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### On status and conservation of marine turtles along the Egyptian Mediterranean Sea coast: results of the Darwin Initiative Sea Turtle Conservation Project 1998-2000

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# On status and conservation of marine turtles along the Egyptian Mediterranean Sea coast: results of the Darwin Initiative Sea Turtle Conservation Project 1998–2000

by Andrew Campbell, Michael Clarke, Samir Ghoneim,  
Waheed S. Hameid, Christopher Simms, and Cassian Edwards

**Abstract.** Surveys showed that a small population (max. 37 nests per year) of Loggerhead Turtles (*Caretta caretta*), and the occasional Green Turtle (*Chelonia mydas*), nest along this coastline. Prime nesting areas are concentrated in the eastern region of the Northern Sinai coast close to the border with the Gaza Strip. Turtle nesting activity in the western region from Alexandria to the border with Libya is negligible, and no evidence of nesting was found in the Nile Delta region. The small population of nesting turtles that does exist in the eastern Sinai region is under severe pressure from human activity. Throughout the three year study evidence was found of capture and slaughter of adult turtles at sea; disturbance of nests and eggs on the beaches; reduction in hatching survival due to heavily polluted nesting beaches; and the loss of nesting sites due to widespread coastal development for tourism. Many hundreds of kilometres of seemingly suitable nesting beaches exist along the Mediterranean coast of Egypt. The number of sea turtles currently nesting in the area has probably been reduced to a fraction of its historic value due to human induced pressures. If the current population is to survive an immediate conservation effort is required; protection of the few remaining nesting beaches and education of the local population about the current plight of sea turtles is essential.

**Kurzfassung.** An der ägyptischen Mittelmeerküste existiert eine kleine Population (max. 37 Nester pro Jahr) der Unechten Karettschildkröte (*Caretta caretta*), und gelegentlich nistet auch die Suppenschildkröte (*Chelonia mydas*). Die wichtigsten Niststrände liegen im östlichen Teil der Küste des Nord-Sinai, nahe an der Grenze zum Gaza-Streifen. Dagegen ist die Anzahl der Nester zwischen Alexandria und der libyschen Grenze vernachlässigbar gering, und im Nil-Delta wurde kein Hinweis auf Nisten gefunden. Die kleine Population im nördlichen Sinai ist einem starken Druck ausgesetzt: während der gesamten Untersuchungsdauer wurden Hinweise auf Fang und Tötung von Alttieren auf See gefunden; Nester und Gelege der Schildkröten am Strand sind einer starken Beunruhigung ausgesetzt; die Schlüpflinge sind durch starke Verschmutzung der Niststrände einer erhöhten Mortalität ausgesetzt; die Entwicklung der Küstenregionen für den Tourismus verursacht einen Verlust von Niststränden. Entlang der ägyptischen Mittelmeerküste existieren viele hundert Kilometer an Stränden, die offenbar als Niststrände für Meeresschildkröten geeignet sind. Die Anzahl der Meeresschildkröten, die tatsächlich nisten, stellt jedoch aufgrund des starken menschlichen Druckes offenbar nur noch einen Bruchteil der einstigen historischen Population dar. Zum Überleben der gegenwärtigen Population ist ein sofortiges Schutzprogramm notwendig, dessen wichtigste Elemente der Schutz der verbliebenen Niststrände und eine Öffentlichkeitsarbeit unter der lokalen Bevölkerung sein sollten.

**Key words.** Sea turtles, *Caretta caretta*, *Chelonia mydas*, *Dermodochelys coriacea*, Mediterranean Sea, Middle East, nesting, threats.

## Introduction

By the mid-1990's, the locations of most of the marine turtle rookeries in the eastern Mediterranean have become known (CLARKE et al. 2000), and some areas in Cyprus, Greece and Turkey were particularly well surveyed (e.g. BARAN & TÜRKOZAN 1996, BRODERICK & GODLEY 1996, MARGARITOU LIS 1982). However, Egypt remained an exception, and apart from a pioneering survey carried out in 1993 that covered the coastline between Alexandria and El-Salum (KASPAREK 1993), little information was available on the use of its Mediterranean beaches by nesting turtles.

