

## Reproductive Ecology of the Loggerhead Turtle, *Caretta caretta*, on Fethiye and Kizilot Beaches, Turkey

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**ABSTRACT.** – *Caretta caretta* nesting was investigated on Fethiye and Kizilot beaches, Turkey, for three breeding seasons (1995–97). On Fethiye Beach a total of 1414 emergences were recorded over three nesting seasons with 374 (26.4%) resulting in nests (30,188 eggs). Of the eggs, 18,696 produced hatchlings, of which 14,150 were able to reach the sea. At Kizilot Beach, a total of 730 emergences were recorded over two nesting seasons with 233 (31.9%) resulting in nests (18,265 eggs). Of the eggs, 11,493 produced hatchlings, of which 10,734 were able to reach the sea. The overall nesting density was 26.0 nests/km on Kizilot Beach and 15.6 nests/km on Fethiye Beach. The mean straight carapace length of nesting females was  $71.6 \pm 5.86$  cm ( $n = 71$ ) on Fethiye Beach and  $70.5 \pm 4.33$  cm ( $n = 43$ ) on Kizilot Beach. The overall incubation period averaged 56.0 days on Fethiye Beach and 49.8 days on Kizilot Beach.

**KEY WORDS.** – Reptilia; Testudines; Cheloniidae; *Caretta caretta*; sea turtle; ecology; reproduction; nesting; predation; hatchlings; conservation; Turkey

Two species of marine turtle, *Chelonia mydas* (green turtle) and *Caretta caretta* (loggerhead turtle), are known to nest in the Mediterranean. Both species are protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention) and the Convention for the International Trade in Endangered Species (CITES) and classified as Endangered and Vulnerable, respectively, by the IUCN (International Union for the Conservation of Nature and Natural Resources, the World Conservation Union) (Márquez, 1990).

The first nesting records of *Caretta caretta* and *Chelonia mydas* from Turkey were published by Hathaway (1972). Later, Basoglu (1973) and Basoglu and Baran (1982) gave information on the carapace scutes of *C. caretta* found at İzmir, Köycegiz, and Fethiye. Geldiay and Koray (1982), Geldiay et al. (1982), and Geldiay (1983, 1984) described marine turtle populations and their protection on the Mediterranean coasts of Turkey. The 1988 WWF-EEC-DHKD project was the first comprehensive survey of the Turkish Mediterranean coast for turtle nesting sites, the primary objective being location of nesting sites and assessment of their relative importance (Baran and Kasperek, 1989). In recent years population studies were also carried out on several beaches, and problems affecting the turtles were documented (Canbolat, 1991; Erk'akan, 1993; Baran et al., 1992, 1994, 1996; Baran, 1993a, 1993b; Türkozan and Baran, 1996; Baran and Türkozan, 1996).

Previous surveys have revealed 17 important nesting grounds in Turkey. Green turtle nesting is more or less confined to a few eastern beaches (Kazanli, Akyatan, and Samandagi) with almost all other nesting beaches utilized only by loggerhead turtles (Baran and Kasperek, 1989). On the other hand, a few records of the leatherback turtle, *Dermochelys coriacea*, have been reported from the Turkish Mediterranean and Aegean Coasts (Baran and Kasperek,

1989; Oruç et al., 1996; Baran et al., 1998; Taskavak et al., 1998). In recent years, the loggerhead and the green turtle have become endangered in the Mediterranean. Turkish coasts are therefore of great importance in providing nesting continuity for these species.

Fethiye and Kizilot beaches (Fig. 1) are among the most important sites for loggerhead turtle nesting in Turkey (Baran and Kasperek, 1989). Fethiye Beach is among the first three areas designated as "Specially Protected Areas" in the framework of the Barcelona Convention of 1988. An archeological site is also situated within the boundaries of the nesting area. Kizilot Beach has not been accorded any special status in spite of being very important for turtle nesting. In order to provide for improved planning as regards the protection of sea turtles on Fethiye and Kizilot beaches, and to augment information concerning their sea turtle populations, we carried out the following research.

This study provides information gathered over three nesting seasons concerning relative abundance and size of nesting females, and seasonal and spatial distribution of nesting, hatching success, emergence period, clutch size, predation, and ecology of loggerhead turtles on Fethiye and Kizilot beaches (Türkozan, 1998).

