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People for Ecosystem based Governance in Assessing Sustainable development of Ocean and coast

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Report on the Mediterranean and Black Sea Basin Regional Participatory Assessment including Fact sheets showing the integration, outcomes and conclusions in addition to recommendations and Policy options in the region.

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Acronyms

ABNJ	Areas Beyond National Jurisdiction
Adricosm	Adriatic sea integrated coastal areas and river basin management system pilot project
AG	Advisory Group on the Development of Common Methodologies for ICZM
AoA	UN marine Assessment of Assessments
BEACHMED	Strategic management of beach protection for sustainable development of Mediterranean coastal zones
BOD	Biochemical Oxygen Demand
BSC	Black Sea Commission
BSC-PS	Black Sea Commission-Permanent Secretariat
BSEC	Black Sea Economic Cooperation
CAMP	Coastal Area Management Programmes
CASES	Collaborative Application Sites
CBD	Convention for Biological Diversity
CIESM	Mediterranean Science Commission
CIM	Cumulative Impact Mapping
CoCoNet	Coastal Communities Network
COP	Conference of Parties
CORINE	Coordination of Information on the Environment
CPUE	Catch Per Unit Effort
DG RES	EU Directorate-General for Research and Innovation
DPSIR	Driving forces-Pressures-State-Impact-Responses
DRB	Danube River Basin
EcAp	Ecosystems Approach (acronym in IUCN and MAP context; see also EsA)
EEA	The European Environment Agency
EE-AoA	Europe's Environment Assessment of Assessments
EIA	Environmental Impact Assessment
Empafish	Marine Protected Areas as tools for Fisheries Management and conservation
ENCORA	European Network for Coastal Research
ENPI CBC Med	European Neighbourhood and Partnership Instrument Cross-Border Cooperation Mediterranean Sea Basin Programme
EsA	Ecosystem Approach (see also EcAp)

EU	European Union
EUCC	European Union for Coastal Conservation
EUROSION	European initiative for sustainable coastal erosion management
FAO	Food and Agriculture Organization of the United Nations
FP7	Seventh Framework Programme for Research
GEF	Global Environmental Facility
GES	Good Environmental Status
GFCM	General Fisheries Commission for the Mediterranean
GHG	greenhouse gas
GIS	Geographic Information System
GPA	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities
IA	Integrated Assessment
ICPDR	International Commission for the Protection of the Danube River
ICZM	Integrated Coastal Zone Management
IMP	Integrated Maritime Policy
INSPIRE	INSPIRE Directive
IOC	Intergovernmental Oceanographic Commission of UNESCO
IRA	Integrated Regional Assessment (IRA
IUCN	International Union for Conservation of Nature
LEAC	Land and Ecosystem Accounting
LME	Large Marine Ecosystems
LOICZ	Land-Ocean Interaction in the Coastal Zone
MAP	Mediterranean Action Plan
MCA	Multi-Criteria Analysis
MCSD	Mediterranean Commission on Sustainable Development
MDG	Millennium Development Goal
Medcities	Network of Mediterranean coastal cities
MEDCOAST	Mediterranean Coastal Foundation
MEDINA	Marine Ecosystem Dynamics and Indicators for North Africa
MedPan	Network of Marine Protected Area Managers in the Mediterranean
MedWet	Mediterranean Wetlands Initiative

MoU	Memorandum of Understanding
MPA	Marine Protected Areas
MPO	microbial pathogens organisms
MSFD	Marine Framework Strategy Directive (MSFD
MSP	Marine Spatial Planning
MSSD	Mediterranean Strategy for Sustainable Development
MWO	Mediterranean Wetlands Observatory (
NFPs	National Focal Points
NGO	Non-Governmental Organisation
NUTS	Nomenclature of Territorial Units for Statistics / Nomenclature des unités territoriales statistiques
PAP	Priority Actions Programme
PEGASO	People for Ecosystem based Governance in Assessing Sustainable development of Ocean and coast
PLC	Land Cover Product
RA	Regional Assessment
RAC	Regional Activity Centre
SDG	Sustainable Development Goal
SDI	Spatial Data Infrastructure (SDI
SEA	Strategic Environmental Assessment
SHAPE	Shaping an Holistic Approach to Protect the Adriatic Environment
SIPAM	System Information for the Promotion of Aquaculture in the Mediterranean
SPA	Special Protected Area
SPICOSA	Science and Policy Integration for Coastal System Assessment
SPINCAM	Southeast Pacific data and Information Network in support to integrated Coastal Area Management
SWOT	Strengths, Weaknesses, Opportunities and Threats
TDA	Transboundary Diagnostic Analysis
UNCSD	United Nations Conference on Sustainable Development
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
VLIZ	Vlaams Instituut voor de Zee (Flanders Marine Institute)

WAVES	Wealth Accounting and the Valuation of Ecosystem Services
WFD	EU Water Framework Directive
WP(1-7)	PEGASO Work Packages
WWF	World Wildlife Fund

Executive Summary

In 2011, the Protocol on Integrated Coastal Zone Management (ICZM) to the Barcelona Convention entered into force. The entry into force of the Protocol in 2011, including its ratification by EU, means that the Protocol has now become part of EU law and have binding effects. To support ICZM in the Mediterranean and Black Seas, the EU co-funded a research project, PEGASO formed of 25 partners from EU and non-EU countries. The main objective of PEGASO was to construct a shared ICZM governance platform of scientists, end-users and decision-makers. This platform was pivotal in guiding the PEGASO integrated regional assessment (IRA) of marine and coastal assessments in the Mediterranean and Black Sea region.

The chapters in this IRA Report describe the four years of PEGASO activity, culminating in a policy-oriented blueprint for steering an integrated approach to marine and coastal ecosystem management. The work is presented in this brochure version, as well as electronically (PEGASO Coastal Wiki); in a policy-makers summary; and a comprehensive deliverable report.

In accordance with the ICZM Protocol, the PEGASO work draws on multidisciplinary competencies to test and validate various assessment tools at regional and local scales. Two main policy objectives were focused on: a balanced use of coastal zones, and the preservation of natural capital. Based on these objectives, PEGASO devised an ecosystem-based approach for assessing and managing impacts. This was done by building on existing capacities as well as developing common, novel approaches to support integrated policies for the coastal, marine and maritime realms of the Mediterranean and Black Sea basins.

A number of tools were required to fill research gaps that were recognised in ICZM processes. Most importantly from a methodological perspective, PEGASO showed how the integration of certain tools can help describe complex phenomena, despite having limited access to high-resolution data. These tools not only improved the understanding of marine and coastal processes, but could also be applied to socio-economic dynamics, interactions between terrestrial and marine processes, and critically to model future conditions in order to guide the most appropriate governance framework.

Chapter one provides a brief introduction to the PEGASO methods and tools used for integrated assessments. The various context-specific factors that influence the suitability of method(s) are discussed across a range of temporal and spatial scales. Chapter two describes the governance and scientific stocktakes that were performed to evaluate the current state of ICZM-related knowledge, resources, and activities. Chapter three presents a selection of results from using the PEGASO tools, highlighting key findings, and particular strengths of different methods. Chapter four emphasises the benefits of the governance platform and creating a means to share data and knowledge. This is not only critical for the implementation of ICZM, but also to continue supporting ICZM strategies in the future, such as in the Black Sea countries. Chapter five focuses on particular management and policy issues that need to be addressed, explaining the issue of ‘spatial misfit’ between ecosystem dynamics and governance systems. And finally, chapter six concludes the guidelines for the implementation of this integrated approach, setting priorities for future marine and coastal ecosystem assessments.

Introduction

Many efforts have been made to develop integrated coastal zone management (ICZM) in the Mediterranean and Black Seas. Both basins have historically suffered from environmental degradation, and problems persist to the present day. In many cases this has led to unsustainable trends, impacting economic activities and human wellbeing. Numerous incentives were successfully implemented to achieve ICZM goals, such as: Coastal Area Management Programmes (CAMPs) at localities around the Mediterranean; and publications of ICZM guidelines, recommendations, action plans, and a White Paper on ICZM. However, coastal areas throughout the Mediterranean continued to face severe pressures that threatened resources and the viability of economic activities. It became apparent that no real progress would be achieved on the basis of recommendations alone. Thus, it was decided in 2001 to develop the Integrated Coastal Zone Management (ICZM) Protocol for the Mediterranean Sea as a stronger instrument to ensure sustainable management of coastal natural resources (for further details of ICZM activities, see [1]). It is one of seven protocols to the Barcelona Convention that address specific aspects of Mediterranean environmental conservation. The ICZM Protocol was signed in Madrid on 21 January 2008 and to date, has been ratified by eight countries and the EU. The entry into force of the Protocol on 24 March 2011, including its ratification by EU, means that the Protocol is now part of EU law and has binding effects.

Coastal zones have traditionally been governed in a fragmented manner, often by discrete sectors on broad geographical scales, particularly in Europe. Prior to the Protocol, 'good practice' would frequently be relied upon as a way of bringing together sectoral policies to guide national systems. Governance was wide in scope, yet assessments were frequently made in isolation without considering interdependent habitats. A crucial value of the Protocol is to emphasise a more holistic ecosystem approach (EsA), i.e. a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Prior to this, a common definition of the 'coastal zone' was lacking. By defining the coastal zone, a series of integrative measures were established and a geographic space was identified within which these measures could be applied in a consistent way.

In the Box 1 the results of a comparative analysis between the EsA, and described in The Convention for Biological Diversity (CBD) and the principles of the ICZM as described in the ICZM Protocol is presented. This is particularly important in understanding the scope and intention of the Protocol, as well as how it relates to other contemporary policy initiatives.

To support implementation of the ICZM Protocol, the EU Directorate-General for Research and Innovation launched a call for proposals under the Seventh Framework Programme for Research (FP7). The call was wide in scope and required issues and developments in the Black Sea to be included in considerations. After the bid was awarded to the PEGASO consortium, activities were launched in February 2010.

The main objectives of PEGASO were to build on existing capacities and develop common, novel approaches to support integrated policies for the coastal, marine and maritime realms of the Mediterranean and Black Sea basins. PEGASO gleaned guidance from the ICZM Protocol, adopting practices that were consistent with implementation in the Mediterranean. Existing models were adjusted to suit the Black Sea through three innovative actions:

- Construct an ICZM Governance Platform as a bridge between communities of scientists and end-users, going far beyond conventional bridging.

- Refine and further develop efficient, easy-to-use tools and approaches for making sustainability assessments in the coastal zone (indicators, accounting methods, models and scenarios).

- Implement a Spatial Data Infrastructure (SDI) following the INSPIRE Directive. Organise and standardise spatial data to support information sharing on an interactive viewer, making it available on the ICZM Platform to disseminate project results to end-users and interested parties.

Consistent assessments are essential for identifying major threats to the environment. Methodical monitoring of ecosystems over various temporal and spatial scales enables sound decision making and strategic policy-shaping. For marine and coastal habitats, an ecosystem-based approach is essential if we are to support sustainable development. Ultimately, this will be of mutual benefit to the environment and socioeconomic activities that depend on these marine ecosystems, hence improving overall human wellbeing.

Recent progress in creating large-scale global and regional assessments is evidenced by the United Nations' (UN) marine Assessment of Assessments (AoA; UNEP and IOC-UNESCO, 2009) and Europe's Environment Assessment of Assessments (EE-AoA, 2011) processes and protocols. Together with the regionalisation of environmental assessment frameworks for the Mediterranean and Black Seas in the context of the Barcelona and Bucharest Conventions, protocols related to the UN and EEA processes, and to the conventions, illustrate the evolving scope and objectives of environmental assessments (e.g. Article 19 of the ICZM Protocol).

In the last decade, there has been a rise of integrated European Union (EU) environmental legal instruments along with initiatives in the framework of the Barcelona and Bucharest Conventions and related protocols. This has provided a real impetus to give a legal basis to environmental assessments in coastal and marine environments, and improve both the frequency and quality of programmes that monitor the environmental status. This has led to an improved understanding of human–environment interactions. In the front line of this has been the Water Framework Directive (WFD), the Marine Strategy Framework Directive (MSFD), the protocols for protection of the Mediterranean and Black Seas from land-based sources and last but not least, the Protocol on

Integrated Coastal Zone Management in the Mediterranean Sea (hereinafter referred to as 'the Protocol').

The ultimate purpose of socio-environmental assessments is to support sustainable decision making through the provision of credible information [2,3]. An assessment intrinsically aims to produce policy-relevant information by answering context-based questions that improve the understanding of interactions between the environment and society. With reference to the ICZM, socio-environmental assessments are recognized as appropriate tools in working towards sustainable coastal activities and reducing coastal and marine environmental degradation [4,5].The main entry point of this work is therefore the recognition of integrated (regional) assessments (IRAs) as a necessary process at the science-policy-society interface. IRAs play a pivotal role in the ICZM process, supporting policies on sustainable development at the land-sea interface and in the marine domain, covering a wide range of aspects including urban development, climate change, habitat degradation and conservation.

The ICZM Protocol is a main driver of the PEGASO project. PEGASO objectives include building on existing capacities, and developing common, novel approaches to support integrated policies as required for the coastal, marine and maritime realms of the Mediterranean and Black Sea basins. In accordance with the ICZM Protocol, the PEGASO work draws on multidisciplinary competencies to test and validate various assessment tools at regional and local scales. PEGASO aims to support the development of forward-looking concepts, and explores approaches and methods for the Integrated Regional Assessment (IRA) of coastal and marine areas. Rather than a comprehensive, in-depth assessment, the current IRA Report should be seen as a blueprint for the approach of integrated assessments in coastal and marine areas at a regional basin level. In delivering this, the PEGASO IRA adheres closely to the structure of the ICZM process. For a more detailed description of the ICZM Process visit the PEGASO Wiki: http://www.pegasoproject.eu/wiki/ICZM_Process_diagram#Structure_of_the_ICZM_Process

Guidelines developed by the Priority Actions Programme / Regional Activity Centre (PAP/RAC) are the "how" of ICZM, structured into five key stages: Establishment; Analysis and Future; Setting the vision; Designing the Future; and Realising the vision. These stages identify key tasks that constitute the guiding structure of this IRA Report and have shaped PEGASO's work. The clear objectives on how to implement the ICZM Protocol in the Mediterranean may help pave the way for a similar process in the Black Sea, and in other regional seas worldwide

The PEGASO work addressed a wide-spanning, multidisciplinary audience including policy and decision –makers, practitioners and scientists from the Mediterranean and Black Sea basins, as well as the wider ICZM community outside of these two regions. In the context of the PEGASO project, the IRA Report aims to support the governance platform as a "*forum for the building of a common*

knowledge by sharing of experience, data, methods and interpretation of the processes in a long term vision" [6].

Chapter 1 PEGASO Scope and Objective

Santoro F., Lescrauwaet A.K., Taylor J., Raux P., Potchin M., Haines-Young R., Ivanov E., Morrisseau F., Breton F., and Brochier F.

The Protocol defines ICZM as:

"a dynamic process for the sustainable management and use of coastal zones, taking into account at the same time the fragility of coastal ecosystems and landscapes, the diversity of activities and uses, their interactions, the maritime orientation of certain activities and uses and their impact on both the marine and land parts"

Article 2, ICZM Protocol

The ICZM therefore takes into account the interrelationships that exist between coastal and marine habitat uses, and the environmental ramifications of these. Natural capital has been defined by the International Union for Conservation of Nature (IUCN), as

"the world's stocks of natural assets including geology, soil, air, water and the millions of species of plants and animals. It provides us with a wide range of services, often called ecosystem services, which make human life possible."

The World Forum on Natural Capital, IUCN

Much of the recent interest in the Ecosystem Approach (EsA) can be traced back to the influence of the Convention on Biological Diversity (CBD, which in 1995 adopted it as the 'primary framework' for action (Shepherd, 2004). Under the convention, the Approach is the basis for considering all the goods and services provided to people by biodiversity and ecosystems (Secretariat of the Convention for Biological Diversity, 2000). According to the CBD, the EsA:

"….places human needs at the centre of biodiversity management. It aims to manage the ecosystem, based on the multiple functions that ecosystems perform and the multiple uses that are made of these functions. The ecosystem approach does not aim for short-term economic gains, but aims to optimize the use of an ecosystem without damaging it" [7]

According to the CBD, the formal definition of the Ecosystem approach is:

"…. a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. It is based on the application of appropriate scientific methodologies focused on levels of biological organization which encompass the essential processes, functions and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of ecosystems." [8]

Box 1. Definitions of Integrated Coastal Zone Management and the Ecosystem Approach

1.1 Methodology for an Integrated Regional Assessment

A review conducted in the context of the PEGASO project [9] showed that increasing numbers of broad environmental assessments over the past few decades have considerably improved the current knowledge on sustainable development issues. Additionally, assessments have revealed consequences that follow from a lack of appropriate actions. Environmental assessments have also gradually moved from being status-oriented and descriptive in nature, to becoming valuable tools for decision making that examine **relationships between environment and socio-economic processes**. State-of-the-environment reports have broadened their ambition and scope. More assessments are now conducted at transnational regional levels, discovering emerging issues including those in the

Mediterranean and Black Sea regions. However, despite this progress and the existence of excellent regional reviews, there is no periodic, comprehensive, reliable compilation of essential information on the overall state of the coastal and marine environment at the regional level.

One of the major criticisms of current regional assessments is the **lack of information** on **cumulative and synergistic effects**. Due to the complexity of monitoring interrelated factors acting on the human–environment interface, practices must be highly methodical and structured. Current regional-level assessments focus heavily on environmental status, trends and threats, whereas a greater emphasis is needed on context-dependent impacts, related measures, and environmental management strategies. This requires continued and increased research efforts on cause-effect relationships, and an improved and structured dialogue between science, policy and management at the appropriate scale. Quantitative impact assessments that specifically look at how **multiple anthropogenic threats** interact, and how these combined threats impact coastal and marine habitats have rarely been conducted over such large scales. The PEGASO desktop review [9] supports this growing need to better understand and identify synergistic threats, such as those between climate and anthropogenic stressors, as well as quantifying the magnitude of their impact.

As a result of the review, it was concluded that future approaches should strive for **more integrated assessments** which are capable of addressing effects from multiple stressors at various scales, and understanding driving and root causes. Improving strategies in such a way would lead to more appropriate management and mitigation measures. Not only do integrated assessments provide information about status and trends, but they stretch beyond this to provide future outlooks based on policy directions [10].

1.2. Integrated Assessment Methods and Tools in support of ICZM

Inadequate pressures on ecosystems and the goods and services they provide, ultimately has an impact on society and human wellbeing. Although pressures may not directly affect human activities or welfare, they may significantly compromise essential ecosystem functioning on which we depend.

Implementing public environmental policies is challenging. Interactions between natural (i.e. physical, chemical, biological) and social (i.e. institutional, cultural, and economical) processes are complex and often poorly understood. Strategies for environmental management do not just rely on technical solutions, but may depend on arbitration and negotiation. During the process, conflicting interests may need to be reconciled, and public legitimacy must be recognised. An improved understanding of pressures on coastal and marine ecosystems supports the development and implementation of appropriate management measures for the preservation of ecosystems and to the benefit of societies that depend on them. The current systems within areas of environmental research and governance often operate in isolation and may not always be prepared for effective responses to complex environmental issues. In general, the objectives and regulatory requirements of public policies are becoming ever-more stringent for most of the current environmental concerns. Some of the more recent environmental policies regarding water management (e.g. Water

Framework Directive), nature conservation (e.g. Habitats Directive, Birds Directive, Natura 2000) and marine waters (e.g. Marine Strategy Framework Directive) are based on the concepts of integrated and ecosystem-based management. These public policies aim to relate human activities to the state of the environment so that impacts can be monitored and appropriate responses can be developed (e.g. DPSIR scheme).

The main challenges in creating an ecosystem-based approach arise from the need to integrate different disciplines and sectors, and coordinate improved ways of sharing and distributing knowledge. It is essential to involve stakeholders in the implementation of ICZM processes and to adopt interdisciplinary approaches. Collaboration between distinct disciplines and levels of governance is needed to facilitate the implementation of an integrated approach, especially concerning shared areas such as land-sea interfaces and watersheds. In addition, every effort should be made to translate scientific information to support and inform adequate political and management decisions. Conversely, policy-related literature and information should be actively communicated to the scientific community, practitioners and managers, and the general public.

In the ICZM policy context, one of the objectives is to develop reliable sources of comprehensible information to assist in public decision-making. To serve this objective, PEGASO developed an approach for integrated assessments based on assessment tools and sources. This 'new' resource is an integration of existing data, information, tools and approaches which have been made accessible to a wider user group. This should ultimately expedite better-informed deliberation processes by creating and supporting an integrated science–policy interface. This both serves the needs of decision makers and managers, supporting them by making use of scientific expertise, reliable data and existing information systems, and the needs of scientists, managers and stakeholders to become better informed of their roles in ICZM processes.

The tools and methods are briefly explained below in section 1.2.1 and 1.2.2, then results are exemplified in sections 3.3.1 and 3.3.2.

1.2.1 A Step-by-Step Analysis Framework

The proposed integrated assessment framework follows the structure of the ICZM Process as co-developed and coordinated by the Priority Actions Programme/Regional Activity Centre (PAP/RAC; [11]; Split, Croatia) with the support and participation of the Mediterranean Action Plan (MAP-UNEP; [12]), and the 21 Mediterranean countries and the EU as Contracting Parties to the Barcelona Convention [13]

The ICZM Process is structured into 5 key stages (see also Figure 10):

1) Establishment,

2) Analysis and Futures

3) Setting the Vision

4) Designing the Future

5) Realising the Vision

The 5 stages are further structured into Key Tasks for each stage. The weight that is given to each of the stages and respective key tasks is largely influenced by individual, local circumstances.

During the process of an integrated assessment, a number of questions are addressed. The process is likely to be influenced by institutions and stakeholders involved. Therefore, there must be adequate representation and participation from stakeholders and end-users throughout the integrated assessment process. Once this preliminary analysis is complete, appropriate responses can be performed through the following step-by-step analysis framework:

i) Identify and inform issues through relevant PEGASO tools and other existing tools available (e.g. EIA)
ii) Institutional analysis (e.g. existing governance schemes and ICZM processes), describing the political and environmental regulations applicable.
iii) Mapping Research capacities and outputs in the multiple disciplines of coastal and marine research, and their networks and collaborations
iv) Outline interactions between interdependent activities and environmental functions by building a causal chain diagram of influence under a Pressures Impacts Framework.
v) Inform and characterise this web of relationships using PEGASO tools (e.g. LEAC, CIM, and Indicators) to build a shared diagnosis of the area and issues.
vi) Support the deliberation process based on the shared diagnostic to explore barriers, opportunities and options for ICZM (e.g. by using scenarios).

The methodology for the work with indicators consists of building **regional and local indicator frameworks** that describe key aspects in the current ecosystem status. The DPSIR scheme is a widely accepted approach for environmental assessments and for ICZM, as it provides a useful description of coastal systems with an emphasis on the causality chain in relation to sustainable management. PEGASO developed an approach to identify the main environmental issues affecting an area, as well as the associated interactions, processes and impacts, under a simplified **Pressure Impact Framework**. This approach acts as the crucible to build indicators for informing integrated assessments in coastal and marine environments.

The framework can also estimate changes over time and aims at providing an explanation for past causalities, and assessments for the future. The next stage is to build **spatial indicators** for an improved analysis of interactions between uses, pressures, ecosystem goods and services, and the wellbeing of coastal populations.

Subsequent scenarios are using these results as input in the method, so the framework becomes increasingly powerful as it is validated from real experiences, and parameters are refined to provide more accurate estimates and analysis.

Before impacts on ecosystem services and natural capital can be understood, clear definitions for the value of ecosystem goods (e.g. fish, oil) and services (e.g. coastal defence, waste repositories) must be developed. The PEGASO assessment analyses relationships between ecosystem services, production, economic value, and human welfare. Ideally it can be completed by comparing the cost of environmental degradation (due to overuse, misuse or mismanagement) to the cost of management responses. Several approaches such as multi-criteria analysis (MCA) or Strengths, Weaknesses, Opportunities and Threats (SWOT) analyses can be used to test the potential of new management schemes.

The deliberation process is also part of the integrated assessment, providing a basis to support informed management and policy decisions. At the regional level, a key output of PEGASO is the inception and implementation of an ICZM platform. The platform aims to enable the science, policy-level and end-user communities to build a common understanding of issues and institutional perspectives affecting the Mediterranean and Black Sea coastal zones by sharing data, information, case studies and insights. At a local scale, the platform can benefit existing fora identified in the institutional analysis, or recognise when there is a need to create new working groups, whether these are formal bodies (e.g. the Nile Delta Coastal Group) or informal structures (e.g. PEGASO stakeholders group in other CASES). The suite of tools that were further developed, refined and integrated are briefly presented in this IRA Report.

1.2.2 Tools in Support of an Integrated Assessment

An Introduction to Land and Ecosystem Accounting (LEAC)

LEAC assesses a range of policy-relevant ecosystem properties and functions, such as land cover, habitats and primary production. The information is derived from remote-sensing products, statistics and other spatial data, which are processed and analysed in a spatially explicit way. Spatial data is extracted using units that are relevant for decision making, such as areas of river catchments, administrative divisions, or protected sites. This accounting approach helps to structure multiple sources of spatial data to construct accounts of natural and human-built stocks, flows (changes) and therefore balances. Land cover, protected areas and biodiversity accounts were used as proxies to assess progress towards conservation of natural capital. This resulted in the measurement of ecosystem stock and change between 2000 and 2011 (Figure 1), based on a PEGASO definition of land cover for the whole Mediterranean and Black Sea coastal regions. Maps were produced at 250mx250m resolution using a classification nomenclature designed for the production of land accounts. For more details on the LEAC methodology and results of PEGASO LEAC for the Mediterranean and Black Sea regions, refer to the PEGASO Coastal Wiki [14] and the PEGASO Spatial Data Infrastructure (SDI).

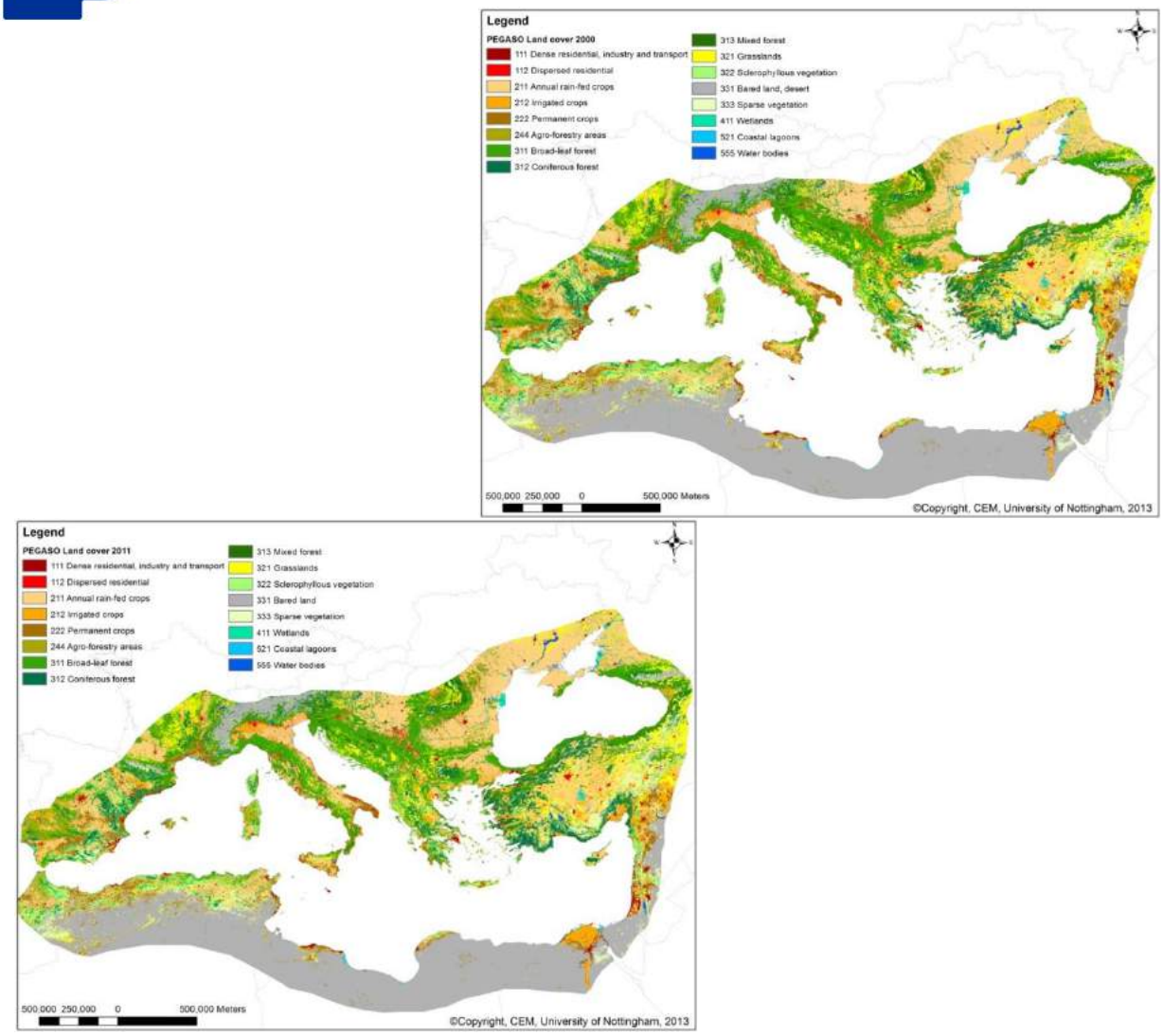


Figure 1. Example: PEGASO Land-cover for Mediterranean and Black Sea basins, in 2000 and 2011 [15**].**

An evaluation of the accuracy of the PEGASO Land Cover Product (PLC) suggests that it is more appropriately applied to assessments at the broad regional levels of the Mediterranean and Black sea basins, whereas the standardised CORINE land cover inventory performs better at smaller scales of higher spatial resolution. CORINE is however, limited in its coverage to the European part of the study area (see Chapter 3).

An Introduction to Cumulative Index Mapping (CIM): Pressures and ImpactsThe changing states of ecosystems and related services are directly or indirectly linked to the pressures and impacts from human activities, which is want we want to manage in ICZM. An innovative approach applied by PEGASO was to map the cumulative impact of human activities on marine ecosystems. Cumulative impact mapping is created by overlaying individual threat maps and using vulnerability scores to estimate ecological impacts. Individual threat maps look at individual human activities that impact marine ecosystems by estimating the ecological consequences of these activities and by quantifying the vulnerability of different ecosystems to these activities. Based on a methodology designed by

Halpern et al. [16], the cumulative impact maps provide critical information on the sustainability of human activities. These can be put into practical use for evaluating where certain activities can continue with little effect on marine habitats, where other activities might need to be stopped or moved to less sensitive areas, and where to focus efforts on protecting remaining pristine areas.

In PEGASO the approach is used to evaluate, in a systematic way, the potential impact of anthropogenic **pressures,** hereinafter called "stressors", on different marine ecosystems. Uses and land-based pollution data are considered as proxies for stressors, and the cumulative **impact** they have on ecosystem components is based on expert judgment. Estimates of cumulative impact are provided in units of square kilometres. Cumulative pressure and cumulative impact indices were calculated over the western Mediterranean (Figures 2 and 3). The geographical scope was limited by constraints of testing preliminary prototypes on wider scales (due to access of data and models), as well as challenges in identifying and coordinating relevant survey-specific experts at the Mediterranean regional scale. However, following the success of cumulative mapping indices used in the western Mediterranean, it has been proved that the method can easily be scaled up and can therefore be extended for the whole Mediterranean and Black Sea region.

The **cumulative *pressure* index** incorporates additional pressure layers in order to locate where multiple pressures are occurring at the same time with high intensity (Figure 2). This index is independent of ecosystem-related parameters, i.e. pressures are displayed with the same intensity whether they affect sensitive or resilient ecosystems.

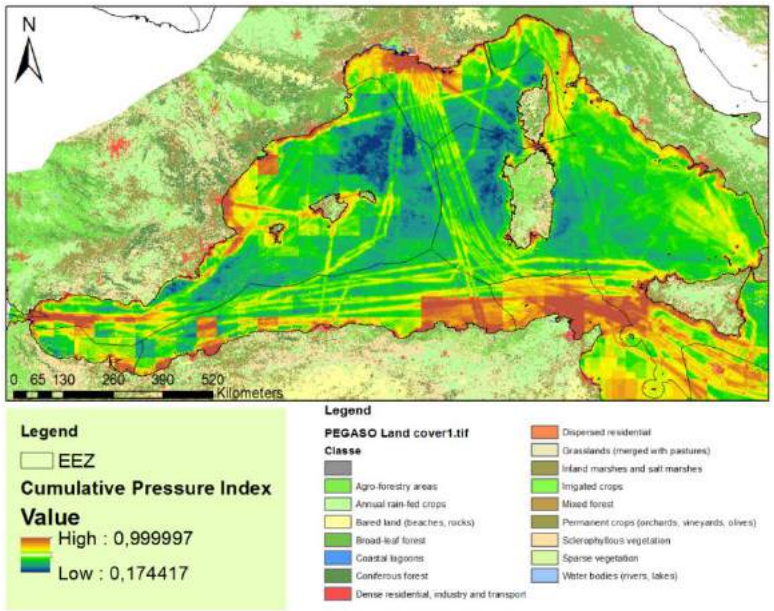


Figure 2. Example: Cumulative pressure indices for the western Mediterranean Sea. Source: Morrisseau, 2013 (PEGASO Project)

The **cumulative *impact* index** represents the modelled impact of pressures over the ecosystem components under study. The displayed impact intensity in a grid cell depends both on the intensity

of the pressure(s) and the specific vulnerability of the ecosystem (Figure 3). Climate-change-related stressors have a very high impact and are not represented as they often mask the other pressures. This is mainly due to the large spatial scale of stressors, and high value of importance as perceived by experts.

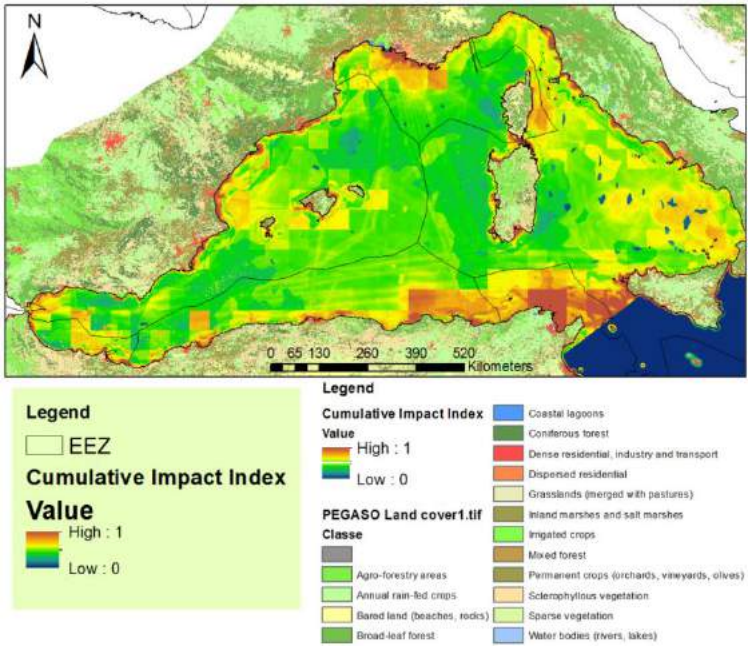


Figure 3. Example: Western Mediterranean cumulative impact indices, excluding climate-change-related stressors. Source: Morrisseau, 2013 (PEGASO Project)

For more details on the CIM methodology and results of PEGASO CIM for the Mediterranean and Black Sea regions, refer to the PEGASO Coastal Wiki and the PEGASO Spatial Data Infrastructure (SDI; [17]).

An Introduction to Indicators and Indices

In support of integrated assessments and the ICZM Protocol, a set of indicators was developed. The goal was to develop a suite of indicators that could be applied at different scales, both in the Mediterranean and Black Seas, as sustainability assessment tools, and as tools to measure the implementation of ICZM policy and programmes. This was structured through three steps:

- review of existing indicator initiatives to measure the progress towards sustainable development in coastal zones, in particular for the Mediterranean and Black Sea Basins;
- assessment of these initiatives against the needs of relevant policy instruments;
- definition of new indicators where necessary, taking into account existing recommendations for ICZM indicators, and the sustainability framework in which they need to operate

As a result of this work, a core set of indicators was identified to support ICZM across the Mediterranean and Black Sea regions. They cover biophysical issues and socio-economic themes,

taking account of threats to the coastal zone. Indicators were used under a DPSIR framework and a multi-scale approach for the design of indicators was adopted, to take into account the needs at

local, national and regional scales. A series of socio-economic indices were produced to operate at regional scales and assess the cost of ecosystem degradation at local scales. These indices covered socio-economic development, marine industry activities, environmental threats, and levels of environmental protection (see Table 5 in Section 3.3.1). Indices were designed around the economics of the Large Marine Ecosystems approach [18]. The work identifies the data and statistics needed to populate and maintain the indicators, and the outputs were tested iteratively with end-users, across the region and within the 10 PEGASO Collaborative Application Sites (CASES) areas [19].

For more details on the process, methodology and results of PEGASO's core set of indicators for the Mediterranean and Black Sea regions, refer to the PEGASO Coastal Wiki [20] and the PEGASO SDI [17].

Ecosystem Based Approach

The Convention on Biological Diversity (CBD), adopted the Ecosystem Approach (EsA) in 1995 as the 'primary framework' for action [21,22]. Under the convention, the EsA is the basis for considering all the goods and services provided to people by biodiversity and ecosystems [23]. The EsA is taken to embody a core set of 12 principles that seek to encourage an understanding of how ecosystems function, how ecosystem integrity is important for sustaining the output of ecosystem services, and how ecological thresholds and limits need to be considered [24]. The principles argue that management and policy must be undertaken at appropriate spatial and temporal scales. The principles also emphasise the need to identify the multiple benefits that ecosystems can provide to people, and the importance of assessing the value of these benefits so that they can be reflected in decision-making. Finally, the principles explain the importance of trying to understand how ecosystem integrity may be threatened by stressors, and how cumulative impacts may arise, especially in the context of environmental change. To clarify the relation between EsA principles and its relevance to ICZM principles and policies, PEGASO cross-referenced the principles of the Mediterranean ICZM Protocol to those of the CBD EsA. Although there is no simple 'read-across' between the two sets of ideas, there are clearly strong resonances between them reflecting, in part, their common origins, and the desire to overcome fragmented approaches to environmental management.

Creating a Shared Data Infrastructure

One major challenge of the PEGASO project was to share results with stakeholders and end users at different spatial scales. The governance platform was supported by the development of a SDI and local geonodes that were created in order to deliver harmonised sets of data accessible through an Internet viewer. Implementing a SDI, following the INSPIRE Directive, allowed the use of spatial data

generated within the project as well as externally, through an interactive viewer, making it available to the governance platform.

A SDI is a group of technologies, politics, standards, services and human resources, necessary for the compilation, manipulation, access, distribution and use of geographic data at different levels. Its is a basis for the discovering of spatial data, its evaluation and its use. Conceptually, the SDI can be compared to the network of roads and highways: it improves communications provides a better accessibility; this brings a better communication between regions and, therefore, an increase of exchange of geographic information and data.

Participation Tools

Public participation is widely recognised as a necessary tool to ensure a successful implementation of environmental policies: the Conference on Environment and Development (Earth Summit) in Rio de Janeiro in 1992, Principle 10 [25] and Agenda 21 [26] both called for increased public participation in environmental decision-making and led to the adoption in Europe of the Aarhus Convention [27].

Furthermore, participation has become a fundamental pillar of environmental processes as described in the Water Framework Directive (2000/60/EC), the 2002 EU Recommendation on ICZM (2002/413/EC), the 2008 Marine Strategy Framework Directive (2008/56/EC), and the Mediterranean Protocol on ICZM. Participation can be defined as a process where individuals, groups and organisations choose to take an active role in making decisions that affect them [28]. A widely recognized categorisation of participation is the so called "*Ladder of participation*" [29]. The categorisation shows the different ways in which the organisation responsible for activity (e.g. an authority) can involve participants, in this case citizens.

For more information on the participation tools developed and refined by PEGASO for the purpose of ICZM, refer to the PEGASO Coastal wiki information [30,31]

Scenarios

Scenarios are "*sets of plausible stories, supported with data and simulations, about how the future might unfold from current conditions under alternative human choices*" [32]. Scenarios have become important management and policy-support tools. Broadly their purpose is to allow decision makers to think through the implications of different assumptions about the ways socio-ecological systems might respond to different drivers of change [33,34]. This is, of course a difficult task because in practice it is very hard to make predictions about the future for anything other than simple, well-behaved systems. Scenario thinking is therefore intended to help us cope with more complex situations involving a high degree of uncertainty [35].

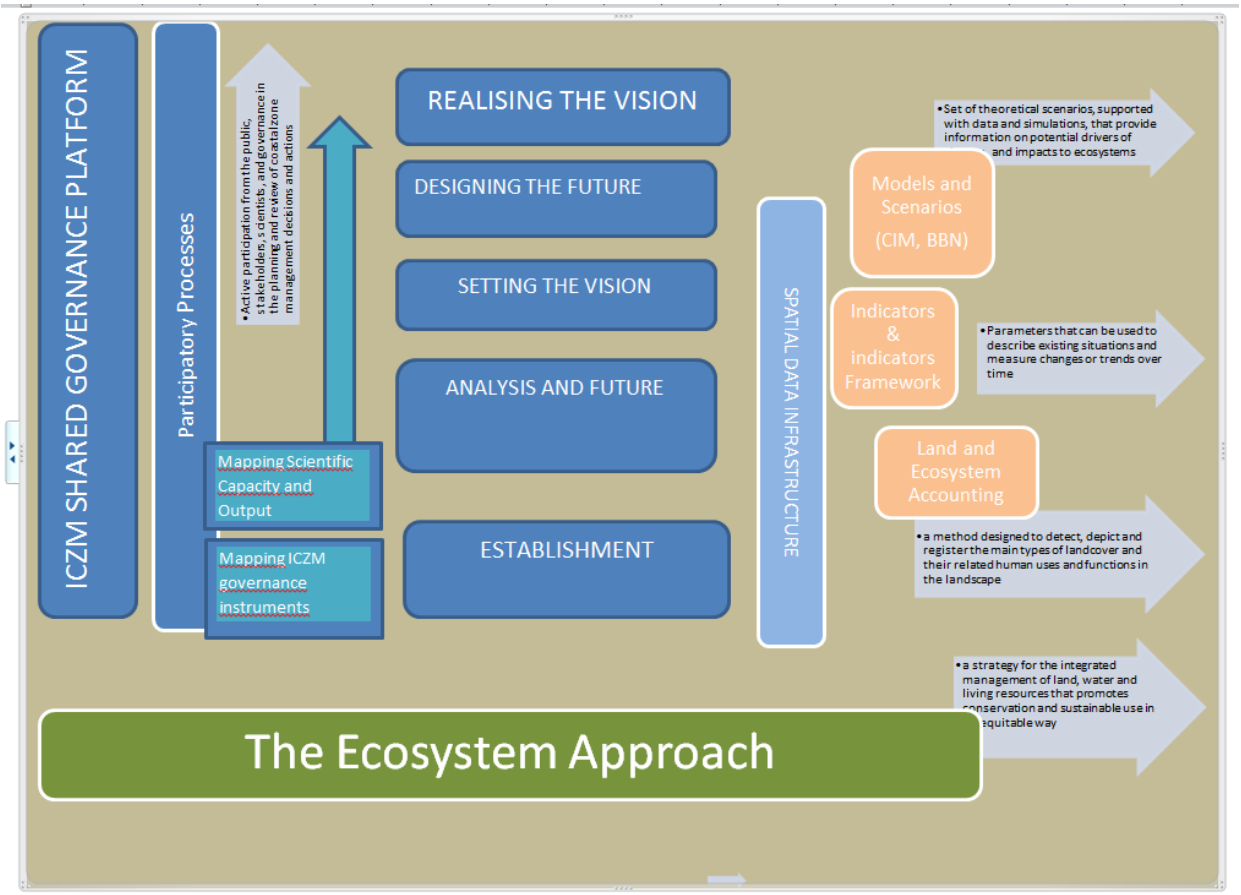
Mapping and Inventories of Structures and Capacities

ICZM ultimately depends on human capacities, technical, scientific and legal resources, and governance mechanisms and processes. Inventories of existing resources and mapping of governance structures and cooperation networks is one of the basic components for the development of

strategies and action plans to deliver ICZM and ultimately a sustainable development of the coastal and marine environments.

These different tools, approaches, and methods have been integrated and combined by the PEGASO project. They can be applied at different and specific stages of the ICZM process (refer to Coastal Wiki ICZM diagram and process [36]). They also form essential elements for the purpose of conducting an integrated assessment. To illustrate this process and an integrated approach, these tools and methods are visualised in Figure 4.

Figure 4: Diagram showing the integration of the different PEGASO tools and methods in support of ICZM.



1.3 Geographical Scope

The Mediterranean and Black Sea regions pose a particular challenge for management due to their positions at a crossroad; geographically, socio-culturally and politically. The Mediterranean and Black Seas are two interlinked basins bordering 15 diverse countries, sitting at the juncture of three

continents. Each basin, however, has its own specific features and identity. For this reason, the Mediterranean and the Black Seas are considered two independent Large Marine Ecosystems (LMEs). Most assessments and state-of-the-environment reports treat each basin as a separate entity, while few consider them together as a single unit as they are for instance in, EUROSTAT and FAO reports, IASON project outputs, and some IUCN assessments [37,38].

The Mediterranean Sea is the largest semi-enclosed European sea, covering approximately 2.5 million km^2, with an average water depth of about 1.3 km (Table 1). By surface area, it comprises only 0.7 per cent of the total world's seas and oceans, yet the extent is approximately 3,800 km from east to west, with a maximum north-south distance of around 900 km from France to Algeria. The shelf is narrow, with mainly mountain chains bordering the north resulting in steep coastal slopes and smaller drainage basins. The Siculo-Tunisian strait separates two physically distinct sub-regions; the western and the eastern basin, acting as a geographical and hydrological frontier. Based on bio-geographical and oceanographic considerations, the Mediterranean Sea is also commonly subdivided into four distinct sub-regions namely the (i) Western Mediterranean Sea, (ii) Adriatic Sea, (iii) Ionian Sea and Central Mediterranean Sea, and (iv) Aegean-Levantine Sea. Employed by the EU Marine Strategy Framework Directive (MSFD), this subdivision is becoming widely accepted for strategic planning, reflecting an emerging consensus for assessing marine systems at a smaller scale based on ecological functions.

The Black Sea is an inland sea located between the far south of Eastern Europe and the far-western edges of Asia and Turkey (see Table 1). Comprising some 4,338 km of coastline [39], the Black Sea connects to the Mediterranean Sea starting at the Bosporus Strait, leading to the Sea of Marmara and the Dardanelles Strait, then south through the Aegean Sea and Sea of Crete. Bordered by six countries (Romania and Bulgaria to the west; Ukraine, Russia, and Georgia to the north and east; and Turkey to the south), the Black Sea is also impacted by the 17 nations whose major rivers empty into its basin, of which the largest is the Danube River. This unusually high river discharge into a relatively small, semi-enclosed sea is a particularly important feature when considering environmental impacts. With a drainage basin covering nearly a third of Europe, the Black Sea is highly vulnerable to pressures from land-based activities. The health of the Black Sea depends not only on bordering countries, but also critically on those riparian countries connected to its river basins.

Table 1. Main features of the Mediterranean and Black Seas.

AL, Albania; BA, Bosnia-Herzegovina; BG, Bulgaria; CS, Serbia and Montenegro CY, Cyprus; EL, Greece; ES, Spain; FR, France; HR, Croatia; IT, Italy; MT, Malta; PT, Portugal; RO, Romania; SI, Slovenia; TR, Turkey. The Black Sea includes the Azov Sea.

	Black Sea	**Mediterranean Sea**
Neighbouring EEA and collaborating countries	BG, RO, TR	ES, FR, IT, SI, MT,

		HR, BA, CS, AL, EL, CY, TR
Coastline (km; from Corine LC data)	4,338	51,471
Area of the 0–10 km zone (km^2; from Corine LC data)	64,743	265,999
Sea surface area (km^2)	432,000	2,500,000
Water volume (km^3)	547,000	3,750,000
Average and max. depth (m)	1,500 Max. 5,267	1,300 Max. 2,210
Temperature (average °C)	11	15-21 (W-E)
Salinity (average ‰)	17.5	36.2-39 (W-E)
Area of catchment (km^2)	2,000,000	1,900,000
Ratio of catchment area to sea volume	3.6	0.51
Total population of basin (million inhabitants)	160	450
Coastal zone highlights (0–10 km terrestrial coastal zone)	Incipient increase of artificial surfaces, still low overall in the coastal zone, but already a high percentage in the first km coastal strip. Still an important presence of natural and semi-natural land, including the Danube delta — the biggest delta in Europe. Presence of erosion is relatively low (13 % of coast length), but also relatively low level of coastal defences.	High level of urbanisation (16 %) along the coast, with increase of built-up areas during last decade; dense along coastline, and sprawling throughout the rest of the coastal zone. High level of coastal defences creating the 'Med wall'. Loss of semi-natural and natural land. Low levels of protection based on number of Natura2000 sites. Long stretch of coast affected by erosion (30 %).

Source: The Black Sea Commission; UNEP Mediterranean Action Plan; the Large Marine Ecosystems of the World; and EEA, 2006 [40].

Although the geographic scope of the PEGASO IRA is regional, it includes important local-scale contributions from PEGASO Collaborative Application SitES (CASES; Figure 5). These aim at testing and validating the assessment tools developed during the project at different spatial scales, thus contributing to the Integrated Regional Assessment at a basin-wide scale.

Figure 5. The location of the PEGASO CASES

Table 2. Summary of PEGASO CASES

CASES	Coastal issues considered	Objectives	Outcomes of activities undertaken in PEGASO	PEGASO tools tested
Mediterranean Sea				
Al Hoceima coast, central part of northern Morocco	- Urban sprawl and Coastal Planning - Coastal resources management - Climate change impacts	- Remediate coastal degradation - Elaborate future *Scenarios* based on a participatory process and using quantified *Indicators*. - Assess coastal vulnerability to climate change and propose adaptation strategies. - Help decision-makers to implement ICZM Protocol	- Environmental Territorial Diagnosis (ETD) - Calculation of a set of ICZM Indicators - Maps of vulnerability to sea-level rise - Prospective analysis using Scenarios and Indicators - Decision Support System (DSS) for coastal managers and planners, using a Multi-Criteria Analysis (MCA)	- Indicators - Participation - Vulnerability Assessment
Bouches du Rhône, southern France	- Conflicted use among coastal and marine areas - Population growth impacting the suburbs - Agriculture development - Urbanisation	Implement and test tools that help decision makers and stakeholders to: - share a common view and understand multiple anthropogenic pressures exerted. - preserve coastal ecosystem services. - manage conflicting coastal use	- - Environmental Territorial Diagnosis (ETD) - Calculation of a set of ICZM Indicators - LEAC maps - Socio-economic valuation	- Indicators - LEAC - participation - Socio-economic valuation

CASES	Coastal issues considered	Objectives	Outcomes of activities undertaken in PEGASO	PEGASO tools tested
	- Traffic and access issues			
North Adriatic Sea, a transboundary case comprising coastal zones of three different nations bordering the Upper Adriatic sea; Italian, Slovenian, and Croatian coastal zones.	- Climate change impacts and risks assessment - Water quality assessment - Lack of common vision for the implementation of the ICZM Protocol in the Adriatic	- Coastal adaptation strategies - Monitoring activities of coastal water qualities - Cooperation among countries at institutional level for common vision of Marine Protected Areas	- DSS Climate change - Water Quality Model - North Adriatic transboundary strategy	- Indicators and participation (DSS-Desyco (DEcision support SYstem for COastal climate change impact assessment) and BHAM (Beach Health Advisory Model)).
Aegean Islands, Cyclades Islands complex of Greece, focus on Naxos Island.	- Fishery - Tourism - Transportation of goods and people	- Planning options and guidelines - Training on ICZM - Conflicts mitigation among stakeholder groups	Contribution to national ICZM strategy and policies for the coastal areas	- Indicators - Basic Scenarios - Socio-economic valuation (to be applied)
Dalyan-Köycegiz Specially Protected Area (SPA), south-west coast of Turkey	- Water quality management - Climate change impacts - Nature conservation	- To increase local community awareness - To enhance collaboration of authorities and public involvement in coastal management	Planned results: - Development of participatory approaches and dissemination actions - Capacity Building (with regard to	- Indicators - Participatory methods

CASES	Coastal issues considered	Objectives	Outcomes of activities undertaken in PEGASO	PEGASO tools tested
	- Management of habitats of endangered species (marine turtles) - Management of recreational activities and boat traffic in the Delta - Fisheries - Urban sprawl	- To enhance knowledge of tools and methods for ICZM	ICZM and PEGASO tools) - A report on the state-of-the-art of the main coastal management issues of the SPA.	
North Lebanon Coastal Zone	- Erosion - Urban sprawl - Impacts on fisheries	- To mitigate coastal risk - To improve urban sprawl and fishery resources management	Reports on conservation and coastal issues (coastal dynamics and pollution, urban sprawl and artificialisation, erosion, accretion and sea filling)	- Indicators - Scenarios - Economic assessment (to be applied)
Nile Delta, north coast of Egypt	- Fishery - Climate change effects e.g erosion - Land use	- Adaptation strategies to climate change - Fishermen well-being - Planning options for decision makers	- adaptation policy - support local communities in designing/implementing local development plans with particular	- Indicators - LEAC - Scenarios - Participatory

CASES	Coastal issues considered	Objectives	Outcomes of activities undertaken in PEGASO	PEGASO tools tested
			reference to fishery and mariculture.	methods Training needs: - LEAC - Scenarios - Participatory methods
Black Sea				
Danube Delta, Romania	- Habitat degradation - Loss of biodiversity - Global Changes impacts on population livelihood and wellbeing - Coastal/Sea Spatial Planning	- coastal ecosystem knowledge - Biodiversity conservation - Regulate economic activities on ecological bases - Protection and rehabilitation of habitats and ecosystems	- Creation of a database for ICZM - Development of thematic maps - maritime spatial planning - Preliminary ICZM strategy - Project proposal for new funding	- Indicators - LEAC - Scenarios - Participatory methods. - SketchMetch method (Spatial planning tool; to be applied)
Bay of Sevastopol, coast of Crimea,	- Eutrophication and water	- Information about ICZM tools	- Coastal Information System	- Indicators

CASES	Coastal issues considered	Objectives	Outcomes of activities undertaken in PEGASO	PEGASO tools tested
Ukraine	pollution - Biological diversity loss - Climate change impacts	- Knowledge of the coastal zone	(web portal: legal arrangements, environmental status and assessment, atlas)	- LEAC and Scenarios
Guria Coastal Region, coast of Georgia, spreading from River Natanebi to the southern edge of the city of Poti.	- Bathing water quality and beach litter -Quality of the Environmental Impact Assessment (EIA) - Inadequate erosion control - Habitat loss	- Development of coastal management tools - Improvement of erosion control and watershed management	- Application of ICZM sustainability indicators (SDI)	- Indicators - LEAC (Land and Ecosystem Accounting method) - SDI (to be applied)

Principles of the Ecosystem Approach

Adopted by The Conference Of The Parties to the Convention On Biological Diversity at its Fifth Meeting, Nairobi, 15-26 May 2000. Decision V/6, Annex 1. CBD COP-5 Decision 6 UNEP/CBD/COP/5/23

1. The objectives of management of land, water and living resources are a matter of societal choice.
2. Management should be decentralised to the lowest appropriate level.
3. Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.
4. Recognising potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programme should:
    a. Reduce those market distortions that adversely affect biological diversity;
    b. Align incentives to promote biodiversity conservation and sustainable use; and
    c. Internalise costs and benefits in the given ecosystem to the extent feasible.
5. Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the Ecosystem Approach.
6. Ecosystems must be managed within the limits of their functioning.
7. The Ecosystem Approach should be undertaken at the appropriate spatial and temporal scales.
8. Recognising the varying temporal scales and lag-effects that characterise ecosystem processes, objectives for ecosystem management should be set for the long term.
9. Management must recognise that change is inevitable.
10. The Ecosystem Approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.
11. The Ecosystem Approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.

Box 2. Principles of the Ecosystem Approach

Chapter 2 PEGASO Institutional and Governance Stocktakes

Škariĉić Z., Prem M., Petit S., Shipman B., Gvilava M., Allenbach K., Özuslu S., Ozhan E.

Coastal governance systems of the Mediterranean and Black Seas are discussed in this chapter in relation to two stocktakes performed in the context of the PEGASO project. First an overview of legal, institutional and organisational frameworks related to ICZM in the Mediterranean and Black Seas is provided, assessing the current state of ICZM implementation (Section 2.1). Second, the results of a stocktake on the scientific capacity and expertise on ICZM in both the Mediterranean and Black Seas were assessed (Section 2.2). Furthermore, consideration was given to the importance of both formal and informal institutions involved in coastal and marine governance, with an overview of existing networks relevant to ICZM in the Mediterranean and Black Seas (Chapter 2.3).

2.1 Stocktake of Legal, Institutional and Organisational Frameworks

One of the main tasks of the PEGASO's shared ICZM Platform was to carry out a benchmark assessment of the current state of ICZM in Mediterranean and Black Sea countries. This was performed in relation to the requirements of article 16 in the ICZM Protocol for the Mediterranean. Then, in September 2010, the Black Sea Commission-Permanent Secretariat (BSC-PS) agreed to follow this approach for the Black Sea basin. Stocktaking for ICZM was then carried out in a comparable way for both the Mediterranean and Black Sea countries, which included an analysis of current ICZM-related legislative, institutional, policy and financial frameworks. The stocktake process was based on a comprehensive and exhaustive ICZM implementation audit questionnaire, which closely reflected the structure of the ICZM Protocol for the Mediterranean. The questionnaire contained 53 questions grouped into 16 core themes (Box 3).

- **Coastal zone boundaries;**
- **ICZM and/or coastal legislation;**
- **Coordination;**
- **Protection and sustainable use of the coastal zone;**
- **Economic activities;**
- **Coastal ecosystems, landscapes and cultural heritage;**
- **Participation;**
- **Awareness raising, training, education and research;**
- **Monitoring and review;**
- **National coastal strategies, plans and programmes, trans-boundary cooperation;**
- **Environmental and strategic assessments;**
- **Land policy;**
- **Economic, financial & fiscal instruments;**
- **Natural hazards and coastal erosion;**
- **Exchange of information and activities of common interest; and**
- **Transboundary cooperation.**

Box 3. Core themes of questionnaire for stocktake of legal, institutional and organisational framework related to ICZM

The draft questionnaire was prepared by PAP/RAC and widely consulted upon, including a workshop with National Focal Points (NFPs) for the ICZM Protocol in the Mediterranean in Portoroz, Slovenia in September 2010. The Mediterranean NFPs subsequently validated the Mediterranean questionnaire, whilst the Advisory Group (AG) on the Development of Common Methodologies for ICZM validated the questionnaire on behalf of the Black Sea Commission (BSC), also in September 2010.

In October, 2010, twenty-seven questionnaires were distributed to the NFPs: six to Black Sea countries and 21 to Mediterranean countries. Turkey received the questionnaire in both formats. The questionnaires were completed either by the NFPs or their nominated experts, or by national partner institutions participating in the PEGASO project, and subsequently validated by the NFPs. The BSC-PS coordinated the responses of the Black Sea countries.

In the Mediterranean, the stocktake resulted in an important contribution to the Barcelona Convention system in terms of providing:

1. **Initial guidance for the preparation of the official UNEP/MAP reporting format to the ICZM Protocol.**
2. **A baseline for measuring the progress made with regard to ICZM Protocol implementation.**

Moreover, early results of the stocktake were instrumental in informing the action plan for the implementation of the ICZM Protocol for the period 2012 to 2019, which was officially adopted by the 17th Ordinary Meeting of the Contracting Parties to the Barcelona Convention.

For the Black Sea, the AG ICZM members advised using the regional stocktake synthesis report as the basis for the ICZM part of the report on the implementation of the Black Sea Strategic Action Plan (SAP), due in 2014-2015. By this logic, it would seem appropriate to update future regional ICZM implementation audits by performing periodic stocktakes prior to ministerial meetings as part of the Black Sea SAP reporting (convened on a 5-year basis).

Results of the Stocktake for the Mediterranean Sea (PAP/RAC, 2013)

The stocktake offered a wealth of data and information on the current state of ICZM in the Mediterranean, and the level of implementation of the ICZM Protocol. The broad pattern that emerged showed a substantial level of activity overall, but that distribution was uneven both thematically and geographically.

At a very basic level, the aggregated answers could be seen as a simple snapshot of the scale of ICZM activity as perceived by the individual respondents, measured against the Articles of the ICZM Protocol. Caution should of course be exercised when making inferences from these responses since they are based on the subjective interpretation of individual respondents. However, the results do provide useful pointers to the perceived level of activity. For example, the respondents' perceived engagement was substantially positive, with 35% of the responses to all 53 questions given as a 'yes'

- indicating a completed or operational status, and 22% as 'In preparation', for a combined total of 57% positive responses (Figure 6).

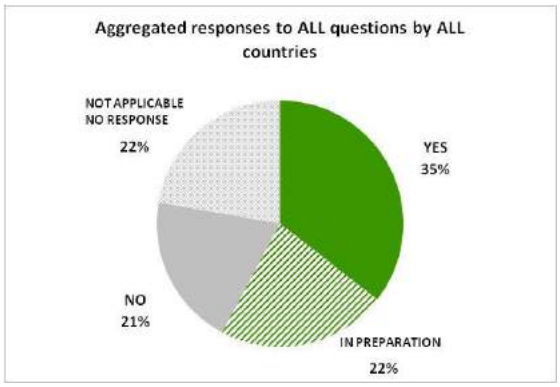


Figure 6. Aggregated responses to ALL questions by ALL Mediterranean countries

Going in to further detail, breaking down the 16 core themes, there was a wide variety of responses by theme (Figure 7). Negative responses were highest in relation to the use of: economic, financial and fiscal instruments (>55%); economic activities (indicators) (>45%); and land policy (>40%). Conversely, the highest levels of positive responses ('yes' or 'in preparation') were related to aspects of environmental protection and management, arguably reflecting the focus of effort over past decades. Encouragingly, the level of positive responses to themes that were developed in the capacity of the ICZM was relatively high (>70%), such as: participation; raising awareness, training, education and research; and coordination. Conclusions of overall responses to individual Articles of the ICZM Protocol are summarised in Table 3.

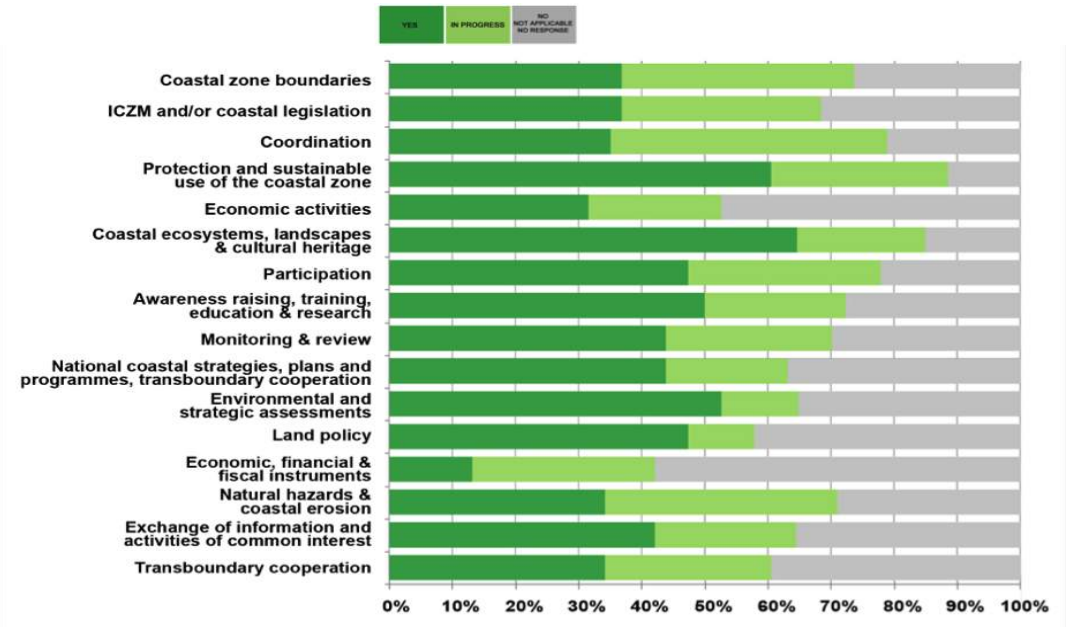


Figure 7. Aggregated responses by theme: Mediterranean

Table 3. Key findings of the ICZM stocktake for the Mediterranean region, related to Articles of the ICZM Protocol. Table adapted from [9]

Article 3 Geographical Coverage
The harmonised delimitation of Coastal Zone boundaries is still incomplete. Whilst some countries adopt the Protocol coastal zone definition, the landward limit varies widely, from narrow coastal strips measured in metres, to those recommended by the Protocol.
Good progress is being made in the complex process of transposing ICZM into national legislation. There are a wide variety of approaches reflecting the breadth of national administrative and legal structures, and there is potential to share this experience across the region, and indeed globally.
Article 7 Coordination
Progress is slow in establishing ICZM consultation mechanisms, with some examples of good practice. Interestingly, progress in establishing coordination at a national level corresponds to improved coordination at local levels. Developing coordination at the relative spatial levels of government does not appear to be mutually exclusive – improved coordination at one level supports the development of coordination mechanisms at others.
Article 8 Protection and Sustainable Use of the Coastal Zone
The principle of a "set back" zone for development is widely accepted and, in many cases, long established. In some cases national legislation already exceeds the Protocol's 100-metre recommendation. However these 100-m minimum setback zones are proving to be an evolving challenge with respect to factors such as natural risk and climate change, or the need to protect natural and landscape heritage, dictating a more flexible dynamic approach. Enforcing compliance remains a challenge.
Similarly, control of urbanisation remains a problem as only a minority of countries have development control provisions consistent with the Protocol.
Freedom of access rights to the foreshore and sea by the public are widespread and are seen as common rights across much of the Mediterranean.
Article 9 Economic Activities
The use of indicators to evaluate economic impacts on the coastal zone is extremely limited, with no comprehensive activity evidenced in this field.

Article 10 Specific Coastal Ecosystems
The protection and regulation of sensitive areas through designation is well advanced. Most states have specific protection measures in place for nominated sites. In contrast, however, few countries have yet taken positive measures to restore and reactivate the positive role of coastal wetlands.
In the last 10 years international and European agreements have stimulated a high level of activity around the Mediterranean in the field of coastal and marine habitat conservation and protection, with most countries reporting coastal reserves or protected areas.
There is a high level of participation in international cooperation programmes, agreements or activities to protect marine habitats, with numerous and diverse positive examples. The region-wide MedPAN network is active in promoting Mediterranean marine protected areas (MPAs) and supports management activities.
Landscape protection is intended primarily for the conservation of sites with biological, geological or cultural values rather than a purely aesthetic value. Coastal landscape protection is generally contained within measures intended for the benefit of entire national territories rather than specifically for the coast. Types of habitats included in the legal protection of landscapes are diverse.
The specificity of islands is generally recognised in national legislation.
Article 13 Cultural Heritage
The protection of land-based cultural heritage is well established. The protection and accessibility of underwater sites, however, is still underdeveloped.
Article 14 Participation
There is little consistency in the involvement of stakeholders through consultation, formal inquiries or mediation across the Mediterranean. It is not seen as a basic right in all countries and where it exists, it ranges from a mandatory right to *ad hoc* discretionary arrangements. Similarly, arrangements for partnerships are more often short-term and project-based. The right to challenge plans, programmes or projects is better developed with most countries having statutory mechanisms. There is considerable scope for improvement in this field.
Article 15 Awareness-Raising, Training, Education and Research
Awareness-raising, education, training and public programmes are characterised by a huge variety of approaches and a wealth of experience. Target audiences range from key civil servants to the general public. The annual Mediterranean Coast Day is seen as a key activity. This is an opportunity to share ideas and innovation in this field.