The northern Egyptian coastline is naturally divisible into 3 zones: the western zone from El-Salum on the Libyan border to Alexandria; the delta zone from Alexandria to Port Said; and north Sinai from Port Said to Rhafa on the border with Gaza (see Fig. 1). To the west of Alexandria the coast has already been affected by tourist development, and very few beaches remain there that are used for nesting (KASPAREK 1993a, 1993b). The Delta coastline is less developed, but it is suffering from erosion problems necessitating major works on the sea defenses that are incompatible with turtle nesting. The north coast of the Sinai Peninsula is now subject to re-population following the end of the Israeli occupation, and considerable development is planned there.

Apart from the pressures on nesting beaches, adult turtles at sea in Egyptian waters are frequently caught as by-catch. Reproductively active individuals are being lost from the population by drowning in fishing nets or removal for sale as food. Despite legislation making it illegal to sell turtles for human consumption in Egypt, some of these animals are slaughtered for food in the fish markets of Alexandria (KASPAREK 1993a, 1993b, LAURENT et al. 1996, VENIZELOS & NADA 2000, NADA 2001). Thus an evaluation of turtle nesting, exploitation and conservation in northern Egypt was timely and necessary to complete our knowledge of turtle ecology in the eastern Mediterranean and to put conservation proposals in place.

Support under the Darwin Initiative scheme was obtained in 1997 to establish the status of marine turtles along the Mediterranean coasts of Egypt and to identify the beaches currently used for nesting by Green and Loggerhead Turtles (*Chelonia mydas*, *Caretta caretta*). Other objectives of the project were the protection of nesting areas, eggs, hatchlings and breeding adults and raising the level of public and government awareness of the serious situation facing turtles in the Eastern Mediterranean.

## Strategies and methods

### Beach Surveys

During the main nesting season, from 20 May to 1 September 1998, all beaches deemed potentially suitable for turtle nesting on the Mediterranean coast of Egypt (615 km) were surveyed during daylight hours by two-man teams. Access to beaches was not permitted at night. Surveys were conducted by walking along a beach from east to west, one man on the waterline, the other following a parallel track 4 to 5 meters landwards. In this manner the tracks of emerging females usually up to two weeks old could be identified. Due to the very large distances involved, from 1999 onwards surveys were conducted using an all terrain vehicle, with two men riding along the beach. One rider scrutinized the water line while the other scrutinized the upper beach. Because the results of the 1998 survey indicated that virtually no nesting was taking place in the western zone and around the delta beaches (see Fig. 1), the surveys in 1999 and 2000 concentrated on the shores of the Sinai Peninsula (total length 200.7 km) where nesting had been recorded. Beaches

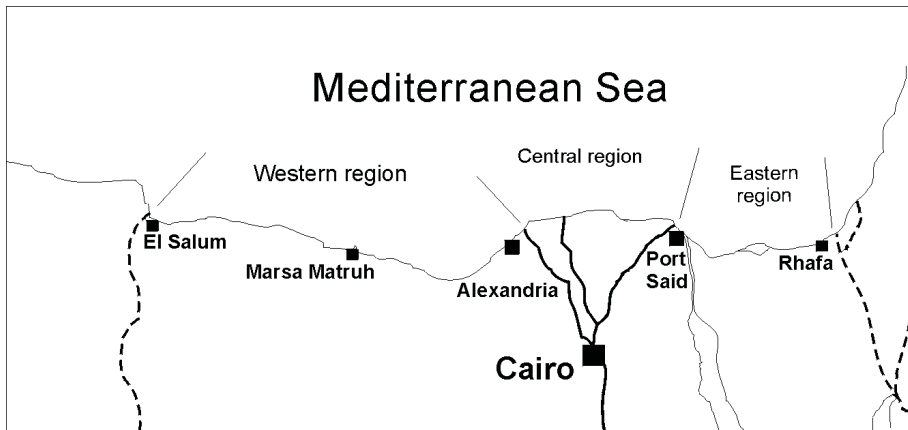


Fig. 1. Map to show the division of the Mediterranean coast of Egypt into three zones.

