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Report on Marine Turtle Nesting activity and conservation, Sirte-Libyan Arab Jamahiriya
9 June-30 September 2006



presented to UNEP-MAP-RAC/SPA by Abdulmaula Hamza



December 2006





Technical Report
Marine Turtle Nesting activity and conservation,
Sirte-Libyan Arab Jamahiriyah

9 June-30 September 2006

Edited by

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Summery

After the encouraging results of the first year of EGA's long term monitoring and conservation program in 2005 nesting season for Loggerhead marine turtles, at three locations west of Sirte (see RACSPA 2005, by Hamza and El Ghmati), the Environment General Authority in collaboration with UNEP-MAP-RAC/SPA have conducted similar surveys and activities during 2006 season.

The work conducted between 9 June and 30 September 2006, in three sites west of Sirte, namely Al-Ghbeba (20 km W Sirte) and Thalateen (28 km W Sirte) and the Arbaeen (36 km W Sirte); in addition to bi-weekly surveys of Misuratah-Bouerat Lahsuon (89 km) composing of 14 local identified nesting beaches. Activities in April 2006 also included the release of three transmitter equipped loggerheads in Tajoura and Misuratah, in frame work of collaboration between EGA, RACSPA, MBRC and the biological station Anton Dhorn of Napoli. Total protected nests at Sirte sites were 199 nests at Al Ghbeba (nesting density=39.1 nest/km). At Thalateen beach 67 nests (nesting density=13.1 nests/km). Less monitoring were done at Arbaeen site where 20 nests protected insitu (nesting density= 2.4 nest/km). A total of 9256 hatchlings from Al Ghbeba and were successfully released to the Mediterranean Sea. Measurements for seven stranded loggerheads all reported at Al Ghbeba and potential causes of mortality were discussed.

Acknowledgements

The authors would like to thank both Dr. Abdul-Hakim ELWAER, Secretary of the people's committee of the Environment General Authority (EGA) for his continuous support and encouragement of this program. Also our sincere gratitude goes to UNEP-MAP-RAC/SPA for support and staff time, particularly to Mr. Atef Ouerghi, program officer in charge.

Thanks also to EGA Sirte branch, the Shabiyah of Sirte, officials and private sector who presented their best to achieve this conservation program.

1. Introduction:

The Mediterranean hosts several species of marine turtles, but only two species are laying their eggs in the sandy beaches of some Mediterranean states, i.e. Loggerhead *Caretta caretta* and Green *Chelonia mydas*. Main nesting grounds of loggerheads are Greece, Turkey, Cyprus and Libya (Margaritoulis *et al.*, 2003; Canbolat, 2004; Broderick *et al.*, 2002; Laurent *et al.*, 1997 and 1999). Green turtles are exclusively nests in the eastern basin countries, i.e. Cyprus and Turkey (Canbolat, 2004; Kasperek *et al.* 2001; Broderick *et al.*, 2002) and more recently Lebanon (MedAsset, 2004) and Syria (Rees 2005).

Marine turtles nesting activity was studied since early 1970's (Sheliech, 1977 Armsby, 1978) more recently TCEP (EGA), Marine biology Research centre (MBRC) in collaboration of WWF, MEDASSET and UNEP-MAP RAC/SPA has organized two nation-wide coastal survey of sandy beaches for assess the nesting density (Laurent *et al.*, 1995, 1998). The outcome of those surveys suggests that Libyan coast would host a substantial number of loggerhead nests each season, and Libya might be the first or second country in number of turtle nests laid each year.

Following the preparation of the national Action Plan for conservation of sea turtles and their habitats, under the framework of SAPBIO project (Hamza, 2002), the Environment General Authority take the initiative to start monitoring and conservation program (Hamza and El Ghmati, 2006). The program was a shared activity of EGA, MBRC with support of Regional Activity Centre for Specially protected Areas (UNEP-MAP-RAC/SPA).

The encouraging results of 2005 campaign lead EGA to continue the activity in 2006 season, by establishing the Libyan Sea Turtle Program (LibSTP) which responsible to conduct all activities (conservation, research, awareness and training) related to marine turtle conservation in Libya.

This report presents the results of LibSTP activities in Sirte as mentioned by the MoU No. 2006 signed between EGA and UNEP MAP RAC/SPA.

