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Integrated Regional Assessments in support of ICZM in the Mediterranean and Black Sea Basins

Intergovernmental Oceanographic Commission
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SEVENTH FRAMEWORK PROGRAMME

United Nations Educational, Scientific and Cultural Organization

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PEGASO supports the implementation of the Integrated Coastal Zone Management Protocol for the Mediterranean and the development of ICZM policies in the Black Sea. PEGASO bridges the gap between science and policy-making by providing easy-to-use tools in support of science-based decisions for the sustainable development of the coastal and marine areas in the Mediterranean and Black Seas.

PEGASO promotes the integration of a suite of tools to improve the understanding of marine and coastal processes and to use these within a science-policy interface. This publication is intended to provide guidance on how to promote integrated approaches in the assessment of coastal and marine ecosystems to develop strategies and plan for their sustainable management. It is intended as a blueprint in support of future assessments in the Mediterranean and in the Black Seas, while being applicable in other regional seas.

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No formal representation is necessary

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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
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
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

Foreword

Coastal and marine ecosystems provide important economic and social benefits to citizens (food, employment, carbon storage, coastal hazard protection amongst others). However, the capacity of these ecosystems to provide those benefits is increasingly hampered by the lack of preservation of natural capital and the unbalanced use of coastal and marine space. In order to restore and sustain critical monetary and social/cultural ecosystem services, a framework for the integrated governance of coastal and marine areas is necessary. Integrated Coastal Zone Management and Marine Spatial Planning are the two acknowledged approaches to promote sustainable development in coastal and marine areas. International institutions such as the European Commission, UNESCO with its Intergovernmental Oceanographic Commission and UNEP are committed in promoting these approaches and frameworks globally as well as regionally. However, these approaches and concepts need to be operationalized and tools for their implementation developed.

PEGASO's main objective was to support the implementation of the UNEP-MAP Integrated Coastal Zone Management Protocol for the Mediterranean and to support the development of a similar policy instrument in the Black Sea. PEGASO was successful in bridging the gap between science and policy-making by providing easy-to-use tools for the final users, to help them make science-based decisions that promote the sustainable development of the coastal and marine areas of the two basins. The ICZM processes had recognized several research gaps for which a number of tools were needed.

From a methodological perspective, PEGASO's most important achievement was perhaps demonstrating that the integration of certain tools can help to describe complex phenomena, despite having limited access to high-resolution data. Not only do these tools improve the understanding of marine and coastal processes, but they can also be applied to socio-economic dynamics, to interactions between terrestrial and marine processes, and –critically– to model future conditions in order to guide the most appropriate governance framework.

This publication is intended to provide guidance to a number of actors on how to promote integrated approaches in the assessment of coastal and marine ecosystems to develop strategies and plan for their sustainable management. We hope that this publication can be considered as a blueprint for future assessments and can be of help in the Mediterranean and in the Black Seas as well as in other regions of the world. It should work at the interface between science and policy providing opportunities for scientists, practitioners, and decision-makers in the field of Integrated Coastal Zone Management and Marine Spatial Planning for dialogues and debates.

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Executive Summary

In 2010, the Protocol on Integrated Coastal Zone Management (ICZM) under the umbrella of the Barcelona Convention was ratified, becoming part of EU law. To support ICZM in the Mediterranean and Black Seas, the EU co-funded a research project, PEGASO consisting of 25 partners from EU and non-EU countries. The main objective of PEGASO was to develop 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 areas in the Mediterranean and Black Sea regions.

The current document reflects the four years of PEGASO activity, culminating in a policy-oriented blueprint for an integrated approach to the assessment of marine and coastal ecosystems. The work is presented in the current brochure, but is also available online in the PEGASO Coastal Wiki; as a summary for the policy level; 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 by 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 identified 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 improve the understanding of marine and coastal processes, but can also be applied to socio-economic dynamics and interactions between terrestrial and marine processes. Moreover, they are crucial to model future conditions in order to guide the most appropriate governance framework.

Chapter one provides a brief introduction to the PEGASO methods and the tools used for the 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 of the PEGASO tools, highlighting key findings and particular strengths of different methods. Chapter four emphasises the benefits of the governance platform and a portal to share data and knowledge. This is not only critical for the implementation of ICZM, but also for the future support for ICZM strategies, for example in the Black Sea countries. Chapter five focuses on specific management and policy issues that need to be addressed, elaborating on the issue of ‘spatial misfit’ between ecosystem dynamics and governance systems. Finally, chapter six concludes the guidelines for the implementation of this integrated approach, setting priorities for future marine and coastal ecosystem assessments.

Chapter 1
PEGASO Scope and Objective

ICZM Protocol for the Mediterranean Sea

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, a White Paper on ICZM, and the EU Recommendation 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 solely on the basis of recommendations. 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 under the umbrella of the Barcelona Convention that addresses specific aspects of Mediterranean environmental conservation. The ICZM Protocol was signed in Madrid on 21 January 2008 and to date, it has been ratified by eight countries and the EU. The Protocol entered into force on 24 March 2011, including its ratification by EU, which means that the Protocol is now part of EU law and is legally binding. Prior to the Protocol, a common definition of the 'coastal zone' for the Mediterranean was lacking. By defining the coastal zone, a series of integrative measures were established and an area was delineated within which these measures could be applied in a consistent way.

Ecosystem Approach

A crucial value of the Protocol is the emphasis on 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.

The relationship between the principles of the ICZM and those of the EsA, as expressed in the Convention for Biological Diversity (CBD), has been investigated during the PEGASO project (Box 1). This is particularly important to understand the scope and intention of the Protocol, as well as how it relates to other contemporary policy initiatives.

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." [2]

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." [3]

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..."

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

Maritime Spatial Planning

More recently, the need to link the management of the coastal zone with approaches aiming at promoting sustainable management and use of the marine space has emerged. A framework to guide sustainable development of the ocean can be inspired by the Marine Spatial Planning (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*' [4].

In 2008, the European Union published a roadmap for *Maritime Spatial Planning: Achieving Common Principles in the EU* [5]. This roadmap and the 2011 Communication on *Maritime Spatial Planning in the EU: Achievements and Future Developments* [6] paved the way for the recently by the EU Parliament approved Directive on Maritime Spatial Planning (MSP). MSP is a cornerstone of the Commission's Blue Growth strategy and of the EU Integrated Maritime Policy. Member States must transpose the Directive into their national legislation by 2016 and draw up their national maritime spatial plans by 2021.

Integrated Assessments in support of ICZM policies

In order to facilitate the implementation of these policy frameworks and management approaches, which share the same underlying principles as expressed by the EsA, science-based information and knowledge has to be provided to policy and decision-makers in a way that helps putting these principles into practice. These policies are not only presenting principles but are also setting policy objectives. Therefore, the information provided should be framed around those policy objectives.

The ultimate purpose of socio-environmental assessments is to support sustainable decision-making through the provision of science-based and reliable information [8,9]. 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 ICZM, MSP, and EsA, socio-environmental assessments are recognized as appropriate tools in working towards sustainable coastal activities and reducing coastal and marine environmental degradation [10,11]. 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 can play a pivotal role in the ICZM and MSP processes, if the analytical and methodological frameworks adopted are conceived and shaped around the EsA principles.

In this context, this **IRA's main objective** is not to provide a comprehensive marine and coastal assessment but **to identify a number of management and policy issues that have to be addressed both in the implementation and assessment of existing policies and in the definition of future ones. Moreover, these management and policy options have to be dealt with and tackled at the appropriate scale. Driving forces exert different influences at the various temporal and spatial scales in which they operate; with a range of intensities of impact. Therefore, one needs to consider how well the institutions of a wider governance system, from local to global level, match the dynamics of biophysical systems**; this is what researchers denote as the 'problem of fit' [12,13].

Galaz *et al.* [14] reviewed the types of misfit between ecosystem dynamics and governance systems:

— Spatial misfit

The institutional jurisdiction is too small or too large to cover or affect the areal extent of the ecosystem(s), subject to the institutions

— Temporal misfit

The institutions were established too early or too late to cause the desired ecosystem effects

— Threshold behaviour

The institutions do not recognise, or prevent abrupt shift(s) in biophysical systems

— Cascading effect

The institutions are unable to buffer or trigger further effects between or among biophysical and/or social economic systems

Folke and colleagues [16] highlighted 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, as well as 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.

PEGASO proposal for an IRA to support ICZM and MSP in the Mediterranean and Black Seas

A review conducted in the context of the PEGASO project showed that increasing numbers of broad environmental assessments have been conducted over the past few decades, which improved considerably the current knowledge on sustainable development issues. Additionally, assessments have identified consequences that follow from a lack of appropriate actions. Environmental assessments have also moved gradually from being status-oriented and descriptive in nature, towards 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. Increasingly, assessments are 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 level of regional seas or sea basins.

One of the major criticisms of current regional assessments is the **lack of information** on **cumulative and synergistic effects**. Due to the complexity of the monitoring of interrelated factors that act on the human–environment interface, practices must be highly methodical and structured. Current regional-level assessments focus on environmental status, trends and threats, whereas a greater emphasis is needed on context-dependent impacts, related measures, and 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 on scales this large. A PEGASO desktop review [17] 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 also provide future outlooks based on policy directions [18].

Inadequate pressures on the goods and services provided by marine and coastal ecosystems ultimately have 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 and biological) and social (i.e. institutional, cultural and economical) processes are complex and often poorly understood. Strategies for environmental management do not only 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 in the 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

Venice. © Marko Prem.

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 controversial areas such as land-sea interfaces and watersheds. In addition, efforts 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, as well as the general public.

To summarize, the IRA methodological and analytical framework should include the following aspects:

1. **An assessment of existing institutional settings and governance mechanisms**
2. **An assessment of the environmental status and trends taking into account cumulative and synergistic effects of land-based and marine-based human activities**
3. **An assessment of regional trends and their relations with local conditions**
4. **A definition of future scenarios**
5. **A proposal for management and policy options**

These aspects should ultimately expedite better-informed deliberation processes by creating and supporting an integrated science–policy interface. This serves the needs of decision makers and managers, supporting them by making use of scientific expertise, reliable data and existing information systems, as well as the needs of scientists, managers and stakeholders to become better informed of their roles in ICZM processes.

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; [19]; Split, Croatia) with the support and participation of the Mediterranean Action Plan (MAP-UNEP; [20]), and the 21 Mediterranean countries and the EU as Contracting Parties to the Barcelona Convention [21].