There are relatively few dedicated ICZM centres, but many professionals operating in related fields are working to implement the concepts. There is a continued need for networking research activity. PAP/RAC and the MEDCOAST are identified as region-wide networking organisations.
Article 16 Monitoring and Review
There are insufficient national inventories of coastal resources and activities, institutions, legislation and planning. Although the majority of countries report some activity, there appears to be little consistency. The Protocol is not clear on what is meant by such an inventory so there may be scope for some further discussion and guidance.
Article 18 and 28 National Coastal Strategies, Plans and Programmes, Transboundary Cooperation
There are few national coastal strategies. However, this is a relatively new area of activity and the Protocol has had little time to influence their shape. Guidelines are now available, and a number are in preparation. The sharing of experience would help maintain momentum across the region.
Only a minority of countries report comprehensive and up-to-date assessments on the use and management of coastal habitats. There is no common methodology for interpreting the nature, or the undertaking of such assessments. This may be an area for further development.
Many ICZM Projects took place throughout the Mediterranean in the past decade, and nearly all countries supported their value in developing national strategies. The CAMP projects are both the most widespread and frequent of these.
Article 19 Environmental Assessment
The Environmental Impact Assessment (EIA) process is widely used in all but one country. Its effectiveness was not investigated. Strategic Environmental Assessments on the other hand are predominantly used in Member States of the EU and candidate countries. There is a potential for improved guidance on this process, particularly for its applicability to the coastal zone.
Article 20 Land Policy
Mechanisms for land designation and management of coastal land in the public domain vary widely. Little is known of the amount of coastal land in the public domain. There are public domain models that may be transferable and could provide the basis for transnational projects. It may be worth further considering how the various models currently available in the Mediterranean could be transferred to administrations currently lacking suitable powers or effective legislation.

Article 21 Economic, Financial and Fiscal Instruments
Only a small minority of states possess the economic instruments to support ICZM. There would appear to be large potential, and a strong need, for further development and testing of such measures.
Article 22 Natural Hazards
Comprehensive risk assessments for the coast are rare. There are many analyses for risks of particular interest such as flooding or pollution, but although intrinsically linked, few have considered impacts from climate change. There is considerable scope for collaborative efforts in this area as many risks are shared.
Article 27 Exchange of Information and Activities of Common Interest
Only a minority of countries have carried out comprehensive analyses of the potential impacts of climate change and of these, only a handful of specific examples recommended adaptation and mitigation measures. It is a matter of concern that this important area is so underdeveloped in the region.
Only four countries have a set of indicators for the coast, and there was some confusion in the responses between the 'state' and 'process' indicators. There is clearly scope for further guidance on the issue of indicators and environmental assessments both in terms of the indicators required and the means of implementation.
Demonstration projects have had a significant impact across the stocktake, underlying their wider importance both as 'test beds' for the development of ICZM and for contributions to the wider experience; helping to shape policy at higher national and Mediterranean levels, as well as the UNEP Regional Seas Programme.
Across the region there are a wide variety of host institutions operating in a scientific capacity in line with the ICZM Protocol. There is on-going potential for sharing this expertise through a meta-network such as a "Mediterranean Network of Coastal Research".
Article 29 Transboundary Environmental Assessment
Bilateral memoranda of understanding or projects are common and have been particularly successful in promoting cross-border, transnational and interregional cooperation.
Cooperation between states exists concerning marine pollution prevention, but sustained transboundary cooperation on plans, programmes and projects is not universally systemic.

Results of the Stocktake for the Black Sea

In the Black Sea quantitative interpretations should again be made with due caution (Figures 8 and 9). Despite a wide variation in self-rating scores, it is worth noting that the level of ICZM-related progress was similar in all Black Sea countries.

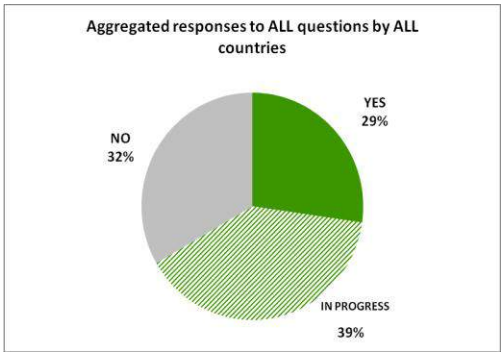


Figure 8. Aggregated responses to ALL questions by ALL Black Sea countries

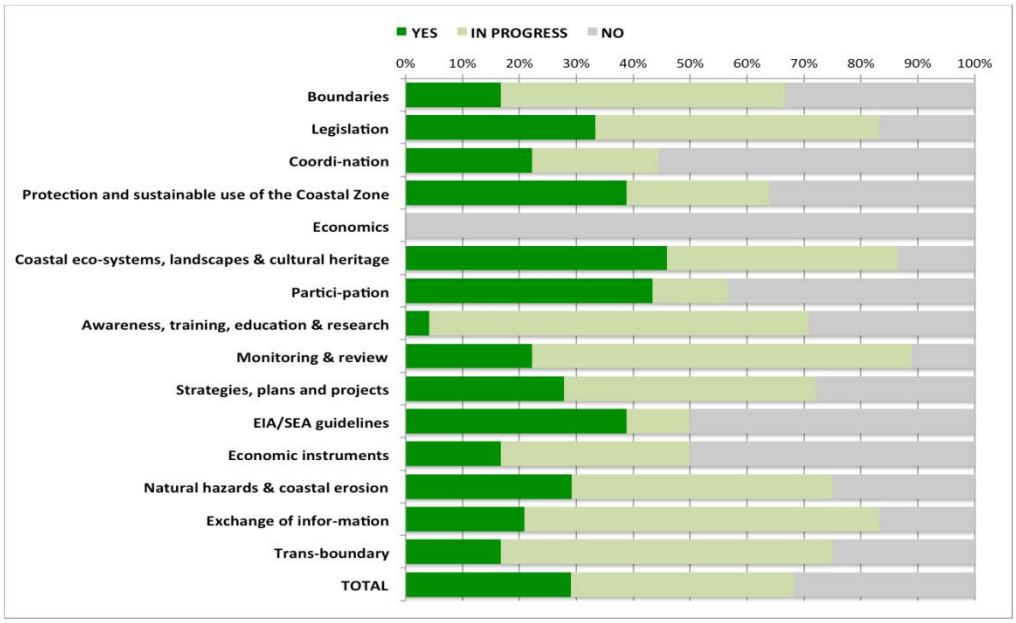


Figure 9. Aggregated responses by theme: Black Sea

As with the Mediterranean there was a wide variety of responses by theme. The highest level of negative responses related to: economics (100%); coordination (~55%); EIA/SEA guidelines (50%); and the use of economic instruments (50%). Themes with some of the highest positive responses related to aspects of environmental protection and management. The comparatively high level of "In progress" responses could represent the lack of a formal agreement, such as the Protocol for the Mediterranean, against which to establish a common benchmark.

The BSC-PS produced a synthesis report to document outcomes of the ICZM implementation audit in the Black Sea coastal states "*Implementation Audit (2012): Stock-Taking on ICZM in the Black Sea Region*" (PEGASO Deliverable D2.2C). The report was co-authored by ICZM NFPs of the Black Sea countries, including Chairperson of the BSC ICZM Advisory Group [41]. The deliverable is largely based on, and is an extension of preliminary findings from the initial stocktaking audit conducted in 2010, presented in the proceedings of the 11th MEDCOAST Conference [42].

A concise assessment of overall results from the stocktake helped draw conclusions that were accompanied by a preliminary set of recommendations for possible ways forward for the Black Sea ICZM process at both national and regional levels. The long-term aim was to resolve the issues identified during the stocktake process. Findings and conclusions for each main theme of the Black Sea stocktake are reproduced in Table 4.

Table 4. Key findings of the ICZM stocktake for the Black Sea region, related to Articles of the ICZM Protocol. Table adapted from [9]

Coastal Zone Boundaries
A harmonised delimitation of coastal zone boundaries is required.
ICZM Legislation
Defining common principles would assist national initiatives to legislate ICZM.
Article 7 Coordination
Consultative fora should contribute to integration rather than dilute the focus.
Article 8 Protection and Sustainable Use of the Coastal Zone
Better control is required for coastal development, setback regulations and practical mechanisms for guaranteeing cross-shore and long-shore access provisions.

Articles 10, 11 and 13 Specific Coastal Ecosystems, Landscapes and Cultural Heritage
More attention needs to be given to marine protected areas, wetland restoration and the protection of coastal landscapes as part of the ICZM agenda.
Article 14 Participation
Participation should be seen as an integral part of the ICZM governance process. There should be genuine opportunities and mechanisms for the public to challenge strategies, plans and projects prior to key decision-making steps.
Article 15 Awareness-raising, Training, Education and Research
ICZM centres of excellence are missing in the majority of countries and at the regional level.
More effort is required to develop and deliver training and education in ICZM processes.
Article 16 Monitoring and Review
Monitoring and reviewing ICZM-related progress should be built into administrative arrangements.
Article 18 National Coastal Strategies, Plans and Programmes
Regional arrangements should prescribe common format to guide national ICZM strategies and plans.
Pilot projects and cases should be pursued to apply ICZM concepts at all levels.
Article 19 Environmental Assessment
Some Black Sea countries need to upgrade their EIA systems to bring them in line with the best international practice, as well as to introduce SEA.
Regional arrangements for EIA in a transboundary context should be pursued and agreed upon for the Black Sea marine region.

Article 20 Land Policy
The various models for transfer and management of coastal land in the public domain are worth considering by administrations lacking suitable powers or effective legislation.
Article 21 Economic, Financial and Fiscal Instruments
Sound economic and financial instruments are evidently missing throughout the region.
Article 22 and 23 Natural Hazards and Coastal Erosion
Assessment of impacts and preparation for responses to climate change and other induced or natural coastal hazards need advanced planning, to be started immediately.
Article 27 Exchange of Information and Activities of Common Interest
An upgraded, easy-to-use common set of coastal indicators (including socio-economic) and ecosystem accounts are necessary to statistically monitor changes in coastal zones, as well as to assess the outcomes of management efforts.
The use of ICZM progress indicators should be continued on a permanent basis.
Article 28 Transboundary Cooperation
International cooperation within the BSC framework is the key driver for ICZM in the region. More evidence of this, including the different functionalities, would support the process.
Black Sea countries should take advantage of Turkey being the only Mediterranean and Black Sea country, drawing on examples of using best management solutions available in neighbouring marine regions. This would promote how strategies such as the ICZM Protocol could be adapted for partnering regions.

2.2 Stocktake of Coastal and Marine Research

With no single overarching body to act as a platform for the diverse array of scientific research in the Mediterranean and Black Sea ecosystems, it is difficult to comprehensively assess the current state of marine and coastal research. Without a standardised and internationally agreed method in place to

monitor the many capacities and outcomes of research, it is necessary to use outreach, and various other resources to record the status. Typically marine and coastal research activities are documented somewhere in the public or scientific domain, such as in peer-reviewed journals, websites, funding records, conferences, reports, etc. It is important to gather this information in as systematic a way as possible, and potentially develop a system for routinely recording newly established research activities in the future.

The PEGASO stocktake of coastal and marine research in the Mediterranean and Black Seas followed two approaches: a web-based bibliometric mapping exercise and a questionnaire survey. The results of the survey are qualitative, providing a wide-reaching overview of opinions from a subset of the people that put ICZM concepts into practice. Results from both exercises contained unquantified biases due to different reasons. Despite these limitations, it is essential to provide an avenue for feedback from the people that make use of ICZM practices [43].

Scientific Stocktake, Web literature review

An online literature search of key coastal zone management publications resulted in 511 references published from 1984 to 2010. An increase in ICZM-related publications and citations since 2000 reflected the interdisciplinary nature of the topic. The main ICZM themes appear in natural sciences, technology, engineering and legal domains, whereas neither social nor economic sciences were in the top 25 fields. The disparity between numbers of peer-reviewed publications on coastal zones in natural sciences compared to socio-economic sciences could either reflect a lack of work in the latter, or point towards the stronger tradition in the field of natural sciences to publish in peer-reviewed journals.

Scientific Stocktake, Questionnaire

The main aim of the questionnaire was to collect information related to ICZM on scientific contributions, existing projects, data networks, main challenges and research gaps and to describe the disciplinary backgrounds of researchers involved in ICZM-related work. Additionally, information on training opportunities offered by research institutes in the Mediterranean and Black Seas was collected.

The questionnaire was sent to 155 contacts, of which 57 completed the entire questionnaire (see Figure 10 for responses from Mediterranean and Black Sea countries). It was therefore not a

comprehensive sample, and the results should be interpreted with caution.

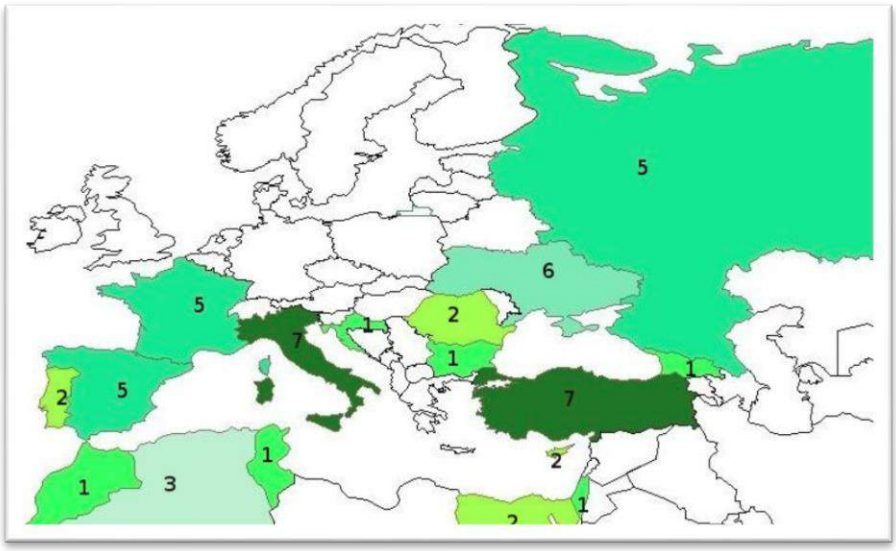


Figure 10. Number of responses from institutions in the countries that responded to the scientific stocktake questionnaire

Results showed an irregular distribution in the disciplinary backgrounds of responders, as well as an irregular geographical distribution of the institutes. Responses were not received from every Mediterranean coastal country, whereas at least one questionnaire was compiled by a representative of each Black Sea coastal country (Figure 10). The majority of specialists were biologists and engineers whereas interdisciplinary professionals such as planners, geographers, and environmental scientists were under-represented.

Key themes from responses were focused around educational training and emphasised physical and technical aspects rather than socio-political. While this may have had some influence on the results, responses seemed to suggest that ICZM continues to be more oriented towards a few specific disciplines, which is likely preventing the development of a truly inter and trans –disciplinary approach. Moreover, it is interesting to note that despite ICZM implementation being a mainly political process, closely dependent on the current legislative framework, there was no mention of legal or political science backgrounds among the completed questionnaires.

An investigation into the research expertise of respondents proved revealing with regard to academic involvement, fields of expertise, and specific areas of scientific contribution. Less than half of the institutions that returned questionnaires provide educational programmes. These were mainly in the fields of engineering and technology, with other courses occasionally offered in subjects such as sustainability and environmental planning. Programmes mainly focus on physical and technical

aspects of coastal management, with little attention devoted to socio-economic and political dimensions of coastal issues. Regarding the experience of participants, over half of those that responded had been directly involved in ICZM projects, mainly at the national scale. Results from the questionnaire showed that project outcomes mainly came from scientific research, monitoring programmes, strategy development, programme development, and land-use planning.

To evaluate collaborative actions, a review of existing networks relevant to ICZM was made and a third of the respondents declared to actively use data-sharing networks.

Participants were asked to identify aspects of projects that were particularly challenging. The survey showed the importance of stakeholder involvement; with 85% of the projects described involving cooperation with stakeholders. Collaborations with policy and decision –makers appeared to be the most challenging; with success depending on the ability to synthesise knowledge contributions in a way that was easily understood by all of those involved. Trans-disciplinary approaches, skills, and experiences are required in order to deal with the various knowledge aspects of ICZM. A common complaint on both the science and policy sides is that information is not presented in a way that is easy to comprehend by people working outside of these fields. Another practical concern was the lack of a legal or governance framework to legitimate implementation of ICZM principles and practices, which could weaken the entire project. Appropriate time management, and adhering to predetermined timescales for projects was also important, as the roles of people within a collaborative structure are all interdependent. Finally, other main challenges noted by a small subset (6%) of participants were: data access and availability; lack of trained coastal managers; and consensus building.

A number of research gaps were evident in ICZM processes. There was a need for tools to better understand natural coastal processes, socio-economic dynamics, and interactions between terrestrial and marine processes, but also to model future conditions in order to guide most appropriate coastal and marine governance frameworks.

There was a clear willingness within ICZM to integrate different disciplines and specialist fields. Half of the researchers were dealing with largely administrative and managerial tasks, despite having very different disciplinary backgrounds. For example, a large portion of time was allocated to management, integration among sectors, encouraging participation, and economical evaluations.

A review of existing ICZM-related projects [44] showed that the main issues being addressed were within marine science (17%), governance (13%), capacity development (10%), pollution (9%), freshwater (9%) and ecosystem (8%). The other key subjects were climate change, tourism, urbanisation, biodiversity, aquaculture, technology, coastal erosion, wastewater and restoration.

Despite limitations associated with this approach, the results of the stocktake suggest that within ICZM research, hard science contributions predominate over the social and political sciences. As previously stated, results of the questionnaire should be interpreted with caution. The mailing list mainly targeted natural scientists, therefore largely under-represented other key players. Implementing ICZM is challenging since it requires interdisciplinary approaches, yet it is the nature of this approach that adds such value to the outcome. Although the involvement of stakeholders in the

execution of processes and principles can be laborious; integration among the different disciplines, sectors and fields of expertise can prove highly beneficial in the long run. It is encouraging to note that the majority of scientific articles cited involve integration among multiple sectors.

2.3 Stocktake of Networks and Informal Cooperation Mechanisms

To complete the stock-take of institutional, governance and scientific settings in the Mediterranean and Black Seas it is very important to also report on the networks that exist in both regions. Informal networks, in previous decades, have greatly contributed to the cooperation and exchange of information and best practices, promoting the spread of ICZM concepts, methods, and approaches for its implementation.

Although some of the networks were created to deal with a specific issue, e.g marine protected areas or coastal wetlands, they have contributed to a wider scope. The formal and informal networks that exist in these regions have been at the origin of a number of projects and programmes which have provided the foundation for a shared vision on coastal management and sustainable development which, in the case of the Mediterranean, has led to the signature of the ICZM Protocol.

A comprehensive internet search was performed to retrieve information on coastal and marine networks of significance for the Mediterranean and Black Seas. The networks can be grouped into five classes:

- **Intergovernmental,**
- **Decentralized (non-governmental),**
- **Project,**
- **National, and**
- **Networks with wider geographical scope.**

Brief characteristics of networks are discussed below using examples from each:

Intergovernmental Networks

Intergovernmental networks have the advantage of influencing management at a high level, as well as the implementation of mandatory, in addition to recommended, measures. Objectives and goals are of utmost priority and are addressed by widespread collaborations. Platforms present an opportunity for input from international representatives that is not typically possible from other networks. The downside of this is that decisions are typically subject to extensive administrative requirements which can slow down progress.

Activities of intergovernmental networks are financed through annual financial contributions of the member countries. In some cases, projects financially supported by external donors such as the European Union and Global Environmental Facility contribute to the activities of the networks. The intergovernmental networks are financially the most robust institutions in the Mediterranean and the Black Sea regions for international collaboration.

Decentralized (Non-Governmental) Networks

There are relatively few decentralized coastal and marine networks that are active in the Mediterranean and Black Seas. The first Mediterranean networks, established in the early 1990s, are MedPan, MedWet, MEDCOAST, Medcities and the Intermediterranean Commission. MEDCOAST is an example of a network of academic and professional institutions with the purpose of bringing the knowledge and wisdom from the scientific community to development and practice of integrated coastal management in the Mediterranean and the Black Sea countries.

The importance of stable financial resources for decentralized networks is clearly illustrated by the early history of the MedPan Network; being supported by various groups, switching between dormancy and revival, changing status, and today a strong network throughout the Mediterranean holding a permanent secretariat in France. Non-governmental Networks tend to be more adaptable to the more changeable financial resources in which they operate. There is more evidence of networks becoming inactive, such as MEDITERRANEAN SOS Network, and Mediterranean Island Coastal Network, MEDISLE. Primarily it is the lack of financial resources, and secondarily the compatibility of activities with regional interests, that are the main reasons for network cessation. One option is to internally generate funds from activities such as conferences, training programs, research and development projects. Or another example can be taken from the Intermediterranean Commission that forms a

network of provincial or municipal administrations (public institutions), and for this reason does not suffer from financial fragility.

Project Networks

Depending on their research objectives, marine researchers can apply for different funding sources for the financing of their research projects and network activities. Although the EU Framework Programmes FP are the best known funding instruments, they do not necessarily have dedicated budget lines for marine and coastal research. FP5, FP6 and FP7 – except for Ocean of Tomorrow – did not include specific budgets for marine research. Dedicated efforts to inventory marine research projects, however, allow quantifying the budgets spent on marine research (EUROCEAN Marine Knowledge Gate). Ocean of Tomorrow (total budget of 134 million euros; [45]) is a special programme within FP7 in which multidisciplinary projects addressing great challenges for marine research are financed. Horizon 2020 will address marine research as a crosscutting activity [46,47,48].

The EU-wide inventory of marine knowledge output, EUROCEAN Marine Knowledge Gate [49], provides an overview of marine research projects by programme and by budget size. The database 'OURCOAST' developed by DG Environment, provides an overview of ICZM 'best practices' projects [50].

Some major earlier projects funded under FP6, such as EUROSION, ENCORA, PlanCoast and Empafish, were European in scope. However, there were also important projects like Adricosm, BEACHMED and WADI that had exclusive Mediterranean coverage. The number of large-scale coastal and marine projects that were funded increased considerably with the arrival of the 7th Framework Program of the European Union (FP7). Many of these projects had involvement of Mediterranean and Black Sea institutions from both member and non-member countries and some, like the PEGASO, MEDINA, SHAPE and CoCoNet Projects, were solely for the Mediterranean and Black Sea regions. In addition to the framework programs there were other major sponsors, for example the MED ENPI Program of the European Union and The Global Environmental Facility (GEF).

The majority of FP projects have been carried out by consortiums formed of 20 to 45 Euro-Mediterranean/Black Sea institutions. The successful work carried out by these capable networks during the lifetime of a project stopped soon after its completion, and the network disseminated. Significant coastal networks like EUROSION, ENCORA and SPICOSA could not remain as functioning institutions after the respective projects were concluded. This indicates a major challenge to Project Networks to remain as a functioning entity beyond the duration of sponsorship.

National Networks

National coastal networks exist in some of the Mediterranean and Black Sea countries. Several of these were formed during the FP6 project, such as ENCORA. Online information available about national networks is scarce.

Networks with Wider Geographical Scope

There are a number of powerful networks like LOICZ and EUCC, which have wider geographical scope (i.e. European or global) than the Mediterranean and Black Sea regions.

These networks however also contribute directly or indirectly to the Mediterranean and Black Sea coastal and marine science, management and conservation.

Chapter 3 Analysis and Future

Raux P., Bailly D., Ivanov E., Morrisseau F., Lescrauwaet A.K., Santoro F.

Although the Mediterranean and Black Seas are considered to be some of the best-studied seas of the world, much remains unknown about past, present and future pressures impacting these large ecosystems. Still, it is generally agreed from previous assessments in the Mediterranean and Black Seas, that the marine and coastal environment is undergoing unprecedented changes at a regional level [51, 52]. In the absence of appropriate measures, this may have major consequences for human wellbeing in the near future. Despite slight variations in approach and design, available reports are almost unanimous in identifying the main environmental issues affecting coastal and marine ecosystems.

It is challenging to assess complex physical processes that influence ecosystems. Baseline interactions in a stable or pristine environment must be understood before we can determine causal effects from anthropogenic pressures. Furthermore, in order to understand impacts from cumulative and synergistic pressures at various spatial and temporal scales, it is necessary to have a thorough understanding of individual pressures and interactions. It is this complex nature of environmental threats that dictate an ecosystem-based approach if we are to fully understand processes, and mitigate impacts.

An improved understanding of impacts across a range of scales, from local to global, is required to gain greater insight into potential solutions towards sustainable development.

3.1 Main Threats and Issues in the Mediterranean and Black Seas

In the context of PEGASO, a Desktop review of published literature and regional assessments was conducted and structured around six principal topics: climate change; water resources; protecting fragile marine and coastal ecosystems from issues such as biodiversity loss and invasive alien species; land-based, marine-based and atmospherically deposited pollution; urban development; and fisheries and aquaculture.

Although ideally all environmental threats would be investigated comprehensively, this is not feasible in the reality of limited resources. A comprehensive investigation of the current state-of-knowledge on the main threats and issues in the Mediterranean and Black Sea is outside the scope of this review. Focus was given in the present IRA Report to the objectives '**balanced urban development**' and '**preservation of natural capital**'. By focusing on assessments of threats related to these issues, the different approaches, methods, and overall gaps in research efforts were reviewed.

Efforts should focus on [9]:

- **fragile ecosystems, such as wetlands and seagrass habitats;**
- **vulnerable species and populations;**
- **ecosystems that are particularly important for providing socio-economic goods and services;**
- **data-deficient areas, both geographically and in terms of areas of research;**
- **temporal scalability;**
- **spatial scalability; and**
- **consistent data collection methods**

Reliable assessments are based on high-quality data and unbiased information. There are considerable disparities in the quality and quantity of data collected throughout Mediterranean and Black Sea coastal states. It is not only important to use consistent data-collection methods to allow for cross-comparisons, but also to represent data collected at various temporal and spatial scales. Regarding the temporal scale; baseline data needs to be collected so that current environmental health indices can be compared to future studies and historic data. Regarding the spatial scale; ideally effort should be equally distributed throughout the geographical scope of an assessment. However in both of these cases this is not always possible for large-scale assessments, and therefore methods must be scalable and standardised whenever possible. Data can also be biased by influences related to political, economic, or scientific issues, and this should be prevented when possible.

An Integrated Approach to the Assessment of Urban Development

When considering the effects of urban development on the environment and social wellbeing, a multitude of potential impacts must be considered such as reduced quality-of-life in urban areas, increased cost-of-living, loss of arable land, competition for space, reduction in the quality of water resources, destruction of valuable natural habitats, coastal erosion, or depleted fish stocks. However, many of these impacts cannot be considered in isolation because they are closely interrelated. Similarly, the environmental and socio-economic sectors that are affected are also integrally linked. For example, ecologically fragile habitats that are most susceptible to degradation are often the very areas that are attractive to tourists and developers, leading to increased pressures on the ecosystem and reducing its potential for recovery.

The EEA documents, *Urban sprawl in Europe – the ignored challenge,* 2006 [53), and *Balancing the future of Europe's coasts*, 2013 [54], highlight the many impacts of urban sprawl in Europe. The report brings attention to the need for concerted policy actions to address underlying causes in order to ensure a sustainable social, environmental and economic future for European cities. Statistical comparisons of international urbanisation data are limited by the lack of commonly accepted definitions for urban land cover categories, and an absence of historical time-series data. Determining patterns in urban sprawl is further complicated by the many interrelated driving forces

that are context-specific, varying widely between cities, regions and countries. This combination of numerous interdependent variables, undefined quantifiable terms, and limited historic data are repeated challenges.

3.2 Integrated Analysis in Practice

Building a scalable infrastructure of information to enhance decision-making processes is challenging. Coastal ecosystems are highly complex with a wide range of social and environmental functional scales, disproportionate relationships, and multifaceted interactions. There are a multitude of variables, adaptive mechanisms (e.g. memory effects) and limiting factors (e.g. choke points and saturation points) to consider for processes at any particular time.

Intensified use of coastal and marine areas can quickly lead to conflicts of interest and unsustainable pressures on the ecosystem. One aim of PEGASO was to develop a process to identify the main environmental issues affecting an area, as well as all of the associated interactions, processes and impacts, under a simplified Pressure Impact Framework. This was intended to act as the crucible to build indicators for informing integrated assessments of pressures in coastal and marine habitats. The DPSIR scheme is a popular approach for ICZM, and provides a useful description of coastal systems with an emphasis on the causality chain in relation to sustainable management.

The PEGASO methodology consists of building regional and local indicator systems which describe the current ecosystem status. The framework also estimated change over time based on dependence on ecosystem health, impacts and feedback loops. It aimed at providing an explanation for past causalities, and assessments for the future. The next stage was to build new spatial indicators to better analyse interactions between uses, pressures, ecosystem goods and services and the wellbeing of coastal populations. As this method is subsequently used, the framework becomes increasingly powerful as it is validated from real experiences and parameters are refined, improving the accuracy of estimates.

3.3 Use of Coastal Zones, Natural Capital, and Urban Sprawl

The vision of the ICZM Protocol is to achieve balanced use of the coastal zone, while ensuring sustainable socio-economic development and the conservation of natural capital. In the Mediterranean, urban development and especially urban sprawl is one of the main threats exerted by socio-economic development. The Protocol emphasises that *"allocation of uses throughout the entire coastal zone should be balanced and unnecessary concentration and urban sprawl should be avoided".*

This is well illustrated by one of the PEGASO CASES, the Aegean Islands (Cyclades archipelago; Figure 11). Tourism, the dominant activity on these islands, relies on attractiveness of the area mainly based on natural capital (Figure 11 *A*-*B*). However, at the same time tourism causes a shift in populations between islands in the archipelago due to employment opportunities, driving coastal development,

and contributing to threats from over natural-capitalisation (Figure 11 *C-D*). Consequentially, this increases the percentage of the population at risk from climate-change-related pressures, such as sea-level rise (Figure 11*E*).

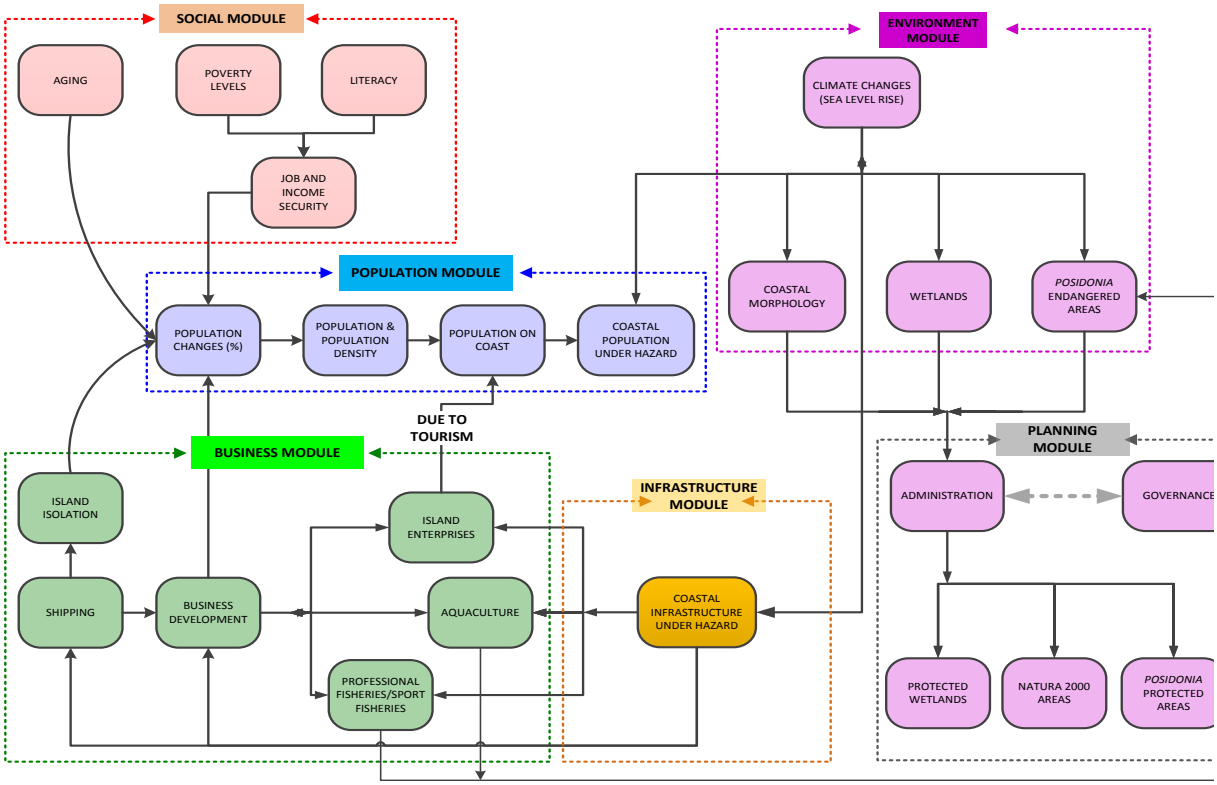
These two sides of "balanced use" can be classified into main categories and interactions through identifying pressures-impacts indices. Furthermore, factors driving coastal development can be

ascertained by monitoring previous feedback responses. Impacts can be considered in terms of changes to the state of ecosystems or human wellbeing. This process can be informed through a web of relationships among uses and the environment, taking the form of a causal chain or diagram of influence (Box 4), characterised by the set of tools developed and/or refined by PEGASO (indicators, LEAC, CIM, participation, and scenarios). The coastal and maritime economy derived from these uses is highlighted by the Protocol, and can be defined as *marine and coastal activities that are impacted by, or exert a pressure on, the ecosystem*. The scale of the assessment requires working at an ecosystem level.

In the following chapters (3.3.1 and 3.3.2), the use of the various PEGASO tools to assess pressures on coastal zones is demonstrated, with particular reference to their application to the issues of land use and urban sprawl and the preservation of natural capital. PEGASO tools employed at basin-wide scales are used to provide an initial overview, identifying areas of particular importance that need finer-scale investigations using tools that are appropriate at the local-level to validate initial findings. Table 5 illustrates the number of local CASES where these indicators were calculated, and some of the most frequent alternative indicators used in ICZM context in these CASES.

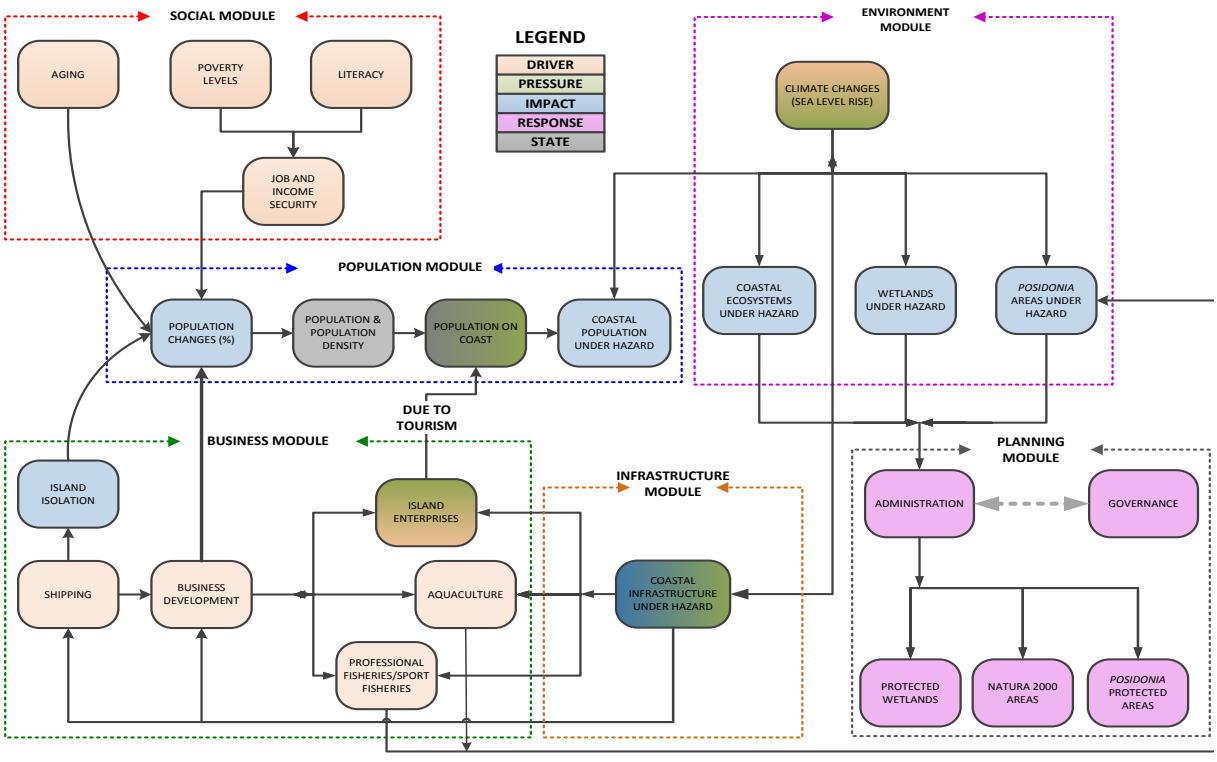
Scale/CASE	Mediterranean Sea	Al Hoceima coast	Bouches du Rhône	North Adriatic Sea	Aegean Islands	Dalyan-Köycegiz SPA	North Lebanon	Nile Delta
Area of built-up land	LEAC	x	x	x	x	x	x	x
Land use, various categories	LEAC		x				x	x
Natural Capital, Favourable conservation status	LEAC	x			x			
Land connectivity	LEAC							
Number of IUCN species	LEAC							
Population density and trends		x		x	x			x
% of change in the population between yr1 and yr 0					x			
water quality parameters								x
Coastal Risk/hazard		x			x			
Areal extent of coastal erosion		x						
Protected areas	LEAC				x			
Protected habitat (e.g. wetlands, algae, coastal reefs,..)			x		x			

Table 5. Overview of urban sprawl and natural-capital-related indicators calculated by PEGASO CASES



Network of interactions of the Cyclades archipelago (Greece) regarding issues identified by the ICZM Protocol

The web of relationships regarding ICZM Protocol issues over the Cyclades archipelago takes the form of a cause-effect network or a network of interactions that allows for outlining interactions and dependencies between activities, the environment and the governance scheme. This diagram of influence was also built under a Pressure-Impact framework. It is also an important tool for informing and involving stakeholders:



Network of interactions of the Cyclades system under a DPSIR framework

Box 4. Designing a web of relationships – Application over the Cyclades archipelago CASE, Greece

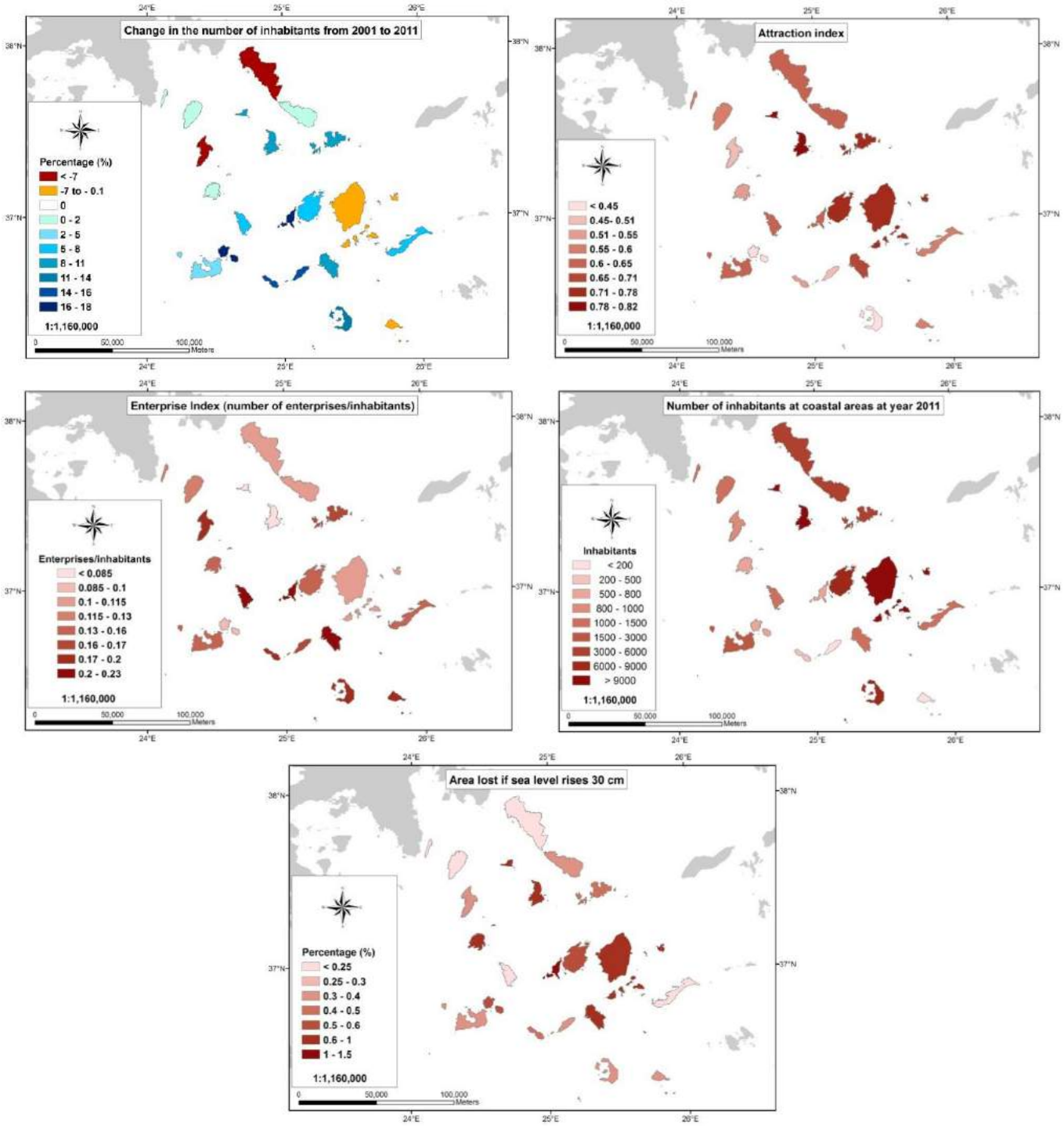


Figure 11. Maps of indicators to inform ICZM issues over the Cyclades archipelago, Greece

3.3.1. Assessment of Natural Capital and the Use of Coastal Zones

From an economic perspective, natural capital is closely linked to the ecological debt concept. The role of the environment in the measurement of economic activity is not fully accounted for in traditional economic assessments. Besides capital used to produce goods and services, there are additional values of natural capital to be accounted for. Ecosystems are degraded by over-use, and ecosystem services need to operate at sustainable levels in order to continue supporting economic welfare and social wellbeing. Although there are considerable costs associated with remediating and/or preventing ecosystem degradation; in the lack of remediation and preventative measures, ecosystem capital is depreciated, leading to an ecological debt [55]. This situation can result in biased, inaccurate statistics on economic growth and development [56], hiding critical concerns about rapid economic growth. Short-term benefits achieved through depletion of natural capital are temporary strategies that create no basis for sustainable development.

Land and Ecosystem Accounting to Assess Natural Capital and the Use of Coastal Zones

The PEGASO tool, **LEAC** gives an initial overview of natural capital at the regional scale. This tool is used to estimate accounts of land containing natural and semi-natural areas; species and habitats of conservation importance; and accounts of protected areas.

Accounts for areas of natural cover were constructed by extracting data on natural and semi-natural land cover types from the PEGASO Land Cover PLC at level 1, such as forests, grasslands, shrublands, sparse vegetation and deserts, wetlands and water bodies (i.e. classes 3, 4 and 5). In the PLC Product nomenclature, level 1 is the most general classification level.

Stocktakes of 50 km coastal strips containing natural areas were assessed for various parameters: per cent of natural areas (Figure 12); per cent of increase or decrease in natural areas over an eleven-year period (Figure 13); and per cent of protected areas (Figure 14).

Stocks of natural area coverage (Figure 12) were categorised as: High (> 60%); Intermediate (30% to 60%); Low (15% to 30%); and Critically low (<15%). High proportions of preserved natural and semi-natural areas are mainly located around the Dalmatian coast of the Adriatic, as well as Greece, Turkey and Spain. The southern and eastern Mediterranean countries, except Israel, Palestine and Morocco, also have high proportions of natural areas, in the form of desert. Possibly critically low stocks of natural areas are found for Malta, Ukraine, Israel and Palestinian Territories, reflecting intensive land use, which includes both urban and agricultural land. Whether these areas do, in fact, have critically depleted stocks of living renewable resources needs to be confirmed by local-level studies focused on issues, such as the maintenance of habitats and provision of basic ecosystem services.

Figure 12 illustrates locations where higher proportions of natural areas have been depleted, in relation to distance from the coast. Near-coastal areas of the Black Sea countries have more natural

land compared to the hinterland, e.g. in Bulgaria, Romania, Ukraine and Algeria. Several Mediterranean countries show the opposite; a lower proportion of natural land closer to the coastline; these countries include Spain, France, Israel and Italy. This pattern of coastal development is a widely observed phenomenon in countries and regions where there has been longer-term economic growth and development.

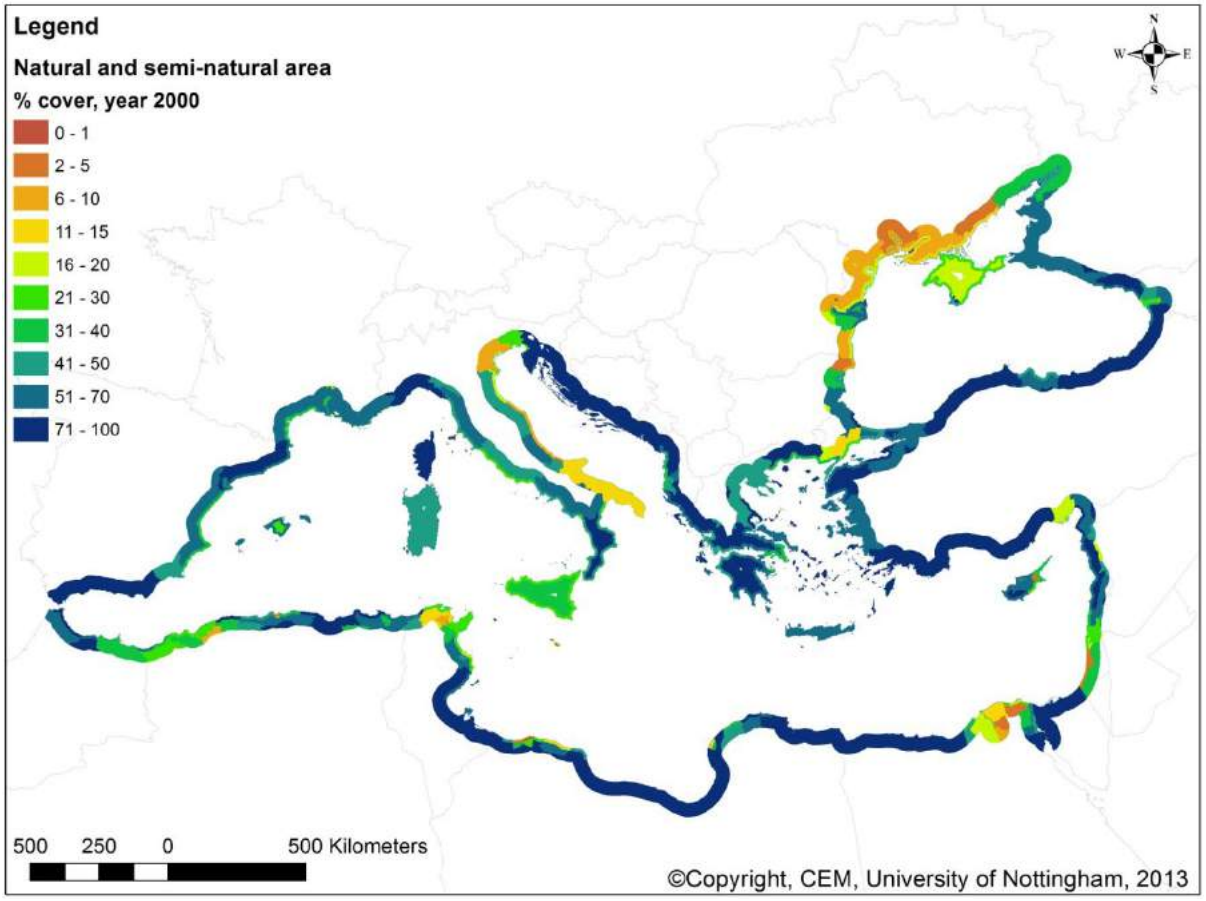


Figure 12. Map of natural area accounts from PEGASO land cover in year 2000, estimated as a per cent of the total area of coastal accounting units [57].

Temporal change in the per cent of natural area coverage is shown in Figure 13. This illustrates a trend of losses in natural and semi-natural areas for the Russian and Egyptian coasts. Conversely, there is a general trend of increased natural land in the coastal strip of the northern Mediterranean, except Andalucía, and a decrease in the south, except Algeria. This pattern is consistent with the EU countries that have a relatively high per cent of coasts included in the NATURA 2000 network of protected areas. The results suggest that, due to the designation of NATURA sites on the EU coast, there is an increase of natural areas, but mostly in the hinterland. Regarding the Black Sea, there is an intermediate increase of natural areas in Bulgaria, a low increase in Georgia and a low decrease in Ukraine. Caution should be used with further interpretation of the change accounts, given that

parameters need to be independently validated.

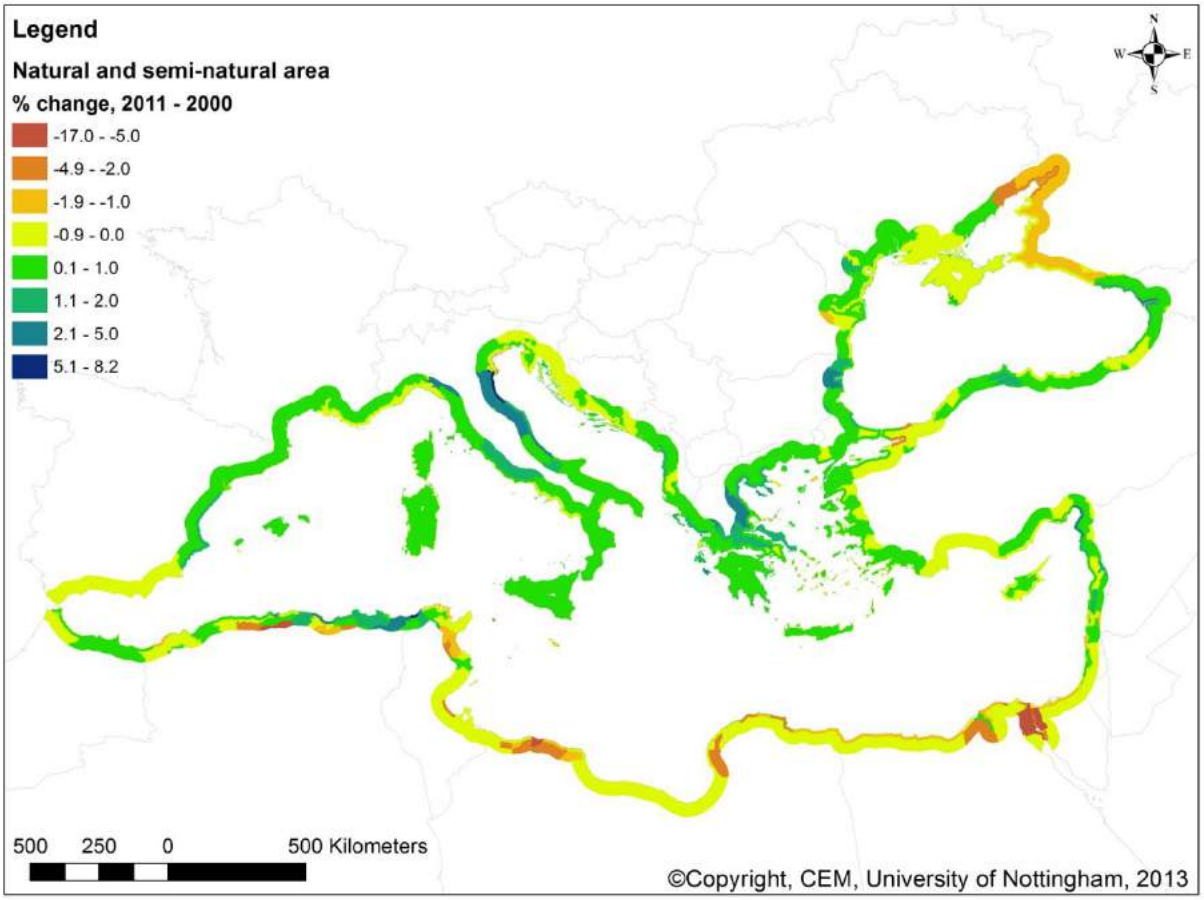


Figure 13. Map of temporal change of natural area coverage from PEGASO (between 2000 and 2011), expressed as a per cent of total unit area of the coastal accounting units [57].

Accounts of protected areas were constructed using the world database of protected areas as a source (Figure 14). Results are shown for coastal zones divided into three buffers, and for coastal accounting units. The accounts show higher percentages closer to the coast in parts of Spain, France and Italy; and lower in others, including Cyprus, Israel and Slovenia. The northern countries, especially EU-member States, have relatively high proportions of protected coastal areas whereas certain countries from the southern Mediterranean do not appear to have similar protection measures. However, these results could be due to the inability to collect data for these countries

from the global source used for this assessment.

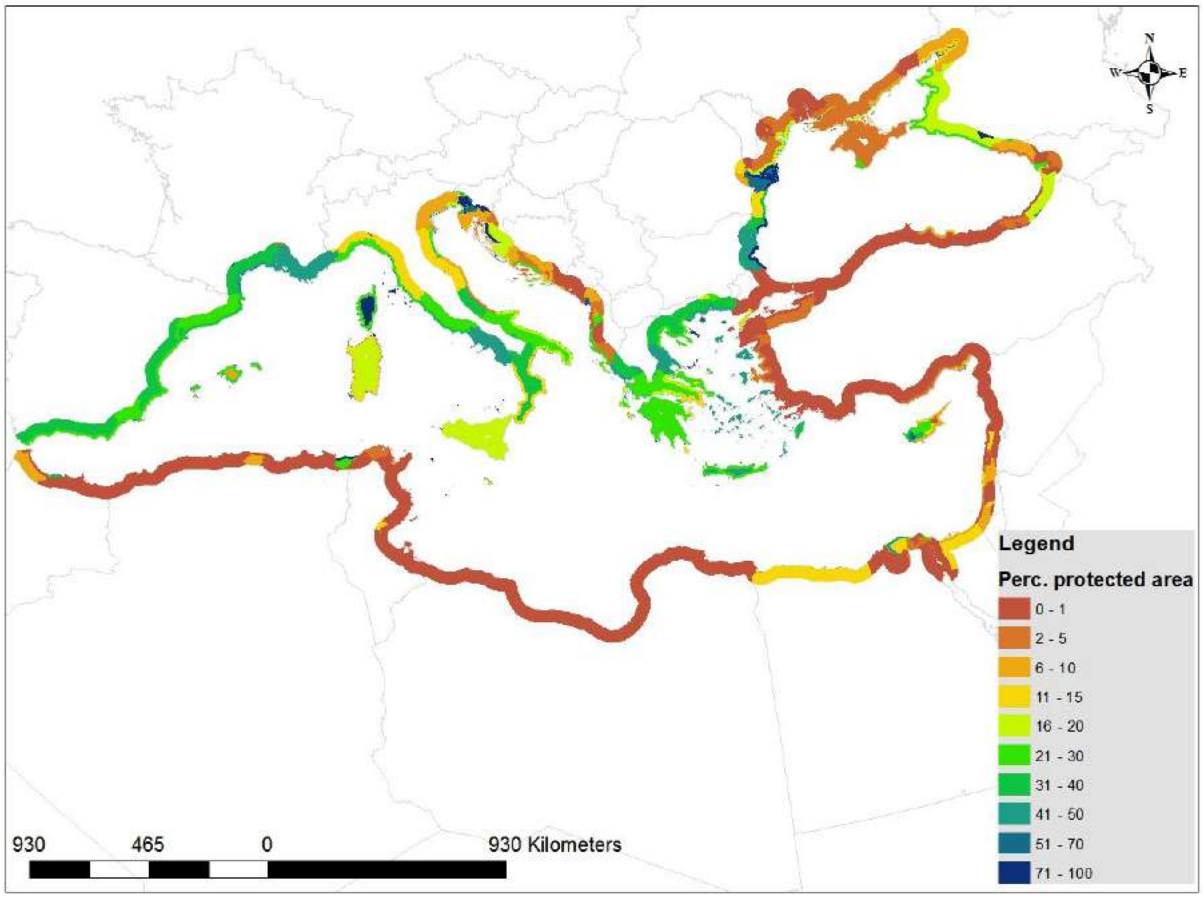


Figure 14. Percentage of areas protected [57]. Source: world database of protected areas.

Cumulative Impact Mapping to Assess Natural Capital and Use of Coastal Zones

The PEGASO tool, **CIM** provides additional material to inform estimates of natural capital and related issues in the western Mediterranean. Impacts considered are the result of pressures and stressors that lead to natural-capital degradation. Figure 15 underlines the relative impact of anthropogenic stressors in the western Mediterranean Sea, excluding stressors directly related to climate change (e.g. acidification, ocean warming, and increased UV radiation). The most severe pressure came from marine litter, followed by riverine input and atmospheric deposition of heavy metals; riverine input and atmospheric deposition of nutrients; fisheries, and; oil spills, respectively. This illustrates the important weight of land-based pressures.

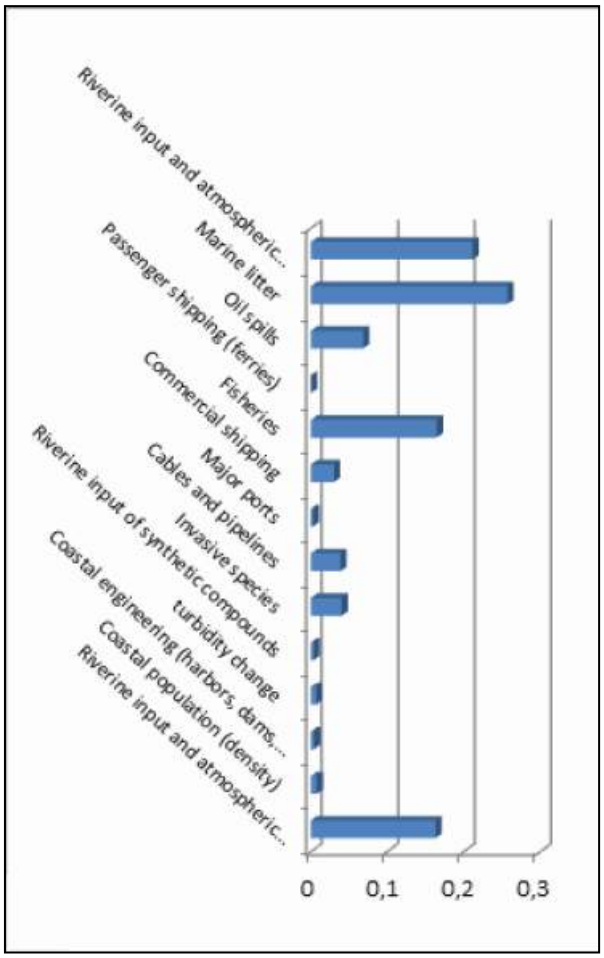


Figure 15. Relative impact of anthropogenic stressors in the western Mediterranean Sea, excluding climate-change-related stressors.

Impacts from these pressures depend both on the intensity of the pressure(s) and the specific vulnerability of the ecosystem under study. The impact index can be disaggregated according to spatial area to look at the respective influence of each pressure type in relation to the total intensity of pressures. Disaggregation was made according to marine-based, land-based and fishery-related impacts (Figure 16). Marine-based impacts are related to important harbours and associated traffic (Figure 16*A*). Areas of intense land-based impacts were located north of Algeria and in the Tyrrhenian Sea (Figure 16*B*), mainly resulting from marine debris accumulation. Areas of high fishery-related impacts follow the continental shelf contours and are mainly located off the North African

coast and in the Gulf of Lion, off southern France (Figure 16*C*).

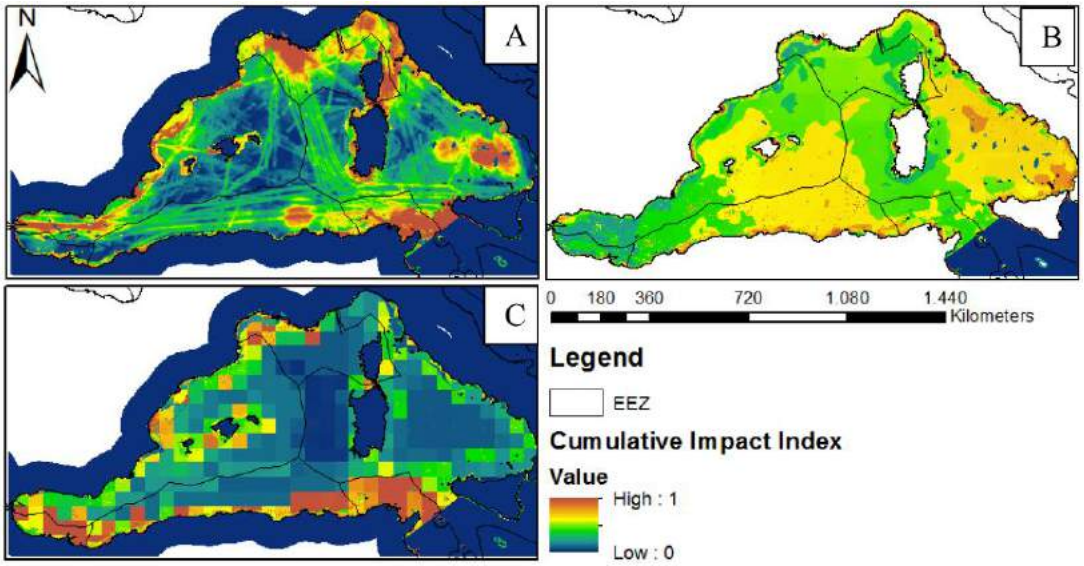


Figure 16. Cumulative Impact Index disaggregated into marine-based impacts (A), land-based impacts (B) and fishery-related impacts (C) in the western Mediterranean Sea.

A Cost-Based Approach for Assessing Natural-Capital Depreciation

Ecosystem degradation results in losses to the value of natural capital. Degradation can result from overuse, misuse or mismanagement of marine ecosystems and resources. PEGASO designed a framework to assess such degradation costs, but at a regional scale there is no existing database that allows for such an approach. Few marine and coastal analyses focus on economic activities that are dependent on both fisheries and shipping –related issues (normally an analysis focuses on one or the other). In most cases analyses are designed for measuring impacts from land-based activities. This illustrates the gap between maritime policies as expressed at national and international levels, and the spatial scale of monitoring programmes and reporting. Nevertheless, an alternative was to work at the level of the administrative unit of the coastal zones, and refine the spatial scale for work done in the CASES. Degradation costs were then assessed at a local scale over the Bouches-du-Rhône CASE regarding water quality issues, and addressed at a regional scale for the French territorial units of the 'façades maritimes' (Box 5 and 6).

Compared to other approaches (monetary valuation), the cost approach produces minimum, but realistic values of degradation. The residual impacts (e.g. cost of remaining pollution) can be documented quantitatively and/or qualitatively through multi-criteria analysis or monetary reference value if available. Residual impact costs are assessed against a baseline of no degradation. This socio-economic approach is useful to decision-makers for the market-derived information produced.

Costs of ecosystem degradation over the French 'façades maritimes' (North/Channel, Atlantic/Biscay and Mediterranean)

i) Maintenance costs for French marine ecosystems in 2010:

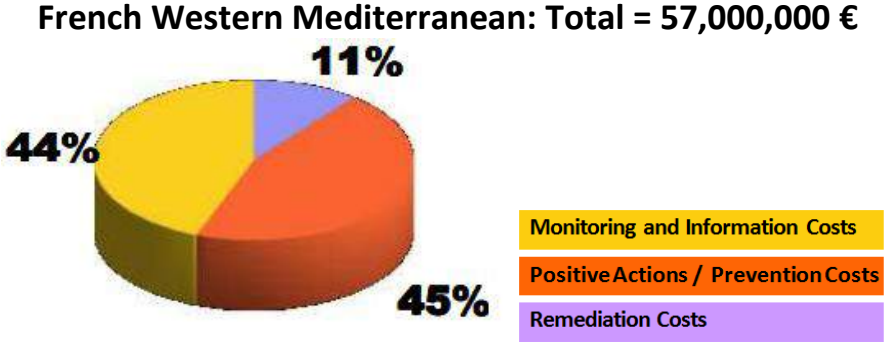
- The total amount of maintenance costs is over **2 billion Euros per year**.
- The most significant proportion of these costs (1.25 billion €) is spent on **avoidance measures against microbiological contamination**, mostly in the form of wastewater treatment (99%) for reaching sanitary standards.
- As a corollary of this result, the maintenance costs are the highest where urban density on the coast is the highest in the Mediterranean sub-region..
- Other important degradation thematics are **chemical pollution** (347 M€), **loss of biodiversity** (148 M€) and the **degradation of fishery resources** (133 M€).
- The majority of chemical pollution costs are also generated from avoidance measures (81%).
- Loss of biodiversity mostly generates costs from monitoring and information (52%) which indicates a persistent lack of data in this field, while efficient positive actions (28%) may be difficult to implement.
- Fishery resource degradation mostly generates prevention costs (67%) in the form of management measures (enforcement and control for sustainable fishing, and also monitoring and information costs (27%).

ii) International comparisons with member States applying a similar approach:

- At a very large scale, the results obtained by the Netherlands, France and Spain follow similar patterns, but there are some inconsistencies:
  - In the Netherlands, total expenditure amounts to 1.58 billion Euros a year, split into land-based costs (1.45 billion) and marine-based costs (0.132 billion) (Walker et al., 2011). French estimates are fairly close to this, but for a coastline seven times longer in France than in the Netherlands.
  - In Spain, total expenditures for the maintenance of marine natural capital was about 1.53 billion Euros in 2010, divided into seven issue areas or thematics (Ministerio de medio ambiente y medio rural y marino, 2011), where the cost of wastewater treatment accounts for only 38% (73% FR, 90% NL).
- These comparisons highlight the need for consistent and standardised costs-assessment methods, in contrast to conventional monetary economic valuations which have evolved over decades and are more stable from a technical point-of-view. Ecosystem accounting can easily be improved if common criteria are adopted to define expenditures and to standardise use of referentials.

Costs associated with biodiversity losses in the French western Mediterranean

Reduced marine biodiversity is a multifaceted issue as it is related to many different pressures and focuses on impacts which are not taken into account by the other degradation topics.



Box 5. Ecosystem degradation - A cost-based approach

Water quality is a major issue for the Bouches-du-Rhône because of its importance for coastal tourism and nautical activities. Main causes of non-compliance of bathing water are structural deficiencies in sewage systems, occasional failures, and non-point-source discharges. Agricultural and urban areas have a direct impact on the sanitation quality of bathing and shellfish waters. The impacts of microbial pathogens organisms (MPO) on human health result from the practice of leisure activities (swimming, nautical sports) in contaminated water, or consumption of contaminated shellfish from aquaculture activities, or professional and recreational fishing. Presence of MPO can cause loss of amenities for recreational activities as well as economic losses to tourism, aquaculture and fisheries.

