Sea turtles ın the Mediterranean Regıon

MTSG Regional Report 2018

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Edited by

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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 report, published in 2010 (http://iucn-mtsg.org/publications/med-report/).

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). 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 updated guidelines provided by the MTSG Co-Chairs, where each country is represented as an independent chapter (Country and Regional Overview), 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.).

MTSG members from each country in the Mediterranean were asked to provide Excel files following templates provided. A total of 8 out of 21 Mediterranean countries turned in information which is included in the present report: Italy, Greece, Turkey, Cyprus, Israel, Morocco, Tunisia, Spain (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 original Mediterranean report (2010) (http://iucn-mtsg.org/publications/med-report/).

Table 1. Overview of Mediterranean Country Chapters and Information submitted

Country	**Country abbreviations used in main table (Table 2)**	**INCLUDED IN PRESENT REPORT (YES/NO)**
Albania	AL	NO
Algeria	AG	NO
BOSNIA & HERZEGOVINA	BH	NO
Croatia	HR	NO
Cyprus		
Region A	CY_A	YES
Region B	CY_B	YES
Egypt	EG	NO
France	FR	NO
Greece	GR	YES
Israel	IL	YES
Italy	IT	YES
Lebanon	LB	NO
Libya	LY	NO
Malta	MT	NO
Monaco	MC	NO
Montenegro	MG	NO
Morocco	MA	YES
Slovenia	SI	NO
Spain	ES	YES
Syria	SY	NO
Tunisia	TN	YES
Turkey	TR	YES

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., In Press), 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). As per the data included in this report, 8,653 – 11,638 loggerhead turtle clutches are documented annually at 25 "major" (>20 nests/yr AND >10 nests/km yr) and 72 "minor" (<20 nests/yr OR <10 nests/km yr) nesting sites (Table 2) totalling 926.7 km. Based on an Estimated Clutch Frequency of 2 nests/female/season, this corresponds to approximately 1,822 nesting females per year.

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 (Table2).

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 2).

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

Protection status

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 2). Based on the current updated report, between 1,164 and 2,674 green turtle clutches are laid annually in 12 "major" and 53 "minor" nesting sites in Turkey, Cyprus, and Israel. There are no updated data on Lebanon, Syria and Egypt where green turtle nesting is known to occur. Based on an Estimated Clutch Frequency of 3 nests/female/season, this corresponds to approximately 784 nesting females per year.

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).

Past distribution and abundance

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. Monitoring studies show an upward trend in nesting activity reflecting an increase in adult female individuals.

2.2. Other biological data

Age at sexual maturity for remains unknown for green turtle populations in the Mediterranean. Average clutch size is 114 eggs and mean hatching success ranges between 70 and 77%. 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 2).

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 (45 sites representing 90% 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.).

Protection Status

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.).

Conservation Priorities

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. 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.

Past distribution and abundance

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. They are also particularly prone to marine debris, as their

diet consists predominantly of gelatinous plankton and are therefore likely to ingest plastic waste mistaking it for jellyfish.

4. Other species

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

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.

Table 2: Summary of key biological information, threats and conservation activities for the Mediterranean region

RMU (all RMUs of all species occurring in a Country or Region) add or remove columns on the right according to the RMUs	**CC-MED**	Country Chapters from which the info is taken	**CM-MED**	Country Chapters from which the info is taken	**DC-ATL**	Country Chapters from which the info is taken	**LC-ATL***	Country Chapters from which the info is taken	**LO-ATLE***	Country Chapters from which the info is taken	**EI-?***	Country Chapters from which the info is taken
Occurrence												
Nesting sites	Y	CY_A, CY_B, GR, IL, IT, ES, TN, TR	Y	CY_A, CY_B, IL, TR	N	ALL	N		N			
Pelagic foraging grounds	Y	GR, IL, IT, ES, TR	Y	IL, IT, TR	JA	IT, ES	Y	ES	Y	ES		
Benthic foraging grounds	Y	CY_A, GR, IL, IT, MA, ES, TN, TR	Y	CY_A, CY_B, GR, IL, TR	Y	TR	N		N			
Key biological data												
Nests/yr: recent average (range of years)	1325 (2002-2016)	CY_A, CY_B, GR, IL, IT, TN, TR	2469 (2008-2016)	CY_A, CY_B, IL, TR	n/a	ALL	N		N			

Nests/yr: recent order of magnitude	8603 - 11438	CY_A, CY_B, GR, IL, IT, TN, TR	1164-2674	CY_A, CY_B, IL, TR	n/a	ALL	N		N			
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	25	CY_A, CY_B, GR, TN, TR	12	CY_A, CY_B, TR	n/a	ALL	N		N			
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	72	CY_A, GR, IT, TN, TR	53	CY_A, IL, TR	n/a	ALL	N		N			
Nests/yr at "major" sites: recent average (range of years)	1021 (2007-2016)	CY_A, CY_B, TN, TR	242; 1931 (2008-2015)	CY_A, TR	n/a	ALL						
Nests/yr at "minor" sites: recent average (range of years)	75 (2010-2017)	CY_A, CY_B, IL, TN, TR	30-148	CY_A, IL, TR	n/a	ALL						
Total length of nesting sites (km)	927.6	CY_A, CY_B, GR, IL, IT, TN, TR	356.4	CY_A, IL, TR	n/a	ALL	N		N			
Nesting females / yr	1822	CY_A, CY_B, ES, TN, TR	784	CY_A, TR	n/a	ALL	N		N			
Nests / female season	2	CY_A,	3	CY_A	n/a	ALL	N		N			

(N)		TN										
Female remigration interval (yrs) (N)	2	CY_A	3	CY_A	n/a	ALL	N		N			
Sex ratio: Hatchlings (F / Tot) (N)	0.37 - 0.89 (1837)	CY_A, GR, IL	0.56-0.93 (143*)	*	n/a	ALL	N		N			
Sex ratio: Immatures (F / Tot) (N)	0.52 - 0.69 (389)	IT, TN	n/a	ALL	n/a	ALL	N		N			
Sex ratio: Adults (F / Tot) (N)	0.4 - 0.88 (399)	GR, IT, TN, TR	0.42	CY_A	n/a	ALL	N		N			
Min adult size, CCL or SCL (cm)	63 CCL/ 60 SCL	CY_A, CY_B, GR, IL, IT, TN, TR	77 CCL	CY_A, IL, TR	n/a	ALL	N		N			
Age at maturity (yrs)	21 - 34	IT (FOR ALL)	n/a	ALL	n/a	ALL	N		N			
Clutch size (n eggs) (N)	109.7 (11259)	CY_A, GR, IL, IT, TN, TR	114 (1412)	CY_A, TR	n/a	ALL	N		N			
Emergence success (hatchlings/egg) (N)	0.56-0.86 (12030)	CY_A, GR, IL, IT, TN, TR	0.7-0.77 (1373)	CY_A, TR	n/a	ALL	N		N			
Nesting success (Nests/ Tot	0.26-0.4	CY_A, GR, IL,	0.29-0.37	CY_A, TR	n/a	ALL	N		N			

emergence tracks) (N)	(38876)	IT, TR	(5879+)									
Trends												
Recent trends (last 20 yrs) at nesting sites (range of years)	mostly Up (1993-2017)	CY_A, CY_B, GR, IL, TN	up (1993-2017)	CY_A, CY_B, IL	n/a	ALL	N		N			
Recent trends (last 20 yrs) at foraging grounds (range of years)	STABLE/UP (1992-2001)	IT, TN, TR	UP	TR	n/a	ALL	N		N			
Oldest documented abundance: nests/yr (range of years)	Y	CY_A, CY_B, TR	50-461 (1978-2004)	CY_A, CY_B	n/a	ALL	N		N			
Published studies												
Growth rates	Y	CY_A, GR, IT	Y	CY_A	N	ALL	N		N			
Genetics	Y	CY_A, GR, IT, ES, TN, TR	Y	CY_A, IL, ES, TR	N	ALL	Y	ES	Y	ES		
Stocks defined by genetic markers	Y	CY_A, GR, IT, ES, TN,	N	ALL	N	ALL	N		N			

		TR										
Remote tracking (satellite or other)	Y	CY_A, GR, IL, IT, ES, TN, TR	Y	CY_A, IL, TR	N	ALL	N		N			
Survival rates	Y	IT, ES	N	ALL	N	ALL	N		N			
Population dynamics	Y	CY_A, IT, TR	Y	CY_A, IL, TR			N		N			
Foraging ecology (diet or isotopes)	Y	CY_A, GR, IT, ES, TN	Y	CY_A, ES, TN	Y	TN	N		N			
Capture-Mark-Recapture	Y	CY_A, GR, IT, ES	Y	CY_A	N	ALL	N		N			
Threats												
Bycatch: presence of small scale / artisanal fisheries?	Y (PLL, SN, DLL, ST, MT, OTH)	CY_A, CY_B, GR, IT, IL, MA, ES, TN, TR	Y (SN, DLL, PLL, ST, MT, OTH	CY_A, CY_B, GR, IL, IT, ES, TR	Y (PLL, DN, SN, ST, MT)	GR, IL, IT, MA, TR	Y	ES	N			
Bycatch: presence of industrial fisheries?	Y (PLL, SN, BT, ST, MT,	GR, IL, IT, MA, ES, TN, TR	Y (SN, BT, DLL, ST, MT)	GR, IL, IT, TN, TR	Y (PLL, DN, SN, ST, MT)	GR, IL, IT, MA, ES	Y	ES	Y	ES	Y	ES

	PT)											
Bycatch: quantified?	Y	CY_A, GR, IL, IT, MA, ES, TN, TR	Y	CY_A, IL, ES, TR	Y	MA, ES	Y	ES	Y	ES	Y	ES
Take. Intentional killing or exploitation of turtles	Y	CY_B, GR, IT, MA, TN	Y	CY_B, GR	n/a	ALL	N		N			
Take. Egg poaching	N	CY_A, CY_B, GR, IT, IL, MA, ES, TN, TR	N	ALL	n/a	ALL	N		N			
Coastal Development. Nesting habitat degradation	Y	CY_A, CY_B, GR, IL, IT, TN, TR	Y	CY_A, CY_B, IL, TR	n/a	ALL	N		N			
Coastal Development. Photopollution	Y	CY_A, CY_B, GR, IL, IT, TN, TR	Y	CY_A, CY_B, IL, TR	n/a	ALL	N		N			
Coastal Development. Boat strikes	Y	CY_A, IL, IT, TN	Y	CY_A, CY_B, IL, TR	n/a	ALL	N		N			
Egg predation	Y	CY_A, IT	Y	CY_A, CY_B,	n/a	ALL	N		N			

