/a
Remote tracking (satellite or other)	Y	16-33, 79	N	n/a	N	n/a

Survival rates	N	n/a	N	n/a	N	n/a
Population dynamics	Y	98, 107	Y	107	N	n/a
Foraging ecology (diet or isotopes)	Y	33, 39, 88, 116	Y	34, 86	N	n/a
Capture-Mark-Recapture	Y	11, 13, 14, 15, 19, 38	N	n/a	N	n/a
Threats						
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, SN, OTH)	50, 52, 54-61, 63, 64, 114	Y (SN, OTH)	50, 53, 55	Y (PLL, DN, SN)	77, 102
Bycatch: presence of industrial fisheries?	Y (PLL, SN, BT)	50, 51, 53, 54, 115	Y (SN, BT)	50, 53	Y (PLL, DN, SN)	62, 102
Bycatch: quantified?	Y (BT, PLL)	51, 62	N	n/a	N	n/a
Take. Intentional killing or exploitation of turtles	Y (intentional killing)	52, 54, 56, 57, 59, 61	Y (intentional killing)	56, 57	Y (intentional killing)	77
Take. Egg poaching	N	n/a	n/a	n/a	n/a	n/a
Coastal Development. Nesting habitat degradation	Y	2, 4, 66, 69, 73, 84, 111	n/a	n/a	n/a	n/a
Coastal Development. Photopollution	Y	1, 2, 4, 66, 68, 69, 73	n/a	n/a	n/a	n/a
Coastal Development. Boat strikes	Y	4, 11, 56, 57, 66, 67, 69, 80	n/a	n/a	n/a	n/a
Egg predation	Y (incl. plants)	1, 4, 6, 11, 65, 69, 70	n/a	n/a	n/a	n/a
Pollution (debris, chemical)	Y	4, 66, 97	n/a	n/a	Y	4
Pathogens	n/a	n/a	n/a	n/a	n/a	n/a
Climate change	Y	89-96, 100	n/a	n/a	n/a	n/a
Foraging habitat degradation	n/a	n/a	n/a	n/a	n/a	n/a
Other (hatchling predation)	Y	4, 66, 104, 105	n/a	n/a	n/a	n/a

Other (adult predation by monk seals)	Y	71, 72	n/a	n/a	n/a	n/a
Other (egg infestation by invertebrates)	Y	112	n/a	n/a	n/a	n/a
Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	Y (1984-ongoing)	1-6, 8-10	n/a	n/a	n/a	n/a
Number of index nesting sites	6	78	n/a	n/a	n/a	n/a
Monitoring at foraging sites (period: range of years)	Y (2000-ongoing)	19, 38	n/a	n/a	n/a	n/a
Conservation						
Protection under national law	Y	4, 11, 52, 73, 74, 75, 76, 77, 81, 82, 83	Y	4, 52, 76, 77	Y	4, 52, 76, 77
Number of protected nesting sites (habitat preservation) (% nests)	1 (38% of all nests)	74, 85	n/a	n/a	n/a	n/a
Number of Marine Areas with mitigation of threats	1 (Zakynthos)	4, 74, 80, 113	n/a	n/a	n/a	n/a
N of long-term conservation projects (period: range of years)	2 (1984-2017); 1 (1990-2017); 1 (1992-17); 1 (1993-17); 1 (1995-17)	1-6, 8-10	n/a	n/a	n/a	n/a
In-situ nest protection (eg cages)	Y (incl. nest relocations)	1, 2, 4, 8, 9, 10, 65, 70, 73, 99	n/a	n/a	n/a	n/a
Hatcheries	N	n/a	n/a	n/a	n/a	n/a
Head-starting	N	n/a	n/a	n/a	n/a	n/a
By-catch: fishing gear modifications (eg, TED, circle hooks)	N	n/a	N	n/a	N	n/a
By-catch: onboard best practices	Y	52	Y	52	Y	52
By-catch: spatio-temporal closures/reduction	N	n/a	N	n/a	N	n/a
Other	N	n/a	N	n/a	N	n/a

Table 2. The nesting beaches in Greece.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
CC-MED				Long	Lat	Long	Lat	Long	Lat					
Laganas Bay, Zakynthos	Y	1218 (1984-2009)	4463 (1984-2009)	20,874167	37,728105	20,989722	37,703458			5,5	100%	5, 6	1	n/a
Southern Kyparissia Bay	Y	781 (1994-2002, 2013-2015)	1654 (1994-2002)	21,681647	37,376539	21,691389	37,290797			9,5	100%	3, 8, 9, 10	1	n/a
Rethymno, Crete	Y	350 (1990-2004)	n/a	24,483998	35,367504	24,614466	35,393679			10,8	100%	2	1	n/a
Lakonikos Bay	N	197 (1992-2007)	n/a	22,521989	36,701247	22,78661	36,795463			23,5	100%	4	1	n/a
Bay of Chania, Crete	Y	94 (1992-2007)	n/a	23,781704	35,543395	23,954406	35,512599			13,1	100%	4	1	n/a
Koroni	Y	53 (1995-2002)	149 (1995-2002)	21,935057	36,779777	21,95968	36,793628			2,7	100%	1	1	n/a
Messaras Bay, Crete	Y	51 (1993-2007)	n/a	24,740106	35,081273	24,759257	35,007406			8,1	100%	4	1	n/a
Kotychi-Strofylia	N	50 (1986, 89, 95)	n/a	21,272222	37,991914	21,364722	38,164089			21,0	100%	4	1	n/a
Mounda, Cephalonia	N	29 (1993-1998)	n/a	20,764136	38,069183	20,786278	38,057777			2,8	100%	11	1	n/a
Romanos	N	22 (1989, 98, 99)	n/a	21,633611	37,01	21,649167	36,989722			2,7	100%	4	1	n/a

Adjacent to Kyparissia town	N	64 (1989,98)	n/a	21,63 1389	37,23 1886	21,68 6667	37,28 98			3,5	100%	4	1	n/a
Ipirus coast (several beaches)	N	40 (1990)	n/a	20,18 5556	39,51 8611	20,72 5833	38,95 1111			23,2	Three surveys	7, 4, 11	2	A
Lefkas island (several beaches)	N	50 (1990)	n/a	n/a	n/a	n/a	n/a	20,64 8056	38,71 0833	17,1	Three surveys	7, 4, 11	2	A
Kerkyra Island (several beaches)	N	20 (1990)	n/a	19,87 3611	39,45 3178	20,07 9167	39,36 8611			7,8	Three surveys	7, 4, 11	2	A
Kos Island (several beaches)	N	60 (1991)	n/a	n/a	n/a	n/a	n/a	27,13 1944	36,82 5834	23,0	Three surveys	7, 4, 11	2	A
Rhodes Island (SE coast)	N	4 (1988-89)	n/a	27,81 6389	35,90 3836	27,93 1944	36,02 3611			16,0	100%	7, 4, 11	1	n/a
Rhodes Island (SW coast)	N	11 (1988-89)	n/a	27,72 6111	35,94 8333	27,75 0834	36,10 5278			18,0	100%	7, 4, 11	1	n/a
Northern Kyparissia Bay	N	100 (1984-89)	n/a	21,45 3889	37,61 1717	21,68 1647	37,37 6539			34,0	100%	3	1	n/a
SE Peloponnesus (Astros)	N	16 (1990)	n/a	22,74 8611	37,44 64	22,78 3611	37,37 1692			9,5	Three surveys	7, 4, 11	2	A
Kythira Island	N	4 (1990)	n/a	23,05 8611	36,22 2158	23,07 1111	36,22 663			1,0	Two surveys	7, 4, 11	2	A

Table 3. Conventions signed by Greece.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Barcelona Convention	Y	Y	Y	CM, CC		
Convention Biological Diversity	Y	Y	Y	CM, CC		
CMS	Y	Y	Y	CM, CC		
CITES	Y	Y	Y	CM, CC		
Bern Convention	Y	Y	Y	CM, CC		
Habitats Directive (EU)	Y	Y	Y	CM, CC		

ISRAEL

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Author provided Tables 1 to 4 for the Mediterranean Report in 2018, but they were not updated since then. No additional text was provided. More detailed information about this country can be found in the Med Turtle report published in 2010. (http://iucn-mtsg.org/publications/med-report/).

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Table 1. Biological and conservation information about sea turtle Regional Management Units in Israel.

TOPIC	REGIONAL MANAGEMENT UNIT					
	CC-MED	Ref #	**CM-MED**	Ref #	**DC-ATL**	Ref #
Occurrence						
Nesting sites	Y	PS	Y	PS	N	PS
Pelagic foraging grounds	JA	PS	Y	PS	n/a	
Benthic foraging grounds	Y	PS	Y	PS	n/a	
Key biological data						
Nests/yr: recent average (range of years)	137.3 (2007-2016)	PS	17.3 (2007-2016)	PS	n/a	
Nests/yr: recent order of magnitude	100-200	PS	10 to 20	PS	n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	0	PS	0	PS	n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	All	PS	3	PS	n/a	
Nests/yr at "major" sites: recent average (range of years)	n/a		n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	1.1 (2010-2017)	PS	0.3 (2010-2017)	PS	n/a	
Total length of nesting sites (km)	150	PS	150	PS	n/a	
Nesting females / yr	n/a		n/a		n/a	
Nests / female season (N)	n/a		n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	0.37 (520)	PS	0.56 (76)	PS	n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a		n/a	
Min adult size, CCL or SCL (cm)	72 CCL	PS	86 SCL	PS	n/a	
Age at maturity (yrs)	n/a		n/a		n/a	
Clutch size (n eggs) (N)	98.2 (287)	PS	n/a	PS	n/a	

Emergence success (hatchlings/egg) (N)	0.82 (1569)	PS	n/a	PS	n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	0.4 (228)	PS	n/a	PS	n/a	
Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	Up (1993-2017)	PS	Up (1993-2017)	PS	n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a		n/a	
Oldest documented abundance: nests/yr (range of years)	n/a		n/a		n/a	
Published studies						
Growth rates	N		N		N	
Genetics	N		Y	4	N	
Stocks defined by genetic markers	N		N		N	
Remote tracking (satellite or other)	Y	1	Y	1	N	
Survival rates	N		N		N	
Population dynamics	N		Y	5	N	
Foraging ecology (diet or isotopes)	N		N		N	
Capture-Mark-Recapture	N		N		N	
Threats						
Bycatch: presence of small scale / artisanal fisheries?	Y (DLL, SN, ST, MT)	2	Y (DLL, SN, ST, MT)	2	Y (DLL, SN, ST, MT)	2
Bycatch: presence of industrial fisheries?	Y (DLL, SN, ST, MT)	2	Y (DLL, SN, ST, MT)	2	Y (DLL, SN, ST, MT)	2
Bycatch: quantified?	Y	2	Y	2	n/a	
Take. Intentional killing or exploitation of turtles	N		N		n/a	
Take. Egg poaching	N		N		n/a	
Coastal Development. Nesting habitat degradation	Y		Y		n/a	
Coastal Development. Photopollution	Y	3	Y	3	n/a	
Coastal Development. Boat strikes	Y		Y		n/a	
Egg predation	N		N		n/a	

Pollution (debris, chemical)	Y		Y		n/a	
Pathogens	n/a		n/a		n/a	
Climate change	n/a		n/a		n/a	
Foraging habitat degradation	Y		Y		n/a	
Other	Y (see text)	6	Y (see text)	6	N	
Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	Y (1982-ongoing)		Y (1982-ongoing)		n/a	
Number of index nesting sites	5		5		n/a	
Monitoring at foraging sites (period: range of years)	N		N		n/a	
Conservation						
Protection under national law	Y		Y		Y	
Number of protected nesting sites (habitat preservation) (% nests)	1 (12%)		0		0	
Number of Marine Areas with mitigation of threats					0	
N of long-term conservation projects (period: range of years)					0	
In-situ nest protection (eg cages)					n/a	
Hatcheries					n/a	
Head-starting					n/a	
By-catch: fishing gear modifications (eg, TED, circle hooks)					n/a	
By-catch: onboard best practices					n/a	
By-catch: spatio-temporal closures/reduction					n/a	
Other					N	

Table 2. Sea turtle nesting beaches in Israel.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls /yr: recent average (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
CC-MED				Long	Lat	Long	Lat	Long	Lat					
West Galil		15.3 (2010-2017)		32°55'8.11"N	35° 3'57.75"E'	33° 5'34.79"N	35° 6'19.22"E'			20	90%			
Carmel		32.7 (2010-2017)		32°50'1.85"N	34°58'36.59E'	32°28'37.67"N	34°53'12.40"E'			42	85%			
Hasharon		33.7 (2010-2017)		32°27'50.55"N	34°52'59.21"E'	32°11'53.55"N	34°48'28.25"E'			31	97%			
Pleshet		15 (2010-2017)		32° 5'56.23"N	34°46'22.49"E'	31°51'5.46"N	34°39'35.86"E'			32	38%			
Southern coastal plains		23.1 (2010-2017)		31°48'45.79"N	34°38'13.73"E'	31°35'40.97"N	34°29'29.48"E'			28	39%			

CM-MED				Long	Lat	Long	Lat	Long	Lat					
West Galil		0.25 (2010-2017)		32°55'8.11"N	35° 3'57.75"E'	33° 5'34.79"N	35° 6'19.22"E'			20	90 %			
Carmel		2.25 (2010-2017)		32°50'1.85"N	34°58'36.59E'	32°28'37.67" N	34°53'12.40"E '			42	85 %			
Hasharon		7.375 (2010-2017)		32°27'50.55" N	34°52'59.21"E '	32°11'53.55" N	34°48'28.25"E '			31	97 %			
Pleshet		1.875 (2010-2017)		32° 5'56.23"N	34°46'22.49"E '	31°51'5.46"N	34°39'35.86"E '			32	38 %			
Southern coastal plains		6.625 (2010-2017)		31°48'45.79" N	34°38'13.73"E '	31°35'40.97" N	34°29'29.48"E '			28	39 %			

Table 3. International conventions protecting sea turtles and signed by Israel.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Convention A	Y	Y	Y	CM, CC		
Convention B	Y	N	Y	DC		
Convention C	N	N	n/a	ALL		

Table 4. Projects and databases on sea turtles in Israel

RMU	Country	Region / Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/Private	Collaboration with
CM-WIO	France	Europa, Juand de Nova, Glorieuse, Tromelin	Tracking green in the mozambique Channel	Tracking; Fastloc GPS tag; Nesting female; western Indian Ocean	2010	2013	YY	Public	ZZ, RR,TT

ITALY

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1. RMU: Loggerhead Turtle (*Caretta caretta*) Mediterranean

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

Italy hosts only minor nesting sites for loggerhead turtles, and most of the nesting activities are dispersed over large stretches of coastline (with exception of the Islands Lampedusa and Linosa). The Ionian coastline of Calabria has been identified as a regular nesting area and makes up for 52% of all nesting activities in Italy which counts 30 – 40 nests year-1 (Table 1). Nesting occurs also along the south-western coast of Sicily facing the Sicily Channel and on the Pelagian Islands of Lampedusa and Linosa, however, there may be years at these sites without any nest. Only the Ionian coastline of Calabria, Lampedusa and Linosa have been systematically monitored (Table 2), but there are no recent updates on these monitoring efforts with respect to the previous report, which provided nesting densities of 0.2, 14.7 and 16.3 nests year^{-1}km^{-1}, respectively. There is, however, evidence of a new regular nesting area on the southern Tyrrhenian coast of Campania, where the first report on a nest dates back to the mid-1960s, and where nesting is now being observed every year since 2012 (Figure 1, Table 1).

Apart from these, there are occasional reports of single nests in Sardinia, on the whole Tyrrhenian coastline up to high northern latitudes in Tuscany, and along the Adriatic coastline from Apulia up to the region of Abruzzo (Province of Teramo, 42.683402°N, 14.013791°E).

The Ionian coastline of Calabria and the Tyrrhenian coastline of Campania are the two Italian nesting areas with the highest average number of nests per year (4.6 nests yr^{-1}). Clutch size and emergence success reported for these areas range between 93 and 99 eggs and between 70.7 and 86%, respectively, and are thus well within the ranges of eastern Mediterranean nesting beaches (Table 2).

1.1.2.Marine Areas

The Italian peninsula lies in the center of the Mediterranean and the surrounding marine areas are among the most frequented by turtles in the basin (Fig. 1). Most data on turtle presence and size of turtles derive from stranding data and fisheries by-catch data. The north Adriatic Sea is an important neritic developmental area for juveniles as well as a foraging area for adult turtles. Further to the south of the Italian Adriatic coast lies the Gulf of Manfredonia which also hosts a neritic foraging habitat for small juveniles through adult turtles.

Although stranding data suggest that turtles occur all around Italy no publication confirm the presence of other neritic foraging habitats, apart from a study demonstrating that loggerhead turtles use the abundant prey in the shallow soft-bottom habitats in the Naples areas, SW Italy. It is frequented by turtles from at Greece, Turkey, and also from the Atlantic, although the latter make a smaller proportion.

Oceanic developmental and foraging habitats can be found in the southern Adriatic, north-western and central-western Ionian. Stranding data show a higher occurrence of small turtles (<30 cm CCL) on the south Adriatic-Ionian coasts than in other Italian areas, suggesting that this area is a developmental habitat for small turtles in the oceanic phase. This is further supported by high catch rates by drifting longline in the Ionian and by tag returns. Genetic studies showed that this area is frequented by turtles from at least Greece, Turkey and the Atlantic. Also the south Tyrrhenian Sea has recently been shown to be of importance for foraging turtles, albeit for larger and adults sized turtles.

A migratory corridor is present along the Italian Adriatic coast for turtles moving southwards, either seasonally when the northern waters become too cold, or at the beginning of the reproductive season when turtles migrate towards their nesting grounds. The Strait of Sicily and the Strait of Messina are obligatory pathways between the western and the eastern Mediterranean, as also directly observed through satellite tracking.

1.2. Other biological data

A most recent review on marine turtles in the Mediterranean summarises key biological data on loggerhead turtles in Italy (283). Table 1 also provides references for the major research outputs in respect to growth rates, genetics, stocks defined by genetic markers, satellite tracking (or other), survival rates, population dynamics, foraging ecology (diet or isotopes), and Capture-Mark-Recapture data.

1.3. Threats

Given that Italy is more important for foraging areas than for nesting grounds, bycatch resulting from the Italian fleet fishing activity is the most important threat for this country. Several studies provided the order of magnitude of bycatch in different marine areas (Table 1). Boat strikes represent a source of mortality too, although difficult to quantify (Table 1). Nesting sites are reported to be threatened by coastal development and egg predation (Table 1). Light pollution is also a threat on recently frequented nesting sites along the southwestern coasts, but the impact has not been assessed yet.

1.4. Conservation

Sea turtles are protected by national laws and international conventions (Tables 1 and 3). Several long-term conservation projects are active in the country, with some since 1980s (Tables 1, 4). However, measures aimed to mitigate the main threat (bycatch) are still at an initial phase and are mostly limited to informing fishers about the onboard best practices to reduce post-release mortality (Table 1). A national strategy led by relevant governmental authorities is needed, with the aim to reduce the impact of the Italian fishing fleet on sea turtle RMU. Due to their bycatch and mortality levels, bottom trawl and pelagic longline should be the priority fishing gear targeted.

1.5. Research

The Italian nesting population is still poorly quantified. More research is needed on the distribution (needed to identify priority sites for conservation) and the level of nesting activity as well as on remigration interval and clutch frequency (Table 1). Although incubation duration may provide a rough indication, hatchling sex ratio has not been estimated yet.

Abundance estimates at sea should be considered as a priority, in order to provide fishery-independent information about the spatial distribution and temporal trends. This information would be useful to identify hot-spot areas in need of special management and to contribute to a better understanding of population trends at Mediterranean level.

2. RMU: Loggerhead Turtle (*Caretta caretta*) North West Atlantic

2.1. Distribution, abundance, trends

2.1.1. Nesting sites

This RMU does not breed in the Mediterranean

2.1.2. Marine areas

Individuals belonging to this RMU have been reported in the waters around Italy, except the Adriatic. They mainly frequent offshore waters, with a limited number occurring in coastal waters (Table 1). Genetic studies provided estimates of contribution of this RMU to mixed stocks (with wide confidence intervals) but no estimates of abundance or trends are available.

2.2. Other biological data
Given that this RMU shares the same foraging grounds around Italy of the Mediterranean RMU, several biological data ascribed to that RMU (Table 1) may be partially based on individuals from the Atlantic too. One study estimated specific growth rates of individuals of this RMU in Italy (206).

2.3. Threats
Same of Mediterranean RMU. See 1.3, for areas where this RMU occurs.

2.4. Conservation
Same of Mediterranean RMU. See 1.4, for areas where this RMU occurs.

2.5. Research
Studies specifically focusing on this RMU are almost exclusively limited to mixed stock analyses with low resolution and limited application for other studies. Specific studies on the biology and ecology of the individuals of this RMU probably require a better genetic approach to identify them.

3. RMU: Green Turtle (*Chelonia mydas*) Mediterranean

3.1. Distribution, abundance, trends

3.1.1. Nesting sites
This RMU does not breed in Italy.

3.1.2. Marine areas
Individuals belonging to this RMU have been reported in all the waters around Italy, and occurrences are more frequently observed during the warmer months of the year (Table 1). No estimates of abundance or trends are available.

3.2. Other biological data
No other information is available, except size of the reported individuals indicating that the majority of turtles are smaller juveniles (mean CCL = 39 cm).

3.3. Threats
No specific studies have been done focusing on this species. However, a few captures by longliners have been reported (277), and for some stranding records the causes were attributed to interaction with fishing gear and boat strikes.

3.4. Conservation
Protection status in Italy is the same for all sea turtle species. No specific conservation measures have been developed. However, it is plausible that measures aimed to reduce the impact of fishing gears on loggerheads would provide benefit to this species as well.

3.5. Research
Other than distribution of the few reports, studies specifically focusing on this RMU are lacking.

4. RMU: Leatherback Turtle (*Dermochelys coriacea*) Atlantic (unknown)
It is unknown to which Atlantic RMU the individuals frequenting Italian waters belong.

4.1. Distribution, abundance, trends

4.1.1. Nesting sites
This RMU does not breed in the Mediterranean.

4.1.2. Marine areas
Individuals belonging to this RMU have been reported in all the waters around Italy (Table 1). No estimates of abundance or trends are available.

4.2. Other biological data
No other information is available, except size of the reported individuals. This indicates that only large juveniles or adults frequent Italian waters (280).

4.3. Threats
Captures by driftnets, set nets and longlines have been reported (280), but no estimates of bycatch levels are available.

4.4. Conservation
Protection status in Italy is the same for all sea turtle species. No specific conservation measures have been developed. However, it is plausible that measures aimed to reduce the impact of fishing gears (at least pelagic ones) on loggerheads would provide benefit to this species as well.

4.5. Research
Studies specifically focusing on this RMU are lacking.

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Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Italy.

TOPIC	REGIONAL MANAGEMENT UNIT							
	CC-MED	Ref #	CC-ATL NW	Ref #	CM-MED	Ref #	DC-ATL	Ref #
Occurrence								
Nesting sites	Y	2,3,11,12,249,23,35	N		N		N	
Pelagic foraging grounds	JA	19,20,238, 242,244,253,277	J	210,214	J	244,278,279	JA	280
Benthic foraging grounds	JA	13,15,20,213,249	J	213-215	n/a		N	
Key biological data								
Nests/yr: recent average (range of years)	7.67 (2002-2004)	2	n/a		n/a		n/a	
Nests/yr: recent order of magnitude	30-40	2	n/a		n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a		n/a		n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	6	2,3,11,16,17,18,223	n/a		n/a		n/a	
Nests/yr at "major" sites: recent average (range of years)	n/a		n/a		n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	1-13	2,3	n/a		n/a		n/a	
Total length of nesting sites (km)	175	2,3,223,11,17	n/a		n/a		n/a	
Nesting females / yr	n/a		n/a		n/a		n/a	
Nests / female season (N)	n/a		n/a		n/a		n/a	
Female remigration interval (yrs) (N)	2-3 (3)	223	n/a		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a		n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	0.52 (83) - 0.61 (218)	7,8,9	n/a		n/a		n/a	

Sex ratio: Adults (F / Tot) (N)	0.4 (45), 0.52 (97), 0.61 (69)	4,6	n/a		n/a		n/a	
Min adult size, CCL or SCL (cm)	71 CCL (7)	223	n/a		n/a		n/a	
Age at maturity (yrs)	21-34	230	n/a		n/a		n/a	
Clutch size (n eggs) (N)	93 (14) - 99 (17)	2,3	n/a		n/a		n/a	
Emergence success (hatchlings/egg) (N)	70.7 (12) - 86.0 (17)	2,3	n/a		n/a		n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	43.6 (17)	2	n/a		n/a		n/a	
Trends								
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a		n/a		n/a		n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	stable/up (1992-2001)	201	n/a		n/a		n/a	
Oldest documented abundance: nests/yr (range of years)	n/a		n/a		n/a		n/a	
Published studies								
Growth rates	Y	201-206	N		N		N	
Genetics	Y	207-216,24,23, 44	Y	210, 213, 214, 215	N		N	
Stocks defined by genetic markers	Y	207,213	N		N		N	
Remote tracking (satellite or other)	Y	217-227,246	Y	21	N		N	
Survival rates	Y	228-229	N		N		N	
Population dynamics	Y or n/a	230	N		N		N	
Foraging ecology (diet or isotopes)	Y	13,231, 22	N		N		N	
Capture-Mark-Recapture	Y	232-234	N		N		N	
Threats								

Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, SN, DLL, OTH)	201, 235-238,241-245,247-248,255, 277	Y	see CC-MED	Y(PLL)	277	Y	see other RMUs
Bycatch: presence of industrial fisheries?	Y (PLL, SN, BT, PT)	15,235-238,240,242-247,254,277, 30,37,38,39	Y	see CC-MED	Y(PLL)	277	Y	
Bycatch: quantified?	10600-20100 (BT), 12300 (PLL), 700 (DLL), 500-23800 (SN)	245,247, 38, 39	N		N		N	
Take. Intentional killing or exploitation of turtles	Y	239,244	n/a		n/a		n/a	
Take. Egg poaching	N		n/a		n/a		n/a	
Coastal Development. Nesting habitat degradation	Y	2	n/a		n/a		n/a	
Coastal Development. Photopollution	Y	2	n/a		n/a		n/a	
Coastal Development. Boat strikes	Y	244	n/a		n/a		n/a	
Egg predation	Y	249	n/a		n/a		n/a	
Pollution (debris, chemical)	Y	250-253,256-270,281,282	n/a		n/a		n/a	
Pathogens	Y	271-272	n/a		n/a		n/a	
Climate change	N		n/a		n/a		n/a	
Foraging habitat degradation	N		n/a		n/a		n/a	
Other	N		n/a		n/a		n/a	
Long-term projects (>5yrs)								
Monitoring at nesting sites (period: range of years)	2 (2000-2011)	2,5,17	n/a		n/a		n/a	
Number of index nesting sites	1	2	n/a		n/a		n/a	
Monitoring at foraging sites (period: range of years)	N		N		N		N	
Conservation								
Protection under national law	Y	249, 276	Y	249, 276	Y	249, 276	Y	249, 276
Number of protected nesting sites (habitat preservation) (% nests)	1 (<1%)	17	n/a		n/a		n/a	

Number of Marine Areas with mitigation of threats	0		n/a		0		0	
N of long-term conservation projects (period: range of years)	4	17, T4.4, T4.5, T4.6	n/a		0		0	
In-situ nest protection (eg cages)	Y	2,12,17	n/a		n/a		n/a	
Hatcheries	N		n/a		n/a		n/a	
Head-starting	N		n/a		n/a		n/a	
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y	236, 273-275	n/a		n/a		n/a	
By-catch: onboard best practices	Y	T4.3, T4.4	n/a		n/a		n/a	
By-catch: spatio-temporal closures/reduction	N		n/a		n/a		n/a	

Table 2. Sea turtle nesting beaches in Italy.

	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)	
				Long	Lat	Long	Lat	Long	Lat						
S Tyrrhenian Coastline	N	4.7 (2012-2017)	5.5 (2012-2017)	14.8965	40.5628	15.3380	40.0090			120	0	3, T.4.6	n/a	n/a	integrated with own recent data
Ionian coastline	Y	4.6 (2000-2004)	n/a	15.788	37.918	16.145	38.04			40	100	2,223	1	D	100% monitored only 2002-2004, 50% 2000-2001
Pelagian Islands - Lampedusa - Conigli	N	1.9 (1997-2012)	n/a					12.558	35.513	0.15	100	16,17	1	B	night time monitoring 2004-2009
Pelagian Islands - Linosa -	N	1.4 (2000-2004)	n/a					12.854786	35.863	0.1	100	18	1	B	no recent monitoring report

Pozzolana di Ponente															published
Sicily - Sicily Channel - Siculiana Marina - Porto Empedocle	N	0.8 (2000-2011)	n/a	13.38694	37.33897	13.524	37.28868			15	0	2,11	n/a	n/a	no recent data published

Table 3. International conventions protecting sea turtles and signed by Italy.

