OCEANA MEDNET. PROPOSAL FOR THE PROTECTION OF THE MEDITERRANEAN SEA. 100 REASONS TO REACH 10%

P. Marín[*], S. García[*], R. Aguilar[***], X. Pastor[****], J. Ubero[*****]
Oceana Europe, Leganitos 47, 28013, Madrid, España

** Marine Scientist & MedNet Project Coordinator, pmarin@oceana.org*
*** Marine Scientist, sgarcia@oceana.org*
**** Director of Researching and Projects, raguilar@oceana.org*
***** Executive Director, xpastor@oceana.org*
****** Marine GIS Analyst, jubero@oceana.org*

Abstract

One of the main mistakes made in marine conservation on a global scale is the delay in the designation of Marine Protected Areas (MPA), often justified by a lack of available scientific information. As a result of this error, there is a significant imbalance between protected land and protected marine areas. To date, only 1% of the world's oceans are protected, compared to 11% of land areas.
There has been an increase in the number of MPA designations in the last decade. However, progress has been too slow to meet the objective of protecting at least 10% of the marine ecoregions of the world by 2012, as established by the Convention on Biological Diversity (CBD). This deadline has been pushed back to 2020 after it became clear that it would not be met. Nevertheless, the latest advances in marine research have provided significant information on the geological and oceanographic characteristics which generate habitats of greater biodiversity and vulnerability. Thus, on the basis of the Precautionary Principle, there is no longer any excuse for further delay.
The lack of proper MPA coverage along with the well-known problems of the overexploitation of fishing resources, species in danger of extinction, climate change, chronic pollution, the destruction of habitats, the appearance of invasive species, etc. has led to the accelerated loss of marine biodiversity, which is probably irreversible in some cases. Faced with this situation, and in its role of protecting and preserving the world's oceans, Oceana is committed to encouraging governments to act urgently before it is too late.
With this action, Oceana aims to contribute in reaching the 10% target recommended by the CBD, in collaboration with the different national administrations and organizations which participate in the protection and preservation of the Mediterranean Sea. Due to the Mediterranean's special jurisdictional situation, integrated and multilateral cooperation is necessary in order to conserve resources on the high seas. In this sense, Oceana MedNet is a useful tool for identifying marine areas in need of protection in waters where national sovereignty or jurisdiction has not yet been defined.

Keywords: marine protected areas, Marine Spatial Planning, governance, MPA networks.

The need for global protection: A pending task

According to the Millennium Ecosystem Assessment (UNEP, 2006), marine and coastal ecosystems are among the most endangered on the planet. Fisheries continue to decline, pressure on coastal ecosystems continues to increase, and climate change places ever more stress on a weakened environment, diminishing its capacity to produce goods and services. We have detailed knowledge of the reach of the effect of human activity due to extended resource exploitation (deforestation, pollution, fishery overexploitation, etc.) even though significant changes have been generated in trophic relationships in food chains (Sala, 2004).
Even now, in the 21st century, there is a general gap in our knowledge regarding the treasures found in the oceans and the processes ruling them – a gap which is particularly serious when it comes to the deep seas. However, in this context of limited knowledge of ecosystems and resources (currently or potentially exploited), international recommendations necessitate the adoption of a Precautionary Approach (CBD COP 10 Decision X/29 - Marine and coastal biodiversity). This involves considering a series of conservative (and/or conservation) measures, including the establishment of MPAs. In turn, this approach should be supported by greater efforts in researching deep-sea and high-sea ecosystems with the aid of new

technologies (Remotely Operated Vehicles, ROV) and by long-term monitoring of known vulnerable ecosystems.

MPAs have been described as efficient tools for preserving biodiversity (Allison *et al*. 1998; Halpern, 2003), so global efforts to use MPAs have gradually increased in order to protect the sea and its resources. Data from recent years is summarised below; despite progress, MPAs represent scarcely 4% protection of coastal areas and 1% of open sea.

Table 1. Summary of the global increase in MPAs in number and surface (IUCN, 2010)

	YEAR							
	2003		**2006**		**2008**		**2010**	
NUMBER of MPAs	4116		4435		5045		5850	
MPA COVERAGE	**Mill. Km^2**	**%**	**Mill. Km^2**	**%**	**Mill. Km^2**	**%**	**Mill. Km^2**	**%**
GLOBAL TOTAL	1.64	0.45	2.35	0.65	2.59	0.72	4.21	1.17
Within Exclusive Economic Zone	1.14	1.14	2.35	1.63	2.59	1.80	4.12	2.86
On continental shelf					1.20	4.09	1.27	4.32
Off-shelf					1.39	0.42	3.01	0.91

The importance of protected areas is globally acknowledged, and thus in the 7th CBD Conference of the Parties in 2004 the following objectives were established as regards marine protection:

- "*To establish a global network of MPAs through national and regional systems of protected areas which are efficiently managed and ecologically representative*" (Decision VII/28)
- "*At least 10% of each of the marine ecoregions must be effectively conserved*" (Decision VII/30)

Later, and in order to create representative networks including open sea areas and deep-sea habitats, a series of guiding criteria for selecting priority areas was produced (UNEP/CBD/EWS.MPA/1/2, 2007: UNEP/CBD/COP/DEC/IX/20, 2008; UNEP/CBD/BCS&IMA/1/2, 2009), as well as a list of areas which would fulfil the scientific criteria to be identified as "*Ecologically and Biologically Significant Areas"* (EBSA). These include various habitats, species, and formations, divided into three categories: benthic, pelagic habitats, and vulnerable and/or highly migratory species. In this sense, the following are just some of those considered as requiring protection: seamounts, cold-water coral reefs, submarine canyons, upwelling areas, sharks, whales and turtles.

