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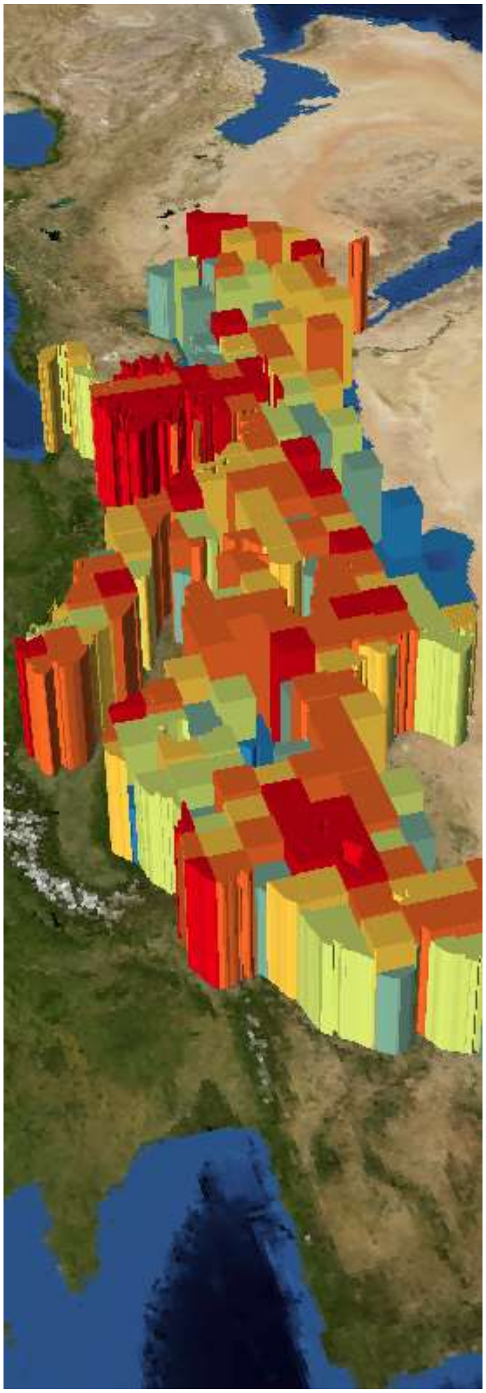
MEDITERRANEAN REGIONAL WORKSHOP TO FACILITATE THE DESCRIPTION OF ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT MARINE AREAS
Málaga, Spain, 7-11 April 2014

DATA TO INFORM THE MEDITERRANEAN REGIONAL WORKSHOP TO FACILITATE THE DESCRIPTION OF ECOLOGICALLY OR BIOLOGICALLY SIGNIFICANT MARINE AREAS

Note by the Executive Secretary

1. The Executive Secretary is circulating herewith a background document containing data to inform the Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas. This document was prepared by the Marine Geospatial Ecology Lab, Duke University, as commissioned by the Secretariat, in support of the Secretariat of the Convention on Biological Diversity in its scientific and technical preparation for the above-mentioned workshop.

2. The document is being circulated in the form and language in which it was received by the Secretariat.



Data to inform the CBD Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas (EBSAs)

Patrick Halpin, Jesse Cleary, Corrie Curtice, Ben Donnelly, Daniel Dunn, and Jason Roberts
7 April – 11 April 2014

Prepared for the Secretariat of the Convention on Biological Diversity (SCBD)

Marine Geospatial Ecology Lab

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1. Background

Pursuant to CBD COP decisions X/29 and XI/17, and decision IG.21/5 of the Contracting Parties to the Barcelona Convention, the Mediterranean regional workshop to facilitate the description of ecologically or biologically significant marine areas (EBSAs), is being convened by the Secretariat of the Convention on Biological Diversity in collaboration with the Secretariat of the Barcelona Convention/Mediterranean Action Plan, with logistical and technical support provided by the IUCN Centre for Mediterranean Cooperation (IUCN-Med) and the Regional Activity Center for Specially Protected Areas. The workshop will take place 7 to 11 April 2014, in Málaga, Spain.

The Marine Geospatial Ecology Lab at Duke University, as commissioned by the CBD Secretariat with kind financial support of the European Commission, in conjunction with international partners, has identified and mapped a large number of data sets and analyses for consideration by the Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas (EBSAs). Both biological and physical data sets are included in this report. The data are intended to facilitate the description areas meeting EBSA criteria (annex I of decision IX/20) as well as other relevant compatible and complementary nationally and inter-governmentally agreed scientific criteria. Each data set may be used to meet one or more of the EBSA criteria.

Printed maps will be available for annotation at the workshop. Digital versions of these maps are also available online: http://mgel.env.duke.edu/med-ebsa

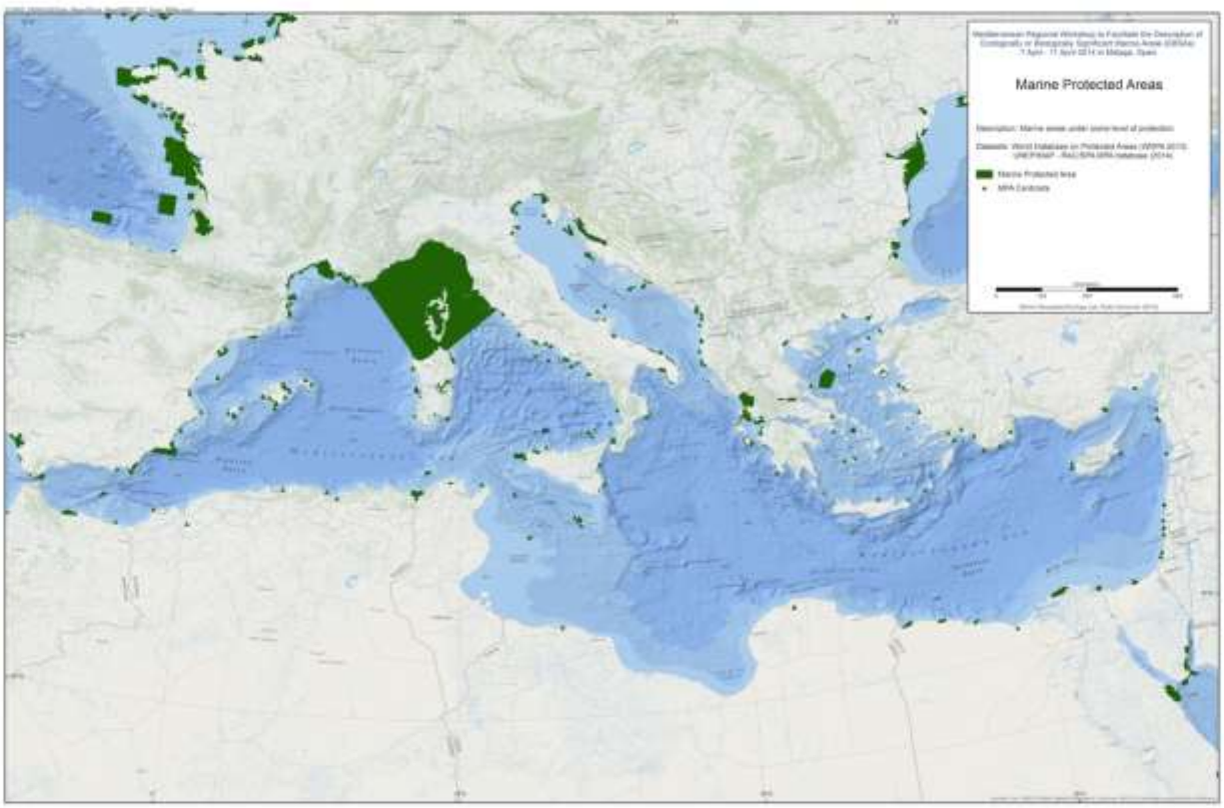


Figure 0.1-1 Existing Marine Protected Areas

2. Biogeographic Classifications

2.1 Marine Ecoregions of the World (MEOW)

MEOW is a biogeographic classification of the world's coasts and shelves. It is the first-ever comprehensive marine classification system with clearly defined boundaries and definitions and was developed to closely link to existing regional systems. The ecoregions nest within the broader biogeographic tiers of Realms and Provinces.

MEOW represents broad-scale patterns of species and communities in the ocean, and was designed as a tool for planning conservation across a range of scales and assessing conservation efforts and gaps worldwide. The current system focuses on coast and shelf areas (as this is where the majority of human activity and conservation action is focused) and does not consider realms in pelagic or deep benthic environment. It is hoped that parallel but distinct systems for pelagic and deep benthic biotas will be devised in the near future.

The project was led by The Nature Conservancy (TNC) and the World Wildlife Fund (WWF), with broad input from a working group representing key NGO, academic and intergovernmental conservation partners.
(source: http://www.worldwildlife.org/science/ecoregions/marine/item1266.html)

Reference:
Spalding, M. D. Fox, H. E. Allen, G. R. Davidson, N. Ferdana, Z. A. Finlayson, M. Halpern, B. S. Jorge, M. A. Lombana, A. Lourie, S. A., (2007). Marine Ecoregions of the World: A Bioregionalization of Coastal and Shelf Areas. Bioscience 2007, VOL 57; numb 7, pages 573-584.

Data available from: http://www.marineregions.org/sources.php#meow

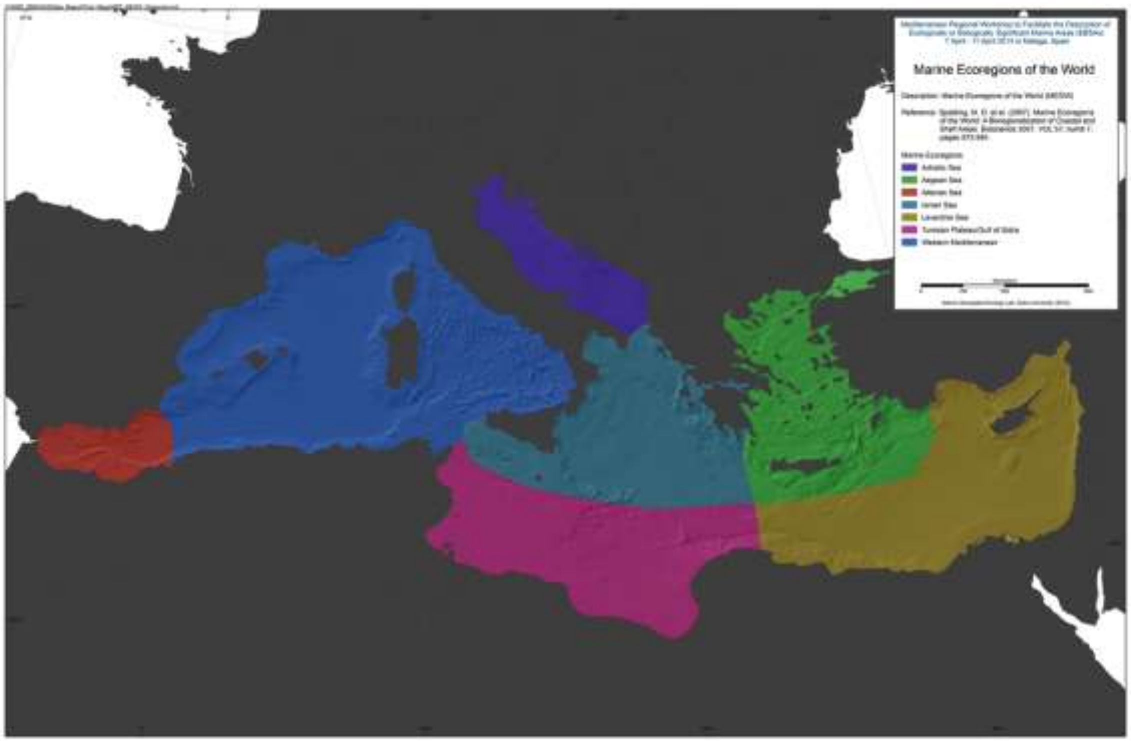


Figure 0-1 MEOW Provinces

3. Biological Data

3.1 Marine Mammals and Sea Turtles of the Mediterranean

Abstract:
"This booklet presents information on the conservation status of the marine mammals and sea turtles that inhabit the Mediterranean … It presents brief details on resident species (those recorded all year round and breeding in the region), visitor species (scarcer but occurring regularly every year) and vagrant species (rare and unexpected ones that do not occur annually).

The information presented in this document is compiled from the Mediterranean Red List assessment of resident cetacean species first produced by a group of cetacean experts in Monaco in March 2006 and later updated in 2010. This work was carried out in collaboration with ACCOBAMS—the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area—and the IUCN Cetacean Specialist Group."

Reference:
IUCN (2012). Marine Mammals and Sea Turtles of the Mediterranean and Black Seas. Gland, Switzerland and Malaga, Spain: IUCN. 32 pages.

Figure 0-1 Distribution of Sperm Whale

Figure 0-2 Distribution of Cuvier's Beaked Whale

Figure 0-3 Distribution of Fin Whale

Figure 0-4 Distribution of Long-finned Pilot Whale

Figure 0-5 Distribution of Risso's Dolphin

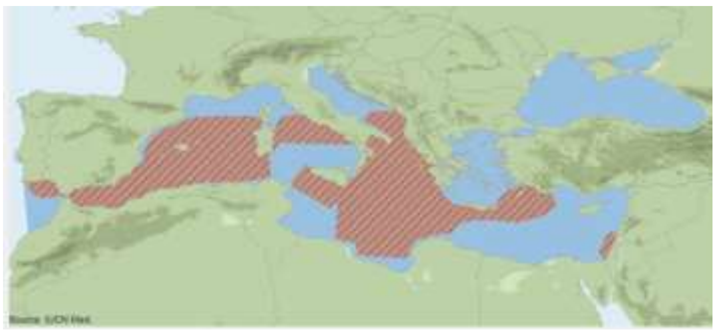


Figure 0-6 Distribution of Short-beaked Common Dolphin

Figure 0-7 Distribution of Striped Dolphin

Figure 0-8 Distribution of Common Bottlenose Dolphin

Figure 0-9 Distribution of Mediterranean Monk Seal

3.2 Catch of Commercial Pelagic Species

Figures of pelagic commercial species catch were drawn from the FAO Tuna Atlas data service. This service summarizes catch data in 5-degree squares, aggregating data submitted to FAO by Regional Fisheries Management Organizations. Gaps may exist, depending on RFMO submission. Maps show total catch from 1996-2013 for Albacore, Atlantic Bluefin Tuna, and Swordfish. The maps show total catch for all gear types. The data can also be subset by gear type: longline, pole and line, purse seine, and other. Similar data are also available for other species: Atlantic White Marlin, Yellowfin tuna, Skipjack tuna, Bigeye Tuna and Blue Marlin, also split by gear type.

Reference: http://www.fao.org/figis/geoserver/tunaatlas/

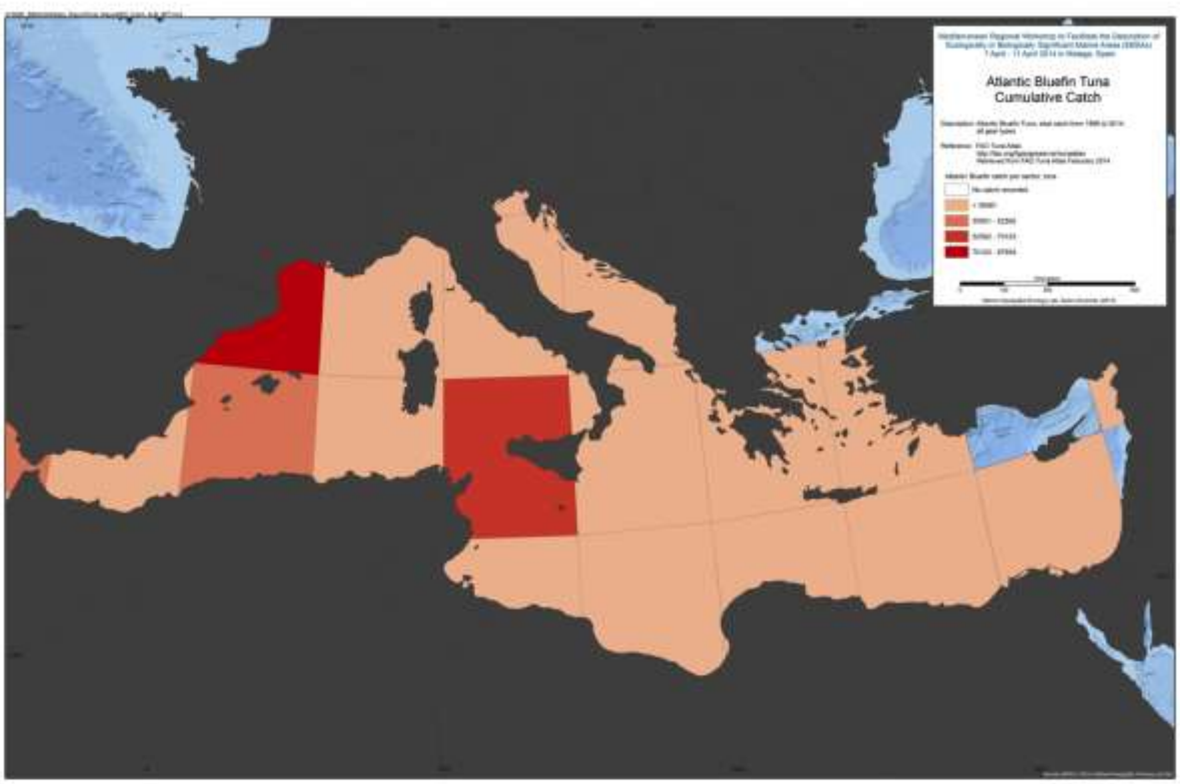


Figure 0-1 Bluefin Tuna Catch Statistics (5 deg)

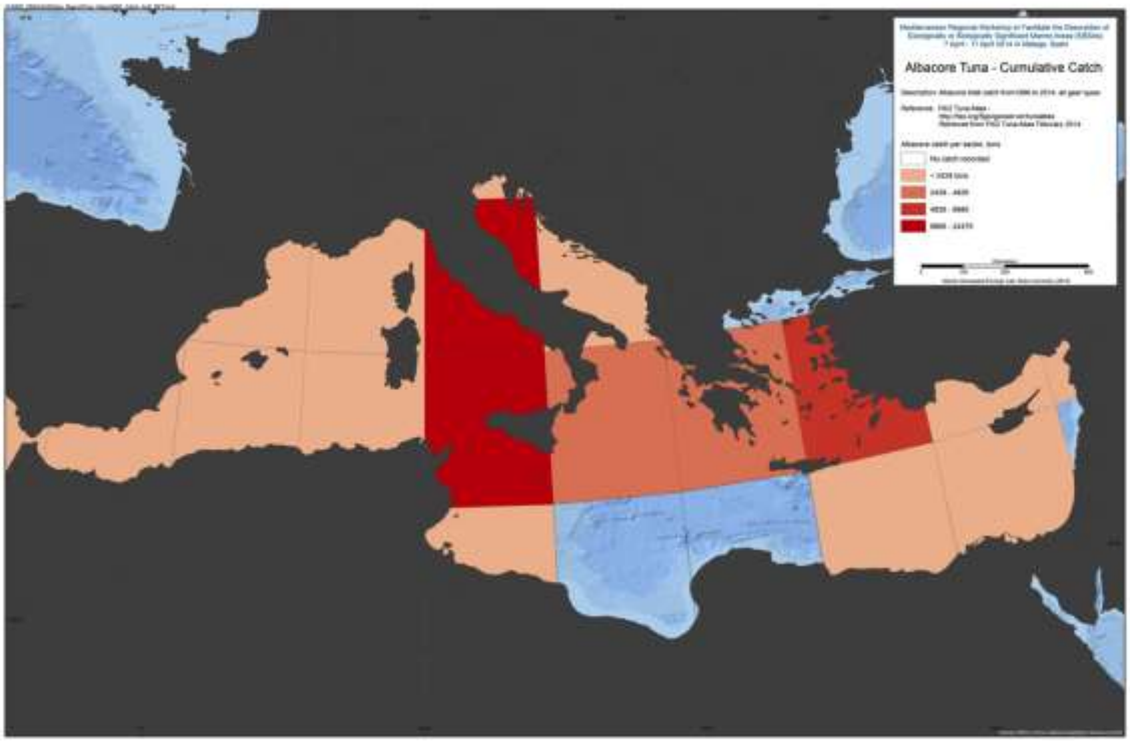


Figure 0-2 Albacore Tuna Catch Statistics (5 deg)

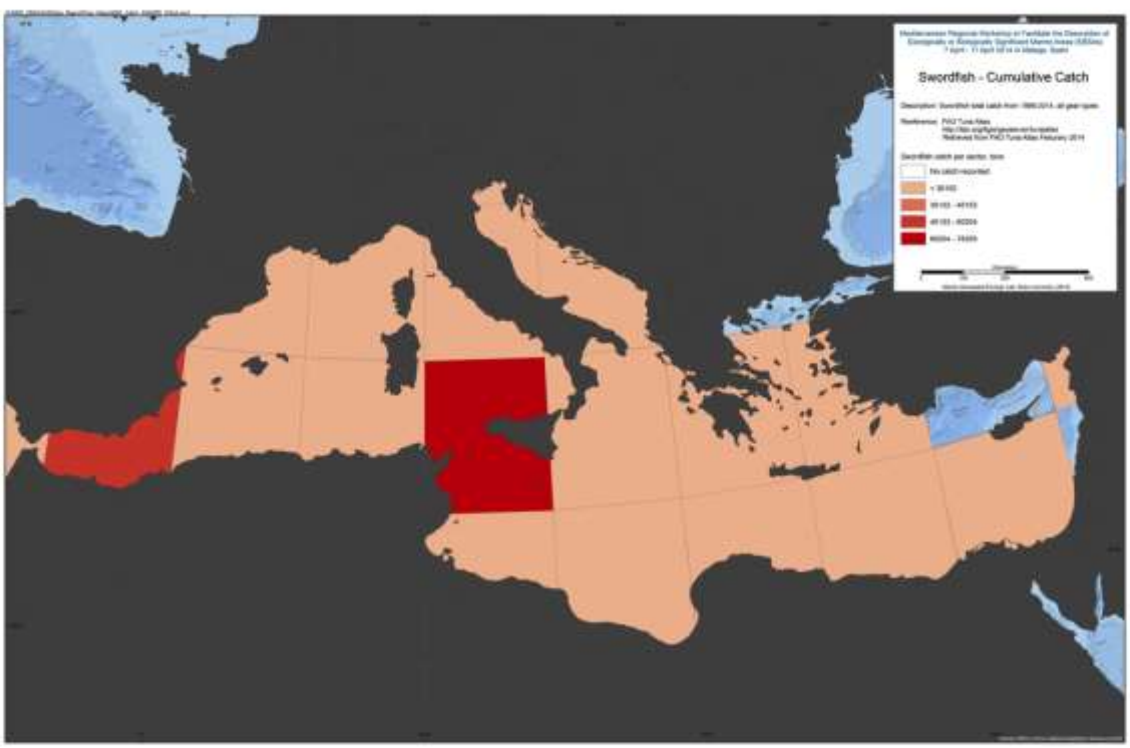


Figure 0-3 Swordfish Catch Statistics (5 deg)

3.3 Sea Turtle Telemetry and Nesting Beaches

OBIS-SEAMAP, Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations, is a spatially referenced online database, aggregating marine mammal, seabird and sea turtle observation data from across the globe.
(source: http://seamap.env.duke.edu/)

Data from several turtle tracking efforts were extracted from OBIS-SEAMAP data center for the study area and displayed on a per species basis. Data available from: http://seamap.env.duke.edu/

Reference:

Halpin, PN, AJ Read, E Fujioka, BD Best, B Donnelly, LJ Hazen, C Kot, et al. 2009. "OBIS-SEAMAP The World Data Center for Marine Mammal, Sea Bird, and Sea Turtle Distributions." *OCEANOGRAPHY* 22 (2): 104–15.

SWOT — the State of the World's Sea Turtles — is a partnership led by the Sea Turtle Flagship Program at Conservation International (CI), the IUCN Marine Turtle Specialist Group (MTSG), and supported by the Marine Geospatial Ecology Lab (MGEL) at Duke University.

However, the lifeblood of the effort is the network of more than 550 people and projects that contribute data to the SWOT database, the only comprehensive, global database of sea turtle nesting sites. The SWOT team has completed six years of data collection including the global nesting locations of all seven marine turtle species: green, leatherbacks, loggerheads, hawksbills, flatbacks, olive and Kemp's ridleys. SWOT now collects data for all species in its annual data collection.

In addition to collating nesting abundance and distribution information for all species, SWOT now hosts data compiled by the MTSG Burning Issues Working Group that includes Regional Management Units for all seven marine turtle species, including all available georeferenced mtDNA and nDNA stocks. These files can be viewed on the SWOT website and downloaded for analyses once the Terms of Use are agreed to. Furthermore, SWOT also supports recommendations for monitoring effort schemes that will allow for comparison of long-term nesting abundance and trend estimates for regional and global populations of sea turtle species. These advances will solidify SWOT as the premier global monitoring system for sea turtles. Information on Minimum Data Standards are available at http://seaturtlestatus.org/data/standards.

The current SWOT database contains sea turtle nesting records from over 120 countries all over the world. This online tool, hosted by OBIS-SEAMAP, builds on previous work initiated and supported by WIDECAST organization as well as data from several other regional sea turtle organizations. Records coming from projects that are both a part of a regional organization are flagged as such. The WIDECAST Atlas can still be accessed as a stand-alone application. New data from the WIDECAST network is added to the SWOT database annually.
(source: http://mgel.env.duke.edu/projects/swot/)

References:

DiMatteo, A., E. Fujioka, B. Wallace, B. Hutchinson, J. Cleary and P. Halpin. 2009. SWOT Database Online. Data provided by the SWOT Team. World Wide Web electronic publication.

SWOT Report - State of the World's Sea Turtles, vol. I (2006); *SWOT Report - State of the World's Sea Turtles*, vol. II (2006); *SWOT Report - State of the World's Sea Turtles*, vol. III (2008); *SWOT Report - State of the World's Sea Turtles*, vol. IV (2009); *SWOT Report - State of the World's Sea Turtles*, vol. V (2010); *SWOT Report - State of the World's Sea Turtles*, vol. VI (2011); *SWOT Report - State of the World's Sea Turtles*, vol. VII (2012); http://seamap.env.duke.edu/swot.

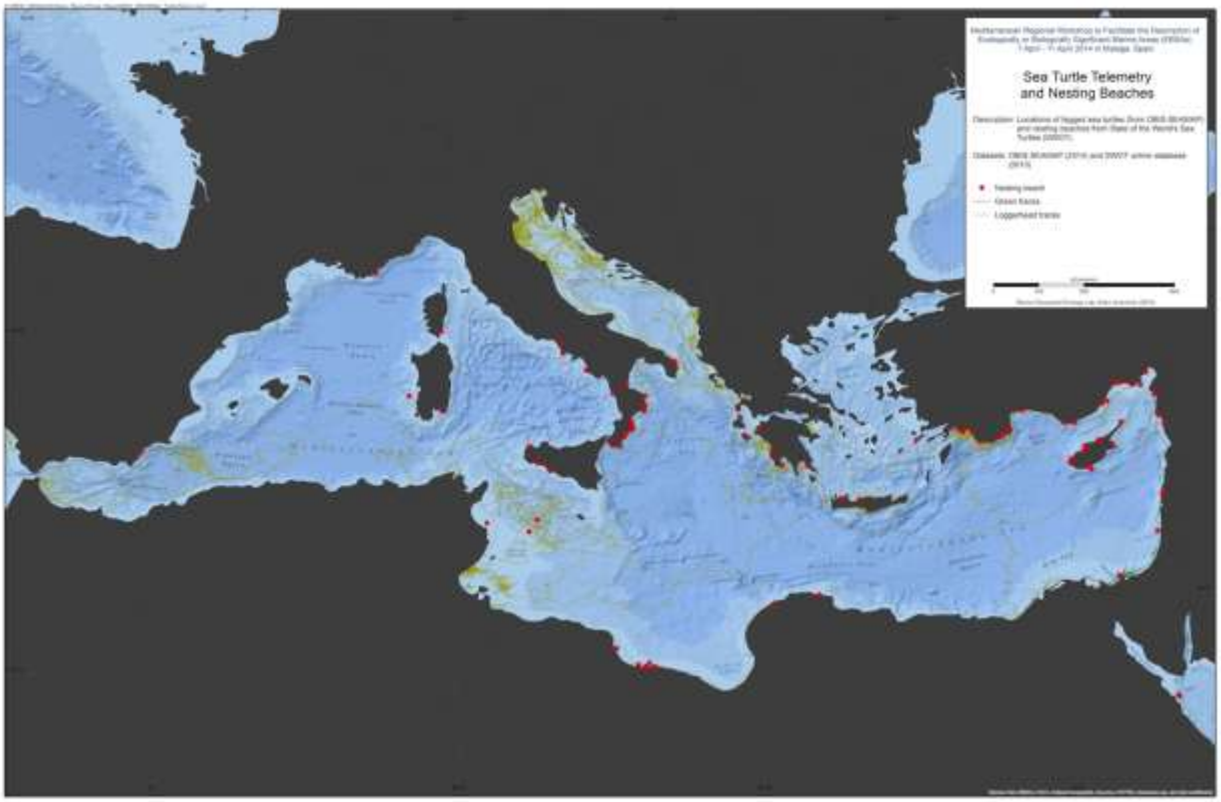


Figure 0-1 Sea Turtle Telemetry and Nesting Beaches

3.4 Ocean Biogeographic Information System (OBIS) Biodiversity Data

The Ocean Biogeographic information System (OBIS) seeks to absorb, integrate, and assess isolated datasets into a larger, more comprehensive picture of life in our oceans. The system hopes to stimulate research about our oceans to generate new hypotheses concerning evolutionary processes, species distributions, and roles of organisms in marine systems on a global scale. The abstracts that OBIS generates are maps that contribute to the 'big picture' of our oceans: a comprehensive, collaborative, worldwide view of our oceans.

OBIS provides a portal or gateway to many datasets containing information on where and when marine species have been recorded. The datasets are integrated so you can search them all seamlessly by species name, higher taxonomic level, geographic area, depth, and time; and then map and find environmental data related to the locations.
(source: http://www.iobis.org/about/index)

The data provided here are summaries of available OBIS data. Species Richness and Hurlbert's Index (ES[50]) data summaries for 1 degree grids are provided for all species, mammals, turtles, shallow species (<100m depth), deep species(>100m depth), and species on the IUCN Red List. Data gaps do exist in OBIS and thus these summaries are not exhaustive.

Reference:

OBIS (2014). Data from the Ocean Biogeographic Information System. Intergovernmental O Oceanographic Commission of UNESCO. Web. http://www.iobis.org (consulted on 2014/01/20).

