Establishment of Mersin University Sea Turtle Application and Research Center (Me.U.DEKUYAM) and the Studies of this Center on Marine Turtles in Mersin, Turkey

In Mersin University, the first efforts on sea turtles study began with sending two person from the department of Biology for working on the field in the green turtle monitoring programme which was supported by the RAC/SPA (Regional Activity Center/Special Protected Areas) conducted by Aureggi (2001) in 2001 nesting season in Kazanlı beach, Mersin. In the later years, with subsequent studies in the Kazanlı, Davultepe 100. Yıl, Alata, Göksu Delta and Anamur beaches in Mersin, our studies on marine turtles have been conducted and progressed. Then, with the need of gathering under a corporate roof, in 2009, Mersin University Sea Turtle Application and Research Center (Me. Ü. DEKUYAM) was established in Mersin which is situated on the east Mediterranean coast of Turkey. Later, on 26 May 2009, the Higher Educational Council of Turkey officially recognized the application and research center and its constitution was published in the Official Gazette of Turkey (numbered: 27239). The objectives of this center are (a) research, (b) conservation, (c) education (especially environmental awareness), and (d) supporting of rehabilitation efforts. Furthermore, in 2015, by the team of center, Mediterranean Turtles and Nature Conservation Association (Akdeniz Kaplumbağaları ve Doğa Koruma Derneği-AKKAP) have been established in Mersin. Now, the center (Me. Ü. DEKUYAM) and association (AKKAP) work together. In Turkey, there are other centers working on sea turtles and these centers are located (east to west in Turkey) in Mustafa Kemal University (in Hatay), Pamukkale University (in Denizli) and Çanakkale Onsekiz Mart University (in Çanakkale). Besides, there are Mersin Sea Turtles Rescue, Rehabilitation and Information Center depending on the Republic of Turkey Ministry of Agriculture and Forestry.

Along the Mediterranean coasts of Turkey, 21 important nesting grounds for both *Caretta caretta* (loggerhead turtle) and *Chelonia mydas* (green turtle) sea turtles have been identified in studies conducted on the beaches (Türkozan & Kaska, 2010) (Fig.1). Namely Alata beach is included in these 21 nesting beaches and this beach was added to the nesting areas in Mersin (Aymak 2004; Aymak *et al.* 2005; Ergene *et al.* 2006a, 2009; Türkozan & Kaska, 2010) by our research team. Then, the other nesting beach in Mersin was added by our investigations, namely Davultepe 100. Yıl nesting beach (Ergene *et al.* 2010; Ergene *et al.* 2016a). So, two nesting sites were added to the nesting areas in Mersin, Turkey by our center team. The beaches of Mersin are very important sites since both green and loggerhead turtle nests have laid regularly (Fig.1).

Figure 1. The important nesting beaches for marine turtles in Turkey (modified from Türkozan & Kaska 2010).

Our priority action is to survey marine turtles along the Mersin coasts and since 2002, our research team in Mersin University has conducted studies on green turtle, loggerhead turtle and Nile soft-shelled turtle in beaches of Mersin. However, only in 2006 nesting season, in Demre (Kale) beach, Antalya, Turkey, the population of loggerhead turtle nesting was investigated by us (Ergene 2006c; Ergene *et al.* 2007a). Besides, in our field studies, the GPS (Global Position System) measurements have been recorded in Geo mode: World Geodetic System (WGS84) (map datum), latitude and longitude in degrees and minutes (hddd°mm.mmm').