Although there has been a progressive increase in the number of MPAs designated in recent decades, data shows that the aforementioned objectives are far from being met in the short term. Six years after achieving the commitment to 10% and despite recommendations from the most prominent conservation organisations concerning marine issues that this target should be increased to 20%-30% to be truly significant, the delay in achieving the target set is evident. For that reason, during the last Conference of the Parties to the CBD (COP X- October 2010, Nagoya) it was decided to postpone the target to 2020, ignoring the fact that its short term conservation would mean avoiding the continuous degradation of marine ecosystems.

To this insufficient protection should be added the fact that most of the protected areas are linked to land areas, with a much lower percentage of completely open-sea MPAs. Furthermore, one must consider the large difference in levels of protection between different ecosystems; in other words, the high representation of mangrove, coral reefs and seagrass meadows in comparison, for example, with seamounts (Wood *et al.* 2008). Although the existing protection is completely justified, a wider and more innovative direction needs to be taken, encompassing lesser known ecosystems, such as seamounts, canyons, cold water corals, cold seeps, pelagic habitats, etc. These are equally important to achieving a coherent global network (Secretariat of the CBD, 2008).

International Union for Conservation of Nature data (Toropova *et al.* 2010) shows that the current list of MPAs cannot be regarded as an effective "network of networks" (national/regional/global), and points out that regional efforts (OSPAR, Barcelona Convention) are greater than those performed on a national scale. Moreover, it should be pointed out that

scarce coverage in open seas is probably linked to political factors arising from claims concerning jurisdictional limits rather than to environmental factors.

Is the Mediterranean Sea already protected?

The Mediterranean Sea is a biodiversity hotspot and contains a high percentage of endemic species and endangered, vulnerable, and threatened habitats and species. Although some 17,000 species have been catalogued in the Mediterranean, it is estimated that the list would grow with the inclusion of so far undiscovered species (Coll *et al.* 2010).
It is a fact that marine biodiversity is less well known than earth biodiversity, and that there exists a particularly significant information gap concerning the deep sea. In the case of the Mediterranean, this lack of information becomes more pronounced in the East area and the South coast. Moreover, marine resources are under threat due to the influence of human activity, which has resulted in overexploitation, habitat destruction, invasive species, pollution, etc.
For all the previous reasons, the Mediterranean Sea, despite its small size – less than 1% of the world sea surface – is regarded as a priority conservation area. Regional threats are more significant due to its semi-enclosed nature, as well as due to the high population concentration on the coast. According to UICN (2010) these threats can be managed or channelled through the implementation of effective MPA management. However, the legally protected surfaces amount to a total area of just 4%. Taking into account that this percentage includes the Ligurian Sea Sanctuary (87,500km^2), the remaining protected marine surface is scarcely 0.3%. In summary, the situation in the Mediterranean Sea can de described thus: the great majority of MPAs are located in coastal waters; there are large gaps in protection in the South coast and in the Levantine region; there is a significant difference between the North and the South coasts; and there is no open-sea protection. Similar to what is observed on a global scale, the Mediterranean network of MPAs is neither representative nor coherent.

Regional protection initiatives

Given the previous data, the current situation is far from reaching the protection levels recommended by the United Nations in the short term. However, various actions have been launched through existing initiatives, based on both conservationist and fishing perspectives. The main initiative falls under the Barcelona Convention and more specifically within the Regional Activity Centre for Specially Protected Areas (RAC/SPA). In it, 12 EBSAs have been defined as priority areas wherein Specially Protected Areas of Mediterranean Importance (SPAMI) can be designated. Other initiatives include: (1) protecting Essential Fish Habitats (EFHs) and Sensitive Habitats (SHs), (2) Marine Peace Parks within the framework of the Mediterranean Science Commission (CIESM), (3) Fisheries Restricted Areas (FRA) based on General Fisheries Commission for the Mediterranean recommendations (GFCM), (4) the proposal for protection of cetaceans within the ACCOBAMS regional agreement, or even (5) the "Marine Reserves for the Mediterranean Sea" proposed by Greenpeace.
However, several of the previous initiatives have a certain pelagic bias, and a common trait to most of them is the fact that they do not propose specific sites to protect, but rather large areas within which MPAs might be located.

OCEANA MedNet: Origin and justification of the proposal

Aware of the situation and the weaknesses in the existing Mediterranean MPA network, Oceana saw an urgent need to elaborate a comprehensive protection proposal which would involve a great step forward towards achieving the 10% target recommended by the CBD. Oceana's proposal, called MedNet, is mainly based on the adoption of the precautionary approach when following the guidelines established by the latest conservation strategies on a regional level in light of the current lack of biological information.
Unlike the aforementioned initiatives, Oceana proposes a network of defined sites rather than large priority areas for conservation. The MedNet approach is not only a presentation of geographically localised proposals, but would also be backed by a group of social agents (NGOs), institutional organisations and scientific organisations with direct links to the protection

of the Mediterranean Sea who could participate in the process of creating and developing the network.
Thus, the main goal of MedNet is *"To establish a joint Mediterranean initiative to create a network of MPAs under the recommendations established by the CBD with the aim of protecting vulnerable and high ecological value areas within a context of limited knowledge and under a precautionary approach ".*
As previously described, until now, "de facto" protection in the Mediterranean has been concentrated in the coastal zone with a significant difference between the northern and southern coasts, as well as the eastern and western basins. Most MPAs in the Mediterranean basin are located along the north coast (European countries), probably because of the obligation resulting from compliance with the inclusion of priority habitats and species (e.g. *Posidonia oceanica* seagrasses associated with shallow waters near to the coast) in the Natura 2000 network under the Habitats Directive 92/43/EEC. The exception is the Marine Sanctuary of the Ligurian Sea, the sole MPA in waters beyond national jurisdiction and in open sea.
So far the lack of scientific knowledge has greatly limited the capacity for developing appropriate criteria for the selection of sites and their size, in order to develop an open sea network of Mediterranean MPAs. In addition, there exists an "invisible barrier" of maritime jurisdictions and conflicts due to claims over marine areas. Despite all this, it is urgent to take protection measures for the more fragile known areas or for those in which impacts with irreversible consequences can be found.

