

Population status and conservation of marine turtles at El-Mansouri, Lebanon

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Abstract. The nesting activity of marine turtles was studied at El-Mansouri, Lebanon during the peak nesting period 15th June to 18th July 2002. A total of 37 Loggerhead (*Caretta caretta*) nests and 5 Green Turtle (*Chelonia mydas*) nests were recorded. Nests were not evenly distributed but showed distinct areas of concentration. The nesting success of *C. caretta* was 40.2% and for *C. mydas* 50%. *C. caretta* nesting density was 26.4 nests/km, and *C. mydas* 3.6 nests/km. The average distance of nests from the sea was 12.9 m for *C. caretta* and 19.7 m for *C. mydas*. Nests threatened by inundation were relocated to safe areas of the beach. Protective metal grids were placed over some nests to prevent nest predation. Efforts were made to raise public awareness of the plight of marine turtles in Lebanon. There is severe development pressure along the Lebanese coastline, and if the population of nesting turtles at El-Mansouri is to survive, immediate conservation efforts should be implemented.

Kurzfassung. In El-Mansouri, Lebanon, wurde während der Haupteiblagerperiode vom 15.6.–18.7.2002 das Nistgeschehen von Meeresschildkröten verfolgt. Insgesamt wurden 37 Nester der Unechten Karettschildkröte (*Caretta caretta*) und 5 Nester der Suppenschildkröte (*Chelonia mydas*) erfasst. Die Nester waren nicht gleichmäßig verteilt, sondern in bestimmten Flächen konzentriert. Der Nisterfolg betrug bei *C. caretta* 40,2% und bei *C. mydas* 50,0%. Die Nestdichte bei *C. caretta* betrug 26,4 Nester/km und bei *C. mydas* 3,6 Nester/km. Die durchschnittliche Entfernung der Nester von der Wasserkante betrug 12,9 m bei *C. caretta* und 19,7 m bei *C. mydas*. Nester, die durch Überspülung bedroht waren, wurden an sichere Stellen des Strandes versetzt. Zur Verhinderung der Prädation wurden Metallkäfige eingesetzt. Es wurden Maßnahmen zur Bewußtseinsbildung bei der Bevölkerung durchgeführt. Entlang der libanesischen Küste besteht ein starker Entwicklungsdruck und zum Überleben der Meeresschildkröten von El-Mansouri ist die Einleitung von sofortigen Schutzmaßnahmen erforderlich.

Key words. *Caretta caretta*, *Chelonia mydas*, population assessment, threats, public awareness.

Introduction

In the Mediterranean, the location of most marine turtle rookeries is known. Extensive research has revealed that the main nesting grounds for *Caretta caretta* are in Turkey, Greece (YERLI & DEMIRAYAK 1996, MARGARITOU LIS 2000), and possibly in Libya (LAURENT et al. 1995), with smaller numbers recorded in Cyprus, Israel, Syria and Egypt (BRODERICK & GODLEY 1996, CAMPBELL et al. 2001, KASPAREK 1993, 1995, SILBERSTEIN & DMIEL 1991). Annual nesting numbers remain speculative due to lack of standardised monitoring on several nesting beaches especially in Libya and Turkey. *Chelonia mydas* nesting is mainly concentrated in Turkey and Cyprus. It has been estimated that only 115–580 Green Turtles nest there annually (KASPAREK et al. 2001). Globally, both species are categorised as endangered

in the 2000 IUCN Red Data list while the Green Turtle Mediterranean population has been classified as critically endangered (HILTON-TAYLOR 2000).

An Action Plan for the Conservation of Mediterranean Marine Turtles has been prepared by the *Regional Activity Centre for Specially Protected Areas (RAC/SPA)* of the *United Nations Environmental Programme / Mediterranean Action Plan (UNEP/MAP)* aiming to conserve and enhance the populations and habitats of marine turtles in the Mediterranean. One of the stated priorities of the Action Plan is the identification of new potential nesting areas with special priority accorded to *C. mydas* (UNEP/MAP RAC/SPA, 1999).

A survey carried out in 2001 along the entire 200 km Lebanese coastline by MEDASSET, RAC/SPA and the Lebanese Ministry of the Environment provided evidence that besides the known nesting beach in the Palm Island reserve, both *C. caretta* and *C. mydas* nest in areas previously not known to host nesting populations (DEMIRAYAK et al. 2002). There was additional evidence that in particular the beach at El-Mansouri could be an important nesting site for both turtle species. Little data was available regarding the relative importance of other nesting beaches along the Lebanon coast as the 2001 survey was mostly carried out late in the nesting season.

This study was carried out for MEDASSET, the Mediterranean Association to Save the Sea Turtles, aiming to gain further information about nesting numbers of *C. mydas* and *C. caretta* at El-Mansouri beach. Other objectives were to identify possible threats to the nesting populations, to carry out relevant conservation measures and to raise public awareness about the serious threats facing marine turtles in Lebanon and the Eastern Mediterranean.