Nesting sites in Mersin that we study

Kazanlı beach: This beach is one of the most important sites for green turtles (Fig. 1). Besides, small amount of loggerhead turtle nests regularly and this beach is designated as a

Natural SIT area (Türkozan & Kaska 2010). This beach is located in the southern Mediterranean Coast of Turkey, and it is approximately 12 km far from the center of Mersin. D-7 Drainage channel (Çomak) (36°48.262′ N, 034°47.289′ E) is located at the most eastern part of Kazanlı beach and Soda Sanayii A.Ş. and Kromsan Factory (36°48.677′ N, 034°43.430′ E) at the western end of the beach. The beach is a total of 6.1 km in length (Fig. 2). However, the suitable part of the beach for sea turtle nesting is 4.7 km in length (Uçar *et al.* 2020; Aymak *et al.* 2020). We started monitoring and conservation studies on sea turtles in 2006 during the nesting season (Ergene *et al.* 2006b, 2013). Then, between 2009 and 2016, our studies continued for eight nesting seasons (without interruption) (Şengezer 2012; Ergene *et al.* 2012b, 2015, 2016b; Uçar *et al.* 2018a). Besides, other than the monitoring and conservation studies, the age distributions of dead-stranded loggerhead turtle individuals which were collected from Kazanlı beach were also determined by applying skeletochronological method (Yaşar 2010) and in this beach, the haematological, biochemical and genotoxic properties of loggerhead and green turtles were investigated (Kaya 2011). The effect of invertebrate infestation on green turtle (*Chelonia mydas*) nests on this beach was evaluated (Aymak *et al.* 2020).

Figure 2. A sketch map of Kazanlı Beach with its sectors and the back structure (modified from Elmaz & Kalay 2006, not to scale).

Davultepe 100. Yıl beach: This beach was found to be one of the most important nesting sites for green turtles, and also has a small number of loggerhead turtle nests laid annually (Ergene *et al*. 2010, 2012a, 2016a,b; Ergene 2014) (Fig. 3). Davultepe is located between Kandak Stream (36°43.446′ N, 34°30.336′ E) in the northeast and Onur Resort (36°42.535′ N, 34°28.410′ E) in the southwest of Mersin, totals 2.8 km in length, and includes Davultepe public beach, the picnic area and Gümüşkum Natural Park (Ergene *et al.* 2016a) (Fig. 3). The

Gümüşkum Natural Park, designated on 7 November 2011, is 1.8 km long and located between Kandak Stream in the northeast and Kuğu Resort (36°43′008″ N, 34°29′290″ E) in the southwest (Fig. 3). It is administered by Mersin Sea Turtle Rescue, Rehabilitation and Information Center in Gümüşkum Natural Park of Davultepe 100. Yıl Beach, and the Republic of Turkey Ministry of Forestry and Water Affairs, 7th Regional Directorate, Section of Mersin (Ergene *et al.* 2016a). Firstly, in 2006, 23 nests were reported on this same beach (Ergene 2006). Besides, our surveys on green and loggerhead turtles have been conducted since 2009 (without interruption) (Ergene *et al*. 2010; 2012a,b; 2016a,b; Ergene 2014 (M.Sc. thesis)). Accordingly, as a result of the our monitoring studies, the Sea Turtles Science Commission in Turkey decided to evaluate this beach as a sea turtle nesting area in 2019.

Figure 3. A sketch map of Gümüşkum Natural Park of Davultepe 100. Yıl Beach with its sectors and the back structure (not to scale) (modified from Ergene *et al.* 2010).

Alata beach: This beach was found to be one of the most important nesting sites for green turtles, and also has a small number of loggerhead turtle nests laid annually (Fig. 1). This beach is 30 km from the center of Mersin and is located within the borders of Alata Horticultural Research Institute., which is a 1st degree natural site. It extends over 3 km from the marine resorts in the east of the Research Institute (36°37.930′ N, 34°21.187′ E) to the Topraksu camping site, which belongs to the Research Institute (36°36.868′ N, 34°19.711′ E), at the western end of the beach (Aymak *et al.* 2017) (Fig. 4). The Alata nesting beach discovered in 2002 as an important nesting area and registered as 18th nesting beach of Turkey in 2005 was put under protection and the monitoring and conservation studies on green and loggerhead sea turtles have conducted since 2002 by our research team (Aymak 2004 (M.Sc. thesis); Aymak *et al.* 2005; Ergene *et al.* 2006a,b, 2009, 2012b, 2016b). Besides, in this

