

RESEARCH ARTICLE

Onboard surveys results for the loggerhead turtle (*Caretta caretta*) and the green turtle (*Chelonia mydas*) in the Finike (Anaximander) Seamounts region and adjacent waters

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Abstract

Identification of key habitats of migratory marine megafauna species is of great importance, especially for the conservation of threatened species. In this study, the occurrence and distribution of sea turtles in coastal and offshore areas were investigated for the first time by offshore onboard observations in the Finike Seamounts (Anaximander) Specially Protection Area and its adjacent waters. The study was carried out in spring and autumn in 2021 and two sea turtle species known to breed in Türkiye, the loggerhead turtle (*Caretta caretta*) and the green turtle (*Chelonia mydas*) were observed. Of the total of 11 individuals observed, five of them were identified as the loggerhead turtle and two were identified as the green turtle. The species of four individuals could not be determined. The detection of individuals both during and after the breeding period for both species indicates that the Finike Seamounts Specially Protection Area and adjacent waters host sea turtle species throughout the year. The results of the study show that coastal and offshore observations should be continued systematically in order to make conservation measures specific to the region and to determine the abundance of both species in the region.

Keywords: Offshore habitats, eastern Mediterranean Sea, marine turtles, in-water observation, migratory species

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Introduction

Two sea turtle species, the loggerhead turtle (*Caretta caretta*) and the green turtle (*Chelonia mydas*) inhabit and regularly breed in the Mediterranean. These two species have been identified as two different Regional Management Units (RMUs) (Wallace *et al.* 2010). The Mediterranean loggerhead turtle population is identified as Least Concern - LC (Casale 2015), and the green turtle population is identified as Endangered - EN globally (Seminoff 2004) in the IUCN (International Union for Conservation of Nature) Red List, but the regional assessment of Mediterranean population of the latter species has not been completed yet. The number of adult individuals was estimated as approximately 16,000 for the loggerhead turtle and approximately 4,000 for the green turtle in the Mediterranean (Casale and Heppell 2016). Türkiye is one of the most important countries in terms of sea turtle conservation in the Mediterranean, which has both nesting beaches, foraging and wintering areas for both species (Casale *et al.* 2018).

Regular monitoring and conservation studies have been carried out on nesting beaches since the late 1980s and our knowledge of sea turtles in Türkiye is mainly based on studies conducted at 21 main nesting beaches. The first expedition on sea turtle nesting activities on Turkish beaches was conducted by Geldiay *et al.* (1982) but the most comprehensive study covering all Mediterranean coasts of Türkiye was conducted by Baran and Kasparek (1989). Since then, numerous studies have been conducted on the status and population of sea turtles on nesting beaches. (e.g. Canbolat 2004; Türkozan *et al.* 2003; Yalçın-Özdilek 2007; Kaska *et al.* 2010). However, sea turtles spend almost all of their lives in the sea (Lutz and Musick 1997). In addition, most of the knowledge gaps on Mediterranean sea turtles are on their biology in marine habitats (e.g. foraging and wintering areas, population structure) (Casale *et al.* 2018). The most important reasons for this are the difficulty of observing sea turtles at sea, the need for large effort and cost. Therefore, the main studies carried out in Turkish coasts so far have been based on opportunistic observations and stranding records.

Stranding records contribute to the determination of foraging and development areas of sea turtles. Studies on stranded individuals have shown that Turkish coasts are important for sea turtles (Kaska *et al.* 2004; Türkozan *et al.* 2013; Tonay and Oruç 2016; Başkale *et al.* 2018). The limited number of studies on individuals tracked by satellite transmitters also indicate that the Turkish coasts are important for both species (Stokes *et al.* 2015; Almpanidou *et al.* 2022; Cerritelli *et al.* 2022). In addition, two studies involving direct sampling at the sea confirmed the wintering and foraging areas of the loggerhead turtle on the Turkish

coast (Sözbilen and Kaska 2018; Sözbilen *et al.* 2021). Although it has been observed that both sea turtle species use the Turkish coasts throughout the year, these studies provide information about a limited number of individuals. Sea turtles are migratory species, and they use various regions throughout their life span. Marine species interact with anthropogenic stressors, primarily activities related to fisheries (Casale and Heppell 2016; Snape *et al.* 2016). These stressors affect migratory species and scale to affect population abundance, distribution, and persistence of species (Dunn *et al.* 2019). For instance, Casale (2011) indicated that over 132,000 individuals bycaught in the fishing gears and over 44,000 incidental deaths per year for both sea turtle species from all age classes in the Mediterranean. Therefore, it is important to determine their distribution in coastal and offshore areas, to understand the biology of these species and to take effective conservation measures.