2. Program Goals:

1. Reporting nesting activity for a whole season at two beaches W Sirte.
2. Capacity building for Libyan conservationists and raising public awareness.
3. Preparing Standard Data Entry Form for the nesting site of W Sirte.

3.0. Materials and Methods:

3.1.1. Beach selection, camping and dates: Two beaches (Al Ghbeba and Thalateen) were selected according to previous year campaign results as the highest nesting sites in the province.

3.1.2. Training of participants: Selected EGA-Nature conservation department and EGA branches' employees from Surman, Sirte, Misuratah, Benghazi and Al Baida were trained by A. Hamza with assistance of S. Deryagh and A. SAIED.

Trainees were divided into groups of three persons per week, intensive theoretical and practical training it included both lecture sessions on general marine turtle ecology and biology, as well as practical training on track/nest identification skills, routine data collection, eggs handling and translocation method. Training period was started on 21 June till 30 July. Trainees then started under A. HAMZA supervision to implement monitoring and conservation skills at their respective home town beaches.

3.1.3. Beach prospecting method: All beaches were prospected on foot, on daily basis; beach prospecting was carried out by 2-3 persons, a supervising researcher, along with 1-2 trainees. All data were collected in special data sheets similar to that used in 2005 campaign.

3.2. Description of selected beaches: for full description of Al Ghbeba and Thalateen beaches, see (Hamza and El Ghmati, 2006)

3.3. Classification of nesting signs:

Based on shape of the track, left by turtle's front and rear flippers, nesting signs were classified according to the same method used in 2005 survey (Hamza and El Ghmati, 2006).

3.4. Data collection: At each beach, all types of crawl tracks and nest, were recorded at a previously prepared data forms; these data include: Date, time, beach name, track type, track coordinates (using Garmin e-Trex GPS), measurements for track width (to nearest cm), track distant point from seashore, nest depths (total depth and depth from surface till upper egg group), were taken using 50m measuring tape; nest serial number, nest condition (natural, poached or predated), protection method (*insitu* protection or translocation to hatchery), Clutch size, expected hatching date, Actual hatch date, total hatched eggs (from counting egg shells), total dead in egg, dead in nest, Early and late embryonic stages and notes on stranding and dead sea turtles (carapace measurements), dead hatchlings and late embryos' tissue samples were collected for a genetic study.

Beach patrolling was conducted according to guidelines listed in (Demetropoulis and Hadjichristophorou, 1998).

3.5. Nest translocation: As in 2005 campaign, to minimise the risk of predation and poaching nests were transferred using plastic cool containers (vol. 10 L), into fenced area "Hatchery" that setup near the program field station. Fence made of 5 cm size metal mesh, covering an area of about 200 m², about 15m away of seashore to avoid inundation. After translocation, each nest was further protected with square metal screen (dimensions 50x50 cm), and labelled with information on deposition date, clutch size and expected hatching date.

4.0 Results and discussion:

4.1. Turtle species observed: According Based on tracks asymmetrical shape, only the Loggerhead turtles have been observed during the present study, however the other species (green turtle) are frequently reported by fishermen, particularly at the end of nesting season, which in confirms studies on post nesting movements tracked by satellite telemetry (Godley et al., 2002). more effort is needed to proof the nesting activity of Green turtles especially at the distant eastern region of Derna-Salloum (350 km).

4.2. Egg predation and poaching: Due to translocation of most nests, only one nest were found predated by foxes, however poaching still pause a threat to nests, although only five nests were poached (3 at Al Ghbeba, and 2 at Thalateen).

4.3. Stranding marine turtles: Nine Loggerhead turtles were observed stranded at Al Ghbeba, whilst no stranding were recorded at Thalateen beach. Mortality cause was a fishing long-line hooks (See Table 2, Annex I). This is partially due to the concurrence of cartilaginous fish season with the start of nesting season for turtles.

4.4. Nesting activity: From track records, a total of **288** different tracks were reported, similar nesting activities were reported in June and July (June, 183 tracks, 51%; July 168 tracks, 46%), and only 3% of tracks were reported during the first week of August in Ghebeba.

First tracks were recorded in May 27th 2006. Daily patrolling of nesting sites were commenced from June 6th till August 7th. Nesting season duration was 73 days.