The ICZM Process is structured into 5 key stages:

1) Establishment

   The overall aim of this stage of the ICZM Process is to establish an operational foundation for the subsequent steps of the ICZM Process; to begin the process of understanding the challenges facing the coastal areas and the differing perceptions of those challenges; and to begin building a constituency of support for the ICZM Process and for its expected outcomes. The purpose is to map the likely range of human and natural drivers, the existing sectoral policies, and their potential interrelationships to be used as a trigger for the process and a focus for discussion, full analysis and identification of priorities in subsequent stages.

2) Analysis and Futures

   The overall aim of the Analysis and Futures stage is to add substance to the issues and aspirations initially identified in the preceding Establishment stage – making the invisible visible and engaging stakeholders in the search for outcomes. This stage aims at analysing in greater detail the key problems and issues and, then, summarising the existing conditions of the area and root causes, focusing on the agreed priorities (governance, environmental and socio-economic). Projecting the conditions forward on the basis of possible or likely trends for periods compatible with the lifespan of the ICZM strategy, plan or programme. Examining factors such as the goods and services provided by the ecosystem, along with wider area's issues such as erosion, land husbandry, deforestation and pollution (both point sources and diffuse).

3) Setting the Vision

   The overall aim of the Setting the Vision stage is to engage the stakeholders in the identification of the key problems and issues for the ICZM Process to deal with, and to set the course for the eventual "shape" of the strategy, plan or programme and its implementation. It

will build on and substantiate the findings of the Establishment and Analysis and Futures stages.

4) Designing the Future

The ultimate aim of this stage - and indeed of the whole Process - is to lay the foundations for a self-sustaining process of sustainable coastal development. It will be based on a combination of instruments including concrete actions materialised through an investment portfolio, awareness-raising, institutional adjustments, and policy changes - ultimately transforming the governance culture and the community's understanding and care for the coastal zone. It is at the end of this stage that the Process shifts from analysing, consulting, planning, etc. to catalysing change, i.e. making things happen.

5) Realising the Vision

This is the critical stage in the Process where policy design shifts to the facilitation of change. ICZM strategies, plans or programmes for coastal areas will deploy a combination of policy instruments, management processes and actions. The strength of ICZM is its flexibility, adaptability to local circumstances, and operability across a range of sectors and issues, and with a representative governance structure.

In the context of the PEGASO project tools, methods and approaches were developed to implement the analytical framework described above to support the realization of the ICZM stages. The tools methods and approaches that are components of the IRA are presented and discussed further below.

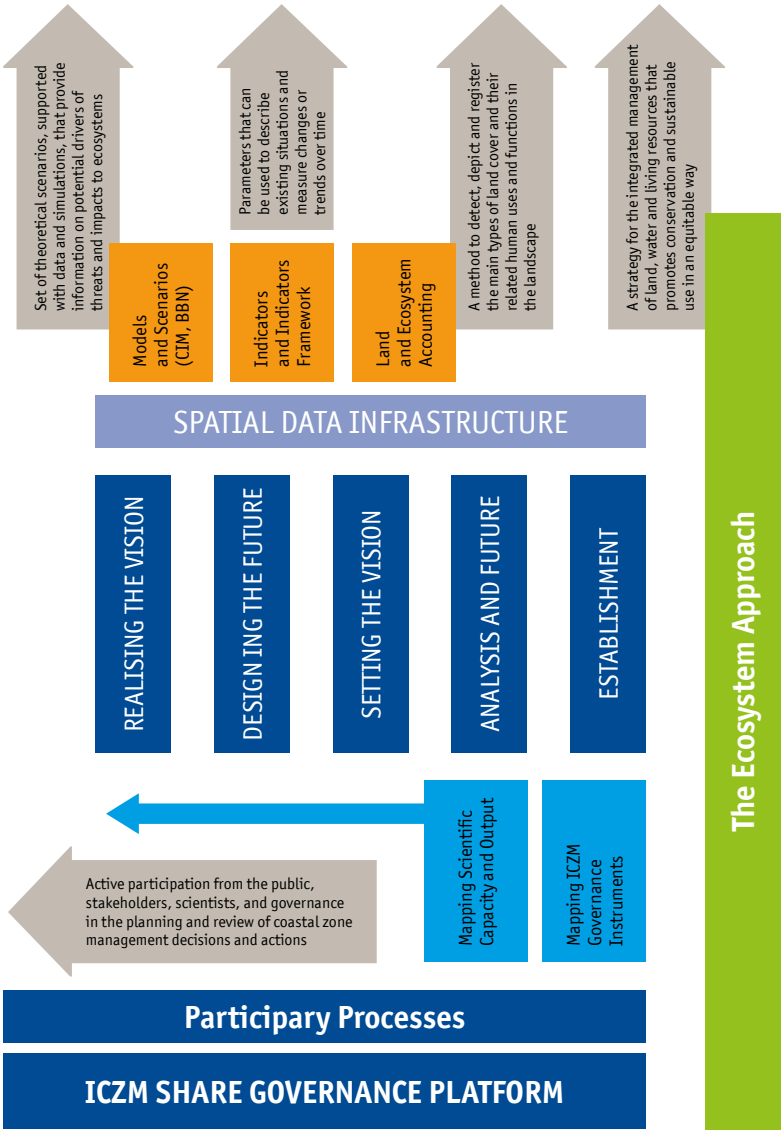


Figure 1.
Methods and approaches to implement an integrated regional assessment in support of the ICZM stages.

Sulina, Danube Delta, Rumania.

Chapter 2
PEGASO Institutional and Governance Stocktakes

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

Article 16 in the ICZM Protocol for the Mediterranean requires carrying out a benchmark assessment of the current state of ICZM. In September 2010, the Black Sea Commission-Permanent Secretariat (BSC-PS) agreed to follow this approach for the Black Sea basin. Hence, Stocktaking for ICZM was carried out in a comparable way for both the Mediterranean and Black Sea countries. It covers an analysis of current ICZM-related legislative, institutional, policy and financial frameworks.

Mapping the scientific capacity and expertise on ICZM in both the Mediterranean and Black Seas is a second important part of stocktaking to support ICZM in the region. Thirdly, both formal and informal institutions involved in coastal and marine governance, including an overview of existing networks relevant to ICZM in the Mediterranean and Black Seas, form part of the stocktake effort.

2.1 Stocktake of Legal, Institutional and Organisational Frameworks

The stocktake process is 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. The draft questionnaire was prepared by PAP/RAC and widely consulted upon, including a workshop with the 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 Sea, the stocktake contributes to the Barcelona Convention system in terms of providing:

1. **Initial guidance for the preparation of the official UNEP/MAP reporting format in the framework of 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 to use 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. Hence, 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).

Nile Delta, Egypt.

Results of the ICZM Stocktake for the Mediterranean Sea (figures 2, 3)

The stocktake provided 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, however, the distribution was skewed both thematically and geographically.

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 be taken when making inferences from these responses as they are based on the subjective interpretation by individual respondents. However, some general trends can be distinguished:

— There is a positive perception of the level of activity (figure 2).

— The level of activity varies depending on the theme (figure 3): negative responses are pronounced in economic, financial and fiscal instruments, economic activities and land policy. The responses to of environmental protection and management and themes that were developed in the capacity of the ICZM were rather positive.

Rabat © Marko Prem.

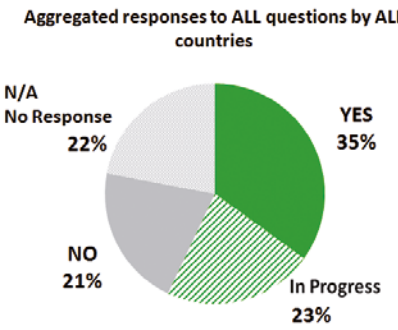


Figure 2.
Aggregated responses to ALL questions by ALL Mediterranean countries

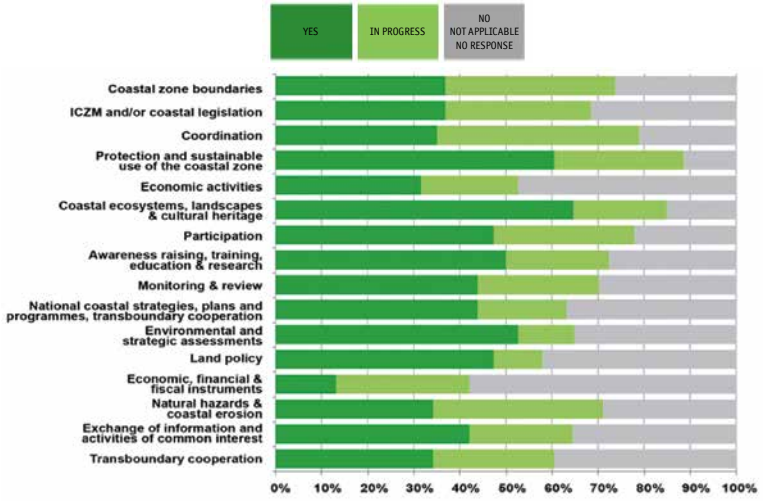


Figure 3.
Aggregated responses by theme: Mediterranean

Results of the ICZM stocktake for the Black Sea (figures 4, 5)

Comparable to the Mediterranean there was a wide variety of responses by theme. The highest level of negative responses related to: economics; coordination; EIA/SEA guidelines; and the use of economic instruments. Themes with some of the highest positive responses also related to aspects of environmental protection and management. The high level of "In progress" responses could reflect the lack of a formal agreement, such as the Protocol for the Mediterranean, against which to establish a common benchmark for the Black Sea region.

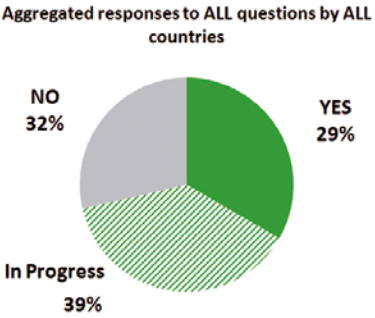


Figure 4.
Aggregated responses to ALL questions by ALL Black Sea countries

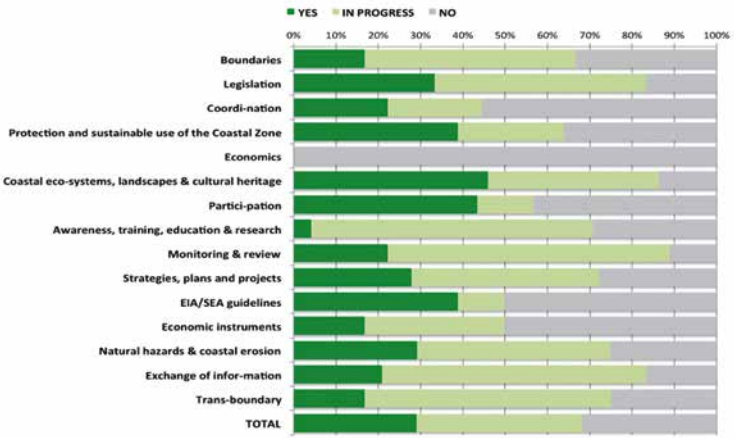


Figure 5.
Aggregated responses by theme: Black Sea

The BSC-PS produced a synthesis report to document the 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 D2.2B). The report was co-authored by ICZM NFPs of the Black Sea countries, including the Chairperson of the BSC ICZM Advisory Group [22]. 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 10th MEDCOAST Conference [23].