beach, the genetic polymorphism of green turtle hatchlings emerged in subsequent years on Alata nesting beach of Mersin were analysed by mtDNA-RFLP analysis (Hançer 2010) and microsatelite locus analysis performed on green turtles (Kaçar 2011). The age distributions of dead-stranded loggerhead turtle individuals which were collected from Alata beach were determined by applying skeletochronological method (Yaşar 2010) and in this beach, the haematological, biochemical and genotoxic properties of loggerhead and green turtles were investigated (Kaya 2011). The carapacial scute variation of green and loggerhead turtle hatchlings from Alata beach were examined within carapacial scute series and in carapacial scute pattern (Ergene *et al.* 2011). Invertebrate infestation in green and loggerhead turtles nests was examined on this beach (Aymak *et al.* 2017).

Figure 4. A sketch map of Alata beach with its sectors and the back structure (Aymak *et al.* 2017) (not to scale).

Göksu Delta beach: Göksu Delta on the Mediterranean shoreline of Turkey is among the most important nesting grounds for loggerhead turtles (Fig. 1) and the beach is designated as Special Environmental Protection Area (SPA) (Durmuş *et al.* 2011). Besides, the importance of this area is enhanced because it is also used as 'Reproduction and Conservation Zone for Water Birds' as well as included in RAMSAR and 1st degree Natural Site (Durmuş *et al.* 2011). Göksu Delta (36º17'N- 33º39'E), is located at 80 km west of Mersin and almost 35 km in length (Durmuş *et al.* 2011) (Fig. 5). The Turkish Authority for the Specially Protected Areas coordinates regular monitoring of Göksu Delta for nesting activities of sea turtles by producing a projects for researchers from the Turkish universities and provides financial support for these projects. We only participated one project for helping on the field works

during 2004 nesting season. So, nesting activity of loggerhead turtles was observed in cooperation with Dokuz Eylül and Mersin Universities in this beach.

Figure 5. A sketch map of Göksu Delta with its subsection and spatial distribution of dense nesting sites (Durmuş *et al.* 2011).

Anamur beach: Anamur Beach is located in the south of Anamur, Mersin, Turkey and this beach is among the most important nesting grounds for loggerhead turtles. The historic town of Ören (Anamurium) (36°01.201′ N, 32°48.216′ E) is located at the most western part of the beach and Pullu Forest Camp (36°05.260′ N, 32°54.868′ E) at the eastern end of the beach, for a total of 12.7 km in length. The beach is divided into 5 sectors from southeast to northeast by Sultansuyu (Sultançayı, rivulet), İskele (the wharf), Dragonçayı (Kocaçay, rivulet) and Mamure Castle (Uçar 2009) (Fig. 6). During the 2006 and 2007 nesting seasons, the population of loggerhead turtle, green turtle and Nile soft-shelled turtle which nest on Anamur beach were investigated (Uçar 2009 (Ph.D. dissertation)). Besides, The mean sex ratios of loggerhead sea turtle were estimated based on gonad histology of dead hatchlings and late stage embryos in this beach (Uçar *et al.* 2012).

Figure 6. A sketch map of Anamur Beach showing the sub-sectors, beach-back structures, and nest density (Uçar *et al.* 2012).

Demre (Kale) beach:

This beach is located between Beymelek lagoon and Kale town in Antalya province. In addition, this beach is almost 8.5 km in lenght and consists of five subsections namely, Çayağzı (36°13.80'N, 29°56.39'E), Sülüklü, Taşdibi, Beymelek-Sıfat beach and Beymelek-

Dalyan beach (36°15.560'N, 30°4.180'E) (Ergene *et al.* 2007a) (Fig. 7). The nesting activity of loggerhead turtle in this beach was investigated only once by us (Ergene 2006c; Ergene *et al.* 2007a) during 2006 nesting season.