	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Barcelona Convention	Y	Y	Y	CM, CC, DC	to assess and control marine pollution to ensure sustainable management of natural marine and coastal resources; to integrate the environment in social and economic development; to protect the marine environment and coastal zones through prevention and reduction of pollution, and as far as possible, elimination of pollution, whether land or sea-based; to protect the natural and cultural heritage;	Specific Action Plan for the conservation of Mediterranean Marine Turtles with objectives: Development, implementation and enforcement of legislation; • Protection and effective management of nesting areas (include adjacent sea); • Protection and management of feeding, wintering and mating areas and key migration passages; • Minimization of incidental catches and elimination of intentional killings. • Restoration of degraded nesting beaches

Convention on Biological Diversity	Y	Y	Y	ALL	(a) Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity; (b) Develop, where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity; (c) Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use; (d) Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings; (e) Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas; (f) Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, inter alia, through the development and implementation of plans or other management strategies; (g) Establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse environmental impacts that could affect the conservation and sustainable use of biological diversity, taking also into account the risks to human health; (h) Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species; (i) Endeavour to provide the conditions needed for compatibility between present uses and the conservation of biological diversity and the sustainable use of its components; (j) Subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage	

					the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices; (k) Develop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations; (l) Where a significant adverse effect on biological diversity has been determined pursuant to Article 7, regulate or manage the relevant processes and categories of activities; and (m) Cooperate in providing financial and other support for in-situ conservation outlined in subparagraphs (a) to (l) above, particularly to developing countries.	
Convention on the Conservation of Migratory Species of Wild Animals	Y	Y	Y	ALL		
Convention on International Trade in Endangered	Y	Y	Y	CC, CM, DC, EI, LK		

Species of Wild Fauna and Flora						
Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)	Y	Y	Y	CC, CM, DC, EI, LK	promote national conservation policies promote measures against pollution promote educational and informative measures co-ordinate efforts to protect migratory species establish legislative and administrative measures	

Table 4. Sea turtle conservation projects in Italy.

#	RMU	Country	Region / Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/ Private	Collaboration with	Reports / Information material	Current Sponsors	Primary Contact (name and Email)
T4.1	CC-Mediterranean, CC-Atlantic North east, CC-Atlantic North west	France, Italy, Spain, Greece, Portugal, Turkey, Tunisia		INDICIT (Implementation Of The Indicator Of Marine Litter On Sea Turtles And Biota In Regional Sea Conventions And Marine Strategy Framework Directive Areas)	marine litter, bio-indicator, marine strategy framework directive	01/02/2017	01/02/2019	CNRS-EPHE, Center of functional and evolutionary ecology, Montpellier, France	Public	CNR-IAMC (IT), DEKAMER (TR), FRCT (PT), HCMR (GR), IMAR (PT), INSTM (TN), ISPRA (IT), MNHN (FR), ULPGC (ES), UNIVERSITY OF VALENCIA (ES), SZN (IT)	https://indicit-europa.eu/	EU	coordination@indicit-europa.eu
T4.2	CC-MED	Croatia, Slovenia,Italy, Malta, Greece, Cyprus		LIFE15-NAT/HR/000997 - LIFE EUROTURTLES		01/09/2016	31/08/2021	Croatian Natural History Museum, Zagreb	Public	BWI (HR), Univ Primorska (SL), Sapienza Univ Roma (IT), WWF Italy (IT), Nature Trust Malta	http://www.euroturtles.eu/	EU	info@euroturtles.eu

										(ML), ARCHELON (GR), Oceanography Centre University of Cyprus (CY), Department of Fisheries and Marine Research (CY)			
T4.3	CC-MED	Italy		LIFE12 NAT/IT/000937 - TARTALIFE		01/10/2013	30/09/2018	CNR-ISMAR	Public		http://www.tartalife.eu/en/project	EU	Alessandro Lucchetti (CNR-ISMAR) - a.lucchetti@ismar.cnr.it
T4.4	CC-MED	Italy		Sea Turtle Project		02/01/2000		WWF Italy	Private	St. Zool. Anton Dohrn, Naples (IT),University of Bari Veterinary Medicine (IT), University of Calabria(UNICAL) Dip. Ecology(IT)			Luigi Agresti - l.agresti@wwf.it
T4.5	CC-MED	Italy	Southern Tyrrhenian Sea, Aeolian	Project: "Monitoraggio e Tutela della tartaruga marina *Caretta caretta* nell'Arcipelago		01/01/2010	31/12/2018	Filicudi WildLife Conservation	Private	University of Messina; University Tor Vergata; National	www.filicudiconservation.com		blasimf@yahoo.com

			Archipelago	Eoliano” (PROT. N° 0001735 del 02-02-2010; renewal: PROT N° 0006876 del 25-01-2013; renewal : PROT N° 0011903 del 01-06-2016)						Institute of Health (Italy); Marine Turtle Research Center, Stazione Zoologica Anton Dohrn			
T4.6	CC-MED	Italy	Campania	Azioni per la conservazione delle tartarughe marine nel Mediterraneo	rehabilitation, rescue center, stranding, nesting, satellite telemetry	1985		Stazione Zoologica Anton Dohrn	Public	Istituto Zooprofilattico Sperimentale del Mezzogiorno, WWF Italy, TartaLazio, Sea Shepherd	www.szn.it	Regione Campania	Sandra Hochscheid sandra.hochscheid@szn.it

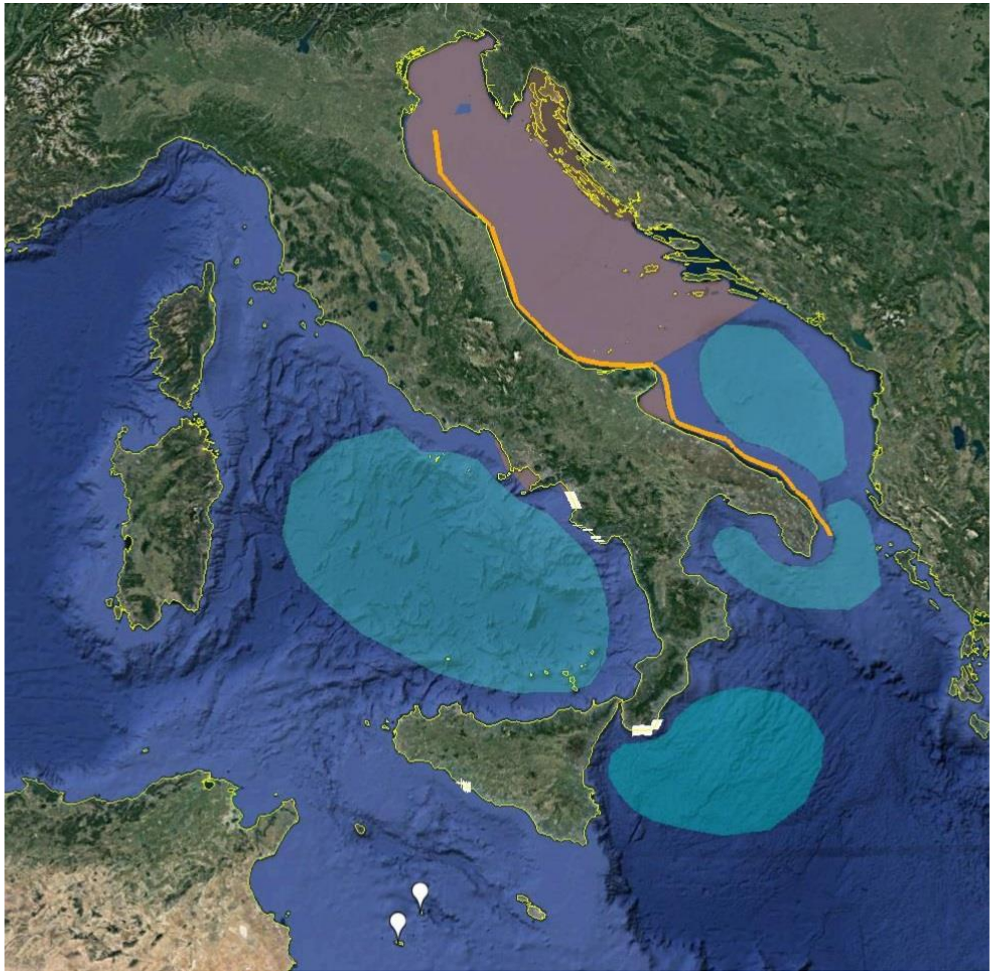

Figure 1. Map showing the location of the loggerhead turtle nesting beaches and marine areas in Italy. White place marks and coastal lines indicate the location of the nesting areas listed in Table 2. Blue shaded areas are approximate locations of oceanic developmental and foraging habitats, whereas orange shaded areas are neritic developmental and foraging habitats. Please note that borders of foraging areas are graphical assumptions and do not correspond to true and exact borders, which are not known. The orange line indicates a migratory corridor

LEBANON

Ali Badreddıne

Marjeeoun Road-Nabatieh- Lebanon

1. RMU: Loggerhead Turtle (*Caretta caretta*) and Green Turtle (*Chelonia mydas*) Mediterranean

Two species of marine turtles frequent the Lebanese sea: the loggerheads (*Caretta caretta*) and the greens (*Chelonia mydas*). As on many parts of the sandy Mediterranean beaches, loggerheads and greens females turtles lay their eggs on many Lebanese sandy beaches.

Study area: Lebanon has about 220 km of coast long from Al-Arida in the north to Al-Nakoura in the south. The Lebanese Coastal Zone (LCZ) is narrow (3-7 km wide), and the coastline is characterized by the presence of a few bays (Bay of Beirut, Bay of Jounieh, Bay of Shekka and Bay of Akkar), 4 commercial ports and over 15 fishing harbors, dozens of sea pipelines for petroleum imports, various industries, three power plants and fuel tank farms. Pebble beaches and rocky coasts are dominant along the coast, sandy beaches interesting only 20 percent of the coast. However, the LCZ is suffering from many sources of pollution and human pressures such as untreated domestic/agricultural/industrial sewages, solid wastes/marine litter and the uncontrolled urban development, especially involving coastal constructions.

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

Very few studies on marine turtles presence, nesting, abundance and patterns of distribution have been performed along the Lebanese coast. Between 1998 and 2001, a first detailed monitoring of the Lebanese sandy beaches to find potential female marine turtles nesting sites have been done ([8] and references therein). From 2001 to 2005, a re-survey of the Lebanese Mediterranean coast was conducted by MEDASSET in cooperation with the Ministry of Environment in Lebanon (MoE), aiming to assess both potential nesting sites for marine turtles and nesting concentrations ([1] and references therein). It is worth noting that some potential nesting sites of female turtles (e.g. the beach of Al-Mansouri-south of Lebanon) have been subject of a long term monitoring [10, 15], while others (e.g. the two Marine Reserves: Tyre (TCNR) in the south and the Palm Island (PINR) in the north of Lebanon) were monitored sporadically ([1, 2 (and references therein), 5]. As result of the studies done between 1997 and 2006, the average number of turtle nests recorded along the surveyed Lebanese beaches varied from 36 to 52 nests of *Caretta caretta* and from 4 to 14 of *Chelonia mydas* (Table 2). In 2019, in the framework of a project for the “Conservation of Marine Turtles in the Mediterranean Region”, funded by the

Regional Activity Centre for Specially Protected Areas (SPA/RAC) and in cooperation with the MoE, a large survey to find new potential turtles nesting sites has been carried out along the Lebanese coast from the south (Al-Mansouri) to the north (Cheikh-Zannad) (SPA/RAC–UN Environment/MAP, 2020a). This first large survey done after 13 years, confirmed the presence of three important marine turtle nesting sites, in addition to the two Marine Reserves of Tyre (TCNR) and Tripoli (PINR), from the south of the Lebanese coast: Al-Mansouri, Al-Abbasiyeh and Al-Addousiyeh (Fig. 1). As a result, a total of 77 nests were recorded in all the surveyed beaches, of which the majority are from the south of Lebanon with 55 nests representing 90%. Loggerhead turtles were the most abundant nesting species with 74 nests, while only three green turtle nests were recorded. Subsequently, a total of 2591 loggerhead and 279 green turtle hatchlings were successfully released from all the survey sites (Tab. 2). It is worth noting that no estimates of abundances and trends of the marine turtles are available until now in Lebanon. However, in 2012 and around the Tyre regions one individual of both *Caretta caretta* and *Chelonia mydas* were monitored via a satellite tracking by the TCNR group with the RAC/SPA team. This showed that the loggerhead individual stayed close to the Tyre area in shallow waters of less than 10 m depth for seven months. Also the green turtle stayed also around Tyre area but for only two months before moving to the south of Lebanon (SPA/RAC–UN Environment/MAP, 2018 and references therein).

1.1.2. Marine areas

No foraging grounds/mating areas or migratory corridors for sea turtles were clearly identified/ or mapped until now in the Lebanese sea. However, some mating areas can be confirmed in many localities of the Lebanese waters especially in the south of Lebanon (e.g. around Al-Mansouri/ Tyre/Al-Abbasiyeh and Al-Addousiyeh areas), Beirut and the north (e.g. around the PINR and Tripoli) (Badreddine, personal observation). Yet, no aerial surveys and bycatch data of marine turtles in Lebanon are available up to date. Based on a national stranding network for marine turtles and cetaceans along the Lebanese coast established in 2019 (SPA/RAC–UN Environment/MAP, 2020b) funded by the S and in cooperation with the MoE, a total of 32 dead stranding incidents were reported over a year-long period from November 2018 to November 2019. The loggerheads *Caretta caretta* were the most accounted with 17 incidents, while five stranded green turtles *Chelonia mydas* were reported. However, the species could not be identified in 10 incidents of sea turtles stranding.

1.2. Other biological data

Under the project for the “Conservation of Marine Turtles in the Mediterranean Region”:

- In 2018, a monitoring of the sea turtle nests temperature by using data loggers have been done in some surveyed areas of the Lebanese coast (e.g. in the south (TCNR) and Jiyeh beaches).
- Samples from the dead hatchlings and from the stranded turtles were also collected for isotope analysis (SPA/RAC–UN Environment/MAP, 2020a, 2020b). All the collected samples were sent to the DEKAMER laboratory, Pamukkale University for the analysis.

- Based on a protocol for monitoring interactions between marine litter and marine turtles in Lebanon, a total percentage of 14.12% (with a number of marine litter fragments, N= 43) of the 32 dead stranded marine turtles had ingested marine litter (SPA/RAC–UN Environment/MAP, 2020b).
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1.3. Threats

The marine turtles in the Lebanese waters, as the entire Mediterranean Sea, are under a complex mix of human (e.g. urban/industrial/agricultural outfall, solid wastes including marine litter, touristic disturbance, illegal fishing methods and uncontrolled coastal development), biological (e.g. macroinvertebrates infections) and natural (e.g. inundation, humidity (Fig. 2A) from the sand or the vegetation) threats.

1.3.1. Nesting sites

The marine turtles nesting sites along the Lebanese coast are under many pressures (Fig. 3):

- The most important predators of sea turtle eggs and hatchlings along the Lebanese nesting sites are crabs (Fig. 2B), foxes and recently the infection of the macro insect *Pimelia* sp. (Tenebrionidae, Coleoptera, Fig. 2C) (SPA/RAC–UN Environment/MAP, 2020a)
- The light and noise pollution coming from the tourist and the private resorts on the beach
- The uncontrolled coastal development (Fig. 3D): it contributes to the loss of turtle nesting habitats by sand extraction and the destruction of some beaches for touristic purposes (e.g. build private resort/port).
- The uncontrolled tourist pressures (e.g. walking, camping, using vehicles (Fig. 3A) on the beach) can also be added as a major threat.
- The use of some beaches for livestock (Fig. 3B)
- The solid wastes coming from tourists and houses around the sandy beaches (Fig. 3C)
- Marine litter: marine litter was present in all the surveyed marine turtles nesting sites along the Lebanese coast (Fig. 3C). It is worth noting that this waste comes from the waves of the sea, carrying litter to the shores while in other cases, it was apparent that large objects are left behind by tourists and local people.
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1.3.2. Marine areas

The marine turtles in the Lebanese waters (Fig. 4) are most affected by:

- The chemical pressures coming from the illegal urban/industrial and agricultural sewage
- The illegal fishing methods (Fig. 4A)
- The solid waste and marine litter (see paragraph before, Fig. 4C)

It is worth noting that most of the stranded marine turtles recorded along the Lebanese coast during 2019 are related to a collision with fishing or touristic vessels (Fig. 4B) and especially during the mating season.

1.4. Conservation

In Lebanon, the marine turtles are protected through (see also Table 3):

- The Barcelona Convention 1976 signed by Lebanon in 1976
- The Mediterranean Action Plan law, (UNEP) 1975, which attempts to protect the Mediterranean Sea.
- The UN Convention on the Law of the Sea signed in 1995 by the Ministry of Agriculture (MoA) of Lebanon.
- The Decision of the MoA (no. 125/1 of 23/9/1999) banning the fishing of cetaceans, whales, monk seal and marine turtles.

It is worth noting that one important nesting site located at the south of Lebanon (Al-Abbasiyeh) has recently been declared a Marine Protected Area by the Lebanese government. In addition to these legal texts and in cooperation with the RAC/SPA and the MoE, some important steps allowing to protect and conserve the Lebanese marine turtles were already taken to face the major future challenge (e.g. related to the oil exploration and marine litter):

1- In 2019, an action plan for the conservation of the marine turtles in Lebanon has been implemented for the next five years (2020-2025).
2- A large awareness campaign has already been set up and is under work: this awareness campaign allows to motivate and encourage the public at large and especially the ecovolunteers and the non-governmental organizations (NGOs) to help and participate to the monitoring program during nesting/hatchling season and essentially sharing the information with the experts, allowing to obtain better results for the protection of marine turtles in Lebanon.

From a protection and a conservation point of view, it is important to:

- Increase the number of Marine Reserves in Lebanon, especially by adding important marine turtles nesting sites (e.g. Al-Mansouri and Al-Addoussiyeh)
- Set up a regular long term and sustainable monitoring program of the important marine turtle nesting sites
- Develop the monitoring program of marine turtles by using important techniques (e.g. monitoring through tagging/ telemetric devices/ aerial observations/ drone)
- Apply the already existing regional laws (e.g. banning the fishing of marine turtles) concerning the protection of the marine turtles and take new legal steps to ensure the protection of *Caretta caretta* and *Chelonia mydas* and especially during mating and nesting season.
- Enhance the link and the cooperation between NGOs, public, scientists, fishermen and governmental institutes (e.g. MoE, Lebanese University, MoA)
- Enhance the public awareness, especially during the marine turtles nesting season.
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1.5. Research

The Lebanese coast is under multiple stressors affecting marine turtles. Therefore, an assessment of the effects of the human impacts and marine litter on marine turtles along the Lebanese coast is an important future step. Hence, a continuous long-term monitoring should be also a priority for monitoring the population trend of marine turtles in the future. In this context, it is necessary to maintain the good ecological status of the important nesting sites allowing to conserve the current populations of marine turtles in Lebanon.

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Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Lebanon

TOPIC	REGIONAL MANAGEMEN UNIT			
	CC-MED	Ref #	CM-MED	Ref #
Occurrence				
Nesting sites	Y	1-14	Y	1-14
Pelagic foraging grounds	N	-	N	-
Benthic foraging grounds	N	-	N	-
Key biological data				
Nests/yr: recent average (range of years)	74 (2019)	12	3(2019)	12
Nests/yr: recent order of magnitude	n/a	-	n/a	-
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	4	12	3	12
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	11	12	12	12
Nests/yr at "major" sites: recent average (range of years)	41(2019)	12	3(2019)	12
Nests/yr at "minor" sites: recent average (range of years)	33(2019)	12	0(2019)	12
Total length of nesting sites (km)	26	12	26	12
Nesting females / yr	n/a	-	n/a	-
Nests / female season (N)	74(n/a)	12	3(n/a)	12
Female remigration interval (yrs) (N)	n/a	-	n/a	-
Sex ratio: Hatchlings (F / Tot) (N)	n/a (2671)	12	n/a(300)	12
Sex ratio: Immatures (F / Tot) (N)	n/a	-	n/a	-
Sex ratio: Adults (F / Tot) (N)	n/a	-	n/a	-
Min adult size, CCL or SCL (cm)	65 CCL	-	65 SCL	-
Age at maturity (yrs)	n/a	-	n/a	-
Clutch size (n eggs) (N)	n/a (4019)	12	n/a(380)	12
Emergence success (hatchlings/egg) (N)	0.66 (74)	12	0.79(3)	12
Nesting success (Nests/ Tot emergence tracks) (N)	0.47 (125)	12	0.37(8)	12
Trends				
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a	-	n/a	-

Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a	-	n/a	-
Oldest documented abundance: nests/yr (range of years)	n/a	-	n/a	-
Published studies				
Growth rates	N	-	N	-
Genetics	N	-	N	-
Stocks defined by genetic markers	N	-	N	-
Remote tracking (satellite or other)	Y	11	Y	11
Survival rates	N	-	N	-
Population dynamics	N	-	N	-
Foraging ecology (diet or isotopes)	N	-	N	-
Capture-Mark-Recapture	N	-	N	-
Threats				
Bycatch: presence of small scale / artisanal fisheries?	Y (SN, DN)	-	Y(SN/DN)	-
Bycatch: presence of industrial fisheries?	N	-	N	-
Bycatch: quantified?	Y	-	Y	-
Take. Intentional killing or exploitation of turtles	N	12	N	12
Take. Egg poaching	Y	12	Y	12
Coastal Development. Nesting habitat degradation	Y	12	Y	12
Coastal Development. Photopollution	Y	12	Y	12
Coastal Development. Boat strikes	Y	12	Y	12
Egg predation	Y	12	Y	12
Pollution (debris, chemical)	Y	12	Y	12
Pathogens	Y	12	Y	12
Climate change	Y	12	Y	12
Foraging habitat degradation	n/a		n/a	All the ref
Other	Y (see text)		Y(see text)	-
				-
Long-term projects (>5yrs)				
Monitoring at nesting sites (period: range of years)	N	-	N	-
Number of index nesting sites	N	-	N	-
Monitoring at foraging sites (period: range of years)	N	-	N	-
Conservation				
Protection under national law	Y	12	Y	12

Number of protected nesting sites (habitat preservation) (% nests)	4(0.58)	12	4(0.58)	12
Number of Marine Areas with mitigation of threats	0	-	0	12
N of long-term conservation projects (period: range of years)	n/a	-	n/a	-
In-situ nest protection (eg cages)	Y	-	Y	12
Hatcheries	N	-	N	-
Head-starting	N	-	N	-
By-catch: fishing gear modifications (eg, TED, circle hooks)	N	-	N	-
By-catch: onboard best practices	N	-	N	-
By-catch: spatio-temporal closures/reduction	N	-	N	-
Other	Y (see text)	-	Y(see text)	-

Table 2. Sea turtle nesting beaches in Lebanon

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Central point		Length (km)	% Monit-ored	Refer-ence #
Cc-MED				Long	Lat			
Al-Mansouri		32-37 (2001-2003) and 13 (2019)	n/a	35°11'40.01"E	33°11'15.34"N	1.4	100	1,3,4,9,10,12,14
Ras-El-Ain		0 (2003-2004) and 1-2 (2018-2019)	n/a	35°12'40.58"E	33°13'41.18"N	1.5	100	1,12
Tyre Marine Reserve		0-9 (2003-2004) and 3-4 (2018-2019)	n/a	35°12'40.35"E	33°15'16.79"N	1.7	100	1,12
Al-Abbasiyeh		4-6 (2002-2004) and 12 (2019)	n/a	35°13'2.04"E	33°17'9.96"N	3.3	100	12
Al-Quasmiyeh		0 (2019)	n/a	35°14'9.14"E	33°19'23.05"N	1.5	100	12
Al-Kharayeb		2(2019)	n/a	35°14'40.51"E	33°20'12.65"N	1	100	12
Adloun		2(2019)	n/a	35°15'50.87"E	33°24'27.55"N	1.5	100	12
Sarafand		1(2019)	n/a	35°17'3.93"E	33°27'19.10"N	0.5	100	12
Al-Addousiyeh		16 (2019)	n/a	35°19'27.97"E	33°29'7.30"N	3	100	12
Jiyeh		0-2 (2018-2019)	n/a	35°25'2.98"E	33°39'58.04"N	0.5	100	12
Beirut		0 (2019)	n/a	35°28'48.09"E	33°52'41.51"N	1.6	100	12
Byblos		0-2(2018-2019)	n/a	35°38'35.53"E	34° 7'33.64"N	1.6	100	12
Tripoli		3(2019)	n/a	35°49'14.93"E	34°25'21.88"N	1.95	100	12
Cheikh-Zennad		0 (2019)	n/a	35°59'10.80"E	34°36'19.29"N	1	100	12
Palm Island Marine Reserve		3-36 (1997-2000) and 21(2019) (Jaradi.pers.comm.)	n/a	35°46'34.82"E	34°29'37.17"N	0.2	100	12
Cm-MED								
Al-Mansouri		**3-5 (2001-2003) and 1 (2019)**	n/a	35°11'40.01"E	33°11'15.34"N	1.4	100	1,3,4,9,10,12,14
Ras-El-Ain		0 (2003-2004) and 0 (2019)	n/a	35°12'40.58"E	33°13'41.18"N	1.5	100	1,12
Tyre Marine Reserve		0 (2003-2004) and 0 (2019)	n/a	35°12'40.35"E	33°15'16.79"N	1.7	100	1,12
Al-Abbasiyeh		1-9 (2003-2004) and 0 (2019)	n/a	35°13'2.04"E	33°17'9.96"N	3.3	100	12
Al-Quasmiyeh		0 (2019)	n/a	35°14'9.14"E	33°19'23.05"N	1.5	100	12
Al-Kharayeb		0 (2019)	n/a	35°14'40.51"E	33°20'12.65"N	1	100	12
Adloun		0 (2019)	n/a	35°15'50.87"E	33°24'27.55"N	1.5	100	12

Sarafand		0 (2019)	n/a	35°17'3.93"E	33°27'19.10"N	0.5	100	12
Al-Addousiyeh		**2 (2019)**	n/a	35°19'27.97"E	33°29'7.30"N	3	100	12
Jiyeh		0 (2019)	n/a	35°25'2.98"E	33°39'58.04"N	0.5	100	12
Beirut		0 (2019)	n/a	35°28'48.09"E	33°52'41.51"N	1.6	100	12
Byblos		0 (2019)	n/a	35°38'35.53"E	34° 7'33.64"N	1.6	100	12
Tripoli		0 (2019)	n/a	35°49'14.93"E	34°25'21.88"N	1.95	100	12
Cheikh-Zennad		0 (2019)	n/a	35°59'10.80"E	34°36'19.29"N	1	100	12
Palm Island Marine Reserve		0 (2019)	n/a	35°46'34.82"E	34°29'37.17"N	0.2	100	12

Table 3. International convention protecting sea turtles and signed by Lebanon

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
The Barcelona Convention 1976	Y	Y		*Cm*, *Cc*	Protection of natural heritage	Y
The UN Convention on the Law of the Sea	Y	Y		*Cm*, *Cc*	Species protection	Y
The Mediterranean Action Plan law, (UNEP) 1975	Y	Y		*Cm*, *Cc*	Species protection and conservation	Y

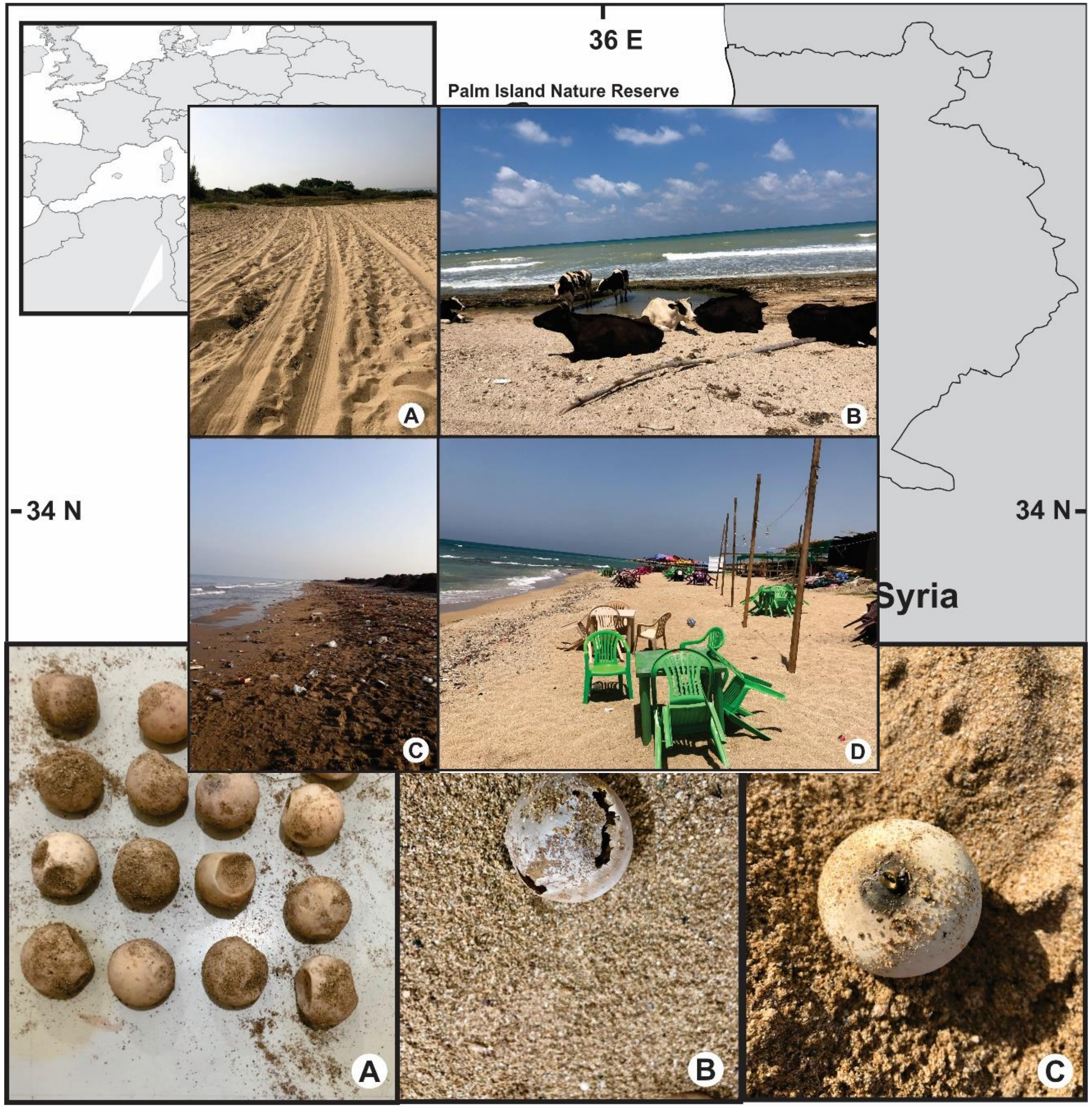

Figure 2. Unhatched *Caretta caretta* eggs from a nest in Al-Addousiyeh-south of Lebanon because of the A) Humidity, B) Crabs and C) Infection of the macroinsect *Pimelia* sp. (SPA/RAC–UN-Environment/MAP, 2020a).