Degradation costs associated to Microbial Pathogens Organisms	
1. Monitoring and information measures	
Monitoring networks of the microbiological quality of shellfish waters	7,608 €
Bathing water monitoring network	159,273 €
Nautical activities monitoring network	17,784 €
Research projects, surveys, sanitary classification	Not available (minor costs)
Total 1	**184,665 €**
2. Prevention and avoidance measures	
Collective sewage system	154,875,500 €
Non collective sewage system	724,055 €
Liquid manure control (< 1 km from shoreline)	Not available (minor costs)
Total 2	**155,599,555 €**
3. Mitigation and remediation measures	
Total costs of shellfish purification in B-areas	70,200 €
DEGRADATION COSTS	**155,854,420 €**
4. Residual impacts	
Percentage of beaches with insufficient quality (C or D)	1.7%
Percentage of recreational sites with insufficient quality (C or D)	6.9%
Number of beach closures per year (days)	92
Number of temporary bathing interdiction (days)	19
Percentage of shellfish farming zones in C or D	0%
Number of shellfish farming zone closures (days)	0
Number of human diseases due to contaminated shellfish products	Not available (very few number)

The sum of degradation costs totals over 150 million € (2010), with prevention representing the majority of costs (99.8% of quantifiable costs).

Box 6. Cost of water quality degradation in the Bouches-du-Rhône, France CASE

Indices to Assess Natural Capital and Use of Coastal Zones

A typology of Mediterranean and Black Sea nations was developed from multivariate analyses using a series of composite indices (Table 6): socio-economic development (education, health, income, new businesses and population), marine industry activities (fisheries, aquaculture, tourism, ship building, shipping and oil) and environmental threats (threatened species, natural resource depletion and environmental protection index).

Table 6. PEGASO socio-economic and environmental composite indices, normalised over Mediterranean and Black Sea coastal nations

Nations	HDI 2012	Marine Industry Index	Fisheries Aquaculture	Tourism	Ship Building	Shipping	Offshore Oil	Species Threat	Envt. Threats	MPA	Envt. Protection	Natural Resource Depletion	Population	Coastal Population	New Business
Albania	74.9	1.5	0.5	6.4	0	0.6	0	24.8	13.9	3.0	65.9	13.7	5.1	13.9	3.7
Algeria	71.3	4.0	12.6	5.2	0	2.3	0	41.5	29.4	17.4	48.6	100	63.1	5.4	0.6
Bosnia and Herzegovina	73.5	0.2	0.02	0.8	0	0	0	20.4	13.7	7.0	36.8		6.2	0	2.7
Croatia	80.5	12.2	7.5	21.5	30.2	1.9	0	47.9	24.6	1.4	64.2	5.1	6.9	4.1	9.5
Cyprus	84.8	5.9	0.5	5.2	0	17.3	6.6	12.9	10.9	8.9	57.2	0.0	1.8	11.2	100
Egypt	66.2	24.0	60.4	8.0	0	18.1	33.3	51.4	26.0	0.5	55.2	42.3	51.6	52.5	0.2
France	89.3	15.4	3.8	51.1	10.3	11.9	0	36.5	18.3	0.2	69.0	0.1	31.2	6.5	12.5
Greece	86.0	24.2	19.3	35.6	0.2	41.3	24.7	63.8	32.8	1.9	60.0	1.8	18.5	11.9	2.6
Israel	90.0	7.1	0.4	6.1	0	15.7	13.2	43.2	27.2	11.2	54.6	1.1	12.9	7.4	14.3
Italy	88.1	77.3	37.9	100	100	75.2	73.2	37.1	18.7	0.2	68.9	0.6	100	12.7	6.4
Lebanon	74.5	2.1	0.5	3.6	0	6.5	0	23.8	35.5	47.1	47.4		7.2	18.9	
Libya	76.9	3.1	6.8	0	0	1.9	6.6	28.8	64.4	100	37.7		10.0	21.4	
Malta	84.7	9.6	0.4	3.1	0	44.4	0	7.9	10.2	12.5	48.5		0.6	17.8	32.2
Monaco		0.1	0	0.6	0	0	0	1.5	0.8	0			0	100	
Montenegro	79.1	0.5	0.1	2.6	0	0	0	19.2	12.5	5.8			1.0	0.09	42.1
Morocco	59.1	2.8	4.6	5.7	0	3.9	0	53.6	28.6	3.7	45.8	9.3	14.8	11.0	4.0
Palestinian Territories	67.0	0.2	0.2	1.0	0	0	0						6.6	6.7	
Slovenia	89.2	1.6	0.1	4.4	0	3.2	0	18.8	13.1	7.3	62.3	1.5	3.3	2.0	16.2
Spain	88.5	40.2	15.3	79.2	11.2	56.2	39.2	71.1	36.2	1.4	60.3	0.2	48.9	10.6	10.3
Syria	64.8	1.0	0.4	0	0	4.5	0	43.4	25.7	8.0	42.8	76.3	36.7	0.8	0
Tunisia	71.2	6.8	13.5	10.4	0	3.4	6.6	39.0	21.6	4.2	46.7	28.1	17.6	20.3	2.4
Turkey Med	72.2	27.1	13.9	51.7	36.0	29.5	4.6	72.8	37.4	2.0	44.8	2.2	85.0	5.0	2.9
Bulgaria	78.2	3.3	1.3	13.7	0	1.4	0	16.3	8.9	1.5	56.3	10.5	11.9	2.1	26.6
Georgia	74.5	2.3	3.4	6.1	0	1.9	0	13.8	12.4	11.1	56.8	2.5	7.3	8.6	18.0
Romania	78.6	23.7	0.03	16.5	98.3	3.9	0	16.3	8.2	0.1	48.3	8.7	35.0	4.7	17.7
Russian Federation	78.8	1.0	4.1	0.7	0.0	0.3	0	70.8	35.6	0.4	45.4	79.2	2.9	3.3	3.2

Turkey BS	72.2	20.8	51.6	22.1	15.4	12.6	2.0	72.8	37.4	2.0	44.8	2.2	36.4	5.0	2.91
Ukraine	74.0	12.1	9.4	46.4	0.0	4.8	0	24.7	12.9	1.0	46.3	20.6	74.8	3.6	2.90

HDI: composite index of Income, Health and Education indices

Marine Industry Index: composite index of Fisheries and Aquaculture, Shipping and Ship Building, Offshore Oil and Tourism

Fisheries Aquaculture: composite index of Fisheries (catches) and Aquaculture (production) indices

Shipping: composite index of Cargo Traffic and Merchant Fleet indices

Offshore Oil: composite index of Offshore Rig Count and Offshore Oil Production indices

Species Threat: composite index of Fish Species Threatened and Mammal Species Threatened indices

Environmental Threats: composite index of Marine Protected Areas, Natural Resources Depletion and Environmental Protection Indices

MPA: Marine Protected Areas

Mediterranean and Black Sea countries are differentiated according to index values and form three main groups (Figure 17).

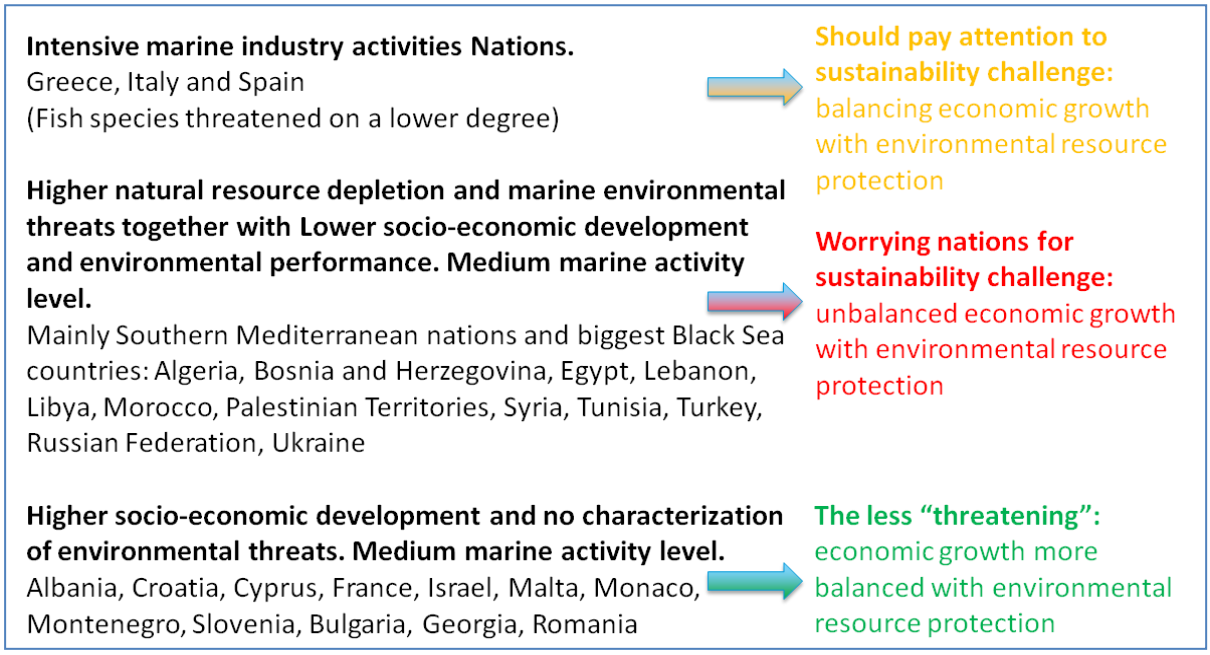


Figure 17. Typology of Mediterranean and Black Sea countries according to marine industry activity, socio-economic development and environmental threats.

Greece, Italy and Spain were found to be the nations with the most intense marine-industry activity (based on Marine Industry Index, Table 6), capitalising from important coastlines. However, these countries were intermediate in terms of environmental threats and resource depletion. To achieve a sustainable marine economy there should be more attention paid to preserving natural capital. Southern Mediterranean and the largest Black Sea countries presented the most evidence of unsustainable coastal zones based on high natural resource depletion. Despite less marine-industry activity, an economic growth achieved through depletion of natural capital is a temporary and short-term strategy that will not generate sustainable development of coastal zones. In contrast to this, according to the methodology applied, the Mediterranean countries; Albania, Croatia, Cyprus, France, Israel, Montenegro and Slovenia present greater socio-economic development, while natural capital is less threatened.

Indicators to Assess Natural Capital and the Use of Coastal Zones

Together with LEAC, CIM and the various indices; indicators are also complementary tools to explore balanced use of the coastal zone, as well as measuring the effectiveness of mitigation responses. Indicators have a further use for describing the health status of natural capital. At a local scale, a number of natural-capital-related indicators from the PEGASO core set have been identified and then calculated by CASES that dealt with natural capital conservation issues. The list of indicators is diverse and hence, indicator results are not necessarily comparable. This diversity is reflected in the CASES reports and descriptions available from the PEGASO website and Coastal Wiki. The indicator factsheet to calculate 'Natural Capital' is a first step in standardizing and harmonisation for a common representation of the supporting data (http://pegasoproject.eu/images/stories/Factsheets/PEGASO_Natural%20capital.pdf). A next step to achieve harmonization was developed through a guideline for spatial data harmonization. Based on these guidelines, datasets can be combined with other harmonised data in a coherent way, within a distributed network of geonodes.

Format files, reference systems and symbolization

If not explicitly imposed by data owner, a dataset has to be transformed to file formats depending on data type:

- ***Shapefile* for geometric vectors**
- ***GeoTiff* for grid/raster files**

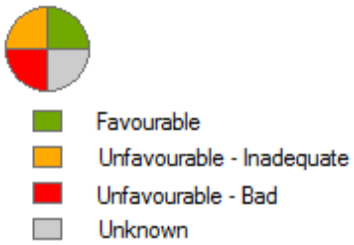
Any produced data in PEGASO was transformed to **ETRS89-LAEA (EPSG: 3035)**, as recommended by EU EEA, to be download from a geonode server and can be public available as WMS layer in **Web Mercator (EPSG: 3857).**

For the Indicators derived from the factsheet

- ***Number of habitat types by conservation status category***
- ***Number of species by conservation status category***
- ***Percentage of habitat types within each category of conservation status (proportional of total number of habitat types)***
- ***Percentage of species within each category of conservation status (proportional of total number of habitat types)***

The graphical output is a layer whose attributes can be symbolized with charts onto a map, however kind of symbolization cannot be readily attached to a spatial dataset. Number of habitat types in a

given area can be computed by using EU database for Habitats & Species Directive, online available in both EEA and PEGASO catalog.

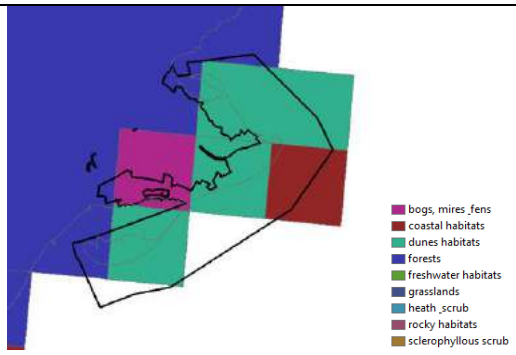


An indicator can be composed of one or more values per reporting unit. For instance, indicator PI.09.01 “Number of habitat types by conservation status category” will have at least four values per protected area: number of habitat types having a favorable status, number of habitat types having a unfavorable - inadequate status, number of habitat types having an unfavorable - bad status and finally number of habitat types having an unknown status.

Therefore, in order to harmonise the production of the indicators, these values were codified using a predefined scheme (see harmonization guidelines), including code derived from INSPIRE implementation rules as well as code that identifies each geometry used as reporting unit in the indicator computation. For instance, local codes for different administrative units which are used to report and assessment (e. g, ES512 for NUTS3), code coming from reporting unit and begin/end of lifespan of the data.

Number of habitat types by conservation status category

Geometry for Ebro Delta Profile as extracted from Natura2000 database (code ES0000020)



Groups of habitat types as defined in Annex I EU Directive overlaying in Ebro Delta

Example of final output for some fields related to structure harmonization:

INSPIREID	INDICAT_ID	LOCAL_CODE	VL_HAB_CS1	VL_HAB_CS2	VL_HAB_CS3	VL_HAB_CS4	VL_HAB_TOT	RU_ID
PI.09.1.UAB. ES0000020	PI.09.1.UAB	ES0000020	5	8	11	15	39	uuid

3.3.2. Assessment of Urban Sprawl

With 55% of the world's population living on coastal strips, and most of the big cities located on the coast, our knowledge is still limited on how to handle this inflow. Negative effects of coastal urban sprawl are numerous in the Mediterranean and include degradation of urban quality-of-life (e.g. due to congestion), growing costs of urban infrastructures, exacerbated pressures on water resources, inefficient waste management, air and water pollution, ecosystem fragmentation, coastal erosion and overall degradation of the Mediterranean coastal landscapes.

Pressures related to population growth are usually higher in coastal areas. For instance, in France the coastal population density (285 inhabitants/km²) is 2.5 times higher than the national average (116 inhabitants/km²). This is further explained by the hinterland population density being 3.3 times less than that in coastal regions. Along the economically important French coastlines, the growth rate of populations slowed between 1982 and 1999, but increased in the last decade. The contrast between coastal areas and the hinterlands is highest in the Mediterranean region, with a coastal population density (366 inhabitants/km²) that is 4.1 times higher than in the hinterlands. On the Provence-Alpes-Côte d'Azur (NUTS2 level [58]) coastal area, population density even reaches 729 inhabitants/km².

Pressures on land also have important impacts on coastal agriculture which is often affected more than inland agriculture. The number of farms and arable areas available may be significantly reduced with loss of habitats. Additionally, environmental degradation leads to less desirable areas that become difficult to sell.

With an average of 63% of the population living in urban areas in 2005, the Mediterranean is considered to be one of the most urbanised regions of the world. The rate of urbanisation is more rapid in southern and eastern Mediterranean countries as a result of expanding populations (higher fertility rates) and migration. The Mediterranean and Black Sea coastal zones are more urbanised than the corresponding inland regions or states, illustrating a "coastalisation" of population distribution. This is reflected by associated pressures on the economy, and is a major concern for waste management. Throughout the Mediterranean and Black Sea region, cities which used to be compact are now sprawling and exacerbating pressures on the natural environment (UNEP/MAP-Plan Bleu, 2009). Besides increasing the potential risks to coastal populations from climate change, urbanisation is also driving a change in land use which can impact coastal communities in different ways. There are 25% more artificial surfaces on the European coast than there are inland (EEA, 2006). In terms of coastal urbanisation, the continuous growth of populations and infrastructure tends to follow coastlines with precision, resulting in nearly 40% of the length of coastal areas being occupied (UNEP/MAP-Plan Bleu, 2009). Nearly 50% of the coastline could be artificial by 2025 according to Plan Bleu's prospective (2008). Tourist accommodation facilities and services significantly contribute to urban sprawl, especially for the Mediterranean which is the world's leading holiday destination.

Urban sprawl is one of the main pressures on natural capital in coastal zones and as such, was also partly addressed through the natural capital issue.

Land and Ecosystem Accounting to Assess Urban Sprawl

The accounts for urbanised areas were extracted from PEGASO land cover at level 1, in which urban areas include two subclasses; densely built-up land, and dispersed developments. Although the latter may include significant proportions of agricultural land or areas of natural vegetation, when found within urban areas they are likely to be impacted by urban activities associated with residential, transport, and industrial uses; thus have been included in the estimate of urban areas.

For the year 2000, PEGASO **LEAC** showed densely urbanised areas along the coastal strips of Israel, Malta, Monaco and Palestinian Territories, and intermediate levels for Cyprus, France, Greece, Italy,

Lebanon, Spain and Tunisia. Other countries of the Mediterranean and Black Sea show lesser extents of coastal urbanisation (Figure 18).

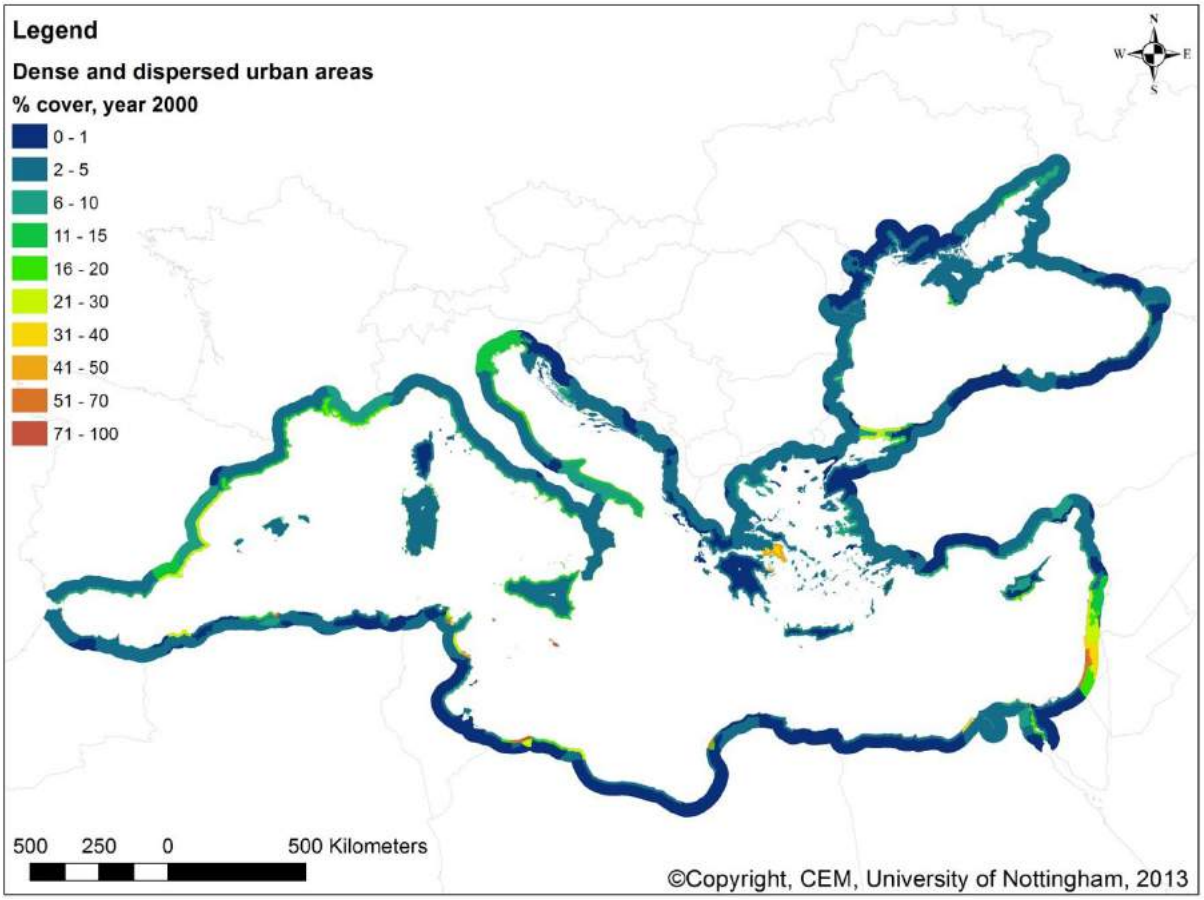


Figure 18. Map of per cent of urban areas from total areas of coastal accounting units in 2000, PEGASO LEAC (57).

The greatest pressures from urbanisation (based on per cent of urban areas) are found along Near-East coasts and large coastal cities (Athens and Istanbul). However, the spatial resolution of the 250 m grid used for mapping is too coarse for assessment of finer-scale patterns to be assessed, such as the 100 m setback coastal zone. Figure 19 illustrates the results of land accounts in 2011 for three buffers around the coast: 1km, 10km and 50km distance buffers. The degree of coastal urbanisation in 2011 for the Mediterranean and Black Sea countries was expressed as a percentage of the total area for the three coastal buffers. Significant urban development was concentrated within the first kilometre of the coast in most countries. The relation between per cent of urban coverage within the first kilometre and the hinterland was used to assess the degree of urban sprawl in Figure 22.

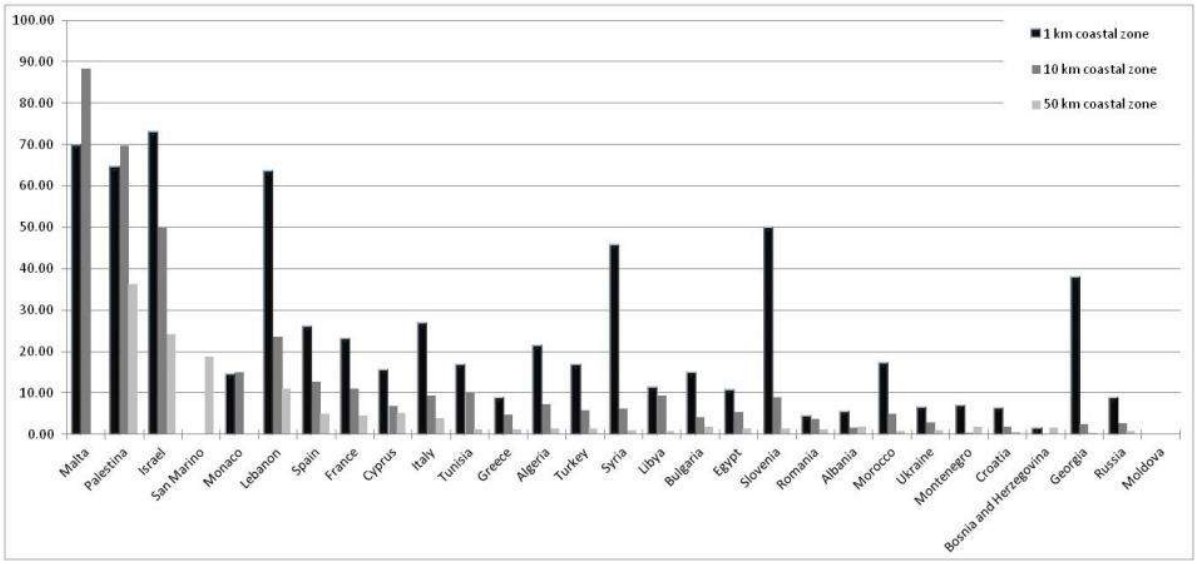


Figure 19. Per cent of urban and artificial land cover in 2011, for 3 coastal buffer zones in Mediterranean and Black sea countries

Trends in coastal urbanisation over a 12-year period (2000 to 2011) were assessed in the Mediterranean and Black Sea (Figure 22). Trends expressed as percentages of increase in urbanised land coverage were categorised as: high (>1.5%), intermediate (>0.5% to 1.5%), or low (0.1% to 0.5%). Decreasing percentages of urbanisation were categorised as low (0.1% to 0.5%) or intermediate (>0.5% to 1.5%). Results indicated an intermediate increase in the per cent of urbanisation in Egypt, Israel and Palestine. A decrease of urban areas for some countries needs to be interpreted with caution and may partly reflect a decrease in intensity of nightlight, which was used to help classify land cover, due to social or economic conditions in the field. In 2011, the data again illustrated much higher concentrations of urban areas within the first kilometre of the coast.

When shown as an increase in total number of hectares of urban area (Figure 20), a clear pattern of change was observed, with increases taking place mostly within the 50km buffer in the northern Mediterranean countries, while in the south development was concentrated closer to the coast. Higher rates of increase can also be observed in the northern and western Black Sea coasts. These higher rates of urban sprawl within the last decade imply that there was more urbanisation in the first kilometre buffer on the Black Sea coast.

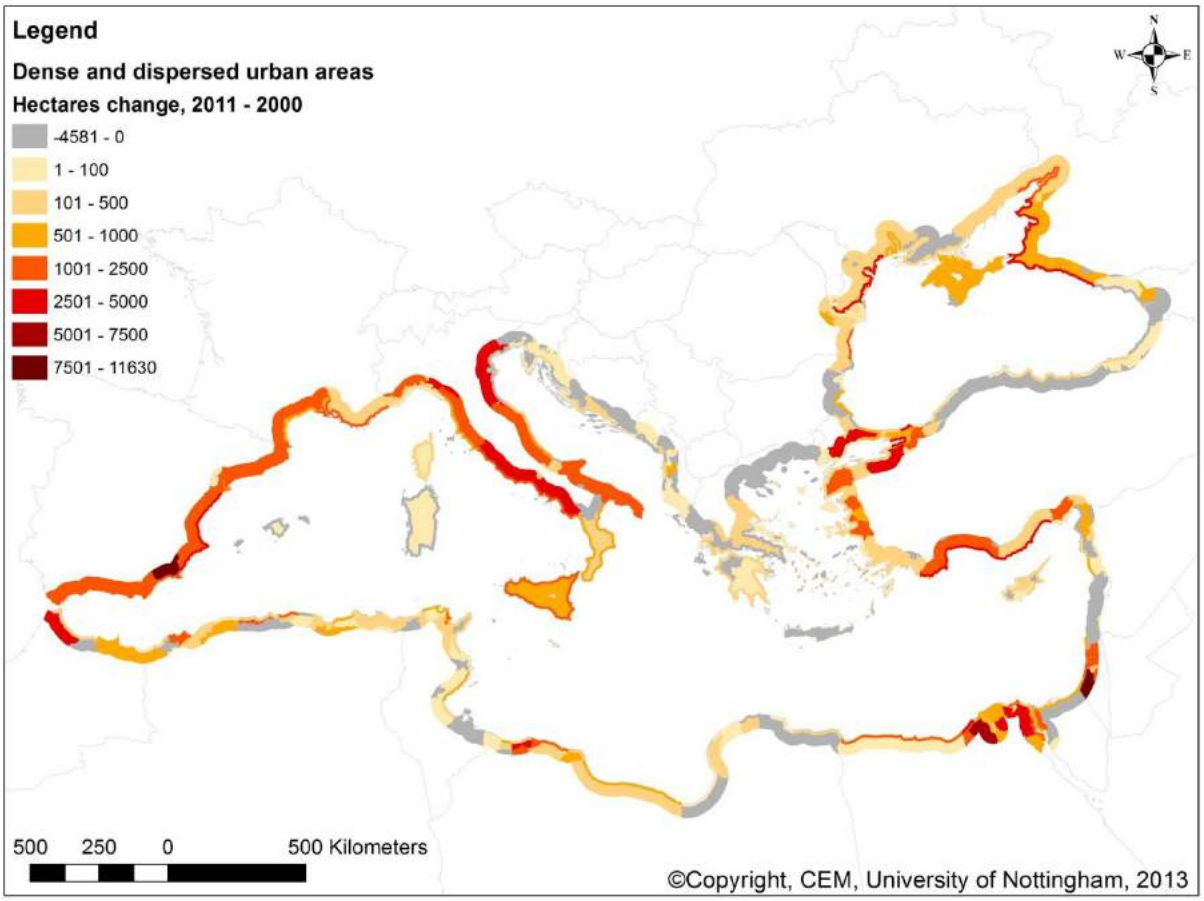


Figure 20. Number of hectares increase in level of urbanisation between 2000 and 2011 from PEGASO land cover, per coastal accounting unit, (57).

Urban Concentration Index to Assess Urban Sprawl

Urban development on the first kilometre coastal strip (Figure 21), and a 10 km strip (Figure 22), were analysed to further distinguish between balanced and unbalanced coastal development.

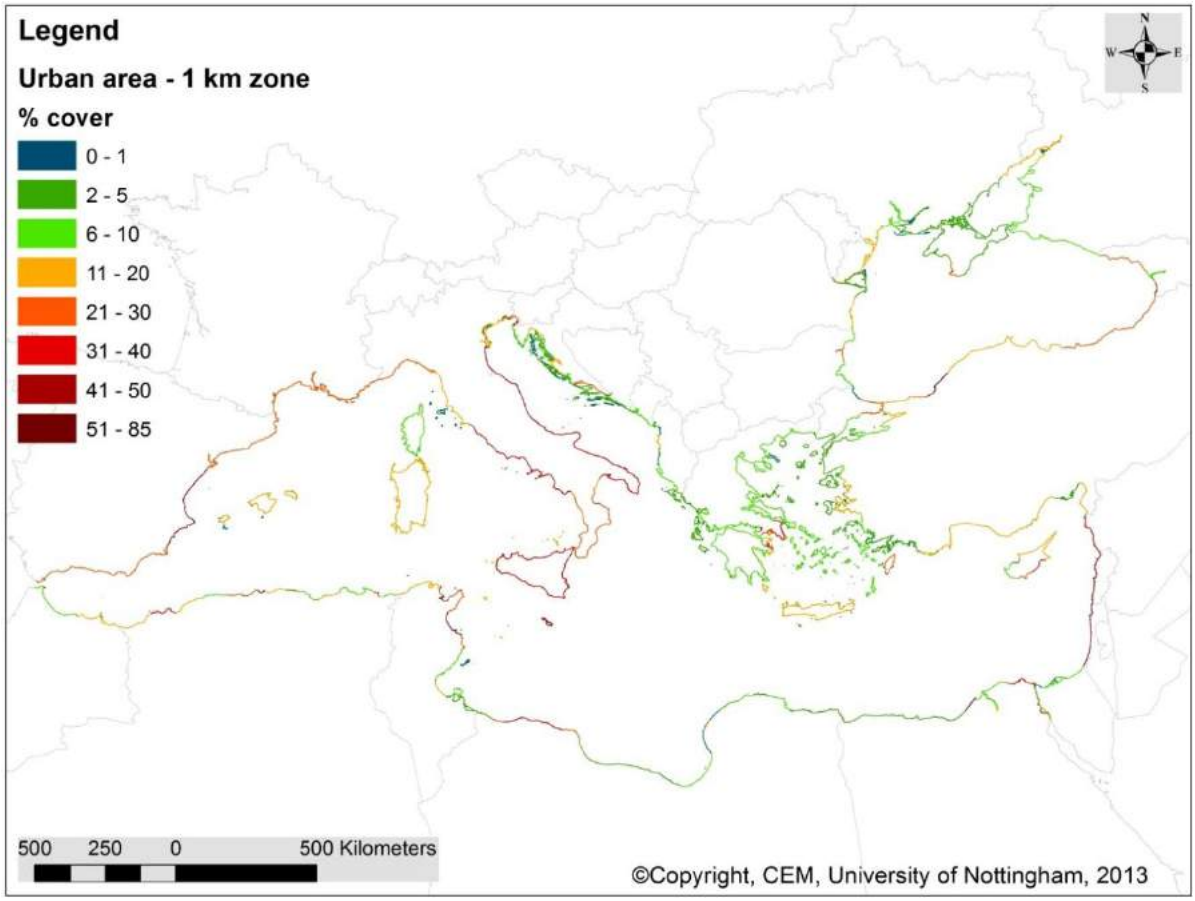


Figure 21. Percentages of urbanised land cover in 2011 on a 1 km coastal strip, reported by administrative divisions as spatial units (source: World Administrative Divisions).

The highest value (85%) of urbanised coast in 2011 was found in the region of Tarabulus, Libya. The longest stretches of highly urbanised coastal areas (>20% of the reporting unit), extend along most of the north-west Mediterranean coast from Gibraltar to Genoa. Most of the Italian coast has values exceeding 30%, as well as the coastal region of Valencia, Spain. The majority of coastal Croatia, Montenegro, Greece and Aegean Turkey have low values (<10%), with the exception of the metropolitan areas of Athens, Istanbul, Izmir, and the islands of Rhodes and Crete. Data for the first kilometre of the coastline in the Black Sea region shows considerable variation, with higher percentages on the southern and eastern shores, e.g. Turkish and Georgian coasts, and lower values in the north. Considerably high percentages of coastal urban development are found along the entire

Near-east Mediterranean coast. The southern Mediterranean has long stretches of less-urbanised coast (<5%), but with contrastingly high percentages around the major urban centres of Damietta, Alexandria, Benghazi, Tripoli and Tunis.

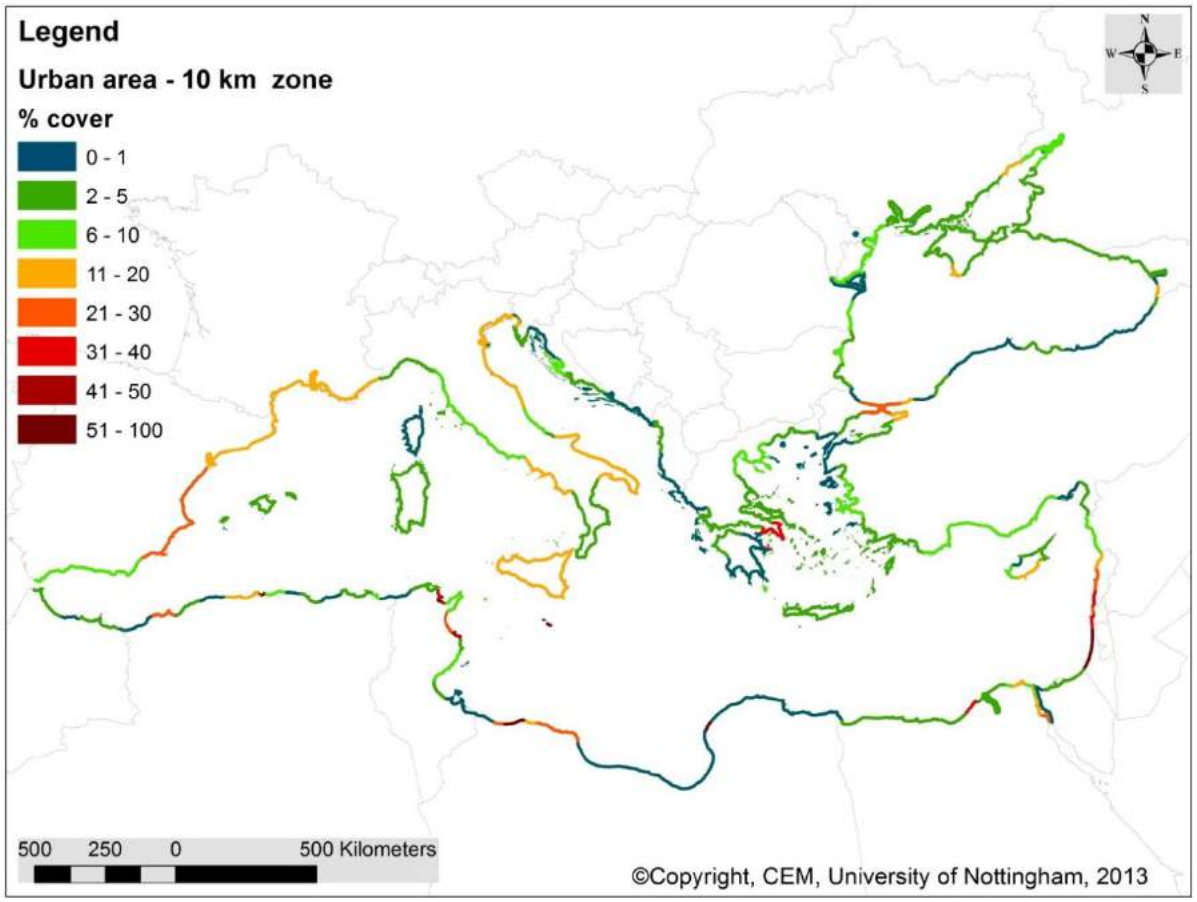


Figure 22. Percentages of urbanised land cover in 2011 on the 10km coastal strip, reported by administrative divisions as spatial units (source: World Administrative Divisions).

The highest value (100%) of urbanised 10 km coastal strip is found in the region of Beirut in Lebanon (Figure 22). Other exceptionally high percentages (>90%) include Port Said in Egypt, Tarabulus in Libya, and Malta. The longest stretches of highly urbanized 10km coastal strips are located on the northwestern and Near-east Mediterranean coasts. Relatively high percentages are found on certain stretches of the Mediterranean coast, including Valencia, Athens, Istanbul, Israel, the Gaza strip,

Alexandria, Tripoli and a few other pockets on the southern coast. However, the majority of 10 km coastal strips have values below 10% of urban development.

An index showing the normalised difference between percentage of urban land on the 10 km and 1 km coastal strips in 2011 was constructed for administrative divisions bordering the Mediterranean or the Black Sea (Figure 23). The assumption was that regions with balanced urban development, which strive to protect their coastal areas, should have higher percentages of urban land cover in the 10 km coastal strip, compared to the 1 km. The reverse would indicate the contrary, rather unbalanced development, often associated with long stretches of linear construction patterns along the coast. The index is called Urban Concentration Index (UCI).

The index value ranged between 1 and -1. In regions where more urban land was concentrated in the hinterland, i.e. in the 10 km coastal strip, the values were positive, which indicated an effect of coastal setback, or less urbanisation on the first kilometre of coastline. In regions where the value equalled zero or was a negative value, an unbalanced situation was interpreted with no effective coastal setback or more urbanisation on the first kilometre coastal strip compared to the hinterland. Regions with no, or very little, urban land within the two coastal strips would also display values close to zero, which needed to be distinguished from other regions where the value represented an unbalanced situation. To overcome this problem, all of the regions with less than 5% urban land were excluded from the analysis.

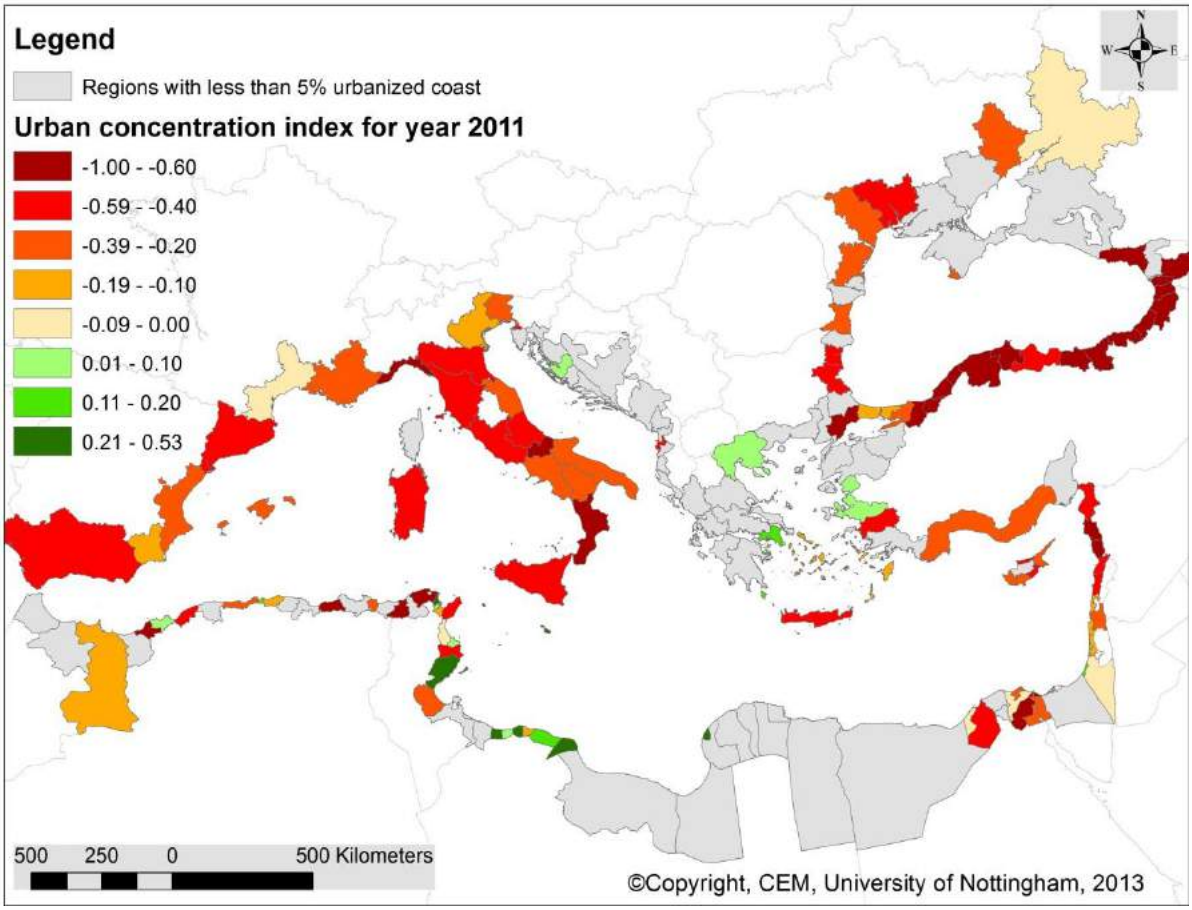


Figure 23. Urban Concentration Index for year 2011, estimated for administrative divisions (source: World Administrative Divisions).

The index revealed a broad distribution of unbalanced development for the majority of the northwestern and Near-east Mediterranean coast, and the Black Sea coasts of Bulgaria, Turkey and Georgia. This pattern of development is also evident on the southwestern Mediterranean coast. Most of the coasts of Libya and Egypt, besides the Nile delta, appear to be either less developed or developed in a more balanced way. The administrative regions of Attiki and central Macedonia in Greece, and Izmir in Turkey show positive values because they contain rather extensive stretches of non-urbanized coastline, including many of the islands.

Cumulative Index Mapping to Assess Urban Sprawl

Cumulative Index Mapping (CIM) further enhances information on coastal urbanisation at the western Mediterranean regional level.

Similar to the *Impact* index, the *Pressure* index can be disaggregated according to spatial area. This allows for the assessment of respective influences of individual pressures in relation to the total intensity of combined pressures. Figure 24 underlines land-based pressures within the first 20 km from the coast. Figure 25 disaggregates results into land-based, marine-based, and fishery-related pressures for a 20 km coastal strip. There were higher proportions of land-based pressures in France, Spain and Italy, which could be accounted for by the higher urbanisation and coastal population densities for these countries.

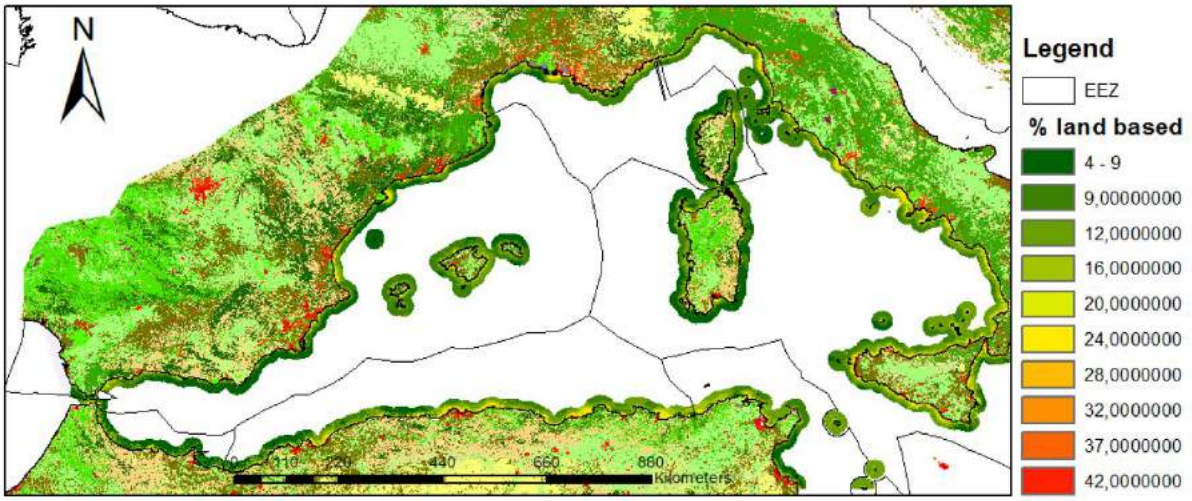


Figure 24. Influence of land-based pressures in the first 20 km from the coast in the western Mediterranean (source PEGASO-CIM 2013).

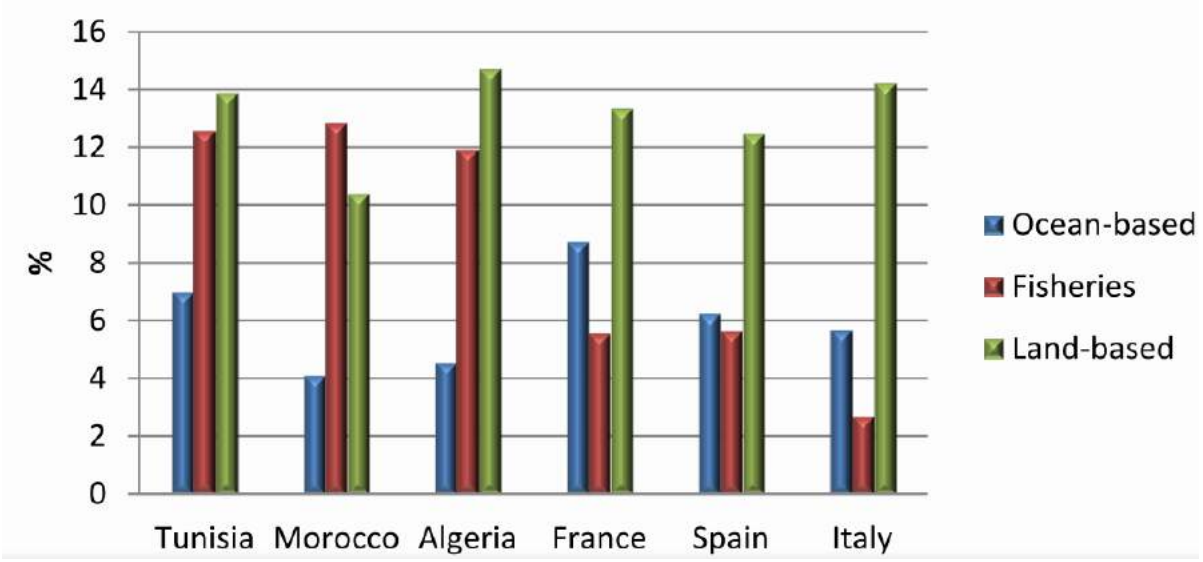


Figure 25. Influence of pressures on the first 20 km from the coast of western Mediterranean Sea littoral countries.

Indicators to Assess Urban Sprawl

Similar to the natural capital issue, indicators are also complementary tools to explore urban sprawl processes. At a local scale, a number of indicators from the PEGASO core set have been identified and then calculated by CASES that dealt with urban sprawl. Although different indicators were used, a good deal of coherence was achieved in the use of 'Area of built-up land' and 'Population density' as a direct indication or indirect measure of urban sprawl. These indicator factsheets are a first step in standardizing and harmonisation for a common representation of the supporting data http://pegasoproject.eu/images/stories/Factsheets/PEGASO_Area%20of%20built-up%20space.pdf and http://pegasoproject.eu/images/stories/Factsheets/PEGASO_Population%20size%20and%20density.pdf

Through specific guidelines for spatial data harmonization a next step was achieved in combining spatial data from different areas in a coherent way, e.g. within a distributed network of geonodes (see also above).

For the Indicators derived from the factsheet

For the indicators derived from the factsheet 'Area of built-up space'

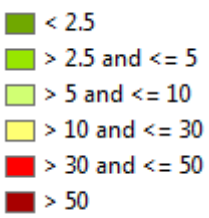
- ***Percentage of built-up space by 0-1 km buffer at year X by NUTS3***
- ***Percentage of built-up space by 0-10 km buffer at year X by NUTS3***
- ***Percentage of change in built-up space by 0-1 km buffer in year X compared to year Y***
- ***Percentage of change in built-up space by 0-10 km buffer in year X compared to year Y***

Class boundaries and colors for data symbolization (Legend) were chosen as follows at the local scale:

Percentage of built-up space

LABEL	*COLOURS (RGB)*
<=2.5	*112 168 0*
>2.5 and <= 5	*152 230 0*
>5 and <=10	*209 255 115*
>10 and <=30	*255 255 0*
>30 and <=50	*255 0 0*
> 50	*168 0 0*

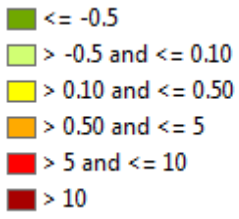
Units: %



Percentage of change in built-up space

LABEL	*COLOURS (RGB)*
<= - 0.5	*112 168 0*
>-0.5 and <= 0.1	*152 230 0*
>0.10 and <= 0.5	*255 255 0*
>0.5 and <=5	*255 170 0*
>5 and <=10	*255 0 0*
> 10	*168 0 0*

Units: %



For the indicators derived from the factsheet 'Population density'

- ***Number of inhabitants per km^2 (population density) in municipality units in year X***
- ***Number of inhabitants per km^2 as a proportion of total population of NUTS3 region***
- ***Percentage of change in number of inhabitants in year X compared to year Y (difference in 10 year periods)***

Class boundaries and colors for data symbolization (Legend) were chosen as follows at the local scale:

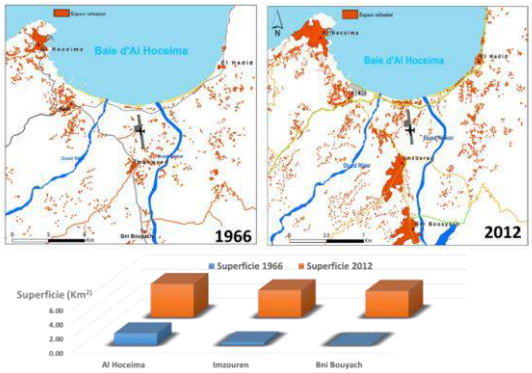
Population density		*Percentage of change*	
LABEL	*COLOURS (RGB)*	*LABEL*	*COLOURS (RGB)*
<= 50	*255 255 128*	*<= -5*	*112 168 0*
>50 and <=250	*250 209 85*	*>-5 and <= 0*	*209 255 115*
>250 and <=500	*242 167 46*	*>0 and <= 5*	*255 255 0*
>500 and <=1500	*173 83 19*	*>5 and <=15*	*242 167 46*
> 1500	*107 0 0*	*>15 and <=25*	*255 0 0*
		> 25	*168 0 0*
Units: inhabitants per km^2		*Units:*	

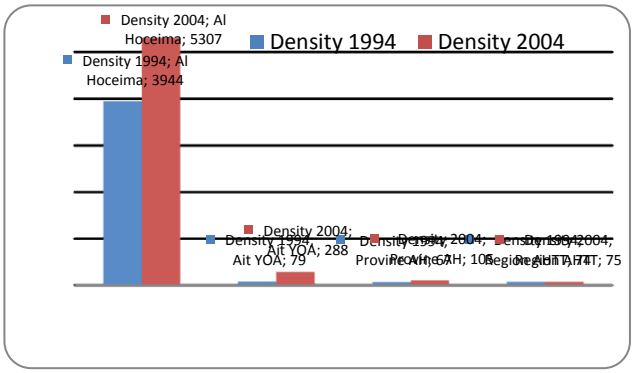
The Al Hoceima PEGASO CASE (Morocco) exemplifies how coastal urbanisation was addressed in relation to erosion and risks, using PEGASO indicator tools (Box 7). Table 7 shows how a number of indicators from the PEGASO core set were identified and then calculated by CASES dealing with the issue of urban sprawl.

The Al Hoceima CASE is located in the central part of the Mediterranean coast of Morocco. Major issues are urban sprawl, resource degradation, coastal risks and erosion. The coast is extensively developed and experienced a coastal real-estate boom including residential construction on fore dunes or on vulnerable cliffs, combined with a high population density (5,310 inhabitants/Km² in Al Hoceima city). A major issue is the achievement of balanced development while protecting biodiversity and managing coastal risks.

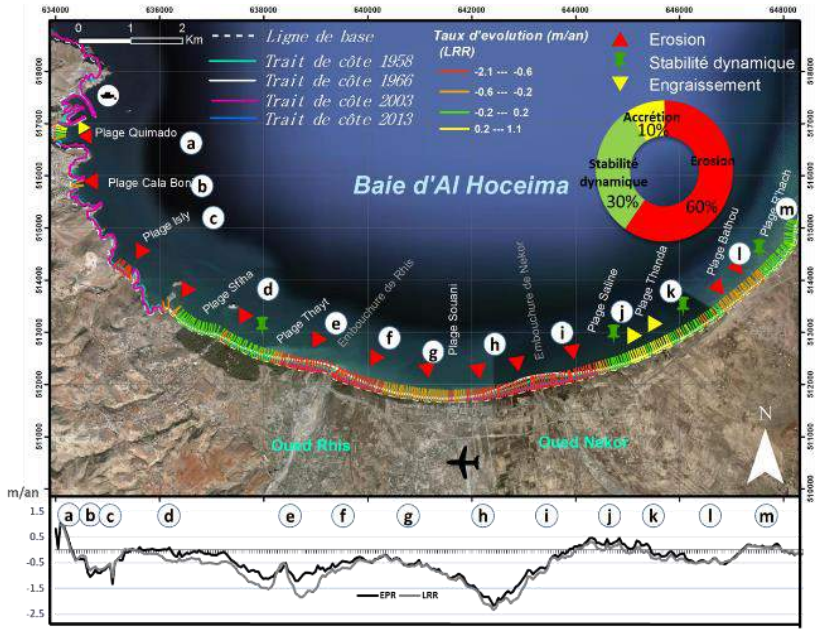
Three indicators calculated:

- **Coastal urbanisation (km²)**
- **Coastal population density (inhabitants/km²)**
- **Coastal erosion rate (m/year)**





Coastal urbanisation between 1966 and 2012 **Coastal population density change**



Shoreline changes between 1958 and 2013, and rate of change

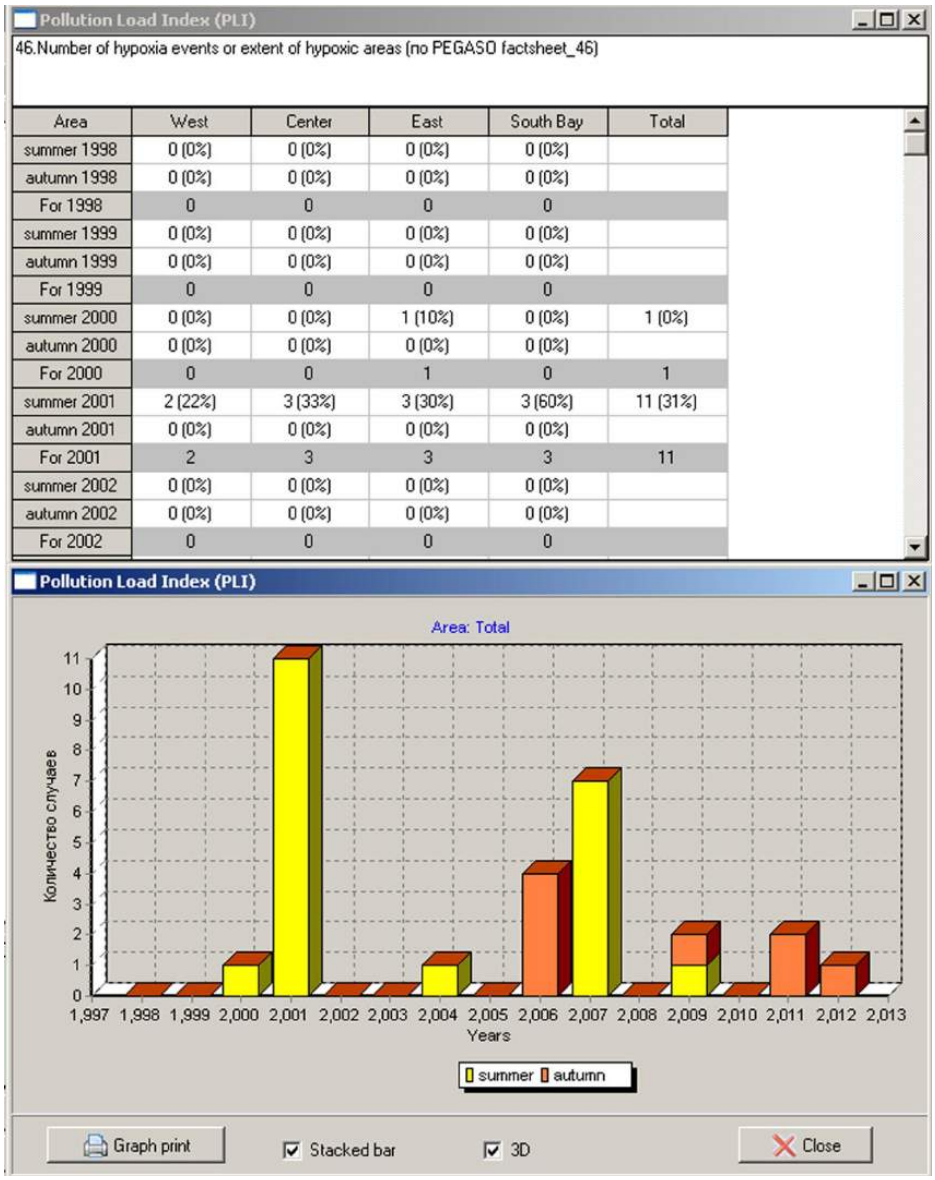
Assessments based on selected indicators showed that one of the direct consequences of dense urbanisation on land use is the encroachment on natural buffer zones such as dunes and beaches, thus increasing the exposure to coastal erosion. Setback lines should be defined and applied in accordance with the ICZM Protocol.

Box 7. Coastal urbanisation: erosion and risks in the Al Hoceima CASE [59]

Communication tools to disseminate assessment outputs.

Appropriate and effective dissemination of the outputs of assessments is crucial to achieve either a support to existing or future ICZM polices, and to achieve a change in behaviour of key actors (see also participatory approach). In the Bay of Sevastopol (Ukraine), several research institutions, including the Marine Hydrophysical Institute (MHI) and Institute of Biology of the Southern Seas of the National academy of sciences (IBSS) and controlling organizations carry out monitoring programs for the state of the marine environment of the Sevastopol Bay. Scientific support, which is one of the components of ICZM assumes participation of various specialists and utilization of various data depending on a specific task. The major disadvantage of traditional sources of data, such as atlases and databases, is the need to address various specialists, different sources of information, and usually paper-printed materials. A standalone version of the GIS-type system for the Sevastopol Bay is available at http://wiki.iczm.org.ua/en/index.php/Download_the_latest_version_of_the_atlas. It starts with information on data available for specific chemical, physical, ecological parameters and pollutants for individual months and years. The system incorporates general information for the Sevastopol Bay, including meteorological, physical, biogeochemical, and ecological properties, and supplementary materials, but it also incorporates an extensive set of documents and scientific publications. Yet, the most valuable part of this atlas in the set of preprocessed maps that can be displayed and compared or printed for further analysis. The tool is basically an extended set of regular numerical grids for all considered properties that can be arranged as needed (scale of maps, color scheme, isolines and their format) and combined with other layers of information (municipal and industrial buildings, sources of pollutants and their properties, etc.). Though this tool is powerful for environmental assessment, it also provides basic scientific information, and serves as a basis for calculation of indexes for a wider public of professionals and end-users. While interaction with gridded data makes possible to construct different maps, which have not been preloaded, indexes make possible to evaluate the state of environment and achieve an integrated regional assessment and ICZM. Thus, for example, a "traffic light" index has been constructed and introduced into the system. This index is universal and can be applied to any analyzed properties. As an example, this index has been applied to assess average summer concentrations of ammonium in the surface layer of water. The result clearly demonstrates that only the central part of the bay can be considered as "clean", but the most inner part of the bay and that one under heavy municipal and maritime pressures are highly polluted. Information on indexes is generated in the form of tables and various maps and graphs and all indexes are calculated "on demand" for needed stations, areas, and periods

of time. This makes possible to actually provide an integrated regional assessment, to monitor spatial and temporal variations in the state of coastal environment, to trace negative and positive trends due to changes in anthropogenic pressures or/and climate changes. The Bay of Sevastopol has been chosen as one of the sites for practical application and the demonstration of a dissemination tool, to assess local conditions and to provide practically useful end-products for the purpose of ICZM implementation.

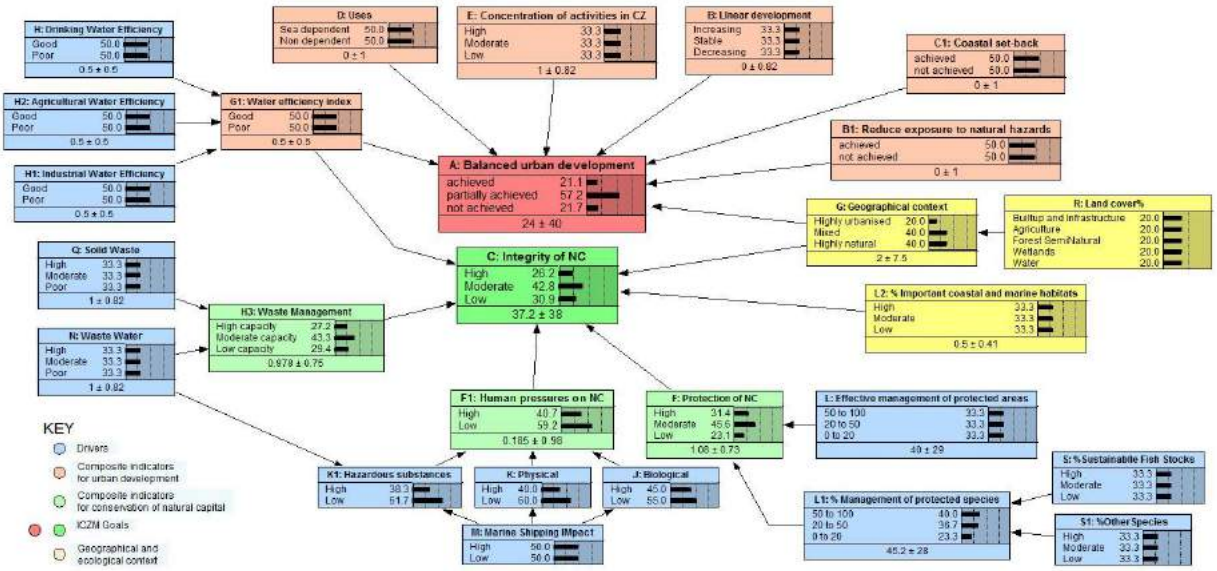


Chapter 4 Setting the Vision of PEGASO

Le Tellier J., Breton F., Škariĉić Z., Guisado E., Malvarez G.

PEGASO tools can be used individually, or in conjunction as complementary tools to support collective expertise in pursuing policy objectives. PEGASO established an ICZM governance platform to share knowledge and experience, facilitating collaborations and a common understanding between decision-makers and scientists. This approach enables proactive and adaptive management of coastal zones that can address specific issues, and the scale of impacts.

PEGASO held participatory visioning workshops, bringing together collective knowledge and expertise to explore desirable futures for the Mediterranean and Black Sea coastal zones. Workshops provided an opportunity to discuss common-agreed definitions of key terms, discuss how to measure stressors and impacts, gain experience using participatory processes to develop influence diagrams, and gain insight into how PEGASO tools could be implemented.



This network of influence was designed to explore how PEGASO ICZM indicators could be used to characterise and potentially measure the two policy goals of balanced urban development and preservation of natural capital in the Mediterranean. It does not cover all factors affecting ICZM, but it is considered to be a useful starting point for discussions, and especially for the development of scenario thinking.

Box 8. Causal diagram of urban development and natural-capital-related issues in the Mediterranean

Workshops made significant strides in developing integrated assessment tools. Participants at the meeting in Rabat, Morocco [60], incorporated influence diagrams into a Bayesian Belief Network (BBN) to qualitatively and quantitatively model the behaviour of systems. A BBN weights influences of various inputs to a system, and estimates the probability of the interactions and outcomes. This was used in Rabat to model the balanced use of coastal zones and the preservation of natural capital (Box 8). Models were used as a vehicle for discussions, and to focus topics on future outlooks. Participatory exercises were effective in supporting decision-making, and were a useful way of engaging with stakeholders.

4.1 Governance Platform

Knowledge and governance are the two key pillars of the governance platform (Figure 26).

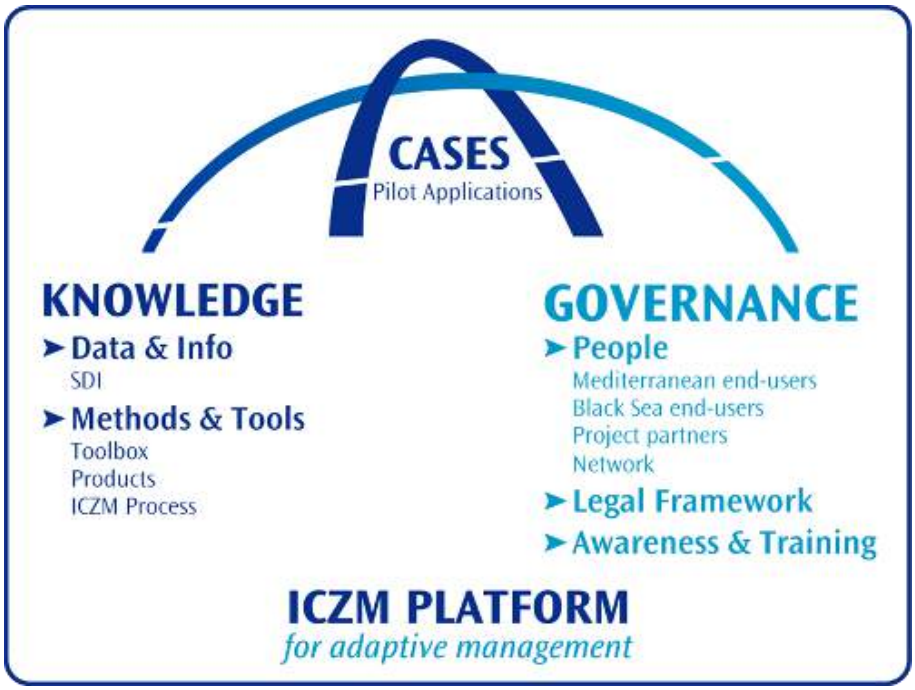


Figure 26. Bridging two pillars of ICZM: knowledge and governance for efficient decision-making

Efficient governance is fundamental for the goals of ICZM, and is only possible with the convening of decision-makers, top experts in relevant fields, end-users, and members of the public, to form a science-policy-societal interface. Bringing these key players together, however, is only effective if input successfully feeds back into governance processes. Similarly, bringing expertise together is only worthwhile if there is an effective method for sharing data and knowledge. The governance platform fulfils these objectives and encourages all interested parties to work together on specific coastal issues by providing appropriate institutional, legal and societal settings. Designed to boost communication among Mediterranean and Black Sea stakeholders, the platform is an opportunity to:

- **discuss needs among stakeholders;**
- **exchange knowledge on priority issues related to ICZM;**
- **ensure a common understanding;**

- **encourage the use of project tools and methods;**
- **facilitate data and information sharing;**
- **improve the understanding of scientific and pragmatic rationales of the tools offered;**
- **build a shared, scalable knowledge-base.**

4.1.1 Mechanisms to set up the Governance Platform

The PEGASO governance platform is composed of people with a shared interest in effectively implementing ICZM through collaborations, sharing knowledge and experience, and testing new planning and management tools. This group consists of: approximately 150 people working in the institutions involved in ICZM projects; 18 renowned Mediterranean stakeholders representing international organisations, national and regional authorities, and several Mediterranean key sectors (e.g. tourism, aquaculture); members of the Black Sea Commission; and approximately 200 people involved in the ten PEGASO pilot cases, either as direct implementers or local stakeholders. Collaborative work to date has yielded several important products for implementing the ICZM Protocol, which represents the legal framework for the work of the platform in the Mediterranean, and a source of inspiration for the Black Sea ICZM initiatives

From its inception, this governance platform has involved many key external contributors, such as the PAP/RAC National Focal Points and members of the BSC Advisory Group on ICZM. It has also attracted several other coastal and marine initiatives (e.g. RAMSAR, MEDWET, MEDPAN, the Small Islands Network, the Water Network in the Mediterranean and the Adriatic-Ionian Commission), becoming a privileged place of exchange and a hub for projects, studies and initiatives related to the ICZM Protocol.