Proposal development
Following Oceana's line of research during the latest Mediterranean campaigns, and considering that underwater elevations are hotspots of biodiversity (Morato *et al.* 2010), Oceana MedNet is above all geared towards protecting this type of enclave. However, it is evident that it is not possible to fulfil the CBD targets solely with a proposal based on underwater elevations. Therefore, the development of MedNet is focused on offering a varied proposal, where not only underwater elevations are considered, but also another series of oceanographic (e.g. eddies) or geological formations (e.g. mud volcanoes), in compliance with the initial requirements of the CBD.
Thus, and given the lack of biological knowledge, a systematic selection of a series of candidate sites as part of an MPA network covering open sea areas will first depend on geomorphological criteria (Rachor and Günther, 2001). This entails that, in the medium to long term, the proposal should be complemented by necessary research to document the richness of the figures proposed.

Methodology
Based on the above premises, background data documentation compiled by Oceana during its years of research was used, in addition to GEBCO (General Bathymetric Chart of the Oceans) information about underwater relief and the potential locations of seamounts published by Morato & Pauly (Kitchingman & Lai, 2004. *Seamounts*: *Biodiversity and Fisheries*). All of these locations were compiled in a Geographic Information System and, after a process of homogenisation and standardisation, resulted in a total of 385 sites that could be included in the OCEANA MedNet (see Figure 1).

Although the Mediterranean Sea is relatively small in size in comparison to the rest of the world's seas and oceans (approximately 2,530,000km^2) it is not easy to plan a proposal of this kind for the entire area. It was therefore necessary to use subdivisions (planning units) in order to complete the proposal based on a detailed analysis and as homogenously as possible.
Theoretically, it might be thought that the Marine Ecoregions of the World (MEOW) would be an ideal instrument in order to plan a regional MPA network, as they reflect the various biological units and work as an instrument for ocean management. There are 7 marine ecoregions in the Mediterranean [Adriatic Sea, Aegean Sea, Levantine Sea, Gulf of Sidra, Ionian Sea, West Mediterranean, and Alborán Sea] although they are too broad to develop a detailed proposal, particularly in the western basin, where most of the potential sites were located. However, there is a more useful classification for practical purposes, which divides the basin into 30 subareas.

This is the division used by GFCM, which splits the region into the Geographical Sub Areas (GSAs) used to manage fishing statistics (see Figure 2).

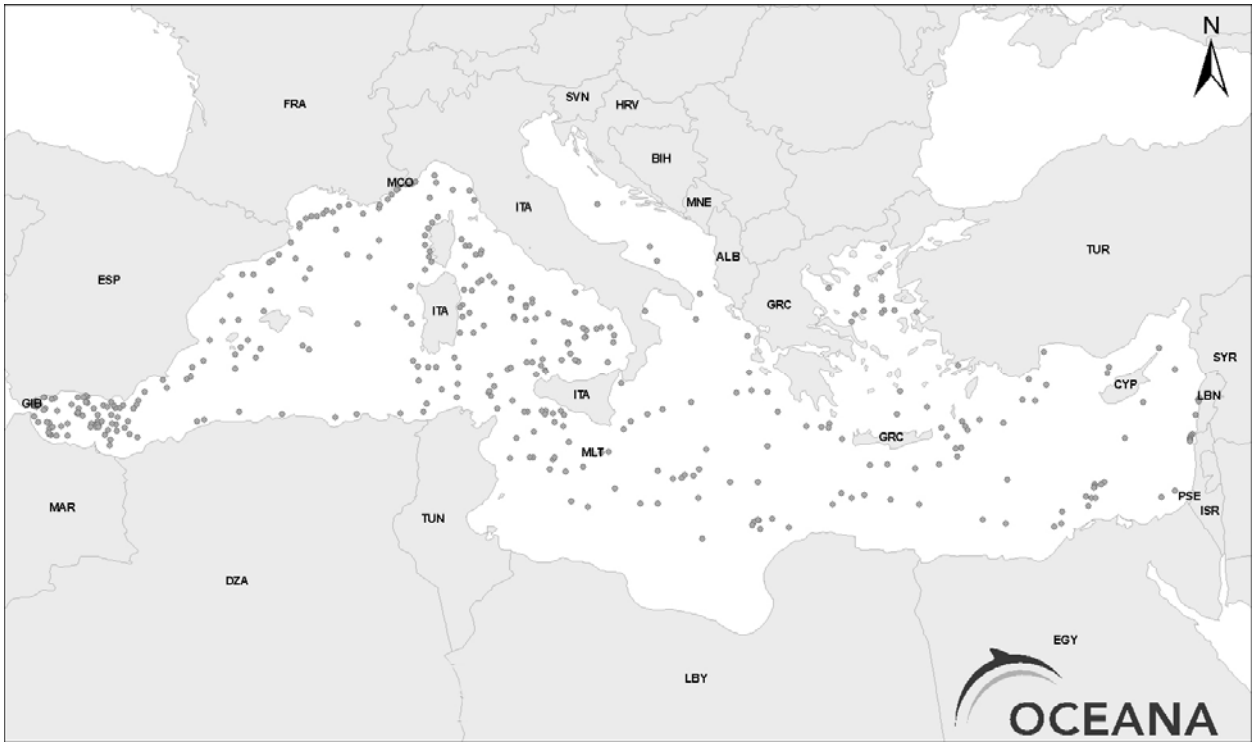

Figure 1. Location of the 385 locations which might be potentially included in MedNet