Figure 3. Some pressures on the turtles nesting sites. A) Vehicles, B) Livestock, C) Solid waste/Marine litter and D) Coastal development (SPA/RAC–UN Environment/MAP, 2020a).

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Figure 4. Stranded marine turtles (*Caretta caretta*) because of A) Fishing nets (bycatch), B) Collision with a fisherman boat and C) Marine litter (SPA/RAC–Environment/MAP, 2020b).

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Table 1. Biological and conservation information about sea turtle Regional Management Units in Libya.

RMU	CC-MED	Ref #	CM-MED	Ref #	DC-ATL	Ref #
Occurrence						
Nesting sites	Y	1	N	1	n/a	
Pelagic foraging grounds	n/a		n/a		n/a	
Benthic foraging grounds	Y	2, 10	Y	1, 3, 10	n/a	
Key biological data						
Nests/yr: recent average (range of years)	681 (2006-2007)	1	n/a		n/a	
Nests/yr: recent order of magnitude			n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	5	1	n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	23	1	n/a		n/a	
Nests/yr at "major" sites: recent average (range of years)	425 (2006-2007)	1	n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	456 (2006-2007)	1	n/a		n/a	
Total length of nesting sites (km)	155	1	n/a		n/a	
Nesting females / yr	n/a		n/a		n/a	
Nests / female season (N)	n/a		n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	0.704-0.854 (13)	4	n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a		n/a	
Min adult size, CCL or SCL (cm)	62.3 (SCL)	13	n/a		n/a	
Age at maturity (yrs)	n/a		n/a		n/a	
Clutch size (n eggs) (N)	67.2 (13), 91.1	4, 12	n/a		n/a	
Emergence success (hatchlings/egg) (N)	79.2 (13) Hatching Success	4	n/a		n/a	

Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a		n/a	
Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a		n/a		n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a		n/a	
Oldest documented abundance: nests/yr (range of years)	n/a		n/a		n/a	
Published studies						
Growth rates	n/a		n/a		n/a	
Genetics	Y	9, 5, 6, 7	n/a		n/a	
Stocks defined by genetic markers	Y	9, 6	n/a		n/a	
Remote tracking (satellite or other)	Y	2, 8, 10, 11	Y	3, 10	n/a	
Survival rates	n/a		n/a		n/a	
Population dynamics	n/a		n/a		n/a	
Foraging ecology (diet or isotopes)	Y	12	n/a		n/a	
Capture-Mark-Recapture	n/a		n/a		n/a	
Threats						
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, DLL, SN)	1	n/a		n/a	
Bycatch: presence of industrial fisheries?	n/a		n/a		n/a	
Bycatch: quantified?	n/a		n/a		n/a	
Take. Intentional killing or exploitation of turtles	Y	1	n/a		n/a	
Take. Egg poaching	Y	1	n/a		n/a	
Coastal Development. Nesting habitat degradation	N	1	n/a		n/a	

Coastal Development. Photopollution	N	1	n/a		n/a	
Coastal Development. Boat strikes	n/a		n/a		n/a	
Egg predation	Y	1	n/a		n/a	
Pollution (debris, chemical)	Y	1	n/a		n/a	
Pathogens	n/a		n/a		n/a	
Climate change	n/a		n/a		n/a	
Foraging habitat degradation	n/a		n/a		n/a	
Other	n/a		n/a		n/a	
Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	Y	1				
Number of index nesting sites	n/a					
Monitoring at foraging sites (period: range of years)	N					
Conservation						
Protection under national law	Y	1	Y	1	Y	1
Number of protected nesting sites (habitat preservation) (% nests)	n/a		n/a		n/a	
Number of Marine Areas with mitigation of threats	n/a		n/a		n/a	
N of long-term conservation projects (period: range of years)	1	1	n/a		n/a	
In-situ nest protection (eg cages)	n/a		n/a		n/a	
Hatcheries	n/a		n/a		n/a	
Head-starting	N		n/a		n/a	
By-catch: fishing gear modifications (eg, TED, circle hooks)	N		n/a		n/a	
By-catch: onboard best practices	N		n/a		n/a	
By-catch: spatio-temporal closures/reduction	N		n/a		n/a	

MALTA

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1. RMU: Loggerhead Turtle (*Caretta caretta)* Mediterranean

1.1. Distribution, abundance and trends

Historic / Past records

Nesting of *Caretta caretta* on the Maltese Islands was not an uncommon event in the remote past. Despott (1915)[1], describes that nesting used to occur on 'unfrequented beaches, especially at Gozo', hinting that such nesting was probably minor and quite irregular.

It is evident that, however, nesting stopped occurring in the period between 1910 to 1940. This was probably due to the intensification of coastal development and other such anthropogenic disturbance. Prior to the nesting events mentioned below (2012, 2016, 2018), which seemed to have re-started in 2012, the last officially recorded nesting of *Caretta caretta* occurred in the early 1940's, in an unknown location[2]. However, there are a number of other unconfirmed declarations made by locals and NGOs indicating the possibility of other nesting occurrences (or attempts) after the 1940s. In fact, Deidun & Schembri (2005)[3] describe a local who reported nesting at Ir-Ramla tal-Mixquqa (NW Malta) in 1960. The turtle in question after having crawled up the beach, started excavating in the sand and deposited between 50 and 100 eggs. The authors were then informed by this local that both the turtle and all the eggs were taken and eaten. There were also some other unverified statements by fishermen of possible nesting in Għajn Tuffieħa and in other places, including Gozo (Mr. Edwin Lanfranco, personal communication). Bonett, 1982[4] makes reference to Ramla l-Ħamra (NE) in Gozo as a past nesting site for *Caretta caretta* based on Despott (1930a)[5] and Gulia (1890)[6]. Gramentz (1989)[7] had also referred to this bay in Gozo as a former rookery. However, this record seems quite doubtful, as this beach was never actually historically reported as a nesting site, as Gulia (1890) only makes a general reference to 'nesting on sandy beaches' and Despott (1915) refers to 'unfrequented sandy beaches **especially in Gozo'**. In 2015, however, Piludu *et., al.*[8]*(2015)* reported finding 9 eggs (3 hatched and 6 un-hatched) along the southern end of Ramla Bay in Gozo on 31 March 2015. They postulated that the nest was disturbed by winter tides or the winter water flow coming down from Ramla Valley and that the eggs may have been laid back in 2013.

1.1.1. Nesting sites

Malta holds only minor and what seems to be sporadic events (the same seem to apply to the historic ones which are referred to as being irregular and minor) in the recent nesting occurrences, that happened between 2012 and 2020. Most of the recent nesting have occurred in 2 at maximum 4 localities [if one is to consider Piludu's *et., al. (2015)*[8] and Deidun & Schembri (2005)[3]] with 3 of these being immediately adjacent to each other. All sites lie in the North of the Maltese Islands (NW or NE region). Like what happens in Sicily and the Pelagian Islands[9], in Malta there has been years (greater than the remigration interval) without nesting which may however be due to lack of proper monitoring. Clutch size and emergence success from the recent nesting events we had in 2012, 2016 and 2018 were 79, 94 and 112 eggs with 0%, 86% and 99.1 % respectively (see Table 1). These values with the exception

of the 2012, failed nest, are well within the ranges of eastern Mediterranean nesting beaches (see reports of Cyprus and/or Greece).
The first nesting in Malta in this century occurred on the 21st June 2012. This nest was found less than 5 meters from the sea on the lowest part of the beach, which was known to be completely inundated during north westerly winds. It was thus decided, to relocate the eggs, into a dug out egg chamber in the same beach, some 40m away from the original nest. This particular nest did not hatch and it was hypothesized [10] that this was most probably, due to the high amount of clay present in Ġnejna beach (NW- Malta). This clay, combined with the high wave events, which happened towards the end of the nesting cycle and a major rainfall event experienced during the last weeks, probably inhibited the normal development of the embryos and the normal gas exchange in the nest in this area. After 79 days, the eggs were excavated and analysed. Results showed that the embryos had died at different developmental stages, with embryos in the upper layer of eggs having died at the very late stages, about 1-3 days before hatching[10].
In August of 2016, Malta experienced another nesting event at Golden Bay (known as 'ir-Ramla Tal-Mixquqa'), just few metres away from Ġnejna (NW Malta).
In June 2018, another nesting event happened in Ġnejna (same site of the 2012 nesting), this time with an extraordinary hatching rate of 99.1%, which occurred in August.
On the night of the 29th May 2020, another nestign occured on Malta's sister island Gozo (opposite Malta - some 20 mins away by Ferry), in Ramla l-Hamra (North Coast of Gozo) where no recent scienitfic proper records, except for historic general records & a recent note which reports the finding of 3 hatched and 6 un-hatched eggs found at the southern end of Ramla Bay on 31 March 2015 (Piludu *et al.,* 2015). The authors suggested that the nest was disturbed by winter water flow coming down from Ramla Valley and from the weathering state of the eggs they envisged that the eggs been laid in 2013.
Back in 1989, Gramentz had postulated that the beach at Ramla l Hamra had represented a former rookery, however, this the authenticity of this site as a former rookery is still questionable as it had ever been actually reported as the 'real' site of such nestign in histroic litertaure and may only ahve been a postulation in view of the size of the said beach being 300 m long and 20-50 m wide, whch is quite large compared to other sandy beaches on the Maltese Islands. Although Gulia in 1890 refers to nesting, he only makes a general refernce to nesting, whils Despott (1915) doe snot specifcally mention Ramla l-Hamra, but rather mentions 'unfrequented sandy becahes espevially in Gozo' . Ramla l-Hamra beign quite a large sandy beach does not qualify as an unfreuented beach. Hence the confusion. Later Bonnett, 1982, quoted Ramla l- Hamra as the actual beach quoting only despott (1930a) and Gulia (1890), who in reality never mentiond this particular site.
For the 2016, 2018 and 2020, no relocation was necessary as the nest was more than 8/10 meters away from the edge. The decision for the 2018 was quite difficult in view of the previous predictions of the effect of the clay on the 2012 nest. However, after NTM (Nature Trust Malta- a local e-NGO), informed that they had 'gently' dug the nest to confirm its presence and there seemed to be no clay present, it was decided not to relocate.
Following notification of such nesting events, a number of Government officials who have experience with turtles from the Environment Authority as well as staff and volunteers from NTM, visited the area immediately to assess the situation and proceed with the constant monitoring and set up of conservation orders and plans.
Emergency conservation orders were issued in all the three nesting events, to protect these 2 beaches from any potentially harmful activities, during the incubation time. The sites were also physically protected and a 24 hour monitoring scheme was set-up, through the help of volunteers from Nature Trust Malta and government officials from ERA and from other Departments. Few days after nesting, an Aluminium cage was made and used, following the Cypriot protocol, such that the nest got further protected. Material on frequently asked question, what to do in case a female laying eggs is met and in case this or another female come to the beach again to nest was provided to the general public. A number of other measures (including the switching on of red lamps in the nearby car park, instead of the white lamps), the spread of site notices and the drafting of notices to fishermen in the surrounding areas were also set-up to further enhance conservation. Training on what to do in the eventuality of

hatching was also provided interested officials and volunteers. Many other measures and policies were drafted for the hatching event, including a draft notice to mariners to stop all maritime traffic in the area for a number of hours and days following hatching. Making the nearby five star hotel switching off its outside lights upon the first signs of hatching was another measure achieved. A protocol on conduct and action to be done by officials (with a version also in Maltese) and NGOs for the hatching event was also drafted along with a number of speeches for media (TV and radio) in order to inform the public on what was being done.
Campaigns are currently ongoing to solicit greater reporting of nesting through increase in monitoring for sporadic nesting prior to beach cleaning carried out daily in summer in the early mornings.
Though only 2.5 % [11] of the Maltese beaches are sandy and nesting is not occurring yearly in Malta, these events do imply that future more frequent nesting events cannot be excluded from Maltese beaches. Nesting occurs quite regularly in nearby islands like Sicily and it is mostly a result of constant monitoring.
In Malta we do not know if the nesting events were done by different or the same female as genetic analysis is still pending.
Refer to *Figure 1* for all nesting locations including historic ones.
Although they cannot really be considered as index beaches, Ġnjena and Ramla Tal-Mixquqa (Golden Bay) have been considered for Table 2.

1.1.2. Marine areas

The Maltese archipelago is a group of small, low islands located in the Central Mediterranean region at a distance of 96km from Sicily and about 290km from the Tunisian coast. The archipelago is made up of three main inhabited islands: Malta, Gozo and Comino, together with a number of uninhabited rocks, and with an overall total area of about 315 km2 only, with highest point being of 253m above sea level. The islands are situated on a shallow shelf, the Malta-Ragusa Rise, part of the submarine ridge, which extends from the Ragusa Peninsula of Sicily southwards to the African coast of Tripoli and Libya. Generally the archipelago is characterised by a southwest to northeast inclination, with the north-eastern sides of the main islands gently sloping, and the western and southern coastlines essentially characterised by steep cliffs.

The presence of marine turtles, off the Maltese Islands was probably first reported by Gavino Gulia (1890)[6] who was the first naturalist to report not only the presence, but also nesting of the Loggerhead in the Maltese Islands.
The marine area around Malta is quite commonly frequented by turtles and in fact according to many authors the loggerhead was always quite common around Malta (e.g. Despott (1915)[1] and Mifsud, *et al.,* 2009 a[12]). According to Groombridge (1994)[2], relatively large numbers of foraging *Caretta* still occur in Maltese waters; highest numbers are generally reported between June and September, coincident with maximum fishing activity for swordfish, tuna and dolphin fish (Balzan, in Groombridge,1994)[2]. Turtles, in fact, are not infrequently observed basking at the surface or beneath palm leaves used for fishing floats. Fishermen and other sea-users commonly encounter large aggregates of migrating turtles[17] basking on the sea surface (if the sea is flat calm and it's a sunny day) during late Summer, beginning of Autumn.
Since the Loggerhead turtle is found relatively common in Maltese waters, probably year-around off the Maltese Islands (from the stranding or incidental captures by fishermen), hence incidental captures of such turtles is also quite frequent as well, since this period coincides with the maximum . Some of these incidentally caught turtles are nowadays landed and transferred to the recently available holding and rehabilitation facility at Malta centre of Fisheries Sciences at Torri San Lucjan Marsaxlokk, of the Fisheries Conservation and Control Division. Most of these turtles are released after treatment and rehabilitation (Mifsud *et al*., 2009 a[12] & b[14]).
With regards to migration patterns, some *Caretta* specimens tagged on Zakynthos, Greece (Margaritoulis, 1988[13] and Mifsud, *et al*., 2009 b[14]) and Italy (Mifsud *et al*., 2009 b[14]) have been

recaptured in Maltese waters, whilst other tagged here have been found in Spain (Mifsud *et al*., 2009 b).
The 'Maltese population', unlike what had been initially thought, does not seem to be influenced by the Atlantic contingent and seem to be inhabited solely by individuals of Mediterranean origin with a major contribution from the nearest and largest loggerhead colonies[15]. Garofalo *et al.,* (2015)[16] showed that the waters around Malta and the Italian Ionian Sea represent important areas for the conservation of rookeries in Turkey and that waters off the Italian peninsula and the islands of Lampedusa and Malta are mainly inhabited by individuals of Mediterranean origin, with a major contribution from the nearest and largest colonies.
Data on *Caretta caretta* was until recently reported only from stranding/beaching and/or incidental captures by fisheries, the latter generally collected for rehabilitation purposes and for EU reporting purposes. However lately, data sightings has been accruing from a number of projects like data collated by BIRDLIFE for the EU LIFE Yelkouan Shearwater Project (2008)[18] and for the EU LIFE+ Malta Seabird Project (2012)[19]. Data on stranding/beaching and/or injured or accidentally captured turtles used to be collated by the then Malta Environment and Planning Authority (this was later split into the planning Authority and ERA) and later by ERA.
As stated above BirdLife Malta (2008 and 2012) collected data on turtles systematically through observations from boat trips following specific transects perpendicular to the Maltese coast in accordance with the standard European Seabirds at Sea methodology (ESAS), a widely used census system for logging observations of seabirds and other marine animals. Whereas the EU LIFE Yelkouan Shearwater Project focused on the area within 7 nautical miles of the Maltese coastline, the EU LIFE+ Malta Seabird Project covered up to 25 nautical miles.
It seems that the 2012 data sightings of loggerhead turtles seem to be more common in areas off the northwestern to southeastern coast of the Maltese archipelago. The data may also imply a seasonal pattern of occurrence with a higher numbers of sightings in spring[20]. However, these patterns would need to be verified through long-term monitoring.
Through the LIFE + MIGRTE surveys it was again confirmed that marine turtles are relatively common around Malta. Densities ranged[21] between 0.4 turtles/Km^2 to 7.2 turtles/Km^2. High densities were found in in the NW and SW areas of the Maltese Islands. In the NE-SE zone, it was also found common to find migrating turtles around the months of September. Most turtles were observed alone occasionally in small groups of 2 or 3 animals[21]. During the LIFE MIGRATE project which was carried out from 2012 till 2016, 293[21] loggerhead turtles were observed during the actual surveys, though many more were recorded from the observations of people and from data obtained directly from fishermen (this also formed part of the project). The relative abundance ranged from 46.9 turtles[21]on 100 km of effort in NW area, to 0.5 turtles in the SE area. The average turtle abundance for 100 Km of effort in Maltese waters is 5 individuals according to the Guidelines document [21] of this project.
Between 2012 and 2016, through the EU LIFE + MIGRATE Project (LIFE11 NAT/MT/001070 – 'Conservation Status and potential Sites of Community interest for *Tursiops truncatus* and *Caretta caretta* in Malta'), Malta proposed three[22] key marine areas (see figure 2 a, b and c) for the loggerhead turtle. It has been postulated in the Life MIGRATE project[22] that these areas may be serving as migratory corridors and/or foraging grounds, though the experts who concluded these reports, recommended that further studies need to be carried out, to completely prove the importance of such areas for the life and reproduction of this species and the exact type they are. The 3 areas were proposed and subsequently accepted in 2016 in the EU's network of Natura 2000 (protected) sites. These 3 sites are in different 'geographic marine sub-zones' around Malta. All areas lie at a considerable distance from the coast, with some points of these areas also bordering the territorial sea.
The proposed sites[22]:

Site 2- *'Parti mill- Baħra tan- Nofsinhar'*
This site was postulated to form part of the migratory corridor on the west of Malta. Various reports were obtained directly from fishermen, as pert of the EU LIFE MIGRATE project, apart from the results

of the direct boat observation carried out in this same project. Modelling was also applied in this area. **Figure 2 a**

Site 3- '*Il-Baħra tat-Tramuntana'*
This site lies in to the North of the islands and borders an area in which dense agglomerations were both directly observed and obtained from modelling **Figure 2 b**

Site 1 – *'Il-Baħra tal-Punent'*
Dense aggregations of turtles had been observed in this area during the above mentioned LIFE + MIGRATE project. This was done through a modelling exercise overlaying the different oceanographic features. This site has been postulated as being part of a migratory route in Malta. It is partially located on the borders of the territorial sea. **Figure 2c**

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The 3 areas are thus in the South, North and West of Malta. Please refer to Figure 2 a, b, c in below.
It is to be noted that the LIFE MIGRATE project confirmed the previous postulations (which had been gathered, from the stranding and beaching data, which the author and NTM had been gathering since 2000) that the turtle population in Malta consisted of sub-adults and juveniles. Due to the transient nature of turtles in such areas, the most important feature is probably the water column which represents the pelagic habitat of the species[22].
Until the Management plans for these areas are issued, management of the sites is being addressed through existing mechanisms, particularly through the Programme of Measures of the Marine Strategy Framework Directive (MSFD)[23], the Marine Monitoring Programme adopted by Malta in 2015, and its implementation, and the EU Mediterranean Fisheries Regulation (EU regulation 1967/2006). Malta will have 6 years from 2016 i.e. until 2022, to fully establish the Conservation objectives and management measures (though many of these had already been suggested as part of the '*After-LIFE Conservation Plan'* [24] of said project, an obligatory output of said project) to ensure that the favourable conservation status of this species within the site is either maintained and/or improved. The After-LIFE Conservation Plan[24] is a strategy which explains the procedures to be followed in order for the proposed pSCIs (which later became Natura 2000 sites), to be designated as SACs and the appropriate management measures required for each site in order to ensure the long-term management of the site (s) and the species concerned.

1.2. Other biological data

With the assistance of the Regional Activity Centre for Specially Protected Areas -RAC/SPA and *Istituto Zoologico di Napoli*, in 2008, the Malta Environment and Planning Authority (MEPA) together with the Veterinary Resources and Fisheries Control and Conservation Division released 2 rehabilitated turtles with satellite tags. Their migration route can be followed on: http://www.seaturtle.org/tracking/index.shtml?project_id=358.
'Zeus', the bigger of the 2 turtles released had been incidentally caught by fishermen and had spent several weeks in the rehabilitation centre. It was released with a satellite tag in July 2008, and it subsequently stayed for a month in Eastern Malta, then ascending towards the Sicilian coast and continued swimming in the Sicilian Channel. The other turtle 'Vicky', had suffered severe head and neck injuries and lost the left front flipper due to entanglement in a fishing line, had spent some years in the rehabilitation centre. Vicky was released together with Zeus in July 2008, with the satellite tag, and also swam to the coast of Sicily and after nearly 2 months reached the coast of Sardinia from where she swam straight to the Spanish coast. After more than 3 months, it reached the Algerian coast, where it remained in the neighbourhood.

1.3. Threats

1.3.1. Nesting sites

Coastal development

Coastal development and constructions with the associated photo-and noise pollution are the main problems which probably deterred nesting from continuing after the 1910-1940s. This together with human presence and heavy disturbance on beaches, also at night (during the BBQ high season), may be one of the main factors of gaps in nesting events. The conservation orders issued when nesting has been signalled, has been quite effective for the terrestrial spatial protection measures relevant to turtles (G.N.683/12[25], G.N.985/1647 and GN for 2018[26]), these orders are aimed at providing protection to turtle eggs hatched on sandy beaches in the North Western coast of Malta. Though greater beach monitoring is necessary in view of such nesting activities which may otherwise remain unknown or may be discovered when it's too late e.g. as the case of the eggs found in Ramla L-Hamra – Gozo[8.] Driving on the beaches is strictly controlled.

Non human predation

This is not an issue on the Maltese Islands as there are no foxes and/or ghost crabs on our beaches. Moreover, to avoid any interferences of the nest by any domestic animals, the nests in Malta are protected with the Aluminium cages described further above (as guided by Cyprus- Demetropoulos A. pers comm).

Human Exploitation

There is no human exploitation of eggs and we are not aware of any turtles being killed for exploitation purposes

Other threats

Erosion

Tourism pressures has led to construction of breakwaters in some areas irrelevant of erosion issues. Some beaches have also been revamped through beach replenishment projects.

- Effect of debris on the nesting beaches does not seem to have a great effect. Manual beach clean-ups are also quite frequent by volunteers and other NGOs.
- Clay

This seems to be quite a problem, with the related flooding on particular wet seasons during the end of summer, beginning of autumn (if the nest has not hatched).

1.3.2. Marine areas

Incidental captures

According to the MSFD Initial Assessment for Malta[20] and the GES & targets documents[27] of the MSFD, incidental capture of marine turtles by fisheries is one of the major threats on this functional group. However, since at the time of writing this initial assessment not a lot of data on the actual population was available the extent of by-catch, hence the level of pressure, could not be quantified with a level of certainty. The proposed target emanating from the MSFD, aimed at achieving better information on this pressure with a view to inform the development of measures which may be required to address the identified threats.

Incidental captures and sighting notifications though occurring all year round in Malta have the highest numbers generally reported between June and September. As described further above, this period coincides with the maximum fishing activity for swordfish, tuna and dolphin fish, hence the high numbers reported could be attributed to the fact that most of the information available is based on incidental captures. By-catch in surface long-lines is of high risk from May to September on hooks baited with mackerel and soaking of hooks during daylight in depths less than 50 m. Adequate handling and release techniques are, however, available for fishermen.

In the past Gramentz (1988)[7] estimated that 2000-3000 loggerheads were caught on longline hooks around the Maltese Islands during the swordfish fishing season (spring-summer); Groombridge (1994)[2] published an estimate of 1000-2000 turtles caught annually. Longlining can result in by-catch due to the turtle trying to feed on bait and may eventually get hooked or even swallow the snood.

Estimates through an indirect approach, in a more recent published data by Casale, 2011[28]indicates that the number of turtles incidentally caught yearly by Maltese fishing gear, is 3,240 individuals, with pelagic longlining accounting for 96% of this bycatch. Turtle by-catch from bottom trawling is estimated at 8 turtles/year, from demersal long-liners at 286 turtles/year and from set-nets at 185 turtles/year. *In 2006 the same author[29]* published other data based on the EU fleet register data. He estimated the total by-catch of marine turtles for pelagic long-liners for Malta at about 2,965 individuals per year.

Turtle by-catch data from blue-fin tuna long-ling fishing, obtained through **direct methods of assessment**, had been published by Burgess et al. (2009)[30]. The authors state that the number of turtle specimens caught as by-catch by this type of fishing activity were the most abundant with values of 40.3% of the total catch in numbers and 7.3% of the total catch in weight. According to the initial assessment of the MSFD[20], the mean number of turtles incidentally caught per year based on fishermen's reports in the period 2008-2010, is approximately 58 turtles per year, which is a much lower number than what was estimated in above-mentioned publications.

Stranded turtles with evidence of fishing lines and turtles incidentally captured by fishermen and landed for rehabilitation purposes, are still quite frequent. About 10-15 turtles per year are usually washed up ashore.

By-catch in other fisheries- interaction with Fish Aggregation Devices (FAD) fishery are quite common. The FAD used to target the dolphinfish - *Lampuki* -are possibly the most likely fishing methods that can have a negative interactions with turtles. Again adequate handling and release techniques are, however, available for fishermen. The use of FADs in fishing, apart from the possibility of incidental catches which may at times be released on site unharmed, may also lead, according to the report provided through the LIFE+ MIGRATE[21], to turtles being entangled in the twine of the FAD itself.

These impacts would need to be assessed in detail and quantitative data to its effect needs to be collected. This will allow the drawing up of measures such as for example, the use of special hooks or other alterations that may be made to the longline so as to make it less dangerous or less attractive to turtles. Other possible measures may be the improvement of FADs twine to biodegradable.

<u>Intentional killing and exploitation</u>

Deliberate killing is now probably very limited, however it is difficult to have a good statistics on this, being an illegal activity. It is assumed that a maximum of 1 or 2 turtles a year may still be killed deliberately, but this may be an overestimation through expert judgement.

There is no killing for trade, though in the past before the 1992 local legislation was enacted hanging of dried carapaces on walls for decorations was quite widespread in fish restaurants especially in the South in places like Zurrieq.

<u>Other threats</u>

<u>Ship strikes</u>

In the past marine turtles have known to be injured or killed through collisions with marine vessels e.g. Gramentz (1989)[7] and Bonett (1982)[4] report turtles with different types of injuries resulting from possible boat collisions.

Nowadays vessel strikes (boats are on the increase in Malta) are a particular issue on calm weather days when the turtles are basking and generally cannot dive quickly due to drying of their carapace and possible bloating and gas formations on the surface, which may prohibit quick escape diving behaviour. High speed craft > 12 knots may be an issue near such turtle aggregates.

Recreational equipment such as jet skis also pose a danger due to collisions and harassment. Disturbance by vessels or other sea-craft may also disrupt the normal behaviour of the marine turtles especially during mating, feeding or other delicate periods or phases.

<u>Entanglement</u>

Entanglement in debris and drifting or bottom ghost fishing gear is a high potential risk. Micro-plastics analysis done during the LIFE + MIGRATE project [21] did not identify this as being a risk in Maltese waters. There is no evidence of any other significant threat, though noise pollution and seismic surveys (as reported from Israel in 2018) may be an issue for turtles (impulsive noise- see below).