A concise assessment of overall results from the stocktake helped to draw 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.

2.2 Stocktake of Coastal and Marine Research

The absence of a single overarching body to act as a platform for the diverse domains of scientific research in the Mediterranean and Black Sea regions makes it difficult to comprehensively assess the current state of marine and coastal research. Without a standardised and internationally agreed method in place, it is necessary to use a variety of resources to monitor and map science capacity, resources and output. Typically marine and coastal research activities are documented 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 a systematic way, and develop a system for identifying 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 scientists and 'ICZM practitioners' that put the ICZM concepts into practice. In spite of the biases and limitations of this mapping exercise, it is essential to provide a channel for feedback from the people that make use of ICZM practices [24].

Scientific Stocktake, Web literature review

A bibliographic research was performed to build a database of key publications for the Mediterranean and Black Sea region, covering articles on a broad range of ICZM relevant issues. The research included a broad web-based search, based on scientific literature databases and specific web sites, and experts' consultation. The most important data sources were:

— Scientific bibliographic search engines and databases (e.g. Scopus, Science Direct, Mendeley, Scirus, Google scholar).

— Internal databases for scientific and technical reports: in this case the catalogues of JRC PUBSY repository and the HCMR Library Anavissos

— Specific web sites (e.g. http://www.pap-thecoastcentre.org/ from PAP/RAC; http://ec.europa.eu/environment/water/index_en.htm from DG ENV; or http://www.medcoast.org.tr/ from MEDCOAST)

— International theses repositories, in particular the DART-Europe E-theses Portal (http://www.dart-europe.eu), Open Thesis (http://www.openthesis.org), OAIster (http://oaister.worldcat.org), and NDLTD (http://www.ndltd.org).

Results were manually controlled to verify their relevance for ICZM in the Mediterranean and Black Seas. Outputs were quality controlled and imported into reference management software. Two main software programmes were used for the database construction: Endnote X, due to its robustness and its wide applicability within the scientific community; and Mendeley Desktop version 0.9.8.1, due to its versatility and correctness. Possible export formats for the database include xml, bib, ris, and enl (only for Endnote).

The 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 questionnaire aims at collecting information on scientific contributions, existing projects, data networks, main challenges and research gaps related to ICZM and to describe the disciplinary backgrounds of the researchers involved in this ICZM-related work. Additionally, information on training opportunities offered by research institutes in the Mediterranean and Black Seas is collected. The template of the questionnaire can be re-utilized in other regional sea contexts.

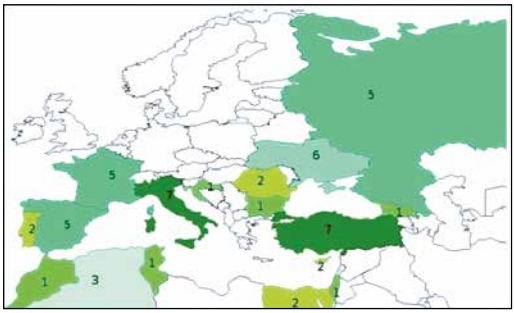


Figure 6. Number of responses from institutions in the countries that responded to the scientific stocktake questionnaire. The questionnaire was sent to 155 contacts, of which 57 completed the entire questionnaire (see Figure 10 for responses from Mediterranean and Black Sea countries). It was therefore not a comprehensive sample, and the results should be interpreted with caution.

Some key features of the questionnaire results:

— Respondents were mainly biologists and engineers whereas interdisciplinary professionals such as planners, geographers, and environmental scientists were under-represented.

— Key themes from responses focused around educational training and emphasised physical and technical aspects rather than socio-political issues.

— With regard to ICZM research, natural science contributions seem to predominate over the social and political sciences.

— 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.

— With regard to networks for ICZM: a third of the respondents declared to actively use data-sharing networks.

— Stakeholder involvement and collaborations with policy and decision–makers were identified as challenging aspects of ICZM projects.

— Information is not always presented in a way that is easy to comprehend for people working outside of these fields of ICZM.

— Some research gaps were identified: tools to better understand natural coastal processes, socio-economic dynamics, and interactions between terrestrial and marine processes as well as models for future conditions in order to guide most appropriate coastal and marine governance frameworks.

— There was a clear willingness within the ICZM community to integrate different disciplines and fields of specialisation.

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, a comprehensive desktop survey was performed to map the coastal and marine networks of significance for the Mediterranean and Black Seas. In previous decades, informal networks have greatly contributed to the cooperation and exchange of information and best practices, promoting the dissemination 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.

The coastal and marine networks of significance for the Mediterranean and Black Seas can be classified into five types (see text box):

— Intergovernmental networks

— Decentralized (non-governmental) networks

— Project networks

— National networks

— Networks with a wider geographical scope.

Coastal and marine networks of significance for the Mediterranean and Black Seas: An Overview

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. Their objectives and goals tend to be of utmost priority and addressed by widespread formal collaborations. They present an opportunity for input from international representatives that is not typically possible from other types of networks. One disadvantages 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 expertise from the scientific community with regard to of integrated coastal management in the Mediterranean and the Black Sea countries into practice.

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; [25]) is a dedicated marine 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 [26,27,28]. The inventory of marine knowledge output, EUROCEAN Marine Knowledge Gate [29], provides an overview of European marine research projects which can be sorted by programme and by budget size. The database 'OURCOAST' developed by DG Environment, provides an overview of ICZM 'best practices' projects [30].

Some major projects funded under FP6, such as EUROSION, ENCORA, PlanCoast and Empafish focussed on Europe as a whole. However, projects like Adricosm, BEACHMED and WADI that had an exclusive Mediterranean coverage. The number of large-scale

coastal and marine projects that were funded, increased considerably during 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 focussing on the Mediterranean and Black Sea regions. In addition to the framework programmes there were other major sponsors, for example the MED ENPI Programme of the European Union and The Global Environmental Facility (GEF).

A number of coastal networks like EUROSION, ENCORA and SPICOSA could not remain as functioning institutions after the respective project funding ended. 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 a wider Geographical Scope

There are a number of powerful networks like LOICZ and EUCC, which have a wider geographical scope (i.e. European or global) than the Mediterranean and Black Sea regions. However, these networks also contribute directly or indirectly to the Mediterranean and Black Sea coastal and marine science, management and conservation.

Pegaso on the beach.

Chapter 3
Analysis and Future

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

3.1 Integrated Analysis in Practice: policy context

Unbalanced and unsustainable use of ecosystems and the goods and services they provide, may significantly compromise essential ecosystem functioning on which we depend and ultimately impact on society and human wellbeing. To counter this, current legislation frameworks for the marine and coastal environment rely on concepts and guiding principles that aim for achieving/maintaining healthy and productive ecosystems. Existing environmental policies regarding water management (e.g. WFD), nature conservation (e.g. HD, BD, Natura 2000) and marine waters (e.g. MSFD) relate human activities to the state of the environment so that impacts can be monitored and appropriate responses can be developed. In the ICZM policies, the IMP and the MSFD, as well as in the proposed directive for ICM-MSP, the ecosystem-based approach (EsA) is cornerstone (see 'concepts'). The EsA also calls for an integrative approach in planning, monitoring and assessment. Specifically, in the European IC(Z)M policy context, one of the objectives is to develop reliable sources of comprehensible information on the human-environment interface to assist in better-informed public decision-making. An integrated science–policy interface, would support the needs of decision makers and managers by making use of scientific expertise, reliable data and existing information systems. At the same time it would support scientists, managers and stakeholders to become better informed of their roles in ICZM processes.

Due to the complexity of the human–environment interface, the **tools and instruments** used for the purposes of **assessment and analysis** must be highly **methodical and structured**. At the same time, they must be flexible to **adapt to the wide diversity of coastal zones** in the EU and around the regional seas bordered by its member states.

To serve this purpose PEGASO developed an approach for an integrated regional assessment IRA. This 'new' resource is an integration of existing data, information sources, tools and approaches that have been made accessible to a wider user group within a contextual framework. The present IRA approach proposes a policy-oriented blueprint for guiding future assessments at the scale of (sub)regional seas, taking into account the scientific research, policy making and socio-economic activities.

The proposed IRA approach for assessment and analysis specifically acknowledges the need to:

a) **Develop a consistent and basin-wide assessment framework**

b) **Focus on the land-sea interface and interaction between both**

c) **Assess the cumulative and synergistic effects of multiple anthropogenic stressors and threats at various spatial scales: from local to basin-wide**

d) **Assess the effects of stressors and threats and their impact on coastal and marine ecosystems and social communities**

e) **Examine the relationships between the environment and socio-economic processes**

f) **Deliver science-based assessments in a periodic and systematic way**

Furthermore, the assessment must be set in a coherent planning and management process aiming to:

1) **Focus on context-dependent impacts, related measures, and strategies for the management of human activities**

2) **Stretch beyond the description of status and trends of the environment and human activities, and tackle future outlooks for policy directions including appropriate management and mitigation measures**

3) **Invest efforts in applied research to unravel cause-effect relationships and identify gaps in knowledge and suggesting future research needs**

4) **Build on continuous, improved and structured dialogue between science, policy and management at the appropriate scale**

The PEGASO project identified, tested and further developed a number of these instruments and tools that are components of the IRA. By integrating them into an assessment framework, PEGASO aims to address and meet policy needs and contribute to the implementation of the ICZM Protocol. The present proposal must be viewed as a blueprint or guidance for conducting integrated assessments at the scale of regional seas. It aims to demonstrate the value of using the IRA tools both at the local scale with the ten PEGASO pilot sites (CASES) as well at the scale of the Mediterranean and Black Sea region.