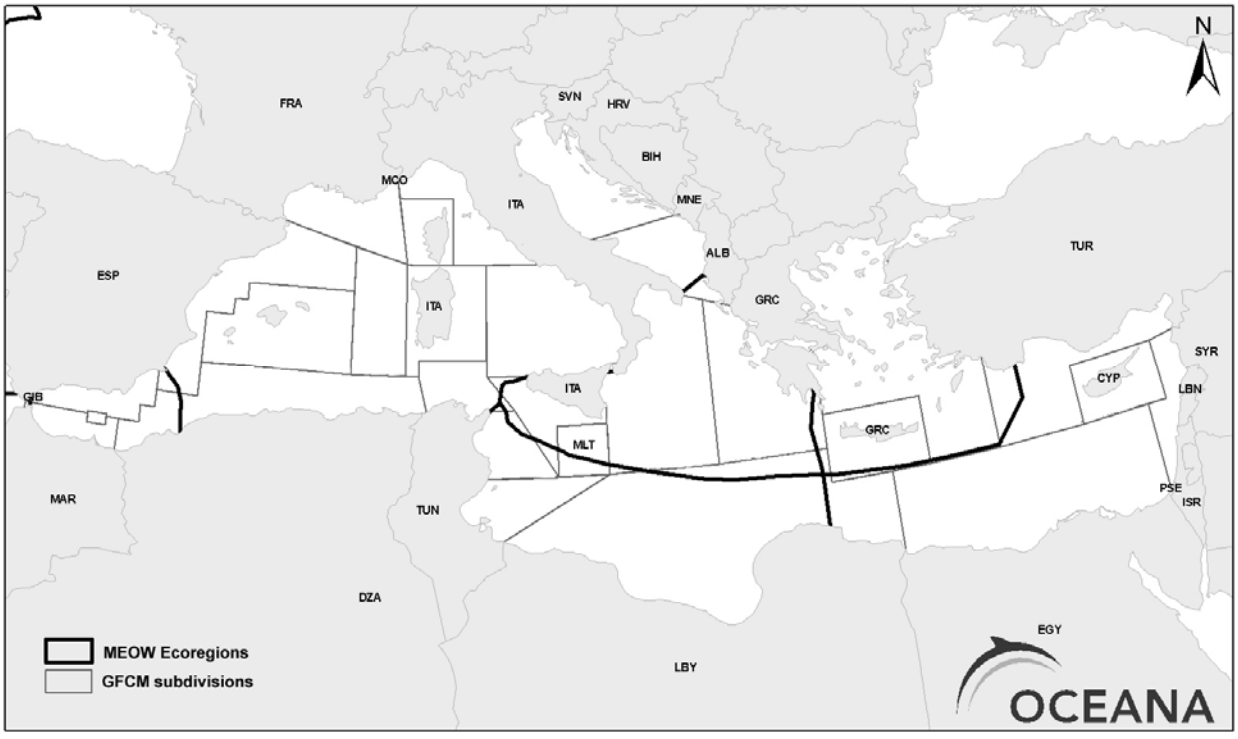

Figure 2. Mediterreanean marine ecoregions and GSAs.

However, after a brief analysis, it was decided to slightly modify the divisions as there still remained large areas and areas which were taken as a single unit (e.g the Alboran Sea). Finally, a total of 31 planning units were used to design MedNet (see Figure 3).

Figura 3. Planning units used to design MedNet

Once all the locations were obtained, an in-depth analysis was performed on each of the areas, compiling all possible information in a continuous documentation process, using a specially-designed Access database as a storage tool. The sum of this information gave us an idea of the ecological importance of each of the locations and made selection possible based on the criteria below.

Table 2. Criteria used to select the MedNet sites

BIOLOGICAL	- Key species (commercial or of biological/ecological interest) - CBD criteria
GEOLOGICAL	- Type of elevation or geological formation (escarpments, seamounts, canyons, trenches, etc.)
ADMINISTRATIVE	- Affected by waters of national jurisdiction - Jurisdictional conflicts
OCEANOGRAPHIC	- Connection by currents, gyres - Fronts
DETECTED OR POTENTIAL THREATS	- Undeclared and unregulated illegal fishing - Potential oil and gas prospecting - Pollution - Maritime traffic - Bycatch
AVAILABLE SCIENTIFIC LITERATURE	- Biological, geological, oceanographic, etc.
PREVIOUS PROPOSALS	- Barcelona Convention - EBSA - ACCOBAMS - Vulnerable Habitats - EFH/SH - GFCM (FRAs) - Greenpeace

After applying these criteria, a total of 159 sites were obtained and these are included in the proposal (see Figure 4). Following a spatial analysis, the locations were grouped on the basis of their proximity and by performing an adjustment according to the sea bed morphology they were transformed onto the surface. To do so, a 10x10 km grid was employed, using the ETRS89 LAEA (Lambert Azimuthal Equal Area) reference system. This grid is recommended by the INSPIRE Directive (which establishes a spatial information infrastructure in the European Community) and the European Environment Agency (EEA), since it makes it possible to

perform spatial analysis by means of regular cells, preserving the area of the represented elements. Moreover, another reason for using a grid of this size is to guarantee some protection for benthic communities. According to Rachor and Günther (2001), the minimum surface to achieve this goal is 100km^2. The full proposal finally obtained for MedNet can be seen in Figure 5.