According to the MSFD POMs[23] other pressures (apart from the above) or interactions may include:

- the presence of pollutants in the marine environment;
- interactions with marine litter (plastic, wood and textiles) which could lead to injury or mortality following ingestion or entanglement;
- disturbance by continuous noise from maritime traffic and impulsive noise generated by other activities such as seismic and sonar surveys.

However, all these pressures have not been quantified and further knowledge would be required on the extent and distribution of such pressures in Maltese waters.

1.4. Conservation

Marine turtles are protected by national laws, regional and international multilateral environmental agreements (MEAs- see further below and Table 3).

As stated above, until the Management plans for the Natura 2000 areas (for turtles) are issued, management of the sites is being addressed through existing mechanisms, particularly through the Programme of Measures of the MSFD[23], the Marine Monitoring Programme adopted by Malta in 2015, and its implementation, and the EU Mediterranean Fisheries Regulation (EU regulation 1967/2006).

The After-Life Conservation Plan[24] focuses on conservation objectives that target the loggerhead turtle, amongst others. A number of objectives were identified that are expected to either complement or enrich the output of the Life Migrate project. Apart from these objectives, associated management measures within the management plan are also identified. These are expected to be developed by ERA with relevant stakeholders and other relevant governmental bodies. The safeguarding of the selected areas from negative impacts is of utmost importance. The assessment of impacts from plans and projects (as dictated by article 6 of the Habitats Directive) within protected areas can be used to identify measures to mitigate those activities that would be identified to have a significant negative impact on the status of the marine protected areas or the protected species that are hosted within them.

A number of issues were already identified in the National Marine Monitoring Plan reported in 2015 as part of the MSFD reporting processes. Such Monitoring Plan is already being implemented by various Governmental entities. The Monitoring Plan governed the first phase of implementation, i.e. 2016-2018, and selected issues earmarked in the After-Life Conservation Plan[24] will be incorporated into the next phase of the reporting cycle, from 2019-2021, in line with the timeframes indicated.

Some 3 proposed conservation objectives, 12 Management objectives and a number of actions as well as their related cost and when they should be implemented can be found in the After-Life Conservation Plan[24] in the pages 22-28

Measures aimed to mitigate the main threat of by-catch are still in the initial phases and mostly limited to informing the fishers about on-board best practice to reduce mortality.

Malta is in also implementing EC Regulation 2015/2102, which requires records of all events of incidental catch and release of sea turtles and cetaceans in fishing logbooks. Malta's Work Plan for Data Collection (2017-2019) (https://datacollection.jrc.ec.europa.eu/wps) is seeking the collection of data during scientific observer trips on incidental by-catch of reptiles as listed in Table 1D of the Commission Implementing Decision (EU) 2016/1251 per métier, in order to estimate the level of fishing and the impact of fishing activities on these species.

Regulation 2015/2102 stipulates procedures to be followed at the moment of catch, including the need for accidentally caught turtles and cetaceans to be safely handled and released unharmed/alive. Also, turtles may only be brought ashore under schemes set by specific rescue or national conservation programmes (unless otherwise required) and following official notice to competent authorities. Purse seines should avoid encircling sea turtles, and vessels practicing long-lining or using bottom-set gillnets should practice safe-handling, disentanglement and release in ways that maximize the probability of survival. The data collection process on by-catch is in line with Article 12 of the Habitats Directive, which requires the establishment of systematic monitoring of incidental capture/killing for cetacean and turtles with a view to use this information to guide and implement measures for the mitigation of by-catch impacts. Such a suggestion is also included within UNEP/MAP Action Plans for the Conservation of Marine Turtles and Cetaceans (Barcelona Convention).

1.5. Research

Greater systematic monitoring of marine turtles aimed at assessing the population status of this species in Malta is needed. At present, long-term data on turtle sightings, on the basis of which species distribution and abundance can be assessed, is lacking. Data collection with respect to population condition (demographic characteristics) is currently carried out on an *ad hoc* basis depending on the collection of incidentally caught and/or injured specimens or on standings. More research is also needed on nesting, particularly on remigration interval and genetic analysis of such nesting events.

2. RMU: Loggerhead Turtle (*Caretta caretta*) North West Atlantic

2.1. Distribution, abundance trends

2.1.1. Nesting sites

We think that this RMU does not breed in Malta

2.1.2. Marine Areas

No genetic studies are available to prove that individuals belonging to this RMU have been reported in waters around Malta, hence no estimates of abundance or trends are possible.

2.2. Other Biological data

If Turtles from this RMU are in fact present in Malta they may share the same foraging grounds and hence several data ascribed to the previous RMU may be attributed to this one.

2.3. Threats

Same as for before

2.4. Conservation

Same as for before

2.5. Research

Same as for before

3. RMU: Green Turtle (*Chelonia mydas*) Mediterranean

3.1. Distribution, abundance trends

3.1.1. Nesting sites

This RMU does not breed in the Malta

3.1.2. Marine areas

Individuals belonging to this RMU have been reported from Malta[2], however this species is very rare locally and mostly known only from one record in 1929[2]. In the 2012-2015, other specimens may have been sighted by non-governmental organisations (BirdLifeMalta and Nature Trust Malta - Ben Metzger & Vince Attard, Personal Communication) during their surveys at sea and from information forwarded by fishermen.

The foraging grounds of green turtles are different than those for loggerhead turtles since they start grazing on *Posidonia oceanica* and *Cymodocea nodosa* meadows, when they reach 30-40cm in length, and abandon the pelagic stage and descend to their foraging grounds. If turtles from this RMU are still present in Malta they probably wont share the same foraging grounds as for the Loggerhead.

3.2. Other Biological data
No other information is available

3.3. Threats
No stranding or incidental by-catch of green turtles were encountered in recent years. The absence of bycatch incidences of this species could also be due to the herbivorous nature of adults, as a consequence of which, they are less likely to be caught by long-line fishing.

3.4. Conservation
Same as for before

3.5. Research
Same as for before

4. RMU: Leatherback Turtle (*Dermochelys coriacea*) Atlantic North-West
Though genetic analysis was done in 2016, it is still unknown to which Atlantic /Pacific RMU the individuals frequenting Maltese waters belong.

4.1. Distribution, abundance trends
4.1.1. Nesting sites
This RMU does not breed in Malta

4.1.2. Marine Areas
Individuals from this RMU have been reported from Malta. No estimates of abundance or trends are however available. The Leatherback turtle has been recorded on several occasions with at least 12 records of sightings and/or captures in Malta mostly in the period 1970- 1980[32,33,34 &7]. Birdlife also signalled a single sighting of a leatherback turtle in 2013.

4.2 Other Biological data
No other information is available except for size of the reported individuals. This indicates that possibly large juveniles frequent Maltese waters.

4.3. Threats
Capture by drift nets, set nets and longlines were reported from the region and adjacent ones, but no estimates of bycatch are available
Same as for before threats are also applicable

4.4. Conservation
Same as for Loggerhead

4.5. Research
Same as for before. Further studies focusing specifically on this RMU are almost missing except for the above mentioned paper on genetic analysis[31]

5. RMU: Hawksbill Turtle (*Eretmochelys imbricata*) Indian North West /Atlantic East
5.1. Distribution, abundance trends
5.1.1. Nesting sites
This RMU does not breed in the Mediterranean

5.1.2. Marine Areas
A hawksbill turtle (*Eretmochelys imbricata*) was recorded in 1980[35] some five miles off the East coast

of Gozo. According to this author, it is likely that this specimen came from the Indian Ocean through the Suez canal.

5.2. Other Biological data

No other information is available

5.3. Threats

No stranding or incidental by-catch of hawksbill turtles were encountered in recent years.

5.4. Conservation

Same as for before

5.5. Research

Same as for before

6. RMU: Kemp's Ridley (Lepidochelys kempi) Atlantic North-West

6.1. Distribution, abundance trends

6.1.1. Nesting sites

This RMU does not breed in the Mediterranean

6.1.2. Marine Areas

The first record of the Kemp's Ridley (*Lepidochelys kempi*) in the Mediterranean was in fact from Malta. This was a specimen captured off the north-eastern coast of Malta in 1929, one mile from the Grand Harbour[35]. Despott[1] had erroneously identified this specimen as *Chelonia mydas*. The specimen, which was stuffed and preserved and is presently at the Natural History Museum in Mdina, was identified correctly in 1983.

Carr (1963)[36] included Malta as a locality of the Kemp's Ridley in a distributional chart.

6.2. Other Biological data

No other information is available, except for the size of this single specimen caught.

6.3. Threats

No other stranding or incidental by-catch of this turtles was encountered in recent years.

6.4. Conservation

Same as for before

6.5. Research

Same as for before

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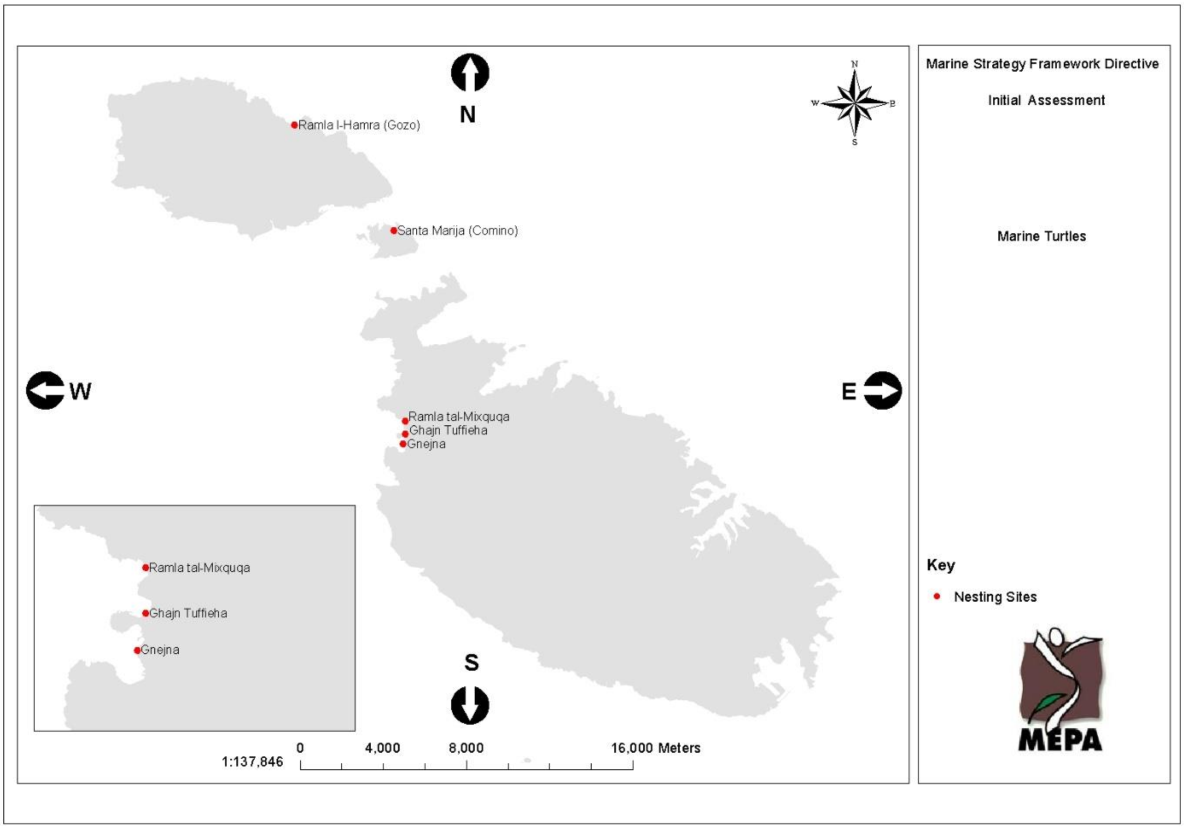

Figure 1- for all nesting locations including historic ones- *extracted from the MSFD* - Initial Assessment for Malta – Marine turtles.

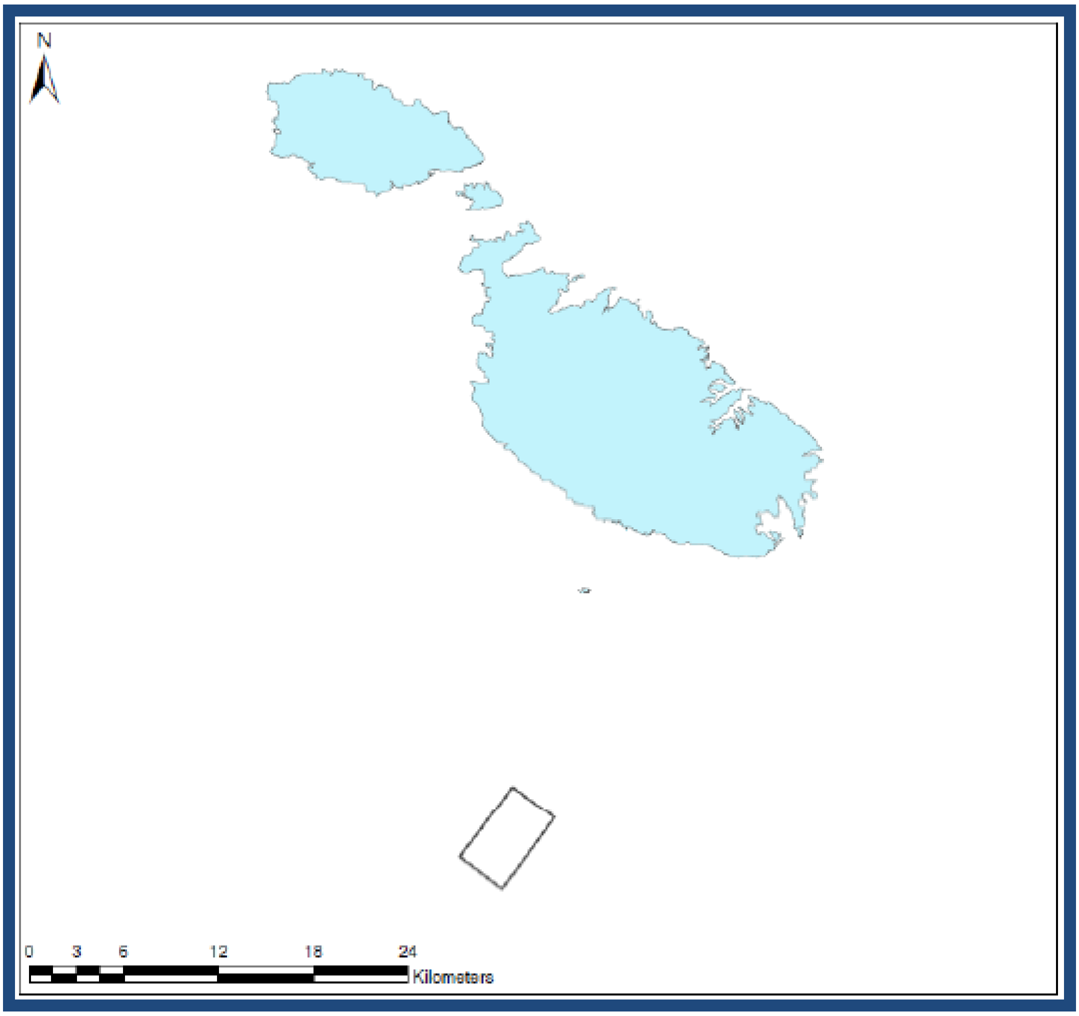

Figure 2 a- SW Malta- Natura 2000 Site for turtles (extracted from LIFE MIGRATE- Layman's Report-2016)

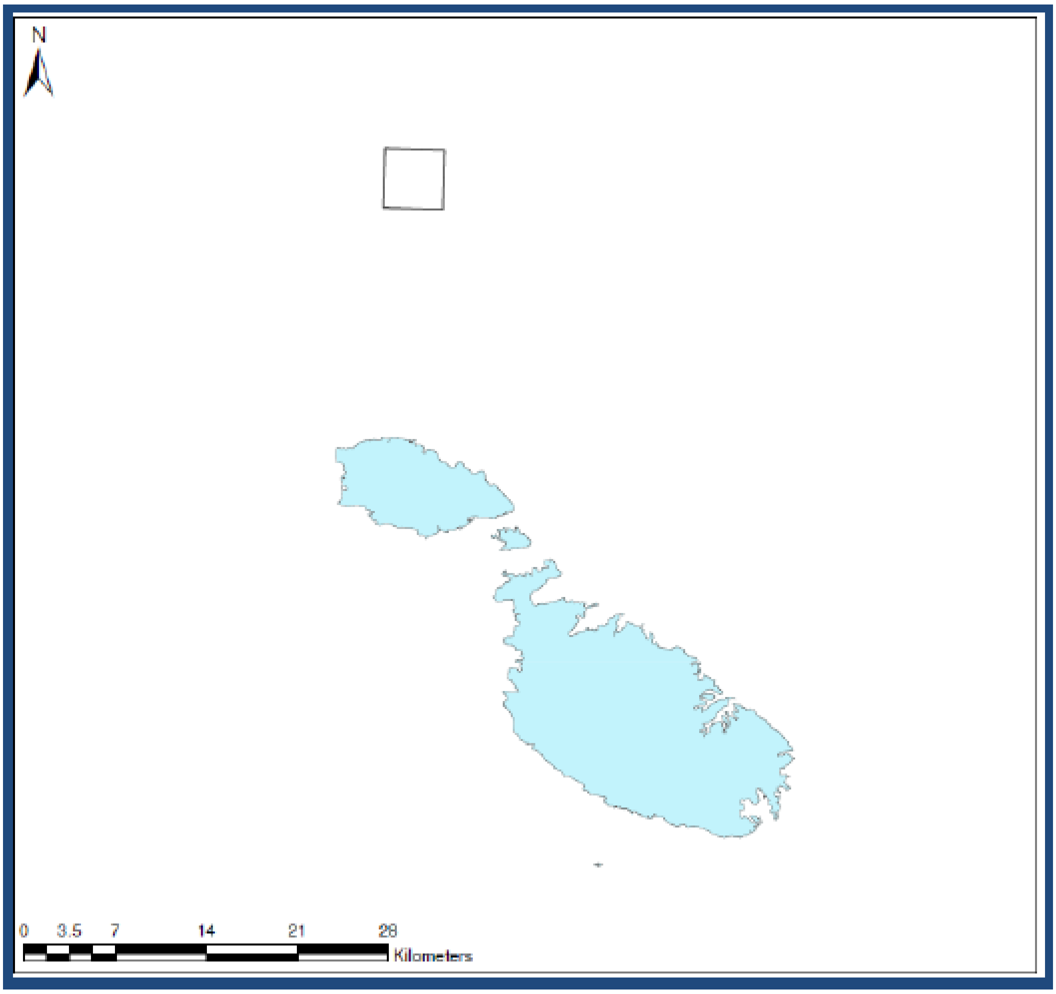

Figure 2 b- N Malta- Natura 2000 Site for turtles (extracted from LIFE MIGRATE- Layman's Report-2016)

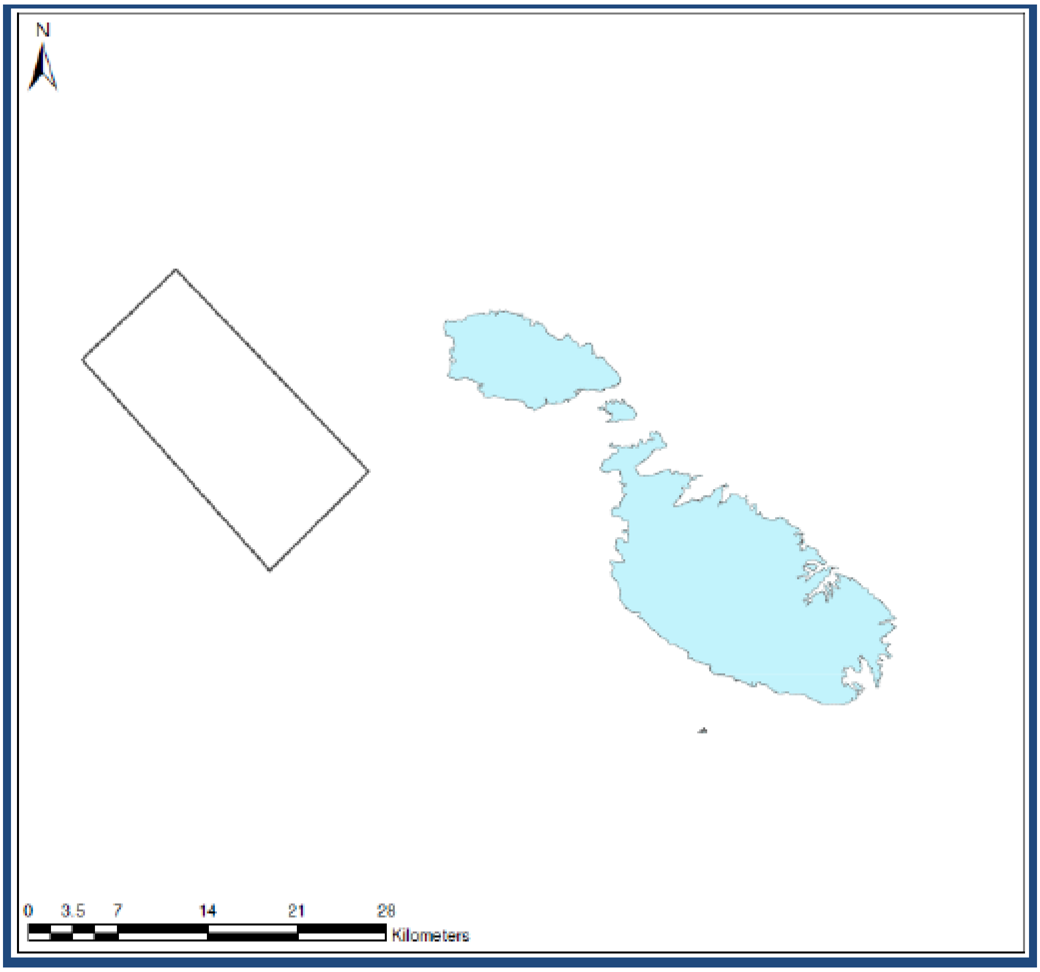

Figure 2 c- W Malta- Natura 2000 Site for turtles (extracted from LIFE MIGRATE- Layman's Report-2016)

Table 1. Biological and conservation information about sea turtle Regional Management Units in Malta

RMU (all RMUs of all species occurring in a Country or Region) add or remove columns on the right according to the RMUs	CC-NW IND	Ref #	CM-NW IND	Ref #	DC-SW IND	Ref #
Occurrence						
Nesting sites	Y	1,2	N	n/a	n/a	n/a
Pelagic foraging grounds	Y	3	Y		n/a	
Benthic foraging grounds	?	n/a	n/a		n/a	
Key biological data						
Nests/yr: recent average (range of years)	0.25 (2010-2014)	1,2	n/a		n/a	
Nests/yr: recent order of magnitude	0-1	1,2	n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a	n/a	n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	2	1,2	n/a		n/a	
Nests/yr at "major" sites: recent average (range of years)	n/a		n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	0,25		n/a		n/a	
Total length of nesting sites (km)	2		n/a		n/a	
Nesting females / yr	Not known		n/a		n/a	
Nests / female season (N)	Not known		n/a		n/a	
Female remigration interval (yrs) (N)	Not known		n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	Not known		n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	Not known		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	Not known		n/a		n/a	
Min adult size, CCL or SCL (cm)	Not known		n/a		n/a	
Age at maturity (yrs)	25-30		n/a		n/a	
Clutch size (n eggs) (N)	95 (3)		n/a		n/a	
Emergence success (hatchlings/egg) (N)	61.7% (3)		n/a		n/a	

Nesting success (Nests/ Tot emergence tracks) (N)	not known		n/a		n/a	
Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	Up (1995-2015)		n/a		n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	Up (1995-2015)		n/a		n/a	
Oldest documented abundance: nests/yr (range of years)	unknown		n/a		n/a	
Published studies						
Growth rates	N	n/a	N		N	
Genetics	Y	4	N		N	
Stocks defined by genetic markers	N		N		N	
Remote tracking (satellite or other)	Y	5	N		N	
Survival rates	n/a		N		N	
Population dynamics	Y		N		N	
Foraging ecology (diet or isotopes)	N		N		N	
Capture-Mark-Recapture	N		N		N	
Threats						
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, DLL, SN, MT)	6, 7	N		n/a	
Bycatch: presence of industrial fisheries?			Y		n/a	
Bycatch: quantified?	N		N		n/a	
Take. Intentional killing or exploitation of turtles	Y		N		n/a	
Take. Egg poaching	N		n/a		n/a	
Coastal Development. Nesting habitat degradation	Y		n/a		n/a	
Coastal Development. Photopollution	Y		n/a		n/a	
Coastal Development. Boat strikes	Y		n/a		n/a	

Egg predation	N		n/a		n/a	
Pollution (debris, chemical)	n/a		n/a		n/a	
Pathogens	n/a		n/a		n/a	
Climate change	n/a		n/a		n/a	
Foraging habitat degradation	n/a		n/a		n/a	
Other			N		N	
Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	Y (2012,2015,2018)		n/a		n/a	
Number of index nesting sites	N		n/a		n/a	
Monitoring at foraging sites (period: range of years)	N		n/a		n/a	
Conservation						
Protection under national law	Y		Y		Y	
Number of protected nesting sites (habitat preservation) (% nests)	temporarily during the nesting		0		0	
Number of Marine Areas with mitigation of threats	0		0		0	
N of long-term conservation projects (period: range of years)	>1 (2012-2016)	3	0		0	
In-situ nest protection (eg cages)	Y		n/a		n/a	
Hatcheries	N		n/a		n/a	
Head-starting	N		n/a		n/a	
By-catch: fishing gear modifications (eg, TED, circle hooks)	N		n/a		n/a	
By-catch: onboard best practices	Y		n/a		n/a	
By-catch: spatio-temporal closures/reduction	N		n/a		n/a	
Other	N		N		N	

Table 2. Sea turtle nesting beaches in Malta.

Crawls/yr: recent average (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
	Long	Lat	Long	Lat	Long	Lat					
Not known							0,317		1,2		Yes during the incubation time of the nest
Not known							0,228		1,2		Yes during the incubation time of the nest

Table 3. International conventions protecting sea turtles and signed by Malta.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Bern Convention	Y	Y	Y	CM, CC		EMERALD network : ASCIs sites
Barcelona Convention- Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean	Y	Y		CC, CM, DC, EI, LK	Action plan	SPAMIs & SPAs & protection of species
Convention on Biological Diversity (CBD)	Y	Y		ALL		EBSAs

Convention on International Trade in Endagered Species of Wild Fauna and Flora (CITES)	Y	Y				
The EU Wildlife (Wild Fauna and Flora) Trade Regulations	Y	Y	Y		Marine Turtles are stirctly protected against trade as live specimens or their derivatives	
The Conservation of Natural Habitats and of Wild Fauna and Flora (better known as the EC Habitats Directive)- European Council Directive 92/43/EEC	Y	Y	Y	CM, CC	Article 17 & article 11 reporting	Natura 2000 sites
Bonn Convention (Convention on Migratory Species)	Y	Y		All		
UNCLOS (United Nations Convention on the Law of the Sea)	Y	Y				Not directly
Council Regulation (EC) 1967 of 2006, concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea	Y	Y	Y	CM, CC, LK, EI, DC	Article 3- prohibits deliberate catching, retention on board, transshipment or landing of protected species listed in Annex IV of the Habitats Directive and this includes marine turtles as listed in the above-mentioned Habitats Directive.	Yes - reporting of bycatch

GFCM (General Fisheries Commission for the Mediterranean) Recommendation -35/2011/7 and 35/2011/4	Y	Y			Monitoring & **recording of incidental taking** and advice & guidance from the Scientific Advisory Committee with respect to mitigation measures. Purse seine vessels should avoid encircling sea turtles & release entangled sea turtles. Pelagic longline vessels should carry on-board equipement capable of releasing sea turtles unharmed and in a manner that maximises the probability of their survival	Yes - reporting of bycatch & guidance on mitigation measures

MONACO

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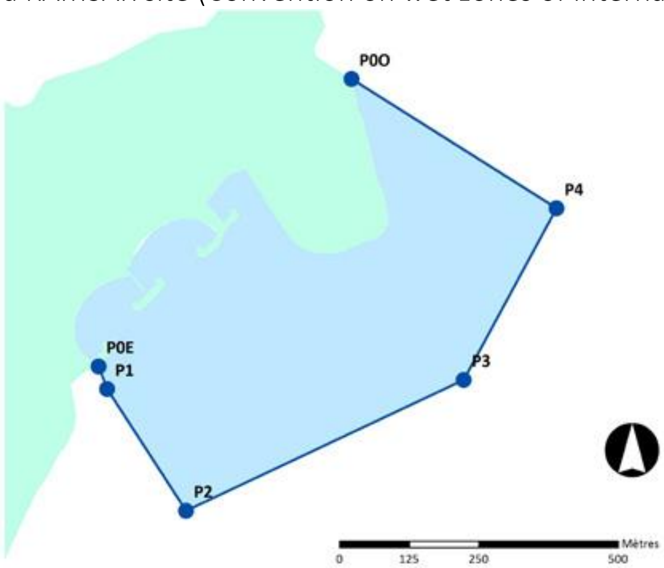
1. RMU: Loggerhead turtle (*Caretta caretta*) Mediterranean
1.1. Distribution, abundance, trends
1.1.1. Nesting sites
Due to its small size and urbanized shore, Monaco has no nesting beach.