Tools in Support of an Integrated Assessment

The Ecosystem Approach requires monitoring trends and assessing impacts, at the scale of ecologically relevant spatial scales such as regional seas and/or large marine ecosystems. In order to monitor trends and impacts in a consistent and basin-wide approach it is crucial to develop IRAs within a policy framework that is legally adopted throughout the region, such as the ICZM Protocol for the Mediterranean. However, countries bordering the regional seas may or not be part of larger geo-political agreements such as the EU. Countries such as Turkey even need to address regulations under different Regional Sea Conventions, reporting both to the Mediterranean and the Black Sea Conventions. To date, however there is no standardized or coherent approach between ICZM provisions established at the scale of the different regional seas. However, the concepts and principles of ICZM and the EsA (EcAp) provide guidance for building a coherent and consistent framework between regional seas. Next to these agreed concepts and principles, an important degree of coherence between spatial scales and regionals seas can be achieved by building IRA on science-based, robust and standardized methods and scientifically validated tools.

Indicators and Indices as key components

Cornerstone in the IRA, are the indicators and indices. In support of the IRA and the ICZM Protocol, PEGASO developed a suite of indicators that could be applied at different scales and both in the Mediterranean and Black Seas. The indicators are deployed as sustainability assessment tools, and as tools to measure the implementation of ICZM policy and programmes. In the process, the following issues are central:

— Taking stock of existing indicator initiatives to measure the progress towards sustainable development in coastal zones, in particular for the Mediterranean and Black Sea Basins;

— Assessing these initiatives against the needs of ICZM and other relevant policy instruments;

— Designing indicators adopting a multi-scale approach, to address the needs at local, national and regional scales.

— Fine-tuning indicators taking into account recommendations from previous experiences

— Using the indicators in a sustainability framework applying a DPSIR framework

The indicators become policy-relevant when applied in **regional and local frameworks** that describe key aspects in the current ecosystem status as well as the associated interactions, processes and impacts. A simplified **Pressure Impact Framework** was applied as approach for informing integrated assessments in coastal and marine environments. The framework is able to detect changes over time and aims at providing an explanation for past causalities, and assessments for the future.

The use of **spatial indicators** further improves the analysis of interactions between uses, pressures, delivery of ecosystem goods and services, and the wellbeing of coastal populations.

Land and Ecosystem Accounting (LEAC) uses indicator and indices to 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 and other spatial data, which are processed and analysed in spatial units that are relevant for decision-making (e.g. river catchments, administrative divisions, 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.

Cumulative Index Mapping (CIM) builds on indices to map the *cumulative pressures* and *impacts* of human activities on marine ecosystems. The cumulative *pressure* index combines individual *pressure* layers in order to locate where multiple pressures are occurring at the same time with high intensity (Figure 11). This index is independent of ecosystem-related parameters, i.e. pressures are displayed with the same intensity whether they affect sensitive or resilient ecosystems. 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. CIM is based on a methodology designed by Halpern *et al.* (2009) [15] and provides critical information for IC(Z)M and the management of human activities. *Cumulative pressure* and *cumulative impact* indices were calculated over the western Mediterranean however the method is applicable at different scales and can easily be scaled up to the entire regional sea basins. CIM allows comparing impacts of different anthropogenic pressures (e.g. marine litter, riverine input, atmospheric deposition of heavy metals and nutrients) and distinguishing marine-based, land-based and fishery-related impacts.

Spatial data and information (spatial indicators, LEAC and CIM products, maps) are stored and organised in a structured way so that query and access is optimised. A Shared Data Infrastructure SDI is a common technical platform for sharing, storing, querying and accessing this spatial information. Although it is regarded as a technical component of the ICZM Platform, it needs steering by a common vision and strategy by the 'human' component of the platform.

Public 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 Marine Stratgy Framework Directive (2008/ /EC) and the Mediterranean Protocol on ICZM. The Conference on Environment and Development (Earth Summit) in Rio de Janeiro in 1992, Principle 10 [31] and Agenda 21 [32] both called for increased public participation in environmental decision-making and led to the adoption in Europe of the Aarhus Convention [33]. Participation can be defined as a process where individuals, groups and organisations choose to take an active role in making decisions that affect them [34]. A widely recognized categorisation of participation is the so-called "*Ladder of participation*" [35]. The categorisation shows the different ways in which the organisation responsible for activity (e.g. an authority) can involve participants.

Scenarios use the results of these (spatial) analyses based on indicators and indices as input, so the framework becomes increasingly powerful as it is validated from real data, and parameters are refined to provide more accurate estimates and analysis. The purpose of **scenarios** is to allow decision makers to think through the implications of different assumptions about the ways (socio)ecosystems might respond to different drivers of change [36, 37]. Scenario thinking is intended to help address more complex situations involving a high degree of uncertainty [38].

The framework is further completed by comparing the **cost of environmental degradation** (due to overuse, misuse or mismanagement) to the cost of management responses.

In PEGASO, a core set of indicators was identified to support IC(Z)M across the Mediterranean and Black Sea regions. They cover biophysical issues and socio-economic themes, taking account of threats and impacts to the coastal zone, and assessing the cost of ecosystem degradation at local scales. Indices were also designed around the economics of the Large Marine Ecosystems approach [39]. The work further 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) [40].

The process and integrated approach, consists therefore of an integration of coherent and standardized tools and methods that can be applied at different spatial scales (diagram overview Figure 1).

3.2 Integrated Analysis in Practice

A comprehensive overview of the current state-of-knowledge on the main threats and issues in the Mediterranean and Black Sea is outside the scope and objective of this blueprint. However, by focusing on the objectives '**balanced urban development**' and '**preservation of natural capital**', the different approaches and methods for an IRA are demonstrated in the present document.

The vision of the ICZM Protocol is to achieve a 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 emphasizes that *"allocation of uses throughout the entire coastal zone should be balanced and unnecessary concentration and urban sprawl should be avoided"*. Therefore, tools and methods to assess progress in moving towards this policy objective, should address the requirements as described above a) to f); see above):

Develop a consistent and basin-wide assessment framework, focusing on the land-sea interface (a)-b))

Land and Ecosystem Accounts LEAC were extracted from a purposely developed PEGASO land cover PLC layer (spatial data) to assess policy priorities such as Urban Sprawl and Natural Capital. PLC focuses specifically on the coastal zone in order to allow analysis of land-sea interface. The definition of 'Urban areas' includes two subclasses; densely built-up land, and dispersed developments. Indices to measure progress in achieving these policy objectives were calculated at basin-wide scale so as to allow for a coherent assessment among regions and coastal zones. They cover:

- Standardized different spatial reporting 'coastal accounting' units (1km, 10 km and 50 km land strips)
- Reporting within relevant administrative divisions as reporting units (NUTS3, countries)
- Agreed years of reporting over an agreed time interval (e.g. 2000 and 2011)
- Standardized units for reporting (e.g. % of change over time interval) and agreed indices (e.g. 'Urban Concentration Index')

Ideally, the accounts must be expanded towards the marine realm to include categories in the marine ecosystems. Furthermore, to assess some of the specific policy objectives for the Mediterranean Sea such as the 100m 'setback zone', the analysis must be conducted for land strips of 100 m from the officially established coastline and at the entire basin-wide scale. However, current spatial resolution of the available basin-wide PEGASO land cover layer (250 m grid) is too coarse for assessment of these finer-scale patterns. Both issues are crucial and need urgent attention in order to achieve a full assessment.

Land accounts were calculated for three buffers around the coast at 1km, 10km and 50km distance and 2 different years (example Figure 7, 2011).

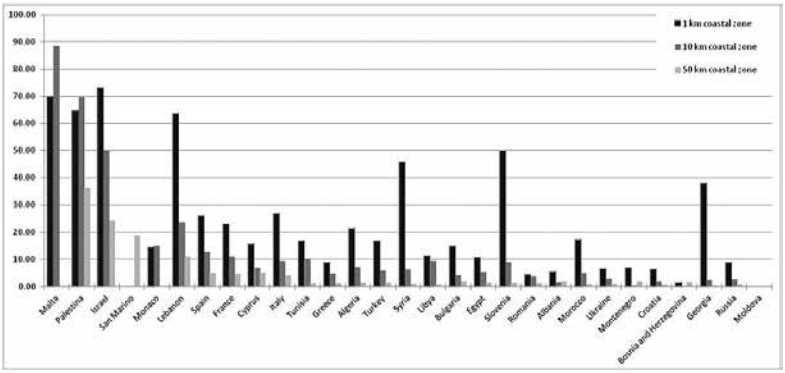


Figure 7. Percentage of urban and artificial land cover in 2011, for 2 coastal zones (1km and 10km land strip) and the inland 50km land strip, in Mediterranean and Black Sea countries

Trends in coastal urbanisation over a 12-year period (2000 to 2011) were assessed in the Mediterranean and Black Sea (Figure 8). 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%). The relation between percentage of urban coverage within the first kilometre and the hinterland was used to assess the degree of urban sprawl. The Urban Concentration Index (UCI) is calculated to further distinguish between typologies and spatial patterns of coastal development. The UCI calculates the normalised difference between percentage of urban land on the 10 km and 1 km coastal strips for administrative divisions bordering the Mediterranean or the Black Sea, in 2011. The underlying assumption for the UCI is that regions with a more balanced urban development have higher percentages of urban land cover in the 10 km coastal strip, compared to the 1 km. Coastal areas that tend towards unbalanced development are often associated with long stretches of linear construction patterns along the coast. The index values range between 1 and -1. In regions with a higher proportion of coastal protection, hence an effective policy implementation of the coastal setback, the UCI is a positive value. Regions with less than 5% urban land cover in both of the land strips need to be excluded from the analysis so as to ensure relevance of interpretation.

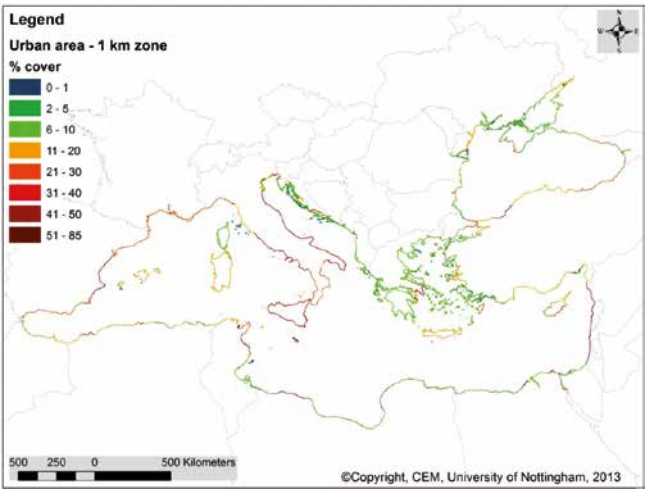


Figure 8. Percentages of urbanised land cover in 2011 in a 1 km coastal strip, reported by administrative divisions as spatial units (source: World Administrative Divisions).

