

Extant coccolithophore distribution in the Mediterranean Sea: A review

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We present a systematic review of extant coccolithophore studies in the Mediterranean Sea. We compare coccolithophore communities and their ecological preferences and show the influence of environmental factors on their abundance. We consider differences between specific biogeochemical regions in the Mediterranean Sea including the Adriatic, Aegean, Cretan, Ionian, Ligurian, Balearic, Tyrrhenian and Alboran Seas, the Levantine Basin, as well as the Strait of Sicily and the Gulf of Sidra. There will be a particular focus on differences between the two major sub-basins of the Mediterranean Sea– the Eastern and Western. A total of 59 studies were selected starting from 1990, 32 of which focus solely on coccolithophores, while 27 examine the entire phytoplankton community.

The Western Mediterranean Sea is underrepresented in coccolithophore research, with approximately 25% of all studies conducted in this sub-basin (14 studies compared to 39 in the Eastern basin). The Aegean and Adriatic Seas are the most studied regions, followed by the Ionian Sea and Tyrrhenian Sea (the most studied region in the Western Mediterranean). Summer is the most represented season (24 studies), followed by spring (20 studies), autumn (10) and winter (8 studies). In the Eastern Mediterranean, coccolithophores make up an average 11% of the phytoplankton community and in the Western basin they make up 15.6% of the phytoplankton community (Alboran Sea). Mean average abundance is greater in the Eastern than in the Western Mediterranean ($2 \times 10^4 \text{ L}^{-1} \pm 2.3 \times 10^4 \text{ L}^{-1}$ compared with $1.8 \times 10^4 \text{ L}^{-1} \pm 1.6 \times 10^4 \text{ L}^{-1}$, respectively). Average maximum abundance is also greater in the Eastern Mediterranean Sea compared to the Western ($20.7 \times 10^4 \text{ L}^{-1}$ compared to $15.4 \times 10^4 \text{ L}^{-1}$).

The most common species across the Mediterranean Sea is *Emiliana huxleyi*, and other common genera include *Rhabdosphaera* and *Syracosphaera*. There are many differences when reporting findings (cells per L^{-1} , relative abundance %, frequency of occurrence %, flux) and many studies do not include raw data, making direct comparisons difficult. Studies that focus on the entire phytoplankton community may be underestimating coccolithophore abundance and species diversity through the use of inappropriate counting methodology. Of the 14 studies in the Western Mediterranean, six use only inverted light microscopy, suggesting that abundance estimates for this region could be underestimated. Further field studies in this sub-basin using suitable methodology could improve abundance and species diversity estimates.