4.4.1. Nesting activity at Al Gbeba beach

A total of 288 crawl tracks and 136 nests were reported at this beach from May 27th till the night of August 7th (See Table 3, Annex I for details). Crawl track mean width was 74.84 cm (67.85 cm in 2005) (SD= 7.33) 7.17 in 2005, range 52-94 49-86, N=132: 77). Total Crawl density was 56.58

tacks/km (13.6 in 2005), while total nesting density (NCT+N) = 26.72 (8.8 in 2005).

A total 10988 1329 eggs from 134 23 nests (188 at transferred to Hatchery and 16 were insitu protected). Clutch size ranged from 30-136 -27-153 eggs, average clutch size 86.47 87.85 eggs/nest. A total of 9442 918 eggs were successfully hatched (hatching rate=85.9 69.07%). Other 301 eggs from 9 nests were *insitu* protected using the metal screen; about 259 eggs were hatched (hatching rate= 86.04%).

Distance passed by turtle on the beach, varied from 1-46 2-47meters (Mean=14.18 18.05m), this reflecting the wide sandy beach utilized by turtles and the low level of disturbance, while searching for suitable place to dig the nest. Nest total depth ranged from 32-59 20-49 cm (Mean=46.24 47.31 cm).

4.4.2. Nesting activity at the Thirtieth beach

A total of 145 63 crawl tracks and 67 47 nests were observed at this beach from June 6th till July 30th July 13th till the last nest laid on the night of September 5th (See Table 4, Annex I). Mean width of crawl tracks was 62.45cm (SD= 7.11, range 50-83, N=63). Total Crawl density was 28.26 17.3 tacks/km, while total nesting density (NCT+N) = 26.6 12.9 nest/km.

A total 850 eggs from 13 nests were collected and transferred in to the fenced area; Clutch size ranged from 52-153 eggs, with an average of 77.4. Total of 727 eggs were successfully hatched (Hatching rate= 85.52%). Other 307 eggs from 7 nests were *insitu* protection. 295 eggs were hatched and the hatching rate= 96.09%.

Distance passed by turtle on the beach, varied from 2-49 meters (Mean=17.05m), that closely similar to results in Al Gbeba beach. Nest depth ranged from 40-65 (Mean=49.38 cm).

4.5 Preliminary results of Genetic Analysis: After the encouraging results of 2005 season genetic analysis, done with generous help from Luis Cardona of

Barcelona University, 26 tissue samples from dead hatchlings were collected and sent to Prof. Cardona for the analysis .
results are not yet ready.

4.7 Capacity building:

Training of local and national staff, volunteers and students, is one of the main objectives of LibSTP. The growing number of trained personnel is one of the guarantees of the program sustainability.

This season 13 EGA staff were trained at two stations; Sirte beaches and Benghazi station. Program coordination team is considering training of more young researchers and volunteers from cities and towns around main nesting sites might help greatly in obtaining clearer idea on density and distribution of marine turtles along the Libyan coast.

4.8. Public awareness activities:

Understanding of the objectives and goals of turtle conservation program of Libya is a major step for success. This success needs a wide range of information dissemination via different media tools. In 2005 t-shirts, leaflets, RACSPA seaturtle posters were widely used to convey the importance of the seaturtle as a part of the whole Mediterranean ecosystem, which is Libya constitute most of its south central part.

Program coordinator and team members interviewed weekly by Libyan satellite TV broadcasted from Sirte, every week development of the project results, general ecological concepts and importance of the Mediterranean to Libya and other countries were discussed. In addition to this the main newspaper of Sirte, Al Gordabiyah, issued three times a full coverage of the program. Other local radio stations of Tripoli, Zwara, Al Zawia, Misratah, Benghazi and Bayda hold similar phone interview with program team.

A student Visit of Al fateh University Tripoli for one day was conducted on 14 August 2006, students spent one day practicing daily activities with program team, and many of them showed a great interest in volunteering next seasons. Also we had some tourist visits (French and Germans) on August 22nd, they were passing to Sirte when the program sign on the main road side lured their

curiosity. Planning of contacting tour agents are in place to increase awareness for residents and visitors of Libya.

6. Recommendations:

1. Continuing the daily monitoring of the three nesting beaches next years, and expanding the program to other nesting sites along the coast.
2. Training of more staff and volunteers to work in new sites.
3. Raising public awareness using all available media tools to demonstrate the importance of sea turtles as an important component of the marine ecosystem in Libya and in the Mediterranean, with special concentration on fishermen and workers in fishing sector.
4. Starting a tagging activity with Libyan tags, to follow migration routs of nesting females, taking into account the measures issued by IUCN-MTSG.
5. Collecting more samples for the genetic study, and improving collaboration with research centres in Libya and abroad in this filed.
6. Strengthening the cooperation between EGA and RAC/SPA in turtle conservation, by organising joint activities and training sessions.