Collaboration of researchers from different fields has come to the fore in recent years to monitor marine species that are difficult to monitor in offshore and coastal areas. ACCOBAMS (Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area) organized a basin wide survey in the Mediterranean Sea to provide an estimate, abundance and distribution of marine megafauna and marine litter (ACCOBAMS 2021). Offshore onboard and aerial surveys made during the ACCOBAMS surveys carried out in 2018 provided an opportunity to observe different marine animals such as sea turtles and to fill the information gap. This study aims to determine the importance of the Finike Seamounts (Anaximander) region and adjacent waters for sea turtles.

Materials and Methods

Study Area

This study was carried out in the the Finike Seamounts (Anaximander Sea Mountains) and the adjacent area. The area is located between the Greek and Cyprus arc (Öztürk *et al.* 2012; Senoz 2015) and was designated as "Finike Seamounts Special Environmental Protection Area (SEPA)" by the Republic of Türkiye Council of Ministers (Official Gazette 2013).

Study Design and Observations

Two survey periods were chosen for the study. The first survey was carried out between May 11 and 25, 2021, and the second was carried out between September 18 and 30, 2021. The observations were conducted by three persons; two observers and one recorder. To prevent fatigue, rotation was made between three positions every hour. Sea turtle sightings were determined by visual observations onboard on the research vessel R/V YUNUS-S with the standard line transect method. The linear section method with equally spaced zig-zag line arrangements was designed for the surveys (Buckland *et al.* 2001). Surveys started at 07:00 AM and continued until sunset and, the cruise speed was set at 8 knots constant speed.

The date, time, coordinates, observers, and sea conditions were recorded at the beginning of each transect line. If the sea state is above 3 Beaufort, no observation effort has been made to avoid negatively affecting the operation. Survey design and applied transects are given in Figure 1.

The port and starboard observers scanned an area of 100° in total, from 0° on the ship's bow to 10° on the opposite side, with binoculars and the naked eye, thus providing more observation effort for the 20° angle on the line. The sightings of sea turtles, time, and coordinates were recorded not only during transects but also recorded off effort (out of transects).

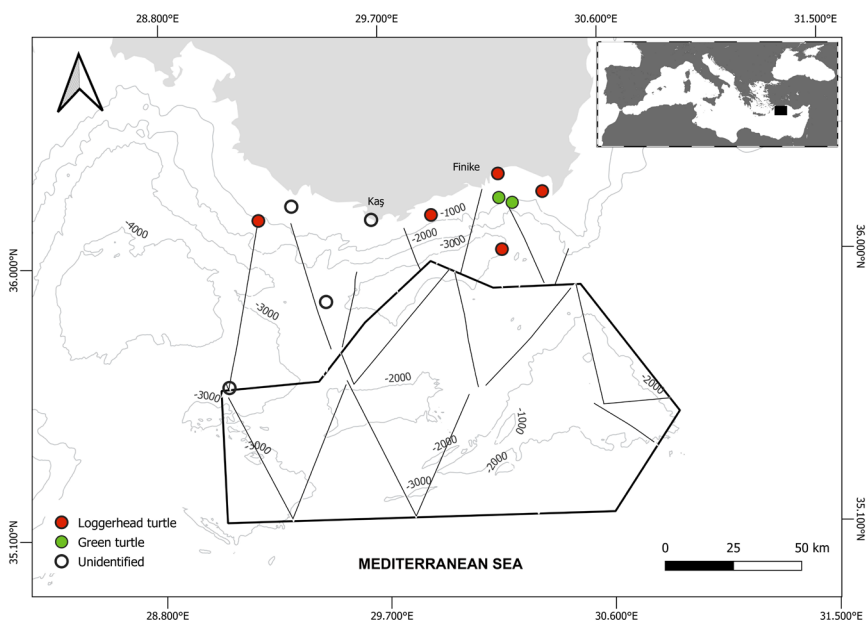


Figure 1. Study area and sea turtle observations recorded in two surveys. Solid black lines show the Finike Seamounts SEPA. Line transects represented as thin lines.

Results

A total of 11 individuals belonging to Cheloniidae were identified in the studies carried out in the Finike Seamounts SEPA and its adjacent waters. A total of five individuals were identified as the loggerhead turtle, two individuals were identified as green turtle, and the remaining four could not be identified due to the observation condition or the only visible body part was the top of the carapace, which did not allow identification. In addition, three individuals were identified as juvenile. One of these observations was the carcass of a dead adult green turtle. The number of individuals observed according to the observation periods are

given in Table 1. Examples of identified and unidentified individuals are shown in Figure 2.

