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Title: A few effective trees hiding a forest of unprotected marine protected areas

Running head: Shedding light on marine conservation efforts

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One sentence summary: Our current efforts at managing human uses of nature at sea are not sufficient to deliver tangible benefits for biodiversity.

10 **Abstract:** Ocean health is critical for achieving sustainable development but is threatened by multiple stressors. Member States Parties to the Convention on Biological Diversity agreed to protect 10% of their waters by 2020. The scientific evidence supporting the use of marine protected areas (MPAs) to conserve biodiversity stems primarily from knowledge concerning fully protected areas but at present, most of what is being established are partially protected areas. Here, we assess the protection levels of the 1062 Mediterranean MPAs. While 6.01% of the Mediterranean is covered by an MPA, 85% of these MPAs do not impose regulations stronger inside than outside. Full and high levels of protection, the most effective for biodiversity conservation, represent only 0.23% of the basin and are unevenly distributed across political and eco-regions. Our current efforts are insufficient at managing human uses of nature and protection levels should be increased to deliver tangible benefits for biodiversity conservation.

Key-words: conservation; UN Sustainable Development Goals; Convention on Biological Diversity; Mediterranean Sea; marine policy

Main text:

Introduction

25 The ocean is critical for achieving sustainable development of human society as a whole. Many Sustainable Development Goals (SDGs) may not be realized without achieving SDG 14 for healthy ocean ¹. However, oceans are threatened by multiple stressors; direct exploitation of organisms, mainly fishing, being the most impactful driver ². While there is an urgent need to modify human behavior to allow sustainable development pathways ^{3,4}, mitigating strategies still need to be put into practice. Marine protected areas (MPAs) are an effective spatial, ecosystem-based management tool in this respect ⁵ and Member States Parties to the Convention on Biological Diversity (CBD) agreed to cover 10% of their Economic Exclusive Zones (EEZs) by MPAs by 2020 ⁶. The SDG target 14.5 is of exactly the same figure. We ask here whether this led to effective conservation strategies or if Member States had misguided the original aim of the target, which is to deliver conservation outcomes.

35 While the science supporting the usefulness of MPAs was only based on fully protected areas ^{7,8}, where all extractive activities are forbidden, most recently established MPAs to meet the CBD Aichi target 11 are partially protected ^{9,10}. Partially protected areas are often preferred over fully protected areas as they can satisfy access to a boarder range of users. However, allowed uses, even if regulated, often concentrate inside such areas ^{11,12} with potentially higher detrimental impacts on biodiversity ¹³.

45 A recently developed regulation-based classification system for MPAs allows to group MPAs according to the potential impacts on species and habitats of allowed uses ¹⁴. Its global application on published literature on MPA effectiveness showed that, on average, only fully and highly protected areas, allowing only infrequent use of some types of non-industrial, highly selective, low impact, recreational, commercial or subsistence fishing gears, could deliver ecological benefits ¹⁵. Protection levels are therefore a good indicator of MPA performance.

50 Here, focusing on the Mediterranean Sea, which is both a global hotspot for biodiversity ¹⁶ and human pressure ¹⁷, and features an extensive system of MPAs ¹⁸, we critically assess whether conservation efforts are appropriately strategized to deliver ecological benefits.

Results and Discussion

55 We compiled information from MAPAMED ¹⁹, the most complete database on MPAs for the Mediterranean. We worked at the zone level in case of multiple-zone MPAs and reviewed the management plans and legal texts for the 1062 existing MPAs (or 1346 zones) to classify them using the regulation-based classification system ¹⁴. All 1062 MPAs included in our study are validated by Countries or focal points of the Barcelona Convention (UNEP Regional Sea Convention), thus counting toward international biodiversity conservation targets. When several zones (or MPAs, or designations) were overlapping, only the one conferring the strongest protection level were kept.

60 We found that 6.01% of the Mediterranean Sea is covered with an MPA. This situation is well representative of the global one with the United Nations Environment Program's World Conservation Monitoring Centre (WCMC) and the International Union for the Conservation of Nature (IUCN) reporting 6.97% of global ocean protection as of 2017 ¹⁰. In the Mediterranean Sea, more than a fifth of those are not managed or established as no management plan or legal text could be found, and two thirds don't have any restrictions on activities that can impact biodiversity (Figure 1). Hence, for 65 85% of the Mediterranean MPAs there is no difference in regulations between the inside and the outside.