### METHODS

Our investigation was carried out on Fethiye Beach during the sea turtle breeding seasons (early May to late September) over varying periods: 6 May – 26 September 1995, 31 May – 20 September 1996, and 31 May – 20 September 1997 (without interruption). Research was conducted over varying periods on Kizilot Beach as well: 31 May – 27 September 1996 and 31 May – 20 September 1997. Depending on the number of personnel available, continuity of night and morning patrols was provided by three groups



Figure 1. Map showing locations of the study areas in southern Turkey.

consisting of 2–3 people each on the beach. During night patrols, after sea turtles had completed their nesting process, body measurements were taken and turtles tagged with monel tags on the right front flipper. Carapace lengths and widths (curved and straight) were measured in cm using flexible tape and wooden calipers. When we had the opportunity to observe turtles without disturbing them, we counted eggs as they were laid. During morning patrols, the shape and pattern of tracks were noted and those tracks that resulted in nests were marked. Nest locations were confirmed by carefully probing with a metal stick (with care being taken not to break any eggs) and then marked. Tracks with no nests were counted as non-nesting emergences.

In cases of partial predation, nest chambers and surrounding areas were cleared of destroyed eggs and fully covered with moist sand to its original level. Care was taken not to move intact eggs still in the egg chamber. All destroyed eggs and egg shells were also counted and disposed elsewhere. For all *in situ* nests, where pressure from land predators such as the fox (*Vulpes vulpes*) was severe, a protective metal grating (72 x 72 cm) with a mesh opening of 9 cm was placed over the nest centered around the egg chamber. Nests near the influence of human activities were protected by wire cages with a sign placed on the surface of the sand.

During hatchling emergence season, the numbers of hatchling tracks coming from each nest were counted, and by following them, the numbers of hatchlings reaching the sea were determined. When tracks were interrupted by tracks of such predators as fox, dog, bird, or crab we assumed that the hatchlings were destroyed by those predators. After 8 or 10 days from the first emergence of hatchlings, nests were opened and checked. The number of retained hatchlings, empty egg shells, infertile eggs, and developmentally delayed eggs were counted and the total number of eggs in the clutch determined exactly.

Some nests considered to be threatened by tidal inundation or human activities were transferred to artificial hatcheries on the beach. Transplantation of the nests occurred within the first 24 hours after egg deposition.

### STUDY SITES

**Fethiye Beach.** — The beach is situated within the boundaries of Vilayet Muğla and is approximately 8 km in

length. The beach examined during the breeding season consists of 3 subsections: Çalis, Yanıklar, and Akgöl. The first subsection (Akgöl) starts from Uzun Burun in the north and extends to the mouth of Kargı Çayı in the south; the length is approximately 1 km and the width 50 m or more. The lower beach here consists of pebbles up to 2 cm in diameter. Behind this zone, the beach becomes much steeper and consists of sand mixed with pebbles; sand is the dominant substrate in some places, shingle in others. However, the entire subsection is not suitable for nesting because of an area of approximately 300–400 m is covered with pebbles. Agricultural areas are situated behind this section.

The second subsection (Yanıklar) starts from the mouth of Kargı Çayı and ends at Çalistepe. The length of the beach is approximately 4.5 km and the width varies between 50 and 80 m. The first few meters of the beach slope gently up from the sea. The beach here consists of pebbles. Behind this zone, sand is mixed with pebbles but sand is the dominant substrate. Behind the beach there is a large wetland with several small creeks. Large parts of this wetland are covered by a forest which is partly inundated until June.

The third subsection (Çalis) starts from Çalistepe and extends to where the main road approaches the beach at a right angle. The length of this part is about 2.5 km and the width varies from 17 to 19 m. Behind the beach is a concrete road. Human settlements and tourist developments (hotels, restaurants, bars, etc.) are located just behind this road. The beach is flat and consists of shingle in general but is completely sandy where it is used by tourists.

