D5.1A CASES reporting (10 CASEs at end of the 5 Phases: preparatory, Phase 1, Phase 2, Phase 3 and Conclusions) including comparison amongst CASEs and relevance of CASEs in the whole basin.
5.1B Evaluation report on CASEs multi sector, multi administrative and multi scale work, Integrated approach method in CASEs.

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

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Integrated Coastal Zone Management

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Authorisation

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1. Introduction

The PEGASO project aimed at the construction of a shared Integrated Coastal Zone Management (ICZM) Governance Platform with scientists, users and decision-makers linked with new models of governance. Within this framework, Collaborative Application SitEs (CASEs) play a key role as it emerges from Figure 1. In order to assess the sustainability of coastal zones and the state of the art in the development and implementation of ICZM processes, also with respect to the Mediterranean Protocol, 10 CASEs were considered. The CASEs were selected both in the Mediterranean Sea: Al Hoceima (Morocco), Bouches du Rhône (France), North Adriatic (Italy), Aegean islands (Greece), Dalyan-Köycegiz (Turkey), Nile Delta (Egypt), North Lebanon Coastal zone (Lebanon) and in the Black Sea: Danube Delta (Romania), Sevastopol Bay (Ukraine) and Guria coastal region (Georgia).

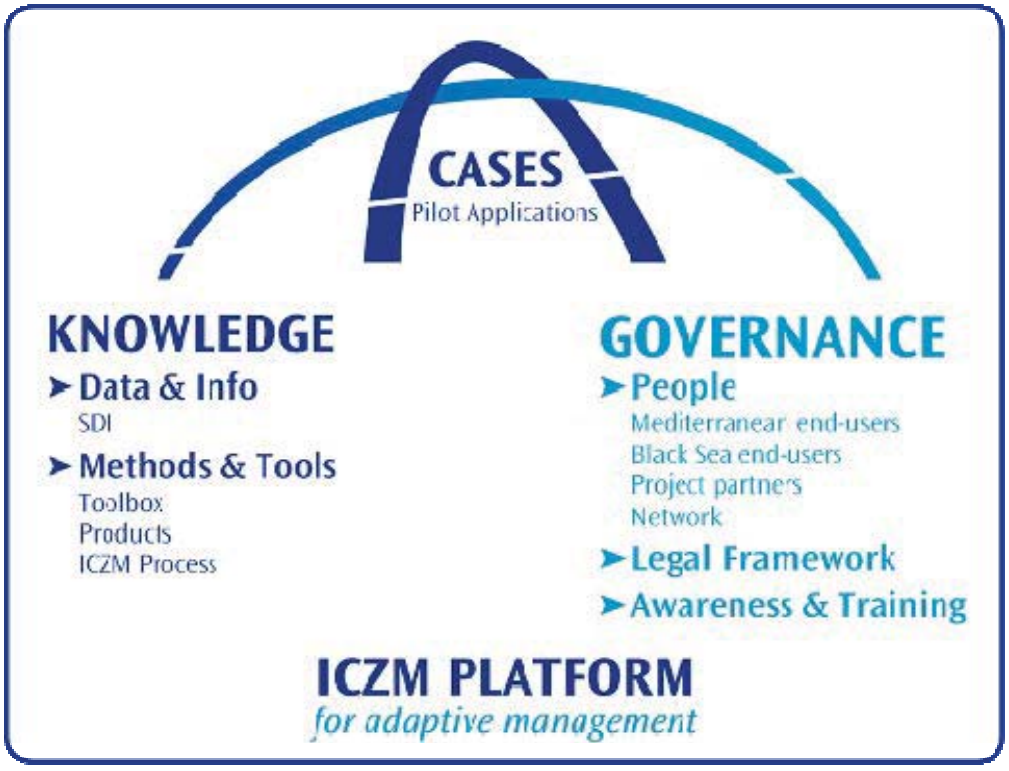


Figure 1 The ICZM Platform for adaptive management

In particular the CASEs had the possibility to test, validate and further develop the PEGASO tools (indicators, Land and Ecosystem Account (LEAC), participatory methods, scenarios, socio-economic valuation), or to develop and test other suitable tools while sharing data, experience and learning from specific training provided by the project.

CASEs were selected in order to be representative of each basin and to address the main land uses (coastal cities, harbours, and natural areas), maritime activities (tourism, fisheries, aquaculture, and protection) and relevant coastal issues (impacts of climate change, ecosystem health, water

quality, urbanization growth) as well as different spatial scales: local (Dalyan-Köycegiz), sub-national (North Lebanon), and supra-national (the Aegean Sea, the North Adriatic). Furthermore, they were selected because of their relevance for:

- the ICZM Protocol (National coastal interface),
- the eco-regions of the Marine Strategy Framework Directive (e.g North Adriatic, Aegean islands),
- trans-boundary management (North Adriatic).

Moreover, they were chosen based on their representativeness of specific coastal vulnerable areas (wetlands and deltas, islands) and on the possibility to provide support in better understanding the synergies between land and sea, especially in the case of cities impacts on gulf ecosystems (Bouches du Rhone and Marseille, Sebastopol bay). CASEs were also selected based on the different experience in ICZM.

The following paragraphs describe the coordination process of the 10 CASEs, the coastal issues and tools selected. Furthermore, the main results achieved and lesson learned, also concerning integration, are presented.

Figure 2: The CASEs (1 Al Hoceima (Morocco), 2 Bouches du Rhône (France), 3 North Adriatic (Italy), 4 Aegean islands (Greece), 5 Dalyan-Köycegiz (Turkey), 6 North Lebanon Coastal zone (Lebanon), 7 Nile Delta (Egypt), 8 Danube Delta (Romania), 9 Sevastopol Bay (Ukraine) and 10 Guria coastal region (Georgia).

2. CASEs coordination

Ca' Foscari University (UNIVE) has been in charge with the coordination of the CASEs activities; the overall aim of the coordination was to assist the different CASEs in the implementation of ICZM initiatives in their site, and to provide a link between the PEGASO tools, the capacity building and the specific needs of the CASEs. In order to manage and harmonize the CASEs work several actions have been carried out during the 4 years of the project. An introductory explanation of the coordination activities is here presented. Finally all the coordination activities are summarized in Table 2.

In order to get an overview of the characteristics, coastal issues, expertise and objectives of the 10 CASEs a questionnaire was circulated at the very beginning of the project in 2010. The questionnaire was also aimed at preparing the work for the test phase to be done during the 2nd year. In October 2010 the "*Inception CASES Workshop*" was organized in Alexandria (Egypt). The meeting aimed at getting a common understanding of the PEGASO CASEs and tools, and clarifying the link between CASEs, implementation of ecosystem approach and the ICZM Protocol. During the meeting a first definition of CASEs scope and preliminary development of a work plan was carried out.

Figure 3: The First CASEs Meeting

Figure 4: The Nile delta field trip

CASEs activities officially started the 1st of February 2011 and during the month of May the identification document (CASE ID) was finalized. By filling the CASE ID, the teams had the possibility to deepen their awareness in choosing the coastal issues, the objectives to fulfill and the end products. The CASE ID was also meant to help each team selecting the main tools and their training needs. Moreover, team members clarified their role in the project, their expertise and needs. It is important to highlight that the coastal issues and tools chosen strongly reflected since

the beginning the expertise that were present in the CASES team, as well as the previous experiences matured/developed/accumulated in the ICZM field.

In May 2011 UNIVE, in collaboration with PlanBleu and PAC/RAC, developed a template for the CASES work-plan. The template aimed both at supporting CASEs in the organization and monitoring of their work as well as to provide UNIVE with homogeneous standard data about how CASEs were proceeding, emerging problems and possible solutions. The template consisted of four parts, namely: a) the *CASE Planning Document, Phase planning, b) Technical Specification Checklist, c) Quality Assurance Plan and d) the communication plan.* Each part was specifically addressing management, monitoring and evaluation of CASEs activities as well as communication of the results. Table 1 below shows an example of a filled CASE Phase planning outline of the activities during the second year of the project .

Deliverable No.	**Task No.**	**Task description**	**Person Responsible *(for carrying out task)***	**Applicable Resources**	**Deadline**	**Dependencies *(between tasks – helps determine timeline)***
1. CASE ID	1.1	Filling of the CASE ID	Bazaïri & Snoussi	CASE experts	31.12.2010	
2. Diagnosis Analysis	2.1 Land use map	Spatial data collection	Khouakhi & Raji	GIS Software, GIS experts	31.07.2011	2.2, 2.3, 2.4, 3.1
	2.2 Environmental diagnosis	Environmental (terrestrial & marine) data collection & analysis	Mhamdi & Niazi	Coastal geoscientists	31.07.2011	2.1, 2.3, 2.4, 3.1
	2.3 Ecological diagnosis	Biodiversity and Natural resources	Bazaïri	Marine Biologist	31.07.2011	2.1, 2.2, 2.4, 3.1
	2.4 Socio-economic diagnosis	Socio-economic data collection & analysis	Adidi	Socio-economist	31.07.2011	2.1, 2.2, 2.3, 3.1
3. GIS database	3.1	Georeferenced Data	Khouakhi & Raji	GIS Experts	20.08.2011	2.1, 2.2, 2.3, 2.4
4. Final Diagnosis Report		Synthesis	Adidi, Bazaïri & Snoussi	CASE experts	31.08.2011	2.1, 2.2, 2.3, 2.4, 3.1

Table 1: Phase planning of Al Hoceima (period 1)

Thanks to the information received during the Second General Meeting (Tulcea Romania, July 2011), CASES were asked to revise their work-plan. During the months of September and October 2011, the activities carried out during the first phase of work (1st February 2011-31st August 2011) were revised by UNIVE and summarized in the Internal Deliverable Input to D5.1A. At the end of the second work phase in April 2012, UNIVE started collecting information on:

- the work done, the main results attained and the planned activities for the next steps;
- the relation of these elements with the ICZM principles and approaches and
- the common problems encountered by CASES.

All the information was then posted within the document "CASEs evaluation summary" on the Intranet of the project (http://gstgis.com/alfresco/d/d/workspace/SpacesStore/a101d549-b4a9-4749-a82a-d376375684cb/CASES_evaluation_summary_22_12_11.pdf).

UNIVE organized in Venice (Italy) the Second CASEs meeting (2nd and the 3rd of July 2012). The meeting aimed at discussing progress and problems encountered especially in relation to the PEGASO tools. By using the participatory method Open Space Technology (http://www.pegasoproject.eu/wiki/Open_space_technology) the meeting aimed at fostering cooperation between CASEs coordinators and the responsible for the development of the tools. Furthermore, the meeting aimed at clarifying the relation between CASEs and the Regional Assessment and the contribution of the CASEs to the Visioning Exercise.

Figure 5: Organization of the Visioning workshop


Figure 6: Working group

In Mid-September 2013, CASEs delivered the final Evaluation Report. The questionnaire was aimed at investigating the socio-political and economic relevance of the identified coastal issues as well as their relation with the ICZM Protocol and Principles implementation. The report, on the basis of the collected information, shed light upon the relation between the current policies addressing the selected coastal issues and the referring ICZM Protocol articles and principles. The contribution and relevance of the work carried out in PEGASO for the ICZM process was also addressed. The second part of the questionnaire asked CASES coordinators to focus on the process of stakeholders involvement within each CASE, the tools used and the main constraints faced. The main achievements and the lessons learned (both regarding the ICZM process and the project management) were also reported. All the reports are included in this document.

Within the PEGASO project capacity building is strictly related to the main objective of the project, namely: "*Bridging science and decision making, enabling possibilities of thinking together, sharing the different knowledge from the different Mediterranean and Black Sea experiences and cultures, to build a set of common knowledge on ICZM as geared by the ICZM Protocol*". In this framework

capacity building is not only considered as training but also as building awareness, strengthening cooperation and integration, sharing knowledge and skills, and learning common technical capabilities. For this reason a specific space of the WIKI has been dedicated to the CASE (http://www.pegasoproject.eu/wiki). For each CASE the main characteristics are presented (coastal issues, ICZM phase, relation between the coastal issues and the ICZM protocol principles and articles, relevance of the coastal issues, objectives, end products and tools). Furthermore, in order to share the experiences of the CASEs in attempting to bridge the gap between science and decision-makers the CASEs experiences in stakeholders' involvement and lesson learned were uploaded on the Coastal WIKI (http://www.pegasoproject.eu/wiki/Participation_in_the_North-Adriatic_(DSS-DESYCO).

Action and Time	Objective	Results
Development, distribution, collection and analysis of the questionnaires for the 10 CASEs. (April-June 2010)	To gain information on CASEs characteristics and coastal issues.	Collection of standardize information about CASEs
Analysis of the questionnaire (June- September 2010).	To present information on the CASEs	Analysis of CASES characteristics including description of the area, main issues, conflicts and links with the ICZM protocol.
Organization of the first CASES Workshop (September 2010).	To present to the CASEs the questionnaire analysis and guidelines for the implementation of a strategy for the activities development and implementation.	Participation to the Workshop (6-8 October 2010, Alexandria, Egypt).
Submission and collection of Input. (September 2011)	To gain main information regarding the evaluation of the CASES after the first work period (1st February 2011- 31st August 2011).	10 reports collected. Reports are available in the Intranet. D5.1A (10 CASES at the end of the 5 phases: preparatory, phase 1, phase 2, phase 3 and conclusions) including comparison among CASES and relevance of CASES in the whole basin).
Submission and collection of the Progress Report. Input to D5.1A. (April- May 2012)	To collect information on activities undertaken, main results attained, and planned activities, 2) relation to the ICZM principles.	10 reports collected. Reports are available in the Intranet.
Submission to all the WP4 tool leaders of the report and invitation to the Second CASEs meeting. (May 2012).	To foster collaboration between WP4 and WP5.	Minutes available on the Intranet CASEs participation to the VIC02
Organization of the Second CASEs meeting (2-3 July Venice, Italy)	To understand how the work in CASES are progressing, the different results and the common problems encountered; To allow comparison of the different CASES, and to link the CASES work with the Regional Assessment phase.	Minutes available on the Intranet
Collection of information on CASEs participatory strategy (September 2012)	To highlight CASEs strategy to bridge the gap between science and decision makers.	I.D 5.1 phase 2. Bridge the gap between science and decisions makers participatory strategies in the CASEs
Collection of final Evaluation Report	To collect comprehensive input on CASEs work	Final reports D5.1A and D5.1B

Table 2: CASEs coordination activities

3. CASEs description

In this chapter, based on the analysis of the reports collected during the different phases of the PEGASO project, an analysis of the main characteristics of the CASEs is provided. Firstly the coastal issues considered in the Mediterranean and Black Sea sites are discussed (paragr. 3.1). Secondly, the tools applied by CASEs in order to cope with the selected coastal issues are described (paragr. 3.2). Finally in paragraph 3.3, based on the comparative analysis of the final CASEs reports a synthesis of the results of the CASEs is provided.

3.1 Coastal issues

The selection of coastal issues

CASEs have selected those coastal issues that were considered the most relevant for the area but also that could be better analysed according to the research team expertise. These coastal issues were proposed by the different CASES teams during the preparation phase of PEGASO and the first year of activity of the project. Some coastal issues (Table 3) were common among CASEs, for example climate change impacts and water quality were considered of main concern in both basins. Nevertheless, the final objectives, tools and end-products were different from CASE to CASE and reflected local priorities and conditions.

The selection was mainly based on the available expertise and perceived priorities of the research teams. However, the CASEs of Bouches du Rhône, Nile Delta, Danube Delta and Al Hoceima selected the coastal issues in a participative way. The Bouches du Rhône selected the coastal issues by the mean of key-stakeholders interviews, while the Nile Delta CASE organized specific workshops with the stakeholders for their identification. The Danube Delta, on the other hand, identified the main coastal issues by a twofold approach: first a field research regarding the main coastal issues afferent to Sulina CASE and afterwards a prioritization with the local stakeholders. Finally, the Al Hoceima CASE made a SWOT analysis to defined with the stakeholders the main coastal issues to analyze.

Same coastal issues, different management

The selected coastal issues, as mentioned above, were sometimes shared by different CASEs. However, the ways in which they have been considered differ dramatically. As an example we here refer to the different ways maritime transportation has been consider with respect to ICZM or territorial/environmental management.This topic has been addressed by the Aegean Islands, Bouches du Rhône and Dalyan-Köycegiz Specially Protected Area (SPA)CASEs. In the former CASE, maritime transportation is the basis for local development because it represents the main logistic platform for people and goods interconnecting all the economic activities entailing also a negative

externality (risk) related to maritime accidents. For Bouches du Rhône, maritime transportation has been identified as one of the main coastal issue by the stakeholders because of its implication for water quality and risk management. In the CASE of Dalyan-Köycegiz Specially Protected Area (SPA), on the other hand, transportation represents the main origin of pressures on ecosystems due to tourists' boats sailing from the town of Dalyan to the turtle beach through the river and the delta. Therefore in this CASE the issue is strictly linked to the effective management of the SPA.
Another coastal issue addressed in different way according to the CASEs specificity is nature conservation and how it relates to coastal system's dynamics and management. For instance, the North Adriatic CASE has investigated the existence of transboundary management network of MPAs among Italy, Slovenia and Croatia. On the other hand the CASE of Bouches du Rhône has studied how the different territorial units (the Calanque National park is one of those) share common management issues and how these issues are managed by neighboring units.
Again, it is important to stress that these problems and approaches have been defined and chosen by CASES coordinators, according to the specific characteristics of their CASE, previous experiences in ICZM matters and expertise available within the team.

Partnership among CASEs

The CASEs of Bouches du Rhône and Al Hoceima, due to some common coastal issues, decided to share their experiences in coastal management. For this reason the Al Hoceima CASE was invited to attend the stakeholders meeting of the French CASE "*Atelier de travail du projet européen PEGASO* " (Marseille 11th February 2013).

Al Hoceima	Bouches du Rhone	North Adriatic	Aegean islands	Dalyan-Köycegiz	North Lebanon Coastal	Nile Delta	Guria Coastal Region	Sevastopol bay	Danube Delta
Urban sprawl	Urban sprawl			Urban sprawl	Urban sprawl	Urban sprawl			
Erosion					Erosion	Erosion			Erosion
Climate change impacts		Climate change impacts	Climate change impacts	Climate change impacts		Climate change impacts		Climate change impacts	
	Water quality	Water quality		Water quality		Water quality	Water quality	Water quality	
	Nature conservation	Nature conservation		Nature conservation					Nature conservation
	Maritime transportation		Maritime transportation	Maritime transportation					
	Fishery		Fishery			Fishery			
Coastal resources and habitat degradation						Coastal resources and habitat degradation	Coastal resources and habitat degradation	Coastal resources and habitat degradation	Coastal resources and habitat degradation
			Tourism						

Table 3: Coastal issues

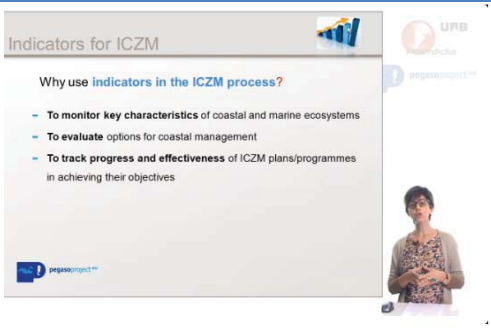
3.2 Tools

In order to assess the sustainability of coastal zones, PEGASO has developed 5 tools, namely: indicators, Land and Ecosystem Account (LEAC), scenario, participation and socio-economic assessment. In order to support CASEs in the implementation of the tools, training and tutorials were prepared and provided. For what concerns the tool on participation, UNIVE organized with PAP/RAC and PlanBleu the on-site '*Training of Trainers*' for the CASEs. The event was targeted to those CASES that expressed their interest and need in training on participatory tools and more specifically to those CASES team members that were responsible for the realisation of participatory approaches. The training was held on the island of San Servolo (Venice-Italy) from the October, 31st to November, 3rd 2011. Only the CASEs of Bouches-du-Rhône (France), Aegean Sea Islands (Greece), North Lebanon Coastal Area and Sevastopol Bay (Ukraine) declined the invitation to attend the training.

The main objectives of the training could be summarized as follow:

- To prepare facilitators.
- To understand principles and tools for dealing with stakeholders (stakeholder management).
- To know how to prepare, conduct and follow-up on participatory events (in relation to CASE Work Plan and stakeholder analysis).
- To practice facilitation skills.
- To contribute to capacity building for realisation of participatory approaches.

Besides the on-site training for participation, specific video tutorial providing information on the PEGASO tools were prepared and uploaded on the PEGASO website. Each video explains the objectives, data requirements and results of each tool. In Figure 6, a screenshot of the 4 tutorial with the related link to the online video is provided.