here were surveyed weekly at the beginning of the nesting season until the first emergence track was found, thereafter a beach was visited twice weekly. This meant that no track recorded was more than four days old. Observations on the longevity of tracks indicated that they could usually be identified up to two weeks after they were made, providing an exceptionally high spring tide had not occurred during that time. This allowed an estimate of the date of egg deposition accurate to within 4 days, to be made.

The location of all emergence tracks was recorded using a Magellen 2000 Global Positioning System (GPS). The species of turtle making the tracks and track width was recorded (cf. DEMETROPOULOS & HADJICHRISTOPHOROU 1995). The presence or absence of a nest and its distance from the shoreline was also carefully noted in every case. Each nest was investigated to determine the presence or absence of eggs. If eggs were found the nest was marked in a cryptic fashion to allow precise re-location at a later date.

During the 1999 and 2000 seasons, initial return visits were made to the nests to check for hatching 40 days after egg deposition, they were then re-checked every other day, this allowed the hatching date to be estimated to within one day. After hatching, the nests were excavated and an assessment of the number of eggs laid and the percentage hatching success was made in each case. The status of unhatched eggs was also determined as unfertilised, early development failure, mid development failure or late development failure.

The curved carapace length (CCL), species and location of all dead stranded adult turtles was also recorded.

The chief apparent threats to nesting turtles on the various beaches were also assessed during the course of the beach surveys and the proximity of beachfront developments to nesting beaches was measured.

### Public awareness creation

These were held at regular intervals and in various localities before invited audiences. Particular groups targeted were central and local government officials, police, the military who guard the beaches, fishermen, fish wholesalers, fish retailers, school children and the wider public. School visits were arranged in advance and in every case persons attending were given an appropriate



Fig. 2. Large unspoilt sand dunes are found in the western region between Marsa Matruh and El Salum. However, the number of nesting marine turtles is not significant. Photograph by Max KASPAREK, 1993.

momento, e.g. certificate of attendance, mosque prayer timetable for Ramadan, child's colouring book, address and telephone booklet, T-shirt or illustrated leaflet. All these items carried the essential conservation message for marine turtles along with details of how to contact the project.

In order to support the public awareness for turtle nesting beaches, beaches found to be significant nesting sites were marked with large signs, approximately 1.5 m by 2.5 m, bearing the Darwin Initiative and project logos (Fig. 3). These signs were written in both English and Arabic, explaining that the beach was a nesting site for marine turtles and that under Egyptian Law, it was illegal for nests to be tampered with. Local fishermen, their families and nearby villagers, as well as holiday makers using the beach, were leafleted.

Public awareness activities also included linking with international organisations and non-governmental organisations. A workshop, which was attended by 110 people, was held in November 2000 in Cairo. It attracted great interest from both national conservationists and the international conservation community.

### **Training**

A three-month training course, for four Egyptian biologists was arranged in London in early 1998 followed by field experience at the Lara marine turtle sanctuary in Cyprus. It covered basic turtle biology, systematics, anatomy, physiology, reproductive and nesting behaviour, track identification, migration and feeding. The field element included track identification, nest identification, nest protection, hatchery and hatchling management. A shorter one-week course, containing the essential elements of the above, was conducted in Egypt at the Zaranik protected area in northern Sinai. This was attended by university students, staff of the Egyptian Environmental Affairs Agency and local officials.