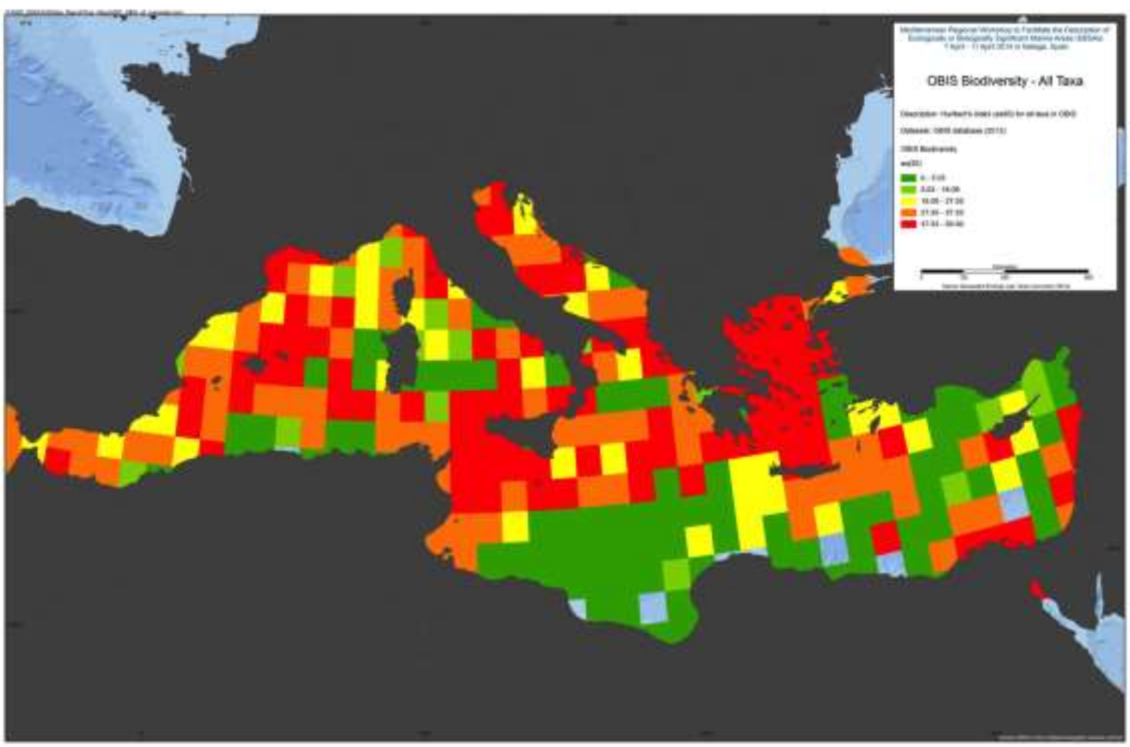


Figure 0-1 ES(50) for All Taxa

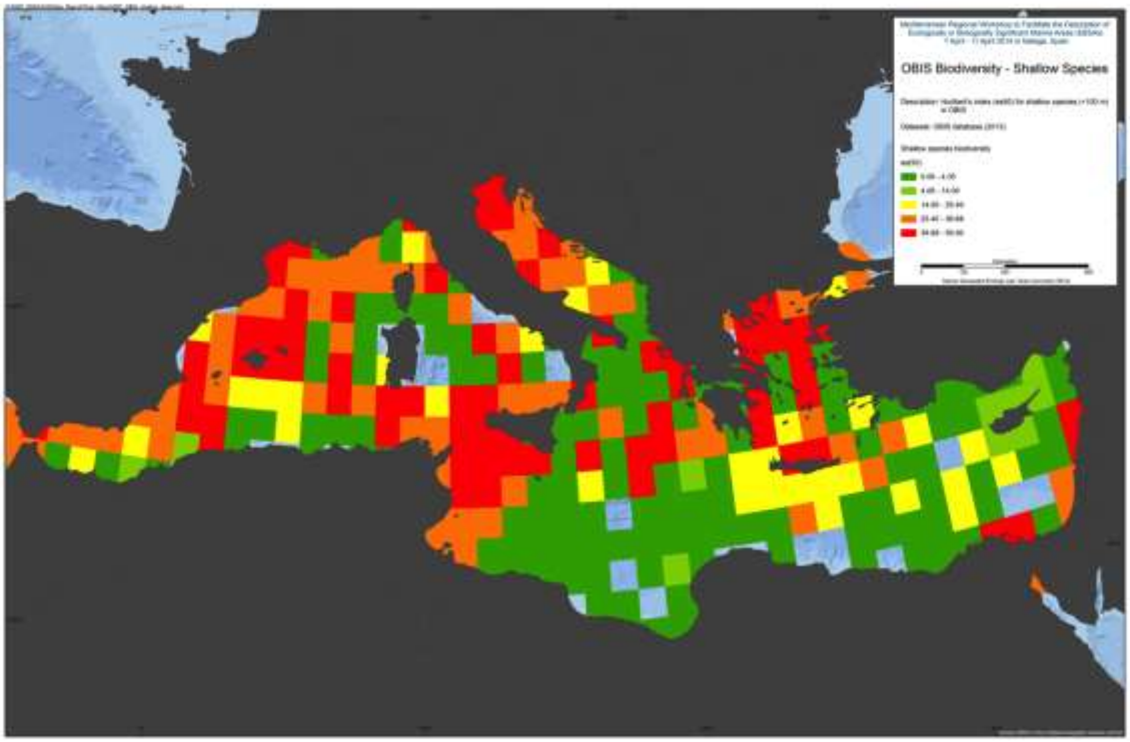


Figure 0-2 ES(50) for Shallow Species

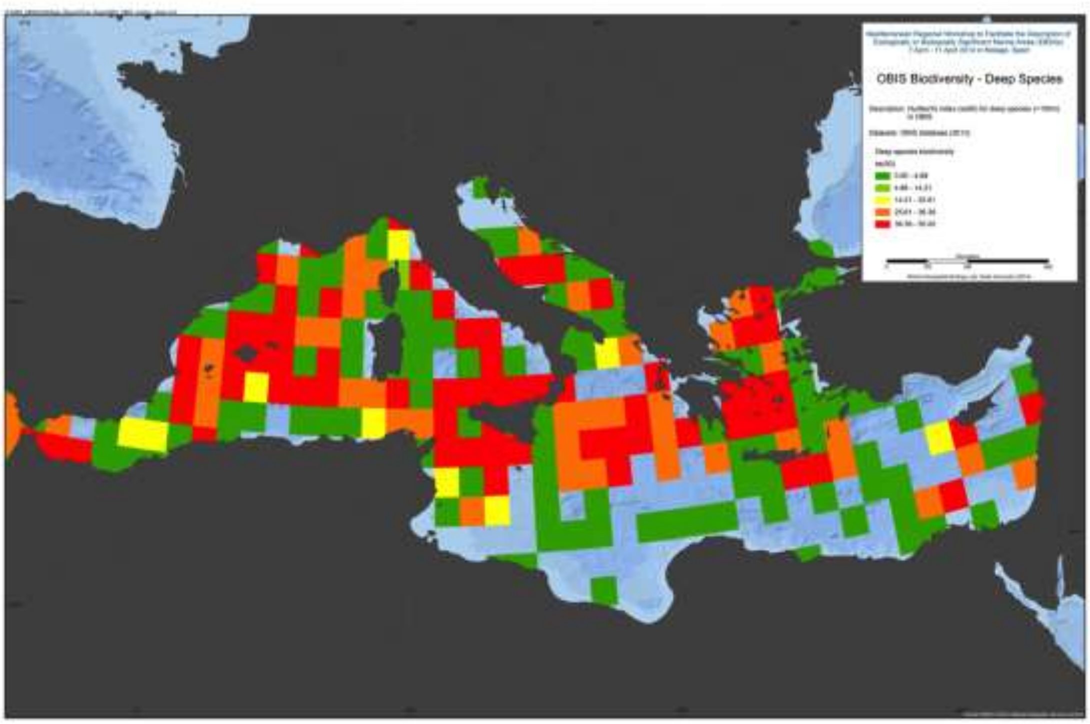


Figure 0-3 ES(50) for Deep Species

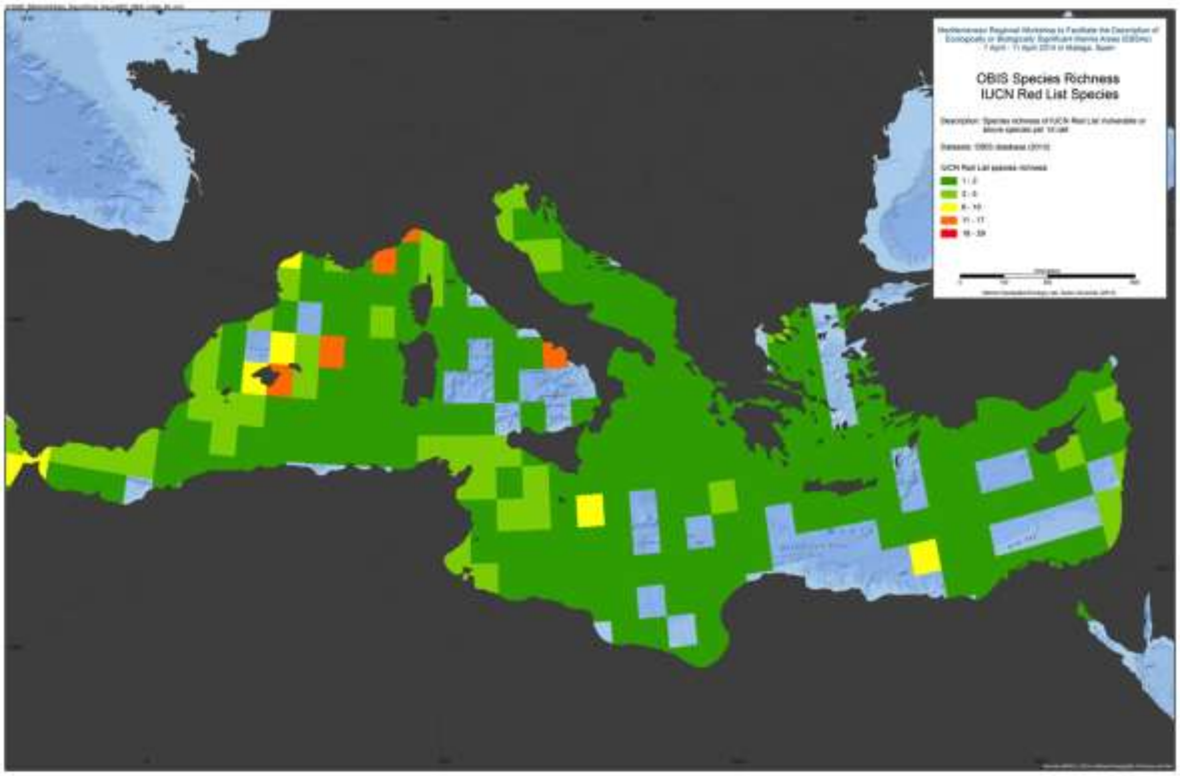


Figure 0-4 Species Richness for IUCN Red List species

3.5 Predictions of Deep Sea Corals

Abstract:
"Predictive habitat models are increasingly being used by conservationists, researchers and governmental bodies to identify vulnerable ecosystems and species' distributions in areas that have not been sampled. However, in the deep sea, several limitations have restricted the widespread utilisation of this approach. These range from issues with the accuracy of species presences, the lack of reliable absence data and the limited spatial resolution of environmental factors known or thought to control deep-sea species' distributions. To address these problems, global habitat suitability models have been generated for five species of framework-forming scleractinian corals by taking the best available data and using a novel approach to generate high resolution maps of seafloor conditions. High-resolution global bathymetry was used to resample gridded data from sources such as World Ocean Atlas to produce continuous 30-arc second (1 km^2) global grids for environmental, chemical and physical data of the world's oceans. The increased area and resolution of the environmental variables resulted in a greater number of coral presence records being incorporated into habitat models and higher accuracy of model predictions. The most important factors in determining cold-water coral habitat suitability were depth, temperature, aragonite saturation state and salinity. Model outputs indicated the majority of suitable coral habitat is likely

to occur on the continental shelves and slopes of the Atlantic, South Pacific and Indian Oceans. The North Pacific has very little suitable scleractinian coral habitat. Numerous small scale features (i.e., seamounts), which have not been sampled or identified as having a high probability of supporting cold-water coral habitat were identified in all ocean basins. Field validation of newly identified areas is needed to determine the accuracy of model results, assess the utility of modeling efforts to identify vulnerable marine ecosystems for inclusion in future marine protected areas and reduce coral bycatch by commercial fisheries."

Reference:
Davies AJ, Guinotte JM (2011) *Global Habitat Suitability for Framework-Forming Cold-Water Corals*. PLoS ONE 6(4): e18483. doi:10.1371/journal.pone.0018483

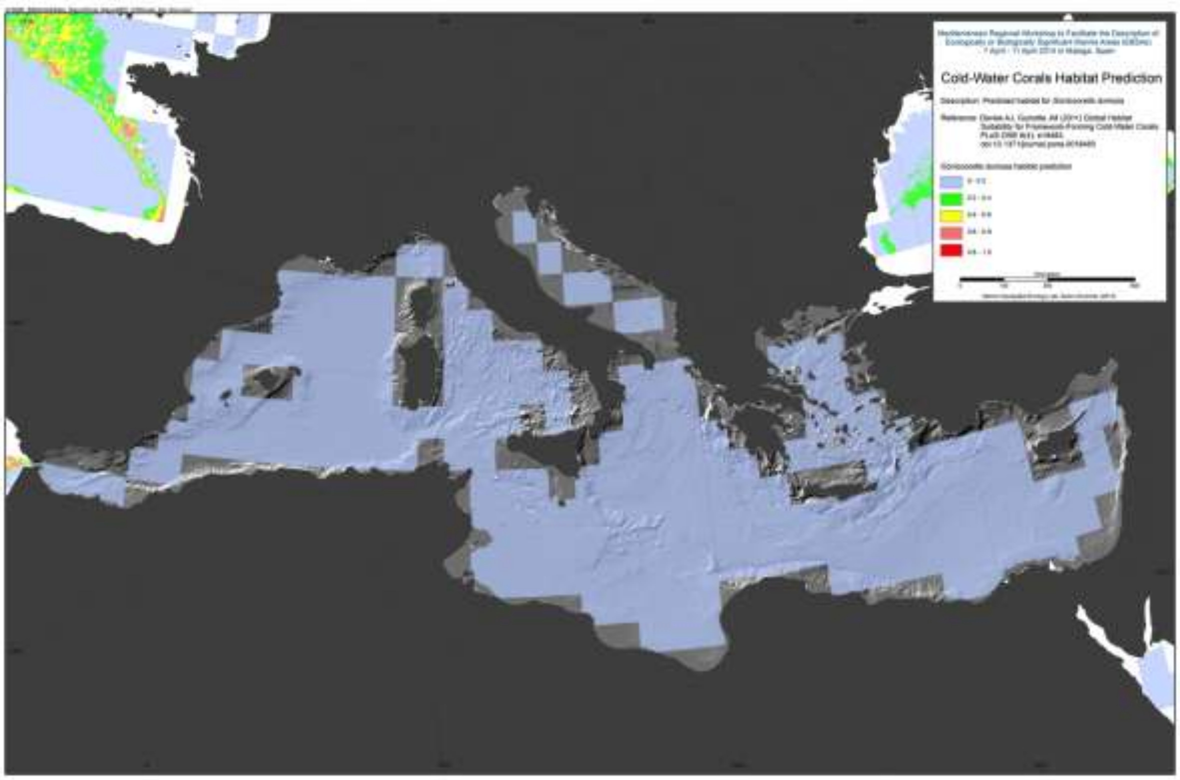


Figure 0-1 Goniocorella dumosa Habitat Prediction

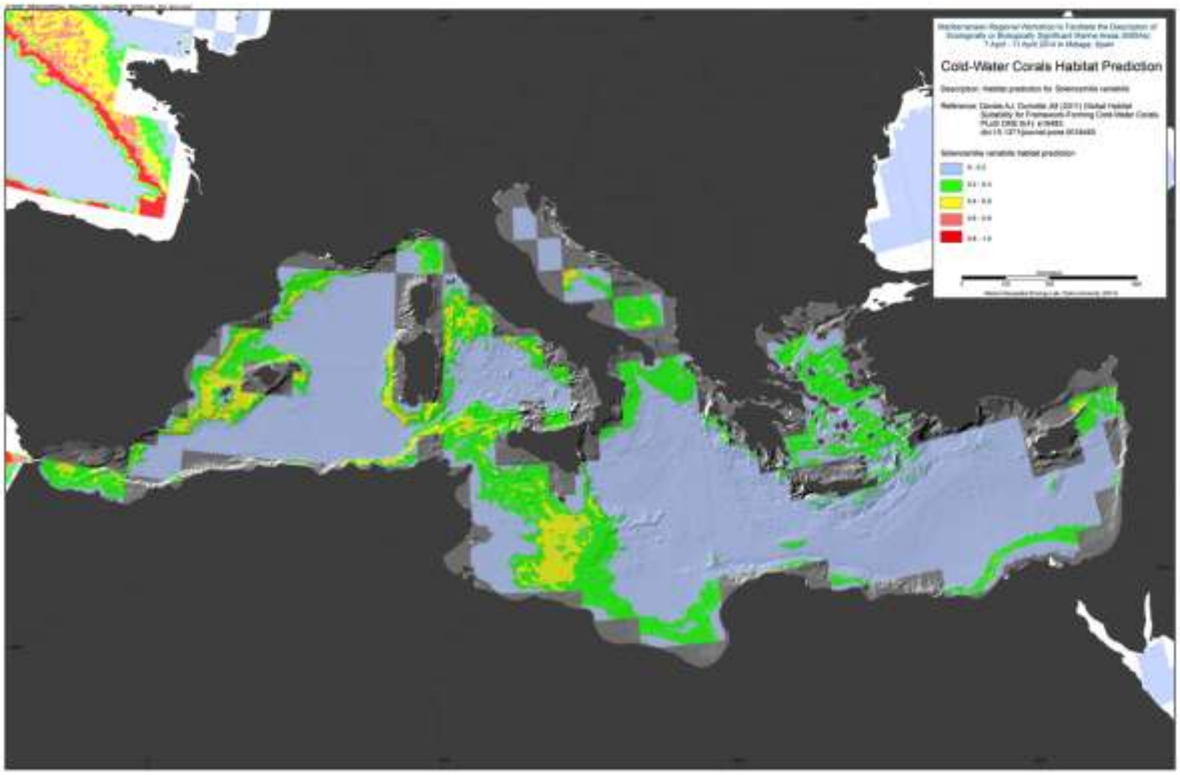


Figure 0-2 Solenosmilia variabilis Habitat Prediction

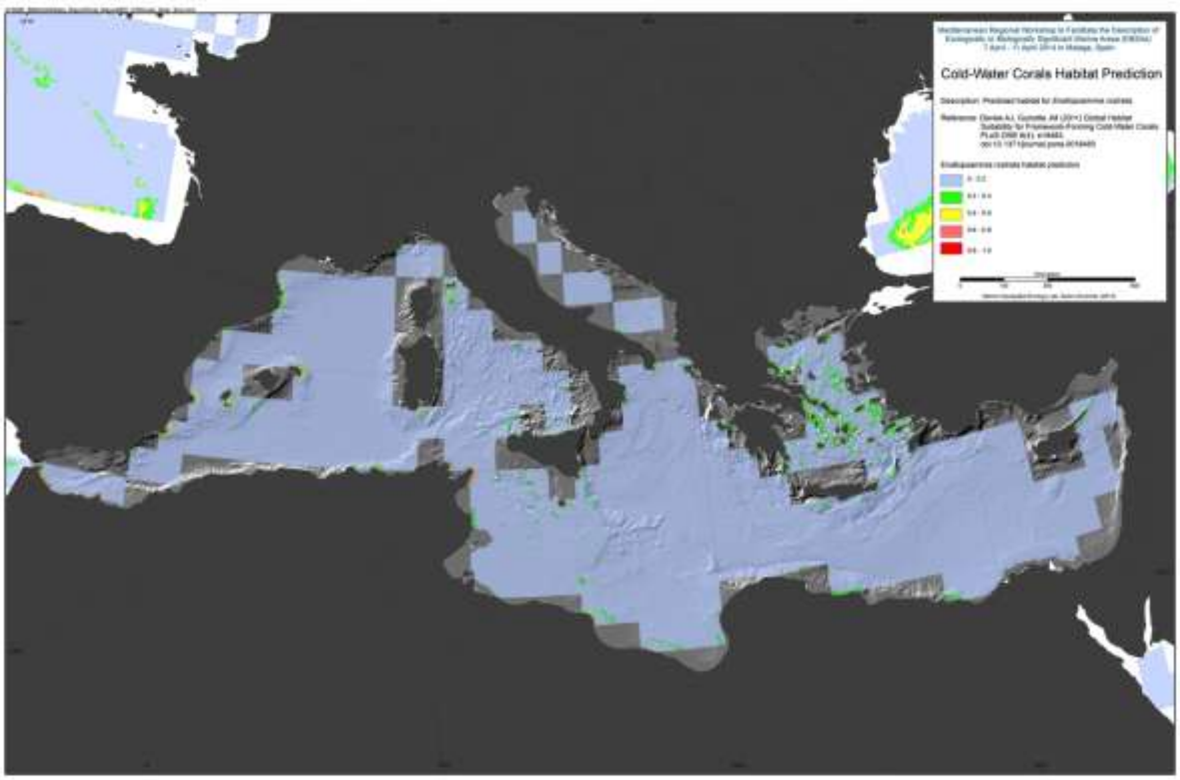


Figure 0-3 Enallopsammia rostrata Habitat Prediction

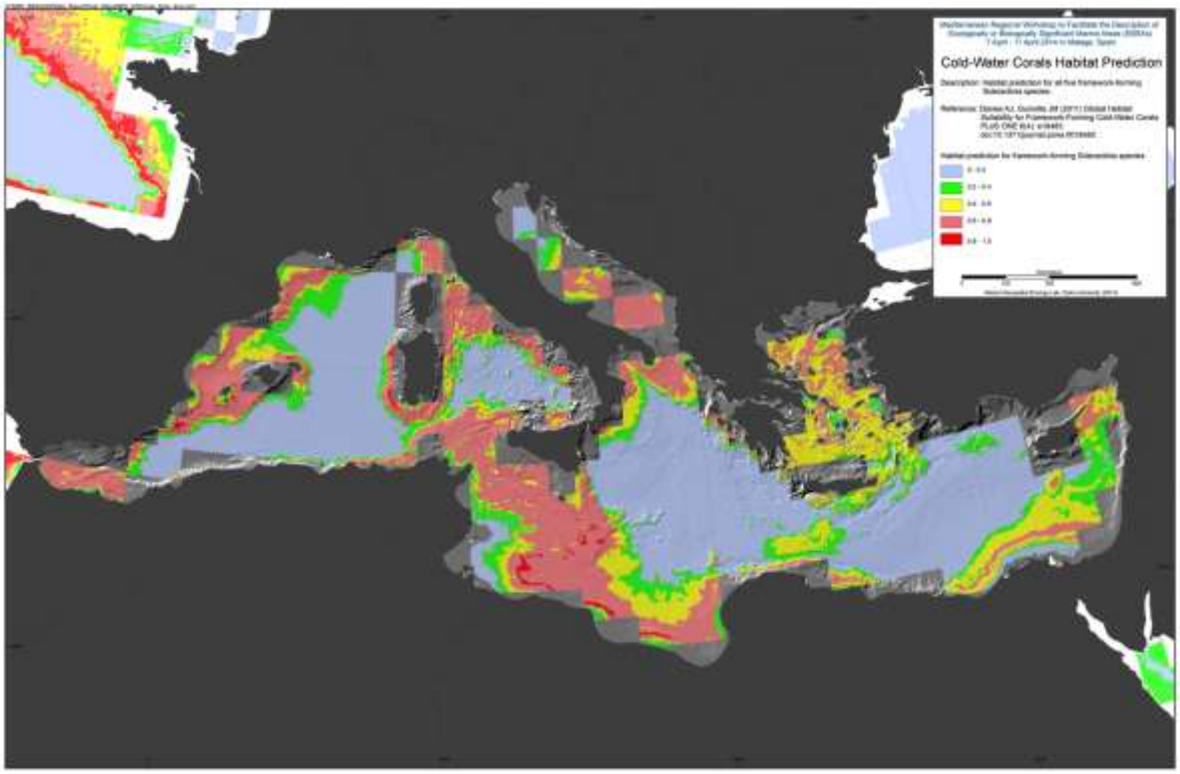


Figure 0-4 Framework-forming Scleractinia spp. Habitat Prediction

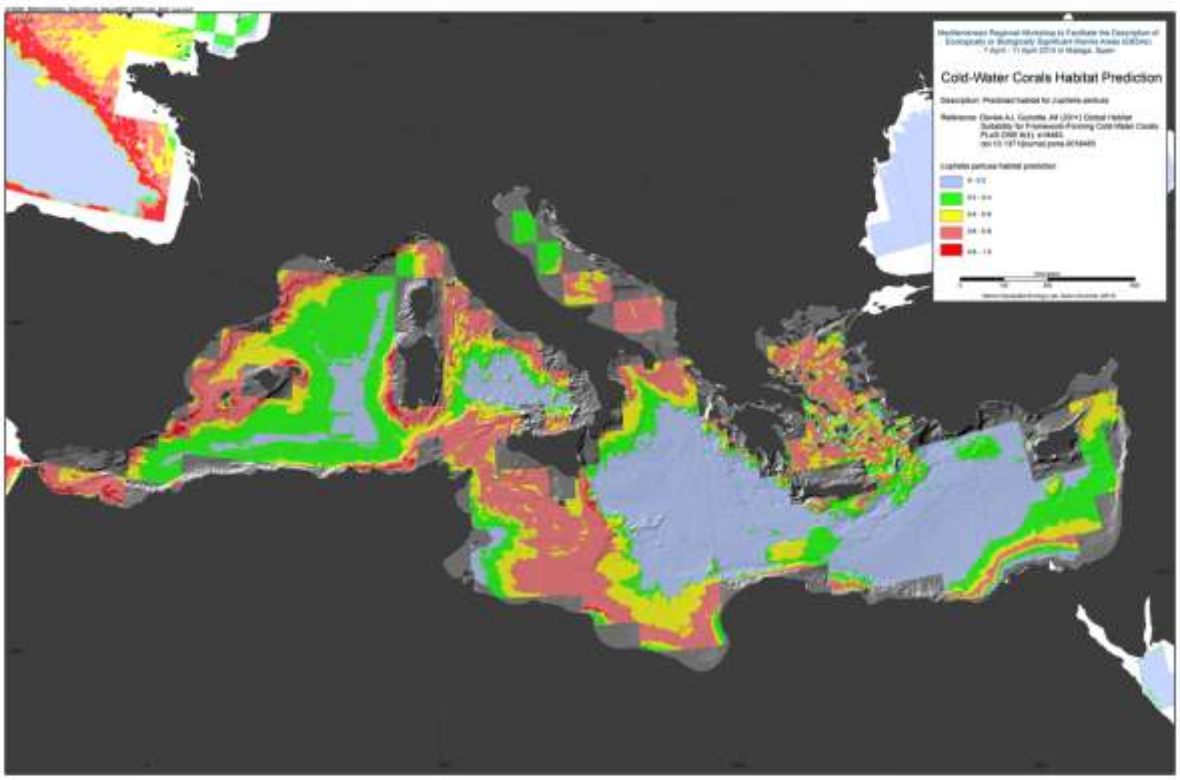


Figure 0-5 Lophelia pertusa Habitat Prediction

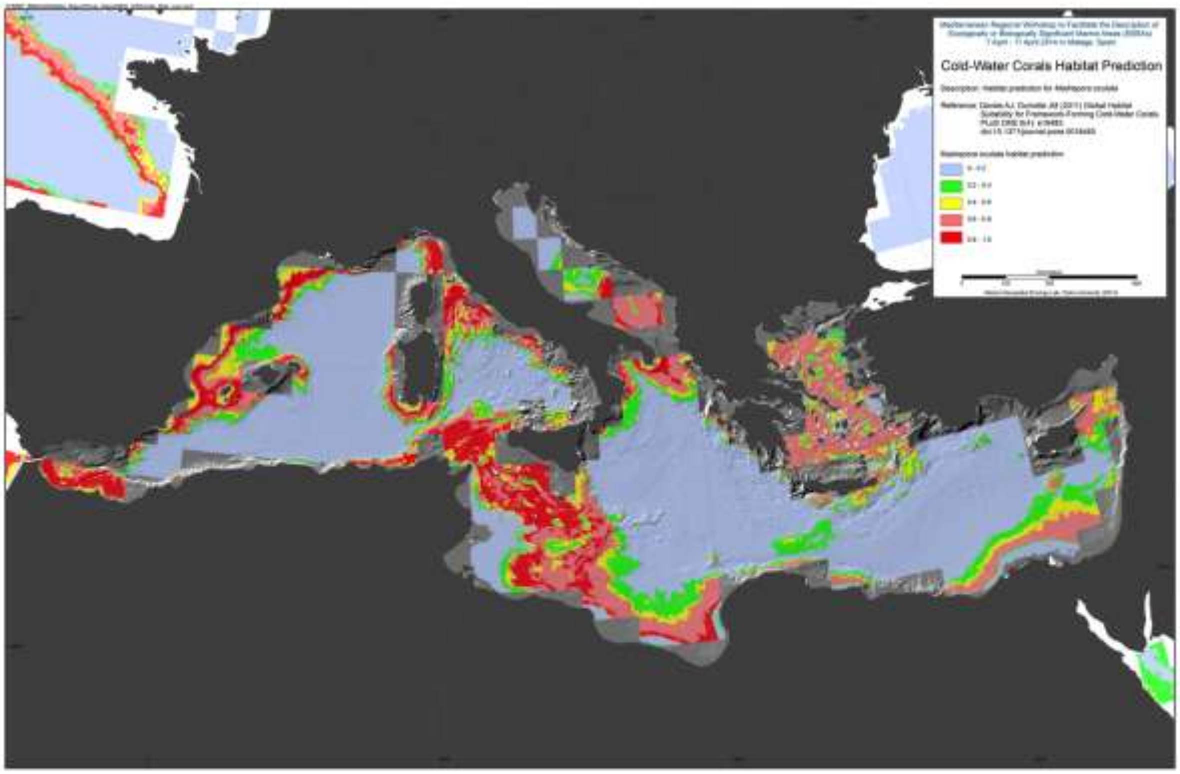


Figure 0-6 Madrepora oculata Habitat Prediction

3.6 Predictions of Deep-Sea Octocorals

Abstract:

"Three-quarters of Octocorallia species are found in deep waters. These cold- water octocoral colonies can form a major constituent of structurally complex habitats. The global distribution and the habitat requirements of deep-sea octocorals are poorly understood given the expense and difficulties of sampling at depth. Habitat suitability models are useful tools to extrapolate distributions and provide an understanding of ecological requirements. Here, we present global habitat suitability models and distribution maps for seven suborders of Octocorallia: Alcyoniina, Calcaxonia, Holaxonia, Scleraxonia, Sessiliflorae, Stolonifera and Subselliflorae."

Reference:
Yesson C, Taylor ML, Tittensor DP, Davies AJ, Guinotte J, Baco A, Black J, Hall-Spencer JM, Rogers AD (2012) *Global habitat suitability of cold-water octocorals*. Journal of Biogeography 39:1278–1292.

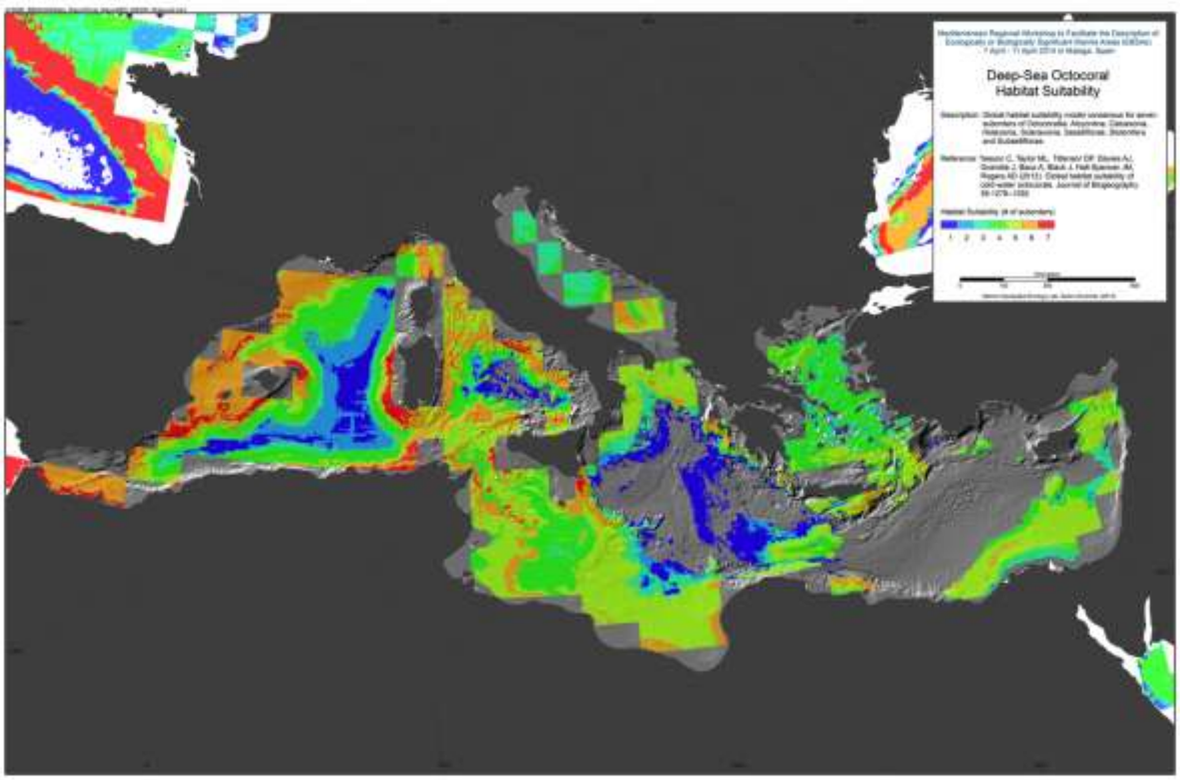


Figure 0-1 Deep-Sea Octocoral Habitat Suitability - Consensus

3.7 Important Bird Areas

BirdLife Important Bird Areas (IBAs) have been used to inform the description of areas meeting EBSA criteria in previous EBSA regional workshops. Previously the data provided has been used to either support the designation of an EBSA for a range of taxa and habitats, or to identify EBSAs solely on the basis of bird data.

IBAs have been identified using several data sources:

1. Terrestrial seabird breeding sites are shown with point locality and species that qualifies at the IBA
   – see http://www.birdlife.org/datazone/site/search
2. Marine areas around breeding colonies have been identified based on literature review where possible to guide the distance required by each species. Where literature is sparse or lacking, extensions have been applied on a precautionary basis.
   – see http://seabird.wikispaces.com/
3. Sites identified by satellite tracking data via kernel density analysis, first passage time analysis and bootstrapping approaches.
   - www.seabirdtracking.org

Together these IBAs form a network of sites of importance to coastal, pelagic, resident and or migratory species. EBSA criteria of particular relevance are “important for life-history stages”, “threatened species”, “diversity” and “fragility”. For further information Google “IBAs vs EBSAs”.

