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THE INVESTIGATIONS OF THE NESTING STATUS OF THE GREEN TURTLE *CHELONIA MYDAS* ON YENIYURT BEACH (HATAY) IN THE NORTHEASTERN MEDITERRANEAN, TURKEY

ABSTRACT

A new nesting site that is not previously designated as a nesting beach was investigated for the green turtle (*Chelonia mydas*) nesting. The Yeniyurt Beach is bordered by BOTAŞ Port to the south and Seçil Holiday Houses to the north. The small water channel in Yeniyurt Public Beach is taken to the reference point of which can be divided as the north, 2600 m long, and the south, 1400 m long. The beach was monitored between 15 June and 15 September in 2019. A total of 182 green turtle emergences occurred, and 85 (46.7%) of them were recorded as nests. The nest density was found as 21.2 clutches yr^{-1}. The temporal distribution of the nests was found to be 52.9%, 45.8% and 1.3% in June, July and August, respectively. Besides, the average nest depth and incubation duration was 71.9cm ±8.2 (n=70) and 52.6 days ±4.4 (n=70), respectively. A total of 7362 eggs were laid in these nests and 6274 (85.2%) of them hatched. The average clutch size and number of empty eggshells were found to be 105.2 ±30.1 (40-199) and 89.6 ±26.4 (35-154), respectively. The average number of hatchlings reaching the sea was 62.8 ±20.8 (70.1%). Yeniyurt beach can be considered as a moderate dense beach (20–99 clutches yr^{-1}; ≥6.5 clutches km^{-1} yr^{-1}) for green turtle nesting based on previous studies in the Mediterranean.

Keywords: Green Turtle, *Chelonia mydas,* New Nesting Beach, Hatay, Northeastern Mediterranean

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1. INTRODUCTION

Three species of sea turtles are found regularly in the Mediterranean. These are *Caretta caretta (*Linnaeus, 1758) (loggerhead turtle), *Chelonia mydas*, (Linnaeus, 1758) (green turtle) and *Dermochelys coriacea*, (Vandelli, 1761) (leatherback turtle) [1 and 2]. The most abundant species is loggerhead turtle in the Mediterranean, and the main nesting area are Greece, Turkey, Cyprus and Libya [1 and 2]. The main nesting areas of green turtles are Turkey, Cyprus and Syria) [1 and 2]. The leatherback turtle is considered as visitors from the Atlantic Ocean and recorded at the Aegean and Mediterranean coastline of Turkey [3 and 4]. The loggerhead turtle and green turtle have been identified as 2 independent Regional Management Units (RMUs) out of 11 and 17 RMUs for the worldwide [5]. The Mediterranean population of loggerhead turtle represents 3 independent RMUs, and green turtle represents an independent RMU [5]. According to the IUCN (International Union for Conservation of Nature) Red List criteria, the Mediterranean subpopulation of the green turtle and the loggerhead turtle are categorized as Endangered (EN) and Least Concern (LC), respectively [6 and 7].

The average annual number of loggerhead turtle nest in the Turkish coast was estimated ranged 769 to 2710 in previous studies [1, 8, 9, 10 and 11]. The average 8179 loggerhead turtle nests for per year are recorded in the entire Mediterranean in the most recent 5 yr period, and 2822 of them were reported to be on the coast of Turkey in a recent review [2]. The average annual number nest number of green turtle throughout the Mediterranean coast of Turkey was estimated ranged 350 to 2051 in previous studies [1, 10, 11 and 12]. It is estimated that there are an average of 2204 green turtle nests in all Mediterranean coasts [2]. Approximately 60% of these nests (1331 nests/year^{-1}) are recorded on the Turkish coast [2].