To support exchanges among remote PEGASO members, and to allow interactions in various spatial scales, a powerful technical infrastructure was provided that included a number of communication and information tools (Table 8).

Table 8. Technical components of the PEGASO ICZM governance platform (Source: PEGASO, 2013 [61])

PEGASO Component	Contribution
Intranet	Designed for sharing and communication; it is a restricted common work space, but has an active forum and is a document repository for participants (upload/download). ***This can be extended as the basis of a wide resource in the region.***

Intranet Management System	Designed to organise and disseminate resources and results (reports, maps, data, application, etc.). It uses open source code, ***and provides an asset that can be used to create a generation of review tools as the platform goes forward.***
Web Portal	Designed to provide complete transparency to the project. One of the main features linked to the web portal and allowing further dissemination is the Coastal & Marine Wiki (www.coastalwiki.org). The portal enables selected outputs of the project to be available to wider audiences and ***this can become an important resource for the wider community as the platform develops.***
Spatial Data Infrastructure (SDI):	A central source of comprehensive, shared data in a compatible system allowing access to primary data for users from the public, commercial, academic, or government sectors. Complying with OGC standards and the INSPIRE Directive, ***it supports interactive information sharing, assuring the spatial data is organised and standardised.***

Following the objectives of PEGASO, four major questions were addressed by the platform members:

1. **What is the added value of ICZM and more precisely, the ICZM Protocol, in relation to other policies, and how does it link the Mediterranean with EU policies?**
2. **What is the role of science in bringing a policy into action? How can we bridge scientific knowledge and practitioners' knowledge to support decision making?**
3. **What kind of actions are already in place for the implementation of the ICZM Protocol at different scales in the countries?**
4. **How can we link data, information and processes at different scales (regional and local/sub-regional), integrating the experiences at local level from the PEGASO CASES i.e. pilot projects?**

Answers to these questions have been sought by all of the members of the PEGASO platform, through virtual exchanges or face-to-face meetings, as well as through exchanges with other projects and networks, including CASES. A considerable amount of information has been collected and some new knowledge has been produced with the ultimate goal of providing this to the Mediterranean and Black Sea coastal community. This information is summarised in a series of technical outputs: (a)

stocktake reports; (b) the ICZM process diagram uploaded to the Coastal Wiki; (c) the common conceptual framework for ICZM with special reference to the ecosystem-based management; (d) a set of ICZM indicators; (e) a land-use map using simplified CORINE classes and MODIS images of the Mediterranean and Black Sea basins; (f) mapping of natural capital; (g) a cumulative mapping exercise of the impacts to ecosystem components by pressures from human activities and global change in coastal and marine areas; and finally, (h) this is all integrated in the PEGASO IRA Report, presented here.

4.1.2 How the Governance Platform Works to Implement the Vision

Unless PEGASO data and tools are utilised, they have little value. With strong governance mechanisms like the PEGASO platform, and a goal to becoming institutionalised after the project ends, the data and tools created should continue serving the implementation of ICZM in the Mediterranean and Black Sea regions.

One question is how the PEGASO governance platform can become an institutionalised structure to ensure the continuation of ICZM governance in the post-project period. How can it remain the hub that it has become; gathering networks; providing existing infrastructure and services e.g. SDI, tools, methods of elicitation; improving collaborations; exploring new ways to form associations; focusing priorities; identifying major threats; and offering best responses ?

Two Regional Activity Centres of UNEP/MAP (PAP/RAC and Plan Bleu) are actively involved in the PEGASO governance platform. This provides a realistic opportunity for using results and outputs in synergy with other UNEP/MAP initiatives, such as those related to the seven protocols of the Barcelona Convention, the Mediterranean Commission on Sustainable Development (MCSD), the EcAp activities, the climate change, and vulnerability initiatives.

Similarly, the active involvement of the BSC members and the support they have provided to the platform across the project, act as strong indications that the products and working methods will continue to be used in the future. Since the project has resuscitated the interest for ICZM in this region, it is expected that the BSC will take advantage of this experience by preparing ICZM guidelines adapted to the specific needs of the Black Sea countries, which is seen as a priority in the years to come.

In light of all these developments, and the global pressures affecting both of these regional seas, long-term ICZM-strategies are needed. Strategies should be guided by the indicators and other PEGASO products to support prospective exercises such as those led by Plan Bleu. Adhering to this structure will lead to a better understanding of the different scenarios, potential impacts, and where

to focus future efforts within the ICZM Protocol and other initiatives. Many elements for building strong regional strategies for marine and coastal management already exist, yet they need to be (or remain) integrated to improve performance e.g. active and motivated stakeholders at all levels, including those mobilised within PEGASO. In this way the governance platform established under PEGASO would fulfil its ultimate goal of serving for the long-term policy implementation under the Barcelona and Bucharest Conventions.

4.2 Spatial Data Infrastructure

The PEGASO SDI was designed to support the PEGASO shared governance platform for the delivery of ICZM and integrated assessments of coastal zones and marine areas in the Mediterranean and Black Seas. It supports the ICZM platform, and the suite of sustainability assessment tools required for making multi-scale integrated assessments in the coastal zone, in many ways:

- through the creation of a network of local geonodes (which are provider-specific, compatible, shared nodes of geoinformation that together form a SDI) throughout the Mediterranean and Black Sea;
- by compiling accessible, reliable datasets and cartography, such as administrative boundaries, land uses, and protected areas, and making them accessible among others in the network; and
- by producing an agreed set of multi-scale tools, such as indicators, according to ICZM principles.

Therefore, through the development and implementation of a full SDI consisting of central and local geonodes, the IZCM platform was supported by ensuring the delivery of harmonised sets of data that were accessible through a web portal.

Building the PEGASO SDI: a collaborative project

The rationale behind the development of the PEGASO SDI was to construct an infrastructure by drawing on existing SDIs from project participants (for instance VLIZ, Envirogrids) and, to support the creation of new geonodes to extend online data-sharing and allow access to coastal zone management indicators.

This process of building a connected infrastructure for sharing spatial data based on ICZM principles was developed in several steps: firstly through the provision of capacity-building activities to support the construction of a functional network of geonodes, secondly in connecting the existing geonodes and making data accessible from core institutions such as EEA, and finally to co-develop local/regional or national geonodes where requested by stakeholders.

The creation of the PEGASO SDI was a collaborative project in which the contribution of each partner institution was a requirement, either by developing a local geonode or by providing results of indicator calculations. However, it is important for the contributors, both external and within the project consortium, to understand the benefits of sharing repositories of data. That is the main reason why PEGASO focused much attention on demonstrating how the SDI, and more specifically the network of geonodes, contributed to ICZM and supported the platform. For instance, by helping to manage and coordinate the dissemination of results among partners and ICZM platform members, this allowed better access to reliable data for informed decision-making. By sharing common principles in coastal management and by sharing local and regional experiences, advances in this field will be far greater, and future directions for research will be planned more efficiently.

The SDI is a practical tool, accessible via the Internet, acting as a central repository for geographical information that improves the understanding of coastal features and issues. Understanding the benefits of SDI has increased the willingness of partners to share data and contribute more datasets that are easily accessible through the web portal [62].

Efforts to set up the PEGASO SDI included the aggregation of national portals and datasets from regional organisations with information on the coasts of the Mediterranean and Black Seas. This resulted in a powerful tool that allowed governmental bodies, private companies and citizens to easily find, understand, and re-utilise coastal data for information in evaluations and decision making.

Benefits of the SDI for ICZM

Many of the benefits to ICZM can be drawn from the implementation and operation of the SDI. In broad terms, the SDI supports the ICZM platform by making existing coastal and marine data more widely accessible. In this sense, various layers of information can be cascaded synchronously in the map, facilitating decision makers to coordinate and share updated information on top of the map viewer and visually appraise and/or evaluate the effects of activities in relation to policy targets and indicators. Furthermore, the access to a variety of relevant information supports decision-making

processes with valuable cartographic tools, acting as a repository for Mediterranean and Black Sea spatial information. In this sense, it increases effectiveness for planning and managing a coastal area by allowing the examination of different interests and demands for a coastal space, and its overlaying results.

The specific benefits of a SDI for ICZM are:

- It allows the visualisation, comparison and downloading of relevant data for more detailed local analysis by a simple Geographic Information System (GIS) manipulation. The geospatial tool can assist in identifying ideal or potential locations for new projects in the coastal area.
- It offers a means to discover, visualise, and evaluate the existing coastal information for different purposes, and provides access to the raw data.
- The local geonodes can be integrated with other SDIs through standard services and thus significantly enlarge the capacity to access available geographical information.
- It allows better coordination across organisations, joining together land and sea management bodies and reducing the cost of delivery.
- It allows managers and decision makers to create and evaluate different policy scenarios for coastal zone management by examining the effects of different coastal activities in relation to policy targets, thus supporting the ICZM platform.
- In certain circumstances, it can help visualise the consequences of different management approaches on coastal processes such as erosion, floods or other associated risks. Maps may be generated in support of disaster prevention efforts and responses to emergencies.

SDIs have proven to be efficient tools to address the need for accurate, reliable and scientifically underpinned spatial data for informed decision making on coastal zones. The construction of the SDI involves a collaborative process, to define common objectives, targets and actions. It also requires a participatory process and capacity-building activities to share data and information, and to achieve this common view within the network of key stake and share –holders and end users. In this sense, the PEGASO SDI provides the most relevant spatial information and a set of suitable indicators that can provide useful information to policy makers to measure and encourage implementation of ICZM policies and programmes. By offering an overall picture of the different users in the coastal area and the state of the coastal environment, the SDI with its suite of integrated assessment tools, supports the assessment of coastal policies at different scales and measures progress in achieving sustainable development of the Mediterranean and Black Sea coastal zones.

The PEGASO Coastal Atlas: an end-product in support of ICZM

The Coastal Atlas prototype for the Mediterranean and the Black Seas is one of the results of PEGASO project. The atlas is regarded as a systematic collection of maps that describes some aspects of the knowledge of a specific territory, and is usually complemented with text, images, tables or charts. It is an online tool that is fully integrated in the PEGASO geoportal and combines interactive maps with text and images, organized in different sections or topics. It contains predefined maps of main findings for both basins, with the interpretation of the results among other reports. The PEGASO Coastal Atlas is one of the three components of the PEGASO SDI (Map Viewer, Data catalogue and Atlas) developed to support coastal management in the framework of ICZM.

- It consolidates essential data onto a state of the art mapping and visualization platform that allows end users to visualize, query, map, and analyze coastal data and PEGASO products (the Indicators factsheets, Integrated Regional Assessment products and other relevant outcomes related to the work made in PEGASO).
- It supports collaborative decision making and robust regional and local coastal management and planning.
- It acts as a repository of relevant documents, in different formats, accessible through the PEGASO SDI.
- It enhances the comprehension of tools and spatial information loaded on the viewer, and supports decision making process
- It acts as a window for visualising PEGASO outcomes.

Chapter 5 Policy and Management Options

Santoro F., Barbière J.

Assessments are efforts to assemble selected knowledge with a view towards making information publicly available in a form intended to be useful for decision making [63]. As reported in the AoA (UNEP and IOC-UNESCO, 2009), assessments should develop products that advise policy-makers. However, in many regions of the world there is no clear link between how scientific assessments inform policy and management processes. The ability of making this connection at different levels of policy and decision making is particularly challenging in the case of marine resource management. The natural capital of coastal and marine ecosystems is governed by a complex set of use rights, economic demands and functional requirements for a healthy ecosystem. It is a tendency for assessments to generate long-term perspectives and prognoses, rather than directly informing short-term management decisions. However even in such cases, making sure that results are timely and in a form that is accessible to policy makers is essential. In the EU legislative framework, for example, integrated policies are used to guide ongoing assessment work (e.g. EU Marine Strategy Framework Directive, 2008).

The IRA report is not a comprehensive marine and coastal assessment of the Mediterranean and the Black Sea regions, yet it has worked to identify a number of management and policy issues that have to be addressed both in the implementation of existing policies and in the definition of future ones. Moreover, the multi-scale approach adopted throughout the PEGASO project, as documented here, has highlighted the need of defining these management and policy options at an appropriate scale. Driving forces exert different influences at the various temporal and spatial scales in which they operate; with a range of impact intensities. Therefore, one needs to consider how well the institutions of a wider governance system, from local to global levels, match the dynamics of biophysical systems; this is what scholars denote as the 'problem of fit' [64,65].

Galaz et al. [66] reviewed the types of misfit between ecosystem dynamics and governance systems:

- **Spatial misfit**
    - Institutional jurisdiction too small or too large to cover or affect the areal extent of the ecosystem(s) subject to the institutions (e.g. local management institutions of sea urchin are unable to cope with the development of global market)

- **Temporal misfit**
    - Institutions formed too early or too late to cause the desired ecosystem effects (e.g. the speed of invasive species is not matched by the speed of response institutions)
- **Threshold behaviour**
    - Institutions do not recognise, or prevent abrupt shift(s) in biophysical systems (e.g. application of single species 'maximum sustainable yield' triggers fish stock collapse due to overharvesting of key functional species)
- **Cascading effect**
    - Institution is unable to buffer, or trigger further effects between or among biophyisical and/or social economic systems (e.g. abrupt shifts from freshwater to saline ecosystems might make agriculture a non-viable activity at a regional scale and trigger migration, unemployment and weakening of social capital)

Folke and colleagues [67] highlight the following four interacting aspects in addressing the problem of fit:

- **Build knowledge and understanding of resource and ecosystem dynamics to be able to respond to environmental feedbacks**
- **Feed ecological knowledge into adaptive management practices to create conditions for learning**
- **Support flexible institutions and multilevel governance systems that allow for adaptive management**
- **Deal with external perturbations, uncertainty and surprise.**

In conclusion, a good fit between governance and biophysical systems requires multilevel involvement from institutions, and the creation of partnerships between, and among different segments of the society. Additionally, a thorough understanding of the relevant ecological processes that operate across temporal and spatial scales is essential.

5.1 Avoiding Spatial Misfit: the Mediterranean and Black Sea in a Global Context

Although the geographical scope of this IRA Report is focused on the Mediterranean and Black Sea regions, it is clear that some of the issues identified have to be dealt with at a global level. There are several reasons for this. Firstly, there is only one global ocean which is the vast body of water that covers 71% of the Earth. Secondly, the increasing use of ocean space and marine and coastal resources is driven by global processes, and global market developments. Marine-related economic growth in recent decades has mainly been accomplished through unsustainable exploitation of many marine resources.

As shown through the results of CIM (Chapter 3), issues such as climate change, unsustainable fisheries, and shipping-related risks are some of the greatest potential threats. Dealing with these issues requires a global perspective regarding institutions, cooperation and negotiations.

The ocean was given marginal priority in the Millennium Development Goals (MDGs), despite significant contributions to the three dimensions of sustainable development. However, in 2012 Member States of the UN recognised the importance of sustainable development and management of the ocean and seas in order to achieve international development goals. One of the main outcomes of the Rio+20 Conference was the agreement by member States to launch a process to develop a set of Sustainable Development Goals (SDGs), to build upon the MDGs and converge with the post-2015 development agenda. It was decided to establish an "*inclusive and transparent intergovernmental process open to all stakeholders, with a view to developing global sustainable development goals to be agreed by the General Assembly*". There are currently a number of proposals regarding the definition of a stand-alone SDG for Ocean and Coast, recognising the importance of the ocean for sustainable development and humanity as a whole. It is argued that the ocean and coasts are high priorities due to the complexity of processes and significance of contributions to the three dimensions of sustainable development. The following proposals have been put forward:

- **Sustainable development goal for oceans and coasts to face challenges for our future ocean [68] with four targets:**
    - Ensure basic life-sustaining and regulating functions of the ocean

- Ensure healthy and productive marine environments to sustain all provisioning and non-provisioning services of ocean and coasts
- Build resilient coastal communities through mitigation and adaptation strategies, innovation, and sustainable development by sharing benefits and responsibilities
- Engage in integrated multi-level ocean governance

- **Ensure the health, protection and preservation of oceans, seas, and marine ecosystems [69]**
  - Establish a representative network of MPAs covering 20-30% of the ocean's area
  - Enact a moratorium on all fish stocks that are overfished, no longer resilient, or in decline
  - Establish and implement an agreement concerning the protection of marine biodiversity in areas beyond national jurisdiction (ABNJ)
- **Healthy seas and oceans - blue economy with four priority areas [70]**
  - Protection of marine biodiversity
  - Elimination of unsustainable fishing practices
  - Reduction of marine pollution
  - ABNJ

The ocean plays a key role in the post-2015 agenda. This role will be efficiently and effectively realised through global efforts towards adopting necessary measures. Improved governance, increased coordination and cooperation, political will, and the targeted allocation of sufficient resources remain key components of future goals. Investments in ocean economy, sustainable management of ocean and coastal resources, and adoption of the ecosystem approach can ultimately be highly profitable and promote sustainable growth. Increased cooperation and cross-sectoral coordination of stakeholders at local, national, regional and global levels is crucial for developing new global partnerships for sustainable development, especially in the areas of technical and scientific cooperation, information sharing, and resource mobilisation.

Following discussions at a global level, the Conference of Parties (COP) to the Barcelona Convention, held in Istanbul in December 2013, launched the revision of the Mediterranean Strategy for Sustainable Development (MSSD; [71]) adopted in 2005. The countries bordering the Mediterranean expressed the willingness to adopt, by 2015 a "MSSD 2.0" articulated with the SDG being developed at a global level. This exercise will be an opportunity to engage more widely around the implementation of the Barcelona Convention and the achievement of good environmental status (GES) of marine and coastal ecosystems.

The BSC-PS is as well committed in the achievement of the GES of marine and coastal ecosystems as highlighted in the 4th Bi-annual Black Sea Scientific Conference, *Black Sea - Challenges Towards Good Environmental Status*, held in October 2013. The conference was organised to continue the concerted efforts initiated by the previous BSC scientific conferences to use science and information technology to understand and deal with the environmental problems of the Black Sea. Further goals were to strengthen the science/policy interface and regional cooperation towards better governance of environmental protection to preserve the Black Sea ecosystem as a valuable natural endowment of the region. This was done in a way that would ensure the sustainable use of its marine and coastal resources for the economic development, well-being, health and security of the population of the Black Sea coastal States.

5.2 Avoiding Spatial Misfit: Managing the Coast and Sea in an Integrated Manner

In order to apply an ecosystem-based approach Marine Spatial Planning (MSP) should be linked to ICZM with respect to the interdependencies of coastal and marine ecosystems. It is important to reflect the interrelationships of human and natural systems in oceans and coasts, as well as the complex processes involved in these areas.A framework to guide sustainable development of ocean and coasts can be inspired by the MSP Approach. According to the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO) MSP is understood as '*a promising way to achieve simultaneously social, economic, and ecological objectives by means of a more rational and scientifically-based organisation of the use of the ocean space*' [72].

MSP does not lead to a one-time, final product, it is a constantly evolving, iterative process that learns and adapts over time. The development and implementation of MSP involves a number of steps, including:

1. **Identifying need and establishing authority**
2. **Obtaining financial support**
3. **Organising the process through pre-planning**
4. **Organising stakeholder participation**
5. **Defining and analysing existing conditions**
6. **Defining and analysing future conditions**
7. **Preparing and approving the spatial management plan**
8. **Implementing and enforcing the spatial management plan**
9. **Monitoring and evaluating performance**
10. **Adapting the marine spatial management process**

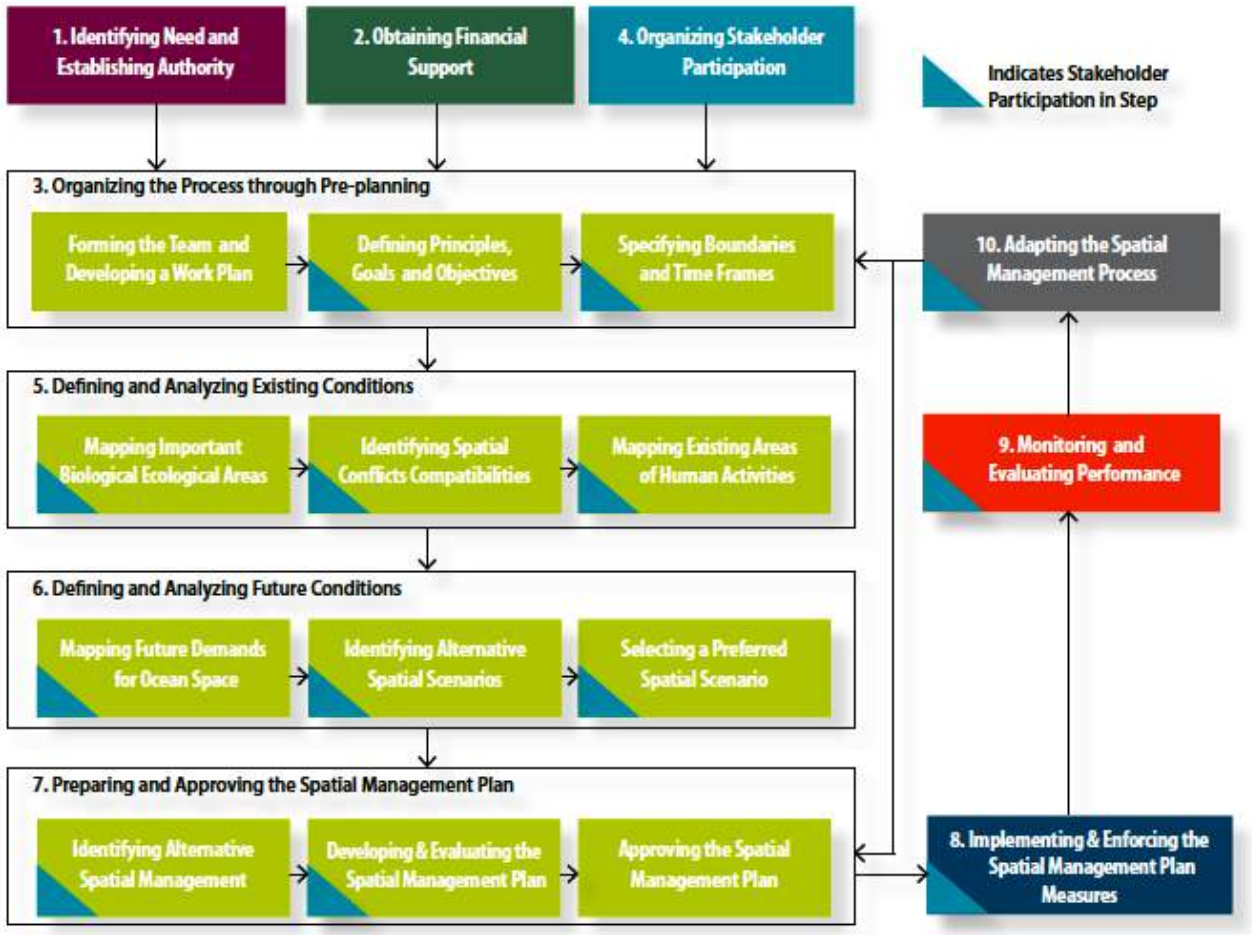


Figure 27. MSP a step-by-step approach (from Visions for a sea change, IOC-UNESCO 2007, [73])

MSP is influenced by international law and practice, as well as national policy legislation. The inclusion of the ecosystem-based approach in the CBD or the UNEP Regional Seas Programme policies, aiming to address environmental problems in the management of marine and coastal areas, are both good examples of the influence that international policies have on widely spreading concepts and approaches.

The ICZM Protocol for the Mediterranean is another important example of how international policies can provide an integral framework to guide the implementation of common principles and

approaches. Previously, coastal zones were still governed in a fragmented way by international law, while the rare instruments aimed at transcending sectoral policies and guiding national systems towards integrated coastal management were confined to the realm of soft law. [74].

MSP and ICZM can also be initiated through national legislation as in the United Kingdom Marine Bill which has MSP as one of its keystone agenda items. National policy can also cover this, as in 2005 when the Dutch Ministry of Housing, Spatial Planning and the Environment published a North Sea paragraph for the first time in its National Spatial Planning Policy Document for the Netherlands. Core objectives of management plans address the need for a healthy, safe and profitable sea.

In 2008 the European Union published a road map for *Maritime Spatial Planning: Achieving Common Principles in the EU* [75]. This and the 2011 Communication on *Maritime Spatial Planning in the EU: Achievements and Future Developments* [76] paved the way for the recently proposed Framework Directive on Maritime Spatial Planning and Integrated Coastal Management [77]. Aware of the great opportunities offered by the maritime sector for innovation, growth and employment the '*aim is to identify the most efficient and sustainable current and future utilization of the maritime space*' on Europe's way towards a Blue Economy.

Box 9 Proposed Framework Directive on Maritime Spatial Planning and Integrated Coastal Management (2013/0074)

This proposed directive is the result of a consultative process developed in the context of a specific policy framework:

Policy Framework: Integrated Maritime Policy (IMP)

2007 Blue Book on an Integrated Maritime Policy for the EU:

- **Maritime Spatial Planning: Challenges that emerge from the growing competing uses of the sea must be addressed.**
- **ICZM: Commitment is needed at EU level to ensure sustainable management of cross-border coastal ecosystems.**

2008 Marine Strategy Framework Directive

- **The environmental pillar of the IMP.**
- **Recognises MSP as a tool to support an ecosystem-based approach to the management of human activities to require good environmental status.**
- **2012 Blue Growth**
- **The present legislative proposal is an essential part of the ambition to develop Europe's Blue Economy.**

2012 "Limassol Declaration"

- **MSP is one of the instruments to bolster sustainable growth in offshore areas.**

The aim of the proposed Directive is:

To establish a framework for maritime spatial planning and integrated coastal management that promotes:

- **the sustainable growth of maritime and coastal economies and**
- **the sustainable use of marine and coastal resources**

Key obligations of the proposed Directive are:

- **Develop and implement maritime spatial plans and coastal management strategies.**
- **Mutually coordinate or integrate plans and strategies to ensure land-sea connectivity.**
- **Cooperate with Member States and Third countries to ensure coherent approaches across sea-basins.**

- **Appropriate consultation of stakeholders.**

5.3 Avoiding Spatial Misfit: Identifying Management Options at a Local Level

Following decades of implementation experience with ICZM in the Mediterranean and Black Sea, mainly from the UNEP-MAP and the BSC-PS, it is evident that management plans have to be defined at the local level. Considering previous discussions on the importance of setting common global and regional priorities (Chapter 5.1), even if coastal and marine areas around the world share common issues, it still remains true that management options can only be successfully implemented when local specificities and local governance settings are taken into account.

The PEGASO CASES work has demonstrated that it is only at the local level that problems and issues can be correctly identified and lead to appropriate solutions. The application of assessment tools at a regional level (such as the use of LEAC at basin levels), as exemplified in this IRA Report, has proven merits in describing trends and providing a more comprehensive view. Yet, it is only by applying those assessment tools at a local level that will help to understand phenomena that may have similar impacts, but very different drivers and root causes. One of the main contributions of the ICZM-indicators approach, as developed in the PEGASO project, was to define a framework (e.g. the DPSIR) that used a set of indicators to provide an integrated analysis of a specific coastal issue in a specific coastal area. The main aim of such an approach is to present a tool that can guide the definition of appropriate responses at the appropriate level.

One of the two themes that were a focus for this IRA Report serves as an appropriate illustrative example; urban sprawl. Conclusions formed here are consistent with a number of other assessments and reports that confirm coastal urbanisation to be one of the main threats for the Mediterranean, and also for some areas of the Black Sea. However, the same phenomenon observed throughout the region has different drivers and different potential impacts according to the geographical, environmental and socio-economic characteristics of the particular coastal area analysed.

Issues related to urban sprawl and densely populated coastal areas may be due to a combination of concentrated economic activities, a lack of land-use planning, and increasing environmental vulnerability. Either way, urban sprawl is increasingly viewed as a significant problem that entails a wide range of social and environmental costs that need to be addressed.

A number of local management options have been proposed to tackle this issue. Some of them are based on land use, top-down approaches and some of them are based on the definition of public-private partnerships. Some examples are reported below.

Local-Level Regulatory Approaches to Avoid Urban Sprawl

a. **Cluster zoning** or clustered development is a regulatory technique that has been used for decades at the local level for protecting open space, reducing the cost of development, and in some cases keeping land such as farmland and forest in existing use. Cluster zoning ordinances allow or require houses to be concentrated together on small lots on a particular part of a parcel of land, leaving the remainder in open space. **Downzoning** or **large-lot zoning** is an approach to protect open space that stands in sharp contrast to cluster zoning. Rather than concentrating development on small lots, downzoning in rural areas requires minimum lot sizes large enough to discourage residential development.

Public acquisition of land to protect open space:

b. In this case the aim is to protect the "wild third" of the shoreline by controlling land ownership (through the gradual acquisition of outstanding sites) and by prohibiting construction on the protected land while at the same time leaving these areas open to the public. Important examples exist in the Mediterranean that show the effectiveness of a public intervention in purchasing coastal land in order to promote integrated and sustainable management practices. In 1975, the French parliament decided to create a public organisation: the 'Conservatoire de l'Espace littoral et des Rivages lacustres'. In charge of purchasing natural sites which are endangered (sites which may disappear in the long term through degradation), the Conservatoire is a public government agency responsible for developing appropriate land-use policies for the protection of threatened natural areas. The one objective is to '*conduct a*

land acquisition policy to safeguard coastal zones, respect natural sites and maintain their ecological equilibrium'. In this geographical area, the Conservatoire's mission is twofold; quantitative and qualitative. Its main priority is to acquire endangered natural sites; but it also acts as a safeguard for the quality of these areas and their ecological equilibrium. For this reason the Conservatoire can make recommendations concerning its mission to the relevant authorities. Following the example of the French Conservatory, the Sardinia Region created the Region Coastal Conservatory in 2008 as a prompt response of the Region of Sardinia to the challenges of implementing ICZM policies at the local level (Box 10).

Box 10. The "Conservatoria delle coste" of Sardinia Region

The Agency has a specific mandate on coastal areas protection in synergy with current planning instruments and regulations. The objective of the Agency is that of implementing a dynamic process where conservation and management are carried out respecting the fragility of ecosystems and coastal landscapes, and the diversity of uses and activities, including their interactions and impacts.

The objective is to begin a dynamic process of stewardship, management and enhancement which takes account of the fragility of ecosystems and coastal landscapes, the different activities and uses that they host, and their interactions and impacts. The agency was created as the tool to activate these policies.

Its main activities are:

Conservation

Conservatoria delle coste aims to promote research and valorisation of the cultural, material, historical and anthropological heritage linked to the coasts and seas of Sardinia. Conservatoria delle Coste has acquired regional heritage, and is undertaking a range of work in order to valorise them. The areas entrusted to the Agency become "coastal conservation areas".

Beach management

Conservatoria delle coste is responsible for project management and coordination actions delivering integrated management activities in Sardinia's coasts. The Agency adopts areas which are subject to degradation, such as ancient fishing villages and locations isolated by historical and logistical problems. The Agency uses highly innovative initiatives aimed at the sustainable growth of parts of

Sardinia which are less well known by the wider public.

Sustainable development

Sustainable Development is one of the founding principles of the Agency's management strategy. Through the valorisation of natural resources, safeguard of culture and traditions, involvement of local communities and the sustaining of existing economies, the Agency aims to create new opportunities of dynamic growth.

Environmental education

As detailed in Article 3 of the founding law of Conservatoria delle coste, the main functions of the Agency include the promotion and diffusion of themes related to the sustainable development of coastal areas, and the stewardship of the environment and landscapes.

Chapter 6 Guidelines for the Implementation of Ecosystem-Based Coastal and Ocean Management

Santoro F., Lescrauwaet A.K., Taylor J., Mamuka G., Abaza, V., Antonidze, E

This IRA Report has described efforts and progresses made in the context of the PEGASO project towards the implementation of the ecosystem-based approach to coastal and ocean management for the Mediterranean and Black Sea regions. These efforts have been framed in the context of both ICZM and the Ecosystem Approach. Moreover, a common conceptual framework has been developed by PEGASO partners in order to highlight similarities between the two concepts and offer a common ground for work [78] (see Box 1).

According to the CBD the Ecosystem Approach (EsA):

"….places human needs at the centre of biodiversity management. It aims to manage the ecosystem, based on the multiple functions that ecosystems perform and the multiple uses that are made of these functions. The ecosystem approach does not aim for short-term economic gains, but aims to optimize the use of an ecosystem without damaging it "

Article 6 of the ICZM Protocol defines a set of principles that guide the Parties in the implementation of the Protocol itself, among which a specific reference to the EsA is made:

"…The ecosystems approach to coastal planning and management shall be applied so as to ensure the sustainable development of coastal zones…"

The development of this common conceptual framework shows clearly that the EsA is embedded in the ICZM thinking, and reveals a number of key points:

• While the two sets of ideas are broadly consistent, the ICZM framework tends to focus more on institutional and governance issues whereas the EsA tends to present more of an ecosystem or biodiversity management perspective. Thus, in adhering to ICZM Principles as a basis for management there is a partial shift in emphasis towards societal issues;

• The extent that EsA promotes sustainability and conservation of natural resources is also covered in ICZM, but there is not a particularly strong emphasis on issues of liability and restoration of ecosystem functionality. Thus, linking the ideas in the ICZM framework is a valuable step in taking the CBD principles forward into operation.

It is also very important to highlight that the principles of ecosystem-based management as they apply to the coastal zone need to be considered from a process perspective. That is that they are as much about designing management and governance processes as they are in helping to set objectives that current or future management and governance structures might deliver. This IRA Report has, therefore, focused on two ICZM-EsA common framework principles:

- ICZM seeks to take account of the **wealth of natural capital in coastal zones** represented by ecosystems and the output of ecosystem services that depend on the complementary and interdependent nature of marine and terrestrial environments

- The **allocation of uses** throughout the entire coastal zone **should be balanced**. Moreover, coastal developments need to be in balance with related processes in the hinterlands.

Based on these two principles, the IRA Report tested the value of using the PEGASO integrated assessment toolbox in the governance platform, making use of the SDI, with a view to produce a blueprint for integrated assessments of coastal and marine environments.

A number of lessons were gleaned from applying the various methods and approaches in the context of the Mediterranean and Black Sea basins at different scales. These lessons can be considered as the legacy of PEGASO and pave the way for future assessments at national or local scales

6.1 Setting Priority Areas and Bridging Themes

With the purpose of making a concrete proposal for implementing ecosystem-based ocean and coastal management, the following matrix was developed (Table 9). The matrix is a reflection of the assessment detailed in this IRA Report, devised by the editors, and using feedback from the PEGASO end-user committee, mainly from a participatory workshop held in Rimini, Italy in September 2013. The aim of the workshop was to convene members of the PEGASO end-user Committee and partners to analyse preliminary results of the IRA, with particular reference to the indicators calculated at local (CASES) and regional levels, as well as other tools (e.g. LEAC, CIM, and economic assessments). The validity of these methods and tools were reviewed in light of developing proposals for policy responses and guidelines to implement ICZM in the Mediterranean and Black Seas.

The analysis of the current situation, and insights about how the future might unfold, informed a discussion on the use of policy instruments and management tools for responding to the main identified issues as well how they could best-inform governance processes (e.g. how to continue promoting a better dialogue between scientists, practitioners and policy and decision makers). Moreover, a reflection has been developed on the methodologies proposed and the validity of using PEGASO tools and methods to support decision-making for ICZM.

The meeting was carried out in collaborative sessions, in line with one of the main PEGASO principles; to work in a collaborative and participatory manner to promote exchange between scientists, practitioners, and decision-makers. The co-working exercise aimed at building a common knowledge from science, field experiences and expertise to ensure efficient working of the ICZM governance platform.

Table 9. Matrix of priority areas and bridging themes summarising the main findings of this IRA Report, and main directions for future work

Priority Areas / Bridging themes	Governance Platform	Building Basin-Wide Views	Filling Research Gaps	Building capacity	ICZM and other relevant policies
Science-Policy Interface	Further develop mechanisms for exchange of information e.g. workshops, conferences, intranet, fora	- Maintain updated stocktakes of experts, institutions, and networks - Develop compatible data that can be collated at a basin-wide level to inform decision-makers	- Translate scientific data to inform decision-making - Translate policy-related material to better-inform members of the public and scientific community - Further develop tools that aggregate data such as CIM, LEAC	Develop targeted training for Science-Policy interactions for scientists, policy and decision – makers, and ICZM practitioners	Create mechanisms for scientific input to ICZM legislation e.g. 100m setback, vulnerability of ecosystems
Bridging the gap between different sub-regions of the two basins and beyond	Increasing ownership of processes by providing opportunities for inputs from initiatives and networks throughout the	- Strengthen data-sharing, SDI - standardise data-collection methods for cross-comparisons	Create common standards and methodologies that can be pooled for data analysis	Create a 2-way process of sharing methods, tools, approaches to implement management at the regional-seas level e.g. geonodes, training	Explore and facilitate the replication of the ICZM Protocol to other regional seas

Priority Areas / Bridging themes	Governance Platform	Building Basin-Wide Views	Filling Research Gaps	Building capacity	ICZM and other relevant policies
	two regions	- Utilise data to create basin-wide snapshots of where there are research gaps and help define management priorities		on indicators	
Ecosystem-based Management	Seek consensus on the societal perceptions and choices on the priorities for coastal and marine management	Translate theoretical concepts into the field	- Set priorities for research agenda (societal challenges) - Incorporate ecosystem-based management into methods of EIAs / SEAs	- Translate theoretical concepts into the field - Build common understanding of concepts	- Better consideration of environmental degradation costs - Incorporate ecosystem-based management into legal requirements for EIAs / SEAs
Scalability	Test the validity and relevance of regional measures at	Link regional priorities with local specificities	Develop and test research techniques that can be scaled up or down		- Correct fit between scales of management objectives and governance

Priority Areas / Bridging themes	Governance Platform	Building Basin-Wide Views	Filling Research Gaps	Building capacity	ICZM and other relevant policies
	local scales		depending on objectives e.g. LEAC at Nile delta scale		levels - Subsidiarity Principle
Land-Sea Interface and Interactions	Ensure there are land-based and marine-based representatives	Have a holistic view of interactions between land-based activities and marine-based, and vice-versa, showing real dimensions of potential impacts	-Improve knowledge of impacts from cumulative and synergistic pressures -Improve knowledge of how marine developments impact development in the coastal zone	Bring awareness to scientists, managers, and people involved in industries that are land-based or marine-based	Integrate policy instruments MSP / ICZM to address mismatch between land-based and marine-based policies
Integrated Approach (multidisciplinary, multi-sectoral, and multi-level)	Further develop mechanisms for testing and sharing integrated regional assessments, approaches,	Evolve from a sectoral to an integrated basin-wide view	- Improve knowledge of impacts from cumulative and synergistic pressures, and feedback loops - Find ways of	Stimulate multidisciplinarity, inter-disciplinarity, and trans-multidisciplinarity	Integrate policy instruments to address mismatch between sectoral policies

Priority Areas / Bridging themes	Governance Platform	Building Basin-Wide Views	Filling Research Gaps	Building capacity	ICZM and other relevant policies
	methods, and tools		integrating different sources and methods - Improve methods of integrated assessments to support better-informed decision making		

Five priority areas have been identified:

1. **<u>The Governance Platform</u>**

   The Governance Platform is undoubtedly one of the most important added values of the PEGASO project. It has provided, and will continue to provide, the precondition for the continuation of the present work. Future work will be determined according to the prioritisation of different issues (e.g. institutional settings, ICZM practice) and elements (e.g. the SDI and the tools) as deemed fit by the Platform.

2. **<u>Building a Basin-Wide View</u>**

   In order to prioritise actions for management and policy-making, efforts to build views at a basin level need to continue. Deficiencies in data that could be addressed by adopting a basin-wide view should be focused on e.g. improving the precision of land-cover analyses at the regional level by acquiring new, and higher-resolution data, or expanding the CIM

to other sub-regions of the two basins. This will define a baseline condition in order to measure progress towards the implementation of ecosystem-based management at a basin scale.

3. **Filling Research Gaps**

PEGASO highlighted a number of research gaps that need to be filled in future research programmes and frameworks, that require strong collaborations across multiple disciplines. As reported in Chapter 2 of this IRA Report, ICZM science is still predominated by the natural sciences, therefore efforts should promote a stronger presence of the social sciences to support the ecosystem-based management e.g. further develop tools to make socio-economic evaluations of coastal and marine resources, and on the cost of environmental degradation.

4. **Building Capacity**

Although significant progress has been made in the context of PEGASO, there is still much work to be done for building capacity in the two basins if the principles of ecosystem-based management are to be fully implemented. Targeted trainings should be developed for policy and decision–makers, ICZM and MSP practitioners, and scientists in order to create a common understanding of concept, methods and tools.

5. **ICZM and Other Relevant Policies**

Although the ICZM Protocol represents a milestone for sustainable development in the Mediterranean, there are still some policy gaps that exist. Moreover, much work needs to be done in the future to define strategies for the full implementation of existing legislations. Chapter 5 presents some concrete examples and proposals for future policy developments.

In order to define some concrete actions and guidelines that suitably exemplified these five priority areas, the editors identified six themes that bridged various PEGASO objectives:

1. **Science-Policy Interface**

PEGASO experience clearly illuminated a need for better-informed solutions to environmental issues in governance and institutional settings. This requires improved knowledge-producing systems that are capable of informing and shaping well-matched solutions. Progress has been made through various stages of the PEGASO process, by stimulating dialogues and debates among scientists, practitioners and policy and decision –makers. However, some of the clear actions defined in this IRA Report should be put forward in order to better-develop this interface in a way that could produce more effective outcomes. For example, the value of tools that help aggregate different sources and types of data should be further highlighted and exlpored. CIM and LEAC, despite their limitations and drawbacks, have been highly appreciated by the members of the end-user committee. These tools satisfy a pressing need in many different sectors to use indices and indicators to estimate potential impact intensities on marine and coastal habitats of different human activities, both marine-based and land-based.

2. <u>Bridging the Gaps Between Different Sub-Regions of the two Basins and Beyond</u>

The PEGASO project has been undertaken in a continuous search for exchange among different contexts and cultures. This has proved to be an essential condition for the full implementation of common objectives and views. However, there is still much room from improvement, for example in: the definition of concepts and approaches; legislation; data acquisition; and standardisation of data-collection methods. This is also pertinent when addressing issues at a global scale, or when extending practices and experiences outside of the Mediterranean-Black Sea basins.

3. <u>Ecosystem-Based Management</u>

Ecosystem-based management was the guiding approach throughout this PEGASO assessment and it is clear that some work needs to be done in the future to continue putting this concept into practice. One of the main principles of the EsA is that economic, cultural and social perceptions of ecosystems vary among different elements of human society. Human rights, interests and cultural diversity must be taken into account, and ecosystems should be equitably managed for their intrinsic, tangible and intangible benefits. The governance platform could provide an ideal setting for discussions among all areas that are influenced by, or rely on marine and coastal ecosystems. Ecosystem-based management must seek to identify, prioritise, and provide a consensus on the objectives from all of the different areas that have an interest in the ecosystem.

4. The land-Sea Interface and Interaction

The Mediterranean and the Black sea are two semi land-locked basins where interactions between the land and sea have to be studied in more detail. Examples are related to river run-off and the effects this has on marine habitats, as well as impacts that marine activities have on land. Attention tends to focus on the effects of land-based activities on the marine environment, yet in light of the rapidly increasing blue economy, efforts should also focus on the potential impacts of marine activities (e.g. renewable energy, shipping) on coastal zones, such as urbanisation and coastal development.

5. Scalability

Working at different scales has been one of the other added values of PEGASO. For the first time, regional views of land cover throughout the Mediterranean and Black Sea coastal zones has been produced, as well as cumulative impact mapping of land and marine activities at sub-regional scales. Assessment tools like LEAC have been experimentally applied at the local scale in Bouches du Rhône, in the North Adriatic, in the Cyclades and in the Nile Delta. Future work needs to be done in order to verify the scalability of the PEGASO tools, in order to fine tune methods and approaches to adapt them for use at appropriate scales for various actions. Since impacts are context-specific, mitigation efforts should also be adaptable depending on the context. Management of the different processes and ecosystem activities should be scalable based on wide-ranging variables, such as: temporal and spatial variability; the vulnerability of different ecosystem components; the intensity of impact(s); and cultural and economic values, to name but a few. The aim should be for decentralised management (i.e. subsidiarity). Management should: involve all stakeholders; balance local interests and wider public interests; ensure that management is closely related to the ecosystem; and encourage ownership and accountability for all of those that are influenced by the ecosystem.

6. The Integrated Approach

The previous PEGASO Desktop review of assessments, as well as the AoA, clearly identified a major gap in the lack of integrated assessments. Assessments that take account of interactions and cumulative effects across all pressures and ecosystem components are needed to fully inform policy development and management. Moreover, PEGASO has made an attempt to adopt inter- multi- and trans-

disciplinary approaches. "*Because of the complexity involved in it, it is usually difficult if not impossible for one or few people to possess the range of knowledge needed for effective ecosystem managemen*t" [79]. Collaborative sessions among PEGASO partners and PEGASO end-users have proven to be an effective way to quality-check scientific work, as well as guide future improvements.

6.2 A Roadmap for ICZM in the Black Sea

A specific case in the context of the PEGASO project regards the Black Sea. PEGASO project was considered as a manner to make the debate on ICZM restart in the region. Some specific activities were undertaken in collaboration with the Permanent Secretariat for the Black Sea Commission, with the main objective of checking the feasibility of the development of a policy document similar to the ICZM Protocol for the Mediterranean. To test the feasibility of the applicability of the instrument such as ICZM Protocol, the Permanent Secretariat engaged the Black Sea country representatives (ICZM National Focal Points to the Black Sea Commission and Members of ICZM Advisory Group) in the important PEGASO project task, jointly with the Mediterranean countries, an ICZM implementation audit inventory, performed through stock-taking questionnaires, modelled against the requirements of the ICZM Protocol, and appropriately modified for the Black Sea to reflect the non-binding nature of the ICZM Protocol for this region. Black Sea countries successfully completed stock-taking exercise individually as well as produced regional synthesis report, which is documented in Abaza et al. [80] and Antonidze et al. [81].

Instrumental in reviewing the state of coastal governance in Black Sea region and in brainstorming the recommendations for the next steps was the PEGASO Visioning Workshop for ICZM in the Black Sea, organized by Permanent Secretariat in Istanbul, Turkey, on 5-7 December 2012 (similar visioning exercise for the Mediterranean was held on 16-17 October 2012 in Arles, France). Discussions at the Black Sea Visioning Workshop aimed at assessing the potential for coastal management, related policy initiatives and support tools, as a governance response to threats posed by the impacts of various coastal pressures and drivers in the Black Sea region. Outcomes of the workshop also aimed to contribute into shaping and development of PEGASO deliverables for the Black Sea region, such as the roadmap for institutional and legal development, coastal management guidelines (key requirement of BS-SAP, 2009), as well as the integrated regional assessment.

Visioning Workshop for ICZM in the Black Sea came up with certain conclusions on priorities with regard to coastal governance needs in the region. Note should be taken of substantive similarity of the findings of two independently composed working groups of regional stakeholders present at the Istanbul Visioning Workshop, which could be summarized as follows:

- ICZM Regional Activity Centre/Advisory Group with sustainable support
- ICZM Governance Framework/Platform/Guideline/Forum etc. for the Black sea with legal mandate
- ICZM Pilot Projects and CASES
- Public participation/communication set up
- Education of coastal managers

- Informal education
- Public access to data and information
- Economic and social incentives for sustainable development
- Ultimately ICZM Regional Legal Act

The concluding session of the Istanbul Visioning Workshop on ICZM in the Black Sea Region provided certain guiding considerations and wrap-up discussions with regard to how to shape the Guideline for ICZM In the Black Sea, recommending specifically the following:

- Guideline should utilize the language of the Protocol at full extent and serve to interpret its provisions for furtherance of good coastal governance in the spirit of the existing Protocol. Above all, this would further harmonize ICZM approaches in the Mediterranean and Black Seas.

- The Guideline should extend further by incorporating PEGASO Tools (stock-taking, indicators, marine and land ecosystem accounts, scenario building, SDI, CASES, etc.) and other ICZM tools successfully applied in the Black Sea region (coastal code of conduct, ICZM spatial planning methodology, progress indicators, etc.). ICZM Platform, including coastwiki and SDI tools, could provide the best format for the development and presentation of the Guideline.

6.3 Conclusions

An overarching goal of the PEGASO work to review marine and coastal assessments was to identify ways to improve the efficiency of processes at various stages. Not only were methodologies considered for collecting high-quality data, but particular focus was given to the translation and availability of data to directly inform policy- and decision-making. PEGASO investigated various different ways to collate current spatial data; portals for sharing data and knowledge; and platforms to promote collaborations among disciplines, sectors and levels. Methods using various tools to promote these objectives were developed and tested to support best-informed decision making, in line with objectives of the ICZM Protocol.

Starting with a stocktake of existing resources, the PEGASO work highlighted the current state of ICZM-related activities within both scientific and governance sectors. The purpose of this was to review the structure of: legal, institutional and organisational frameworks; coastal and marine research; and informal and formal networks. Since threats to marine and coastal ecosystems are extensive, two critical topics were chosen as a focus and used to test the various tools: land use and natural capital. Both of these are high-priority in relation to the ICZM Protocol objective to achieve balanced use of the coastal zone.

The next step was to test the various innovative new and existing assessment tools, using unbalanced land development and use of natural capital as focal points. Although there are a multitude of threats to coastal ecosystems from different land uses, land-based pressures associated with coastal urbanisation are of particular concern in the Mediterranean. Tools such as LEAC and CIM achieved an overview of land use in the Mediterranean and Black Sea coastal zone and an overview of the potential impacts of land-based and marine-based human activities on the martine habitats, and local-level tools were used to validate causal effects at a finer scale. Data were yielded on the density of urban development. Outputs could be refined to show temporal and spatial trends. For example data could be disaggregated to show the per cent of urbanisation in strips of varying distance from the coastline; or trends in hectares of urbanisation over a multi-year period; or the difference in percentages of urban land on far and near coastal strips to indicate the overall degree of balance in urban development. Data could be further disaggregated to identify which pressures have the greatest impact in an area e.g. comparing land-based, marine-based and fishery-related pressures on the coastal strip of different littoral countries. All of these methods use specific indicators to represent the degree of anthropogenic influence, such as population density (inhabitants/km2), coastal erosion rate (m/year), and hectares of urban land.

Marine and coastal ecosystems provide valuable natural capital for the economy of the Mediterranean and Black Sea regions. Data to describe the use of natural capital included measuring natural and semi-natural areas, species and habitats of conservation importance, protected areas, natural-capital degradation, ecosystem vulnerability, and the cost of natural-capital depreciation. Specific indicators to measure threats to natural capital included: per cent of natural area coverage, per cent of areas protected; marine debris accumulation; fishery activity; pollution levels; or the monetary value of processes associated with natural capital depreciation such as the cost of prevention, preservation, management or monitoring.

Margins of error are recognised in the various methods for measuring threats to ecosystems both due to uncertainties from methodologies and the lack of data. For example, in some situations intensity of nightlight was used to help classify the degree of urban land cover however, this could represent other parameters such as vegetation coverage, therefore biasing inferences. The world database of protected areas was used as a source of data for natural capital assessments, yet data was not available for some countries included in the regional assessment, therefore skewing regional effort. However, by using a combination of complimentary assessment tools (such as MSP, SDI, LEAC, CIM, Indicators, Indices, and Scenarios), general patterns can be drawn despite these uncertainties. Subsequently, appropriate tools can be selected for finer-scale analysis of areas identified by broad-scale methods.

Ecosystem goods and services are being yielded unsustainably in some areas, with irreversible detriment to the health of ecosystems and this can be masked by assessment methods that do not use an ecosystem-based approach. For example, if long-term sustainability of natural capital is not considered, the short-term benefits of depleted resources and services appear to be economically advantageous, yet this is a temporary strategy. Research and management of socio-economic activities must adopt an ecosystem-based approach, with a more holistic consideration of impacts, in order to reach a sustainable equilibrium that will be of greater benefit to communities in the long-term.

It is clear that a deterioration in the health of an ecosystem significantly affects ecosystem functioning and production. It is critical to consider the various scales of impact, and this applies to all of the threats to marine and coastal ecosystems discussed in this IRA Report. Assessment methods and tools must be scalable, but also context-specific since interactions within ecosystem processes are complex, and impacts of stressors can be independent, cumulative, synergistic, or interrelated. An integrative approach is necessary across all scales, from research to governance. This is only possible with a platform that allows data sharing and collaborations among the key players of ICZM-related activities, forming a science-policy-societal interface. To account for the ever-changing dynamic ecosystem processes, management responses should have a correspondingly adaptive structure with a constant feedback of up-to-date knowledge.

Participatory workshops have proven valuable for prompting discussions, forming collaborations, sharing knowledge, guiding future research and governance, and developing and testing the various methods and tools. It is for this reason that the ICZM Platform will have to continue in the future to provide the 'space' for continuing discussion, dialogues and deliberations.

Work described in this PEGASO IRA Report has produced a policy-oriented blueprint for guiding future directions in scientific research, policy-making, and socio-economic activities related to the ICZM Protocol in the Mediterranean, and can be applied to processes in Black Sea countries. With constantly evolving feedback of improved decision-making, rigorous scientific data, and sustainable practices, the integrated ecosystem-based approach to marine and coastal assessments detailed here will strengthen governance of these valuable ecosystems6.2 A roadmap for ICZM implementation in the Black SeaReferences

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Appendices: CASES Contributions to Integrated Assessment report:

- Sebastopol
- Cyclades
- North Lebanon
- Nile Delta (NIOF)
- UNOTT
- Tour du Valat
- Al Hoceima
- Adriatic Coast

Pegaso Project
People for Ecosystem based Governance
in Assessing Sustainable development of
Ocean and coast

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Integrated Coastal Zone Management

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Report on Sevastopol Bay CASE

July 2013

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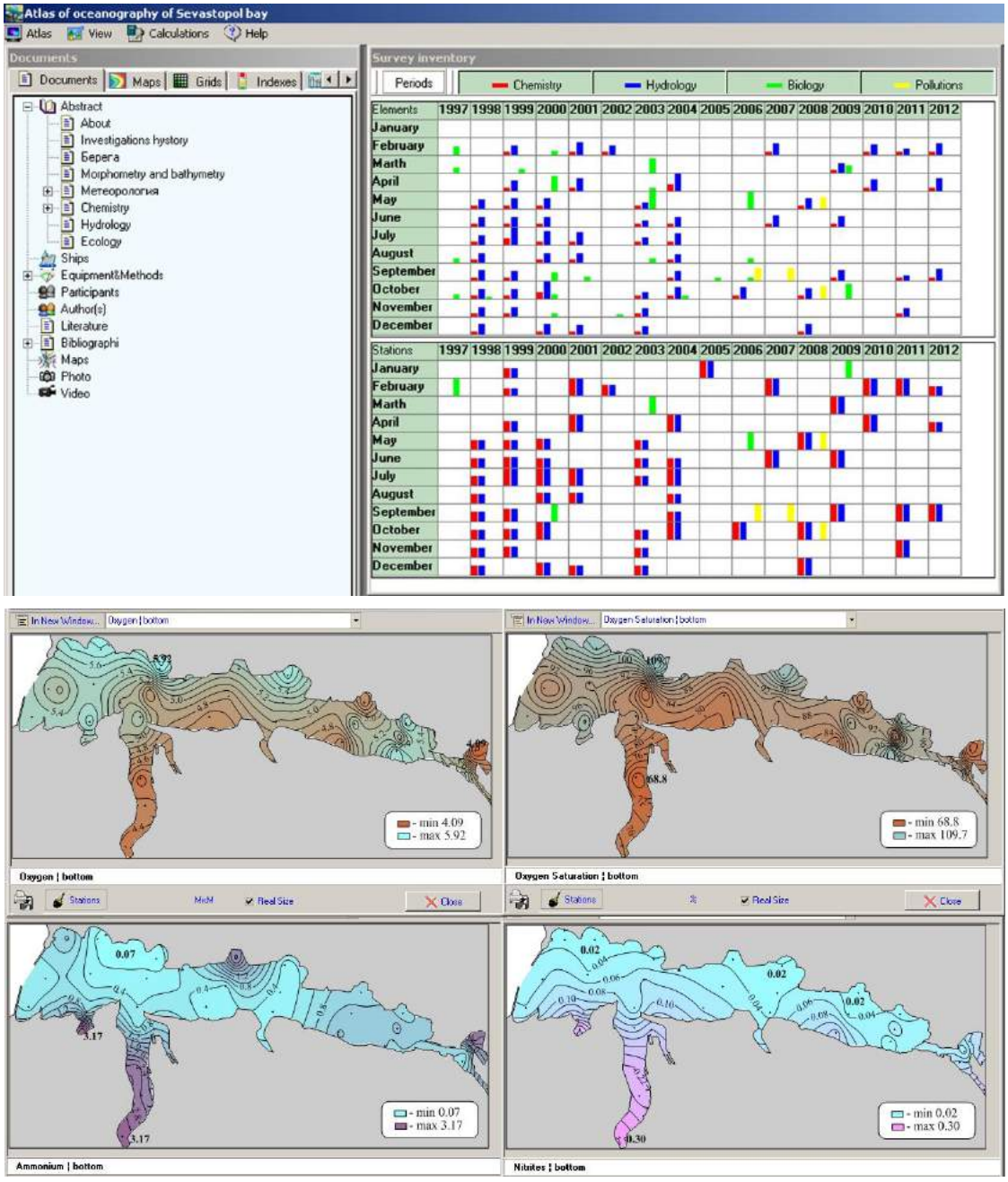
Section 1. Individual partners achievements

The Bay of Sevastopol at the Crimean coast in the Black Sea is one of the PEGASO CASES. The major ISZM Protocol issues related to this site have been identified as eutrophication and water pollution, biological diversity loss, climate change impacts. The major part of environmental problems of this site is of anthropogenic nature and they are due to poorly managed or uncontrolled exploitation of all natural resources. Another problem preventing efficient integrated coastal zone management is the absence of a platform for "coherence between public and private initiatives and between all decisions by the public authorities, at national, regional and local levels, which affect the use of the coastal zone" (Protocol ICZM in the Mediterranean, p.13). Beside legislative and social problems, the bridge between scientists and stakeholders has never been established.

There are several major threats indentified for the Black Sea environment by various international and national organizations. The most persistent of them are (i) biological desertification and (ii) eutrophication and pollution, especially pollution from coastal sources. Previous studies and publications demonstrate that biological desertification and anthropogenic eutrophication and heavy metal pollution are the major problems of the Sevastopol Bay. There are several other threats. They are currently less important but they will grow in line with the coastal development. These are urban development, industrial development, recreational development, agricultural development, land use, coastal erosion. Thus, coastal erosion is considered in the line of problems, but it has never been considered as a major problem for the entire coast of the Black Sea, though it can be important for specific areas of river mouths and lowlands. It has been widely accepted that one of the most important reasons of these problems is lack of Integrated Coastal Zone Management. Though the Problem is known and a number of national, international and NGO programs/projects/activities has been applied, the problem remains unresolved and it is actually worsening. One of the reasons is with the lack of information (all statements and decisions are waved away in a while) and the absence of tools that can be applied and used to estimate and demonstrate the current state of the coastal environment.

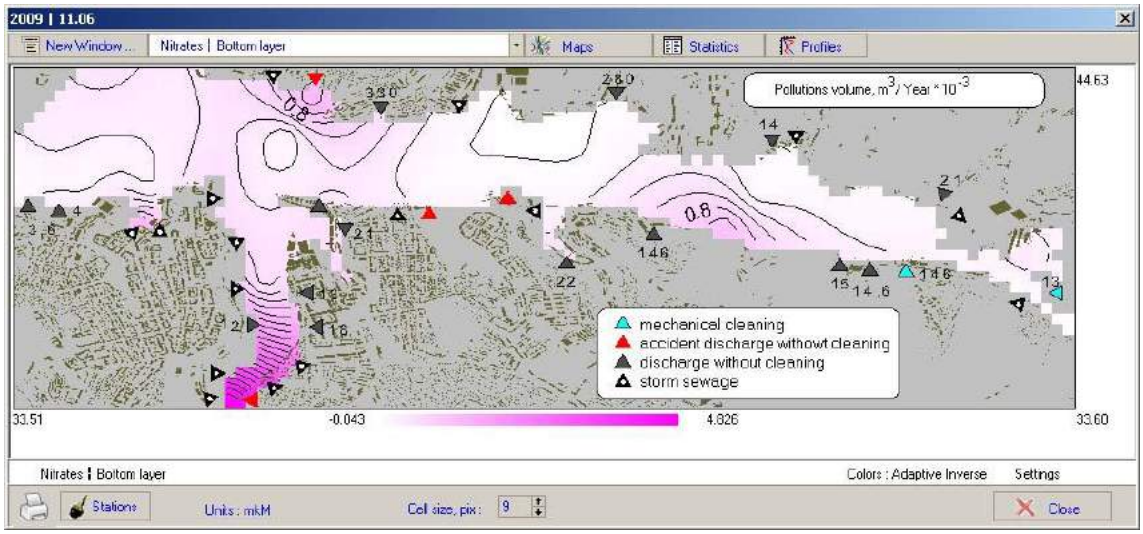
The major coastal issues identified for this CASE are eutrophication and water pollution, biological diversity loss, climate change impacts.

To provide information about ICZM tools (firsts of all, on local indicators); to improve the knowledge of the coastal zone; to provide tools for scientific support of ICZM a web-portal (http://wiki.iczm.org.ua/en/index.php/Main_Page), a WMS server (as the first example, http://193.42.157.77/ru/index.php?r=atlas/wms/view&id=19), and a standalone CD version of a GIS-type tool for the Sevastopol Bay (http://wiki.iczm.org.ua/en/index.php/Download_the_latest_version_of_the_atlas) has been updated from their initial version to further improve data coverage and provided tools (legal arrangements, environmental status and assessment, interactive digital atlas, indexes, scenarios).



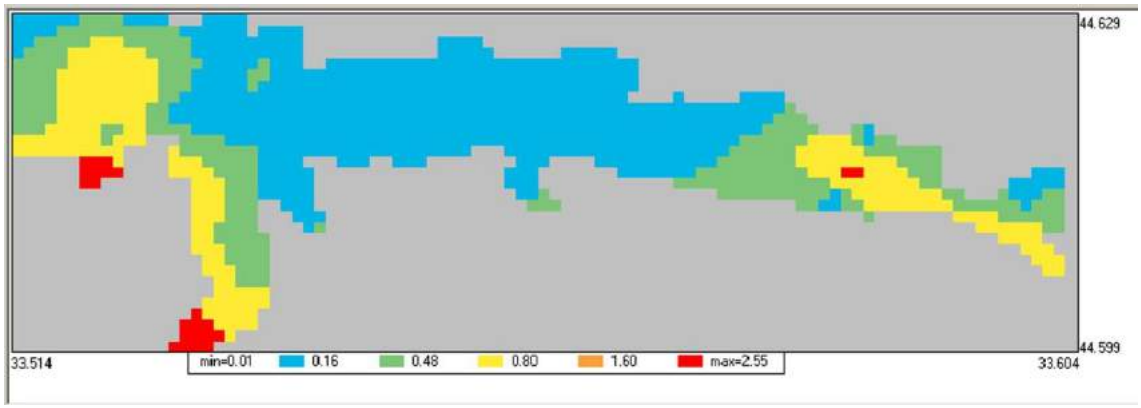
The data base and digital atlas of the Sevastopol Bay.

There are several tools developed within the frame of the PEGASO project and incorporated in the GIS-type system for the Sevastopol Bay. The major of these tools are GIS and indexes. The GIS tool is basically an extended set of regular numerical grids for all considered properties that can be arranged as needed (scale of maps, color scheme, isolines and their format) and combined with other layers of information (municipal and industrial buildings, sources of pollutants and their properties, etc.). Though this tool is far more powerful for environmental assessment, it still provides basically scientific information, but it serves as a basis for calculation of indexes.



The GIS-type tool for the Sevastopol Bay.

While interaction with gridded data makes possible to construct different maps, which have not been preloaded, indexes make possible to evaluate the state of environment (Marti-Rague, 2007) and achieve an integrated regional assessment and ICZM (Antonidze, 2010). Thus, for example, a "traffic light" index has been constructed and introduced into the system. This index is universal and can be applied to any analyzed properties. As an example, this index has been applied to assess average summer concentrations of ammonium in the surface layer of water. The five-grade color scale is color and boundary value adjustable either following the expert values or making a personal choice. We have used 1-, 3-, 5-, and 10-fold the maximum allowed concentrations for coastal waters used for common purposes. The result clearly demonstrates that only the central part of the bay can be considered as "clean", but the most inner part of the bay and that one under heavy municipal and maritime pressures are highly polluted.

