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POINT-OF-VIEW

Advancing marine conservation planning in the Mediterranean Sea

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Abstract Twenty leading scientists in the field of marine conservation planning attended the first international workshop on conservation planning in the Mediterranean Sea. This globally significant biodiversity hotspot has been subjected to human exploitation and degradation for 1,000s of years. Recently, several initiatives have tried to identify priority areas for conservation across the Mediterranean Sea. However, none of these efforts have led to large-scale actions yet. The aim of the workshop was to establish a network of scientists who are involved in large-scale conservation planning initiatives throughout the Mediterranean basin to promote collaboration and reduce redundancy in conservation initiatives. The three focus groups of the workshop build on existing efforts and intend to deliver: (1) a roadmap for setting conservation priorities, (2) a methodological framework for linking threats, actions and costs to improve the prioritization process, and (3) a systematic conservation planning process tailored to complex environments such as the Mediterranean Sea. Joining forces and involving more scientists (especially from the South-eastern part of the region) in following meetings, the participants endeavour to provide guidelines on how to bridge the science-policy gap

Please refer the ''Appendix'' section for the workshop participants-authors.

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and hence aid decision-makers to take efficient conservation actions.

Keywords Biodiversity · Collaboration · Marine conservation planning · Mediterranean Sea · Marine protected areas

Background

Despite the agreement by most Mediterranean countries to conserve 10 % of the sea by 2020 under the Convention on Biological Diversity (http://www.cbd.int/convention/), only ~4 % of the Mediterranean Sea is currently included in marine protected areas (MPAs) and merely 0.01 % is designated as no-take reserve (Abdulla et al. 2008; Portman et al. in print). The Mediterranean Sea is a biodiversity hotspot with nearly one-fifth of the total known number of marine species world-wide, which has been subjected to human exploitation for centuries (Bianchi and Morri 2000; Coll et al. 2010). Current MPAs only partially protect fundamental biodiversity traits of the Mediterranean (Mouillot et al. 2011). Therefore, the need to expand and increase the number of spatially managed areas in the region to progress towards an ecosystem-based approach to marine resources (Pikitch et al. 2004) and ecosystem-based marine spatial management (Katsanevakis et al. 2011) is essential. Such necessity is also highlighted by the European Commission with the adoption of the Marine Strategy Framework Directive (2008/56/EC). The directive specifically calls for the establishment of a network of MPAs in European waters.

Recently, several large-scale conservation initiatives for the entire Mediterranean Sea have suggested increasing the number and extent of MPAs in the region (see Oceana 2011 and references therein). Intergovernmental bodies have identified priority areas for conservation (e.g. the European Union, the Regional Activity Centre for Specially Protected Areas of the United Nations Environmental Programme—Mediterranean Action Plan), NGOs (such as Greenpeace, Oceana), scientific committees (Scientific, Technical and Economic Committee for Fisheries and General Fisheries Commission for the Mediterranean), regional scientific commissions and Agreements (CIESM-The Mediterranean Science Commission, ACCOBAMS-Agreement on the Conservation of Cetaceans in the Black Sea, Mediterranean Sea and contiguous Atlantic area) and research groups (Coll et al. 2012; Micheli et al. http://globalmarine.nceas.ucsb.edu/mediterranean/). However, little or no action has yet been taken to act on these large-scale plans or recommendations in response to their valuable findings. The socio-economic, political and cultural complexity in the Mediterranean Basin, which comprises 21 countries, could be a possible explanation for this delay (Kark et al. 2009).

The great deal of current research in the region often lacks coordination. With the increasing threats to the region's biodiversity, scientists and managers are faced with the need to integrate their efforts to more efficiently conserve the biodiversity of the Mediterranean Sea. The production of multiple maps with both alternative and converging information, while useful in serving specific aims, should provide clarity and coordination among plans to better inform decision-makers. Furthermore, there is a need to explicitly account for the complexity of the Mediterranean Basin and to advance the bridge between science and policy issues. Basic science and theory need to be translated into real action in order to foster marine protection and secure the valuable ecosystem services that the Mediterranean Sea provides.

Within this context, the first workshop on advancing marine conservation planning in the Mediterranean Sea was organised last April in Santorini (Greece) to create a network of scientists who are involved in large-scale spatial conservation planning initiatives throughout the basin. The aim of the workshop was to promote collaboration and reduce redundancy in future scientific contributions. Building on existing efforts, the workshop participants discussed: (1) a roadmap for setting conservation priorities, (2) a process for integrating and incorporating threats, actions and costs into the prioritization process, and (3) recommendations for a systematic conservation planning process in complex environments such as the Mediterranean Sea.