70 Full and high protection, those levels of protection known to deliver ecological benefits ¹⁵, cover only 0.23% of the Mediterranean Sea, representing only 3.42% of what is being protected. As the CBD 10% target of countries' EEZs was designed with the aim to reaching conservation outcomes, they should concern mostly, if not only, those protection levels.

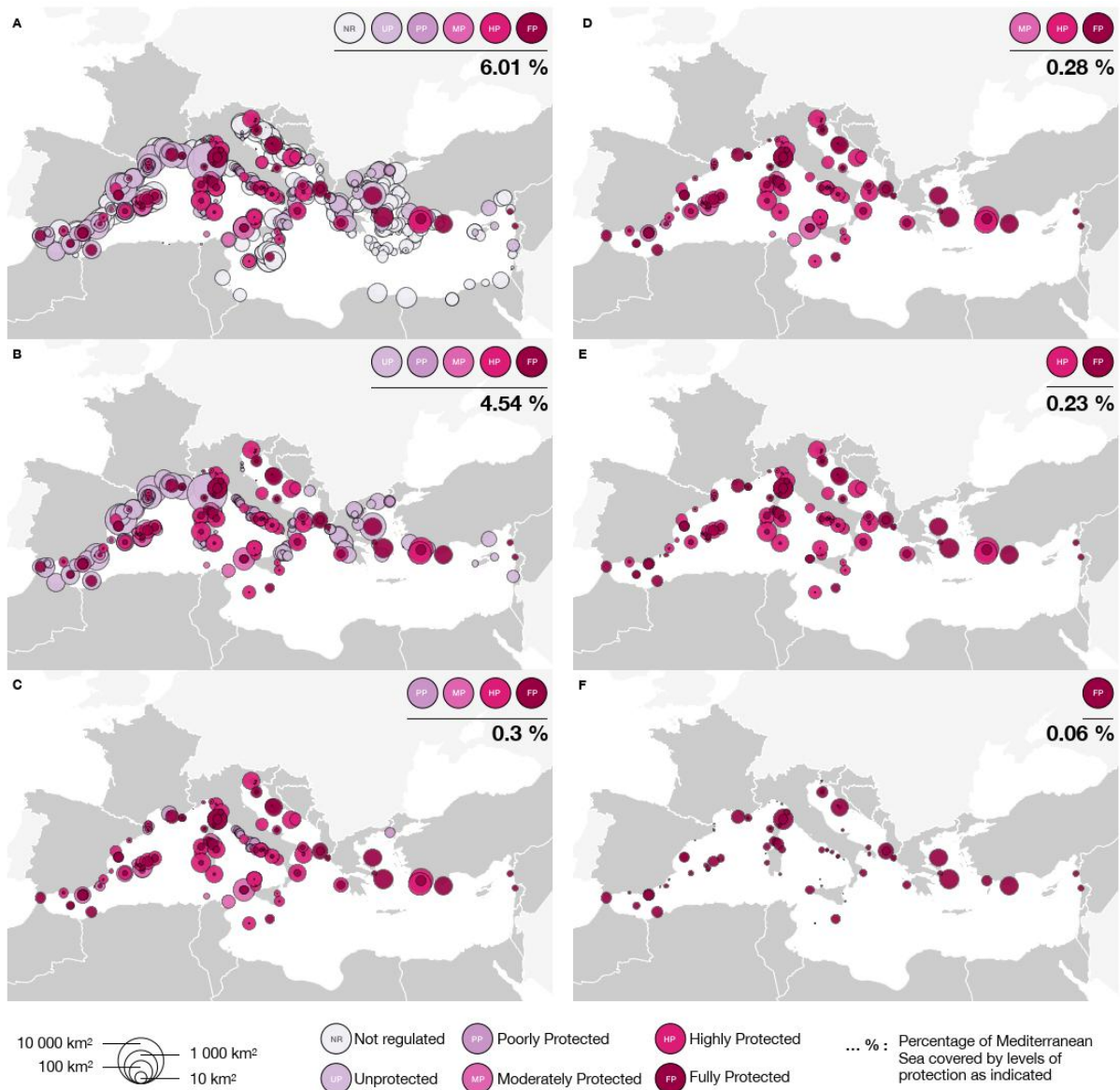
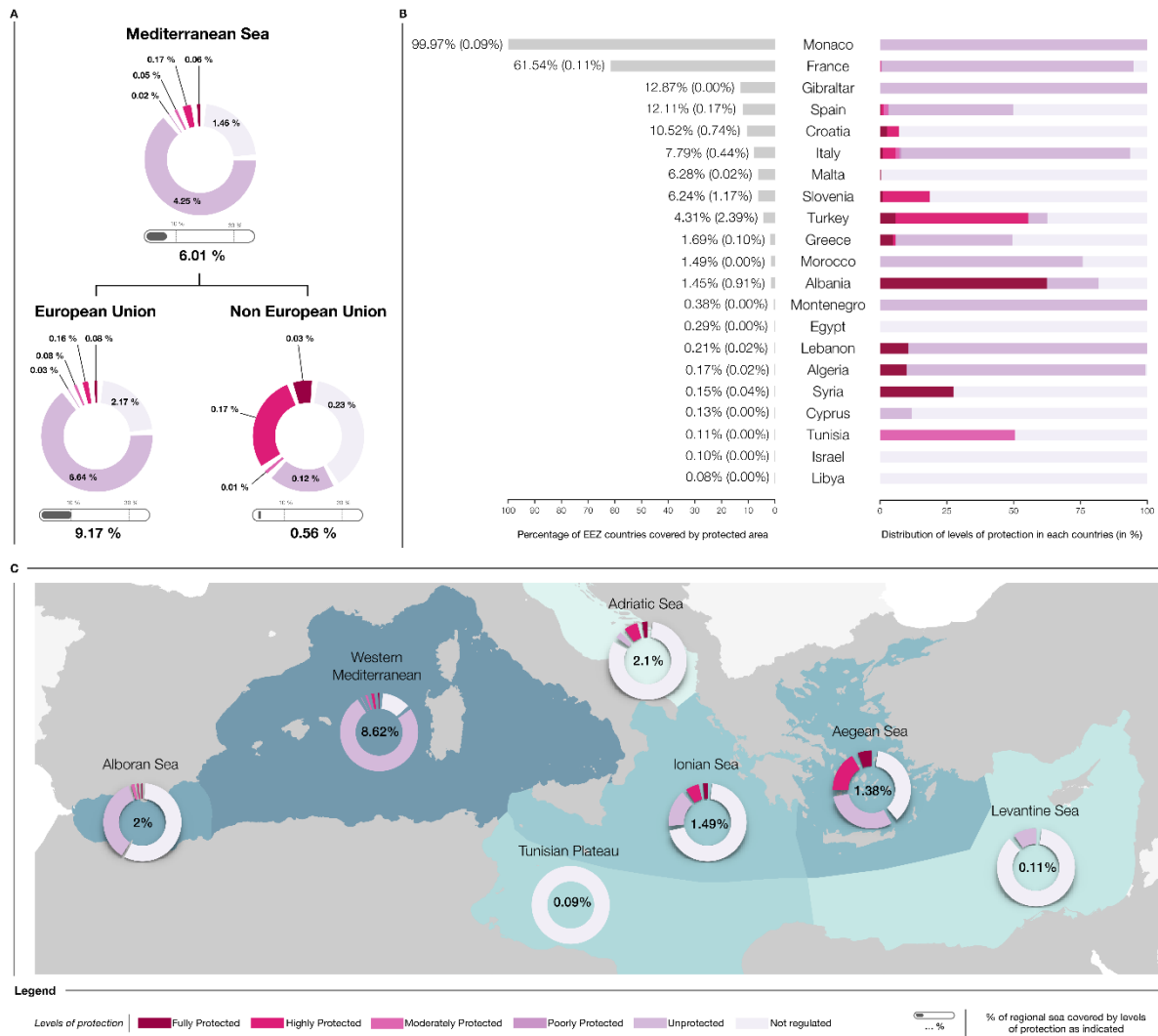