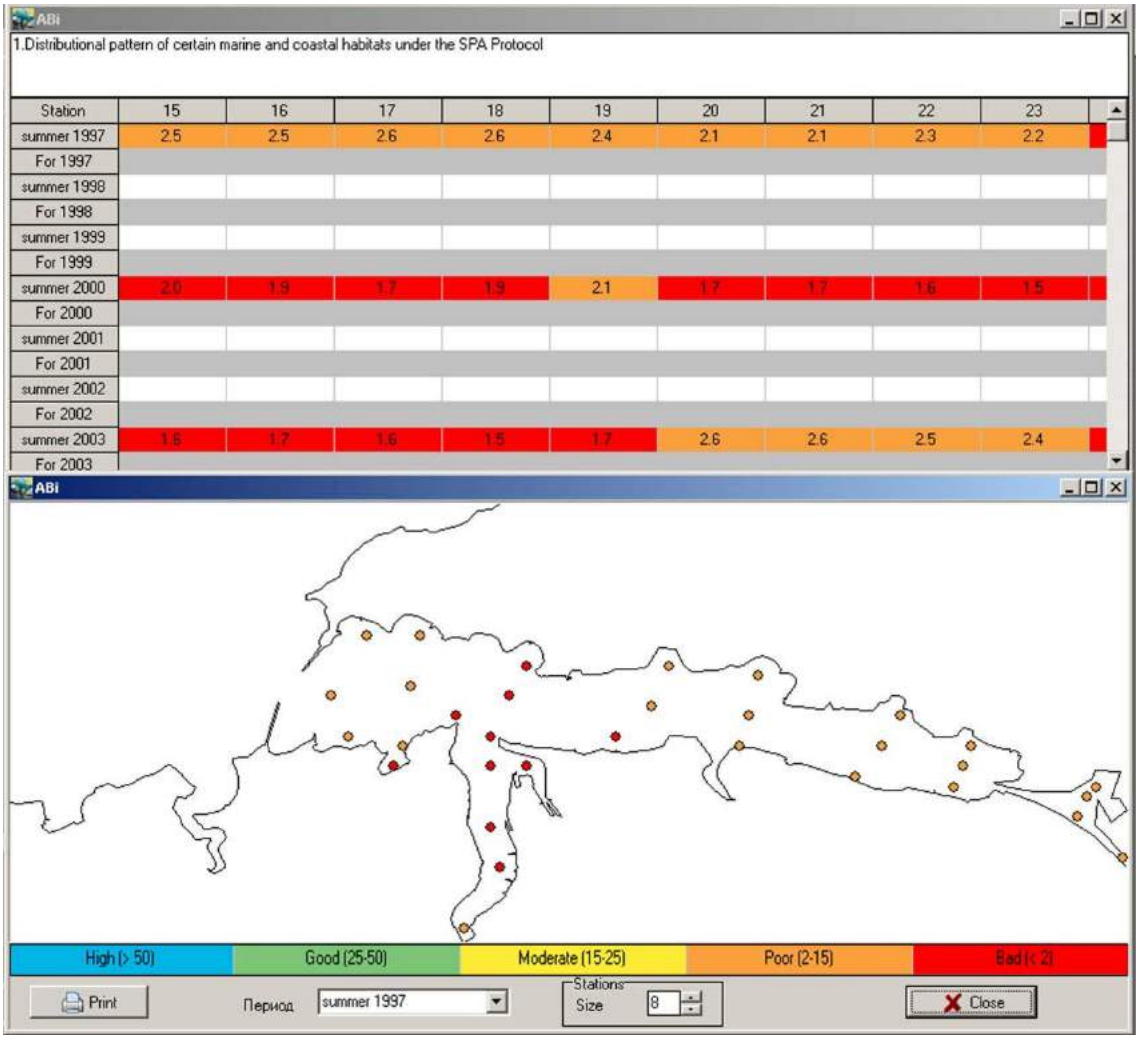


The 5-grade "traffic light" index for the average summer concentration of ammonium in the Sevastopol Bay waters.

Yet, the most valuable part of the current version of the system incorporates a number of indexes chosen within the PEGASO project for environmental assessment (http://www.coastalwiki.org/w/images/b/b6/PEGASO_T4.1_Indicator_methodological_paper_V1.pdf). All indexes have been divided in 8 groups in line with the considered policies:

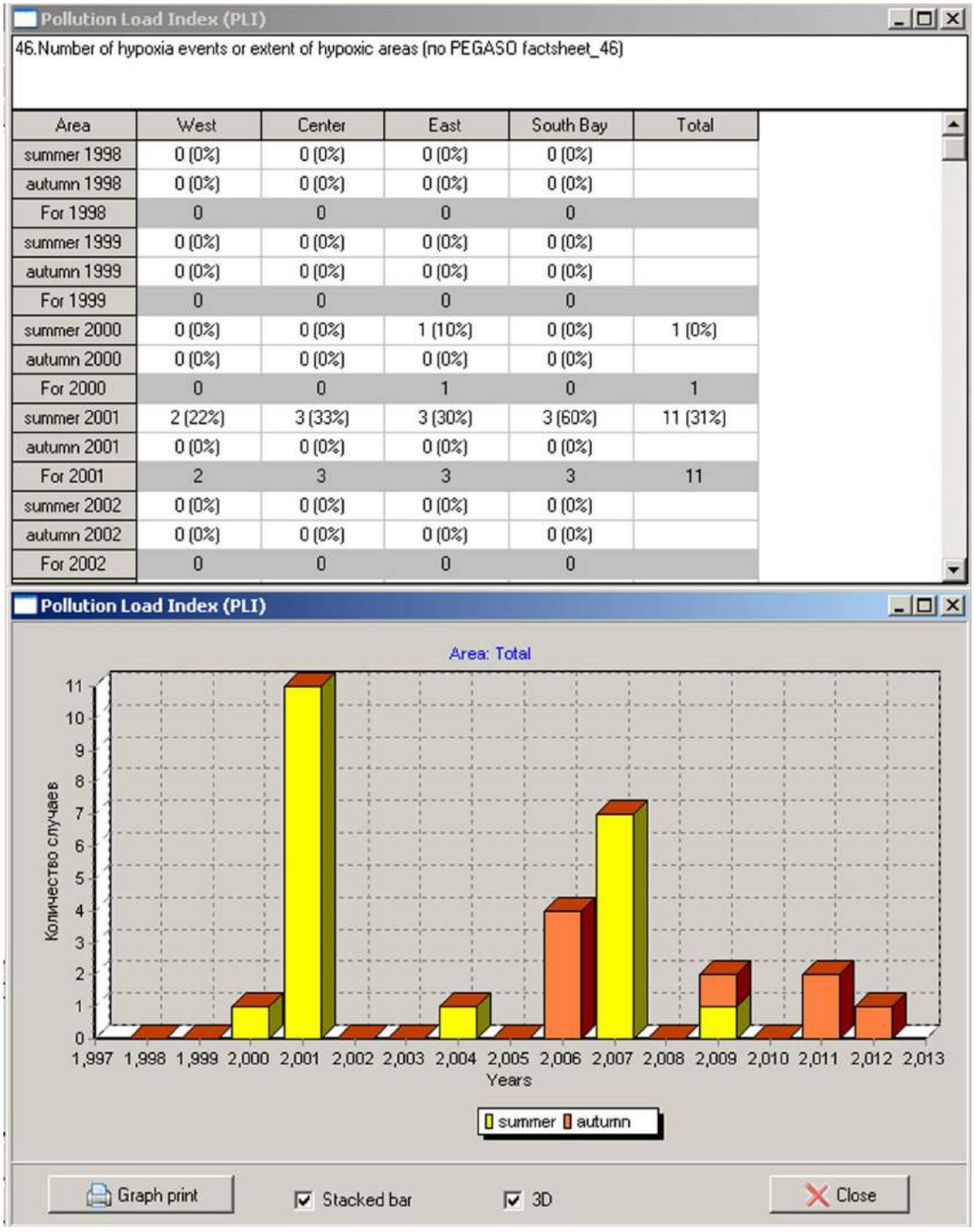
1. Preserve the wealth of natural capital in coastal zone

    1. Distributional pattern of certain marine and coastal habitats under the SPA Protocol
    2. State of the main species stocks by sea area
    3. Effective management of protected areas: share of coastal and marine habitats and species listed under international agreements (SPA protocol) that are in good
2. To ensure appropriate governance allowing adequate and timely participation in a transparent decision-making process of all relevant social actors
3. To ensure cross-sectorial coordination among competent authorities
4. To formulate land-use strategies, plans, and programmes covering all coastal and marine uses
    1. A governance system and legal instrument in support of Marine Spatial Planning is in place
    2. There are spatial development plans which include the coastal zone but do not treat it as a distinct and separate entity
5. To give priority to public services and activities requiring the proximity to the sea, and to take into account the specific characteristics of the coastal zones when deciding about coastal uses
    1. Economic production per sector (turnover)
    2. Employment structure
    3. Percentage of economic activities area in the coastal area
    4. Value added per sector
6. To have a balanced use of coastal zone, and avoid urban sprawl
    1. Land use flows: The area of new developments and its share on previously developed and undeveloped land in the coastal zone
    2. Area of built-up space in the coastal zone (both the emerged and submerged area of the coastal zone)
    3. Water efficiency index (special reference to article 9.1c)
    4. Changes in size, density, and proportion of the population living on the coast
7. To perform Environmental Impact Assessment for human activities and infrastructures
    1. Bathing water quality
    2. Hydrochemical quality
    3. Concentration of nutrients
    4. Number of hypoxia events or extent of hypoxic areas
    5. Eutrophication index
    6. Water column stratification
    7. Pollution by hazardous substances in biota, sediment and water columns (PLI)
    8. Trends in the amount of litter washed ashore and/or deposited on coast
8. To prevent damage to coastal environment, and appropriate restoration if damage already occurred
    1. Areal extent of coastal erosion and coastal instability
    2. Areal extent of sandy areas subject to physical disturbance (beach cleaning by mechanical means, sand mining and beach sand nourishment)
    3. Risk assessment: economic assets at risk of storm surges and coastal flooding (considering sea level rise scenario's and return periods of storm surges)
    4. Risk assessment: biological diversity (habitats/species) at risk of storm surges and coastal flooding (considering sea level rise scenario's and return periods of storm surges)
    5. Risk assessment: Population living in the at risk area of storm surges and coastal flooding (considering sea level rise scenario's and return periods of storm surges)
    6. Productive and protected areas lost due to siltation, saltwater intrusion
    7. Sea surface temperature
    8. Sea level rise



An example of information in the form of tables and maps for ABi (distributional pattern of certain marine and coastal habitats under the SPA Protocol).

Information on indexes is generated in the form of tables and various maps and graphs. The most important advantage is that all indexes are calculated "on demand" for needed stations, areas, and periods of time. This makes possible to actually provide an integrated regional assessment, to monitor spatial and temporal variations in the state of coastal environment, to trace negative and positive trends due to changes in anthropogenic pressures or/and climate changes.



Area	West	Center	East	South Bay	Total
summer 1998	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
autumn 1998	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
For 1998	0	0	0	0	
summer 1999	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
autumn 1999	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
For 1999	0	0	0	0	
summer 2000	0 (0%)	0 (0%)	1 (10%)	0 (0%)	1 (0%)
autumn 2000	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
For 2000	0	0	1	0	1
summer 2001	2 (22%)	3 (33%)	3 (30%)	3 (60%)	11 (31%)
autumn 2001	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
For 2001	2	3	3	3	11
summer 2002	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
autumn 2002	0 (0%)	0 (0%)	0 (0%)	0 (0%)	
For 2002	0	0	0	0	

An example of information in the form of tables and graphs for hypoxia events.

Section 2. Dissemination activities

This system has made possible to effectively interact with stakeholders (National focal point of ICZM in Ukraine, Ministry for environmental protection and natural resources, Public Administration on Ecology and

Environmental Resources in Sevastopol, Black Sea Commission, Sevastopol's department of the Geographic society of Ukraine, etc.) both demonstrating the importance of ICZM principles and possibilities of ICZM. The overall list of potential and addressed stakeholders is available at http://wiki.iczm.org.ua/en/index.php/Stakeholders.

Regular discussions of all project-related issues with stakeholders, presentation of current results of the PEGASO project, assessment of their responses have become elements of a joint platform. As the results a number of letters of endorsement have been issues by stakeholders of different level and nature: Permanent commission on environmental protection and safety, and emergencies of the Sevastopol city council; "SGS PLUS" Ltd., Sevastopol; Levant Inc., Crimea; Yalta city council, department of ecology, etc. This has also made possible to disseminate the results of this work through local newspapers and television, as well as via translated issues of the PEGASO newsletters (http://wiki.iczm.org.ua/en/index.php/Dissemination).

Section 3. Expected activities and milestones for the next period

We plan to extend the list of indexes incorporated in the developed system, to present this system to stakeholders, and to use this system for IRA.

Section 4. Problems encountered

We have not encountered unexpected and irresolvable problems over the time period of the project.

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REPORT

CONTRIBUTION OF GREEK CASE TO THE REGIONAL ASSESSMENT

Greek CASE
the Cyclades Archipelago

by

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Dimitris Klaoudatos Kostas Kapiris Alexis Conides

Hellenic Centre for Marine Research
Institute for Marine Biological Resources and Inland Waters

Athens 2013

CONTENTS

1. Brief introduction of the Greek CASE: Cyclades Archipelago

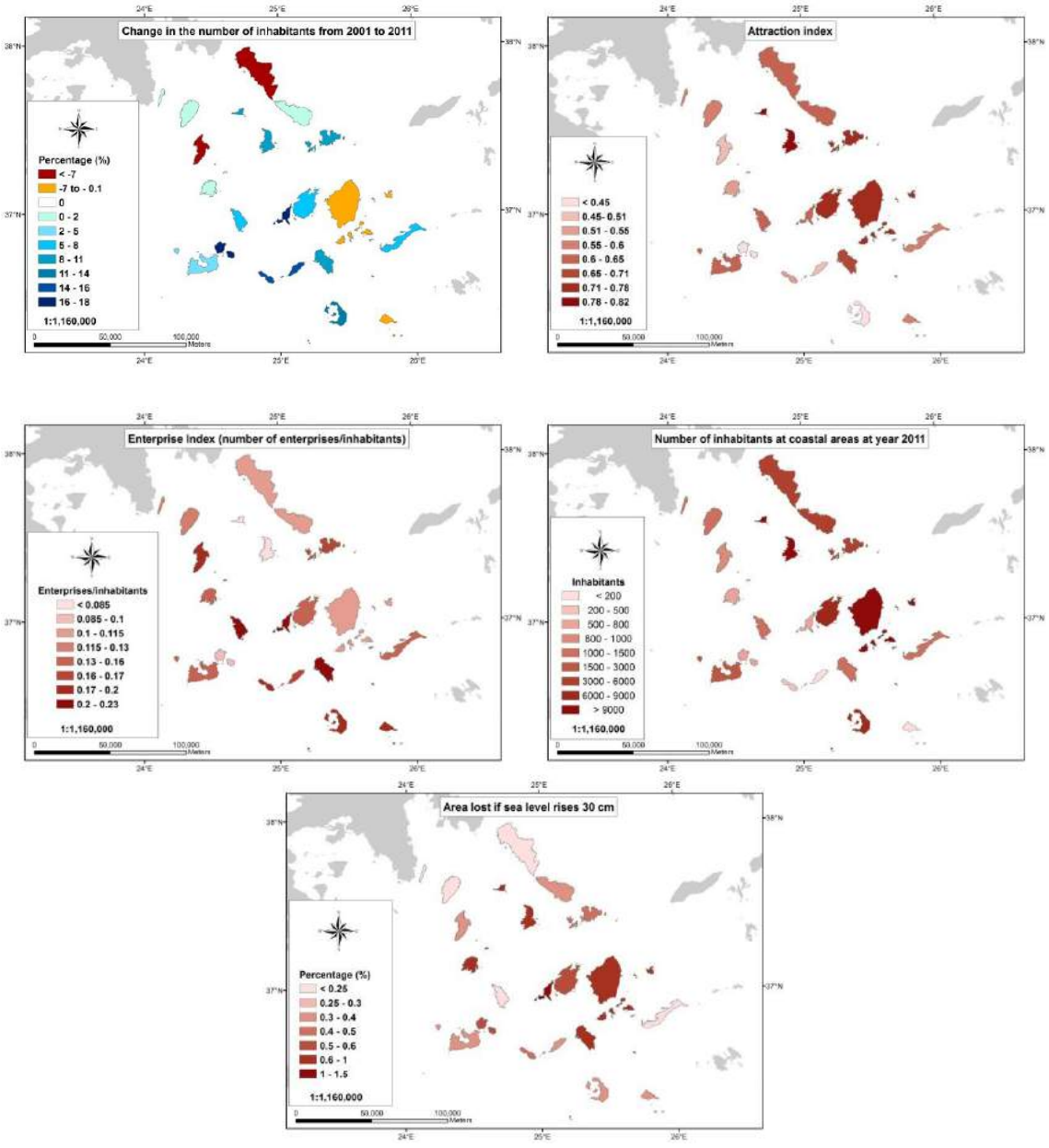
The Cyclades is an island group in the Aegean Sea, southeast of mainland Greece and constitutes one of the administrative entities of Greece. They form one of the island groups which constitute the Aegean archipelago. The Cyclades comprise about 220 islands, the major ones being Amorgos, Anafi, Andros, Antiparos, Ios, Kea, Kimolos, Kythnos, Milos, Mykonos, Naxos, Paros, Folegandros, Serifos, Sifnos, Sikinos, Syros, Tinos, and Thera or Santorini. Most of the smaller islands are uninhabited. Ermoupolis city, on Syros, is the capital and administrative center of the prefecture. The islands are peaks of a submerged mountainous terrain, with the exception of two volcanic islands, Milos and Santorini (Thera). The total area of the islands is 2572 km^2 with 120000 inhabitants.

Cyclades Islands entered Greek sovereignty in 1833. In terms of administration they are divided in 9 provinces, 20 municipalities and 11 communities.

2. Link between the coastal issues: *'balanced urban development'* and *'natural capital'*

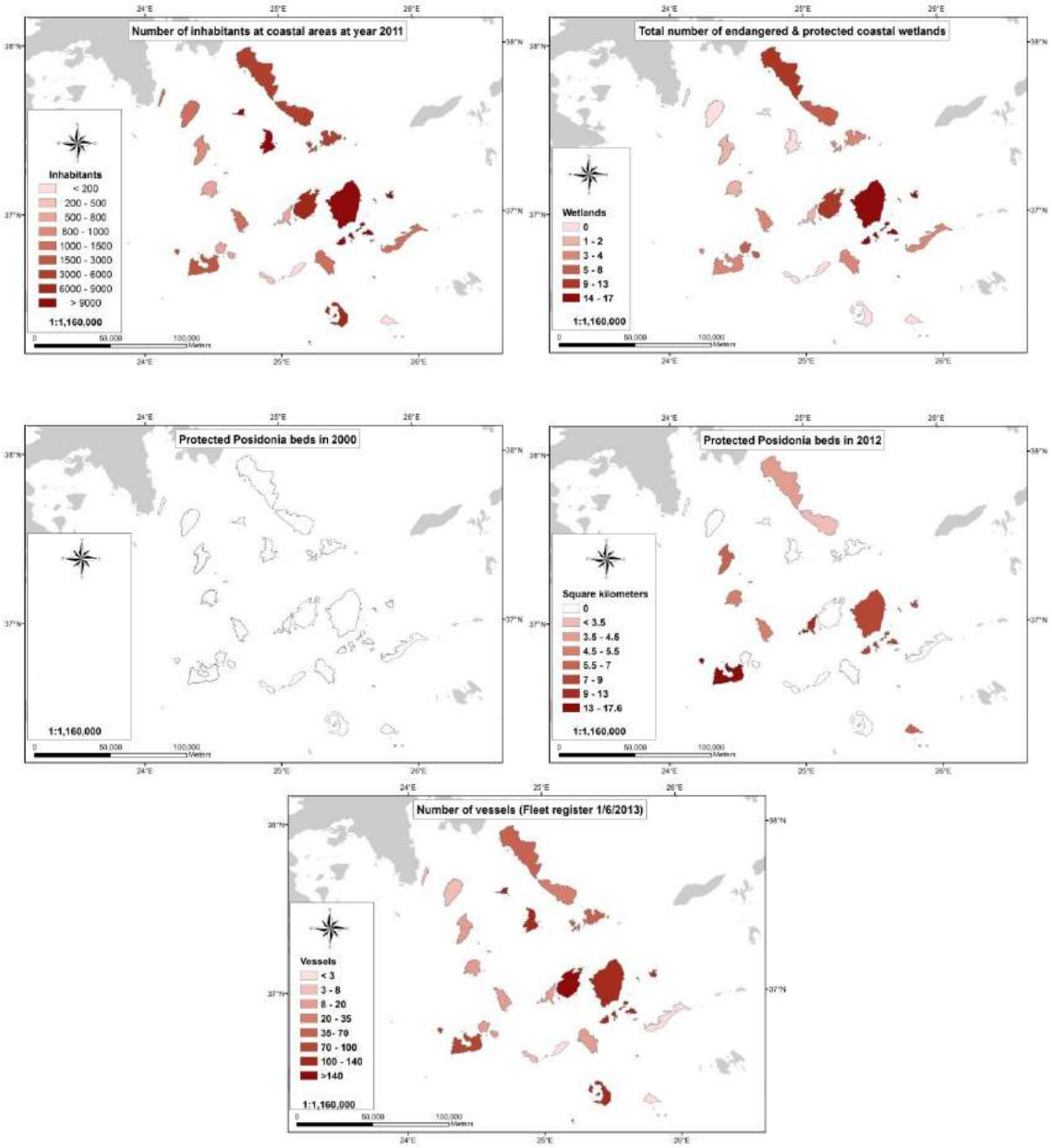
2.1. Population growth versus island attraction index

According to the indicators studied, the percent change of population shows relation to the attraction index of the islands and the inhabitants to active enterprises ratio indicating that the driving force of seeking job and income security has caused a shifting of the populations between the islands. The main activity is tourism and therefore, this has created a force for coastal habitation of the population, indicated by the percentage of population inhabiting the coastal zone and increasing the percentage of population which is under risk from climate changes (sea level rise).



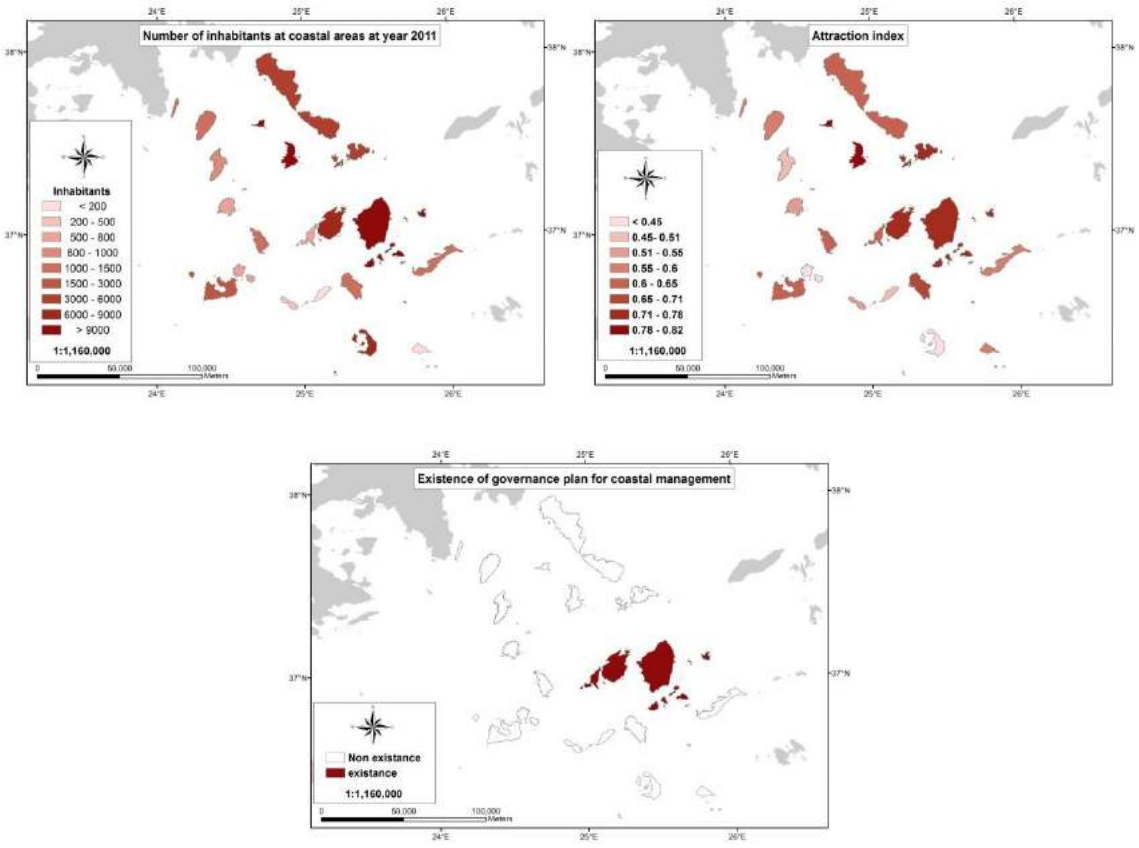
2.2. Protected areas (*Posidonia*) versus population

The increase of population along the coast as well as the recent EU policies, forced the administration to establish protected zones for *Posidonia*. The selection of protected areas for *Posidonia* also is in accordance to the distribution of the fleet indicating that - eventhough by mere chance - the protected areas are related to the distribution of most fishing vessels in the region. Detailed maps of the Posidonia protected areas in Cyclades region can be found in Annex I



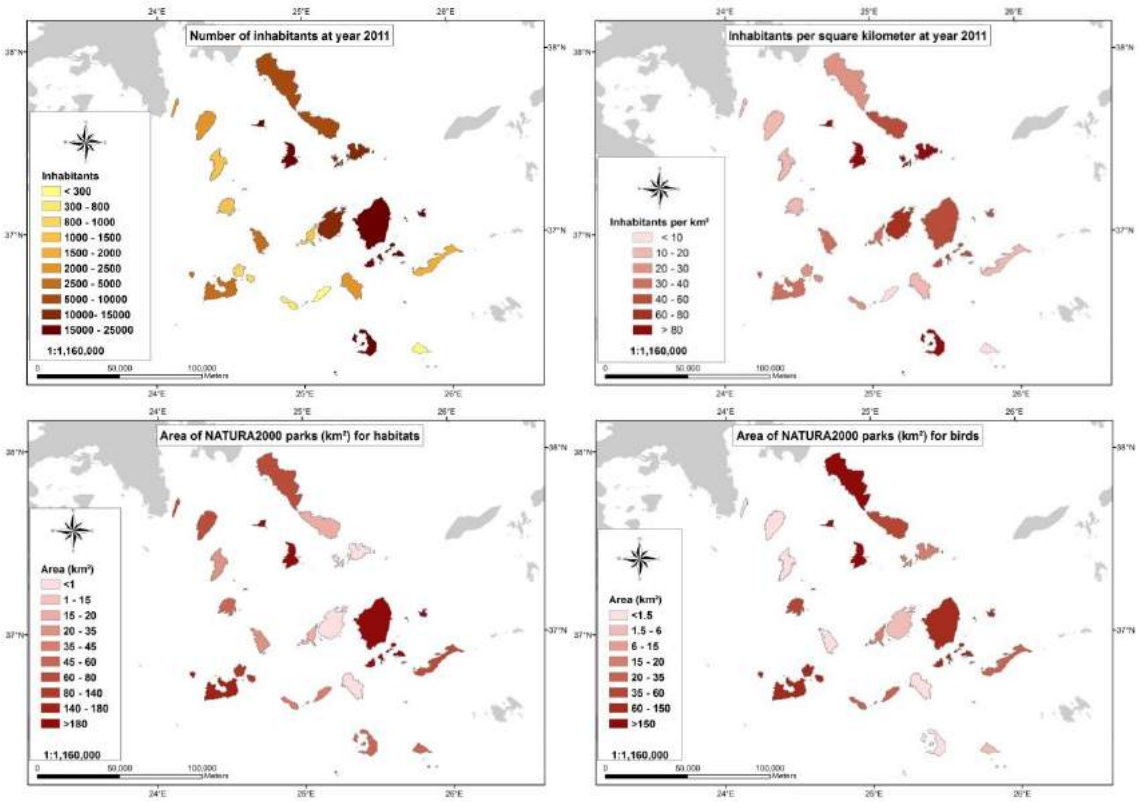
2.3. Governance versus coastal habitation

The indicators show that coastal habitation density index is related to the existence of coastal spatial plans. Unfortunately the connection is weak since today there are only 2 plans enforced (for the islands of Paros and Naxos). However it seems that the administrators initiated the process of spatial planning from the most inhabited islands with high attraction index in order to be pro-active for the future investments.



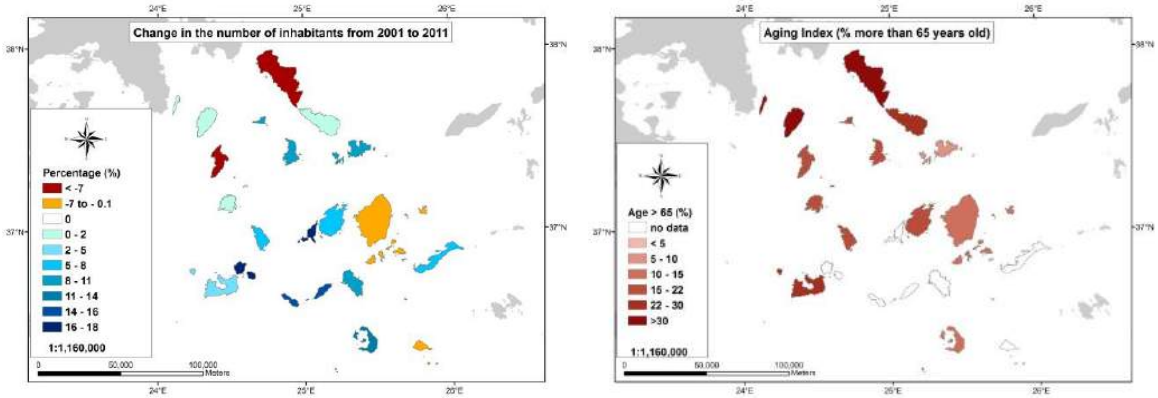
2.4. Habitat protection versus population

The indicators show that the administration has selected specific areas for NATURA 2000 protected sites for birds and habitat related to the population of each island so that islands with higher numbers of inhabitants exhibit also larger protected areas.



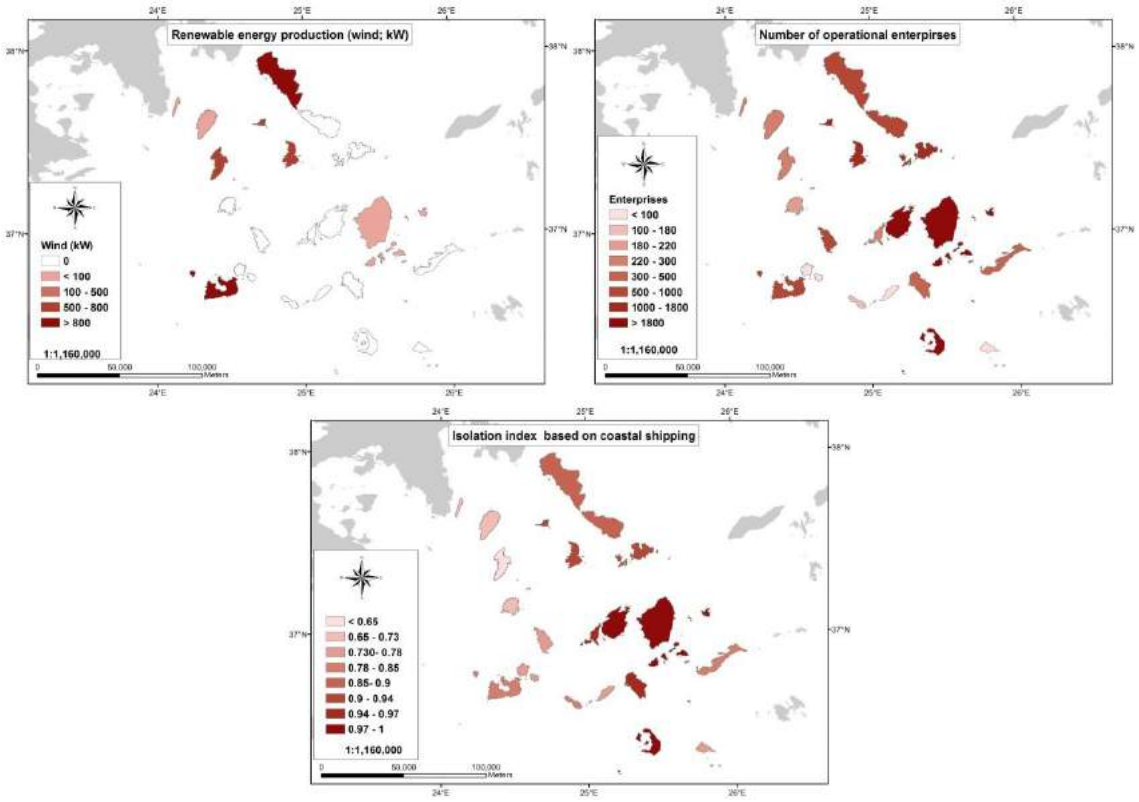
2.5. Population change versus aging index

The indicators show that a driving force for migration is the aging indicators since the negative or near zero changes of population in the period 1971-2011 accounts for the islands with high percentage of over 65 years of age individuals.



2.6. Systemic inadequacies

The indicators show that the establishment of renewable energy production plants is not correlated to the actual demand for the primary, secondary and tertiary sectors. The most probable reason for this is that, since tourism development is the primary objective for the region, the renewable energy plants were established in the most isolated islands.



Index values 0-1, 0; high isolation, 1; low isolation

3. Selected indicators[1]

3.1. Overall

The approach to integrated coastal zone management in Cyclades regions was based on the following indicators in detail:

1. Population

Origin:	local development plans and studies National Statistical Survey of Greece
Period:	1971-today
Method:	data analysis; spreadsheets
Availability:	free through Internet
Restrictions:	none
Scale:	municipality (= per island)
Number of products:	12 maps

2. Land data (area, coastline)

Origin:	local development plans and studies National Statistical Survey of Greece HCMR Fisheries Data Centre GIS
Period:	N/A[2]
Method:	GIS[3]
Availability:	free through Internet
Restrictions:	none
Scale:	municipality (= per island)
Number of products:	N/A

3. Sea level rise effects on coast

Origin:	Fisheries Data Centre GIS Geographical Survey of Greek Army
Period:	N/A[4]
Method:	data analysis; spreadsheets
Availability:	published in conference
Restrictions:	none
Scale:	municipality (= per island)
Number of products:	3 maps

[1] Focus on selected indicators: presentation of the indicators selected, data available and visualization on the SDI
[2] Not applicable
[3] ESRI ArcView/ArcInfo
[4] Not applicable

4. Wetlands and protected areas

Origin:	Greek Government Official Journal Ministry of Environment, Energy and Climate Change sources HCMR Fisheries Data Centre GIS Island coastline maps NATURA 2000 maps
Period:	N/A[5]
Method:	GIS; spreadsheets
Availability:	free through Internet
Restrictions:	none
Scale:	municipality (= per island)
Number of products:	12 maps

5. Fishing fleet

Origin:	HCMR Fisheries Data Centre GIS National Statistical Survey of Greece EU fleet register
Period:	N/A
Method:	GIS
Availability:	free through Internet
Restrictions:	none
Scale:	municipality (= per island)
Number of products:	1

6. Entrepreneurship indicators

6.1. Island attractiveness
6.2. Island accessibility = index of isolation
6.3. Number of enterprises
6.4 Ratio of enterprises

Origin:	PhD study National Statistical Survey of Greece Cyclades Chamber of Commerce
Period:	2002-2005
Method:	GIS;
Availability:	free through Internet
Restrictions:	none
Scale:	municipality (= per island)
Number of products:	4

[5] Not applicable

7. Social Indicators

7.1. Aging indicator (>65)
7.2. Youth indicator (<24)
7.3. Level of illiteracy

Origin:	National Statistical Survey of Greece
Period:	2000-2013
Method:	GIS
Availability:	free through Internet
Restrictions:	none
Scale:	municipality (= per island)
Number of products:	6 maps

8. Economic indicators

8.1. Level of unemployment (in total population)
8.2 Level of unemployment (in economically active population)
8.3 Income sufficiency indicator (population below poverty level)

Origin:	National Statistical Survey of Greece
Period:	2000-2013
Method:	GIS
Availability:	free through Internet
Restrictions:	none
Scale:	municipality (= per island)
Number of products:	6 maps

9. Renewable energy production

Origin:	Background (state study) study for Cyclades development
Period:	N/A
Method:	GIS
Availability:	free through Internet
Restrictions:	none
Scale:	municipality (= per island)
Number of products:	1 map

3.2. Relation of selected indicators to PEGASO indicators.

The above indicators correspond to the PEGASO indicator groups as following:

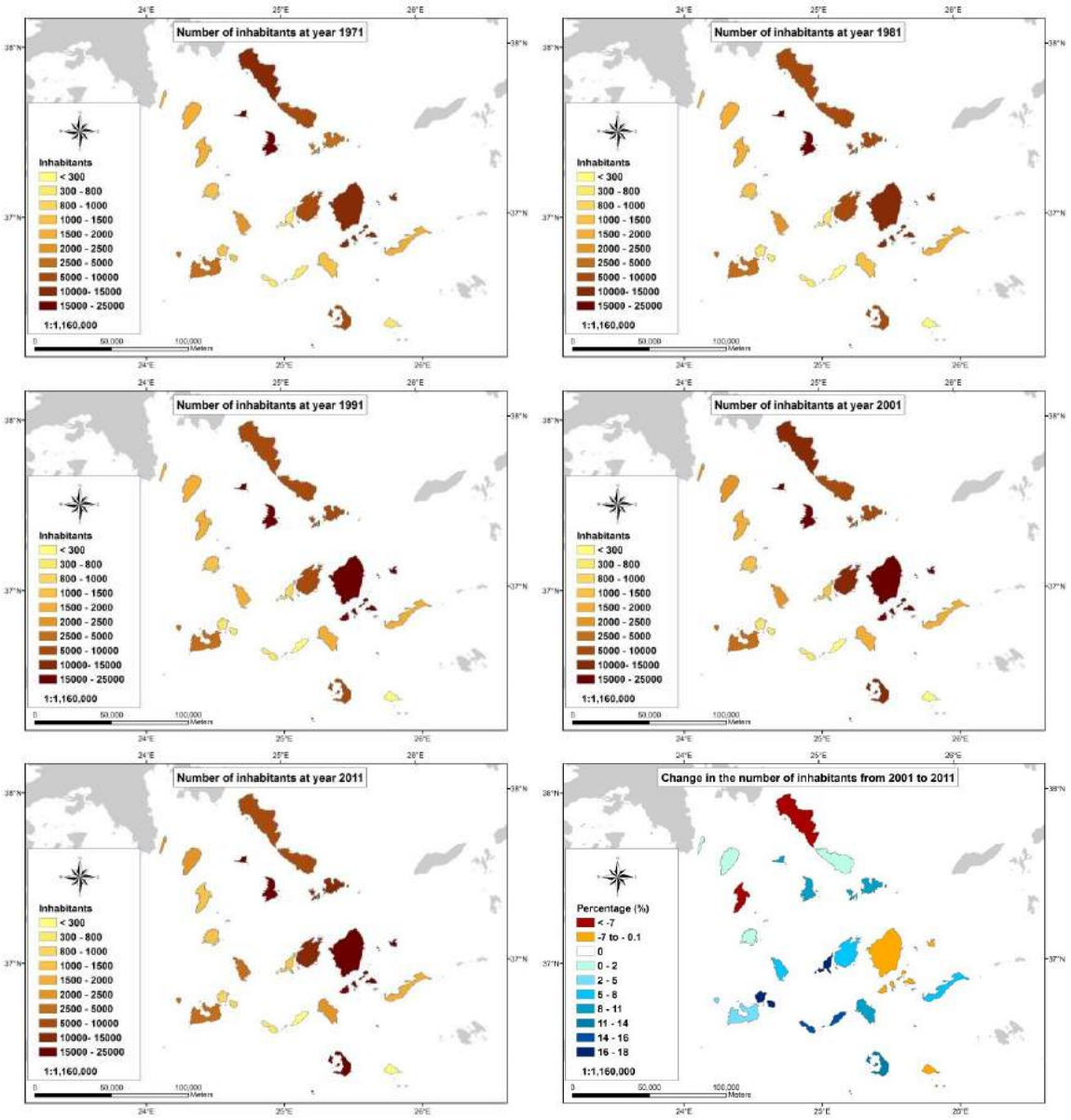
Natural Capital	3. Sea level rise
	4. Wetlands and protected areas
Public Service	6. Entrepreneurship indicators
	8. Economic indicators
	9. Renewable energy production
Balanced use	1. Population
	5. Fishing fleet
	7. Social Indicators

The sole purpose of and data (indicator 2) is to provide areas and lengths suitable to calculate spatial indicators

4. Spatial data[6]

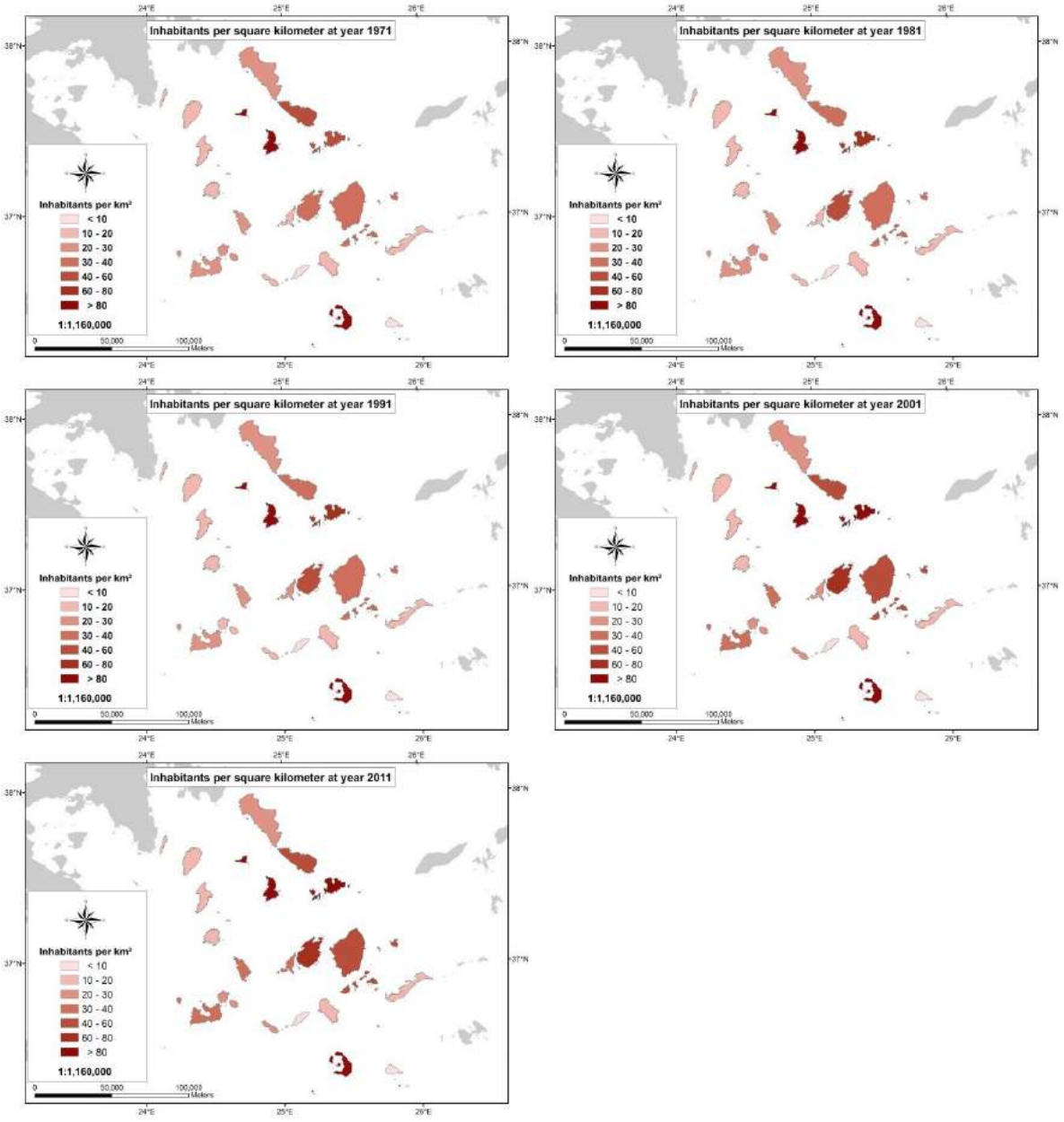
4.1. Population indicators (1971-2011)

4.1.1. Population 1971-2011 and % change

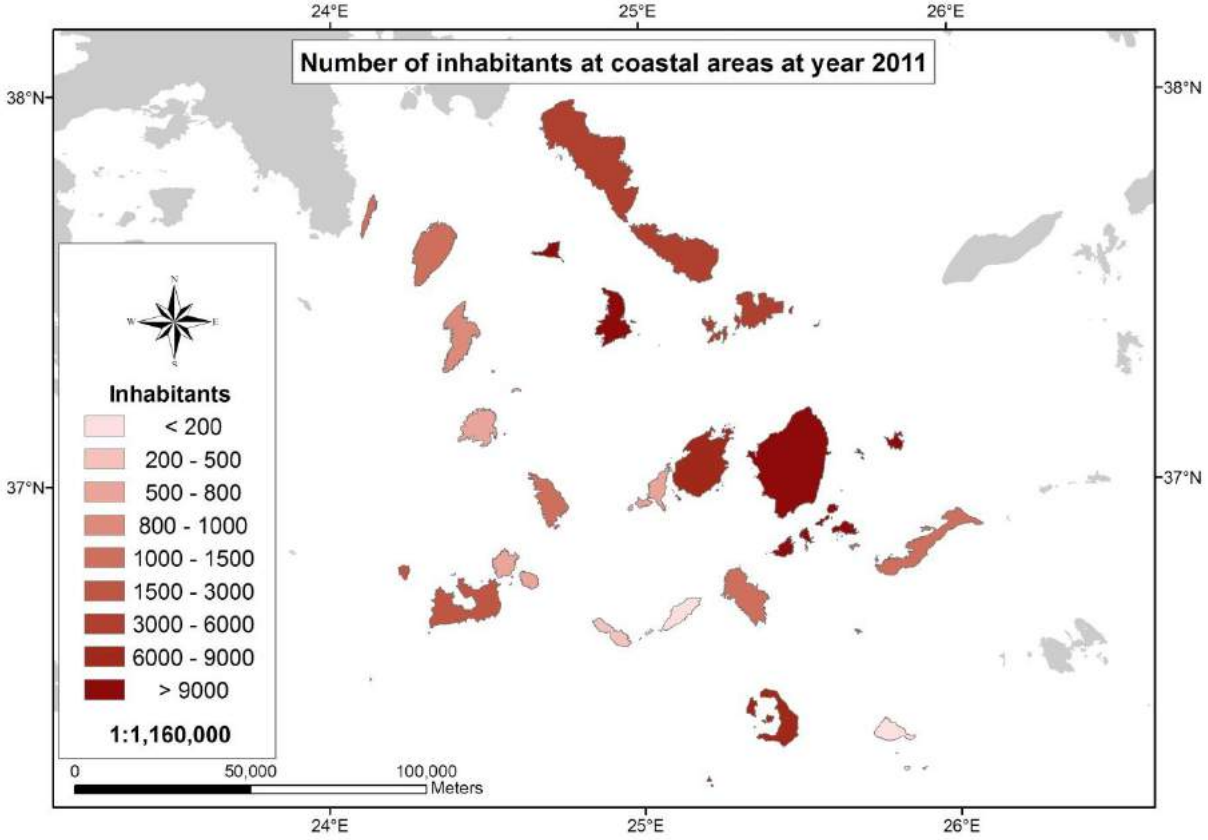


[6] Presentation of spatial data and maps, graphs (images)