Material and methods

Study Area

El-Mansouri beach is located in South Lebanon, approximately 15 km south of the city of Sour and within the boundaries of Qaliye and Mansouri municipalities (Fig. 1.) The beach is 1.4 km long and extends from 33°11'48''N and 35°11'69''E in the north to 33°10'73''N and 35°11'49''E in the south. The southern end of the beach lies within the United Nations security zone of South Lebanon. A stretch of beach 170 m long is unsuitable for nesting, as the sand has been completely extracted leaving exposed rock. A further 250 m section has an exposed tidal rocky shelf, which is only submerged at infrequent high tides making this beach area mostly inaccessible to nesting turtles. The remainder of the beach consists of fine sand behind a coralline reef at the low tide line, so the total length of beach available for nesting throughout the nesting season is approximately 1 km.

The sandy area of the beach varies in width from 10 to 30 m, with dune vegetation extending a further 10-40m to a wall demarcating private agricultural land. The beach is flattest at the northern and southern ends with a higher profile in the middle. There is also a steep wave cut platform extending for about 150 m in the middle section of the beach. At the northern end a large beachside house illuminates the beach with bright security lights at night. At the southern end



Fig. 1. Map of Lebanon showing the location of the study area.

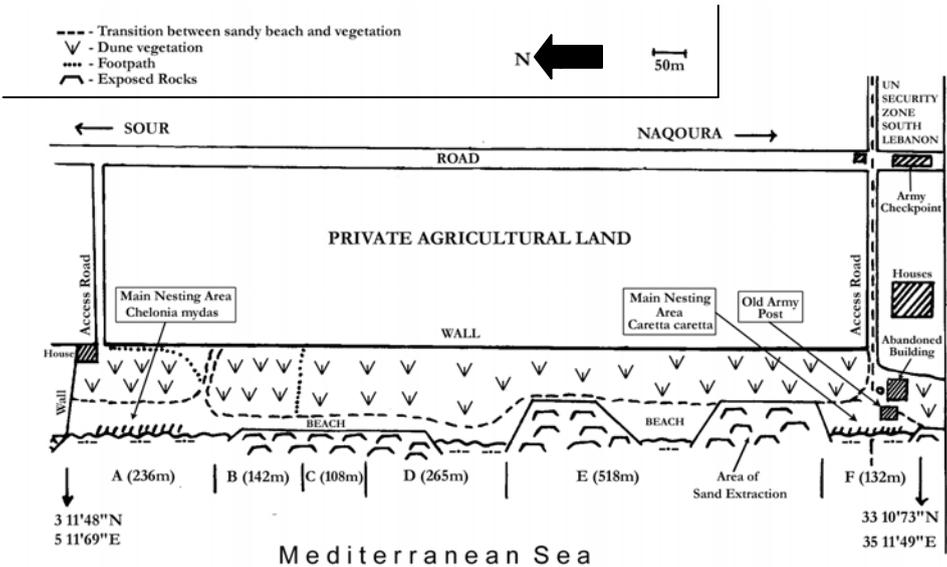


Fig. 2. Map of El-Mansouri beach.

stands a ruined house next to the beach with inhabited buildings behind it and streetlights that illuminate part of the beach at night. There is also an abandoned army watch-post on the beach that is crumbling, with tyres, sandbags and concrete blocks spilling from it, onto the beach. Access to the beach is limited by private agricultural land, but there is an open access road next to the ruined building at the southern end, and a road and footpath at the northern end. Few people, mostly fishermen, use the beach during the week (usually less than 10) but at weekends local families frequent it for swimming (30–80 people).

There is a moderate level of litter on the beach, some of which is sea-borne, most being left by visitors. The access road at the southern end is used for dumping rubbish in the dunes behind the beach. There are no litter collection facilities.

Nest survey methodology

El-Mansouri was surveyed every day from 15th June 2002 until 18th July 2002. The beach was divided into 6 sectors (A-F), co-ordinates and description of which can be found in the Appendix. Sectors were marked out using painted wooden posts. It is advised that the same sectors should be used for any future monitoring study thus allowing seasonal comparisons of nesting activity.

Surveys normally began around 5.30 am and involved walking the length of the beach looking for signs of nesting activity. The location of all emergence tracks was recorded using a Geographical Positioning System (GPS). The turtle species making the tracks, track width and pattern were recorded (cf. DEMETROPOULOS & HADJICHRISTOPHOPOULOU 1995, PRITCHARD & MORTIMER 1999). Tracks not resulting in nests were recorded as “false crawls” while those resulting in nests were recorded as “nesting emergences”.

Each nest was investigated to confirm the presence of eggs. If eggs were found then the distance of the nest from the sea was recorded and location measurements were taken to at least two

distinctive beach features. The nest was marked in a cryptic fashion to allow for re-location at any later date. Each nest was given a sector code and numbered incrementally. Given the period when the survey was conducted, no nests hatched during the survey.