Figure 1: Coverage the different levels of protection in the Mediterranean Sea.

75 The overall effort is greatly unbalanced since close to 97% of total marine protection, and 80% and 63% of full and high protection, respectively, lay in European Union's waters (Figure 2A). In the European union, full and high protection cover 0.15% of countries' EEZs while it is less than half in non-European countries. Countries protecting a large part of their EEZ most of the time benefit from large MPAs with low levels of protection (Figure 2B).



80 *Figure 2: Distribution of protection levels (A) in the Mediterranean Sea; (B) per country, percentage in parenthesis are the percentage of countries' EEZ covered by fully and highly protected areas; (C) by Mediterranean marine ecoregions.*

The CBD Aichi target 11 stipulates that protected areas have to be “ecologically representative”⁶. In the Mediterranean, marine ecoregions²⁰ are not equally protected (Figure 2C). The Western Mediterranean is by far the most protected (8.62%), but only 1.89% of what is being protected is done so by full or high protection levels. The Adriatic and Alboran Seas are the second most protected marine ecoregions. Aegan and Ionian Seas have very similar coverage of protection but full and high protection coverage vary up to three orders of magnitude. The Levantine Sea and the Tunisian plateau are the least protected ecoregions in the Mediterranean.

Our results suggest that much of the Mediterranean Sea is not protected, and more than 85% of what is supposed to be protected do not convey regulations strict enough to confer any ecological benefit¹⁵. As in other parts of the world, where too loose regulations cannot deliver ecological outcomes^{13,21,22}, or where protected areas are not properly resourced or managed^{23,24}, it is important to ensure that the race to meet key biodiversity targets does not lead us to a false sense of security about appropriate actions being undertaken^{25,26}. We believe that classifying MPAs according to their protection levels as we did here is a much needed step towards shedding light on our actual insufficient efforts at managing human uses of nature²⁷. We hope this will translate into more will from our policy-makers to establish and appropriately manage MPAs with protection levels that are able to deliver tangible benefits for biodiversity conservation.

Methods

100 Legally binding MPAs were retrieved from MAPAMED¹⁹. Fishing Restricted Areas (n=7), Specially
Protected Area of Mediterranean Importance (n=34) and Particularly Sensitive Sea Area (n=1) were
removed. In the case of non-strictly marine protected areas (n=46), only the marine part was kept. In
the case of multiple-zone MPAs (n=75), MPAs were considered at the zone level. We then collected
information on allowed or prohibited activities from legal texts, management plans and personal
105 communication with MPA managers, using all needed native languages. Specific information from
Natura 2000 sites was also obtained from the European Environment Agency official website
(<https://www.eea.europa.eu/data-and-maps/data/natura-10>), but we cross-referenced it as in many
cases it was outdated. We then classified all MPAs, or zones in the case of multiple-zone MPAs, using
the regulation-based classification system¹⁴. We thus obtained a protection level for each of the
110 1062 MPAs (or 1346 zones). In the case of MPAs with no legal text or management plan establishing
regulations, we assigned the MPAs to a non-regulated category.

Existing georeferenced information in MAPAMED was used. When missing, in multiple instances, and
almost for all zoning schemes in the case of multiple-zone MPAs, additional information was
obtained as detailed above for the regulations. To avoid overestimating the total area covered by
protection we removed overlapping area, keeping only those conferring the strongest levels of
115 protection for each overlapping layers. Exclusive Economic Zones were retrieved from Flanders
Marine Institute, Maritime Boundaries Geodatabase, version 10 (2018; Available online
at <http://www.marineregions.org/>. <https://doi.org/10.14284/319>). Mediterranean eco-regions were
retrieved from²⁰. All analyses were conducted using QGIS v.2.18.0 and R²⁸.

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Author contributions

J.C. designed the study. M.S., M.Z. and C.L. compiled the data. J.C., C.L. and M.S. analyzed the data.
J.C. and C.L. produced the figures. J.C. wrote the manuscript. All authors approved the manuscript.