**Kızılot Beach.** — The beach is situated within the boundaries of Vilayet Antalya. The beach examined in this study is 5 km in length. Our study area started from the mouth of the Karpuz Çayı in the west and ended at the Petrol Office leisure complex in the east. The width of the beach varied from 25 to 70 m. The beach is flat in general, but the slope increases slightly at some places. The beach consists of fine sand in general, however, to the east of the DSI leisure complex fine and coarse grained sands occur. The Antalya-Alanya highway runs rather close to the shore in some places in the north. Several other houses and small buildings occur along the shore. A lagoon system is located behind the beach east of Karpuz Çayı. Fine sand dunes and vegetation are also

**Table 1.** Start and end dates of nesting and hatching seasons for *Caretta caretta* on Fethiye and Kizilot beaches in Turkey. Question marks indicate hatching occurring after the research period. The first nestings of the 1996 and 1997 seasons on Fethiye Beach were provided by a volunteer living in Fethiye.

	Fethiye		Kizilot	
	Nesting	Hatching	Nesting	Hatching
1995	12 May–9 Aug	15 Jul–22 Sep	—	—
1996	15 May–4 Aug	14 Jul–?	31 May–30 Jul	19 Jul–?
1997	24 May–3 Aug	18 Jul–?	31 May–31 Jul	20 Jul–?

located behind the beach. Several artificial sand banks are also found on the beach and some cliffs occur halfway along the beach.

## RESULTS AND DISCUSSION

Our investigations on Fethiye and Kizilot beaches confirmed the importance of these beaches for the breeding of marine turtles. Only emergences of loggerhead turtles, *Caretta caretta*, were encountered, although a few green turtle nests were recorded from Kizilot Beach (Kaska, 1990). Several juvenile green turtles, *Chelonia mydas*, approximately 30 cm in carapace length, were seen in the sea at Yaniklar Beach.

**Nesting and Hatching Seasons.** — The breeding season for *C. caretta* started in early May and extended to late September for both beaches. Hatchling emergence periods extended from mid-July to late September (with a few exceptions). Throughout the breeding seasons, peak nesting and emergence occurred in June on Fethiye Beach, whereas peak nesting was in June and emergence in July on Kizilot Beach. On Fethiye Beach a total of 1414 emergences of nesting females were recorded with 374 (26.4%) resulting in nests. Of these, 15.2% occurred in May, 50.9% in June, 32.8% in July, and 1.1% in August. On Kizilot Beach a total of 730 emergences of nesting females were recorded with 233 (31.9%) resulting in nests. Of these, 11.5% occurred in May, 52.4% in June, 35.2% in July, and 0.9% in August. These beaches may receive up to 316 nests per season. Using the assumption that each female nests an average of 3 times in a season every 2–3 years (Groombridge, 1990) approximately 105 loggerheads visit both beaches. Groombridge (1990) estimated 2000 *C. caretta* females nesting annually in the Mediterranean. Assuming these estimates are reliable, the population estimates for both beaches suggest that 5.25% of the *C. caretta* population of the Mediterranean nests in

this region. Table 1 gives the dates of first and last nests laid and hatched in each year.

There appears to be variation in the nesting season of *C. caretta* cited in the literature for the Mediterranean. In the 1994 season, Margaritoulis and Dimopoulos (1994) recorded the first nesting activity in Zakynthos, Greece, on the 28 May with the last on 3 September. In southern Cyprus, both species generally nest from mid-June until mid-August (Demetropoulos and Hadjichristophorou, 1989). Broderick and Godley (1996) recorded the earliest nesting activity in northern Cyprus on 24 May with the latest on 19 August during their 3-year survey. Clearly there are geographical and, as the data from this study indicate, annual variations in the loggerhead turtle nesting season in the Mediterranean.

**Morphometrics.** — On Fethiye Beach 74 females were tagged and measured, 65 for the first time and 9 recaptures. Their overall mean straight carapace length (SCL) was  $71.6 \pm 5.86$  cm and straight carapace width (SCW)  $53.7$  cm ( $n = 71$ ). On Kizilot Beach 47 females were tagged and measured, 45 for the first time and 2 recaptures from 1990. The overall mean SCL of these females was  $70.5 \pm 4.33$  cm and SCW  $52.2$  cm ( $n = 43$ ). The dimensions and nesting parameters of both beaches are presented in Tables 2 and 3.