It was not possible to collect data during the night due to the proximity of El-Mansouri to the border, and for safety concerns.

After all data had been recorded, the tracks and other nesting signs such as body pit escarpments were covered over to prevent predators from recognising visual nesting clues and to avoid recounting the same tracks on the following day.

Nest protection

During the 2001 nesting survey at El Mansouri there were signs of considerable nest predation by dogs and/or foxes (DEMIRAYAK et al 2002). As the placing of protective metal grills over turtle nests has been demonstrated to have reduced nest predation in several experiments, protective metal grills were placed over some nests at El-Mansouri. The strong metal grills (1 m²) with a mesh opening of 8x10 cm were placed over the nests, centred above the egg chamber. The grills were secured at the four corners by metal pegs and covered with an 8-10 cm layer of sand in order to disguise their location. Four nests considered threatened by tidal inundation were relocated to safer places higher up the beach, within the first 12 hours after egg deposition (Tab. 2).

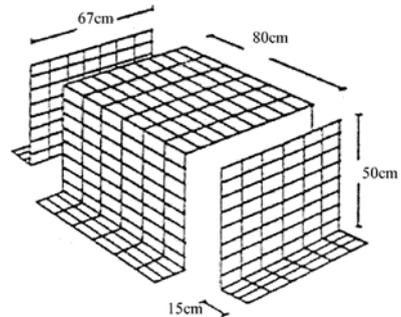


Fig. 3. Cage designed to protect turtle nests, used for Public Awareness.

Public awareness creation

The success of any sea turtle conservation effort largely depends on raising public awareness of the plight of these species in order to change the way people view their relationship with nature. To fulfil this aim various informative and educational initiatives were carried out in Lebanon.

- Articles referring to the El-Mansouri sea turtles were published in the Arabic daily "Al-Mustaqbal" and the English language "Daily Star" newspapers.
- An article in the "Al-Mustaqbal" referred to a stranded Green Turtle and the need for establishing special treatment facilities.
- A television interview was broadcast on the Al-Mustaqbal TV channel news.
- The international French agency AFP (Agence France Presse) covered a morning beach survey.
- Video footage of the work at El-Mansouri was recorded with a view to creating an educational video.
- Production of a conservation leaflet was initiated.
- An open day and beach clean-up operation was held.
- A set of monitoring guidelines was produced to help training of any future project volunteers.

Public awareness of nest protection

ADDISON & HENRICY (1994) demonstrated that mesh cages were more effective than mesh squares at protecting turtle nests as they prevented predators from digging underneath them. In

order to provide a visual aspect to turtle nest protection at El-Mansouri, two cages designed to protect turtle nests were placed on the beach on July 3rd 2002: one in Sector A and the other in Sector F. Both cages were built to the design of ADDISON (1997) but to different dimensions using available material (Fig. 3). Stiff fencing mesh with a mesh size of 8x10 cm was used, small enough to prevent predators from getting at the eggs but large enough for the hatchlings to exit. The top was 67x80 cm, two sides were 50x80 cm and the other two sides were 50x67 cm. A 15 cm flap was bent outwards along the base of all the sides. The sides were held together with strong nylon ties. The cages were buried to a depth of about 30 cm, and a trench was dug around the cage to enable the flaps to be set flat. Once covered with sand the cages required considerable effort to remove.

Both these beach sectors have public access and are subject to both intensive nesting activity and beach use by locals. A sign was placed next to each cage with a photograph of a nesting green turtle and an inscription in Arabic that read "Will you help us protect the sea turtles nests? Please Do Not Disturb" and signed as "Friends of the Sea Turtles". In addition, the cage in Sector A had the name of the Municipality of Qaliye written on it. The cages and notices were checked daily for any sign of interference. It should be noted that although the signs indicated that the cages were placed on live nests, in reality they were placed arbitrarily on the beach. The purpose was to use the cages as a public awareness tool and depending on the reaction of people to their presence on the beach, to evaluate their suitability for future nest protection.

Results and discussion

Population size and nest distribution

A total of 42 nests were recorded at El-Mansouri between June 16 and July 18, of which 37 were *C. caretta* and 5 were *C. mydas*. For *C. mydas* the beach at El-Mansouri would appear to be a nesting area of moderate importance, with numbers comparable to some beaches of the Southern Karpaz, Cyprus (KASPAREK et al. 1998). The number of *C. caretta* nests recorded is at least similar to some of the Turkish nesting sites, e.g. those at Patara (TAŞKIN & BARAN 2001) over a corresponding time period. According to this data, El-Mansouri seems to be the only known beach of the Syrian-Lebanese coastline where *C. caretta* nesting numbers compare to other acknowledged nesting sites of the Mediterranean.