1.1.2. Marine areas
Two Marine Protected Areas exist in Monaco: the "Larvotto Protected Area" and the "Tombant des Spélugues Protected Area".
The Larvotto protected area stands from the east border of Monaco to the Grimaldi forum, covering a coastline of 600 m and a surface of 32 ha. It is mainly dedicated to the preservation of a *Posidonia oceanica* grass bed covering half of its surface. Part of the area is also registered as a RAMSAR site (Convention on wet zones of international importance).



Réserve du Larvotto		
Superficie	32	Hectares
Délimitation	Longitude	Latitude
P0E	7°25',99 E	43°44',67 N
P1	7°26',00 E	43°44',66 N
P2	7°26',10 E	43°44',54 N
P3	7°26',48 E	43°44',66 N
P4	7°26',60 E	43°44',81 N
P0O	7°26',35 E	43°44',94 N

Figure 1
The protected area called « Tombant des Spélugues" is located near the entrance of Hercule Port of Monaco, covering an area from the coast to 90 m off shore. The depth of the area varies from 0 to 42 m, and its surface is around 1,9 ha. This site is pretty unique as it, in an

urbanized area, includes a coralligene reef made of a main 30 m high wall. Many emblematic Mediterranean species live there, such as red coral, sponges, gorgons, groupers etc…

Réserve du Tombant des Spélugues		
Superficie	1,9	Hectares
Délimitation	Longitude	Latitude
1	7°25',79 E	43°44',22 N
2	7°25',85 E	43°44',26 N
3	7°25',88 E	43°44',31 N
4	7°25',80 E	43°44',33 N

Figure 2

It is also important to remember here that Monaco is located in the heart of the Pelagos area, thus being managed by a specific regulation, which, so far, doesn't include sea turtles.
Marine turtles don't really frequent those protected areas, or at least, no reports have been made on seeing sea turtles there.

1.2. Other biological data
No biological data available

1.3. Threats
The main threats in the Monaco area are:
- collisions with boats as the two harbors are pretty active, especially during summer season when cruise ships and private yachts visit the shore.
- Ingestion of plastics or marine debris

1.4. Conservation
Several conservation actions are set up in Monaco to protect sea turtles.
A rescue center opened in February 2019 to support Monaco's Government policy to protect marine species, including sea turtles. This rescue center is hosted by the Oceanographic Museum of Monaco and operated by its staff. It is designed to host 5 to 6 turtles in the same time and has an outside rehabilitation tank of 160 m3. The rescue center has a partnership with the French sea turtle network (Reseau Tortues Marines de Méditerranée Française – RTMMF) to work on public awareness, scientific programs and turtle rescue.
The Government of Monaco is also involved in many conservation programs on sea turtles through different agencies such as the Oceanographic Museum and the Prince Albert 2 Foundation.
An educative Marine area has also been launched in Monaco in 2019. It concerns all marine species, including sea turtles.

Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Monaco.

TOPIC	REGIONAL MANAGEMENT UNIT					
	CC-MED	Ref #	CM-MED	Ref #	DC-ATL	Ref #
Occurrence						
Nesting sites	N		N		N	
Pelagic foraging grounds	N		N		N	
Benthic foraging grounds	N		N		N	
Key biological data						
Nests/yr: recent average (range of years)	N		N		N	
Nests/yr: recent order of magnitude	N		N		N	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	N		N		N	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	N		N		N	
Nests/yr at "major" sites: recent average (range of years)	N		N		N	
Nests/yr at "minor" sites: recent average (range of years)	N		N		N	
Total length of nesting sites (km)	N		N		N	
Nesting females / yr	N		N		N	
Nests / female season (N)	N		N		N	
Female remigration interval (yrs) (N)	N		N		N	
Sex ratio: Hatchlings (F / Tot) (N)	N		N		N	
Sex ratio: Immatures (F / Tot) (N)	N		N		N	
Sex ratio: Adults (F / Tot) (N)	N		N		N	
Min adult size, CCL or SCL (cm)	N		N		N	
Age at maturity (yrs)	N		N		N	
Clutch size (n eggs) (N)	N		N		N	
Emergence success (hatchlings/egg) (N)	N		N		N	
Nesting success (Nests/ Tot emergence tracks) (N)	N		N		N	

Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	N		N		N	
Recent trends (last 20 yrs) at foraging grounds (range of years)	N		N		N	
Oldest documented abundance: nests/yr (range of years)	N		N		N	
Published studies						
Growth rates	N		N		N	
Genetics	N		N		N	
Stocks defined by genetic markers	N		N		N	
Remote tracking (satellite or other)	N		N		N	
Survival rates	N		N		N	
Population dynamics	N		N		N	
Foraging ecology (diet or isotopes)	N		N		N	
Capture-Mark-Recapture	N		N		N	
Threats						
Bycatch: presence of small scale / artisanal fisheries?	1 (DN)		1 (DN)		1 (DN)	
Bycatch: presence of industrial fisheries?	N		N		N	
Bycatch: quantified?	N		N		N	
Take. Intentional killing or exploitation of turtles	N		N		N	
Take. Egg poaching	N		N		N	
Coastal Development. Nesting habitat degradation	N		N		N	
Coastal Development. Photopollution	Y		Y		Y	
Coastal Development. Boat strikes	Y		Y		Y	
Egg predation	N		N		N	
Pollution (debris, chemical)	Y		Y		Y	

Pathogens	N		N		N	
Climate change	N		N		N	
Foraging habitat degradation	N		N		N	
Other	N		N		N	
Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	N		N		N	
Number of index nesting sites	N		N		N	
Monitoring at foraging sites (period: range of years)	N		N		N	
Conservation						
Protection under national law	Y		Y		Y	
Number of protected nesting sites (habitat preservation) (% nests)	N		N		N	
Number of Marine Areas with mitigation of threats	1		1		1	
N of long-term conservation projects (period: range of years)	1		1		1	
In-situ nest protection (eg cages)	N		N		N	
Hatcheries	N		N		N	
Head-starting	N		N		N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	N		N		N	
By-catch: onboard best practices	Y		Y		Y	
By-catch: spatio-temporal closures/reduction	N		N		N	

Table 3. International conventions protecting sea turtles and signed by Monaco

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Washington / CITES	Y	Y	Y	All		
Barcelone	Y	Y	Y	CC, DC, CM		

Table 4. Sea turtle conservation projects in Monaco

#	RMU	Country	Region / Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/Private	Collaboration with	Reports / Information material	Current Sponsors	Primary Contact (name and Email)
T4.1		Monaco	Europe	Centre Monégasque de Soins des Espèces marines	rescue center	february 2019		Institut océanographique	Fondation				Olivier BRUNEL - o.brunel@oceano.org

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3 Holcer, D., Fortuna, C.M. (2015): Atlas of Cetacean and Sea turtle distribution in the Adriatic Sea. Blue World Institute of Marine Research and Conservation, Veli Lošinj
4 Official Gazette of Montenegro no. 76/06 (2006): Decision on protection of some plant and animal species. Republic Institute for Nature Protection of Montenegro, Podgorica

Table 1. Biological and conservation information about sea turtle Regional Management Units in Montenegro.

RMU	CC-MED	Ref #	CM-MED	Ref #
Occurrence				
Nesting sites	N	1,2	N	1,2
Pelagic foraging grounds	n/a		n/a	
Benthic foraging grounds	n/a		n/a	
Key biological data				
Nests/yr: recent average (range of years)	n/a		n/a	
Nests/yr: recent order of magnitude	n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a		n/a	
Nests/yr at "major" sites: recent average (range of years)	n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	n/a		n/a	
Total length of nesting sites (km)	n/a		n/a	
Nesting females / yr	n/a		n/a	
Nests / female season (N)	n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a	
Min adult size, CCL or SCL (cm)	n/a		n/a	
Age at maturity (yrs)	n/a		n/a	
Clutch size (n eggs) (N)	n/a		n/a	
Emergence success (hatchlings/egg) (N)	n/a		n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a	

Trends				
Recent trends (last 20 yrs) at nesting sites (range of years)	n/a		n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a	
Oldest documented abundance: nests/yr (range of years)	n/a		n/a	
Published studies				
Growth rates	N		N	
Genetics	N		N	
Stocks defined by genetic markers	N		N	
Remote tracking (satellite or other)	N		Y	1,2,3
Survival rates	N		N	
Population dynamics	N		N	
Foraging ecology (diet or isotopes)	N		N	
Capture-Mark-Recapture	N		N	
Threats				
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, SN)	1	Y (SN)	1
Bycatch: presence of industrial fisheries?	Y (BT)	1	N	
Bycatch: quantified?	N		N	
Take. Intentional killing or exploitation of turtles	Y	1	n/a	
Take. Egg poaching	n/a		n/a	
Coastal Development. Nesting habitat degradation	n/a		n/a	
Coastal Development. Photopollution	n/a		n/a	
Coastal Development. Boat strikes	Y	1,2	n/a	

Egg predation	n/a		n/a	
Pollution (debris, chemical)	Y	1	Y	1
Pathogens	n/a		n/a	
Climate change	n/a		n/a	
Foraging habitat degradation	n/a		n/a	
Other	N		N	
Long-term projects (>5yrs)				
Monitoring at nesting sites (period: range of years)	N		N	
Number of index nesting sites	N		N	
Monitoring at foraging sites (period: range of years)	N		N	
Conservation				
Protection under national law	Y	4	Y	4
Number of protected nesting sites (habitat preservation) (% nests)	N		N	
Number of Marine Areas with mitigation of threats	n/a		n/a	
N of long-term conservation projects (period: range of years)	1 ()		1 ()	
In-situ nest protection (eg cages)	n/a		n/a	
Hatcheries	n/a		n/a	
Head-starting	n/a		n/a	
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a		n/a	
By-catch: onboard best practices	n/a		n/a	
By-catch: spatio-temporal closures/reduction	n/a		n/a	
Other	n/a		n/a	

Table 3. International conventions relevant to sea turtle conservation in Montenegro

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, Barselona 1995	Y					
United Nations Convention on the Law of the Sea, 1982	Y					
Convention on Biological Diversity – CBD 1992	Y					
Convention on International Trade in Endangered Species of fauna and flora – CITES 1973	Y			CC		
Convention on the Conservation of European Wildlife and Natural Habitats, Bern 1979	Y			ALL		
Convention on the Conservation of Migratory Species of Wild Animals – CMS, Bonn 1979	Y			ALL		
Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean, Barselona 1994 and Monaco 1995	Y					
Protocol on Integrated Coastal Zone Management in the Mediterranean, Barselona 2008	Y					

Table 4. Projects and databases relevant to sea turtle Regional Management Units in Montenegro.

#	RMU	Country	Region / Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/Private
T4.1	CC-MED CM-MED	Italy, Slovenia, Croatia, Montenegro, Albania	Adriatic Sea	Network for the Conservation of Cetaceans and Sea Turtles in the Adriatic		2012	2016	City of Venice	Public

Table 4. (cont.)

#	Collaboration with	Reports / Information material	Current Sponsors	Primary Contact (name and Email)	Other Contacts (name and Email)
T4.1	University of Padua IT, City of Pescara IT, Cetacea Foundation IT, Italian National Institute for Environmental Protection and Research IT, State Institute for Nature Protection CR, Herpetofauna Albanian Society AL, Association for Protection of Aquatic Wildlife of Albania AL, Institute of Marine Biology MNE, University of Primorska SL, WWF IT, Marine Educational Centre Pula CR	netcet.eu	The project is co-funded by the European Union Instrument for Pre-Accession Assistance		

MOROCCO

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General remarks

More detailed information about this country can be found in the Med Turtle report published in 2010 (http://iucn-mtsg.org/publications/med-report/).
The Mediterranean coastline of Morocco stretches approximately over 490 km from Tangier in the west to the border with Algeria in the east, with varying levels of human habitation and access to the coastline. To date, most of the effort in monitoring for sea turtle occurrences has focused on the western and eastern end of the coastline. The status of sea turtles on the Mediterranean coast was largely unknown until the late 1980s, when the first systematic survey was completed (14). Since then, efforts have been made to report on turtles that have been found stranded along the coast or that have been captured incidentally in fisheries. Plans to institute a consistent monitoring program and a national sea turtle network are in their infancy. Three species of sea turtles regularly occur in the waters of Mediterranean Morocco: loggerheads (*Caretta caretta*), green turtle (*Chelonia mydas*) and leatherbacks (*Dermochelys coriacea*). This information is derived mainly from observations of turtles incidentally captured in fishing gear or turtles found stranded dead along the coast.

1. RMU: Loggerhead turtle (*Caretta caretta*) Mediterranean

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

Laurent (14) evaluated the possibility of sea turtle reproductive activity along the Mediterranean coast of Algeria and Morocco, and found no indications or signs of sea turtle nests. Benhardouze (8) and Kaddouri et al. (4) interviewed local residents, but no nesting was reported. The beach habitat may be unsuitable for nesting because the majority of Moroccan beaches are composed of rock; even the sandy beaches that do exist appear not to support any nesting (14, 9).

1.1.2. Marine areas

<u>North West of Morocco</u>

Incidental capture of sea turtles by fishing gear is one of the most urgent problems to solve in order to conserve and protect sea turtles worldwide. This study presents estimates of sea turtle bycatch in the Martil-M'diq region in 2016. These estimates were obtained by analyzing information on the interactions between turtles and fisheries using an integrated approach based on interviews. The responses of 43 fishermen allowed us to identify the impact of each type of fishing gear on sea turtles in this region. A total of 46 turtles were estimated to be captured in 2016 by these fishermen, of which 95.6% (n = 44) were loggerheads and 4.4% (n = 2) were green turtles. Results indicate that 21 loggerheads were caught by purse seine, 17 loggerheads by longline, 5 turtles (3 loggerheads and 2 green turtles) by trawl, and 3 loggerheads by trammel net; none were captured by beach seine nets (4).

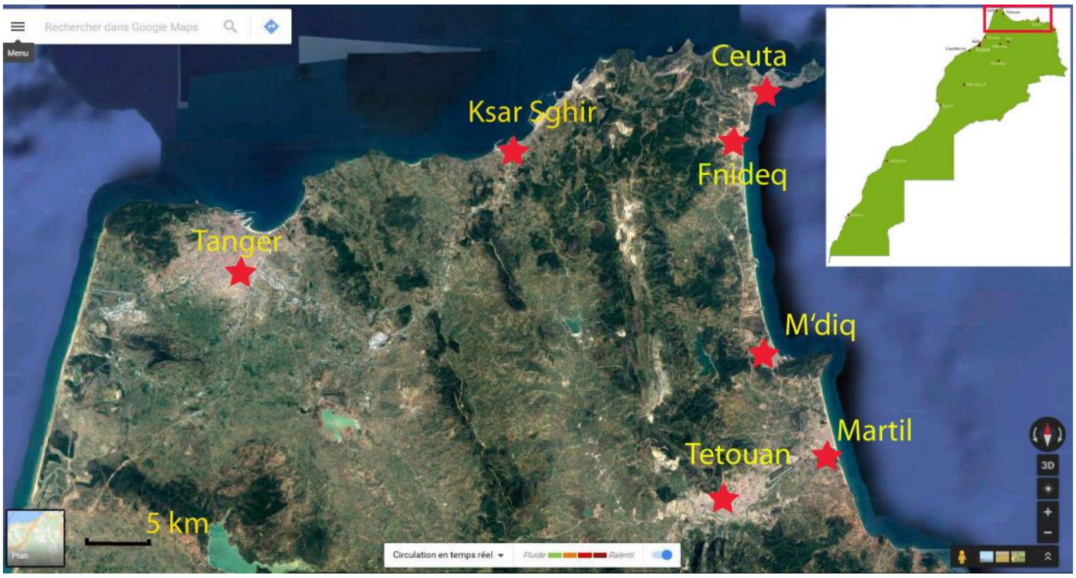

Figure 1: Study area in Mediterranean North West Morocco

East of Morocco

This study examines the bycatch and strandings of marine turtles along the eastern Mediterranean of Morocco from Al Hoceima in the west to Cape de l'Eau in the east between November 2013 and December 2015. Thirty-seven fishermen (10 seines, 6 trawlers, 11 longliners and 10 artisanal boats) were interviewed and followed. The most frequently caught species is the loggerhead, followed by the green turtle and the leatherback. The interaction with seines and longlines is more frequent than with trawls. Capture season is from March to September (5).

Figure 2: Study area in Mediterranean East Morocco

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Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Morocco.

TOPIC	REGIONAL MANAGEMENT UNIT					
	CC-MED	Ref #	CM-MED	Ref #	DC-ATL?	Ref #
Occurrence						
Nesting sites	N	6	N		N	
Pelagic foraging grounds	n/a		n/a		n/a	
Benthic foraging grounds	Y	1 to 5	n/a		n/a	
Key biological data						
Nests/yr: recent average (range of years)	N		N		N	
Nests/yr: recent order of magnitude	N		N		N	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	N		N		N	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	N		N		N	
Nests/yr at "major" sites: recent average (range of years)	N		N		N	
Nests/yr at "minor" sites: recent average (range of years)	N		N		N	
Total length of nesting sites (km)	N		N		N	
Nesting females / yr	N		N		N	
Nests / female season (N)	N		N		N	
Female remigration interval (yrs) (N)	N		N		N	
Sex ratio: Hatchlings (F / Tot) (N)	N		N		N	
Sex ratio: Immatures (F / Tot) (N)	N		N		N	
Sex ratio: Adults (F / Tot) (N)	N		N		N	
Min adult size, CCL or SCL (cm)	N		N		N	
Age at maturity (yrs)	N		N		N	
Clutch size (n eggs) (N)	N		N		N	
Emergence success (hatchlings/egg) (N)	N		N		N	
Nesting success (Nests/ Tot emergence tracks) (N)	N		N		N	

Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	N		N		N	
Recent trends (last 20 yrs) at foraging grounds (range of years)	N		N		N	
Oldest documented abundance: nests/yr (range of years)	N		N		N	
Published studies						
Growth rates	N		N		N	
Genetics	N		N		N	
Stocks defined by genetic markers	N		N		N	
Remote tracking (satellite or other)	N		N		N	
Survival rates	N		N		N	
Population dynamics	N		N		N	
Foraging ecology (diet or isotopes)	N		N		N	
Capture-Mark-Recapture	N		N		N	
Threats						
Bycatch: presence of small scale / artisanal fisheries?	Y	1 to 7	Y		Y	
Bycatch: presence of industrial fisheries?	Y		Y		Y	
Bycatch: quantified?	Y	4 and 10	Y		Y	
Take. Intentional killing or exploitation of turtles	some	13				
Take. Egg poaching	N					
Coastal Development. Nesting habitat degradation	N					
Coastal Development. Photopollution	N					
Coastal Development. Boat strikes	N					
Egg predation	N					
Pollution (debris, chemical)	Y					
Pathogens	N					
Climate change	N		N		N	
Foraging habitat degradation	N		N		N	
Other						

Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	N		N		N	
Number of index nesting sites	N		N		N	
Monitoring at foraging sites (period: range of years)	N		N		N	
Conservation						
Protection under national law	Y	10	Y		Y	
Number of protected nesting sites (habitat preservation) (% nests)	N		N		N	
Number of Marine Areas with mitigation of threats	N		N		N	
N of long-term conservation projects (period: range of years)	N		N		N	
In-situ nest protection (eg cages)	N		N		N	
Hatcheries	N		N		N	
Head-starting	N		N		N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	N		N		N	
By-catch: onboard best practices	N		N		N	
By-catch: spatio-temporal closures/reduction	N		N		N	
Other	N		N		N	

Table 2. The conventions signed by Morocco.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Memorandum of Understanding concerning Conservation Measures for Marine Turtles of the Atlantic Coast of Africa	Y	Y	n/a	DC, EI, LO, CM, CC	Marine turtle monitoring program	Y
Convention on Biological Diversity	Y	Y	n/a	ALL	Marine turtle monitoring program	Y
Convention on Migratory Species (CMS)	Y	Y	n/a	ALL	Marine turtle monitoring program	Y
CITES	Y	Y	n/a	ALL	Marine turtle monitoring program	Y

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Table 1. Biological and conservation information about sea turtle Regional Management Units in Croatia.

RMU	CC-MED	Ref #	CM-MED	Ref #
Occurrence				
Nesting sites	N		N	
Pelagic foraging grounds	N		N	
Benthic foraging grounds	Y	1,2,3,4	N	
Key biological data				
Nests/yr: recent average (range of years)	n/a		n/a	
Nests/yr: recent order of magnitude	n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	n/a		n/a	
Nests/yr at "major" sites: recent average (range of years)	n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	n/a		n/a	
Total length of nesting sites (km)	n/a		n/a	
Nesting females / yr	n/a		n/a	
Nests / female season (N)	n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	57.9% (N = 57)	5	n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a	
Min adult size, CCL or SCL (cm)	n/a			
Age at maturity (yrs)	n/a		n/a	
Clutch size (n eggs) (N)	n/a		n/a	
Emergence success (hatchlings/egg) (N)	n/a		n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a	

Trends				
Recent trends (last 20 yrs) at nesting sites (range of years)	N		n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a	
Oldest documented abundance: nests/yr (range of years)	N		n/a	
Published studies				
Growth rates	N		N	
Genetics	Y	6	N	
Stocks defined by genetic markers	Y	6	N	
Remote tracking (satellite or other)	Y	7	N	
Survival rates	N		N	
Population dynamics	N		N	
Foraging ecology (diet or isotopes)	Y	3, 4, 8	N	
Capture-Mark-Recapture	Y	9	N	
Threats				
Bycatch: presence of small scale / artisanal fisheries?	Y (SN, MT,PT)		n/a	
Bycatch: presence of industrial fisheries?	Y (MT,PT)		n/a	
Bycatch: quantified?	Y	3, 10	n/a	
Take. Intentional killing or exploitation of turtles	N		n/a	
Take. Egg poaching	N		n/a	
Coastal Development. Nesting habitat degradation	N		n/a	
Coastal Development. Photopollution	N		n/a	
Coastal Development. Boat strikes	n/a		n/a	
Egg predation	N		n/a	

Pollution (debris, chemical)	Y	11, 12	n/a	
Pathogens	n/a		n/a	
Climate change	n/a		n/a	
Foraging habitat degradation	n/a		n/a	
Other	n/a		n/a	
Long-term projects (>5yrs)				
Monitoring at nesting sites (period: range of years)	N		n/a	
Number of index nesting sites	n/a		n/a	
Monitoring at foraging sites (period: range of years)	n/a		n/a	
Conservation				
Protection under national law	Y		Y	
Number of protected nesting sites (habitat preservation) (% nests)	n/a		n/a	
Number of Marine Areas with mitigation of threats	0		n/a	
N of long-term conservation projects (period: range of years)	1 (2012-ongoing)		n/a	
In-situ nest protection (eg cages)	N		n/a	
Hatcheries	N		n/a	
Head-starting	N		n/a	
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y		n/a	
By-catch: onboard best practices	Y		n/a	
By-catch: spatio-temporal closures/reduction	N		n/a	
Other	n/a		n/a	

Table 4. Projects and databases relevant to sea turtle Regional Management Units in Croatia.

#	RMU	Country	Region / Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/Private
T4.1	CC-MED	Slovenia	Northeastern Adriatic Sea	NETCET-Network for the Conservation of Cetaceans and Sea Turtles in the Adriatic	Marine habitat use, satellite telemetry, movements, bycatch, aerial survey, critical habitats, conservation, education	2012	2015	Department of Biodiversity, University of Primorska	Public
T4.2	CC-MED	Slovenia	Northeastern Adriatic Sea	LIFE EUROTURTLES-Collective actions for improving the conservation status of the eu sea turtle populations	Marine habitat use, GSM telemetry, movements, bycatch, gill nets, LED lights, in-water population density, conservation, education	2016	2021	Department of Biodiversity, University of Primorska	Public

Table 4. (cont.)

#	**Collaboration with**	**Reports / Information material**	**Current Sponsors**	**Primary Contact (name and Email)**	**Other Contacts (name and Email)**
T4.1		www.netcet.eu	EU-CBC/IPA Adriatic Programme	Bojan Lazar (bojan.lazar@upr.si)	Matic Jancic (matic.jancic@famnit.upr.si)
T4.2		https://www.euroturtles.eu/	EU LIFE Ionaian-Adriatic Programme	Bojan Lazar (bojan.lazar@upr.si)	Matic Jancic (matic.jancic@famnit.upr.si)

SPAIN

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1. RMU: Loggerhead Turtle (*Caretta caretta*) Mediterranean

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

Sporadic nesting is found along the Spanish Mediterranean coast (Carreras *et al.* 2018 and references therein). The detection of nesting events has been steadily increasing since the beginning of the XXI century and has been associated using genetic markers to colonisation events of the Mediterranean and Northwestern Atlantic RMUs (Carreras *et al.* 2018). Since 2014, 6-7 nesting records/attempts are reported every year in the Spain's Mediterranean coast (Marco et al. 2016, 2018a, 2018b, Tomás et al. 2018), but numbers are increasing yearly (9 nesting events, 5 of them with successful nests in 2019, Tomás et al. unpublished data). However, nesting is still scattered and sporadic, with no stable nesting beach identified yet.

1.1.2. Marine areas

All size classes of loggerhead sea turtle are very common throughout the Spanish Mediterranean and the Atlantic adjoining waters. These areas are inhabited by turtles from three different RMUs as detected using genetic markers (Carreras *et al.* 2006, 2011, Clusa *et al.* 2014, Monzón-Argüello *et al.* 2009) and tagging-recapture (Eckert et al., 2;008; Moncada et al., 2010). Turtles from the Mediterranean RMU are the most abundant in the northwestern Mediterranean coast up to the Ibiza channel, although may be found also in the remaining Spanish Mediterranean waters, and some individuals of Mediterranean origin have been detected crossing the Straits of Gibraltar (Revelles *et al.* 2007a; Eckert et al, 2008; Moncada et al., 2010). Despite the admixture of loggerhead turtles from different origin, Atlantic and Mediterranean RMUs remain isolated (Carreras *et al.* 2011). Turtles from Mediterranean RMU are thought to arrive to Spain through the Messina channel and following the Liguro Provençal current (Carreras *et al.* 2006, Clusa *et al.* 2014). Based in all the scientific information, the neritic waters around the Ebro river Delta (provinces of Castellón and Tarragona, East Spain) are considered as neritic foraging ground and wintering site for loggerhead turtles *Caretta caretta* from the Mediterranean and the Atlantic (Casale et al. 2018 and references therein). Bellido et al (2018) suggest that the gulf of Cádiz (South West Spain) may also represent a neritic habitat used by the sea turtles.

1.2. Other biological data

Feeding ecology of the loggerhead turtle has been studied in the Spanish Mediterranean, showing the importance of pelagic jellyfish, fish baits and fisheries bycatch in the diet of the species in the area (Tomás et al. 2001, Revelles et al 2007b, Báez et al. 2012, Cardona et al. 2012). Recent studies on feeding ecology and epibionts are providing strongly suggest that both the habitat use and the ontogenetic habitat shift in *C. caretta* are very flexible in the Spanish Mediterranean, with temporary exploitation of oceanic resources regardless of size (Domènech et al. 2018, Ten et al. 2019).

1.3. Threats

1.3.1. Nesting sites

The Mediterranean Spanish coast is heavily affected by tourism and coastal development. Thus, it should be considered as a potential threat to the sporadic nesting events and included in regional management plans to prevent its impact on the ongoing colonization of the beaches by the loggerhead turtles (Tomás et al. 2008).

1.3.2. Marine areas

Bycatch is dependent of active fleets and fix structures, as tuna traps. GFCM adopted the Recommendation GFCM/35/2011/4 to reduce turtle's bycatch (FAO, 2016).
Fisheries are considered primary threats for marine turtles. According to Baéz et al. (2013), the main fishing gears affecting loggerhead sea turtles in Spanish Mediterranean waters include the suite of surface longline targeting albacore (*Thunnus alalunga*), bluefin tuna (*Thunnus thynnus*) and swordfish (*Xyphias gladius*). Baez et al. (2013) reported differences in the gear type used that have an effect on catch rates and size selectivity. Thus, surface longliners targeting albacore (LLALB) using smaller hooks tend to capture smaller loggerheads but have the highest by-catch per unit of effort (BPUE), whereas other longlines, such as surface longliners targeting bluefin tuna (LLJAP) and traditional surface longliners targeting swordfish (LLHB), using larger hooks tend to select the larger animals; moreover, LLHB had the lowest BPUE.
Main bycatch occurs in an area around Balearic Islands and in waters north Gata Cape (Fig. 1)

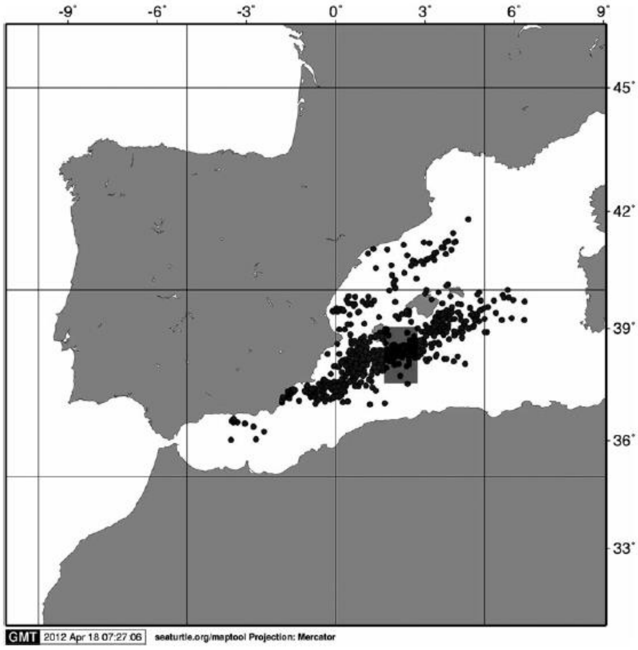

Fig.1. Observed set with positive bycatch of sea turtles in Spanish surface longline (In Báez et al., 2013)

Báez et al. (2013) also observed that LLALB and LLAM presented the highest sea-turtle by-catch rates (BPUE), whereas LLHB presented the lowest. The mean SCL for by-caught turtles across all fleets was 49 cm (N ¼ 697) (Table 5). This result could be due to the dynamics of the fleet, given that LLALB, LLAM and LLJAP are used in spring and summer, whereas LLHB is used throughout the year.