Figure 7. A satellite imagine of Demre (Kale) beach showing the sub-sectors [1. Demre Çayağzı Beach, 2. Demre Sülüklü Beach, 3. Demre Taşdibi Beach, 4. Beymelek-Sıfat Beach, 5. Beymelek-Dalyan Beach] (modified from Google Earth Pro, October 29, 2020).

As mentioned before, our center regularly monitor the Mersin beaches for nesting activities by accepting volunteers from both different departments of our university and all other universities. Besides, the center conducts public awareness studies in Mersin, with the objective of studying and protecting the important nesting population of sea turtle in the east Mediterranean. For this purpose, our center participates in some activities in which the public is heavily involved such as science festivals, nature education and science schools support programs, Caretta bicycle festivals, activities with associations, beach cleaning campaigns. Furthermore, our center was participated within the scope of the "Social Responsibility Activities" program of the Introduction to University Life (ÜYG) course, which was carried out for the adaptation of the students from different departments who were newly enrolled in the university, in order to inform both native and foreign students about studies on research, conservation, education on sea turtles and nesting beaches. The center hopes to be able to make fishermen consicous in order not to harm turtles and make them participate in protecting and preventing them from the extinction. Furthermore, regarding the marine turtles in postgraduate education in Mersin University Institute of Science, four M.Sc. theses (Aymak 2004; Yaşar 2010; Kaya 2011; Şengezer 2012) and one Ph.D. dissertation (Uçar 2009) were completed under the supervision of Prof.Dr. S. Ergene. Besides, two M.Sc. theses (Hançer

2010; Ergene 2014) were completed under the supervision of Prof. Dr. Y. Kaçar and Prof. Dr. B. Cicik, respectively.

Additionally, other than our actions of research, conservation, education on sea turtles in Mersin beaches, supporting of rehabilitation efforts are also carried out. The first effort on treatment of sick or injured marine turtles in Mersin was begun by us. The medical operation was carried out to one loggerhead turtle, which was found to have large-scale fractures and fragment loss in the frontal region of the skull, by one veterinary, one doctor from the department of orthopedics and traumatology, one doctor from the department of neurosurgery in Mersin University faculty of medicine, and three biologists from department of Biology in Mersin University in 2007. Besides, we presented our initial results regarding the main cause of injure of one loggerhead sea turtle and the process of treating it until it died after 41 days (Ergene *et al.* 2007b) (Fig. 8).

Figure 8 (a-b). The operation from the head trauma of loggerhead sea turtle in veterinary clinic.

Later, in 2010, Mersin Sea Turtles Rescue, Rehabilitation and Information Center (depending on the Republic of Turkey abolished Ministry of Environment and Forestry, Section of Mersin and now this center depends on the Republic of Turkey Ministry of Agriculture and Forestry) has been established in 100. Yıl (Gümüşkum) Natural Park of Davultepe Beach. Our center provided consultancy services to this center for many years. This center and our center (Me. Ü. DEKUYAM) work with collaboration and, when injured sea turtles are found on the beach during our field observations on the nesting seasons, the first health interventions are performed in the beach and injured turtles are also brought to the center of ministry in Davultepe for taking care of their necessary medical treatment and rehabilitation.

Overall, Me. Ü. DEKUYAM Sea turtle research and application center has the advantage of being close to nesting beaches in Mersin and coordinates regular monitoring of beaches in Mersin for nesting activities by accepting volunteers from Turkey and all around the world. Further more, there are studies (Güçlü *et al.* 2009; Türkozan *et al.* 2013, 2018; Uçar *et al.* 2018b) we have done with other researchers. So, Me. Ü. DEKUYAM center is also open for both national and international collaborations in all types of scientific studies. Organizations interested in receiving more information about Me. Ü. DEKUYAM and AKKAP may follow to center and association at the our social media addresses below:

Me. Ü. DEKUYAM adress:

http://www.mersin.edu.tr/akademik/deniz-kaplumbagalari-uygulama-ve-arastirma-merkezi

https://www.instagram.com/dekuyam/

AKKAP adress: *https://www.facebook.com/groups/998103066896385*

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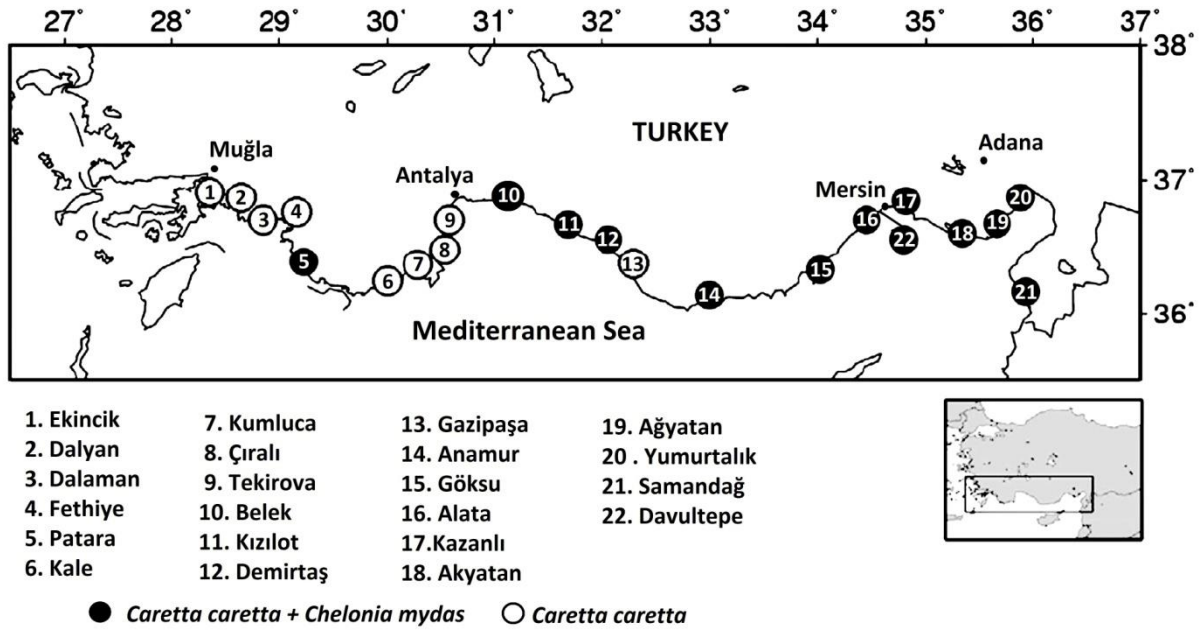

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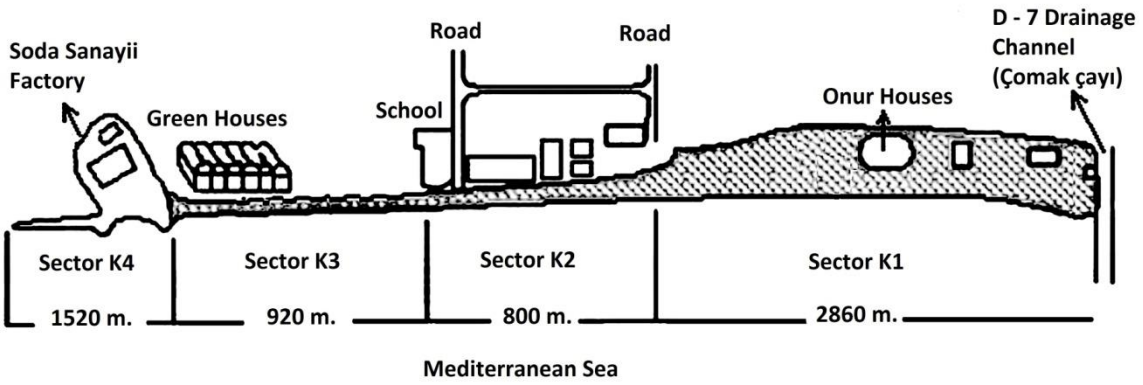


Figure 2. A sketch map of Kazanlı Beach with its sectors and the back structure (modified from Elmaz & Kalay 2006, not to scale).

