

ARTICLES

Update of Green Turtle Nesting in Greece: A Second Nest Recorded on Crete Island

Dimitris Margaritoulis[#], Saskia K Johnson, Aliko Panagopoulou, Odysseas Paxinos

ARCHELON, the Sea Turtle Protection Society of Greece, Athens, Greece

([#]margaritoulis@archelon.gr)

Nesting of green turtles *Chelonia mydas* in the Mediterranean is traditionally restricted in its easternmost part (Levantine basin), presumably due to higher water temperatures (Kasperek et al. 2001; Casale et al. 2018). Major nesting of green turtles occurs in Turkey, Cyprus and Syria with less nestings in Israel, Lebanon and Egypt (Kasperek et al. 2001; Rees et al. 2008; Casale et al. 2018). The westernmost boundary of green turtle regular nesting in Turkey seems to be Fethiye Gulf (36.744981°N, 28.924861°E) (Sözbilen et al. 2018). However, in recent years green turtle nests have been reported in areas distant from the species' known nesting range. Specifically, green turtle nests were confirmed in Greece (Rethymno) in 2007 (Margaritoulis et al. 2019), in Tunisia (Rejich beach) in 2019 (Ben Ismail et al. 2022) and in Libya (near Tobruk) in 2021 (Saied et al. 2023). Here, we report one more nesting of green turtle on the Island of Crete, Greece.

ARCHELON systematically monitors the main nesting areas of loggerhead turtles in Greece (Margaritoulis & Panagopoulou 2010). One of these areas is the westwards-facing 8 km beach of Messaras Bay on the southern coast of Crete (Fig. 1). The greatest part of the beach is included in the EU's NATURA 2000 network of protected sites under the code GR4310004 "DYTIKA ASTEROUSIA (APO AGIOFARANGO EOS KOKKINO PYRGO)". The beach has been divided in four main sectors, of which one –B Sector or Kalamaki beach- is backed by a coastal village causing extensive human-induced disturbances to turtle nesting on the beach. Standard field activities in

Messaras Bay include surveying the beach early in the morning, counting emergences and nests, and protecting nests through *in situ* caging (against trampling) and/or relocating (against inundation). Nests continue to be observed until hatching, and once hatching is complete, they are excavated to assess clutch size, hatching success, in-nest mortality and other parameters relating to reproductive output and population recruitment. All fieldwork is implemented by trained volunteers supervised by experienced field assistants.

On 22 July 2019, the volunteer team in Messaras Bay was called to Kalamaki beach because people were preventing a sea turtle from nesting. Indeed, the turtle was observed at about 22:30 on the beach, with several people around, obstructing it from reaching the high beach. The volunteers identified the turtle as a green turtle (*Chelonia mydas*) and made sure that everyone moved away to allow the turtle to nest (Fig. 2). Eventually, the turtle nested at a distance of 31 m from the water, albeit close to a wooden walkway and a tamarisk tree (35.02743°N, 24.75898°E) which advocated relocation of the nest according to ARCHELON protocols. The nest contained 142 eggs and had a total depth of 68 cm from the sand surface, with the top egg at 38cm. The clutch, relocated to a more appropriate site (35.02700°N, 24.75905°E) near the original location, at a distance of 29 m from the water, was caged and monitored throughout the incubation period. First hatch occurred on 4 September, indicating an incubation duration of 44 days.





Figure 1. Map of Crete showing (in red) the three main nesting areas of loggerhead turtles on the island. Asterisk in the inset map indicates the approximate position of the green turtle nest.

Hatchling emergence continued until 9 September and post-hatch excavation was carried out on 16 September. The nest contained 75 hatched eggs, three half-pipped hatchlings (of which one dead), 64 unhatched eggs (13 with no visible embryos, 49 with dead embryos, and two with live embryos) and 11 hatchlings (of which four dead). In total, the clutch showed a hatching success of 54.9% and a hatchling emergence success of 45.1%. All live hatchlings were assisted to reach the sea, and the dead hatchlings and some developed embryos were preserved in 95% alcohol for future analyses. Morphological inspection of hatchlings and developed embryos confirmed that the turtle was a green turtle (Fig. 3).