				TR								
Pollution (debris, chemical)	Y	CY_A, IL, IT, TN	Y	CY_A, IL, TR	n/a	ALL	N		N			
Pathogens	Y	IT, TN	n/a	ALL	n/a	ALL	N		N			
Climate change	Y	CY_A	Y	CY_A, TR	n/a	ALL	N		N			
Foraging habitat degradation	Y	IL	Y	IL	n/a	ALL	N		N			
Other	Y (see text)	IL, TN	Y	IL	n/a	ALL	N		N			
Long-term projects (>5yrs)												
Monitoring at nesting sites (period: range of years)	Y (1985-ongoing)	IL, TN	Y (1978-)	CY_A, CY_B, IL, TR	n/a	ALL	N		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		N			
Monitoring at foraging sites (period: range of years)	Y (2000-ongoing)	GR, ES, TR	n/a	ALL	n/a	ALL						
Conservation												

Protection under national law	Y	CY_A, CY_B, GR, IL, IT, MA, ES, TN, TR	Y	ALL	Y	ALL	Y	ES	Y	ES	Y	ES
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		N			
Number of Marine Areas with mitigation of threats	4	CY_A, CY_B, TR	3	CY_A, CY_B, TR	0	ALL	N		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		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		N			
Hatcheries	Y	CY_B, ES	Y	CY_B	n/a	ALL	N		N			
Head-starting	Y	CY_B, ES	Y	CY_B	n/a	ALL	N		N			
By-catch: fishing gear modifications (eg, TED, circle hooks)	Y	IT, ES, TN, TR	Y	ES, TR	Y	ES	Y	ES	Y	ES	Y	ES
By-catch: onboard best practices	Y	GR, IT, ES, TN, TR	Y	ES, TR	Y	ES	Y	ES	Y	ES	Y	ES
By-catch: spatio-temporal	Y	CY_B, TN	Y	CY_B	n/a	ALL	N		N			

closures/reduction												
Other	Y (see text)	TR	N	ALL	n/a	ALL	N		N			

References

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

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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.

CYPRUS

Editors' note: If reference is made in this report to any "Ministries", "Departments", "services", "bodies", and/or "authorities" in the northern part of Cyprus, this is to allow a clear understanding of the administrative structures but without any intention to recognize the self-proclaimed "Turkish Republic of Northern Cyprus"; on the contrary the activities carried out by the IUCN are aimed at objectives mentioned in Article 2 of EU Council Regulation No 389/2006:

- the preparation of legal texts aligned with the acquis communautaire for the purpose of those being immediately applicable upon the entry into force of a comprehensive settlement of the Cyprus problem;

and,

- the preparation for implementation of the acquis communautaire in view of lifting the suspension in accordance with Article 1 of Protocol No 10 to the Act of Accession of Cyprus Republic to the EU.

Authors' note: The two regions of the island of Cyprus (as defined in Chapter: CYPRUS, Figure 1, page 39 in the Med Turtle report published in 2010), will be treated separately in two subchapters. However, the Chapter B does not cover the coastal tracts of the British sovereign military bases, where some nesting has been recorded.

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 has been 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] 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 530 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 24 years [3] and average 223 nests/yr (Table 1), 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 24 years (r^2 = 0.49, p=0.0001, 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 (58.1 nests/yr), three other index beaches (Monster, Tatlisu and West beaches total 110.9 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 125.5 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 issues. 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 fisherman[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 *Knowlege 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 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 (Fig1b). The five major nesting sites are found in the following areas: North Karpaz (beaches 51-56), Alagadi (76-77), South Karpaz (45-46) and the West Coast (83-84) (see Table 2). The major sites constitutes 62% of all recorded nesting (390 nests/yr) at 49 beaches for this species along the coast of the northern part of Cyprus. Eleven index sites have been monitored consistently over the past 24 years [3] and average 146.5 nests/yr, accounting for almost 40% of all green turtle nesting in northern Cyprus. A significant positive nesting trend has been experienced at these index sites over the past 24 years (r^2 = 0.33, 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 little 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 (Fig 6; [15, 36, 38, 39]. 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 a number of 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).

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

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

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)	536 (5-24 yrs)	PS	390 (5-24 yrs)	PS
Nests/yr: recent order of magnitude	500-1000	PS	100-500	PS
Number of "major" sites (>20 nests/yr AND >10 nests/km yr)	7	PS	5	PS
Number of "minor" sites (<20 nests/yr OR <10 nests/km yr)	42	PS	44	PS
Nests/yr at "major" sites: recent average (range of years)	295	PS	242	PS
Nests/yr at "minor" sites: recent average (range of years)	241	7PS	148	PS
Total length of nesting sites (km)	43	[2]	43	[2]
Nesting females / yr	282	PS	130	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]
Stocks defined by genetic markers	Y	[43, 44]	N	
Remote tracking (satellite or other)	Y	[10, 11, 15],[16]	Y	[10], [15], [36]
Survival rates	N		N	
Population dynamics	Y	[27]	Y	[27, 31]
Foraging ecology (diet or isotopes)	Y	[12, 19]	Y	[19]
Capture-Mark-Recapture	Y	[5]	Y	[5]
Threats				

Bycatch: presence of small scale / artisanal fisheries?	Y	[13, 16]	Y	[13]
Bycatch: presence of industrial fisheries?	na		na	
Bycatch: quantified?	Y	[13, 16]	Y	[13]
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]	Y	[3]
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)	1993-2017	PS	1993-2017	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		Y	
Number of protected nesting sites (habitat preservation) (% nests)	40 (c.75%)		40 (c.90%)	
Number of Marine Areas with mitigation of threats	1		1	
N of long-term conservation projects (period: range of years)	1 (1992 to date)		1 (1992 to date)	
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. The nesting beaches in Cyprus-Region A.

RMU / Nesting beach name (number)	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 (+)**					
Alagadi (76-77)	Y	58.1 (1993-2016)						33,486	35,333	1,70	100	47-71	1	B
Monster North (new)		47.8 (2013-2016						32,939	35,289	2,10	100	47-71	1	B
Monster (85)	Y	44.6 (1995-2016)						32,938	35,279	3,00	100	47-71	1	B
Guzelyali (new)		43.7 (2008-2016)						33,090	35,353	0,90	100	47-71	1	B
Tatlisu (71)	Y	35.2 (1993-2016)						33,835	35,412	0,26	100	47-71	1	B
Secret (new)		34.0 (2013-2016)						32,940	35,306	0,35	100	47-71	1	B
West 1 & 2 (83-84)	Y	31.1 (1993-2016)						32,936	35,333	2,17	100	47-71	1	B
Ronnas (52-56)		12.7 (1993-95, 98-99, 2008)						34,333	35,600	2,41	100	47-71	1	B
Bogaz Military (9)		15.0 (1993-99, 2001-2007)						33,972	35,324	0,96	100	47-71	1	B
Golden Beach 1 & 2 (45-46)		14.0 (1993-95, 98-99, 2008)						34,536	35,639	4,09	100	47-71	1	B
Kaplica (69)	Y	12.8 (1993-2016)						33,89	35,42	0,79	100	47-71	1	B

								9	5					
753 Meter beach (16)		12.6 (1993-1999)						34,176	35,444	0,75	100	47-71	1	B
Kantara (70)	Y	12.1 (1993-2016)						33,863	35,416	0,13	100	47-71	1	B
Big Beach (24)		12.0 (1993-1999)						34,241	35,467	2,11	100	47-71	1	B
Cyprus Gdns (6)		11.8 (1993-99, 2001-2007)						33,920	35,274	1,69	100	47-71	1	B
Esentepe 1 & 2 (73-74)	Y	11.4 (1993-2016)						33,595	35,353	0,53	100	47-71	1	B
Message in a Bottle (82a)	Y	9.9 (1993-2016)						32,923	35,367	0,80	100	47-71	1	B
Istanbul (5)		7.6 (1993-99, 2001-2007)						33,913	35,262	1,19	100	47-71	1	B
Long Beach II (4)		7.3 (1993-99, 2001-2007)						33,904	35,252	2,21	100	47-71	1	B
Second Last (28)		6.4 (1993-99)						34,282	35,480	0,74	100	47-71	1	B
Aydins (59)		6.2 (1993-96, 1999)						34,201	35,556	0,59	100	47-71	1	B
Very Big Beach (25)		5.6 (1993-99)						34,257	35,473	2,50	100	47-71	1	B
Bafra (11)		5.5 (1993-99, 2002-2007)						34,078	35,364	2,12	100	47-71	1	B
First Beach (13)		5.3 (1993-99)						34,147	35,424	0,25	100	47-71	1	B
New Beach West (62)		5.3 (1993-99)						34,171	35,548	0,41	100	47-71	1	B
Doune (50)		5.2 (1993-95, 1998-99)						34,409	35,636	0,29	100	47-71	1	B
Greenfields II (30)		5.1 (1993-99)						34,34	35,52	0,35	100	47-71	1	B

								1	4					
Dolphin (38)		4.9 (1993-99, 2008)						34,387	35,548	0,82	100	47-71	1	B
Smalls (new)		4.8 (2013-2016						33,794	35,412	0,10	100	47-71	1	B
Ruined Village (51)		4.7 (1993-95,1998-99, 2008)						34,221	35,375	0,83	100	47-71	1	B
Lost (82b)	Y	4.3 (1993-2016)						32,923	35,358	0,15	100	47-71	1	B
Dipkarpaz Sth (39)		4.1 (1993-99)						34,421	35,643	0,40	100	47-71	1	B
Balalan (new)		3.8 (2013-2016)						34,398	35,555	0,10	100	47-71	1	B
Bumpy (21)		3.7 (1993-99)						34,189	35,446	0,32	100	47-71	1	B
Greenfields I (31)		3.0 (1993-99)						34,345	35,526	0,60	100	47-71	1	B
One Goat (48)		3.0 (1993-95, 1998-99)						34,421	35,643	0,46	100	47-71	1	B
Malibu (58)		2.9 (1993-99)						34,216	35,555	0,30	100	47-71	1	B
Yeni Erenkoy Bel Plaj (60)		2.9 (1993-99)						34,194	35,556	0,72	100	47-71	1	B
Thyme (49)		2.8 (1993-95, 1998-99)						34,413	35,639	0,31	100	47-71	1	B
Small Harbour (29)		2.4 (1993-95, 1998-99)						34,295	35,488	0,16	100	47-71	1	B
Military (75)	Y	1.8 (1993-2016)						33,580	35,350	0,93	100	47-71	1	B
Tatlisu Belediya (72)	Y	1.8 (1993-2016)						33,820	35,412	0,16	100	47-71	1	B
Melons 2 (34)		1.7 (1993-99)						34,36	35,53	0,49	100	47-71	1	B

