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# Sea turtles in the Mediterranean: distribution and conservation aspects

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## SUMMARY

Three of the seven extant marine turtle species are found in the Mediterranean Sea: *Caretta caretta*, *Chelonia mydas* and *Dermochelys coriacea*. The human activities in the basin put several threats to these animals, especially in the last decades. At land, nesting activity and hatchling production are compromised by several factors, from disturbance to physical destruction of the sites. At sea, the incidental captures by fishing gears induce high mortality both due to the capture itself and to the commercial use of the specimens. Although substantial gaps still exist on the population structure and habitat use in the Mediterranean, the ever-increasing studies using different approaches are improving the general picture substantially. Here, a synthesis is given of the present knowledge on the distribution and conservation of these species in the Mediterranean.

## INTRODUCTION

Of the seven extant sea turtle species and of the five with a circumglobal distribution, three species are regularly found in the Mediterranean: *Caretta caretta*, *Chelonia mydas* e *Dermochelys coriacea*.

As it is for many other taxa, the history and present characteristics of the basin make it a 'natural laboratory' which is very interesting and highly promising for increasing our knowledge on the biological dynamics of these species. Moreover, it holds some of the most ancient evidences of interaction between sea turtles and humans (Frazier, 2003), and the important human presence since the far past is suggestive of a 'historical' impact on the populations, which in the last decades has increased at levels unlikely to be sustainable (Gerosa and Casale, 1999). This is a general problem, however, and is reason of global concern for the future of these animals. In particular, *C. caretta* and *C. mydas* are listed as 'Endangered' and *D. coriacea* as 'Critically Endangered' in the IUCN Red List of Threatened Species.

Here we present a synthetic overview of the occurrence and distribution of these three species in the Mediterranean, with particular reference to the main conservation issues and the research perspectives based on recent results.

### *Caretta caretta*

This is the most abundant sea turtle species in the basin and its nesting grounds are almost exclusively restricted to the eastern part (east to Sicily Channel) (Fig. 1). The available data (Margaritoulis et al., 2003) give an estimate of about 5,000 nests a year, almost all laid in Greece (ca. 3,000), Turkey (ca. 1,400) and Cyprus (ca. 570). In recent years, some preliminary surveys have shown the importance of Libya in this respect, since they estimated that more than 1000 nest a year may be laid along its coasts (Margaritoulis et al., 2003). In Italy the number of nests is very low (unlikely to exceed 15 a year). Hence, Italian nesting sites, though to be preserved, have a relative role for the conservation of Mediterranean populations.

In the last decade molecular analyses showed that even though the Mediterranean colonies originated from the Atlantic ones, there is a high reproductive isolation between the two areas, at least at the female level (Bowen et al., 1993; Encalada et al., 1998; Laurent et al., 1998).

Within the Mediterranean there is evidence of a further sub-structuring: the relatively small sample used to date detected at least a divergence between Turkish colonies and the others (Laurent et al., 1998) and a certain isolation even between different Turkish colonies (Schroth et al., 1996). In general, such a structuring of *Caretta caretta* colonies is due to the homing behavior displayed by females and probably by males too, though at a lesser degree. This represents a further risk for threatened populations, and conservation measures should be thought considering each colony as an independent Management Unit.

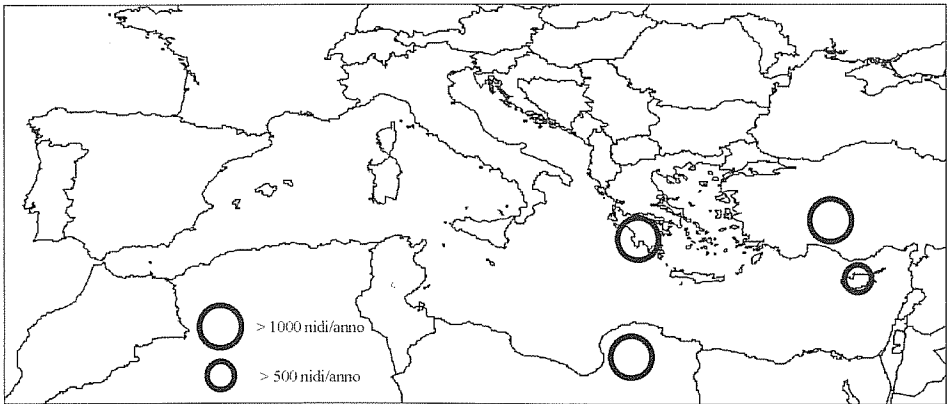


Fig. 1 - Main nesting sites of *Caretta caretta* in the Mediterranean. Other countries in the eastern basin host less than 50 nest/year each, while nesting is considered exceptional in the western basin (data from Margaritoulis et al., 2003).