Similarly, **LEAC** gives a broad overview of natural capital at the regional scale; it estimates accounts of natural and semi-natural areas on land, species and habitats of conservation importance, and accounts of protected areas for different protection classifications (Natura2000 and national/local designations). Data on natural and semi-natural land cover types include the PEGASO Land Cover level 1 classifications, such as forests, grasslands,

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. The highest value (100%) of urbanised 10 km coastal strip is found in the region of Beirut in Lebanon (Figure 7). 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.

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.

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 were assessed for parameters: percent of natural areas; percent of increase or decrease in natural areas over an eleven-year period; and percent of protected areas (Figures 9 & 10).

Stocks of natural area coverage (Figure 9) were categorised as: High (> 60%); Intermediate (30% to 60%); Low (15% to 30%); and critically low (<15%). LEAC allows to identify areas with likelihood of high proportions of preserved natural and semi-natural areas, as well as critically low stocks of natural areas. These basin-wide data then need to be confirmed by local-level studies focused on e.g. the maintenance of habitats and provision of basic ecosystem services. The approach allows identifying patterns of coastal development. Furthermore, the PLC on urban development and natural capital can compared and subjected to an integrated analysis.

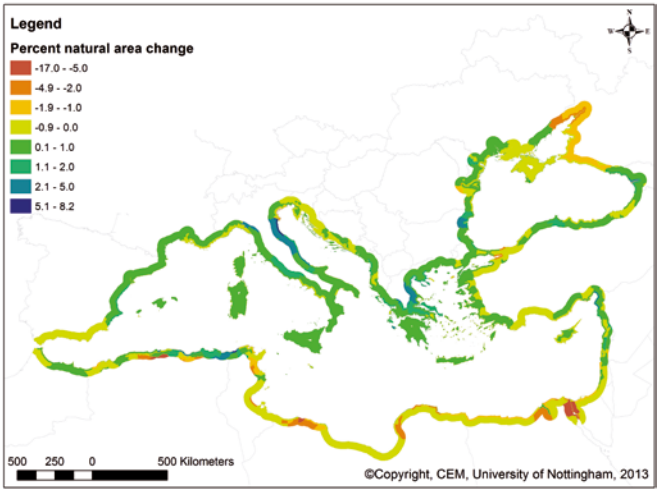


Figure 9. Map of temporal change of natural area coverage from PEGASO (between 2000 and 2011), expressed as a per cent of total unit area of the coastal accounting units.

The percent of natural area coverage shows a decreasing trend in natural and semi-natural areas for the Russian and Egyptian coasts from 2000 to 2011. 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. The results suggest that, due to the designation of NATURA sites on the EU coast, there is an increase of natural areas, however this is mostly situated 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 is required with further interpretation of these trends, given that parameters need to be independently validated.

Accounts of protected areas were constructed using the world database of protected areas as a source (Figure 10). 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.

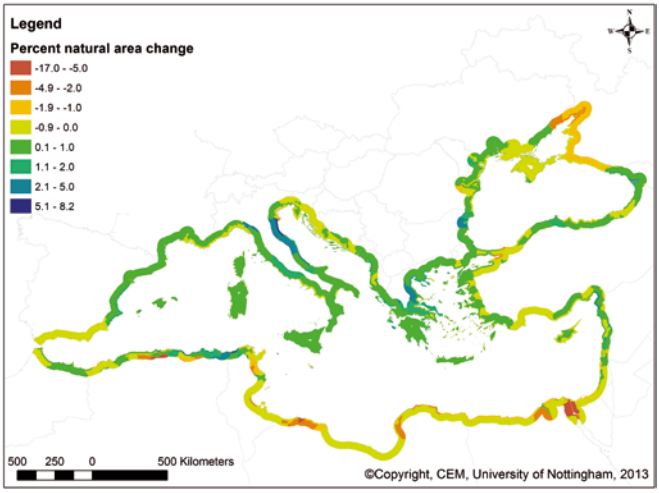


Figure 10. Percentage of areas protected.
Source: World database of protected areas.

Using Indicators in the assessment framework: from the local to the basin-wide scale

Although different indicators may be used in planning and management at the local scale, coherence and standardization at different scales offers a number of strengths and opportunities. A regional assessment based on a coherent set of standardized indicators and indices allows to:

— Monitor trends and progress in moving towards the priority policy objectives

— Identify areas of special concern, based on comparable methods and standards

— Support the setting of priorities for strategic action within the region.

However, the causalities that explain the observed trends may be very different in origin, depending on the processes that take place in a particular area. Applying indicators at the local level provides additional information:

— Cause-effect relationships are often complex and easier to disentangle at a local scale

— Cause-effect relationships that explain the observed trends can provide crucial insights for the development of effective policy instruments and targeted management actions in other regions or at the regional scale

— Local high-quality data can support validation of data used in broad basin-wide assessments

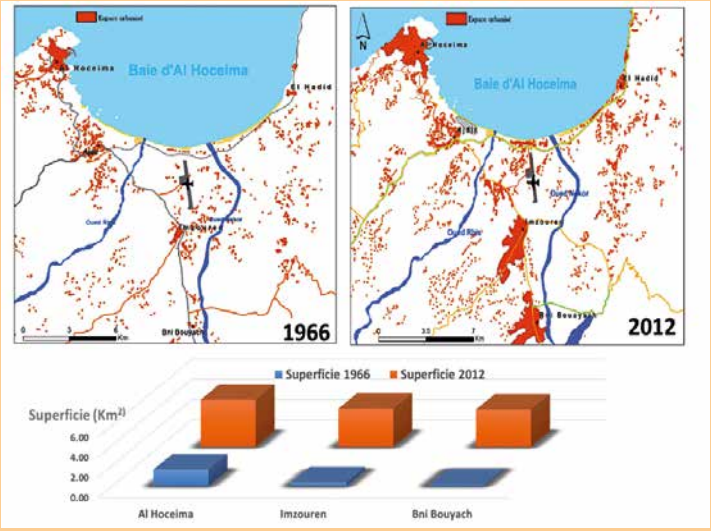
The Al Hoceima CASE is located in the central part of the Mediterranean coast of Morocco. Major issues are urban sprawl, resource degradation, coastal risks and erosion. The coast is extensively developed and experienced a coastal real-estate boom including residential construction on fore dunes or on 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)

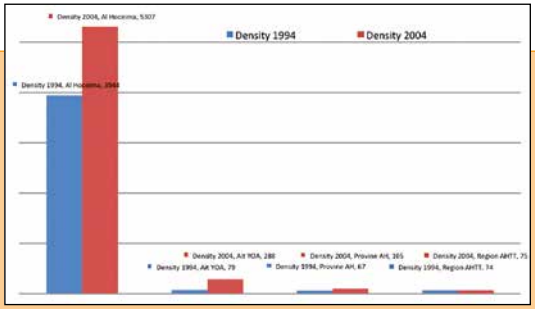
— Coastal population density (inhabitants/km²)

— Coastal erosion rate (m/year)

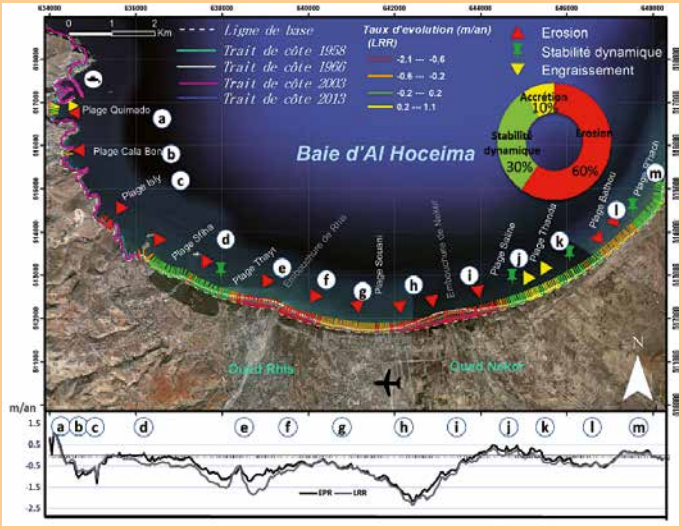


Coastal urbanisation between 1966 and 2012

Box 2.
Coastal urbanisation: erosion and risks in the Al Hoceima CASE [41]



Changes in coastal population density



Changes in the shoreline 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.

In the context of the PEGASO project, coherence was achieved for indicator calculations both at the local and basin-wide scale. Developing methodological indicator factsheets is a first step in standardizing and harmonizing a common representation of the supporting data. Specific guidelines for spatial data harmonization are a next step in order to combine spatial data from different areas in a coherent way, e.g. within a distributed network of geonodes in the SDI (see also above).

At the local scale, CASES calculated a number of indicators from the PEGASO core set, e.g. on urban development and population density. The Al Hoceima PEGASO CASE (Morocco) illustrates the integrated assessment based on indicators of 'natural capital' and 'urban development', as calculated in one of the CASES. Furthermore, the calculated indicators for changes in urban land use and population density in Al Hoceima are related to driving forces (erosion and risks) and to impacts (natural capital), using PEGASO indicators within the assessment framework (Box 2). This constitutes an example of how a standardized approach (indicator calculation) allows comparison at the basin-wide scale while taking into account of local specificity (causal relationship of pressures and impact).

Assess the cumulative and synergistic effects of **multiple anthropogenic stressors and threats** and their impact on coastal and marine ecosystems and social communities at **various spatial scales b) c) d)**.

Cumulative Index Mapping allows identifying and mappinig *Pressures* and *Impacts* in a systemic way at different spatial scales (from basin-wide to local) and disaggregated by spatial reporting unit. By selecting drivers that are most relevant for the coastal and marine regions, it focuses the analysis on the land-sea interaction. The method allows separating between marine-based, land-based and fishery related pressures and impacts (figure 11) and assessing the influences of individual pressures in relation to the total intensity of combined pressures.

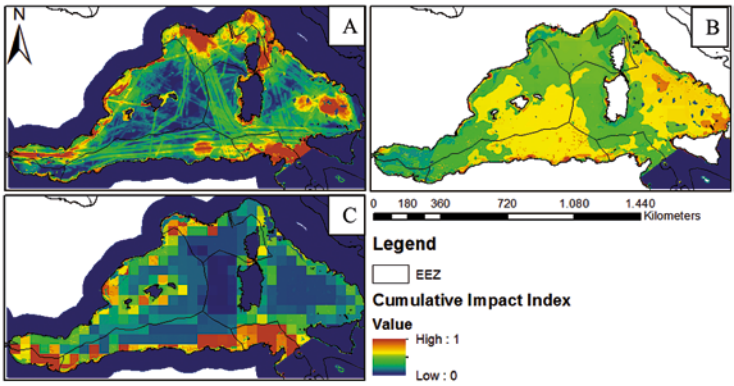


Figure 11. Cumulative Impact Index disaggregated into marine-based impacts (A), land-based impacts (B) and fishery-related impacts (C) in the western Mediterranean Sea. Climate-change-related stressors are excluded from the analysis. Source: Morrisseau, 2013 (PEGASO Project)

Marine-based impacts are related to important harbours and associated traffic (Figure 11A). Areas of intense land-based impacts were located north of Algeria and in the Tyrrhenian Sea (Figure 11B), 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 11C).