								4	7					
Wolf 1 (33)		1.4 (1993-99)						34,358	35,535	0,30	100	47-71	1	B
Wolf 2 (32)		1.4 (1993-99)						34,356	35,534	0,24	100	47-71	1	B
Melons 1 (35)		1.3 (1993-99)						34,368	35,539	0,25	100	47-71	1	B
Cove 4 (20)		0.4 (1993-95, 97, 99)						34,183	35,444	0,06	100	47-71	1	B
Cove 3 (19)		0.3 (1993-95, 97, 99)						34,183	35,444	0,06	100	47-71	1	B
Cove 1 (17)		0.2 (1993-95, 97, 99)						34,183	35,444	0,21	100	47-71	1	B
CM-MED														
Ronnas (52-56)		81.9 (1993-95, 98-99, 2008)						34,333	35,600	2,41	100	47-71	1	B
Alagadi (76-77)	Y	80.4 (1993-2016)						33,486	35,333	1,70	100	47-71	1	B
Ruined Village (51)		37.5 (1993-95, 98-99, 2008)						34,221	35,375	0,83	100	47-71	1	B
Golden Beach 1 & 2 (45-46)		21.8 (1993-95, 98-99, 2008)						34,536	35,639	4,09	100	47-71	1	B
West 1 & 2 (83-84)	Y	20.8 (1993-2016)						32,936	35,333	2,17	100	47-71	1	B
Message in a Bottle (82a)	Y	14.7 (1993-2016)						32,923	35,367	0,80	100	47-71	1	B
Lost (82b)	Y	13.1 (1993-2016)						32,923	35,358	0,15	100	47-71	1	B
Dolphin (38)		12.5 (1993-99, 2008)						34,38	35,54	0,82	100	47-71	1	B

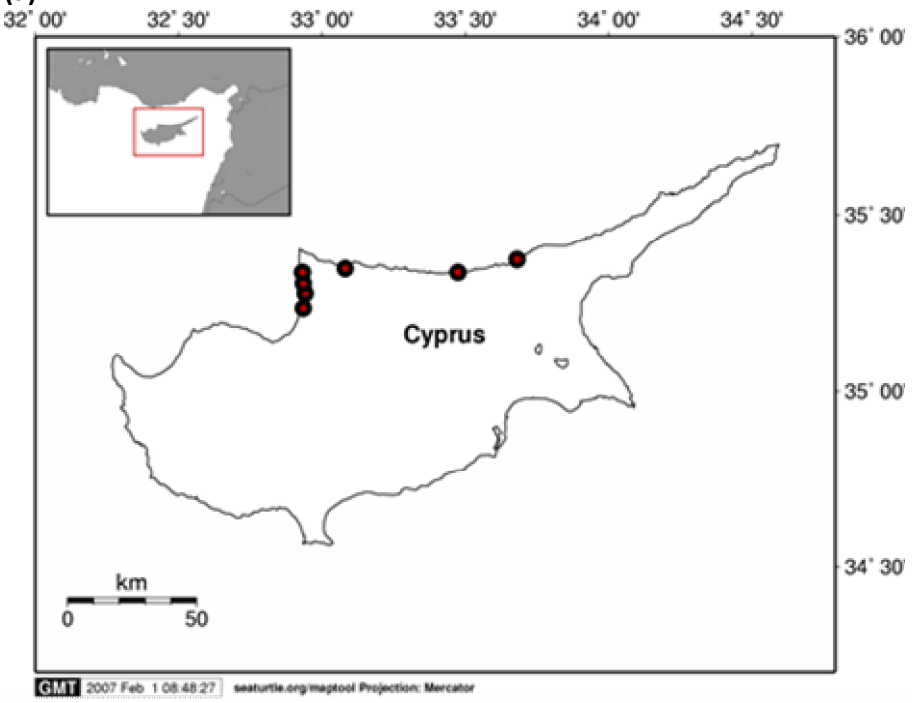
								7	8					
Dipkarpaz Sth (39)		12.0 (1993-99, 2008)						34,421	35,643	0,40	100	47-71	1	B
Esentepe 1 & 2 (73-74)	Y	10.8 (1993-2016)						33,595	35,353	0,53	100	47-71	1	B
Secret (new)		9.0 (2013-2016)						32,940	35,306	0,35	100	47-71	1	B
Guzelyali (new)		8.5 (2008-2016)						33,090	35,353	0,90	100	47-71	1	B
Monster North (new)		8.5 (2013-2016)						32,939	35,289	2,10	100	47-71	1	B
Melons 1 (35)		7.0 (1993-99)						34,368	35,539	0,25	100	47-71	1	B
Aydins (59)		5.8 (1993-96, 1999)						34,201	35,556	0,59	100	47-71	1	B
Melons 2 (34)		5.3 (1993-99)						34,364	35,537	0,49	100	47-71	1	B
Doune (50)		4.6 (1993-95, 1998-99)						34,409	35,636	0,29	100	47-71	1	B
Thyme (49)		4.4 (1993-95, 1998-99)						34,413	35,639	0,31	100	47-71	1	B
One Goat (48)		3.6 (1993-95, 1998-99)						34,421	35,643	0,46	100	47-71	1	B
Monster (85)	Y	3.5 (1993-2016)						32,938	35,279	3,00	100	47-71	1	B
New Beach West (62)		3.3 (1993-99)						34,171	35,548	0,41	100	47-71	1	B
Wolf 2 (32)		3.1 (1993-99)						34,356	35,534	0,24	100	47-71	1	B
Wolf 1 (33)		3.0 (1993-99)						34,358	35,535	0,30	100	47-71	1	B
Balalan (new)		2.0 (2013-2016)						34,39	35,55	0,10	100	47-71	1	B

								8	5					
Military (75)	Y	1.3 (1993-2016)						33,580	35,350	0,93	100	47-71	1	B
Big Beach (24)		1.3 (1993-99)						34,241	35,467	2,11	100	47-71	1	B
First Beach (13)		1.3 (1993-99)						34,147	35,424	0,25	100	47-71	1	B
Kaplica (69)	Y	1.3 (1993-2016)						33,899	35,425	0,79	100	47-71	1	B
Tatlisu (71)	Y	1.3 (1993-2016)						33,835	35,412	0,26	100	47-71	1	B
Small Harbour (29)		1.2 (1993-95, 1998-99)						34,295	35,488	0,16	100	47-71	1	B
753 Meter beach (16)		1.0 (1993-99)						34,176	35,444	0,75	100	47-71	1	B
Greenfields I (31)		1.0 (1993-99)						34,345	35,526	0,60	100	47-71	1	B
Yeni Erenkoy Bel Plaj (60)		0.9 (1993-99)						34,194	35,556	0,72	100	47-71	1	B
Bumpy (21)		0.6 (1993-99)						34,189	35,446	0,32	100	47-71	1	B
Greenfields II (30)		0.4 (1993-99)						34,341	35,524	0,35	100	47-71	1	B
Cove 4 (20)		0.3 (1993-95, 97, 99)						34,183	35,444	0,06	100	47-71	1	B
Bogaz Military (9)		0.3 (1993-99, 2001-2007)						33,972	35,324	0,96	100	47-71	1	B
Second Last (28)		0.3 (1993-99)						34,282	35,480	0,74	100	47-71	1	B
Bafra (11)		0.2 (1993-99, 2002-2007)						34,078	35,364	2,12	100	47-71	1	B
Cyprus Gdns (6)		0.2 (1993-99, 2001-						33,92	35,27	1,69	100	47-71	1	B

		2007)						0	4					
Malibu (58)		0.1 (1993-99)						34,216	35,555	0,30	100	47-71	1	B
Very Big Beach (25)		0.1 (1993-99)						34,257	35,473	2,50	100	47-71	1	B
Kantara (70)	Y	0.1 (1993-2016)						33,863	35,416	0,13	100	47-71	1	B
Istanbul (5)		0.1 (1993-99, 2001-2007)						33,913	35,262	1,19	100	47-71	1	B
Cove 1 (17)		0.0 (1993-95, 97, 99)						34,183	35,444	0,06	100	47-71	1	B
Cove 3 (19)		0.0 (1993-95, 97, 99)						34,183	35,444	0,21	100	47-71	1	B
Long Beach II (4)		0.0 (1993-99, 2001-2007)						33,904	35,252	2,21	100	47-71	1	B
Smalls (new)		0.0 (2013-2016)						33,794	35,412	0,10	100	47-71	1	B
Tatlisu Belediya (72)	Y	0 (1993-2016)						33,820	35,412	0,16	100	47-71	1	B