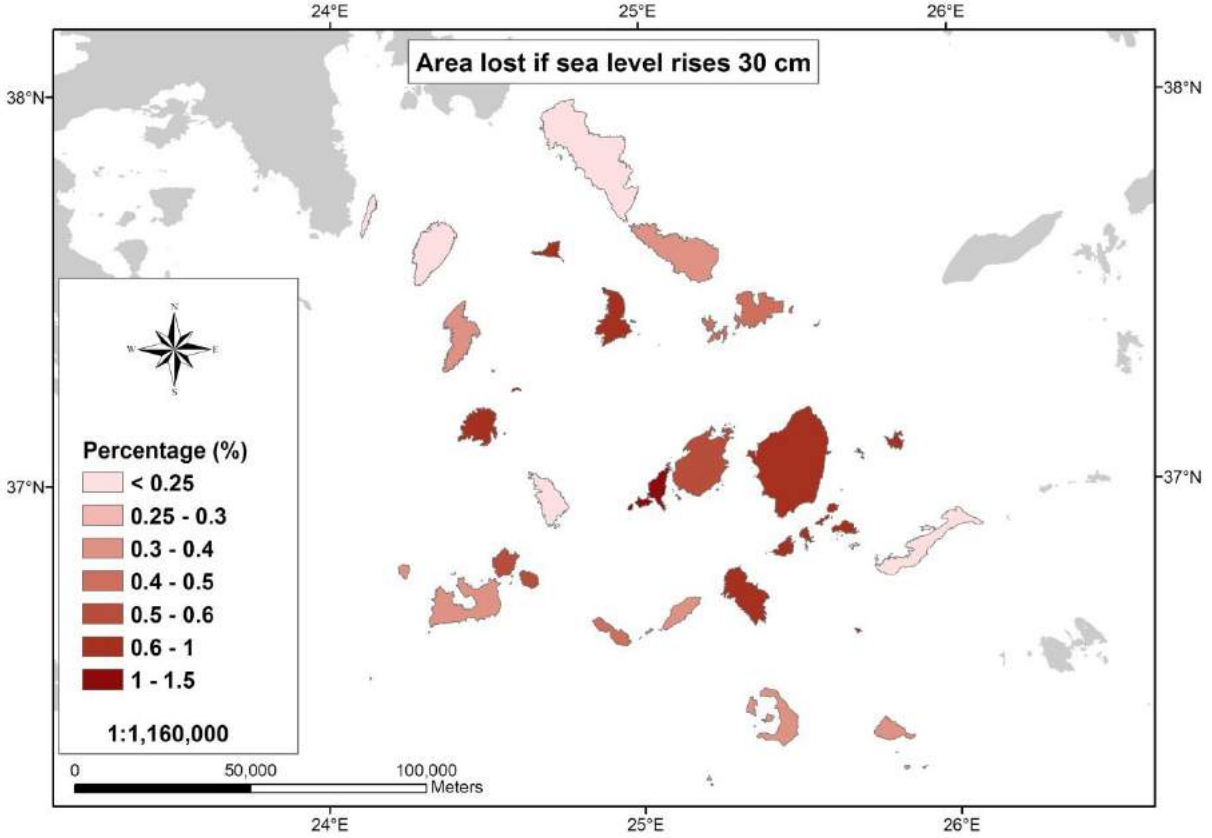
4.1.2. Population density 1971-2011

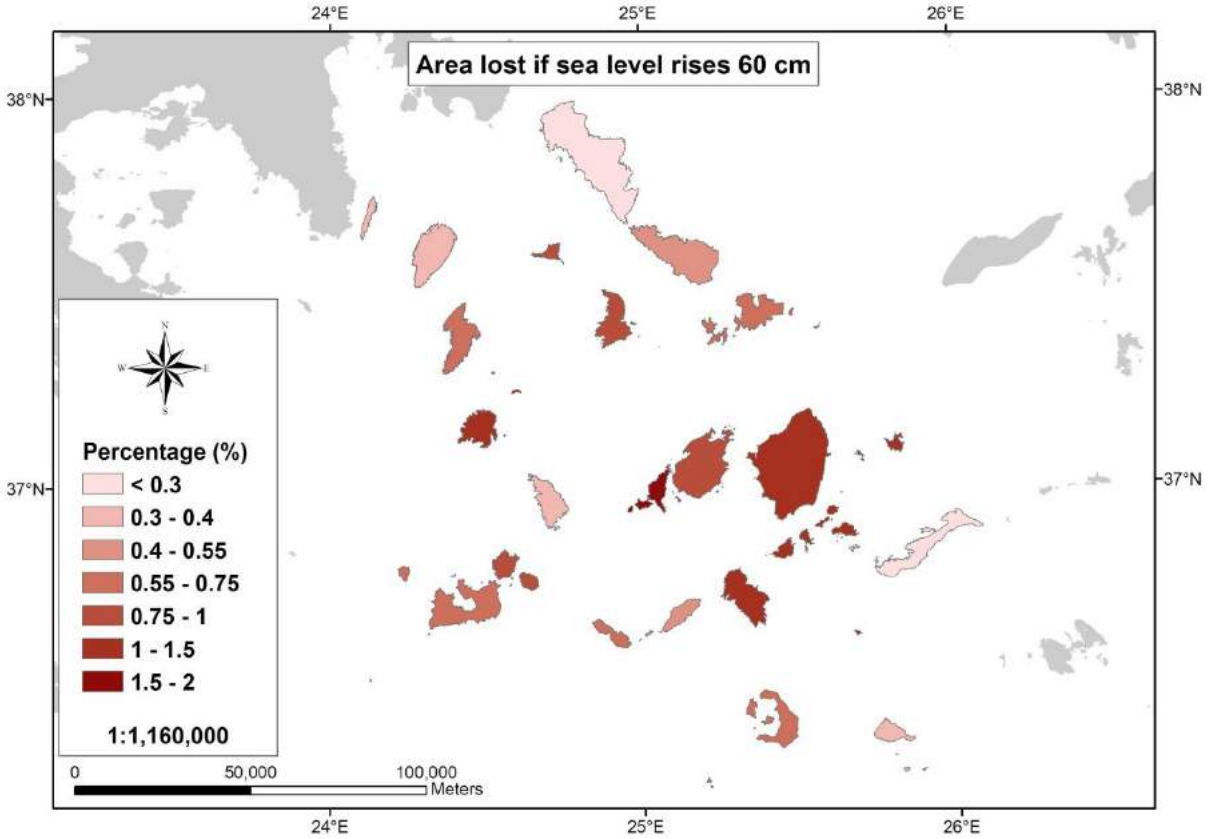


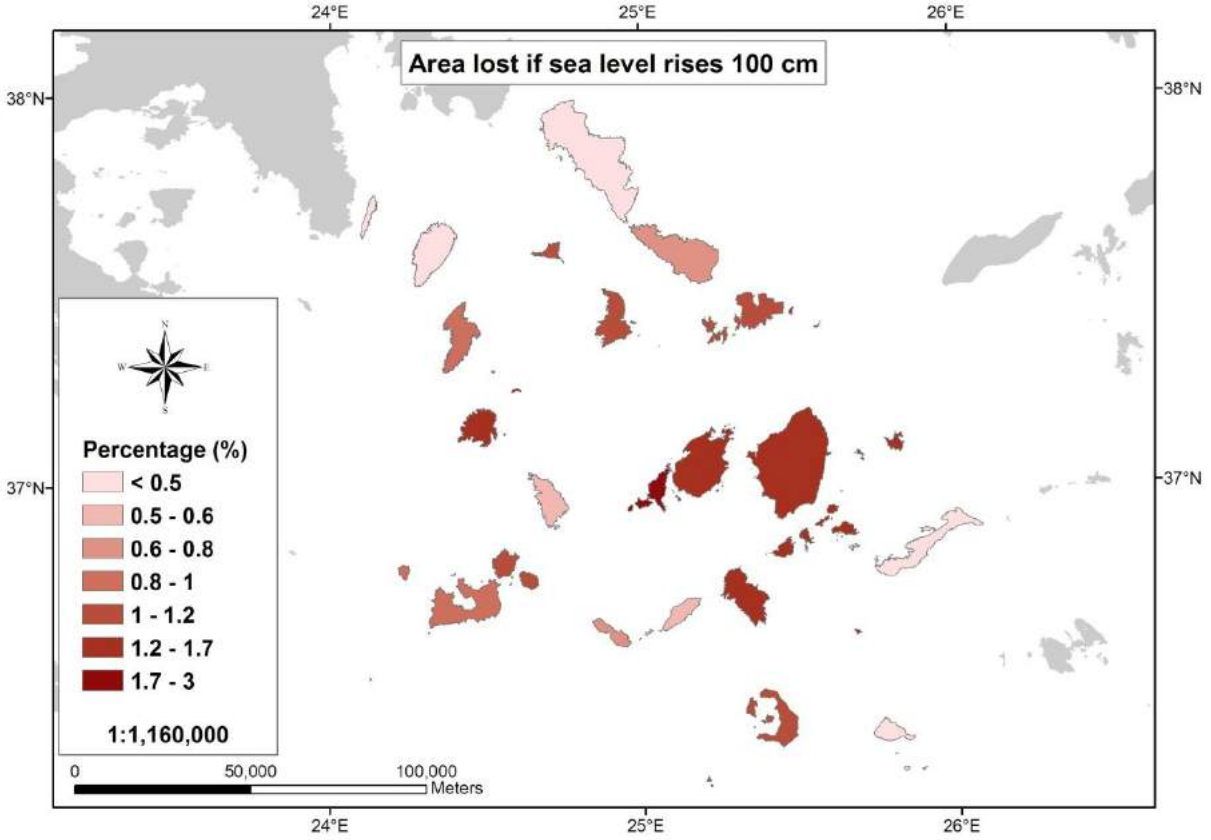
4.1.3. Population on coast, 2011



4.2. Hazard indicators

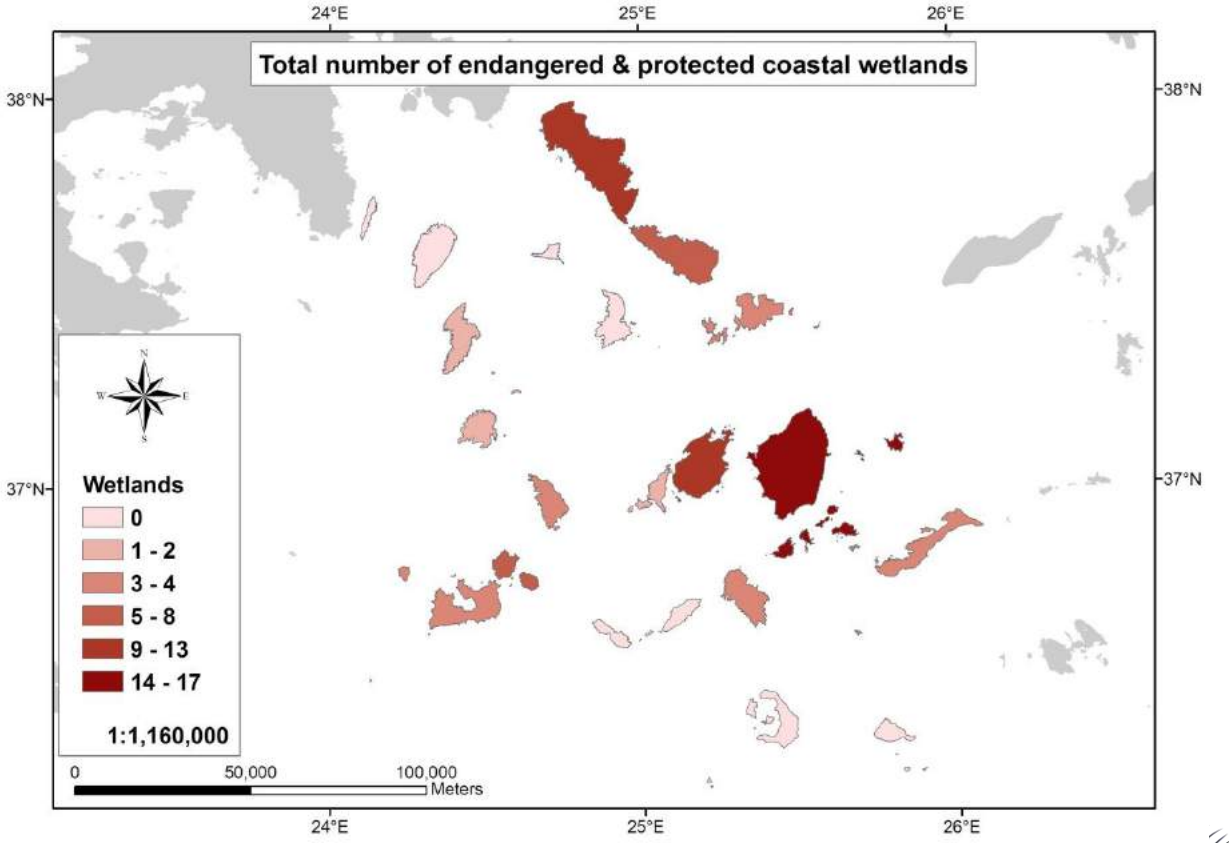




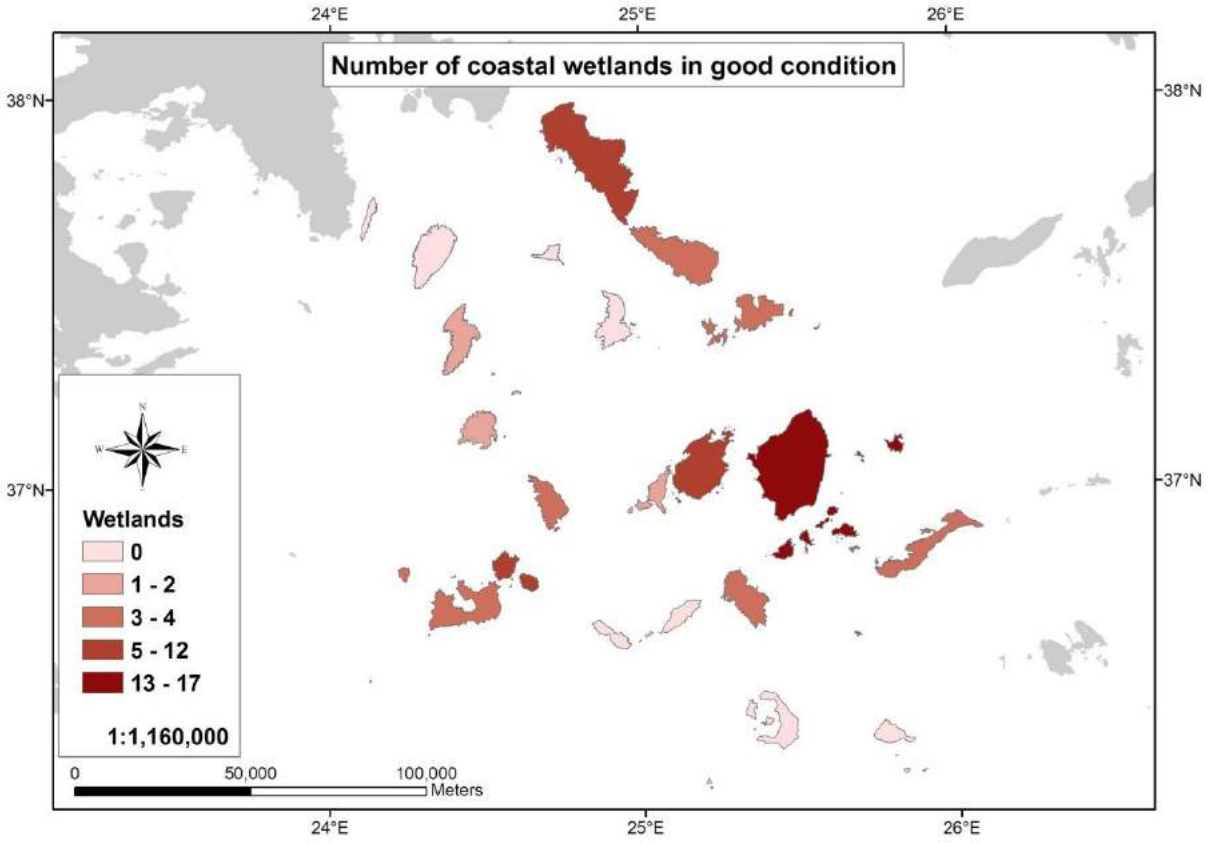


4.3. Protected habitat indicators

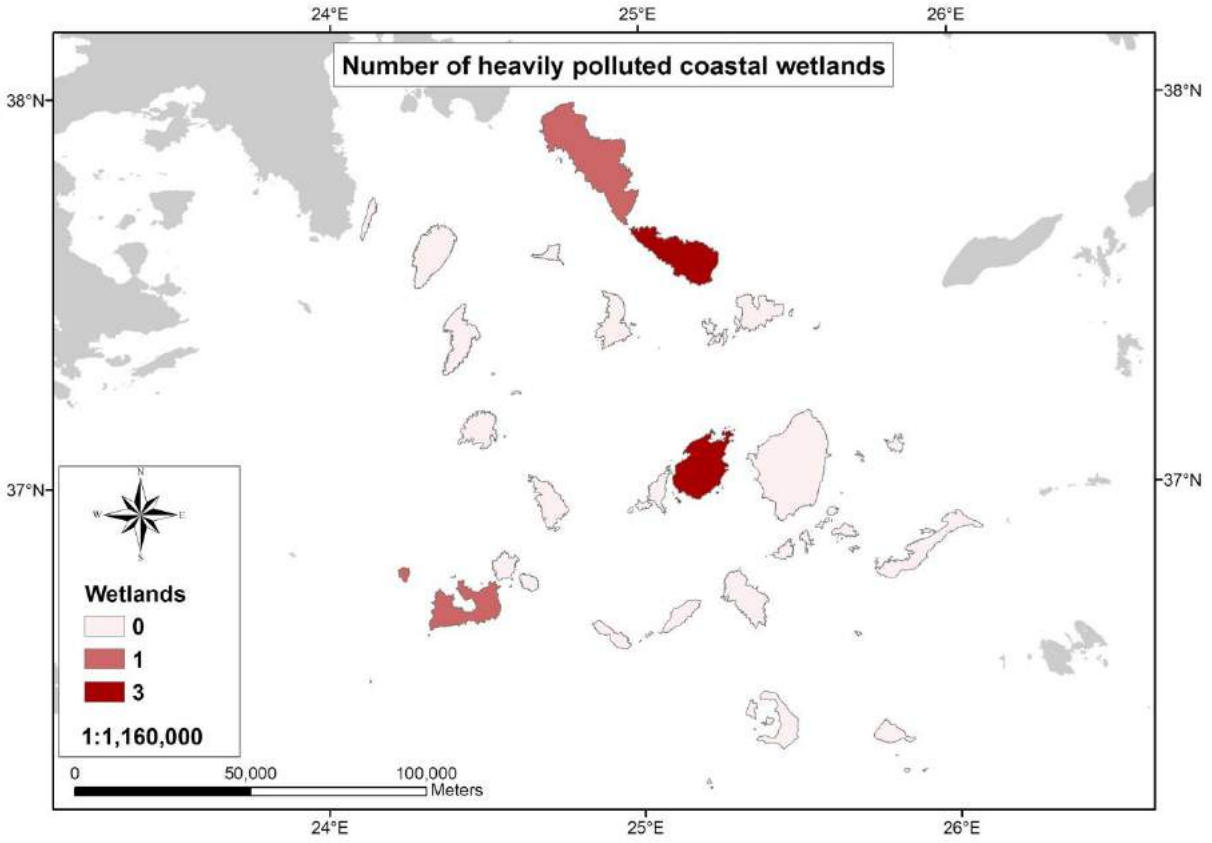
4.3.1. Endangered wetlands



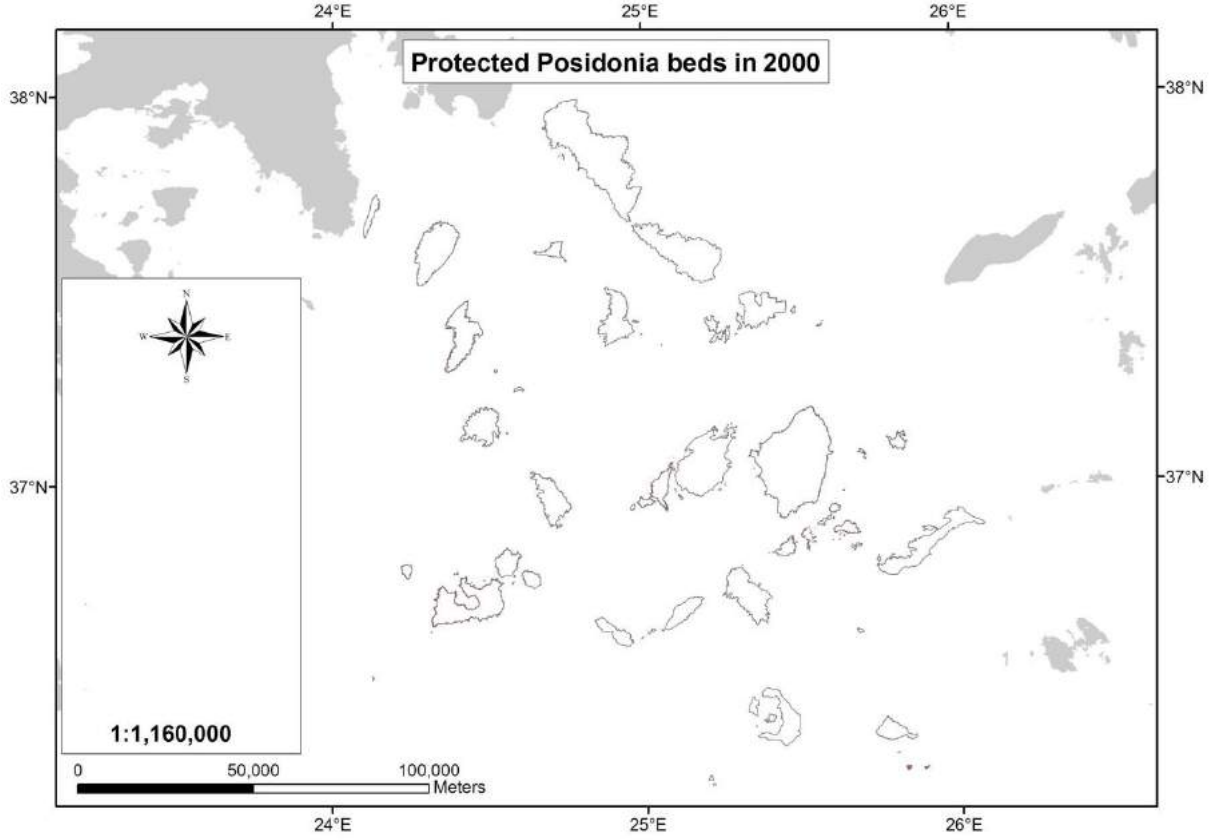
4.3.2. Wetlands in good condition

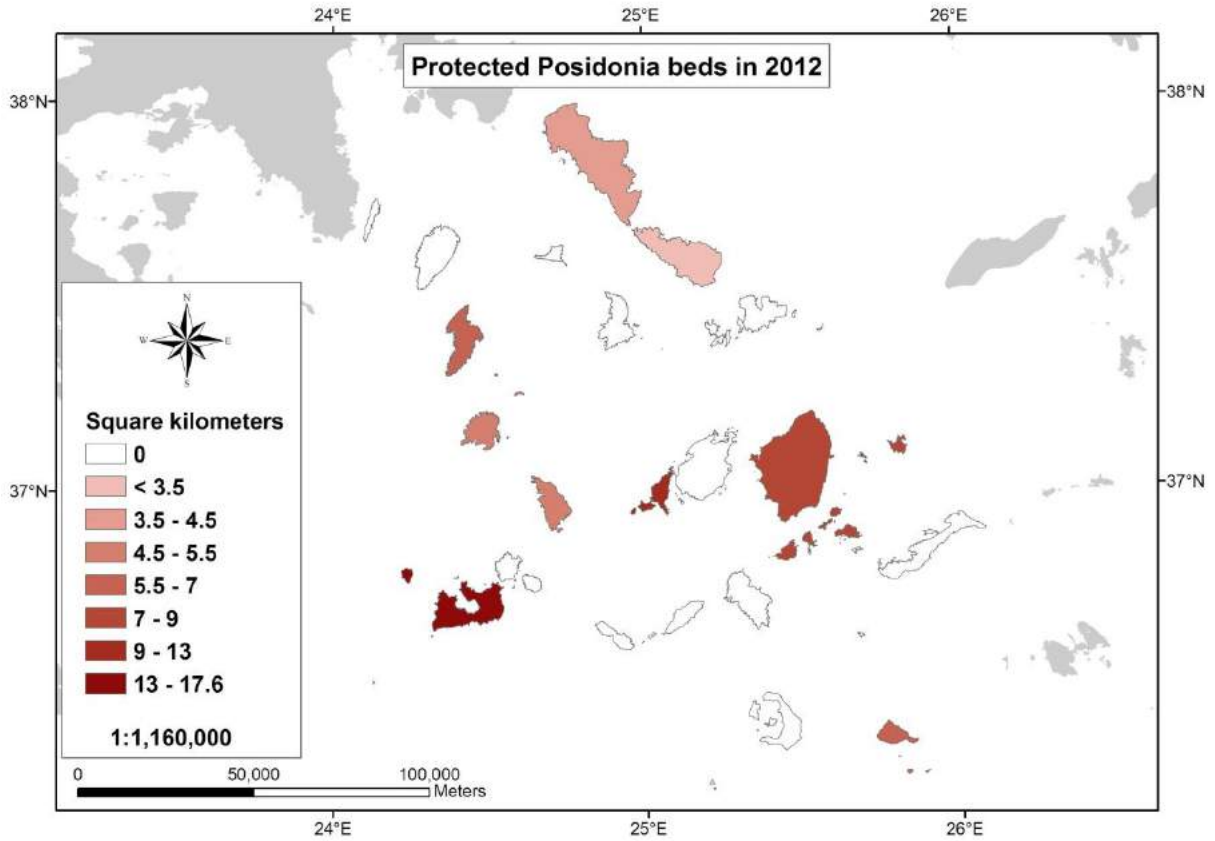


4.3.3. Wetlands polluted

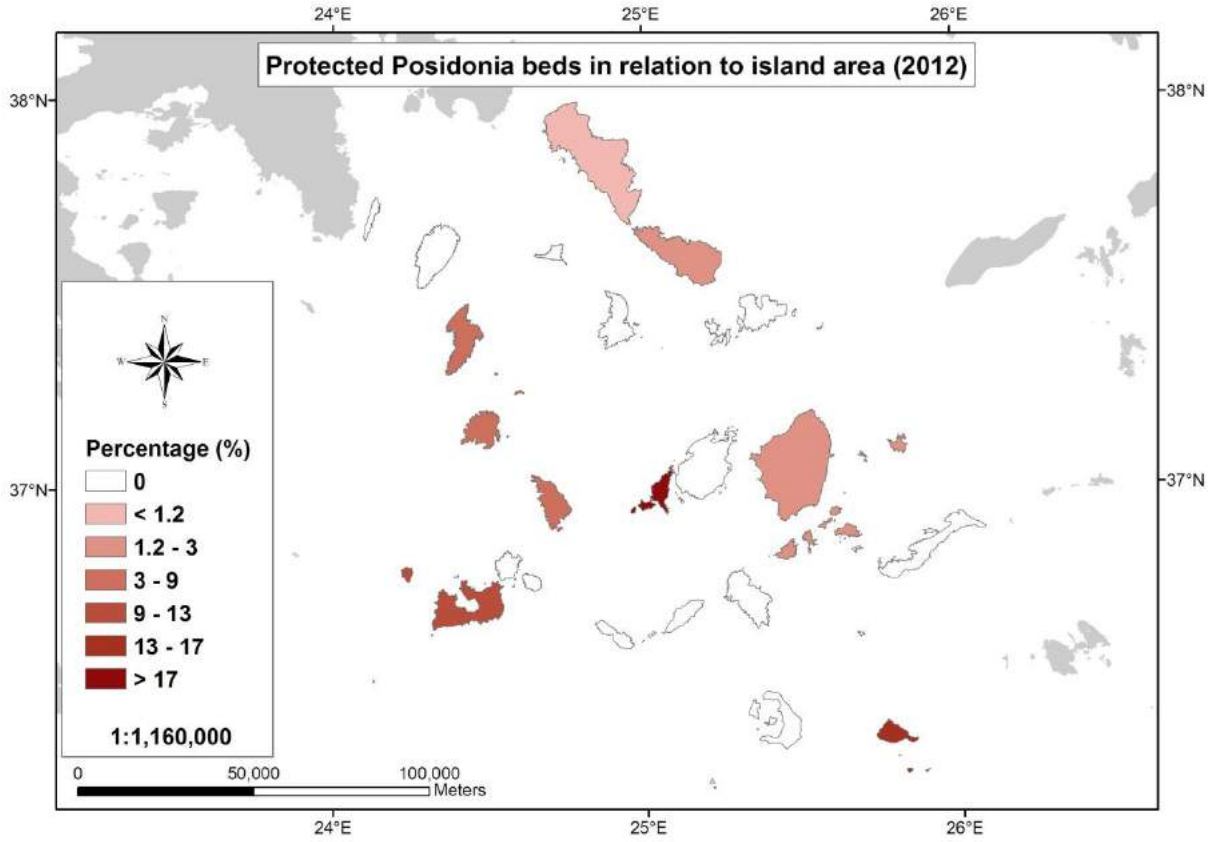


4.3.4. Protected Posidonia beds

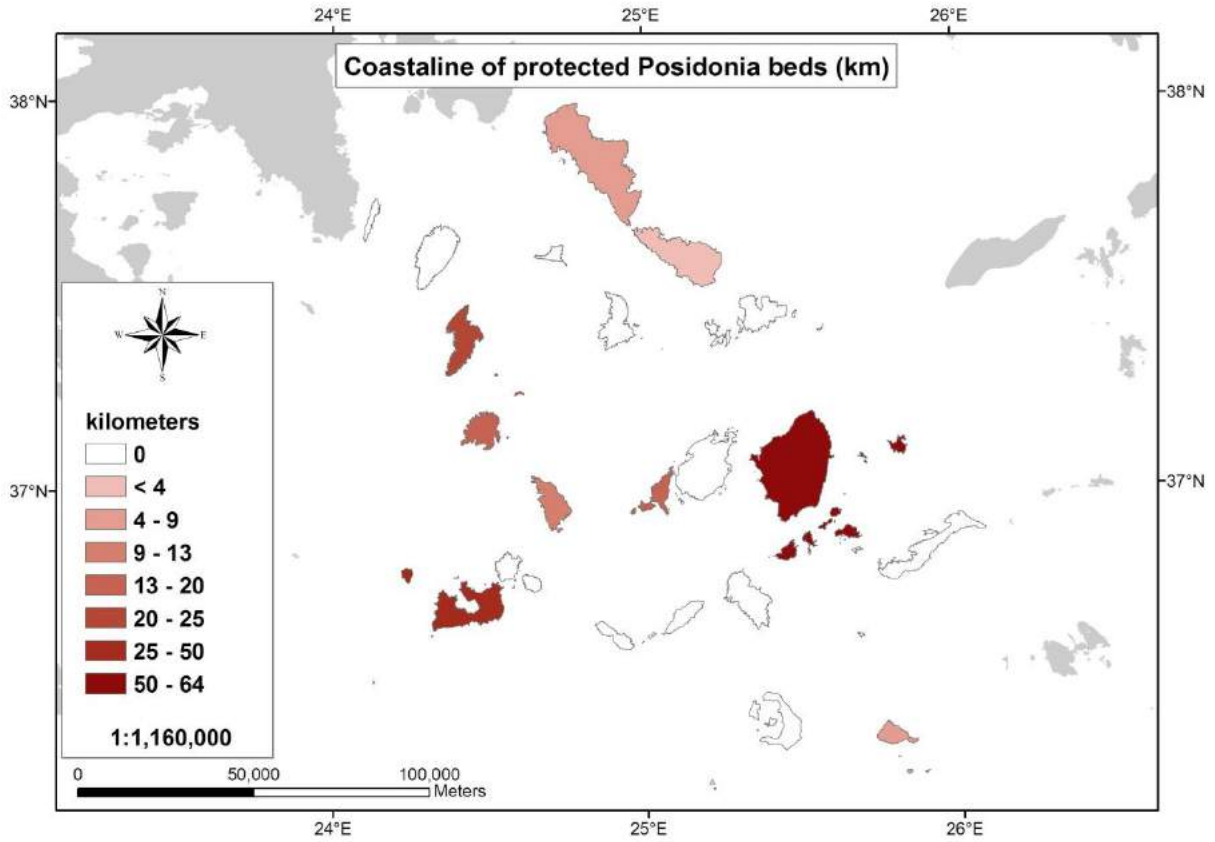




white polygons indicate no value

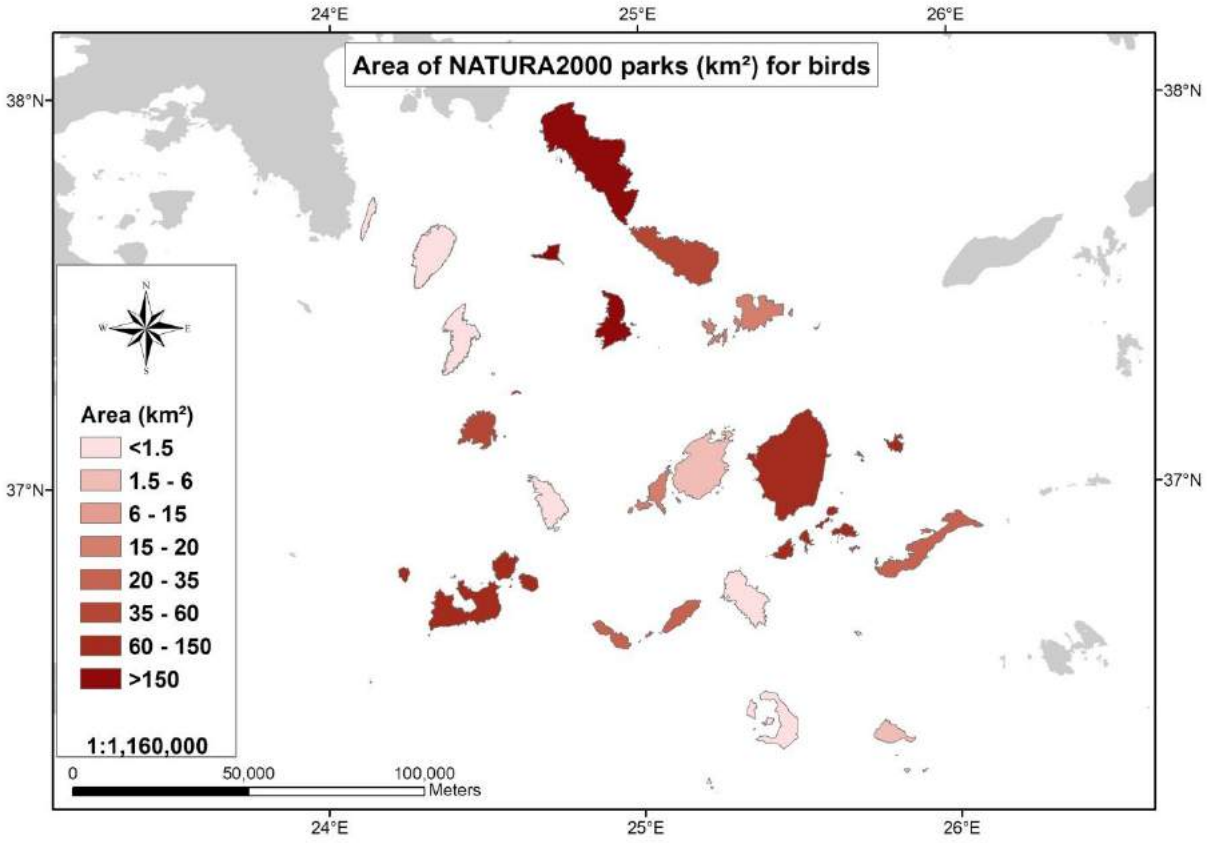


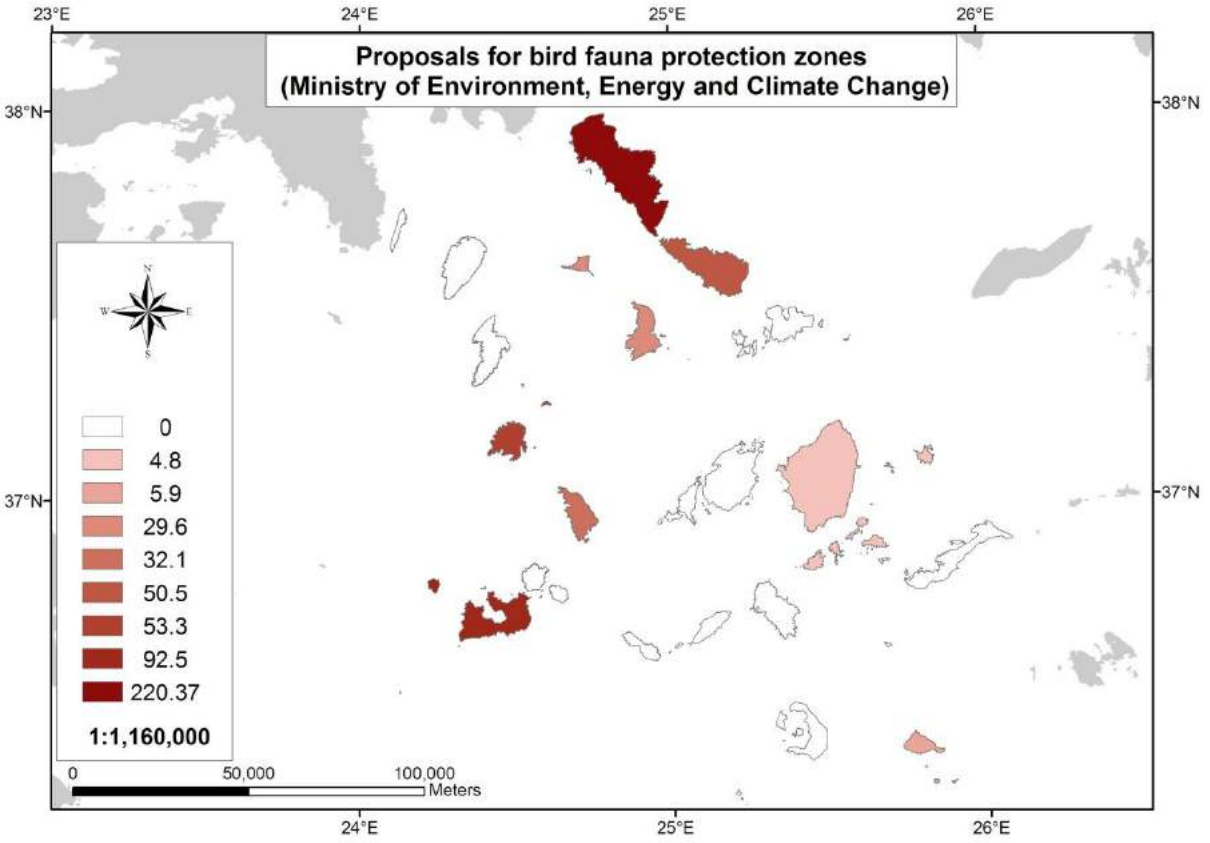
white polygons indicate no value



white polygons indicate no value

4.3.5. Bird fauna protected areas





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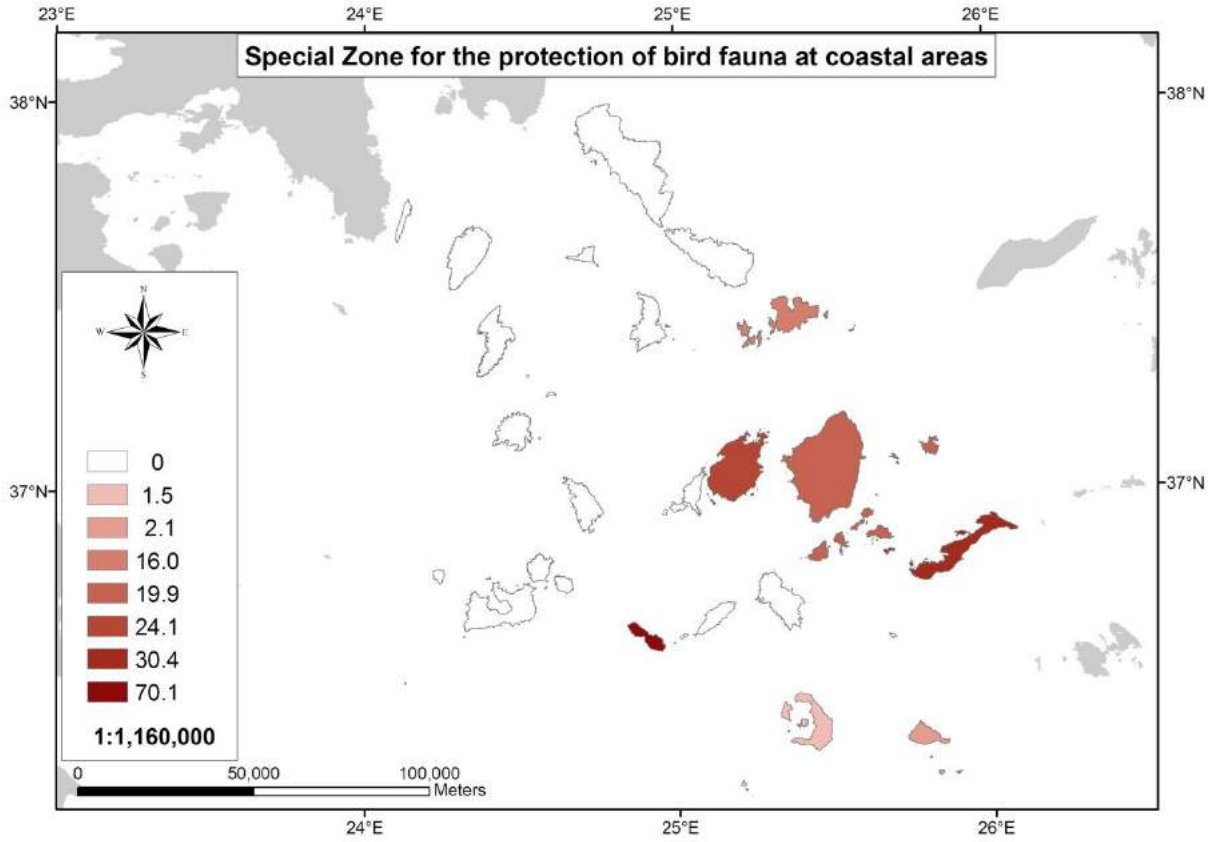

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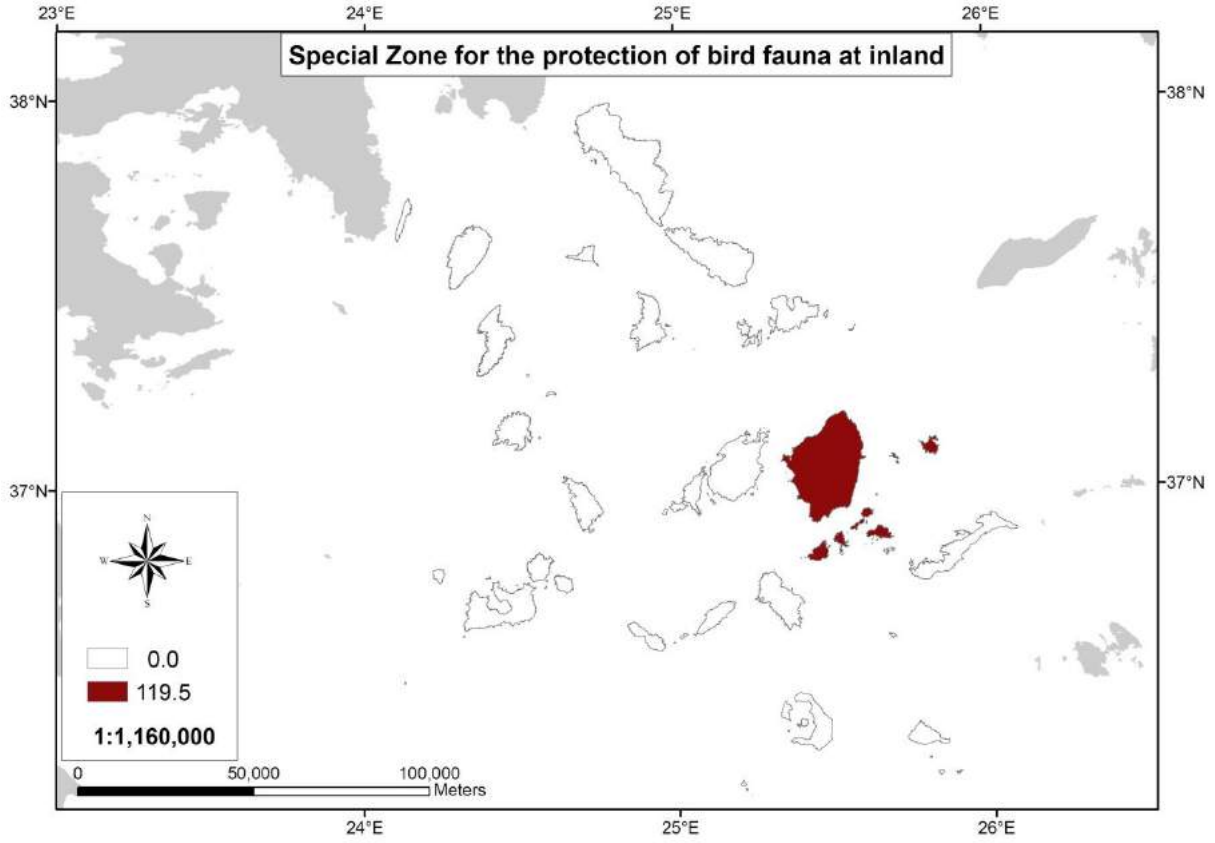

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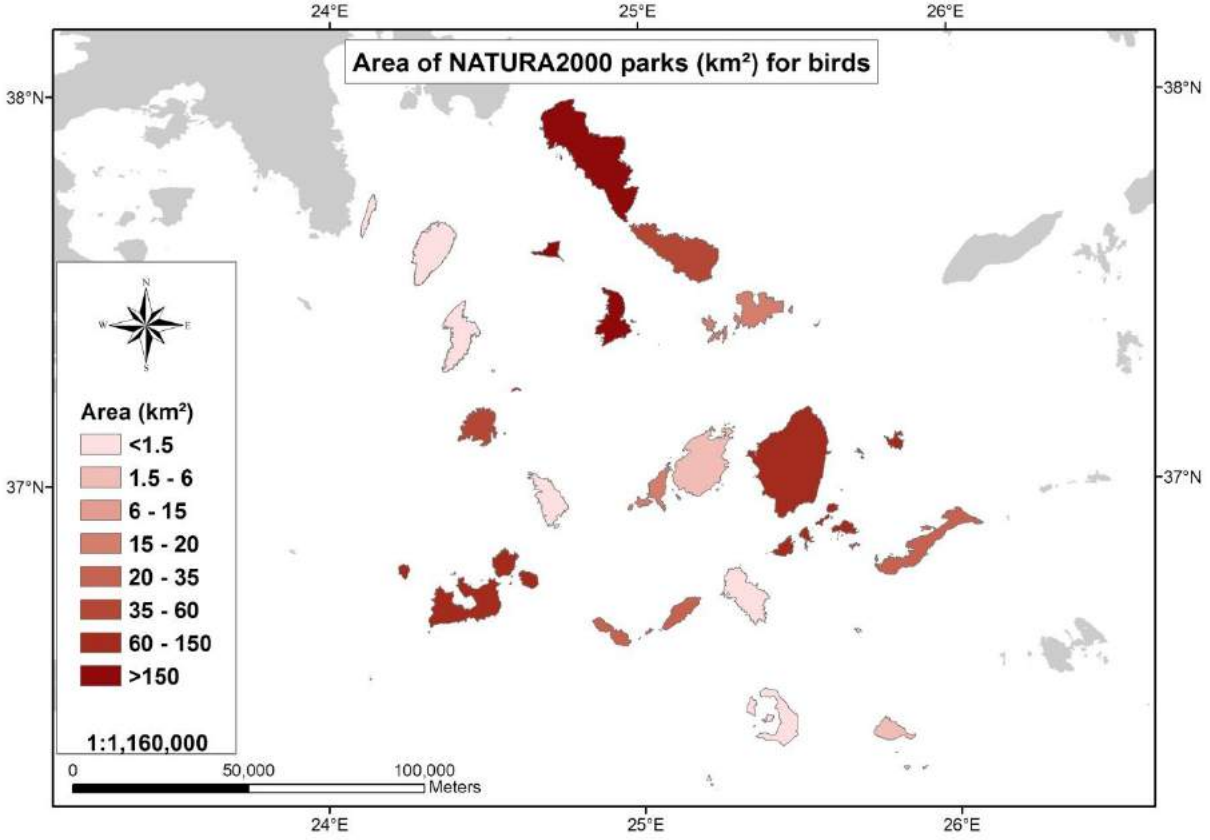
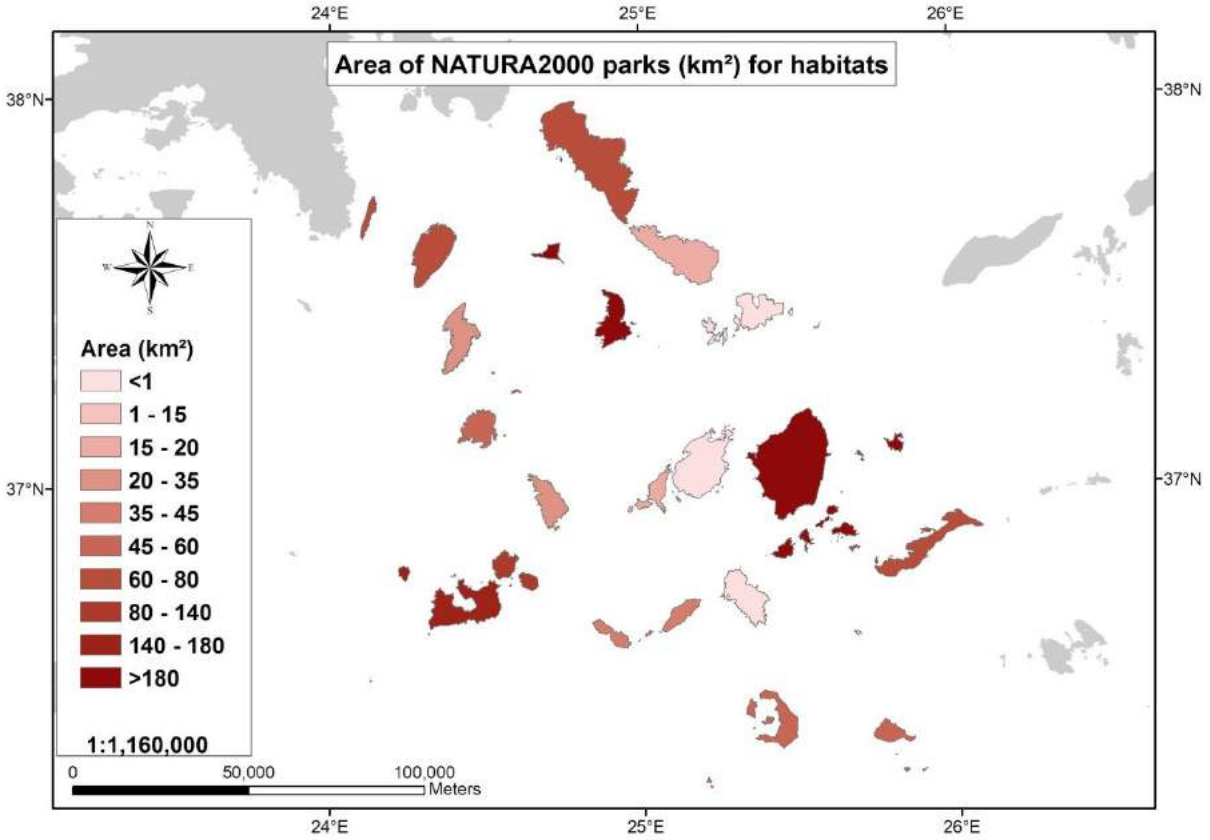
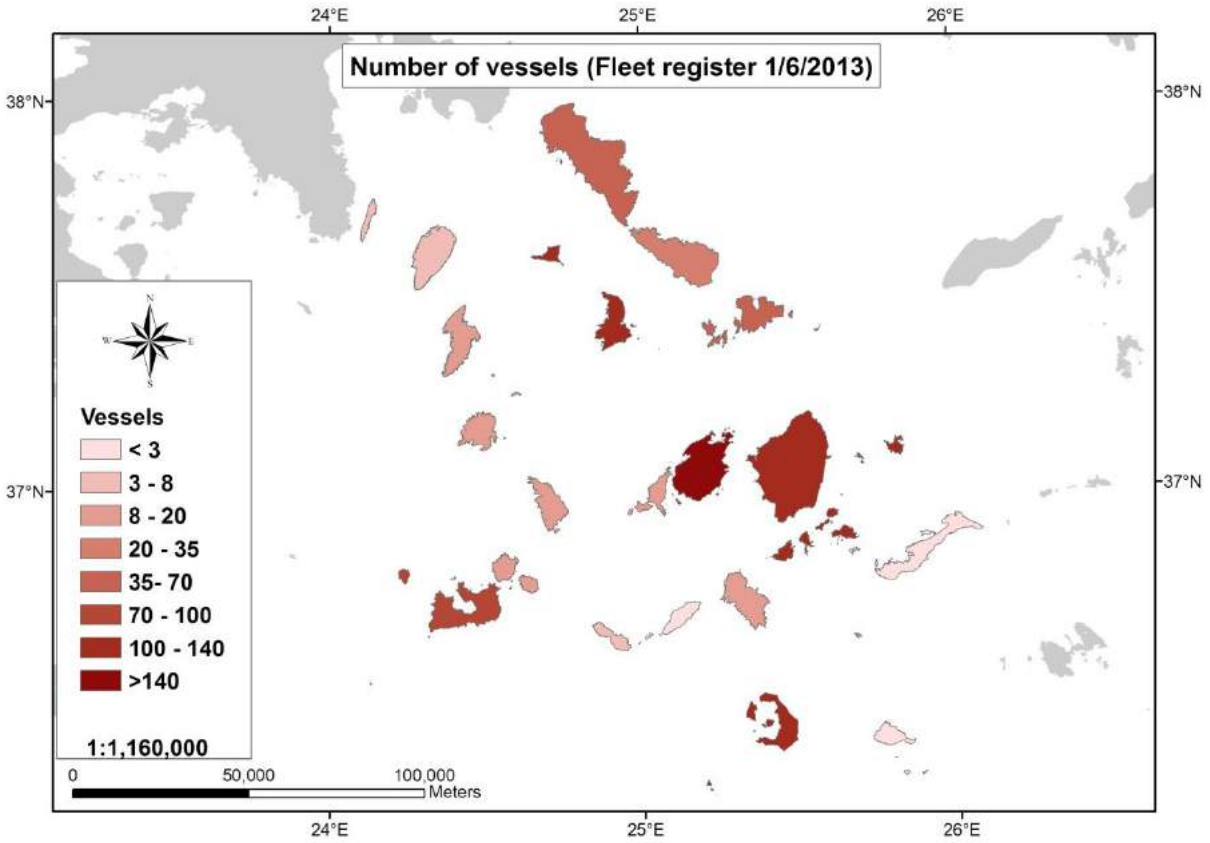
4.3.6. NATURA 2000 areas

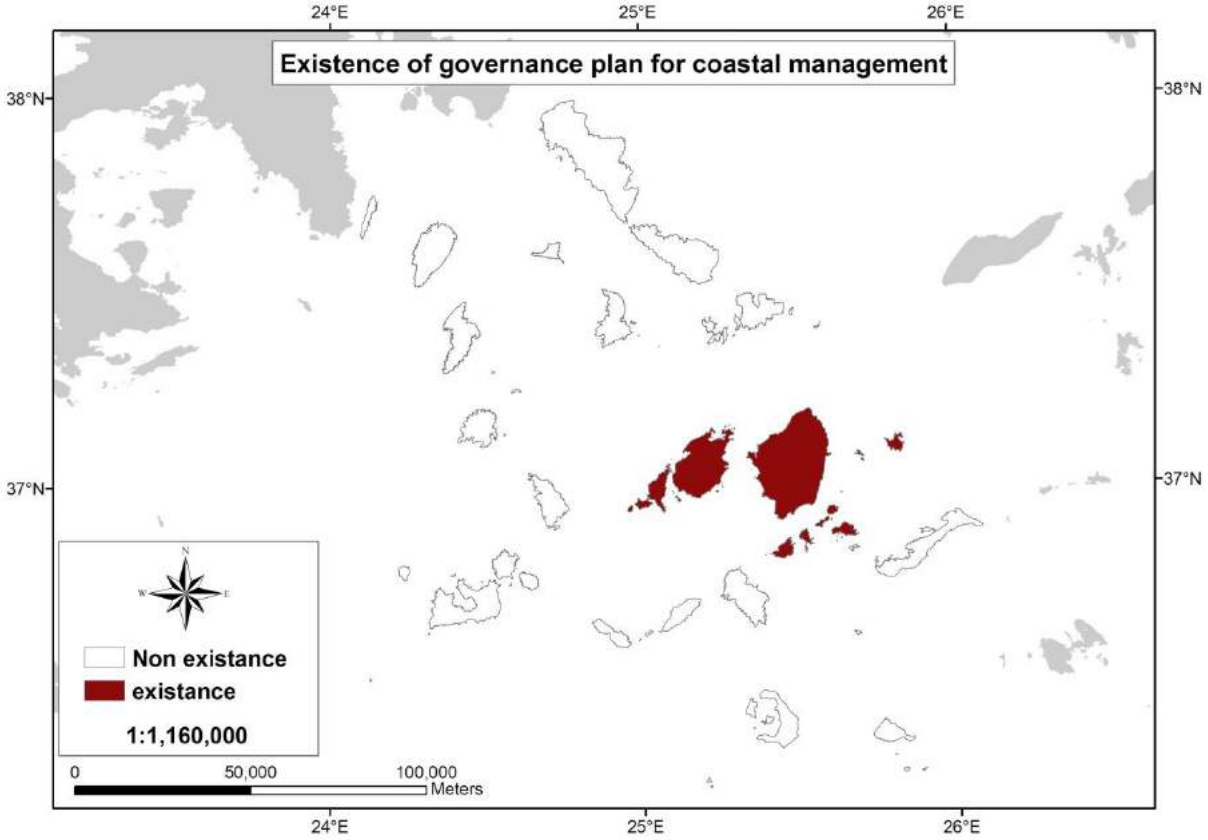




4.4. Fisheries indicators

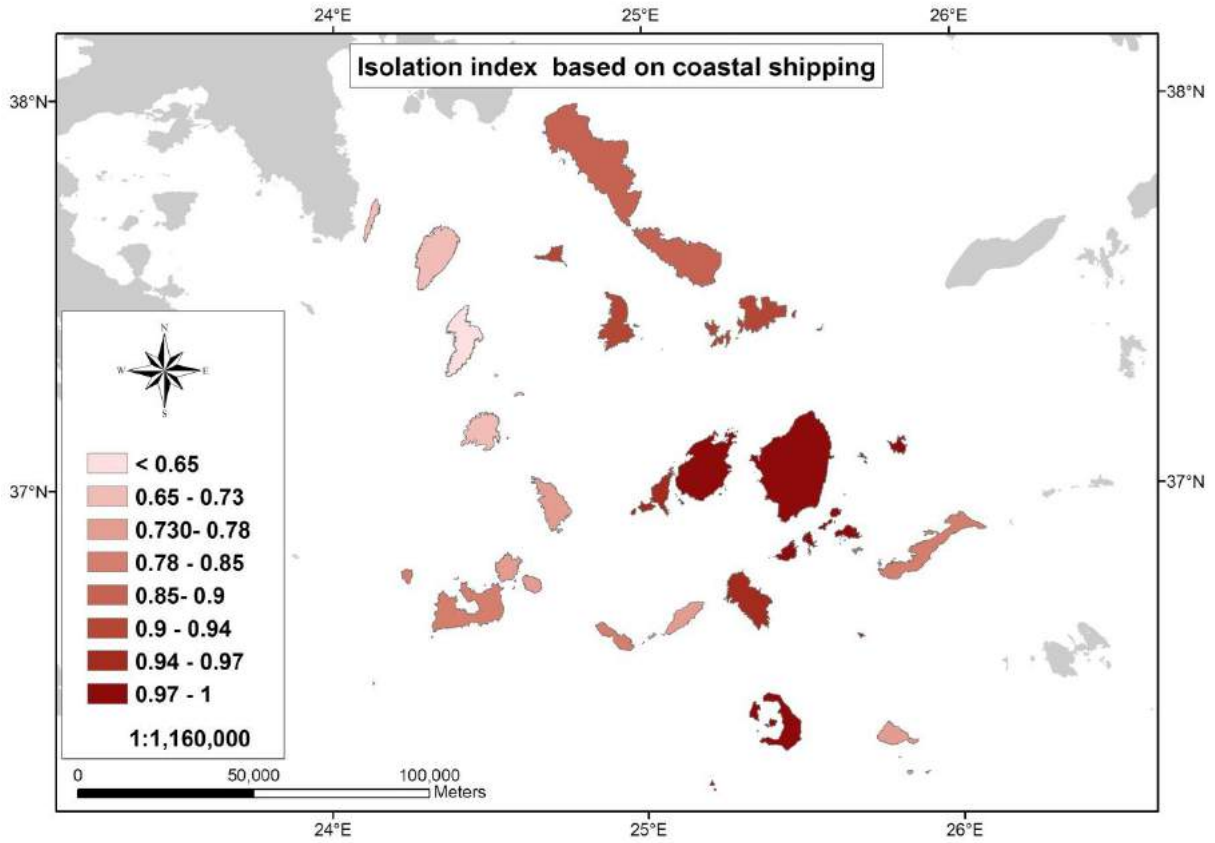


4.5. Governance indicators

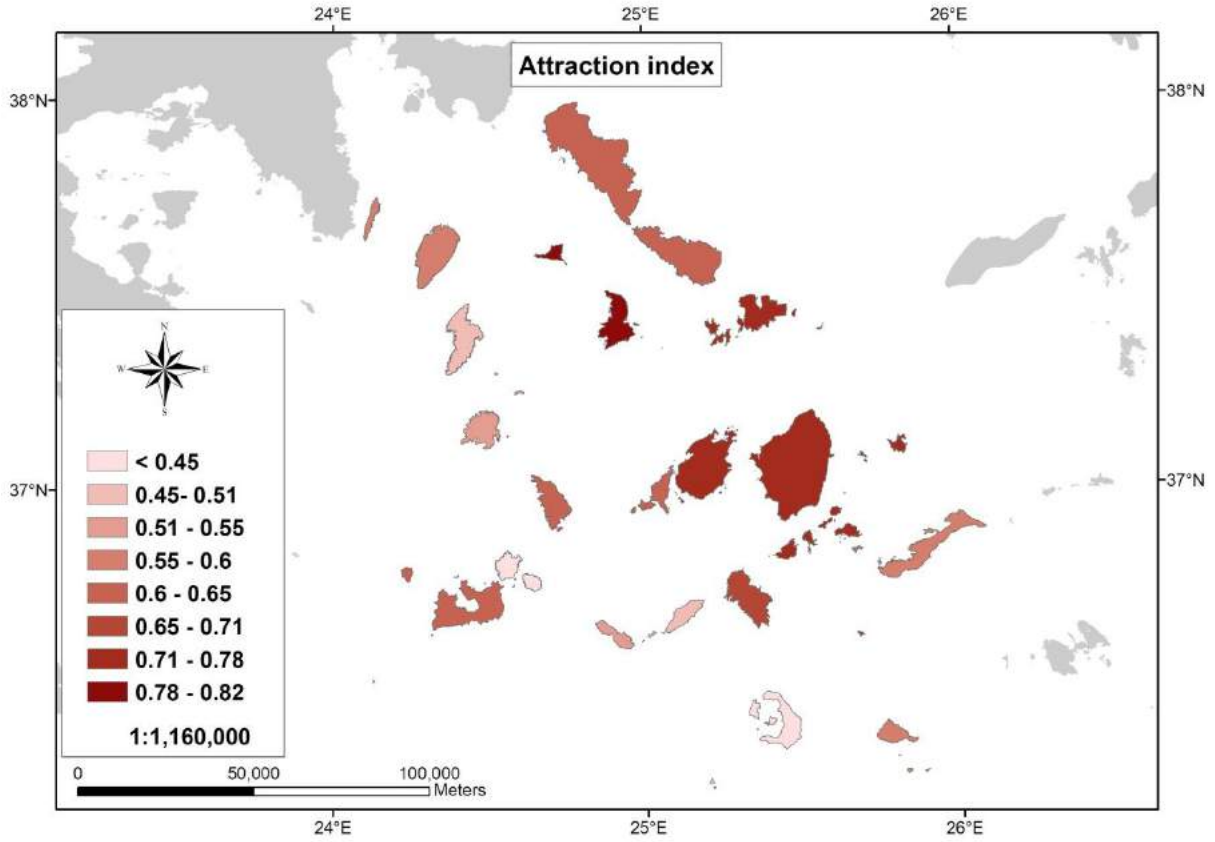


white polygons indicate no value

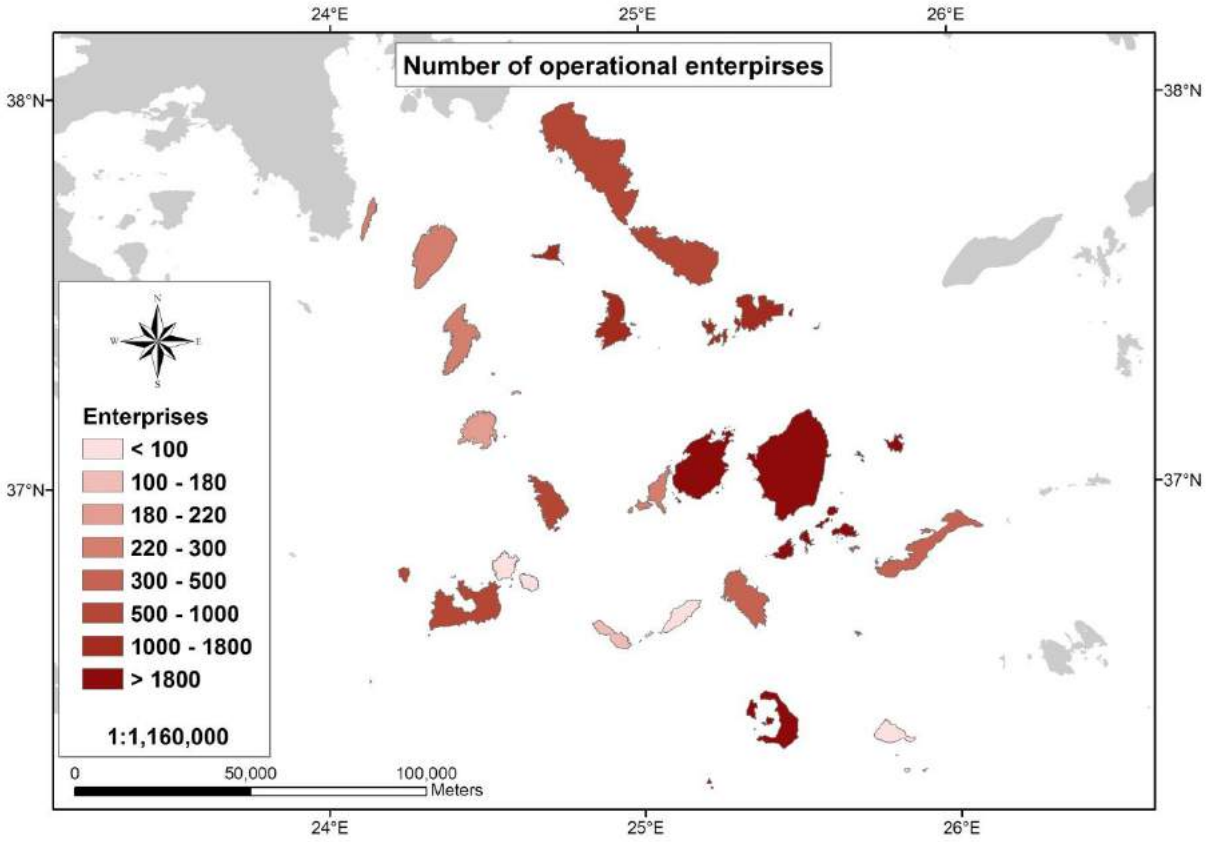
4.6. Economic environment indicators

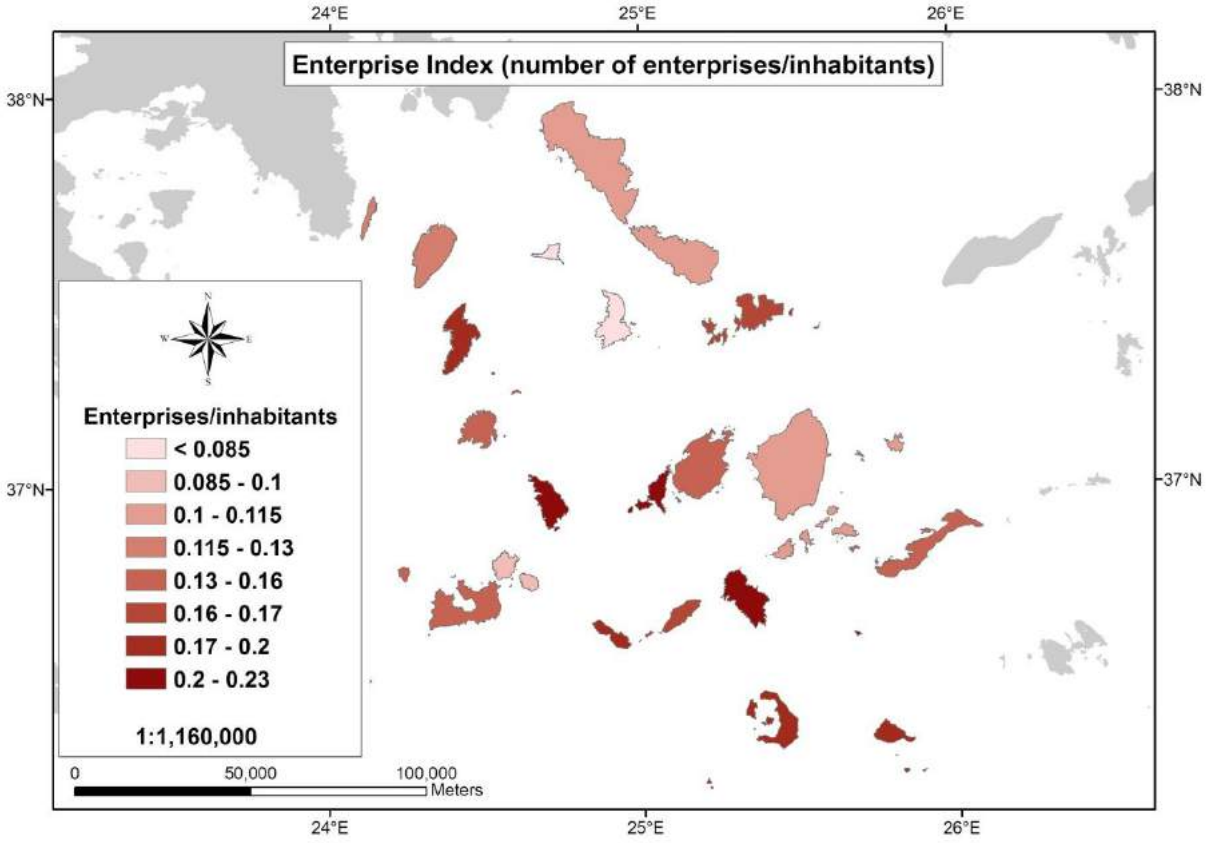


Index values 0-1, 0; high isolation, 1; low isolation



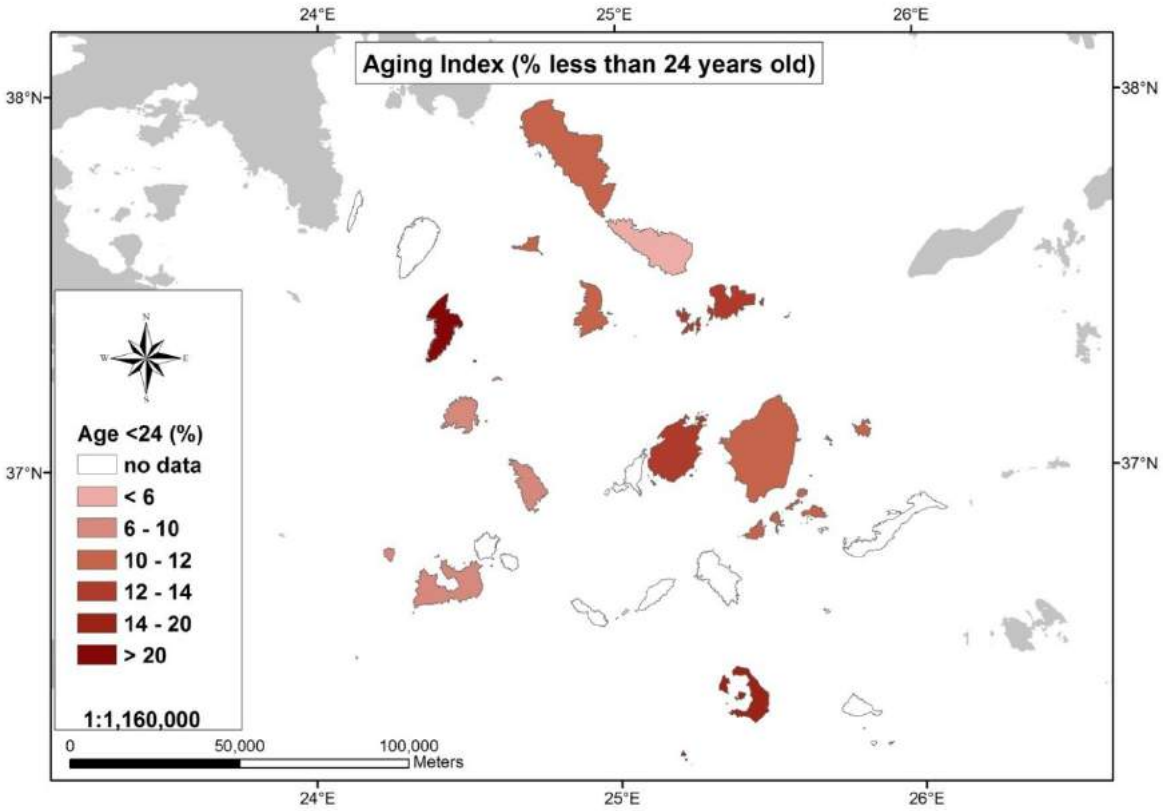
Index values 0-1, 0; low attraction, 1; high attraction


Number of operational enterpirses
24°E
25°E
26°E
38°N
37°N
Enterprises
< 100
100 - 180
180 - 220
220 - 300
300 - 500
500 - 1000
1000 - 1800
> 1800
1:1,160,000
0
50,000
100,000
Meters


Enterprise Index (number of enterprises/inhabitants)
24°E
25°E
26°E
38°N
37°N
Enterprises/inhabitants
< 0.085
0.085 - 0.1
0.1 - 0.115
0.115 - 0.13
0.13 - 0.16
0.16 - 0.17
0.17 - 0.2
0.2 - 0.23
1:1,160,000
0
50,000
100,000
Meters

4.7. Social structure indicators

4.7.1. Aging/Youth indicators



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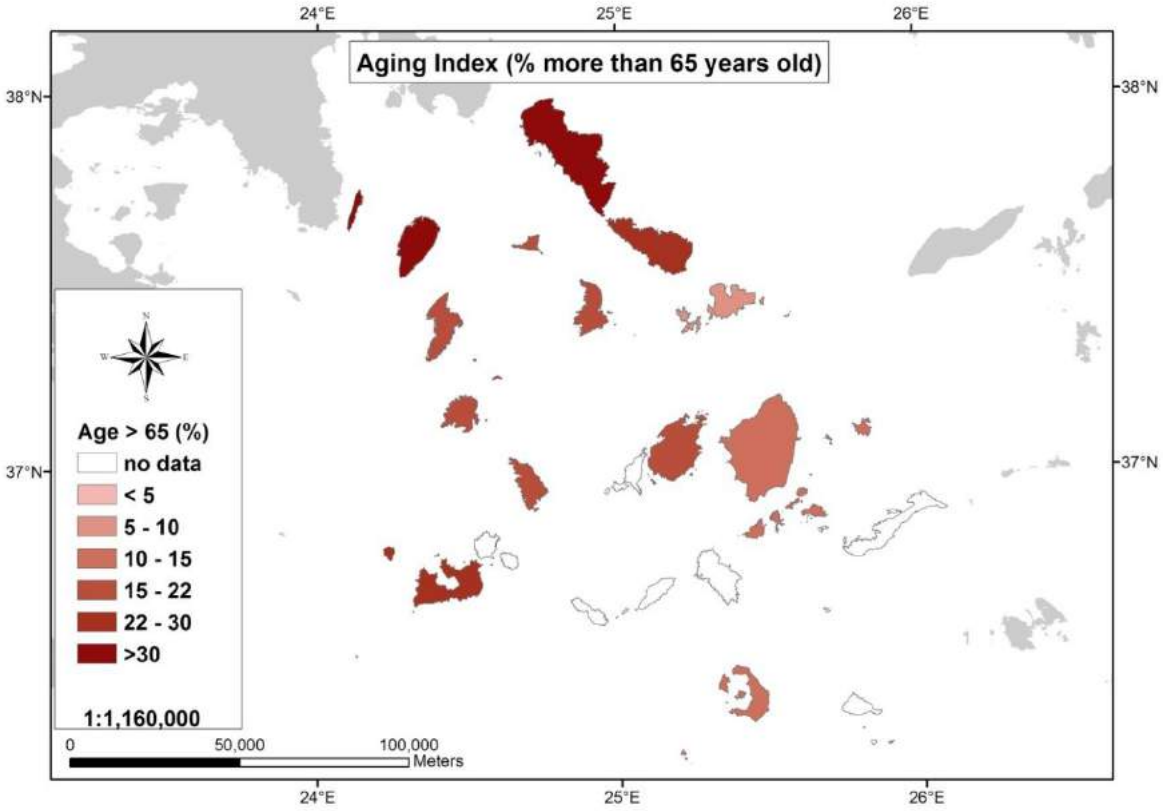
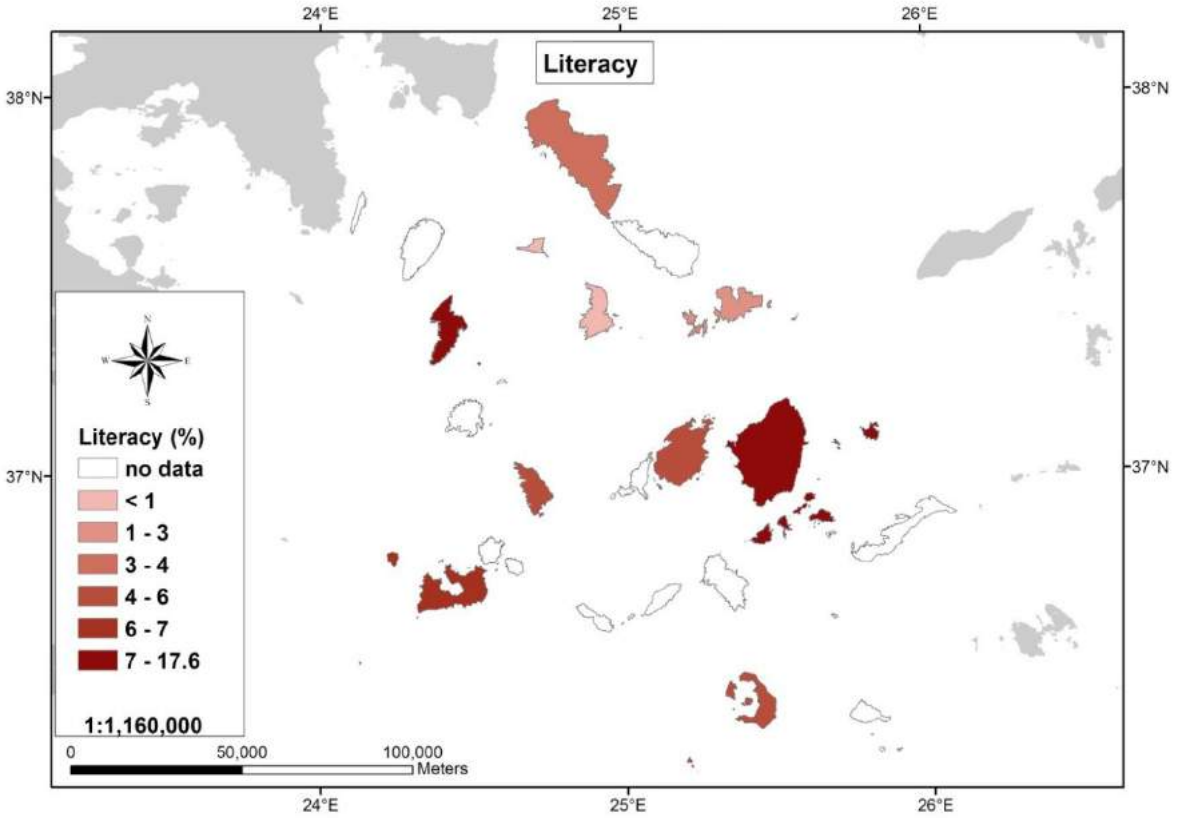


white polygons indicate no value

4.7.2. Literacy indicator



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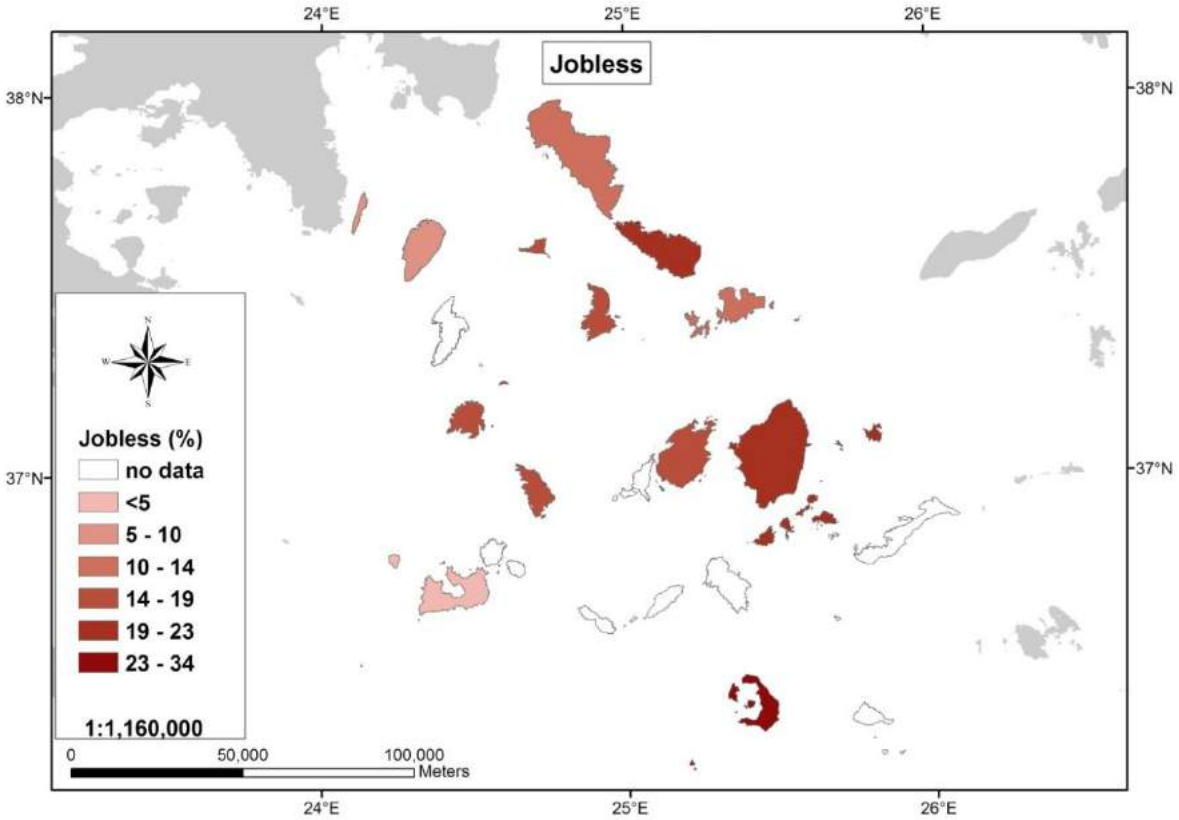
4.7.3. Employment indicators



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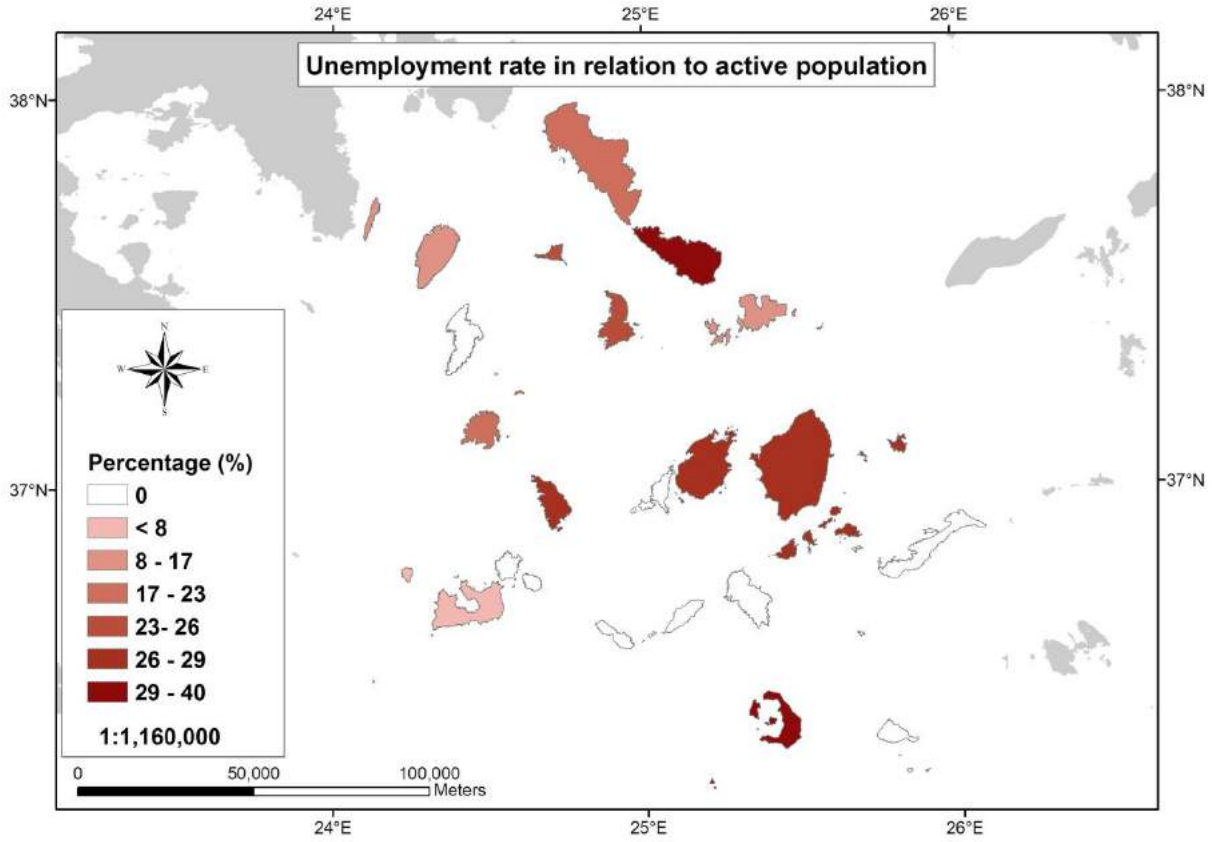
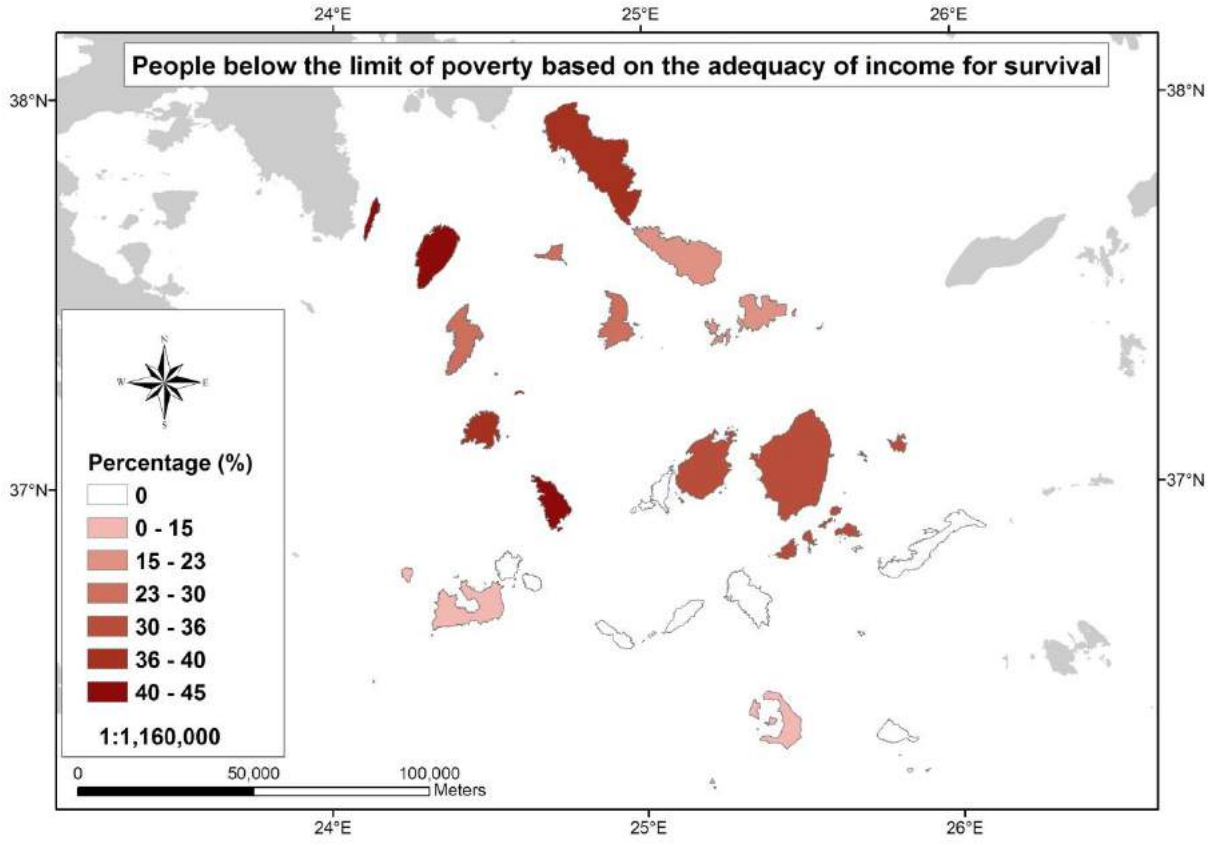


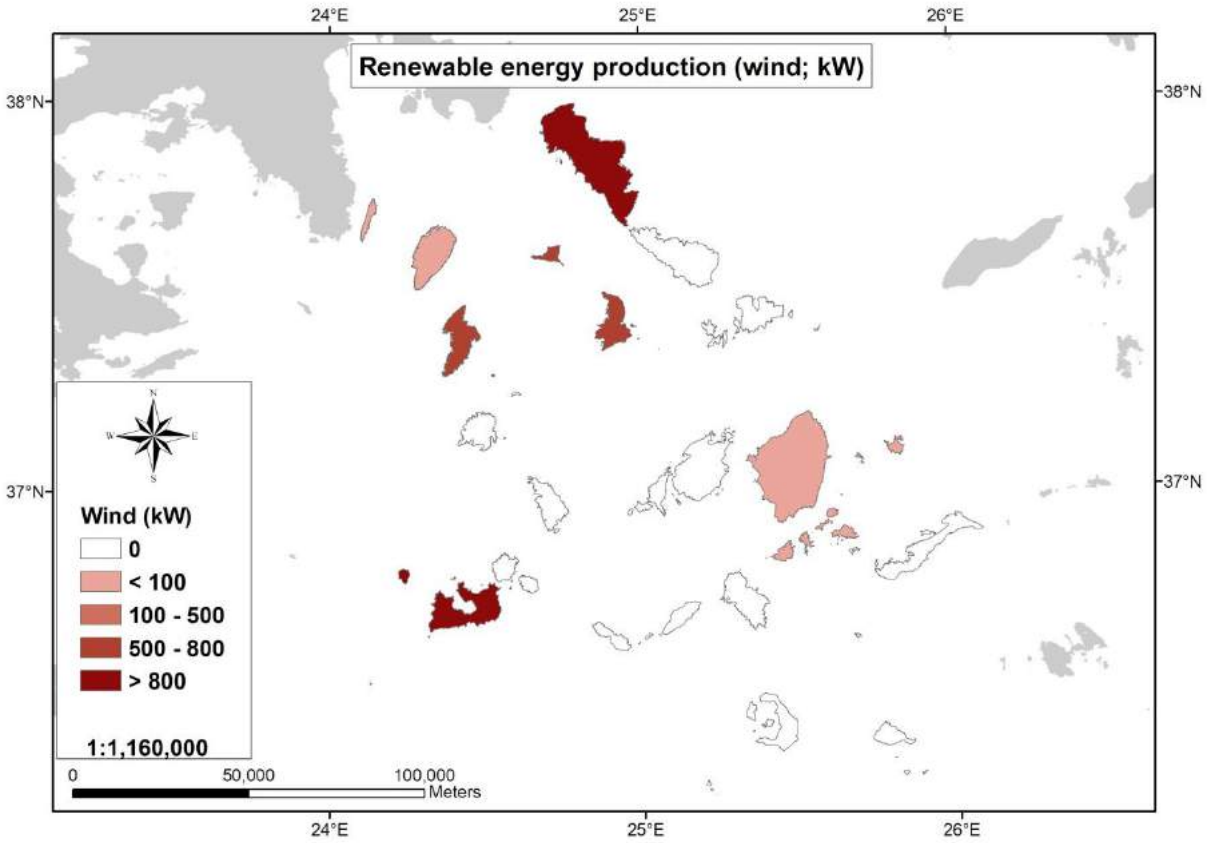
white polygons indicate no value

4.7.4. Poverty levels indicators



white polygons indicate no value

4.8. Renewable energy production indicators



5. Contextualization of the results in the coastal issues and the ICZM[7]

ICZM is an extremely complicated localized process with several common characteristics (guidelines) as described in the protocoll. Within the Cyclades CASE, 6 interacting modules of issues have been identified:

- social
- environmental
- population
- business
- infrastructure
- planning

All modules include drivers, pressures, impacts, responses and states and in some cases the same issue can be more than 1 (pressure/state or driver/pressure) at the same time.