To calculate the nesting population, an assumption that each turtle nests on average three times in a season every 2-3 years is usually used. On this basis, approximately 12 *C. caretta* and 2 *C. mydas* nested at El-Mansouri during the course of this study. The total nesting over the course of the entire nesting season is thought to be higher.

Nests were not evenly distributed along the beach, but showed areas of distinct concentration (Tab. 1). In Sectors A and F the tidal rocky shelf is permanently submerged and the beach being generally flat these are the most accessible areas for nesting. Sector F has the most human use and there is a garbage problem together with light pollution. It is also the sector where sand extraction was witnessed. Sectors B and C are accessible from the sea but have a very steep wave cut slope that restricts turtle access to the beach. Sector D has areas of exposed rocks and a stretch of sandy beach more suitable for nesting, while sector E, the widest stretch of the beach, has suffered heavily from sand extraction and is mostly characterized by exposed rocks with only part of the beach suitable for nesting. For *C. caretta* the highest nesting activity occurred in Sector F with 17 nests (46%) while for *C. mydas*, 4 of the 5 nests were laid in Sector A (80%). Therefore, with the heavier human use, *C. caretta*

Tab. 1. Nest distribution of *Caretta caretta* and *Chelonia mydas* at El-Mansouri beach in 2002.

Sector	<i>Caretta caretta</i>				<i>Chelonia mydas</i>				Total	
	Emergences	Sector % of emergences	Nests	Sector % of nests	Emergences	Sector % of emergences	Nests	Sector % of nests	Total Nests	Sector % of total nests
A	23	25	10	27	8	80	4	80	14	33
B	4	4	0	-	0	-	0	-	0	-
C	5	6	0	-	1	10	0	-	0	-
D	16	17	7	19	1	10	1	20	8	19
E	3	3	3	8	0	-	0	-	3	7
F	41	45	17	46	0	-	0	-	17	41
A-F	92	100	37	100	10	100	5	100	42	100

Tab. 2. Results of nest protection and relocation at El-Mansouri beach in 2002.

Sector	<i>Caretta caretta</i>			<i>Chelonia mydas</i>		
	Nests per sector	Nests relocated and protected	Nests protected in situ	Nests per sector	Nests relocated and protected	Nests protected in situ
A	10	2	7	4	0	1
B	0	0	0	0	0	0
C	0	0	0	0	0	0
D	7	1	5	1	0	0
E	3	1	1	0	0	0
F	17	0	11	0	0	0
A-F	37	4	24	5	0	1

nests in Sector F are most at risk from human disturbance. There is no nesting of either species in Sectors B and C. Most *C. mydas* nesting activity occurred in Sector A, which has a wide beach and fine sand, however, a bright spotlight illuminates part of the section and *C. mydas* nesting occurred in the unlit part of the beach.

The mean distance of *C. caretta* nests from the water line was 12.9 m. (6.0–20.0 m), while *C. mydas* nests averaged 19.7 m (10.5–30.0m).

Nesting proportion and success

A total of 92 *C. Caretta* emergences were recorded at El-Mansouri during the study period, of which 37 (40.2%) resulted in nests; for *C. mydas*, the corresponding values were 10 emergences of which 5 (50.0%) resulted in nests. Although these figures do not represent a whole nesting season, it is perhaps useful to make some comparisons with nesting percentages recorded at other nesting beaches. For *C. caretta*, TAŞKIN & BARAN (2001) gave the nesting success at Patara, Turkey as 25.4%; ILGAZ & BARAN (2001) reported 36.4% at Dalyan, Turkey and 19.4% at Northern Karpaz, Cyprus. For *C. mydas*, ILGAZ & BARAN (2001) reported the nesting percentage at Northern Karpaz as 18.2%, and also noted that DURMUŞ (1998) gave the nesting percentage for *C. mydas* at Kazanlı and Samandağ in Turkey as 40.0% and 34.4% respectively.

The higher than average nesting success at El-Mansouri possibly reflects the low level of human disturbance on the beach, maybe as a result of the beach having been off limits at night recently. Other influencing factors could be the quality of the sand, the beach profile or the absence of much artificial illumination of the beach at night. Again full season monitoring would be needed to determine a more accurate assessment of nesting success.

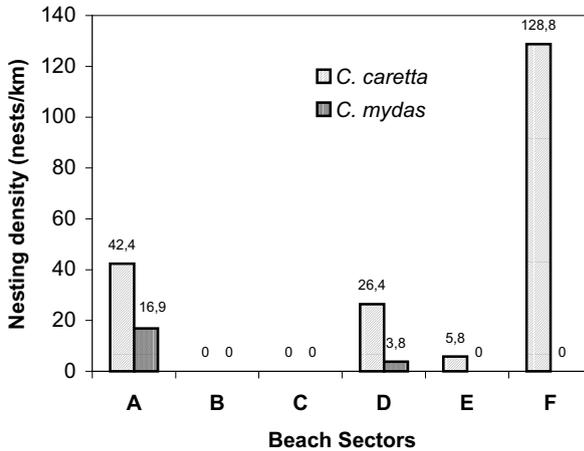


Fig. 4. Nesting density of *C. caretta* and *C. mydas* per sector, at El-Mansouri.