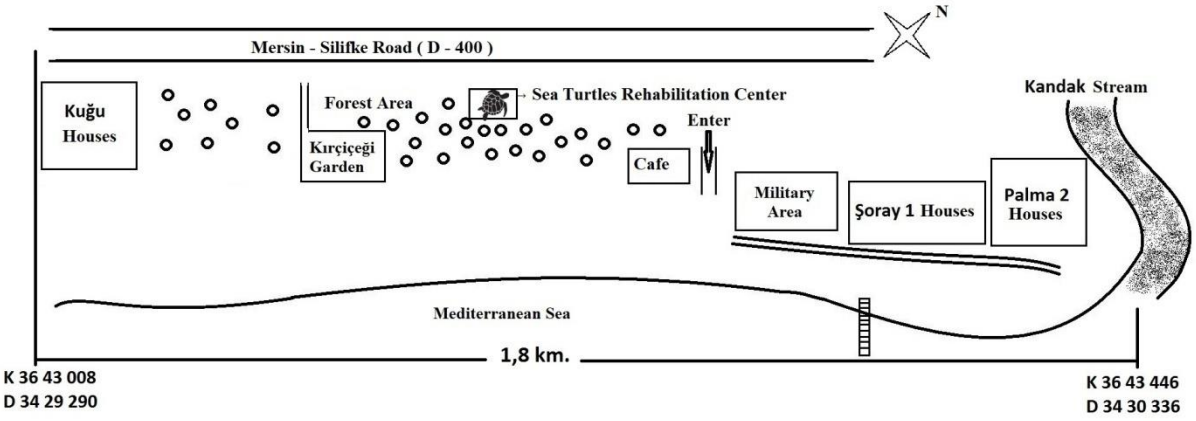


Figure 3. A sketch map of Gümüşkum Natural Park of Davultepe 100. Yıl Beach with its sectors and the back structure (not to scale) (modified from Ergene *et al.* 2010).