The workshop

The twenty workshop participants came from several Mediterranean countries—from Spain and Italy, to Greece and Israel. Experts from the USA, Australia and Canada also attended. This brought together knowledge and expertise from NGOs, universities, research institutes and the European Union.

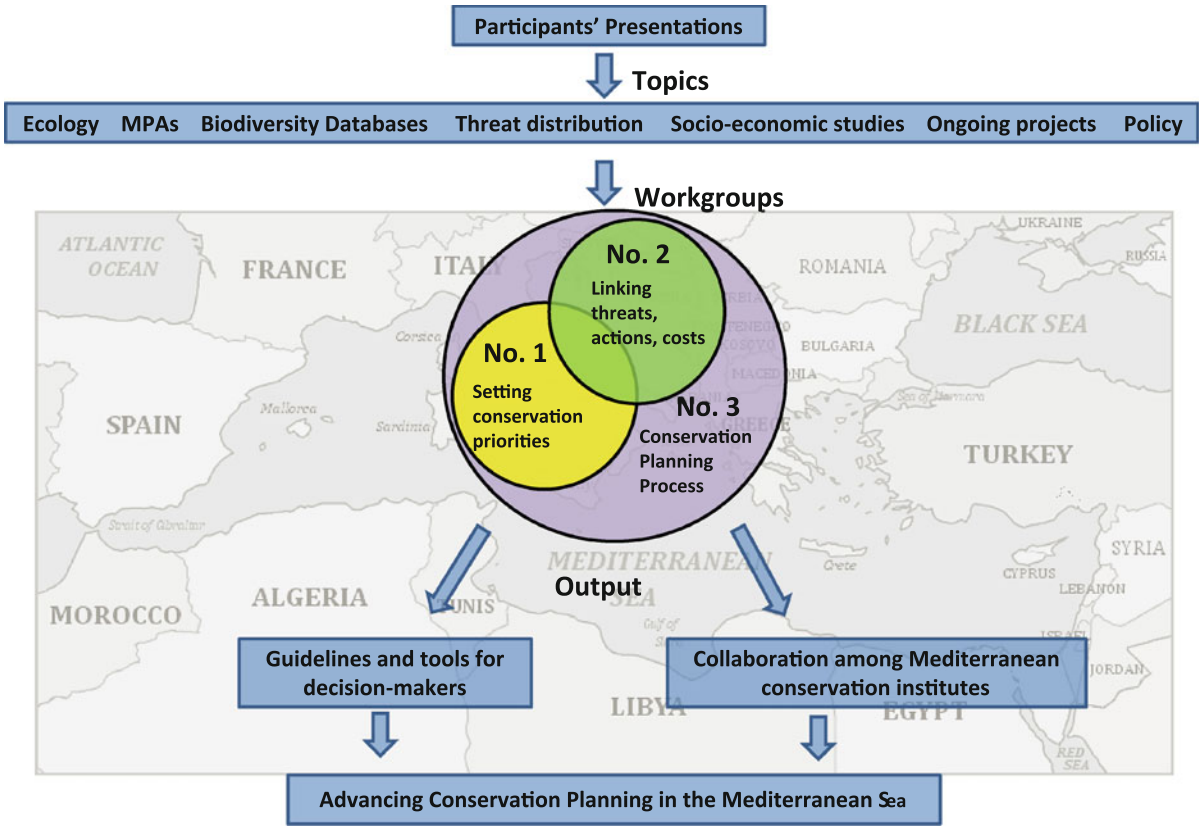

Fig. 1 Steps towards advancing marine conservation in the Mediterranean Sea. Broad topics presented by the workshop participants are illustrated on the *top* of the *chart*; the subjects of the three working groups appear in the *circles* in the *centre* of the *chart* whereas the outputs of the workshop at the *bottom* of the *chart*