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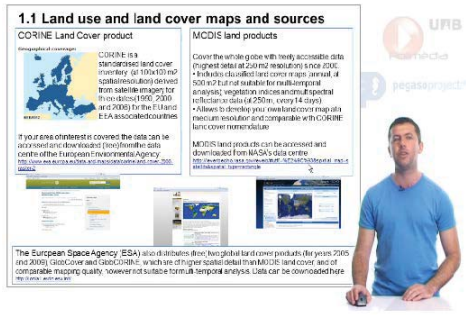


http://polimedia.uab.cat/#Inici

Figure 7: The polimedia tutorial videos

On the base of the intended objectives and available expertise, each CASE team selected the tools to adopt (table 2). It should be stressed that the availability of data has strongly influenced the selection of the tools; for example the lack of systematic monitoring of economic activities in coastal areas has strongly limited the possibility to carry out socio-economic assessment in the majority of the CASEs. In other circumstances the spatial scale of the CASE has been the limiting factor for the adoption of a particular tool (LEAC and some indicators above all). Besides the tools developed in the framework of PEGASO, CASEs have developed and implemented other tools, such as the Vulnerability assessment of climate change, Decision Support System, Model for monitoring bathing water quality and system modelling for spatial planning initiatives.

CASEs	Pegaso tools					Other tools developed			
	Indicators	Socio economic assessment	Participation	LEAC	Scenario	Vulnerability assessment	DSS for Climate Change	Bathing Water quality Model (BHAM)	Sketch Match scenario
Al Hoceima	X	X	X			X			
Bouches du Rhone		X	X	X					
North Adriatic	X		X				X	X	
Aegean islands	X	X	X	X	X				
Dalyan-Köycegiz	X		X						
North Lebanon Coastal									
Nile Delta	X		X						
Guria Coastal Region	X			X					
Sevastopol bay	X								
Danube Delta	X		X						X

Table 4: CASEs and Tools

Following, a description of the application of the different tools in the PEGASO CASEs is provided. For each tool, an information box depicts the main characteristics of the tool.

Participation and LEAC

Participation

In order to ensure good governance, provide and gain useful information, mitigate conflicts, and understanding the needs of local population, participation is essential. Accordingly, Integrated Coastal Zone Management (ICZM), dealing with contrasting perspectives and interests in coastal areas, needs to embed participation as a pillar of the development and implementation of its strategy. As other environmental policies, ICZM requires different participation processes according to the aim, the available tools, the process phase and the level of involvement, interest and knowledge of stakeholders. Within PEGASO, participation is a cross-cutting issue and the basis for the integration of the tools developed (e.g. scenarios, indicators, LEAC and economic assessment).

The participation tool has been used both as a stand-alone tool and as the main mean for integration of data and information. For example, the Bouches du Rhône CASE has organized a workshop for presenting the results of the LEAC analysis to the stakeholders. During the workshop stakeholders' suggestions were collected and afterwards included in an updated version of the LEAC output. Furthermore, the completed tool was transferred to the Water Agency which will be responsible for its updating in the coming years.

Land and Ecosystem Accounting (LEAC)

LEAC is designed to provide multi-scale (hierarchical) outputs, to facilitate the assessment of processes that manifest at different levels e.g. continental, country, region and local level. The following outputs are expected:

- Assessment of the quantity and quality of the existing ecosystem capital.
- Assessment of the quality and quantitative of the derived annual flows of related ecosystem services or functions.
- Assessment of the 'balances' of remaining natural capital in a given year and also the potentials or trends in longer term.

On the other hand, in the North Adriatic CASE, and in particular in the framework of the development of the BHAM (Beach Health Advisory Model), the participation tool has been used to collect information on water quality issues in a specific site of the North Adriatic coast; while in the development of the Decision Support System (DSS- DESYCO) participation has been used to better address stakeholder's needs in the DSS output. In the Danube Delta CASE the tool has been used to promote spatial planning initiatives. For instance the CASE adopted the Sketch Match method: a participatory rural appraisal technique which involves the knowledge, the experience and the will of the local stakeholders in the process of identifying the main coastal issues, possible solutions or mitigation measures. Other CASEs, such as Dalyan Köycegiz, Aegean Islands, Nile Delta, Al Hoceima have organized specific workshop aiming at fostering knowledge on ICZM and on specific coastal issues.

Environmental Territorial Diagnosis (ETD)

Environmental Territorial Diagnosis (ETD)

it is an inventory on a given territory that lists problems, strengths and weaknesses, economic social and ecological issues, taking into account the diversity of stakeholders. It aims at providing explanation on the past evolution and assessment of the future one. it allows analyzing stakeholders' behaviors in terms of uses of shared natural resources for a site, according to the interest for these resources from an economic and ecological point of view.

The Al Hoceima CASE carried out an Environmental Territorial Diagnosis (ETD). The study allowed highlighting how the major economic activities (fisheries, agriculture and tourism) interact with the selected coastal issues (urban sprawl, coastal resources degradation and coastal vulnerability and climate change). The ETD showed how the degradation and decline of coastal resources have affected the well being of the local population and led to an increase of unemployment and to a large migration to Europe. The ETD was also carried out in the Bouches du Rhône CASE with the aim of identifying the main coastal uses and the environmental pressures, factors and impacts that influence the coastal zones.

Indicators

Indicators

Indicators are quantitative/qualitative statements or measured-observed parameters that can be used to describe existing situations and measure changes or trends over time. Their three main functions are simplification, quantification, and communication. Indicators can be used either to define the main objectives of the ICZM plan/ project by identifying the emerging issues, or to monitor the progress and the achievements of the ICZM plan/project objectives.

In order to assess the state of coastal resources, the Sevastopol Bay CASE selected and calculated several indicators. The CASE also developed a web portal which incorporates digital atlas and GIS features as well as a "traffic light" index. The index was applied, for instance, to assess average summer concentrations of ammonium in the surface layer of water. In such a way the tool not only assesses the state of coastal resources, monitor spatial and temporal variations in the state of coastal environment and trace negative and positive trends due to changes in anthropogenic pressures or/and climate changes, but also it foster awareness regarding coastal issues among stakeholders and citizens.

Scenario

Scenarios are "sets of plausible stories, supported with data and simulations, about how the future might unfold from current conditions under alternative human choices" (Polasky et al., 2011). In looking to the way scenarios might be used in Pegaso, it is important to note that there is no single 'right way' but that a different approach might be appropriate in different situations. Thus it is apparent that there are many global or regional studies that have already developed scenarios that should be discussed and updated and even extended within Pegaso.

In a coastal zone context, the Bayesian Belief Network (BBN) is used to improve the quality of decision-making in regards to the interaction between the manmade and the natural environment and to study and analyze relationships between people and their environment. The Lebanon North Coastal Zone implemented the BBN; the discussions focused on the objective of "*controlling artificialization*" on the coast of North Lebanon. The BBN tool was used to identify drivers and influences and their importance in "controlling artificialization". Twenty two participants representing 16 institutions were divided into five groups composed of 4-5 individuals each and moderated by a member of the CASE team.
Bayesian Belief Network (BBN) for Koycegiz – Dalyan CASE with the theme of Preserving and Enhancing Natural Capital has been carried out in Dalyan. Three workshops were organized with the stakeholders for the BBN study. The first BBN meeting took place on 6 November 2013 in Dalyan and it was attended by 38 local stakeholders. The second meeting was organised on 17 December 2013 with 19 stakeholders and local media members and the last on 7 January 2014.

3.3 CASEs results

Each CASE during the Project life span attained a set of results according to the selected coastal issues and related objectives. Moreover, CASEs have contributed, by developing local geonodes, to enrich the Spatial Data Infrastructure (SDI). In addition they have contributed to the Integrated Regional Assessment (IRA) by calculating specific indicators. The following table 5 and 6 and 7 summarised the main results achieved by each CASE encompassing also their contribution in to the SDI and the IRA.
For a more detailed description of the results, please refer to the final report edited by each CASE team and reported in the next chapters.

CASE	Main results	Contribution the SDI (data published)	Contribution to the IRA
Aegean Sea Islands	• Analysis of sea level rise on the coastal zone of the Aegean Islands. • Indicators calculation. • Improvement of stakeholders communication and awareness.	YES	• Population 1971-2011 and % change • Population on coast, 2011 • Are lost is sea rises 30 cm • Enterprise index • Attraction index[1]
Bouches de Rhone	• Set up of a local end users steering committee involved in the indicator set development. • Implementation of a territorial diagnostic. • Application of LEAC to detect changes in the land use of the area. • Enhancement of the collaboration between the local stakeholders and the Water Agency.	NO	• Change detection[2]
Al Hoceima	• Elaboration of physical and socio-economic vulnerability maps for the coastal zone • Erosion and land use change maps • Implementation of a territorial diagnostic. • Prospective analysis (choice of indicators and scenarios) based on a participatory process. • Enhancement of awareness on the ICZM protocol. • Involvement of local stakeholders in promoting ICZM initiatives.	YES	• Conservation condition of coastal and marine focal habitats and species in protected areas. • Area of built-up space in the coastal zone. • Density of the population living in the coastal zone. • Areal extent of coastal erosion.

Table 5 CASEs results and contribution to SDI and IRA

CASE	• Main results	Contribution the SDI (data published)	Contribution to the IRA
Sevastopol Bay	• Setting of a GIS type interactive system for the Sevastopol Bay to make available information on state of the environment, ICZM data and tools. • Application of Indicators for ICZM. • Development of a local SDI geonode providing information on the state of marine environment • Establishment of strong relations with local, national, and regional stakeholders.	YES	

- [1] The CASE has also calculated the following indicators: Hazard indicators, endangered wetlands, wetlands in good condition. wetlands polluted, protected Posidonia beds, bird fauna protected areas, NATURA 2000 areas, fisheries indicators, governance indicators, economic environment indicators, social structure indicators, aging/youth indicators, literacy indicator, employment indicators, poverty levels indicators, renewable energy production indicators.
- [2] In particular the following aspects have been detected: conversion of agricultural land to urban area, conversion of natural or semi-natural land to urban area, conversion of natural or semi-natural land to agricultural land, conversion of agricultural land to industrial area, conversion of natural or semi-natural land to industrial area, conversion of agricultural land to transport infrastructure, conversion of natural or semi-natural land to transport infrastructure, conversion of agricultural land to ports and conversion of natural or semi-natural land to ports.

Danube Delta	• Development of a spatial plan for the city of Sulina using participatory methods and scenarios • Awareness raising among local people on ICZM protocol. All the inputs and ideas of the 2 days work session with stakeholders came together into final sketches of problems, qualities and possible solutions to identified problems.	NO	
Nile Delta	• Set up of local coastal fora and development of land use plans. • Involvement of local stakeholders and awareness raising on ICZM	YES	• Coastal water quality. • Climate change (sea level rise).
• North Adriatic	• Development of a Decision Support System for climate change risk assessment for the coastal area. • Development of a forecasting model for the coastal water quality. • Analysis of the link between Marine Protected Areas and ICZM at transboundary scale. • Analysis of ICZM implementation at the Italian subnational level in the North Adriatic. • Involvement of stakeholders both from management and scientific sector in different workshops and focus group.	YES	• Area of built-up space in the coastal zone and size. • density of the population living in the coastal zone.

Table 6: CASEs results and contribution to SDI and IRA

CASE	**Main results**	**Contribution the SDI (data published)**	**Contribution to the IRA**
Köycegiz-Dalyan SPA	• Monitoring and auto-analysis of boat traffic in Dalyan Channel. • Application of a BBN methodology. • Increase stakeholder awareness on ICZM and coastal issues.	NO	NO
North Lebanon Coastal Zone	• Elaboration of Coastal vegetation, Land use, Coastal evolution,, Currents and wave description, Bathymetry, Granulometric analysis • Analysis of fisheries data • Set up of a coastal forum on indicators and data gathering • Application of a BBN methodology. • Increase stakeholder awareness on ICZM and coastal issues.	NO	NO
Guria Coastal Region	• Set up of the hydrological model for the catchment basin. Development of an ICZM progress marker input tool. • Participatory assessment and evaluation with the local community of the progress of Tskaltsminda ICZM plan. • Better access to coastal management information by stakeholders and the public.	YES	NO

Table 7 CASEs results and contribution to SDI and IRA

3.4 Lesson learnt

The experiences of CASEs in attempting to foster the adoption of Integrated Coastal Zone management has remarked the role of several key issues which still constrain its effective implementation. In particular the following key issues have emerged from the CASEs work:

- the importance (and difficulty) of bridging science and decision-makers;
- the need (and difficulty) of promoting organizational changes;
- the difficulties involved in the definition of the spatial scale that is needed for effectively representing problems/opportunities as well as for evaluating solutions;
- the issues related to the integrated approach;
- the role played by the problems of ensuring sustainability of ICZM efforts as basic main barrier to ICZM development and implementation.

Following, each identified key issue is discussed. The text boxes report considerations made by the CASEs as emerging from their CASE report.

The importance of bridging science and decision-makers

It is well known that despite the wide range of available scientific information related to coastal areas, the communication between science and policy still represents a neglected aspect of ICZM (Portman et al., 2012; Stojanovic et al. 2009; National Research Council, 1995). Against this background, CASEs have underlined the following issues as the main constraints faced in bridging the gap between science and decision-makers:

- the poor involvement of scientists in the management phase of coastal resources;
- the lack of reliable information for planning management initiatives;
- the difficulties related to the communication of scientific findings and their applicability for decision-making;
- the difficulties in the definition and prioritization of coastal issues and related management issues.

- *Despite, the strong interest of the decision-makers to scientific tools, the integration of the results in the management plans is not guaranteed because the decisions are often made from top to down, without the involvement of university scientists (Al Hoceima).*
- *The definition of objectives and structure of the ICZM plans and programmes is problematic as well as the prioritization of coastal issues (Bouches du Rhone).*
- *Need to reach consensus on the cause-objectives and issues of the management (Bouches du Rhone).*
- *Lacks of physical, ecological and cultural information hinder effective coastal management (Köyceğiz-Dalyan SPA).*
- *Data on costal resources has been traditionally summarized in the form of scientific studies leaving stakeholders and managers with the problems of data accessibility and utilization of data of different nature for integrated coastal zone management (Sevastopol Bay).*
- *The lack of information and effective information collection and exchange systems, the insufficiencies in environmental awareness and the low public participation in almost all decision making levels constitute additional obstacles to resolving the problems and to anticipating and preventing serious conditions in the future (Aegean islands) .*

The need of promoting organizational changes

The conflicting uses and the plethora of uncoordinated legislation that distinguish coastal areas require the development of new governance models built on partnerships and participatory processes. ICZM seeks to coordinate the different policies affecting coastal zones by promoting integration and cooperation among the different interests and responsibilities of the actors involved. In order to go beyond sectoral policies, a radical change in the existing management practices for coastal areas should occur; in particular for what concern the medium-long term scale perspectives of coastal measures in contrast with the short-term perspectives of political and socio-economic interests and the jurisdictional and natural boundaries of coastal areas (Le Tissier and Hills, 2010). Within this context, CASEs remarked how unclear competences management framework hinder the coordination of management actions for coastal zones. Furthermore, the existence of strong centralized environmental policies competencies causes dramatic mismatch with the local scale of management. To conclude, the experience of CASEs has also highlighted that the governance change implied by ICZM is still far for being a common reality.

- *The system of competences in coastal management (who-does-what) remains unclear and poorly coordinated (North Adriatic).*
- *ICZM continues to be not formally acknowledged within the public bodies that have jurisdiction and competences over the coastal zone (North Adriatic).*
- *There is an evident mismatch between national legislation and the specificity of local management (Köyceğiz-Dalyan SPA).*
- *There is the need of improving governance in order to progress policies coordination (Al Hoceima).*
- *On the administrative level, there is no mechanism responsible for the co-ordination and arbitration of initiatives and actions regarding coastal management. The coastal planning system is fragmented between national, regional and local bodies. It is characterized by many gaps and duplication, resulting in conflicts of jurisdiction in decision making. It is often oriented to addressing problems of the past and cannot foresee future needs and problems. The achievement of governance and inter-sectoral co-ordination in all levels constitutes a condition for the rational management of coastal areas (Aegean islands).*

The difficulties involved in the definition of the spatial scale.

Environmental governance and the implementation of ICZM in particular, stress on the need of building initiatives based on the specific conditions of the area of interest. However, in the current situation of global change, where several economic, social and environmental impacts are the results of global mechanisms there is the need of framing ICZM initiatives within strong national and regional management framework. CASEs have remarked the need of considering since the planning phase of ICZM initiatives the different organizational, scientific and management scale and at the same time they have highlighted the difficulties encountered in coordinating these different scales. It is important to highlight how the Black Sea Countries call for the adoption of an overarching legal framework on ICZM, in order to address all the initiatives for the management of coastal areas.

- *Need to find the proper scale not only from a scientific point of view but also from an organizational one (Bouches du Rhone).*
- *Need of coordinating plans and policies of different typology at different scales (Aegean islands).*
- *Need of an overarching legal framework (Sevastopol Bay).*
- *Because the coastal system is complex and multidisciplinary, it needs an integrated approach at national level, as mentioned in the ICZM Protocol. However, a good coordination at local level is needed in order to get ahead sectorial approaches of the Regional and Local government regarding the coastal issues (Al Hoceima).*

The issues related to the integrated approach

Integration is the cornerstone of an ideal ICZM (Portman *et al*., 2012) but at the same time it is one of the trickiest dimensions to achieve and measure. Integration has several dimensions: (1) spatial integration, (2) temporal integration, (3) horizontal (among different sectors) and vertical (among levels of government) and (4) among disciplines, which should all be considered in the implementation of ICZM initiatives. During the implementation of their activities CASEs have tried to promote integration in several ways (by involving stakeholders, by integrating different sources of information, by integrating knowledge and point of views on coastal issues, by using different PEGASO tools and promoting interdisciplinary topics). However, different remarks on the difficulties concerning integration, such as the complexity of achieving integration during a short-time project, the impossibility of having vertical integration where there is a predominance of top-down approaches were reported.

- *Integrated management is a long process that cannot be limited to the length of a 3-year project. Efforts must be made at the beginning of the project to not only stimulate participation from local stakeholders, but to create local stakeholder leadership. This will ensure not only the mobilization of the different actors throughout the process but also the continuation after the end of the project (Bouches du Rhone).*
- *The implementation of a top down approach and the lack of political commitment do not allow integration (Aegean islands).*
- *One of the most critical constrains in implementing ICZM principles and tools, is to ensure the integration of all the components of coastal management within an effective governance system. Strengthening the governance system is the most challenging tasks. Indeed, most of the problems and conflicts encountered proved to be attributable to the institutional (non-coordination of sectoral actions, inflexibility of procedures, and absence of prospective vision) and legal aspects (obsolete texts or unenforced laws, lack of control) (Al Hoceima CASE).*

The sustainability of ICZM efforts represents the main barriers to ICZM.

ICZM process is largely still developed through time limited projects (Mckenna and Cooper, 2006; Sorensen, 1993): this can lead to problem of funding, instability, and lack of commitment from statutory agencies (projects could be considered less relevant than statutory drivers) (Shipman and Stojanovic,2007). Therefore, there is a need to enable a follow up of the path and results set during single ICZM projects. CASEs, have in many occasion underlined the fact that ICZM initiatives based on project are not enough to involve a change in the governance of coastal resources; moreover, short time initiatives may cause mistrust of stakeholders in participation and ICZM effectiveness.

- *A weak point of the several ICZM projects carried out in the region is the lack of consistency and capitalization of knowledge, as well as the lack of integration between these projects and the structural elements of planning policies. None of these projects has actually implemented the identified actions. In fact, the challenge of integration and the real inclusion of these projects in the decision-making instruments of national policies rarely exceed the declaration of intent (Al Hoceima).*
- *A short time ICZM initiative risks undermining trust, transparency and stakeholder involvement (Aegean Islands)*
- *Participation and ICZM are long term process and if activities are not sustained in the long period efforts and results will be lost (Al Hoceima).*

4. The Mediterranean Sea Basin

The Mediterranean Basin encompasses an area of 2,085,292 km2 surrounding the semi-enclosed Mediterranean Sea, with 46,000 km of coastline. It includes 21 countries which are spread across 3 continents. From west to east the Mediterranean Basin stretches around 3,800 km while the maximum north-south distance is around 900 km. It also includes some 5,000 islands. The Mediterranean is a deep basin, with an average depth of around 1,500 m, composed of two main sub-basins, western and eastern, which communicate through the Sicilian Channel.

