

CO-EVOLVE

Promoting the co-evolution of human activities
and natural systems for the development of
sustainable coastal and maritime tourism

Deliverable 3.8.2

Thematic Atlas of coastal protection plans and measures in Mediterranean touristic area

Activity 3.8

Enabling factors for sustainable co- evolution
in touristic areas - Mediterranean scale:
Coastal protection measures

WP3

CNR-ISMAR



Authors

Sandro Carniel, Davide Bonaldo, M.Gabriella Gaeta

CNR-ISMAR, Arsenale-Tesa 104, Castello 2737/F, I-30122 Venice (IT)

Table of contents

1. Introduction	5
2. Development of the Thematic Atlas	6
2.1 Overview of the technical information for the Thematic Atlas	6
2.2 Thematic maps on coastal protection measures in the Mediterranean Sea.....	11
References	30
Annex I List of the study sites included in the Thematic Atlas and their related reference	36

List of tables

Table 1 List of coastal protection measures as described in Section 3.2 of the Deliverable D3.8.1 and their abbreviation used in the Atlas.	7
Table 2 Examples of collected information used in the Thematic Atlas: 3 paradigmatic case studies of Lido di Dante (1); Lakopetra Beach (2) and Catalan shoreline (3).	10
Table 3. List of the study sites included in the Thematic Atlas and their related reference...	38

1. Introduction

The present document pertains to the Deliverable 3.8.2 – “Thematic Atlas of coastal protection plans and measures in Mediterranean touristic area”, foreseen as outputs from “Activity 3.8 - Enabling factors for sustainable co- evolution in touristic areas - Mediterranean scale: Coastal protection measures”.

The main goal of the deliverable is to organize and summarize the data and information collected in D3.8.1 through the reviews of scientific and technical papers, including the state of art of coastal protection plans and the description of representative case studies in order to populate a database from which Thematic maps are derived.

2. Development of the Thematic Atlas

In the following section, the types of information obtained by papers or technical reports included in Thematic Atlas, are described. Focus is posed on aspects regarding coastal management plans and defence measures. The structure is the result of the coordination between Tasks 3.8 and 3.2, and is functional to the maps that are aimed to be produced by the two activities. An example of the organization of the data used in the compilation of the Atlas is reported in Table 2.

2.1 Overview of the technical information for the Thematic Atlas

Thematic Atlas reports all the available information as listed in the followings for the proposed case studies:

- ID

GEOGRAPHIC DATA

- LATITUDE ⁽¹⁾
- LONGITUDE ⁽¹⁾
- COUNTRY
- NUTS III ⁽²⁾

COASTAL PROTECTION FEATURES

- STUDY AREA
- EXTENT ⁽³⁾
- TYPE OF PROTECTION MEASURE ⁽⁴⁾
- YEAR OF MEASURE
- EFFECTS
- AIM

HYDRODYNAMIC CHARACTERISTICS ⁽⁵⁾

- WIND (m/s; Dir)
- WAVES HEIGHT (m)
- TIDES (cm)
- CURRENTS (m/s; Dir)

MANAGEMENT FEATURES ⁽⁶⁾

- PLAN
- YEAR OF PLAN

REFERENCE ⁽⁷⁾

- TITLE

- AUTHORS
- JOURNAL

where explanations of some relevant features to be collected is here reported:

⁽¹⁾ in degrees;

⁽²⁾ according to NUTSIII 2013 classification (EUROSTAT, 2015) valid from 2015.

⁽³⁾ indicators whether the study area is punctual or extended; in this latter case, indicate the coordinates of the centre point of the analysed coastal strip; assign to each point a different ID number depending on the extent of the studied area;

⁽⁴⁾ indicators of the adopted/planned coastal protection measure following the abbreviation list as follows:

Abbreviation	Coastal protection measure
BR	Breakwater
GR	Groin
RV	Revetment
SW	Seawall
SB	Sand bags
GB	Gabions
NO	Nourishment
BD	Beach drainage
DF	Dune fencing
AR	Artificial reef
VG	Vegetation planting and/or stabilization
SG	Seagrass meadow planting
MU	Mudflat recharge
BS	Beach scraping

Table 1 List of coastal protection measures as described in Section 3.2 of the Deliverable D3.8.1 and their abbreviation used in the Atlas.

⁽⁵⁾ indicators of hydrodynamic characteristics of the studied site, with reference to annual (A), design (D), extreme (E), maximum (M) conditions of wind, wave, tide and current forcings, abbreviation that has to be added to the values of the proposed hydrodynamics characteristics;

- (6) information on the application of ICZM policies, and/or coastal protection plans, as summarized in Table of the deliverable D3.8.1;
- (7) collected information on the documents (papers and/or technical reports) where following data of the case study are reported;

ID	GEOGRAPHIC DATA				COASTAL PROTECTION FEATURES					
	LATITUDE	LONGITUDE	COUNTRY	NUTS III	STUDY AREA	EXTENT	TYPE OF PROTECTION MEASURE	YEAR	EFFECTS	AIM
1	44.39°	12.32°	Italy	Ravenna	Lido di Dante	600 m	BR, GR, NO	1978, 1983, 1995, 2001	Increased beach width; Increase tourist safety	Reduce erosion induced by waves
2	38.167°	21.45°	Greece	Peloponnese	Lakopetra Beach	300 m	BR	90's	Increased beach width; Increase of recreational activities and safety of swimmers	Reduce erosion to prevent economic loss by the Hotel
3	41.38879°	2.15899°	Spain	Catalonia	Catalan shoreline	600 km	DF	1998-2000	Stabilize dune systems	Reduce erosion

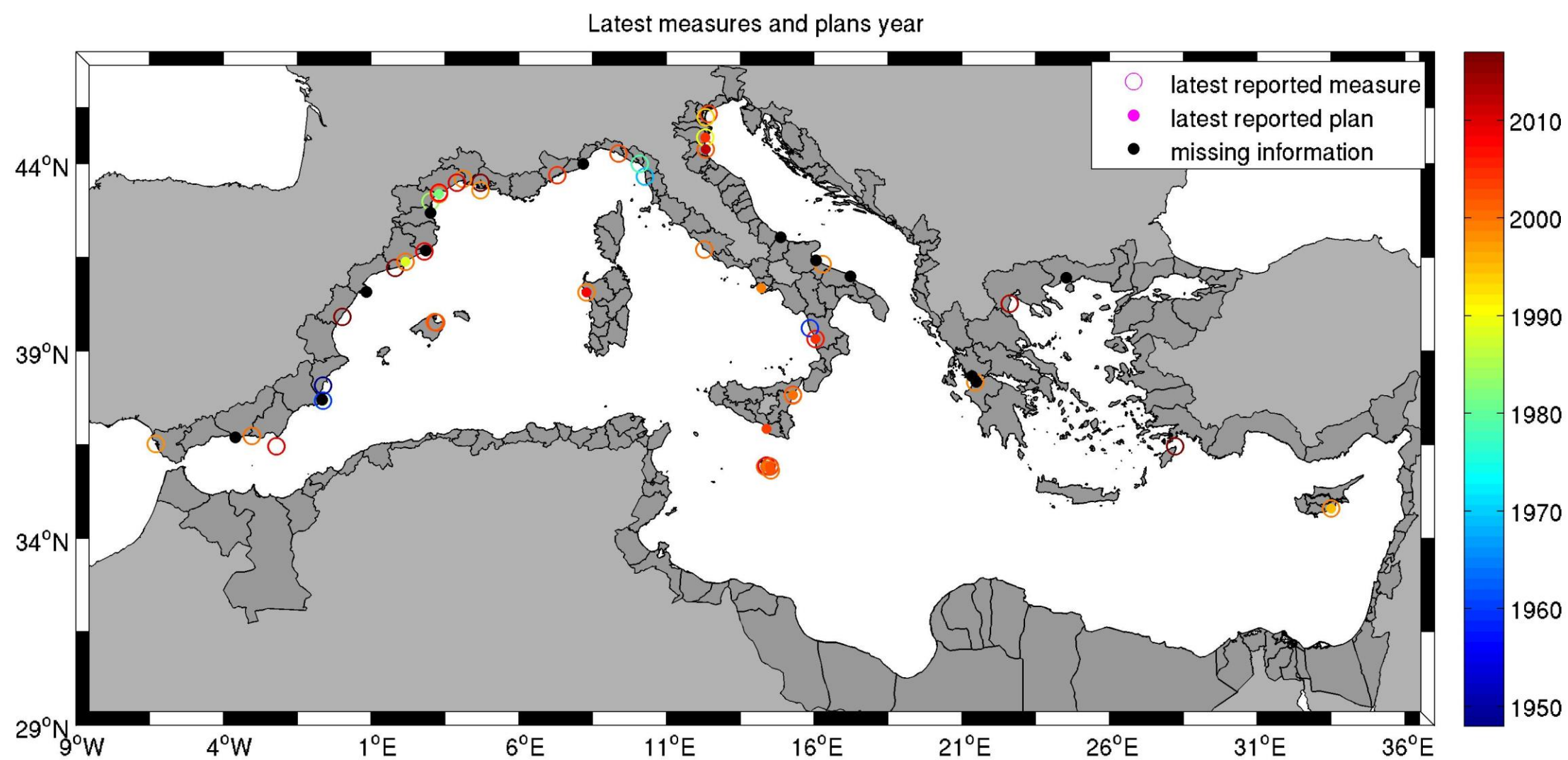
MANAGEMENT FEATURES		HYDRODYNAMIC CHARACTERISTICS				REFERENCE		
PLAN	YEAR OF PLAN	WIND (m/s; Dir)	WAVES HEIGHT (m)	TIDES (cm)	CURRENTS (m/s; Dir)	TITLE	AUTHORS	JOURNAL
ICZM Guideline; Littoral Regional Plan	2005; 2012	15; ESE (M) 18; NNW (M)	3.5 (A)	±85 (M)	NNW	An integrated approach to beach management in Lido di Dante, Italy	Lamberti, A., Zanuttigh, B.	Estuarine, Coastal and Shelf Science, 62 (2005), 441–451.
-	-	16; W (M) 22; NE (M)	2.4 ; NE (A) 1.7; NW (A)	±105	-	EUROSION - Case Study of Lakkopetra (GR)	Spyropoulos, K.	EUROSION(2005), Shoreline Management Guide
Ley de Costas	1988	>16; NNW (M)	-	-	-	Current status and future restoration of coastal dune systems on the Catalan shoreline (Spain, NW Mediterranean Sea)	Garcia- Lozano, C., Pintó, J. J.	Journal of Coastal Conservation, 2017, pp 1– 14, doi:10.1007/s11852- 017-0518-4

