



MONITORING OF MEDITERRANEAN COASTAL AREAS: PROBLEMS AND MEASUREMENT TECHNIQUES

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***Caretta caretta* nesting in Tuscany (Northwestern Mediterranean Sea): an update of a new expansion phenomenon**

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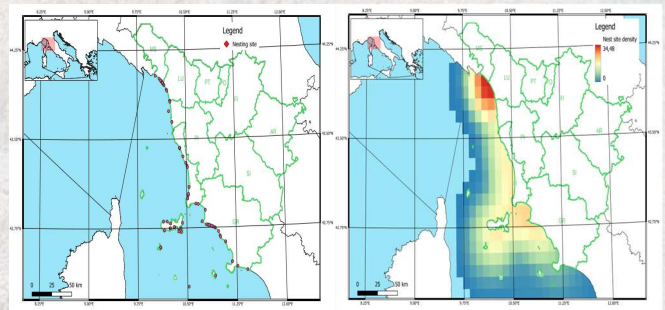
Introduction

The loggerhead turtle (*Caretta caretta*) is protected under a wide range of international treaties and national laws, also including some relevant frameworks and fisheries-related agreements. Almost all Mediterranean countries, including those hosting major nesting and foraging habitats for loggerheads, are signatories to these international conventions and have adopted national legislations for sea turtle protection. As a result of these collective efforts, the global conservation status of the species has improved in recent decades: in the IUCN Red List, it has changed from Endangered (1996) to Vulnerable (2015), while the Mediterranean subpopulation is now listed as Least Concern. In Italy, particular attention has been devoted to the protection of nesting sites, also through targeted conservation projects implemented at national and regional levels.

Materials and methods

Along the Tuscan coast, systematic monitoring of nesting activity has been conducted since 2013 through the coordinated action of regional authorities, particularly ARPAT (Regional Agency for the Protection of the Environment of Tuscany), the Universities of Siena, Florence and Pisa, NGOs and local networks of trained personnel.

From June 1st to August 30th, teams of at least two volunteers regularly patrol identified and coded coastal stretches (transects), with monitoring activities carried out from two to seven days per week depending on local needs and volunteer availability, so that surveys can be consistently repeated each year. The monitoring effort (days spent monitoring out of the total number of days available during the period) is recorded. Each sea turtle female's exit is recorded, noting its latitude and longitude, date, distance from the sea, and distance from the vegetation behind the dunes. Authorized personnel verifies the presence of the eggs chamber, in derogation of the DPR 357/97 (Articles 8 and 7). If eggs have been laid, the nest is secured and kept under observation until the hatchlings hatch and emerge from the sand. After 5-7 days without emergence, the nest is digged and all its contents collected and analyzed: shells, unhatched eggs, live pipped eggs, dead pipped eggs, live hatchlings, and dead hatchlings.

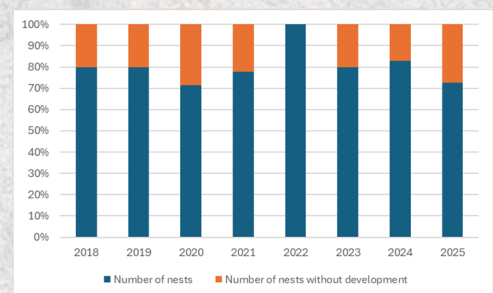
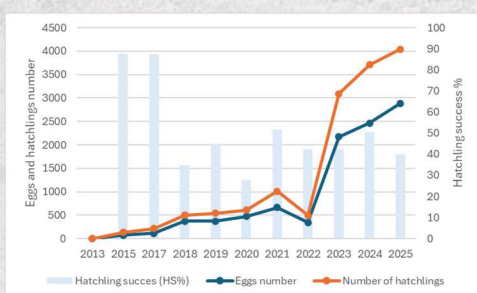


Results and discussion

The number of nests recorded in Tuscany (Italy) has shown a marked increase in the period 2023–2025, with 85 nests compared to 28 nests documented between 2013 and 2022. Over the same period, both the number of eggs laid, and the number of hatchlings increased substantially (mean eggs from 347 to 2393; mean hatchlings from 156 to 1107), although a slight decrease was observed in 2025 for laid eggs and hatchlings.

The spatial distribution of nests revealed a progressive northward expansion, reaching a maximum of eight nests within the Massa municipality in 2025.

Additional parameters such as incubation period, frequency of unhatched nests, occurrence of late-season nesting events, and the presence of viable eggs in late fall (October) were also documented.



Conclusion

These findings provide updated evidence of the ongoing expansion of loggerhead turtle nesting in the north-western Mediterranean and highlight the importance of coordinated monitoring efforts for understanding and managing this emerging phenomenon.

Acknowledgments

Thanks to all the volunteers, without their tireless commitment and dedication it would not have been possible to collect so much important data.