Figure 4. Planning units and the 159 locations selected on MedNet

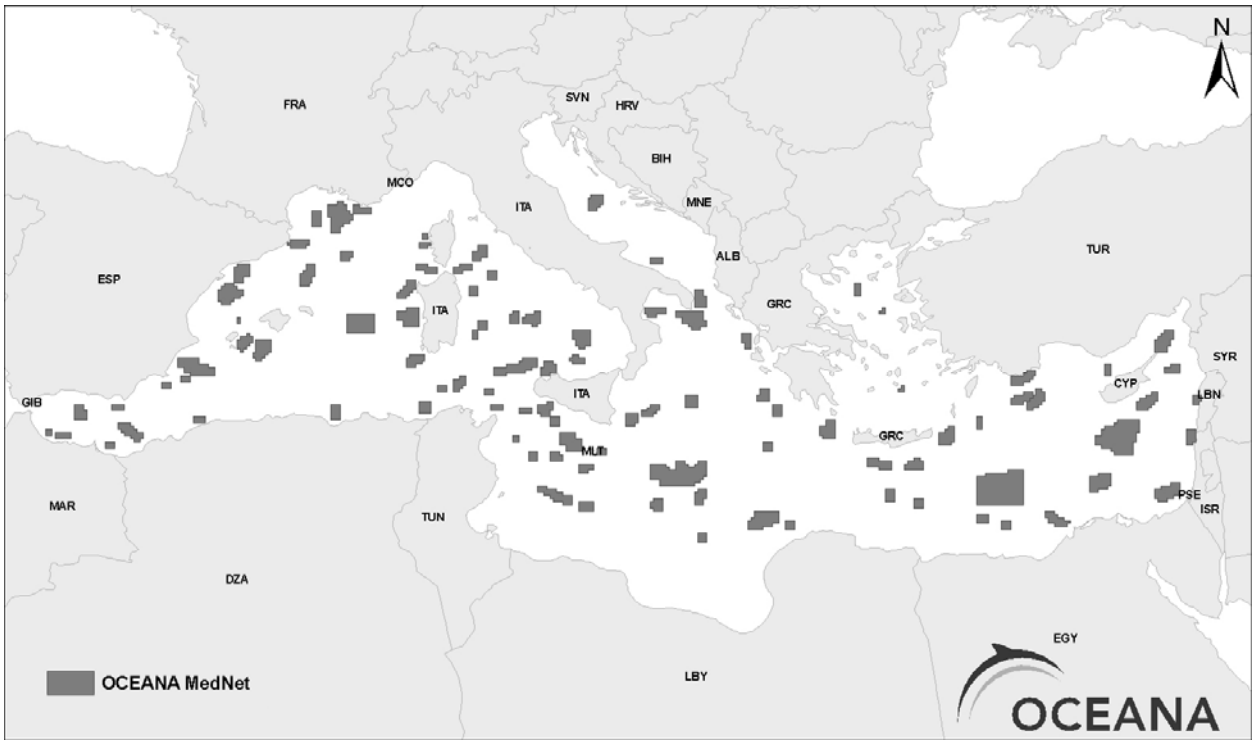

Figure 5. Oceana MedNet proposal

Analysis

According to De Juan & Lleonart (2010), a network of MPAs should be representative of the diversity of habitats, permit connectivity between areas and each should be sufficiently large to enable a structured habitat and to eliminate (or mitigate) the negative influences of human activity (e.g. fishing) in surrounding areas. Furthermore, to guarantee a national/international network of MPAs in the long term, it must include pelagic and demersal areas. Moreover, the results of Hasting & Bostford (2003), in which the designs of MPAs with different objectives are compared, state that the size of the MPAs will directly depend on their purpose (biodiversity *vs* fishery aims). In this sense, when conservation objectives are undertaken the MPAs surface should be as large as possible.

Protected surface

Oceana's principal goal with this project is to promote the achievement of the CBD target to protect 10% as soon as possible, and so build a representative, coherent, and effectively managed Mediterranean MPA network before 2020. The surface of the Mediterranean Sea being approximately 2,530,000km^2, implementation of the MedNet proposal would cover a surface of 207,100km^2 and thus 8.2% of its total surface. Adding in the surface already protected by existing MPAs, the 10% target would be surpassed and a total protected area of 12% would be reached (see Table 3).

Thus, the main features of the proposal would be:

- MPAs would have a minimum surface of 200km^2 and a maximum surface of 15,200km^2.
- 50% of MPAs would surpass 1,500km^2.
- The largest MPAs are located in the Eastern basin, which is considered the most "unprotected" and least well known.
- The network is mainly composed of MPAs with a size between 200 and 2,300km^2, with three areas of more than 10,000 km^2 located in the Eastern area.

Table 3. Result of the implementation of the MedNet proposal

	Surface (km^2)	Percentage
OCEANA MEDNET	**207,100**	**8.2%**
Ligurian Sea Sanctuary	87,500	3.5%
Protected surface	8,624	0.3%
TOTAL	**303,224**	**12%**

Connectivity

Most of the studies measuring the effectiveness of the implementation of MPA networks are based on the measurement of larval dispersion phenomena between protected areas, as genetic exchange between populations would ensure their connection. In recent years, various experiments have been carried out with regard to connectivity in MPA networks. However, there is still no generalised methodology or standard value to determine the minimum distance to ensure the effectiveness of an MPA network. The main reason for this is that it is not realistic to extrapolate to different biological communities, even less so when dealing with large-scale planning. These studies provide very different results, and even though they have been mainly performed in tropical areas, some have also been performed in the North Sea (see Table 4).