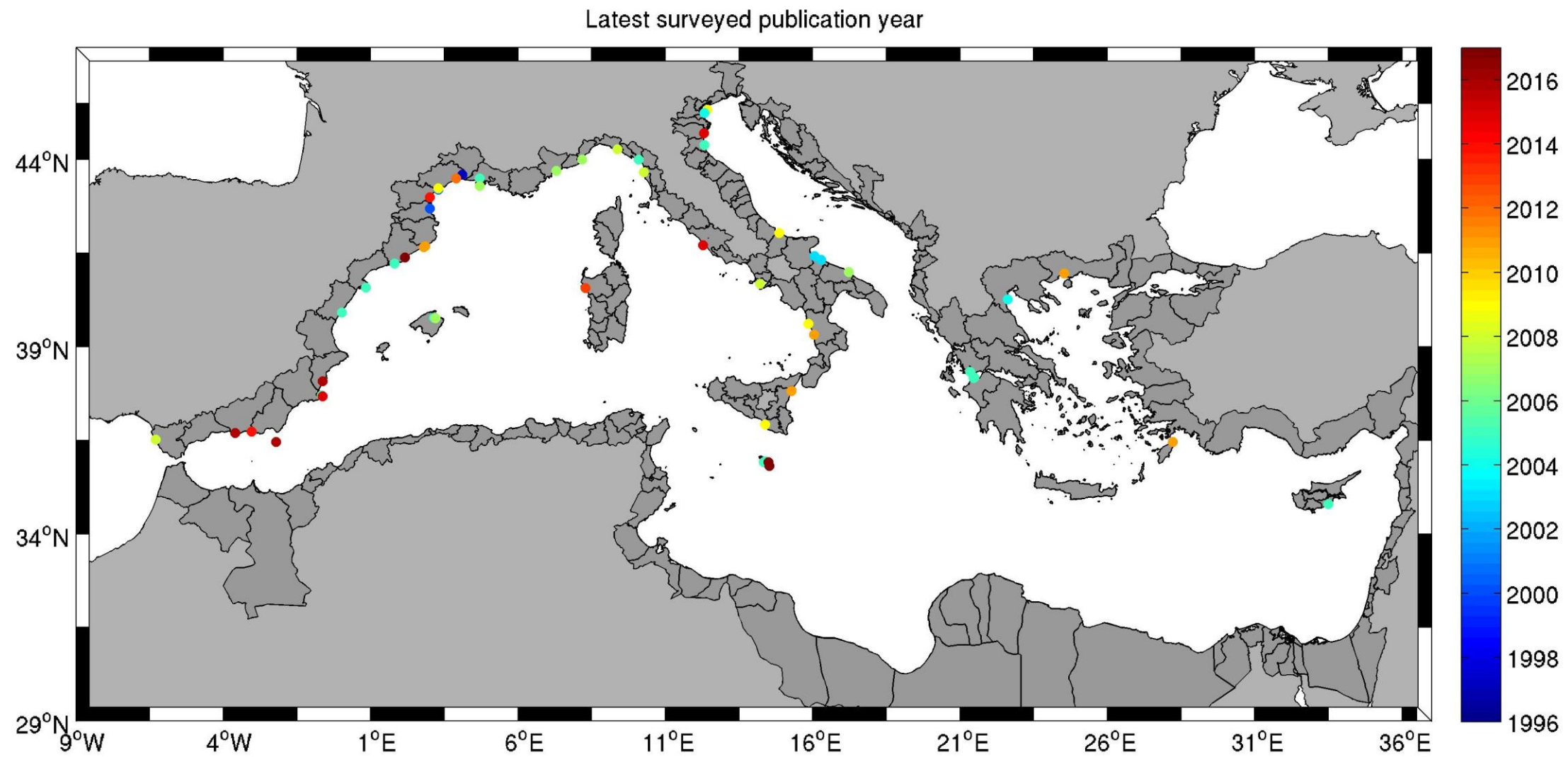
Table 2 Examples of collected information used in the Thematic Atlas: 3 paradigmatic case studies of Lido di Dante (1); Lakopetra Beach (2) and Catalan shoreline (3).

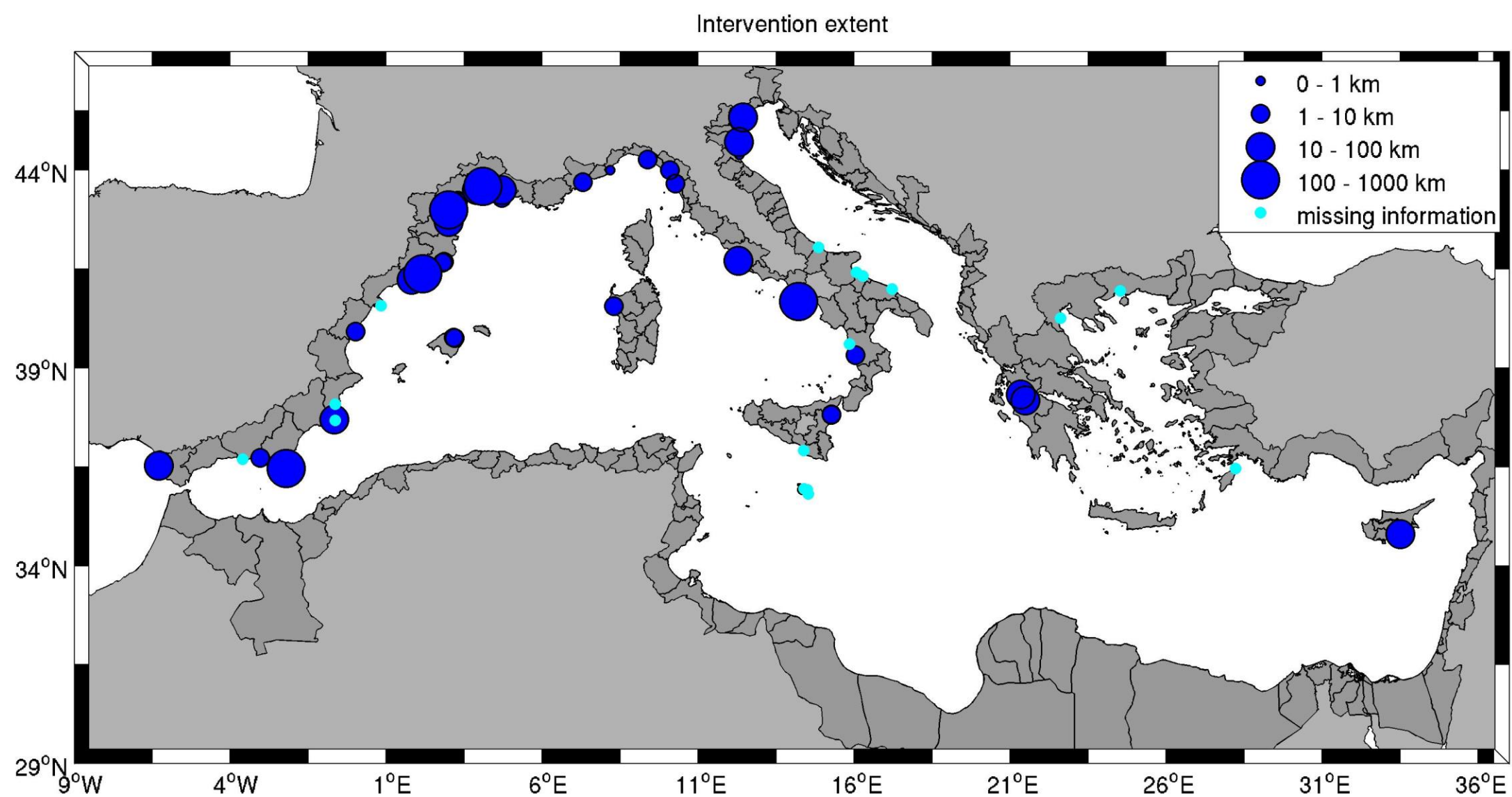
2.2 Thematic maps on coastal protection measures in the Mediterranean Sea

