

# SPATIOTEMPORAL DISTRIBUTION OF GREAT WHITE SHARK (*Carcharodon carcharias*, Linnaeus 1758) ALONG ITALIAN COASTS: RECORDS FROM INTERNATIONAL MEDLEM PROGRAM AND OTHER CONTRIBUTIONS

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The Great white shark (*Carcharodon carcharias*, Linnaeus 1758) is an apex predator living in almost all the seas of the world, preferring cold and temperate waters among the 8 and the 25° C (Compagno *et al.*, 2005). It is nevertheless present with important populations in only 8 areas of the globe: California and Baja California, Mexico, central Chile, New England, Mediterranean Sea, Western South Africa, southern Australia, New Zealand and Japan (Compagno *et al.*, 2005). Although it is one of the 72 species that have been observed in Italian waters (Vacchi & Serena, 2010), some aspects of its biology and ecology of this shark in the Mediterranean is still quite misunderstood. The aim of the present work was to organize and analyze data concerning the spatiotemporal pattern of distribution of white sharks along Italian coasts. Data presented in this work come from the MEDLEM international program and from other local contributors or from published paper (Sperone *et al.*, 2011). The archive contains following information for each record: year and month of observation, locality, type of report (observation, catch, food remains), biological data (total length, weight, sex) and other supplementary information (gear, observer, bibliography, photo). At the moment, no kind of scientific research aimed at understanding distribution and ecology of white sharks in Italian waters is active, with the exception of Medlem. Statistical data analysis was performed by the software Instat 3.0 for Mac.



TABLE 1

REGION	N of records
SICILY	54
SARDINIA	13
CALABRIA	13
LIGURIA	13
TUSCANY	11
FRIULI VENEZIA GIULIA	9
MARCHE	5
LATIUM	4
MOLISE	2
APULIA	2
CAMPANIA	1
EMILIA ROMAGNA	1
VENETO	1



CHART 1

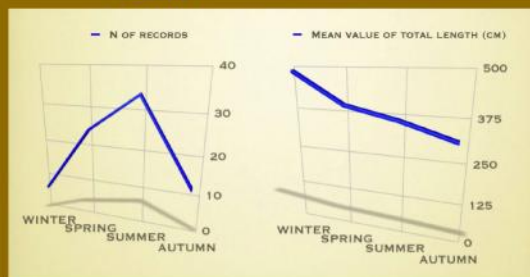


TABLE 2

Sub-basin	N of records	Seasonality	Mean value of total length
MESSINA STRAIT	5	Spring/Summer	375
LIGURO-PROVENCAL	15	Spring/Summer	448
TYRRHENIAN	41	Spring/Summer/Autumn	424,1
SICILY-TUNISIAN RIDGE	34	Spring/Summer	323,4
IONIAN	16	Winter/Summer	450
ADRIATIC	17	all year	418



From 1666 to 2099, 128 records of white sharks in Italian waters are known: 55% of them has been collected from 1961 to 2009. In table 1 the localization of considered records for each of the Italian regions is reported. It is interesting to observe that 42,2% of the records is located along the coasts of Sicily and 39,0% along the Tyrrhenian coasts of Sardinia, Calabria, Tuscany and Liguria. Mean value of total length for the sharks observed in Italian waters was 395,7 cm; for the weight, observed mean value was 1127,1 kg. The population structure of observed records was constituted by 36% of immature specimens (Total Length  $\leq$  350 cm) *sensu* Compagno *et al.*, 2005, 48% of mature specimens (Total Length  $\geq$  450 cm, Klimley & Ainley, 1996); the remaining 15% is represented by specimens with total length values comprised between 350 and 450 cm: due to the fact that for these records no information about sex is available, we were not able to assess if they are mature or immature.

Regarding the temporal distribution of records, 33,7% of records has been collected in spring, 48,8% in summer, 17,4% in autumn and 12,1% in winter. This seasonality results to be statistically significant ( $\chi^2=12,7-11$ ,  $N=86$ ,  $df=3$ ,  $P=0,0053$ ). No significant correlation (Chart 1) was found between mean values of total lengths of sharks versus the seasons of the year (Kruskal-Wallis=5,966;  $N=86$ ;  $P=0,1133$ ). We assigned each record to one of the Mediterranean sub-basins that are present around the Italian peninsula (Amblàs *et al.* in Serena, 2005) and for each of the sub-basins the number of records, the seasonality and the mean value of total length are reported in Table 2. A significant association between the mean values of total length among sub-basins was found: in particular, white sharks from Messina strait and the Basin of the Sicily-Tunisian Ridge are significantly smaller than others (One-way ANOVA  $P=0,0488$ ). 90% of immature specimens was observed, in fact, along the coasts of Sicily. These data support the hypothesis suggested by Cigala Fulgosi (1990) and by Fergusson (1996) that waters around Sicily could be represent a potential reproductive site for this species in the Mediterranean. It should be now priority to direct the research effort to the population dynamic trying to tag several specimens or along the Sicily coasts or in the central Tyrrhenian sea.

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made using Mac

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