Nest density

Nesting density of *C. caretta* at El-Mansouri during the course of the study was 26.4 nests/km. This figure does not take account of nests laid outside this peak period, which would give a higher density. Full season monitoring at other locations gave rise to the following figures, among others: 2.9 nests/km at Northern Karpaz, Cyprus and 28.7 nests/km at Dalyan, Turkey (ILGAZ & BARAN 2001), 7.4 nests/km at Patara, Turkey (TAŞKIN & BARAN 2001), 235.6 nests/km on Zakynthos (Greece), 12.8 nests/km at Kyparissia Bay (Greece) and 36.6 nests/km at Rethymnon, Crete, Greece (MARGARITOU LIS 2000) and 1.0 nests/km in Israel (SILBERSTEIN & DMIEL 1991).

The nest density of *C. mydas* at El Mansouri during the study was 3.6 nests/km, however, full season figures may well be higher. KASPAREK et al. (2001) reviewed nesting densities in the Mediterranean, and report densities ranging from <0.1 nests/km at some less significant nesting beaches to local concentrations of up to 143.3 nests/km at some of the significant nesting beaches.

The spatial distribution of nesting density, per sector, for *C. caretta* and *C. mydas*, is shown in Fig. 4.

Nest protection and relocation

Four *C. caretta* nests with a total of 291 eggs, being threatened by tidal inundation, were transferred to other parts of the beach: Two from Sector A and 1 each from Sectors D and E (Tab. 2). The mean clutch size of these nests was 72.7 (53–86, $n = 4$) eggs per nest. BRODERICK & GODLEY (1996) gave a mean clutch size of 70.0 for the whole of northern Cyprus beaches, and other comparative studies gave 80.1 at Patara (TAŞKIN & BARAN 2001), 81.0 at Dalyan (ILGAZ & BARAN 2001), 82.0 for Israel (SILBERSTEIN & DMIEL 1991), and 64.3 in Northern Sinai, Egypt (CAMPBELL et al. 2001). Average clutch size can vary between seasons, and with such a small sample size only tentative comparisons can be made to other



Fig. 5. El-Mansouri beach looking south from Sector D, showing irrigation stream running into the sea (Photograph: N. NEWBURY).

studies, but the mean clutch size at El-Mansouri appears to fall within the known range for the Eastern Mediterranean area.

A total of 24 *C. caretta* and 1 *C. mydas* nests were covered with protective metal grids (Tab. 2). During the course of the study none of the protected nests were predated, however dogs destroyed 1 unprotected nest. Dogs were encountered on at least twelve occasions on the beach during the morning surveys, sometimes up to 3 at a time, and there were often signs of digging in the sand. A fox, *Vulpes vulpes*, was also seen on one occasion close to the beach.

In 2001 considerable nest predation was recorded at El-Mansouri (DEMIRAYAK et al. 2001), therefore the placing of metal grids in this study can be considered to have helped reduce predation. It must be noted however that the increased presence of researchers on the beach could have also deterred nest predators. YERLI et al (1997) have suggested that human scent signs from digging activities around the nests could influence predator behaviour.

Public awareness

There was positive feedback about the beach clean-up from people in the local community. Although the municipality was very slow to act in removing the collected rubbish, they indicated a willingness to help and it is hoped this will improve the situation in the future and will lead to a more regular clean up system. The municipality was also asked for some informative signs to be placed at the end of the beach access roads to dissuade people from leaving litter on the beach and to suggest ways in which they can help the conservation efforts.



Fig. 6. Cage and sign used in public awareness programme at El-Mansouri beach (sector A). This was an experiment to assess the reaction of the public to the presence of cages and their suitability for nest protection in the future (Photograph: N. NEWBURY)

Other beaches

Several beaches close to El-Mansouri were occasionally visited during the study period to check for any signs of nesting. To the north of El-Mansouri the following were visited:

North Sour beach (10th July 2002)– The beach is compacted and heavily used. No signs of turtle nesting, but a stranded dead *C. caretta* was found, too decomposed to measure. Locals on the beach reported having seen turtles nesting in the northern part of the beach, which is morphologically more suitable for nesting purposes. Sadly the same locals told how they collect the turtle eggs to sell for their reputed aphrodisiac qualities.

Shaaron beach (10th July 2002)– A false crawl by *C. mydas* and evidence of a *C. caretta* nest were discovered. The nest was laid in front of an illuminated beach house.

Qasmiye beach (18th June 2002)– 2 false crawls belonging to *C. caretta*.

South of El-Mansouri beach (8th July 2002) - there are several rocky coves with thin strips of sand. A *C. caretta* false crawl was recorded and a dead *Caretta* was found.