2. RESEARCH SIGNIFICANCE

It is important to monitor nesting beaches and reporting the nest numbers, thus the data will be helpful for more accurate estimation on the population status of the sea turtles not only for the Mediterranean, but also for the global. It is inevitable that these results contribute to conservation measures and management priorities, such as relocation and/or hatching sites on their nesting beaches, breeding production, hunting and beach management programs. Also, a continuous long-term annual monitoring program is recommended to produce reliable and realistic solutions to specific problems at each nesting beach [13]. If population size and nest density estimations are not based on long-term annual monitoring, misleading results can be obtained [14]. This is because annual changes in weather conditions can cause fluctuations in the number of nests [15], which causes the population to calculate bias. However, long-term annual monitoring studies are valid for the nesting beaches that are pre-determined. Because the existence of new nesting beaches along the Mediterranean coast that has not been discovered and monitored should not be ignored. This case Casale et al.) [2] confirms the idea that the average number of annual nests should be a minimum. Because nesting also occurs in other non-monitored nesting sites, and these are non-reported nest. In this way, the monitoring of new and non-discovered nesting beaches and report of nests is important as it will give real results about the population status of sea turtle in the entire Mediterranean. These real results will inevitably contribute to their IUCN status and priorities of protection management. The Yeniyurt beach was visited first time by Sert et al. [16]. However; they only visited twice and provided limited information on nest features of green turtle. Considering important of the detailed information on new nesting beaches,

this study aimed to reveal the nesting status of green turtle on the Hatay/Yeniyurt beach.

3. MATERIAL AND METHODS

The research area is approximately 10km away from the Dörtyol district center. It is bordered by BOTAŞ Port to the south and Seçil Holiday Houses to the north. When a small water channel in Yeniyurt Public Beach is taken to the reference point, the beach can be divided as north, where is 2600 meters, and the south, where is 1400 meters (Figure 1). The widest part of the beach is 70 meters and the narrowest part is 15 meters. At the back of the northern part of the beach, there is a lagoon system of approximately 100 meters in width. Also, 650 meters of the beach is used as a public beach, where is covered some parts of the north and south sections.

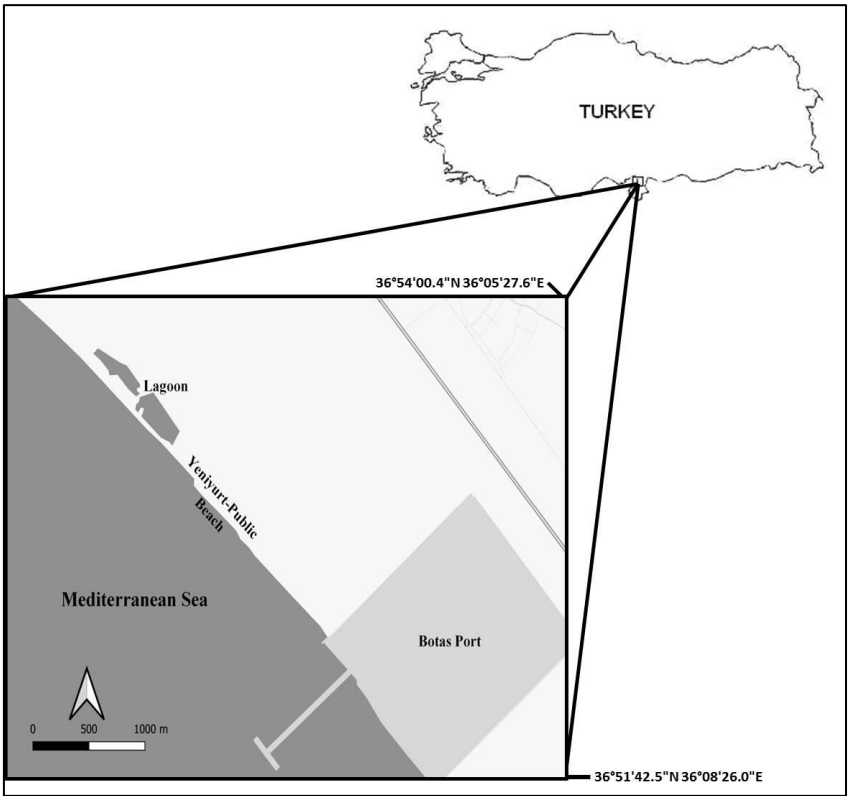

Figure 1. Map showing research area

The beach was monitored between 15 June and 15 September in 2019. Three people monitored the northern part of the beach three times a week and the southern part of the beach was monitored once a week during the nesting season. The southern part of the beach was monitored once a week. The nesting emergence was recorded, and the symmetry of tracks was used for determining species [17]. Nest location was determined using a metal stick from the body pit and egg chamber and were marked by planting stick. The distance from the sea (DFS) (from the high tide line to the nest) and the distance from the nearest vegetation (DFV) was measured with the flexible tape measure (accuracy ±1 cm) from the vertical line on the egg chamber of each nest. The incubation duration (ID) of nests was calculated as the time between the day the egg was laid and the day the first hatchlings emerged. After the hatchling emerge was finished, each nest was excavated. The clutch size (CS) was determined by counting the number of unhatched eggs and empty eggshells. Nest depth (ND) was measured using a tape measure as a straight vertical distance from the

sand surface to the deepest point of the nest. The success of reach to the sea of the hatchlings was calculated according to the percentage of the tracks of the hatchlings on the nest chamber with direction to the sea and back. The number of eggshells obtained after digging the nest was matched with this percentage of tracks. The hatching success was calculated by empty egg shells/clutch size. Nest density was calculated as the ratio of the total number of nests to the beach length. All means are presented with ± SD and min-max.