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Annex I

Table 1. Nest status at the three studied beaches

Table 2. Curved Carapace measurements for four stranded loggerheads

Table 3. Loggerhead marine turtle nesting activity at Al Gbeba beach

Table 4. Loggerhead marine turtle nesting activity at the Thirtieth beach

Table 5. Loggerhead marine turtle nesting activity at the Fortieth beach

Table 1. Nest status at the three studied beaches

Beach name	Natural %	Poached %	Predation %
Al Ghbeba	72.7	11.3	16.0
Thirtieth	48.8	14.7	36.5
Fortieth	53.5	11.6	34.9
Mean (%)	58.3%	12.5%	29.1%

Table 2. Curved Carapace measurements for four stranded loggerheads

Beach Name	Recovery Date	CCL*	CCW**	Cause of Mortality
Al Ghbeba				Not Clear
<i>Thalateen</i>				Fishing (long line)

* Curved Carapace Length; ** Curved Carapace Width. Both measured in (cm)

Table 3: Loggerhead marine turtle nesting activity at Al Gbeba beach

Gulf of Sirt	Name	Surveyed length (km)	Beach coordinates	Date	Method	Crawl tracks						N	NCT+N	
						UCT	FCT	CT	NCT	Total	Density		total	Density
	AL Ghbeba	5.67	N 31 13 18, E 16 21 77	09.06.06	W	6	2	0	3	11	1.9	1	4	0.7
	AL Ghbeba	5.67		09.06.06	W	0	0	0	4	4	0.7	1	5	0.9
	AL Ghbeba	5.67		10.06.06	W	1	0	0	2	3	0.5	0	2	0.4
	AL Ghbeba	5.67		10.06.06	W	0	0	0	2	2	0.4	0	2	0.4
	AL Ghbeba	5.67		11.06.06	W	0	0	0	0	0	0.0	0	0	0.0
	AL Ghbeba	5.67		11.06.06	W	1	0	0	0	1	0.2	0	0	0.0
	AL Ghbeba	5.67		12.06.06	W	2	4	0	3	9	1.6	0	3	0.5
	AL Ghbeba	5.67		12.06.06	W	2	0	0	1	3	0.5	0	1	0.2
	AL Ghbeba	5.67		13.06.06	W	3	1	0	4	8	1.4	0	4	0.7
	AL Ghbeba	5.67		13.06.06	W	2	0	0	1	3	0.5	0	1	0.2
	AL Ghbeba	5.67		14.06.06	W	5	0	0	3	8	1.4	0	3	0.5
	AL Ghbeba	5.67		15.06.06	W	3	2	0	3	8	1.4	0	3	0.5
	AL Ghbeba	5.67		16.06.06	W	1	1	0	0	2	0.4	0	0	0.0
	AL Ghbeba	5.67		16.06.06	W	0	0	0	1	1	0.2	0	1	0.2
	AL Ghbeba	5.67		17.06.06	W	2	0	0	0	2	0.4	0	0	0.0
	AL Ghbeba	5.67		18.06.06	W	0	0	0	2	2	0.4	0	2	0.4
	AL Ghbeba	5.67		18.06.06	W	2	1	0	0	3	0.5	0	0	0.0
	AL Ghbeba	5.67		19.06.06	W	2	0	0	3	5	0.9	0	3	0.5
	AL Ghbeba	5.67		19.06.06	W	0	0	0	1	1	0.2	0	1	0.2
	AL Ghbeba	5.67		20.06.06	W	0	0	0	1	1	0.2	0	1	0.2
	AL Ghbeba	5.67		20.06.06	W	0	3	0	1	4	0.7	0	1	0.2
	AL Ghbeba	5.67		21.06.06	W	1	1	0	2	4	0.7	0	2	0.4
	AL Ghbeba	5.67		21.06.06	W	0	0	0	2	2	0.4	0	2	0.4
	AL Ghbeba	5.67		22.06.06	W	1	2	0	0	3	0.5	0	0	0.0
	AL Ghbeba	5.67	22.06.06	W	0	1	0	2	3	0.5	0	2	0.4	