Figure 1

(a)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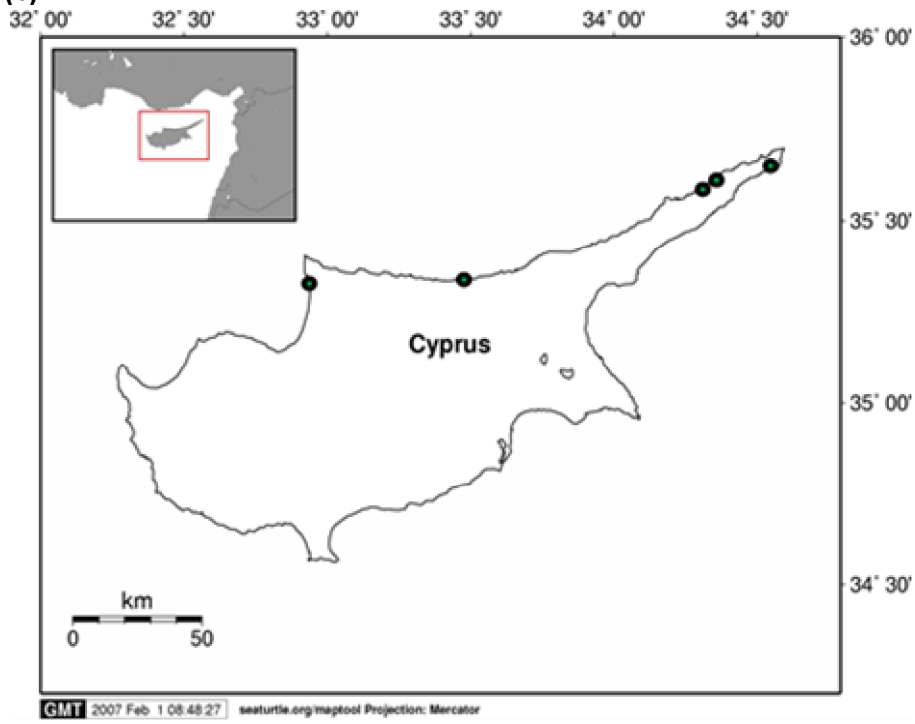
(b)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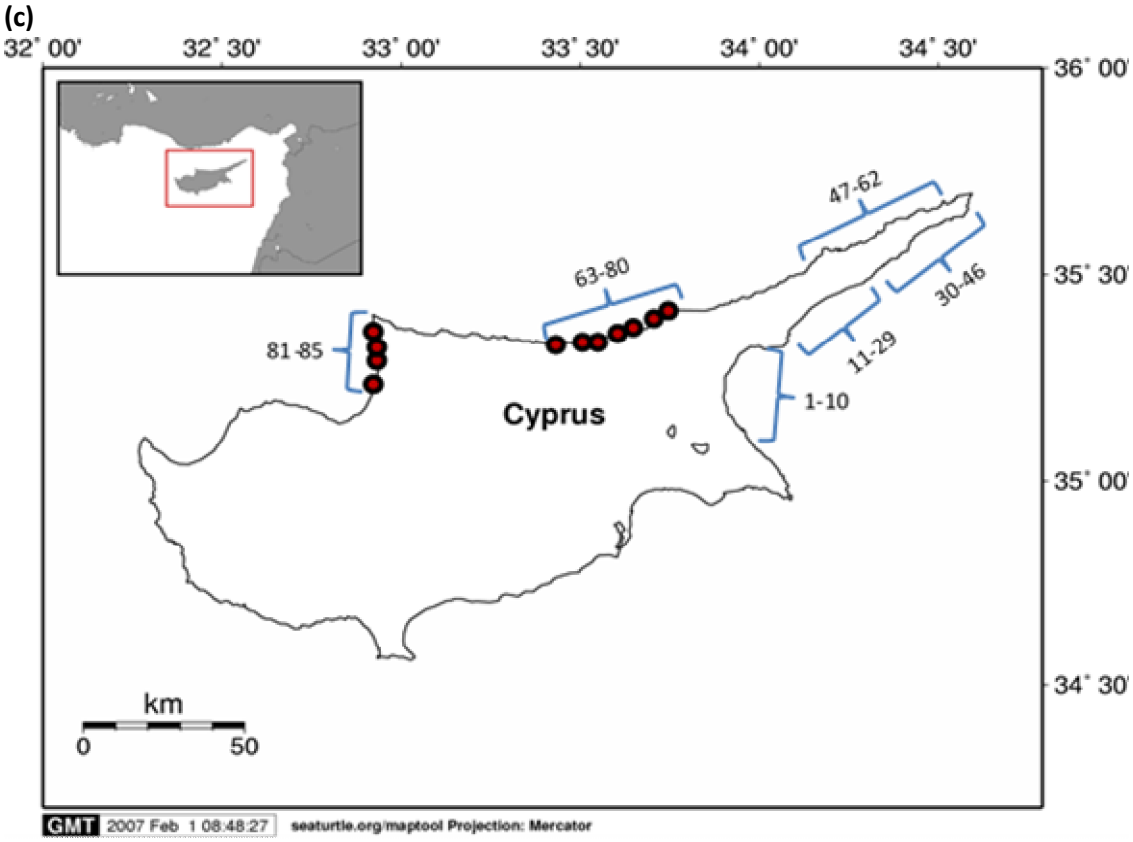

Figure 1. Map of loggerhead turtle (a) and green turtle (b) major nesting areas, together with minor nesting locations for both species and beach numbering as per Godley & Broderick 1992, together with eleven index beaches (c).

Figure 2

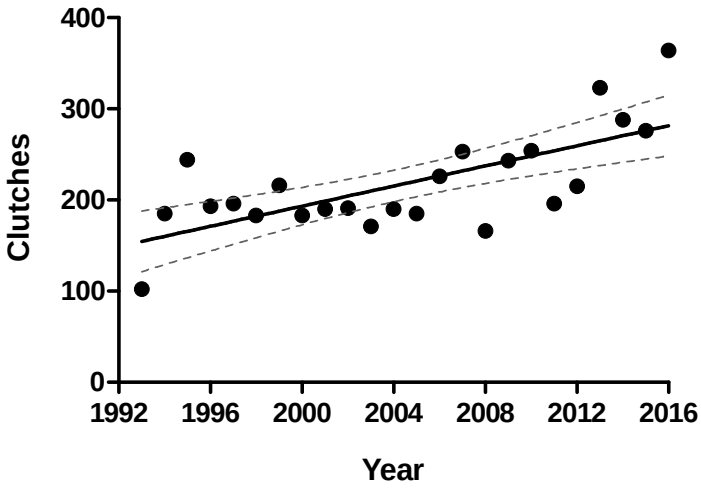

Figure 2. Loggerhead turtle nesting abundance (1993-2016) and positive linear trend (solid line) with 95% confidence band (dashed line) at eleven index sites in northern Cyprus.

Figure 3

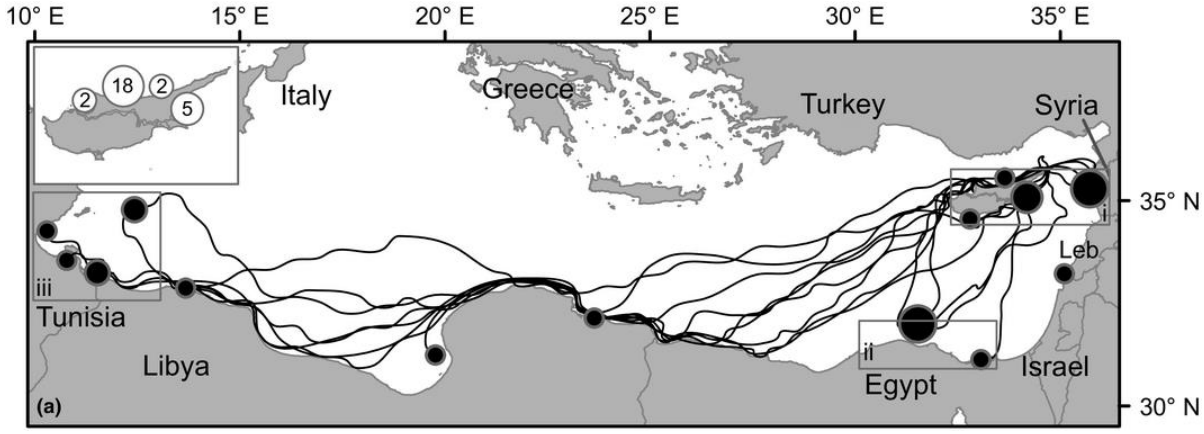

Figure 3. Loggerhead turtle migration routes (n=24) and final locations of residence by turtles that made post-nesting migrations directly from North Cyprus (see insert box for deployment sites. Map taken from Snape et al 2016). Black circles are scaled to the number of individuals residing in each area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

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

Figure 5

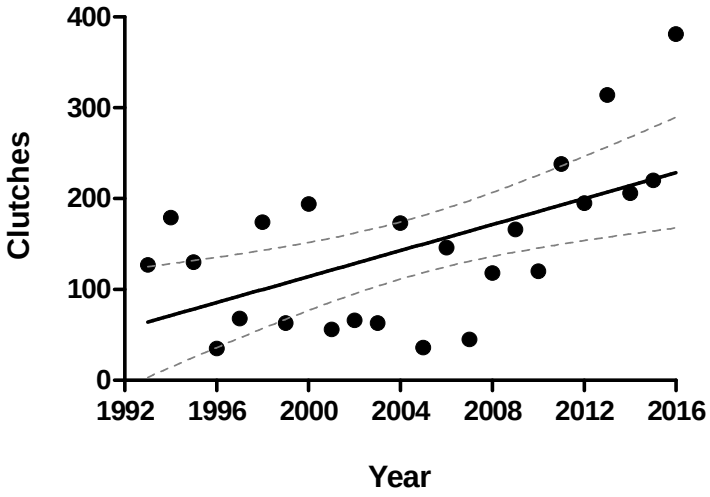

Figure 5. Green turtle nesting abundance (1993-2016) and positive linear trend (solid line) with 95% confidence band (dashed line) at eleven index sites in northern Cyprus.

Figure 6

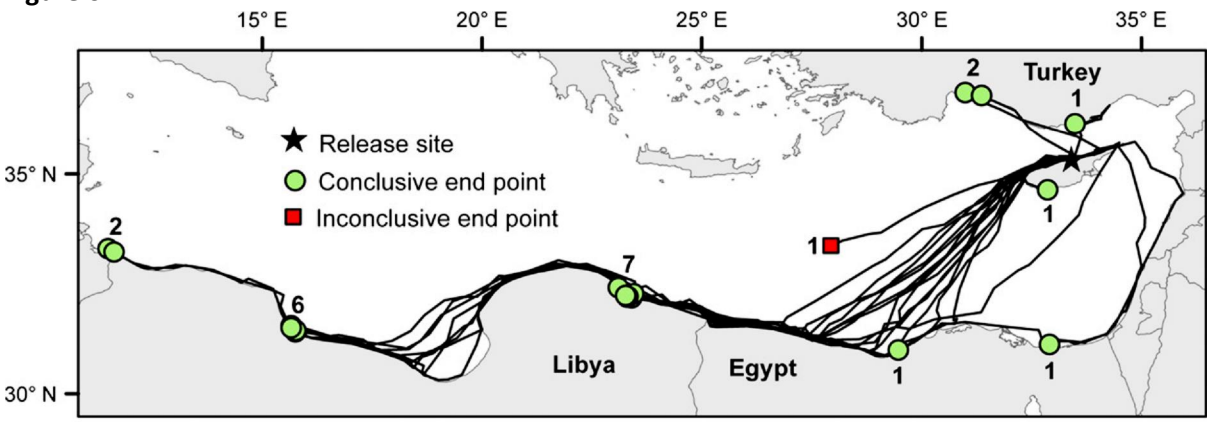

Figure 6. Green turtle migration routes and final locations of residence (n=21) of female turtles satellite tagged and tracked from Alagadi beach northern Cyprus. Numbers at final destinations indicate the number of individuals who have been tracked to that specific location (Map taken from Stokes et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

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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

Coastal development

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.

Beach restructuring

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.

Non-human predation

Fox predation was the major problem and, before the protection of nests with cages, predation reached 80% on some beaches. Now all nests are protected against foxes with cages and predation

is limited to about 10%, depending on the beach. Ghost crabs are also a minor predator on a small number of beaches.