The Mediterranean climate is characterised by mild, wet winters and relatively hot, dry summers. These features are associated with the great pressure systems: the permanent Azores anticyclone, the great continental cyclone of Eurasia, and the low pressure over the north African desert and the tropical Atlantic. In spite of this generalisations, the temperature and rainfall can vary greatly throughout the region (from 100 mm/year to over 4,000 mm/year). The main rivers flowing into the Mediterranean are Rhone, Po, Ebro, Drini, Neretva, Tevere, and Nil. Apart from Nile, these rivers are all concentrated in the northern rim. River basins are generally small. Over the past 40 years, water inputs into the Mediterranean Sea have dramatically decreased, due to damming and irrigation.

Although the Mediterranean Sea makes up less than 1% of the global ocean surface, up to 18% of the world's macroscopic marine species are found there, of which 25 to 30% are endemic – an incredibly rich biodiversity for such a small area (Bianchi and Morri, 2000). A total of some 12,000 marine species recorded in the Mediterranean Sea is not equally distributed: it is greater in the western than in the eastern part. The most typical assemblage of communities is represented by Posidonia oceanica.

Flora and fauna diversity is outstanding: the Region is recognised as one of the first 25 Global Biodiversity Hotspots (Myers et al., 2000) hosting between 15,000 and 25,000 species, 60% of which are endemic. About one third of the Mediterranean fauna and a high proportion of Mediterranean animals are unique to the region. The Mediterranean is also hosting 253 species of endemic freshwater fish. Moreover, millions of migratory birds from the far reaches of Europe and Africa use Mediterranean wetlands and other habitats as stopover or breeding sites.

4.1 Human Pressure, State and Impacts

Coastal zones & urbanisation. One third of the Mediterranean population is currently concentrated in the coastal regions. Over the past 50 years, the population growth has been accelerated and it continues to expand, especially on the southern shores. In 2000, the stable population of the northern Mediterranean countries (193 M) has been overtaken by the population in the southern and eastern countries, which in 2000 totalled 234 M people, i.e. an

increase of 65 M. According to Plan Bleu (2009), the permanent population of the Mediterranean coastal states was approximately 460 M in 2008, with projection growth to 520 M by 2025. Projections for the coastal regions are approximately 186 million by 2025. The urbanisation rate in 1995 was 62%, forecasted to grow to 72% in 2025. However, the urbanisation rate in the North will increase from 67% to 69%, while in the South it is expected to be from 62% to 74%.

The migration to the coastal cities is accompanied by drastic changes in the region, with severe effects on marine ecosystem due in the first place to the discharge of wastewater. Even though, the biggest problem is not only continued growth in population, but also in infrastructure (urban sprawl). In fact, today nearly 40% of the total length of the coastal area is already being occupied (*Figure 1).*

Figure 1. Population Density and urban centres in the Mediterranean basin (Source UNDESA, 2011)

Tourism. Owing to its favourable position, mild climate, natural beauty, lavish cultural and built heritage, the Mediterranean basin is the world leading destination in terms of international and domestic tourism, accounting in 2011 for a third of total arrivals worldwide. Tourism is an essential economic activity in all the riparian countries. According to the World Tourism Organisation, the total number of tourists visiting Mediterranean region in 2000 was 220 M; in 2011, there were 306 M visitors, representing 215 billion euros in export earnings from international tourism. According to the latest estimates, this trend will continue, with 10 M new arrivals a year per average up to 2030 (*Figure 2*).

France, Italy and Spain are among the ten strongest market-destinations in the world, with the highest net income gained from international tourism. These are also countries that have large-scale domestic tourism. From 1990 to 2010, the 11 countries of the southern and eastern Mediterranean recorded the highest growth rates of inbound world tourism. Since 2008, the economic performance was subject to various serious crises (political, financial and economic) which had no major impact on this growth, which confirmed the resilience of tourism in the southern and eastern Mediterranean. The Arab Spring brought this trend to an abrupt halt in early 2011, but it may resume after 2014 with the gradual democratisation process, despite the economic slowdown of the European Union as its main market.

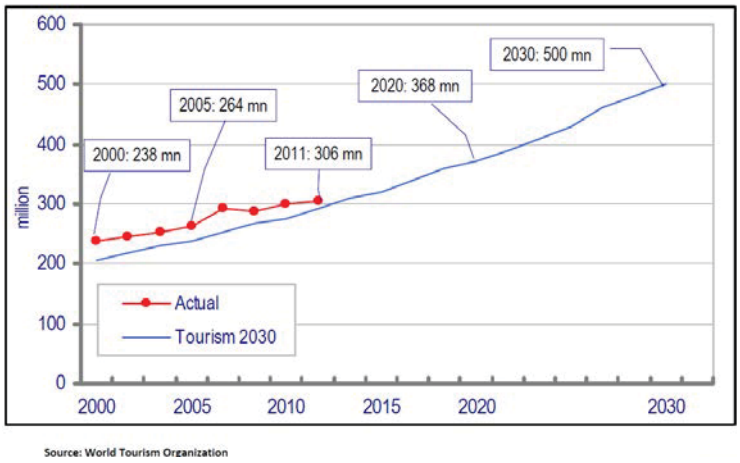


Figure 2: Mediterranean: Actual trend vs Tourism Vision 2030 (Source: WTO, 2011)

Agriculture. The Mediterranean area has been subjected to extensive farming, grazing and exploitation of forests. In the countries of northern and western coasts, there is an important decrease of arable land due to urbanisation and a strong increase of agricultural land under irrigation. In the south and east, where agricultural populations grew from 61 to 71 million in 40 years, cultivated surfaces expand at the expense of forest and grazing land. Agriculture in the Region, despite many different sub-climates, is mainly rain-fed. Cereals, vegetables, and citrus fruits account for over 85 % of the Mediterranean's total agricultural production (*Figure 3*). Cultivation of other products, such as olives for olive oil and grapes for wine, also occupies a significant amount of agricultural land (Leff et al., 2004).

The issue of food remains central. Losses of arable land due to eviction from land and natural events, associated with aridity (winds, heavy rain...), are exacerbated by inadequate cultivation and pastoral farming which are responsible for erosion. At the same time, pressure on water resources and land (from 0.55 ha per capita in 1960 to 0.30 ha in 2005) in a context of negative effects of climate change on agricultural production makes it more difficult to solve the issue of food security.

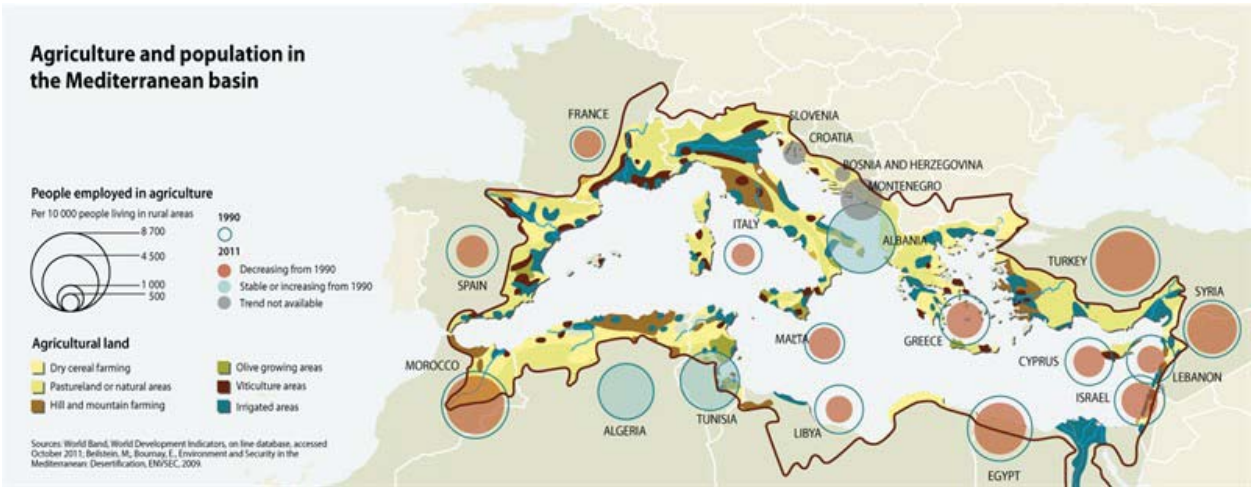


Figure 3: Agriculture and population in the Mediterranean basin (Source: World Bank, 2011)

In Mediterranean regions in transition, agriculture remains the second largest source of employment, after the services sector. The income from these jobs is lower than for other economic activities and informal work is still of great importance. In North Africa, agricultural employment accounts for 80% of the rural activity. In Turkey, agriculture still accounts for more than 65% of employment in rural areas and the workforce continues to grow. Organic farming is one way of tapping into agricultural added value whilst protecting the environment[3]. In the Mediterranean as a whole, the period 1990-2001 witnessed a drop in total use of pesticide of around 30%, but still agricultural run-off through rivers is by far the largest input of pesticides to the marine environment.

Fisheries and aquaculture. Mediterranean fish catches represent a bit more than 1% of total catches worldwide. Nevertheless, this volume is significant given that the Mediterranean sea represents less than 1% of global oceans. It is estimated that total catches by Mediterranean countries currently ranges between 1,500,000 t to 1,700,000 t per year, 85% being attributable to six countries (Italy, Turkey, Greece, Spain, Tunisia and Algeria). The Mediterranean has highly prized demersal fish, molluscs and crustaceans. According to the GFCM, certain species of economic and commercial importance are in an alarming state as a result of over-fishing. The situation is particularly alarming regarding blue fin tuna *Thunnus thynnus*, which is widely over-fished. Fishing is a major contributor to habitat damage in the Mediterranean Sea, mostly because of trawling operations.

Aquaculture is the fastest growing food industry in the world, in the Mediterranean area it has grown tremendously since its inception, almost forty years ago (*Figure 4*). Total aquaculture production has increased from 487,488 tonnes in 1995 to 1,228,457 tonnes in 2007. Moreover, the share of marine fish species in overall aquaculture output has risen from 13 percent in 1995 to 36 percent in 2007[4]. Fish farming development has been continouesly increasing and has led to obvious damages in the quality of the environment and priority habitats in the Mediterranean, especially regarding the proliferation of non-indigenious species.

[3] Source: CP/RAC
[4] FAO Fisheries and Aquaculture Department, Statistics and Information Service [FIPS], 2009

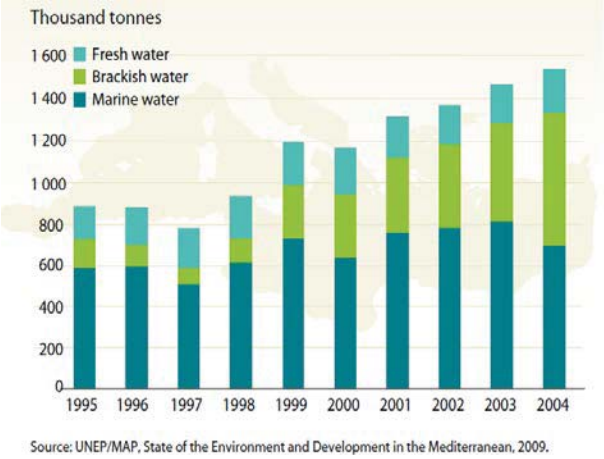


Figure 4: Aquaculture production in the Mediterranean (Source: UNEP/MAP, 2009)

Industry. Taking into consideration the world's 16 most important raw material, the Mediterranean countries production is higher than the world average. Generally, the gap in industrial development between the northern and southeastern countries is considerable. Italy, France and Spain together are predominant with 87% over the rest of the Mediterranean countries.

The oil and gas industry is very active in the region, Algeria, Egypt, Libya, Syria and Italy, leading to a very busy industry in terms of trade and distribution, such as the establishment of many refineries, networks of pipelines and port terminals. Two of the world oil transit points are located in the Mediterranean region: the Strait of Istanbul (Bosphorus) and the Suez Canal. Apart from the metallurgy and (petrol) chemical sectors, the other main industrial sectors include waste treatment plants, paper, paints, plastics, tanneries (*Figure 5*).

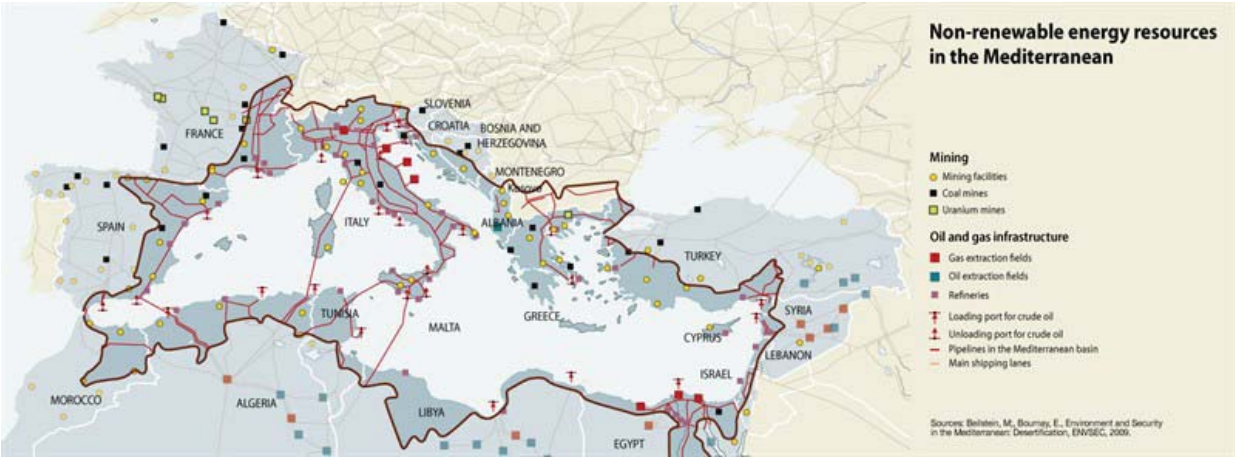


Figure 5: Non-renewable energy resources in the Mediterranean (Source: ENVSEC, 2009)

Industry can be considered as a major source of land-based pollutants of the Mediterranean Sea, especially of those known as toxic, persistent and bio-accumulative (TPBs). Less than a half of industrial wastewater is treated before being discharged into the sea or rivers, contributing with 410,000 t/y to the total BOD load of 805,000 t/y. There is a number of "hot spots" concentrated in the north-west part.

Energy production. The Mediterranean region accounts for 10,2% of the world electricity consumption and 8,2% of the primary energy consumption. This primary energy consumption - being overwhelmingly dominated by fossil fuels (80%, and only 6% renewable energies) - accounted for around 8% of the global CO_2 emissions in 2006. The Mediterranean still holds 5% of the world oil and gas reserves, concentrated at 98% in the South, and Libya alone accounts for 69% of the proven oil reserves[5]. Moreover, the real capacity in oil and gas supply of the Eatern and Southern Mediterranean are relatively underexplored, and recently large scale offshore discoveries in the Levantine basin since 2009 have raised the expectations about the hydrocarbons potential in the Eastern Mediterranean. Shale gas resources, although believed to be widespread, have not yet been quantified for most countries.

Since 1971, sustainable energy production has increased significantly in volume (+88%), and has been further stimulated since 2000 throughout incentives, policies and technological progress towards renewable energies. Hydrolic power is the most exploited source, reaching in 2006, 76% of the electric production based on renewable energy. The increase of solar and wind energy production represents a possible benefit for the region.

Maritime traffic. It is estimated that about 220,000 vessels of more than 100 tonnes cross the Mediterranean each year, accounting for 15 % of global shipping activity by number of calls and 10 % by vessel deadweight tonnes (dwt). More than 325,000 voyages occurred in the Mediterranean Sea in 2007, representing a capacity of 3,800 million tonnes (REMPEC, 2009). The major axis (90% of the total oil traffic) goes from east to west, from Egypt to Gibraltar. Also, the oil transport is the main commercial link between countries of the north and south Mediterranean (*Figure 6*). Liquefied natural gas (LNG) and liquefied petroleum gas (LPG) shipments also make up a considerable proportion.

On average, there are about 60 maritime accidents in the Mediterranean annually, 15 of which cause oil and chemical spills. Between 1977 and 2003, approximately 304,700 t of oil was spilled as a result of accidents. The direct environmental impact is on birds and marine mammals, less so on fish. From the economic point of view, the most directly affected activities are fishing, aquaculture and tourism.

[5] OME database based on Oil and Gas Journal and US Energy Information Administration, 2012.

Figure 6: Maritime transpoortation routes in the Mediterrenean (Source: ENVSEC, 2009)

Environmental state

From the available analysis it is very difficult to give an overall picture of the actual state of the Mediterranean Sea. Although data on environmental and pollution parameters is rather scarse for deep waters, their state is considered to be generally good. However, certain contaminants, such as lead and cadmium, have been found in significant concentrations within the deep canyons bordering the continental shelf, suggesting possible risks of long-term pollutant accumulation.

Because there are many differences (meteorology, geomorphology, water masses circulation, ecology, etc.) between the western and eastern sub-basin, the environmental characteristics and marine pollution problems in the two basins are to a large extent independent. The same is true for the Adriatic Sea vis-à-vis the central Mediterranean, or again the Aegean vis-à-vis the Levantine Sea.

All harmful substances stem from urbanisation and industrial development. These substances have been used to evaluate the pollution "hot spots" or "coastal areas where the coastal marine environment is subject to pollution from one or more points or diffused land-sources which potentially affect human health in a significant manner, ecosystems, biodiversity, sustainability or economy" (UNEP/MAP, 1998). The presence of these "hot spots", typically located in semi-enclosed gulfs and bays near harbours, big cities and industrial areas, probably constitutes the major problem of the Mediterranean Sea. The main identified pollutants are: municipal sewage (including micro-organisms), Persistent Organic Pollutants (POPs) including pesticides, Polychlorinated Biphenyls (PCBs) and Polycyclic Aromatic Hydrocarbons (PAHs), heavy metals, oils, radioactive substances, nutrients and suspended matter. Focusing on human activities, 131 "pollution hot spots" have been identified by the countries in the frame of the UNEP's Strategic Action Programme (SAP) of 2006. These hot spots are point pollution sources or coastal areas, which may affect human health, ecosystems, biodiversity, sustainability, or economy. From these hot spots, 26 % are urban, 18 % industrial and 56 % mixed (urban and industrial).

Land occupation and sea pollution negatively affect the distribution, diversity and survival of flora and fauna, and the natural ecosystems in general. In heavily disturbed or polluted areas, benthic communities disappear to a great extent. When organic enrichment exceeds the potential for re-mineralisation by benthic organisms, anoxic zones are formed and the seabed is covered by bacterial mats with damaging consequences in cases in which the affected seabed is a critical habitat and nursery, such as the seagrass beds.

One of the major manifestations of environmental degradation is habitat loss for certain endangered species, due to human activities. As an example, 1,500 km of coastline in the Euro-Mediterranean area is considered to be artificial, with harbours and ports constituting the major part (1,250 km). Wetland loss and degradation have also been identified as a serious threat to many aquatic species, especially water bird species nesting along the Mediterranean coastline.

The introduction of new organisms, in the form of exotic species may be threatening to a given ecosystem. It is estimated that about 80% of species introduced into the Mediterranean (naturally, through the Suez Canal or the Straits of Gibraltar, or accidentally from ship ballast) do not affect indigenous communities. However, certain species impact negatively, through changes in the natural environment and the possible genetic degradation of indigenous stock.

Water scarcity is part of the Mediterranean history; water is at the heart of economic and social development, and also a continuous source of conflicts between countries. The level of exploitation of water resources is high around the Basin and the water stress is increasing in most of the countries, particularly in the south and east Mediterranean. Exploitation ratios are over 50%, or even nearing 100% in many parts of the Mediterranean (Egypt, Palestinian Authority, Israel, Libya, Malta, Tunisia, most Islands and the Eastern regions of Spain)[6]. Up to date 80% of the population has access to safe drinking water, but it decreases to 60% or less in the rural areas of the South. The major deficits, in rural areas concern the water supply systems, sanitation services. In cities, the main issue is the maintenance of the distribution systems, with important losses ranging from 20 to 50%. Irrigation for agriculture is the biggest consumer of water, with an average proportion of 72% of the total consumption, exceeding 85% in some of North African countries.