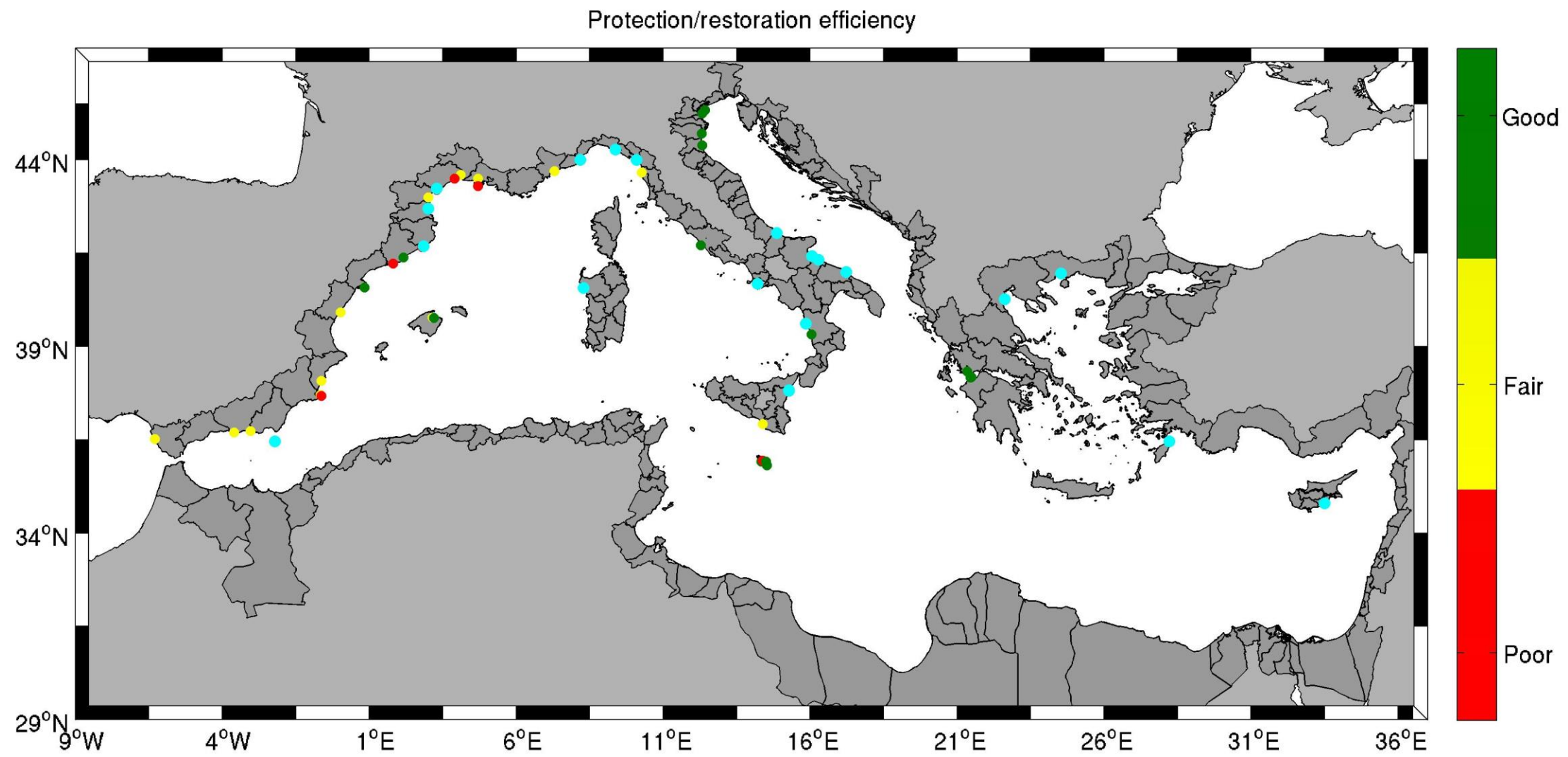
The database organising the information collected and described from the documents listed in the companion Deliverable D3.8.1 (see Annex I) has been used to prepare the Thematic Atlas, a visual tool aiming at providing an overview of coastal practices in relation to coastal tourism development and protection from erosion and flood risks. A set of maps has been produced in MATLAB environment based on the data collected in an Excel spreadsheet, organising the information as explained in Section 2.1 for paradigmatic case studies. The following maps visualise in particular information about the efficiency and the extent of the protection measures put in place along the Mediterranean coast, the date of their realization and, where a coastal plan exists, its implementation year. In addition, the publication year of the studies considered for the different study sites is visualised.

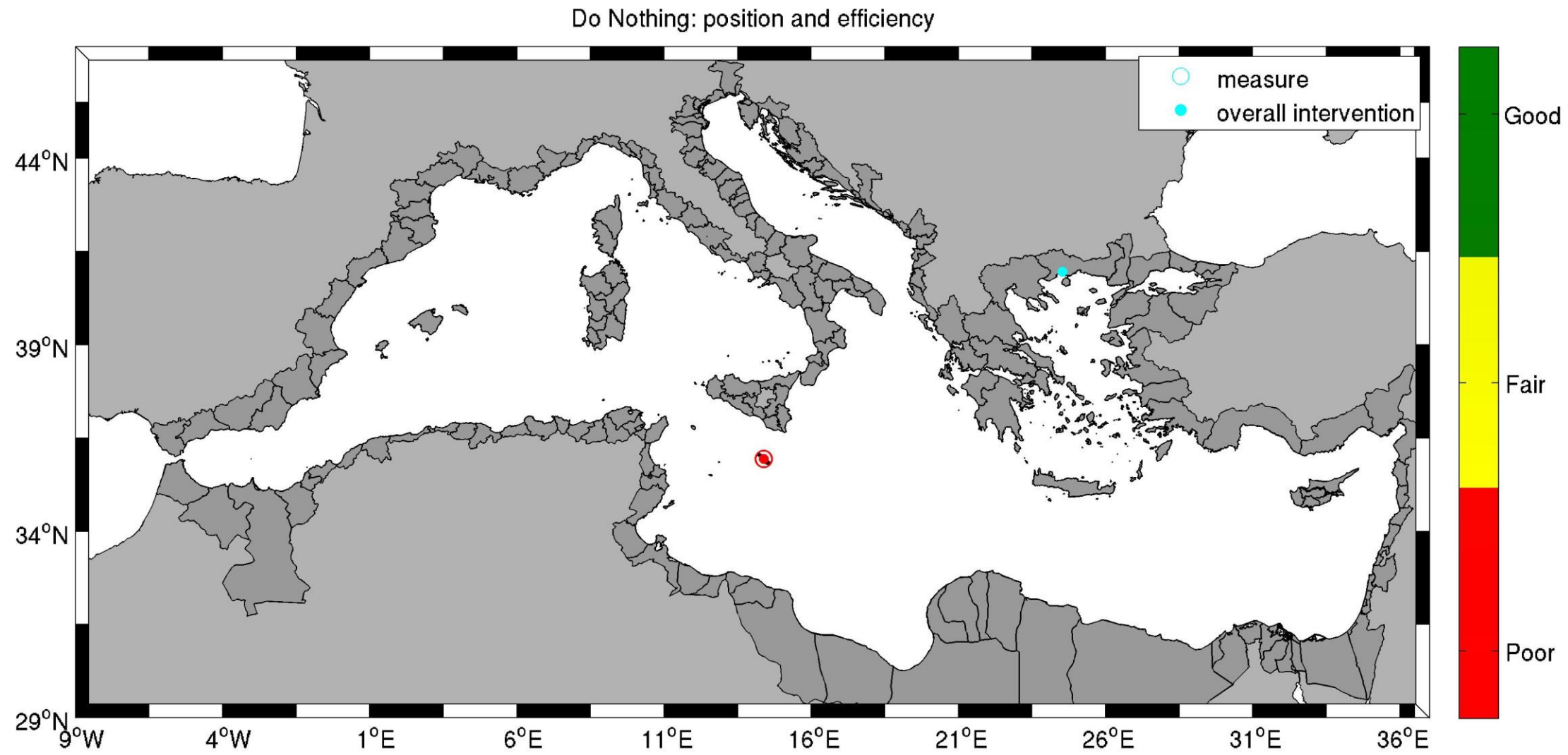
The structure of the database and the map generation procedure allow for a straightforward update of the products as further items are added to the database, providing the possibility of updating and expanding the information to be visualised. In this perspective, it is worth mentioning that hydrodynamic information provided in the studies are too heterogeneous to be directly implemented in a database (the physical quantities and the statistical variables considered vary from site to site). Therefore, if in a possible follow-up activity the present maps are to be complemented with a hydrodynamic characterization, a unification effort will be necessary, possibly by integrating literature data with hydrodynamic parameters derived from numerical modelling analyses.