Mean carapace lengths for loggerhead turtles have been recorded as 73.1 cm on Dalyan Beach in Turkey (Erk'akan, 1993), 78.6 cm in Greece (Margaritoulis, 1988), and 90.3–100.6 cm in Florida, USA (Dodd, 1988). As can be seen from the values the size of the turtles appeared to become smaller from west to east. Broderick and Godley (1996) pointed to a possibility of subpopulations within the Mediterranean. We believe that this could be as a result of geographic variation due to ecological differences related to feeding grounds.

**Nests, Eggs, and Hatchlings.** — On Fethiye Beach, 374 nests were recorded, of which 336 (89.8%) were opened and checked for their contents. The remaining 38 were either completely destroyed by fox (*V. vulpes*) predation or lost for a variety of reasons. A total of 27,131 eggs were counted in 336 nests. The mean number of eggs in each clutch on Fethiye Beach was calculated as 80.7 (range 18–144).

On Kizilot Beach a total of 191 (81.9%) nests were opened and checked for their contents. In these nests, 14,994 eggs were counted. The mean number of eggs in each clutch on Kizilot Beach was 78.5 (range 17–148). The study carried out in 1993 on Fethiye Beach (Baran and Türkozan, 1996)

**Table 2.** Dimensions and nesting details of *C. caretta* tagged on Fethiye Beach during the years 1995–97.

	1995				1996				1997			
	<i>n</i>	Mean	S.D.	Range	<i>n</i>	Mean	S.D.	Range	<i>n</i>	Mean	S.D.	Range
Straight carapace length (cm)	37	72.08	4.51	63–85	18	71.52	4.77	63–82	15	72.60	4.92	63–79
Straight carapace width (cm)	37	53.96	5.01	46–73	18	54.21	3.91	48–64	15	53.63	6.06	43–62
Curved carapace length (cm)	37	77.37	5.13	62–89	18	76.26	5.01	67–89	15	78.40	5.00	69–86
Curved carapace width (cm)	37	67.85	5.40	47–78	18	67.93	4.30	60–77	15	69.86	6.42	58–77
Re-emergence interval (days)	102	9.45	9.94	0–38	9	18.22	15.44	0–40	14	10.92	11.40	0–38
Interesting interval (days)	13	26.76	15.65	12–66	3	25.66	10.21	14–33	2	17.00	9.89	10–24
Clutch frequency (per season)	40	1.48	0.56	1–3	17	1.20	0.42	0–2	10	1.25	0.46	0–2
Clutch size (no. of eggs)	40	81.55	17.74	54–133	16	80.18	26.20	18–115	10	65.10	21.01	24–98



**Table 3.** Dimensions and nesting details of *C. caretta* tagged on Kizilot Beach during the years 1996–97.

	1996				1997			
	<i>n</i>	Mean	S.D.	Range	<i>n</i>	Mean	S.D.	Range
Straight carapace length (cm)	26	70.79	4.60	63-79	17	70.14	3.95	65-78
Straight carapace width (cm)	26	52.06	4.01	46-60	17	52.41	3.27	47-59
Curved carapace length (cm)	27	75.51	5.64	62-86	19	76.21	4.64	71-88
Curved carapace width (cm)	28	66.97	4.85	57-78	19	66.73	4.42	61-77
Clutch size (no. of eggs)	10	79.70	19.22	37-104	8	88.75	18.70	61-121
Re-emergence interval (days)	3	6.33	9.23	1-17	—	—	—	—

give the mean clutch size as 86 eggs. The same researchers (Baran and Türkozan, 1996) recorded the mean clutch size as 82.9 eggs on Fethiye Beach in their research of 1994. Kaska (1993) gave the mean clutch size as 79.7 on Kizilot Beach. Mean clutch sizes elsewhere in the Mediterranean have been reported as 82 (Silberstein and Dmi'el, 1991) in Israel, 70 in northern Cyprus (Broderick and Godley, 1996), 117.7 in Greece (Margaritoulis, 1988), 75.7 in Dalyan, Turkey (Canbolat, 1991), 95 in Patara, Turkey (Baran et al., 1992) and 91.7 in Göksu Delta, Turkey (Peters and Verhoven, 1992). Worldwide mean clutch size has been reported to vary from 101 to 126 eggs for loggerhead turtles (Hirth, 1980). The natural hatching success and survival on both beaches are presented in Tables 4 and 5.