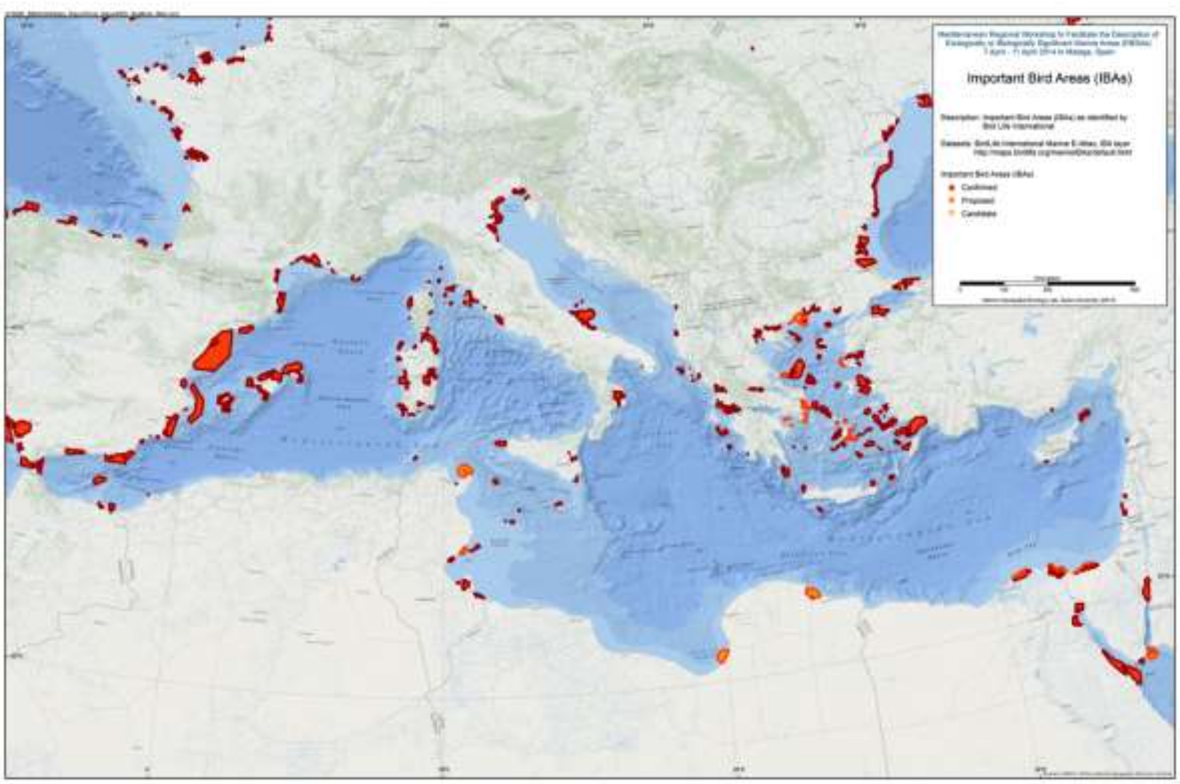


Figure 0-1 Important Bird Areas (IBAs)

3.8 Compilation Of important offshore areas for bird

Introduction:
"The Mediterranean region is widely recognised as a source area for endemism at several biological levels, from plants to mammals (Margalef, 1985). Seabirds in particular are a good example of the region's richness and diversity in biota – eight of the nine breeding taxa of exclusively marine birds are either endemic species or subspecies (Zotier, 1999). The Mediterranean is only a small but important sea in the context of global biodiversity; a relatively poor environment with comparatively harsh conditions and that has been in isolation long enough to force the development of new forms of life.

Mediterranean seabirds have a long history of coexistence with man and its consumption of natural resources (Oro, 2003). This is reflected in the current distribution of species and their numbers. The Mediterranean seabird community is exposed to a variety of threats, ranging from industrial fisheries (causing disruptions in the availability of food, and incidental mortality) to pollution (discharge from industry and agriculture, oil, heavy metals) in offshore areas (Mínguez et al. 2003). These may cause mortality of adult birds, with important consequences on the demography of long-lived birds, and are additive to land-based factors impacting on the same species: predation (by alien species) on nesting islands, habitat deterioration and destruction, large-scale development, disturbance, etc.

Aims:
By mapping the (known) distribution range of seabirds in the Mediterranean, it is hoped:

a) to highlight heterogeneities in the marine environment that may reflect differences in habitat quality;
b) to signal areas of high conservation value, particularly as habitat for seabirds;
c) to point at shared responsibilities by two or several States, particularly for the conservation of non-coastal areas."

Reference:
UNEP-MAP-RAC/SPA. 2010. Report presenting a georeferenced compilation on bird important areas in the Mediterranean open seas. By Requena, S. and Carboneras, C. Ed. RAC/SPA, Tunis: 39p

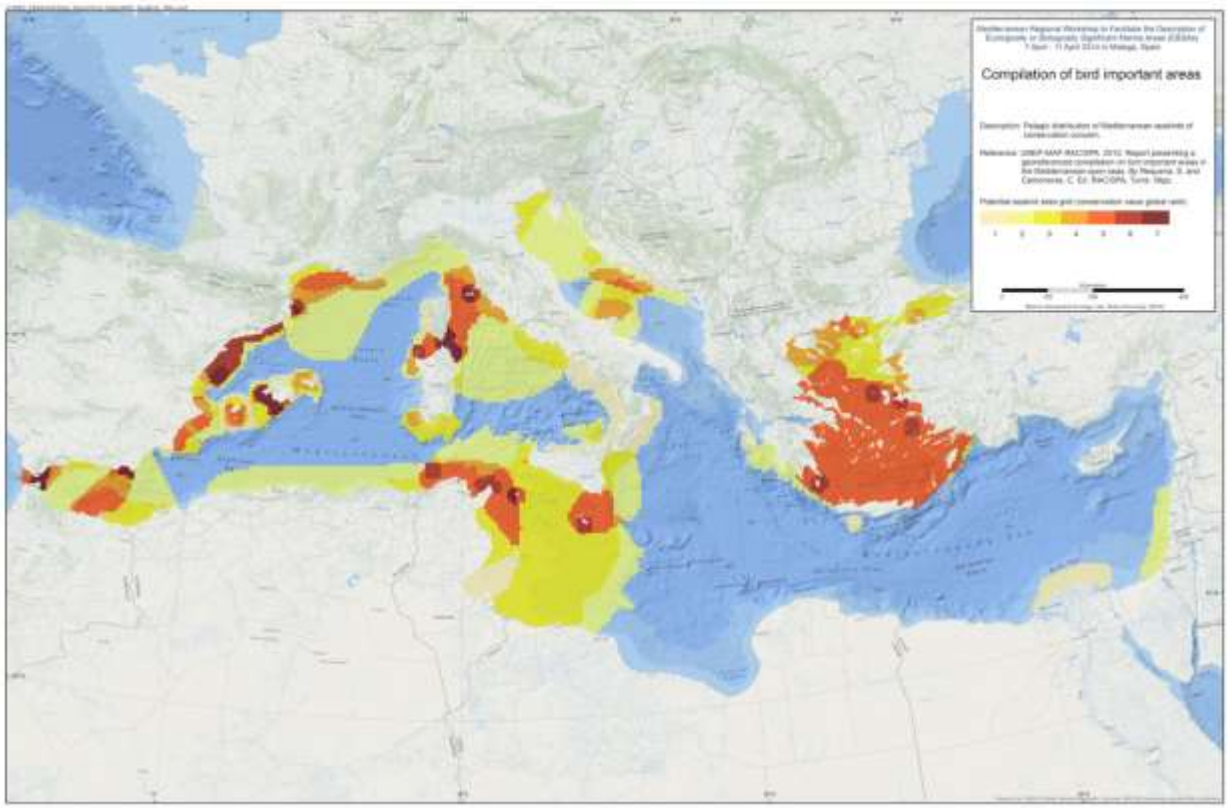


Figure 0-1 Pelagic distribution of Mediterranean seabirds of conservation concern

4. Physical Data

4.1 Seamounts

Abstract:
"Seamounts and knolls are 'undersea mountains', the former rising more than 1000 m from the seafloor. These features provide important habitats for aquatic predators, demersal deep-sea fish and benthic invertebrates. However most seamounts have not been surveyed and their numbers and locations are not well known. Previous efforts to locate and quantify seamounts have used relatively coarse bathymetry grids. Here we use global bathymetric data at 30 arc-second resolution to identify seamounts and knolls. We identify 33,452 seamounts and 138,412 knolls, representing the largest global set of identified seamounts and knolls to date. We compare estimated seamount numbers, locations, and depths with validation sets of seamount data from New Zealand and Azores. This comparison indicates the method we apply finds 94% of seamounts, but may overestimate seamount numbers along ridges and in areas where faulting and seafloor spreading creates highly complex topography. The seamounts and knolls identified herein are significantly geographically biased towards areas surveyed with shipbased soundings. As only 6.5% of the ocean floor has been surveyed with soundings it is likely that new seamounts will be uncovered as surveying improves. Seamount habitats constitute approximately 4.7% of the ocean floor, whilst knolls cover 16.3%. Regional distribution of these features is examined, and we find a disproportionate number of productive knolls, with a summit depth of o1.5 km, located in the Southern Ocean. Less than 2% of seamounts are within marine protected areas and the majority of these are located within exclusive economic zones with few on the high seas. The database of seamounts and knolls resulting from this study will be a useful resource for researchers and conservation planners."

Reference:
Yesson, C., et al., The global distribution of seamounts based on 30 arc seconds bathymetry data. Deep-Sea Research I (2011), doi:10.1016/j.dsr.2011.02.004

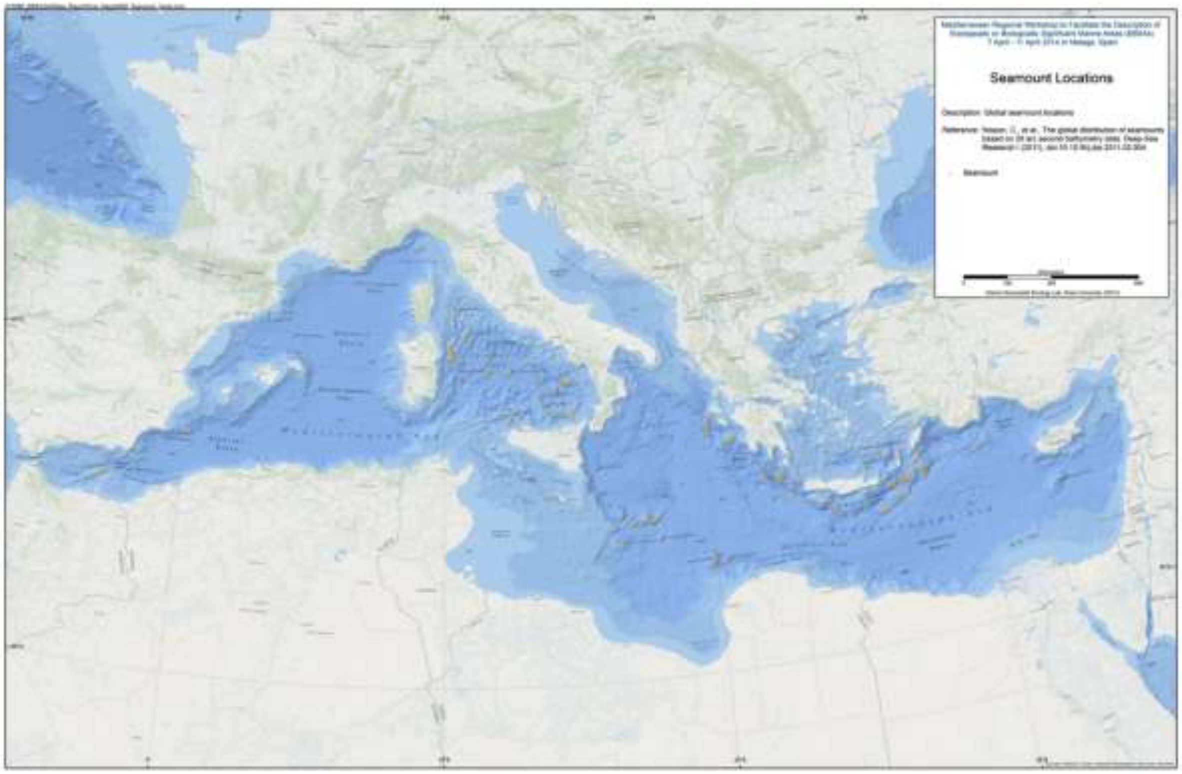


Figure 0-1 Seamount Locations

4.2 Vents and Seeps

ChEss (Chemosynthetic Ecosystem Science) was a field project of the Census of Marine Life programme (CoML). The main aim of ChEss was to determine the biogeography of deep-water chemosynthetic ecosystems at a global scale and to understand the processes driving these ecosystems. ChEss addressed the main questions of CoML on diversity, abundance and distribution of marine species, focusing on deep-water reducing environments such as hydrothermal vents, cold seeps, whale falls, sunken wood and areas of low oxygen that intersect with continental margins and seamounts. (source: http://www.noc.soton.ac.uk/chess/)

ChEssBase is a dynamic relational database available online since December 2004. The aim of ChEssBase is to provide taxonomical, biological, ecological and distributional data of all species described from deep-water chemosynthetic ecosystems, as well as bibliography and information on the habitats. These habitats include hydrothermal vents, cold seeps, whale falls, sunken wood and areas of minimum oxygen that intersect with the continental margin or seamounts.

Since the discovery of hydrothermal vents in 1977 and of cold seep communities in 1984, over 500 species from vents and over 200 species from seeps have been described (Van Dover et al., 2002. Science 295: 1253-1257). The discovery of chemosynthetically fuelled communities on benthic OMZs and large organic falls to the deep-sea such as whales and wood have increased the number of habitats and fauna for investigation. New species are continuously being discovered and described from sampling programmes around the globe.
(source: http://www.noc.soton.ac.uk/chess/database/db_home.php)

ChEssBase: http://www.noc.soton.ac.uk/chess/database/db_home.php
InterRidge: http://www.interridge.org/irvents/maps

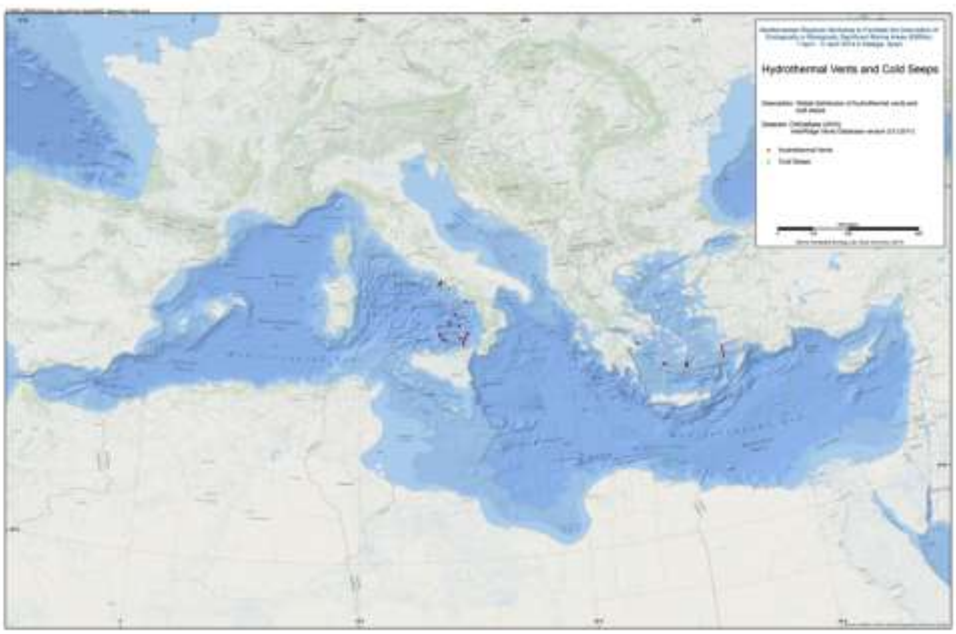


Figure 0-1 Hydrothermal Vents and Cold Seeps

4.3 Bathymetry (EMODnet)

"The EMODnet Bathymetry data products are Digital Terrain Models (DTM) for selected maritime basins in Europe that have been produced from collated bathymetric data sets and that are integrated into a central DTM.

For each region bathymetric survey data and aggregated bathymetry data sets are collated from public and private organizations. These are processed and quality controlled. A further refinement is underway, also by gathering additional survey data sets, and will result in new releases in time. Each of the available regional DTM's has been imported into the central EMODnet Bathymetry Data Products Viewing Service.

The DTM data products are freely available to users as GIS layers for viewing, sharing as WMS services and downloading as files in several output formats. The DTM's have been based, where possible and available, upon high resolution survey data sets. Users can freely retrieve the metadata of these background data sets via the Common Data Index (CDI) metadata service:

The EMODnet Bathymetry CDI data discovery and access service also facilitates users to request access and if granted, to download the bathymetric data sets in NetCDF (CF) format. For data access the data copyrights of owners must be respected. Therefore it is required that users are registered and confirm to accept the SeaDataNet data policy." (from http://www.emodnet-hydrography.eu/)

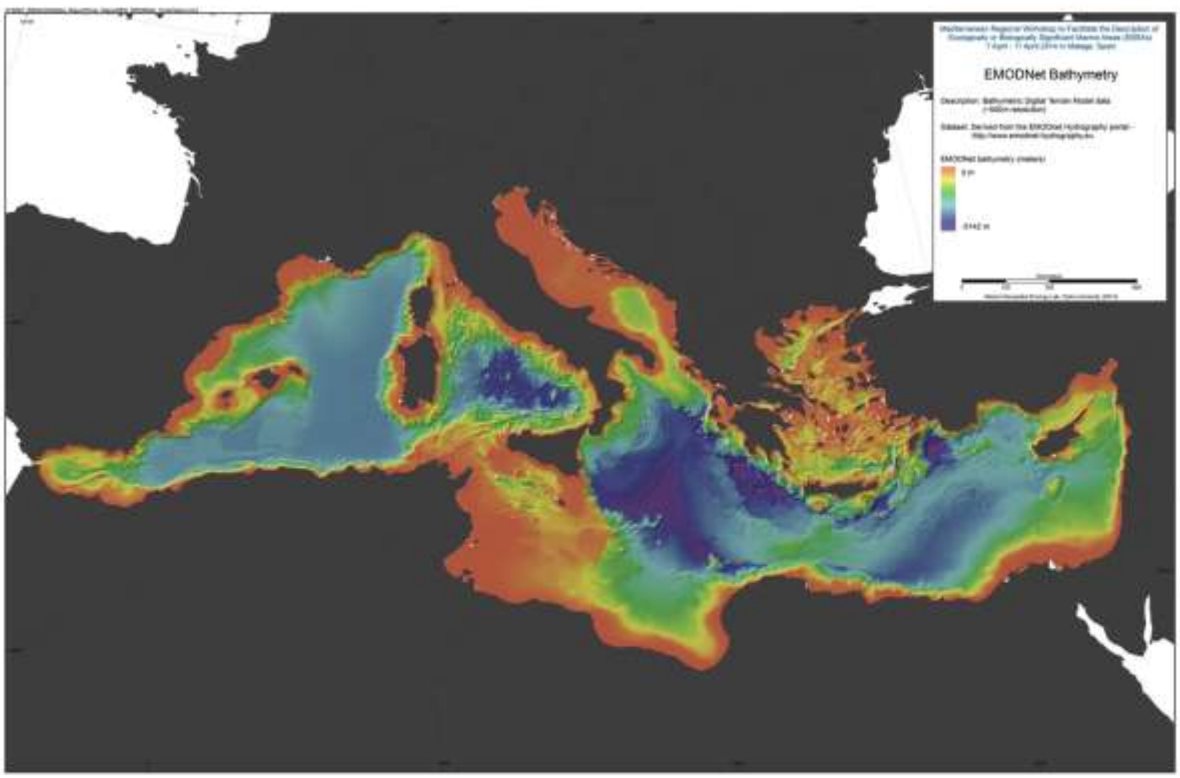


Figure 0-1 Bathymetric Digital Terrain Model data (~500m resolution)

4.4 Distribution of Large Submarine Canyons

Abstract:
"The aim of this study is to assess the global occurrence of large submarine canyons to provide context and guidance for discussions regarding canyon occurrence, distribution, geological and oceanographic significance and conservation. Based on an analysis of the ETOPO1 data set, this study has compiled the first inventory of 5849 separate large submarine canyons in the world ocean. Active continental margins contain 15% more canyons (2586, equal to 44.2% of all canyons) than passive margins (2244, equal to 38.4%) and the canyons are steeper, shorter, more dendritic and more closely spaced on active than on passive continental margins. This study confirms observations of earlier workers that a relationship exists between canyon slope and canyon spacing (increased canyon slope correlates with closer canyon spacing). The greatest canyon spacing occurs in the Arctic and the Antarctic whereas canyons are more closely spaced in the Mediterranean than in other areas."

Reference:
Harris and Whiteway 2011. Global distribution of large submarine canyons: Geomorphic differences between active and passive continental margins. Marine Geology 285 (2011) 6986. doi:10.1016/j.margeo.2011.05.008

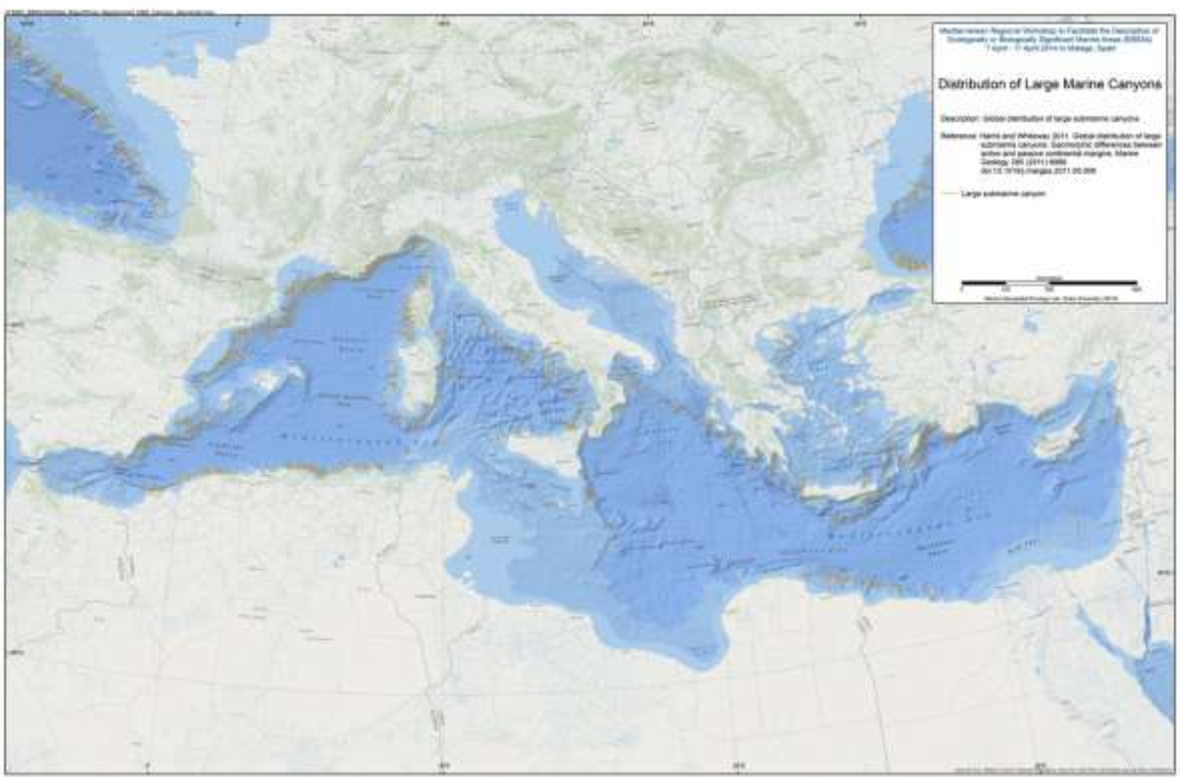


Figure 0-1 Large Marine Canyons

4.5 Seafloor Geomorphology

Abstract:
"We present the first digital seafloor geomorphic features map (GSFM) of the global ocean. The GSFM includes 131,192 separate polygons in 29 geomorphic feature categories, used here to assess differences between passive and active continental margins as well as between 8 major ocean regions (the Arctic, Indian, North Atlantic, North Pacific, South Atlantic, South Pacific and the Southern Oceans and the Mediterranean and Black Seas). The GSFM provides quantitative assessments of differences between passive and active margins: continental shelf width of passive margins (88 km) is nearly three times that of active margins (31 km); the average width of active slopes (36 km) is less than the average width of passive margin slopes (46 km); active margin slopes contain an area of 3.4 million km^2 where the gradient exceeds 5°, compared with 1.3 million km^2 on passive margin slopes; the continental rise covers 27 million km^2 adjacent to passive margins and less than 2.3 million km^2 adjacent to active margins. Examples of specific applications of the GSFM are presented to show that: 1) larger rift valley segments are generally associated with slow-spreading rates and smaller rift valley segments are associated with fast spreading; 2) polar submarine canyons are twice the average size of non-polar canyons and abyssal polar regions exhibit lower seafloor roughness than non-polar regions, expressed as spatially extensive fan, rise and abyssal plain sediment deposits – all of which are attributed here to the effects of continental glaciations; and 3) recognition of seamounts as a separate category of feature from ridges results in a lower estimate of seamount number compared with estimates of previous workers."

Reference:
Harris PT, Macmillan-Lawler M, Rupp J, Baker EK Geomorphology of the oceans. Marine Geology. doi: 10.1016/j.margeo.2014.01.011

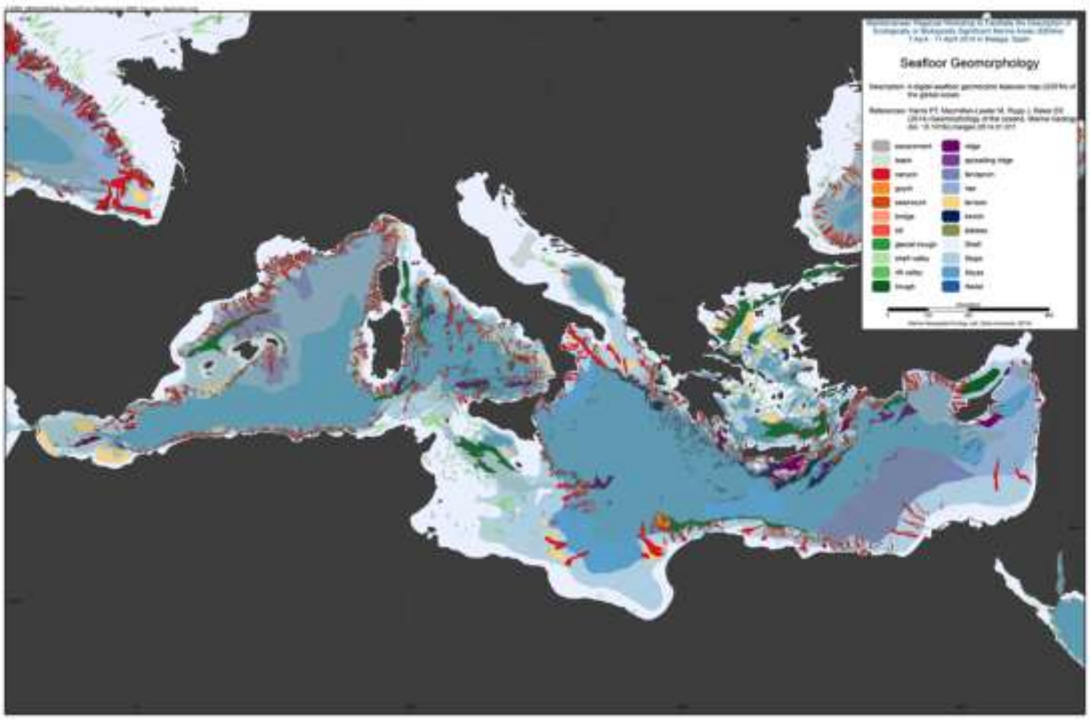


Figure 0-1 Seafloor Geomorphology

4.6 CSIRO Atlas of Regional Seas (CARS) Physical Ocean Climatologies

For items 4.7.1 through 4.7.6, data were downloaded and processed from the CSIRO Atlas of Regional Seas (CARS).

"CARS is a digital climatology, or atlas of seasonal ocean water properties. It comprises gridded fields of mean ocean properties over the period of modern ocean measurement, and average seasonal cycles for that period. It is derived from a quality-controlled archive of all available historical subsurface ocean property measurements - primarily research vessel instrument profiles and autonomous profiling buoys. As data availability has enormously increased in recent years, the CARS mean values are inevitably biased towards the recent ocean state.

A number of global ocean climatologies are presently available, such as NODC's World Ocean Atlas. CARS is different as it employs extra stages of in-house quality control of input data, and uses an adaptive-lengthscale loess mapper to maximise resolution in data-rich regions, and the mapper's "BAR" algorithm takes account of topographic barriers. The result is excellent definition of oceanic structures and accuracy of point values."
(source: http://www.marine.csiro.au/~dunn/cars2009/)

References:
Primary CARS citation:
Ridgway K.R., J.R. Dunn, and J.L. Wilkin, Ocean interpolation by four-dimensional least squares - Application to the waters around Australia, J. Atmos. Ocean. Tech., Vol 19, No 9,1357-1375, 2002
Algorithm details:
Dunn J.R., and K.R. Ridgway, Mapping ocean properties in regions of complex topography, Deep Sea Research I : Oceanographic Research, 49 (3) (2002) pp. 591-604

CARS seasonal fields and MLD:
Scott A. Condie and Jeff R. Dunn (2006) Seasonal characteristics of the surface mixed layer in the Australasian region: implications for primary production regimes and biogeography. Marine and Freshwater Research, 2006, 57, 1-22.