4. RESULTS AND DISCUSSION

During the research period, 182 green turtle emergence was recorded on the beach. Eighty-five of these records (46.7%) were recorded as nests. The nest density was calculated as 21.2 nest/km. The detailed information by sub-section is given in Table 1.

Table 1. The number of nest and non-nesting tracks according to sub-section and nest densities

Beach Section	Number of Nests	Number of Non-nesting Tracks	Nest Density (nest/km^{-1})
Northern Part (2.6km)	70	67	26.9 nest/km^{-1}
Southern Part (1.4km)	15	30	10.7 nest/km^{-1}
Total (4km)	85	97	21.2 nest/km^{-1}

The average DFS and DFV were 25.1 meters ±10.8 (n=85), 13.5 meters ±11.4 (n=85), respectively. The spatial distribution of nests is shown in Figure 2.

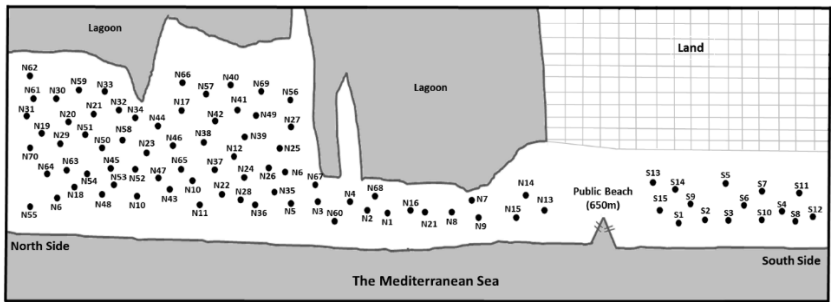

Figure 2. The spatial distribution of nests on the Yeniyurt nesting beach

The temporal distribution of the nests was found in July with 52.9%, and in June with 45.8%, and in August with 1.3%. Also, the average nest depth was 71.9cm ±8.2 (n=70), and the average ID was 52.6 days ±4.4 (n=70). Our result showed that Yeniyurt beach with a total number of 85 nests and a density of 21.2 nests/km based on the one-year monitoring. Sert et al., (2017) [16] determined 114 green turtle nests with the 38 nest/km density on the northern part of beach. However, to obtain reliable data about the density and number of nests, continuous annual monitoring studies should be performed regularly. Because there may be large fluctuations in green turtle nesting activity among the years and only one year of data can give misleading results on the nest density and number of nests [14 and 15]. Also, green turtle emergences indicate a biennial pattern, which means a low year followed by a high year [18]. Moreover, variations in weather conditions among the years may also have an impact on green turtle emergences [15]. Therefore, to make a comparative evaluation with other nesting beaches in the Mediterranean, the long-term annual data need to be for Yeniyurt beach. In green turtle monitoring studies conducted on different beaches in different nesting seasons, the number of nests detected on Yeniyurt beach has a lower

number of nests than those beaches. For example, the average number of nests on the Akayatan beach between 2006-2011 is 362 (range=170-562) [19] and the Kazanlı beach is 385 in the 2006 nesting season [20]. The average number of nests on Samandağ beach between 2001-2005 nesting season is 121 (range:16-325) [21]. Furthermore, Türkozan and Kaska (2010) [1] reported that the minimum and the maximum number of nests for Samandağ beach between 1988 and 2006 was 16-440. However, other nesting beaches (Tuzla, Ağyatan, and Yumurtalık, 2–9 nests per year) have lower nest numbers than Yeniyurt beach [19]. Tuzla, Ağyatan, and Yumurtalık nesting beaches call minor nesting beaches for Turkey's coastline. Casale et al. (2018) [2] stated that average 1331 green turtle nest per year was recorded Turkish coast of Mediterranean. We can say that Yeniyurt beach with 85 nests representing a portion of approximately 6.5% of the coast of Turkey. Nest number 20–99 or nest density ≥6.5 nest/km per year should be considered as a moderate dense beach [2]. Although it is difficult to say this with one-year data, we can say that Yeniyurt beach with 85 nests and 21 nest/km density is a moderate density nesting beach. However, the final result will emerge with a long-term continuous monitoring.