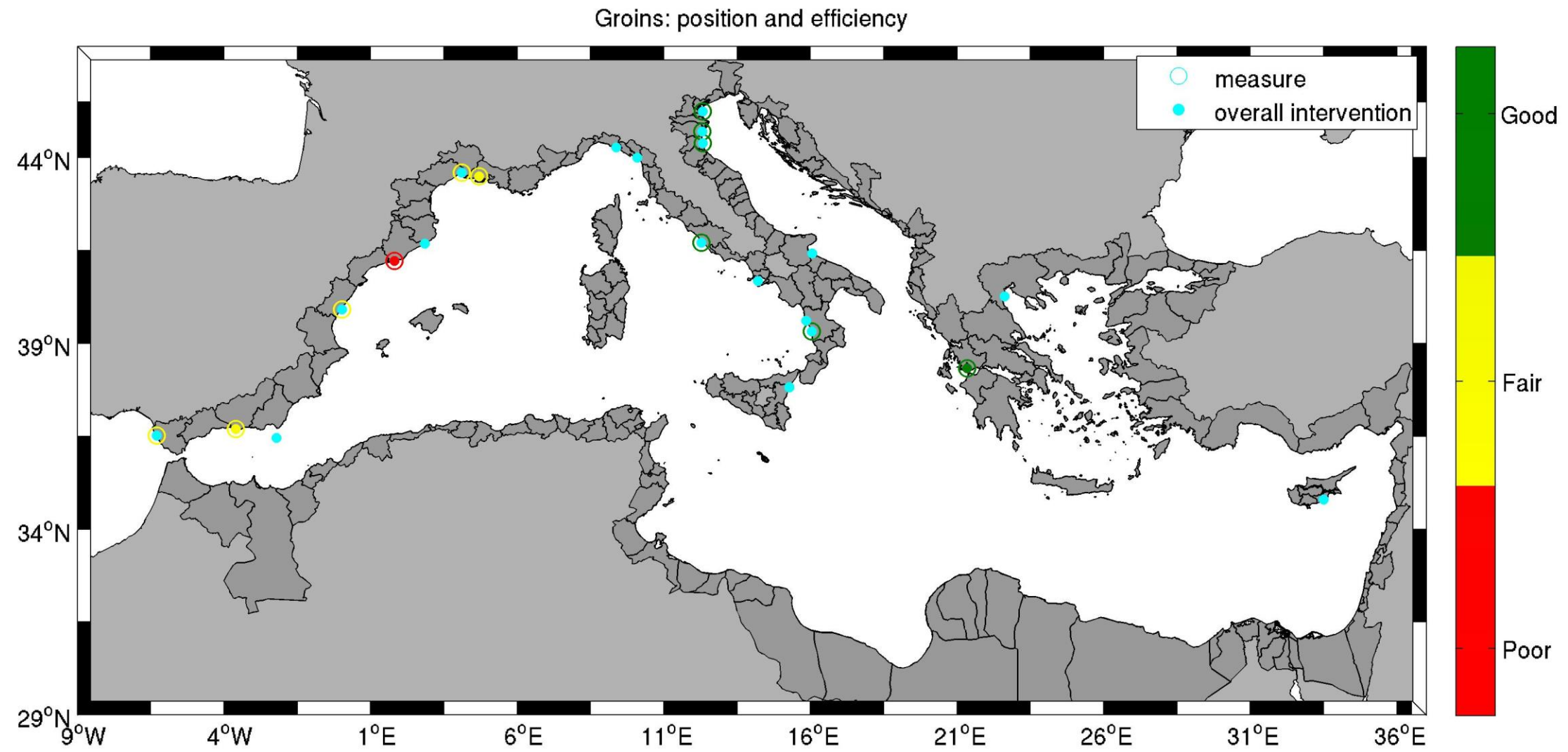


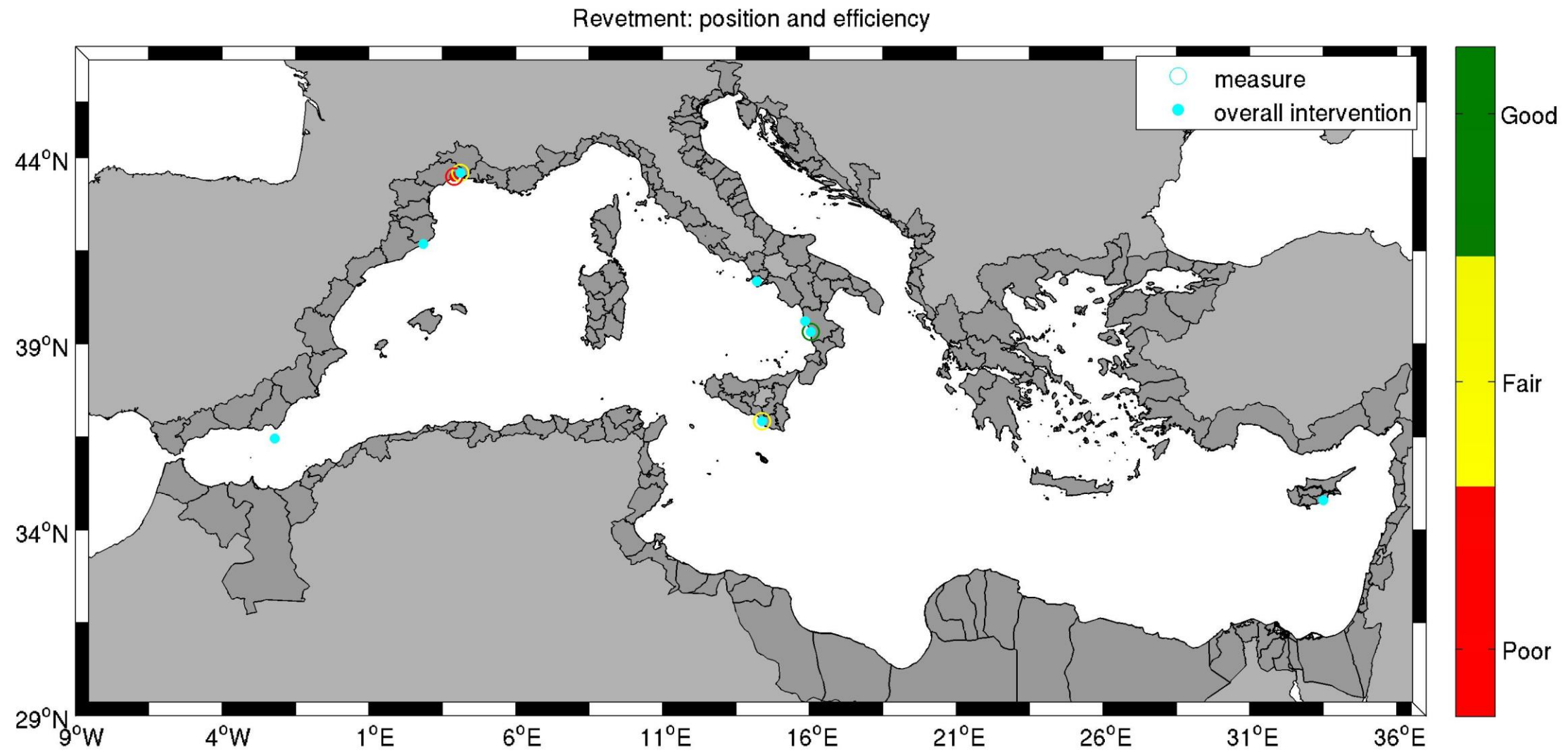


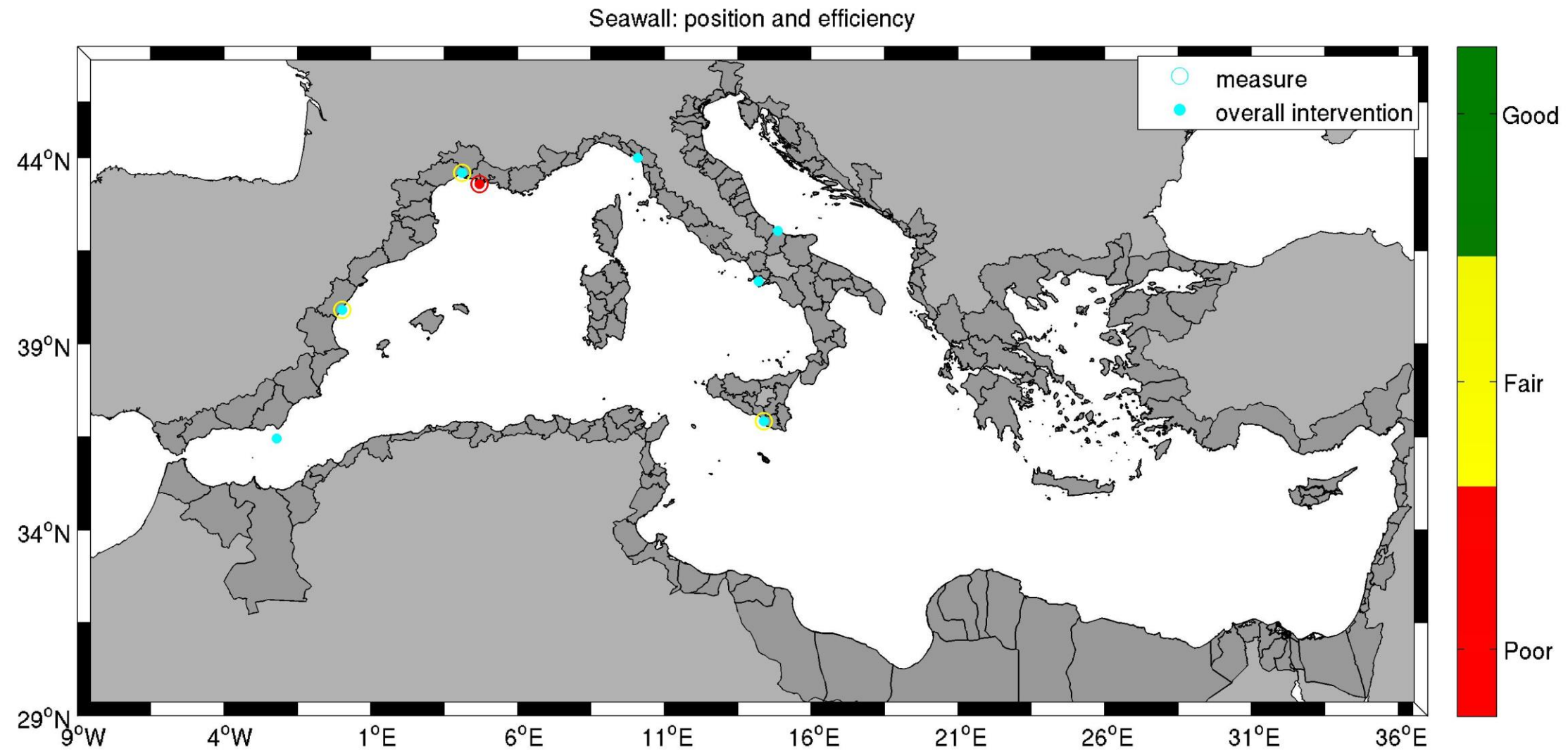


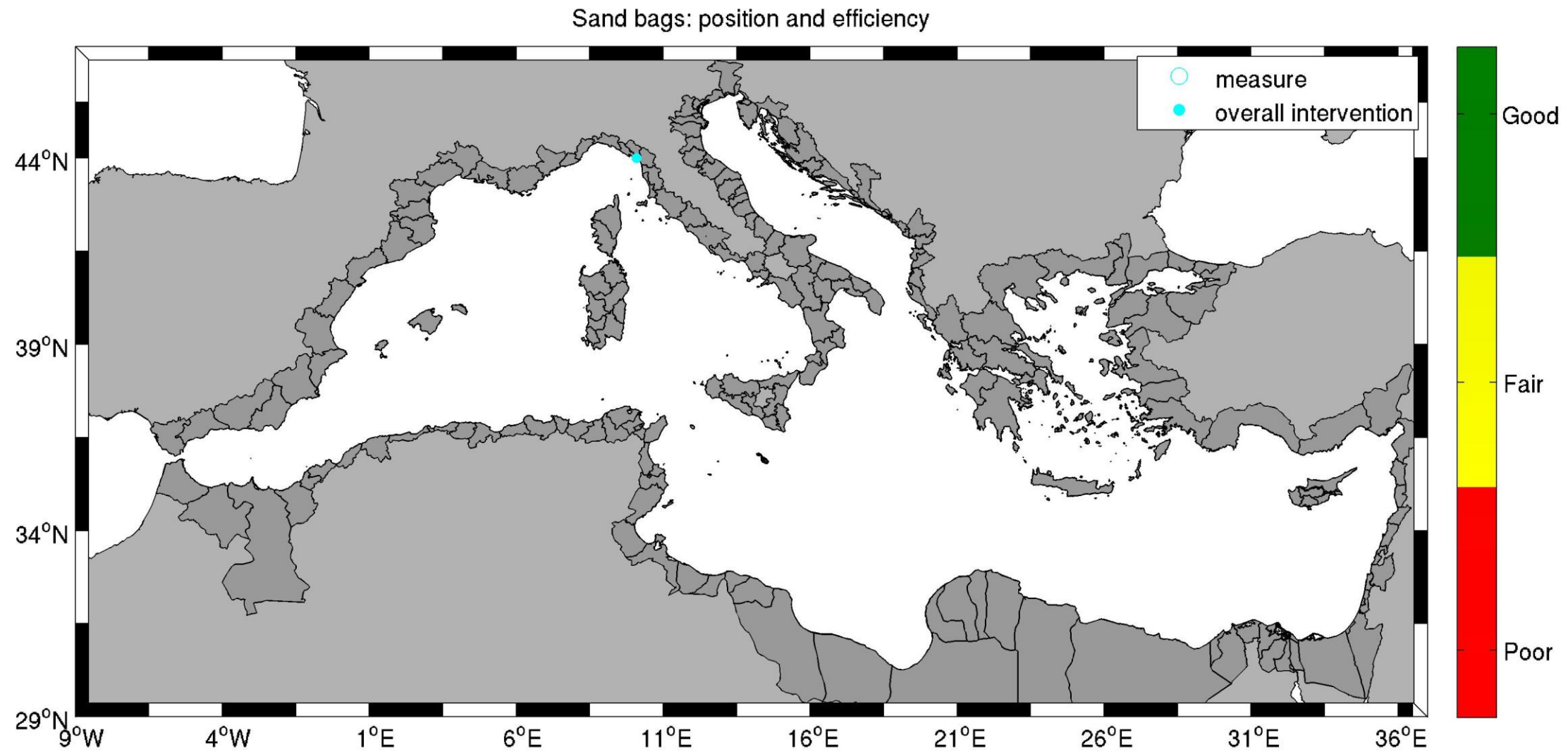


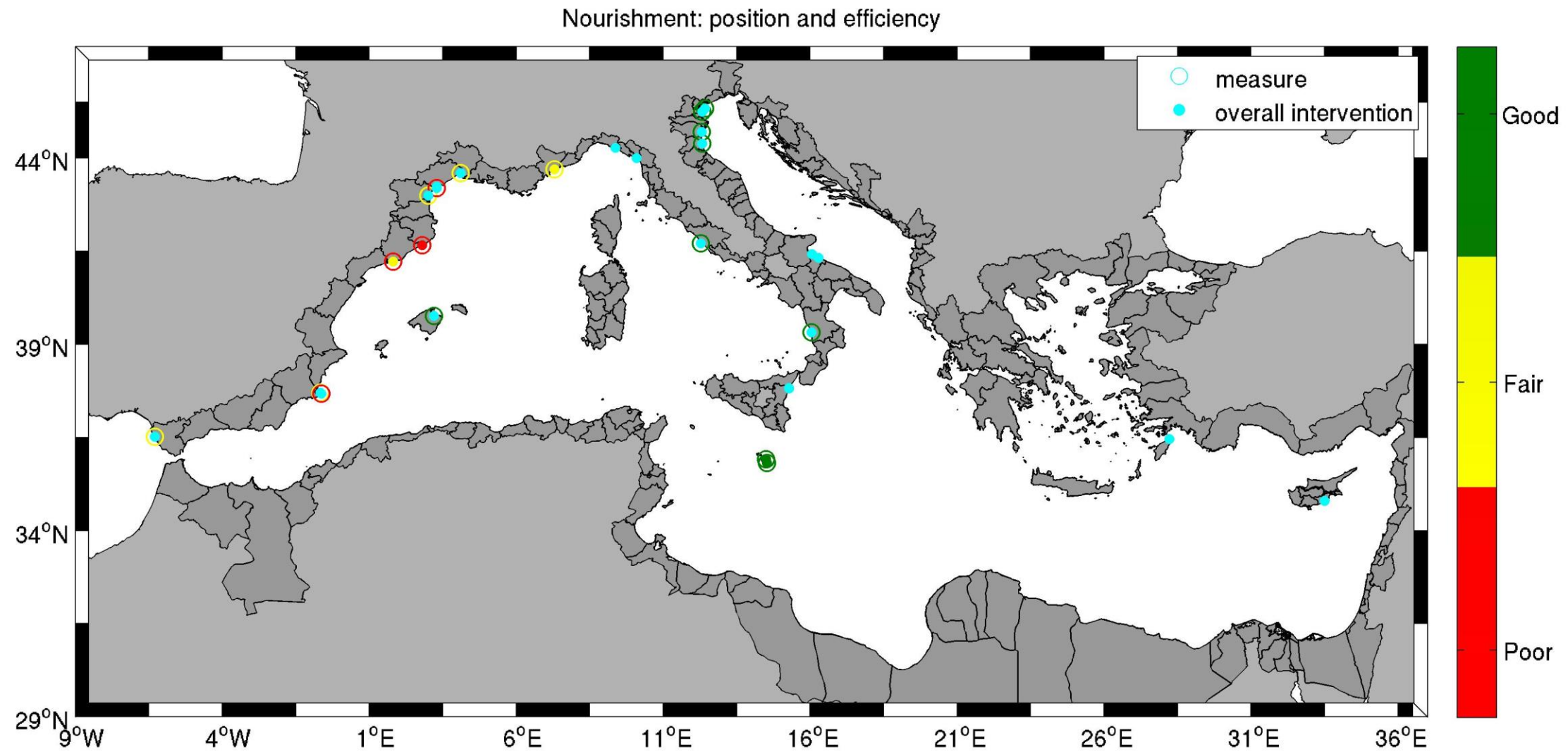


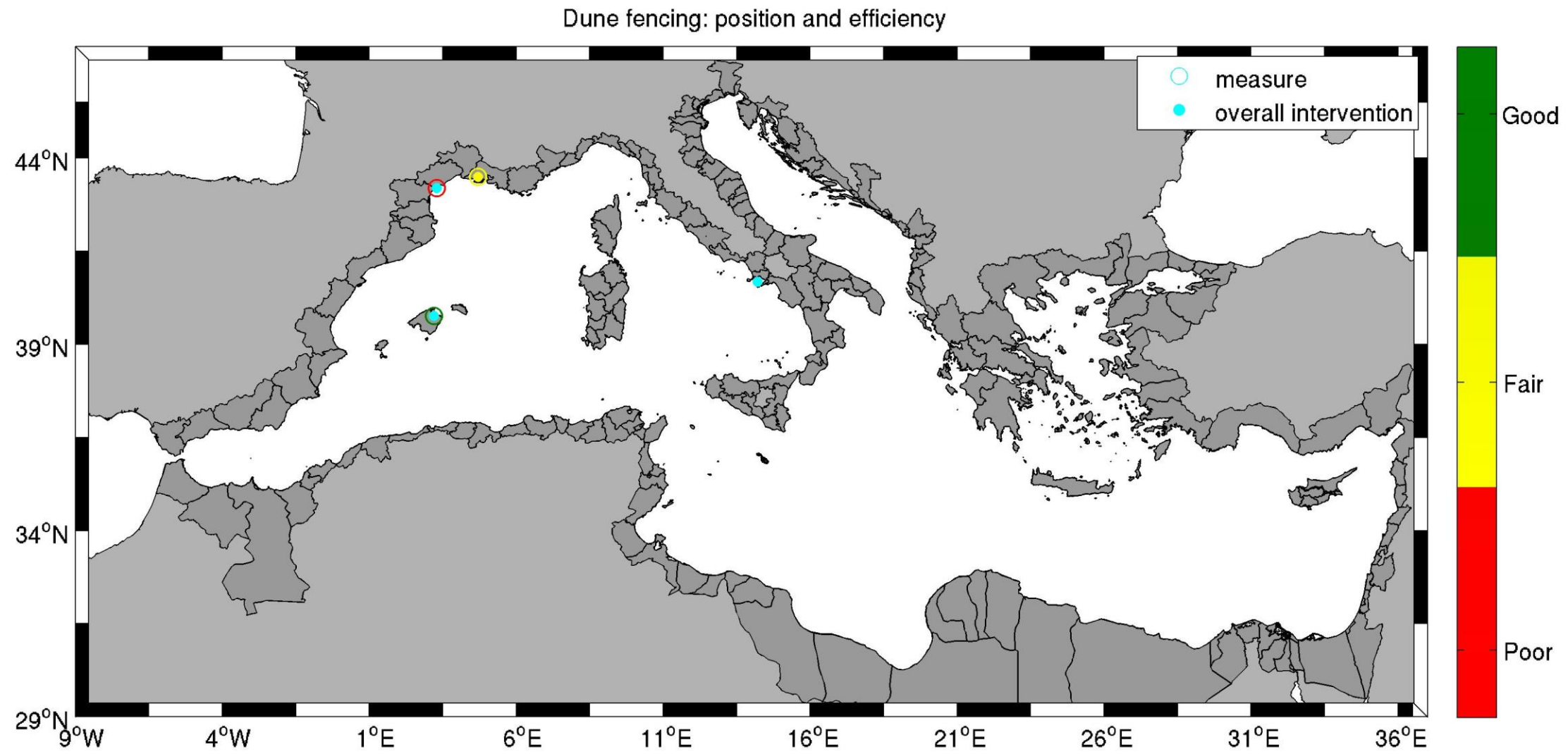


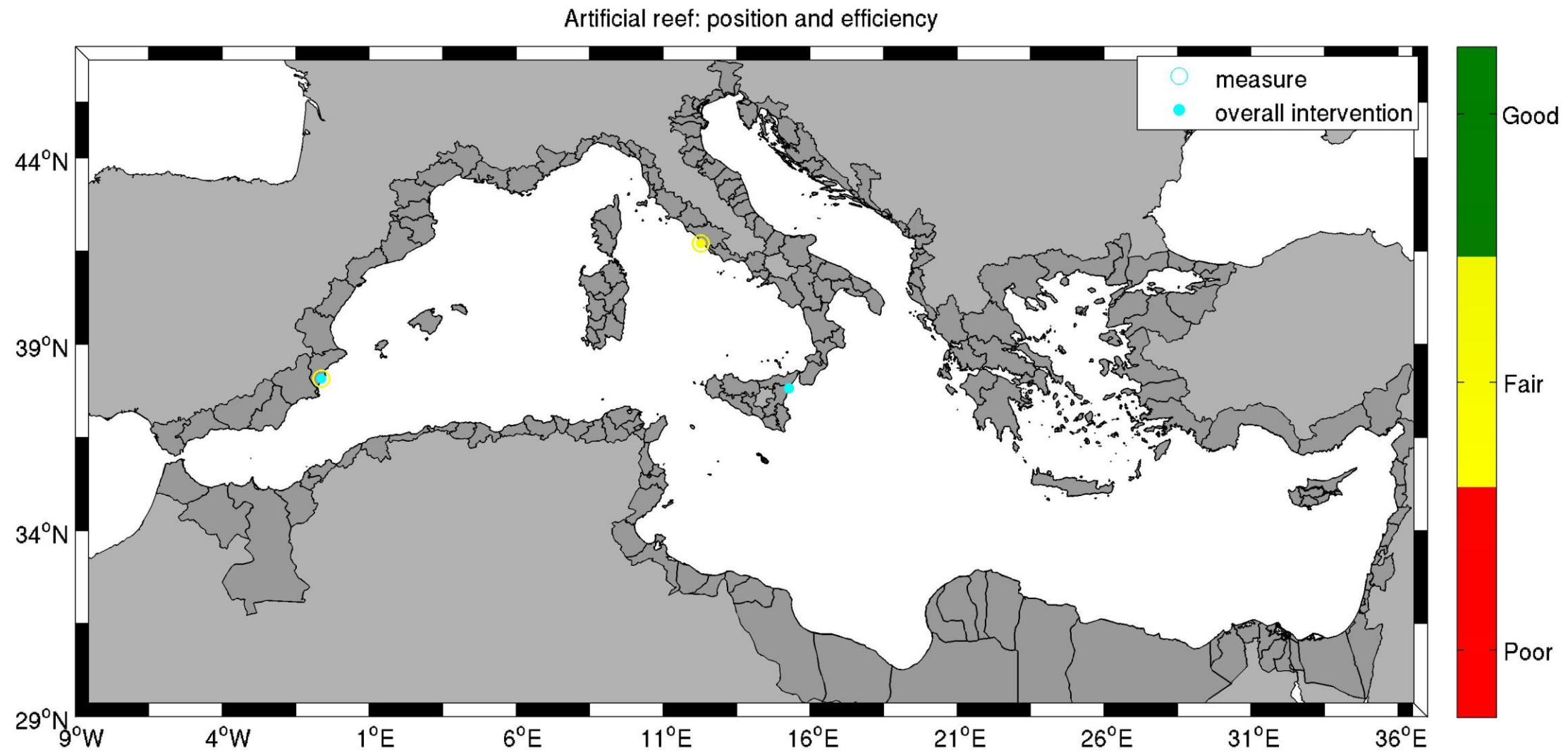


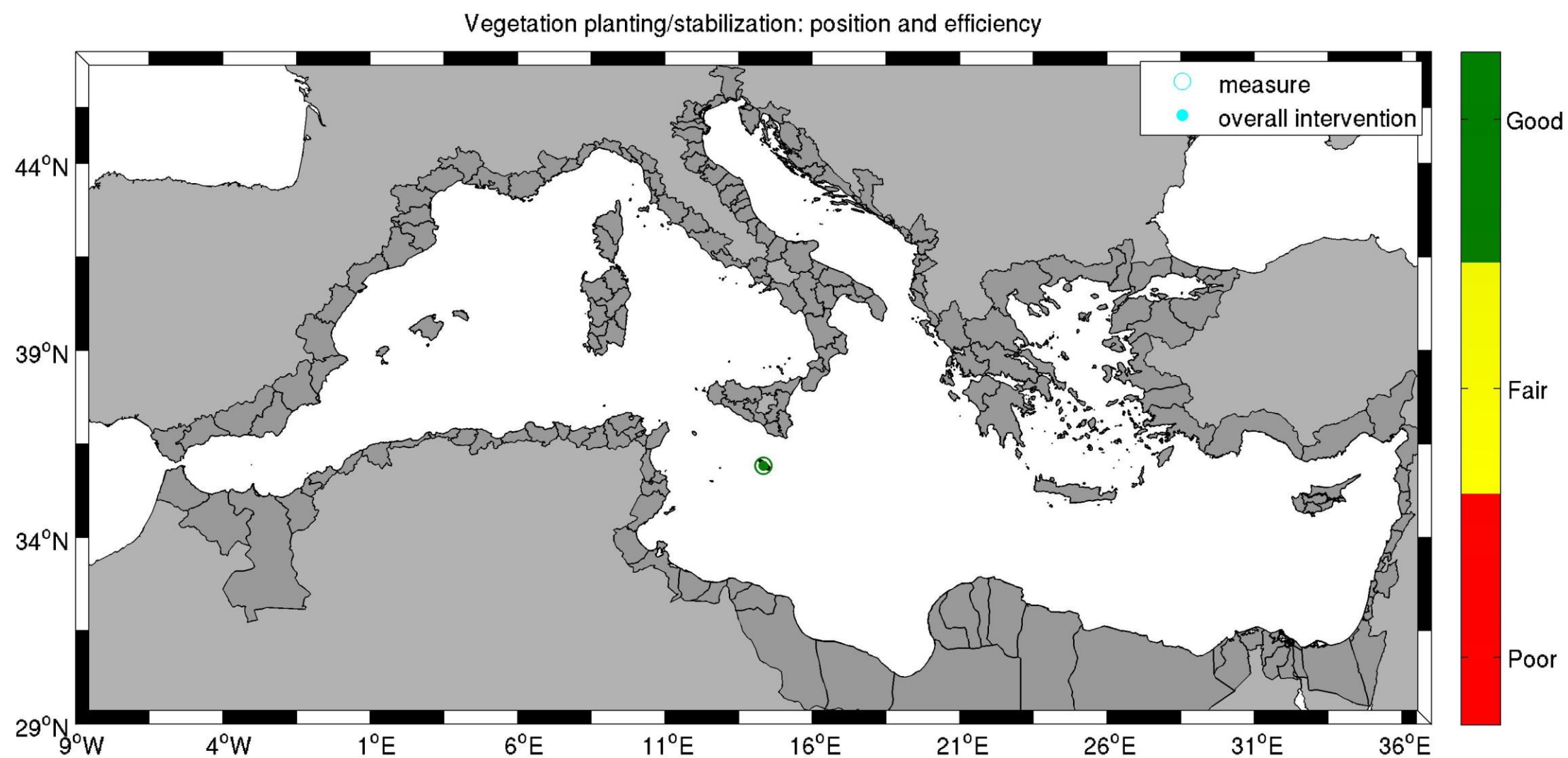


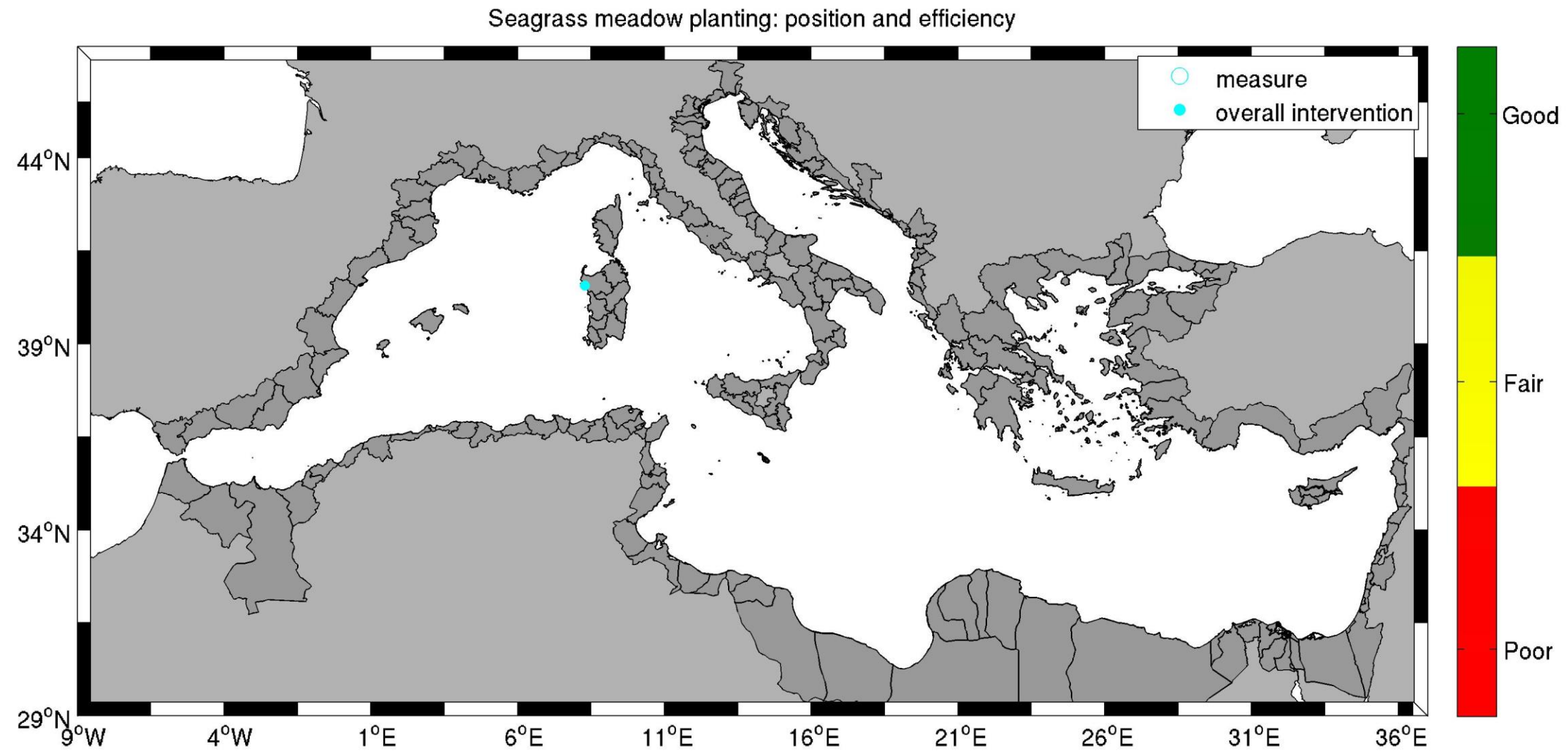


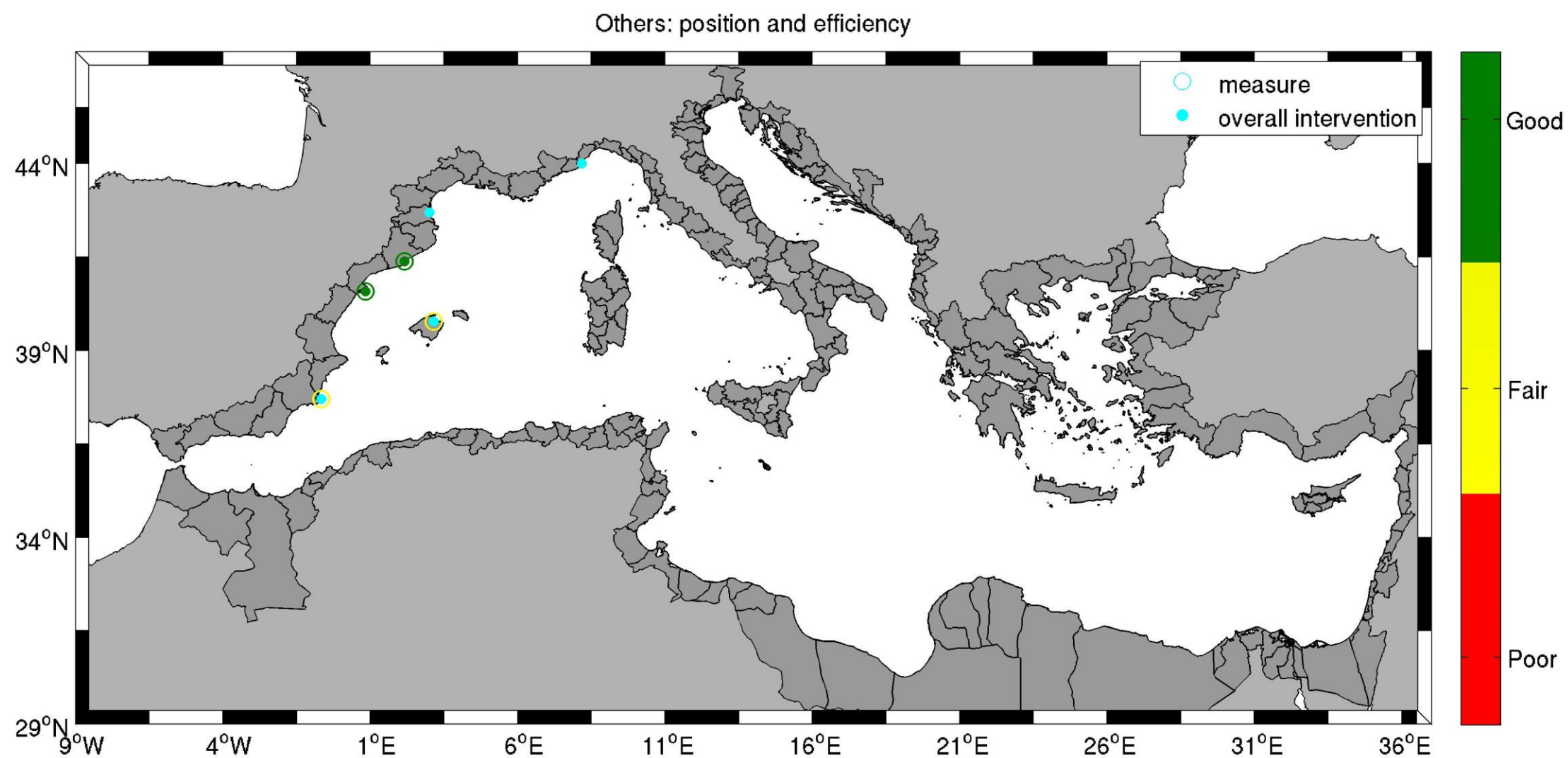


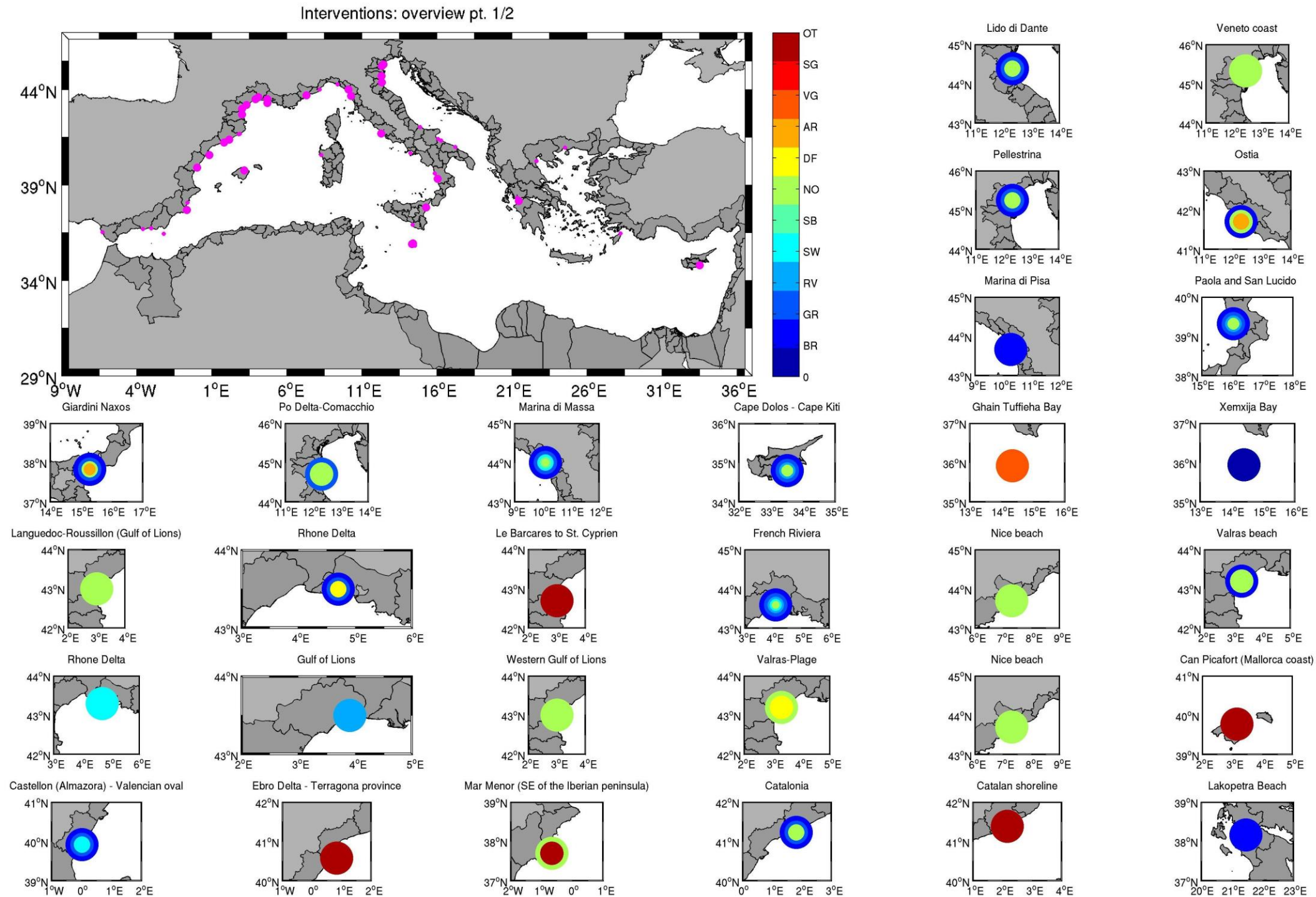


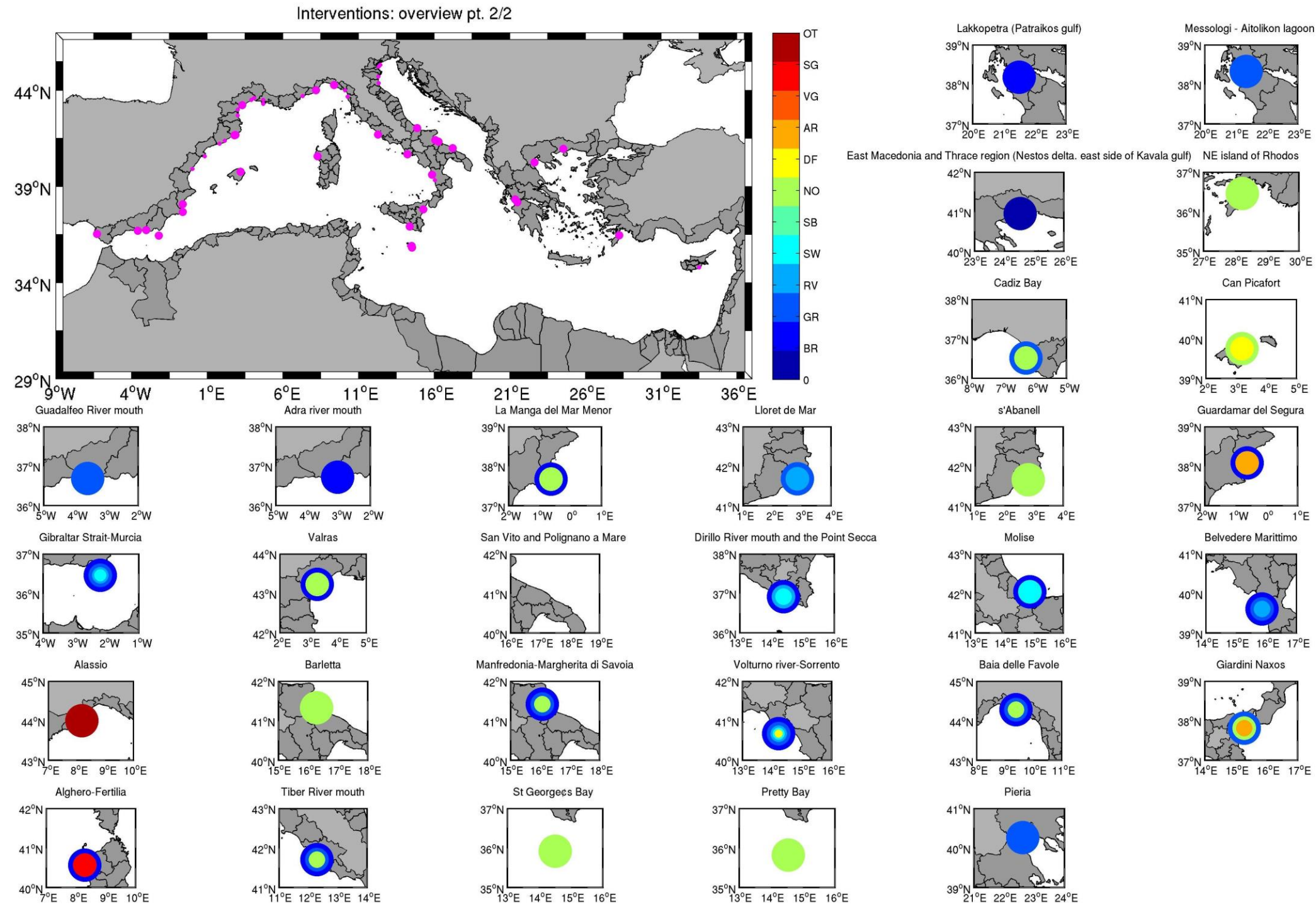












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Annex I List of the study sites included in the Thematic Atlas and their related reference

Country	Study Site	Reference
Cyprus	Dolos Kiti	EUROSION