Human exploitation

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 Habitats

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

Coastal development

In the Lara/Toxeftra Reserve, on the west coast, there has been no coastal development and photopollution is very limited. Human presence on the beaches at night is strictly controlled as is driving on the beaches, though some problems still exist with driving, 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.
Beach restructuring
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.

Chrysochou Bay

In 2002 the Polis/Limni was declared, on the basis of the Town and Country Planning legislation as a "Shore for Ecological Protection". Its provisions include: no permits for the commercial use of 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.

Enforcement

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

Conservation efforts

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.

Conservation methods used

In the Lara-Toxeftra Reserve and on the Polis/Limni/Yialia beaches as well as on practically all other beaches that have any nesting, all nests are protected *in situ*, i.e., where the eggs were laid, by placing open, self-releasing, aluminium (non-magnetic) cages over them (Fig. 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.

Achievements

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

There have been significant increases in the number of loggerhead 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

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.

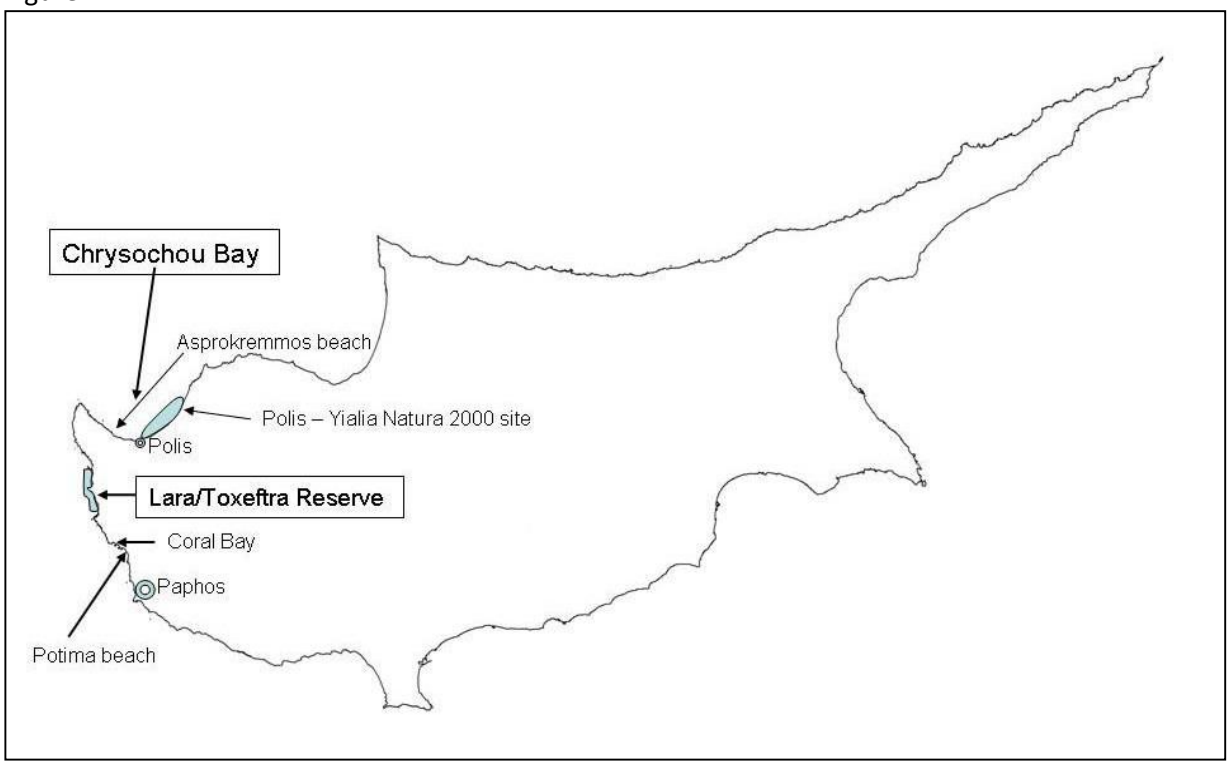

Figure 1. Map of Cyprus with main nesting sites on the West Coast and in Chrysochou Bay.

Figure 2.

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

Figure 3.

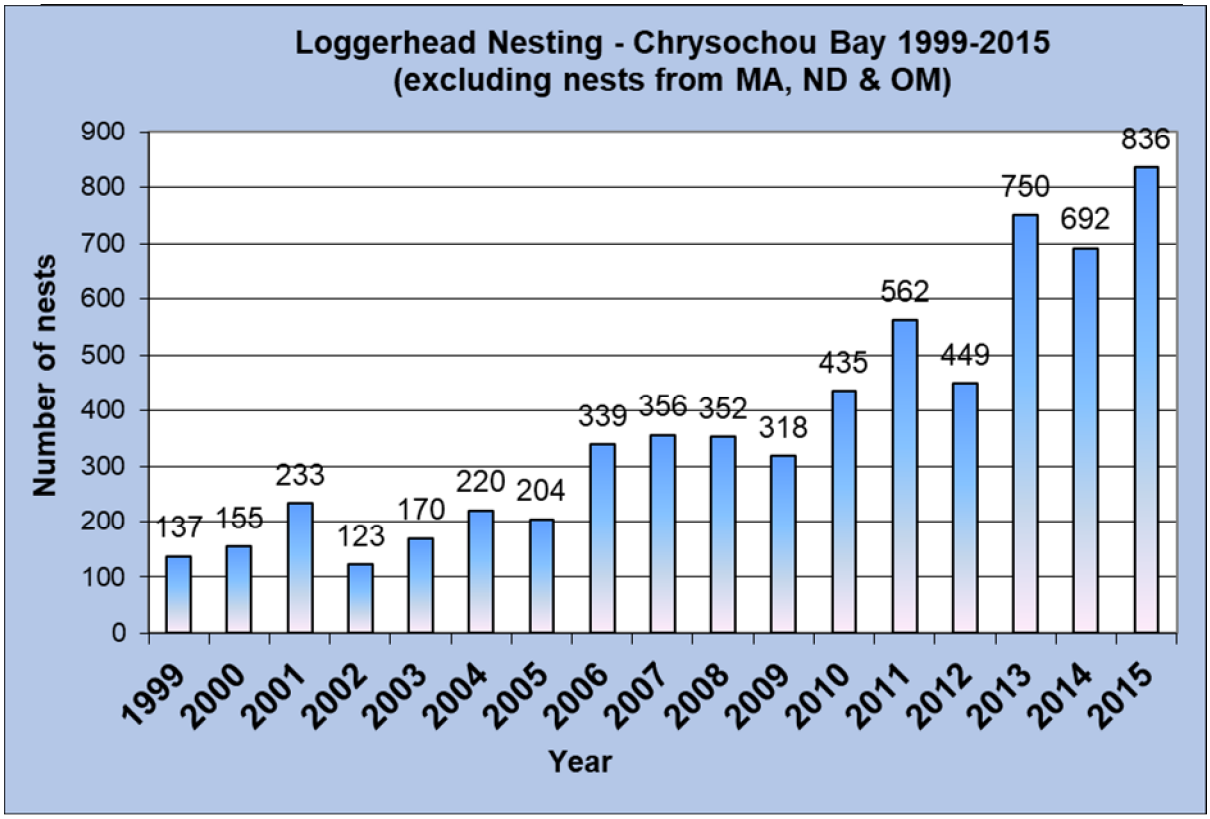

Figure 3. Loggerhead nesting in Chrysochou Bay, 1999-2015. (Sources: Demetropoulos 1989. Demetropoulos and Hadjichristophorou 2009. Hadjichristophorou and Demetropoulos 1990-2007. Demetropoulos and Hadjichristophorou unpublished data. Demetropoulos et al 2015.

Figure 4.

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

Figure 5

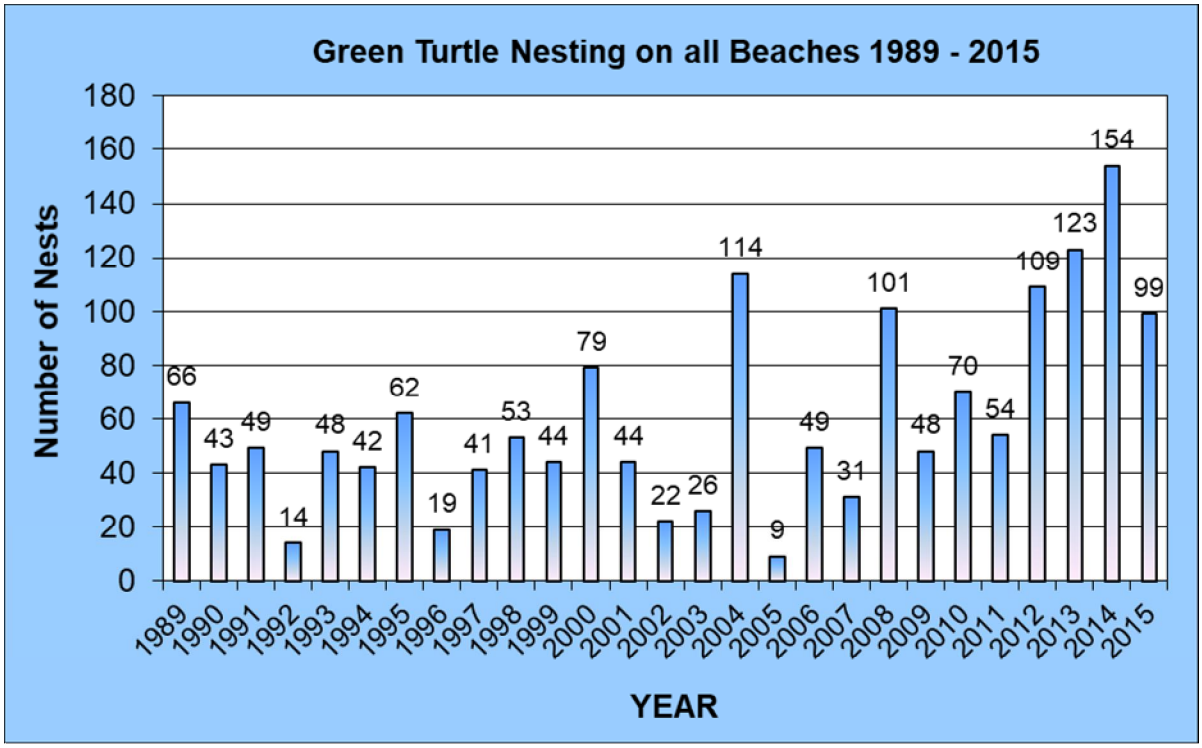

Figure 5. Green Turtle Nesting on the West Coast, 1989-2007. (Sources: Demetropoulos, 1989. Demetropoulos and Hadjichristophorou, 2009. Hadjichristophorou and Demetropoulos, 1990-2007. Demetropoulos and Hadjichristophorou, Unpublished data. Demetropoulos et al 2015)