In the specific terms that are expected for the regional assessment, there are 2 important modules: (a) the population module and (b) the environmental module.

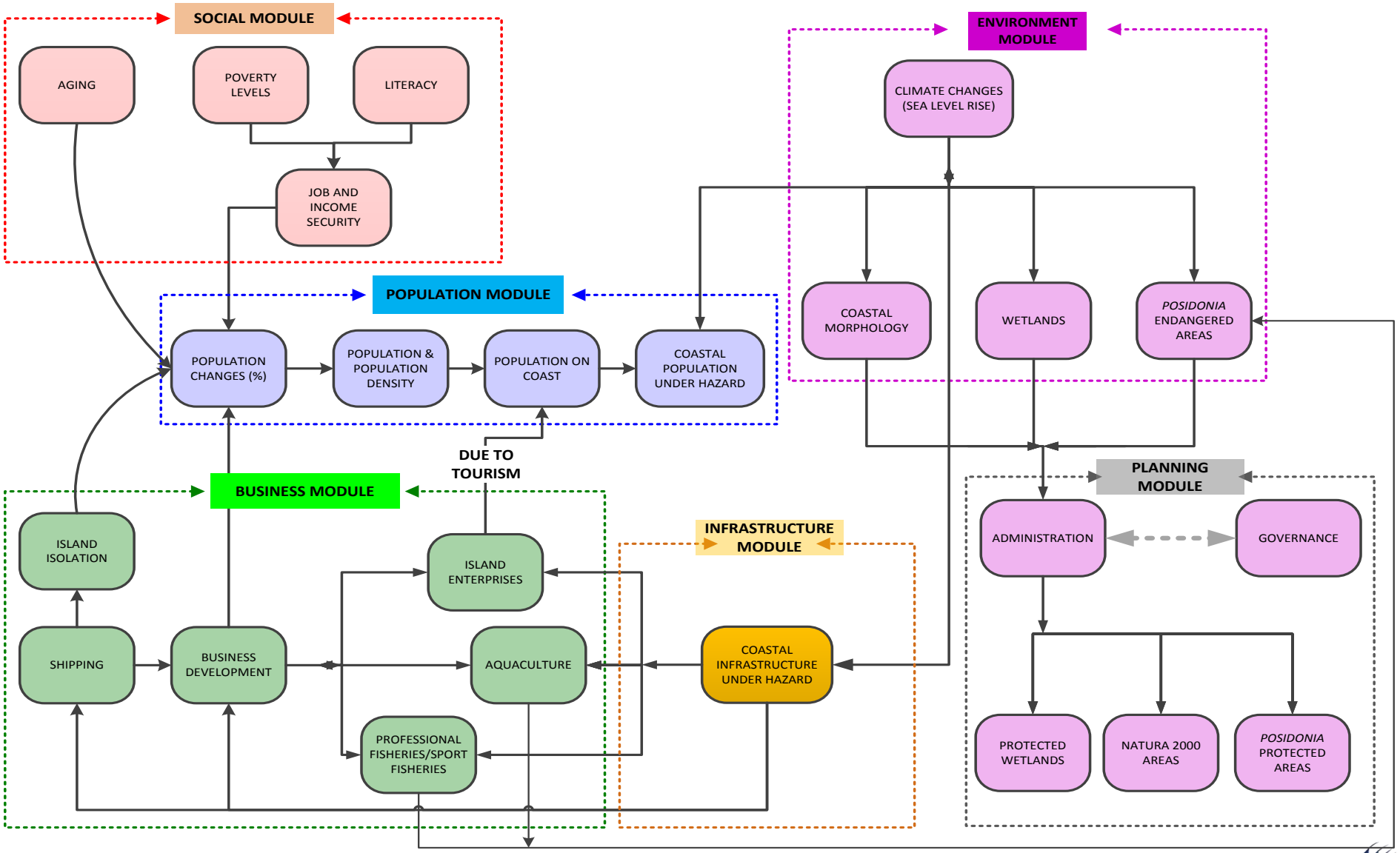
The population module is affected primarily by the social state (aging, labour, poverty and literacy indicators) and the business module (enterprise, shipping, aquaculture and fisheries indicators) creating pressure along the coastline in terms of increased number of coastal inhabitants and urban sprawl (for tourism mainly). At the same time, the coastal habitation and infrastructure building increases (a) the probabilities of hazard from climate changes (sea level rise mainly) to the population, the ecosystem and the infrastructure and (b) the development of coast related business such as fisheries[8] and aquaculture. Infrastructure hazards feedback and affect the development of businesses while the economic sectors as fisheries and aquaculture have a negative effect on coastal sensitive ecosystems. Finally, administration module interferes in the process providing (a) urban plans and (b) designating protected areas for NATURA 2000 / Birds / Habitats/ Posidonia beds. Of course administration is a major constituent of the network since it affects all issues with (a) the planning, (b) the legislation, (c) the policies/priorities and (b) its capacity to mitigate negative effects of internal or external drivers of the system.

Both illustrations regarding the network of interactions of the Cyclades system and the DPSIR network of these issues is illustrated below (see ch. 5.1. and 5.2.).

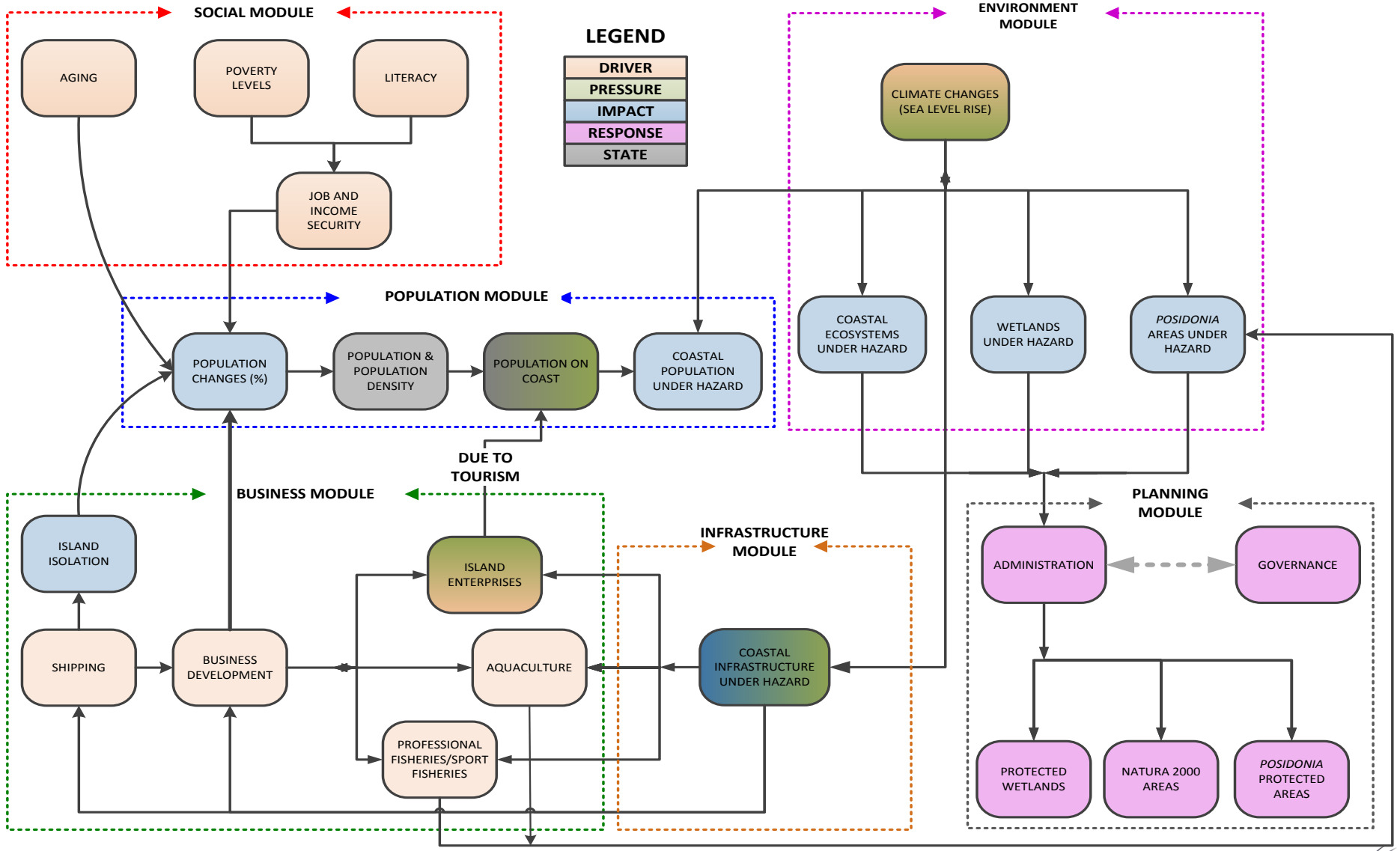
[7] e.g. for the North Adriatic: results of the calculation of indicators on 'built-up' and 'population density', and their contextualization with the results of the analysis of vulnerability to climate change as carried out by the Decision Support System DSS; contribution of the indicators to the ICZM process and policies.

[8] for the purpose of this study, fisheries include professional capture fisheries and sport fisheries

5.1. Cause-effect network



5.2. DPSIR network



6. Conclusions

- there is a clear 'cause-effect' or DPSIR foundation within the network of issues related to the spatial planning process existing in Cyclades region, in which ICZM process could be easily incorporated
- there is a hesitation of the administration to apply ICZM process in the region in the sense described in the protocoll mainly due to their inability to handle stakeholders thus the participation component of ICZM is not applied
- since the participation component is not applied, ICZM process cannot be applied as well; the current system of planning is based on the 'top-down' principle without the participation of several stakeholder groups or the invitation for participation on a case basis procedure while ICZM process is both 'top-down' and 'bottom-up' process
- there seem to be 2 major driving forces for the islands:
    a. the isolation of the islands from the mainland mainly due to inefficient shipping network for the transportation of goods and people.
    b. the primary administration objective for the development of the islands is tourism.

  This has affected the distribution of the population between the islands, the increase of inhabitants and building along the coastline; this in turn has increased the vulnerability of population and infrastructure from climate changes (sea level rise) and also increased activities around coastline such as fishing (professional and sport-fishing) endangering sensitive coastal ecosystems (both land and marine). On the other hand, true exporting business activities have been severely negatively affected by the isolation of the islands because the transportation of products to mainland and to country export gates (ports, airports) as well as supply of raw material is limited; hence the exporting businesses - based on the Cyclades Chamber of Commerce register - are very few in relation to the total (only 0.14%; 32 out of the 22704 enterprises). In relation to the Greek CASES issues, the isolation is responsible for the collapse of the aquaculture sector in the region.

ANNEX I. Detailed protected *Posidonia* areas

Red polygons indicate the protected areas in accordance to Ministerial Decision No. 167378/2007 (O.J. D' 241/4-06-2007)


Paros
Ag. Anna
Naxos
Antiparos
Lefkes
Aliki
Apollonia
Stenо Kimolou
Kimolos
Myrtoan Sea
Polonia
Plaka
Milos
Adamas
Sea of Crete
Folegandros
Sikinos
Ios
Amorgos
Dia
Fira
Mesaria
Kamari
Emporio
Anafi

THE HCMR PEGASO TEAM

ATHENS 2013

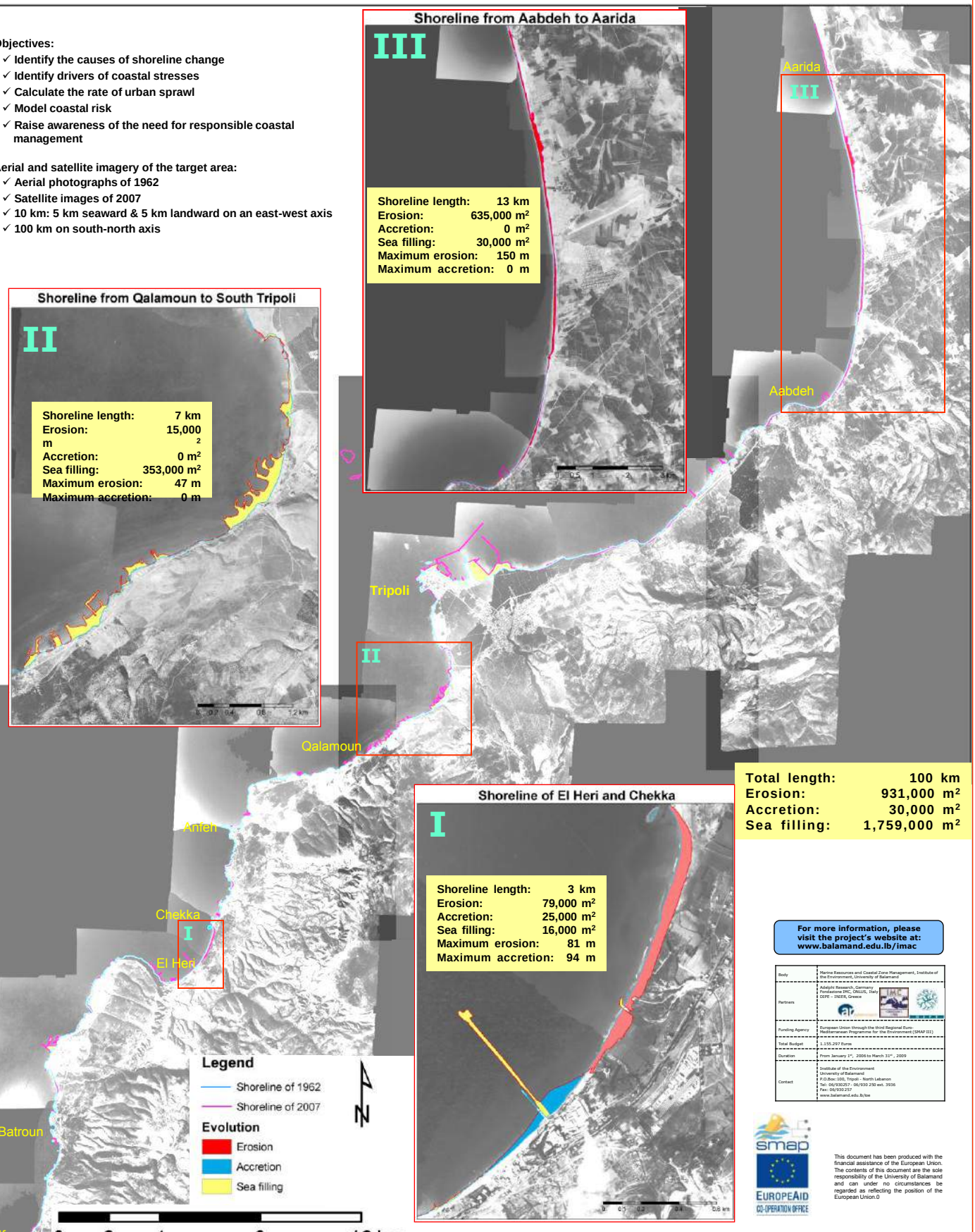
EVOLUTION OF THE NORTHERN LEBANESE SHORELINE FROM MADFOUN TO AARIDA BETWEEN 1962 AND 2007

Objectives:

- ✓ Identify the causes of shoreline change
- ✓ Identify drivers of coastal stresses
- ✓ Calculate the rate of urban sprawl
- ✓ Model coastal risk
- ✓ Raise awareness of the need for responsible coastal management

Aerial and satellite imagery of the target area:

- ✓ Aerial photographs of 1962
- ✓ Satellite images of 2007
- ✓ 10 km: 5 km seaward & 5 km landward on an east-west axis
- ✓ 100 km on south-north axis



Total length:	**100 km**
Erosion:	**931,000 m²**
Accretion:	**30,000 m²**
Sea filling:	**1,759,000 m²**

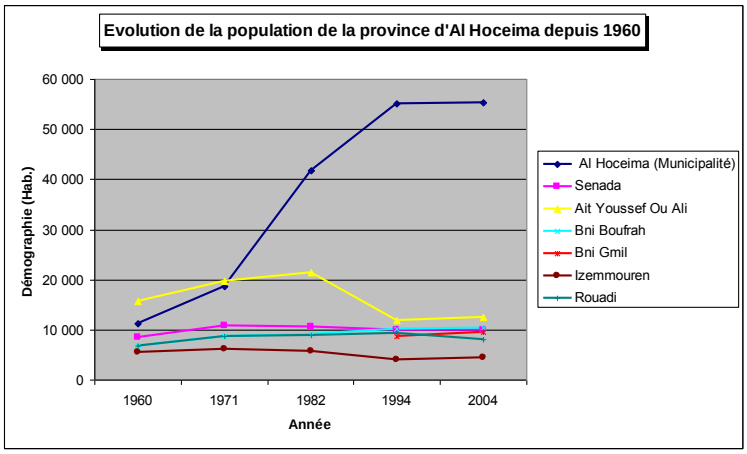
For more information, please visit the project's website at: www.balamand.edu.lb/imac

Body	Marine Resources and Coastal Zone Management, Institute of the Environment, University of Balamand
Partners	Adelphi Research, Germany Fondazione IMC, ONLUS, Italy ISIPE – INSPA, Greece
Funding Agency	European Union through the third Regional Euro-Mediterranean Programme for the Environment (SMAP III)
Total Budget	1.155.297 Euros
Duration	From January 1st, 2006 to March 31st, 2009
Contact	Institute of the Environment University of Balamand P.O.Box: 100, Tripoli - North Lebanon Tel: 06/930257 - 06/930 250 ext. 3936 Fax: 06/930257 www.balamand.edu.lb/ioe

This document has been produced with the financial assistance of the European Union. The contents of this document are the sole responsibility of the University of Balamand and can under no circumstances be regarded as reflecting the position of the European Union.0

Maps produced with the help of the GIS Center-University of Balamand

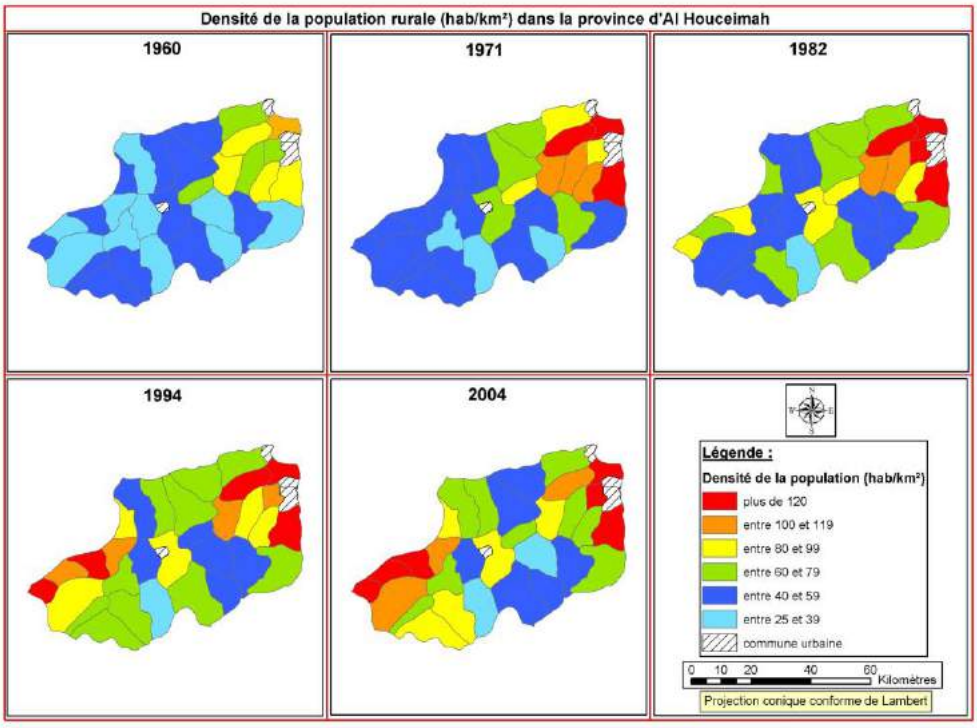
1/ Dynamique de la population dans le CASE Al Hoceima



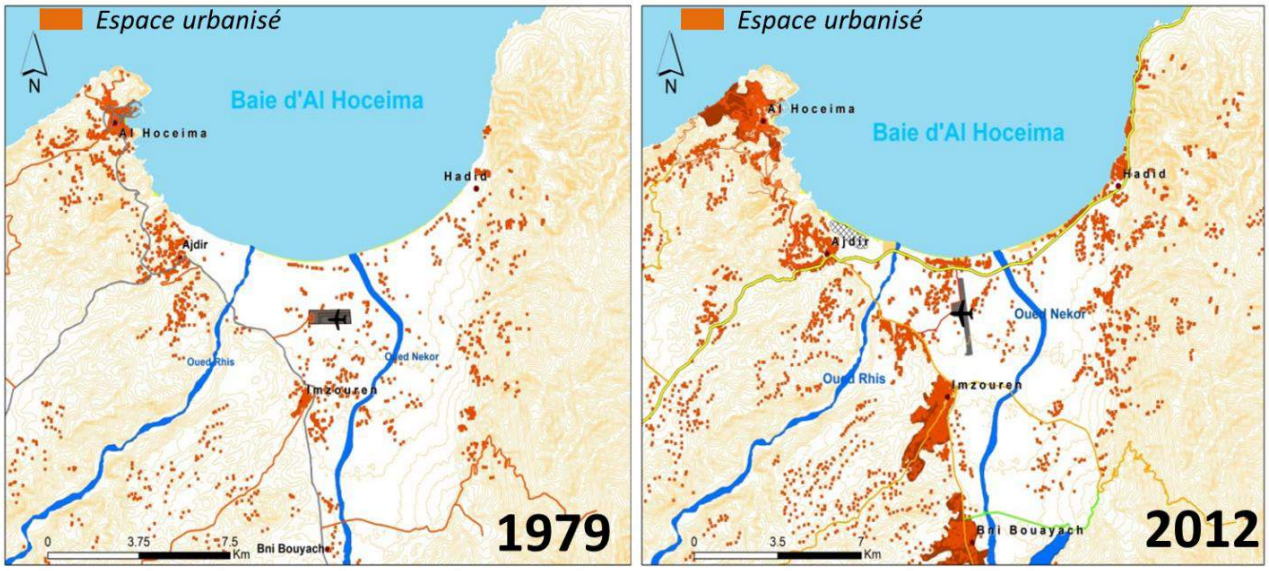
On peut noter les phases suivantes selon les différents recencesements nationaux :

- 1960-1971 : croissance de la population dans toutes les communes côtières
- 1971-1982 : importante augmentation dans la ville d'Al Hoceima au détriment des communes rurales
- 1982-1994 : Diminution de la population surtout dans la commune rurale de Aït Youssef Ou Ali qui migre vers la ville d'Al Hoceima.
- 1994-2004 : stagnation dans toutes les communes

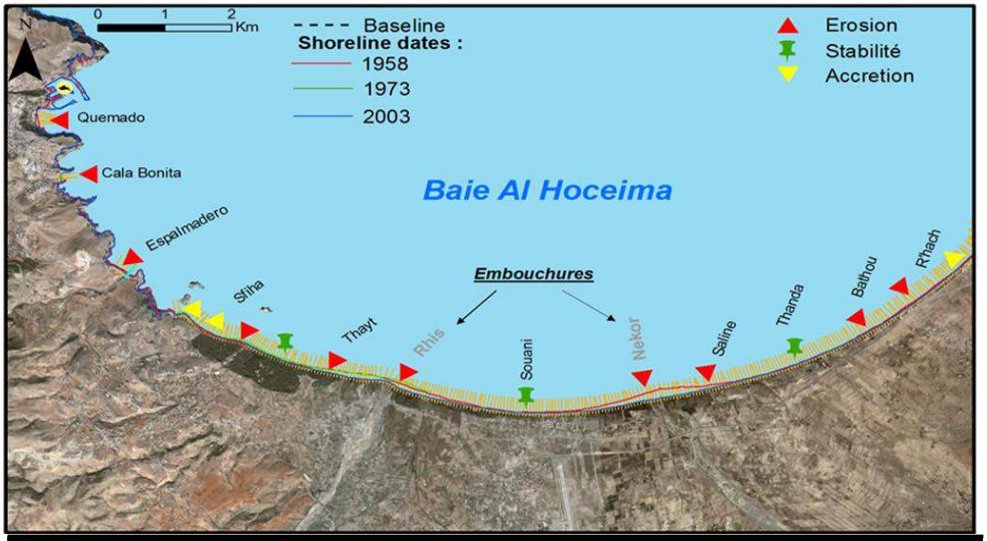
La ville d'Al Hoceima est aujourd'hui une ville saturée comparativement à ses capacités d'accueil.
Le caractère accidenté et rocheux de la côte et les risques d'effondrement ou de glissement de terrain limite toute extension urbaine. En plus le dernier séisme de 2004, a provoqué une migration forcée de nombreuses personnes vers des lieux plus surs. On assiste donc à une micro-urbanisation diffuse qui s'est développée le long des axes routiers et de la plaine centrale de la baie, souvent dans des zones inondables. De nombreux projets touristiques sont pourtant en cours ou programmés au niveau de la côte, sans tenir en compte des « setback lines »



2) Urbanisation

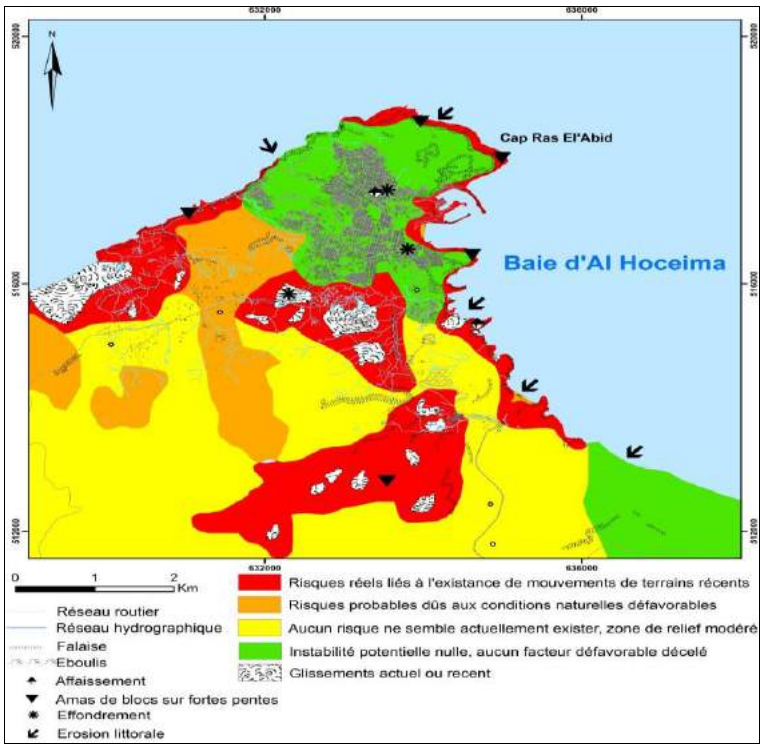


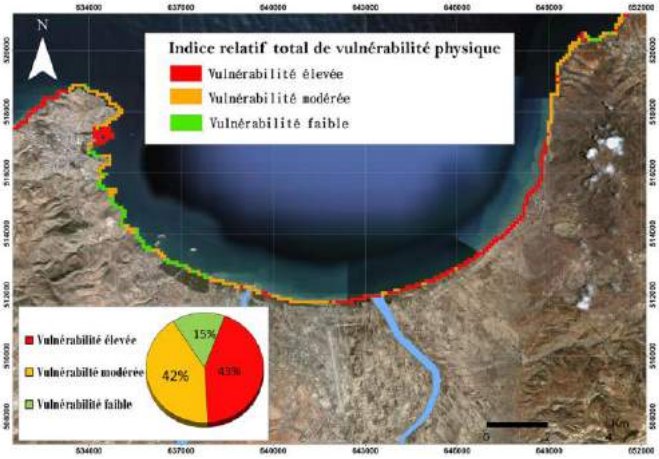
3) Evolution du trait de côte

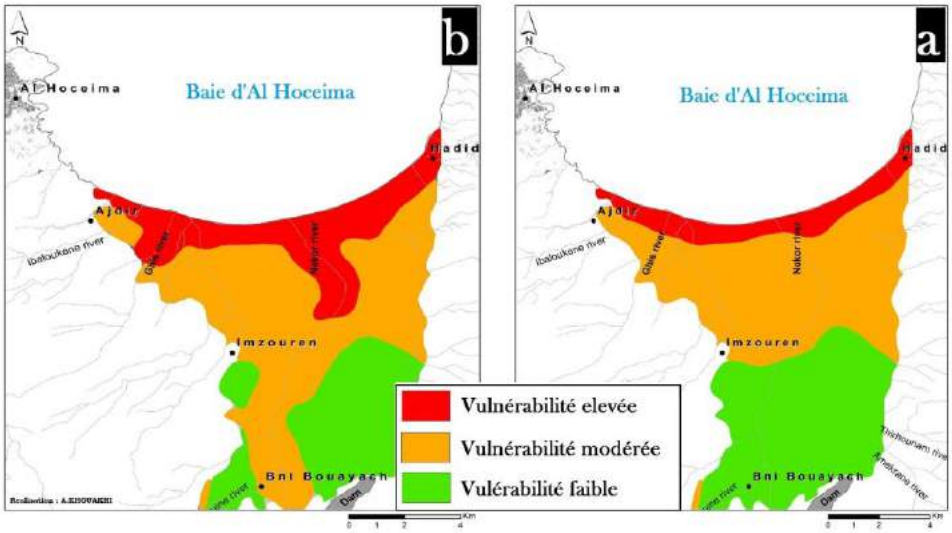


Plage	Longueur (m)	Etat	taux 1958 à 2003 (m/an)
Quemado	300	Érosion	-0.2 à -1
Cala Bonita	120	Érosion	-0.2 à -0.45
Espalmadero (Isly)	394	Érosion	-0.3 à 1.2
Sfiha-Ouest	678	Accrétion	+0.3 à +0.9
Sfiha Centre	504	Érosion	-0.15 à 0.38
Sfiha-Est	560	Stable	
Thayt et embouchure Rhis	2246	Érosion	-0.16 à -2
Souani-Ouest	1616	Érosion	-0.15 à -1.6
Souani centre	1150	Stable	
Souani Est et embouchure de Nekor	1500	Érosion	-0.15 à -3.4
Saline	1326	Érosion	-0.19 à -2.5
Thanda	1120	Stable	
Bathou	1800	Érosion	-0.1 à -0.6
R'hach	1020	Accrétion	+0.17 à +0.5
Total	14334	Tendance régressive	

Vulnérabilité et Risques







Vulnérabilté de la nappe côtière à l'intrusion marine

a: *Conditions actuelles* ***b:*** *en cas d'élévation de 0.5m*

NATIONAL INSTITUTE OF OCEANOGRAPHY AND FISHERIES

Nile Delta ICZM Indicators

Prof. Suzan Kholeif and Prof. Omran Frihy

7/7/2013

Indicators provide an extremely useful way to improve communication, transparency, effectiveness and accountability. They are a tool that helps make clear assessments of and comparisons between management measures through time. They also can be used to simplify the description of the extent to which the objectives for the management programs are being achieved.

1. Introduction

Indicators provide an extremely useful way to improve communication, transparency, effectiveness and accountability. They are a tool that helps make clear assessments of and comparisons between management measures through time. They also can be used to simplify the description of the extent to which the objectives for the management programs are being achieved.

ICZM indicators can be used in two basic, overlapping ways: as a means of communication and as a means for measuring. These uses include: informing decision making, increasing understanding of important issues, assessing conditions and trends, comparing conditions in different geographical areas, projecting trends, measuring performance and results of policies or actions, and showing the links between environmental, social and economic concerns.

The selected Nile Delta indicators were approved by authorities working in Egypt. These indicators are cope with different uses in the coastal zone as planed by different ministries and governorates and in accordance with the present activities concerning the researchs and improvements of coastal zone planning

2. Brief introduction on the CASE

Nile Delta is the delta formed in Northern Egypt where the Nile River spreads out and drains into the Mediterranean Sea in a relatively recent geological ages. Its area is about 20000 km2 was formed by the sedimentary processes which have been occurred at the upper Miocene period. It is one of the world's largest river deltas. It extends from Alexandria in the west to Port Said in the east and covers nearly 240 km of Mediterranean coastline. This coastal plain is backed by topographic features lying below and above the mean sea-level up to the 3 m contour that include coastal wetlands which range from small ponds to large lagoons; these lagoons are also referred as lakes. These lagoons represent 0.25 of total Mediterranean coastal wetlands (Sestini, 1992). The Nile delta has substantial resources in its coastal zone and a number of urban centers. As the coastal zone encompasses more than 40% of Egypt's industries, this region is extremely important economically, containing substantial capital investment.

The coastal environment of the Nile delta has been degraded at many places; this degradation has negatively impacted the human use of the coastal zone, causing the loss of important economic assets. Irrational land use, water pollution, shoreline erosion, flooding and deterioration of natural resources and habitats are the main challenges to be addressed and managed. These challenges moreover will be exacerbated due to the foreseen climate change impacts, land subsidence, and prolonged vulnerability to flooding risks and coastal erosion. The saline intrusion in the groundwater will increase; if no measures are taken.

3. Description of IRA indicators

Two indicators have been used for evaluate the regional risk assessment in order to investigate the environmental risks related to ***water quality and climate change*** ***(sea-level rise)***

- **Quality of coastal Water**

The researchers from National Institute Oceanography and Fisheries and experts from coastal governorates were reviewed the running and terminated monitoring programmers of coastal waters to assess the water quality and define hotspot areas in the study area as well as to propose the activity and to suggest modification of monitoring programme if needed. Their report presented and discussed in general meeting of Nile Delta stakeholders and policy makers.

Due to the increase in development activities whether industrial, agricultural, or urban that are being conducted at the Egyptian coasts, which may lead to generating many kinds of wastes that would negatively affect marine environment and organisms.

The Egyptian Environmental Affairs Agency (EEAA) has developed a national Monitoring program in collaboration with National Institute of Oceanography and Fisheries and the Institute of Postgraduate Studies and Research at the University of Alexandria, aims to monitor water quality along Egyptian coast periodically and identify sources of pollution and to define pollution hot spots along the Egyptian Mediterranean coasts.

This monitoring program started in 1998 by selecting fixed stations along coasts of the Mediterranean Sea. The monitoring activities are conducted seasonally on a regular timing using water quality indicator which measures physical, chemical and microbiological parameters as follows:

- Physical measurements (temperature - pH - dissolved oxygen -electrical conductivity - salinity – transparency).
- Chemical measurements (nitrate - nitrite - ammonia - total nitrogen - phosphate - total phosphorus - chlorophyll-a – silicate) .
- Bacteriological measurements (coliform bacteria -streptococcus bacteria - Escherichia coli).

Monitoring results of water quality for the coastal waters at Nile Delta during last four years:

1. The concentration of dissolved oxygen (DO) is higher than the internationally permissible limits in all stations during the year 2010 with the exception of two stations which recorded the lowest values. This could be due to direct sewage disposal to those areas.
2. Salinity concentrations was ranged in all monitoring sites during between (28.06 -38.35 mg / L)
3. pH values and temperatures were within the natural limits of the coastal water during different periods of the year.
4. The highest transparency of water was recorded in Nile Delta coast less due to

the

5. increase of different activities at the estuaries of the river.
6. By comparing the average concentration of total nitrogen in 2010 with the average concentration during the 2008-2009 year, it was noticed that there was a significant decrease in values in all sites, in addition to a significant decrease in most of the monitoring sites if compared to 2008-2009 values.
7. There was a significant decrease in the concentration of ammonia in most of the monitoring sites, where it was within the acceptable limits during all stations except at outlet of estuaries.
8. By comparing the average concentration of ammonia in 2010 with the previous two years, it was noticed that there is a decrease in concentration during 2010, as a result of some factories reconciliation of their environmental status by stopping discharge of their wastes on the Mediterranean coast.
9. By comparing the average concentration of chlorophyll-a in the four trips in 2010 with those in the last two years, there was noticed that a decline in most of the sites compared to previous years except for Maadia station and the ELborg as a result of
10. water from Edku Lake and agricultural, sanitary and industrial discharge in those areas.
11. Nitrite and Nitrates concentration are low, ranged between (0.002, 0.033 mg / L) and recorded its highest value in the Maadia area (0.098 mg / L).
12. Total phosphorus concentration ranged between (0.007, 0.093 mg / L). The highest concentration was recorded in the Estuaries outlets.

⇨ Bacteriological measurements were made for water samples the coastal area during the four field trips in 2010 for each of the total coliform bacteria, escherichia coli bacteria and fecal streptococci bacteria, living in the intestines and stomach of humans and other living organisms; their presence in water is considered an indicator of sanitation pollution. Results were compared to European standards of 1988 and Egyptian standards of 1996, as follows: -

- Total coliform bacteria 500 cells / 100 ml of water,
- Escherichia coli bacteria (E.coli) 100 cells / 100 ml of water,
- Fecal streptococci bacteria 100 cells / 100 ml of water.

Results of monitoring during 2010 have been improved in some monitoring sites as; water quality was clean and free from fecal than the previous two years. In general, the report shows that there is an improvement in water quality as a general of the Egyptian Mediterranean coasts compared to previous three years as a result of efforts being conducted through cooperation with stakeholders, continuous inspection of industrial and touristic resorts discharging directly or indirectly in the Mediterranean as well as factories reconciliation of their environmental standards.

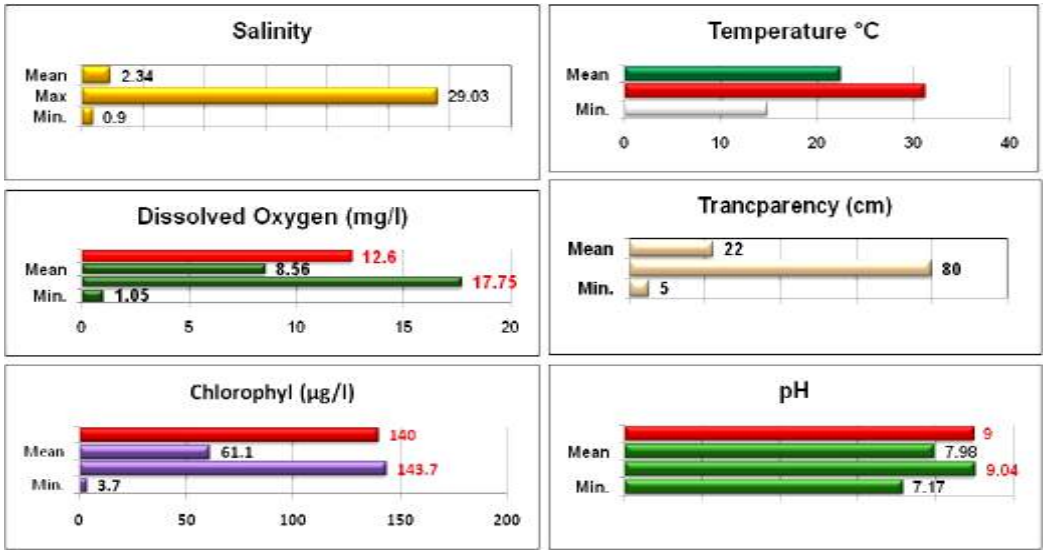


Fig 1: Showing some measurements in the Nile Delta coastal areas during year 2009 (the reference in EEAA report 2009)

⇨ Climate change induced sea level rise

Previous studies have indicated that the Nile River deltaic plain is vulnerable to a number of aspects, including beach erosion, inundation and relatively high rates of land subsidence. Analysis of historical records obtained from tide gauges at Alexandria, Rosetta, Burullus, Damietta and Port Said show a continuous rise in mean sea level fluctuating between 1.8 – 4.9 mm/yr (Figure 2). Projection of averaged sea-level rise trend reveals that not all the coastal plain of the Nile Delta is vulnerable to accelerated sea-level rise at the same level due to wide variability of the land topography. The topography includes high-elevation features: sand dunes carbonate ridges, protection works, and low-lying wetlands (lagoons, fish farms, and ponds). Accretionary or prograding beaches (5-10 m/yr) along embayments and the Nile Delta promontory saddles also can compensate for erosion induced from the effect of accelerated sea-level rise. In marked contrast, local low-lying wetlands and fish farms (<1 m depth) which border the southern margins of Idku, Burullus and Manzala lagoons would be affected if coastal protection measures are not taken. The most vulnerable areas are coastal wetlands (lagoons, lakes and ponds) and most of the 0-1 m elevated strand plain. The most hazardous region would be the Manzala lagoon area, where subsidence rates exceed 5 mm/yr. Consequently, sea incursion will gradually lead to significant change in the ecologic system including fisheries and wildlife as well as water penetration in the surrounding ground water table. Recreation beaches, commercial harbors, fishing ports, cities, villages, fish farms, archeological sites and the coastal highway adjacent to these lagoons appear to be threatened socio-economically as a result of possible change in

climate. Since wetlands act as buffers to the inland penetration of coastal flooding, the loss of cultivated Nile Delta land to south of wetlands will be under threat.

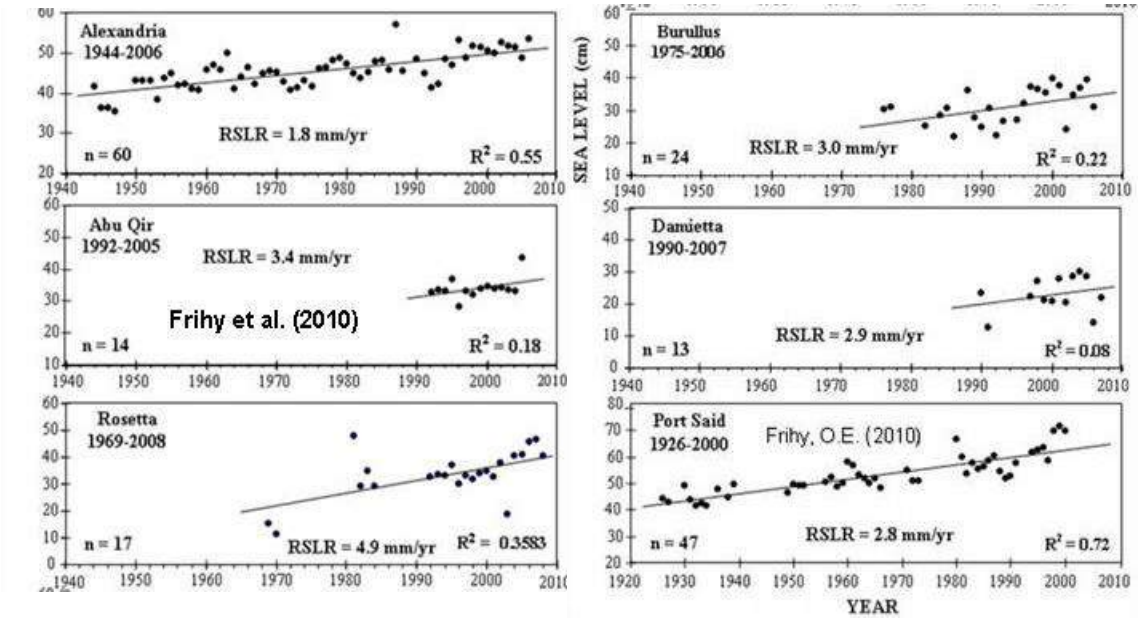


Fig. 2. Comparison of relative sea-level trends estimated from annual tide-gauge records at Alexandria, Abu Qir, Rosetta, Burullus, Damietta and Port Said. Solid line is the regression relationship. The regression lines together with the slopes (RSLR) are indicated. They all show an overall upward trend of relative sea-level (RSLR) fluctuates between 1.8 to 4.3 mm/yr. Tide gauge locations are shown in Figure 1. (after Frihy et al. 2010).

5. *Contextualization of the results in the coastal issues and the ICZM*

The coastal zone in the Nile delta contains a unique ecosystem which is very vulnerable to changes; lakes (two lakes Idku and Burullus with various biodiversity fauna and flora, route of resting area for migratory birds), wetlands, sandy beaches , sand dune , black sand with its economic value and agricultural fertile land sand. Most of the economic activities in Egypt are running or take place in the Nile Delta such as; farming, mining, fishing, harbor, industrial area, tourism resort and archeological tourism (pharaonic, , Coptic and Islamic in Rosetta town), aquaculture fish farming and transportation with associated infrastructure such as the coastal road. Sometimes this diverse of activities increase the conflicts of interest among stakeholders and gives the opportunity for political influence to take place whenever it is positive or negative decision. Hence, an integrated Coastal Zone management plan is required to solve the conflict of interest among stakeholder and to preserve the ecosystem and achieve the sustainable development.

The most important change in land use pattern in the Nile Delta coastal area is uncontrolled urbanization (urban sprawl). It is mostly due to a shift in population and activities along the

coast which generate more pressure in this area. Developments are occurring in unsuitable or unsafe area is resulting in deterioration of land and marine habitats as well as conflicts between those involved in agriculture, human settlements and tourism and nature conservation.

- Regarding the **Climate change** in terms of shoreline erosion, the Coastlines in the Nile Delta are naturally subject to erosion and accretion; however, certain parts of coast are protected by hard coastal structure. The Nile Delta is extensively used for agriculture. In lower parts of the delta, the saline seepage from the aquifer aggravates the salinity problems to agriculture. Human presence in certain areas makes protection from erosion. In undeveloped areas, better planning is required to ensure that human activity is integrated with natural processes rather than acting against them.

- **Coastal waters** serve as a sink for land base-related pollution, for example from large-scale agricultural sources such as drainage water that rich with fertilizer and pesticide, residues and industrial plants, offshore petroleum facilities and shipping accidents.

All of the above issues without no doubt can affect the social and economic conditions for population, but the most vulnerable one that affected by coastal areas risk is fishermen and farmers specially who are living in low-lying areas

Egyptian Government has taken some action to protect water from pollution such as;

1. Established of Supreme Council for the Nile River and waterways protection from pollution according to Article (47), as repeated in Environmental law No.4/1994 as mended by Law No. 9/2009 and its executive regulations.
2. Applying principles of integrated management of water resources, and in this regard, Egyptian Government has been taking several operational steps:
    - Implement monitoring programs for water quality in Nile River and Lakes through monitoring network
    - Amend laws and their executive regulations concerning protection of water resources to deal with development and advanced technology used in the industry for wastewater treatment, such as Law No. 48/1982 for the protection of water resources from pollution and its executive regulations, amended by resolution No. 402/2009, and Law No. 4/1994 amended by Law 9/2009 regarding environmental protection and its Executive Regulation.
    - Expand in providing economically, environmentally sound technology for swage network and treatment stations in all of Egypt; in addition to raising the efficiency of existing network and station
    - Restrict issuance of clearance procedures for industrial establishments for discharging their treated industrial wastewater into waterways.
    - Encourage people to apply clean and environmental friendly technologies

AL HOCEIMA CASE

Brief introduction on the CASE

The Al Hoceima CASE is located in the central part of the Mediterranean coast of Morocco. It encompasses two large entities: 1) The Al Hoceima National Park (AHNP), the unique Marine Protected Area of the Mediterranean coast of Morocco, declared as SPAMI in 2009; and 2) The Al Hoceima Bay, one of the lowest-lying coasts along the Moroccan Mediterranean. The major issues of the region are urban sprawl, resources degradation, physical vulnerability and coastal erosion.

Description of the link with the two IRA issues: balanced urban development and natural capita

The coast of Al Hoceima is being extensively developed following the socio-economic opening up of the region. The bay experienced a coastal real estate boom including residential construction on fore dunes or on vulnerable cliffs. The combination of high population density (5310 inhabitants/ Km² in the Al Hoceima city) and exposure to various coastal hazards do not presage a secure future for coastal populations and stakes, especially in the context of climate change and unsustainable coastal development. Consequently, local authorities are faced with the increasingly complex task of balancing development, protecting biodiversity and managing coastal risks especially coastal erosion and flooding.

Selected indicators:

1. - For the IRA Natural Capital issue:

- The indicator '*Conservation condition of coastal and marine focal habitats and species in protected areas*' was evaluated for the first time, for both the Moroccan Mediterranean and the Al Hoceima National Park. It was calculated considering sensitive/ vulnerable species and habitat of conservation interest in the Mediterranean.

- For the IRA balanced urban development issue, three indicators were calculated:

- *Area of built-up space in the coastal zone*

  Lacking sufficient information and data over a long period to show the progress of changes in land use, the increase in built-up area was evaluated from the comparison between aerial photographs of 1966 and satellite images from Google Earth Pro 2012.

- *Density of the population living in the coastal zone*

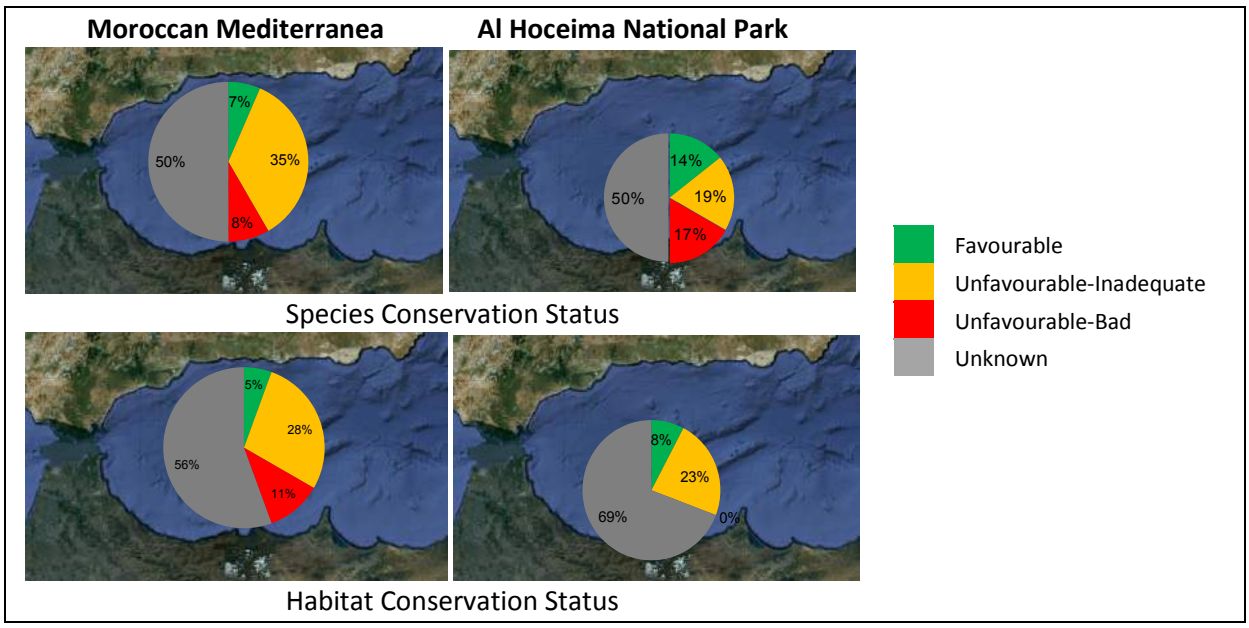
  This indicator was evaluated by comparing the number of inhabitants per square kilometer in the coastal communes of Al Hoceima and Aït Youssef ou Ali compared to the number of inhabitants in the wider administrative areas, namely the Province of Al Hoceima and the Region of Taza-Taounate-Al Hoceima.

- *Areal extent of coastal erosion*

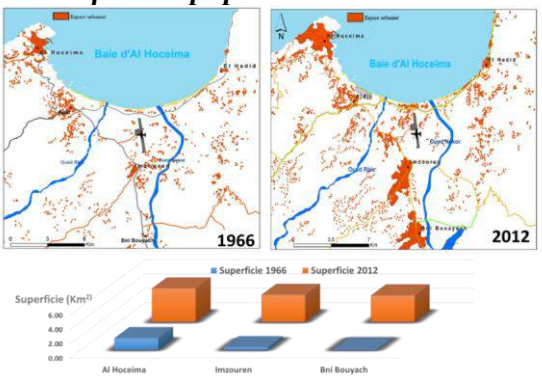
  Multi-date aerial photographs of 1958, 1973, 2003, and 2013 geometrically corrected and geo-referenced, have been used to demarcate shoreline positions. The rates of coastal erosion were performed using the Digital Shoreline Analysis System Statistical (DSAS) technique.

Presentation of spatial data maps and graphs

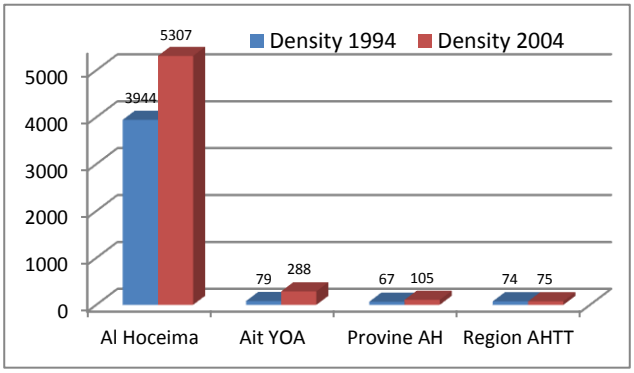
The indicator *'Conservation condition of coastal and marine focal habitats and species in protected areas'*: The values (% Favorable status) are generally higher for the Al Hoceima National Park (14% and 7% for species and habitats respectively) than for the Moroccan Mediterranean (8% for species and 5% for habitats). In both cases, the overall result should be interpreted with caution because of the unavailability of information (% of unknown conservation status exceeds 50% in all cases).

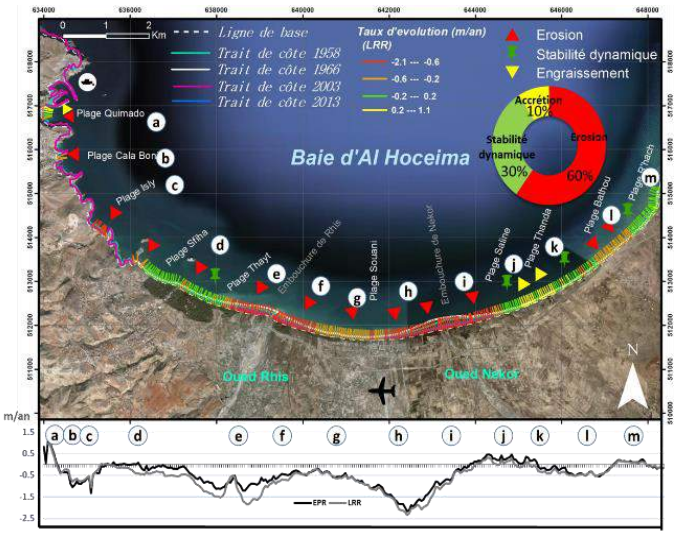


Area of built-up space in the coastal zone



Density of the population living in the coastal zone





Shoreline changes between 1958 and 2013, and rate of change (Khouakhi PhD, ongoing) (a,..m: different beaches)

Conclusion

For the balanced urban development issue, the selected indicators showed that one of the direct consequences of dense urbanization on the land use is its encroachment on natural buffer zones such as dunes and beaches, and thus increasing their exposure to coastal erosion. Setback lines should be defined and applied in accordance with the ICZM Protocol.

Regional Assessment Contribution for the Bouches-du-Rhône CASES
Lisa Ernoul and Anis Guelmami

1. **Brief introduction on the CASE**

The CASES Bouches-du-Rhône organized a three step participative approach to ICZM. The first phase involved preliminary meetings by the scientists involved in the project to organize and propose an action plan. This action plan was then shared with a major stakeholder involved in the entire CASES area. The discussion and suggestions proposed by the stakeholder allowed the action plan to be modified and validated. In the second phase, the scientist interviewed multiple stakeholders from each of the different sectors in the project area to obtain baseline information on different aspects involving local governance, priorities and information available. This information was recorded and synthesized as the base to apply the different PEGASO tools. Between the second and third phases, the territorial diagnostic was completed. LEAC and social-economic valuation were then developed based on the results of the interviews. The third phase brought the different stakeholders together to discuss the results and transfer the tools to a local authority.

2. **Description of the link with the two IRA issues, balanced urban development and natural capital**

Management issues common to different territorial units included:

- Coastal and marine natural zones are becoming increasingly fragile: wetlands in Camargue (exposed to impacts from irrigation); or marine flora and fauna of the Cote Bleue are sensitive to tourism and visits
- Population growth impacts: very high density in the Marseilles and Gulf of Fos. Low in the Camargue but growing.
- The development of farming was contrasted in the different units over the recent years. The activity remains steady in the Camargue, with a need for protecting natural zones against farming irrigation and effluent impacts. Elsewhere in the pilot study area, many farming zones are exposed to the pressure from urban expansion.
- Traffic and access issues: access, transport facility and traffic intensiveness issues exist in the different units of the pilot study for several reasons:

The lack of detailed knowledge on the environmental impacts of certain uses (including shipping and fishing port zones, marinas, beaches, industrial zones, the discharge of waste water) has caused coastal zone management strategies to be developed with a certain degree of uncertainty. Many environment impact indicators exist and can be followed by managers; but the difficulty is to share those indicators with the other managers in order to have a common use and understanding of impacts.

3. **Focus on selected indicators: presentation of the indicators selected, data available and visualization on the SDI.**

LEAC is a generic tool useful for environmental assessments and monitoring; it provides spatial indicators for regional assessment of the status and degradation of natural capital due to the over-use of natural resources. LEAC also provides multi-scale (hierarchical) outputs, to facilitate the assessment of processes that manifest on different levels e.g. continental, country, region and local level. The ecosystem accounts aim to register properties or the state of natural resources and ecosystem components in terms of quality (for example type of land-cover); quantity (volume of biomass, area of certain land-cover, number of species,…) and change in quality and quantity in time and space. The quantity and quality features are basically termed and accounted as physical “stocks”, while the change features are accounted as “flows”.

In this study case, a stock was defined by the natural capital calculated using CORINE Land Cover (CLC) maps. Time scales of work were calculated using three CLC mapping periods: 1990, 2000 and 2006. These data were used to determine the natural capital (stocks) for each period, and the land cover change maps were also used to calculate changes in terms of land use conversion and the lost/gain of natural capital between two time steps.

Once the land cover data was extracted from the CLC maps for each unit, habitats were aggregated to obtain different classes of interest based on the land use type that they cover (table 1) and the conversion rates were calculated for each of the following classes of interest:

- Conversion of agricultural land to urban area
- Conversion of natural or semi-natural land to urban area
- Conversion of natural or semi-natural land to agricultural land
- Conversion of agricultural land to industrial area
- Conversion of natural or semi-natural land to industrial area
- Conversion of agricultural land to transport infrastructure
- Conversion of natural or semi-natural land to transport infrastructure
- Conversion of agricultural land to ports
- Conversion of natural or semi-natural land to ports

4. Presentation of spatial data and maps, graphs (images)

Globally for all units in the pilot study, there were no significant changes in terms of land use between 1990 and 2006. However, given the results presented in Table 1, there was a loss of natural capital (from 58.45% to 55.75%) for the entire surface area. This loss is probably due to a sharp increase of the artificialization of the territory during the same analysed period in some coastal zones. Urbanized areas increased from 8.78% to 9.21% and industrial areas increased from 2.97% to 3.01%. Changes were also seen through the conversion of natural habitats into agricultural areas. It is important to note that although the surface areas remain relatively stable in terms of used surface, it does not necessarily mean that there has been no evolution as natural habitats might be compensated by losses in urbanization for example. Further analysis took into account the different types of changes previously defined (LEAC indicators).

Table 1: Classes of interest changes over time for the entire pilot study area.

Class of interest	1990		2000		2006	
	Area (ha)	%	Area (ha)	%	Area (ha)	%
Urban areas	15225	8.78	15828	9.13	15978	9.21
Agricultural land	50082	28.88	49621	28.61	49481	28.53
Natural or semi-natural land	101363	58.45	96755	55.79	96691	55.75
Transport infrastructures	715	0.41	743	0.43	743	0.43
Industries, mines, dumps	5155	2.97	5174	2.98	5228	3.01
Ports	885	0.51	802	0.46	802	0.46

5. Contextualization of the results in the coastal issues and the ICZM

Taking into account the different municipalities constituting the pilot study area, the most important conversion rates (figure 1) were those of natural habitats to agricultural and built areas (urban, industry and ports), as well as agricultural areas converted into built lands (urban and/or industrial). Moreover, with this analysis, it was possible to identify some trends in economic policies of each administrative units of the Bouches du Rhone pilot site. For example, the communities with the highest rate of industrialization in terms of land cover are those of Martigues and Port-Saint-Louis-du-Rhône, which both are in the geographic unit of the Gulf of Fos. However, the municipalities where urban sprawl was the highest during the 16 years analysed, were Fos-sur-Mer, Marseille and

Sausset-les-Pins (located respectively in units of the Gulf of Fos, Marseille and the Cote Bleue). These urban expansions may be due to strong demographic growth, which itself could result from an economic attractiveness of these regions between 1990 and 2006 (industrial and port activities, agriculture and tourism). Finally, with the LEAC tool, it was possible to localize the changes through maps (Figure 2).