AL Ghbeba	5.67	23.06.06	W	0	1	0	1	2	0.4	0	1	0.2
AL Ghbeba	5.67	23.06.06	W	2	0	0	1	3	0.5	0	1	0.2
AL Ghbeba	5.67	24.06.06	W	0	0	0	2	2	0.4	0	2	0.4
AL Ghbeba	5.67	25.06.06	W	1	0	0	0	1	0.2	0	0	0.0
AL Ghbeba	5.67	25.06.06	W	3	0	0	2	5	0.9	0	2	0.4
AL Ghbeba	5.67	26.06.06	W	0	0	0	2	2	0.4	0	2	0.4
AL Ghbeba	5.67	26.06.06	W	1	0	0	1	2	0.4	0	1	0.2
AL Ghbeba	5.67	27.06.06	W	1	0	0	2	3	0.5	0	2	0.4
AL Ghbeba	5.67	27.06.06	W	0	0	0	2	2	0.4	0	2	0.4
AL Ghbeba	5.67	28.06.06	W	0	1	0	1	2	0.4	0	1	0.2
AL Ghbeba	5.67	28.06.06	W	2	1	0	0	3	0.5	0	0	0.0
AL Ghbeba	5.67	29.06.06	W	0	0	0	2	2	0.4	0	2	0.4
AL Ghbeba	5.67	29.06.06	W	4	0	0	2	6	1.1	0	2	0.4
AL Ghbeba	5.67	30.06.06	W	0	0	0	3	3	0.5	0	3	0.5
AL Ghbeba	5.67	30.06.06	W	1	1	0	2	4	0.7	0	2	0.4
AL Ghbeba	5.67	01.07.06	W	1	0	0	1	2	0.4	0	1	0.2
AL Ghbeba	5.67	01.07.06	W	1	1	0	1	3	0.5	0	1	0.2
AL Ghbeba	5.67	02.07.06	W	2	0	0	0	2	0.4	0	0	0.0
AL Ghbeba	5.67	02.07.06	W	1	1	0	0	2	0.4	0	0	0.0
AL Ghbeba	5.67	03.07.06	W	2	2	0	3	7	1.2	0	3	0.5
AL Ghbeba	5.67	03.07.06	W	1	0	0	1	2	0.4	0	1	0.2
AL Ghbeba	5.67	04.07.06	W	0	0	0	1	1	0.2	0	1	0.2
AL Ghbeba	5.67	04.07.06	W	0	2	0	0	2	0.4	0	0	0.0
AL Ghbeba	5.67	05.07.06	W	5	2	0	3	10	1.8	1	4	0.7
AL Ghbeba	5.67	05.07.06	W	2	0	0	2	4	0.7	0	4	0.7
AL Ghbeba	5.67	06.07.06	W	2	0	0	1	3	0.5	0	3	0.5
AL Ghbeba	5.67	06.07.06	W	0	0	0	1	1	0.2	0	1	0.2
AL Ghbeba	5.67	07.07.06	W	0	1	0	1	2	0.4	0	2	0.4
AL Ghbeba	5.67	07.07.06	W	3	0	0	0	3	0.5	0	3	0.5
AL Ghbeba	5.67	08.07.06	W	1	0	0	0	1	0.2	0	1	0.2