At sea, important areas frequented by specimens in pelagic phase have been identified both in the western and in the eastern basins, while those frequented by specimens in demersal phase (adults and large juveniles) seem to be restricted to the eastern basin only. In particular, re-encounters of turtles tagged while nesting (Margaritoulis et al., 2003) or in other circumstances (Argano et al., 1992; Fig. 2) show the trophic importance of demersal areas in the Gulf of Gabés (broad sense) and in the north Adriatic. Accordingly, in the latter area a recent study on the interaction between sea turtles and trawlers brought evidence of the occurrence of relevant numbers of specimens (Casale et al., 2004).

In spite of the reproductive isolation of the Mediterranean colonies from the Atlantic ones, at least on the female side, re-encounters of tagged specimens demonstrated the possibility of passing through the Gibraltar Strait in both directions (Manzella et al., 1988; Argano et al., 1992; Bolten et al., 1992) and molecular analyses showed high percentages (about 50%) of Atlantic specimens among those in pelagic phase at least as far as the Sicily Channel (Laurent et al., 1998). Possible and partial explanations of the low mtDNA contribution of these Atlantic specimens to the Mediterranean colonies are the numerical superiority of males among them (Casale et al., 2002) and a strong homing behavior.

It is still not clear how specimens from different colonies and in different ecological phases use the several Mediterranean areas. Although the results of mark-recapture studies show the capability of covering great distances within the Mediterranean (Argano et al. 1992; Margaritoulis et al., 2003; Fig. 2), at the same time some of the same studies suggest a certain fidelity to some areas, probably for trophic reasons (Argano et al. 1992; Fig. 2). Other approaches

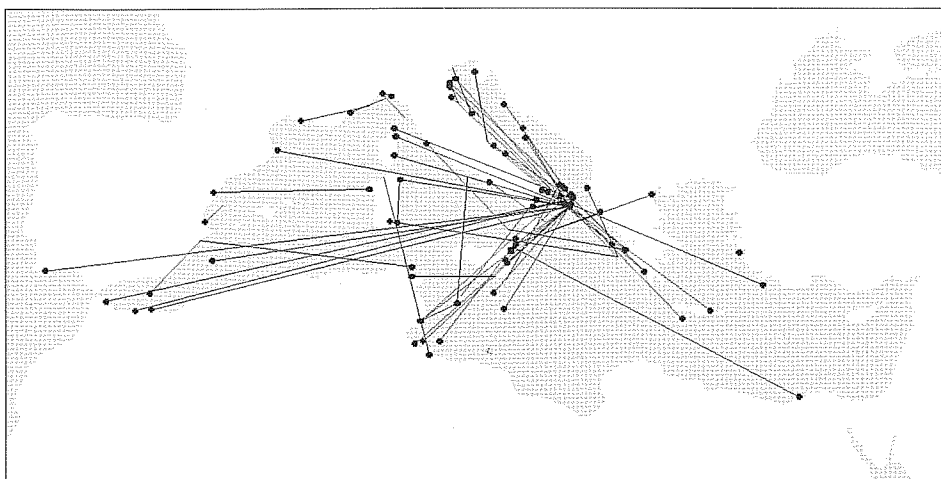


Fig. 2 - Results of release and re-encounter (black dots) of 110 specimens (Argano et al., 1992; unpubl. data).

could give insights on this issue too, for instance the occurrence of some epibionts such as crabs and balanomorph barnacles (Casale et al., in press a). The occurrence of inquiline crabs (e.g. *Planes minutus*) on turtles gathered from the sea surface in different Italian seas may suggest limited movements from the Tyrrhenian (crabs on 27.4% of turtles) to the eastern basin (maximum 3.3% in areas quite far from the Tyrrhenian), although alternative explanations cannot be excluded, such as the limited survival of crabs in the latter area. Also, the higher occurrence of balanomorph barnacles (especially *Chelonibia testudinaria*) on juvenile specimens found in shallow waters (vs. open sea), on large specimens (vs. small ones), and on specimens caught by trawlers (vs. those caught by longliners) suggests both that these epibionts settle preferentially on turtles in the demersal phase and that movement between areas is limited.

