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TITLE: Modeling Macroalgal Forest Distribution at Mediterranean Scale: Present Status, Drivers of Changes and Insights for Conservation and Management

AUTHOR: ['Erika Fabbrizzi', 'Michele Scardi', 'Enric Ballesteros', 'Lisandro Benedetti?Cecchi', 'Emma Cebrián', 'Giulia Ceccherelli', 'Francesco De Leo', 'Alan Deidun', 'Giuseppe Guarnieri', 'Annalisa Falace', 'Silvia Fraissinet', 'Chiara Giommi', 'Vesna Ma?i?', 'Luisa Mangialajo', 'Anna Maria Mannino', 'Luigi Piazzi', 'Mohamed Ramdani', 'Gil Rilov', 'Luca Rindi', 'Lucia Rizzo', 'Gianluca Sarà', 'Jamila Ben Souissi', 'Ergün Ta?k?n', 'Simonetta Fraschetti']

ABSTRACT:

Macroalgal forests are one of the most productive and valuable marine ecosystems, but yet strongly exposed to fragmentation and loss. Detailed large-scale information on their distribution is largely lacking, hindering conservation initiatives. In this study, a systematic effort to combine spatial data on Cystoseira C. Agardh canopies (Fucales, Phaeophyta) was carried out to develop a Habitat Suitability Model (HSM) at Mediterranean scale, providing critical tools to improve site prioritization for their management, restoration and protection. A georeferenced database on the occurrence of 20 Cystoseira species was produced collecting all the available information from published and grey literature, web data portals and co-authors personal data. Data were associated to 55 predictor variable layers in the (ASCII) raster format and were used in order to develop the HSM by means of a Random Forest, a very effective Machine Learning technique. Knowledge about the distribution of Cystoseira canopies was available for about the 14% of the Mediterranean coastline. Absence data were available only for the 2% of the basin. Despite these gaps, our HSM showed high accuracy levels in reproducing Cystoseira distribution so that the first continuous maps of the habitat across the entire basin was produced. Misclassification errors mainly occurred in the eastern and southern part of the basin, where large gaps of knowledge emerged. The most relevant drivers were the geomorphological ones, followed by anthropogenic variables proxies of pollution and urbanization. Our model shows the importance of data sharing to combine a large number of spatial and environmental data, allowing to individuate areas with high probability of Cystoseira occurrence as suitable for its presence. This approach encourages the use of this modelling tool for the prediction of Cystoseira distribution and for supporting and planning conservation and management initiatives. The step forward is to refine the spatial information of presence-absence data about Cystoseira canopies and of environmental predictors in order to address species-specific assessments.

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