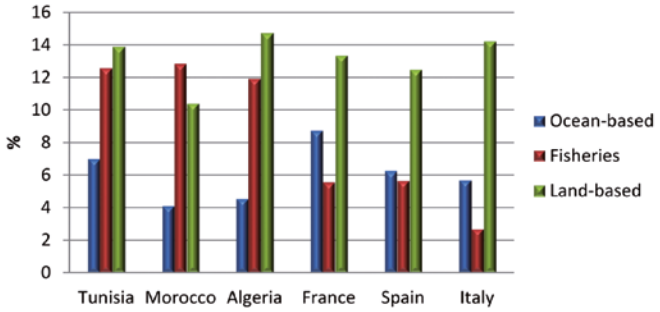


Figure 12. Influence of pressures on the first 20 km in the of western Mediterranean Sea littoral, disaggregated by country and land-based, marine-based, and fishery-related pressures. The results suggest higher proportions of land-based pressures in France, Spain and Italy, which could be explained by the higher urbanisation and coastal population densities in these countries.

Assess the relationships between the environment and socio-economic processes

Traditional economic assessments do nut fully account for the role of the environment in the measurement of economic activity. 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 [42]. This situation can result in biased, inaccurate statistics on economic growth and development, 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.

When considering the effects of urban development on the environment and social wellbeing, a multitude of closely related potential impacts must be considered. 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. This is well illustrated by one of the PEGASO CASES, the Aegean Islands. Tourism, the dominant activity on these islands, relies on attractiveness of the area mainly based on natural capital (Figure 13 A-B). However, at the same time tourism causes a shift in populations between islands in the archipelago due

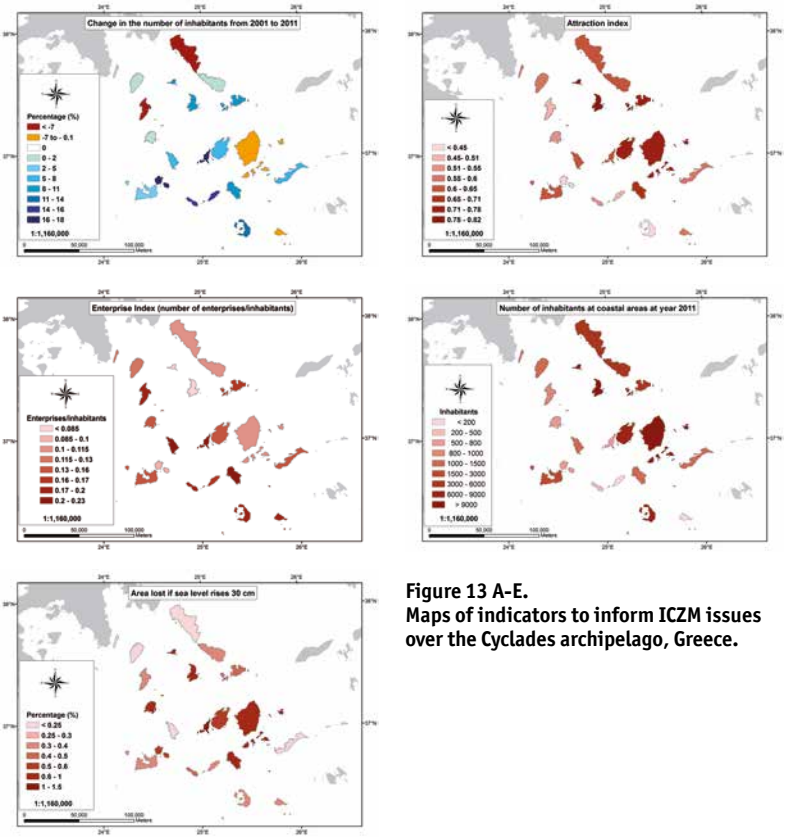


Figure 13 A-E.
Maps of indicators to inform ICZM issues over the Cyclades archipelago, Greece.

to employment opportunities, driving coastal development, and contributing to threats from over natural-capitalisation (Figure 13 C-D). Consequentially, this increases the percentage of the population at risk from climate-change-related pressures, such as sea-level rise (Figure 13E).

This dual character of "balanced use" can be classified into main categories and interactions mapped by identifying pressures-impacts indices. Furthermore, factors that are 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. The diagram can receive input from different analytical tools (indicators, LEAC, CIM, participation, and scenarios). The scale of the assessment requires working at an ecosystem level. The Cyclades case again demonstrates how a basin-wide approach based on agreed and standardized tools, can be set in a analytical framework using causal relationships for processes that are relevant at the local level.

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.

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: 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). This typology can be used to compare coastal zones in a basin-wide context.

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) [43]. French estimates are fairly close to this, but for a coastline seven times longer in France than in the Netherlands.

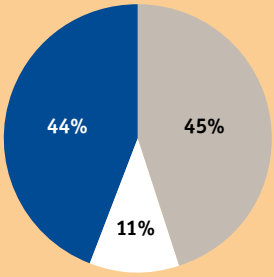
— In Spain, total expenditures for the maintenance of marine natural capital was about 1.53 billion Euros in 2010, divided into seven issue areas or thematics (Ministerio de medio ambiente y medio rural y marino, 2011), where the cost of wastewater treatment accounts for only 38% (73% FR, 90% NL).

Box 3.
Ecosystem degradation - A cost-based approach.

— **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.



French Western Mediterranean:
Total = 57,000,000 €

Monitoring and Information Cost
Positive Actions / Prevention Costs
Remediation Costs

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 4.
Cost of water quality degradation in the Bouches-du-Rhône, France CASE.

Deliver science-based assessments in a periodic and systematic way: 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). 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. In the Bay of Sevastopol (Ukraine), several research institutions carry out monitoring programs for the state of the marine environment of the Sevastopol Bay. The Marine Hydrophysical Institute (MHI) and Institute of Biology of the Southern Seas of the National academy of sciences (IBSS) set up a standalone version of the GIS-type system for the Sevastopol Bay. The system incorporates general information for the Bay (meteorological, physical, biogeochemical, ecological properties, and supplementary materials, catalogue and repository of documents and scientific publications) and provides information on data available for specific chemical, physical, ecological parameters and pollutants for individual months and years. Yet, the most valuable part of this atlas in the set of pre-processed 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. It allows 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.

Training session.

Chapter 4
Setting the Vision of PEGASO

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

Considering the previously presented environmental and institutional contexts of the Mediterranean and Black Sea, this chapter presents the PEGASO strategy to work at the interface between science and policy in order to support countries in the implementation of the ICZM Protocol as well as of other marine and coastal policies.

4.1 The ICZM Governance Platform

The PEGASO project developed tools and approaches to support the implementation of the aforementioned policies. Within the project, an ICZM governance platform has also been established to share knowledge and experience, facilitating collaborations and a common understanding between decision-makers and scientists. This approach enables a proactive and adaptive management of coastal zones that can address specific issues as well as the scale of impacts.

Knowledge and governance are the two key pillars of the governance platform (Figure 14).

Figure 14.
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

In the last decades, there has been an increased attention for coastal and marine issues. Since the early 1970's with the Brundtland Report and followed by UNCLOS, Chapter 17 of Agenda 21 and the World Summit on Sustainable Development in Johannesburg (the Johannesburg Plan of Implementation, JPOI), major global initiatives have advanced principles, goals, timelines and targets for managing the issues threatening the oceans and coasts. In this context, a number of initiatives have been launched or are being launched at the global, regional and national level.

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 the 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. Currently this stakeholders' debate has finished and a proposal for a stand-alone ocean SDG is under discussion. Major issues included in the proposals for the SDG on ocean and coast include ensuring a healthy and productive marine environment, building resilient coastal communities through mitigation and adaptation strategies, engaging in integrated and multi-level ocean governance; establish a representative network of Marine Protected Areas (MPAs) covering 20-30% of the ocean's area, also in Areas Beyond National Jurisdiction (ABNJ).

At the European level, the main marine environmental policy is the Marine Strategy Framework Directive (MSFD, 2008/56/EC) which was adopted on 17 June 2008, and entered into force on 15 July 2008. It was due to be transposed into national legislation by 15 July 2010. The MSFD constitutes the environmental pillar of the European Union's Integrated Maritime Policy.

The MFSD aims to protect the marine environment across Europe more effectively by achieving and maintaining the Good Environmental Status (GES) of the EU marine waters by 2020 and by protecting the resource base upon which marine-related economic and social activities depend. To achieve these objectives, the directive establishes European marine regions (the Baltic Sea, the North East Atlantic, the Mediterranean and the Black Sea) on the basis of geographical and environmental criteria.

Moreover, the European Commission published the text of a Proposal for a Directive establishing a framework for maritime spatial planning and integrated coastal management in 2013. The text of the Proposal Directive states that:

The main purpose of the proposed directive is to promote the sustainable growth of maritime and coastal activities and the sustainable use of coastal and marine resources by establishing a framework for the effective implementation of maritime spatial planning in EU waters and integrated coastal management in the coastal areas of Member States.

Due to some issues raised by EU Member States a further consultation has started on the future of this directive. In particular a trilogue process among the European Commission, the European Parliament and the European Council was set up. A positive outcome of this informal trilogue on the draft for a Framework Directive for Maritime Spatial Planning was obtained at the beginning of March 2014.

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.

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

To support exchanges among remote PEGASO members, and to allow interactions in various spatial scales, a technical infrastructure was developed and equipped with a number of communication and information tools (Table 1).