Conservation outlook and recommendations

El-Mansouri has now been confirmed as one of the main areas of marine turtle nesting activity along the Lebanese coast, hosting both *C. caretta* and *C. mydas*. An ongoing seasonal monitoring programme needs to be established based on the methodology adopted in this study, in order to collect reliable and comparable data on nesting activity over a number of seasons. In order to ensure protection of the nesting beach, a concerted conservation effort is

required to institute active conservation measures yielding maximum conservation returns. It is anticipated that international help may be needed both in terms of finance and personnel.

The local municipality of Qaliye have expressed their wish to help and this should be encouraged, indeed their participation is vital.

- Barriers should be erected to prevent vehicle access to the beach, particularly at the access to Sector F.
- Regular cleaning of the beach and the sand dunes to discourage predators and provision of rubbish bins that get emptied.
- Removal of the old army watch post and associated debris from Sector F.
- Provision of informative signs at the accesses to the beach, informing people about the turtles and their status, also requesting beach users not to leave litter or disturb nests.
- Switching off or screening any lights that shine on to the beach at night.
- Initiate a local awareness programme to inform people about the sea turtles plight and that El-Mansouri is a turtle-nesting beach, and to encourage people to take part in the conservation work. Any conservation project will ultimately only succeed with the involvement of the local community.
- Enforcement of tighter controls over sand extraction from the nesting beach.
- A programme to encourage responsible dog ownership and to deal with the problem of feral dogs in conjunction with a Lebanese or International animal welfare organisation.

The previous survey in 2001 revealed that urban sprawl, uncontrolled development and badly planned tourist investments are all threatening the remaining Lebanese coastline (DEMIRAYAK et al 2002). In the face of such destructive forces it will only be possible to maintain a turtle population in Lebanon by at least protecting the key nesting sites along the coast. The Palm Islands have been declared a Nature Reserve Area and so has the coast from South Sour to Rachidieh Refugee Camp, although both are in need of better implementation of protection measures. In hosting both species of Mediterranean nesting turtle at the reported numbers, it is vital El-Mansouri should be accorded some protective status and conservation activities implemented.

The South Sour Reserve could be extended south to include El-Mansouri, but such a proposition would need a proper workable management plan which would be incorporated into a National Action Plan in order to protect turtles along the whole Lebanese coastline. Ultimately it is hoped that this would lead to the inclusion of El-Mansouri within a wider Mediterranean network of coastal protected areas for marine turtles.

Lebanon is predicting a growth in tourism and when the region stabilises politically there will be pressure for further coastal development. It is possible to draw a parallel with the nesting beaches of Northern Sinai in Egypt. Since the end of the Israeli occupation, the Sinai coast has been undergoing widespread tourist development (CAMPBELL et al. 2001) and a similar pattern could emerge in South Lebanon. It is not too late to learn from the mistakes of other countries, which have allowed extensive tourist development to take place along nesting beaches to the detriment of marine turtles, for example Rethymnon in Crete and Belek in Turkey.

The land next to the beach at El-Mansouri is currently being purchased, with rumours of long-term plans to develop a tourist resort complex, which would undoubtedly have a very negative impact on this small but important turtle population.

There is a need to implement a national public awareness campaign about marine turtles and also the wider threats to biodiversity and the environment, continuing the effort already started at El-Mansouri. It is particularly important to inform fishermen of the impact of their



Fig. 7. Placing a mesh grid over a *C. caretta* nest at El-Mansouri beach. This was considered to have reduced predation in relation to that observed in the previous year's survey (Photograph: Habiba SYED).

activities on the marine turtle populations, and to examine ways of reducing this impact including possibly following the example of Cyprus and banning inshore fishing during the turtle nesting season: this could involve controlling the time of day during which nets can be set, prohibition of bottom set nets during the turtle season and depth limits on trawling (DEMETROPOULOS & HADJICHRISTOPHOROU 1995). Such measures will stand a better chance of being accepted if fishermen can be persuaded that they will contribute to sustainable fish stocks in the future.

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References

- ADDISON, D. S. (1997): Galvanized wire cages can prevent nest depredation. – *Marine Turtle Newsletter* 76: 8–11, Toronto.
- ADDISON, D. S. & S. HENRICY (1994): A comparison of galvanized wire mesh cages vs. flat chain-link screen in preventing *Procyon lotor* depredation of *Caretta caretta* nests. In: K. A. Bjorndal, A. B. Bolten, D. A. Johnson & P. J. Eliazar (Eds.), *Proceedings of the Fourteenth Annual Symposium on Sea Turtle Biology and Conservation*. – U.S. Department of Commerce. NOAA Technical Memorandum NMFS-SEFSC-351. p.174, Miami.
- BRODERICK, A. C. & B. J. GODLEY (1996): Population and nesting ecology of the Green Turtle, *Chelonia mydas*, and Loggerhead Turtle, *Caretta caretta*, in northern Cyprus. – *Zoology in the Middle East* 13: 27–46, Heidelberg.
- CAMPBELL, A. C., M. CLARKE, C. S. EDWARDS, S. GHONEIM & W. SALAMA (2001): On status and conservation of marine turtles along the Egyptian Mediterranean Sea coast: results of the Darwin