As far as conservation is concerned, once nesting sites are protected to a certain extent, the main threat to the populations is the incidental capture by fishing gears. Longline, trawl, and different kinds of nets are known to have a high potential impact in the Mediterranean. Several studies estimated the number of captured by longline as very high (tens of thousands a year; see Gerosa and Casale, 1999, for a review) and even though direct mortality (at the gear retrieval) is low, it is likely that the final one (after release) is about 50% (NMFS, 2001). Apart from difficult solutions like the reduction of fishing effort or spatial/temporal closures, research on this problem has increased recently and might soon offer some effective and more feasible options.

Trawlers catch turtles where they feed mainly on the bottom, at depths less than 100 m and especially less than 50 m (Gerosa and Casale, 1999; Casale et al., 2004). Direct and final mortality depend on the haul duration (representing the maximum duration of forced apnea), which is therefore an important factor for estimating the actual impact of captures on the populations. Apart from the reduction of fishing effort or spatial/temporal closures, a technical solution is already available, the TED (Turtle Excluder Device), a device which select the catch according to the size, diverting large-sized animals like turtles. However, TED was conceived for shrimp trawling and its use with larger target species, as it is the case in most Mediterranean trawl fisheries, may be problematic and certainly needs an initial phase of evaluation.

Set nets are known to induce a high mortality rate (see Gerosa and Casale, 1999, for a review), but the low fishing effort per boat and the lack of reliable estimates of the overall fishing effort in the Mediterranean make it difficult to assess the impact of this fishery. However, a high proportion of recaptures by this fishing gear was observed, suggesting a high total number of captures and therefore an important impact on the populations (Casale et al., in press b).

### *Chelonia mydas*

Genetic studies demonstrated the Atlantic origin of the Mediterranean colonies of this species as well as the low genetic flow between the two areas, at least at the female level (Bowen et al., 1992; Encalada et al., 1996).

Nesting is restricted to the easternmost part of the Mediterranean and particularly to Cyprus and the southern coasts of Turkey, where almost all nests are laid (99%) (Kasperek et al., 2001).

At sea green turtles frequent mainly the area between Turkey and Egypt, as showed by incidental catches by fishing gears (Laurent et al., 1996). However, a foraging area for juveniles has been found in the south of Greece too (Margaritoulis and Teneketzi, 2001). Further westwards, from the Adriatic to the western basin, only few records are known of individuals probably just wandering (e.g.: Delaugerre, 1987; Meschini, 1997; Pastorelli et al., 1999).

As far as conservation is concerned, the geographic concentration, especially of nesting sites, makes the Mediterranean *Chelonia mydas* particularly at risk. Nesting beaches are threatened by several problems not solved yet, such as chemical and light pollution, predation, erosion, agriculture, disturbance, housing, tourism (Kasperek et al., 2001), whereas at sea the main problem is the fishery bycatch (and associated mortality) which in some places is followed by the personal or commercial use of carapace and especially meat (Laurent et al., 1996; Oruç, 2001; Nada, 2002).

### *Dermochelys coriacea*

Specimens of this species found in the Mediterranean are of Atlantic origin, since reproduction in the basin is considered as absent or exceptional (Lescure et al., 1989). A recent analysis of 411 records of adult and large juvenile specimens of both sexes (Casale et al., 2003), suggests that i) leatherback turtles frequent specific areas (e.g. Tyrrhenian and Egean Seas), probably for trophic reasons, rather than distributing along a longitudinal gradient from the entrance point (Gibraltar Strait), ii) they frequent the Mediterranean all the year round, without evident immigration/emigration patterns, while seasonal latitudinal movements may occur, iii) set and drifting nets are responsible for the highest interaction among fishing gears in the Mediterranean.

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