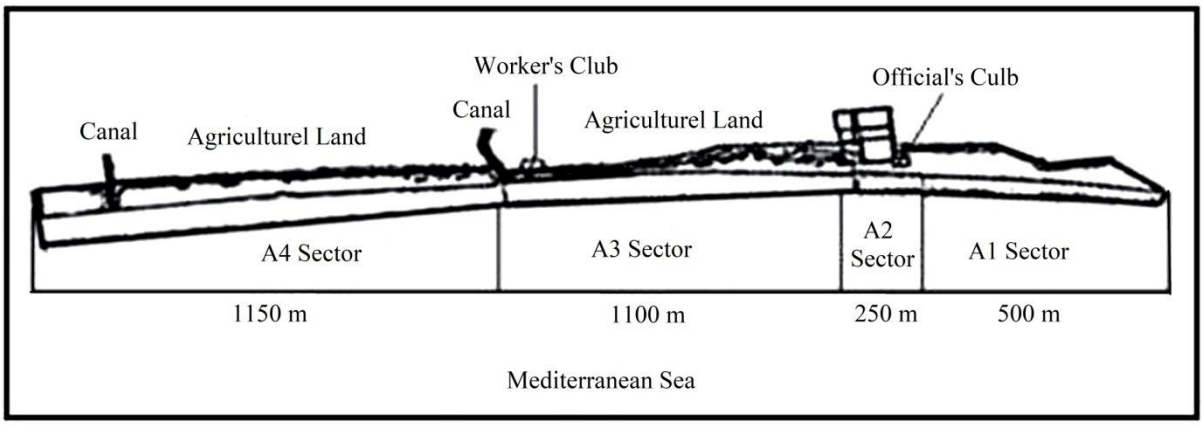
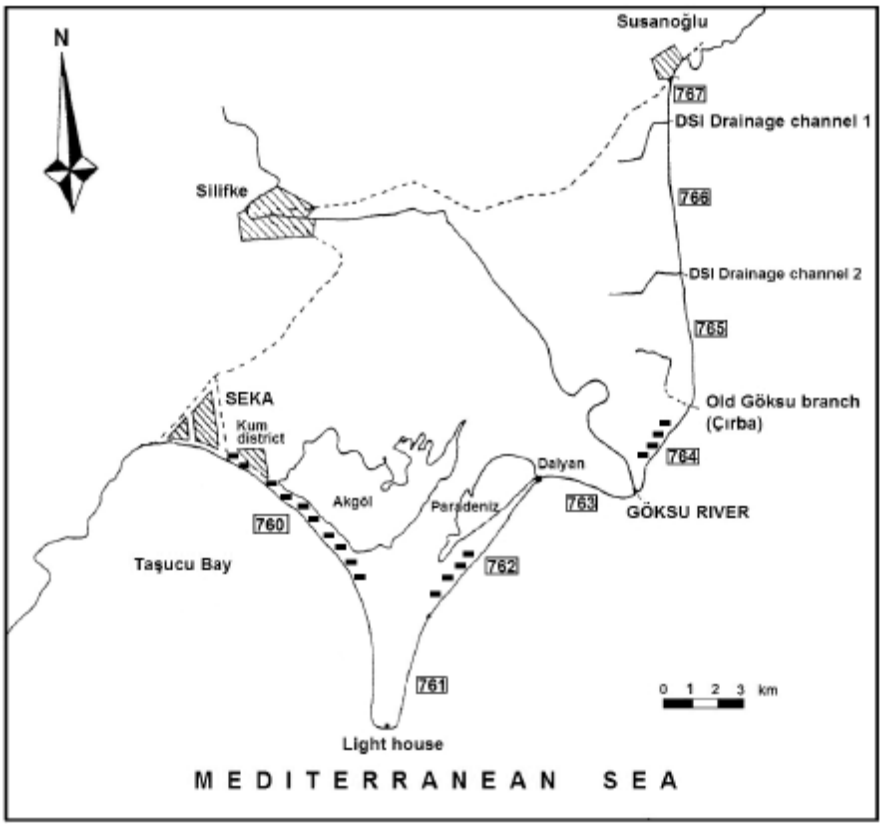


Figure 4. A sketch map of Alata beach with its sectors and the back structure (Aymak *et al.* 2017) (not to scale).



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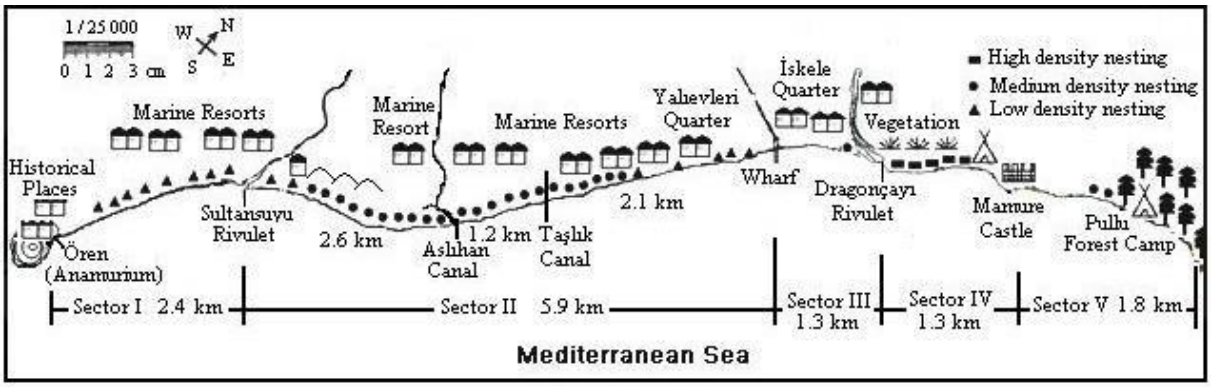

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