Table 5. Total turtles bycatch observed (Turtles) and catch rate (BPUE) per gear in the Spanish surface longline fishery (In Báez et al., 2013). See main text for gear type descriptions.

Gear type	Hooks	Turtles	BPUE	SCLMin.	SCLMax.	SCL mean	SD
LLAM	123	110	0,894	37	69	56	80,75
LLALB	1037	1030	0.992	17	64	33	79,00
LLHB	4251	2096	0.493	29	71	50	80,22
LLJAP	548	410	0.763	33	72	54	75,60

An aspect to consider concerning current marine turtles bycatch rates in these fleets is the use of a mesopelagic LL targeting swordfish introduced in Spain in 2006 (Garcia Barcelona et al., 2010) reducing turtle's bycatch to figures near cero (Tomás et al. 2008, Báez et al., 2009; Alvarez de Quevedo et al., 2013). Báez et al. (2018) described recently this significant reduction in longline bycatch of loggerhead sea turtle in the Western Mediterranean over the period 2000-2016 (SCRS/P/2018/32), particularly after 2006, due to changes in the surface longline fishing strategy (Baez et al., 2013; Báez et al, 2019). The overall mortality rate of turtles bycaught by Spanish longliners operating in the Mediterranean ranges 0.321-0.378 (Álvarez de Quevedo et al. 2013).

Concerning other fishing gears, Doménech et al. (2015) provided bycatch estimates in bottom trawls targeting commercial multi species through interviews to fishermen, and also few studies refers to incidence of artisanal gears near a marine protected area (Gata Cape MPA) (Lozano et al., 2011).

Although most of the incidental captures and CPUE data in western Mediterranean sea come from the IEO scientific observers onboard surface longline vessels, Baez et al. (2017) reported adult loggerhead turtles bycaught in Alboran Sea by longlines in the period May to August. Adults are also reported stranded in the eastern and western areas of the Strait of Gibraltar throughout the year. In the Alboran Sea (Mediterranean), strandings mainly occurred in June and July. The probability of catching a mature loggerhead increases during June and July south of the Balearic Islands. Marine debris has been described also as a potential threat for loggerhead turtles in the Spanish Mediterranean (Tomás et al. 2002). However, in a long term study in East Spain Domènech et al. (2019) found that amounts ingested by this species are low and do not apparently pose a significant threat to the survival of their populations in the region. Moreover, these authors did not find an increase in marine debris ingested by loggerheads >40 cm LCC in the last two decades. Ongoing projects at European and Mediterranean levels are evaluating the current impact of marine debris and microplastics on the species in the area and its use as bioindicator of marine pollution.

2. RMU: Loggerhead Turtle (*Caretta caretta*) Northwestern Atlantic

2.1. Distribution, abundance, trends

2.1.1. Nesting sites

As commented in section 1.1.1., sporadic nesting is found along the Spanish Mediterranean coast (Carreras *et al.* 2018). These nesting events have been associated using genetic markers to colonisation events, with an important contribution of adult turtles from the Northwestern Atlantic RMU (Carreras *et al.* 2018).

2.1.2. Marine areas

All size classes of loggerhead sea turtle are very common throughout the Spanish Mediterranean and the Atlantic adjoining waters. These areas are inhabited by three different RMUs as detected using genetic markers (Carreras *et al.* 2006, 2011, Clusa *et al.* 2014, Monzón-Argüello *et al.* 2009). Turtles from the Northwestern Atlantic RMU are the most abundant in the south Mediterranean coast up to the Ibiza channel, and in the Canary Islands (Carreras *et al.* 2006, 2011, Clusa *et al.* 2014, Monzón-Argüello *et al.* 2009), although they can be found at lower frequency on north Mediterranean Spanish waters. Despite the admixture of loggerhead turtles from different origin, Atlantic and Mediterranean RMUs remain isolated (Carreras *et al.* 2011). Turtles from Northwestern RMU are thought to arrive to Spain following the Gulf Current (Monzón-Argüello *et al.* 2009) and enter the Mediterranean through the Straits of Gibraltar where they have to stay until they reach a certain size (Revelles *et al.* 2007a). Bellido et al (2018) suggest that the gulf of Cádiz (South West Spain) may represent a neritic habitat used by the sea turtles, mainly by the loggerhead sea turtle, with sporadic presence of other species.

2.2. Other biological data

2.3. Threats

Due to the admixture of loggerhead turtles from different origin, Atlantic and Mediterranean RMUs in the western Mediterranean, including loggerhead turtles from the Northwestern Atlantic RMU (Carreras *et al.* 2011, Clusa et al. 2014), the threats described in section 1.3 are applicable also for this RMU in the area. Vulnerability to fishing gears did not differ between loggerhead turtles of different RMU sharing the same foraging ground (Clusa et al. 2016).

3. RMU: Loggerhead Turtle (*Caretta caretta*) Northeastern Atlantic

3.1. Distribution, abundance, trends

3.1.1. Nesting sites

There is no evidence that any of the sporadic nesting events of Spanish Mediterranean coasts is associated to the Northeastern Atlantic RMU (Carreras *et al.* 2018) but this should be re-examined in the future with genetic markers of better resolution. A project started in 2004 consisted in the translocation of threatened clutches from Cape Verde to beaches of Andalucia (south Spain) and for a program of artificial incubation, with successful hatching and release of about 300 post-hatchlings in the Alboran sea (Báez and Bellido 2015).

3.1.2. Marine areas

All size classes of the loggerhead sea turtle are very common throughout the Spanish Mediterranean and the Atlantic adjoining waters, but juveniles 40-60 cm CCL prevail. As said before, these areas are inhabited by three different RMUs as detected using genetic markers (Carreras *et al.* 2006, 2011, Clusa *et al*. 2014, Monzón-Argüello *et al*. 2009). Turtles from the Northeastern Atlantic RMU have been detected by mixed stock analysis at low frequencies (<10%) in the south Mediterranean coast up to the Ibiza channel, and in the Canary Islands (Carreras *et al.* 2006, Clusa *et al.* 2014, Monzón-Argüello *et al.* 2009). This low frequent presence has been confirmed by the presence of exclusive haplotypes from this RMU (Carreras *et al.* 2011, Clusa *et al.* 2014). The presence of loggerheads from the Northeastern RMU north to its distribution range in the subtropical Atlantic has been associated to extreme storm events, as particle dispersal modeling alone did not explain this distribution, and thus reach Spanish waters (Monzón-Argüello *et al.* 2012).

3.2. Other biological data

Not available

3.3. Threats

3.3.1. Nesting sites

The Mediterranean Spanish coast is heavily affected by tourism and coastal development. Despite no contribution of turtles from this RMU has been detected yet in the sporadic nesting activity in the Spanish Mediterranean (Carreras et al 2018), the threats describes in section 1.3.1 should be considered here in the case of future sporadic nesting events in Spain's coasts by Northeastern Atlantic loggerhead turtles, as part of the described colonization process, and included in regional management plans to prevent its impact on the ongoing colonization of the beaches by the loggerhead turtles.

3.3.2. Marine areas

Due to the admixture of loggerhead turtles from different origin, Atlantic and Mediterranean RMUs in the western Mediterranean, including loggerhead turtles from the Northeastern Atlantic RMU (Carreras *et al.* 2011, Clusa et al. 2014), the threats described in section 1.3 are applicable also for this RMU in the area. Special attention deserves fisheries bycatch, with bigger impact in the south-western Mediterranean, where turtles of this RMU have been detected (Clusa et al. 2014).

4. RMU: Green turtle (*Chelonia mydas*) East Atlantic

4.1. Distribution, abundance, trends

4.1.1. Nesting sites

No nesting activity of the species has been recorded yet either in the Iberian Spanish coasts or in the Canary Islands.

4.1.2. Marine areas

Juvenile green turtles have been found at low frequencies in all the Spanish coasts, including the Mediterranean and the Atlantic coasts of the Iberian Penninsula and the Canary Islands (Carreras *et al.* 2014, Monzon et al 2017). The genetic analysis of several animals found in the Mediterranean and Canary Islands indicated that green turtles found in the Spanish coasts, even in the Mediterranean side, come from Atlantic populations, potentially including Aves, Suriname and the populations in Africa (Carreras *et al.* 2014, Monzon-Argüello et al 2017). On the contrary, no genetic evidence was found indicating the presence of individuals from Mediterranean green turtle nesting populations, thus suggesting that the Atlantic individuals do not share foraging areas with the Mediterranean individuals.

4.2. Other biological data

4.3. Threats

4.3.1. Nesting sites

Not applicable

4.3.2. Marine areas

The loggerhead turtle in Atlantic and Mediterranean waters is heavily impacted by different fishing activities (see secions 1.3). Due to the limited records of green turtles, there is little evidence of fisheries interaction with this species. However, the species is known to interact with the same type of fishing gears in other parts of the word. For instance, García Barcelona et al (2017) reported, for the first time in the Spanish fishing fleet, the incidental capture of specimens of *C. mydas* by surface longline fishery targeting albacore tuna (*Thunnus alalunga*) in waters south of the island of Crete (Greece). In fact, most of the green turtles reported in Mainland Spain arrived to rescue centres due to human interaction (Carreras et al. 2014, Monzon-Argüello et al 2018), so probably they are also impacted by the same threats than the loggerhead sea turtle in the area. Furthermore, there are indications of human related supplemental feeding in the Canary Islands that may increase the probability of anthropogenic interaction by boat collision or fisheries bycatch in this area (Monzon-Argüello et al 2018).

5. RMU: Green turtle (*Chelonia mydas*) Atlantic South Caribbean

5.1. Distribution, abundance, trends

5.1.1. Nesting sites

No nesting activity of the species has been recorded yet either in the Iberian Spanish coasts or in the Canary Islands.

5.1.2. Marine areas

As said in section 4.1.2, juvenile green turtles have been found at low frequencies in all the Spanish coasts, including the Mediterranean and the Atlantic coasts of the Iberian Penninsula and the Canary Islands (Carreras *et al.* 2014, Monzon et al 2017). The genetic analysis of several animals found in the Mediterranean and Canary Islands indicated that the green turtles found in Spanish coasts come from Atlantic populations, potentially including Aves and Suriname, both included in this RMU (Carreras *et al.* 2014, Monzon-Argüello et al 2017).

5.2. Other biological data

5.3. Threats

5.3.1. Nesting sites N/A

5.3.2. Marine areas
See section 4.1.2 and 4.3.2.

6. RMU: Kemp's ridley (*Lepidochelys kempii*) Atlantic
6.1. Distribution, abundance, trends
6.1.1. Nesting sites
No nesting activity of the species has been recorded yet either in the Iberian Spanish coasts or in the Canary Islands.

6.1.2. Marine areas
Juvenile Kemp's Ridley turtles have been found at very low frequencies in the Mediterranean and the Atlantic coasts of the Iberian Peninsula (Carreras *et al.* 2014 and references therein). The genetic analysis of three animals found in the Mediterranean revealed the presence of the D haplotype, found on western Atlantic nesting beaches and a new haplotype, matching a partial sequence from Rancho Nuevo, Mexico (Tomás and Raga 2007, Carreras *et al.* 2014). New records of this species have been reported in the Spanish Mediterranean coasts (Tomás J. unpublished data), possibly indicating that the presence of this species in the Mediterranean can be more frequent than expected.

6.2. Other biological data
6.3. Threats
6.3.1. Nesting sites
6.3.2. Marine areas
Due to the limited records of Kemp's ridley turtles, there is little evidence of interaction also with this species. However, the species is known to interact with the same type of fishing gears in other parts of the word, and most of the animals reported arrived to rescue centres due to human interaction (Tomás and Raga 2007, Carreras et al. 2014 and references therein) so probably they are also impacted by the same threats than the loggerhead sea turtle in the area.

7. RMU: Olive ridley (*Lepidochelys olivacea*) Atlantic East or Atlantic West
7.1. Distribution, abundance, trends
7.1.1. Nesting sites N/A
7.1.2. Marine areas
A single record of an olive ridley female has been found in the Spanish Mediterranean coast, confirmed by genetic and biometric analyses (Revuelta et al. 2015). As the individual presented the common haplotype F, it was not possible to determine the exact RMU of origin of the animal. Up to date, this is the single confirmed record of the species in the Mediterranean and few records based only in morphological identification in the Canary Islands (Revuelta et al. 2015 and references therein).

8. RMU: Leatherback turtle (*Dermochelys coriacea*) Atlantic NorthWest
8.1. Distribution, abundance, trends
8.1.1. Nesting sites
No nesting activity of the species has been recorded yet either in the Iberian Spanish coasts or in the Canary Islands.

8.1.2. Marine areas
This seems to be the second most frequent species in the Spanish waters, although most of the information is based on stranding or fisheries bycatch records (e.g., Tomás et al. 2008). In the Spanish Atlantic there are reports from the whole northern coast and Andalucía Atlantic coasts (Southwest Spain) (Marco et al. 2014a, Bellido et al. 2018). The presence of the species is well documented in the Mediterranean and particularly in the Mediterranean Spanish coast (Casale et al. 2003, Tomás et al. 2008, Marco et al. 2014a and references therein).

8.2. Other biological data

8.3. Threats

8.3.1. Nesting sites N/A

8.3.2. Marine areas

Fisheries interaction is the main threat for the species in the Spanish waters. Most of the stranding records are related to entanglement or fisheries bycatch (Casale et al. 2003, Tomás et al. 2008, references in Marco et al. 2014a).

9. RMU: Hawksbill turtle (*Eretmochelys imbricata*) Southwest Indian

9.1. Distribution, abundance, trends

9.1.1. Nesting sites N/A

9.1.2. Marine areas

Presence of hawksbill turtle in the Spanish waters is very rare, and probably the few records correspond to traveling individuals. To date there are only 7 records of the species, all them in Atlantic waters: 5 in Galicia (Northwest Spain), one in Huelva (Southwest Spain) and one in Lanzarote (Cannary Islands) (see references in Marco et al. 2014b).

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Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Spain.

	C. caretta		*C.mydas*		*L.kempii*		*L.olivacea*		*D.coriacea*		*E. imbrincata*	
RMU	**Atlantic, Northeast/Atlantic, Northwest/Mediterranean**	Ref #	**Atlantic, East/Atlantic, South Caribbean/Atlantic South Central**	Ref #	**Atlantic**	Ref #	**Atlantic, East or Atlantic East**	**Ref #**	**Atlantic, Northwest/ SE Indian**	**Ref #**	**DC-NW Atlantic/ SE INDIAN**	Ref #
Occurrence												
Nesting sites	Y	18, 32, 51, 54, 57, 58	N		N		N		N			
Pelagic foraging grounds	Y	2,4,9,10,11,13,15,26,28,40,42, 60	Y	36	Y	36	Y	37	Y	38		
Benthic foraging grounds	Y	2,14,15,25,29, 59	N		N		N		N			
Key biological data												
Nests/yr: recent average (range of years)	1-3/yr (2014-2017)	18, 32, 46	N		N		N		N		N	
Nests/yr: recent order of magnitude	sporadic nesting	18, 32, 46	N		N		N		N		N	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	N		N		N		N		N		N	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	sporadic nesting	18, 32, 46, 51, 57, 58	N		N		N		N		N	

Nests/yr at "major" sites: recent average (range of years)												
Nests/yr at "minor" sites: recent average (range of years)												
Total length of nesting sites (km)	N		N		N		N		N		N	
Nesting females / yr	1-2	18, 32, 47, 58, 59	N		N		N		N		N	
Nests / female season (N)	N		N		N		N		N		N	
Female remigration interval (yrs) (N)	N		N		N		N		N		N	
Sex ratio: Hatchlings (F / Tot) (N)	N		N		N		N		N		N	
Sex ratio: Immatures (F / Tot) (N)	N		N		N		N		N		N	
Sex ratio: Adults (F / Tot) (N)	N		N		N		N		N		N	
Min adult size, CCL or SCL (cm)	N		N		N		N		N		N	
Age at maturity (yrs)	N		N		N		N		N		N	
Clutch size (n eggs) (N)	Y	47	N		N		N		N		N	
Emergence success (hatchlings/egg) (N)	N		N		N		N		N		N	
Nesting success (Nests/ Tot emergence tracks) (N)	N		N		N		N		N		N	
Trends												
Recent trends (last 20 yrs) at nesting sites (range of years)	N		N		N		N		N		N	

Recent trends (last 20 yrs) at foraging grounds (range of years)	Y	48	N		N		N		N		N	
Oldest documented abundance: nests/yr (range of years)	N		N		N		N		N		N	
Published studies												
Growth rates			N		N		N		N		N	
Genetics	Y	10,17,18,19,23,41	Y	36	Y	36	Y	37	N		N	
Stocks defined by genetic markers	Y	10,17,18,19,22,23,42	N		N		N		N		N	
Remote tracking (satellite or other)	Y	1, 3,10,11,13, 21,26,28,29,40,42, 66	N		N		N		N		N	
Survival rates	Y	3,14	N		N		N		N		N	
Population dynamics	N		N		N		N		N		N	
Foraging ecology (diet or isotopes)	Y	4,9,12,36,38,39,44, 60	Y	39	N		N		N		N	
Capture-Mark-Recapture	Y	33,37	N		N		N		N		N	
Epibionts	Y	61	N		N		N		N		N	
Threats												
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL; SN)	2,5,6,14,15,30,48,49,52	Y (PLL)	27	Y	16, 45, 50	N		N		N	
Bycatch: presence of industrial fisheries?	Y	2,3,5,8,14,15, 25, 63	N	5,8	Y	5,8	Y	5,8	Y	5,8	Y	5,8
Bycatch: quantified?	Y, 6060 (Mean PLL); 500 (BT)	2,3,15,35, 62, 63	Y	8	Y	8	Y	8	Y	8	Y	8
Take. Intentional killing or exploitation of turtles	N		N		N		N		N		N	

Take. Egg poaching	N		N		N		N		N		N	
Coastal Development. Nesting habitat degradation	N		N		N		N		N		N	
Coastal Development. Photopollution	N		N		N		N		N		N	
Coastal Development. Boat strikes	Y	52	N		N		N		N		N	
Egg predation	N		N		N		N		N		N	
Pollution (debris, chemical)	Y	35,53, 65, 67	N		N		N		N		N	
Pathogens	Y	24	N		N		N		N		N	
Climate change	N		N		N		N		N		N	
Foraging habitat degradation	N		N		N		N		N		N	
Other	N		N		N		N		N		N	
Long-term projects (>5yrs)												
Monitoring at nesting sites (period: range of years)	N		N		N		N		N		N	
Number of index nesting sites	N		N		N		N		N		N	
Monitoring at foraging sites (period: range of years)	Y	48, 64								64		
Conservation												
Protection under national law	Y		Y		Y		Y		Y		Y	
Number of protected nesting sites (habitat preservation) (% nests)	N		N		N		N		N		N	
Number of Marine Areas with mitigation of threats	N		N		N		N		N		N	

N of long-term conservation projects (period: range of years)	N		N		N		N		N		N	
In-situ nest protection (egg cages)	N		N		N		N		N		N	
Hatcheries/clutch relocation	Y	45, 58	N		N		N		N		N	
Head-starting	Y	23, 45	N		N		N		N		N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y	6,30, 62, 63	Y	30	Y	30	Y	30	Y	30	Y	30
By-catch: onboard best practices	Y	30	Y	30	Y	30	Y	30	Y	30	Y	30
By-catch: spatio-temporal closures/reduction	N		N		N		N		N		N	
Other	N		N		N		N		N		N	

Table 2. The conventions signed by Spain.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
ICCAT	Y	Y	Y	All		
GFCM	Y	Y	Y	All		

SYRIA

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Introduction

Loggerhead turtle nesting in Syria was first documented in Syria from 1990 [9] and green turtle nesting from 2004 [2]. The presence of leatherback turtles in Syria's waters has been confirmed [10] but they are believed to be extremely rare.

1. RMU Loggerhead Turtle (*Caretta caretta*) Mediterranean

1.2. Distribution, abundance, trends

1.1.1. Nesting sites

Syria hosts only diffuse loggerhead turtle nesting, with up to an estimated 40 clutches deposited annually (Table 1). Low-level or sporadic nesting occurs at most sandy beaches along Syria's 190 km coastline (Fig. 1, Table 2). Nesting censuses have not been consistent enough to identify any trends.

1.1.2. Marine areas

Loggerhead turtle strandings and encounters occur widely along the Syrian coastline and they are believed to inhabit much of Syria's coastal waters [4,5,7].

1.2 Other biological data

No other biological data, such as adult size, clutch size and nesting frequency are available on loggerhead turtles in Syria.

1.3 Threats

Loggerhead turtles are subject to threats similar to those of green turtles. See section 2.3 for details.

1.4 Conservation

As for green turtles, loggerhead turtles are protected by national laws and international conventions (Tables 1 and 3). Nest monitoring and protection activities have been undertaken since at least 2004, however internal conflict has limited the amount of work that has been done in recent years.

1.5 Research

Most research in Syria is focussed on green turtles as the more prevalent species. However stranding surveys and nesting beach work have recorded the presence of loggerhead turtles since at least 1991 (Table 1) [1,2,3,9]. However, internal conflict has limited the amount of work that has been done in recent years.

2. RMU Green Turtle (*Chelonia mydas*) Mediterranean

2.1. Distribution, abundance, trends

2.1.1. Nesting sites

Syria hosts the third greatest number of green turtle nests in the Mediterranean after Turkey and Cyprus (see Turkey and Cyprus, this volume, with up to an estimated 300 clutches deposited annually (Table 1). Nesting is concentrated on a 12 km beach located south of Lattakia City but occurs at several other sandy beaches along Syria's 190 km coastline (Fig. 1, Table 2). Nesting censuses have not been consistent enough to identify any trends.

2.1.2. Marine areas

Juvenile green turtles are known to occur year-round in the shallow coastal waters of Lattakia beach, and also north of Lattakia at Ibn Hani. However, green turtle strandings occur much more widely along the Syrian coastline and hence green turtles are believed to inhabit much of Syria's coastal waters [4,5,7].

2.2. Other biological data

Only limited biological data exists for Syria. Minimum breeding size of green turtles in Syria is 85cm Curved Carapace Length, derived from a small sample size. Mean clutch size is 108 eggs with an average of 80% hatchling emergence success. These details and more can be found in Table 1. Genetic characterisation of the population is lacking.

2.3. Threats

Threats to turtles on land include deliberate/malicious killing of nesting adult females, predation of eggs and hatchlings by dogs and ghost crabs and misorientation of hatchling from inland lighting (Table 1) [5]. Threat to turtles at sea include bycatch in fishing activities- including injury and mortality from dynamite fishing – and deliberate killing for sport (Table 1) [5].

2.4. Conservation

Green turtles are protected by national laws and international conventions (Tables 1 and 3). Nest monitoring and protection activities have been undertaken since at least 2004, however internal conflict has limited the amount of work that has been done in recent years.

2.5. Research

As for conservation activities. Basic sea turtle research on nesting biology and turtle movements has been conducted in Syria since at least 2004 (Table 1) [1,2,3] but internal conflict has limited the amount of work that has been done in recent years.

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8 Sönmez B, Türkecan O, Jded A (2017) Long distance movement between nesting sites for two green turtles in the eastern Mediterranean. Marine Turtle Newsletter 153:7-8
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Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Syria.

TOPIC	REGIONAL MANAGEMENT UNIT			
	CM-MED	Ref #	CC-MED	Ref #
Occurrence				
Nesting sites	Y	2,5,6,7	Y	5,6,7
Pelagic foraging grounds	Y	4	Y	4
Benthic foraging grounds	Y (JA)	5	Y(JA)	5
Key biological data				
Nests/yr: recent average (range of years)	176 (2004-2010 & 2016)	5,6,7	11 (2004-2009 & 2016)	5,6,7
Nests/yr: recent order of magnitude	10-300	5,6,7	10-40	5,6,7
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	1	5	0	5
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	5	5	6	5
Nests/yr at "major" sites: recent average (range of years)	152 (2004-2010)	6	n/a	5,6,7
Nests/yr at "minor" sites: recent average (range of years)	24 (2004-2009 & 2016)	5,7	11 (2004-2009 & 2016)	5,6,7
Total length of nesting sites (km)	50	5	47.5	5
Nesting females / yr	n/a		n/a	
Nests / female season (N)	n/a		n/a	
Female remigration interval (yrs) (N)	n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a	
Min adult size, CCL or SCL (cm)	85 (CCL)	1	n/a	
Age at maturity (yrs)	n/a		n/a	
Clutch size (n eggs) (N)	108 (n=29)	2	n/a	
Emergence success (hatchlings/egg) (N)	80% (n=29)	2	n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a	
Trends				
Recent trends (last 20 yrs) at nesting sites (range of years)	~stable (2004-2010)	5,6	~stable (2004-2010)	5,6
Recent trends (last 20 yrs) at foraging grounds (range of years)	n/a		n/a	

Oldest documented abundance: nests/yr (range of years)	see above (2004-2009)	5	see above (2004-2009)	5
Published studies				
Growth rates	n/a		n/a	
Genetics	n/a		n/a	
Stocks defined by genetic markers	n/a		n/a	
Remote tracking (satellite or other)	1 (2006)	3	n/a	
Survival rates	n/a		n/a	
Population dynamics	n/a		n/a	
Foraging ecology (diet or isotopes)	n/a		n/a	
Capture-Mark-Recapture	n/a		n/a	
Threats				
Bycatch: presence of small scale / artisanal fisheries?	SN	4,7	SN	4,7
Bycatch: presence of industrial fisheries?	n/a		n/a	
Bycatch: quantified?	N		N	
Take. Intentional killing or exploitation of turtles	Y	4,5	n/a	
Take. Egg poaching	N	5	N	5
Coastal Development. Nesting habitat degradation	N		N	
Coastal Development. Photopollution	Y	4,5	Y	5
Coastal Development. Boat strikes	n/a		n/a	
Egg predation	Y	4,5	Y	5
Pollution (debris, chemical)	N		N	
Pathogens	n/a		n/a	
Climate change	n/a		n/a	
Foraging habitat degradation	n/a		n/a	
Other	Dynamite Fishing	7	Dynamite Fishing	7
Long-term projects (>5yrs)				
Monitoring at nesting sites (period: range of years)	1 (13 : 2004-2016)	7	1 (13 : 2004-2016)	7
Number of index nesting sites	1	6	1	6
Monitoring at foraging sites (period: range of years)	n/a		n/a	

Conservation				
Protection under national law	Law 12 of 2012		Law 12 of 2012	
Number of protected nesting sites (habitat preservation) (% nests)	Law of the Ministry of State for Environmental Affairs			
Number of Marine Areas with mitigation of threats	0		0	
N of long-term conservation projects (period: range of years)	1 (13 : 2004-2016)	7	1 (13 : 2004-2016)	7
In-situ nest protection (eg cages)	n/a		n/a	
Hatcheries	n/a		n/a	
Head-starting	n/a		n/a	
By-catch: fishing gear modifications (eg, TED, circle hooks)	n/a		n/a	
By-catch: onboard best practices	n/a		n/a	
By-catch: spatio-temporal closures/reduction	n/a		n/a	
Other	n/a		n/a	

Table 2. Sea turtle nesting beaches in Syria.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
			Long	Lat					
CM-MED									
Ras el Basit	N	4 (2004-2009)	35.8548	35.8761	8.5	100	5	2	n/a
Um Toyour	N	3 (2004-2009)	35.7549	35.8448	2.5	100	5	2	n/a
Wadi Kandil	N	7 (2004-2009)	35.7225	35.8317	2	100	5	2	n/a
Lattakia	Y	152 (2004-2010)	35.4595	35.8715	12	100	6	2	n/a
Banias (area)	N	3 (2004-2009)	35.2052	35.9531	3	100	5	2	n/a
Tartous (and south)	N	1 (2004 & 2016)	34.7459	35.9311	22	100	5,7	2	n/a
CC-MED									
Ras el Basit	N	1 (2004-2009)	35.8548	35.8761	8.5	100	5	2	n/a
Um Toyour	N	0 (2004-2009)	35.7549	35.8448	2.5	100	5	2	n/a
Wadi Kandil	N	2 (2004-2009)	35.7225	35.8317	2	100	5	2	n/a
Lattakia	Y	12 (2004-2010)	35.4595	35.8715	12	100	6	2	n/a
Banias (area)	N	2 (2004-2009)	35.2052	35.9531	3	100	5	2	n/a
Tartous (and south)	N	6 (2004 & 2016)	34.7459	35.9311	22	100	5,7	2	n/a

Table 3. International conventions protecting sea turtles and signed by Syria.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles	REF
CBD	Y	y	n/a	CM, CC	-	-	8
CITES	Y	y	n/a	CM, CC	-	-	8
CMS	Y	y	n/a	CM, CC	-	-	8
Protocol of Mediterranean Biodiversity conservation and establishment of special marine and coastal PAs	Y	y	n/a	CM, CC	-	-	8
Amendments on the Protocol of Mediterranean Biodiversity conservation and establishment of special marine and coastal PAs	Y	y	n/a	CM, CC	-	-	8
Barcelona Convention	Y	y	n/a	CM, CC	-	-	8

Table 4. Sea turtle conservation projects in Syria.