AL Ghbeba	5.67	08.07.06	W	1	0	0	1	2	0.4	0	2	0.4
AL Ghbeba	5.67	09.07.06	W	6	0	0	0	6	1.1	0	6	1.1
AL Ghbeba	5.67	09.07.06	W	3	1	0	0	4	0.7	0	4	0.7
AL Ghbeba	5.67	10.07.06	W	0	2	0	4	6	1.1	0	6	1.1
AL Ghbeba	5.67	10.07.06	W	0	0	0	1	1	0.2	0	1	0.2
AL Ghbeba	5.67	11.07.06	W	0	0	0	1	1	0.2	0	1	0.2
AL Ghbeba	5.67	11.07.06	W	1	2	0	2	5	0.9	0	5	0.9
AL Ghbeba	5.67	12.07.06	W	0	0	0	1	1	0.2	0	1	0.2
AL Ghbeba	5.67	12.07.06	W	1	0	0	3	4	0.7	0	4	0.7
AL Ghbeba	5.67	13.07.06	W	2	0	0	2	4	0.7	0	4	0.7
AL Ghbeba	5.67	13.07.06	W	1	0	0	2	3	0.5	0	3	0.5
AL Ghbeba	5.67	14.07.06	W	2	0	0	0	2	0.4	0	2	0.4
AL Ghbeba	5.67	15.07.06	W	0	0	0	1	1	0.2	0	1	0.2
AL Ghbeba	5.67	15.07.06	W	0	0	0	2	2	0.4	0	2	0.4
AL Ghbeba	5.67	16.07.06	W	1	0	0	3	4	0.7	0	4	0.7
AL Ghbeba	5.67	16.07.06	W	2	2	0	2	6	1.1	0	6	1.1
AL Ghbeba	5.67	17.07.06	W	1	1	0	1	3	0.5	0	3	0.5
AL Ghbeba	5.67	17.07.06	W	0	0	0	1	1	0.2	0	1	0.2
AL Ghbeba	5.67	18.07.06	W	0	0	0	2	2	0.4	0	2	0.4
AL Ghbeba	5.67	18.07.06	W	1	1	0	2	4	0.7	0	4	0.7
AL Ghbeba	5.67	19.07.06	W	1	1	0	1	3	0.5	0	3	0.5
AL Ghbeba	5.67	19.07.06	W	0	0	0	1	1	0.2	0	1	0.2
AL Ghbeba	5.67	20.07.06	W	0	0	0	1	1	0.2	0	1	0.2
AL Ghbeba	5.67	21.07.06	W	0	0	0	1	1	0.2	0	1	0.2
AL Ghbeba	5.67	22.07.06	W	0	0	0	1	1	0.2	0	1	0.2
AL Ghbeba	5.67	23.07.06	W	2	0	0	1	3	0.5	0	3	0.5
AL Ghbeba	5.67	23.07.06	W	2	0	0	2	4	0.7	0	4	0.7
AL Ghbeba	5.67	24.07.06	W	1	1	0	2	4	0.7	0	4	0.7
AL Ghbeba	5.67	25.07.06	W	1	0	0	3	4	0.7	0	4	0.7
AL Ghbeba	5.67	25.07.06	W	0	0	0	1	1	0.2	0	1	0.2

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	AL Ghbeba	5.67	26.07.06	W	0	1	0	1	2	0.4	0	2	0.4
	AL Ghbeba	5.67	26.07.06	W	1	0	0	2	3	0.5	0	3	0.5
	AL Ghbeba	5.67	27.07.06	W	0	1	0	1	2	0.4	0	2	0.4
	AL Ghbeba	5.67	30.07.06	W	0	0	0	2	2	0.4	0	2	0.4
	AL Ghbeba	5.67	30.07.06	W	0	2	0	0	2	0.4	0	2	0.4
	AL Ghbeba	5.67	01.08.06	W	1	0	0	0	1	0.2	0	1	0.2
	AL Ghbeba	5.67	03.08.06	W	2	5	0	1	8	1.4	0	8	1.4
	AL Ghbeba	5.67	04.08.06	W	0	1	0	1	2	0.4	0	2	0.4
	AL Ghbeba	5.67	05.08.06	W	0	0	0	1	1	0.2	0	1	0.2
					103.0	52.0	0.0	133.0	288.0	50.8	3.0	199.0	35.1

UTC, FCT, CT, NCT see materials and methods.