As in other parts of the world, potential impacts from climate change in the Mediterranena include drought, floods, changes in soil erosion and desertification, storms, coastal erosion, changes in seawater temperature and salinity, sea level rise and biodiversity reduction. Such changes occur in a way that is likely to exacerbate the pressures on societies in constant development, and problems that already exist, particularly afflicting the natural wetlands and coastal lowland. In the latest IPCC Report[7] "Climate models have improved fidelity in simulating aspects of regional

[6] http://www.gwpforum.org
[7] Working group in contribution to the IPCC Fifth assessment report on CC 2013: the physical science basis, 2013.

climates over Europe and the Mediterranean, (...) there is high confidence in model projections of mean temperature in this region. It is very likely that temperatures will continue to increase throughout the 21st century over all of Europe and the Mediterranean region."

Culture and heritage

The Mediterranean cultural heritage, both in its tangible (monuments, historical settlements, archaeological sites, etc.) and linguistic cultural expressions (languages, literature, traditions, customs, etc.), constitutes a valuable resource for the Region. Certain other "assets" are equally significant: from the era of Ancient Greek colonies to those of the Etruscan centres, the Roman, Celtic and Muslim towns, the variety of landscape configuration, settlement systems and communication networks. One of the most visible monuments of cultural heritage are the manmade landscapes, which were traditionally structured around the three main Mediterranean components, encompassing the sea, the coast, and the mountains.

4.2 Regional and Global Governance and Regulatory Instruments

Besides being a part of many international agreements including the UN conventions and EU policies and directives, the Mediterranean Region has developed its own cooperation mechanisms and frameworks.

Barcelona Convention and its Protocols. In 1995, the Action Plan for the Protection of the Marine Environment and the Sustainable Development of the Coastal Areas of the Mediterranean (MAP Phase II) was adopted by the Contracting Parties to replace the Mediterranean Action Plan of 1975. At the same time, the Contracting Parties adopted an amended version of the Barcelona Convention of 1976, renamed Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean. Ten years later, in 2005, the Mediterranean Strategy for Sustainable Development (MSSD) was adopted to confirm the determination of the 22 Contracting Parties (21 Mediterranean states and EU) to protect the Mediterranean marine and coastal environment. The Barcelona Convention has given rise to seven Protocols addressing specific aspects of Mediterranean environmental conservation: Dumping Protocol / Prevention and Emergency Protocol / LBS Protocol / SPA and Biodiversity Protocol / Offshore Protocol / Hazardous Wastes Protocol, and the ICZM Protocol. Signed in 2008, the ICZM Protocol 'entered into force' in March 2011 after the required 6 ratifications. In the ICZM Protocol, now ratified by 8 countries and the European Union, we have the first supra-state legal instrument in the world aimed specifically at coastal zone management.

The MedPartnership. This programme is a continuation of the Large Marine Ecosystem -GEF Project run by UNEP/MAP (2002-2006)- which designed/elaborated two Strategic Action Programs to address pollution from land-based activities (SAP-MED) and for the Conservation of Mediterranean Marine and Coastal Biological Diversity (SAP- BIO). The two SAPs were formally

adopted by the Contracting Parties of the Barcelona Convention along with National Action Plans (NAPs) for SAP-MED. Today, the MedPartnership is being led by UNEP/MAP and the World Bank and is financially supported by the Global Environment Facility (GEF), and other donors, including the EU and all participating countries, through two lines of actions: (i) technical and policy support led by UNEP/MAP; and (ii) project financing led by the World Bank. The project is being implemented in close association with other relevant regional policies, EU policies and Directives, and contributes to the sustainable development objectives of the Union for the Mediterranean[8].

H2020 Capacity-building/Mediterranean Environment Programme. The "Horizon 2020 Initiative" aims to de-pollute the Mediterranean by the year 2020 by tackling the sources of pollution that account for around 80% of the overall pollution of the Mediterranean Sea: municipal waste, urban waste water and industrial pollution. Now known as H2020, the initiative was endorsed during the Environment Ministerial Conference held in Cairo in November 2006 and is now one of the key initiatives endorsed by the Union for the Mediterranean (UfM) at its launch in Paris in 2008.[9] The ENPI Horizon 2020 Capacity Building/Mediterranean Environment Programme (H2020 CB/MEP) addresses key issues to support the implementation of the Horizon 2020 Initiative Road Map and Work Plan through capacity building and awareness raising activities.

[8] Project carried out in the following GEF eligible countries: Albania, Algeria, Bosnia and Herzegovina, Croatia, Egypt, Lebanon, Libya, Morocco, Montenegro, Syria, Tunisia, Turkeyand The Palestinian Authority.

[9] http://www.h2020.net

Bibliography

Allen, H.D. (2001). *Mediterranean Ecogeography*. Ecogeography Series. Harlow: Pearson Education Limited. xxii + 263 p.

Annarita Mariotti (2011). Decadal Climate Variability and Change in the Mediterranean Region. NOAA's Office of Oceanic and Atmospheric Research, Silver Spring, Maryland . Climate Program Office.

Barazi-Yeroulanos, L. Synthesis of Mediterranean marine finfish aquaculture – a marketing and promotion strategy. Studies and Reviews. General Fisheries Commission for the Mediterranean. No. 88 Rome, FAO. 2010: 198p.

Blondel, J., Aronson, J., Bodiou, J-.Y. and Boeuf, G. (2010) *The Mediterranean Region: Biological Diversity in Space and Time*. Oxford University Press Inc., New York.

Conservation International: Biodiversity Hotspots - Mediterranean Basin (September, 2011). http://www.biodiversityhotspots.org/xp/hotspots/mediterranean/Pages/default.aspx

European Environment Agency (1999). *State and pressures of the marine and coastal Mediterranean environment.* Environmental assessment series No. 5. Luxembourg: Office for Official Publications of the European Communities. 137 p.

IPEMED (2009). Mediterranean 2030 - A foresight project for the Mediterranean region.

GWP (2000) "Integrated Water Resources Management", TAC Background Papers, No.4.

Plan Bleu (2005). *A Sustainable Future for the Mediterranean: The Blue Plan's Environment and Development Outlook*. Edited by G. Benoit and A. Comeau. London: Earthscan. xiii + 450 p.

UNEP (DEC)/MED (2003) Strategic Action Programme, Second report on the pollution Hot Spots in the Mediterranean, Part 1, country results, WG.231/5a.

UNEP/MAP-Plan Bleu: State of the Environment and Development in the Mediterranean, UNEP/MAP-Plan Bleu, Athens, 2009.

UNEP (2005). *Application of the Ecosystem Approach to the Management of Human Activities in the Marine Environment of the Mediterranean Sea: Definitions, Implications and Tentative Road Map*. Working document prepared for the Meeting of MED POL National Co-ordinators (Barcelona, 24-27 may 2005). 38 p.

UNEP/MAP/MED POL (2005): Transboundary Diagnostic Analysis (TDA) for the Mediterranean Sea. Athens: UNEP/MAP. xvii + 195 p.

WTO (2011). Tourism in the Mediterranean: Growth, competitiveness and sustainability. Euromed: Current Cooperation and Future Perspectives in Sustainable Tourism. Brussels, Belgium

5. Al Hoceima CASE

Section 1: Coastal Issues

Why did you select the identified coastal issues?

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

The main coastal issues selected are:

1) ***Urban sprawl and densification of the coast***

   Residential and tourism development at vulnerable areas (not conducive to urbanization) pose serious threats to the sustainability of the beaches, the National Park, and to agricultural lands.

2) ***Coastal resources degradation:***

   Beaches are lost due to the coastal squeeze and shoreline artificialization, river damming, mining of sand from dunes as well as from the Nekor and Ghis rivers. Bathing waters are contaminated by sewages and fertilizers. The coastal forest and other biological species are degraded. Fisheries are decreasing due especially to overfishing and illegal practices.

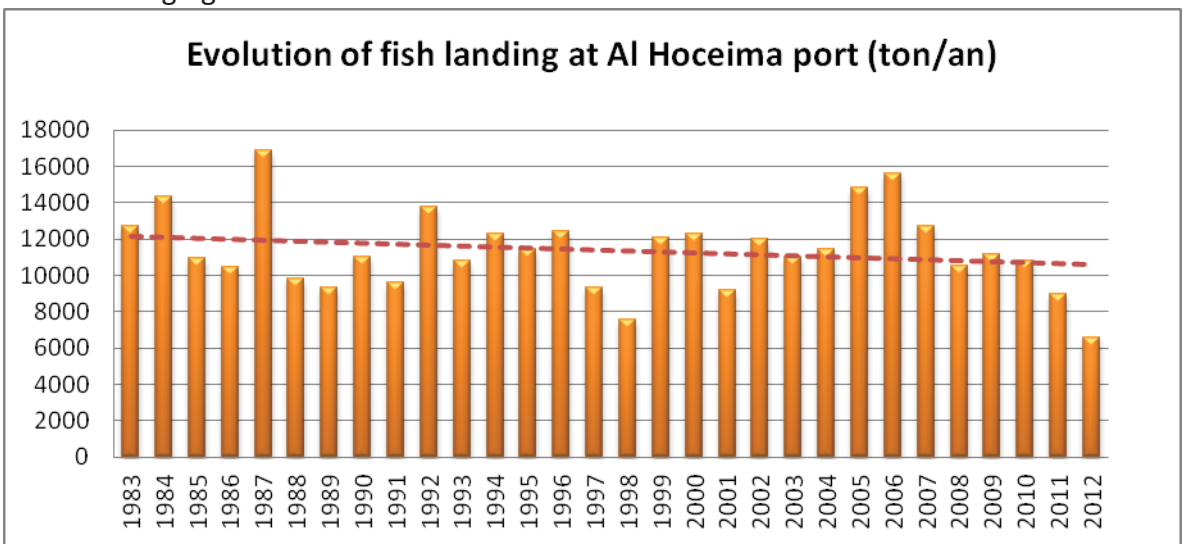
3) ***Coastal Vulnerability and Climate change impacts***: The Al Hoceima bay and the Ghis-Nekor coastal plain are low-lying areas and will thus be seriously affected by climate change and especially sea-level rise and storm surges. The buffer zone will disappear putting the coastal resorts and infrastructures at risk of inundation and erosion. The coastal aquifers are already being salinized due to the over pumping of groundwater but likely also to sea-level rise.

a & b: Coastal erosion (photos AZIR); c & d: Inundation in 2010 (Photos Khouakhi)

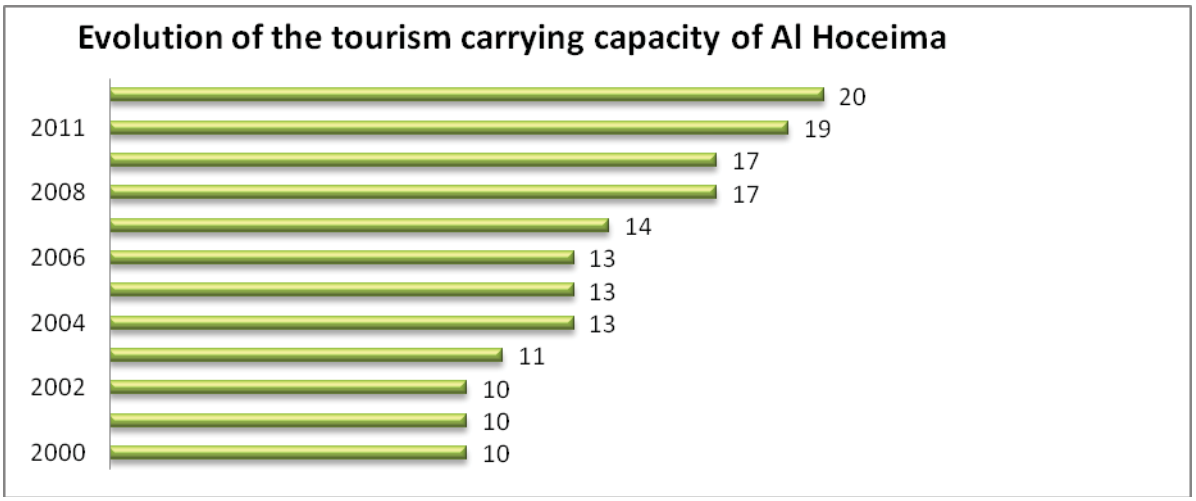
What is the social, political and economical relevance of the identified coastal issues?

The territorial diagnosis has highlighted that the major economic activities in the area are fisheries, tourism, and agriculture. The three identified issues are significant for productivity and sustainability of all these sectors. Indeed, the degradation and decline of coastal resources has affected the well being of the local population and has led to an increase of unemployment and to a large migration to Europe. The predictive impacts of climate change and sea-level rise is likely to exacerbate these impacts.

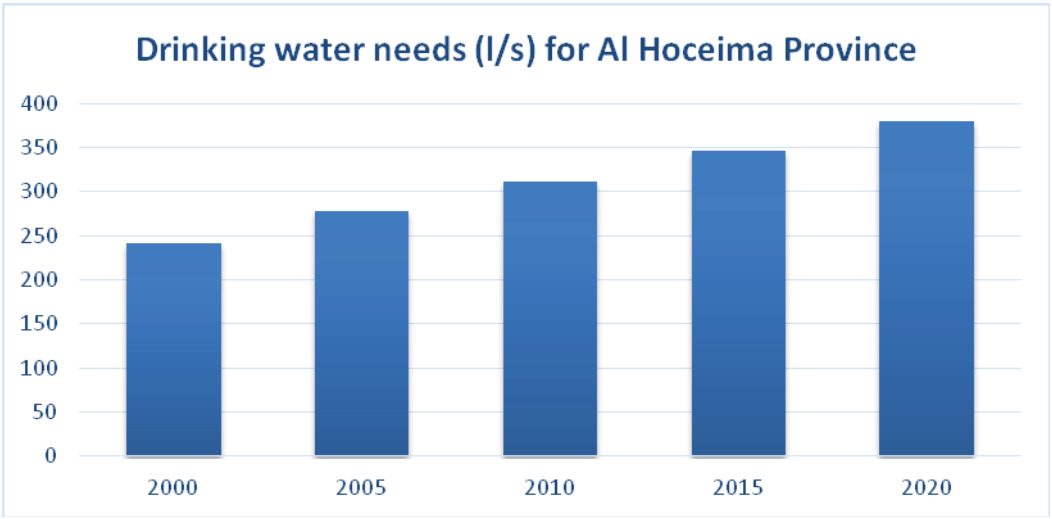
The following figures show the trend of some economic resources.



(Source: National Office for Fisheries)



Source: Tourism Observatory



Source: National Office for Potable Water

Have you developed selected or calculated indicators in order to depict the situation and the problems you planned to consider?

The indicators selected and calculated (given available and accessible data) are represented in the following table:

Indicators selected and developed in Al Hoceima CASE

Al Hoceima CASE Issues	Indicator	D	P	S	I	R	Data sources	Comments	Products
Urban sprawl and densification of the coast Residential and tourism development at vulnerable areas (not conducive to urbanization) pose serious threats to the sustainability of the beaches, the National Park, and to agricultural lands.	Area of built-up space in the coastal zone						Topographical map of 1966 and Google Erath map of 2011	The % of the buildup area is underestimated due to the presence of several scattered dwellings imposed by the rugged nature of the terrain.	Digital maps Excel file (% of urban extension between 1966 & 2011)
	Size of the population living in the coastal zone						National Census	Population living in the Coastal communes (1994 & 2004)	Excel file
	Density of the population living in the coastal zone						National Census	Population living in the Coastal communes	Excel file
Coastal resources degradation: - Beaches are lost due to the coastal squeeze and shoreline artificialization, river damming, mining of sand from dunes as well as from the Nekor and Ghis rivers. -Bathing waters are contaminated by sewages and fertilizers. Fisheries are	Bathing water quality						National Monitoring program & standards [10]	Only 2 stations from 1993 & 2 others from 2004 National standards	Excel file
	Areal extent of coastal erosion						Aerial photographs of 1958, 1973 and 2003	Diachronic analysis	GIS maps Excel file Erosion rate

[10] A: Good quality for swimming (compliant)

B: Average quality for swimming (compliant)

C: Momentarily polluted (non-compliant)

D: Polluted (non-compliant)

decreasing due especially to overfishing and illegal practices.	State of the main commercial fish stocks by species and sea area						Data sourcesfrom the National Office for Fisheries	The indicator was calculated at national level (Moroccan Mediterranean) from 2000 to 2012. It refers to 2-6 fish stocks.	Excel file %
	Conservation condition of coastal and marine focal habitats and species in protected areas						Data sources from the HCEFLD	Indicator calculated both for the National Parc of Al Hoceima and at national level (the Moroccan Mediterranean)	Table %
Vulnerability to sea-level rise: The Al Hoceima bay and especially the Ghis-Nekor coastal plain are low-lying areas and thus very exposed to (i) inundations due to sea-level rise and storm surges and (ii) salinization of the coastal aquifers.	Physical Coastal Vulnerability						CVI based on the following variables: (a) geomorphology/ geology of the coastal area, (b) the width of the beach, (c) the slope and topography, (d) changes in the coastline (e) the distance to isobath of 20m; (f) the exposure of the coast, and (g) the distance from the back beach vegetation.		GIS maps Excel files
	Vulnerability of the coastal aquifer to marine intrusion						GALDIT Method for current sea-level and with 0,5m sea-level rise scenario.		GIS maps Excel files
	Setbacks and Beach erosion predictions due to sea level rise						Predicted Shoreline position in 2050 (without CC) Predicted Shoreline position in 2050 with SLR		GIS maps Excel files

DPSIR: Drivers-Pressures-State-Responses

Section 2: Relations between coastal issues and ICZM Protocol and Principles
2.1 How do the selected coastal issues relate to the ICZM principles and protocol?

The following articles and principles of the ICZM protocol are relevant for the issues selected in our CASE:

Issue	Articles	Principles
Urban sprawl and littoralisation	**Article 6** General Principles of Integrated Coastal Zone Management	(f) The formulation of land use strategies, plans and programmes covering urban development and socio-economic activities, as well as other relevant sectoral policies, shall be required.
	Article 11 Coastal Landscapes	1. The Parties, recognizing the specific aesthetic, natural and cultural value of coastal landscapes, irrespective of their classification as protected areas, shall adopt measures to ensure the protection of coastal landscapes through legislation, planning and management.
	Article 23 Coastal Erosion	2. The Parties, when considering new activities and works located in the coastal zone including marine structures and coastal defence works, shall take particular account of their negative effects on coastal erosion and the direct and indirect costs that may result. In respect of existing activities and structures, the Parties should adopt measures to minimize their effects on coastal erosion.
Coastal resources degradation	**Article 6** General Principles of Integrated Coastal Zone Management	(b) All elements relating to hydrological, geomorphological, climatic, ecological, socio-economic and cultural systems shall be taken into account in an integrated manner, so as not to exceed the carrying capacity of the coastal zone and to prevent the negative effects of natural disasters and of development. (d) Appropriate governance allowing adequate and timely participation in a transparent decision-making process by local populations and stakeholders in civil society concerned with coastal zones shall be ensured.
	Article 9 Economic Activities	1 (d) ensure that the coastal and maritime economy is adapted to the fragile nature of coastal zones and that resources of the sea are protected from pollution; (d) Tourism, sporting and recreational activities, (i) to encourage sustainable coastal tourism that preserves coastal ecosystems, natural resources,

		cultural heritage and landscapes; (ii) to promote specific forms of coastal tourism, including cultural, rural and ecotourism, while respecting the traditions of local populations; (e) Utilization of specific natural resources, to regulate the extraction of sand, including on the seabed and river sediments or prohibit it where it is likely to adversely affect the equilibrium of coastal ecosystems; (iii) to monitor coastal aquifers and dynamic areas of contact or interface between fresh and salt water, which may be adversely affected by the extraction of underground water or by discharges into the natural environment.
	Article 10 Specific Coastal Ecosystems	2. Marine habitats (a) adopt measures to ensure the protection and conservation, through legislation, planning and management of marine and coastal areas, in particular of those hosting habitats and species of high conservation value; 3. Coastal forests and woods The Parties shall adopt measures intended to preserve or develop coastal forests and woods located, in particular, outside specially protected areas. 4. Dunes The Parties undertake to preserve and, where possible, rehabilitate in a sustainable manner dunes and bars.
Climate change impacts	**Article 6** General Principles of Integrated Coastal Zone Management	(i) Preliminary assessments shall be made of the risks associated with the various human activities and infrastructure so as to prevent and reduce their negative impact on coastal zones. (ii) to ensure that fishing practices are compatible with sustainable use of natural marine resources;
	Article 22 Natural Hazards	Within the framework of national strategies for integrated coastal zone management, the Parties shall develop policies for the prevention of natural hazards. To this end, they shall undertake vulnerability and hazard assessments of coastal zones and take prevention, mitigation and adaptation measures to address the effects of natural disasters, in particular of climate change.