A total of 21,498 hatchlings were able to reach the sea (12,731 from Fethiye and 8767 from Kizilot). Accordingly, the total number of hatchlings reaching the sea as a percentage of the total number of eggs was 51%. The overall hatching success was 87.1% (of the 607 nests recorded, 529 hatched).

The nest density was calculated as 15.5 nests/km on Fethiye Beach based on the annual mean number of nests in 1995, 1996, and 1997. Türkozan and Baran (1996) gave the nest density for Fethiye Beach as 14.75 nests/km. Geldiay (1984) listed this area as a medium nesting density site, with 1–4 nests/km per night. Based on the annual mean number of nests, the nest density was calculated as 26 nests/km on Kizilot Beach. Baran et al. (1992) recorded the nest density as 9.13 nests/km on Kizilot Beach. Yerli and Demirayak (1996) gave the nest density as 5.9 nests/km on Kizilot Beach; they stated that this decrease resulted from the increase of tourist activities on the beach. Baran et al. (1996) recorded the nest density for Dalyan Beach as

22.7 nests/km and Taskin (1998) recorded 7.42 nests/km for Patara Beach.

The distribution of numbers of nests, nesting densities, and number of hatchling-producing nests are given in Table 6 with the results of previous studies carried out on the same beaches.

Since there are natural fluctuations in the breeding of marine turtles, even a decade of population study may not give exact results for the assessment of nesting beaches. It is therefore quite difficult to comment on the trend of the populations on both beaches. However, increasing human activities and beach development threaten the turtle populations at both beaches. The locations of nests concentrated in certain areas of both beaches. On Kizilot Beach these areas were from 200 m west of Meryem Hotel and continuing to the mouth of Karpuz Çay and in front of the DSI leisure complex but in areas with lesser lighting effect. For Fethiye Beach these areas were from 300 m south of Yonca Camping and continuing 2 km along Yaniklar Beach, the area starting 200 m south of the first stream and continuing 600 m along Yaniklar Beach, the area starting 600 m south of the reedy area and continuing 500 m along Çalis Beach, and the first and last 200 m of Akgöl Beach (see Türkozan, 1998, for a detailed site map).

Throughout our surveys on both beaches 24 nests (1938 eggs) were transferred to an open air hatchery emulating natural conditions. The same sites were used every year. The overall hatchery hatching success was 67.5% (range 61.6–73.8%). The emergence period for original and transferred nests was about the same and hatching success was usually higher in transferred nests. This shows that an open air hatchery can be an adequate conservation tool in areas where threats to natural nests survivorship are high.

**Table 4.** Natural hatching success and survival on Fethiye Beach; *n* = number of nests.

	1995			1996			1997		
	Observed <i>n</i> = 171	Calculated <i>n</i> = 191	%	Observed <i>n</i> = 78	Calculated <i>n</i> = 88	%	Observed <i>n</i> = 87	Calculated <i>n</i> = 95	%
Total number of eggs	14239	15853		6776	7656		6116	6679	
Depredated eggs	1247	1395	8.8	147	165	2.7	100	107	1.6
Infertile eggs	4035	4486	28.3	956	1080	14.1	1257	1375	20.6
Abnormal eggs	36	48	0.3	2	3	0.03	14	15	0.2
Dead embryos	642	713	4.5	1078	1217	15.9	813	888	13.3
Hatchlings	8279	9211	58.1	4593	5191	67.8	3932	4294	64.3
Remained in nest	380	424	4.6	172	192	3.7	252	275	6.4
Depredated or died on beach	426	470	5.1	86	99	1.9	71	77	1.8
Lost	1192	1326	14.4	1246	1412	27.2	248	271	6.3
Reached the sea	6281	6991	75.9	3089	3488	67.2	3361	3671	85.5