During the first part of the workshop, each of the participants presented their own research on several interrelated topics (Fig. 1). In these presentations, the majority of speakers brought the current status of marine conservation in the Mediterranean Sea to attention. A map of the sea's current MPAs was referred to in many presentations to highlight the need for greater protection of biodiversity (Abdulla et al. 2008, 2009) and also to make the existing situation clear. From this, the presenters led into their efforts and projects to improve conservation within the basin. NGO representatives referred to their efforts to establish new MPAs in the Mediterranean and improve the management of existing ones, with special emphasis and efforts being directed towards eastern and southern areas of the Mediterranean Sea (Marshall et al. 2009). Several academic researchers explained the range of systematic tools and approaches for the identification of priority areas for conservation in the Mediterranean Sea, while other researchers presented available spatial data to identify threats to marine species and habitats at a Mediterranean Basin scale (Micheli et al. http://globalmarine.nceas.ucsb.edu/mediterranean/; Giakoumi et al. 2011; Coll et al. 2012; Sala et al. 2012; Portman et al. print).

Experience and up-to-date computational and modelling tools such as Marxan (Ball et al. 2009) and ecological modelling software (Christensen and Walters 2004) used in other parts of the world such as Australia, the USA and Canada were introduced within the workshop. Participants discussed how modelling tools should be considered and adapted to regional conditions, while new examples of applications to Mediterranean ecosystems were presented (Fraschetti et al. 2009; Giakoumi et al. 2011; Coll and Libralato 2012). Successful examples of large-scale MPA networks, such as the Great Barrier Reef MPA network (Fernandes et al. 2005) could provide

guidance on how to deal with fundamental conservation planning issues. The adaptations of current approaches and planning methods and the development of novel ones to address the complexity of the region have been largely discussed in the workshop.

Participants also discussed EU programs (MEDITS and Med SEA), web-platforms (EMIS and EASIN), the ecosystem approach of the Mediterranean Action Plan and EU projects (CoCoNet, NETMED) relevant to basin-scale conservation planning. Larger and smaller scale efforts were also discussed, via global models of the world's oceans (e.g. Christensen et al. 2012), and specific regional studies such as the Adriatic Sea (Mackelworth et al. 2011; Mackelworth and Caric 2010), the Aegean and Ionian Seas (Giakoumi et al. 2011, in revision; Stelzenmüller et al. in print).

A subsequent plenary session focused on the following subjects:

(1) *Scarcity of data in the southern and eastern Mediterranean Sea*

One impediment to prioritizing initiatives for the entire Mediterranean has been the lack of data and the poor representation of the eastern Mediterranean Sea (Claudet and Fraschetti 2010; Fraschetti et al. 2011; Coll et al. 2010, 2012). Methods should be devised to overcome this problem. One example could be the use of surrogates for biodiversity, threats and cost in data poor regions, i.e. geo-morphological and oceanographic data (Giakoumi et al. 2011). Data uncertainty and subsequent biases can be taken into account in prioritization schemes so lack of complete data is not an excuse for inaction. Moreover, diverse approaches may be required in different ecoregions according to data availability.

(2) *The complexity of the region should be taken into account in conservation planning initiatives*

The Mediterranean Sea, almost completely enclosed by land, has been an important route for merchants and travelers since antiquity allowing for trade and cultural exchange among civilizations. Currently 21 modern states share the Mediterranean coastline. These states present important differences in terms of economic status, political regime, culture and religion. This heterogeneity has generated significant collaborative achievements but also severe conflicts. In such a complex environment, opportunities and obstacles for collaboration in conservation efforts among States should be considered (Marshall et al. 2009; Kark et al. 2009).

(3) *From MPA planning to action*

Why is the Mediterranean Sea receiving so little protection? Explicit and quantitative consideration of socio-economic activities when identifying priority conservation areas could aid decision-making. Up to now systematic planning approaches, explicitly considering opportunity cost, have been applied only to national-scale projects (Fraschetti et al. 2009; Maiorano et al. 2009; Giakoumi et al. 2011; in revision). Furthermore, identification of threats to biodiversity, habitats and ecosystem processes is crucial (Coll et al. 2012; Micheli et al. http://globalmarine.nceas.ucsb.edu/mediterranean/). Equally crucial is the distinction between threats that can be mitigated (e.g. fishing pressure) and those that cannot (e.g. climate change). A homogenous plan of conservation actions throughout the Mediterranean Basin may not be possible. The socio-economic complexity of the Mediterranean Sea requires different strategies for conservation planning, adapted to different contexts by region.

Outreach

A representative from the cabinet of the European Commissioner on Marine Affairs and Fisheries, Mrs Maria Damanaki, attended the workshop in order to report to the European Commission about the efforts required to increase the proportion of the Mediterranean Sea currently protected. The workshop was reported on Greek television, in an attempt to raise people's awareness on marine conservation issues.