Cross-cutting issues	**Article 14** Participation	1. With a view to ensuring efficient governance throughout the process of the integrated management of coastal zones, the Parties shall take the necessary measures to ensure the appropriate involvement in the phases of the formulation and implementation of coastal and marine strategies, plans and programmes or projects, as well as the issuing of the various authorizations, of the various stakeholders, including: the territorial communities and public entities concerned; economic operators; non-governmental organizations; social actors; the public concerned. Such participation shall involve inter alia consultative bodies, inquiries or public hearings, and may extend to partnerships.
	Article 6 General Principles of Integrated Coastal Zone Management	(d) Appropriate governance allowing adequate and timely participation in a transparent decision-making process by local populations and stakeholders in civil society concerned with coastal zones shall be ensured.
	Article 15 Awareness-Raising, Training, Education and Research	1. The Parties undertake to carry out, at the national, regional or local level, awareness-raising activities on integrated coastal zone management and to develop educational programmes, training and public education on this subject. 2. The Parties shall organize, directly, multilaterally or bilaterally, or with the assistance of the Organization, the Centre or the international organizations concerned, educational programmes, training and public education on integrated management of coastal zones with a view to ensuring their sustainable development. 3. The Parties shall provide for interdisciplinary scientific research on integrated coastal zone management and on the interaction between activities and their impacts on coastal zones. To this end, they should establish or support specialized research centres. The purpose of this research is, in particular, to further knowledge of integrated coastal zone management, to contribute to public information and to facilitate public and private decision-making.
	Article 27 Exchange of Information and Activities of Common Interest	Define coastal management indicators, taking into account existing ones, and cooperate in the use of such indicators;

Section 3: Policy issues and ICZM principles and approaches
So far, how have been the coastal issues addressed by the local/regional government?

Several management strategies and plans have been/are carried out by the local/ regional and national government, in a more or less integrative and participative way, to address the coastal issues of Al Hoceima Bay. So far, the following key actions have been undertaken:

- Liquid and solid waste disposals: In 2008, the government launched a large operation of cleaning up the region by building a wastewater treatment plant and a controlled garbage dump.

- In the framework of the national bathing waters monitoring Network, the Ministry of Public Works and the Ministry of Environment have been conducting systematic bathing water quality at a number of stations in several beaches of the CASE.

- As part of Urban Development Plans (PDU), several structural projects were launched; the region is experiencing a significant dynamic in the housing sector, infrastructure and tourism development. However, this building is at the expanse of the agricultural lands and coastal buffer zones. Furthermore, for most of these projects, the economic benefits often outweigh the environmental impact on the coastal zone. In spite of the promotion of ecological tourism, especially within the National Park, coastal developments still do not comply with the basic principles of the ICZM Protocol. To overcome these weaknesses, there is a further need to demonstrate the benefits of ICZM through good practices and success stories.

- Concerning fisheries, the “Programme National d’Aménagement du littoral” (PNAL), addressed primarily to artisanal fisheries, has a major concern to integrate this sector into the socio-economic development through the establishment of basic infrastructure (landing points laid and fisherman's Villages) necessary for the stabilization of fishing effort, the valuation of fish products and improved socio-economic conditions of artisanal fishermen.
The Pargo Project (2007-2009) aimed to improve capacity and increase the incomes of artisanal fishermen of Oulad Amghar Municipality and of Al Hoceima National Park through the creation of a cooperative, improving the marketing of fishery products and the exploitation marine resources.
- In the framework of the MEDMPA program, several management plans for the marine area of the Al Hoceima National Park have been elaborated in 2002 and in 2009 the Park has been declared as SPAMI; however the conservation principles are still to be implemented.
- Climate change issues still need to be addressed and mainstreamed in national/regional and local agendas.

At which spatial scale?
From 10km to nearly 200 Km²

Can you assess the results of the implemented policies? Which are the main results achieved?
There are no quantitative Indicators to assess the results of the implemented policies. In some cases, qualitative evaluation, based on expert judgment can be attempted. For instance: the wastewater treatment plant and controlled garbage dump had big positive impacts on the quality of coastal waters and air in the region. Capacity building and improvement of socio-economic conditions of artisanal fishermen have increased their income and well being.

On the basis of the ICZM principles (as they are expressed by the Protocol), do you think that the coastal issues were addressed with an integrated approach (in terms of organization, politics, tools, etc)?
Despite the implementation of several governmental plans and projects, the sectoral approach still dominates and a holistic integrated approach has never been applied. Individual issues are often addressed on case-to-case basis.

Section 4: Relevance with National ICZM process
Do you think that your work is relevant for the ICZM process of your country? Why and how?
At national level, there have been several ICZM projects carried out for various segments of the Mediterranean coast of Morocco (See Table below). One of the most significant outcomes of these projects was capacity building of the local stakeholders and the increase of their awareness on ICZM concept and process. Our work contributed to the progress in this process, stressing on the importance of the participatory process. The use of a new informed set of indicators and tools such as Vulnerability maps, setbacks …have been highly appreciated by the local stakeholders, who found them very relevant for the most critical issues of the region, namely coastal resources degradation and coastal risks.

Our work fits into national policies for sustainable management of resources, including: The Global National Charter for Environment and Sustainable Development; The Master Plan for Urban Development of the Central Mediterranean Coast; The Local Governance Project in Morocco; The National Program for Coastal development; the new strategy in the fisheries sector entitled "HALIEUTIS 2020"; the National Initiative for Human Development; the Vision 2020 for the tourism sector, the Millennium Challenge Program and the local Agenda 21.

Name of the Project	Objectives	Duration	Location
CAMP Rif Central	To contribute to the socio-economic development of the local population through protection and sustainable use of coastal resources. -To assess natural and cultural assets of the study area -To recommend measures for the management and optimal ways for a balanced and sustainable development of the coastal area.	2008-2010	Central Rif (Al Hoceima and Chefchaouen Provinces)
DESTINATIONS	Sustainable Tourism.	2007-2010	Al Hoceima (as one pilot site)
TOUR MED EAU	Help promote dialogue and cooperation between the governments of both shores of the Mediterranean in order to improve environmental sustainability in urban areas through a more efficient public management of water services. *"Sustainable water management in Mediterranean areas, Al Hoceima (Morocco)"*	2008-2010	Municipality of Al Hoceima
Operation DELPHIS	Marine mammal awareness project	July 2009	Al Hoceima
MED MPA	Elaboration of management plans for the marine areas of the National Park of Al Hoceima , Morocco	2002-2005	Al Hoceima National Park
PARGO PROJECT	Strengthen the capacities and increase the incomes of the artisanal fishermen of Oulad Amghar at Al Hoceima Natioanl Park.	2007-2009	Al Hoceima National Park
BEST-MED	*Business Eco-Sustainable Tourism in the Mediterranean Area* Promote the environmental sustainability in the tourism industry of Mediterranean Area .	2009- 2010	Al Hoceima

On the basis of the work that you have done, which are in your opinion, the main constraints in implementing ICZM principles and tools? What is missing? Where are the main gaps? Where we should put more energy and resources in the future?

One of the most critical constrains in implementing ICZM principles and tools, is to ensure the integration of all the components of the coastal management with an effective governance system. Strengthening the governance system is, in our opinion, the most challenging tasks. Indeed, most of the problems and conflicts encountered proved to be attributable to the institutional (non-coordination of sectoral actions, inflexibility of procedures, and absence of prospective vision) and legal aspects (obsolete texts or unenforced laws, lack of control ...).

In addition, the link between science and policy is often missing. Despite, the strong interest of the decision-makers to our products (especially GIS maps), the integration of these results in their management plans is not guaranteed because the bureaucratic process is so heavy that the decision is often made from top to down, without the involvement of university scientists.

Another weak point of the several ICZM projects carried out in the region is the lack of consistency and capitalization of knowledge, as well as the lack of integration between these projects and the structural elements of planning policies. None of these projects has actually implemented the identified actions. In fact, the challenge of integration and the real inclusion of these projects in the decision-making instruments of national policies rarely exceed the declaration of intent.

In the future, we think that more energy and resources should be put first and foremost in the elaboration of the ICZM national strategy, on a large participatory and democratic basis, according to the ICZM Protocol. Concurrently, the legal and economic instruments and tools of ICZM should be improved. Finally, the link between science and decision-making should be strengthened.

Stakeholders involvement

Have you involved the main stakeholders?

Identification of stakeholders at the local level

The main groups of local stakeholders are governmental agencies, academics, professional associations and NGO's (See the list on table below). For each stakeholder identified at local and regional level, we tried to identify a Contact person (see list in Annex). This will serve to invite people to meetings, update the database, validate the results, but also to integrate them into the process of participation for the success of the activities at their level.

Stakeholders were classified according to their importance, their power, their knowledge and their attitude and perception of coastal zone management.

Institution	Importance	Power	Knowledge	Attitude
Wilaya (Province)	5	4	5	MS
Urban Agency of Al Hoceima	5	2	5	MS
Regional Investment Center	5	2	4	MS
High Commissioner for Water and Forests	5	3	5	MS
Elected officials (Region, Province, Municipalities)	4	2	4	MS
Provincial Delegation of Tourism	3	1	4	MS
Regional Directorate of Public Works	3	2	4	MS
Directorate of the Port of Al Hoceima	3	2	4	MS
Directorate of Al Hoceima National Park	3	2	4	MS
Sectoral delegations (Fishing, Education, Health, Water, Electricity, etc ....)	2	1	2	N
Professional Association of Fishermen	2	1	4	S
Non-governmental organizations	2	1	4	S

Importance *of stakeholders is defined here as their ability to affect the implementation of the policy. The importance values range between 1 (low) and 5 (high).*

Power *is the capacity or ability of the stakeholder to affect the implementation of the project's policy due to the strength or force he possesses. Scale: 1: few resources, hardly mobilized; 5: lot of resources, easily mobilized.*

Knowledge *is the stakeholders' level of knowledge and / or degree of information related to coastal resources use and management issues. Scale from 1 (low level of knowledge) to 5 (high level of knowledge).*

Attitude *refers to the stakeholder's status as a supporter or opponent of the policy. Stakeholders who agree with the implementation of the policy are considered supporters (S); those who disagree with the policy are considered opponents (O); and those who do not have a clear opinion, or whose opinion could not be discerned, are considered neutral (N). Those who express some, but not total, agreement with the policy are classified as moderate supporters (MS). Finally those who express some, but not total, opposition to the policy should be classified as moderate opponents (MO)*

Identification of stakeholders at national level

The following institutions have been identified:

- Department of Environment/Department of Surveillance and Risk Prevention;
- Ministry of Housing, Planning and Urban Policy
- Ministry of Public Works and Transport
- Directorate of Ports and Maritime Public Domain
- Management of Marine Fisheries and Aquaculture Directorate
- National Office for Fisheries
- Department of Facilities and Investments
- Department of Tourism
- Inspection of the Royal Navy

How have you involved them (e.g. focus group, interviews, questionnaires…)?

Stakeholders have been involved especially by focus groups and using interviews.

- ✓ A the local level, meetings have been organized with the Wali of the Region (the highest authority in the region), with focus group (NGOs, professional associations, fishermen,…)

and the main institutional representatives in the region (Managers of the National Park, forests and water (HCEFLCD), Regional Investment Center, the representative of the Department of Environment, official elected…).

- ✓ At national level, several individual meetings and interviews with stakeholders from the Central Administration in Rabat have been organized: Department of Economic and General Affairs, Directorate of Ports and Maritime Public Domain, Ministry of Equipment and Infrastructure, Department of Environment, Department of territory planning…

The objectives of these meetings were to present the progress of the CASE work and collect the feedbacks and perceptions of the different stakeholders, in order to integrate them in our assessments.

Which kind of constraints have you faced?

- The most critical constraint was to engage policy makers in the process. In fact, some of those who agreed to participate in our meetings were not always those who have the power of decision, and it was often difficult for them to adhere to our goals.
- There is a significant lack of coordination mechanisms. Governance by a multitude of departments led to the bursting of skills and fragmentation of efforts.
- It was not easy to put on the same table the decision makers, Elected, and NGOs. Consequently our meetings by focus group could not translate the potential conflicts that could arise from the discussions.
- The mission of some institutions seems to overlap. A realistic action plan must recognize this overlap and try to minimize it by assigning specific roles to each stakeholder.
- It was not easy to communicate with some of the stakeholders (still illiterates) and explain them the valuable input of the PEGASO tools.

The main challenge remained to succeed in convincing the decision makers to mainstream ICZM in their agendas.

Tools

Which tools (indicators, LEAC, scenario, participation, economic assessment and social valuation or others) have you used during the activities of the CASES?

According to the availability of data and information the tools developed in Al Hoceima CASE are: Territorial Diagnosis, Indicators, Vulnerability assessment and participation.

Which have been the main constraints faced during the application of the tools?

- At the CASE level, the problems we encountered during this study can be grouped into three categories:

1) Problems related to the non-availability of/ difficult access to data, which has jeopardized the application of the tools developed in PEGASO to the Al Hoceima CASE, especially the LEAC and the economic valuation.
2) Problems related to the non-applicability of many indicators proposed in the PEGASO project to the CASE scale.
3) Problems related to the many uncertainties, when dealing with the future; indeed, it was hard to select the best and plausible scenarios, easily acceptable by the decision makers.

- At the project level: timing between the readiness of the tools, training, and application.

Main results

Achievements

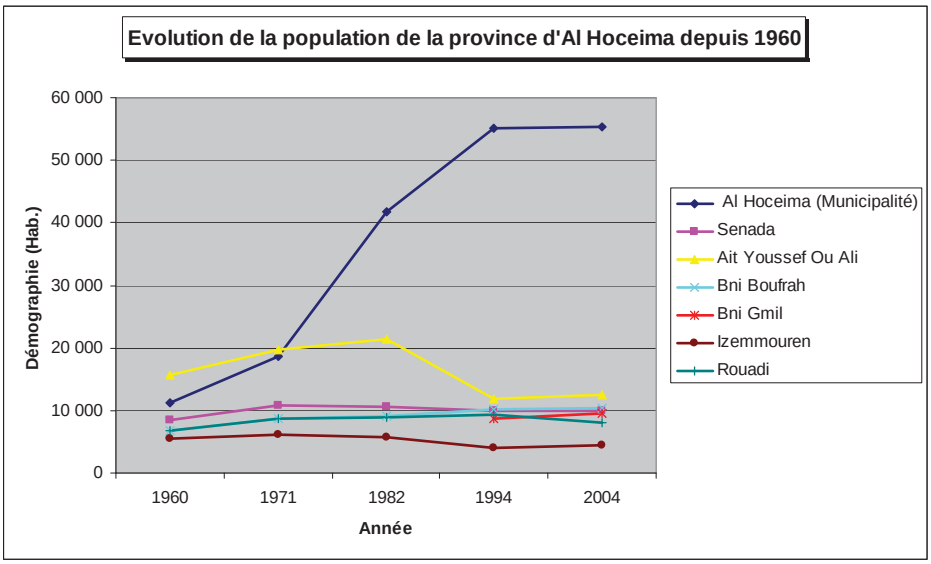
1) ***Diagnosis of the Al Hoceima coast***

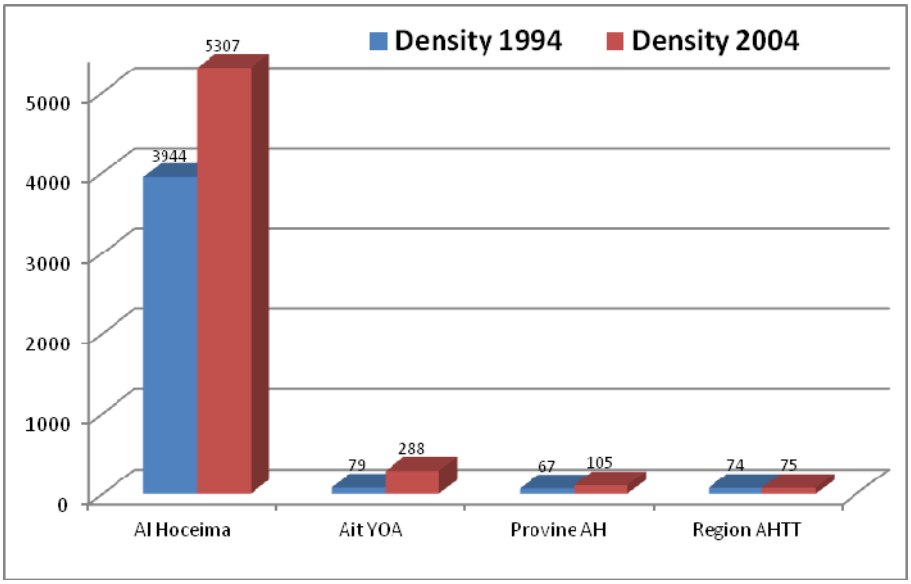
Environmental and territorial diagnosis of Al Hoceima Coast has consisted firstly to assess the physical, ecological and socio-economic components of the study area and their trends, and secondly to assess the governance in the region from an institutional and legislative analysis.
The declination of the priority issues has been made from a SWOT analysis, in consultation with the main local stakeholders. These issues are: *Urban sprawl, Coastal resources degradation and Climate change impacts.*

2) ***Development and calculation of Indicators***

Among the 51 indicators proposed by the PEGASO task team, only few of them have been calculated due to the lack of appropriate spatial and temporal data and information.
The approach consisted to firstly review existing indicator initiatives to measure the progress towards sustainable development in general at national level and in coastal zones at regional and local levels. Secondly, calculate the indicators, when the data are available, and in accordance with the identified priority issues and the policy needs.
The indicators calculated were categorized as indicators of drivers (D), pressures (P), state (S), impacts (I) or responses (R) (See table in Section 1, p.4).

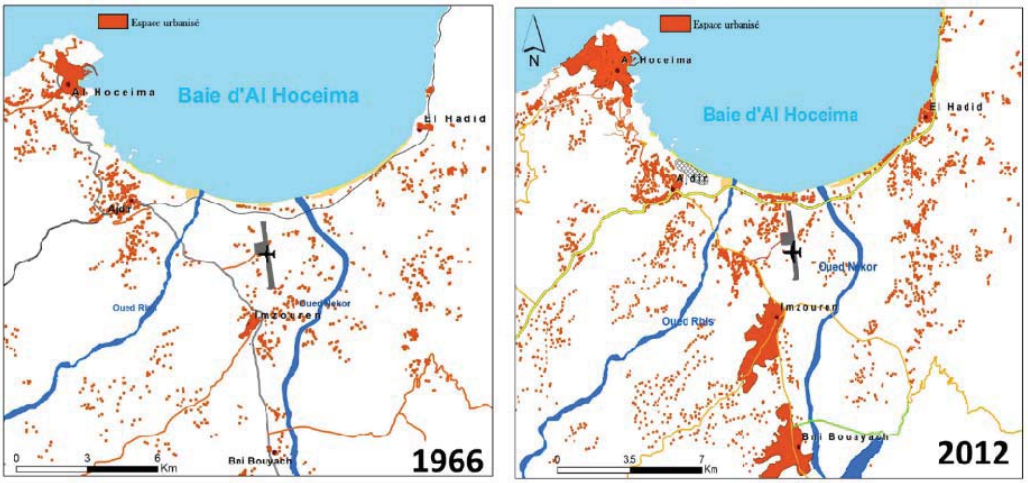
❖ *Size and Density of the population living in the coastal zone*
This indicator was evaluated by comparing the number of inhabitants per square kilometer in the coastal communes of Al Hoceima and Aït Youssef ou Ali compared to the number of inhabitants in the wider administrative areas, namely the Province of Al Hoceima and the Region of Taza-Taounate-Al Hoceima (AHTT).