Figure 6

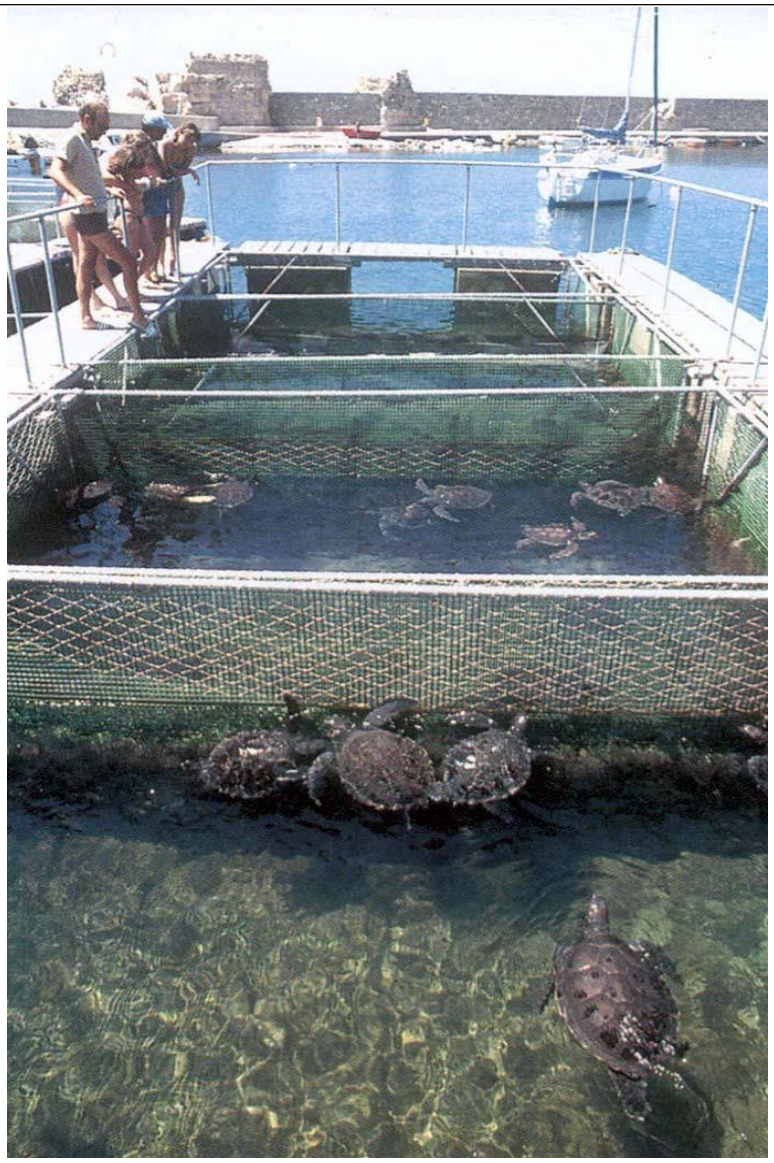

Figure 6. Head-starting was experimented with in the past (Photo: A. Demetropoulos).

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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).

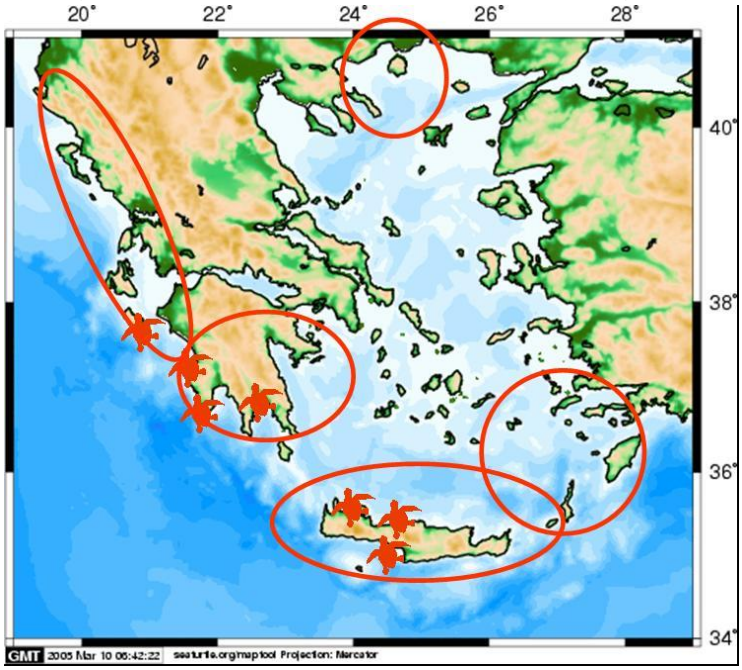

Figure 2. Map showing approximate marine areas, where many turtles are reported as bycaught or stranded. Red turtles indicate main nesting areas.

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 (2010), 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

Key knowledge gaps

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

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

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	21,631389	37,231886	21,686667	37,2898			3,5	100%	4	1	n/a
Ipirus coast (several beaches)	N	40 (1990)	n/a	20,185556	39,518611	20,725833	38,951111			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	20,648056	38,710833	17,1	Three surveys	7, 4, 11	2	A

Kerkyra Island (several beaches)	N	20 (1990)	n/a	19,873 611	39,453 178	20,079 167	39,368 611			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	27,131 944	36,825 834	23,0	Three surveys	7, 4, 11	2	A
Rhodes Island (SE coast)	N	4 (1988-89)	n/a	27,816 389	35,903 836	27,931 944	36,023 611			16,0	100%	7, 4, 11	1	n/a
Rhodes Island (SW coast)	N	11 (1988-89)	n/a	27,726 111	35,948 333	27,750 834	36,105 278			18,0	100%	7, 4, 11	1	n/a
Northern Kyparissia Bay	N	100 (1984-89)	n/a	21,453 889	37,611 717	21,681 647	37,376 539			34,0	100%	3	1	n/a
SE Peloponnesus (Astros)	N	16 (1990)	n/a	22,748 611	37,446 4	22,783 611	37,371 692			9,5	Three surveys	7, 4, 11	2	A
Kythira Island	N	4 (1990)	n/a	23,058 611	36,222 158	23,071 111	36,226 63			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		

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ISRAEL

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Authors provided the Excel database, but no updated text. More detailed information about this country can be found in the Med Turtle report published in 2010. (http://iucn-mtsg.org/publications/med-report/).

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

RMU	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. The nesting beaches of Isreal.

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. The Convention information for 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		

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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 also 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 fishing activity of the Italian fleet is the most important threat from 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 threatened by coastal development and egg predation has been reported (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.

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	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),	4,6	n/a		n/a		n/a	

	0.61 (69)							
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	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	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	Y	see CC-MED	Y(PLL)	277	Y	
Bycatch: quantified?	10600-20100 (BT), 12300 (PLL), 700 (DLL), 500-23800 (SN)	245,247	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 -	N	1.4 (2000-	n/a					12.854786	35.863	0.1	100	18	1	B	no recent

Linosa - Pozzolana di Ponente		2004)													monitoring report 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	Y	Y	Y	CC, CM, DC, EI,		

Trade in Endangered Species of Wild Fauna and Flora				LK		
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 Northeast, CC-Atlantic Northwest	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		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	http://www.eurotu rtles.eu/	EU	info@euroturtles.eu

		, Cyprus								Italy (IT), Nature Trust Malta (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	Project: "Monitoraggio e		01/01/2010	31/12/2018	Filicudi WildLife	Private	University of Messina;	www.filicudiconservation.com		blasimf@yahoo.co

			Tyrrhenian Sea, Aeolian Archipelago	Tutela della tartaruga marina *Caretta caretta* nell'Arcipelago Eoliano" (PROT. N° 0001735 del 02-02-2010; renewal: PROT N° 0006876 del 25-01-2013; renewal : PROT N° 0011903 del 01-06-2016)				Conservation		University Tor Vergata; National Institute of Health (Italy); Marine Turtle Research Center, Stazione Zoologica Anton Dohrn			m
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

