



## Stranded sea turtle records between 2010 and 2017 in northern Aegean and Sea of Marmara



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### HIGHLIGHTS

- Thirty-seven dead and injured sea turtles were found.
- Adult sea turtles are stranded in the Sea of Marmara, sub-adults sea turtles are stranded in the northern Aegean Sea.
- The leading causes of stranded sea turtles are intentional harm and fishing activities.

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### ABSTRACT

Studies on sea turtles in Turkey have mostly been concentrated on nesting beaches. Although there is no sea turtle nesting beaches on the northern Aegean Sea coast, there are stranded sea turtle records from the northern Aegean Sea and the Sea of Marmara. This study aimed to investigate causes of strandings and their spatio-temporal distribution in these two seas between 2010 and 2017. For data acquisition, denunciations to the Çanakkale Onsekiz Mart University's Sea Turtle Research and Application Center (ÇOMU-DEKUM) were used. A total of 37 sea turtles were studied; 8.1% of them were *Chelonia mydas*, and 91.9% were *Caretta caretta*. The number of dead strandings (53%) was higher than that of injured strandings (47%). The mean curved carapace length and width of the 27 *C. caretta* individuals were 68.97 cm and 61.96 cm, respectively, and for *C. mydas*, these values were 34.5 cm and 29.5 cm, respectively. The most intensive area of strandings was Çanakkale (76.5%). Moreover, although adult sea turtles were frequently stranded in the Sea of Marmara, sub-adult sea turtles were frequently stranded in the northern Aegean Sea. The leading causes of strandings in the study site were identified as intentional harm (45.9%) and fishing activities (27%). The results of this study show that coasts of the northern Aegean and the Sea of Marmara may be marine habitats of sea turtles. It is recommended that awareness-raising activities for fishermen in the region should be initiated.

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### 1. Introduction

Three species of sea turtles are regularly found in the Mediterranean (Türkozan and Kaska, 2010). These are the loggerhead sea turtle (*Caretta caretta*), green turtle (*Chelonia mydas*) and leatherback sea turtle (*Dermochelys coriacea*). The most abundant species in the Mediterranean is the loggerhead sea turtle, and its main nesting areas include Greece, Turkey, Cyprus, and Libya (Kasperek et al., 2001; Canbolat, 2004; Casale and Margaritoulis, 2010). Main feeding grounds of the loggerhead sea turtle are North Africa and the Adriatic coast (Casale and Margaritoulis, 2010;

Stokes et al., 2015). Main nesting areas of the green sea turtle are Turkey, Cyprus, and Syria (Canbolat, 2004; Casale and Margaritoulis, 2010), and the main feeding areas are mainly in the eastern Mediterranean and the coast of Libya (Casale and Margaritoulis, 2010; Stokes et al., 2015). The leatherback sea turtle is considered as a visitor species from the Atlantic Ocean and limited strandings of the species have been recorded in Turkey as well (Baran et al., 1998; Taşkavak et al., 1998; Sönmez et al., 2008; Taşkavak et al., 2015; Candan and Canbolat, 2017).

According to the International Union for Conservation of Nature (IUCN) Red List criteria, the Mediterranean subpopulations of the green sea turtle and the loggerhead sea turtle are categorized as under Endangered (EN) and Least Concern (LC) categories, respectively (Seminoff, 2004; Casale, 2015). It is crucial to identify the

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habitats of endangered species to maintain their habitat sustainability. Although the protection of nesting beaches is prioritized to facilitate sea turtle population increase, the identification of their feeding, mating and wintering habitats regarding the number of sub-adult and adult populations within biologically safe boundaries is important for the protection of these species (Bjorndal, 1997). Our knowledge about sea turtles in Turkey is mostly limited to nesting female populations and reproductive outputs. There is little research on marine habitats of sea turtles and factors that threaten their population in these habitats.

Apart from the Eastern and Western Mediterranean coasts, which include the major nesting beaches, there is little known about if the sea turtles use coasts of Aegean Sea, Sea of Marmara and Black Sea as wintering and feeding habitats (Panagopoulos et al., 2003; Öztürk et al., 2011; Akdeniz et al., 2012; Ak et al., 2016). The northern part of the Aegean coast has not gained attention as a sea turtle habitat and a few studies that focused on this area reported that it is used by loggerhead sea turtles in the inter-nesting periods (Hays et al., 2010; Margaritoulis and Rees, 2011; Schofield et al., 2013). Although there are some records on the availability of sea turtles based on a limited number of recorded stranded sea turtles and population survey for Çanakkale (Yalçın Özdilek et al., 2008; Akdeniz et al., 2012), these records are not sufficient to provide concrete evidence that Çanakkale shores have been inhabited by sea turtles. Data on stranded sea turtles allow us to obtain information about their age classes, temporal and spatial distributions (Poli et al., 2014), and mortality rates (Casale et al., 2010). One-third of over 132,000 sea turtles that are caught randomly because of fishing activities die in the Mediterranean (Casale, 2011). About 20 years ago, high rates of sea turtles being incidentally caught by bottom trawlers were reported from the eastern Mediterranean coast of Turkey (Oruç et al., 1997; Oruç, 2001). Çanakkale coast is one of the most important commercial fishing coastal areas in Turkey. A total of approximately 1000 bottom trawlers, purse seiners, and small fishing boats are registered to Çanakkale (Ilgar, 2002). At the same time, it is known that the Çanakkale Strait is a very important sea route for both national and international marine transportation. Approximately 130 ships pass daily from the Çanakkale Strait and approximately 50,000 ships annually pass through the Aegean and Marmara waters from the strait (Ilgar, 2015). Therefore, if sea turtles use these coastal areas as marine habitats, intense ship traffic and fishing activities may lead to either their death or injury cases of sea turtles in that area. This study aimed to investigate the causes of death and injury to sea turtles as well as their distribution in northern Aegean and Marmara seas between 2010 and 2017. Thus, we aimed to emphasize the fact that this area can be a marine habitat of sea turtles, and any potential harm to these species should be taken into consideration in any management plan to be developed in future.