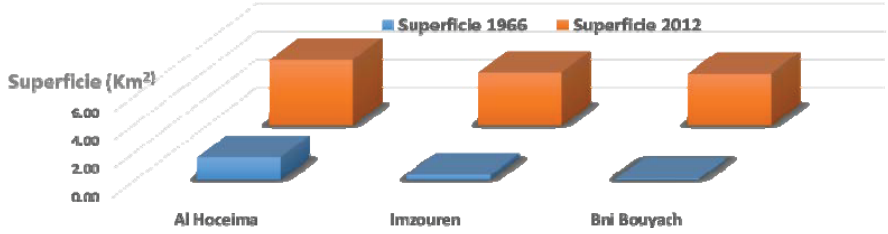




❖ *Area of built-up space in the coastal zone*

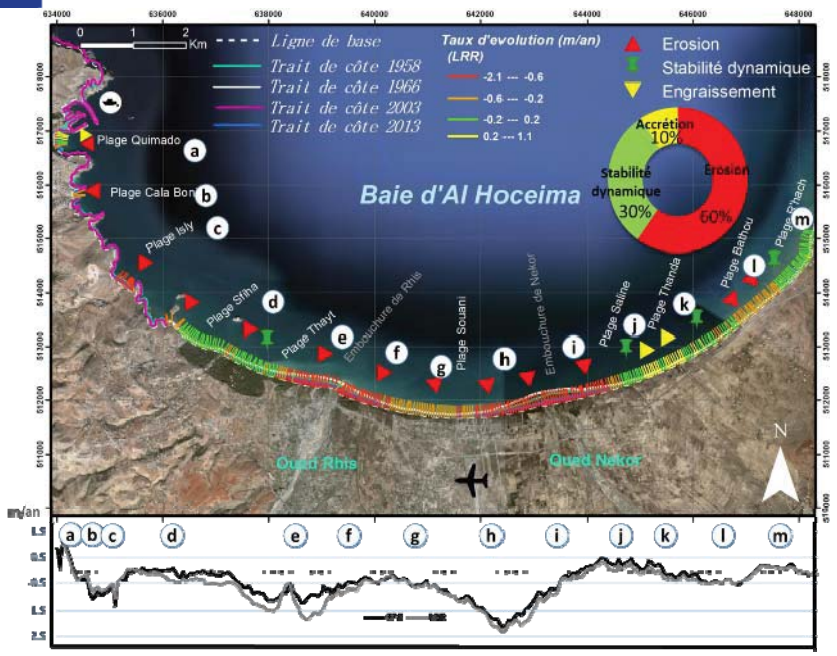
Lacking sufficient information and data over a long period to show the progress of changes in land use, the increase in built-up area was evaluated from the comparison between aerial photographs of 1966 and satellite images from Google Earth Pro 2012.





❖ *Areal extent of coastal erosion*

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



❖ *Bathing water quality*

	Beaches & stations (S)												
	Calabonita		Quemado		Sfiha	Isli	Torres		Cala Iris	Souani		Boussakour	
Season	S1	S2	S1	S2			S1	S2		S1	S2	S1	S2
93-94	A		A										
94-95	B		B										
95-96	B		B										
96-97	B		B										
97-98	B		B										
98-99	B		B										
99-00	A		B										
00-01	A		A										
01-02	B		B										
02-03	A		A										
03-04	B		B										
04-05	B	B	B	B									
05-06	B	B	A	A					A				
06-07	C	D	A	B					A				
07-08	C	D	B	B					A				
08-09	B	C	A	A					A				
09-10	A	A	A	A	A	A	A	A	A			A	A
10-11	A	A	A	A	A	A	B	A	B			B	B
11-12	A	A	A	A	A	A	A	A	A	B	B	A	A
12-13	B	B	B	B	A	B	A	A	B	B	B	A	A

S : Sampling Station

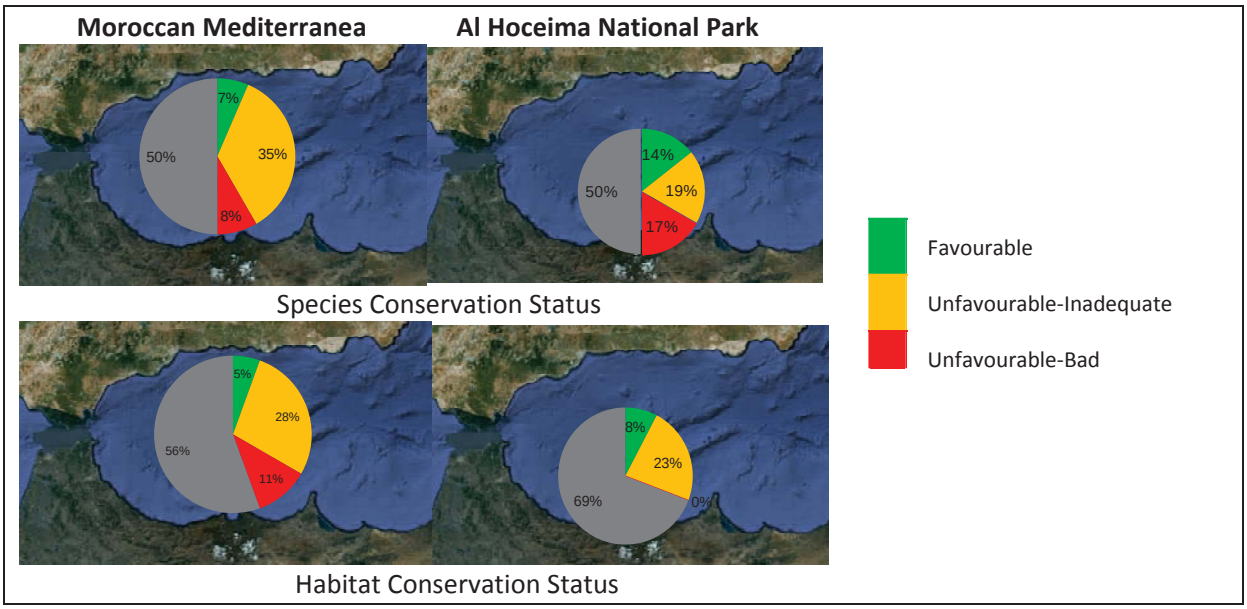
A : *Good quality for bathing (comply)*

B *: Medium quality for bathing (comply)*

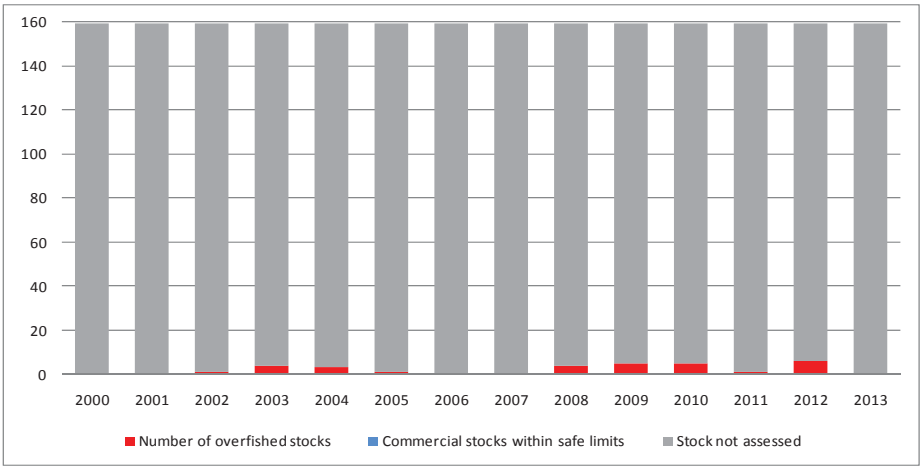
C *: Temporarily polluted (Not comply)*

D : *Polluted (Not comply)*

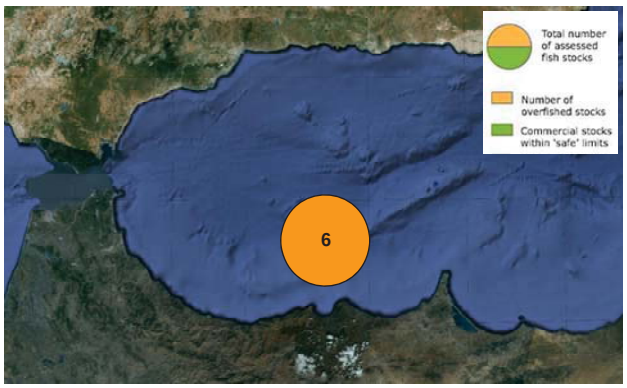
❖ *Conservation condition of coastal and marine focal habitats and species in protected areas:*
The indicator was evaluated for the first time, for both the Moroccan Mediterranean and the Al Hoceima National Park. It was calculated considering sensitive/ vulnerable species and habitat of conservation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



❖ *State of the main commercial fish stocks by species and sea area*
Due to the lack of data at the local level of the CASE, the indicator was calculated at Moroccan Mediterranean level, from 2000 to 2012, fromto the National Office for Fisheries data. It refers to 2-6 fish stocks.



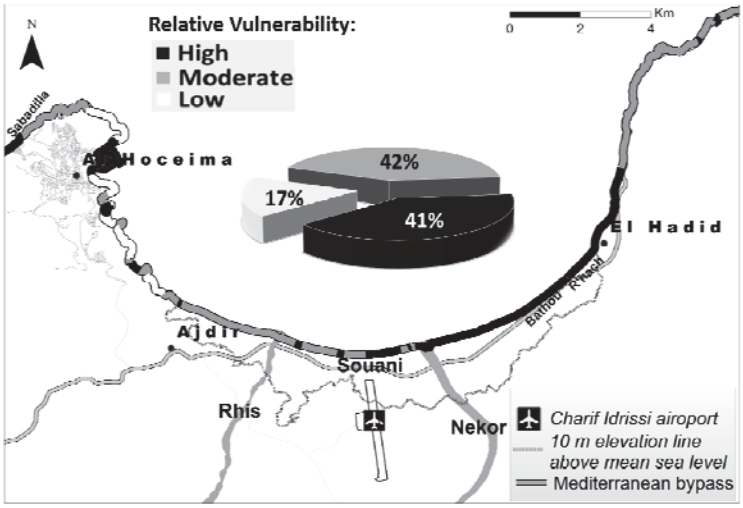
Evolution of the commercial fish stocks assessment in the Moroccan Mediterranean

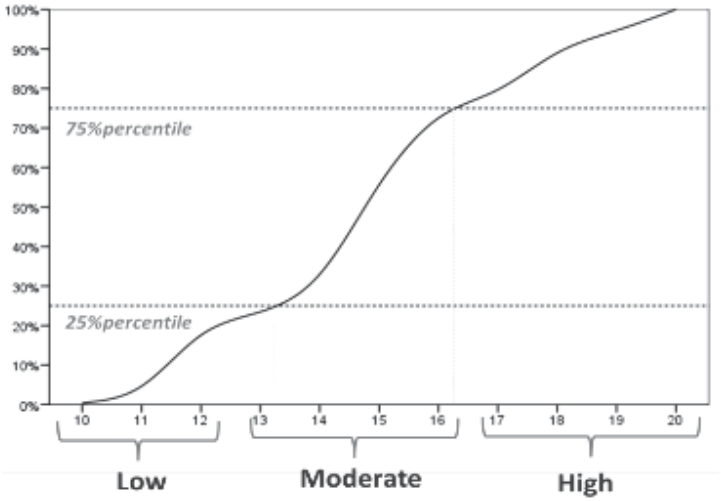


Status of the fish stocks in the Moroccan Mediterranean (2012)

Climate change impacts issue

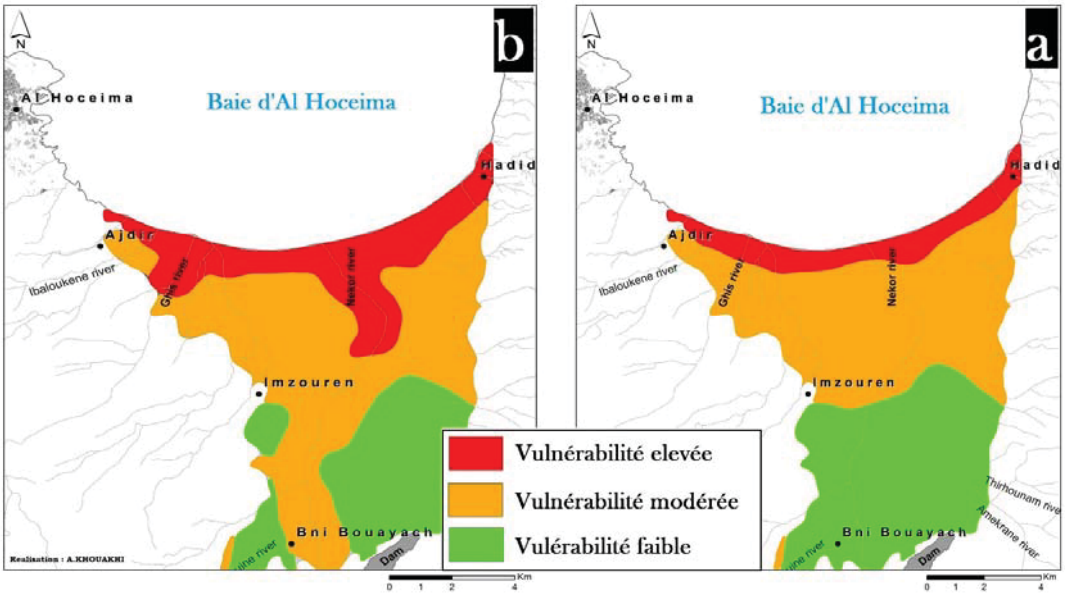
- *Physical Coastal Vulnerability*



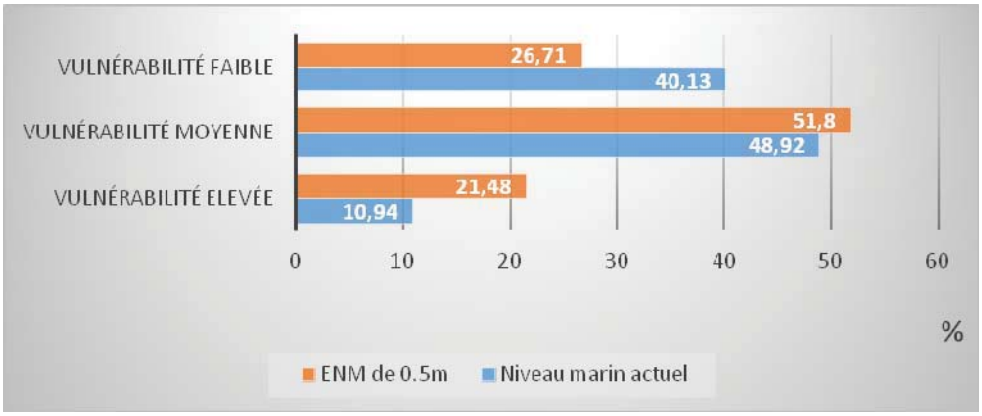


Cumulative percent of CVI values for the study area

❖ *Vulnerability of the coastal aquifer to marine intrusion*



Vulnerability of the Rhis-Nekor coastal aquifer **a:** Current conditions **b;** with 0.5m SLR



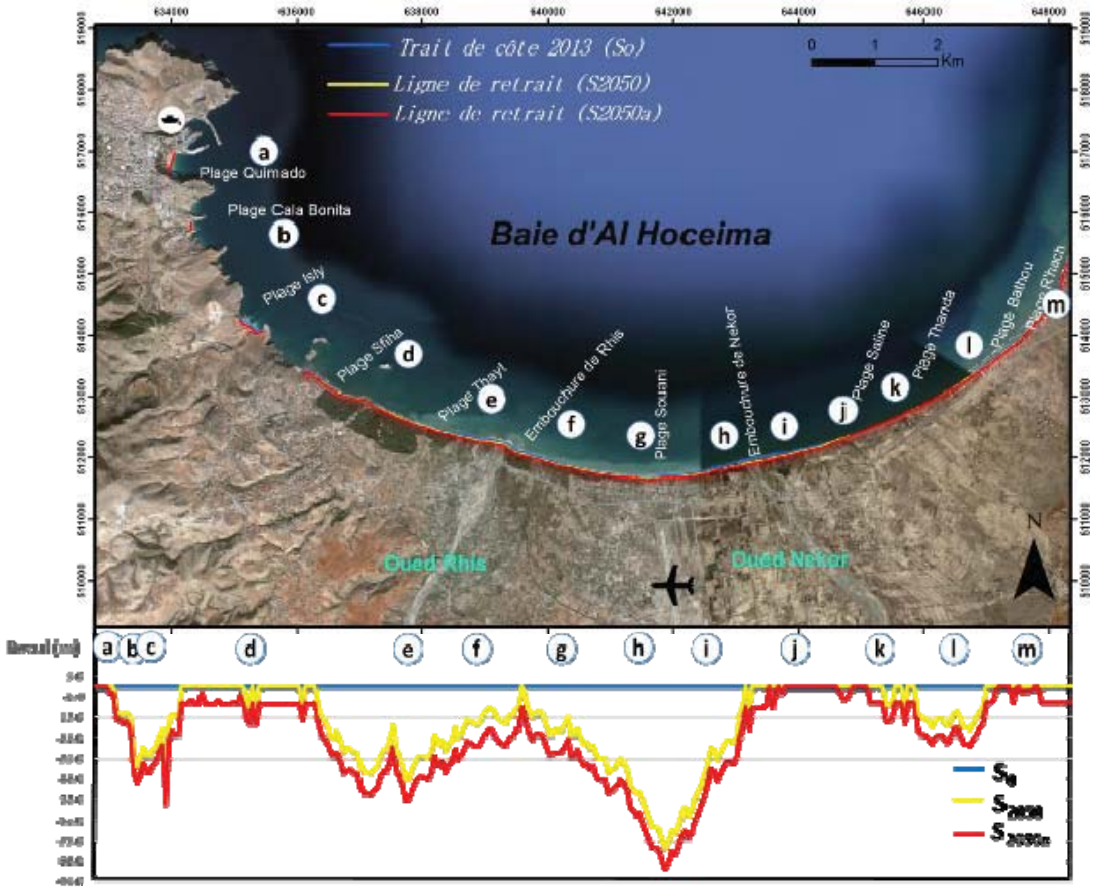
Percentage of areas by classes of vulnerability to seawater intrusion

❖ *Setbacks and Beach erosion predictions due to sea level rise*

Current position of the shoreline (Baseline 2013)

Predicted setback line for 2050 (without climate change)

Predicted setback line for 2050 with accelerated sea-level rise scenario



Predicted retreat of the Al Hoceima beaches with 0.59 m SLR scenario (from Labrèche; 2012).

Beach name	Current beach width (in m)	Predicted loss in the beach width (in %) In case of 0.59 m SLR scenario	
		Low estimate	High estimate
Quemado	40	14	44
Cala Bonita	60	9	30
Isly	18	30	98
Sfiha	80	7	22
Souani	115	5	15
Souani East	80	6	18
Rhach & Hadid	80	7	22

For more details on methodologies, data and calculations of each indicator, please consult the Indicators of Al Hoceima CASE Report uploaded on the PEGASO intranet.

Database and SDI

As it was not possible to set a local geonode at UM5A, VLIZ offered us to create it and link it to the PEGASO SDI. We then prepared the database and all the files needed for its creation.

Participation in scientific conferences

- International Symposium on “Mediterranean coast: Past, present & future states”. 10 - 12th November 2010, Larache (Morocco).
- 3rd European Maritime Day Presentation of the CASE at the PEGASO Round table, Gijon, 20 May 2010.
- Kick-off and 1st Regional Meeting on ‘Integrated Maritime Policy’. Athens, 5-6 April 2011 Presentation on “How better address the maritime and coastal dimensions of climate change in the Mediterranean?”
- Second Economic Conference of the north-western Mediterranean "Territorial Cooperation in the Western Mediterranean" Presentation of the CASE at the PEGASO Round table. Barcelona, 6 et 7 June 2011
- 12th International Coastal Symposium Plymouth University, 8-12 April 2013.Oral Presentation by A. Khouakhi on Vulnerability assessment of Al Hoceima bay.

Publications in scientific journals and Proceedings:

- Khouakhi A., Snoussi M., Niazi S., Raji O. (2013) Vulnerability assessment of Al Hoceima bay (Moroccan Mediterranean coast): a coastal management tool to reduce potential impacts of sea-level rise and storm surges. *Journal of Coastal Research Special Issue No. 65, 2013*
- Adnani M, Jana N, Niazi S, Khouakhi A, Raji O. (2013): Analyse de la cinématique du trait de côte des plages du Parc National d’Al Hoceima : Cala iris, Torres et Bades, à l’aide du couplage télédetection et SIG. Rencontres des Sciences Géomatiques, 8-9 Avril 2013, Rabat, Maroc.
- M. Snoussi (2011): How better address the maritime and coastal dimensions of climate change in the Mediterranean? *1st Regional Meeting on ‘Integrated Maritime Policy’, Athens, 5-6 April 2011.*
- M. Snoussi (2011): The ICZM: Between local practices and Regional engagement: The Al Hoceima CASE and the PEGASO Platform. IIème Conférence économique de la Méditerranée nord-occidentale “La Coopération territoriale en Méditerranée occidentale” Barcelone, 6 et 7 juin 2011.
- M. Snoussi (2010): Overview of Marine activities in the Mediterranean Coast of Morocco and the need of a Maritime Spatial Planning. *Second Working group meeting on Integrated Maritime Policy in the Mediterranean Brussels, 07 July 2010*

- M. Snoussi (2010): The PEGASO case studies to test tools and produce information at multi scales: The CASE of Morocco. *3rd European Maritime Day, Gijon, 20 May 2010*

PhD students

- Abdou Khouakhi: Contribution with scientific tools to ICZM in the Al Hoceima bay. Expected date: October 2013.
- Latifa Flayou: Land use changes and coastal evolution in the Moroccan Mediterranean.