Table 4: Loggerhead marine turtle nesting activity at the Thirtieth beach

Coastal zone	Surveyed beach					Observed nesting signs								
	Name	Surveyed length (km)	Beach coordinates	Date	Method	Crawl tracks						N	NCT+N	
						UCT	FCT	CT	NCT	Total	Density		Total	Density
Gulf of Sirt	Thalateen	5.13		09.06.06	W	2	2	0	6	10	1.9	0	6	1.2
	Thalateen	5.13		09.06.06	W	0	2	0	3	5	1.0	0	3	0.6
	Thalateen	5.13		10.06.06	W	1	0	0	1	2	0.4	0	1	0.2
	Thalateen	5.13		11.06.06	W	3	0	0	0	3	0.6	0	0	0.0
	Thalateen	5.13		12.06.06	W	2	0	0	1	3	0.6	0	1	0.2
	Thalateen	5.13		14.06.06	W	0	0	0	1	1	0.2	0	1	0.2
	Thalateen	5.13		15.06.06	W	0	2	0	0	2	0.4	0	0	0.0
	Thalateen	5.13		15.06.06	W	0	0	0	1	1	0.2	0	1	0.2
	Thalateen	5.13		16.06.06	W	0	0	0	1	1	0.2	0	1	0.2
	Thalateen	5.13		16.06.06	W	0	0	0	3	3	0.6	0	3	0.6
	Thalateen	5.13		17.06.06	W	1	1	0	0	2	0.4	0	0	0.0
	Thalateen	5.13		18.06.06	W	1	1	0	1	3	0.6	0	1	0.2
	Thalateen	5.13		20.06.06	W	0	0	0	1	1	0.2	0	1	0.2
	Thalateen	5.13		21.06.06	W	0	0	0	1	1	0.2	0	1	0.2
	Thalateen	5.13		21.06.06	W	0	0	0	2	2	0.4	0	2	0.4
	Thalateen	5.13		22.06.06	W	0	0	0	1	1	0.2	0	1	0.2
	Thalateen	5.13		22.06.06	W	2	0	0	1	3	0.6	0	1	0.2
	Thalateen	5.13		23.06.06	W	2	1	0	0	3	0.6	0	0	0.0
	Thalateen	5.13		24.06.06	W	1	0	0	1	2	0.4	0	1	0.2
	Thalateen	5.13		25.06.06	W	0	1	0	5	6	1.2	0	5	1.0
	Thalateen	5.13		25.06.06	W	0	0	0	3	3	0.6	0	3	0.6
Thalateen	5.13		26.06.06	W	1	0	0	0	1	0.2	0	0	0.0	
Thalateen	5.13		27.06.06	W	1	0	0	1	2	0.4	0	1	0.2	
Thalateen	5.13		27.06.06	W	1	1	0	0	2	0.4	0	0	0.0	

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Thalateen	5.13	29.06.06	W	0	0	0	3	3	0.6	0	3	0.6
Thalateen	5.13	29.06.06	W	0	1	0	0	1	0.2	0	0	0.0
Thalateen	5.13	30.06.06	W	0	0	0	0	0	0.0	0	0	0.0
Thalateen	5.13	02.07.06	W	1	0	0	1	2	0.4	0	1	0.2
Thalateen	5.13	03.07.06	W	0	0	0	1	1	0.2	0	1	0.2
Thalateen	5.13	03.07.06	W	0	0	0	1	1	0.2	0	1	0.2
Thalateen	5.13	04.07.06	W	0	0	0	1	1	0.2	0	1	0.2
Thalateen	5.13	06.07.06	W	0	0	0	1	1	0.2	0	1	0.2
Thalateen	5.13	08.07.06	W	4	1	0	4	9	1.8	0	4	0.8
Thalateen	5.13	08.07.06	W	0	1	0	2	3	0.6	0	2	0.4
Thalateen	5.13	09.07.06	W	3	0	0	1	4	0.8	0	1	0.2
Thalateen	5.13	09.07.06	W	1	0	0	1	2	0.4	0	1	0.2
Thalateen	5.13	10.07.06	W	1	0	0	0	1	0.2	0	0	0.0
Thalateen	5.13	11.07.06	W	4	0	0	1	5	1.0	0	1	0.2
Thalateen	5.13	12.07.06	W	2	2	0	0	4	0.8	0	0	0.0
Thalateen	5.13	12.07.06	W	0	0	0	1	1	0.2	0	1	0.2
Thalateen	5.13	13.07.06	W	1	1	0	1	3	0.6	0	1	0.2
Thalateen	5.13	14.07.06	W	1	1	0	0	2	0.4	0	0	0.0
Thalateen	5.13	14.07.06	W	0	0	0	3	3	0.6	0	3	0.6
Thalateen	5.13	15.07.06	W	4	1	0	2	7	1.4	0	2	0.4
Thalateen	5.13	16.07.06	W	0	0	0	1	1	0.2	0	1	0.2
Thalateen	5.13	17.07.06	W	0	1	0	1	2	0.4	0	1	0.2
Thalateen	5.13	17.07.06	W	1	0	0	1	2	0.4	0	1	0.2
Thalateen	5.13	18.07.06	W	2	1	0	0	3	0.6	0	0	0.0
Thalateen	5.13	18.07.06	W	0	0	0	1	1	0.2	0	1	0.2
Thalateen	5.13	19.07.06	W	0	2	0	0	2	0.4	0	0	0.0
Thalateen	5.13	20.07.06	W	3	3	0	0	6	1.2	0	0	0.0
Thalateen	5.13	20.07.06	W	1	0	0	0	1	0.2	0	0	0.0
Thalateen	5.13	21.07.06	W	1	0	0	1	2	0.4	0	1	0.2
Thalateen	5.13	21.07.06	W	1	1	0	0	2	0.4	0	0	0.0
Thalateen	5.13	22.07.06	W	1	0	0	1	2	0.4	0	1	0.2
Thalateen	5.13	22.07.06	W	0	0	0	1	1	0.2	0	1	0.2