## 2. Material and methods

The study area includes the northern Aegean Sea in Turkey (from north of Izmir in the south to Edirne in the north) and the Sea of Marmara (Fig. 1). The northern Aegean Sea is separated from the South Aegean Sea by the Cyclades Islands, which are located in Greece across to Izmir on the Aegean coast of Turkey (İşmen et al., 2015). The information on stranded sea turtles between 2010 and 2017 was acquired by evaluating denunciations of reckless fishing to the Çanakkale Onsekiz Mart University Marine Turtle Research and Application Center (ÇOMU-DEKUM), which works in collaboration with the Ministry of Forest and Water Affairs and the local directorate of Nature Protection and National Parks in Turkey.

Straight carapace length (SCL) and width (SCW), as well as curved carapace length (CCL) and width (CCW) of each individual were measured and recorded. A caliper was used to measure SCL

and SCW and a flexible tape measure was used to measure CCL and CCW. Data on species, sex, the cause of injury or death, the location of stranded individuals and the health of sea turtles by visual observation were recorded. Sex of sea turtles was determined by the tail length and the number of nails on front flippers. In addition, sea turtles were classified as adults if CCL value was greater than 85 cm for the green sea turtle and 70 cm for the loggerhead sea turtle (Türkozan et al., 2013). Sea turtles smaller than these values were categorized as sub-adults. Causes of death were determined through a necropsy in cases wherein it was not evident by direct observation. After necropsy and direct observation, the causes of death and injury of sea turtles were categorized as follows: (1) intentional harm [injured or killed with heavy objects or gun (on head, plastron, carapace or other sites)], (2) fishing activities (entanglement with the fishing nets, hook in jaws, mouth, esophagus, stomach or intestine and fishing line in cloaca or mouth), (3) collision with marine vehicles (e.g., fishing boat, cargo ship, and speed boat), and (4) undetermined causes which included individuals whose cause of death could not be determined because of body disintegration before or after necropsy.

Data homogeneity was tested with the Levene test. Inter-regional differences in the carapace measurements of stranded sea turtles were tested by one-way analysis of variance (ANOVA). The seasonal differences in carapace measurements of stranded sea turtles were analyzed by Tukey's HSD *post-hoc* test in one-way ANOVA. All analyses were conducted using Statistical Package for Social Sciences (SPSS, v.17). Each mean value was presented with a standard deviation (SD) and range (min–max).

## 3. Results

Overall, 37 dead and injured sea turtles were found, of which 34 (91.9%) were loggerhead sea turtles and 3 (8.1%) were green sea turtles. The frequency of stranding was 4.62 turtles per year. All green sea turtles were dead, whereas 16 (47%) of the loggerhead sea turtles were injured. The treatment and rehabilitation of injured sea turtles were completed in ÇOMU-DEKUM with a vet experienced about sea turtles. Seven of them were recovered and tagged with metal tags (tag number TR-Y 4200, NBT 681 Monel) and released to places where they were found.

Descriptive statistics of carapace measurements of stranded sea turtles are shown in Table 1. Fifteen (55.6%) of the loggerhead sea turtles were identified as adults and 12 (44.4%) of them as sub-adults. One of the adults was identified as male (6.6%). For the green sea turtle, 2 individuals (66.6%) were identified as sub-adults and 1 individual (33.3%) was a male adult. Measurements of seven loggerhead sea turtles and one green sea turtle could not be taken because of decomposition and fragmentation. The data showed the presence of different sizes and both sexes were found with female predominance among the loggerhead sea turtles in the study site.

When dead and injured sea turtles were evaluated according to stranding locations, Çanakkale was found to be the most intensive (76.5%) which was followed by Balıkesir (8.8%), Edirne (5.9%) and İzmir (2.9%), İstanbul (2.9%), and Yalova (2.9%) (Fig. 2a). Two stranded green sea turtles (66.6%) were found in Çanakkale and one (33.3%) in Şarköy, Tekirdağ. The region-wise distributions of the loggerhead and green sea turtles are shown in Fig. 2b.

When the Çanakkale Strait was considered as a border between the Aegean Sea and the Sea of Marmara, descriptive statistics of carapace measurements of stranded loggerhead sea turtles and distribution frequencies according to these regions are shown in Table 2. The presence rate of sea turtles in the Sea of Marmara was higher (59.2%) than in the Aegean Sea. There were significant differences in measurements of turtles found in these regions in terms of curved carapace ( $F = 7.414$ ,  $df = 1$  and  $p = 0.012$  for CCL;  $F = 12.876$ ,  $df = 1$  and  $p = 0.001$  for CCW). Moreover, there were

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