Other activities:

- Participation to the "*Preparatory Work for PEGASO Training on Participatory Methods"* held in Venice, Italy -31 October - 3 November 2011. The aim of the course was to train the facilitator who will be responsible for the participation activities in the CASES.
- Participation to the "*Ocean Teacher Academy Marine GIS Applications using ArcGIS Training Course"* organized by the UNESCO/IOC Project Office for IODE, Oostende, Belgium, 19 - 23 March 2012. The course provided an in depth overview of the application of Geographic Information Systems (GIS) to the marine environment using ArcGIS.
- Based on the knowledge gained from the training in Belgium, tuition was provided for students of the Master' Module "Climate, Water and Coastal zone" at UM5A, Faculty of Science.
- *MedOpen - Training Course on Integrated Coastal Zone Management.* The MedOpen Advanced Course 2012 started on 14 May 2012 and will be lasting about three months (until the end of July).
- Participation to the e-learning SDI training course organized by WP3 (UPO Team).

Lessons learnt

Strong points:

- Meetings with local stakeholders helped networking, keeping up-to-date, exchanging information and raising issues for discussion.
- Early participation seems to be an adequate tool to ensure that stakeholders are formally and early involved in the ICZM process.
- The role of NGOs participation emerges as an important dimension of coastal management.
- At the project level: trainings, even not enough, have improved the capacity of the team especially in terms of innovative tools, such as LEAC, Visioning and Economic valuation.
- Cross-workshop with the French CASE was successful in terms of sharing experiences, exchanging views, and raising success and failures.

Weak points:

Weaknesses are somehow the problems we encountered and that have been listed above, especially:

In terms of participation and commitment:

- Difficulty to engage policy makers in the process. The lack of national policy created a weakened and sporadic commitment. In fact, for more effectiveness, national support and guidance for ICZM should be executed by a management body, but influenced greatly by the needs of stakeholders, and the cooperation of decision makers and scientists at the local planning level.
- Lack of time for the time-limited project to fully embed its effects.
- No single mechanism for the achievement of the vertical integration and absence of structures for communicating and agreeing shared objectives for coastal management

In terms of other scientific tools:

- Non-availability of/ and difficult access to data, which has limited the application of the tools developed in PEGASO to the Al Hoceima CASE, especially the LEAC and the economic valuation.
- At the project level: Big timing gap between the readiness of the tools, trainings, and application.
- Time dedicated to training was not sufficient to strengthen our capacity to apply all the tools, even if we found them very interesting and relevant for our CASE.

6. Bouches-du-Rhone (France)

Section 1 Coastal issues

1.1 The main coastal issues considered

We selected our coastal issues as a result of key informant interviews with local stakeholders. According to our interlocutors from the General Council (Conseil Général) of Bouches-du-Rhône, there are many environmental issues found in the concerned territory, but they are more or less important according to specific areas. This same message was found repeatedly among the stakeholders as each was concerned with a small section of the CASE area as opposed to the entire Bouches-du-Rhone department. For example, the "Grand Port Maritime de Marseille", there are no major issues, or at least, everything is done in the harbour perimeter so that environmental issues are the least important. Conversely, agents responsible for protected spaces (parc naturel de Camargue, parc marin de la Côte Bleue, GIP Calanques and to a lesser extent the "Conseil Général") have given much more detail on their coastal concerns and the major threats to their proectected areas.

Given the disparity of responses, we could only count the issues that regularly recur amongst stakeholders. This led us to focus on issues of land contamination of marine waters (a problem that covers different forms according to the considered sector), maritime traffic, the exploitation of fishery resources and conflicts of use. Another important risk that was mentioned was the risk of oil pollution due to the project "Melrose Mediterranean Ltd" for natural gas or oil prospection at sea approximately 30km from Marseille (zone of 9375km²).

Finally, it should be stressed that the tighter controls of bathing water quality in the future will certainly be translated by many days of closed beaches in the coming years. The appreciation of the bathing water quality, currently defined by the transposition in the public health legislation related to bathing and swimming pool of the European directive 76/160/CEE of 1975, has recently evolved because of a new European directive 2006/7/CE that provides an implementation of new classification standards in 2013.

Table n°1: Issues mentioned by the different stakeholders

Structure Issues	Manmade coastal spaces, spaces reclaimed from the sea	Erosion, marine submersion risks	Land transport of hazardous products	Harbour dredging	"Land" contamination of marine waters (a)	"Maritime" contamination of marine waters (b)	Soil contamination (chemical substances)
Direction Inter-Régionale de la Mer Méditerranée	–	–	–	–	–	–	–
Conseil Général des Bouches-du-Rhône	–	X	–	X (Marinas)	X	–	–
Martigues	–	–	X	–	X	–	–
Marseille Provence Métropole	–	–	X	–	X	–	–
Ville de Marseille	X (landscape)	–	–	–	X	–	–
Grand Port Maritime de Marseille	–	–	–	–	–	–	–
Parc Marin de la Côte Bleue	–	–	–	X	X	X	–
Parc Naturel Régional de Camargue	–	X	–	–	X (pesticides and fertilisers)	–	–
GIP Calanques (Parc national des Calanques)	–	–	–	–	X (red mud)	X	X

Structure Issues	Coastal traffic		Coastal sea traffic	Marine debris	Fishery resource exploitation	Use conflicts (coastal zone)	Wind power (project)
Direction Inter-Régionale de la Mer Méditerranée	–		–	–	–	–	–
Conseil Général des Bouches-du-Rhône	X (free access)	X (PN Calanques)	–	–	–	–	–
Martigues	–		–	–	–	X	–
Marseille Provence Métropole	–		X (Marinas?)	–	–	–	–
Ville de Marseille	–		–	–	X (Fishing, aquaculture)	X	–
Grand Port Maritime de Marseille	X (free access)		–	–	–	–	–
Parc Marin de la Côte Bleue	–		X (marina, diving)	–	X (trawling)	–	X
Parc Naturel Régional de Camargue	X (free access)		–	–	X (illegal fishing)	X	–
GIP Calanques (Parc national des Calanques)	X	X (PN Calanques)	X (Marina)	X	X (professional and no-professional fishing)	–	–

Remarks: (a) Pathogenic micro-organisms, chemical substances, atmospheric fallouts; (b) accidental pollution, operating spills.

Key: Major issues in orange, issues whose importance is not determined yet or minor issues in pale yellow, threats in green. Dashes in blank boxes indicate issues unmentioned or only touched upon by stakeholders during interviews; these issues are not necessarily regarded as unimportant.

What is the social, political and economical relevance of the identified coastal issues?

All the coastal zone of the department of Bouches-du-Rhône is covered by planning documents and their study is instructive to identify environmental problems present on this territory. However, we cannot assess their priority character according to this process and it deals here with measuring the degree of territorial transversality of identified issues. The documents

consulted, fourteen altogether, are recent (2006-2011), various (management plans, charters, territorial coherence scheme, water development and management master plan, etc.) and include a diagnosis describing the state of the coastal and marine environment.

Have you developed, selected or calculated indicators in order to depict the situation and the problems you planned to consider?

The CASES site - the coastal zone of the Bouche-du-Rhone County - is fragmented and made up of four main "subsites", each of these having its specificities in terms of population density and characteristics, zone management schemes, urban area density and industries including refineries, petrochemical and steel industries, seaport, marinas, tourism and farming. Indicators have been collected from ministries, the national statistical institute and the seaport of Marseilles to assess the demographic and economic components of subsites. The objective was to assess the development of these components over the recent years and to identify the drivers of the main pressures on the site's marine environment, including urban areas and the rice industy in Camargue; port businesses and heavy industry in the Bay of Fos; population, residential and tourism density on the "Blue Coast"; urban area development and management as well as tourism and pleasure boating in the coastal zone of Marseilles and of the "Calanques" protected area. Finally the objective was to identify qualitative links between pressures and the state of the site's coastal waters as measured by Ifremer sourced chemical and biological indicators.

Section 2 Relations between coastal issue and ICZM Protocol and principles

2.1 How do the selected coastal issues relate to the ICZM principles and protocol? When possible and appropriate, refer to the relevant Articles of the Protocol.

Coastal Issue	ICZM principle
Land contamination of marine waters	Article 8: 3 (a) Strive to ensure the legal instruments include identifying and delimiting urban development Article 9 : 1 (c, d) Ensure respect for integrated water resources management and environmentally sound waste management and ensure that the coastal and maritime economy is adapted to the fragile nature of coastal zones and that the resources of the sea are protected from pollution Article 9 : 2 (a) Guarantee a high level of protection of the environment in the location and operation of agricultural and industrial activities so as to preserve coastal ecosystems and prevent pollution of the sea, water, air and soil.
Maritime traffic	Article 9: 2 (g) Conduct maritime activities in such a manner as to ensure the preservation of coastal ecosystems in conformity with the rules, standards and procedures of the relevant international conventions.
Fisheries	Article 9: 2 (c) Take into account the need to protect aquaculture and shellfish area and regulate aquaculture by controlling the use of inputs and waste treatment.
Conflict of uses	Article 5 (a) Facilitate through the rational planning of activities, the sustainable development of coastal zones by ensuring that the environment and landscapes are taken into account in harmony with economic, social and cultural development. Article 5 (f) Achieve coherence between public and private initiatives and between all decisions by the public authorities, which affect the use of the coastal zone.
Oil pollution	Article 6 (j) Damage to the coastal environment shall be prevented and, where it occurs, appropriate restoration shall be effected
Bathing water quality	Article 8:3 (d) Providing for freedom of access by the public to the sea and along the shore. Article 8:3 (c) Ensuring that environmental concerns are integrated into the rules for the management and use of the public maritime domain.

Section 3. Policies issues and ICZM principles and approaches

3.1 So far, how have been the coastal issues addressed by the local/regional/national government?

The coastal issues have been addressed by a variety of local and regional government organizations including the Water Agency, the Conservatoire du Littoral and the Region PACA. These organizations require the creation and use of integrated management plans for each of the sectors and each of the selected issues has been addressed accordingly. The management plans than serve both as a tool to monitor the different coastal sectors and to help finance the different activities.

3.2 At which spatial scale?

The spatial scale for addressing the issues has been more at the sector level and the idea behind the PEGASO Bouches-du-Rhone CASES was to have a broader perspective. As the activities and actions of one sector can directly influence the neighboring sectors, more interaction and joint planning would be useful. The Water Agency and the Region work in the entire Bouches-du-Rhone department and have attempted to have this overall vision for the coast.

3.3 Can you assess the results of the implemented policies? Which are the main results achieved? Which are the main limits and remaining problems?

The current policies have had many positive impacts on improving waste water contamination, monitoring bathing waters and reducing other pollutants in the waters. It has also been effective in creating participative approaches in many of the different protected areas. The policies seem to be less effective in integrated the different sectors to have a global vision of the coast.

3.4. On the basis of the ICZM principles (as they are expressed by the Protocol), do you think that the coastal issues were addressed with an integrated approach (in terms of organization, politics, sectors/thematic, tools, etc)?

Yes, most of the issues have been addressed by the ICZM principles. The large number of protected areas (national parks, natural parks), which are managed by local and national authorities, has helped to facilitate the protocol. These authorities have incorporated ICZM into their daily organization and tools. Despite the implementation of the protocol, there are still many risks and threats to the coastal area.

Section 4. PEGASO in relation to ICZM processes & initiatives

***4*.1 Do you think your work is relevant for the ICZM process of your country? Why and how?**

At the present time, ICZM processes in European countries are overwhelmed by the implementation of the Marine Strategy Framework Directive (MSFD). The MSFD requires Member States to improve existing measures and to implement new measures for achieving the good ecological of coastal and marine waters. The preparation of the future Program of

Measures of the MSFD, at both national and local levels, should be based on the best available knowledge. In this context, the work, which has been carried out by the PEGASO team in the Bouches du Rhône study site, may be seen as a potentially useful contribution:

- it provides an environmental territorial diagnosis which identifies the main management issues as they are currently perceived by local stakeholders;
- it provides a set of local indicators which put together in a more integrated analytical framework most of the Pressure and Impact descriptors which were collected for the MSFD at a larger scale (French Mediterranean Sea).

4.2 On the basis of the work that you have done, which are in your opinion, the main constraints in implementing ICZM principles and tools? What is missing? Where are the main gaps? Where we should put more energy and resources in the future?

ICZM may encompass a very wide range of issues and involve a lot of stakeholders. ICZM initiatives are thus always at risk of embracing too much. In practice, the involvement of the research and science community into ICZM initiatives should be organized so that it may be more useful, which means to have a more focused approach of the work to be carried out. This approach requires considering beforehand some efficiency conditions: will the knowledge to be produced bring something new and understandable to the stakeholders? does the knowledge to be produced apply to a management issue that the stakeholders are willing and able to deal with? Are stakeholders confident enough in the meaningfulness of the tools that the scientific community may propose to develop?

Section 5. Stakeholders involvement

5.1 Stakeholder involvement - Have you involved the main stakeholders? Can you list them?

The selection of stakeholders was an important consideration. We selected at least 1 -2 stakeholders from each geographical sector ranging from site managers to local decision makers. A total of 10 stakeholders were interviewed over a 4 month period between January and April 2012 and the interviews lasted between two to four hours.

The objective of the institutional analysis is to study the current management process including capacity, missions and means of the main territorial agents in coastal zone management to maintain, restore or improve the marine and coastal ecosystem quality and reduce use conflicts. Twelve territorial agents have been met for this purpose. These exchanges allowed us to hear their point of view on the difficulties faced to carry out their missions (institutional deadlock points) and the environmental problems for which they have to intervene.

5.2 How have you involved them (e.g. focus group, interviews, questionnaire)?

The stakeholders were involved in three principal ways:

- Individual stakeholder interviews.
- Participative workshops (a total of 2 workshops were carried out).
- Interactive website to identify indicators.

5.3 Which kind of constraints have you faced?

Overall the stakeholders were happy to participate in the interviews and workshops; but it was very difficult to get feedback through email or telephone contacts. We relied on the local Water Agency to help organize the workshops. This strategy increased the participation of the stakeholders and aided in the logistics of the workshops. On the other hand, the collaboration with the Water Agency required more internal planning and the modification of work plans and strategies. The character (strong and influential) of the Water Agency Coordinator helped ensure the success of the participatory process, yet the final results were heavily influenced by his persuasion.

Section 6. Tools

6.1 Tools applied

For the CASES we have used indicators, participation, territorial diagnostic and LEAC as tools to promote the integrated management of the coast.

6.2, Which have been the main constraints, faced during the application of the tools?

Constraints indicators:

Regarding population and economic indicators, three major contraints have been faced. 1) The limited number of available economic data: though the range of collected data could be seen as sizeable, a number of indicators were lacking e.g. in terms of cleaning and management routines and waste processing at commune level; of tourism, bathing, pleasure and marina visits; and more importantly, of heavy industry and rice farming wastes, which remain largely confidential for business interest reasons. 2) The limited resolution power of collected data: e.g. this was conspicuous in the case of local industry-related data as collected by the National Statistical Institute (principally workforce as measured in full time equivalents - fte), many of which remained confidential in compliance with statistical dissemination rules when the number of production units per commune is too low. It was then difficult to have a detailed assessment of certain aspects of industry development - especially the manufacturing industry - in the coastal communes of the site. 3) Linkages between economic and environmental indicators: this difficulty did not result from the nature of the collected data; it is a general problem. As born out by chemical and biological data, indicators characterizing the state of waters and sediments are difficult to correlate with man-made pressures such as polluting emissions from industry production units or urban areas (though some massive polluting events are easier to assess in terms of marine water components). It is more feasible and reliable to correlate long term trends in the state of waters with main groups of pollutants (emitted by common sources) and long term trends in polluting emissions. This is a major limit to a detailed and local assessment of pressures on marine environment at the scale of the CASES.

Constraints LEAC:

The Land and Ecosystem Accounting technique (LEAC) tool aims to identify how conflicting land use issues have evolved over the years and the consequences that this has on the site. Ecosystem accounts recorded the state of natural resources and ecosystem components in terms of quality (e.g. land-cover); quantity (e.g. volume of biomass, area of certain land-cover, number of species etc.) and changes in quality and quantity in time and space.

Some constraints of the LEAC tool used for the Bouche-du-Rhône CASE, is the spatial resolution of the CORINE Land Cover data used for the analysis. Indeed, the grid (1km/1km) used does not allow to observe changes in small units. In addition to that, the time series used (1990, 2001 and 2006) allow us to see the major trends in the evolution of the land use and land cover, but the total period of analysis (about 15 years) is not long enough to be able to show whether the rate of these changes are spirited to speed up or otherwise to stabilize. Finally, one major constraint of the LEAC used in this study is the CLC classification. Using this classification, it was not possible to identify with precision some habitats (particularly certain classes of wetlands) and see and their evolution over the period of analysis particularly in terms of conversion to agricultural land and urban areas.

The tool was then modified by incorporating additional data including status of protected areas in order to take into account the difference on land use change rates between natural protected and non-protected areas.

Constraints participation and territorial diagnostic:

The majority of the stakeholders that were solicited responded favorably to participating in the interviews and workshops. The major constraint was that this approach was quite time consuming and much of the information could have been retrieved by telephone or email contact. Unfortunately, telephone and emails were much less effective as many of the stakeholders did not respond to the questions or give their opinions appropriately and in a timely manner. Individual interviews allowed the stakeholders to express themselves openly without judgment from other colleagues; however, this method does not promote exchanges between sites and sectors and continues the same status quo of individual site planning and management.

Section 7. Main results of CASES

7.1 Achievements

Individual partners achievements

We have implemented a participatory territorial diagnostic and shared the results with the local stakeholders.

We have applied LEAC to our CASES and shared the methodology and results to the local stakeholders.

We have developed a local end users steering committee which is actively involved in the indicator set development,

All of our activities have been implemented in a participatory manner with individual interviews and group meetings.

Dissemination activities

2 papers accepted and presented at international conferences (MedCoast 2011 and 2013)

1 presentation at a national (French) conference (Berlitz 2012).

1 paper will be presented to the French Managers Journal (Espaces Naturels)

7.2 Lesson learnt

- The CASES was co-coordinated by 3 different organizations (TdV, IFREMER and UOBrest), the geographical distance and the different internal politics of each organization added to the work in the CASES. In the future it would be preferable to have one CASES coordinator who works in the project zone.
- The difference in timing for the tools and the CASES implementation made it very difficult for the CASES to use the work produced by the tools WP as it came very late in the project activities. In the future it would be beneficial to begin the work on the different tools in advance and use that work as a base to test or practice the methodology in the CASES.
- The process of integrated management is a long process that cannot be limited to the length of a 3-year project. Great efforts must be made at the beginning of the project to not only stimulate participation from local stakeholders, but to create local stakeholder leadership. This will ensure the mobilization of the different actors throughout the process and also ensure a continuation after the end of the project. The tools that are used should be transferred in such a way that they can be used/maintained by the stakeholders and are not dependent upon external project funding.

Application of LEAC in the Bouches-du-Rhone
Annex 1

Environmental accounting methodology

LEAC is a generic tool useful for environmental assessments and monitoring. In particular, it can provide spatial indicators for regional assessment of the status and degradation of natural capital due to the over-use of natural resources (Weber and *al*. 2003). LEAC also provides multi-scale (hierarchical) outputs, to facilitate the assessment of processes that manifest on different levels e.g. continental, country, region and local level (Gómez and *al*. 2005).

Essentially the ecosystem accounts aim to register properties or the state of natural resources and ecosystem components in terms of quality (for example type of land-cover); quantity (volume of biomass, area of certain land-cover, number of species,…) and change in quality and quantity in time and space. The quantity and quality features are basically termed and accounted as physical "stocks", while the change features are accounted as "flows". Land cover stock is the area of certain land cover type within a unit of measurement, be it administrative region, river catchment, a country, etc. In this study case, a stock was defined by the natural capital calculated using CORINE Land Cover (CLC) maps. The stock derived from CLC maps were represented in three hierarchical levels on European scales; level three being the most detailed containing 44 classes. In this study, flows were defined by the land cover change rates.

Spatial scale of work and time scale.