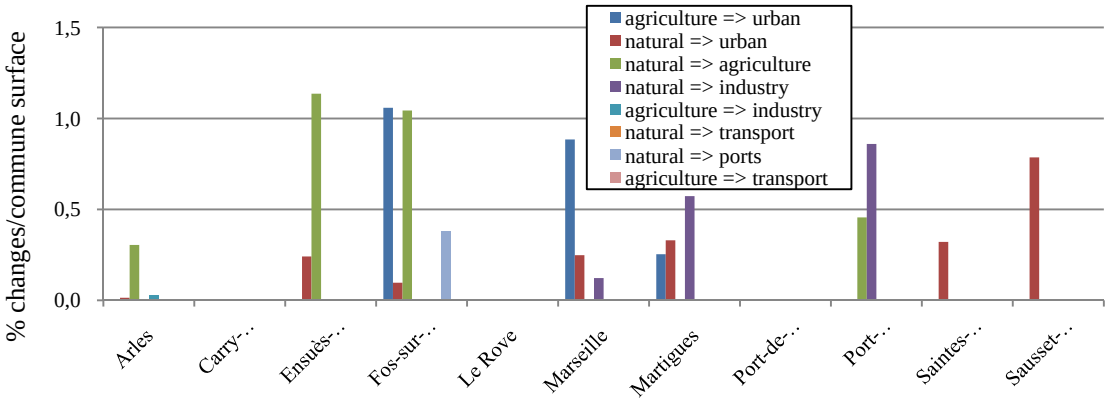


Figure 1: LEAC indicators corresponding to different land use changes between 1990 and 2006.

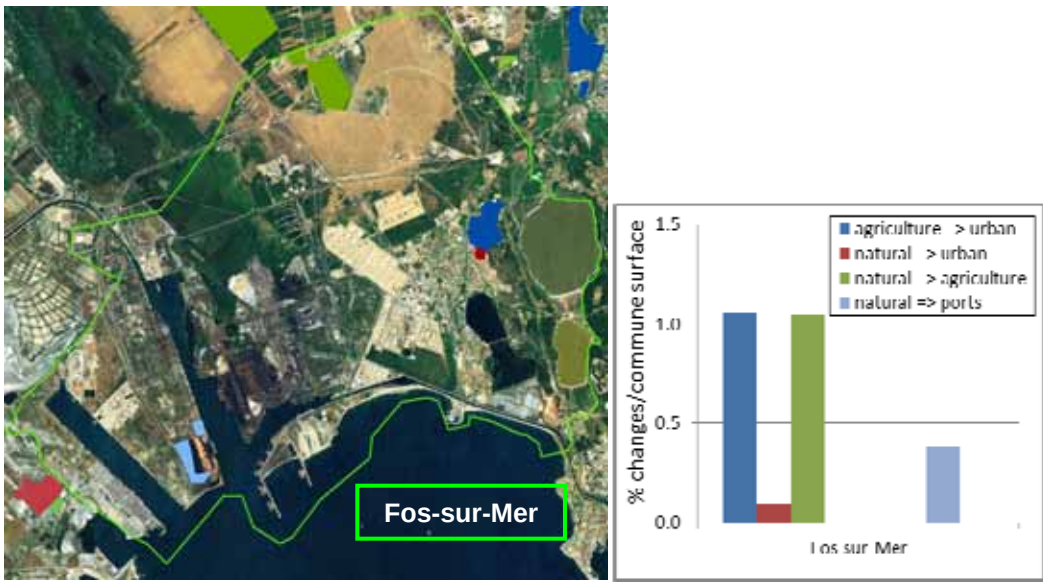


Figure 2: Land use and land cover change map in the municipality of Fos-sur-Mer between 1990 and 2006.

6. Conclusion

Given the participants' interest in the PEGASO tools, a final restitution was presented in a participative workshop to validate the results and to determine potential further uses. The participants validated the territorial diagnostic and were very motivated by the preliminary LEAC results. The participants highlighted their interest in the LEAC tool and particularly appreciated the visual attractiveness of the maps. During the workshop it was mentioned that the maps allowed the stakeholders to visualise the evolution of the sites overtime and the interactions between the different units. Various suggestions were offered by the participants to improve the LEAC tool. In order to keep the tool as user-friendly as possible, the only feasible recommendation was to add the protected area boundaries to the maps. The completed tool is now being transferred to the local Water Agency who will be responsible for updating the classes every five years (with the available CLC data). Using a participative approach for the territorial diagnostic and LEAC ensured an open dialogue between scientist and local stakeholders. This dialogue proved successful in creating tools that will be useful to the management of the coastal region after the end of the PEGASO project.

INDICATORS CALCULATED FOR COASTAL ZONES OF THE NORTH ADRIATIC CASE.

1.1 BRIEF INTRODUCTION ON THE CASE

The North Adriatic coast comprises Veneto and Friuli Venezia Giulia regions from the national border between Italy and Slovenia to the mouth of the southern tributary of the Po Delta system (i.e. Po di Goro) with an overall length of about 286 km. It is a representative example of a Mediterranean coastal zone subject to a multitude of significant and rapidly evolving pressures from natural and anthropogenic drivers that are recurrent in the Mediterranean coastline. It holds high ecological, cultural and economic value and include major centres of population and agriculture.

The North Adriatic coast, comprises a very precarious coastal environment subject to continuous morphological changes that can be appreciable even over short geological time (e.g. erosion is active in several places). Many areas, particularly the Lagoon of Venice and around the Po river Delta, are located below the mean sea level and affected by natural or man-induced subsidence. Furthermore, the municipality of Venice has been experiencing an increase of high tide events with consequent flooding of the city. Moreover, the historical observations and future projections of isostatic and tectonic movements show that the North Adriatic coast (particularly Venice, Grado and Marano lagoons) is particularly vulnerable to future sea-level rise. Therefore, climate change and the related consequences on sea-level rise, storminess and coastal erosion are a prominent issue for the case study area both considering the vulnerability of fragile ecosystems such as coastal lagoons, and the concentration of cultural and socio-economic values.

1.2 LINK BETWEEN INDICATORS FOR THE NORTH ADRIATIC CASE AND IRA ISSUES

Selected indicators for the North Adriatic case are: area of built-up space in the coastal zone and size and density of the population living in the coastal zone. These indicators are mainly related to three of the policy objectives of ICZM protocol, article 6, which are related to different ICZM principles. Specifically:

- Preserve the wealth of natural capital in coastal zone;
- Formulate land-use strategies, plans, and programmes covering all coastal and marine uses;
- Have a balanced use of coastal zone, and avoid urban sprawl (the trend of population living in a risk area should be identified).

The proposed indicators allow assessing how coastal areas are impacted by human presence. These factors have also a great influence on the exposure and vulnerability of the considered region to climate change impacts, and can increase the potential risks and damages related to coastal hazards such as sea-level rise, storm surge flooding, coastal erosion. The definition of new policies, plans and programs aimed at achieving the aforementioned ICZM policy objectives, should therefore take into account the current and past situation of the region represented by the proposed indicators and, as an extension, integrate this information within climate change scenarios.

1.2.1 AREA OF BUILT-UP SPACE IN THE COASTAL ZONE

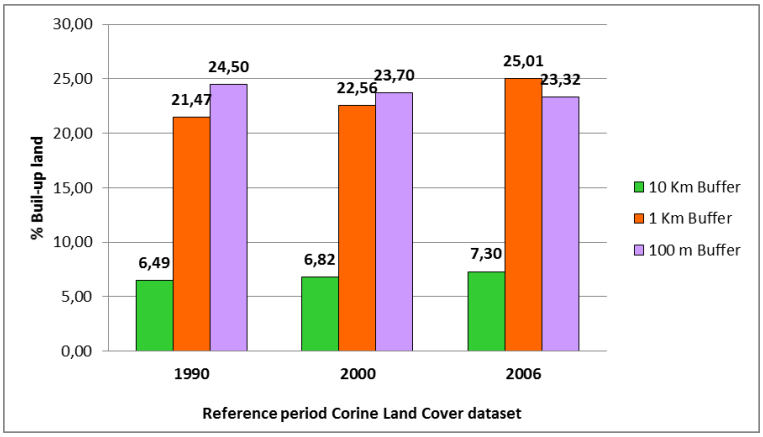
The main aim of this indicator is to analyse the extent to which the coastal zone has been built-up over the past several years in order to highlight the degree of pressure on the coast and the likelihood of further changes in the future. With these purpose this indicator was calculated with reference to five geographical areas:

- The reference area, related to Veneto and Friuli Venezia Giulia Regions (North Adriatic sea);
- The coastal municipalities localised in the reference area;
- The non-coastal municipalities in the reference area;
- A buffer zone of 10 km of distance from the coastline;
- A buffer zone of 1 km of distance from the coastline.

Moreover, a specific analysis has been realized in order to highlight the percentage of built-up lands included in a buffer zone of 100m from the coastline. In fact, the Article 8 of the ICZM Protocol for the Mediterranean orders parties to establish a no-construction zone that may not be less than 100 m in width, as from the highest winter waterline, and if the countries have stricter regulations they should keep applying them. The countries may make exceptions to the ban of construction within the 100 m zone only for the projects of public interest and in areas having particular geographical or other local constraints, especially related to population density or social needs, where individual housing, urbanization or development are provided by national legal instruments.

The area of built-up space (urban areas) is extracted from the Corine Land Cover (CLC) land use map for the years 1990, 2000 and 2006 and selecting only the artificial areas, labelled as land use 1.1 (urban fabric), 1.2 (industrial, commercial and transport units) and 1.3 (mine, dump and construction sites).

Results show a progressive increase of the built-up land in all analysed areas, except in the buffer zone of 100 m. In all the three periods (i.e. 1990, 2000 and 2006), the 1 km and 100 m buffers are the most built-up areas, where the percentage of built up land is higher than 20% (while in all the other regions is similar to that of the 10 km buffer, i.e. around 7 % with an increase of 1% along the considered period).



1. Percentage of built-up land for 10 km, 1 km and 100 m buffer.

1.2.2 SIZE AND DENSITY OF THE POPULATION LIVING IN THE COASTAL ZONE

This indicator is aimed at analysing the degree to which the population of a defined region is concentrated in the coastal zone in order to balance use of coastal zone in the future planning tools, and thus avoid urban sprawl. Tracking changes in the distribution of the population of a coastal region over time will help in the assessment of the amount of pressure being exerted on coastal resources by the demand for land, housing, employment, public services, transport and so on. We are especially interested in determining whether such pressure is general throughout the wider reference region or specific to the coast or specific coastal areas. Accordingly, the indicator was calculated with reference to three geographical areas:

- The reference area, related to Veneto and Friuli Venezia Giulia Regions (North Adriatic sea);
- The coastal municipalities localised in the reference area;
- The non-coastal municipalities in the reference area;

The dataset used to calculate this indicator is retrieved from the Population and Housing Census of 1991 and 2001 realized by the Italian National Institute of Statistics -ISTAT- (http://www.istat.it/it/censimento-popolazione-e-abitazi/).

Results show that in coastal municipalities the population is almost the double than in non coastal municipalities. This indicates a higher pressure related to human presence in coastal zones of the considered region. Despite this in the considered period (i.e. 1991/2001) the density in coastal municipality slightly decreased. Further data related to the 2011 census or to previous census should be considered in order to identify a trend.

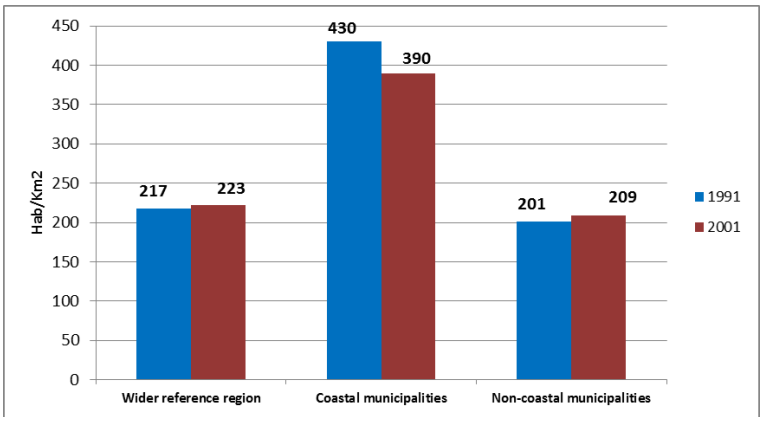


Figure 2. Population Density 1991/2001 for the different areas.

1.3 CONCLUSIONS

The results obtained from the indicators show that coastal zones of the Veneto and Friuli Venezia Giulia regions are characterized by a high anthropic pressure due to the presence of built-up areas and population density. The analysis of changes trough time shows that in the last 20 years the situation is almost stable. More recent data should be integrated in the analysis in order to see if recently this trend changed.

The presented indicators can support the assessment of the exposure and vulnerability to climate change impacts in coastal zones, such as sea-level rise, storm surge flooding and coastal erosion. Specifically, they can be integrated with the assessment of climate change hazard scenarios in order to identify and prioritize areas and targets potentially at risk from climate change.

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Ecosystem Accounts of Assessing Urban Development and Natural Capital in the PEGASO area

UNOTT contribution to Task 5.2 “Integrated Regional Assessment” (Task leader Francesca Santoro)

Date / version	3rd September 2013/version 1.0

Authors	**Emil Ivanov** Roy Haines-Young Marion Potschin

Executive Summary

The purpose of this document is to give a timely contribution into the "PEGASO Project Integrated Regional Assessment end-user Meeting" ("Rimini workshop" on 22-23 September, 2013 and into sub-chapter 3.2.1. "Natural Capital and Balanced Use of Coastal Zone" (the IRA) in time for the PSC meeting.

This document presents ecosystem accounts and related indicators, prepared for the regional assessment undertaken in PEGASO. It includes:

- Application of land-cover, protected areas and species accounts to assess progress towards conservation of natural capital, and;
- Application of land accounts to assess progress towards balanced urban development in the Mediterranean and Black-Sea coastal areas.

The document starts with a short overview of dominant landscapes across the coastal strips of the two sea basins and follows with estimates on the spatial and temporal change.

The reports concludes that PEGASO land cover is more appropriate for assessments at wide regional level across the entire Mediterranean and Black Sea basins, while CORINE land cover performs better at higher spatial detail level.

1. Dominant land types and land accounting inputs

1.1 Dominant land types map

The concept of 'dominant land types' was explained in Deliverable 4.2.2. Domination of major land cover and use in the Mediterranean and Black Sea Basins was assessed for 9 classes (level 2 of PEGASO land cover); the method assigned dominance by looking at the single or combined cover types that made up at least 50% or the area of a given spatial unit. The results are shown in Figure 1.

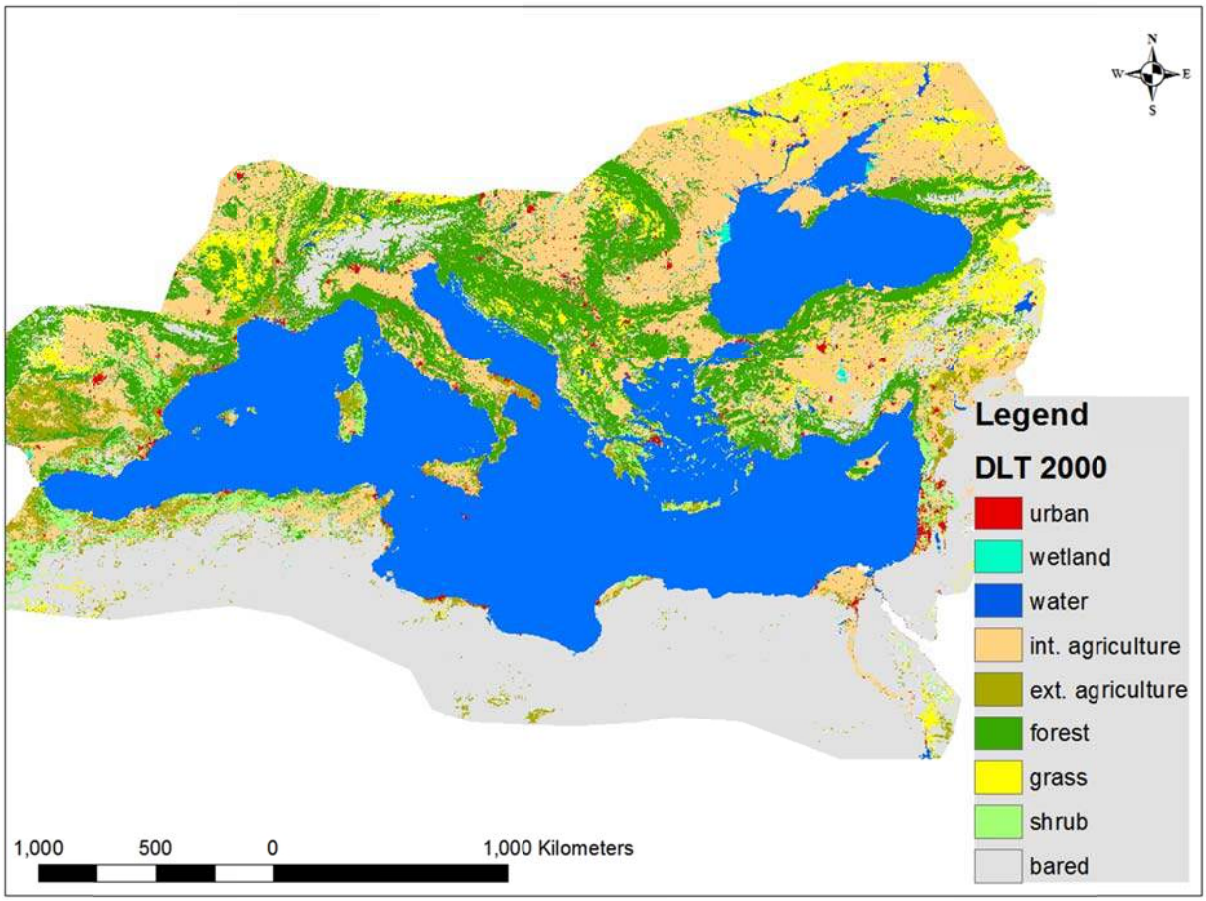


Figure 1: Dominant land types

Figure 1 shows that while urban landscapes pick out the main cities and their surroundings across the study area, they are especially evident in densely populated areas such Lebanon, Palestine, Israel and Malta. Natural and semi-natural landscapes (forest, grasslands, shrublands, extensive agriculture) dominate on the coasts around the south and Easter part of the Black sea, the Dalmatian coast, and parts of the south west Mediterranean. Intensive agriculture landscapes dominate the Nile Delta, Po valley, parts of the northwest Black Sea.

1.2 Land cover accounting inputs

Two sources of accounting inputs, covering a 50 km wide coastal strip of the Mediterranean and the Black Sea were used, namely: CORINE land cover and PEGASO land cover (these inputs are described in Deliverable 4.3 and 4.4). Their coverage is illustrated in Figure 2.

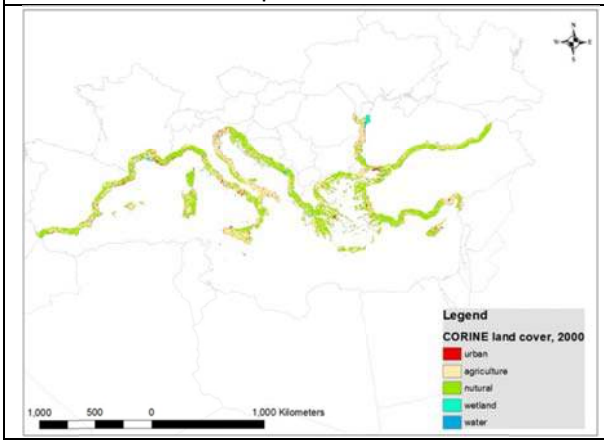
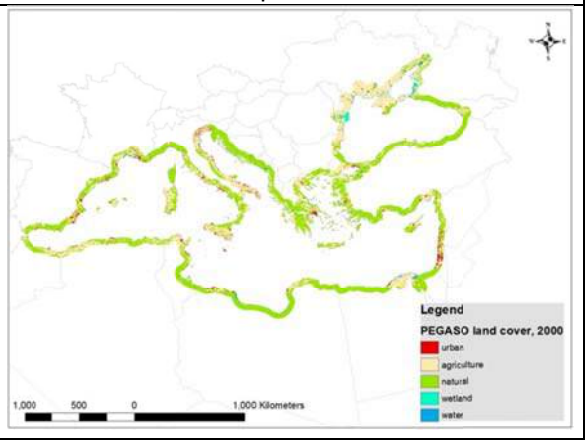
CORINE Land cover inputs	PEGASO land cover inputs
	

Figure 2: Accounting inputs, CORINE LC 2000 (left) and PEGASO land cover 2000 (right)

The accounting inputs were integrated in a database, in which the land cover areas are linked to the spatial units defined through the intersection of administrative divisions (source - World administrative divisions) and three buffers around the coastline, with 1km, 10, and 50km distance. Consequently accounts of urban, natural and protected areas were extracting for various spatial units: countries; countries and coastal buffer divisions; and units defined by the intersection of administrative divisions (source – World Administrative Divisions) and the coastal buffers. The latter are further referred to as '*coastal accounting units*'.

2. Accounts for natural areas

2.1 Sock account for natural areas

These accounts include forested and open surfaces, wetlands and water surfaces (classes 3, 4 and 5 from level 1 of PEGASO and CORINE land cover classifications).

Stocks of areas containing natural areas within the 50 km coastal stripes of the countries were assessed using four categories:

1. High, above 60%
2. Intermediate, between 30% and 60%
3. Low, between 15 and 30%
4. Critically low, below 15 %

The temporal changes were assessed using the following categories:

1. Increase, exceeding 2.5 % can be considered high
2. Increase between 1 and 2.5% intermediate
3. Increase between 0.1 and 1% is low
4. Decrease between -0.1 and -1% is low
5. Decrease between -1 and -2.5 – intermediate
6. Decrease of more than -2.5, is high

First, the accounts of areas were extracted at country level.

Table 1: Accounts of natural areas per country from CORINE land cover (stocks and change between 1990 and 2006)

Accounts from CORINE land cover							
	Total area	**Natural area (ha)**					
countries		1990	2000	2000%	2006	change (06 -90)	change %
Albania	1655237	not assessed	1113452	67.27	1031353		
Bosnia and Herzegovina	760156	not assessed	548866	72.20	551062		
Bulgaria	1633656	623550	623553	38.17	626027	2477	0.15
Croatia	2577953	1714036	1717935	66.64	1876188	162152	6.29
Cyprus	926764	not assessed	412223	44.48	403478		0.00
France	4179975	2611807	2600568	62.21	2586832	-24975	-0.60
Gibraltar	670	291	291	43.42	291	0	0.00
Greece	10547540	5910657	5890728	55.85	not assessed		
Italy	17430048	6296164	6344888	36.40	6211286	-84877	-0.49
Malta	32475	5947	5838	17.98	5921	-25	-0.08
Monaco	278	0	0	0.00	0	0	0.00
Montenegro	571682	452371	452743	79.19	452894	523	0.09
Romania	1717696	567974	567888	33.06	568531	556	0.03
San Marino	5869	948	948	16.15	985	37	0.63
Slovenia	509558	382770	382508	75.07	382046	-723	-0.14
Spain	6888312	3490901	3451698	50.11	3426733	-64168	-0.93
Turkey	17683145	10311771	10328820	58.41	10318662	6890	0.04

According to the accounts extracted from CORINE Land Cover (Table 1), the high proportions of preserved natural and semi-natural areas, exceeding 60% of total unit area, are located in the countries around the Dalmatian Coast of the Adriatic (Slovenia, Montenegro, Croatia, Albania, figures consistent with the dominant land types defined from PEGASO land cover) as well as France. Intermediate proportions between 30 and 60% are located in Spain, Greece, Turkey, Italy, Romania, Bulgaria, Cyprus; and low – in Malta. No country shows 'critically low' values of natural areas on its coast.

The percentages of change show that Croatia is the country with high increase of natural areas. Italy and Spain have a low decrease.

Table 2: Accounts of natural areas per country from PEGASO land cover (stocks and change between 2000 and 2011)

Accounts from PEAGASO land cover						
		Natural area (ha)				
country	Total area	2000	2000%	2011	change	change %
Albania	1655237	1222347	73.85	1227545	5198	0.31
Algeria	5336054	2743848	51.42	2735107	-8741	-0.16
Bosnia and Herzegovina	760156	731353	96.21	733858	2504	0.33
Bulgaria	1633656	675991	41.38	694911	18920	1.16
Croatia	2577953	2380893	92.36	2380017	-877	-0.03
Cyprus	926764	485297	52.36	484888	-409	-0.04
Egypt	6875288	4806022	69.90	4696685	-109337	-1.59
France	4179975	2665078	63.76	2668598	3520	0.08
Georgia	1935494	1357711	70.15	1364626	6914	0.36
Gibraltar	670	530	79.11	530	0	0.00
Greece	10547540	6734555	63.85	6812844	78289	0.74
Israel	968829	248556	25.66	250094	1537	0.16
Italy	17430048	7280921	41.77	7405705	124785	0.72
Lebanon	910782	567685	62.33	570661	2975	0.33
Libya	8503125	7241057	85.16	7168103	-72954	-0.86
Malta	32475	3636	11.20	3642	6	0.02
Moldova	518382	40388	7.79	43385	2997	0.58
Monaco	278	26	9.20	26	0	0.00
Montenegro	571682	537878	94.09	538906	1029	0.18
Morocco	2101777	1178873	56.09	1183921	5048	0.24
Palestinian Territory	324507	91903	28.32	91555	-348	-0.11
Romania	1717696	519301	30.23	519642	340	0.02
Russian Federation	5121738	2644277	51.63	2574578	-69699	-1.36
San Marino	5869	2397	40.84	2489	92	1.56
Slovenia	509558	492987	96.75	492700	-287	-0.06
Spain	6888312	4420784	64.18	4430058	9274	0.13
Syria	969910	592477	61.09	593675	1198	0.12
Tunisia	4305403	2658711	61.75	2643288	-15424	-0.36
Turkey	17683145	12575094	71.11	12589808	14713	0.08
Ukraine	8943436	1343708	15.02	1324282	-19427	-0.22

According to the accounts on natural areas stocks from PEGASO land cover (Table 2), apart from the Dalmatian countries, Greece, Turkey and Spain have also preserved high proportions of such areas. All the south and east Mediterranean countries, except Israel, Palestine and Morocco are also in the same category, but it should be noted that this is mainly because in this analysis the deserts are

considered 'natural area'. Critically low extent of natural area is registered only in Malta according to this source, with Ukraine, just above the threshold (15%) and low in Israel and Palestine.

The account of change indicates intermediate losses on the Russian coast and Egypt and intermediate increase in Bulgaria. There is a low increase in Albania, Georgia, Greece and Italy and a low decrease in Ukraine, Tunisia and Palestine.

The accounts extracted per coastal accounting units are shown next.

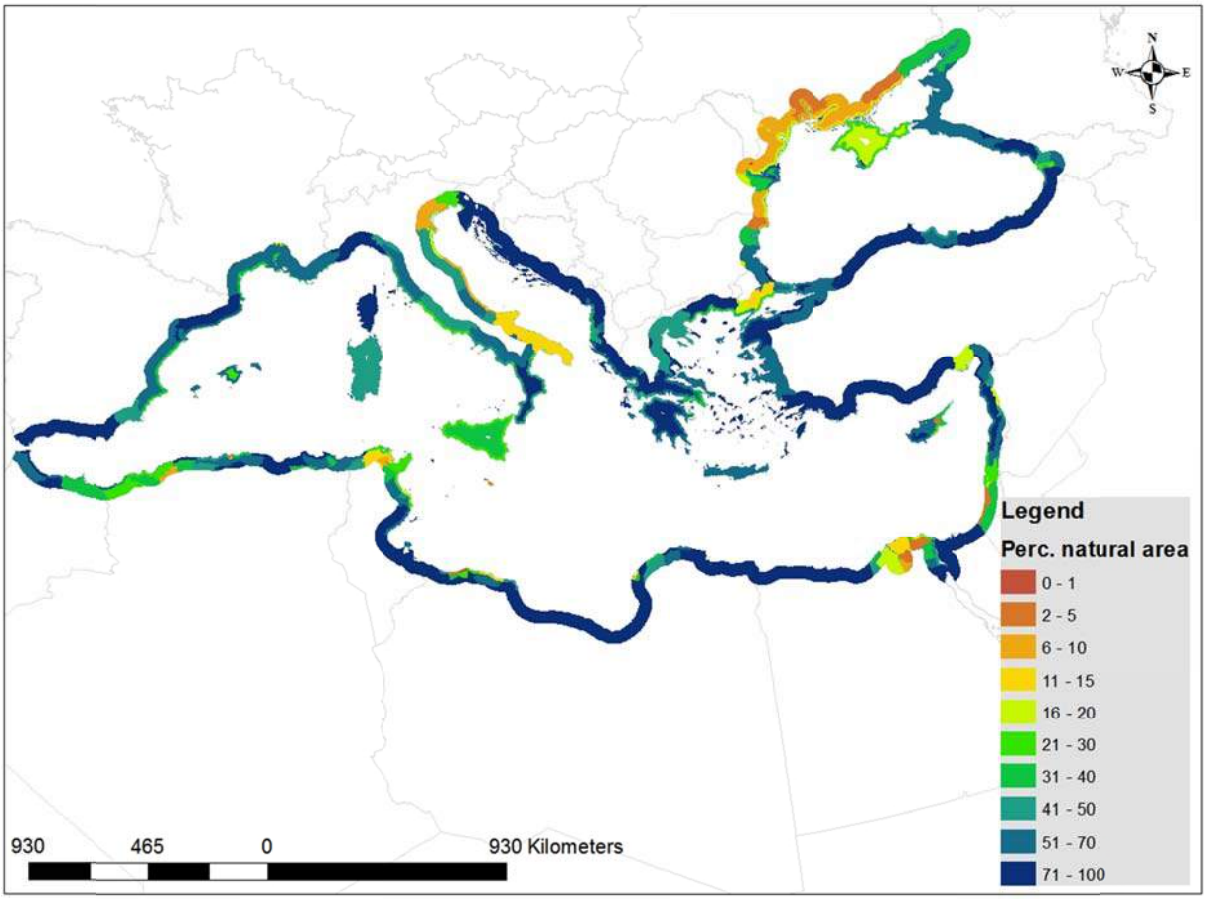


Figure 3: Map of natural area accounts from PEGASO land cover in year 2000, estimated as a per cent from the total area the coastal accounting units

The map (Figure 3) illustrates the areas where higher shares of natural areas were depleted. It indicates that coastal areas of the Black Sea countries contain higher percentages of natural land compared to the hinterland, e.g. in Bulgaria, Romania, Ukraine and also in Algeria. Several Mediterranean countries show the opposite – a lower share of natural land closer to the coast line, including Spain, France, Israel and Italy.

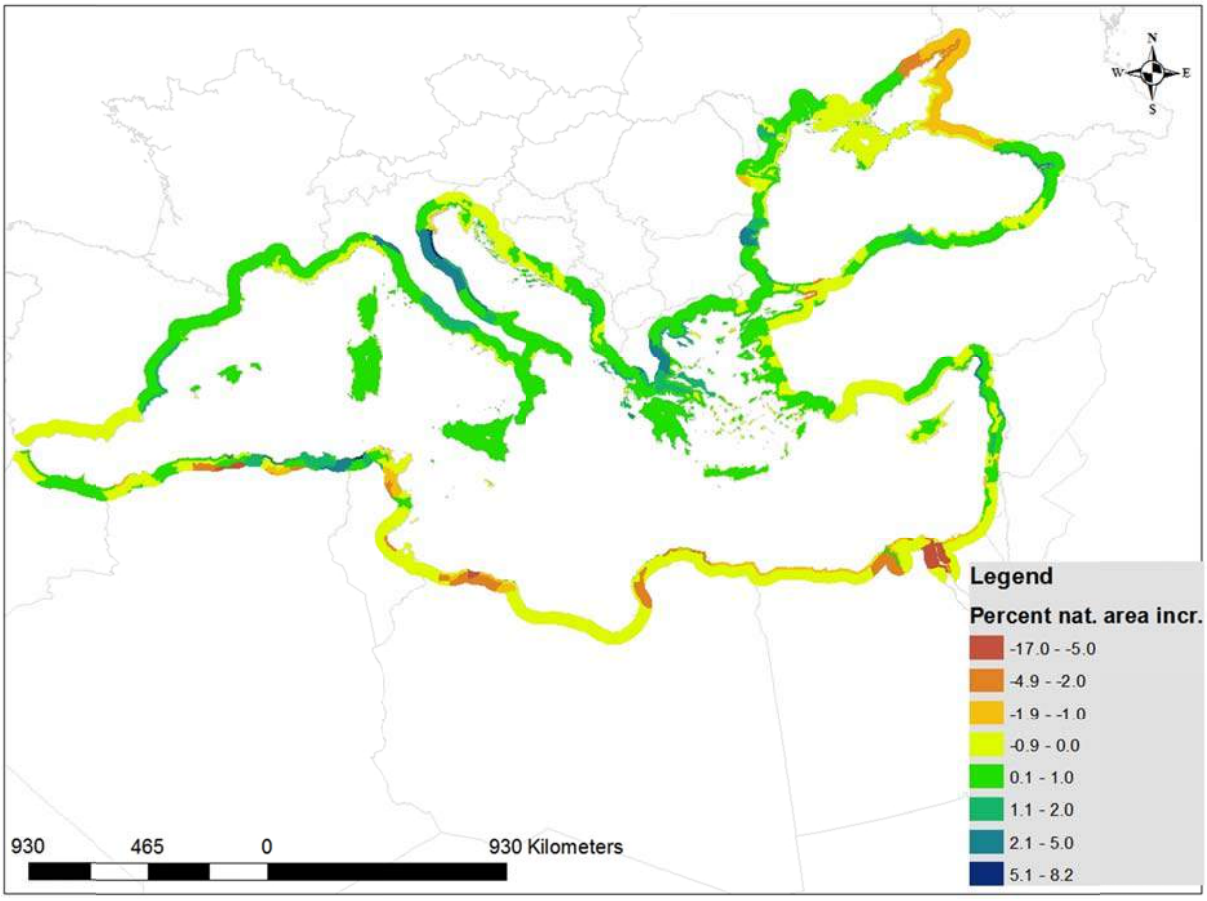


Figure 4: Map of temporal change of natural areas from PEGASO Land cover (between 2000 and 2011), expressed as a per cent from total unit area of the coastal accounting units.

This map (Figure 4) indicates a general increase of natural areas in the north Mediterranean, except Andalucia and a decrease in the south, except Algeria. The highest rate of natural area increase is registered on the 10km coastal zone of the Italian Adriatic area, also certain parts of Spain, Greece, Bulgaria and Turkey.

2.2 Accounts of protected areas

The accounts were estimated using the World Database of Protected Areas. The results are shown for countries coastal zone divided into three buffers and for coastal accounting units (Figure 5).

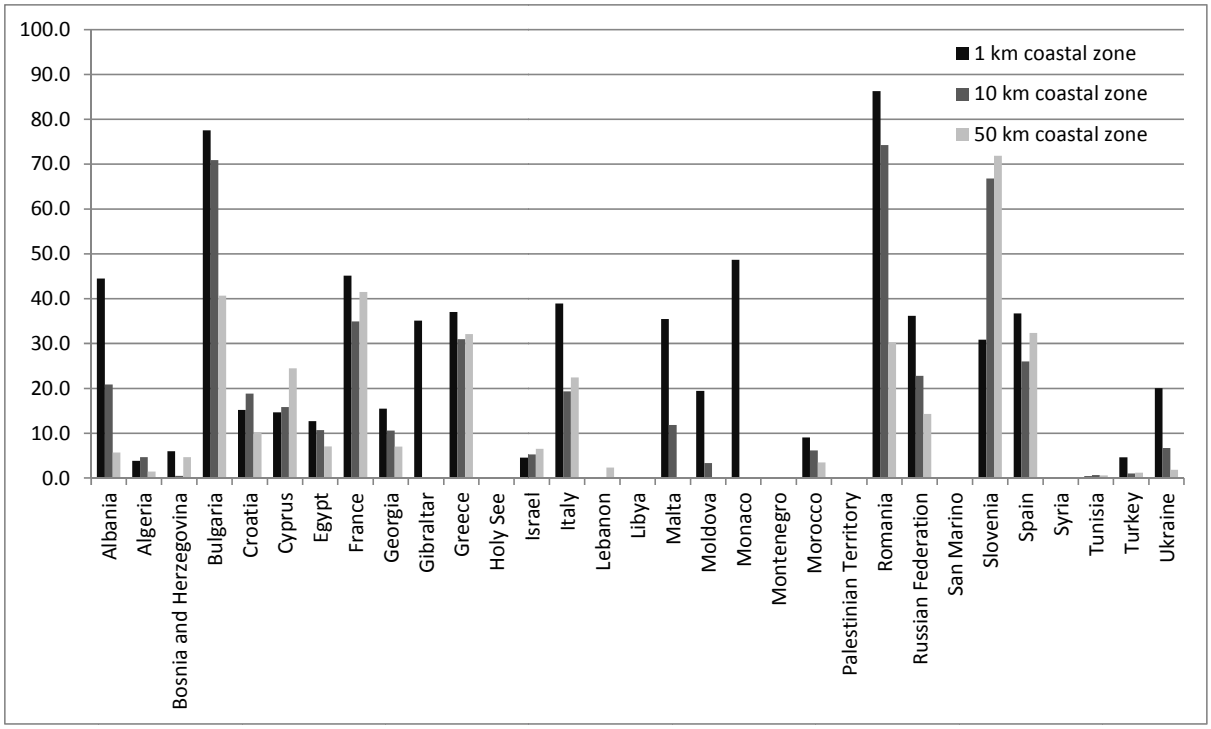


Figure 5: Per cent protected areas for three buffers from the coast per country

Figure 5 shows generally higher per cent cover on in the first km around the coast, except for Cyprus, Israel and Slovenia.

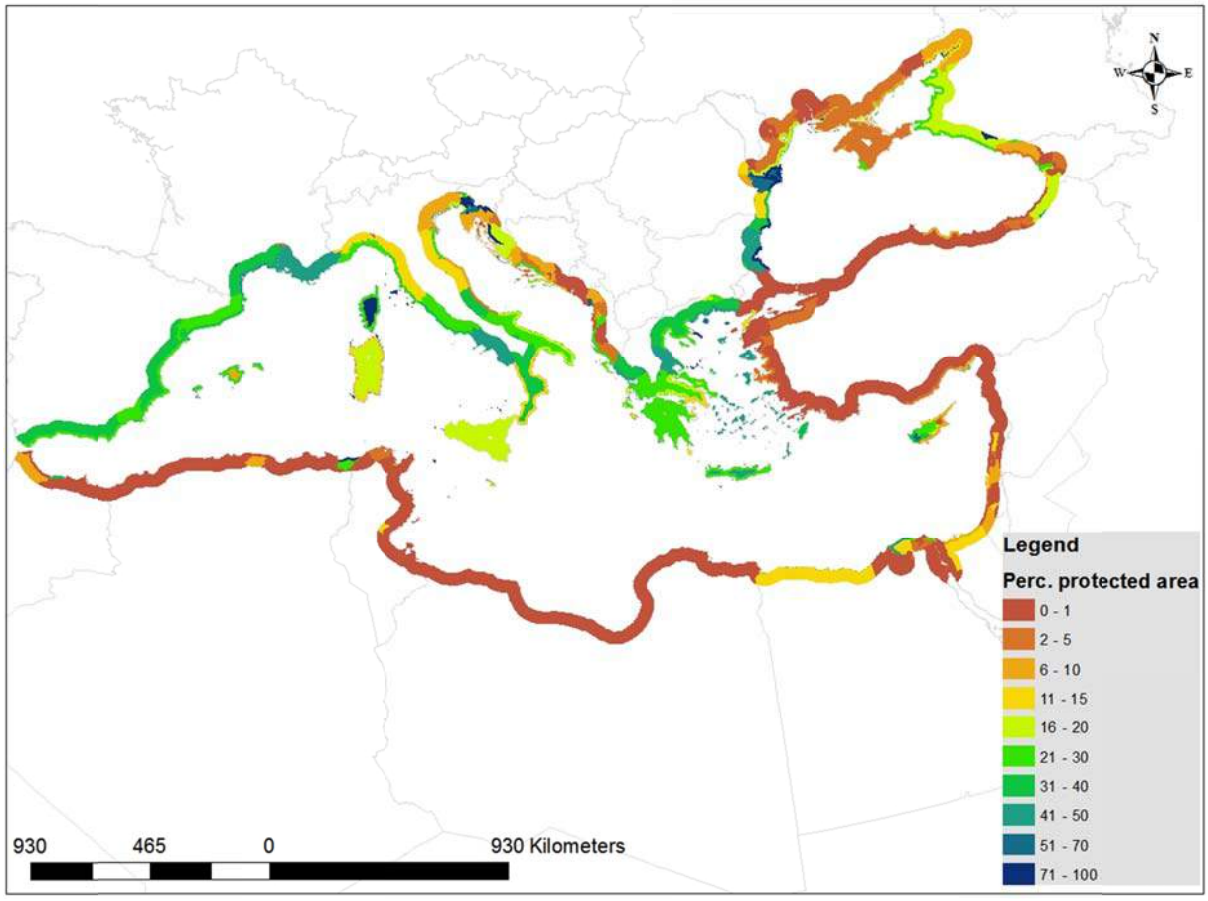


Figure 6: Per cent protected areas for three buffers from the coast per country

The northern countries, especially the ones that are part of the EU, have relatively high percentage of their coast included in protected areas, while certain countries from the southern parts of the Mediterranean do not appear to have any. Nevertheless, this situation could be due the difficulty of collecting such data for these countries and including it in the global source used for this assessment.

2.3 Maps of green-blue areas and their connectivity

An index summarising the extent of natural areas, including the same areas from the above accounts, but also 5% of the intensive and 75% of the extensive agriculture and adjusting the desert with 50% connectivity (rather than 100) was estimated using the inputs form PEGASO Land cover in 2011. The index is called 'Green Blue Areas and Connectivity' (GBAC), with green-blue indicating the amount of habitat structures available to supporting biodiversity, and the connectivity – supporting dispersion and migration processes. The index is expressed in a range from 0 to 100, where:

a) areas below 5 could be characterised as having no green-blue structure, nor connectivity

b) between 5 and 25 – low value of supporting structure and very limited connectivity

c) between 25 and 50 – intermediate values of both

d) between 50 and 75 – high values of supporting structure and connectivity and

e) above 75 – very high values.

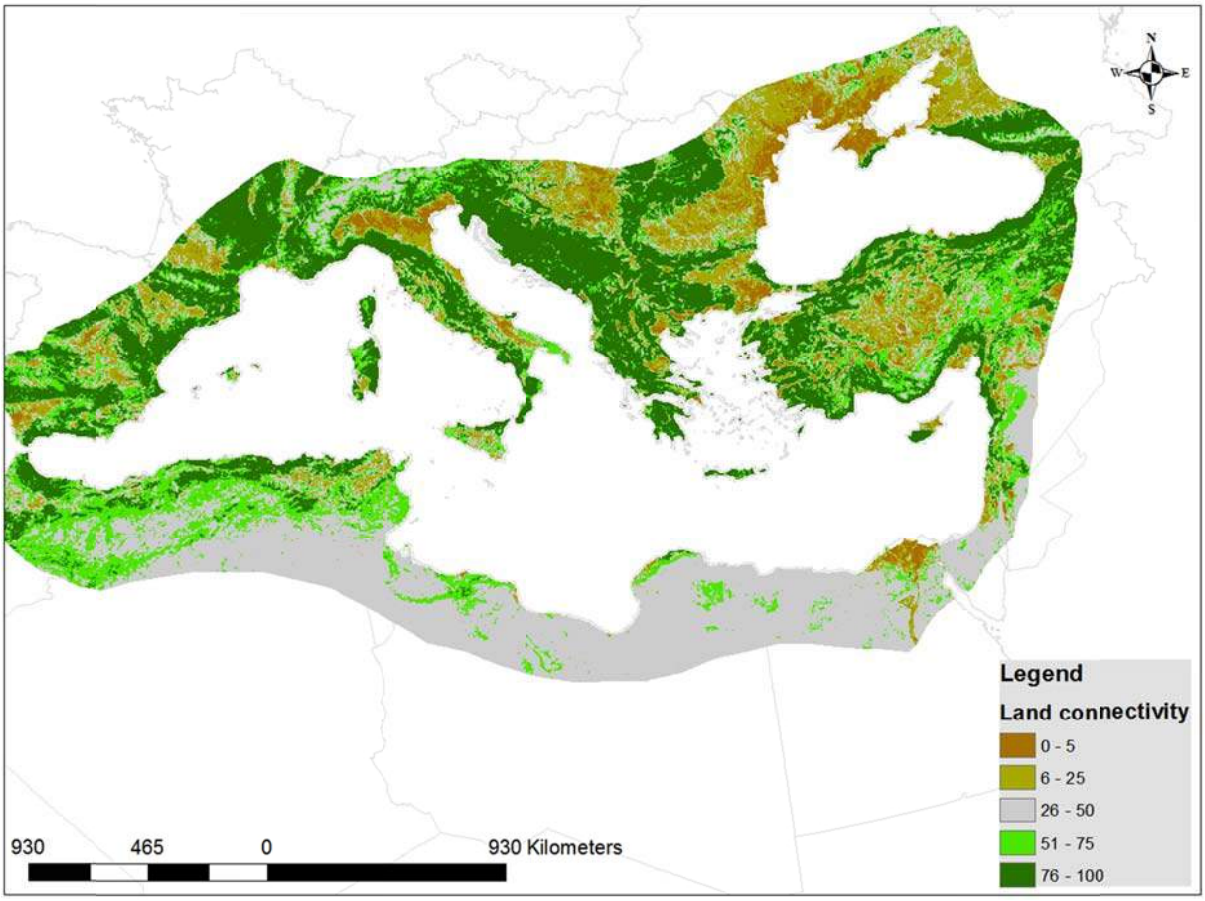


Figure 7: Green-blue areas and corridors (GBAC) extracted from natural areas in PEGASO land cover 2011

The results are shown in Figure 7. The lowest values of the index are located in the urbanized and intensively crop-cultivated lands. Highest values occupy most of the mountain forested areas.

The index was applied as weight to adjust the distribution of IUCN classified species, the density of which was estimated in a 10 km grid covering PEGASO study area (Figure 8).

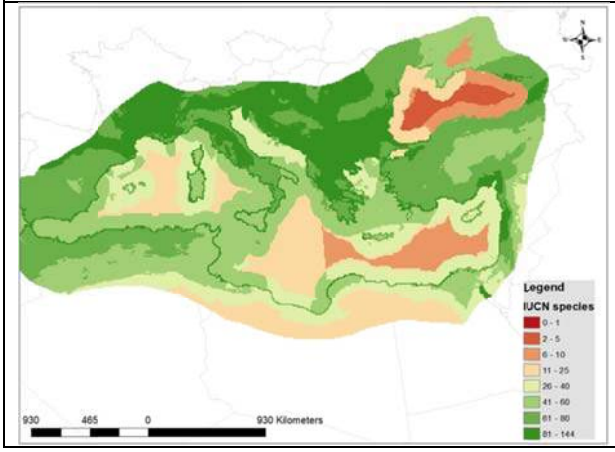
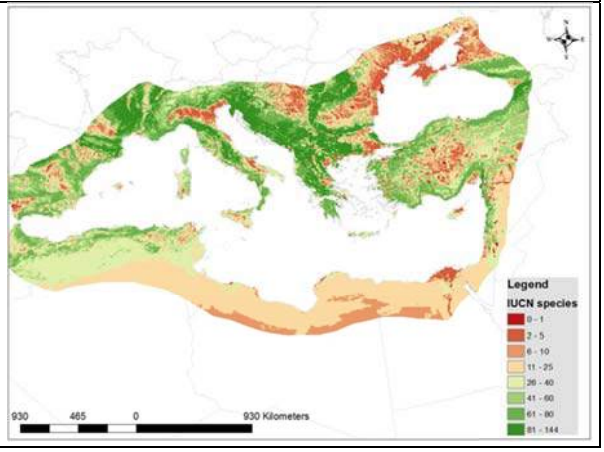
Number of IUCN species	Number of IUCN species weighted by GBAC
	

Figure 8: Number of IUCN classified species adjusted to GBAC

The species distribution map can be used for further spatial analysis of important biodiversity conservation patters around the Mediterranean and the Black Sea.

3. Urban accounts

The extent of areas of urbanized land within the 50 km coastal strips at country level are assessed in four categories:

1. Highly urbanized, above 25%
2. Intermediate, between 3% and 25%
3. Low, between 1 and 3 %
4. Very low, below 1 %

In terms of change:

5. Increase, exceeding 1.5 % can be considered high
6. Increase between 0.5 and 1.5% intermediate
7. Increase between 0.1 and 0.5% is low
8. Decrease between -0.1 and -0.5% is low
9. Decrease between -0.5 and -1.5% – intermediate

The results (Table 3) are shown for countries, first, countries and coastal buffers, second and coastal accounting units, last.

Table 3: Accounts of urban areas per country from CORINE land cover

Accounts from CORINE land cover							
		Urban area (ha)					
countries		1990	2000	2000%	2006	change (06 - 90)	change %
Albania	1655237	not assessed	28012	1.69	65667		
Bosnia and Herzegovina	760156	not assessed	7974	1.05	9444		
Bulgaria	1633656	83592	83707	5.12	84967	1375	0.08
Croatia	2577953	61364	62655	2.43	71155	9791	0.38
Cyprus	926764	not assessed	68824	7.43	77829		
France	4179975	242751	262007	6.27	292334	49583	1.19
Gibraltar	670	281	296	44.14	296	15	2.22
Greece	10547540	209300	239764	2.27	not assessed		
Italy	17430048	763437	812027	4.66	846561	83124	0.48
Malta	32475	8955	9193	28.31	9201	246	0.76
Monaco	278	237	238	85.40	239	2	0.61
Montenegro	571682	11575	11715	2.05	12334	759	0.13
Romania	1717696	83303	84898	4.94	87476	4173	0.24
San Marino	5869	594	661	11.27	733	140	2.38
Slovenia	509558	8481	8627	1.69	8981	500	0.10
Spain	6888312	244899	308622	4.48	362764	117865	1.71
Turkey	17683145	340926	489711	2.77	508025	167099	0.94

The accounts of urban area extents on the coast of the assessed countries show Monaco, Gibraltar and Malta as highly urbanized; Bulgaria, Italy, France, Cyprus, Romania, and Spain intermediate; Albania, Montenegro and Turkey – low.

According to areas of urban expansion, Spain and Gibraltar display high rates; and France, Turkey and (almost) Italy intermediate.

According to the PEGASO land cover source (Table 4) the highly urbanized countries are Israel, Malta, Monaco and Palestine; intermediate – Cyprus, France, Greece, Italy, Lebanon, Spain and Tunisia; and the rest are low.

Table 4: Accounts of urban areas per country from PEGASO land cover

Accounts from PEAGASO land cover						
		Urban area (ha)				
country	Total area	2000	2000%	2011	change	change %
Albania	1655237	29753	1.80	30399	646	0.04
Algeria	5336054	137135	2.57	151053	13918	0.26
Bosnia and Herzegovina	760156	10364	1.36	10083	-281	-0.04
Bulgaria	1633656	40513	2.48	41571	1058	0.06
Croatia	2577953	44671	1.73	44548	-123	0.00
Cyprus	926764	58618	6.32	60629	2011	0.22
Egypt	6875288	142597	2.07	183796	41198	0.60
France	4179975	280708	6.72	285885	5177	0.12
Georgia	1935494	35771	1.85	31809	-3962	-0.20
Gibraltar	670	not assessed		not assessed		0.00
Greece	10547540	343617	3.26	342386	-1231	-0.01
Israel	968829	284626	29.38	297090	12464	1.29
Italy	17430048	1014850	5.82	1044193	29343	0.17
Lebanon	910782	140925	15.47	134638	-6287	-0.69
Libya	8503125	192339	2.26	211767	19428	0.23
Malta	32475	24615	75.80	24602	-13	-0.04
Moldova	518382	6270	1.21	6757	487	0.09
Monaco	278	128	46.14	128	0	0.00
Montenegro	571682	9874	1.73	9746	-128	-0.02
Morocco	2101777	34056	1.62	39514	5458	0.26
Palestinian Territory	324507	125853	38.78	128126	2273	0.70
Romania	1717696	39278	2.29	42812	3535	0.21
Russian Federation	5121738	122405	2.39	129256	6852	0.13
San Marino	5869	1064	18.14	1039	-26	-0.44
Slovenia	509558	10685	2.10	11037	352	0.07
Spain	6888312	488900	7.10	510474	21574	0.31
Syria	969910	25479	2.63	26771	1292	0.13
Tunisia	4305403	143507	3.33	152171	8664	0.20
Turkey	17683145	444237	2.51	479411	35174	0.20
Ukraine	8943436	133432	1.49	142190	8758	0.10

The percentages of change indicate intermediate increase in Egypt, Israel and Palestine. Several countries indicate decrease of urban area which needs to be interpreted with caution3333333. According to the classification scheme applied, such decrease is possible if the intensity of nightlights decreased and simultaneously the vegetation cover, reflected by NDVI, increased. On the coast of Lebanon, where such a change was found to be at the intermediate level, this may have taken place as a result of the wars in 2006.

The percentages of urban and artificial land cover in 2011 (Ivanov E., 2013) illustrate much higher concentration of urban areas within the first km of the coast throughout the study regions (Figure 9). In the most densely populated countries these percentages are also very high in the next, 10km buffer zone

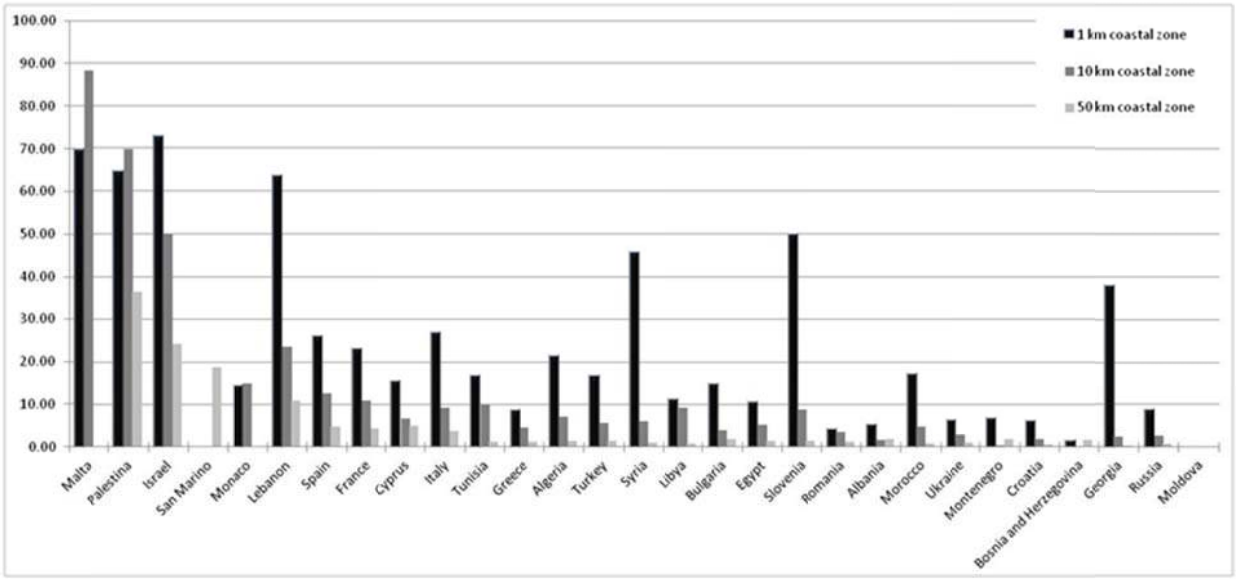


Figure 9: Graph of accounts of urban areas per country and buffer areas from PEGASO land cover in year 2011

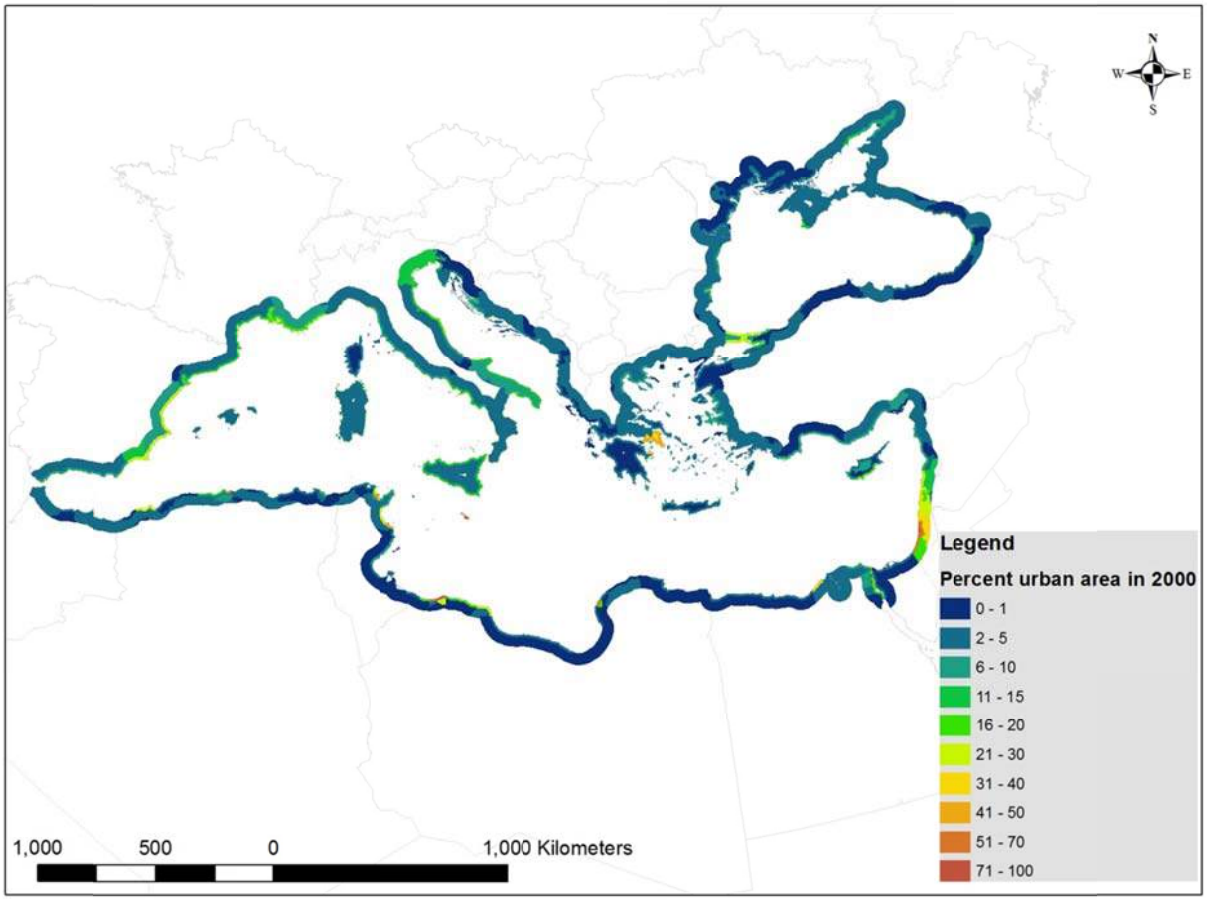


Figure 10: Map of percent urban areas from total are of coastal accounting units, estimated from PEGASO land cover in year 2000

The map (Figure 10) indicated very high percentages on the Spanish and French coasts, the areas of Athens and Istanbul, and the Near-East Mediterranean coast.

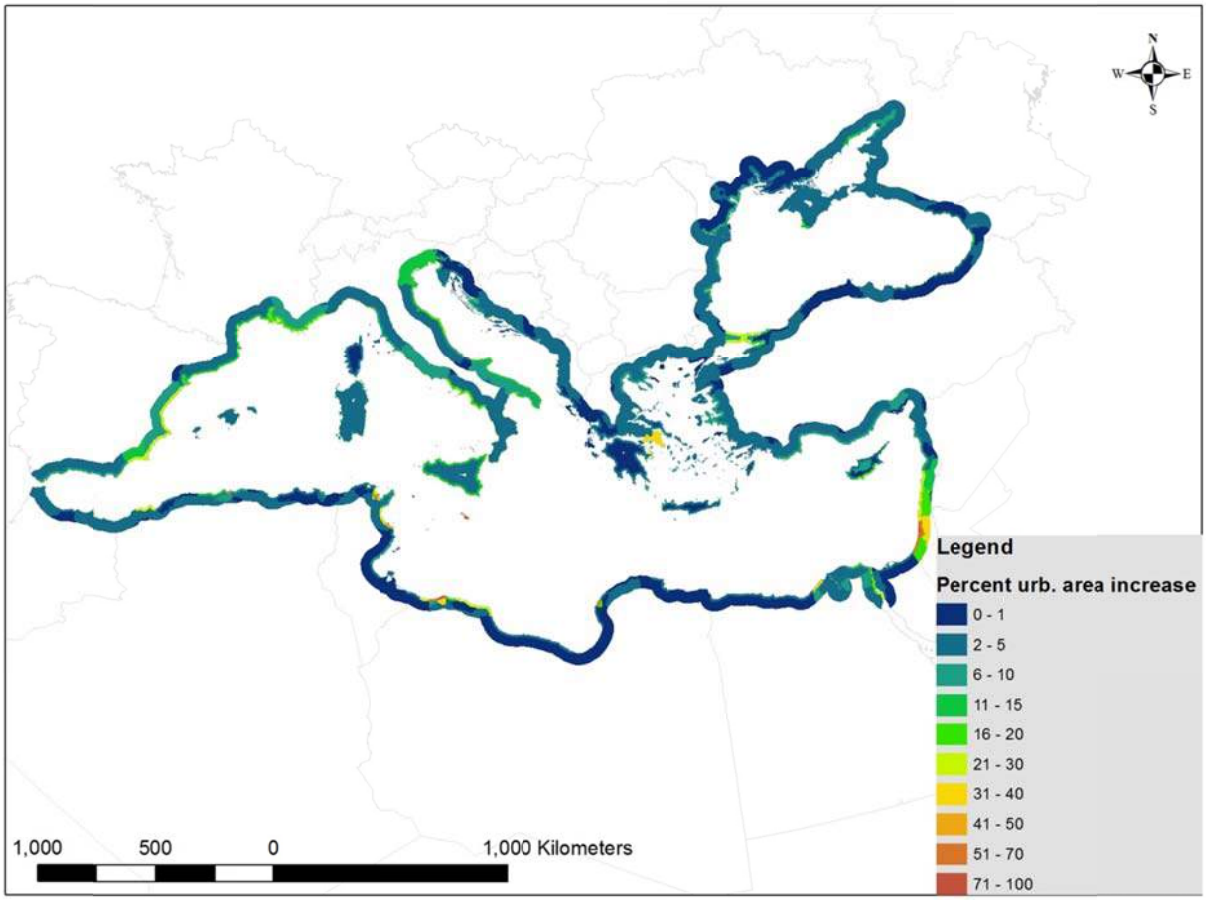


Figure 11: Map of per cent change in urban areas from total unit area between 2000 and 2011 from PEGASO land cover, per coastal accounting units

The percentage increase is high on certain stretches the south and east Mediterranean coasts (Figure 11).

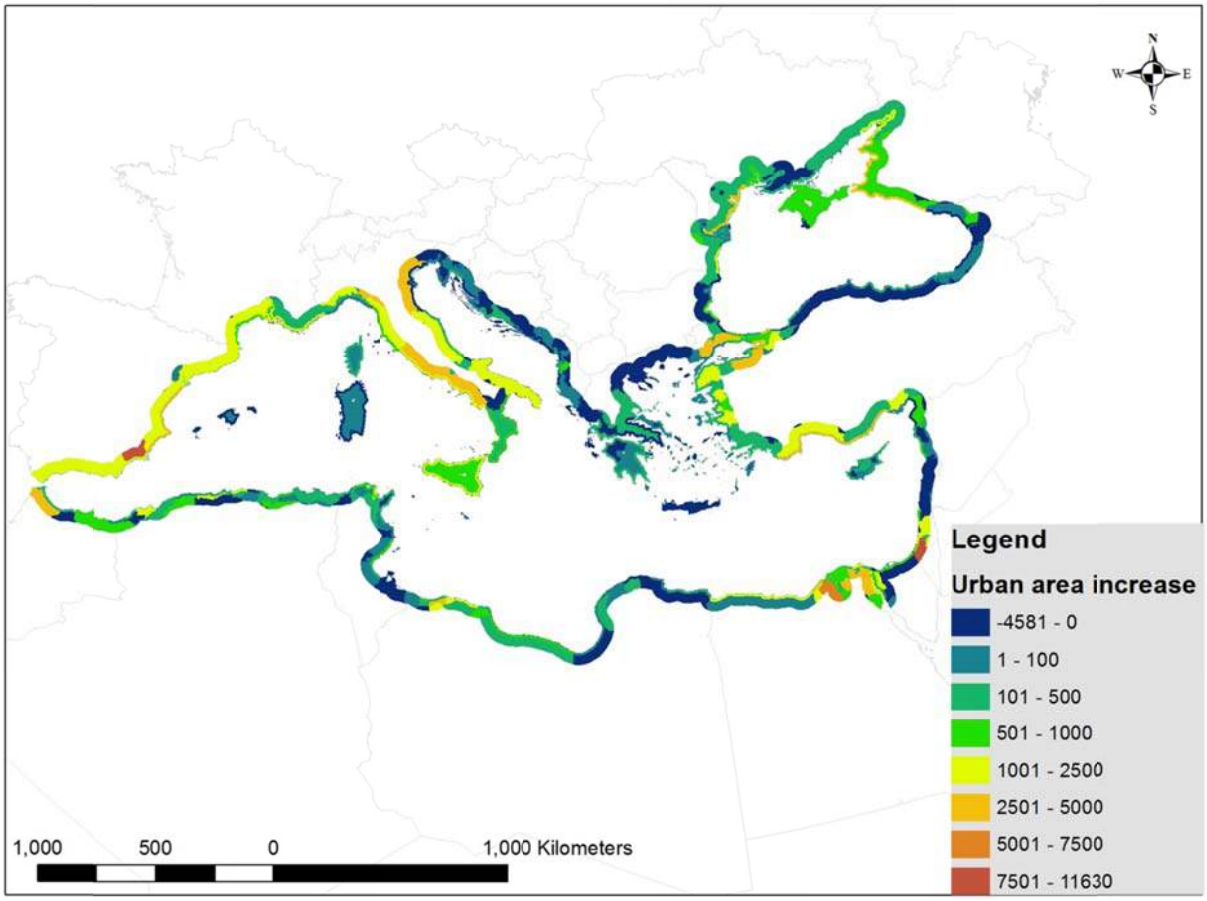


Figure 12: Number of hectares increase in urban areas between 2000 and 2011 from PEGASO land cover, per coastal accounting units

Shown as total numbers of hectares of urban area increase, more clear patterns can be observed, with increase taking place mostly within the 50 km buffer in the north Mediterranean countries, while in the south – nearer to the coast. Higher rates of increase can also be observed in the north and west Black sea coasts (Figure 12).

4. Conclusions

This document presents the accounting outputs produced for the regional assessments in PEGASO (T5.2), supplying relevant inputs for assessing balanced urban development and preservation of natural capital. The quality of the presented results is evaluated and reported in Internal Deliverable D4.2.6. According to the evaluation results, both sources of accounting inputs CORINE land cover and PEGASO land cover compare well with independent and high precision reference data on forested and artificialized land in Europe. PEGASO land cover is more appropriate for assessments at wide regional level across the entire Mediterranean and Black Sea basins, while CORINE land cover performs better at higher spatial detail level.