#	RMU	Country	Region/ Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/ Private	Collaboration with	Current Sponsors	Primary Contact (name and Email)
T4.1	CM-MED	Syria	Med'	Survey of sea turtles nesting and stranding on the beach off the Syrian coast	Sea turtle, nesting, coservation, stranding, baycatch	2004	2011	Tishreen University	Public/ Private	Syrian society for aquatic Environment protection (SSAEP)	Tishreen University and SSAEP	Adib SAAD - adibsaad52 @gmail.com
T4.2	CC-MED	Syria	Med'	Survey of sea turtles nesting and stranding on the beach off the Syrian coast	Sea turtle, nesting, coservation, stranding, baycatch	2004	2011	Tishreen University	Public/ Private	Syrian society for aquatic Environment protection (SSAEP)	Tishreen University and SSAEP	Adib SAAD - adibsaad52 @gmail.com

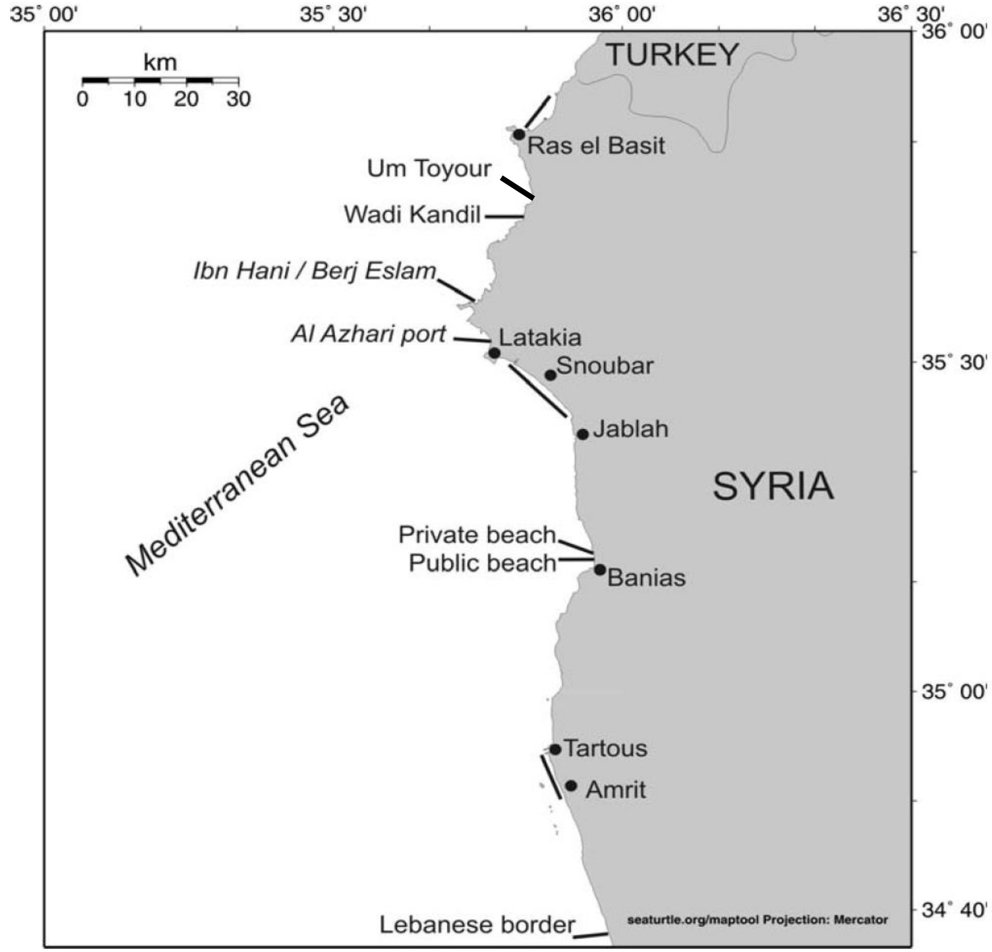

Figure 1 Map showing location of nesting areas and other locations mentioned in the text (reproduced from reference 5).

TUNISIA

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1. RMU: Loggerhead turtle (*Caretta caretta*) Mediterranean

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

The nesting activity of the Loggerhead turtle *Caretta caretta* occurs principally in Kuriat islands and Chebba beaches which are monitored. The first site is the most important in Tunisia. The two sites are located in the eastern coasts. New investigations led to discover new nesting sites (Fig. 1) (44, 45 &46). Although the smallness of the two nesting sites, Kuriat islands and Chebba, at the Mediterranean scale, the nesting activity is regularly registered~~,~~ and the nests number increases since respectively 1997 and 1994.
The DNA investigation showed only one haplotype CC-A2. This haplotype is shared by both Mediterranean and Atlantic nesting populations although it occurs at much higher frequencies in the Mediterranean region (25). The low genetic diversity observed suggests that strong conservation efforts should be taken.
In 2019 and for the first time, a green turtle Chelonia mydas nested on a Tunisian beach (44)
It should also be noted that the Decapoda Ocypode cursor, predator of sea turtle hatchlings, was recently recorded in the Tunisian coasts (47)

1.1.2. Marine areas

The gulf of Gabes (Fig.2) in south Tunisia is likely to be one of the most important areas for marine turtles in the Mediterranean. It is considered as an important foraging and wintering area. Studies on fishery interactions, stranding and tagging confirm this importance (4, 5, 7, 8, 9, 10, 13, 14, 23, 27, 28, 32, 34, 36, 48).
Bycatch assessments were limited, in Tunisia, to the Gulf of Gabès. This area is a “marine biodiversity hot spot” of significant regional importance and the most important fisheries area of the Tunisian fishing fleet. The Gulf is the preferred habitat for many iconic Mediterranean vertebrate species such as the loggerhead turtle (*Caretta caretta*); it is a wintering and foraging area for this species (31, 49)
The high concentration of the fishing effort in the Gulf of Gabès has led to overexploitation of fish stocks and is contributing to bycatches of several charismatic species as well as of many fish species. This along with several other pressures such as pollution and the spreading of alien species has contributed to the degradation of the ecosystems.
Recent genetic and tagging studies suggest that the Gulf of Gabès is an important wintering and feeding area for the loggerhead turtle for the whole Mediterranean (23, 37). In this region, a large fishing fleet using many kinds of fishing gears operates during different seasons and targets a wide variety of commercially important species. These fishing activities interact with sea turtles. It is obvious that fishing poses a threat to loggerhead population in the Gulf of Gabès.
Catch rates of loggerhead turtle registered by onboard observers in the Gulf of Gabès show variation across gears (Table 1). Estimated total capture in pelagic longline is among the highest for sea turtles recorded in the whole Mediterranean Sea.

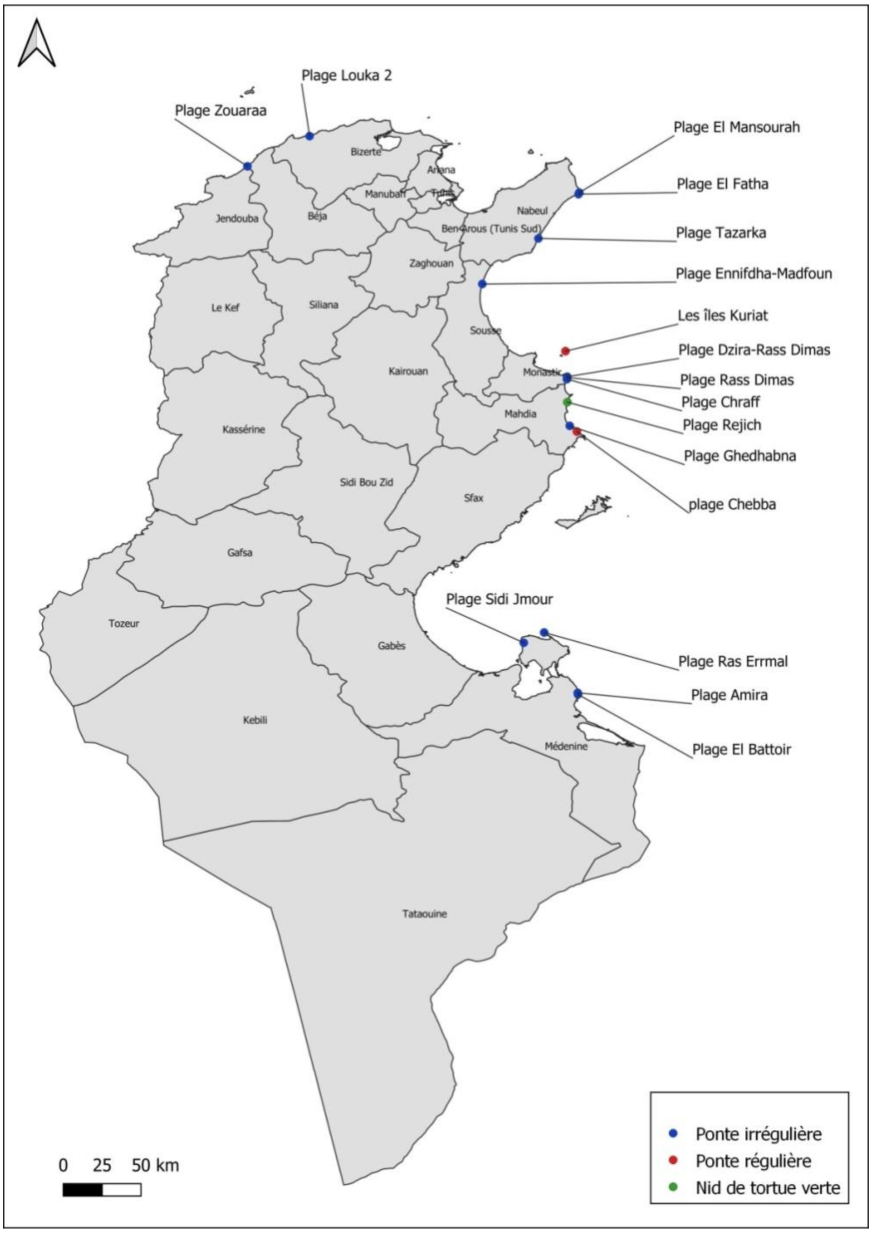

Figure 1: Map of Tunisia with locations of nesting beaches (35, 44, 45, 46)

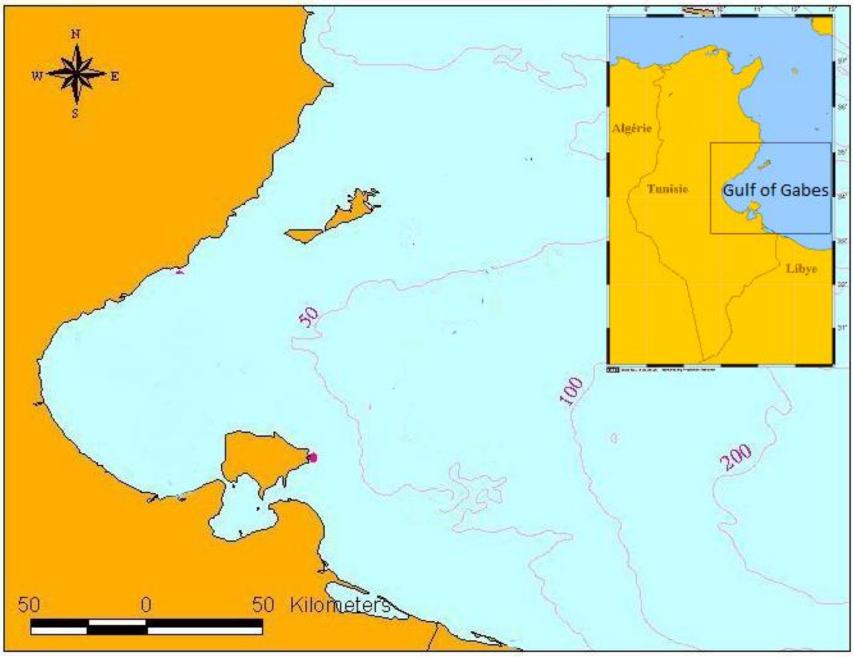

Figure 2: Map of the Gulf of Gabes

Table 5: Observed catch rates (95% C.I), estimated yearly captures (in numbers), and mortality rates of loggerhead turtle registered by different gears in the Gulf of Gabès.

Gear	Observed catch rate	Estimated total captures	Recorded mortality	Reference
Pelagiclongline	0.823 (0.568-0.158) turtle/1000 hooks	486 (335 - 683)	0%	14
Pelagiclongline	0.806 (0.802–0.810) turtle/1000 hooks	437 (299 - 609)	12.1%	5
Bottom longline	0.278 (0.179-0.415) turtle/1000 hooks	733 (470 -1090)	33%	14
Bottom longline	0.333 (0.236-0.591) turtle/1000 hooks	142 (100 - 167)	43.7%	8
Trawl	0.0063 turtle/h.d (lenght of the headrope * haul duration)	5458 ± 1652	3.3%	13
Gillnet	0.527 (0.403–0.649)/km2/day	444 (358 - 501)	69.4%	4

In terms of mortality, the highest rates were registered by gillnet and bottom longlines. In bottom longlines, hooks are close to the bottom and the turtles captured are smaller; therefore, they might not be able to reach the surface to breath and eventually die by asphyxia. The high mortality rates associated with gillnets may be a result of the long soak time. This gear is left at sea for one or more days, which is well beyond the tolerance of turtles. Moreover, gillnets and bottom longline are generally deployed at shallow depths, not exceeding 60 m, where loggerhead turtles are generally concentrated.

Turtles are caught as juveniles and adults. Mortality rates recorded by pelagic longlines and trawls were lower. For the pelagic longlines, hooks are set close to the surface (4-5 m) and thereby a captured animal is more likely to reach the surface to breath. For trawls, the low mortality may be explained essentially by the relatively short haul duration (87 min on average) in the Gulf of Gabès.

ACCOBAMS-GFCM Project on mitigating interactions between endangered marine species and fishing activities (2016-2017)

In the frame of ACCOBAMS-GFCM Project on mitigating interactions between endangered marine species and fishing, developed with the collaboration of the RAC/SPA and a substantial financial support from the MAVA foundation, we executed 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.

Concerning marine turtles preliminary results were as follow:

<u>Bottom longlines</u>

<u>Species caught</u>

During the 129 sets made, 2465 marine vertebrates were captured. Marine turtles represented 3.7% of catches (Fig. 3), the catch rates of marine turtles were 0.26 and 0.022 individuals by 1000 hooks for *Carettacaretta* and *Dermochelys coriaceea* respectively.

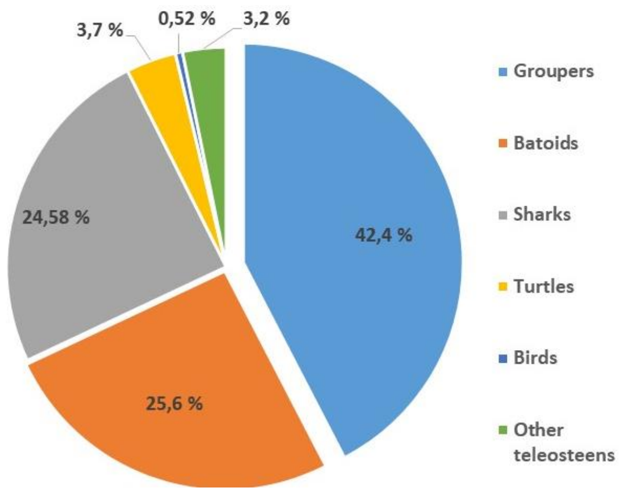

Figure 3: Composition of bottom longline catches during the study period

Surface longlines

In a total of 96 sets made, 1251 marine vertebrates were caught. Marine turtles represented 2.33% of total catch (Fig. 4). The catch rates of marine turtles were 0.25 and 0.02 individuals by 1000 hooks for *Caretta caretta* and *Dermochelys coriaceea* respectively.

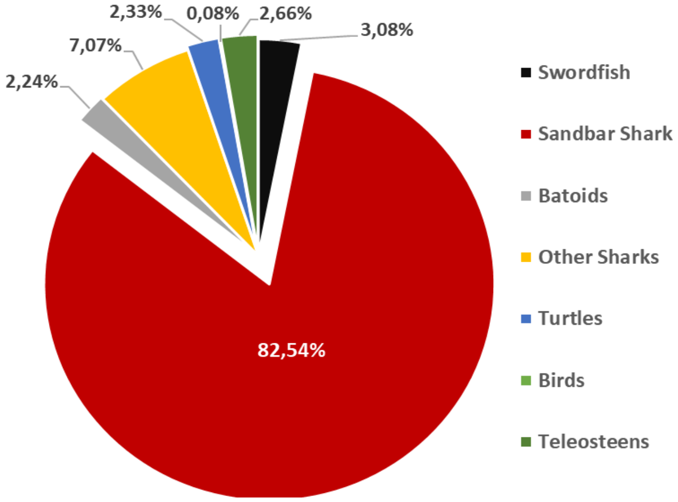

Figure 4: Composition of surface longline catches during the study period

The use of circular hooks seems to be without impact on catch rates of marine turtles.

STRANDING

In Tunisia, causes of marine turtle mortality are associated mainly to the interaction with fisheries (13 and 14). Within the framework of the national stranding network of marine turtles and Cetacean started in 2004, stranded marine turtle were recorded in Tunisian coasts and especially in the Gulf of Gabes (29 & 38). These records allow the collection of biological and ecological data and determine causes of mortality.

From 2004 to 2017, 716 stranded turtles have been recorded along the Tunisian coasts. The majority were loggerhead *Caretta caretta* (95.5%), which is the most common species in Tunisian waters. The proportions of green and leatherback turtles recorded was respectively four (1.1%) and two (1.5%) confirming their status as rare species. 13 turtles were unidentified given their advanced state of decomposition.

Most of stranding data were recorded in the Gulf of Gabes (87.4% of cases registered).

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

Despite the necropsies and external examination, cause of stranding was not possible to be identified in 90% of the cases, due to the bad state of the turtles. Hook ingestion and collision with boats were assigned majors of stranding. It is important to indicate that some fishing gears (particularly trawler and gillnet), which create a significant mortality, generally didn't leave a visible trace on stranded turtles.

The distribution of stranded animals shows a dominance of juvenile individuals in the area, although some adult sized turtles were recorded.

1.2. Other biological data

Please see Table 1

1.3. Threats

1.3.1. Nesting sites

The nesting sites of small Kuriat and Chebba are highly frequented by swimmers during nesting season. The beaches are heavily used by humans and disturbance of the sand may have impeded the detection of turtle tracks or nests.

Beaches restructuring:
This problem concerns mainly the beaches of Small Kuriat and Chebba where beaches were destroyed following summer activities (installation of campsites and coffees) (Photos 1 and 2).

Photo 1: Beaches of small Kuriat highly frequented

Photo 2: Boat taking visitors to small Kuriat

Light pollution
This problem concerns mainly the nesting beaches of Chebba (35). The light of the cornice and the port behind Essir beach and Sidi Messaoud beach respectively attract the hatchlings after the emergence. Hatchlings, disoriented, finish on the road behind the cornice where they are crushed by cars (Photo 3).

Photo 3: Hatchlings, disoriented by cornice light, crushed on the road by cars
Non-human predation:
The black rat *Rattus rattus*, abundant on small Kuriat. attacks hatchlings after emergence (Photo 4). Deratization undertaken by « Notre Grand Bleu » association in 2016 has resolved the problem for the moment.
Sea gulls *Larus carchinans*, common on the Kuriat islands, seems to engender predation of hatchlings, mainly of those emerged during daytime.

Photo 4: Hatchlings on the small Kuriat attacked by rat on their heads

Other threats

The large deposits of the phanerogam (*Posidonia oceanica*) on the beaches of great Kuriat mainly restrict the accessibility of nesting females to the site (Photo 5). These deposits of *Posidonia* hinder also the return of hatchlings to the sea after the emergence. However, the deposits constitute a natural protection of the beaches from waves and inundation.

Photo 5: Large deposits of sea grass (*Posidonia oceanica*) on the beaches of great Kuriat

Human predation:

Following political and social problems appeared last years (2011- 2015), little illegal trade of loggerheads was observed in some localities. For this, Tunisia developed a strategy to mitigate illegal trade of marine turtles in Tunisia (50). This strategy was developed as part of the project "Conservation of marine turtles in the Mediterranean", funded by the MAVA foundation and coordinated by SPA/ RAC.

1.4. Conservation

Marine turtle rescue centre

International conventions on marine turtle conservation were ratified by Tunisia and were sustained by a national decree which forbids the catch of sea turtles and their eggs (decree of Minister of Agriculture of 28 September 1995). In this framework, a sea turtle rescue centre was founded in 2004 by INSTM (National Institute of Marine Sciences and Technologies) in collaboration with SPA/ RAC (Regional Activity Centre Specially Protected Areas) and APAL (Agency of Protection and Management of Littoral). Its mission is conservation through rehabilitation of suffering sea turtle, education, awareness and research.

Impacts of litter on sea turtles and marine fauna, an evaluation of ingestion and entanglement

Marine litter has been reported to interact with species at all trophic levels, being affected mainly through ingestion or entanglement. Sea turtles, which are prone to ingest marine debris items, are of particular concern. Due to its extended distribution and the use of various marine compartments in the Mediterranean Sea, the loggerhead turtle *Caretta caretta* was proposed as a relevant bio-indicator of marine litter impacts by the European Marine Strategy Framework Directive (MSFD) Task Group on Marine Litter (Indicator D10.2.1).

The European project INDICIT (acronym for Indicator Impacts Turtles; February 2017-January 2019) intends to support the implementation of indicators of litter impacts on sea turtles and marine biota. Twenty partners of 10 institutions from 5 European and 2 non-European countries work together on the establishment of a coordinated and harmonized approach necessary for the monitoring of marine litter impacts and the evaluation of the efficiency of conservation/restoration measures. Tunisia and namely the INSTM (Institut National des Sciences et Technologies de la Mer) is a partner in this project. A second project INDICIT II, with more objectives and partners, was launched in the same frame (01 February 2019 – 31 January 2021).
For better conservation strategy, Tunisia developed its National Action Plan for marine turtle conservation (51). The plan was also developed as part of the project "Conservation of marine turtles in the Mediterranean", funded by the MAVA foundation and coordinated by SPA/ RAC.

1.5. Research

Some other reaserchs were undertaken on pollution (52), diet (49), parasits (53) and epibionts (54).

Key knowledge gaps

- Satellite tracking of nesting females and captured animals;
- Identification of new nesting sites;
- Develop mitigation measure in order to reduce the captures and the mortality of sea turtles with the most impacting gears.

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Table 1. Main biology and conservation aspects of sea turtle Regional Management Units (RMU) occurring in Tunisia

RMU	CC-Tunisia	Ref #	CM-Tunisia	Ref #	DC-Tunisia	Ref #
Occurrence						
Nesting sites	Y	1,3,12,16,17,19	N	3,2	N	2,3,21
Pelagic foraging grounds	n/a		n/a		n/a	
Benthic foraging grounds	Y	23, 27	n/a		n/a	
Key biological data						
Nests/yr: recent average (range of years)	22 (2013-2016)	unpublished report	n/a		n/a	
Nests/yr: recent order of magnitude	18-35		n/a		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	1	16,17,19,	n/a		n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	Regular (1) sporadic (6)	12,15	n/a		n/a	
Nests/yr at "major" sites: recent average (range of years)	24 (2007-2016)	unpublished report	n/a		n/a	
Nests/yr at "minor" sites: recent average (range of years)	5 (2013-2016)	unpublished report	n/a		n/a	
Total length of nesting sites (km)	3		n/a		n/a	
Nesting females / yr	25		n/a		n/a	
Nests / female season (N)	2	unpublished report	n/a		n/a	
Female remigration interval (yrs) (N)	2.Mar	unpublished report	n/a		n/a	
Sex ratio: Hatchlings (F / Tot) (N)	0.02 (7)-0.015 (6)	15,12	n/a		n/a	
Sex ratio: Immatures (F / Tot) (N)	69,3 (88)		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	82,7 (81)	umpulished data	n/a		n/a	
Min adult size, CCL or SCL (cm)	70 CCL	16, unpublished report	n/a		n/a	
Age at maturity (yrs)			n/a		n/a	

Clutch size (n eggs) (N)	88,41 (299)	unpublished report, 19, 16,17	n/a		n/a	
Emergence success (hatchlings/egg) (N)	0,66 (393)	unpublished report, 19, 16,17	n/a		n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	n/a		n/a		n/a	
Trends						
Recent trends (last 20 yrs) at nesting sites (range of years)	Up (1997-2016)	30	n/a		n/a	
Recent trends (last 20 yrs) at foraging grounds (range of years)	up	30, 31	n/a		n/a	
Oldest documented abundance: nests/yr (range of years)	2-5 (1988)	31	n/a		n/a	
Published studies						
Growth rates	N		N		N	
Genetics	Y	23,25,29	N		N	
Stocks defined by genetic markers	Y	23	N		N	
Remote tracking (satellite or other)	Y	26,28, 32, 33,34	N		N	
Survival rates	N		N		N	
Population dynamics	N		N		N	
Foraging ecology (diet or isotopes)	Y	27,29	Y	20, 42	Y	2, 42, 43
Capture-Mark-Recapture	N		N		N	
Threats						
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL,DLL, SN,)	4,5,6,7,8,9,10,11,14	N		n/a	
Bycatch: presence of industrial fisheries?	Y (BT)	13	Y		n/a	
Bycatch: quantified?	Y	4,5,6,7,8,9,10,11,13,14	N		n/a	
Take. Intentional killing or exploitation of turtles	Y	3, 31, 50	N		n/a	

Take. Egg poaching	N		n/a		n/a	
Coastal Development. Nesting habitat degradation	Y	12, umpublished reports	n/a		n/a	
Coastal Development. Photopollution	Y	12	n/a		n/a	
Coastal Development. Boat strikes	Y	29	n/a		n/a	
Egg predation	N	47	n/a		n/a	
Pollution (debris, chemical)	Y	Umpublished	n/a		n/a	
Pathogens	Y	41, 53	n/a		n/a	
Climate change	n/a		n/a		n/a	
Foraging habitat degradation	n/a		n/a		n/a	
Other: Epibionts	Y	22, 24, 39, 40	n/a		n/a	
Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	Y (1997-ongoing)	16,17,19	n/a		n/a	
Number of index nesting sites	1		n/a		n/a	
Monitoring at foraging sites (period: range of years)	N		n/a		n/a	
Conservation						
Protection under national law	Y		Y		Y	
Number of protected nesting sites (habitat preservation) (% nests)	1		0		0	
Number of Marine Areas with mitigation of threats	0		0		0	
N of long-term conservation projects (period: range of years)	1 (1997-2017)		0		0	
In-situ nest protection (eg cages)	Y	16,17,19	N		N	
Hatcheries	N		N		N	
Head-starting	N		N		N	
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y	5,1	N		N	
By-catch: onboard best practices	Y	Flyers	N		N	
By-catch: spatio-temporal closures/reduction	Y	Umpublished reports	N		N	
Other	N		N		N	

Table 2. Sea turtle nesting beaches of Tunisia.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls /yr: recent average (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
CC-Tunisia				Long	Lat	Long	Lat	Long	Lat					
Beach Great Kuriat	N	16 (2007-2016)						35°47'6 55''	011°01' 230''	4	100%	1,16,17, 18	1	B
Beach small Kuriat	N	8,2 (2007-2016)						35°46'0 03''	011°00' 713''	2	100%	1,16,17, 19	1	B
Beach Chebba-Sidi Messaoud	N	3,7(2013-2016)		35° 14' 108	011°09' 442	35°13' 998	011°09' 604			0,3	100%	12	1	A
Beach Chebba-Essir	N	1,7 (2013-2016		35° 14' 386	011°08' 557	35°14' 268	011°08' 892			1	not monitored	12	2	A

Table 3. International conventions protecting sea turtles and signed by Tunisia.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea turtles
Convention World Heritage	Y	Y		ALL	Protection of the cultural and natural heritage of outstanding universal value	
Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Y	Y		ALL	Regulate international trade of endangered species	
Convention for the Protection of the Mediterranean Sea against Pollution (Barcelona Convention, 1976), Protocol on Specially Protected Areas and Biological Diversity (SPA &BD, 1995)	Y	Y		ALL	Protection of the Mediterranean Sea against Pollutio	
Convention on the Conservation of Migratory Species of Wild Animals (CMS or Bonn Convention, 1979)	Y	Y		ALL	Protecting migratory wildlife	
Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention, 1982)	Y	Y		ALL	Ensure the conservation of wild flora and fauna and their natural habitats	
Convention CBD	Y	Y		ALL	Conservation of Biodiversity	

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4

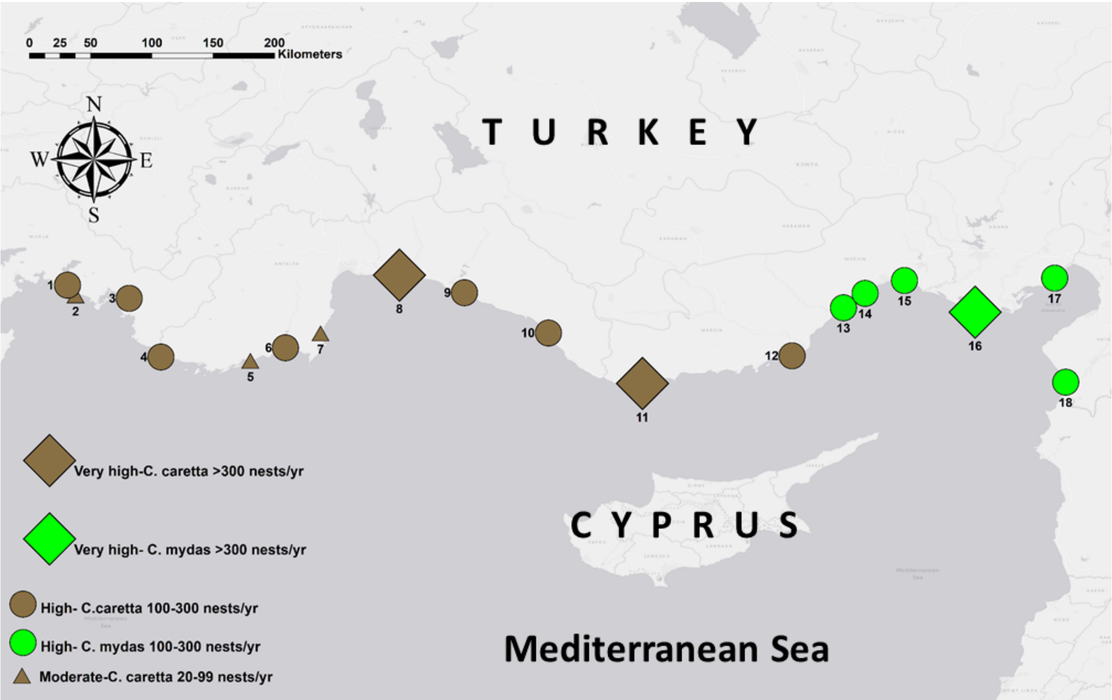
1. RMU: Loggerhead turtle (*Caretta caretta*) Mediterranean

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

The main nesting activity of the loggerhead turtle (*Caretta caretta*) mainly occurs on the western beaches of the Mediterranean coast of Turkey (Figure 1). However, it does not mean that loggerheads do not nest on the eastern beaches, but low in numbers. Alata beach have a special case with comprising high nesting activity for both loggerhead and green turtle (*Chelonia mydas*). The highest nesting activity (>300 nests/yr) occurs on Belek and Anamur beaches. The nesting sites with low nesting activity (<20 nests/yr) was not presented here.