- Initiative Sea Turtle Conservation Project 1998-2000. – Zoology in the Middle East 24: 19–29, Heidelberg.
- DEMETROPOULOS, A. & M. HADJICHRISTOPHOROU (1995): Manual on Marine Turtle Conservation in the Mediterranean. – UNEP(MAP)SPA, IUCN, CWS & Fisheries Department, MANRE (Cyprus). Nicosia, 77pp.
- DEMIRAYAK, F., L. VENIZELOS, R. SADEK, S. HRAOUI & M. KHALIL (2002): Marine Turtle Conservation in the Mediterranean – Lebanon: A first survey for *Chelonia mydas* and *Caretta caretta* in Lebanon. – Proceedings of the Twenty Second Annual Symposium on Sea Turtle Biology and Conservation. Miami (in press).
- DURMUŞ, S. H. (1998): An investigation on biology and ecology of the sea turtle population on Kazanlı and Samandağ beaches [in Turkish]. – Ph.D. Thesis. Dokuz Eylül Üniversitesi, Graduate School of Natural and Applied Sciences, Izmir.
- ILGAZ, Ç. & İ. BARAN (2001): Reproduction biology of the marine turtle populations in Northern Karpaz (Cyprus) and Dalyan (Turkey). – Zoology in the Middle East 24: 35–44, Heidelberg.
- HILTON-TAYLOR C. 2000 (COMP.) (2000): IUCN Red List of Threatened species. IUCN, Gland.
- KASPAREK, M. (1993): Survey of the Mediterranean coast between Alexandria and El-Salum. – Marine Turtle Newsletter 63: 8–9, Toronto.
- KASPAREK, M. (1995): The nesting of marine turtles on the coast of Syria. – Zoology in the Middle East 11: 51–62, Heidelberg.
- KASPAREK, M., B. J. GODLEY & A. C. BRODERICK (2001): Nesting of the Green Turtle, *Chelonia mydas*, in the Mediterranean Sea: a review of status and conservation needs. – Zoology in the Middle East 24: 45–74, Heidelberg.
- LAURENT, L., M. N. BRADAI, D. A. HADOUD & H. E. GOMATI (1995): Marine turtle nesting activity assessment on Libyan coasts. Phase I: survey of the coasts between the Egyptian border and Sirte. – RAC/SPA (MAP-UNEP), Tunis.
- MARGARITOU LIS, D. (2000): An estimation of the overall nesting activity of the Loggerhead Turtle in Greece. In: F. A. ABREU-GROBOIS, R. BRISENO-DUENAS, R. MARQUES & S. SARTI (Eds.), Proceedings of the Eighteenth International Sea Turtle Symposium. – U.S. Department of Commerce. NOAA Technical Memorandum (MFS-SEFSC-436), p. 48, Miami.
- PRITCHARD, P. C. H. & J. A. MORTIMER (1999): Taxonomy, External Morphology, and Species Identification. p. 21–38. In: K.-L. Eckert, K. A. Bjørndal, F. A. Abreu-Grobois & M. Donnelly (Eds.), Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No 4: 21–38, Blanchard.
- SILBERSTEIN, D. & R. DMIEL (1991): Loggerhead Sea Turtle Nesting in Israel. – Marine Turtle Newsletter 32: 6–8, Toronto.
- TAŞKIN, N. & İ. BARAN (2001): Reproductive ecology of the Loggerhead Turtle, *Caretta caretta*, at Patara, Turkey. – Zoology in the Middle East 24: 91–100, Heidelberg.
- UNEP/MAP, RAC/SPA (1999): Revised Action Plan for the Conservation of Mediterranean Marine Turtles as adopted by the contrasting parties Annex IV, Appendix VIII In: Report of the 11th Ordinary Meeting of the Contracting Parties for the protection of the Mediterranean Sea against pollution and its protocols UNEP (OCA)/MED IG 12/9, Tunis.
- YERLI, S. V. & F. DEMIRAYAK (1996): Marine turtles in Turkey: A Survey of Nesting Site Status. – DHKD. CMS Rep No 96/4, Istanbul.
- YERLI, S., A. F. CANBOLAT, L. J. BROWN & D. W. MACDONALD (1997): Mesh grids protect Loggerhead Turtle *Caretta caretta* nests from Red Fox *Vulpes vulpes* predation. – Biological Conservation 82: 109–111.

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Appendix

Description of beach sectors A-F in El-Mansouri (north - south)

Sector A

Boundaries: From the rocks and vegetation at the northern end of the beach, 33°11'48"N and 35°11'69"E extending to the southern bank of the dry stream before the beach starts to narrow at 33°11'35"N and 35°11'68"E.