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Supplementary material

Table 1: Protected area (km²) by protection level and per country

| Country | Member of EU | Protected area | | | | | | | | | |
|------------|--------------|----------------|----------------|-----------------|----------|-----------------|------------------|----------------------|------------------|-------------|--------------|
| | | EEZ area | Number of MPAs | Number of zones | Total | Fully Protected | Highly Protected | Moderately Protected | Poorly protected | Unprotected | Not Reported |
| Albania | No | 11152.0 | 9 | 14 | 161.9 | 101.07 | 0 | 0 | 0 | 31.15 | 29.67 |
| Algeria | No | 128905.5 | 4 | 6 | 220.5 | 21.82 | 0 | 0 | 0 | 197.11 | 1.52 |
| Croatia | Yes | 55866.5 | 267 | 304 | 5876.8 | 161.63 | 250.2 | 0 | 0.54 | 0 | 5464.42 |
| Cyprus | Yes | 98118.5 | 8 | 8 | 129.7 | 0 | 0 | 0 | 0 | 15.49 | 114.17 |
| Egypt | No | 169411.6 | 6 | 6 | 485.0 | 0 | 0 | 0 | 0 | 0 | 485 |
| France | Yes | 88565.8 | 85 | 102 | 54505.0 | 79.127 | 15.27 | 122.27 | 101.86 | 51459.761 | 2726.76 |
| Gibraltar | No | 426.3 | 1 | 1 | 54.9 | 0 | 0 | 0 | 0 | 54.85 | 0 |
| Greece | Yes | 494594.5 | 149 | 160 | 8382.8 | 408.264 | 75.293 | 0 | 18.13 | 3655.89 | 4225.26 |
| Israel | No | 27753.2 | 10 | 10 | 26.5 | 0 | 0 | 0 | 0 | 0 | 26.5 |
| Italy | Yes | 539059.9 | 279 | 414 | 42002.9 | 431.75 | 1957.65 | 644.03 | 303.31 | 35922.01 | 2744.17 |
| Lebanon | No | 19265.9 | 2 | 2 | 39.9 | 4.17 | 0 | 0 | 0 | 35.69 | 0 |
| Libya | No | 357297.6 | 2 | 2 | 300.3 | 0 | 0 | 0 | 0 | 0 | 300.32 |
| Malta | Yes | 55417.4 | 30 | 30 | 3479.6 | 12.98 | 0 | 0 | 0 | 0 | 3466.61 |
| Monaco | No | 283.2 | 3 | 3 | 283.1 | 0.02 | 0.23 | 0 | 0 | 282.889 | 0 |
| Montenegro | No | 7466.1 | 2 | 2 | 28.1 | 0 | 0 | 0 | 0 | 28.1 | 0 |
| Morocco | No | 18776.7 | 2 | 2 | 278.9 | 0 | 0 | 0 | 0 | 211.5 | 67.39 |
| Slovenia | Yes | 193.2 | 15 | 17 | 12.1 | 0.12 | 2.14 | 0 | 0 | 0 | 9.8 |
| Spain | Yes | 261168.8 | 173 | 226 | 31628.1 | 121.723 | 323.42 | 524.68 | 45.066 | 14742.8167 | 15870.43 |
| Syria | No | 10194.2 | 2 | 2 | 15.4 | 4.24 | 0 | 0 | 0 | 0 | 11.14 |
| Tunisia | No | 100550.9 | 4 | 4 | 110.0 | 0 | 0 | 55.47 | 0 | 0 | 54.52 |
| Turkey | No | 72414.9 | 12 | 31 | 3123.7 | 175.93 | 1557.66 | 0 | 0 | 222.1 | 1168.04 |
| TOTAL | | 2516882.5 | 1062 | 1346 | 151145.1 | 1522.8 | 4181.9 | 1346.5 | 468.9 | 106859.4 | 36765.7 |

Table 2: Protected area (km²) by protection level and per eco-region

| Ecoregion | Ecoregion area | Number of MPAs | Number of zones | Protected area | | | | | | |
|--------------------------------|----------------|----------------|-----------------|----------------|-----------------|------------------|----------------------|------------------|-------------|--------------|
| | | | | Total | Fully Protected | Highly Protected | Moderately Protected | Poorly protected | Unprotected | Not Reported |
| Adriatic Sea | 353081.5 | 340 | 388 | 7416.8 | 168.03 | 461.57 | 0 | 0.54 | 202.19 | 6584.47 |
| Aegean Sea | 610233.3 | 127 | 153 | 8394.51 | 576.18 | 1557.66 | 0 | 18.13 | 2844.33 | 3398.21 |
| Alboran Sea | 352546.6 | 42 | 55 | 7048.45 | 51.553 | 23.16 | 96.52 | 0 | 2649.237 | 4227.98 |
| Ionian Sea | 455011.8 | 107 | 128 | 6788.707 | 131.714 | 412.013 | 0 | 0 | 1120.21 | 5124.77 |
| Levantine Sea | 1118761.7 | 32 | 32 | 1180.84 | 8.41 | 0 | 0 | 0 | 130.19 | 1042.24 |
| Tunisian Plateau/Gulf of Sidra | 1077854.3 | 7 | 15 | 986.77 | 0.79 | 39.85 | 0 | 0 | 0 | 946.13 |
| Western Mediterranean | 1383324.4 | 405 | 572 | 119234.483 | 565.567 | 1687.61 | 1249.93 | 450.236 | 99839.22 | 15441.92 |