Table 4. Studies on connectivity in marine protected areas

AUTHOR (Year)	LARVAL DISPERSAL DISTANCE (km)	LOCATION
Rachor & Günther (2001)	Up to 100	North Sea
Treml *et al* (2008)	50-100	Pacific
Planes, Jones & Thorrold (2009)	35	Papua New Guinea
Christie *et al* (2010)	15-184	Hawaii

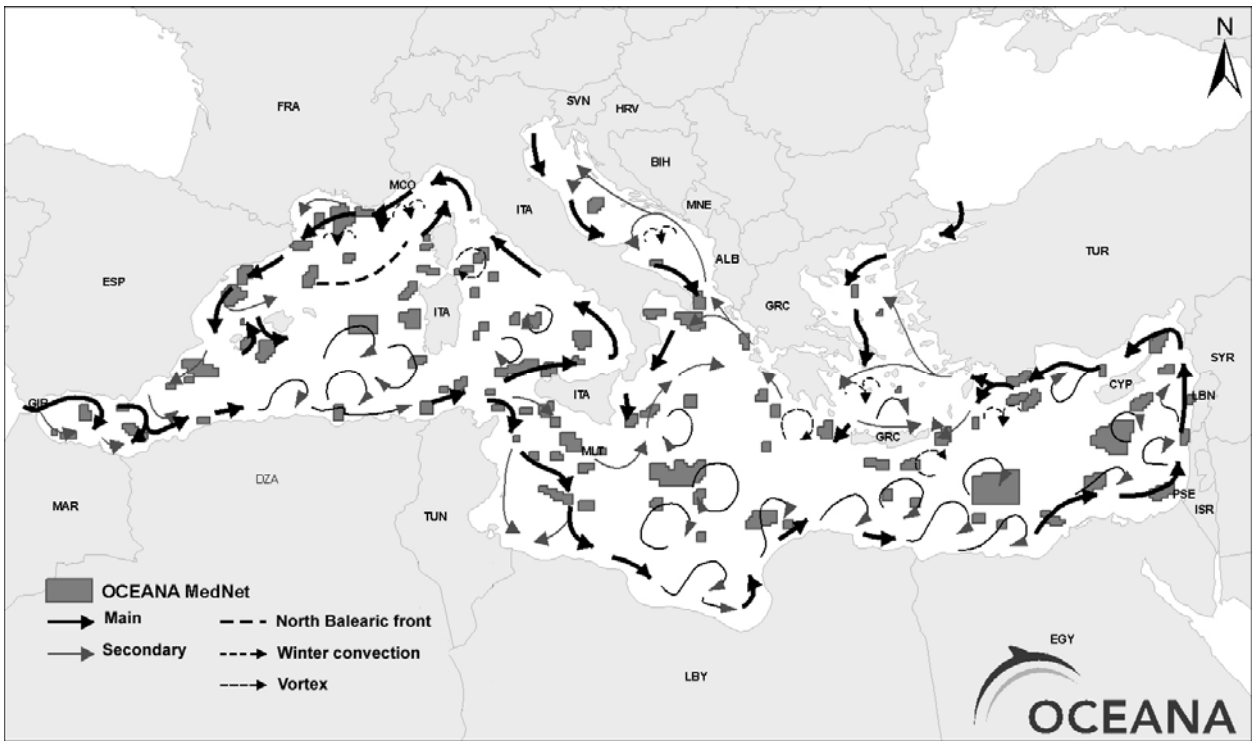

Figure 6. Main and secondary currents and MedNet

This is one of the main features of the Oceana proposal, as it would be the first time a network has been designed for the entire Mediterranean basin taking into account the main oceanic circulation patterns (see Figure 6). According to these authors (Table 4) the effectiveness of the network is determined by the larval dispersal patterns and therefore by their connection to local oceanic or mesoscale currents. Anyway, when selecting the MedNet sites, whether or not they are affected by currents, eddies and areas of dense water formation were considered, with the main source being Millot & Taupier-Letage's pattern of circulation in the Mediterranean (2004), in addition to other sources (Elhmaidi *et al*, 2010; Lastras *et al*, 2010; Millot & Gerin, 2010; Domzig *et al*. 2009; Gerin *et al.* 2009; Tesi *et al*. 2008; Bignami *et al.* 2008; Van Haren *et al.* 2006; Millot & Taupier-Letage, 2005; Testor & Gascard, 2005; Petrenko, 2003; Salas *et al.* 2002; L'Helguen *et al*. 2002; Ruiz et al. 2002; Robinson *et al.* 2001).
Bearing in mind previous references on MPA connectivity and using a value of 100km as the minimum distance for enabling connection between protected areas, a connectivity estimate following implementation of MedNet would be obtained. The results can be seen in Figure 7, and show that practically the entire basin would be connected by means of the Oceana proposal. Remembering the fact that the spaces included in the Natura 2000 network have not been taken into account in performing the estimation, the largest gap in protection would be found in the Lebanese waters of the Gulf of Sirte and the Tunisian waters of the Gulf of Gabes, about which hardly any information is available.

FINAL DISCUSSION

According to the Convention on Biological Diversity, the aim of a global MPA network is to *"Maintain, protect, and conserve global marine biodiversity through the protection of its components in a network that is biogeographically representative of ecologically coherent locations".* In this sense, MedNet is posited as a minimal proposal to achieve the 10% goal established by the CBD, but at the same time is regarded as a network that is open to new incorporations, with a view to achieving the 20-30% values recommended by the main conservationist organisations.
As a final conclusion, it can be stated that the basic implementation of the Oceana proposal would lead to a network of diverse, well distributed and connected MPAs, representative of the

biological and geological wealth of the Mediterranean Seas, and thus the foundations would be laid for achieving the maintenance, conservation, and recovery of a unique marine space.