Length: 236 m.

Width: 15-30 m. of sandy beach, backed by dune vegetation extending up to 40 m. to a wall and trees marking the edge of private agricultural land.

Description: The near shore rocky shelf is submerged, so there is a good stretch of accessible nesting beach with fine sand.

Environmental conditions: There is a large house at the top of the beach at the northern end, which has wall-mounted spotlights that shine on to the beach all night. At present, people do not pay for their electricity so there is no incentive to switch off lights to save money, but charges are soon to be introduced. There is a public access road that runs next to the house. A footpath runs parallel to the wall at the back of the beach and then down on to the beach next to the dry streambed. A high number of Ghost Crab (*Ocypode cursor*) burrows were found.

Sector B

Boundaries: From the southern bank of the dry stream at 33°11'35"N and 35°11'68"E to the raised ridge on the sand dunes at 33°11'27"N and 35°11'68"E.

Length: 142 m.

Width: 10-15 m.

Description: The beach narrows and becomes steeper moving southwards. It is backed by raised sand dunes with bamboo vegetation.

Environmental conditions: The rocky shelf is exposed in some places, limiting access to the beach. There is a pathway leading down to the beach from private property.

Sector C

Boundaries: From the sand dune ridge at 33°11'27"N and 35°11'68"E extending to where there is a gap in the dune vegetation at 33°11'22"N and 35°11'65"E.

Length: 108 m.

Width: 15-20 m.

Description: The rocky reef is heavily exposed and there is a very steep, high wave cut platform. The dune vegetation extends back 40 m. to the boundaries of the agricultural land. The raised sand dunes level out towards the southern end of the sector.

Environmental conditions: The exposed rocks and the steep slope make the top of the beach almost inaccessible for nesting.

Sector D

Boundaries: From the gap in the sand dune vegetation at 33°11'22"N and 35°11'65"E extending to the beginning of the exposed rocky part of the beach at 33°11'08"N and 35°11'60"E.

Length: 265 m.

Width: 15-20 m.

Description: The area of exposed rock gradually becomes submerged moving southwards through the sector. There is a very steep slope, up to 3 m. high, that becomes further set back from the tide line so that a second wave cut slope becomes apparent in the southern part of the sector. Eventually the beach levels out and becomes wider and more suitable for nesting.

Environmental conditions: There is a lot of seaweed along the length of the sector and a large number of Ghost Crab (*Ocypode cursor*) burrows were present at the southern end of the sector.



Fig. 8. Sector E, El-Mansouri beach, showing area of sand extraction with thin strip of beach left at top. The rocks that are exposed at low tides may prevent hatchlings from reaching the sea (Photograph: N. NEWBURY).

Sector E

Boundaries: From where the rocks start at 33°11'08"N and 35°11'60"E up to the end of the rocks at 33°10'80"N and 35°11'51"E. There is an area in Sector E where all the sand has been extracted from the beach leaving only bare rock. This area extends from 33°10'90"N and 35°11'55"E to 33°10'80"N and 35°11'51"E.

Length: 518 m. However the area where the sand has been removed is 169 m. in length so only 349 m. can be considered as sandy beach.

Width: 3-30 m.

Description: At the start of the sector the beach curves inland and the rocky shelf is heavily exposed, with only a thin strip of beach behind it. Most of the sector is inaccessible for nesting, however there is a stretch of about 80 m. where the rocks are submerged, through which turtles have access to the beach. This part of the beach is the widest extending up to 30 m. There are sand dunes behind the beach, which are bounded by the walls of the private agricultural land.

Environmental conditions: Only part of the beach can be used for nesting, and hatchlings may have to struggle to reach the sea. Depending on the tides they could end up stranded behind the rocks. The rocks are frequently used by fishermen. Spear and gillnet fishing at night with lights was often observed close to the rocks.

Sector F

Boundaries: From where the rocks become submerged at 33°10'80"N and 35°11'51"E extending to the rocks at the end of the beach at 33°10'73"N and 35°11'49"E.

Length: 132 m.

Width: 10-25 m.

Description: The beach is widest and least disturbed at the northern end where the sand is fine. It narrows and the sand becomes a coarser shingle moving southwards. The beach is backed by dune vegetation.

Environmental conditions: In the middle of the sector there is an access road that runs right down the beach. Vehicles are sometimes driven on to the beach, leaving deep tracks in the sand. Rubbish is dumped along the sides of the road, which can attract scavengers. There is an abandoned house next to the beach, behind which are inhabited buildings whose lights together with a streetlight further back are visible from the beach at night. An old army watch post on the beach is falling apart littering the beach with concrete blocks, tyres, pieces of metal and other debris. On several occasions people were witnessed extracting sand for building purposes and digging large holes searching for worms to use as fishing bait. The beach is popular during weekends with local families, who often leave their litter behind.