Table 1. The number of sea turtle individuals observed in this study

Species	May		Sep		Total
	Adult	Juvenile	Adult	Juvenile	
<i>Caretta caretta</i>	2	1	2	-	5
<i>Chelonia mydas</i>	1	-	1	-	2
Unidentified	1	2	-	1	4

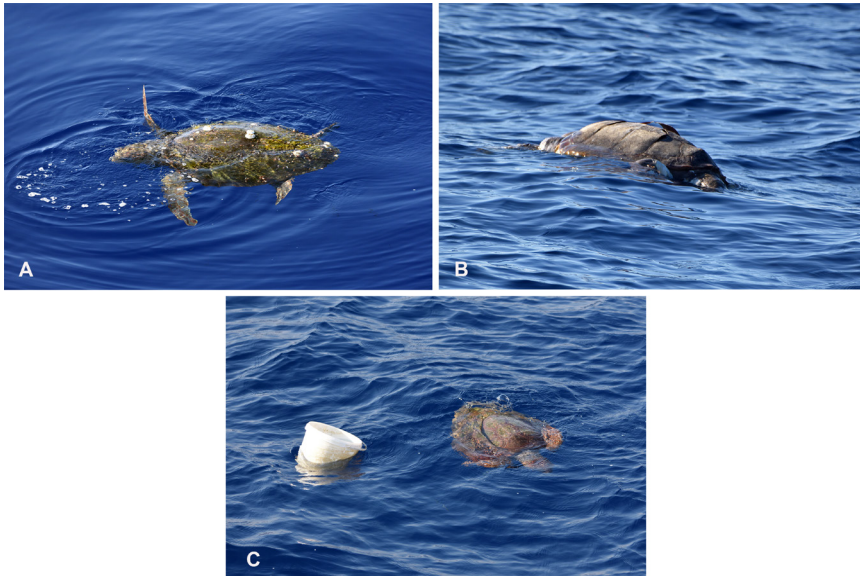


Figure 2. Photos of sea turtle observations in this study.

(A) an adult loggerhead turtle, (B) a dead green turtle, (C) a juvenile loggerhead turtle.

Discussion

This research was designed specifically for cetaceans and therefore sea turtle records were collected based on semi-opportunistic events. This study presents, however, the results of the first offshore sea turtle observations based on ship surveys in Türkiye. The results of the study showed that both the loggerhead turtle and the green turtle use mostly the coastal area of Finike Seamounts Region, although sea turtle observations were previously reported in the Finike Seamounts SEPA and the offshore waters by the ASI aerial surveys (ACCOBAMS 2021). The previous studies based on satellite tracking showed that coastal neritic areas of Türkiye were frequented by the loggerhead turtle (Almpanidou *et al.* 2022; Cerritelli *et al.* 2022), and the green turtle (Stokes *et al.* 2015; Türkecan and Yerli

2011). This study also indicated that offshore areas are also used by sea turtle species in Türkiye. In addition, it was reported that both the loggerhead turtle and green turtle were found in neritic areas up to 30m deep during trawler observations in the east of Türkiye's Mediterranean coast (Oruç 2001).

The study was carried out in May and September. The breeding season of sea turtles in Türkiye is between May and the end of July (Türkozan and Kaska 2010), and they make breeding migration to the nesting areas during May. Kumluca beach is one of the important indexed nesting sites in the Mediterranean for loggerhead turtle (Baran and Kasperek 1989; Canbolat 2004). In addition, very few green turtle nesting events have been observed in this region (Yerli and Demirayak 1996; Maden *et al.* 2022). However, the observations during the September survey also indicated that the Finike Seamounts Region is also used by sea turtles after the breeding season.

The spatial ecology of migratory animals is an important element to understand connection of different areas in the conservation of highly mobile species (Dunn *et al.* 2019). In addition, the identification of foraging, wintering, and developmental areas of migratory animals, as well as understanding their migration routes, is of vital importance for the implementation of effective conservation measures. In this context, the Marine Turtle Specialist Group (MTSG) highlighted the concept of "Important Sea Turtle Area" (IMTA), and defined these areas as "Discrete, manageable units of marine turtle habitats that are important for ensuring that marine turtles persist and thrive as key components of coastal and marine ecosystems, including human cultural ecosystems" and issued a guideline for the identification of these areas (IUCN-SSC Marine Turtle Specialist Group 2021). Previously, the potential area to be IMTA in Türkiye has been reported only in Dalyan, Türkiye, with its indexed nesting beach and the results of the in-water studies (Sözbilen *et al.* 2021). Besides, regional and national action plans prepared for the conservation of species and habitats are important in terms of determining priorities for effective conservation and planning studies accordingly. An action plan for the conservation of Mediterranean sea turtles has been prepared (UNEP MAP RAC/SPA 2007) and the national action plan was adopted by Türkiye. However, these action plans need to be updated on a regional and national scale at certain intervals with up-to-date information.