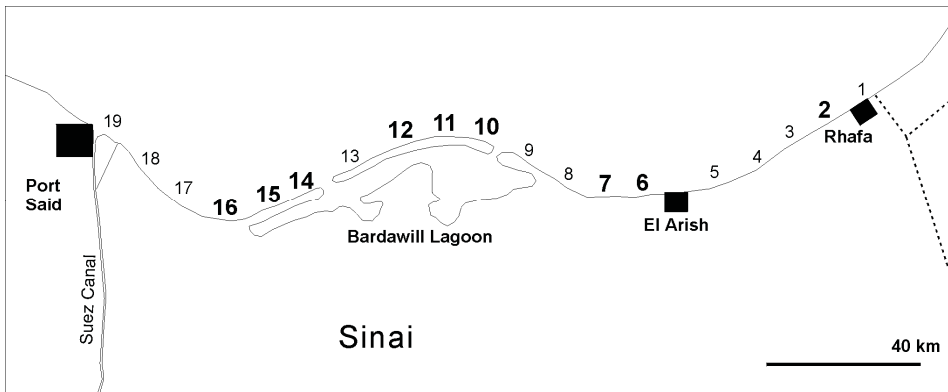


Fig. 3. The beaches of North Sinai. Beaches used for nesting are indicated in **bold**.

## Results and discussion

### Population status

Details of turtle nesting activity and the numbers of dead stranded turtles found along the Mediterranean coast of Egypt are shown in Tab. 1–2. During the 1998 survey season (31 May to 1 October), the western, central and eastern regions were surveyed for evidence of turtle nesting activity. Based on these results efforts were concentrated on the eastern region only during the subsequent 1999 season (23 May to 9 September), and 2000 season (26 May to 26 October). For the Green Turtle, one nest was found in 1998, none in 1999 and three in 1999. Nesting thus takes place on an occasional basis, and the numbers are less significant on a Mediterranean basis (cf. KASPAREK et al. 2001). The annual number of nests of *Caretta caretta* varied between 20 and 37, and all of them were found in the eastern beach section.

In the years 1998–2000, a total of 127 dead sea turtles was found along the coast. 105 of these belonged to *Caretta caretta*, 18 to *Chelonia mydas* and 4 to *Dermochelys coriacea*. It should be noted that significant numbers of turtles were also found on the central and western beaches (Tab. 2) where no regular turtle nesting occurs.

The mean Curved Carapace Length (CCL) of stranded adult *C. caretta* for 1988 were: Central region 602 mm, eastern region 594 mm and western region 446 mm. For 1999 and 2000 in the eastern region they were respectively 630 mm and 645 mm. For *C. mydas* the figures under the same headings were respectively 384 mm, 295 mm, 340 mm, 668 mm, and 680 mm.

Altogether, four stranded Leatherback Turtles, *Dermochelys coriacea*, were found along the coast, two in 1998 and one each in 1999 and 2000. The dates are: one on 4.6.1998 at 31°19'N/34°10'E (Curved Carapace Length 136 cm, Straight Carapace Length 98 cm), one on 10.6.1998 at 31°07'N/33°30'E (134/84 cm), one on 26.5.1999 at 31°17'N/34°56'E (skull only, length 29 cm, width 28 cm), and one on 3.6.2000 at 31°07'N/32°52'E (115/91 cm). There are only a few previous records of this species from the Mediterranean coast of Egypt: FLOWER (1933) had recorded one specimen in the Alexandria fish market and BAHA EL DIN (1992) reported three individuals dead on the coast of Sinai between the years 1985 and 1991.

Tab. 1. Summary of turtle nesting activity along the Mediterranean coast of Egypt from 1998 to 2000.