**Table 5.** Natural hatching success and survival on Kizilot Beach; *n* = number of nests.

	1996			1997		
	Observed <i>n</i> = 113	Calculated <i>n</i> = 125	%	Observed <i>n</i> = 78	Calculated <i>n</i> = 108	%
Total number of eggs	8751	9625		6243	8640	
Depredated eggs	226	250	2.6	861	1192	13.8
Infertile eggs	1880	2069	21.5	917	1270	14.7
Abnormal eggs	33	39	0.4	17	26	0.3
Dead embryos	1153	1261	13.1	482	665	7.7
Hatchlings	5459	6006	62.4	3966	5487	63.5
Remained in nest	121	132	2.2	35	49	0.9
Depredated or died on beach	29	36	0.6	38	55	1.0
Lost	394	432	7.2	41	55	1.0
Reached the sea	4915	5406	90.0	3852	5328	97.1

The average distance of the nests from the tide line ranged from 17.5 to 18.4 m on Fethiye Beach and 21.1 to 23.2 m on Kizilot Beach.

**Predation.** — Throughout three breeding seasons on Fethiye Beach, 1494 eggs and 4073 hatchlings were destroyed. Fox and dog predation played the most important role on the destruction of the eggs (71.9%). Another egg predator was coleopteran larvae (19.9%). Remaining eggs were destroyed by human activities (5.7%), metal probes (2.4%), and plant roots (0.1%). Of the hatchlings destroyed, substrate compression in areas of pebbles caused the death of 804 (19.7%), with other factors as follows: fox or dog predation (9.2%), insolation (3.6%), bird predation (*Corvus c. cornix*) (1.1%), and crab predation (*O. cursor*) (0.3%). Moreover, 2686 (65.9%) hatchlings were unaccounted for and 5 (0.1%) hatchlings were run over by a car.

A total of 1087 eggs and 658 hatchlings were destroyed on Kizilot Beach over two breeding seasons. Of the eggs, fox or dog predated 744 (68.4%) eggs and colepteran larvae 209 (19.2%) eggs. Thirty-four (3.1%) eggs were accidentally destroyed while probing for nests. In addition, 36 (3.3%) eggs were taken from two nests for sex determination. Sixty-four (5.9%) eggs were lost due to human activities. Of the hatchlings destroyed, 6.8% were predated by fox or dogs, 0.5% by birds, insolation killed 19 (2.9%), and substrate compression caused 156 (23.7%) hatchlings to die. A total of 435 (66.1%) hatchlings were unaccounted for.

As a result of our studies on Fethiye Beach over the three nesting seasons, predator destruction of hatchlings and eggs decreased markedly (Table 7). Predation was progressively controlled between 1995–97 by metal grating application. Accordingly, the total extent of egg predation as a percentage of the total number of eggs was 8.8% in 1995 and 1.6%

in 1997. The total number of hatchlings depredated on the beach as a percentage of the total number of hatching eggs was 5.1% in 1995 and 1.8% in 1997. The periodic night surveys allowed us to offer direct protection to hatchlings.

On Kizilot Beach, areas with high predation risk were determined over both nesting seasons. Metal gratings were used in the first year to foil fox and dog predation, but we did not have enough gratings in the second year. Accordingly, the total number of depredated eggs as a percentage of the total number of eggs was 2.6% in 1996 and 13.8% in 1997. The total number of hatchlings predated on the beach as a percentage of the total number of hatching eggs was 0.6% in 1996 and 1% in 1997 (Table 4). This increase demonstrates the importance of the protective measures on the beaches.

**Incubation Period.** — In this study, the mean overall incubation period was recorded as 56.0 days on Fethiye Beach and 49.8 days on Kizilot Beach. The shorter incubation period on Kizilot Beach resulted from higher nest temperatures there (Türkozan, 1998). Türkozan and Baran (1996) gave a mean of 56.9 days at Fethiye Beach and Kaska (1993) recorded 59.6 days on Kizilot Beach. Margaritoulis (1988) recorded a mean of 55.5 days in Greece, Peters and Verhoven (1991) cited 55 days in Göksu Delta, Turkey, Broderick and Godley (1996) gave 48 days in northern Cyprus, Silberstein and Dmi'el (1991) cited 54 days in Israel, and Erk'akan (1993) cited 59.3 days on Dalyan Beach, Turkey. The general range of incubation periods for marine turtle nests worldwide is quoted in the literature as 50–70 days (Hirth, 1980).