Metadata:
CARS2009 metadata record: MarLIN record: 8539, Anzlic identifier: ANZCW0306008539

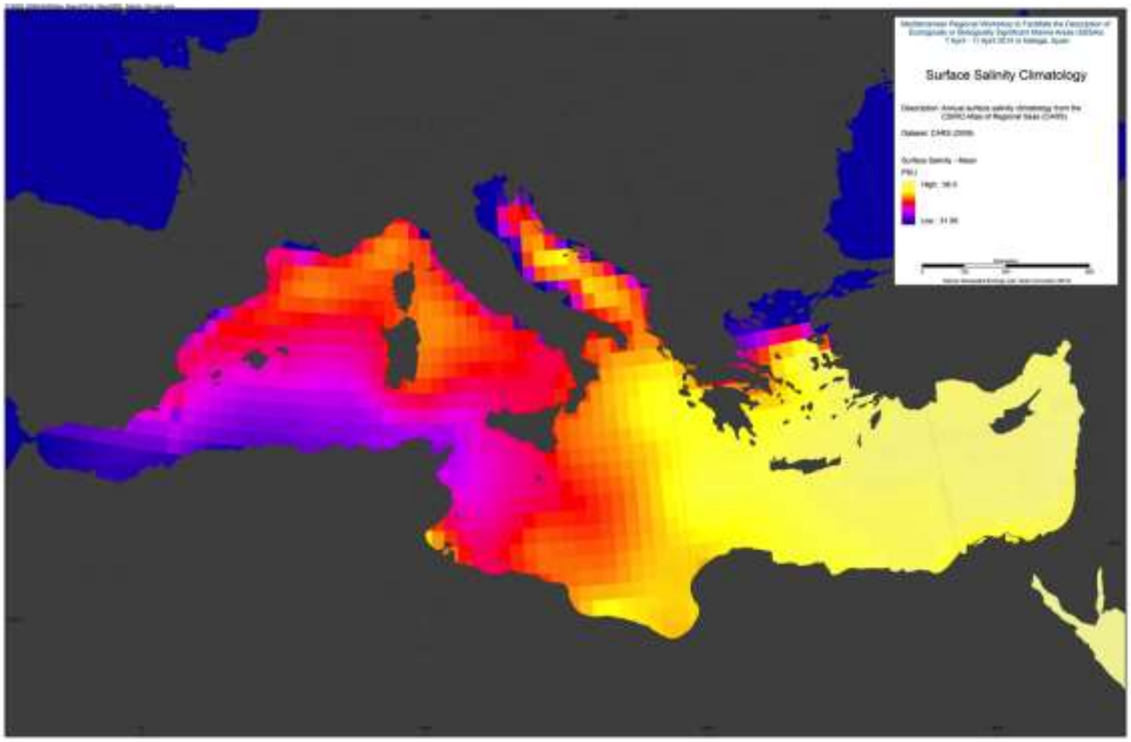


Figure 0-1 Surface Salinity Climatology

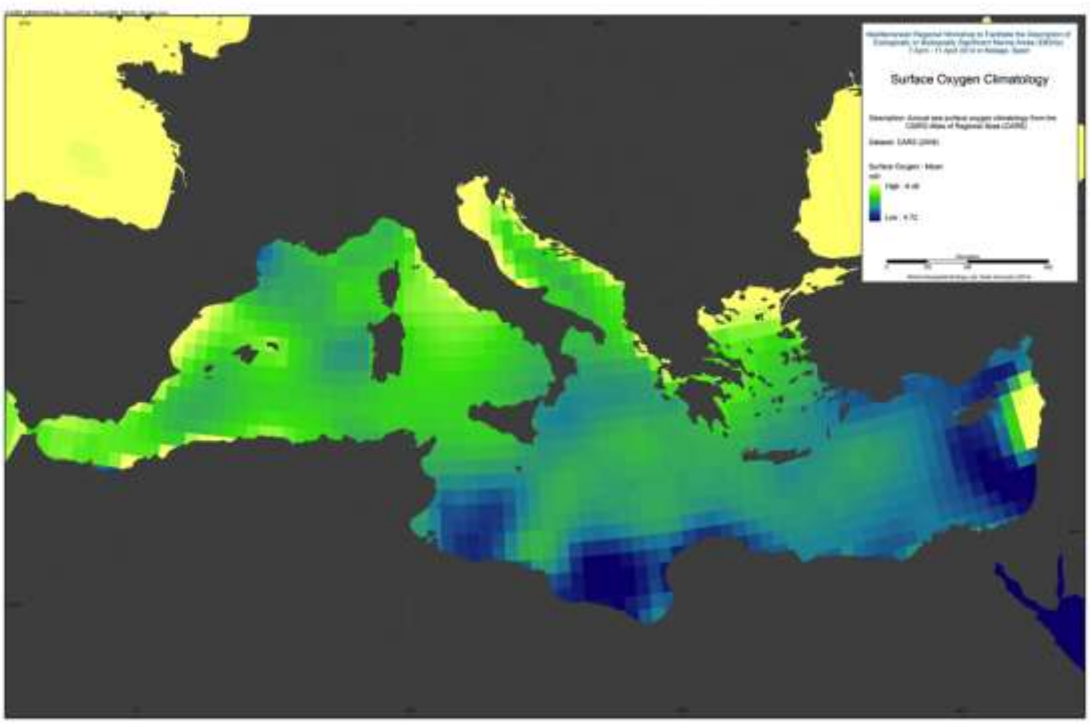


Figure 0-2 Surface Oxygen Climatology

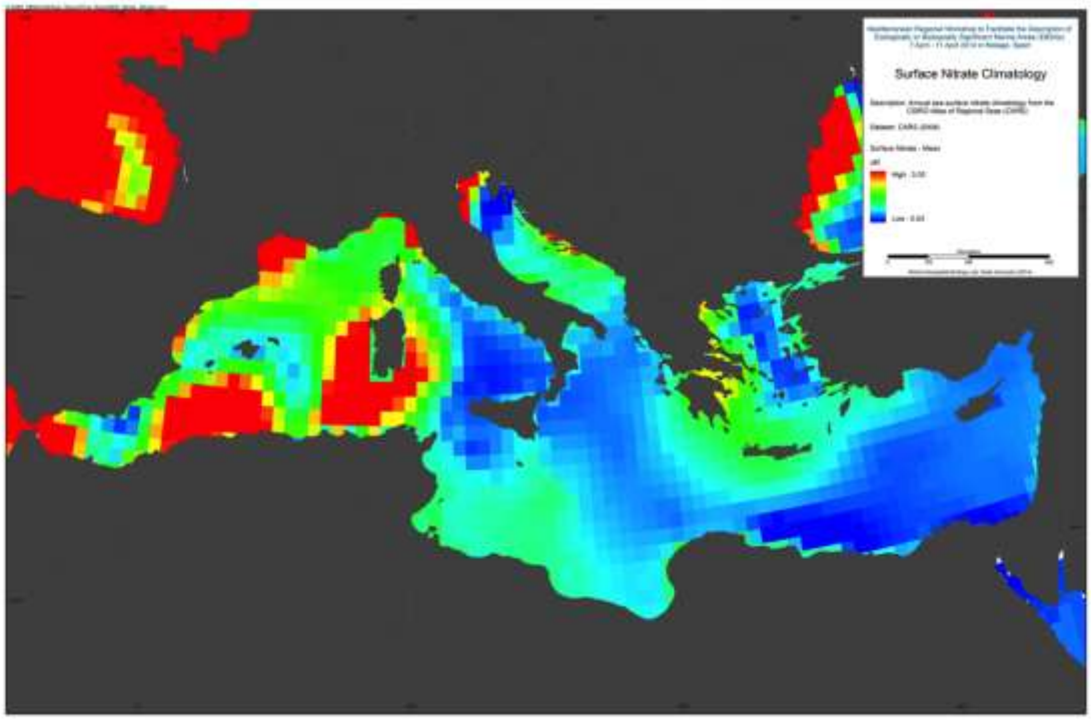


Figure 0-3 Surface Nitrate Climatology

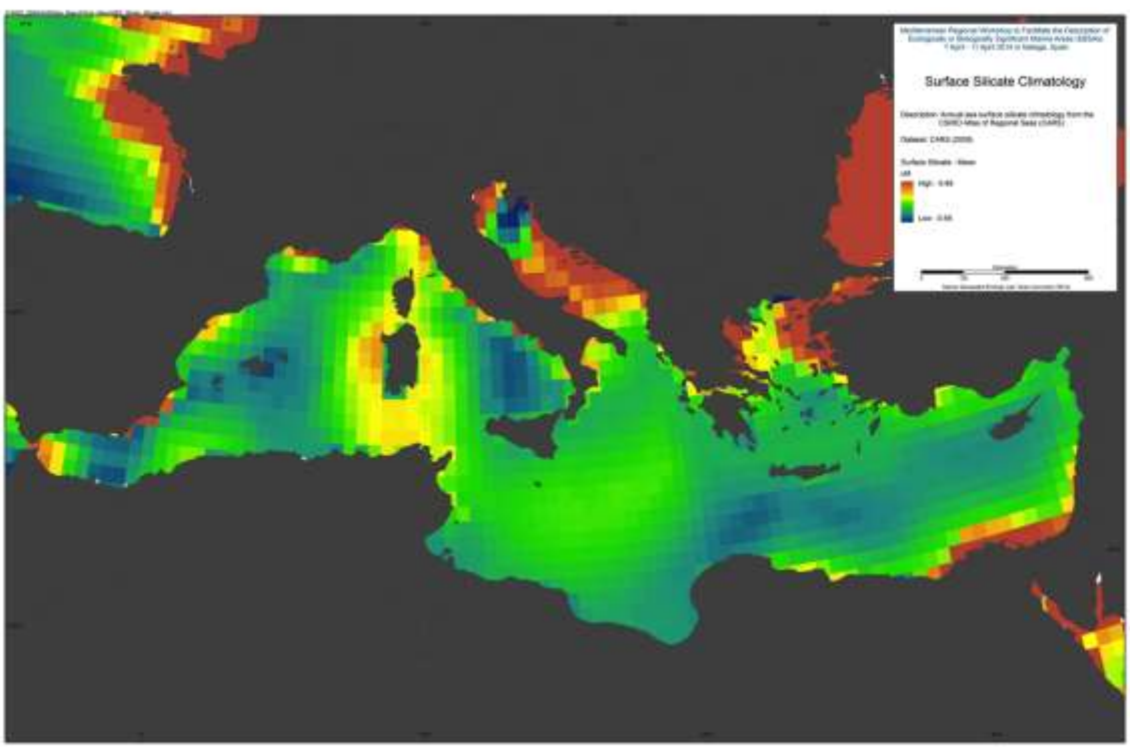


Figure 0-4 Surface Silicate Climatology

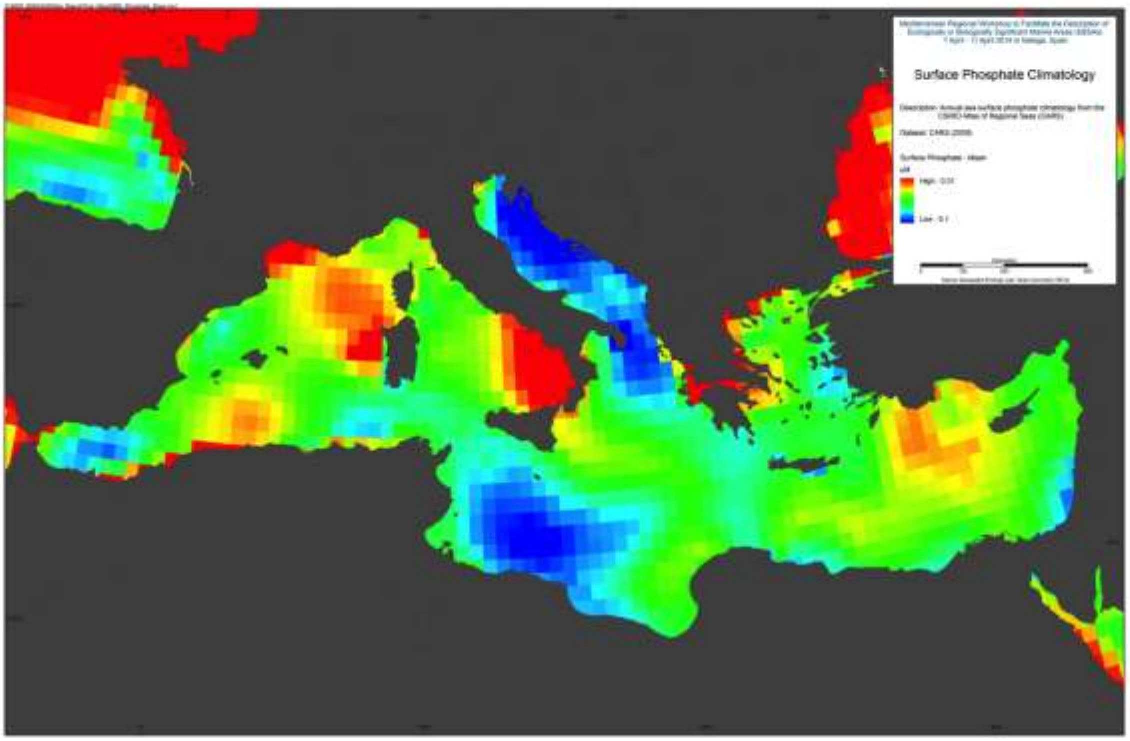


Figure 0-5 Surface Phosphate Climatology

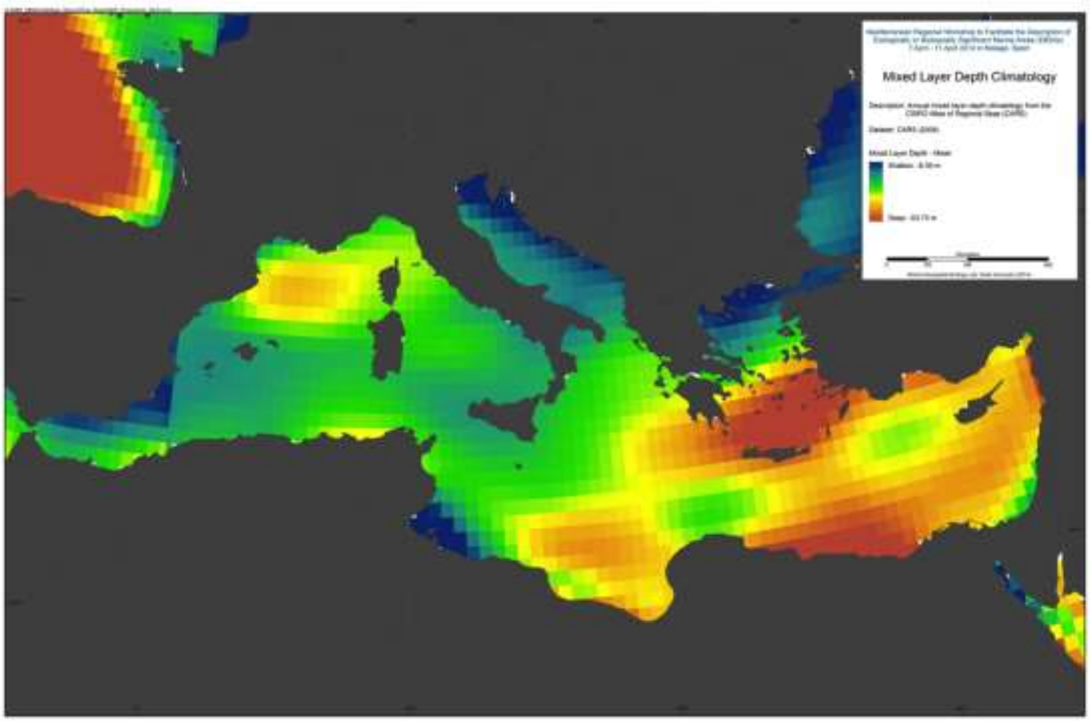


Figure 0-6 Mixed Layer Depth Climatology

4.7 Ocean Surface Temperature

The 4k AVHHR Pathfinder dataset, published by the NOAA National Oceanographic Data Center (NODC), provides a global, long-term, high-resolution record of sea surface temperature (SST) using data collected by NOAA's Polar-orbiting Operational Environmental Satellites (POES).

For this effort, a cumulative climatology (1982 - 2009) was created using the "Create Climatological Rasters for AVHHR Pathfinder V5 SST" tool in the Marine Geospatial Ecology Tools (MGET) for ArcGIS (Roberts et al., 2010).

References:

Casey, K.S., T.B. Brandon, P. Cornillon, and R. Evans (2010). "The Past, Present and Future of the AVHRR Pathfinder SST Program", in Oceanography from Space: Revisited, eds. V. Barale, J.F.R. Gower, and L. Alberotanza, Springer

Roberts, J.J., B.D. Best, D.C. Dunn, E.A. Treml, and P.N. Halpin (2010). Marine Geospatial Ecology Tools: An integrated framework for ecological geoprocessing with ArcGIS, Python, R, MATLAB, and C++. Environmental Modelling & Software 25: 1197-1207.

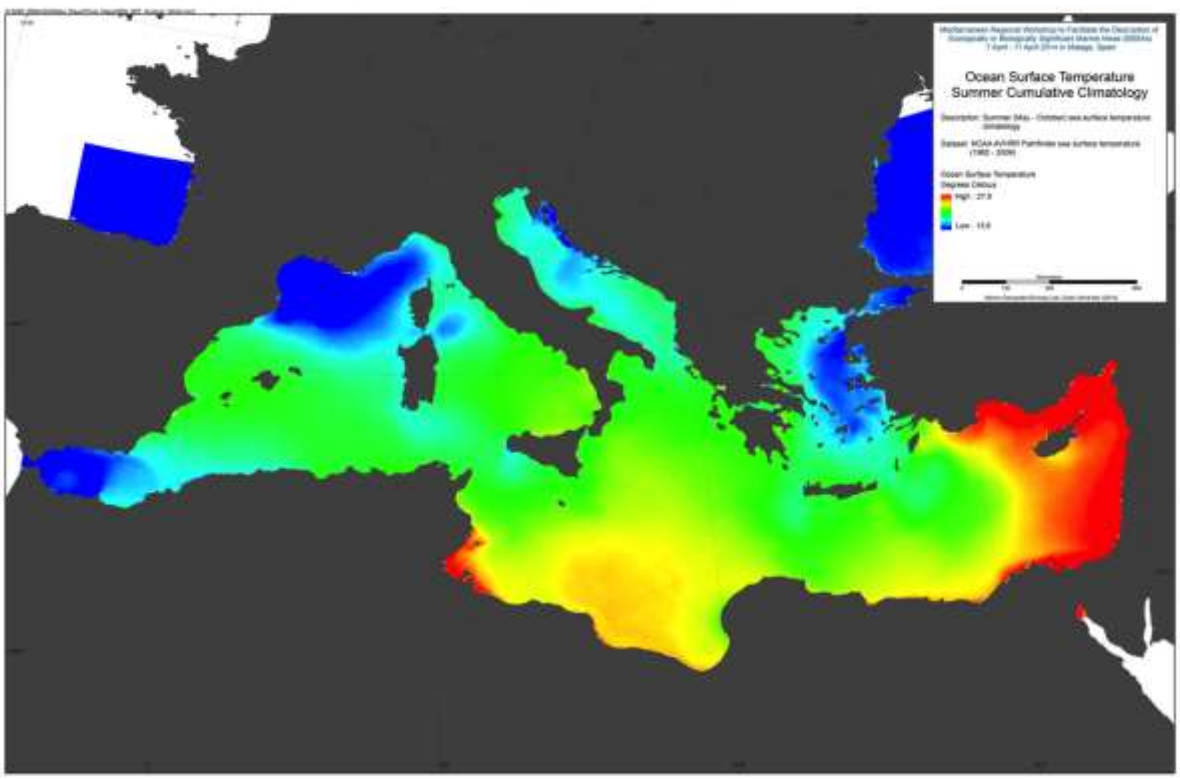


Figure 0-1 Ocean Surface Temperature – Summer Cumulative Climatology

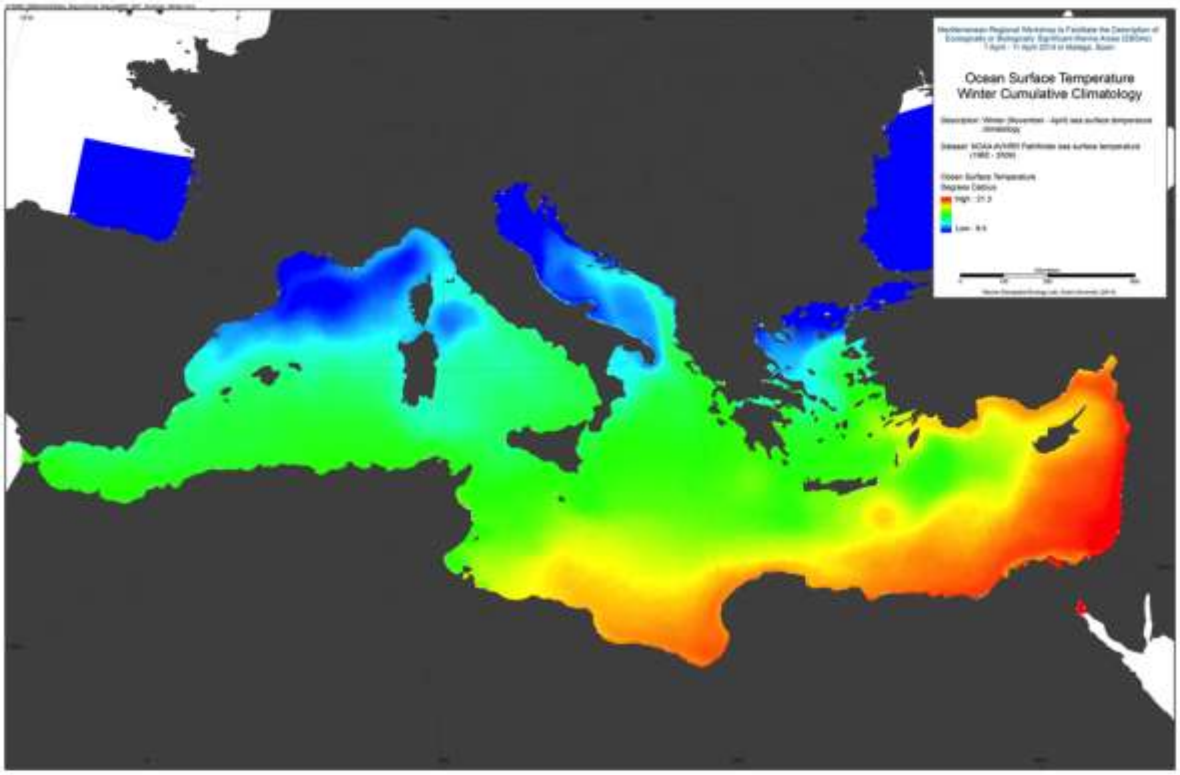


Figure 0-2 Ocean Surface Temperature – Winter Cumulative Climatology

4.8 Sea Surface Temperature Front Occurrence

The NASA Jet Propulsion Laboratory Physical Oceanography Distributed Active Archive Center (PO.DAAC) publishes sea surface temperature images from the Moderate Resolution Imaging Spectroradiometer (MODIS).

For this effort, SST fronts were detected using the "Find Cayula-Cornillon Fronts in PO.DAAC MODIS L3 SST" tool in the Marine Geospatial Ecology Tools (MGET) for ArcGIS (Roberts et al., 2010). The front threshold was set to 2 degrees Celsius, and the tool was run for every image available from 2000 – 2012. A custom Python script was then run to sum all the fronts annually and then average fronts detected over the full time period.

References: Roberts, J.J., B.D. Best, D.C. Dunn, E.A. Treml, and P.N. Halpin (2010). Marine Geospatial Ecology Tools: An integrated framework for ecological geoprocessing with ArcGIS, Python, R, MATLAB, and C++. Environmental Modelling & Software 25: 1197-1207.

J.-F. Cayula, P. Cornillon, Edge Detection Algorithm for SST Images, *Journal of Atmospheric and Oceanic Technology* **9**, 67–80 (1992).

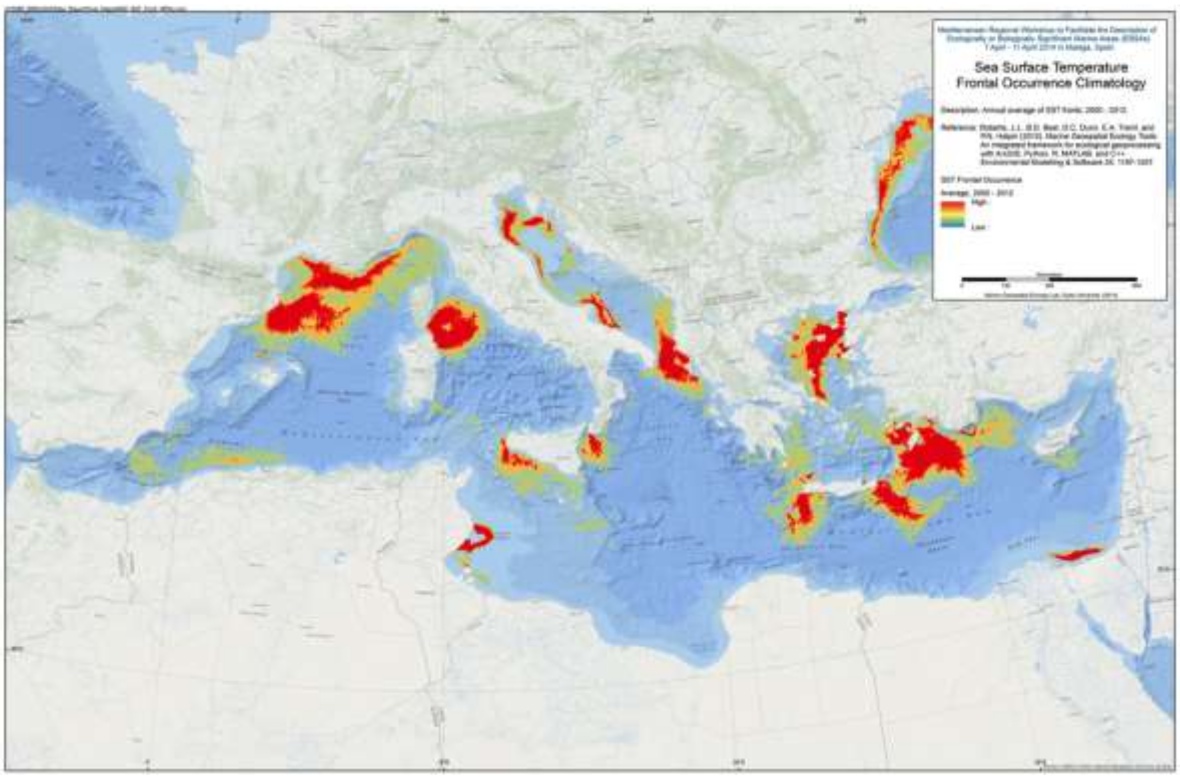


Figure 0-1 Sea Surface Temperature Front Occurrence (2000 - 2012)

4.9 Chlorophyll A Climatology

Here, seasonal cumulative (1998-2009) chlorophyll A climatologies were created using the "Create Climatological Rasters for NASA OceanColor L3 SMI Product" tool in the Marine Geospatial Ecology Tools (MGET) for ArcGIS (Roberts et al., 2010). This tool uses data from the Sea-viewing Wide Field-of-view Sensor (SeaWiFS) Project. One climatology was generated for each season: summer (May – October) and winter (November – April).

Reference:

Roberts, J.J., B.D. Best, D.C. Dunn, E.A. Treml, and P.N. Halpin (2010). Marine Geospatial Ecology Tools: An integrated framework for ecological geoprocessing with ArcGIS, Python, R, MATLAB, and C++. Environmental Modelling & Software 25: 1197-1207.

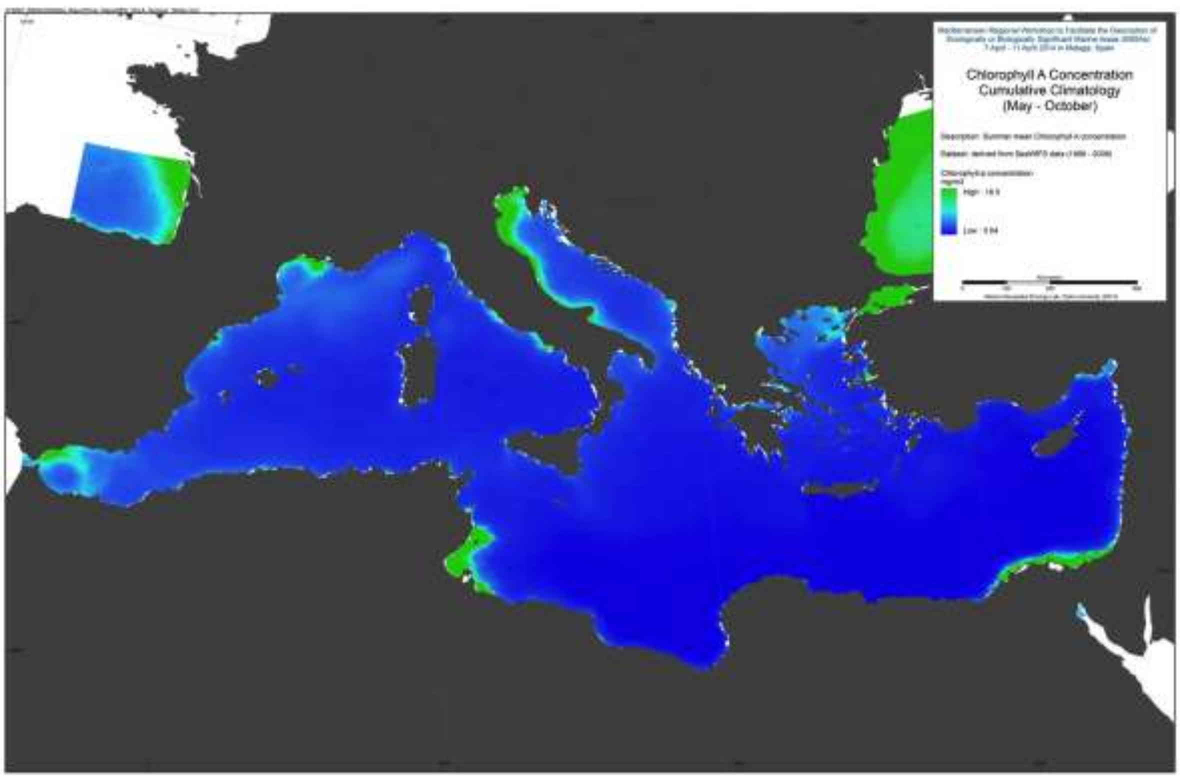


Figure 0-1 Chlorophyll A Concentration Summer Cumulative Climatology (May – October)

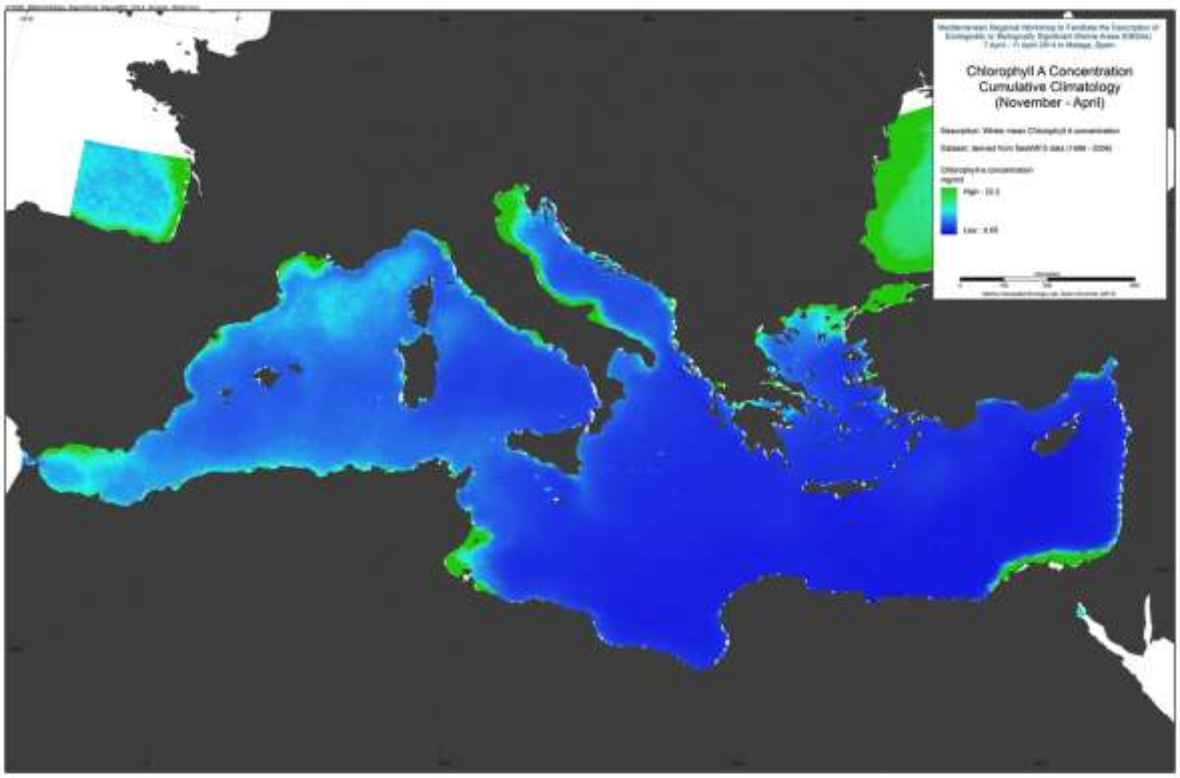


Figure 0-2 Chlorophyll A Concentration Winter Cumulative Climatology (November – April)

4.10 VGPM Ocean Productivity

Standard Ocean Productivity Products are based on the original description of the Vertically Generalized Production Model (VGPM) (Behrenfeld & Falkowski 1997), MODIS surface chlorophyll concentrations (Chl_{sat}), MODIS sea surface temperature data (SST), and MODIS cloud-corrected incident daily photosynthetically active radiation (PAR). Euphotic depths are calculated from Chl_{sat} following Morel and Berthon (1989).
(source: http://www.science.oregonstate.edu/ocean.productivity/standard.product.php)

For this effort, a cumulative climatology was created from Standard VGPM data derived from MODIS AQUA data from 2003-2007.

Reference:
Behrenfeld, M. J. & Falkowski, P. G. Photosynthetic rates derived from satellite-based chlorophyll concentration. *Limnology And Oceanography* 42, 1–20 (1997).