Greece	Rhodes Island Lakkopetra Messalogi Lagoon Kameiros, Rhodes Evrotas Delta Kyparissia Bay Pieria	Anagnoistou et al., 2011 EUROSION EUROSION Karambas, 2011 - MEDASSET (2015) Prospathopoulos et al., 2004
France	Littoral Hérault Saint-Aygulf Valras-Plage Petite Camargue Gulf of Lion La Croisette Gulf of Lion Nice Gulf of Lion Vaccares, Rhone Delta Espiguette Perpignan Valras	Sourisseau J., 1989, Brunel et al., 2014 Chavand and Migniot, 1992 Rihouey et al., 2009 EUROSION Samat et al., 2007 Anthony, 1997 COASTGAP; Brunel et al., 2013 Cohen&Anthony, 2007; Anthony et al., 2011 Durant, 2001, Gervais et al. (2012) http://www.conservatoire-du-littoral.fr/siteLittoral/117/28-vaccares-13_bouches-du-rhone.htm , http://www.conservatoire-du-littoral.fr/siteLittoral/23/28-espiguette-30_gard.htm , Curr et al., 2000 Rihouey et al., 2009



Italy	Pellestrina Lido di Dante Marina di Massa Goro mouth, Po Delta Giardini-Naxos Lido di Ostia Procida Island Marina di Ravenna Marinella di Sarzana Tarquinia Livorno Tyrrenian Coastline Pellestrina Cavallino Riccione Francavilla Punta Marina Vendicari (Sicilia) Rosolina, Po Delta Golfo di Follonica San Vito Polignano a Mare Dirillo mouth Molise coast Belvedere Marittimo Alassio Barletta Manfredonia Sorrento Baia delle Favole Giardini Naxos Alghero-Fertilia Tiber river mouth	DELOS; Bezzi et al., 2009 DELOS; Lamberti & Zanuttigh, 2005 EUROSION EUROSION, Simeoni, 2002 EUROSION; Lanza&Randazzo. 