

First Record of Loggerhead Sea Turtle (*Caretta caretta*) Clutch Predation in Spain

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Introduction

The loggerhead sea turtle is expanding its nesting range in the Mediterranean throughout the western basin, particularly in Italy and Spain according to records, in what seems a colonisation process (Carreras et al. 2018; Hochscheid et al. 2022). This process seems favoured by current suitable thermal conditions in beaches facilitated by global warming (Cardona et al. 2022; Santidrián Tomillo et al. 2022).

Spain's Mediterranean coasts have seen an increasing trend of nesting events in the last decade, with a slight decrease in 2022 probably due to stochastic biotic and abiotic factors. Although sporadic successful nesting events have been recorded in Spain since 2001 (Tomás et al. 2002; 2008), several nests laid in 2014 called the attention of sea turtle researchers and authorities. Since then, awareness campaigns and conservation and management activities, including beach patrolling, are allowing the detection of successful and failed nesting events scattered throughout all Spanish Mediterranean regions, mostly in urban/tourist beaches (Hochscheid et al. 2022). When detected, current regional and national protocols lead to many actions for clutch protection.

Human activities have been the main cause of failure in nesting (Hochscheid et al. 2022). The many unsuccessful events recorded may indicate that turtles are nesting elsewhere, in natural/non visited beaches, and go undetected. Undetected nests remain unprotected and may suffer from different threats such as predation, a major cause for mortality of egg and hatchlings in the Mediterranean (Casale et al. 2018 and references therein), thus compromising their success. Here I

present the first record of loggerhead turtle clutch predation on Spain's Mediterranean coasts.

Results and Discussion

On 19 September 2022, turtle eggshells were detected by chance when members of a local NGO were crossing an isolated beach to conduct field work in a nearby small wetland at Burriana (Castellón province, East Spain; 39.89243°N, -0.03604°E). After receiving the communication, I moved the same morning to the beach confirming that eggshells were from a loggerhead turtle clutch (Fig. 1). The beach, located between the sea and the wetland and close to an inland fish farm, was not very suitable for nesting or for embryo development because most of it was covered with stones, grain size was large, and shoreline was mostly rocky (Fig. 2). Moreover, the ground water table was high, making the sand wet at about 30 cm depth. No matter the beach conditions, the turtle was able to nest at this beach; however, these conditions probably led the turtle to lay the eggs in a shallow nest.

After locating the nest, I found evidence that the clutch was fully predated probably by canids. Nest chamber was sunk, and fragmented eggshells were spread over a diameter of two meters around the nest. Eggshell condition indicated that the predation event occurred several days before the observation date. Digging in the nest chamber, I was able to find 8 broken eggs (Fig. 1), but clutch size was impossible to determine due to the predation. Depth to the bottom of the nest chamber was estimated at 30 cm, too shallow according to the nest depth described for the species (Miller et al. 2003) and to other loggerhead nests found previously in Spain (Tomás, pers. obs.),





Figure 1. From left to right, location at the beach, fragments of egg shells collected nearby, and broken eggs found at the chamber of the loggerhead sea turtle nest predated at Burriana (Castellón province, East Spain) in 2022. Notice the short distance to the sea and the density of stones and gravel at the nest location.

which probably facilitated the predation. The effect of depth on sea turtle nest predation has been described in the literature, with shallower nests being more easily detected and predated (e.g., Leighton et al. 2009). Moreover, the location of the nest, laid only 10 m from the sea, and beach characteristics, including the large grain size, would have compromised its potential success even if it had not been predated (but see Foley et al. 2006).

Members of the local NGO who found the eggshells confirmed the frequent presence of red foxes (*Vulpes vulpes*) nearby the beach, predating on freshwater terrapin nests in the wetlands. Red foxes have been reported predating on loggerhead turtle clutches in beaches near wetlands in other areas of the Mediterranean (e.g., Macdonald et al. 1994; Türkozan et al. 2003). However, despite finding tracks of small canids on the beach, larger tracks and droppings of feral/domestic dogs (*Canis lupus familiaris*) were also found near the nest, indicating dogs were the most likely predators. Predation of loggerhead clutches by feral dogs has been widely reported in East

Mediterranean loggerhead turtle nesting areas (see references in Casale et al. 2018), but, after a literature review, never before in the western Mediterranean basin.

To date, this is the first record of loggerhead turtle clutch predation in Spain. Despite the efforts of researchers, authorities and volunteer monitoring programs and the awareness campaigns currently carried out in Spain, not all nesting events occurring in our beaches are detected; hence more survey/awareness efforts are needed. The case reported here also reveals the need of conservation measures, including clutch relocation to suitable/protected beaches in order to protect the majority of clutches laid thus helping in the colonization process and, subsequently, the establishment of the Spanish Mediterranean coast as a stable nesting area for the loggerhead sea turtle.

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Figure 2. View of the beach at the North of Burriana city (Castellón province, East Spain) where the predated nest was found.

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