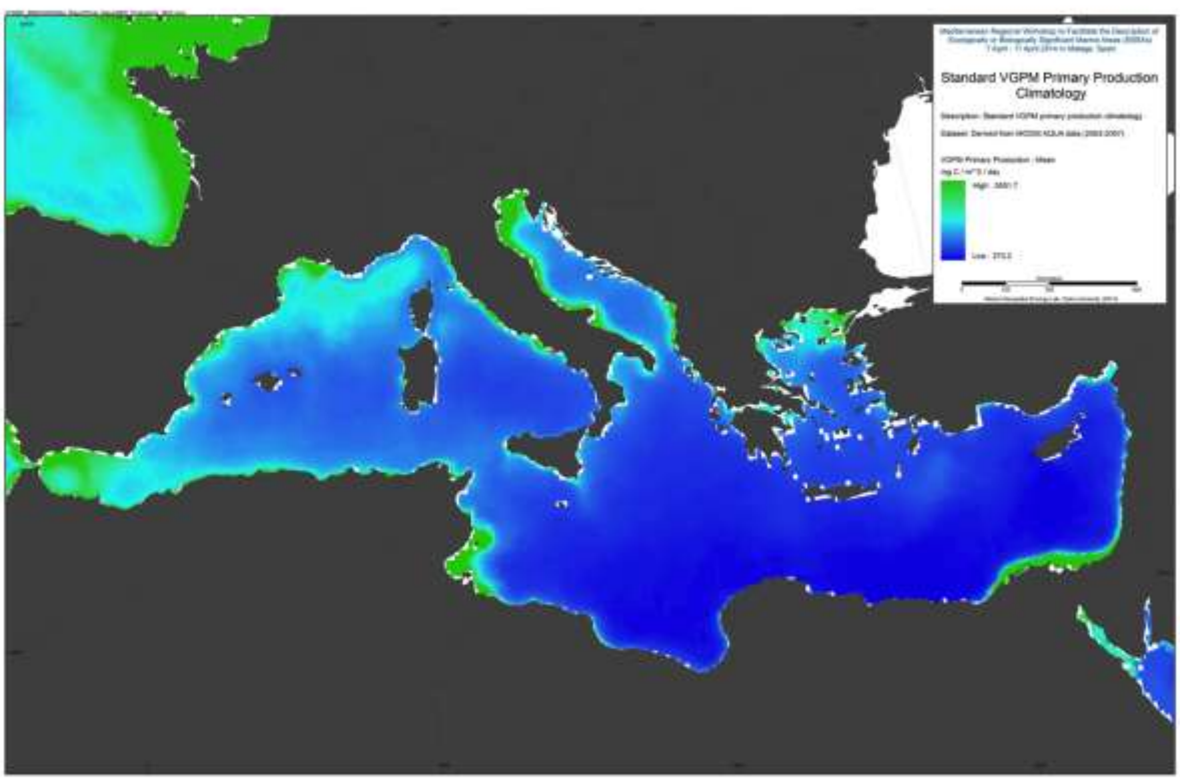


Figure 0-1 Standard VGPM Ocean Productivity

4.11 Sea Surface Height

The Archiving, Validation and Interpretation of Satellite Oceanographic data (AVISO) group publishes various products derived from satellite altimetry data, including estimates of sea surface height (SSH), geostrophic currents, wind speed modulus, and significant wave height. To maximize accuracy and spatial and temporal resolution and extent, AVISO merges observations from multiple satellites, including Topex/Poseidon, Jason-1, Jason-2, GFO, ERS-1, ERS-2, and EnviSat. Most Aviso products are one of these "merged" datasets, although a few products are based on observations from a single satellite.
(source: http://code.nicholas.duke.edu/projects/mget)

For this effort two seasonal climatologies were generated (summer: May – October and winter: November – April).from AVISO Global DT-Ref Merged MADT SSH data, from 1993-2011, using the “Create Climatological Rasters for Aviso SSH” tool in the Marine Geospatial Ecology Tools (MGET) for ArcGIS (Roberts et al., 2010).

Reference:
Roberts, J.J., B.D. Best, D.C. Dunn, E.A. Treml, and P.N. Halpin (2010). Marine Geospatial Ecology Tools: An integrated framework for ecological geoprocessing with ArcGIS, Python, R, MATLAB, and C++. Environmental Modelling & Software 25: 1197-1207.

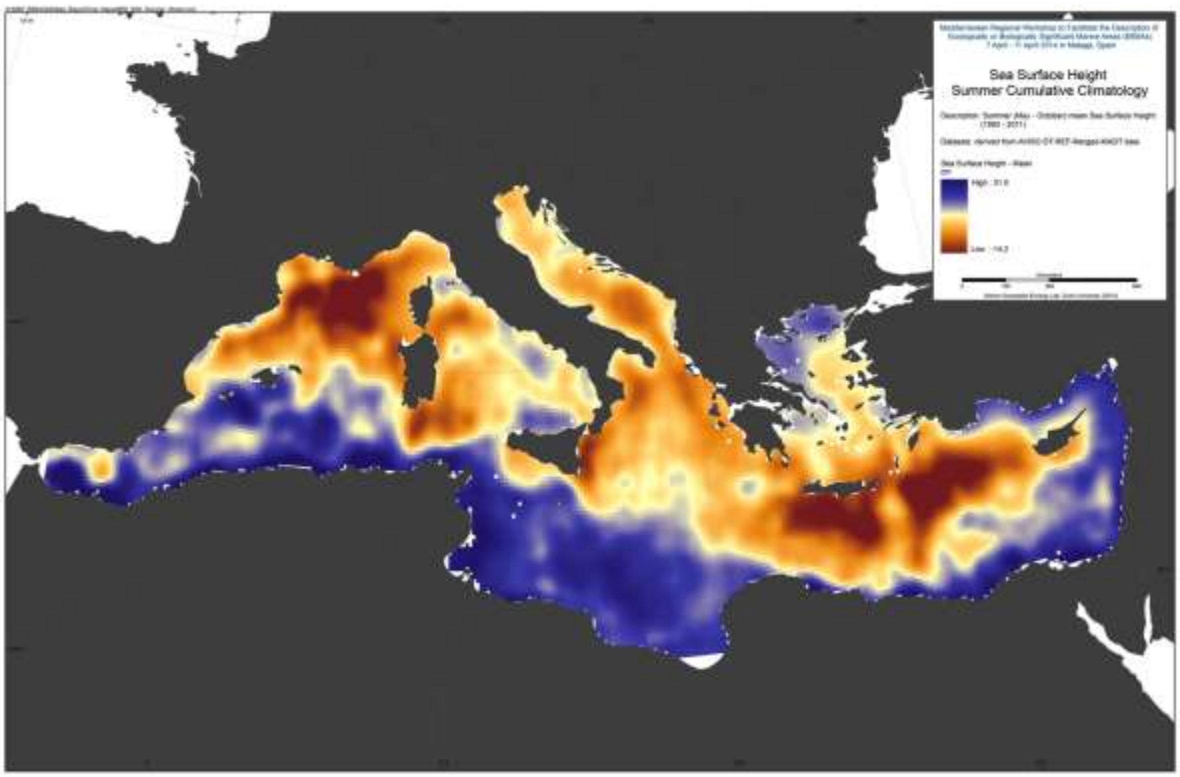


Figure 0-1 Sea Surface Height – Summer Cumulative Climatology (May – October)

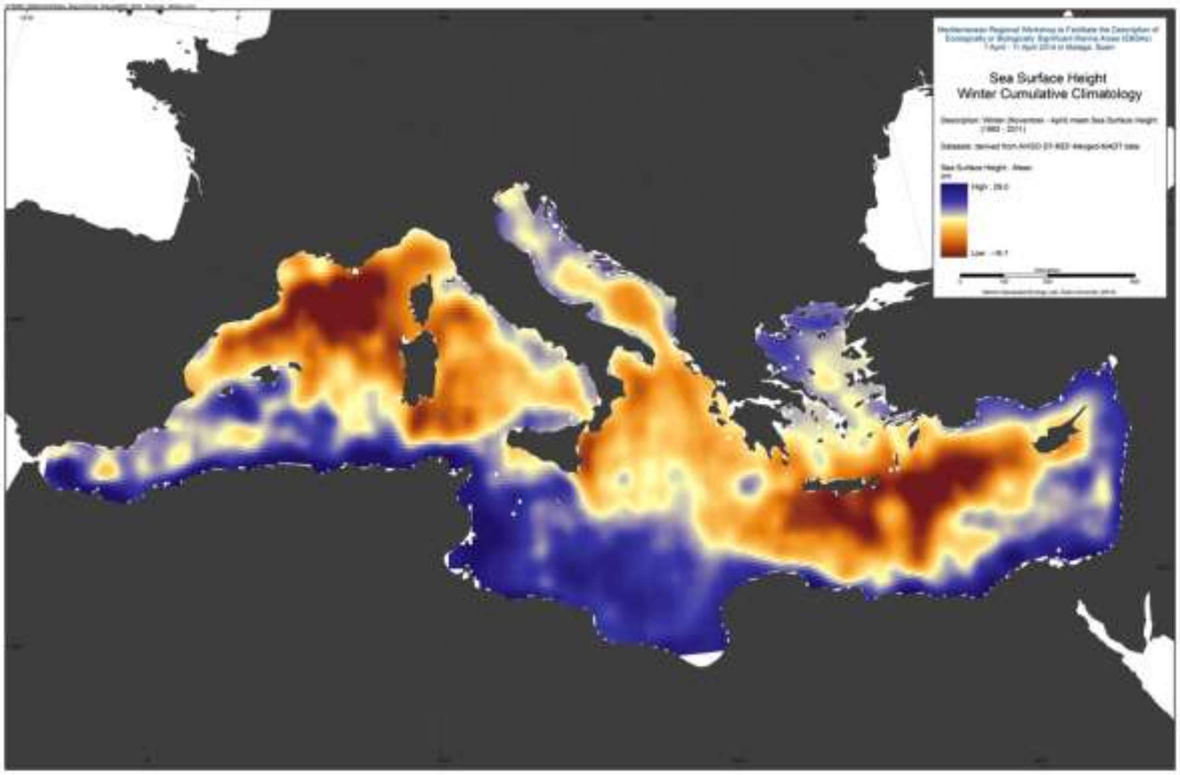


Figure 0-2 Sea Surface Height – Winter Cumulative Climatology (November – April)

4.12 Mesoscale Eddy Density

Dudley B. Chelton and Michael G. Schlax maintain a database of trajectories of mesoscale eddies for the 18-year period October 1992 - January 2011. The eddies are based on the SSH fields in Version 3 of the AVISO Reference Series. Only eddies with lifetimes of 4 weeks or longer are retained; the trajectories are available at 7-day time steps. (source: http://cioss.coas.oregonstate.edu/eddies/)

A density raster of eddy centroids was created from the Chelton database (http://cioss.coas.oregonstate.edu/eddies/). First, the NetCDF file was converted to a SpatiaLite database using the MGET tool "Convert Mesoscale Eddies NetCDF to SpatiaLite". Next, the "Extract Mesoscale Eddy Centroids from SpatiaLite" and "Extract Mesoscale Eddy Tracklines from SpatiaLite" tools were run specifying the date range (1993 - 2010) and the region of interest. For the tracks, only eddies that persisted at least 17 weeks were selected. By joining the centroids and tracks features, we obtained all centroids for eddies that persisted at least 17 weeks. The density raster was created from the Point Density ArcMap tool using 0.5 degree cell size and 0.5 x 0. 5 rectangular window.

References:
Chelton, D.B., M.G. Schlax, and R.M. Samelson (2011). Global observations of nonlinear mesoscale eddies. Progress in Oceanography 91: 167-216.

Roberts, J.J., B.D. Best, D.C. Dunn, E.A. Treml, and P.N. Halpin (2010). Marine Geospatial Ecology Tools: An integrated framework for ecological geoprocessing with ArcGIS, Python, R, MATLAB, and C++. Environmental Modelling & Software 25: 1197-1207.

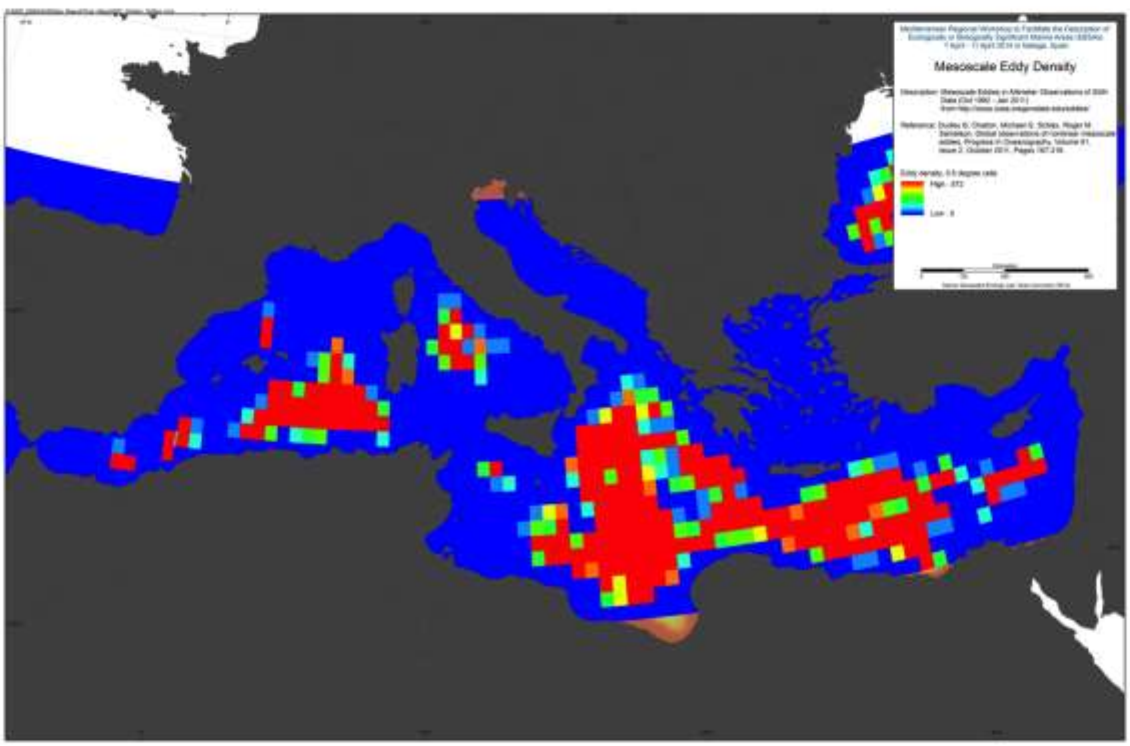


Figure 0-1 Mesoscale Eddy Density

4.13 Eddy Kinetic Energy

Locations where shear between water masses is high can generate productivity due to mixing. One measure of this mixing is estimated using Eddy Kinetic Energy (EKE). EKE was calculated from the velocity maps based on sea surface height from The [Archiving, Validation and Interpretation of Satellite Oceanographic data (AVISO)](). Using the U and V components from the currents data, EKE is defined as $0.5*(U^2 + V^2)$ and was calculated using AVISO data from 1993-2011, inclusive.

For this effort, summer and winter cumulative EKE climatologies (1993-2011) were created using the Global DT-Upd Merged Mean Sea Level Anomaly data product in the "Create Climatological Rasters for Aviso Geostrophic Currents Product" tool in the Marine Geospatial Ecology Tools (MGET) for ArcGIS (Roberts et al., 2010).

Reference:

Roberts, J.J., B.D. Best, D.C. Dunn, E.A. Treml, and P.N. Halpin (2010). Marine Geospatial Ecology Tools: An integrated framework for ecological geoprocessing with ArcGIS, Python, R, MATLAB, and C++. Environmental Modelling & Software 25: 1197-1207.

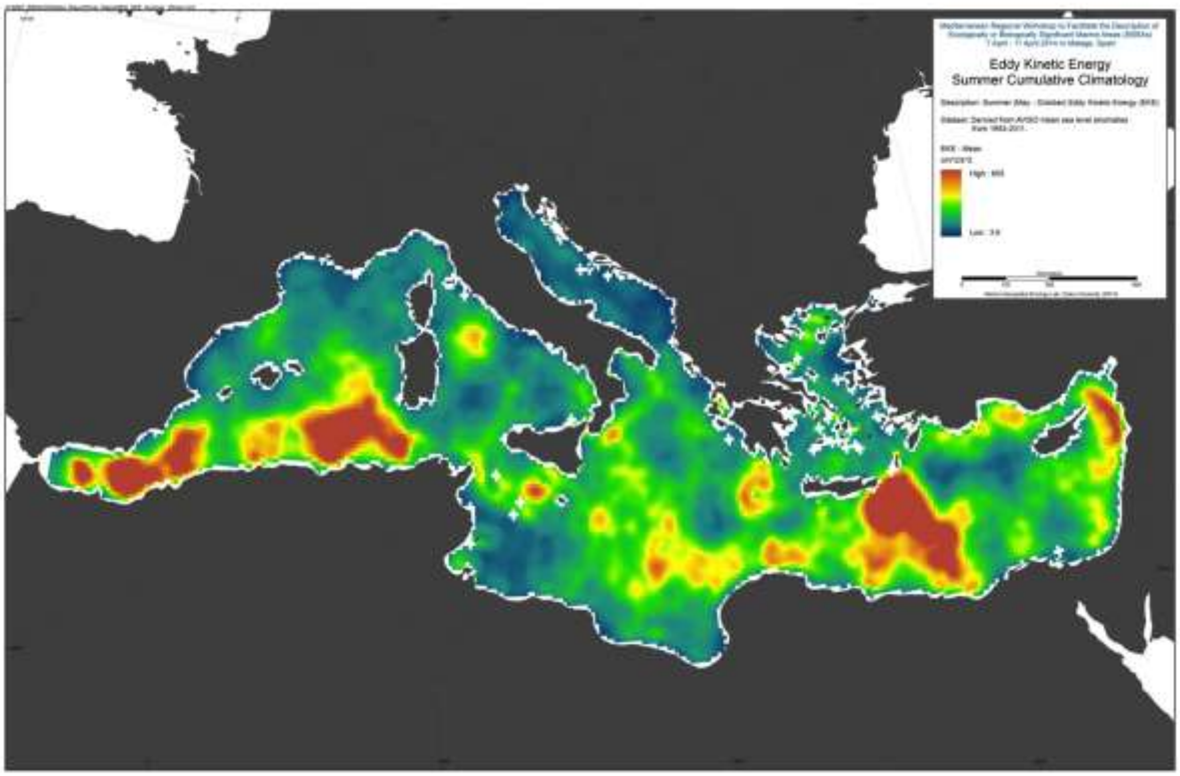


Figure 0-1 Eddy Kinetic Energy – Summer Cumulative Climatology (May – October)

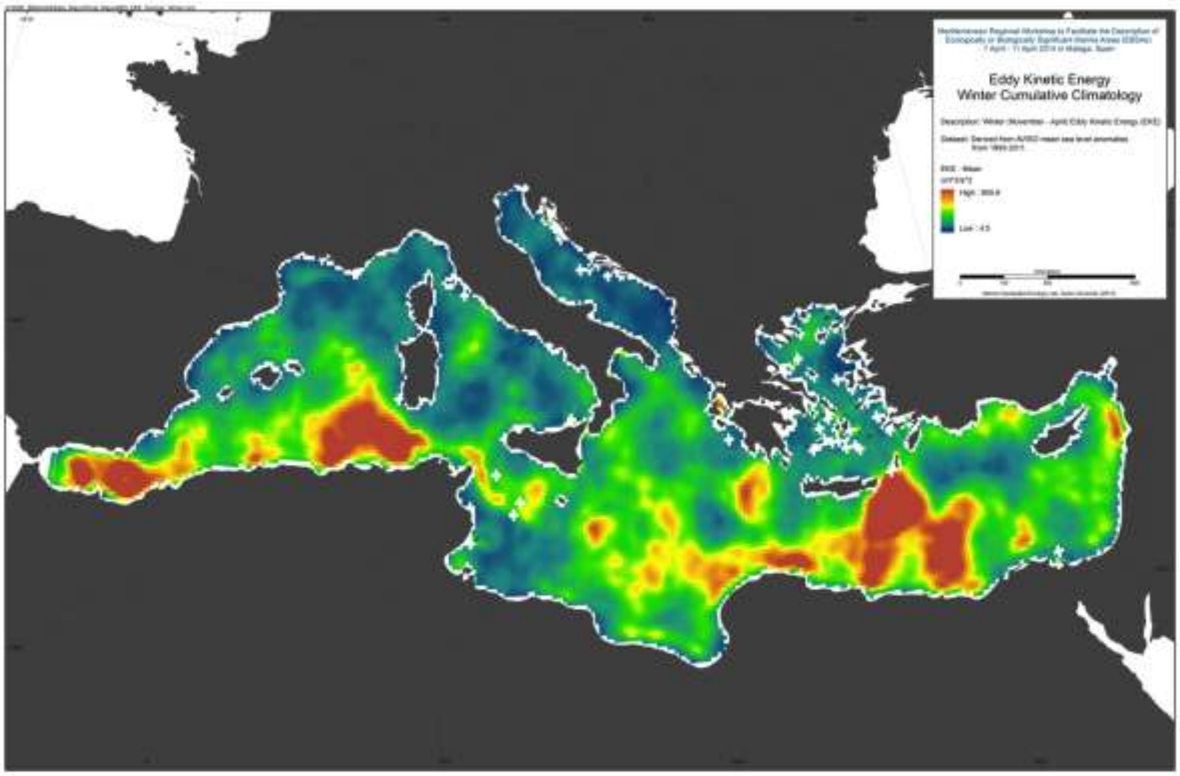


Figure 0-2 Eddy Kinetic Energy – Winter Cumulative Climatology (November – April)

4.14 Drifter Climatology of Near-Surface Currents

"Satellite-tracked SVP drifting buoys (Sybrandy and Niiler, 1991; Niiler, 2001) provide observations of near-surface circulation at unprecedented resolution. In September 2005, the Global Drifter Array became the first fully realized component of the Global Ocean Observing System when it reached an array size of 1250 drifters. A drifter is composed of a surface float which includes a transmitter to relay data, a thermometer which reads temperature a few centimeters below the air/sea interface, and a submergence sensor used to detect when/if the drogue is lost. The surface float is tethered to a subsurface float which minimizes rectification of surface wave motion (Niiler *et al.*, 1987; Niiler *et al.*, 1995). This in turn is tethered to a holey sock drogue, centered at 15 m depth. The drifter follows the flow integrated over the drogue depth, although some slip with respect to this motion is associated with direct wind forcing (Niiler and Paduan, 1995). This slip is greatly enhanced in drifters which have lost their drogues (Pazan and Niiler, 2000). Drifter velocities are derived from finite differencing their raw position fixes. These velocities, and the concurrent SST measurements, are archived at AOML's Drifting Buoy Data Assembly Center where the data are quality controlled and interpolated to 1/4-day intervals (Hansen and Herman, 1989; Hansen and Poulain, 1996)."

Reference:
Lumpkin, R. and Z. Garraffo, 2005: *Evaluating the Decomposition of Tropical Atlantic Drifter Observations*. J. Atmos. Oceanic Techn. I 22, 1403-1415.

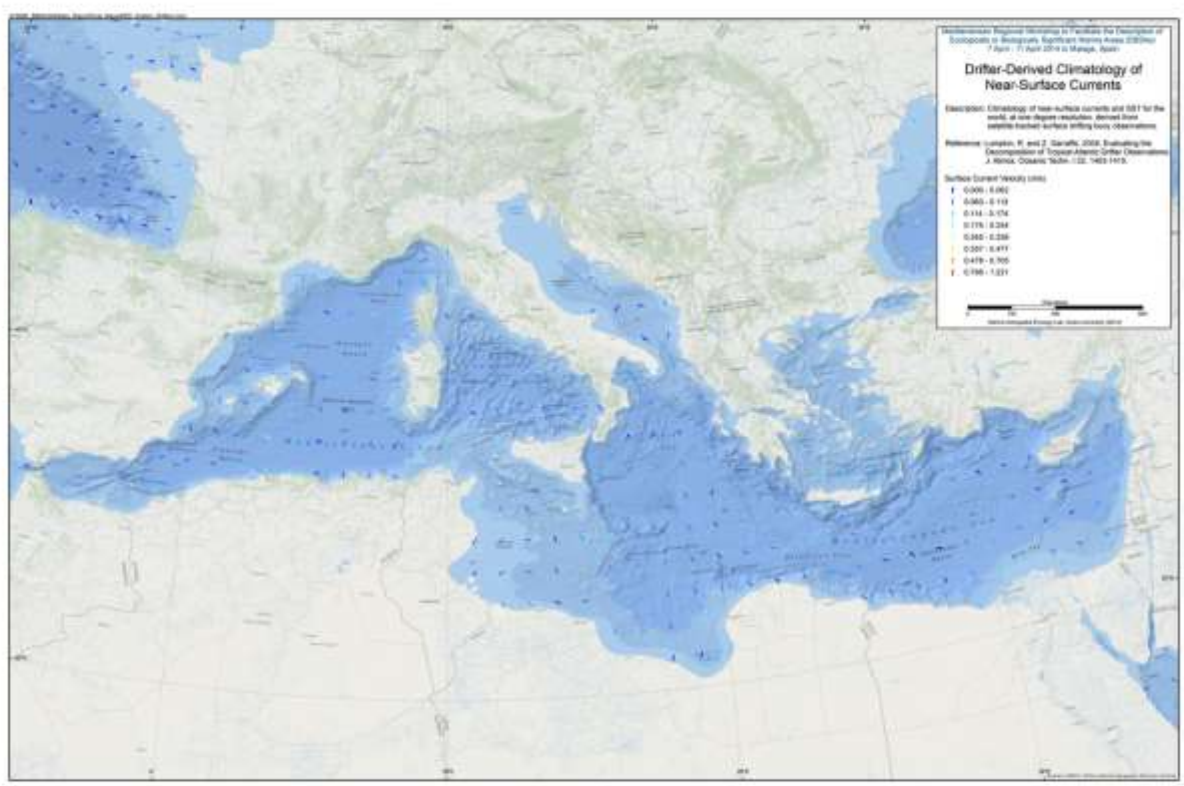


Figure 0-1 Drifter-Derived Climatology of Near-Surface Currents

4.15 Surface Current Velocity

The Archiving, Validation and Interpretation of Satellite Oceanographic data (AVISO) group publishes various products derived from satellite altimetry data, including estimates of sea surface height (SSH), geostrophic currents, wind speed modulus, and significant wave height. To maximize accuracy and spatial and temporal resolution and extent, AVISO merges observations from multiple satellites, including Topex/Poseidon, Jason-1, Jason-2, GFO, ERS-1, ERS-2, and EnviSat. Most Aviso products are one of these "merged" datasets, although a few products are based on observations from a single satellite.
(source: http://code.nicholas.duke.edu/projects/mget)

For this effort, two seasonal cumulative climatologies (1993 - 2011) for ocean current velocity were created using the “Create Climatological Rasters for Aviso Geostrophic Currents Product” tool with the Global DT-Upd Merged MSLA product and “mag” (for magnitude) geophysical parameter selected in the Marine Geospatial Ecology Tools (MGET) for ArcGIS (Roberts et al., 2010).

References:

Bonjean, F. and Lagerloef, G.S.E. (2002) Diagnostic Model and Analysis of the Surface Currents in the Tropical Pacific Ocean. J. Physical Oceano. 32(10):2938-2954.

Roberts, J.J., B.D. Best, D.C. Dunn, E.A. Treml, and P.N. Halpin (2010). Marine Geospatial Ecology Tools: An integrated framework for ecological geoprocessing with ArcGIS, Python, R, MATLAB, and C++. Environmental Modelling & Software 25: 1197-1207.

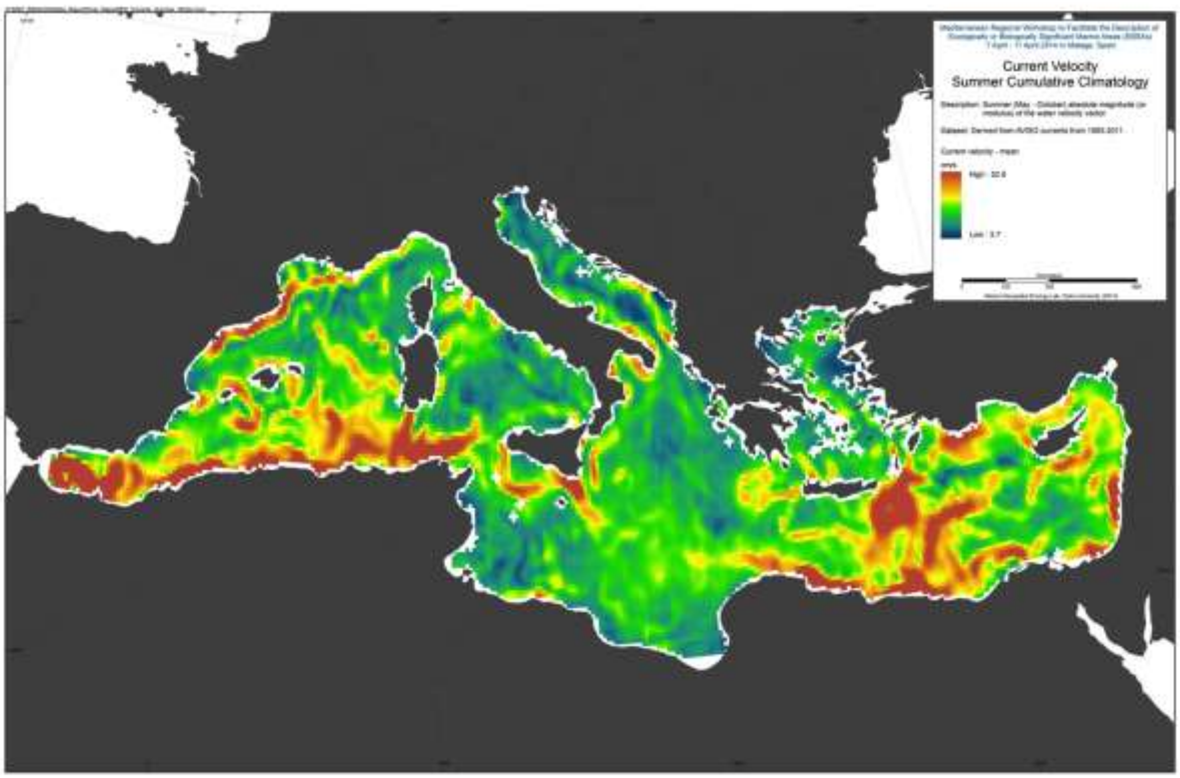


Figure 0-1 Surface Current Velocity – Summer Cumulative Climatology (May – October)

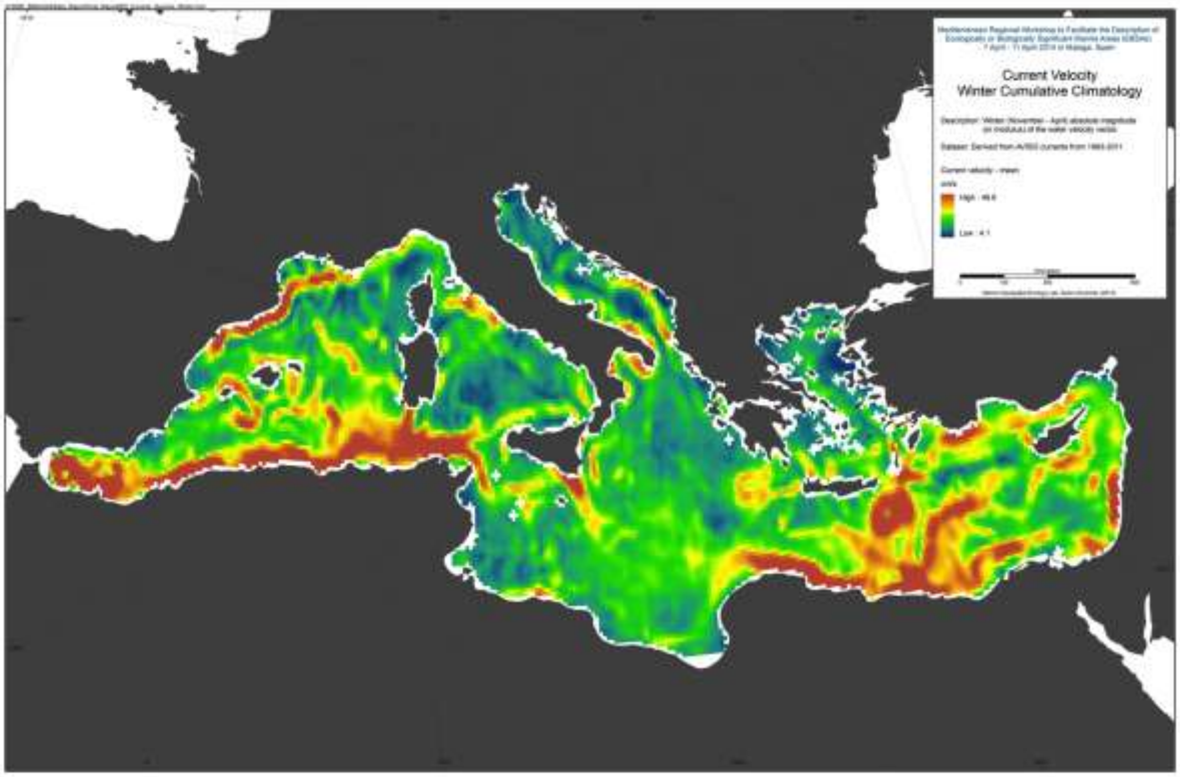


Figure 0-2 Surface Current Velocity – Winter Cumulative Climatology (November – April)

5. Additional Data Reports

Data reports from several ongoing scientific research programs and planning processes were provided for the review of workshop attendees.

5.1 Overview of scientific findings and criteria relevant to identifying SPAMIs in the Mediterranean , including the deep sea

Abstract:
"The Mediterranean Sea is at once highly treasured, and undervalued. While both ancient civilizations and modern societies have acknowledged the sea's importance, large swaths of the basin remain unmanaged and open to threats. Areas beyond national jurisdictions (ABNJ) currently constitute the bulk of the Basin's volume of 2.5 million square kilometres. This vast area is diverse, with pockets of relatively high productivity, and largely unprotected. Creating an ecological network of representative marine protected areas under the aegis of the Barcelona Convention and its Specially Protected Areas of Mediterranean Importance (SPAMIs) listings in the ABNJ could do much to preserve the integrity of this globally important region. This report describes the first phase in the process of developing such a representative network. We describe a strategic and hierarchical process of using existing databases and analyses to delineate areas of conservation importance, using the SPAMI criteria harmonised with criteria from other site selection methodologies to suit Mediterranean conditions and information availability." (Extracted from the Executive Summary. Modified slightly by removing paragraph marks.)