2013 DELOS, Tomasicchio, 1993 EUROSION EUROSION, Utizi et al., 2016 EUROSION Koutrakis et al., 2011 Aminti et al., 2010 D'Alessandro et al., 2011 DELOS, 2005, Bezzi et al., 2009 COASTGAP; SHAPE SHAPE; Miccadei et al., 2011 Utizi et al., 2016 http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=VenetoCoast.pdf Aminti et al., 2002 Andriani and Walsh, 2007 Andriani and Walsh, 2007 Anfuso and Martinez, 2009 Aucelli et al., 2009 Bellotti et al., 2009 Bowman et al., 2007 Damiani et al., 2003 Damiani et al., 2003 De Pippo et al., 2008 Di Matteo et al., 2008 Lanza and Randazzo, 2011 Manca et al., 2013 Tarragoni et al, 2015
Malta	Xemxija Bay Ghajn Tuffieha Bay St George's Bay Pretty Bay	EUROSION EUROSION Farrugia, 2017 Farrugia, 2017



Spain	Malaga	Manno et al., 2016
	Castellón plain	EUROSION
	Sitges	EUROSION
	Mar Menor	EUROSION
	Catalan coast	Gacia et al., 2007; Marchand et al., 2011
	Malagueta, Malaga	Malvárez et al., 2002
	Benidorm	Aragonès et al., 2015
	Valencia	Yepes and Medina, 2005
	Albufera, Valencia	Almonacid-Caballer et al., 2016
	Formentera	Sanjaume & Pardo, 2005
	Ebro Delta	Ministerio De Medio Ambiente, 2001
	Catalunia	Garcia-Lozano – Pintò, 2017
	Cadiz Bay	Anfuso et al., 2008
	Can Picafort	Basterretxea et al., 2007
	Guadalefe River mouth	Bergillos et al., 2016
	Adra River mouth	Jabaloy-Sanchez et al., 2014
	La Manga del Mar Menor	García-Ayllón, 2015
	Lloret de Mar	Jimenez et al., 2011
	S'Abanell	Jimenez et al., 2011
	Guardamar del Segura	Lopez et al., 2016
	Gibraltar Strait – Murcia	Manno et al., 2016

Table 3. List of the study sites included in the Thematic Atlas and their related reference.