Thalateen	5.13		23.07.06	W	0	0	0	1	1	0.2	0	1	0.2
Thalateen	5.13		24.07.06	W	0	1	0	0	1	0.2	0	0	0.0
Thalateen	5.13		30.07.06	W	0	0	0	1	1	0.2	0	1	0.2
					50.0	28.0	0.0	67.0	145.0	28.3	0.0	67.0	13.1

UTC, FCT, CT, NCT see materials and methods.

Table 5: Loggerhead marine turtle nesting activity at the Fortieth beach

Coastal zone	Surveyed beach					Observed nesting signs								
	Name	Surveyed length (km)	Beach coordinates	Date	Method	Crawl tracks						N	NCT+N	
						UCT	FCT	CT	NCT	Total	Density		total	Density
Gulf of Sirt	Arbaeen	8.54		25.06.06	W	7	4	1	7	19	2.2	0	7	0.8
		8.54		02.07.06	W	1	1	0	0	2	0.2	0	0	0.0
		8.54		18.06.06	W	2	2	0	4	8	0.9	1	5	0.6
		8.54		02.07.06	W	1	0	0	0	1	0.1	0	0	0.0
		8.54		28.07.06	W	1	3	0	1	5	0.6	2	3	0.4
		8.54		29.07.06	W	1	4	0	0	5	0.6	2	2	0.2
		8.54		29.07.06	W	1	2	0	1	4	0.5	2	3	0.4
					14.0	16.0	1.0	13.0	44.0	5.2	7.0	20.0	2.3	

UTC, FCT, CT, NCT see materials and methods.

Table 6: Loggerhead marine turtle nesting activity at Misurata-Bowerat Lahson zone

	Name	Surveyed beach				Observed nesting signs							
		Lenght (km)	Surveyed lenght (km)	Method	Crawl tracks						N	NCT+N	
					UCT	FCT	CT	NCT	Total	Density		total	Density
1	ELARAR	6	6	CAR	4.0	5.0	0.0	7.0	16.0	2.6	0.0	7.0	1.2
2	UGLA	0.95	0.95	CAR	0.0	1.0	0.0	4.0	5.0	4.0	0.0	4.0	4.2
3	MAHBULA	5.32	5.32	CAR	2.0	9.0	1.0	9.0	21.0	3.9	0.0	9.0	1.7
4	SEMEDA	9.42	9.42	CAR	11.0	2.0	4.0	14.0	23.0	2.1	0.0	14.0	1.5
5	MaARZUGA	5.36	5.36	CAR	4.0	15.0	1.0	8.0	21.0	3.5	0.0	8.0	1.5
6	MALFA	1.5	1.5	CAR	0.0	2.0	0.0	3.0	5.0	1.6	0.0	3.0	2.0
7	GWEZAT	5.49	5.49	CAR	6.0	11.0	0.0	13.0	27.0	4.2	0.0	13.0	2.4
8	MJAREN	17.7	17.7	CAR	10.0	12.0	1.0	25.0	47.0	2.1	4.0	29.0	1.6
9	MREKEB	4.8	4.8	CAR	1.0	2.0	0.0	1.0	4.0	1.7	0.0	2.0	0.4
10	BURETMA	5.87	5.87	CAR	0.0	2.0	0.0	5.0	7.0	1.7	0.0	5.0	0.9
11	RAML KHAIEB	8.11	8.11	CAR	0.0	3.0	0.0	6.0	9.0	2.0	0.0	6.0	0.7
12	SURRA	4.84	4.84	CAR	0.0	0.0	0.0	1.0	1.0	0.9	0.0	1.0	0.2
13	KHWADA	10.9	10.9	CAR	2.0	5.0	0.0	10.0	17.0	2.4	0.0	10.0	0.9
		86.26			40.0	69.0	7.0	106.0	203.0			111.0	