Reference:
UNEP-MAP-RAC/SPA. 2010. Overview of scientific findings and criteria relevant to identifying SPAMIs in the Mediterranean open seas, including the deep sea. By Notarbartolo di Sciara, G. and Agardy, T. Ed. RAC/SPA, Tunis: 71pp.

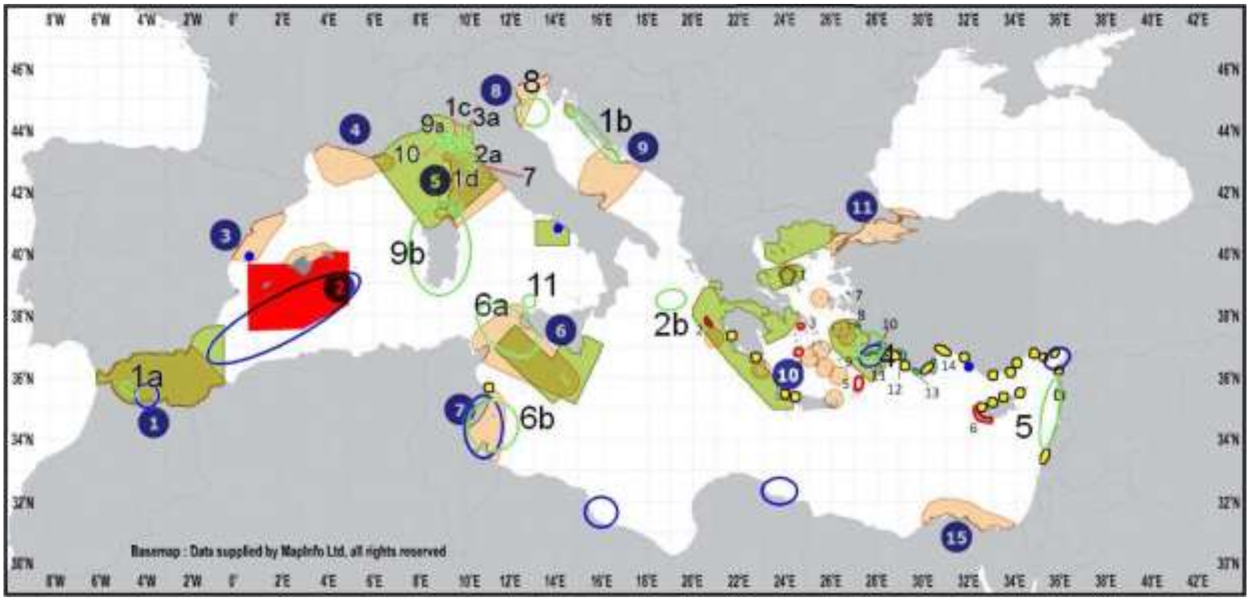


Figure 0-1 Cetaceans, monk seal, seabirds, turtles, sharks and Bluefin tuna critical habitats.

[from UNEP-MAP-RAC/SPA (2010) Fig. 2-9: "Cetaceans, monk seal, seabirds, turtles, sharks and bluefin tuna critical habitats. Cetaceans: light green polygons; monk seal: dark green small circles (established areas) and red small circles (areas to be established); birds: pink areas; turtles: yellow circles (nesting beaches) and blue circles (feeding areas); sharks: light green circles (nursery areas of various species); bluefin tuna: red polygon (from Hoyt and Notarbartolo di Sciara, 2008)."]

5.2 Mediterranean Pelagic Habitat: Oceanographic and Biological Processes, An Overview

Abstract:
"… This document is the first part of a project conducted by The World Conservation Union, IUCN, in an attempt to describe the functioning of the Mediterranean Sea and the threats to the ecosystem, and further to discuss solutions and provide a model for formulating protection plans. The high variability of the Mediterranean ecosystem brings the need for special actions and dynamic protection. …"

Reference:
Würtz, M. (2010). Mediterranean Pelagic Habitat: Oceanographic and Biological Processes, An Overview. Gland, Switzerland and Malaga, Spain: IUCN.

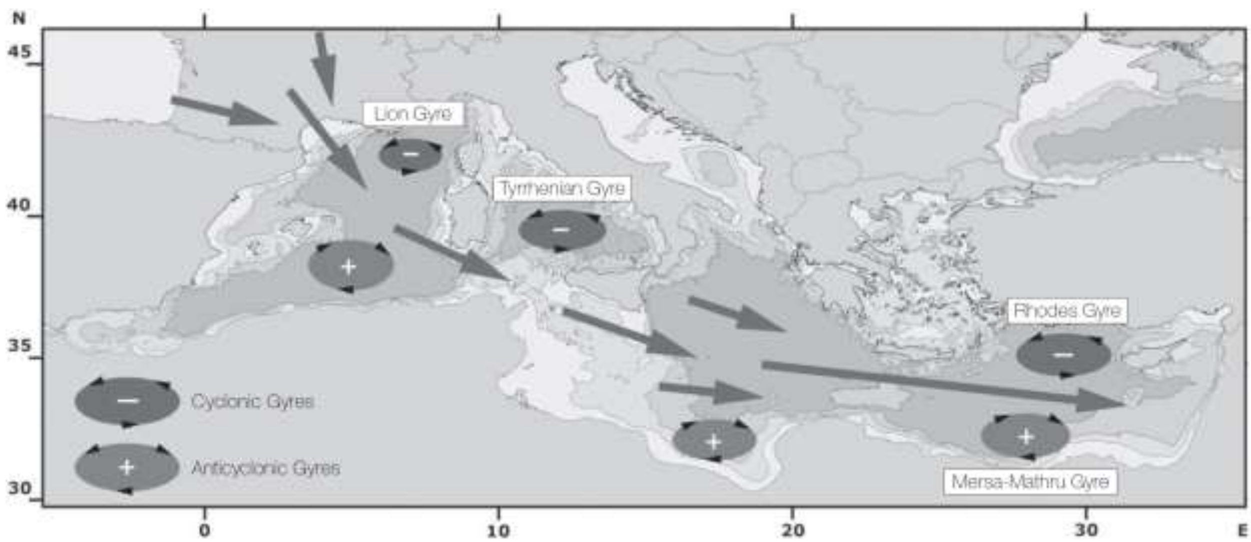


Figure 0-1 Gyres and eddies generated by wind stress (Mistral) along the longitudinal axis of the Mediterranean Sea

[from Würtz, M. (2010). "Fig. 6: Gyres and eddies generated by wind stress (Mistral) along the longitudinal axis of the Mediterranean Sea. "Gyres are spiral currents driven primarily by large-scale wind systems and constrained by the topography of land surrounding the basins. Large, permanent mesoscale eddies can be defined as gyres even if they may have seasonal topography in location and intensity. The direction of a gyre's rotation is determined by the effect of prevailing winds on the mainstream flow. Figure 6 schematically shows wind-driven gyres during winter in the Mediterranean Sea (Pinardi and Masetti, 2000). Their overall effect on water mass dynamics can be the same as explained above for eddies. It must be taken into account that a gyre can encompass two or more eddies with different effects."]

- Pinardi, N. and E. Masetti, 2000. Variability of the large scale general circulation of the Mediter ranean Sea from observations and modelling: a review. Palaeogeogr., Palaeoclimatol., Palaeoecol., 158, 153–173.

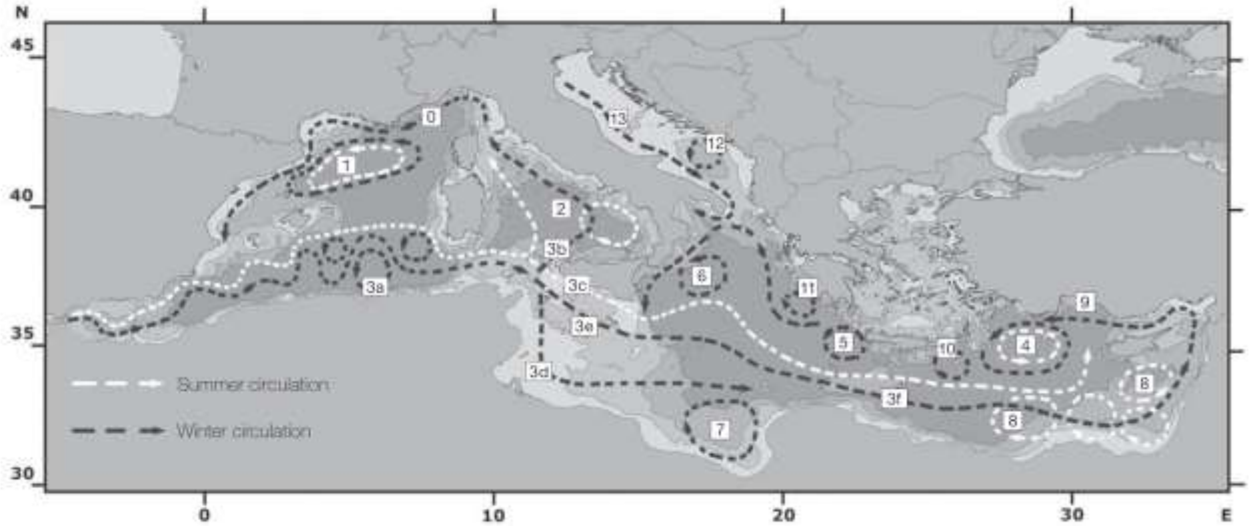


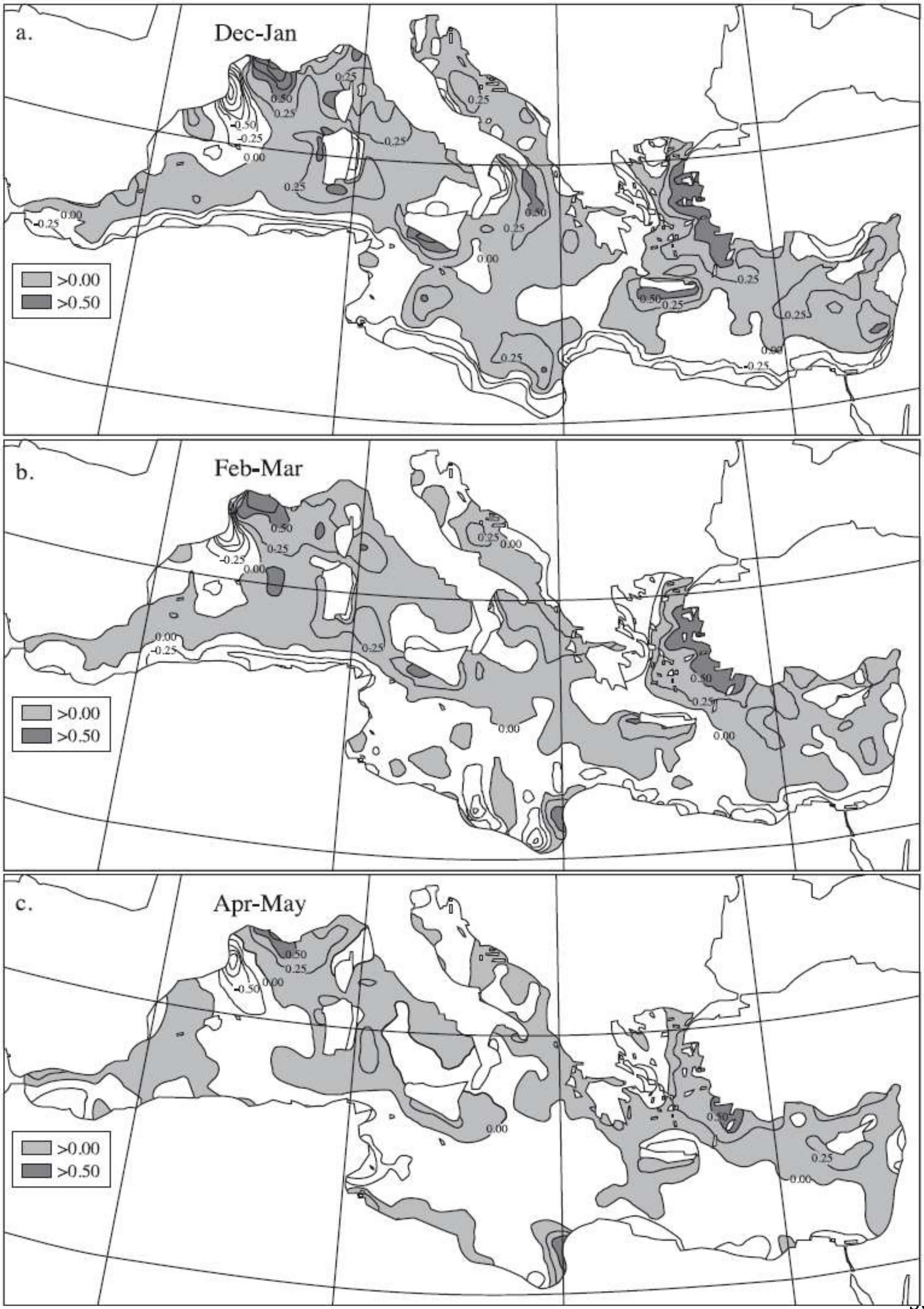
Figure 0-2 Simplified scheme of the Mediterranean's general circulation

[from Würtz, M. (2010). "Fig. 9: Simplified scheme of the Mediterranean's general circulation.

0) Ligurian-Provençal current,
1) Lion Gyre,
2) Tyrrhenian cyclonic circulation with summer weakening and eastern anticyclone,
3a) Algerian current eddies,
3b-e) Atlantic-Ionian stream branches,
3f) Mid-Mediterranean jet,
4) Rhodes Gyre,
5) Western Cretan Gyre,
6) Western Ionian Gyre,
7) Gulf of Syrte anticyclonic eddy,
8) Shikmona and Mersa Matruh gyre system,
9) Cilician and Asia Minor current,
10) Iera-Petra Gyre,
11) Pelops Gyre,
12) Southern Adriatic Gyre,
13) Western Adriatic coast current
(from Pinardi and Masetti, 2000, modified).

…The overall circulation structure is summarized in Fig. 9 for the surface water, and in Fig. 10 for the intermediate depths. In both the western and eastern basins, the AW current (100-200 m deep) flows along slopes, creating counter-clockwise (cyclonic) gyres, which can meander, bifurcate into veins or form branches because of seabed and coastal topography. To the south of each basin, parts of these gyres are markedly unstable and generate mesoscale anticyclonic eddies."]

- **Pinardi, N. and E. Masetti, 2000. Variability of the large scale general circulation of the Mediterranean Sea from observations and modelling: a review. Palaeogeogr., Palaeoclimatol., Palaeoecol., 158, 153–173.**


a.
Dec-Jan
>0.00
>0.50
b.
Feb-Mar
>0.00
>0.50
c.
Apr-May
>0.00
>0.50

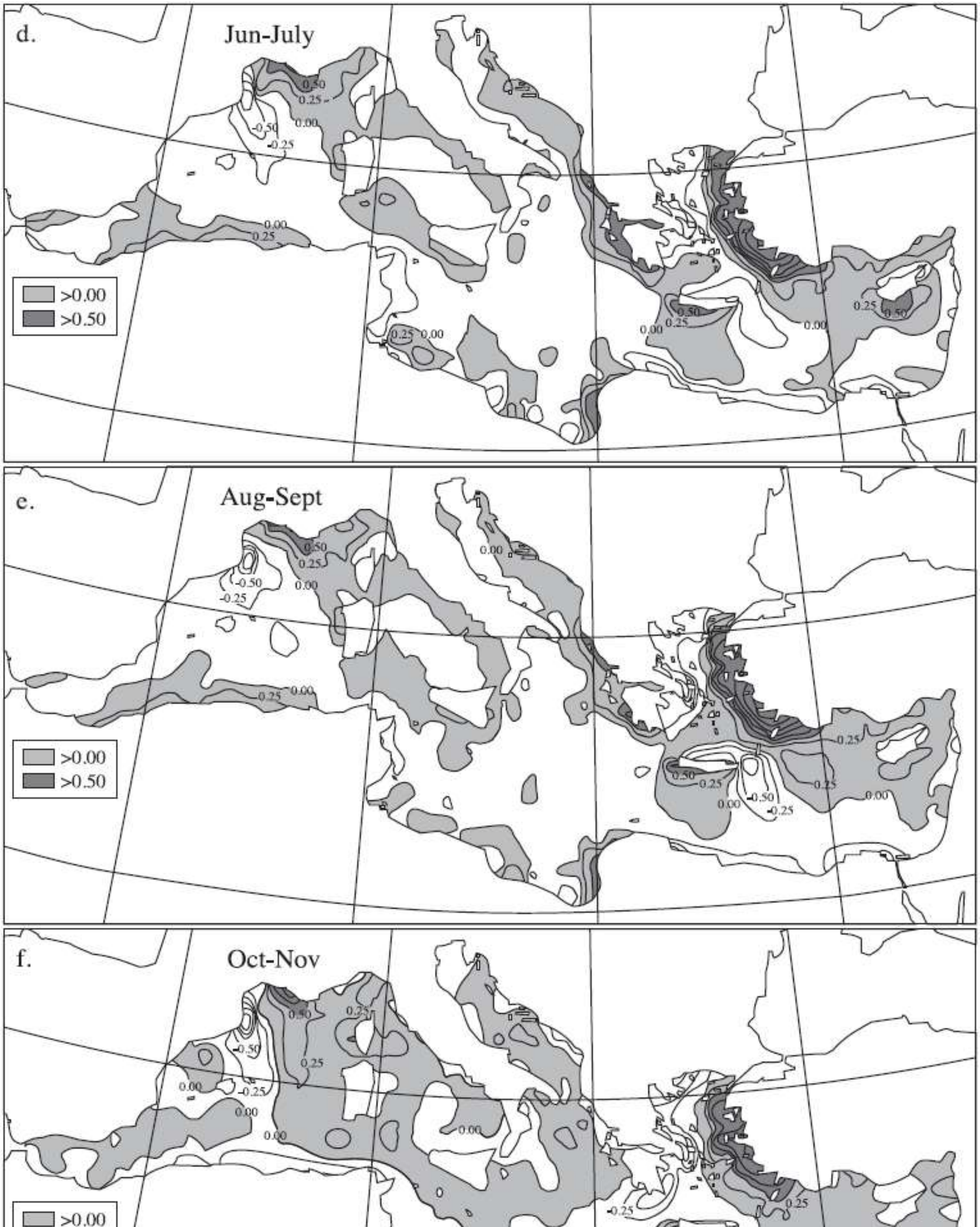

d.
Jun-July
>0.00
>0.50
e.
Aug-Sept
>0.00
>0.50
f.
Oct-Nov
>0.00
>0.50

Figure 0-3 Seasonal variation of wind-driven upwelling zones (shaded areas) and downwelling (unshaded areas) in the Mediterranean Sea

[from Würtz, M. (2010). "Fig. 11: Seasonal variation of wind-driven upwelling zones (shaded areas) and downwelling (unshaded areas) in the Mediterranean Sea. Darker shading indicates greater upward velocities (from Bakun and Agostini, 2001, Fig. 4 pages 252-253).

Indeed, upwelling and downwelling maps for the whole Mediterranean have been already provided by Bakun and Agostini (2001) from the Comprehensive Ocean-Atmosphere Data Set database (Fig 11). The upwelling signatures by cyclonic eddy interactions with other oceanographic structures (anticyclonic vortexes, fronts, bottom topography, chlorophyll concentration, etc.) can also be deduced from more recent satellite imagery. The general patterns, as obtained from Mercator Ocean and NASA's Giovanni satellite images for the year 2007, are presented and discussed in the following paragraphs."]

- Bakun, A. and V.N. Agostini, 2001. Seasonal patterns of wind-induced upwelling/downwelling in the Mediterranean Sea. Sci. Mar., 65 (3), 243-257.

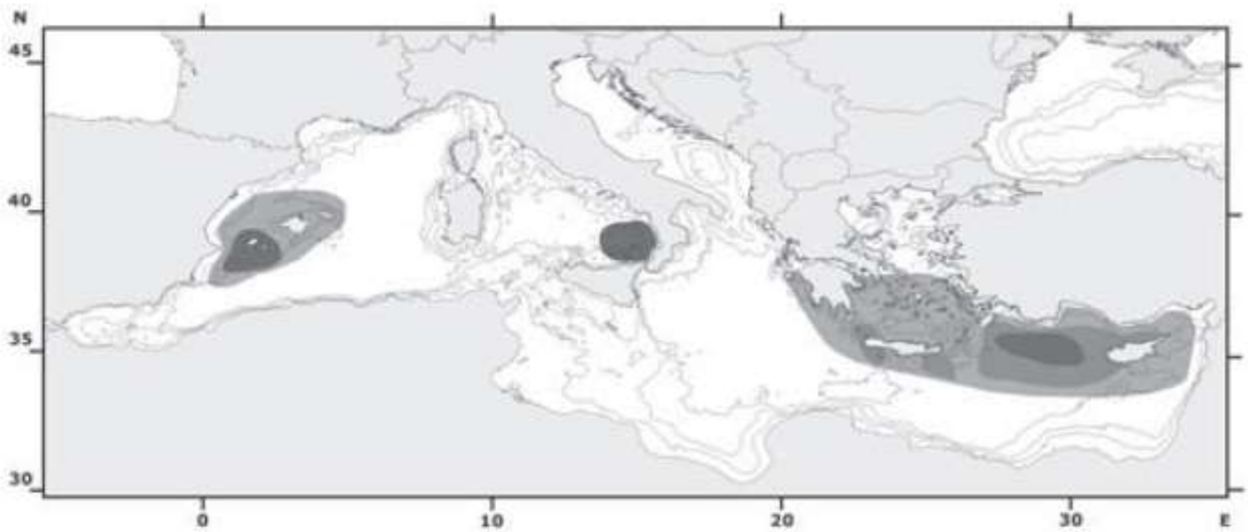


Figure 0-4 Mediterranean swordfish breeding and spawning areas.

[from Würtz, M. (2010). "Fig. 56: Mediterranean swordfish breeding and spawning areas. Grey intensity is proportional to the importance of the area for swordfish reproduction (from Romeo et al., 2008, Tserpes et al., 1995, de la Serna et al., 2008, modified)."]

- Romeo, T., Consol, P., Greco, S., Canese, S. and F. Andaloro, 2008. Swordfish (Xiphias gladius, Teleostea: Xiphiidae) surface behavior during reproductive period in the central Mediterranean sea (southern Tyrrhenian). JMBA2-Biodiversity Records, 1-7. Published on-line.

- Tserpes, G. and N. Tsimenides, 1995. Determination of age, growth of swordfish, Xiphias gladius L., 1758, in the eastern Mediterranean using anal-fin spines. Fish. Bull., 93, 594–602.

- de la Serna, J. M., Ortiz de Urbina, J. M. and S. G. Barcelona, 2008. Factores estratégicos y tecnológicos que influyen en la captura de especies asociadas en la pesquería de pez espada con palangre de superficie en el Mediterráneo. Collect. Vol. Sci. Pap. ICCAT, 62(4), 1039-1051.

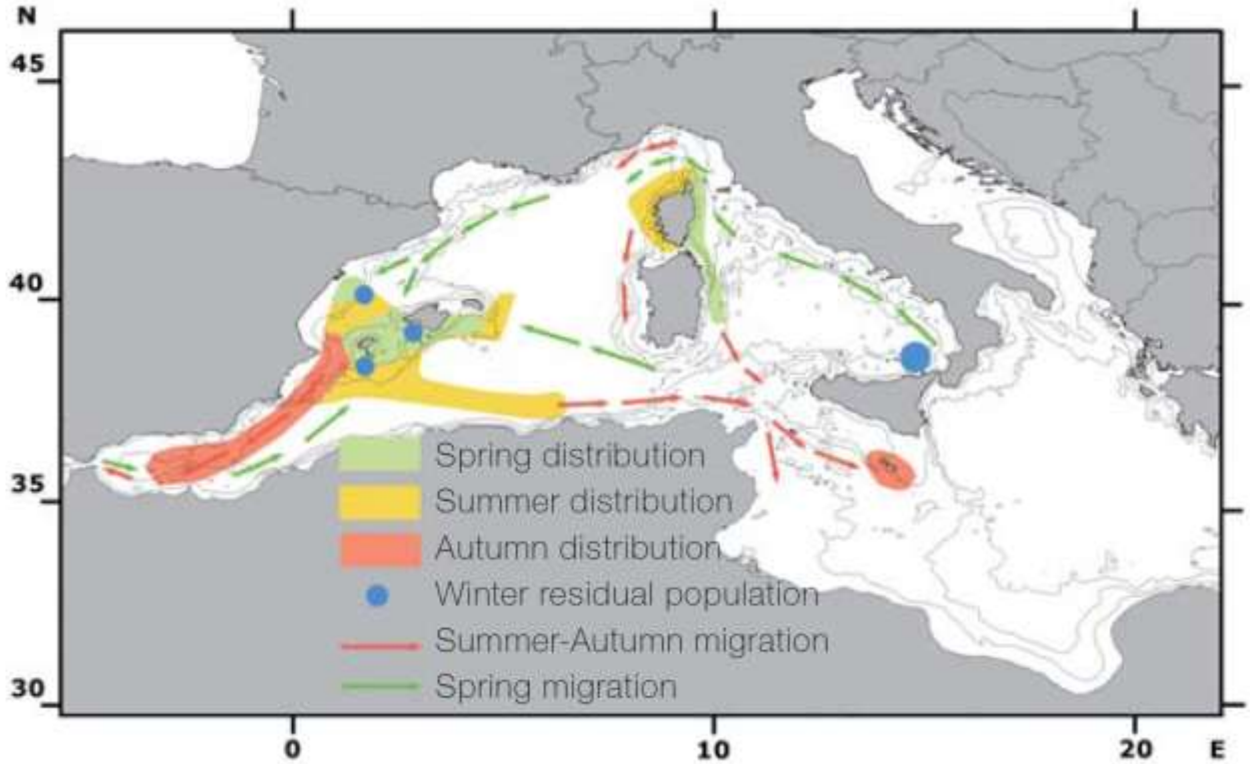


Figure 0-5 Loggerhead turtle (*Caretta caretta*) migration routes and distribution in the western and central Mediterranean Sea

[from Würtz, M. (2010). "Fig. 61 (p. 58): Loggerhead turtle (*Caretta caretta*) migration routes and distribution in the western and central Mediterranean Sea. From Camiñas (2004), modified."]

- **Camiñas, J.A., 2004. Sea turtles of the Mediterranean Sea: population dynamics, sources of mortality and relative importance of fisheries impacts. FAO Fish. Rep., 738 Suppl., 27-84.**

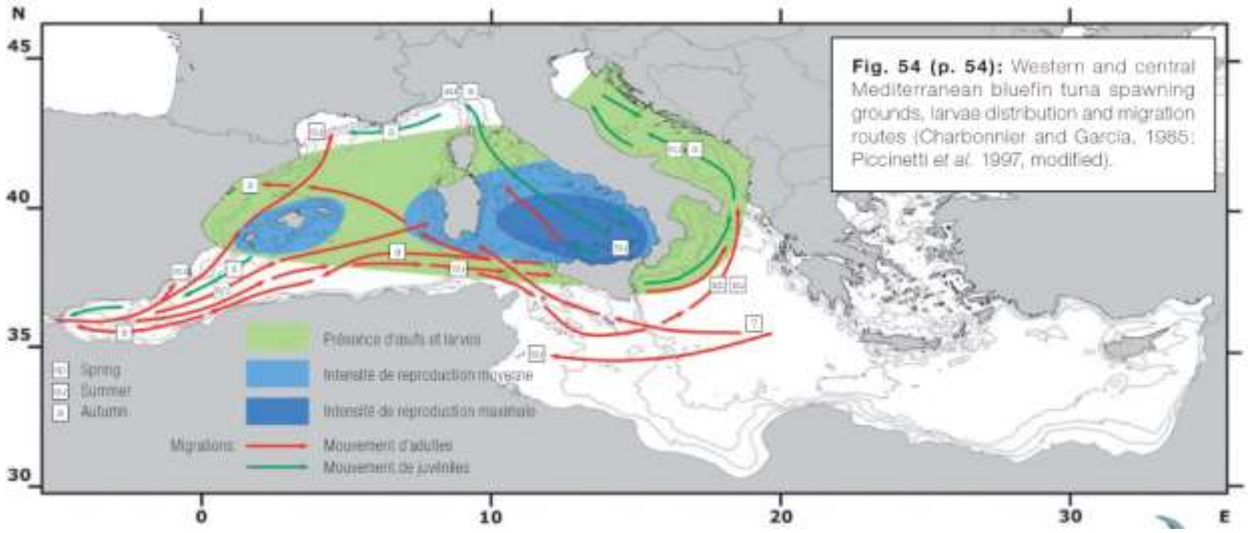


Figure 0-6 Western and central Mediterranean bluefin tuna spawning grounds, larvae distribution and migration routes

[from Würtz, M. (2010). “Fig. 54 (p. 54): Western and central Mediterranean bluefin tuna spawning grounds, larvae distribution and migration routes (Charbonnier and Garcia, 1985; Piccinetti et al. 1997, modified).”]

- **Charbonnier, D. and S. Garcia, 1985. Atlas of fisheries of the western and central Mediterranean. FAO CGPM-GFCM, Rome.**
- **Piccineti, C., Piccineti-Manfrin, G. and S. Soro, 1997. Résultats d’une campagne de recherche sur les larves de Thonidés en Méditerranée. Collect. Vol. Sci. Pap. ICCAT, 46(2), 207-214.**

5.3 Mediterranean deep-sea ecosystems: an overview of their diversity, structure, functioning and anthropogenic impacts, with a proposal for conservation

Forward:
"… The Malaga Workshop on High Seas Protected Areas (January 2003) stressed, *inter alia*, that the level of scientific knowledge of the high seas, and the deep-sea in particular, needs to be raised. The present document therefore arises from a joint initiative between the WWF Mediterranean Programme and the IUCN Centre for Mediterranean Cooperation, to address these issues at a regional level; it contains, for the first time, a comprehensive proposal for conservation firmly based on the scientific information currently available."

Part I Reference:
Cartes, J.E., F. Maynou, F. Sardà, J.B. Company, D. Lloris and S. Tudela (2004). The Mediterranean deep-sea ecosystems: an overview of their diversity, structure, functioning and anthropogenic impacts. In: The Mediterranean deep-sea ecosystems: an overview of their diversity, structure, functioning and anthropogenic impacts, with a proposal for conservation. IUCN, Málaga and WWF, Rome. pp. 9-38.

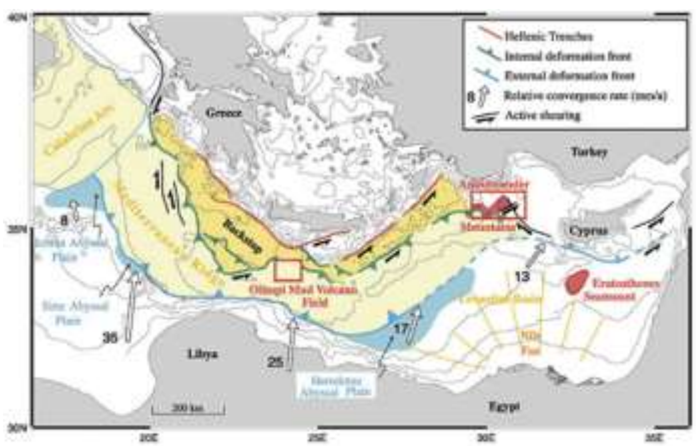


Figure 0-1 The Mediterranean Ridge

[from Cartes et al. (2004). "Box 7. The Mediterranean Ridge: The Mediterranean Ridge consists of a more than 1500 km long tecto-sedimentary-accretionary prism, which results from the offscraping and piling up of thick sedimentary sections, and which runs from the Ionan basin, to the west, to the Cyprus arc to the east. This complex was created by subduction of the African plate beneath the Eurasian plate to the north. It is an extensive fold-fault system corresponding to recent uplift and folding of past abyssal plains. Credit: Loubrieu B. and Satra C., 2001."]

- **Loubrieu B. and Satra C., 2001. Cartographie par sondeur multifaisceaux de la Ride Méditerranéenne et des domaines voisins. Comité Français de Cartographie, n°168, pp. 15-21**

Part II Reference:
Tudela S., F. Simard, J. Skinner and P. Guglielmi (2004). The Mediterranean deep-sea ecosystems: a proposal for their conservation. In: The Mediterranean deep-sea ecosystems: an overview of their diversity, structure, functioning and anthropogenic impacts, with a proposal for conservation. IUCN, Málaga and WWF, Rome. pp. 39-47.