	1998			1999	2000
	East	Central	West	East	East
<b><i>Caretta caretta</i></b>					
number of emergence tracks	93	0	3	60	79
mean inner track width (cm)	20.2	–	21.3	16.8	13.9
mean outer track width (cm)	71.3	–	71.0	69.0	68.6
number of nests	20	0	0	27	37
mean clutch size	78	–	–	64.7	64.3
mean incubation time ( $\pm$ 5 days)	–	–	–	48.1	53.5
hatching success					
▪ successfully hatched	–	–	–	66.4%	76.2%
▪ early failure	–	–	–	1.1%	0.7%
▪ mid failure	–	–	–	0.9%	0.5%
▪ late failure	–	–	–	5.4%	2.4%
▪ unfertilised	–	–	–	25.9%	20.1%
▪ predated	–	–	–	0.5%	0.0%
<b><i>Chelonia mydas</i></b>					
number of emergence tracks	8	0	0	2	10
mean inner track width (cm)	24.4	–	–	15.5	14.8
mean outer track width (cm)	73.4	–	–	76.0	69.3
number of nests	1	0	0	0	3
mean clutch size	–	–	–	–	101
mean incubation time ( $\pm$ 5 days)	–	–	–	–	46.5
hatching success					
▪ successfully hatched	–	–	–	–	53.7%
▪ early failure	–	–	–	–	9.5%
▪ mid failure	–	–	–	–	5.5%
▪ late failure	–	–	–	–	9.5%
▪ unfertilised	–	–	–	–	4.0%
▪ predated	–	–	–	–	0.0%

### Main threats to nesting turtles

Due to the lack of nesting on the western and delta beaches these results concentrate on the eastern beaches of north Sinai. Threats were divisible into predation, pollution and beach development.

There was clear evidence of turtles being caught by fishermen from their boats at sea. Within the Lake Bardawil fishery there were signs of accidental adult turtle by-catch in fishing nets. Evidence was found of egg pilfering by humans during each survey season. A total of 10 pilfered nests was found on beaches 3 and 7 during 1998; four pilfered nests were found on beaches 2 and 3 during the 1999 season; and similarly four pilfered nests were found on beaches 2 and 3 during the 2000 season.





Fig. 4. Tourism development is the main threat to the nesting population of marine turtles. Here a crowded beach to the east of Alexandria, photograph taken in 1993 by Max KASPAREK.

Tab. 2. Spatial distribution of sea turtles found dead along the shores of the Mediterranean coast of Egypt 1998–2000.

	1998			1999	2000
	Central	East	West	East	East
<i>Caretta caretta</i>	13	21	10	33	28
<i>Chelonia mydas</i>	7	1	1	8	1
<i>Dermodochelys coriacea</i>	2	0	0	1	1

The high numbers of Ghost Crabs (*Ocypode cursor*) present on the Northern Sinai coast, almost certainly have an impact of hatchling survivorship (SIMMS et al., in press). Based on work by SMITH et al. (1996), crabs that occupy holes of diameter  $>3.2$  cm are considered to be of a size capable of depredating emerging hatchlings during their migration to the sea. By calculating the mean area of beach covered by hatchlings during their seaward migration, the number of Ghost Crabs and the amount of hatchling depredation was estimated. These estimates suggest that up to 66% of emerging hatchlings could be lost to Ghost Crab predation in this region (SIMMS et al., in press). This arose from direct discussions with fishermen and

from turtles being brought into the hatchery of Suez Canal Fish Research Centre at Al-Arish. Some of these turtles were captured within Lake Bardawill and some from the open sea.

Pollution was found to be a serious problem on almost every beach visited. Apart from tar and oil, non-biodegradable sea borne debris included plastic, rubber and nylon. The beaches in North Sinai were less seriously affected than those of the western zone. Debris affords shelter for Ghost Crabs and provided food in the form of attached invertebrates. Accumulations of sea borne debris on nesting beaches may concentrate crab populations and exacerbate the depredation problems mentioned above (SIMMS *et al.*, in press).