Figure 1: The main loggerhead and green turtle nesting grounds of Turkey 1. Dalyan, 2. Dalaman, 3. Fethiye, 4. Patara, 5. Kale-



Demre, 6. Fenike-Kumluca, 7. Çıralı, 8. Belek, 9. Kızılot, 10. Demirtaş, 11. Anamur, 12. Göksu Delta, 13. Alata, 14. Davultepe, 15. Kazanlı, 16. Akyatan, 17. Yumurtalik/Sugözü, 18. Samandağ

Based on long term monitoring efforts a positive trend was observed in the number of nests for loggerhead turtle in Turkey (Table 5).
The genetic structure of loggerhead turtle is well defined in Turkish coasts (Yılmaz et al. 2011). Of the seven regional management units described within the Mediterranean (Shamblin et al. 2014) 3 occurs in Turkey

Table 5. Trends of nesting activity of loggerhead and green turtle in Turkey (Converted from Casale et al. 2018)

		Mean number of nests/yr		
Species	Beach	till 1999	Since 2000	Change (%)
Caretta caretta				
	Dalyan	165	269	+63.0
	Dalaman	73	92.1	+26.2
	Fethiye	124	89.4	-27.9
	Patara	52.5	117.7	+124.2
	Çıralı	34	66.3	+95.0
	Belek	129.7	638	+391.9
	Göksu Delta	64.6	123.8	+91.6
Total		396	907	+129
Chelonia mydas				
	Akyatan	323	319.1	-1.2
	Kazanlı	149.2	255.8	+71.4
	Samandağ	56	212.3	+279.1
Total		379	787.2	+107.7

1.1.2. Marine areas

Historically, marine turtle monitoring efforts has focused on mainly nesting beaches. Recently, the number of marine biodiversity studies carried out in Specially Protected Areas (SPA) and the number of such studies has been increasing, particularly since 2002 (Oruç et al, 2011). Marine areas are very important for marine turtles but it is the limited studied subject of marine turtles. However, in recent years there is an increasing trend about strandings (Turkozan et al. 2013; Başkale et al. 2018) and satellite tracking studies (Turkecan and Yerli, 2011; Yilmaz and Oruc, 2020).

There are plenty of records from different coastal sites of Turkey about the occurrence of marine turtles. Türkozan and Durmuş (2000) suggested Fethiye region as a feeding gound of immature green turtles based on the strandings in the region. This is further supported by a recent study of stranding in the same region. Başkale et al. (2018) reported 102 loggerhead and 37 green turtles. Of these majority of loggerhead turtle were adults while green turtle were immature individuals. The authors suggested the area as a year-round feeding ground for both species similarly, fisheries and marine turtles interaction study in the area between Mersin and İskenderun detected important feeding and wintering area (Oruç, 2001) at Iskenderun Bay. The importance of this area was supported for both loggerhead and green turtle (Türkozan et al. 2013). In a follow up study (Turkozan et al. 2018) the origin of these loggerhead strandings were identified as western nesting beaches and Cyprus. In the latest study in Samandağ beach, Sönmez (2018) stated that the possibility of Samandağ coastal area as a development and/or feeding area for juvenile *Chelonia mydas* and *Caretta caretta*, based on long term stranded data between 2002-2017. The particle distribution modelling (Casale and Mariani, 2014) suggested Levantine basin as a nursery area for marine turtles originating from eastern rookeries.

Okuş et al.(2004) described Kadırga Cape, Karagelme Bay and Samucak Cape as a mating area for loggerhead turtle. Yokeş (2003) recorded the regular observation of this species in Kaş and Tekirova region. Kaş-Kekova Specially Protected Area (Antalya) appears to serve as a feeding ground for both *C. caretta* and *C.mydas* (Tural and Çiçek 2010; Soysal 2015). Yokeş recorded data on interaction between green turtle and sea meadows in Kas-Kekova MPA during monitoring of flagship fish species study. Results of the study shows that population of both species (*C.caretta* and *C.mydas*) is increasing at Kas-Kekova MPA since 2010 (Yokes,2019).

Photo 1: Green turtle in Kaş-Kekova MPA (Antalya/Turkey)(Emre Soysal/WWF-Turkey)

The satellite tracking of green turtles (Stokes et al. 2015) identify Gulf of Antalya as a coastal foraging ground and furthermore, the same work identified some migratory corridors located between Turkey and Cyprus.

Through the regional "Conservation of Marine Turtles in the Mediterranean Project" which is coordinated by SPA/RAC and funded by MAVA Foundation, WWF-Turkey is deployed 14 satellite tags on green turtles in Akyatan beach between June 2018-August 2019 . The post-nesting migrations and movements of 14 female green turtles were tracked by satellite transmitters at Akyatan nesting beach. The home ranges during the inter-nesting period are in the Eastern Mediterranean borders in Turkey coast. All marine turtles reached to Northern African coast for wintering (Yilmaz and Oruc,2020).

According to media reports of marine turtles and personal communication, there are 16 records (14 *Caretta caretta*, 1 *Chelonia mydas*, 1 unknown) in the Turkish Straits System (TSS) between 2007 and 2016. Several observations at various localities in the Marmara Sea may be linked with the increasing public awareness campaigns aimed at conservation of marine turtles in recent years. However, this should further investigated scientifically whether these records are related to climate change or sproradic records (Tonay and Oruc, 2017).

Figure 2: Map of important migratory corridors, foraging and wintering areas in Turkey (1. Kuşadası area, 2. Fethiye-Göcek Area, 3. Antalya Bay, 4. Iskenderun Bay and Levant region)

1.2. Other biological data
Please see Table 1.

1.3. Threats

1.3.1. Nesting sites

Some nesting sites of Turkey are highly visited by tourists during nesting season. The beaches are heavily used by humans and some parts of the beaches are totally covered with deck chairs and umbrellas which are not removed during night. Furthermore coastal construction and effect of lightening behind the beach cause disorientation of hatchlings. Beach litter is another problem especially throughout the eastern nesting beaches.

Natural predation of eggs and hatchlings is another problem especially on unmonitored beaches since the nests are under protection with wire meshes on the beaches where the research groups and volunteers are working.

1.3.2. Marine Areas

In Turkey, limited data is provided on bycatch. Furthermore, boat collisions and pollution in the sea is another negative affect. Between 2002-2017 on Samandağ beach, it was reported that 167 *C. mydas* and 127 *C. caretta* were stranded, and the main causes of the stranding were reported as fisheries and marine pollution (Sönmez 2018). Similarly, it was reported that 37 dead and injured marine turtles (34 *C. caretta* and 3 *C. mydas*) were found in the Sea of Marmara and northern Aegean sea (Yalçın Özdilek et al., 2018). The authors stated that adults were frequently stranded in the Sea of Marmara, juveniles were frequently stranded in the northern Aegean Sea.

On the other hand, the government declared some part of eastern coast including some nesting sites as energy corridor and allow the construction of coal-fired thermal power plants. The discharge of cooling water into the sea of course will affect the sea water temperature and cause some changes in the ecosystem. However, how this change will impact marine turtles in the region is unknown. Solid waste (plastic bags etc.), long line fishing and ghost fishing gear (abandoned nets and fishing line stuck on the bottom of the sea) were reported to be principal threats in Kaş-Kekova SPA (Tural and Çiçek 2010; Soysal 2015).

1.4. Conservation

All of the 22 nesting sites has the status of being official nesting beach by the force of the Circular of Marine Turtles issued by Ministry of Agriculture and Forestry. 5 of them which are SPAs under monitoring programme of Ministry of Environment.

On a regular basis the monitoring studies are in progress in 12 nesting sites of 22 (Dalyan (SPA), Fethiye (SPA), Patara (SPA), Çıralı, Belek (SPA), Göksu Delta (SPA), Alata, Davultepe, Kazanlı, Akyatan, Yumurtalık, Samandağ).

10 of the marine turtle nesting beaches have at least one or more protected site status. Turkey signed and implemented Bern, Barcelona and Biodiversity conventions. Therewithal applicable national legislations are developed. In 2009 National Species Conservation Action Plan for Marine Turtles is completed in participation with related institutions.

The monitoring and conservation practices and studies in Turkey have been rapidly growing with the support of many different institutions including the Ministry of Agriculture and Forestry , the Ministry of Environment and Urbanization, ,Ministry of Culture and Tourism, the Coast Guard Command, WWF–Turkey, Ecological Research Society (EKAD), DEKAMER, Dokuz Eylul University, Hacettepe University, Pamukkale University, Mersin University, Çanakkale University, Adnan Menderes University, Ordu University, Sivas Cumhuriyet University, Hatay Mustafa Kemal University, Middle East Technical University, local authorities, experts of two aquariums, and the local NGOs such as Ulupinar Cooperative, Samandag Environment Protection and Tourism Association and EKODOSD.

Conservation priorities were mainly given to some key nesting sites such as Dalyan, Fethiye, Patara, Belek and Goksu Delta with long term beach monitoring projects by the Ministry of Environment.

Furthermore, WWF Turkey has been monitoring Akyatan beach since 2006 in collaboration with Local Directorate of Ministry of Agriculture and Forestry, Department of National Parks.

Monitoring and conservation activities in Cirali by Ulupinar Cooperative, Alata, Davultepe by Mersin University, Yumurtalik by EKAD and Samandag by Samandag EPT Association are continue in collaboration with local directorates of Ministry of Agriculture and Forestry, Department of National Parks.

Increasing public awareness and easy access to digital technologies and the advance of citizen science on a global basis have positively contributed to the process of collecting data for marine turtle specialists around the world (Tonay and Oruc, 2017) and further contributed the knowledge and conservation of marine turtles.

Two regional ongoing projects under the coordination of SPA/RAC, Medasset and Bird Life International in collaboration with national and international institutions and local partners and funded by MAVA Foundation are strengthening conservation efforts in the Mediterranean.

Through the Bycatch Project "Understanding Mediterranean multi-taxa bycatch of vulnerable species and testing mitigation-a collaborative approach"(http://www.rac-spa.org/bycatch_pr), DEKAMER, Doğa Derneği and WWF-Turkey are involving the project as local partners. The Bycatch Project (2018-2022)funded by MAVA Foundation aims in particular to support the southern and eastern Mediterranean Contracting Parties to Barcelona Convention (Morocco, Tunisia and Turkey), to identify and test measures to reduce impact of fisheries on marine mammals, sea birds, marine turtles and elasmobranches and develop and implement standardized data collection of bycatch across the Mediterranean.

Photo 2: Observers of MAVA M4 Bycatch Project/Turkey

The Project Conservation of Marine Turtles in the Mediterranean Region (https://medmarineturtles.org) which is coordinated by SPA/RAC and funded by MAVA Foundation (2018-2022)aims to enhance the conservation of marine turtles in the Mediterranean region by reducing human-induced direct mortality. Activities are taking place in 13 countries: Albania, Algeria, Cyprus, Egypt, France, Greece, Italy, Lebanon, Libya, Morocco, Spain, Tunisia and Turkey. WWF-Turkey and DEKAMER are involving the project as direct partners.

Life-Medturtle(www.medturtles.eu) is also recently funded by EU have partners from Spain, Italy, Albania, Tunisia and Turkey. DEKAMER is the partner from Turkey implementing project activities with contribution from Turkish Ministry of Ministry of Agriculture and Forestry, the Ministry of Environment and Urbanization.

Marine turtle rescue centre

There is one Sea Turtle Rescue and Rehabilitation (DEKAMER) located in Mugla and three other First Aid Stations located in Çanakkale, Mersin and Hatay. The injured turtles were treated under the facilities of these stations. The only published report is available for DEKAMER. By the end of 2017, The center received 255 injured turtles, 144 (56%) of them released back to the sea, 109 (42%) of them died during the rehabilitation and two of them continued for rehabilitation in 2018(dekamer.org.tr).
Impacts of litter on marine turtles and marine fauna, an evaluation of ingestion and entanglement
DEKAMER is partner of INDICIT project (https://indicit-europa.eu/) supported by European Union. The plastic ingested by loggerhead turtles were being investigated under this project for two years ending in February 2019

1.5. Research

Key knowledge gaps/limited studies

- Marine turtles and fisheries interaction
- Satellite tracking
- Construction of a national stranding network
- Genetic structure of green turtles
- Identification of origin of strandings
- Identification of marine protected areas

On the other hand, there are plenty of arcane annual reports from different nesting sites. The urgent publication of such data carries great importance for the management and conservation of the species.

2. RMU: Green turtle (*Chelonia mydas*) Mediterranean

2.1. Distribution, abundance, trends

2.1.1. Nesting sites

The main nesting activity of the green turtle mainly occurs on the eastern beaches of the Mediterranean coast of Turkey (Figure 1). It is the same for green turtle, but not as much as the loggerhead, that they also nest on western beaches in low numbers. The western most green turtle nesting was recorded from Fethiye so far (Sözbilen et al. 2018). The peak nesting activity was recorded from Akyatan beach. Akyatan beach also hosts 20% of the total clutches recorded in the

Mediterranean (Casale et al. 2018). The nesting sites with low nesting activity (<20 nests/yr) was not presented here.
The genetic structure of green turtle is described for Turkish coasts (Bagda et al. 2012). However, there is a lack of resolution in term of mt DNA markers due to fixation of single haplotype (Bagda et al. 2012). Recent study using STR analysis described some structure (Ticochinski et al. 2018) but the limited sample size from Turkey.

2.1.2. Marine areas

Please see chapter 1.1.1 for Marine areas

2.3. Threats

2.3.1. Nesting sites

Since green turtle nesting sites mostly located far from tourism, the impact of tourism is limited for the green turtle in this area. However, the green turtle nesting sites remain within the industrial area and suffer mainly pollution and marine litter coming from other countries. In recent years, the announced energy corridor close to the nesting beaches caused the construction of coal-fired thermal power plants nearby nesting grounds.
Natural predation of eggs and hatchlings is another problem especially when not protected by cages. There are some unpublished case reports about dogs attacking and killing nesting females on the beach.

2.3.2. Marine Areas

Please see chapter 1.3.2 for Marine Areas.

2.4. Conservation

Please see chapter 1.4 for Conservation.

2.5. Research

Please see chapter 1.4 for Research.

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Table 1. Biological and conservation information about sea turtle Regional Management Units in Turkey.

RMU	***Caretta caretta* Mediterranean**	Ref #	***Chelonia mydas* Mediterranean**	Ref #	***Dermochelys coriacea* Atlantic (?)**	Ref #
Occurrence						
Nesting sites	Y	62	Y	62	N	
Pelagic foraging grounds	Y	91,112, 117,118,119	Y	91,92, 112, 117,118,119,120	n/a	
Benthic foraging grounds	Y	91, 112,117,118,119	Y	91, 112,117,118,119	Y	109
Key biological data						
Nests/yr: recent average (range of years)	3192 (2007-2016)		1961 (2008-2015)		n/a	
Nests/yr: recent order of magnitude	3000-4000		1000-2000		n/a	
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	6		6	62	n/a	
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	7		6	62	n/a	
Nests/yr at "major" sites: recent average (range of years)	2909(2007-2016)		1931 (2008-2015)		n/a	

Nests/yr at "minor" sites: recent average (range of years)	76 (n/a)		30 (n/a)		n/a	
Total length of nesting sites (km)	289.1 km		163,4 km	62	n/a	
Nesting females / yr	1064		654		n/a	
Nests / female season (N)					n/a	
Female remigration interval (yrs) (N)					n/a	
Sex ratio: Hatchlings (F / Tot) (N)	0.56-0.94	80,81	0.71-0.93	82	n/a	
Sex ratio: Immatures (F / Tot) (N)	n/a		n/a		n/a	
Sex ratio: Adults (F / Tot) (N)	n/a		n/a		n/a	
Min adult size, CCL or SCL (cm)	60 SCL		84 SCL	94	n/a	
Age at maturity (yrs)	n/a		n/a		n/a	
Clutch size (n eggs) (N)	76 (424)	84	114 (1135)	83	n/a	
Emergence success (hatchlings/egg) (N)	0.56	84	0.77 (1335)	83	n/a	
Nesting success (Nests/ Tot emergence tracks) (N)	0.34 (1316)	84	0.37 (5879)	83	n/a	
Trends						
Recent trends (last 20 yrs) at nesting						

sites (range of years)						
Recent trends (last 20 yrs) at foraging grounds (range of years)	Up	93	Up	93	n/a	
Oldest documented abundance: nests/yr (range of years)			n/a		n/a	
Published studies						
Growth rates	N		N		N	
Genetics	Y	85	Y	86	N	
Stocks defined by genetic markers	Y	87	N		N	
Remote tracking (satellite or other)	Y		Y	88	N	
Survival rates	N		N		N	
Population dynamics	Y	84	Y	83	N	
Foraging ecology (diet or isotopes)	N		N		N	
Capture-Mark-Recapture	N		N		N	
Threats						
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, SN,)	62, 111, 112	Y (PLL,SN)	62,111, 112	Y (SN)	109
Bycatch: presence of industrial fisheries?	Y (BT)	62,110, 112	Y (BT)	62,110, 112	n/a	

Bycatch: quantified?	Y	62,110, 111	Y	62,110, 111	n/a	
Take. Intentional killing or exploitation of turtles	N		N		n/a	
Take. Egg poaching	N	62	N	62	n/a	
Coastal Development. Nesting habitat degradation	Y	62	Y	62	n/a	
Coastal Development. Photopollution	Y	62,73	Y	62, 73	n/a	
Coastal Development. Boat strikes	Y	62	Y	62	n/a	
Egg predation	Y	62	Y	62, 2,12,13,14,15,16,17,18,19,20,21,22, 23,24,25,26,27, 28, 123,124	n/a	
Pollution (debris, chemical)	Y		Y		n/a	
Pathogens	n/a		n/a		n/a	
Climate change	Y	89	Y	90	n/a	
Foraging habitat degradation	n/a		n/a		n/a	
Other	Y (see text)		N		N	

Long-term projects (>5yrs)						
Monitoring at nesting sites (period: range of years)	Y (1988-ongoing)		Y (1994-ongoing)		n/a	
Number of index nesting sites	2		2		n/a	
Monitoring at foraging sites (period: range of years)	Y (2007 ongoing)		n/a		n/a	
Conservation						
Protection under national law	Y		Y		Y	62
Number of protected nesting sites (habitat preservation) (% nests)	7	#73,62	3	#73,62	n/a	
Number of Marine Areas with mitigation of threats	2	#112	1	#112	n/a	
N of long-term conservation projects (period: range of years)	>1 (1975-2011)		6 (2001-2017)		n/a	
In-situ nest protection (eg cages)	Y		Y		n/a	
Hatcheries	N		N		n/a	

Head-starting	N		N		n/a	
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y	#108	Y	#108	n/a	
By-catch: onboard best practices	Y	#110	Y	#110	n/a	
By-catch: spatio-temporal closures/reduction	N		n/a		n/a	
Other	Y (see text)		N		N	

Table 2. Sea turtle nesting beaches in Turkey.

RMU / Nesting beach name	Index site	Nests/yr: recent average (range of years)	Crawls/yr: recent average (range of years)	Western limit		Eastern limit		Central point		Length (km)	% Monitored	Reference #	Monitoring Level (1-2)	Monitoring Protocol (A-F)
CC-TR				Long	Lat	Long	Lat	Long	Lat					
Dalyan	Y	273 (1979,1988-2017)								4,7	100%	62,63,64,65,66		
Dalaman	N	78 (2002-2016)								10,4	100%	62,63,67		
Fethiye	Y	102 (1993-2007,2011-2017)								8,3	100%	62,63,68,69		
Patara	N	106 (1989,90,92,93,94,96-02, 04-16)								14	100%	#2,3,4,5,6,7,8,9,10,11, 70		
Kale-Demre	N	67 (1994,98,2006)								8,5		2,71		
Fenike-Kumluca	N	184 (1979,88,94,98,2003)								21		72,4,2,71,73		
Çıralı	N	62 (1994-2011)								3,2	100%	#1,2	Level 1	Protocol B
Belek	N	866 (1994-2006)								16		2,74,75,76,77,78		
Kızılot	N	139 (1990,94,96-98)								8,5		2,4,71,79		
Demirtaş	N	109 (1996,2006)								7,8		26		

Anamur	N	733 (1990,94,96,2006,07)								12		2,95,96		
Göksu Delta	N	124 (1991,92,94,96,98,2004-2008)								34,7		2,9,98,99,100,101,102,103		
Alata	N	14 (2002,03,2005-06)								3		104, 105		
CM-TR														
Akyatan	Y	336 (1988,91,92,94-98,00-01,06-19)								22	100%	#2,12,13,14,15,16,17,18,19,20,21,22, 23,24,25,26,27,28, 123,124	Level 1 (2006-19)	Protocol B
Sugözü	N	213 (2013)								3,4		107		
Kazanlı	Y	240(1988,90,93,94,96,99,2000-12)								4,5	100%	#2,26,28,30,49,50,51,52,53,54,55,56, 57,58,59,60,61		
Samandağ	N	488 (1988,-94,97-99,01-19)								14	100%	#2,29,30,31,32,33,34,35,36,37,38,39, 40,41,42,43,44,45,46,47,48,121,122		
Alata	N	187 (2002-2006)								3	100%	104,105		
Davultepe	N	126 (2009-14)								2,8	100%	106		

Table 3. International conventions protecting marine turtles and signed by Turkey.

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to marine turtles
Bern Convention-Convention on the Conservation of European Wildlife and Natural Habitats	Y	Y		CM, CC	Species and habitat protection	Y
The Barcelona Convention for the Protection of the Marine Environment and Coastal Region of the Mediterranean	Y	Y		CM, CC	Protection of natural heritage	Y
CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora)	Y	Y		CM, CC	Regulation of international wildlife trade, species protection	Y

Table 4. Projects and databases on sea turtles in Turkey.

#	RMU	Country	Region / Location	Project Name or descriptive title	Key words	Start date	End date	Leading organisation	Public/Private
TR-1	Mediterranean	Turkey	Mediterranean/Eastern Mediterranean of Turkey/Adana	Monitoring and conservation of green turtle in Akyatan	Nesting, green turtle, satellite tracking, predation	2006	ongoing	WWF-Turkey	NGO
TR-2	Mediterranean	Turkey	Mediterranean/Western Mediterranean of Turkey/Dalyan	Monitoring and conservation of loggerhead turtle in Dalyan	Nesting, satellite tracking, predation		ongoing	DEKAMER	Rehabilition Centre
TR-3	Mediterranean	Turkey	Mediterranean/Western	Monitoring and conservation of	Nesting, satellite tracking, predation		ongoing	DEKAMER	

			Mediterranean of Turkey/Fethiye	loggerhead turtle in Fethiye					
TR-4	Mediterranean	Turkey	Mediterranean/Western Mediterranean of Turkey/Patara	Monitoring and conservation of loggerhead turtle in Patara	Nesting, predation				
TR-5	Mediterranean	Turkey	Mediterranean/Western Mediterranean of Turkey/Belek	Monitoring and conservation of loggerhead turtle in Belek	Nesting		ongoing	Ecological Research Society (EKAD)	NGO
TR-6	Mediterranean	Turkey	Mediterranean/Eastern Mediterranean of Turkey/Göksu Delta	Monitoring and conservation of loggerhead and green turtle in Goksu Delta	Nesting, predation		ongoing	Vadi Muhendislik	Private
TR-7	Mediterranean	Turkey	Mediterranean/Eastern Mediterranean of Turkey/Sugözü/Botas/Hollanda beach	Monitoring and conservation of green turtle in Yumurtalik/Sugozu	Nesting		ongoing	Ecological Research Society (EKAD)	Private
TR-8	Mediterranean	Turkey	Mediterranean/Eastern Mediterranean of Turkey/Samandag	Monitoring and conservation of green turtle in Samandag	Nesting, predation, litter	2001	ongoing	Samandag Environment and Tourism Society	NGO
TR-9	Mediterranean	Turkey	Mediterranean/Western Mediterranean of Turkey/Cirali	Monitoring and condervation of loggerhead turtle in Cirali	Nesting, tourism	1994	ongoing	Ulupinar Cooperative	NGO
TR-10	Mediterranean	Turkey	Medturtle-Mediterranean	Life-Medturtle(www.medturtle.eu)	Conservation, by-catch, mitigation, rescue, satellite	2019	2023	Italy(UNİPI-coordinator), Spain, Albania, Tunisia, Turkey (DEKAMER)	NGO

TR-11	Mediterranean	Turkey	Mediterranean region	Conservation of Marine Turtles in the Mediterranean	Conservation, satellite, new nesting sites, scaling-up, capacity building	2018	2022	SPA/RAC	NGO

Table 4. (Cont.)

#	Collaboration with	Reports / Information material	Current Sponsors	Primary Contact (name and Email)	Other Contacts (name and Email)
TR-1	Local Directorate of Turkish Ministry of Agriculture and Forestry		Nestle Turkey Cereal Department	Ayse Oruc, aoruc@wwf.org.tr	
TR-2	Ministry of Environment and Urbanization, Ministry of Agriculture and Forestry, Pamukkale University			Yakup Kaska, caretta@pau.edu.tr	

TR-3				Eyup Baskale, ebaskale@pau.edu.tr	
TR-4					
TR-5	Ministry of Environment and Urbanization, Belek Tourism Investors Association			Ali Fuat Canbolat, canbolat@hacettepe.edu.tr	
TR-6	Ministry of Environment and Urbanization		Ministry of Environment and Urbanization	Onur Candan, onurcandan.phd@gmail.com	
TR-7				Onur Candan, onurcandan.phd@gmail.com	
TR-8	Local Directorate of Ministry of Agriculture and Forestry			Bektas Sonmez, bektass@gmail.com	
TR-9	Local Directorate of Ministry of Agriculture and Forestry		Local authorities	Erdal Elginoz, erdalelginoz@yahoo.com	
TR-10	Ministry of Environment and Urbanization, Ministry of Agriculture and Forestry, Pamukkale University		European Union-Life	Yakup Kaska, caretta@pau.edu.tr	

TR-11	ARCHELON, DEKAMER, WWF Turkey, WWF Greece, WWF NA, MedPAN, NMPZ, Medasset	www.medmarineturtles.org	MAVA Foundation	Ayse Oruc, aoruc@wwf.org.tr; Yakup Kaska, caretta@pau.edu.tr	