Revealing migratory connectivity of spatial movement patterns is helping communication to policymakers, fill the knowledge gap in ecological connectivity for the implementation of appropriate conservation measures (Kot *et al.* 2022). Migratory connectivity is of great importance because sea turtles often use their migratory corridor to reach their breeding beaches from foraging areas. Satellite tracked sea turtles are very good example of proving this connectivity. Four individuals have been previously tracked by Sea Turtle Research, Rescue and Rehabilitation Center (DEKAMER) and those animals used Finike region as

a migration route (DEKAMER, unpublished data). In addition to this, adult loggerhead turtles nesting in Greece can also use this area during their migrations (Rees *et al.* 2017), and Antalya region can be a migratory corridor and foraging area for the adult green sea turtle (Stokes *et al.* 2015; Bradshaw *et al.* 2017). Kot *et al.* (2022) analysed the global movement patterns of sea turtles and migratory connectivity and revealed that different migration routes between Levantine basin and the Aegean Sea are located in the Finike Seamount Region and its adjacent waters. The Mediterranean sea turtles are known to have high fidelity to their migration routes between the breeding and foraging areas (Broderick *et al.* 2007). Although the number of individuals observed in the study is limited, it shows the occurrence of two sea turtle species of the Mediterranean in the region during and after the nesting period, and the region also host migratory corridors which connect different rookeries in the Mediterranean. In addition, juvenile individuals were identified in the region and showed that it could be a potential development area. Considering that the Finike region has an important indexed nesting beach with over 700 nests (Maden *et al.* 2022) and together with the results of this study, Finike region has important foraging, and nesting sites and includes migratory corridors for both species. Therefore, specific conservation measures should be considered both on nesting beaches and in the marine environment for this region.

Determination of specific areas for the protection of marine life and taking site-specific conservation measures are one of the most studied subjects today. This study shows that Türkiye has important habitats not only in coastal neritic areas and nesting beaches, but also in offshore areas for sea turtles. The results of this study also highlight the importance of continuing systematic surveys by developing cooperation between researchers from different fields in order to determine the seasonal abundances and age classes of both sea turtle species in the Finike Seamounts region and to take mitigation measures against potential threats in the offshore areas. We believe that this study will not only expand our knowledge of turtles, but also contribute to updating regional action plans and identifying potential marine protected areas. Future studies can be conducted on the samples that collected during offshore surveys to identify their foraging sites by stable isotope analysis and their origins by genetic markers.

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Finike (Anaximander) Denizaltı Dağları Bölgesi ve komşu sularında iribaş deniz kaplumbağası (*Caretta caretta*) ve yeşil deniz kaplumbağası (*Chelonia mydas*) için ilk deniz gözlemi çalışması sonuçları

Öz

Göçmen denizel mega fauna türlerinin yaşadığı anahtar habitatların belirlenmesi, özellikle tehdit altındaki türlerin korunabilmesi için büyük önem taşımaktadır. Bu çalışma ile ilk kez deniz kaplumbağalarının Finike Denizaltı Dağları (Anaximander) Özel Çevre Koruma Bölgesi ve komşu sularında varlığı ve dağılımı, kıyusal ve açık deniz alanlarında tekne gözlemleri yapılarak araştırılmıştır. Çalışma 2021 yılı bahar ve sonbahar aylarında iki dönemde gerçekleştirilmiş ve Türkiye’de ürettiği bilinen iribaş deniz kaplumbağası (*Caretta caretta*) ile yeşil deniz kaplumbağası (*Chelonia mydas*)’a ait toplam 11 birey gözlenmiştir. Gözlenen bireylerin beşinin iribaş deniz kaplumbağasına, ikisinin yeşil deniz kaplumbağasına ait olduğu belirlenmiştir. Dört bireyin ise tür tayini yapılamamıştır. Gözlemlerde her iki tür için hem üreme döneminde hem de üreme dönemi dışında birey tespitinin yapılması, Finike Denizaltı Dağları Özel Çevre Koruma Bölgesi ve komşu sularında yıl boyu deniz kaplumbağalarının varlığını işaret etmektedir. Çalışmanın sonuçları, bölgede her iki türe ait deniz kaplumbağası bolluğunun belirlenmesi ve alana özgü koruma önlemlerinin alınabilmesi için kıyusal ve açık deniz alanlarında gözlemlerin sistematik olarak devam ettirilmesi gerektiğini göstermektedir.

Anahtar kelimeler: Açık deniz habitatları, Doğu Akdeniz, deniz kaplumbağaları, deniz içi gözlem, göçmen türler

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