In the framework of the workshop, a website was created to host the material presented, provide background information on the workshop, and to form a basis for collaboration and discussion within and among the working groups. The site is accessible to the public at large: https://sites.google.com/site/conservationmediterraneanws1/.

Priorities and future opportunities

Three main topics concerning conservation planning in the Mediterranean Sea emerged from the general discussion. To explore possible solutions on these

subjects, the participants were divided into three working groups, each proposing a different strategy for action. The outcomes from these groups will be published in peer-reviewed journals.

Group 1: setting conservation priorities—a cookbook approach

This working group aims at reviewing existing large-scale conservation initiatives and suggestions for the Mediterranean Sea in order to identify areas that emerge as priorities regardless of the planning criteria and methods used. When setting priorities, biases due to data uncertainty must be accounted for. This working group intends to identify these biases and suggest ways to incorporate them, while also detecting a suitable scale for prioritizing actions in the Mediterranean Sea. Another question that emerged during discussions was whether conservation actions and their sequence should be the same throughout the Mediterranean region. Ecological, economic and social divergence among Mediterranean countries dictates that a holistic approach for the entire Mediterranean Sea is likely to fail. The targeted outcome of the group is a roadmap to guide the setting of priorities in complex regions such as the Mediterranean Sea.

Group 2: linking threats, actions and costs

Recent efforts to identify and map threats to biodiversity and habitats of the Mediterranean Sea are very informative, but it is still unknown how this information can be used to advance conservation planning. This group discussed how to summarize available information on threats and move towards a framework for linking threats to conservation actions and further quantify the costs of mitigating the threat as a useful way to use available data. The group is working on a study that will describe the commonalities of existing systematic analyses of threats that have been done, while also showing that there is room for refinement by looking at synergies, better resolution of data, deep-water data and other critical aspects of the analyses that are currently lacking. Documenting successful stories of recoveries in the Mediterranean Sea following the work of Lotze et al. (2011), the group is presently analysing the specific actions involved in past experiences that led to reverting or arresting trajectories of changes resulting from threats. In addition, the use of two case studies on the endemic seagrass *Posidonia oceanica* and loggerhead turtle *Caretta caretta* will illustrate in detail how simple actions can limit habitat degradation and help conserve species of importance, while linking specific threats to actions and to costs.

Group 3: providing a general framework for systematic conservation planning and policy in complex regions

The third group focuses on developing a model planning process that can expedite marine conservation in the Mediterranean within existing institutional frameworks. Currently, spatial planning is invariably hampered because stakeholders often cannot agree on the boundaries of the areas within which planning will occur. However, the exact boundaries at a local scale are of limited importance especially when designing a network of MPAs. This group agrees that the appropriate scale for developing the first detailed marine zoning plans in the Mediterranean is the ecologically or biologically significant areas (EBSAs) (Notarbartolo di Sciara and Agardy 2009; UNEP-MAP-RAC/SPA 2010). Some scientists and decision makers in the region argue that marine spatial planning in the Mediterranean Sea cannot move forward because of insufficient data. This group aims at demonstrating that data available on the EBSAs are sufficient to make credible plans and that insufficient data is no longer an excuse for inaction. A case study will be described to illustrate the main conclusions of the group's work.

After this workshop, participants and hence the institutions they represent are ready to network and exchange information concerning their projects, datasets, research protocols and approaches, sources of literature, on-line databases and other resources. Several new collaborations among scientists within the framework of ongoing Mediterranean-scale conservation projects have already been started as a result of this exchange.

Summarizing, the first international workshop on conservation planning in the Mediterranean Sea gave experts from different parts of the Mediterranean Basin and overseas institutions an opportunity to establish fruitful collaborations. Ongoing EU projects concerning marine conservation planning will help identify gaps and create further opportunities for collaboration among Mediterranean research institutions.

Participants are already organizing a second workshop for spring 2013 in a Mediterranean country. In this next meeting, more scientists will be involved, especially from the southern and eastern Mediterranean regions. We invite scientists and managers interested in the area to join the effort, more information can be found: https://sites.google.com/site/conservationmediterraneanws1/. We believe that collaboration among experts and institutions as well as coordination of ongoing conservation planning projects are necessary for bridging the science-policy gap and the uptake of conservation action across the Mediterranean region.

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Appendix

Workshop participants

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