The western region of the Egyptian Mediterranean coast is already heavily developed for tourism and the sea defense activity on the delta beaches seems likely to deter nesting. The chief threat to the nesting beaches of the eastern region, North Sinai, comes from development associated with tourism, especially around the rapidly developing town of El Arish. The main regions of beachfront development are at Rhafa ( $31^{\circ}19'03$  N/ $34^{\circ}12'67$  E to  $31^{\circ}18'72$  N/ $34^{\circ}12'22$  E; total distance 0.97 km; beach 1, Fig. 2), Sheik Zwayed ( $31^{\circ}15'07$  N/ $34^{\circ}06'26$  E to  $31^{\circ}14'62$  N/ $34^{\circ}05'39$  E; total distance 1.61 km; beach 2, Fig. 2), El Arish ( $31^{\circ}08'53$  N/ $33^{\circ}51'96$  E to  $31^{\circ}06'71$  N/ $33^{\circ}41'26$  E; total distance 18.3 km; beach 5, Fig. 2), El Msagad ( $31^{\circ}06'79$  N/ $33^{\circ}51'96$  E to  $31^{\circ}08'53$  N/ $33^{\circ}33'90$  E; total distance 10.7 km; beach 6, Fig. 2), and Romana ( $31^{\circ}03'36$  N/ $32^{\circ}37'30$  E to  $31^{\circ}03'97$  N/ $32^{\circ}33'93$  E; total distance 5.8 km; beach 16, Fig. 2). Beachfront developments at the towns of Rhafa and El Sheik Zwayed are likely to impact and degrade these important nesting beaches in the future. It is probable that wide scale development around the resort town of El Arish has already excluded nesting turtles from beach 5. Although El Arish beach lies between two areas on which nesting has been observed no evidence of emergence or nesting was found during three years of observation. Most beaches in the Mediterranean that are suitable for turtle nesting are under threat from coastal developers, mainly the tourism industry (GROOMBRIDGE 1990), and this is thought to be a key reason for the poor or very poor state of the marine turtle numbers in the region.

### Public awareness

The data in Tab. 1 shows that only the beaches of North Sinai were found to be used by nesting turtles. The positions of these beaches are indicated on the map in Fig. 2. In order to create awareness among the local human population, beaches 1 through 7 were marked with signs (see Fig. 5), which drew the attention of local people to the fact that an endangered species lives there and needs special protection.

During the three summer seasons over which the project was conducted a total of nine public awareness meetings were conducted at various locations along the Mediterranean coast of Egypt. These meetings targeted groups likely to impact sea turtle survival directly, either through capture or nest disturbance (e.g. fishermen or school children); or indirectly through policy development and enforcement (e.g. government representatives and local law enforcement). Details of the meetings conducted and a breakdown of attendees is given in Tab. 3. The total number attending Darwin sponsored meetings was between 630 and 755, and it is thought that a significant portion of the coastal population has been reached through these and by radio and TV broadcastings.



Fig. 5. Juvenile Loggerhead Turtle displayed in the market of Marsa Matruh, Egypt, in 1993. The inscription reads: »Samara, king of fish« (photograph: M. KASPAREK).

Tab. 3. Details of the public awareness meetings conducted by the Darwin Initiative sponsored marine turtle project from 1997–2000.

	1997	1998	1999	2000
Number of meetings with central and local government	1	5	3	0
Central and local Government representatives attending	15-20	40-50	20-25	–
Number of meetings with military and police	1	3	2	1
Number of military and police representatives attending	10-15	20-25	10-15	10-15
Number of meetings with fishermen and fish sellers	1	5	3	1
Number of fishermen and fish sellers attending	25-30	75-80	60-70	20-25
Number of meetings with school children	0	3	3	2
Number of school children attending	-	60-65	60-70	30-40
Number of meetings with wider public	1	5	5	1
Number of wider public attending	45-50	40-50	70-80	20-30

### Conservation outlook

The main areas of marine turtle nesting activity along the Egyptian Mediterranean coast have now been identified and important parameters relevant to the nesting ecology of this population quantified. In order to ensure its survival a concerted conservation effort is now required. This should involve the enforcement of current laws banning predation on adult turtles and the education of local fishermen as to the potential impact of their actions on the future of turtle species in the region. To compliment this a rigorous management plan should

be implemented for the nesting population, including continuous monitoring of nesting activity to determine long term seasonal patterns in beach selection, judicious transplantation of vulnerable nests with close attention being paid to the duplication of natural temperature regimes, the cleaning of heavily polluted beaches, the protection of nests from predators (primarily through beach cleaning), and cooperation with developers in the area to reduce the negative impact of hotel and resort construction on nesting beaches.

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