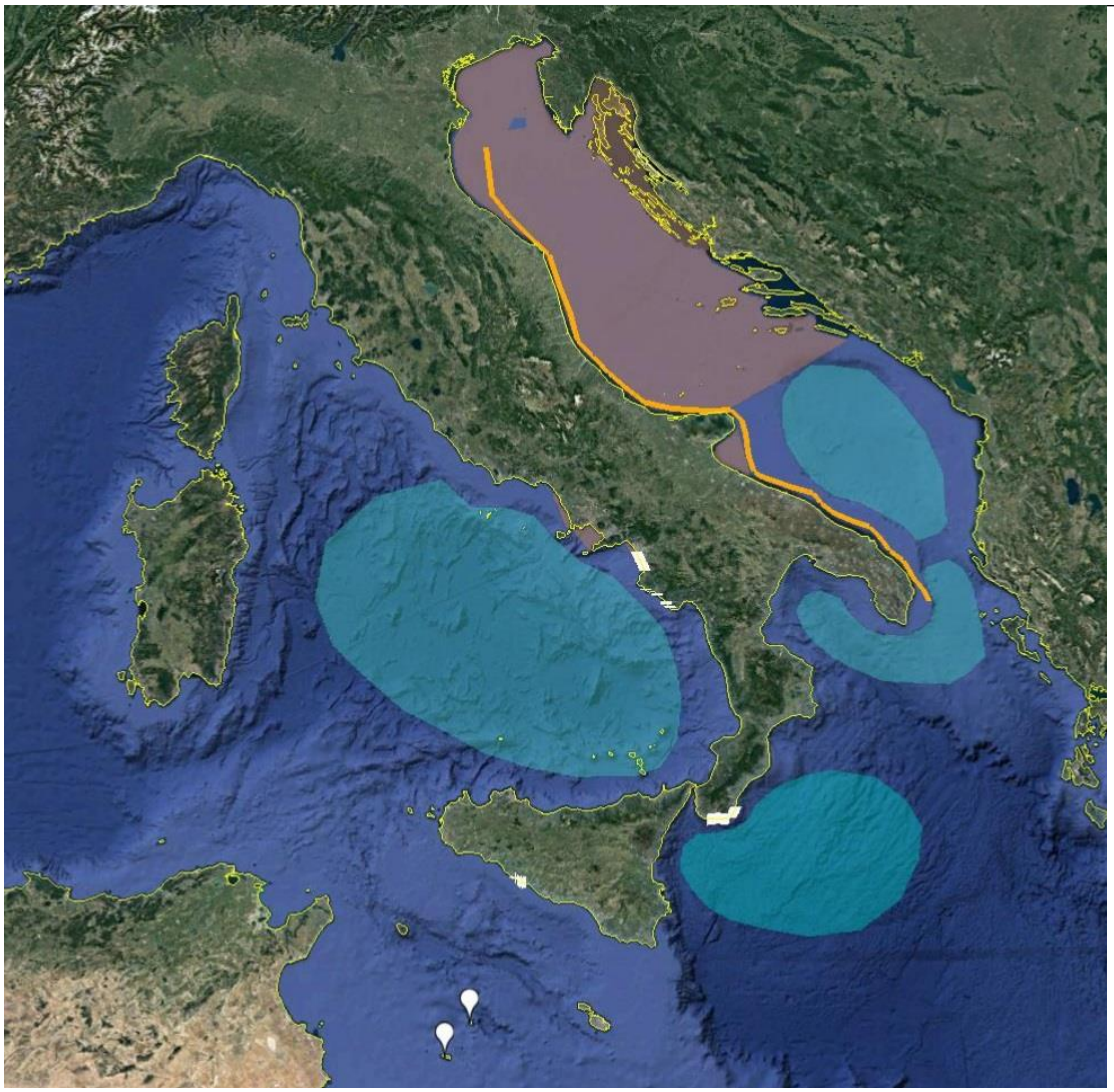

Figure 1 Map showing the location of the loggerhead turtle nesting beaches and marine areas in Italy. White place marks and coastal lines indicate the location of the nesting areas listed in Table 2. Blue shaded areas are approximate locations of oceanic developmental and foraging habitats, whereas orange 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

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MOROCCO

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Authors only provided an Excel database for this report, but no updated text. More detailed information about this country can be found in the Med Turtle report published in 2010 (http://iucn-mtsg.org/publications/med-report/).

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

RMU	CC-MED	Ref #	CM-MED	Ref #	DC-NW ATL	Ref #
Occurrence						
Nesting sites	N	4	N		N	
Pelagic foraging grounds	n/a		n/a		n/a	
Benthic foraging grounds	Y		n/a		n/a	
		1 to 5				
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 5	N		Y	
Bycatch: presence of industrial fisheries?	Y		N		Y	
Bycatch: quantified?	Y	1 and 5	N		Y	
Take. Intentional killing or exploitation of turtles	some	7 and 8				
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	6	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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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.* 2017). 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.* 2017). Since 2014, 6-7 nesting records/attempts are reported every year in the Spain's Mediterranean coast (Marco et al. 2018).

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). Turtles from the Mediterranean RMU are the most abundant in the north 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). 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).

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)

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.

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)

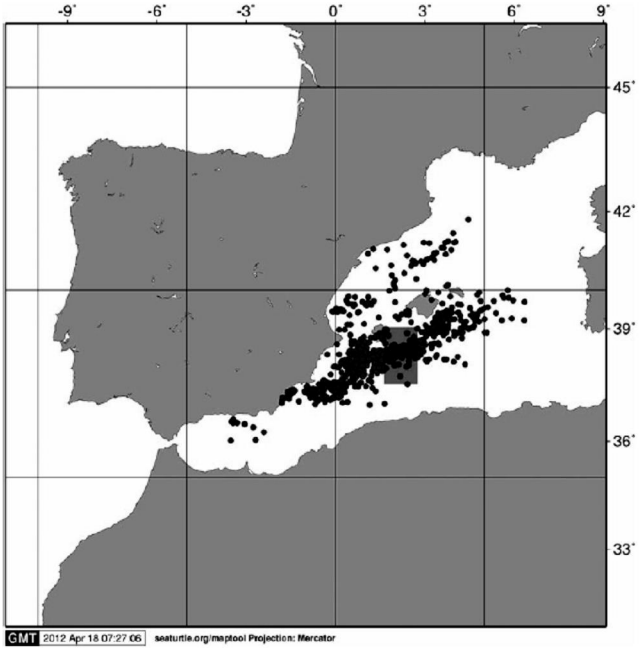

Fig.1. Observed set with positive bycatch of sea turtles in Spanish surface longline (In Báez et al., 2013)

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 1). 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.

Table1. 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, Alvarez de Quevedo et al., 2013; Báez et al., 2009). 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, probably due to changes in the surface longline fishing strategy. 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 observer's onboard surface longline vessels, Baez et al. (2017) reported adult loggerhead turtles bycaught in Alboran Sea on longlines from May to August. Adults were 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). Ongoing projects at European and Mediterranean levels are evaluating the current impact of this threat on the species in the area and its use as bioindicator.

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.* 2017). 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.* 2017).

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).

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.* 2017) 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).

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. In the Spanish Atlantic there are reports from the whole northern coast and Andalucía Atlantic coasts (Southwest Spain) (Marco et al. 2014a). 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).

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. imbricata*	
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	N		N		N		N			
Pelagic foraging grounds	Y	2,4,9,10,11,13,15,26,28,40,42	Y	36	Y	36	Y	37	Y	38		
Benthic foraging grounds	Y	2,14,15,25,29	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	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, 46	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	46	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	47	N		N		N		N		N	
Oldest documented abundance: nests/yr (range of	N		N		N		N		N		N	

years)												
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	3,10,11,13,21,26,28,29,40,42	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	Y	39	N		N		N		N	
Capture-Mark-Recapture	Y	33,37	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	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	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.	N		N		N		N		N		N	

Photopollution											
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	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	47										
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	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	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		

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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. Otherwise, ephemeral nesting activities were recorded in some other beaches such as Zarzis, Hergla, Beja, Tazarka, Mahdia and Ras Dimas (Fig. 1).

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.

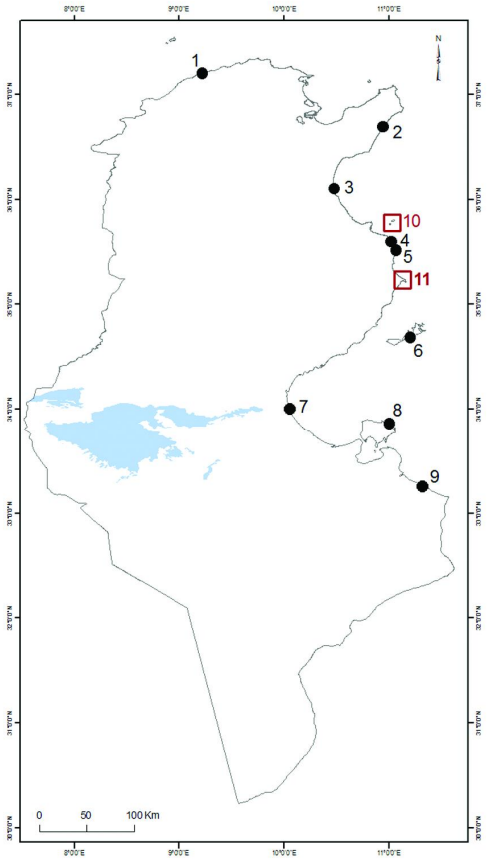

Figure 1: Map of Tunisia with locations of some nesting beaches (35) Cape Serrat; 2) Nabeul; 3) Hammamet; 4) Ras Dimas; 5) Mahdia; 6) Kerkennah Island; 7) Ghannouche (Gabes); 8) Sidi Mehrez (Jerba Island); 9) El bibane to Libyan borders; 10) Kuriat Island; 11) Chebba.

1.1.2. Marine areas

The gulf of Gabes (Fig.2) in south Tunisia is likely to be one of the most important areasfor 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).

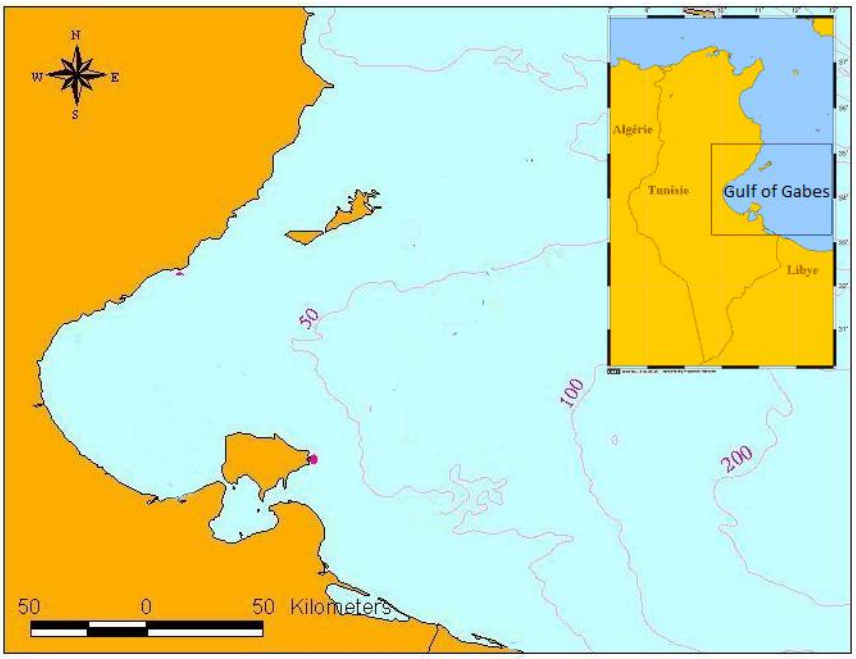

Figure 2: Map of the Gulf of Gabes

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 (*Carettacaretta*); it is a wintering and foraging area for this species.

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.

Table 1.1: 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	Recorded	Reference

		captures	mortality	
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 longlines 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:

Bottom longlines

Species caught

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 *Dermochelyscoriaceea* respectively.

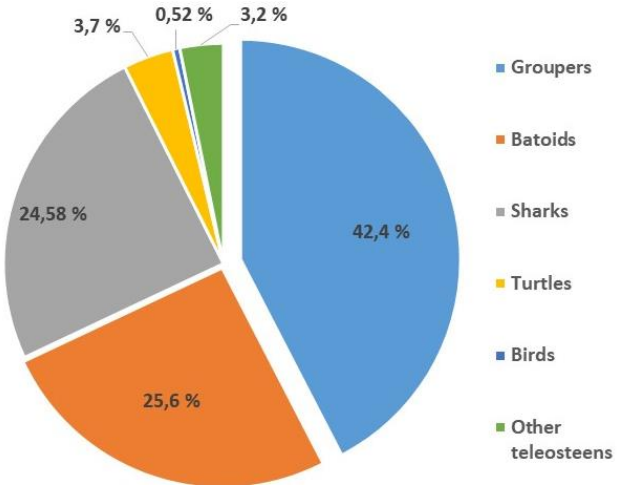

Figure 3: Composition of bottom longline catches during the study period

Surface longlines

In a total of 96 setsmade, 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*Carettacaretta* and *Dermochelyscoriaceea* respectively.