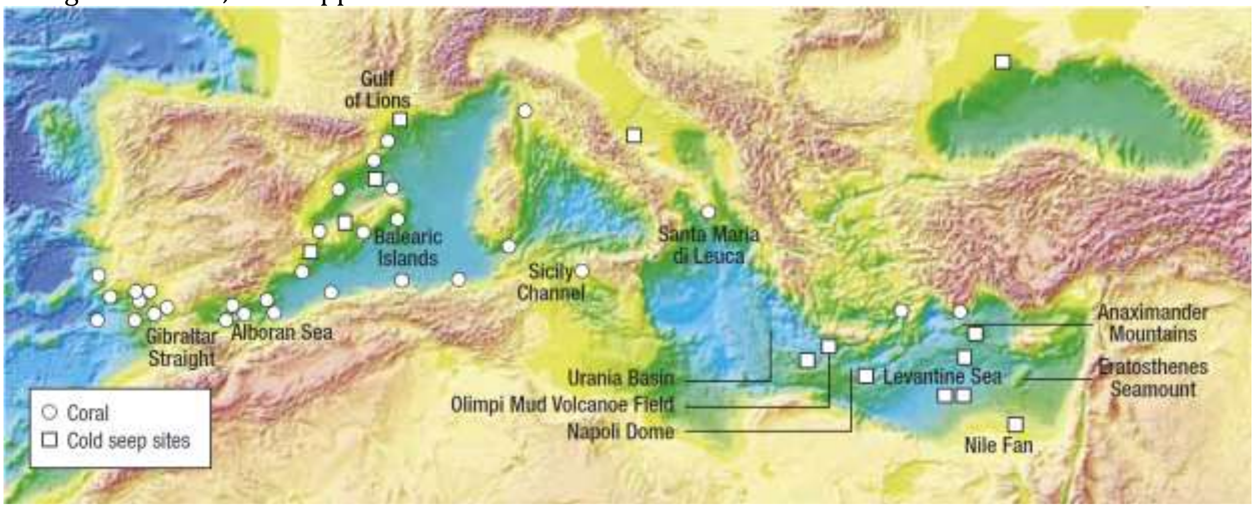


Figure 0-2 Presently known distribution of deep-sea unique biocenoses in the Mediterranean and adjacent Atlantic waters

[from Tudela et al. (2004). "Fig.9. Presently known distribution of deep-sea unique biocenoses in the Mediterranean and adjacent Atlantic waters. Credit: Hermes (Hotspot Ecosystem Research on the Margins of European Seas), VI FP European Commission Project; and An Interactive Global Map of Sea Floor Topography Based on Satellite Altimetry & Ship Depth Soundings. Meghan Miller, Walter H.F. Smith, John Kuhn, & David T. Sandwell. NOAA Laboratory for Satellite Altimetry. http://ibis.grdl.noaa.gov. Modified."]

5.4 Satellite Telemetry Applied to Fin Whales in the Mediterranean Sea

Background:
"The Tethys Research Institute has conducted, as commissioned by the Direzione Generale Protezione della Natura del Ministero dell'Ambiente e della Tutela del Territorio e del Mare (MATTM), two campaigns of satellite telemetry of fin whale (*Balaenoptera physalus*) in the Mediterranean Sea, with the aim of gaining insights on the species fine scale habitat use as well as migration patterns and routes across the Region.

In fact, although a series of research activities have already produced detailed information on the presence, distribution, abundance, density, habitat use and diving behavior for the species, and despite the previous tagging effort, information on movements and migrations of fin whales within the Basin is still rather limited.

For many populations of large cetaceans, the relationship between the summer feeding and the winter breeding grounds is unknown and mostly the subject of speculation. Gaining knowledge on the geographic range, seasonal distribution, population structure, and migration routes is thus essential to identify the potential detrimental effects of anthropogenic activities within the area where those species occur. The current lack of such knowledge hampers the difficulties to develop and implement effective mitigation measures and long-term conservation efforts of these marine mammals within the Mediterranean Sea.

Furthermore, as strongly emphasized during the joint IWC - ACCOBAMS workshop organized in Beaulieu-sur-Mer in September 2010, there is an urgent need to collect information on the population structure of Mediterranean fin whales, important for the correct interpretation of the estimates of abundance and density and to evaluate possible trends is space and time.

Finally, the activities carried out and the data collected so far are therefore not only particularly relevant in terms of conservation and management of the species, but also central in terms of capacity building and education. In fact, in light of the many collaborations established with established national and international professionals and organisations, and given the high profile of the innovative tools used, this project could contribute to the ongoing discussions within the international scientific community on this approach to cetacean research, and represent a leading example for the Mediterranean Region."

Reference:
UNEP-MAP-RAC/SPA. 2014. Satellite telemetry applied to fin whales in the Mediterranean Sea. Draft internal report for the purposes of the Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas, Malaga, Spain, 7-11 April 2014.

Figure 0-1 Fin whale tagging study area in the North-Western Ligurian Sea

Figure 0-2 Fin whale tagging study area in the Sicily Channel

5.5 Seabird Status and Conservation in the Adriatic Sea

Introduction:

"One of the main characteristics of the Mediterranean marine avifauna is the high number of endemic taxa, despite the low diversity and small population densities; this is consistent with a low-productivity ecosystem compared to open oceans (Coll et al. 2010). All four Procellariiforms (petrels and shearwaters) present in the Mediterranean constitute endemic taxa: two at species level (*Puffinus mauretanicus* and *Puffinus yelkouan*) and two at subspecies level (*Calonectris diomedea*, *Hydrobates pelagicus melitensis*). Besides, one endemic cormorant (Shag *Phalacrocorax aristotelis desmarestii*), three gulls (Mediterranean *Larus melanocephalus*, Audouin's *Larus audouinii* and Yellow-legged *Larus michahellis michahellis*) and one tern (Lesser-crested *Sterna bengalensis emigrata*) also originate from the Mediterranean region.

Another characteristic of the Mediterranean marine avifauna is its long-term exposure to human influence. Through history, some aspects of human activity have had positive effects on seabirds (e.g. the creation of specific habitats like rice fields and salt pans, the provision of food through fishing discards, etc.) but overall and in the long-term the result of the human-seabird interaction has been detrimental for seabirds. Their current population sizes are nowhere near what they were before the 'humanisation' of the Mediterranean.

Today, despite the legal protection and the positive management of seabird colonies, several threats imperil the future of this unique seabird community, namely the interaction of seabirds with fisheries (causing unnecessary mortality and impacting heavily on their populations), overfishing (which decimates fish populations and heavily alters the habitats where marine organisms live) and climate change (causing disruptions in the ecosystem).
The Protocol Concerning Mediterranean Specially Protected Areas and Biological Diversity in the Mediterranean has two powerful tools to revert the negative trends of most Mediterranean seabird species: the establishment of a Specially Protected Areas of Mediterranean Importance (SPAMIs) list, and the protection and conservation of the species. This report focuses on the seabird species that: (a) are listed among the 25 of Annex II List of Endangered or Threatened Species; and (b) are present in our focus area, the Adriatic Sea (fig. 2).

The Adriatic Sea is an enclosed water mass in the relatively impoverished Mediterranean Sea. Its oceanography is dominated by shallow depths (average of ca. -250 m) and the discharge of rivers concentrated on the north western coast (the Po amounts to 28% of the total discharge). It is a biologically distinct and a hotspot of diversity for many taxa, although the seabird community in the Adriatic Sea only represents a small fraction of all the seabirds found in the Mediterranean. The small size and the absence of significant oceanographic features in the Adriatic explain the small size of its seabird populations. However, given the high level of endemism of the Mediterranean seabird fauna and its conservation value, those populations need to be maintained for strategic reasons."

Reference:

UNEP-MAP-RAC/SPA. 2014. Seabird status and conservation in the Adriatic Sea. Draft internal report for the purposes of the Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas, Malaga, Spain, 7-11 April 2014

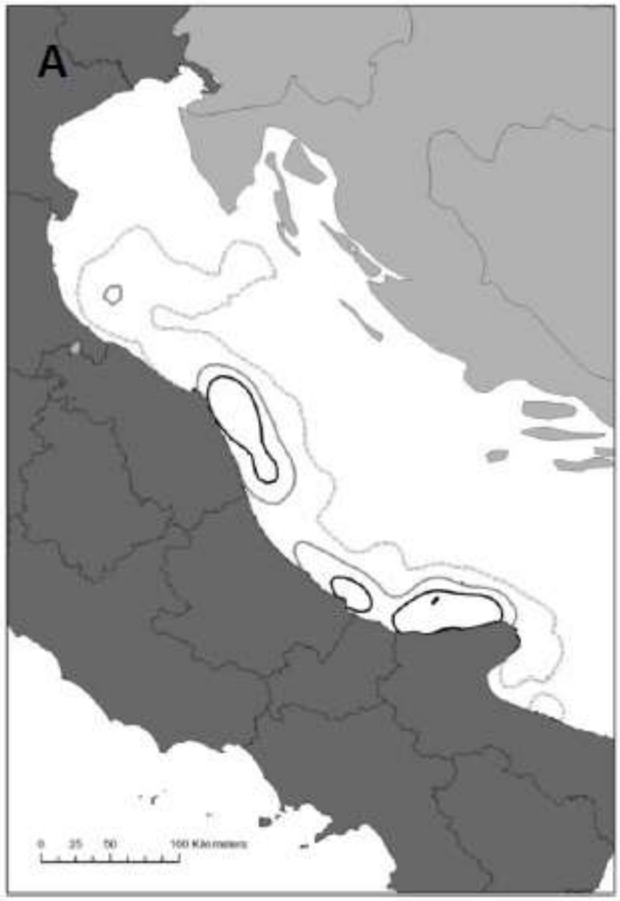


Figure 0-1 50%, 75% and 95% kernels of GPS positions of foraging Cory´s shearwaters from the islands of Tremiti in the Adriatic Sea during incubation in 2009-2010 (26 birds)

[from *UNEP-MAP-RAC/SPA* (2014) "Fig. 1 shows 50%, 75% and 95% kernels of GPS positions of foraging Cory´s shearwaters from the islands of Tremiti in the Adriatic Sea during incubation in 2009-2010 (26 birds) (Cecere et al. 2012)"]

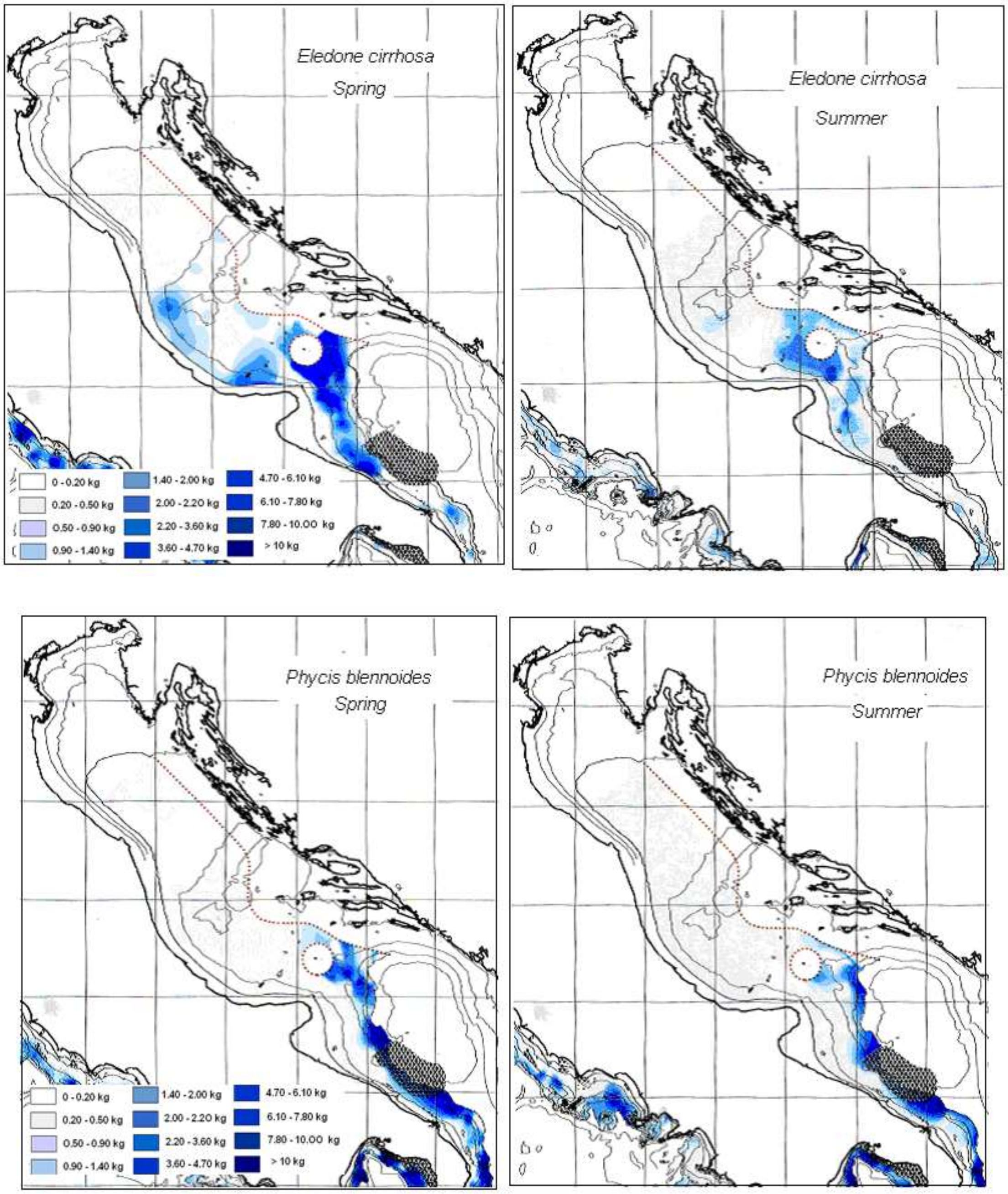
5.6 Status and Conservation of Fisheries in the Adriatic Sea

Introduction:
"The Adriatic Sea is a semi-enclosed basin within the larger semi-enclosed sea constituted by the Mediterranean, it extends over 138000 km^2 and is characterised by the largest shelf area of the Mediterranean, which extends over the Northern and Central parts where the bottom depth is no more than about 75 and 100 m respectively, with the exception of the Pomo/Jabuka Pit (200-260 m) in the Central Adriatic. The Southern Adriatic has a relatively narrow continental shelf and a marked, steep slope; it reaches the maximum depth of 1223 m.

In the Adriatic Sea all types of bottom sediments are found, muddy bottoms are mostly below a depth of 100 m, while in the Central and Northern Adriatic the shallower sea bed is characterized by relict sand. The Eastern and Western coasts are very different; the former is high, rocky and articulated with many islands, the Western coast is flat and alluvial with raised terraces in some areas. The hydrography of the region is characterized by water inflow from the Eastern Mediterranean (entering from the Otranto channel along the Eastern Adriatic coast) and fresh water runoff from Italian rivers. These features seasonally produce both latitudinal and longitudinal gradients in hydrographic characteristics along the basin (32, 33).

For the purpose of fisheries management the fisheries of the Adriatic basin are divided in two Geographical Sub-Areas (GSA): the GSA 17 (North and Central Adriatic) and the GSA 18 (Southern Adriatic). Croatia, Bosnia-Herzegovina, Italy and Slovenia border the GSA 17 (North and Central Adriatic), Albania, Italy (South-Eastern coast) and Montenegro are included in the GSA 18 (fig. 1)."

Reference:
UNEP-MAP-RAC/SPA. 2014. Status and Conservation of Fisheries in the Adriatic Sea. Draft internal report for the purposes of the Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas, Malaga, Spain, 7-11 April 2014.


Eledone cirrhosa
Spring
0 - 0.20 kg
0.20 - 0.50 kg
0.50 - 0.90 kg
0.90 - 1.40 kg
1.40 - 2.00 kg
2.00 - 2.20 kg
2.20 - 3.60 kg
3.60 - 4.70 kg
4.70 - 6.10 kg
6.10 - 7.80 kg
7.80 - 10.00 kg
> 10 kg
Eledone cirrhosa
Summer
Phycis blennoides
Spring
0 - 0.20 kg
0.20 - 0.50 kg
0.50 - 0.90 kg
0.90 - 1.40 kg
1.40 - 2.00 kg
2.00 - 2.20 kg
2.20 - 3.60 kg
3.60 - 4.70 kg
4.70 - 6.10 kg
6.10 - 7.80 kg
7.80 - 10.00 kg
> 10 kg
Phycis blennoides
Summer

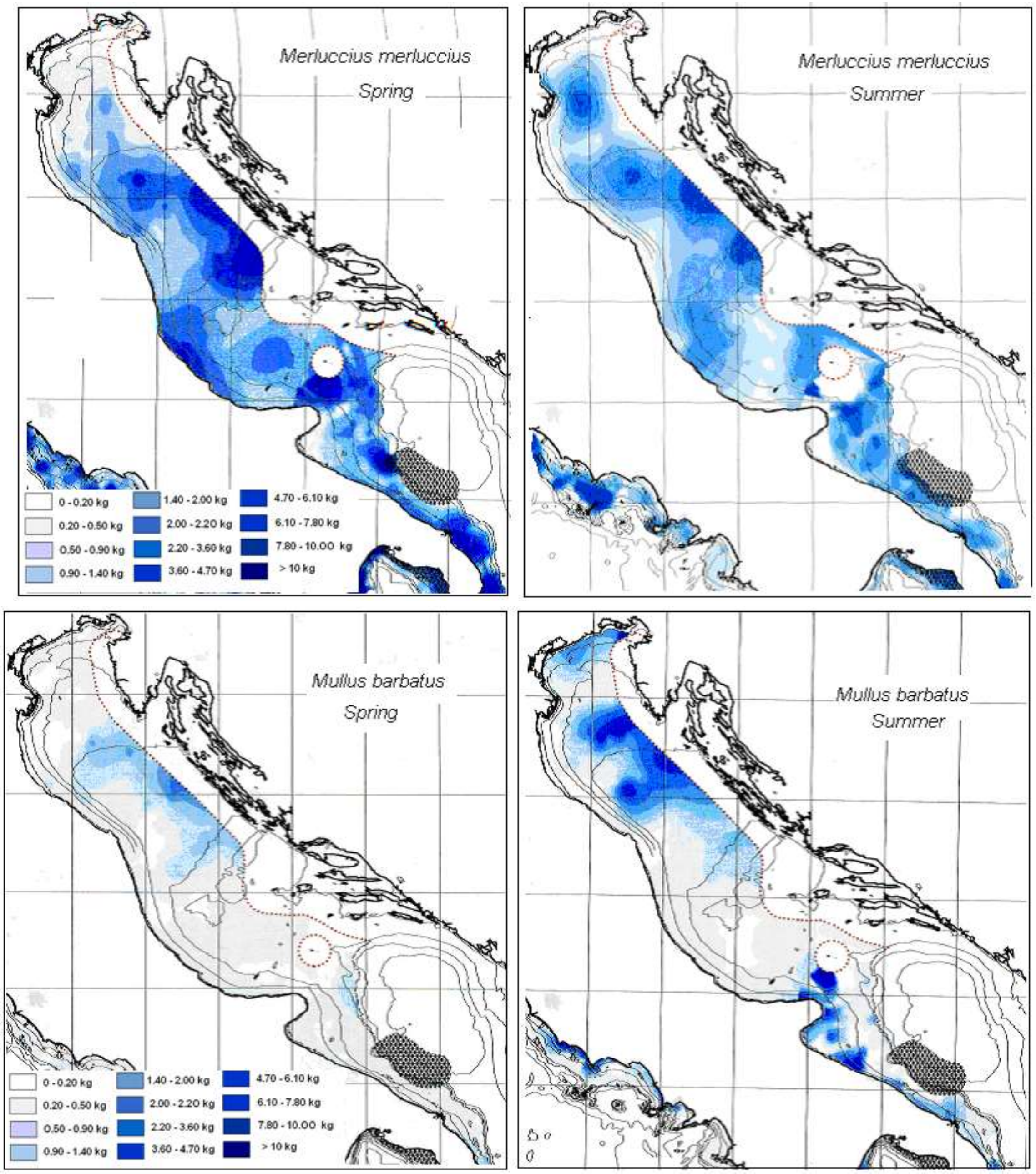


Figure 0-1 Geographical distribution of several primary species fished in the western Adriatic

[from *UNEP-MAP-RAC/SPA (*2014) "Fig.2 Geographical distribution of some main species fished in the western Adriatic (4)"]

5.7 Status of Seabirds in the Alboran Sea

Introduction:
"The Mediterranean basin is recognised as a major biodiversity hotspot, with a high degree of endemic species both inland and at sea (CEPF 2010). Regarding the marine ecosystem, the Mediterranean Sea holds 7.5% of the world's marine fauna and 18% of marine flora. This remarkable diversity of species is found in only 0.8 percent of the surface area and 0.3 percent of the volume of the World's oceans (Bianchi & Morri 2000, Hofrichter 2001). The isolation of the basin is reflected in the high degree of endemism, estimated to be roughly 28%. Most of the biodiversity is concentrated in shallow coastal areas, although there are key biodiversity elements associated with deep waters, as well as with offshore pelagic waters (Hofrichter 2001).

Since 2008, the Regional Activity Centre for Specially Protected Areas (RAC-SPA) under the framework of the Mediterranean Action Plan (MAP) of the United Nations Environment Programme (UNEP) has been implementing the "MedOpenSeas" project to identify and establish Marine Protected Areas (MPAs) in the offshore areas, including the deep seas. The primary objective of this project is to promote the establishment of a representative ecological network of MPAs in the Mediterranean within the framework of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol) on the establishment of Specially Protected Areas of Mediterranean Importance (SPAMIs). The first phase of the project, completed in late 2009, led to the identification of twelve priority conservation areas in the offshore areas, including the deep seas. These priority areas could become candidates for SPAMI listing and/or be recommended for inclusion in other frameworks, such as Ecologically or Biologically Significant Areas (EBSAs) developed under the Convention on Biological Diversity (CBD). The aim of the project's second phase, completed in early 2012, was to support neighbouring Parties of the above-mentioned priority areas in evaluating and potentially presenting these sites as candidate(s) for inclusion in the SPAMI List, in accordance with the provisions of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean.

The present document corresponds to the third phase, which focuses on the spatial planning and evaluation of three priority areas: Adriatic Sea, Alboran Sea and the Sicily Channel/Tunisian Plateau. In particular the Alboran Sea is addressed here, with regard to the seabird community. Specific aims of the report were settled as follows:

(1) Assess the population status of the seabird species which frequent the priority area (ecology, behaviour, breeding, diet, IUCN conservation status, international measures of protection, and national measures of protection).

(2) Illustrate and analyse the distribution of those populations of seabirds which regularly frequent the target priority area (including breeding colonies) and identify critical sites in offshore areas (taking into account any temporal and spatial variation).

(3) Assess the impact of threats affecting the species present, taking into account any interactions with human activities.

(4) Review and refine the spatial mapping of critical sites proposed for different seabird species in the target priority area, including the work on Important Bird Areas published by RAC/SPA in 2009."

Reference:
UNEP-MAP-RAC/SPA. 2014. Status of Seabirds in the Alboran Sea. Draft internal report for the purposes of the Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas, Malaga, Spain, 7-11 April 2014.

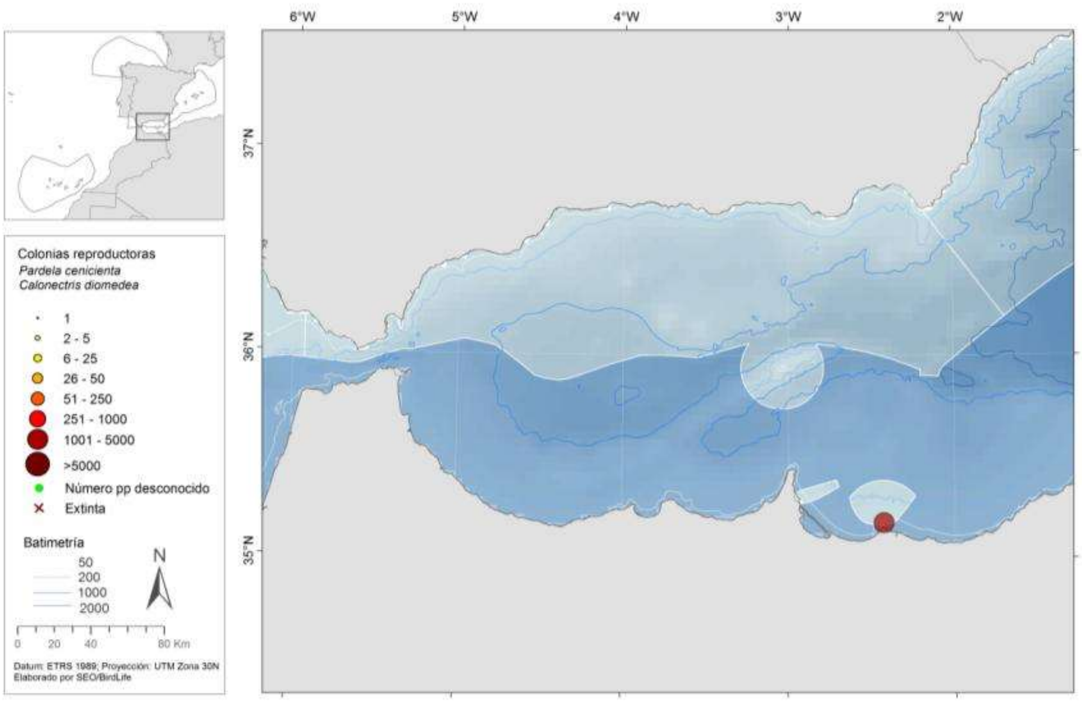


Figure 0-1 Breeding locations of Cory's/Scopoli's shearwaters *Calonectris diomedea* ssp in the Alboran Sea region

[from *UNEP-MAP-RAC/SPA (*2014) "Fig. 3. Breeding locations of Cory's/Scopoli's shearwaters *Calonectris diomedea* ssp in the Alboran Sea region."]

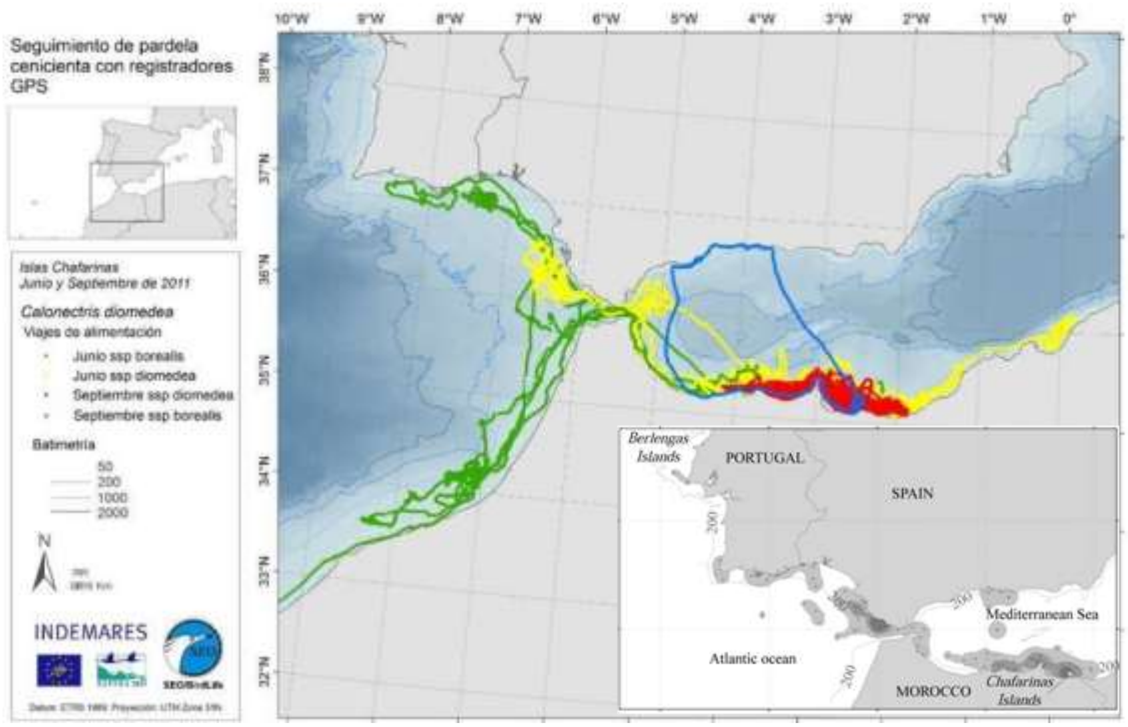


Figure 0-2 Movements of tracked Cory's/Scopoli's shearwaters *Calonectris diomedea ssp* from Chafarinas Islands in 2007 (PTTs, inside box; from Navarro et al. 2009) and 2011 (GPS, large map).

[from *UNEP-MAP-RAC/SPA (*2014) "Fig. 4. Movements of tracked Cory's/Scopoli's shearwaters *Calonectris diomedea ssp* from Chafarinas Islands in 2007 (PTTs, inside box; from Navarro et al. 2009) and 2011 (GPS, large map). Note the similitude of patterns between both studies. "]

5.8 Status of fisheries in the Alboran Sea

Introduction:
"The Alboran Sea extends from the Strait of Gibraltar to an adopted line running from Cabo de Gata (Almeria, Spain) to the Cape of Oran (Algeria). Our study region includes 26 important harbours (Spain= 15; Morocco= 8; Algeria= 3).

There are two important features that characterize the fisheries from Alboran Sea. On the one hand, there is a marked socioeconomic gradient between Spain (within the European Union) and Morocco and Algeria (two least-developed countries). On the other hand, the Alboran Sea is an important area globally for marine traffic as it provides an important corridor that connects the Mediterranean Sea with the Atlantic Ocean which is crossed by 25% of global maritime traffic. Therefore, the bigger boats of greater gross tonnage could break the fishing gear or collide with slower fishing boats during fishing operations. Thus, the fishing grounds in the Alboran Sea are away from the main shipping lanes, and are closer to the coast than in other areas.

The Atlantic Ocean waters entering the Alboran Sea through the Strait of Gibraltar are richer in nutrients than the surface Mediterranean water. For this reason, the plankton productivity levels are highest around the Bay of Malaga, coinciding with the flow of WAG. The plankton productivity peaks occur during spring, summer and autumn, and coinciding with spawning season of European anchovy (*Engraulis encrasicolus*), and sardine (*Sardina pilchardus*). Thus, in the north of the Alboran Sea there are important areas for the spawning of many of fish species near to the coast.

Other important reproductive zones are the submarine canyons of the Alboran Sea for demersal fish. The origin of the submarine canyons is related with ancient fluvial erosion processes."

Reference:

UNEP-MAP-RAC/SPA. 2014. Status of open sea fisheries in the Alboran Sea. Draft internal report for the purposes of the Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas, Malaga, Spain, 7-11 April 2014

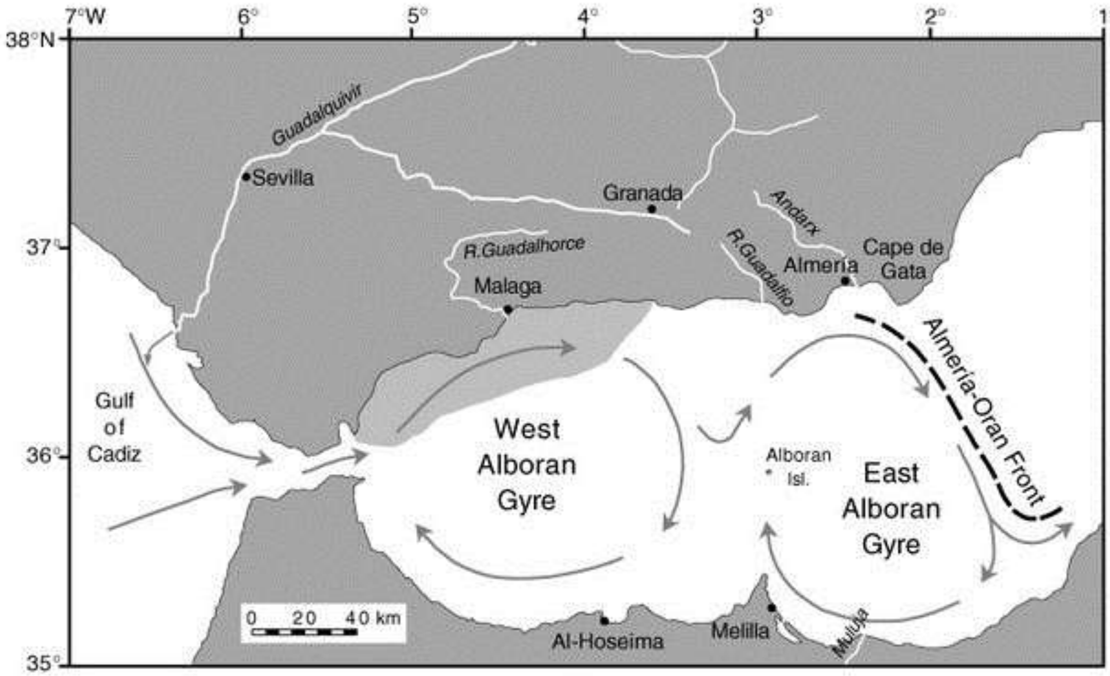


Figure 0-1 Alboran gyre, with the anticyclonics Western Alboran Gyre and the Eastern Alboran Gyre (WAG, EAG).