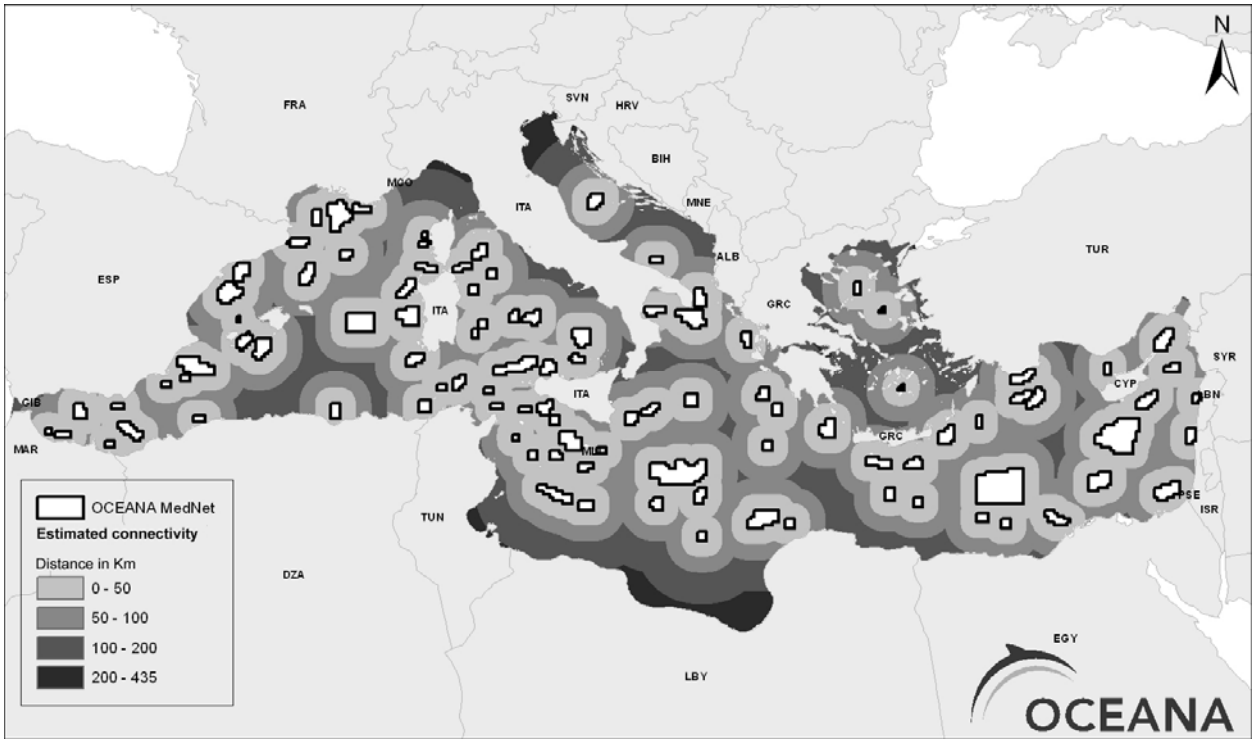

Figure 7. Estimated connectivity

For more information, the full Oceana MedNet report is available at http://eu.oceana.org/es/eu/que-hacemos/proteccion-de-habitats/mediterraneo/mednet/vision-general

BIBLIOGRAPHY

Allison, G.W., Lubchenco, J., Carr, M.H. 1998. Marine reserves are necessary but not sufficient for marine conservation. Ecol. Appl., 8, 79-92.

Bignami, F., Bohm, E., D'Acunzo, E., D'Archino, R., Salusti, E. 2008. On the dynamics of surface cold filaments in the Mediterranean Sea, Journal of Marine Systems, Volume 74, Issues 1-2, November 2008, Pages 429-442, ISSN 0924-7963.

Christie, M.R., Tissot, B.N., Albins, M.A., Beets, J.P., Jia, Y. *et al*. 2010. Larval Connectivity in an Effective Network of Marine Protected Areas. PLoS ONE 5(12): e15715. doi:10.1371/journal.pone.0015715.

Coll M, Piroddi C, Steenbeek, J., Kaschner, K., Ben Rais Lasram, F., *et al*. 2010. The Biodiversity of the Mediterranean Sea: Estimates, Patterns, and Threats. PLoS ONE 5(8): e11842. doi:10.1371/journal.pone.0011842.

De Juan, S., Lleonart, J. 2010. A conceptual framework for the protection of vulnerable habitats impacted by fishing activities in the Mediterranean high seas, Ocean & Coastal Management, Volume 53, Issue 11, November 2010, Pages 717-723,ISSN 0964-5691, doi: 10.1016/j.ocecoaman.2010.10.005.

Domzig, A., Gaullier, V., Giresse, P., Pauc, H., Deverchere, J., Yelles, K. 2009. Deposition processes from echo-character mapping along the western Algerian margin (Oran-Tenes), Western Mediterranean, Marine and Petroleum Geology, Volume 26, Issue 5, Thematic Set on New Insights on Slope Instabilities from Recent Studies within the French Margin Program GDR <<Marges>>, Pages 673-694, ISSN 0264-8172.

Elhmaidi, D., Nefzi, H., Carton, X., Lili, T. 2010. Particle Dispersion in the Western Mediterranean Basin. The Open Oceanography Journal 4, pp. 137-143.

Gerin, R., Poulain, P.M., Taupier-Letage, I., Millot, C., Ben Ismail, S., Sammari, C. 2009. Surface circulation in the Eastern Mediterranean using drifters (2005-2007). Ocean Sci., 5, 559-574. www.ocean-sci.net/5/559/2009/

Halpern, B.S., 2003. The impact of marine reserves: do reserves work and does reserve size matter?. Ecological Applications, 13(1) Supplement, 2003, pp. S117–S137.

Hastings, A., Botsford, L. W. 2003. Comparing designs of marine reserves for fisheries and for biodiversity. Ecological Applications, 13(1) Supplement, 2003, pp. S65-S70.Hermione. Hotspot Ecosystem Research and Man's Impact On European Seas. URL (consulta Enero 2011): http://www.unepmap.org/

Lastras, G., Canals, M., Amblas, D., Lavoie, C., Church, I., De Mol, B., Duran, R., Calafat, A. M., Hughes-Clarke, J. E., Smith, C. J., Heussner S. and 'Euroleon' cruise shipboard party. 2010. Understanding sediment dynamics of two large submarine valleys from seafloor data: Blanes and La Fonera canyons, northwestern Mediterranean Sea, Marine Geology, In Press, Corrected Proof, Available online 13 December 2010, ISSN 0025-3227, doi: 10.1016/j.margeo.2010.11.005.