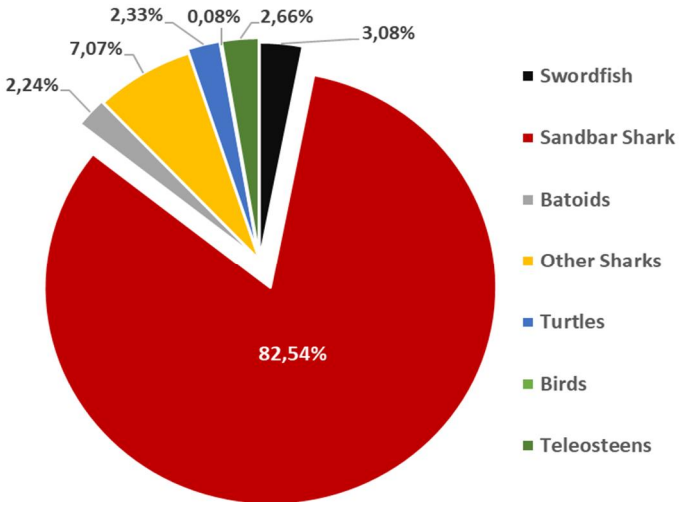

Figure 4: Composition of surface longline catches during the study period

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 *Carettacaretta*(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 *Laruscarchinans*, 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 (*Posidoniaoceanica*) 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.

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 RAC/SPA (Regional Activity Centre of 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.

1.5. Research

Key knowledge gaps

- Interaction with fisheries : estimation of the interaction with some coastal fisheries (trammel nests...) and update of the studied gears.
- 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.

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	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		n/a		n/a	
Pollution (debris, chemical)	Y	Umpublished	n/a		n/a	
Pathogens	Y	41	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. The nesting beaches of Tunisia.

RMU / Nesting beach name	**Index site**	**Nests/yr: recent average (range of**	**Crawls /yr: recent averag**	**Western limit**	**Eastern limit**	**Central point**	**Length (km)**	**% Monitored**	**Reference #**	**Monitoring Level (1-2)**	**Monitoring Protocol (A-F)**

		years)	e (range of years)											
CC-Tunisia				Long	Lat	Long	Lat	Long	Lat					
Beach Great Kuriat	N	16 (2007-2016)						35°47'655''	011°01'230''	4	100%	1,16,17,18	1	B
Beach small Kuriat	N	8,2 (2007-2016)						35°46'003''	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. The conventions 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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TURKEY

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

1.1. Distribution, abundance, trends

1.1.1. Nesting sites

The main nesting activity of the loggerhead turtles 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 turtles. 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.

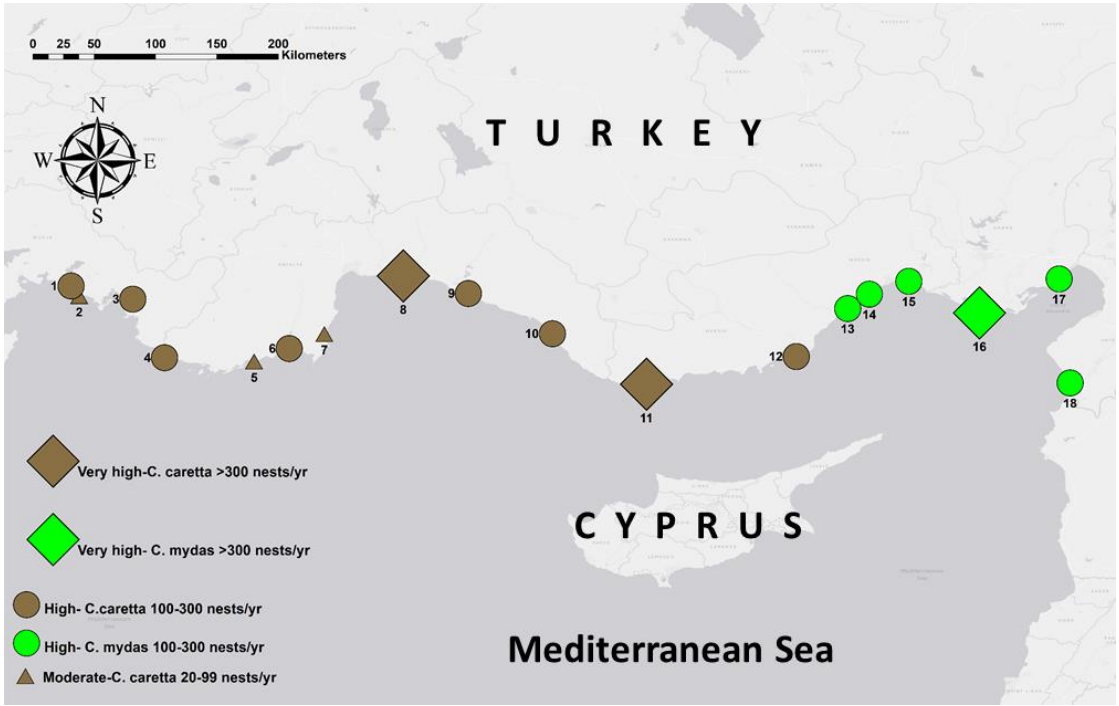

Figure 1: The main loggerhead and green turtle nesting grounds of Turkey 1. Dalyan, 2. Dalaman, 3. Fethiye, 4. Patara, 5. Kale-Demre, 6. Fenike-Kumluca, 7. Çıralı, 8. Belek, 9. Kızılot, 10. Demirtaş, 11. Anamur, 12. Göksu Delta, 13. Alata, 14. Davultepe, 15. Kazanlı, 16. Akyatan, 17. Sugözü, 18. Samandağ

Based on long term monitoring efforts a positive trend was observed in the number of nests for loggerhead turtles in Turkey (Table 1).
The genetic structure of loggerhead turtles 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 1.1. Trends of nesting activity of loggerhead and green sea turtles in Turkey (Converted from Casale et al. 2018)

Species	Beach	Mean number of nests/yr 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 effort 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 stuides has been increasing, particularly since 2002 (Oruç et al, 2011). Marine areas are very important for sea turtles but it is the least 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 studes (Turkecan and Yerli, 2011)

There are plenty of records from different coastal parts of Turkey about the occurrence of sea 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 turtles 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 sea 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 turtles (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. The particle distribution modelling (Casale and Mariani, 2014) suggested Levantine basin as a nursery area for sea turtles originating from eastern rookeries.

Okuş et al.2004 described Kadırga Cape, Karagelme Bay and Samucak Cape as a mating area for loggerhead turtles. Yokeş (2003) recorded the regular observation of this species in Kaş and Tekirova region. Kaş-Kekova Specially Protected Area (Antalya) area appears to serve as a feeding ground for both *C. caretta* and *C.mydas* (Tural and Çiçek 2010; Soysal 2015).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.

According to media reports of sea 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 sea 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 holidaymakers 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

The amount of recent bycatch by fisheries is an unknown threat to sea turtles in Turkey. Furthermore, boat collisions and pollution in the sea is another negative affect. On the other hand, the government announced some part of eastern coast as energy corridor and allow the construction of thermal power plants. The discharge of water into the sea of course will effect the sea water temperature and cause some changes in the ecosystem. However, how this change will impact sea 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

The monitoring and conservation practices and studies in Turkey have been rapidly growing with the support of many different institutions including the Ministry of Forestry and Water Affairs, the Ministry of Environment and Urbanization, the Ministry of Food, Agriculture and Livestock, the Coast Guard Command, WWF–Turkey, Ecological Research Society (EKAD), Dokuz Eylul University, Hacettepe University, Pamukkale University, Mersin University, Çanakkale University, Adnan Menderes University, Ordu University, DEKAMER, other relative ministries, local authorities, experts of two aquariums, and the local NGOs.

Conservation priories were mainly given to some key nesting sites such as Dalyan, Fethiye, Patara, Belek and Goksu Delta with long term beach monitoring projects by Ministry. Furthermore, WWF Turkey has been monitoring Akyatan beach since 2006.

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 sea turtle specialists around the world (Tonay and Oruc, 2017) and further contributed the knowledge and conservation of sea turtles.

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 sea 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

- Sea 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

2.3. Distribution, abundance, trends

1.2.1. Nesting sites

The main nesting activity of the green turtles mainly occurs on the eastern beaches of the Mediterranean coast of Turkey (Figure 1). It is the same for green turtles, but not as much as the loggerheads, that they also nest on western beaches in low numbers. The westernmost 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 turtles 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 sample size from Turkey is too small.

1.2.2. 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 turtles in this area. However, the green turtle nesting sites remain within the industrial area and suffer mainly pollution and beach litter coming from other countries. In recent years, the

announced energy corridor close to the nesting beaches caused the construction of 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.

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

RMU	CC-Turkey	Ref #	CM-Turkey	Ref #	DC-Turkey
Occurrence					
Nesting sites	Y	62	Y	62	N
Pelagic foraging grounds	Y	91,112	Y	91,92, 112	n/a
Benthic foraging grounds	Y	91, 112	Y	91, 112	Y
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)
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		Y	62	n/a
Coastal Development. Boat strikes	Y	62	Y	62	n/a
Egg predation	Y	62	Y	62	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
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. The nesting beaches of 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		#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	335 (1988,91,92,94-98,00-01,06-17)								22		#2,12,13,14,15,16,17,18,19,20,21,22, 23,24,25,26,27,28	Level 1 (2006-17)	Protocol B
Sugözü	N	213 (2013)								3,4		107		
Kazanlı	Y	240(1988,90,93,94,96, 99,2000-12)								4,5		#2,26,28,30,49,50,51,52,53,54,55,56,57, 58,59,60,61		
Samandağ	N	420 (1988,-94,97-99,01-17)								14		#2,29,30,31,32,33,34,35,36,37,38,39,40, 41,42,43,44,45,46,47,48		
Alata	N	187 (2002-2006)								3		104,105		
Davultepe	N	126 (2009-14)								2,8		106		

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

International Conventions	Signed	Binding	Compliance measured and reported	Species	Conservation actions	Relevance to sea 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

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