In this study the interesting period was recorded as 23 days on Fethiye Beach. Baran and Türkozan (1996) cited

**Table 6.** Distribution of numbers of nests and hatchling-producing nests with nest densities with respect to years and studies on Fethiye and Kizilot beaches. Studies (in superscript): a = Türkozan and Baran (1996); b = Baran and Türkozan (1996); c = present study; d = Kaska (1993); e = Yerli and Demirayak (1996).

	Fethiye					Kizilot			
	1993 <sup>a</sup>	1994 <sup>b</sup>	1995 <sup>c</sup>	1996 <sup>c</sup>	1997 <sup>c</sup>	1990 <sup>d</sup>	1994 <sup>c</sup>	1996 <sup>c</sup>	1997 <sup>c</sup>
Total emergence	240	439	888	235	291	299	195	427	303
Total number of nests	118	158	191	88	95	146	50	125	108
Hatchlings reaching the sea	3337	5953	6991	3488	3671	7670	—	5406	3966
Nest density (nests/km)	14.8	19.8	23.9	11.0	11.9	—	—	27.7	24.0
Hatchling-producing nests	102	153	177	83	85	114	40	111	73
Number of eggs	8772	12926	15853	7656	6679	11680	3029	9625	6243

**Table 7.** Predator destruction of eggs and hatchlings of *C. caretta* on Fethiye and Kizilot beaches.

	Fethiye			Kizilot	
	1995	1996	1997	1996	1997
Eggs	1247	147	100	226	861
Hatchlings	426	86	71	29	38

this period as 16.2 days on Fethiye Beach. Broderick and Godley (1996) gave the interesting period for *C. caretta* in northern Cyprus as 13.4 days. Interesting intervals for loggerhead turtles have been recorded as 12–15 days in Florida, USA, 14–17 days in Tongaland, South Africa, and 13.9–15 days in Queensland, Australia (Dodd, 1988), and 15.2 days in Greece (Margaritoulis, 1988). Our value being much higher than those in the literature suggests that we may have missed some intermediate nestings. The mean interesting period for marine turtles around the world is given as between 9–15 days, with each female laying 2–10 clutches in a given year (Ehrhart, 1982).

Throughout the breeding periods, the hatchlings on Kizilot Beach completed their emergence from the nests in 1–3 days, whereas it took more than 5 days on Fethiye Beach. We believe that this is dependent upon the interaction of a number of factors, including salinity, humidity, temperature, gas flow, rainfall, tidal inundation, substrate type and compression, and predation.

**Beach Use at Fethiye.** — Large numbers of tourists use the beach in the daytime. An asphalt road just behind the beach is used by tourists and local people for leisure walking. The area behind the beach is heavily developed. Illumination from these buildings and the road present problems. The beach in front of the buildings is under constant daytime use (umbrellas, beach chairs, etc., but these are removed at night). Sometimes the beach is also visited by tourists at night.

A large tourist club (Tuana Vista) is situated to the south at the mouth of Kargi Çayı. The beach in front of this club is developed (umbrellas and beach chairs not removed at night). Water sports and fishing occur in this area. A bar and camping site are located next to the club. The lights of those buildings illuminate part of this beach. Sand extraction (though on a small scale) has also been found to be a problem.

Some local people use the beach as a picnic site on weekends and also enter the beach on tractors. Some native tourists camp on the beach, leaving litter and broken glass on the beach. An illegal beach bar is situated on the southernmost part of the beach. Beach parties occur in front of this bar and the beach is under permanent use. Cows and sheep can also be seen on the beach, and trawl fishing occurs in front of it. Illegal wooden beach bars are situated at the northern end of the beach, and tents are set up on the beach.

**Beach Use at Kizilot.** — Some local people use the beach for camping and also use tractors on the beach. The beach is used in the daytime by tourists. A large hotel and recreation development of DSI (State Water Works) and Petrol Ofisi are situated on the beach. Both are illuminated

during the night. The Petrol Ofisi recreational development is rather close to the sea. There are several other houses and smaller buildings along the shore. The beach in front of the hotels and bars is under constant daytime use (umbrellas, beach chairs, etc. not removed at night). The Antalya-Alanya highway runs rather close to the shore in some places. Some beach huts are also situated on the beach. Broken glass and rubbish are left on the beach by tourists, who sometimes drive on the beach.

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