The spatial distribution of the nests is concentrated in the northern part of the beach. Although this section of the beach is 2.6 km long, all nests are on the first 1.5 km of the section. The most important reason for this is that after this point on the beach, it is not suitable for nesting due to its pebbled sand structure formed and stones. Furthermore, the presence of a lagoon extending at the back of this section may have been preferred by the green turtle for nesting. It is stated that green turtle’s nest more densely near the mouth of the river (low salinity, appropriate humidity, and sand grain size, etc.) [13 and 21]. Low human activity may also have affected it [13]. The temporal distribution was concentrated in June and July. This is compatible with the other green turtle nesting beaches such as Akyatan, Kazanlı, Samandağ [13, 19 and 20]. Only hatching and hatchling survival of 70 nests in the northern section were evaluated. Accordingly, the average clutch size 105.2±30.1 (40-199), the average number of empty eggshells was found to be 89.6 ±26.4 (35-154). Thus, the average hatching success was calculated as 85.2%. The average number of hatchlings reached to the sea was 62.8 ±20.8 (4-115.5) and the average success rate of reaching to the sea was calculated to be 70.1%. Detailed information about nest and hatchling are given in Table 2.

Table 2. Detailed information about the hatching and hatchling survival in the northern part of the beach

Nest/hatchling Features	Number of Nests	
	(70)	%
Total Eggs	7362	-
Unfertilized Eggs	8	0.1
Dead Embryo	1080	14.6
Number of Hatchlings (Empty eggshell)	6274	85.2
Reach to the Sea	4397	70.1
Dead in Nest	120	1.9
Alive in Nest	205	3.3
Misorientation	1552	24.7

The average clutch size of Yeniyurt beach (105.2 eggs) is lower than that of other green turtle nesting beaches (e.g., Samandağ 115.1: [13]; Akyatan beach: 113.7, [19] and Kazanlı beach: 110.7 eggs, [20]. The females that nest in Yeniyurt beach may have smaller body size. In many studies, it was stated that there is a relationship between clutch size and body size in sea turtle species [22, 23 and 24]. Hatching

success of green turtle in Yeniyurt beach was found 85.2%. This value was found higher on other green turtle nesting beaches such as Akyatan 76% [19], Kazanlı 82.9% [20], Samandağ 69.9% [25], Northern Cyprus 84.2% [26]. Hatching success can be influenced by fungal infections [27], moisture [28] and clutch size [29]. However, Türkozan et al. (2003) [30] concluded that environmental factors they examined were not correlated with hatching success. A total of 4602 hatchlings (including alive in the nest), i.e 73.5% of the hatchlings which have succeeded in pipping the eggshell, have reached the sea. This rate is higher at Akyatan beach and is 76.2%. The reason for this is the presence of a slightly lighting area behind the beach. Or the lagoon system behind the beach may have a misleading effect on the hatchlings towards the sea. Because the rate of reach to the back of hatchlings has a high value of 24.7%. Considering that 2.2 per thousand of green turtle hatchlings reaching the sea can reach adulthood [31], approximately 10 individuals will reach adulthood. This rate is estimated as 0.0013 for loggerhead turtle and about 6 individuals can reach adulthood [32].

5. CONCLUSION AND RECOMMENDATIONS

Yeniyurt beach, which has the potential of a new nesting beach for green turtle in the Mediterranean, is used by the local people for agricultural, animal husbandry, and daily tours. Especially since the presence of public beaches will bring out lighting. Besides, training and awareness-raising on sea turtles should be done for local people using the beach. The fact that some part of the northern section is stony and pebbly may adversely affect the nesting behavior of the green turtles, which means that the nesting will be trapped in a very narrow area in the northern section. In this context, it is inevitable to develop and implement protection strategies such as relocation or hatchery between and/or within northern and southern sections. Yeniyurt beach can be considered as a moderate density nesting beach for the Mediterranean in terms of nest number and density according to the results of one-year monitoring. However, since the results of one-year monitoring will be misleading, it is recommended that the beach be monitored continuously and consecutively to learn the actual population status.

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