Table 1.
Technical components of the PEGASO ICZM governance platform
(Source: PEGASO, 2013 [43])

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 for a 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 for a wider audience. ***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.***

The Governance Platform as a mechanism to Implement the Vision

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

A key question is how the PEGASO governance platform can become an institutionalised structure to ensure the continuation of ICZM governance subsequent to the project. How can it remain the hub it has become; gathering networks; providing existing infrastructure and services such as 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 be used in the future as well. 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 (indicator-based) assessments 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 consists of three components: the Map Viewer, the Data Cataologue and the Atlas. The PEGASO SDI was designed to support the PEGASO shared governance platform, and the suite of sustainability assessment tools required for making multi-scale integrated assessments in the coastal zone:

— Through the creation of a network of local geonodes (which are provider-specific, compatible, shared nodes of geo-information that together form an 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;

— 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 that consists of central and local geonodes, the IZCM Platform is supported by the delivery of relevant and harmonised datasets that can be queried and accessed 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 (e.g. VLIZ, Envirogrids) and to support the creation of new geonodes to expand 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. In a second step the existing geonodes were connected and data from core institutions such as EEA was disclosed. Finally, local/regional or national geonodes were co-developed when 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 a lot of attention on demonstrating how the SDI, and more specifically the network of geonodes, contributed to ICZM and supported the platform. For instance, by enabling 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 may be planned more efficiently.

The SDI is a practical tool that is accessible online and acts as a central repository for geographical information that improves the understanding of coastal features and issues. Understanding the benefits of an SDI has increased the willingness of partners to share data and contribute more datasets that are easily accessible through the web portal [44].

Benefits of the SDI for ICZM

The specific benefits of an 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. 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 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 visualise, query, map, and analyse 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 [45]. As reported in the Assessment of Assessments AoA [46], assessments should develop products that advise policy-makers. However, often there is no clear reference to how scientific assessments inform policy and management processes.

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

Although the geographical scope of this IRA proposal 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, the ocean and seas can be perceived as a 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. As shown through the results of the 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 new global partnerships and perspectives regarding institutions, cooperation and negotiations.

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; [47]) which was originally 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 in the framework of the EU Marine Strategy Framework Directive (MSFD).

The BSC-PS is also committed to achieving a 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, wellbeing, health and security of the population of the Black Sea coastal States.

5.2 Avoiding Spatial Misfit: Linking MSP and ICZM

In order to apply an ecosystem-based approach, MSP should be linked to ICZM due 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. MSP does not lead to a one-time, final product, it is a constantly evolving, iterative process that learns and adapts over time [48]. 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**

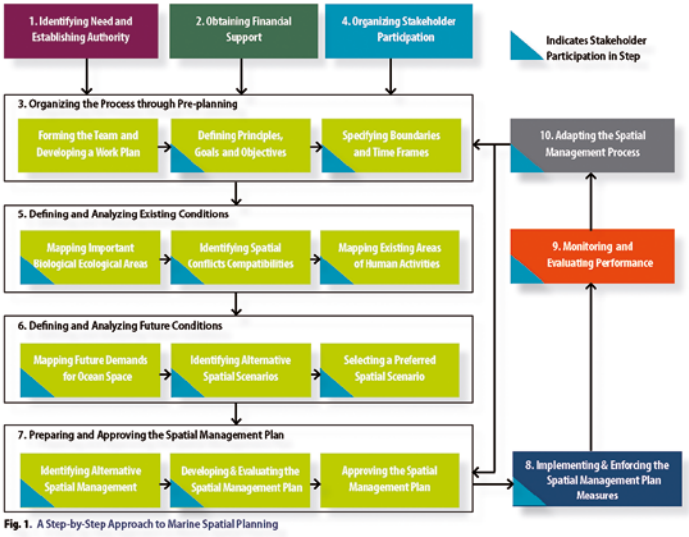


Figure 15.
MSP a step-by-step approach
(from *Visions for a sea change,* IOC-UNESCO 2007, [48])

MSP is influenced by international law and practice, as well as by national policy and 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.

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 has become evident that management plans have to be defined at the local level. Although coastal and marine areas around the world share common issues, management options can only be successfully implemented when local specificities and existing local governance arrangements are taken into account (EsA principles).

The PEGASO CASES work demonstrated that problems and issues can be correctly identified and lead to appropriate solutions mainly if tackled at the local level. The application of assessment tools at a regional level (e.g. LEAC at basin levels), as exemplified in this IRA proposal, has proven merits in describing trends and providing a more comprehensive view. Yet, it is the application of 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 proposal serves as an appropriate illustrative example; urban sprawl. Conclusions drawn 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 concerned coastal area.

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 impact. 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 current uses. 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. 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*'. 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.

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

Santoro F., Lescrauwaet A.K., Taylor J.

This IRA proposal covers efforts and progress made in the context of the PEGASO project towards the implementation of the ecosystem-based approach with regard to coastal and ocean management for the Mediterranean and Black Sea regions. Moreover, a common conceptual framework was developed by PEGASO partners in order to highlight similarities between the concepts of ICZM and the Ecosystem Approach and offer a common ground for work [49] (see Box 1). The development of this common conceptual framework shows 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 to which EsA promotes sustainability and conservation of natural resources is also covered in ICZM, but it does not contain particularly strong emphasis on issues of liability and restoration of ecosystem functionality. Thus, linking these 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. Hence, they are as much about designing management and governance processes as they are about helping to set objectives for current or future management and governance structures. This IRA proposal has, therefore, focused on two ICZM-EsA common framework principles:

— ICZM seeks to take account of the **wealth of natural capital in coastal zones** and the specific 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 their hinterlands.

Based on these two principles, the IRA proposal tested the value of using the PEGASO integrated assessment toolbox. The results of the analysis and assessment components were tested 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 taken 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 and/or local scales.

6.1 Setting Priorities and Bridging Themes

With the purpose of making a concrete proposal for implementing ecosystem-based ocean and coastal management, a matrix was developed (Table 2). The matrix is a reflection of the assessment elaborated in this IRA proposal as 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. 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.

Based on the analysis of the current situation, and insights about how the future might unfold, a discussion was held concerning 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 was made 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. This collaborative exercise aimed at building a common knowledge base, building on science, field experiences and expertise to ensure an efficient ICZM governance platform.

Table 2.
Matrix of priority areas, bridging themes and suggestions for future work, summarising the main findings of the IRA proposal

Priority Areas / Bridging themes	Governance Platform	Building Basin-Wide Views	Research and Science-Policy Interface: Gaps	Building capacity	ICZM and other relevant policies
Science-Policy Interface	Further develop mechanisms for exchange of information e.g. workshops, conferences, intranet, fora, etc.	- Maintain updated stocktakes of experts, expertise, 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 zone, 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 two regions	- Strengthen data-sharing, SDI - standardise data-collection methods for cross-comparisons - Utilise data to create basin-wide snapshots of where there are research gaps and help define management priorities	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 on indicators	Explore and facilitate the replication of the ICZM Protocol to other regional seas

Priority Areas / Bridging themes	Governance Platform	Building Basin-Wide Views	Research and Science-Policy Interface: Gaps	Building capacity	ICZM and other relevant policies
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 a local scale	Link regional priorities with local specificities	Develop and test research techniques that can be scaled up or down depending on objectives e.g. LEAC at Nile delta scale		- Correct fit between scales of management objectives and governance 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

Priority Areas / Bridging themes	Governance Platform	Building Basin-Wide Views	Research and Science-Policy Interface: Gaps	Building capacity	ICZM and other relevant policies
Integrated Approach (multi-disciplinary, multi-sectoral, and multi-level)	Further develop mechanisms for testing and sharing integrated regional assessments, approaches, methods, and tools	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 integrating different sources and methods - Improve methods of integrated assessments to support better-informed decisionmaking	Stimulate multi-disciplinarity, inter-disciplinarity, and trans-disciplinarity	Integrate policy instruments to address mismatch between sectoral policies

Five priority areas have been identified:

1. The Governance Platform

The Governance Platform is undoubtedly one of the most important added values of the PEGASO project. Future work will be determined by the prioritisation of different issues (e.g. institutional settings, ICZM practice) and elements (e.g. the SDI and the tools), as deemed appropriate by the Platform.

2. Building a Basin-Wide View

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, which will require strong collaborations across multiple disciplines. As reported in Chapter 2 of this IRA proposal, ICZM science is still predominantly situated in 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 a lot of work to be done with regard to 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. 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 specific actions and guidelines that suitably exemplified these five priority areas, the editors identified six themes that bridged various PEGASO objectives:

1. Science-Policy Interface

The PEGASO experience illustrated a need for better-informed solutions to address EsA in current governance and institutional settings. This requires improved knowledge-producing systems that are capable of informing and shaping tailored 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 proposal 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. 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 e.g. estimate potential impact intensities of different human activities (both marine-based and land-based) on marine and coastal environments and their ecosystem functioning.

2. Bridging the Gaps Between Different Sub-Regions of the two Basins and Beyond

Throughout the PEGASO project a continuous search for exchange among different contexts and cultures took place. This 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 field of: 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. Ecosystem-Based Management

Ecosystem-based management was the guiding approach throughout this PEGASO assessment and it is clear that work still needs to be done 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. 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 provided 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 *i.a.* 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 were 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 Northern 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 finetune 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. following the EU principle of 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, it is usually difficult if not impossible for one or few people to possess the range of knowledge needed for effective ecosystem management*" [50]. 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.

A Roadmap for ICZM Implementation in the Black Sea

The Black Sea represents a specific case in the context of the PEGASO project. The project was considered as a manner to restart the debate on ICZM in the region. Some specific activities were undertaken in collaboration with the Permanent Secretariat for the Black Sea Commission PSBSC, with the main intention to develop a policy document similar to the ICZM Protocol for the Mediterranean. To test the feasibility of establishing an instrument of this kind, the PSBSC engaged the Black Sea country representatives (ICZM National Focal Points to the Black Sea Commission and Members of the ICZM Advisory Group) in the PEGASO project task, together with the Mediterranean countries. Jointly they embarked in conducting an ICZM implementation audit inventory, 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. The Black Sea countries successfully completed the individual stock-taking exercise and produced a regional synthesis report, which is documented in Abaza *et al.* [22] and in Antonidze *et al.* [21].

Instrumental in reviewing the state of coastal governance in the 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 Sea was held on 16-17 October 2012 in Arles, France). The discussions during this 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 to the development of the 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.

The 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 the substantive similarity in the findings of two independently composed working groups of regional stakeholders, present at the Istanbul Visioning Workshop. The identified key-outcomes and needs can 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 study sites

— 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, an 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 two points:

— The 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 further extend 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.). The ICZM Platform, including the CoastalWiki and SDI tools, could provide the best format for the development and presentation of the Guideline.

6.2 Conclusions

An overarching goal of the PEGASO work to review marine and coastal assessments was to identify ways to improve the efficiency of assessment 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 ways to collate 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 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 the 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 multiple, two critical topics were chosen as a focus and used to test the various tools: land use and natural capital. Both of these are regarded as 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 and existing assessment tools, using balanced land development and conservation of natural capital as focal issues. 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 marine habitats, and local-level tools were used to validate causal effects at a finer scale. Data layers were developed on the density of urban development. Outputs could be refined to show temporal and spatial trends. For example data was disaggregated to show the percentage of urbanisation in strips of varying distance from the coastline; or trends in areas of urbanisation over a multi-year period; or the difference in the share of urban land use, far and near coastal strips, to indicate the overall degree of balance in urban development. The 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/km^2), coastal erosion rate (m/year), and hectares of urban land.