[from *UNEP-MAP-RAC/SPA (*2014) "Figure 5. Alboran gyre, with the anticyclonics Western Alboran Gyre and the Eastern Alboran Gyre (WAG, EAG). The grey area shows the major phytoplankton productivity area. Front: Hauschildt et al. (1999)."]

5.9 Propuesta de una red representativa de áreas marinas protegidas en el mar de Alborán

Introduction:

"Este informe ha sido preparado como parte del trabajo del proyecto MedRAS (identificación de áreas y especies representativas prioritarias a conservar en el mar Mediterráneo), financiado por las Fundaciones MAVA y TOTAL, y la Agencia Española de Cooperación Internacional para el Desarrollo (AECID), y coordinado por el Centro de Cooperación del Mediterráneo (UICN-Med) (Málaga, España). El proyecto MedRAS ha sido llevado a cabo durante su fase piloto en dos regiones, la costa de Libia y el mar de Alborán. Los informes para cada una de estas regiones, Libia y Alborán, son publicados separadamente aunque contienen una metodología similar. Durante los próximos años, la metodología desarrollada por MedRAS se realizará en otras regiones del Mediterráneo como parte del nuevo proyecto llamado Nereus, financiado por la Fundación Mava.

El presente documento *Propuesta de una red representativa de áreas marinas protegidas en el mar de Alborán* es la continuación lógica de las actividades y publicaciones llevadas a cabo desde 2008 en relación con el mar de Alborán. En particular, el documento parte del trabajo de síntesis *Conservación y desarrollo sostenible del mar de Alborán* (Robles, 2010), del cual se toman y se desarrollan numerosos elementos.

Este documento es el resultado de la estrecha colaboración entre numerosos expertos e instituciones de todo el Mediterráneo y en particular de los tres países que bordean el mar de Alborán, Argelia, España y Marruecos. Los coordinadores nacionales han sido Farid Nezzar (Argelia), Jaime Rodríguez (España) y Larbi Sbaï (Marruecos). María del Mar Otero y Alain Jeudy de Grissac han sido responsables de la coordinación general desde el Centro de Cooperación del Mediterráneo.

El informe de Alborán recoge la información recopilada por los distintos expertos que participaron en este trabajo a través de varios talleres y la información existente y accesible sobre la biodiversidad marina y costera para finalmente hacer una propuesta y descripción de una red de áreas de interés para la conservación en el mar de Alborán. Los siguientes expertos han contribuido, por cada país ''

Reference:

UNEP-MAP-RAC/SPA. 2014. Ecology and Human Activities in the Alboran Sea. Draft internal report for the purposes of the Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas, Malaga, Spain, 7-11 April 2014.

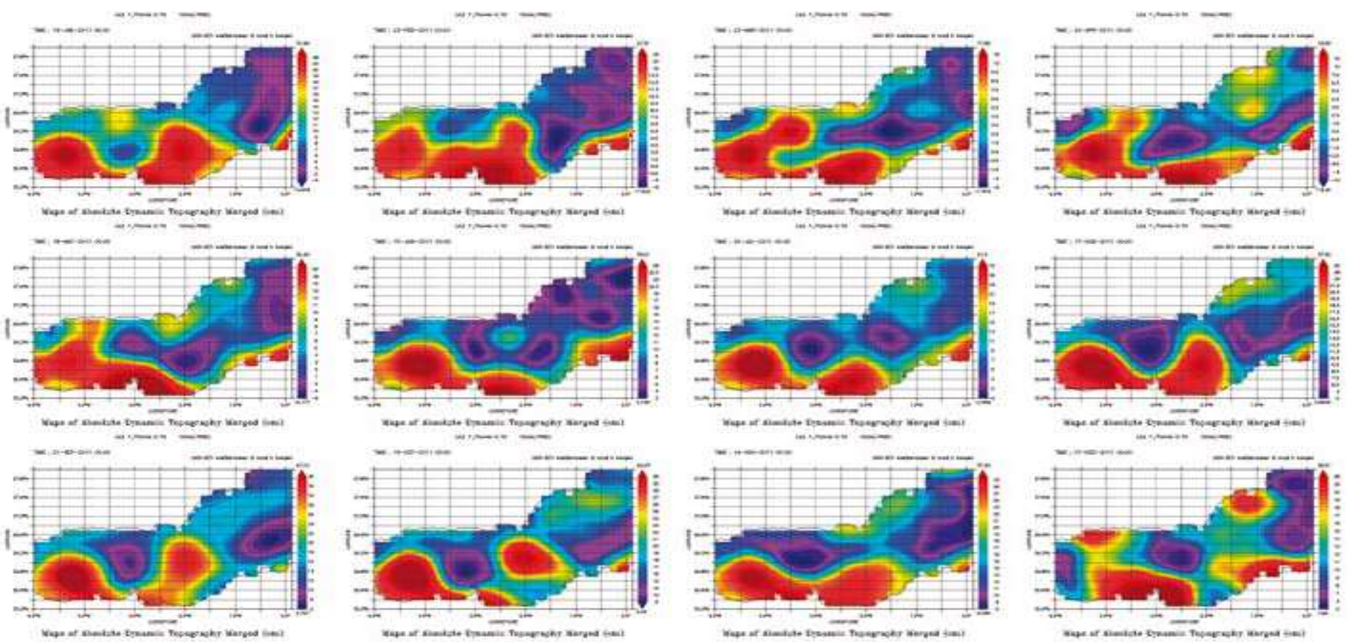


Figure 0-1 La topografía de superficie evidencia la dinámica anual de giros y de frentes en el mar de Alborán (2011). Dynamique annuelle (2011) des gyres et des fronts en mer d'Alboran, mise en évidence par la topographie de surface.

[from *UNEP-MAP-RAC/SPA (*2014) "Fig 3: La topografía de superficie evidencia la dinámica anual de giros y de frentes en el mar de Alborán (2011). Dynamique annuelle (2011) des gyres et des fronts en mer d'Alboran, mise en évidence par la topographie de surface. http://las.aviso.oceanobs.com/las/getUI.do"]

These maps show sea surface height changes over the year with evidence of gyres and annual front dynamics in the Alboran Sea.

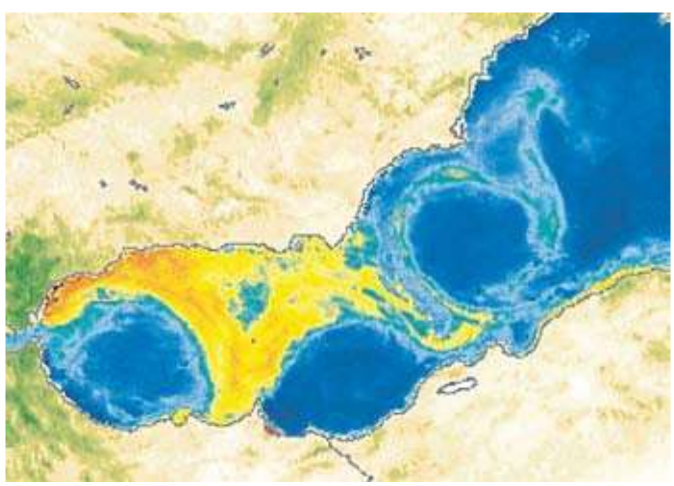


Figure 0-2 Giros y zonas de productividad. Gyres et zones de productivité.

[from *UNEP-MAP-RAC/SPA (*2014) "Fig. 6: Giros y zonas de productividad. Gyres et zones de productivité. ''"]

5.10 Seabird status and conservation in the Sicily Channel / Tunisian Plateau

Introduction:
"One of the main characteristics of the Mediterranean marine avifauna is the high number of endemic taxa, despite the low diversity and small population densities; this is consistent with a low-productivity ecosystem compared to open oceans (Coll et al. 2010). All four Procellariiforms (petrels and shearwaters) present in the Mediterranean constitute endemic taxa: two at species level (*Puffinus mauretanicus* and *Puffinus yelkouan*) and two at subspecies level (*Calonectris diomedea*, *Hydrobates pelagicus melitensis*). Besides, one endemic cormorant (Shag *Phalacrocorax aristotelis desmarestii*), three gulls (Mediterranean *Larus melanocephalus*, Audouin's *Larus audouinii* and Yellow-legged *Larus michahellis michahellis*) and one tern (Lesser-crested *Sterna bengalensis emigrata*) also originate from the Mediterranean region.

Another characteristic of the Mediterranean marine avifauna is its long-term exposure to human influence. Through history, some aspects of human activity have had positive effects on seabirds (e.g. the creation of specific habitats like rice fields and salt pans, the provision of food through fishing discards, etc.) but overall and in the long-term the result of the human-seabird interaction has been detrimental for seabirds. Their current population sizes are nowhere near what they were before the 'humanisation' of the Mediterranean.

Today, despite the legal protection and the positive management of seabird colonies, several threats imperil the future of this unique seabird community, namely the interaction of seabirds with fisheries (causing unnecessary mortality and impacting heavily on their populations), overfishing (which decimates fish populations and heavily alters the habitats where marine organisms live) and climate change (causing disruptions in the ecosystem).

The Protocol Concerning Mediterranean Specially Protected Areas and Biological Diversity in the Mediterranean has two powerful tools to revert the negative trends of most Mediterranean seabird species: the establishment of a Specially Protected Areas of Mediterranean Importance (SPAMIs) list, and the protection and conservation of the species. This report focuses on the seabird species that: (a) are listed among the 25 of Annex II List of Endangered or Threatened Species; and (b) are present in our focus area, the Sicily Channel / Tunisian Plateau (fig. 2).

The Sicily Channel / Tunisian Plateau area enjoys some of the highest productivities in the Mediterranean Sea and, not surprisingly, it also concentrates the largest populations of seabirds, particularly of the more pelagic Procellariiforms (Scopoli´s shearwater and European storm-petrel). This results from the mixing of waters between the eastern and western basins of the Mediterranean Sea, plus mineral-rich freshwater outflows in the Gulf of Gabès. While food is abundant and perhaps not limiting, the seabirds in this area have traditionally been subject to human exploitation, so their populations are far from being in a healthy state. Moreover, industrial fishing may develop further in the future in this area, thus representing a further threat to these populations, which in some cases are the majority of the species' globally."

Reference:
UEP-MAP-RAC/SPA. 2014. Seabird status and conservation in the Sicily Channel / Tunisian Plateau. Draft internal report for the purposes of the Mediterranean Regional Workshop to

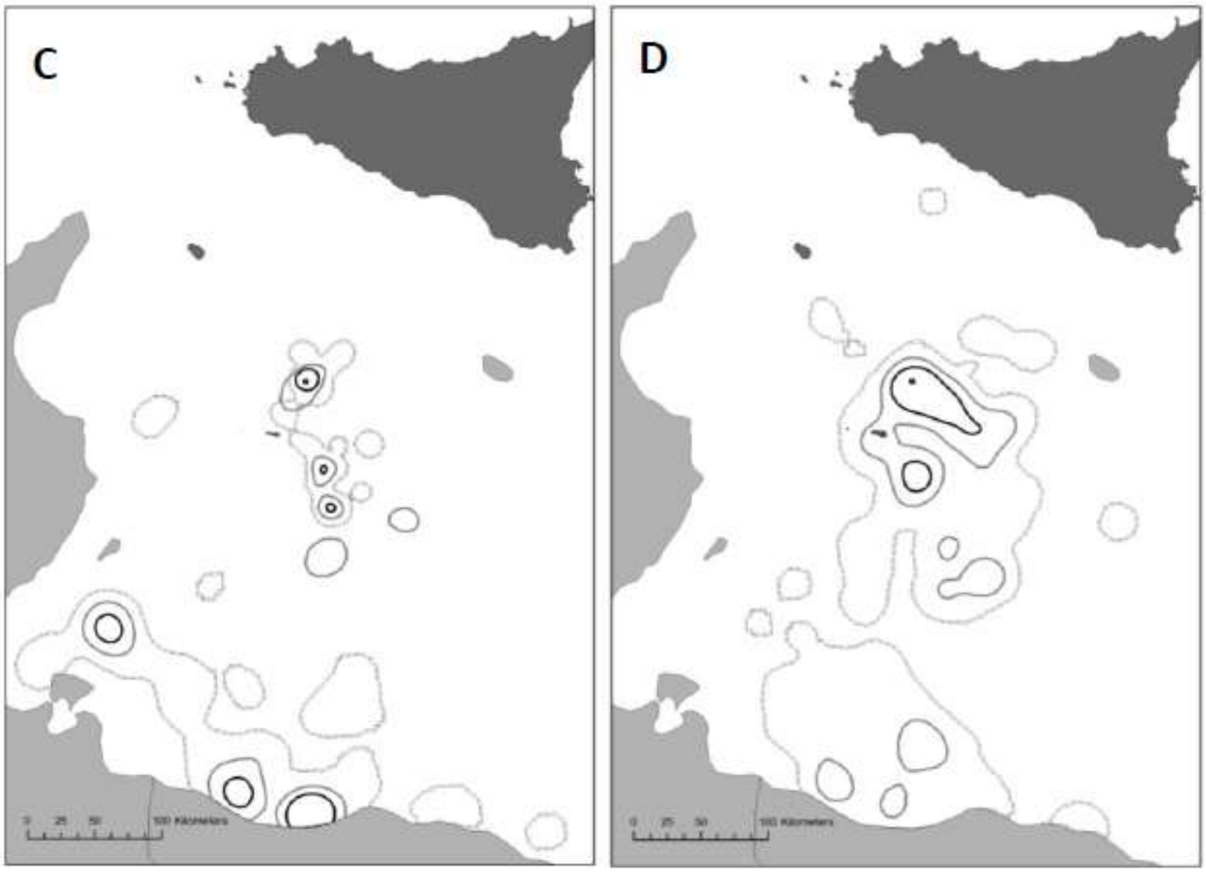


Figure 0-1 Kernels of GPS positions of foraging Cory´s shearwaters from the island of Linosa

[from *UNEP-MAP-RAC/SPA (*2014) "Fig. 1 shows 50% (black), 75% (dark grey) and 95% (light grey) kernels of GPS positions of foraging Cory´s shearwaters from the island of Linosa in the Sicily Channel / Tunisian Plateau area during incubation (C; 14 birds in 2008) and during chick-rearing (D; 46 birds in 2008-09) (from Cecere et al. 2012)."]

5.11 Sicily Channel/Tunisian Plateau: Status of Cetaceans

Introduction:
"The Mediterranean is a semi-enclosed marginal sea with sea-beds up to 5000 m deep (the maximum depth is 5121 m in the Matapan-Vavilov Deep, off the Southern coast of Greece, with an average depth of 2500 m). It harbours most of the same distinctive biodiversity key geomorphologic structures in other regions of the world such as submarine canyons, seamounts, mud volcanoes or deep trenches (WWF/IUCN, 2004).

The only relevant connection of the Mediterranean Sea with the world ocean is the Strait of Gibraltar, a narrow passage of hardly 14 km width at its narrowest section and a sill less than 300m depth. The Strait of Sicily, which is also a relatively constraining topographic feature, divides the Sea into two basins of comparable size, the Western (0.85 106 km^2) and Eastern (1.65 106 km^2) Mediterranean, which in turn are divided into smaller sub-basins.

The Strait is about 145 km wide and divides the Tyrrhenian Sea and the Western Mediterranean Sea from the eastern Mediterranean Sea. It has a high primary productivity with high values of biodiversity due: moderate depths (maximum depth is 320 m), peculiar hydrography and variety of habitat types. Most important human uses of the area are fishing, aquaculture, shipping and tourism. Other important uses are oil drilling and extraction, deployment of gas pipelines and communication cables, and construction of wind-mill farms.

Vessel activity in the Mediterranean has been rising steadily over the past 10 years. The largest vessels observed operating in this area are crude oil tankers (with an increase in size of 26 per cent over the past 10 years). Based on the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC) report, vessel activity within the Mediterranean is expected to increase by 18 per cent whilst through transits are projected to rise by 23 per cent. The most significant increases will occur in the chemical, crude and LNG tanker sectors and also in container vessel movements (unnamed, 2008). The strait of Sicily is henceforth one of the areas within the ACCOBAMS region with the higher level of maritime traffic. The impact is prevalent mainly in the deep sea waters of the strait, especially along traffic routes, harbours and other important commercial coastal areas.

The Mediterranean Sea is considered one of the world`s biodiversity hotspots (it hosts between 4% and 18% of all known marine species, many of them endemic, although it constitutes only 0.8% of global ocean surface) where the impact of those cited anthropogenic pressures together with climate change could be most devastating (Lejeusne et al., 2009; Coll et al., 2010). "

Reference:
UNEP-MAP-RAC/SPA. 2014. Status and conservation of cetaceans in the Sicily Channel/Tunisian Plateau. Draft internal report for the purposes of the Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas, Malaga, Spain, 7-11 April 2014.

5.12 Status And Conservation Of Fisheries In The Sicily Channel / Tunisian Plateau

Introduction:
"The Sicily Channel, also called Straits of Sicily between Sicily and Tunisia is about 100 miles (160 km) wide and divides the Tyrrhenian Sea and the western Mediterranean Sea from the eastern Mediterranean. It is one of the most important fishing areas of the Mediterranean Sea, where significant fleets operate with high fish production.

Along the southern coast of Sicily, the shelf is characterized by two wide and shallow (100 m depth) banks in the western (Adventure Bank) and eastern sectors (Malta Bank), separated by a narrow shelf in the middle part. The North African shelf is very wide, especially along the Tunisian coasts.

The topography of the sea bed below the 200 m depth between Sicily and Tunisia is extremely irregular, incised by many canyons, deep trenches and steep slopes, whereas it is very gentle (average depth of less than 300 m) between Malta and Libya. East of the Malta Bank (Malta Escarpment) the shelf break is very steep."

Reference:
UNEP-MAP-RAC/SPA. 2014. Status and conservation of fisheries in the Sicily Channel/ Tunisian Plateau. Draft internal report for the purposes of the Mediterranean Regional Workshop to Facilitate the Description of Ecologically or Biologically Significant Marine Areas, Malaga, Spain, 7-11 April 2014.

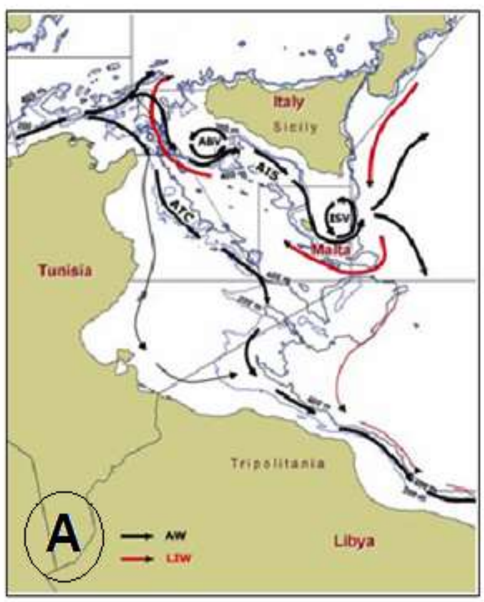
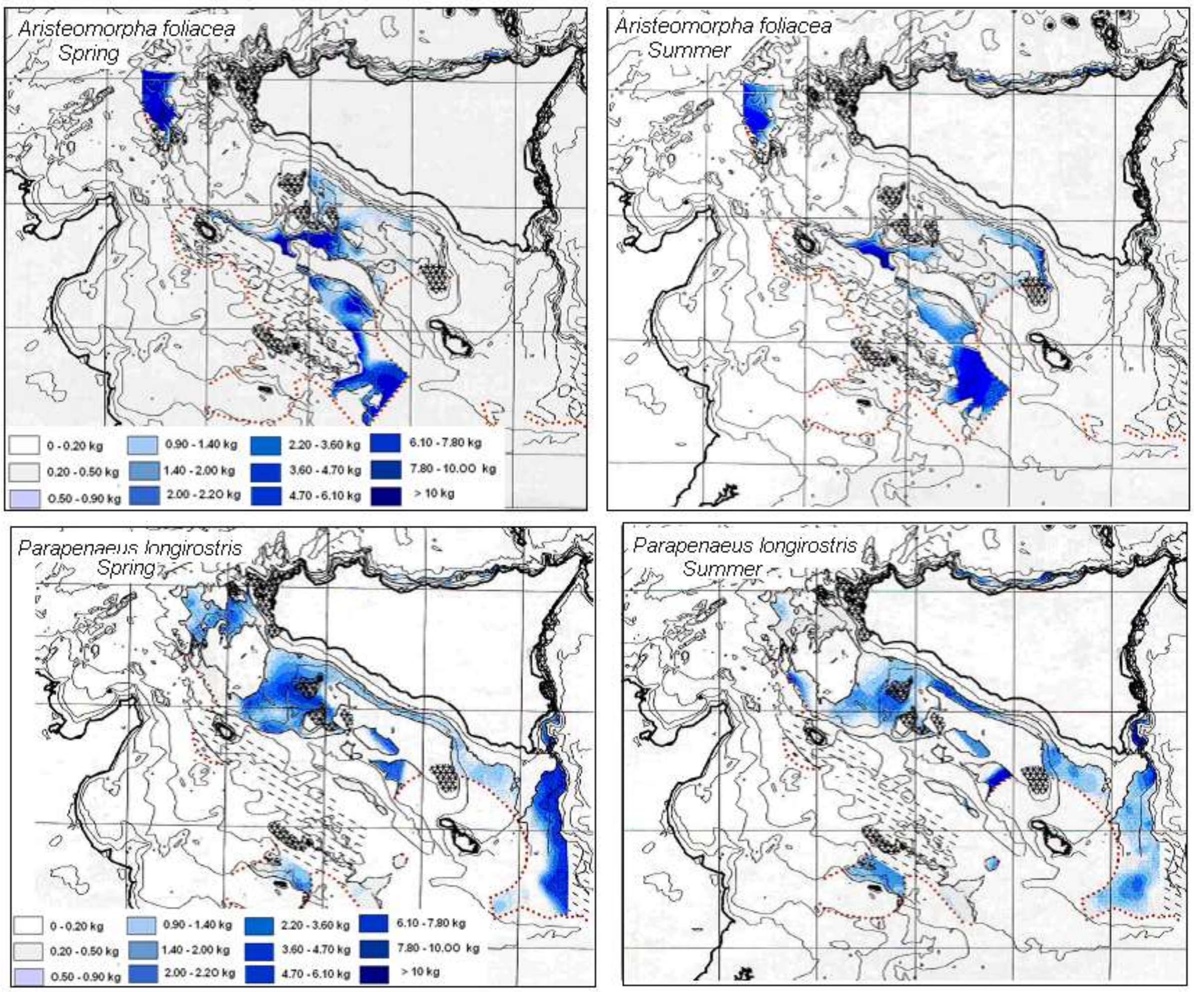
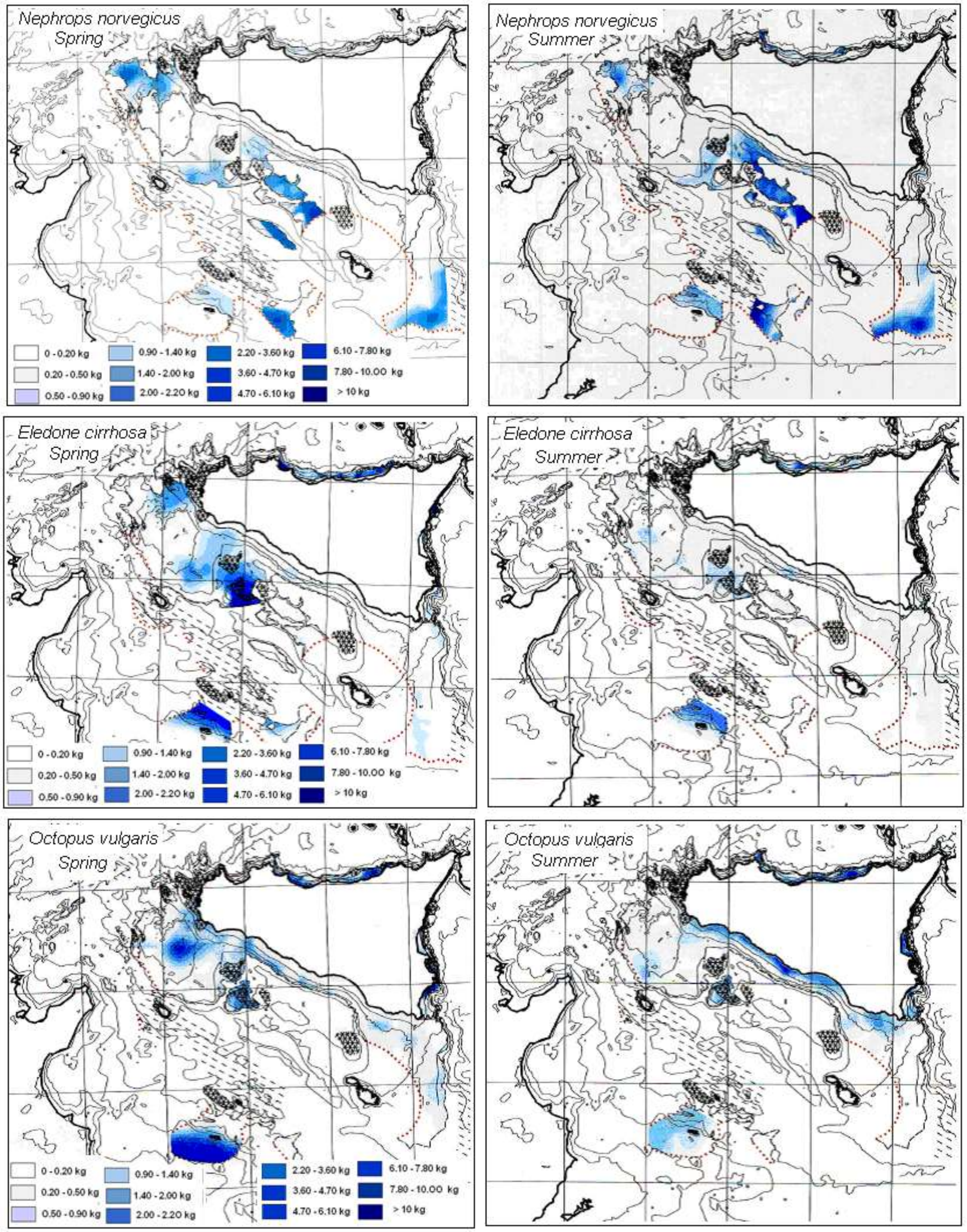


Figure 0-1 .A: water mass circulation in the Sicily channel (AW Atlantic Water, ABV Adventure Bank Vortex, ISV Ionian Stream vortex, AIS Atlantic Ionian Stream, ATC Atlantic Tunisian Current, LIW Levantine Ionian water.

[from *UNEP-MAP-RAC/SPA (*2014) "Fig.2. A: water mass circulation in the Sicily channel (AW Atlantic Water, ABV Adventure Bank Vortex, ISV Ionian Stream vortex, AIS Atlantic Ionian Stream, ATC Atlantic Tunisian Current, LIW Levantine Ionian water. B: GFCM Geographical Sub Areas (GSA)"]**




Nephrops norvegicus
Spring
0 - 0.20 kg
0.20 - 0.50 kg
0.50 - 0.90 kg
0.90 - 1.40 kg
1.40 - 2.00 kg
2.00 - 2.20 kg
2.20 - 3.60 kg
3.60 - 4.70 kg
4.70 - 6.10 kg
6.10 - 7.80 kg
7.80 - 10.00 kg
> 10 kg
Nephrops norvegicus
Summer
Eledone cirrhosa
Spring
0 - 0.20 kg
0.20 - 0.50 kg
0.50 - 0.90 kg
0.90 - 1.40 kg
1.40 - 2.00 kg
2.00 - 2.20 kg
2.20 - 3.60 kg
3.60 - 4.70 kg
4.70 - 6.10 kg
6.10 - 7.80 kg
7.80 - 10.00 kg
> 10 kg
Eledone cirrhosa
Summer
Octopus vulgaris
Spring
0 - 0.20 kg
0.20 - 0.50 kg
0.50 - 0.90 kg
0.90 - 1.40 kg
1.40 - 2.00 kg
2.00 - 2.20 kg
2.20 - 3.60 kg
3.60 - 4.70 kg
4.70 - 6.10 kg
6.10 - 7.80 kg
7.80 - 10.00 kg
> 10 kg
Octopus vulgaris
Summer

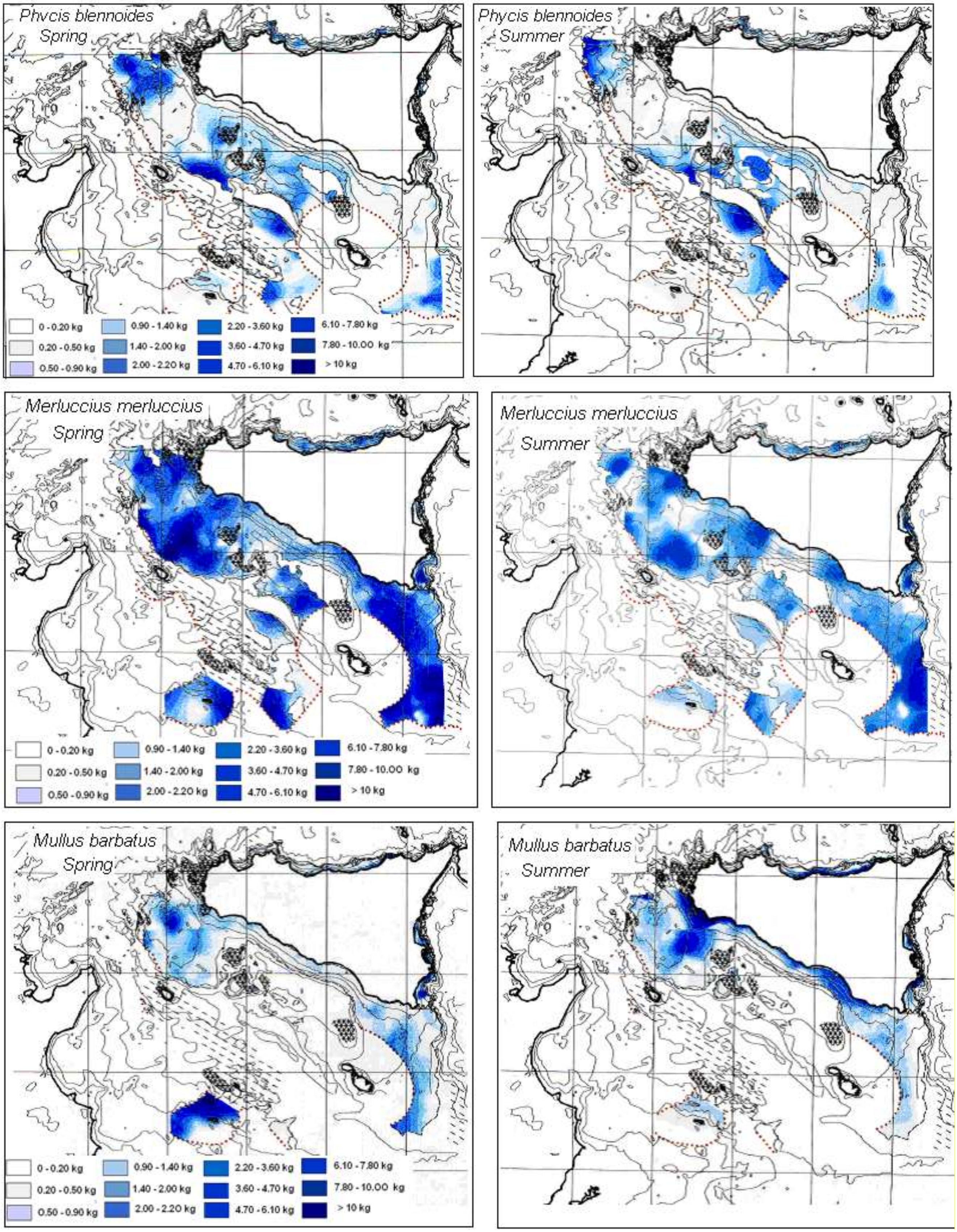

Phycis blennoides
Spring
Phycis blennoides
Summer
Merluccius merluccius
Spring
Merluccius merluccius
Summer
Mullus barbatus
Spring
Mullus barbatus
Summer
0 - 0.20 kg
0.20 - 0.50 kg
0.50 - 0.90 kg
0.90 - 1.40 kg
1.40 - 2.00 kg
2.00 - 2.20 kg
2.20 - 3.60 kg
3.60 - 4.70 kg
4.70 - 6.10 kg
6.10 - 7.80 kg
7.80 - 10.00 kg
> 10 kg

Figure 0-2 Geographical distribution of some main species fished in the Sicily channel

[from *UNEP-MAP-RAC/SPA (*2014) "Fig. 6. Geographical distribution of some main species fished in the Sicily channel (2 bis)"]

6. Acknowledgments

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Leen Vandepitte (EuroOBIS)
Nic Bax, Piers Dunstan (CSIRO)
Ei Fujioka, Connie Kot (Marine Geospatial Ecology Lab, Duke University)
John Guinotte (Marine Conservation Institute)
Ben Lacelles (BirdLife International)
Peter Miller (Plymouth Marine Lab, UK)