Of note, on 6 August 2022, i.e., 14 days after the green turtle nesting, volunteers recorded green turtle tracks on the same beach but without any nesting attempt.

This is the second record of green turtle nesting in Greece, both having been recorded in Crete. The green turtle nesting events in Crete, combined with similar records outside the traditional range of *Chelonia mydas* in the Mediterranean, are driven by the temperature increase noted in the region due to global warming (Patel et al. 2016). A similar expansion towards

the western Mediterranean is presently taking place in loggerhead turtle nestings (Hochscheid et al. 2022).



Figure 2. The green turtle nesting on 22 July 2022 on Kalamaki beach, Messaras Bay, Crete (Photo: SK Johnson).



Figure 3. Dead hatchling from the post-hatch excavation of the green turtle nest on Kalamaki beach, Messaras Bay, Crete (photo: D Margaritoulis).



Acknowledgements

Fieldwork in Messaras Bay was conducted under permit from the Ministry of the Environment. We thank all volunteers and field assistants for their dedicated work.

Literature cited

Ben Ismail M, Jribi I, Kaska Y, Nakhla L, Ben Fradj A, Dibej M, Souki A et al. (2022) The westernmost green turtle (*Chelonia mydas*) nest recorded in the Mediterranean from Tunisia. *MedTurtle Bulletin* 1: 19-23

Casale P, Broderick AC, Camiñas JA, Cardona L, Carreras C, Demetropoulos A, Fuller WJ et al. (2018) Mediterranean sea turtles: current knowledge and priorities for conservation and research. *Endangered Species Research* 36: 229-267

Hochscheid S, Maffucci F, Abella E, Bradai MN, Camedda A, Carreras C, Claro F et al. (2022) Nesting range expansion of loggerhead turtles in the Mediterranean: Phenology, spatial distribution, and conservation implications. *Global Ecology and Conservation* 38: e02194

Kasperek M, Godley BJ, Broderick AC (2001) Nesting of the green turtle, *Chelonia mydas*, in the Mediterranean: a review of status and conservation needs. *Zoology in the Middle East* 24: 45-74

Margaritoulis D, Panagopoulou A (2010) Greece. In: Casale P, Margaritoulis D (eds) *Sea*

Turtles in the Mediterranean: Distribution, Threats and Conservation Priorities. IUCN. Gland, Switzerland, p 85-111

Margaritoulis D, Panagopoulou A, Proctor S (2019) First green turtle nest in Greece and the westernmost record in the Mediterranean. In: Mangel JC, Rees A, Pajuelo M, Córdova F, Acuña N (comps) *Proceedings of the 36th Annual Symposium on Sea Turtle Biology and Conservation*. NOAA Technical Memorandum NMFS-SEFSC-701. National Marine Fisheries Service, Miami, USA, p 286

Patel SH, Morreale SJ, Saba VS, Panagopoulou A, Margaritoulis D, Spotila RS (2016) Climate impacts on sea turtle breeding phenology in Greece and associated foraging habitats in the wider Mediterranean region. *PLoS ONE* 11(6): e0157170

Rees AF, Saad A, Jony M (2008) Discovery of a regionally important green turtle *Chelonia mydas* rookery in Syria. *Oryx* 42(3): 456-459

Saeid A, Almunstasri M, Bellrahal K, Essghaieer M (2023) First green turtle nest recorded in Libya. *MedTurtle Bulletin* 3: 5-8

Sözbilen D, Başkale E, Katılmış Y, Azmaz M, Kaska Y (2018) Green turtle nesting activities at the westernmost Mediterranean coast of Turkey: A new green turtle nest record from Göcek, Turkey. In: *Tentative Proceedings of the 38th Annual Symposium on Sea Turtle Biology and Conservation*, 18-23 February 2018, Kobe, Japan, p 232