Marine and coastal ecosystems provide the valuable natural capital as a basis for the economy and living environment of the Mediterranean and Black Sea regions. Data to describe the current use and trends in 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 include: percentage of natural area coverage, the share 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 also reflect other parameters such as vegetation coverage, therefore biasing inferences. The world database of protected areas was used as a source of data for

assessments of natural capital, yet data were not available for some countries included in the regional assessment, therefore skewing the regional effort. However, by using a combination of complimentary assessment tools (such as LEAC, CIM, Indicators and Indices), general patterns can be drawn despite these uncertainties. Subsequently, appropriate tools can be selected for detailed analysis of areas identified by broad-scale methods.

Assessment methods that do not use an ecosystem-based approach may mask the existence of unsustainable use of ecosystem goods and services. 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 critical to consider the various scales of impact on ecosystem functioning and productivity, and this applies to all of the threats to marine and coastal ecosystems discussed in this IRA proposal. 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 must continue to provide the 'space' for future discussions, dialogues and deliberations.

The work described in this PEGASO IRA proposal aims to produce 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 ecosystems.

References

1. PAP/RAC webpage: www.pap-thecoastcentre.org/
2. http://cmsdata.iucn.org/downloads/mbecosysman.pdf
3. http://www.pegasoproject.eu/wiki/Ecosystem_approach#cite_note-1
4. Douvere, F., Ehler, C., (2007). International Workshop on Marine Spatial Planning, UNESCO, Paris, 8–10 November 2006: A summary. *Marine Policy,* 31 (4):582-583
5. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2008:0791:FIN:EN:PDF
6. http://ec.europa.eu/maritimeaffairs/documentation/publications/documents/com_2010_771_brochure_en.pdf
7. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2013:0133:FIN:EN:PDF
8. Mee, L. D. (2005). Assessment and monitoring requirements for the adaptive management of Europe's regional seas. In: *Managing European Coasts* (pp. 227-237). Springer Berlin Heidelberg.
9. Langmead, Olivia, Abigail McQuatters-Gollop, Laurence D. Mee, Jana Friedrich, Alison J. Gilbert, Marian-Traian Gomoiu, Emma L. Jackson, Ståle Knudsen, Galina Minicheva, and Valentina Todorova. "Recovery or decline of the northwestern Black Sea: A societal choice revealed by socio-ecological modelling." *Ecological modelling 220*, no. 21 (2009): 2927-2939.
10. Meiner, A. (2010). Integrated maritime policy for the European Union—consolidating coastal and marine information to support maritime spatial planning. *Journal of Coastal Conservation,* 14(1), 1-11.
11. Rochette, J., & Bille, R. (2012). ICZM Protocols to Regional Seas Conventions: What? Why? How? *Marine Policy,* 36(5), 977-984.
12. Brown, K. 2003. Integrating Conservation and Development: A case of institutional misfit. *Frontiers in the Ecology and Environment* 1 (9): 479-487
13. Young, O. R. with contributions from A. Agrawal, L.A. King, P.H. Sand, A. Underdal, and M. Wasson. 1999/2005. Institutional Dimensions of Global Environmental Change (IDGEC) Science Plan. Bonn: *IHDP Report* Nos. 9, 16
14. Galaz, V., Olsson, P., Hahn, T. Folke C., and U. Svedin. 2008. The problem of fit among biophysical systems, environmental and resource regime, and broader governance systems: insights and emerging challenges. In . Young, O.R., Leslie, A.K. and H.Schroder (eds) *Institutions and environmental change: principal findings, applications and research frontiers.* The MIT Press, Cambridge MA
15. Halpern BS, Walbridge S, Selkoe KA, Kappel CV, Micheli F, *et al.* (2008) A global map of human impact on marine ecosystems. *Science* 319: 948–952.

16. Folke, C., T. Hahn, P. Olsson, *et al.* 2005. Adaptive Governance of Social-Ecological Systems. *Annual Review of Environment and Resources* 30: 441-73.

17. Brochier F., Santoro F., and Barbiére J. (2012), *Desktop Review of Regional Assessments,* PEGASO Input in Deliverable 5.2A.

18. EEA, 2006. Priority Issues in the Mediterranean Environment. European Environment Agency, *EEA Report* No. 4/2006

19. http://www.pap-thecoastcentre.org/MedPartnership

20. http://www.unepmap.org/

21. http://www.pegasoproject.eu/wiki/ICZM_Process_diagram

22. Antonidze E., Ikomov L., Gvilava M., Ipsas-Sava C., Costache M., Yarmak L.P., Hamamci N., Ozhan E., Karamushka V., and Abaza V. (2013). *Stock-Taking on ICZM in the Black Sea Region*, D2.2.B PEGASO project.

23. Abaza V., Antonidze E. *et al.*, (2011), "Taking the Stock of and Advising the Way Forward with ICZM in the Black Sea Region", In: Ozhan, E. (Ed.), *Proc. of the Tenth Intl Conf. on the Mediterranean Coastal Environment, MEDCOAST 11,* 25-29th October 2011, Rhodes, Greece, vol. 1, p. 1-11.

24. Pegaso Project: D.2.3 *Report on science capacity,* 2011. A. Lehmann, Ozhan E., Breton, F. (eds). Pegaso/D2.3/UNIGE/110929-L-6.0

25. http://ec.europa.eu/research/bioeconomy/fish/research/ocean/index_en.htm

26. http://www.kg.eurocean.org/

27. Santos, R.; Carvalho, T.; d'Ozouville, L. (2007). *Marine science and technology projects funded under the 6th Framework Programme of the European Commission. A statistical overview.* EurOcean: Lisbon. 8 pp. http://www.vliz.be/en/imis?module=ref&refid=229000

28. Jagot, C.; Jellasics, H.; Fuchs, J. (Ed.) (2012). *Marine-related proposals 2007-2010 including proposals with potential applications in the maritime sector.* Publications Office of the European Union: Luxembourg. ISBN 978-92-79-19760-4. 85 pp. dx.doi.org/10.27777/51677. http://www.compendiumkustenzee.be/en/sources?refid=216054

29. http://www.kg.eurocean.org/

30. http://ec.europa.eu/ourcoast/index.cfm?menuID=4

31. United Nations Conference on Environment and Development (UNCED) (1992). *Rio Declaration on Environment and Development.* The United Nations Conference on Environment and Development", Rio de Janeiro 3-14 June 1992.

32. United Nations Conference on Environment and Development (UNCED) (1992). *Agenda 21* United Nations, Rio de Janeiro. The United Nations Conference on Environment and Development", Rio de Janeiro 3-14 June 1992.

33. UN/ECE (1998). *Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters.* ECE Committee on Environmental Policy, Aarhus, pp. 28.

34. Reed M. S., Graves A., Dandy N., Posthumus H., Hubacek K., Morris J., Prell C., Quinn C. H., Stringen L. C. (2009). Who's in and why? A typology of stakeholder analysis methods for natural resource management. In: *Journal of Environmental Management* 90, 1933–1949.

35. Arnstein S. R. (1969). A Ladder of Citizens Participation. *Journal of the American Institute of Planners* 35:216-224.

36. Alcamo, J. (2001): *Scenarios as tools for international environmental assessments*. European Environment Agency, 1-31.

37. Ash, N, Blanco, H., Brown, C., Garcia, K., Henrichs, T., Lucas, N., Raudsepp-Hearne, C., David Simpson, R., Scholes, R., Tomich, T.P., Vira, B. and M. Zurek (Eds). (2010): *Ecosystems and human well-being: a manual for assessment practitioners*. Island Press.

38. EEA (2007). *Pan-European Environment: Glimpses into an Uncertain Future.* EEA Report 2007-4.

39. Hoagland, P., & Jin, D. (2008). Accounting for marine economic activities in large marine ecosystems. *Ocean & Coastal Management,* 51(3), 246-258.

40. http://pegasoproject.eu/wiki/PEGASO_CASES

41. Khouakhi PhD, ongoing.

42. Weber (2011). An experimental framework for ecosystem accounting in Europe, *EEA Technical report,* No 13/2011.

43. PEGASO (2013). *Common conceptual framework for the implementation of ICZM based on the review of current issues.* D2.1B. PEGASO Project.

44. http://pegasosdi.uab.es/catalog/srv/en/main.home

45. Mitchell, R.B., Clark W.C., Cash, D.W. and Dickson, N.M. (eds): *Global Environmental Assessments: Information and Influnce.* The MIT Press, Cambridge MA.

46. UNEP and IOC-UNESCO, 2009. *An Assessment of Assessments, Findings of the Group of Experts. Start-up Phase of a Regular Process for Global Reporting and Assessment of the State of the Marine Environment including Socio-economic Aspects*. ISBN 978-92-807-2976-4.

47. Mediterranean Strategy for Sustainable Development, A Framework for Environmental Sustainability and Shared Prosperity, UNEP-MAP, Athens, 2005.

48. Ehler, C. and F. Douvere. Visions for a sea change. Report of the First International Workshop on Marine Spatial Planning. Intergovernmental Oceanographic Commission of UNESCO and Man and Biosphere Programme. *IOC Manuals and Guide* No. 48, IOCAM Dossier No. 4, Paris: UNESCO 2007.

49. Haines Young, R. and M. Potschin (2011): Integrated Coastal Zone Management and the Ecosystem Approach. PEGASO Deliverable D2.1, September 2011, 11 pp. *CEM Working Paper* No 7. Available under: http://www.nottingham.ac.uk/CEM/WorkingPapers.html

50. Olsson P., C. Folke, and F. Berkes (2004). Adaptive co-management for building social-ecological resilience. *Environmental Management* 34:75-90.

PEGASO supports the implementation of the Integrated Coastal Zone Management Protocol for the Mediterranean and the development of ICZM policies in the Black Sea. PEGASO bridges the gap between science and policy-making by providing easy-to-use tools in support of science-based decisions for the sustainable development of the coastal and marine areas in the Mediterranean and Black Seas.

PEGASO promotes the integration of a suite of tools to improve the understanding of marine and coastal processes and to use these within a science-policy interface. This publication is intended to provide guidance on how to promote integrated approaches in the assessment of coastal and marine ecosystem to develop strategies and plan for their sustainable management. It is intended as a blueprint in support of future assessments in the Mediterranean and in the Black Seas, while being applicable in other regional seas.