L'Helguen, S., Le Corre, P., Madec, C., Morin, P. 2002. New and regenerated production in the Almeria-Oran front area, eastern Alboran Sea, Deep Sea Research Part I: Oceanographic Research Papers, Volume 49, Issue 1, January 2002, Pages 83-99, ISSN 0967-0637.

Millot, C., Taupier-Letage, I. 2005. Circulation in the Mediterranean Sea. In: Saliot A (ed) The Mediterranean Sea, vol 5, Part K. Springer-Verlag, Berlin Heidelberg, pp. 29-66 doi: 10.1007/b107143.

Millot, C., Gerin, R. 2010. The Mid-Mediterranean Jet Artefact, Geophys. Res. Lett., 37, L12602, Millot, C., Taupier-Letage, I., Benzohra, M. 1990. The Algerian eddies, Earth-Science Reviews, Volume 27, Issue 3, May 1990, Pages 203-219, ISSN 0012-8252, doi: 10.1016/0012-8252(90)90003-E.

Morato, T., Pauly, D. (eds.). 2004. Seamounts: Biodiversity and Fisheries. Fisheries Centre, University of British Columbia. 78 pp.

Morato, T., Pitcher, T. J., Clark, M. R., Menezes, G., Tempera, F., Porteiro, F., Giacomello, E., Santos, R. S.. 2010. Can We Protect Seamounts for Research? A call for conservation. Oceanography 23 (1), 190-199.

Petrenko, A.A. 2003. Variability of circulation features in the Gulf of Lion NW Mediterranean Sea. Importance of inertial currents. Oceanologica Acta, Volume 26, Issue 4, September 2003, Pages 323-338.

Planes, S., Thorrold, S. R., Jones, G. P. 2009. Larval dispersal connects fish populations in a network of marine protected areas. Proc Natl Acad Sci April 7, 2009 vol. 106 no. 14 5693-5697.

Rachor, E., Günther, C.P. 2001. Concepts for offshore nature reserves in the southeastern North Sea. Marine Biodiversity Volume 31, Number 2, 353-361, doi: 10.1007/BF03043044.

Robinson, A. R., Leslie, W.G., Theocharis, A., Lascaratos, A. 2001. Mediterranean Sea Circulation. Roussenov, V., Stanev, E., Artale, V., Pinardi, N. 1995. A seasonal modelof the Mediterranean Sea general circulation. Journal of Geophysical Research, Vol. 100. No. C7 pp. 13,515-13,538, July 15 1995.

Ruiz, S., Font, J., Emelianov, M., Isern-Fontanet, J., Millot, C., Salas, J., Taupier-Letage, I. 2002. Deep structure of an open sea eddy in the Algerian Basin. Journal of Marine Systems 33-34. pp. 179-195.

Sala, E. 2004. The past and present topology and structure of Mediterranean subtidal rocky-shore food webs. Ecosystems 7, 333-340.

Salas, J., Millot, C., Font, J., Garcia-Ladona, E., 2002. Analysis of mesoscale phenomena in the Algerian basin observed with drifting buoys and infrared images, Deep Sea Research Part I: Oceanographic Research Papers, Volume 49, Issue 2, February 2002, Pages 245-266, ISSN 0967-0637.

Secretariat of the Convention on Biological Diversity. 2008. Synthesis and Review of the Best Available Scientific Studies on Priority Areas for Biodiversity Conservation in Marine Areas beyond the Limits of National Jurisdiction. Montreal, Technical Series No. 37, 63 pages.

Tesi, T., Langone, L., Goni, M. A., Turchetto, M., Miserocchi, S., Boldrin, A. 2008. Source and composition of organic matter in the Bari canyon (Italy): Dense water cascading versus particulate export from the upper ocean, Deep Sea Research Part I: Oceanographic Research Papers, Volume 55, Issue 7, July 2008, Pages 813-831, ISSN 0967-0637.

Testor, P., Gascard, J. C. 2005. Large scale flow separation and mesoscale eddy formation in the Algerian Basin, Progress In Oceanography, Volume 66, Issues 2-4, Mediterranean physical oceanography and biogeochemical cycles: Mediterranean general circulation and climate variability, August-September 2005, Pages 211-230, ISSN 0079-6611, doi: 10.1016/j.pocean.2004.07.018.

Toropova, C., Meliane, I., Laffoley, D., Matthews, E. and Spalding, M. (eds.). 2010. Global Ocean Protection: Present Status and Future Possibilities. Brest, France: Agence des aires marines protégées, Gland, Switzerland, Washington, DC and New York, USA: IUCN WCPA, Cambridge, UK: UNEP-WCMC, Arlington, USA: TNC, Tokyo, Japan: UNU, New York, USA: WCS. 96 pp.

Treml, E. A., Halpin, P. N., Urban, D. L., Pratson, L. F. 2008. Modeling population connectivity by ocean currents, a graph-theoretic approach for marine conservation. Landscape Ecol (2008) 23:19-36. doi 10.1007/s10980-007-9138-y.

UNEP. 2006. Marine and coastal ecosystems and human wellbeing: A synthesis report based on the findings of the Millennium Ecosystem Assessment. UNEP. 76 pp.

Van Haren, H., C. Millot, and I. Taupier-Letage (2006), Fast deep sinking in Mediterranean eddies, Geophys. Res. Lett., 33, L04606, doi:10.1029/2005GL025367.

Wood, L. J. Fish, L. Laughren, J., Pauly, D. 2008. Assessing progress towards global marine protection targets: shortfalls in information and action. Oryx Vol. 42, pp. 340-351.