Ivanov and al.'s (2012) LEAC application protocol was used for this study case. Accordingly, a grid of 1km² (cell area) was used in order to input data and calculate stocks and flows. This grid approach allowed for data from different times and/or geometries to be combined with continuous (such as CLC) and/or discrete data (e.g. species distribution). In other words, complex spatial, statistical, qualitative and quantitative inputs provided comparable, meaningful outputs. Time scales of work were calculated using three CLC mapping periods: 1990, 2000 and 2006. These data were used to determine the natural capital (stocks) for each period, and the land cover change maps were also used to calculate changes in terms of land use conversion and the lost/gain of natural capital between two time steps.

Aggregation into classes of interest.

Once the land cover data was extracted from the CLC maps for each unit, habitats were aggregated to obtain different classes of interest based on the land use type that they cover (Table 2).

Table 2: LEAC classes of interest (Bouches du Rhone pilot study)

Classes of land cover of interest	**CLC classes**
Urban areas	**11, 14**
Agricultural land	**2**
Natural or semi-natural land	**3, 4, 5**
Transport infrastructures	**122, 124**
Industries, mines, dumps	**121, 13**
Ports	**123**

The conversion rates were calculated for each class of interest as it is shown in the Table 3. Indicators were then identified using the type of conversion from Table 3 and changes were detected between two dates every 1km² cell. The unit, in order of priority, was:

- The surface having experienced such a conversion (ha or km²)
- % of change as compared to the land cover class of interest

Table 3: LEAC indicators for the Bouches du Rhone pilot study

Type of conversion	**From**	**To**
Conversion of agricultural land to urban area	**2**	**11, 14**
Conversion of natural or semi-natural land to urban area	**3, 4, 5**	**11, 14**
Conversion of natural or semi-natural land to agricultural land	**3, 4, 5**	**2**
Conversion of agricultural land to industrial area	**2**	**121, 13**
Conversion of natural or semi-natural land to industrial area	**3, 4, 5**	**121, 13**
Conversion of agricultural land to transport infrastructure	**2**	**122, 124**
Conversion of natural or semi-natural land to transport infrastructure	**3, 4, 5**	**122, 124**
Conversion of agricultural land to ports	**2**	**123**
Conversion of natural or semi-natural land to ports	**3, 4, 5**	**123**

Results.

For the Bouches du Rhone study site, the units for calculating the LEAC indicators were defined by the administrative limits of the coastal communes from Marseille to the Saintes-Maries-de-la-

Mer (Figure 1). Those administrative units as described in the territorial diagnostic were then included into 4 geographic supra-units (see Table 1).

The classes of interest were aggregated for each of three periods analyzed (e.g. in the Figure 2 for 2000). This permitted the estimation of natural capital stocks available, and the determination of the evolution of stocks over time (Table 4).

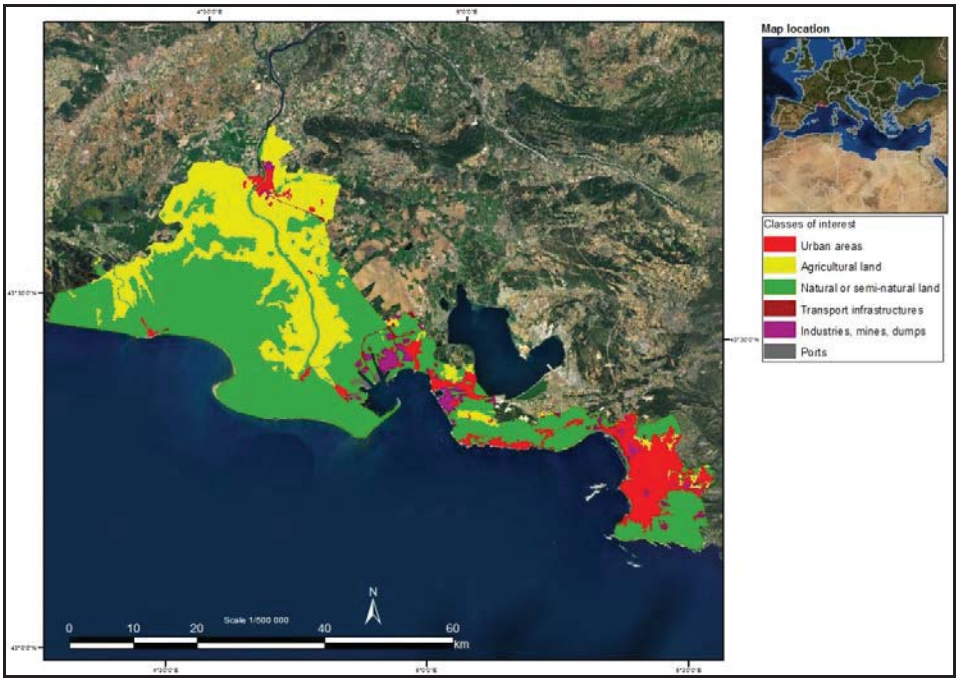


Figure 1: Example of aggregation of the CLC habitats into classes of interest (derived from CLC 2000 data).

Table 4: Classes of interest changes over time for the entire pilot study area.

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

Globally for all units in the pilot study, there were no significant changes in terms of land use between 1990 and 2006. However, given the results presented in Table 4, there was a loss of natural capital (from 58.45% to 55.75%) for the entire surface area. This loss is probably due to a sharp increase of the artificialization of the territory during the same analysed period in some coastal zones. Urbanized areas increased from 8.78% to 9.21% and industrial areas increased

from 2.97% to 3.01%. Changes were also seen through the conversion of natural habitats into agricultural areas. It is important to note that although the surface areas remain relatively stable in terms of used surface, it does not necessarily mean that there has been no evolution as natural habitats might be compensated by losses in urbanization for example. Further analysis took into account the different types of changes previously defined (LEAC indicators).

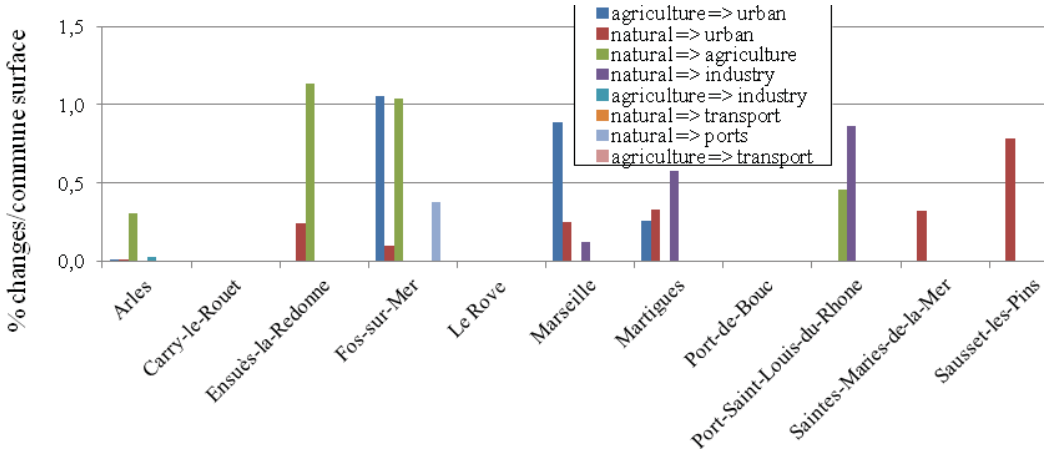


Figure 3: LEAC indicators corresponding to different land use changes between 1990 and 2006.

Taking into account the different municipalities constituting the pilot study area (see Figure 3), the most important conversion rates were those of natural habitats to agricultural and built areas (urban, industry and ports), as well as agricultural areas converted into built lands (urban and/or industrial). Moreover, with this analysis, it was possible to identify some trends in economic policies of each administrative units of the Bouches du Rhone pilot site. For example, the communities with the highest rate of industrialization in terms of land cover are those of Martigues and Port-Saint-Louis-du-Rhône, which both are in the geographic unit of the Gulf of Fos. However, the municipalities where urban sprawl was the highest during the 16 years analysed, were Fos-sur-Mer, Marseille and Sausset-les-Pins (located respectively in units of the Gulf of Fos, Marseille and the Cote Bleue). These urban expansions may be due to strong demographic growth, which itself could result from an economic attractiveness of these regions between 1990 and 2006 (industrial and port activities, agriculture and tourism). Finally, with the LEAC tool, it was possible to localize the changes through maps (Figure 4).

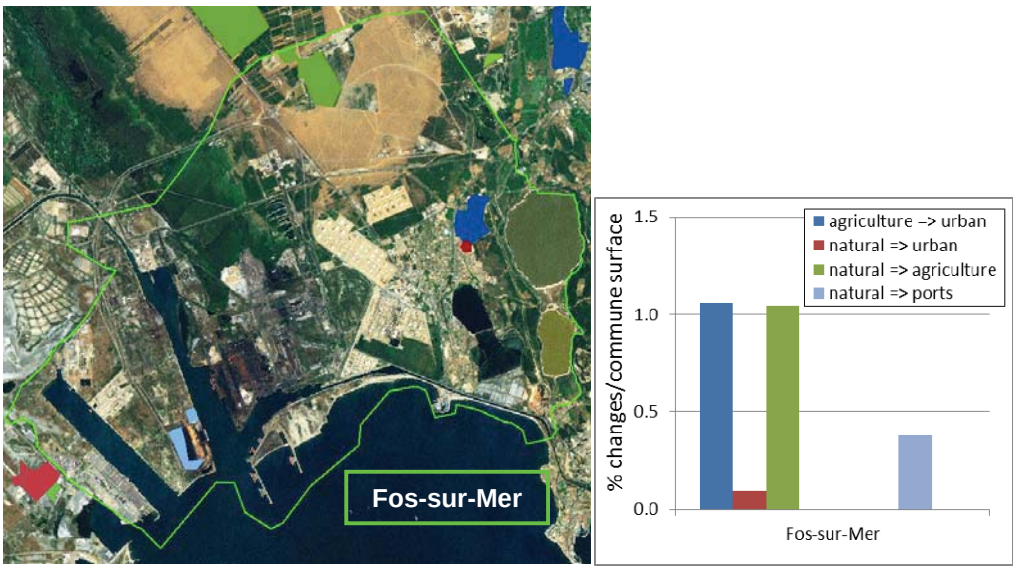


Figure 4: Land use and land cover change map in the municipality of Fos-sur-Mer between 1990 and 2006.

Conclusion.

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

References.

Gómez O., Páramo F. and Weber J.L.; 2005. Environmental Accounting Methodological guidebook: Data processing of land cover flows. Internal report. Universitat Antònoma de Barcelona. 23 pp.

Ivanov E.D.; Weber J.L.; Spyropoulou; R. and R. Haines-Young; 2012. Developing an accounting method for biodiversity conservation in Europe. CEM, School of Geography, University of Nottingham.

Weber J.L., Paramo F., Breton F., Haines-Young R. (2003): Integration of geographical and statistical data in the environmental accounting framework; methodological development based on two case studies Action 2 : Integration of environmental accounts in coastal zones; case study of tourism Contract n° 200141200017 Report of the European Topic Centre on Terrestrial Environment, with the support of the European Environment Agency, Barcelona, 28 February 2003.

Environmental and territorial diagnosis
CASE Bouches-du-Rhône

Summary

The PEGASO project supports the Barcelona Convention and the "Integrated Coastal Zone Management" Protocol. The primary objective of the project is to propose tools to decision makers that will promote integrated coastal management in the Mediterranean and Black Seas. PEGASO aims to refine and further develop efficient and easy to use tools for making sustainability assessments in the coastal zone (indicators, accounting methods, models and scenarios). They will be tested and validated in a multi-scale approach for integrated regional assessment through a number of relevant pilot sites, including the Bouches-du-Rhone in southern France.

The subject of this report is to present the state of progress of the environmental and territorial diagnosis for the coastal zone of the department of Bouches-du-Rhône.

The environmental and territorial diagnosis is made up of two distinct and complementary tasks: firstly, an institutional analysis that gives an account of the territorial agent diversity and their actions for the coastal zone management; and secondly, a multidisciplinary assessment (morphological, ecological, socio-economic indicators) of priority environmental issues. This joint work describes the past evolutions and the current and future issues according to the environmental deterioration, associated effects and answers given to deal with it.

Only the institutional analysis has been completed. This is a description of the current management system, an identification of issues faced by territorial agents interviewed on their management activities in the coastal zone, and an identification of the main environmental issues.

The most common identified difficulty of the territorial agents consulted is to make management issues coincide because contradictions in terms of objectives often exist between different projects.

Among the main environmental issues identified, the most cited by agents was the problem of “land contamination of marine waters”. This problem is, with the “manmade coastal spaces and spaces reclaimed from the sea”, present in the whole coastal zone of Bouches-du-Rhône. It is also, in regard to the nature and geographical and historical dimensions of data available, the only environmental problem that seems to be the subject of a spatiotemporal integrated assessment.

1. The environmental and territorial diagnosis

1.1 Definition

This environmental diagnosis identifies the uses found along the Bouches-du-Rhône coast and their environmental pressures, factors and impacts that influence the coastal zones. Given that coastal management aims to influence, reduce or eliminate these pressures, the diagnosis focused on identifying these pressures through interviews with local stakeholders (directly or indirectly involved in coastal management).

The environmental diagnosis is the first step in most management projects. This diagnosis can enhance the management plans (schémas de cohérence territoriale - SCOT, schémas directeurs d'aménagement et de gestion des eaux - SDAGE, plans locaux d'urbanisme - PLU) and other management documents (Charters for national and regional parks).

According to the Brundtland report (1987), sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (CMED, 1987). This concept represents a process of ecologically sustainable, economically effective and socially fair development. A territorial diagnosis of sustainable development aims to give an account of its implementation, taking into account these three dimensions.

Concerning the particular case of interface areas between sea and land, this diagnosis is inserted in the process of Integrated Coastal Zone Management (ICZM), the "central paradigm of coastal sustainable development" (Billé, 2006). ICZM is defined in an additional protocol to the Barcelona convention for the coastal and marine area protection of the Mediterranean Sea against pollution as "a dynamic process of durable management and use of coastal zones, taking simultaneously into consideration the fragility of ecosystems and coastal landscapes, the diversity of activities and uses, their interactions, the marine purpose for some of them, and also their impacts on marine and land parts" (UNEP/MAP/PAP, 2008). The privileged entry to make the environmental and territorial diagnosis for the process of ICZM is centered on an environmental deterioration in the coastal zone and the repercussions that it has on the coastal population well-being.

In this study, the environmental diagnosis is considered a preliminary step to create other quantitative management tools. It attempts to encompass the most important questions concerning coastal development and management. The final results have been submitted to the local territorial stakeholders involved in coastal management. The second step of the project is to create an indicator set that includes economic and social indicators concerning the coastal zone activities.

1.2 The choice of the territorial unit

The study site is the coastal zone of the Bouches-du-Rhône Department. The 2007 territorial development directive (DTA) established the coastal zone to include twenty-two counties that have a Mediterranean Sea line or a coast along the Etang de Berre (lagoon). This encompasses over 40% of the Department. At the beginning of the project, it was decided not to include the coast of Etang de Berre in the project area. This decision was made because of the extreme geographic diversity of the coastal zone, the limited time available during the project and the need to take into account the marine areas in sufficient detail.

The depth of the coast area for the study zone depends on the uses and pressures that are analyzed. The extent of the coastal zone depends, in general on the uses and pressures to analyze. It is usually confined to "the geomorphologic area either side of the seashore where interaction occurs between the marine and the terrestrial part through ecological systems and complex systems resources including biotic and abiotic coexisting and interacting with human communities and relevant socio-economic activities. The coastal zone of the study site is divided into units that differ in land use and main uses: the Camargue, the Golf of Fos, the Côte Bleue, la rade de Marseille and the Calanques (figure 1).

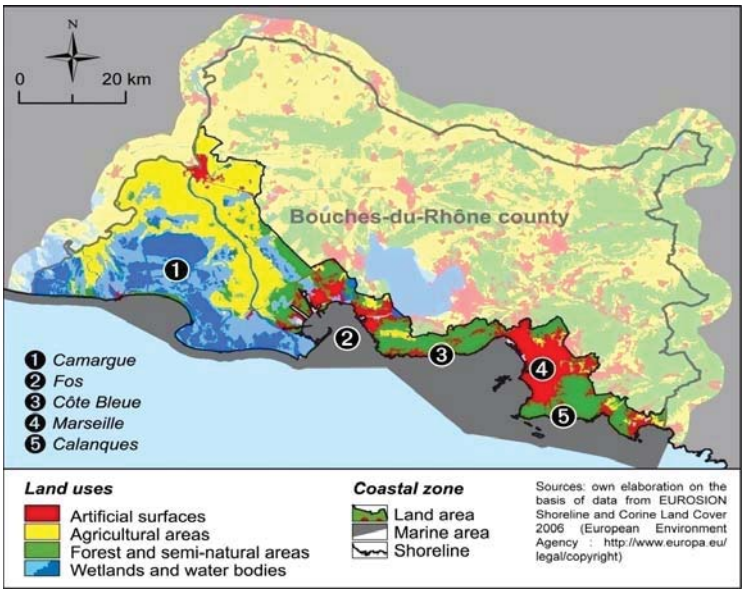


Figure 1. Study site: the coastal zone of Bouches-du-Rhône

1.3. Pressures and management problems

There are numerous pressures and management issues in the coastal zone of the department of Bouches -du- Rhône given that it has been highly industrialized since the 1970s. This report is limited to environmental pressures considered major by users and local managers, and linked to actual degradation phenomena or risks of degradation. For this reason, it does not address the issue of accessibility of the coast (primarily a social issue), the risk of fire (field of civil security) nor hunting.
Pressures considered here are the actual and potential pressures (risks exerted on the coastal zone uses and actual or estimated effects on the environment and the well -being of coastal communities. The study is based on interviews with local stakeholders and the revision of management plans, blueprints, charters and action plan for the land and marine environments. The management documents were used to sketch an overview of environmental issues and the semi-structured interviews were used to update the knowledge and understanding of the issues concerning local managers.

1.4. Institutional analysis and evaluation of environmental priorities

The territorial environmental diagnosis includes, on the one hand, an institutional analysis that reflects the diversity of local actors and their actions in the management of the coastal zone, and secondly, a summary of coastal uses and pressures considered important in the management documents. This information will be supplemented with indicators of the state coastal zones and coastal waters, and economic and social indicators to assess the importance of uses and impacts of degradation. The objective is to analyze the factors and pressures, risks and responses implemented or considered necessary by the actors or planned management documents.

1.4.1. Institutional analysis

The institutional analysis is a non-exhaustive inventory of agents active in the field of coastal zone management, to maintain, restore or improve the marine and coastal ecosystem quality and reduce use conflicts. The objective of this approach is to understand the current management system and collect the point of view of key agents on its functioning. In accordance with the structure adopted for the semi-structured interviews made with territorial agents between January and April 2012 (annex n°1), it particularly concerns:

- The identification of institutional knowledge, i.e. status and missions that they are given

and on which they build their legitimacy as a territorial agent;

- The collection of points of view on the main environmental problems in the intervention area;
- The identification of specific objectives of environmental management policies that they lead in the coastal zone (management tools, financial and human means, etc.);
- And the definition of institutional deadlock points, i.e. pressures met by these agents that prevent them from fully achieving their objectives (problems of management measure acceptability, means and knowledge necessary to make their mission, etc.).

1.4.2. Evaluation of environmental priorities

The environmental assessment of the issues identified as priorities seek to gather quantitative indicators related to the use and environmental pressures on the study site:

- What are the economic, industrial, social and urban pressures observed on the study site?
- What are the environmental impacts of these pressures and their consequences on the uses directly dependent on the coastal environment and coastal communities?
- Can we estimate the cost elements and the effects of management measures (regulations, budgets, incentives to changing usage practices)?

The general identification method of priority issues to elaborate indicators of "pressures/impacts" in the coastal zone is summarized in the following figures (fig.2a and 2b).

Temporal and spatial indicators characterizing the state of the site in relation to major environmental problems will be defined. The economic and social assessment of coastal uses and their associated effects will be conducted using anthropogenic indicators (eg. length of artificial coastlines) and economic and social impacts (eg. annual number closing days of bathing for health reasons). The aim is to highlight the interactions between pressure uses, degradation or modification of the environment, and social and economic impacts on these users or other users. The answers given to prevent or reduce degradation and associated impacts are partially addressed in the assessment of the costs of degradation (cf. Le Gentil et al. , 2011).

The set of indicators is to be determined according to their uses and pressures on the coastal environment. Synthetic indicators must be developed for policymakers, while detailed indicators must be used by the scientific community.

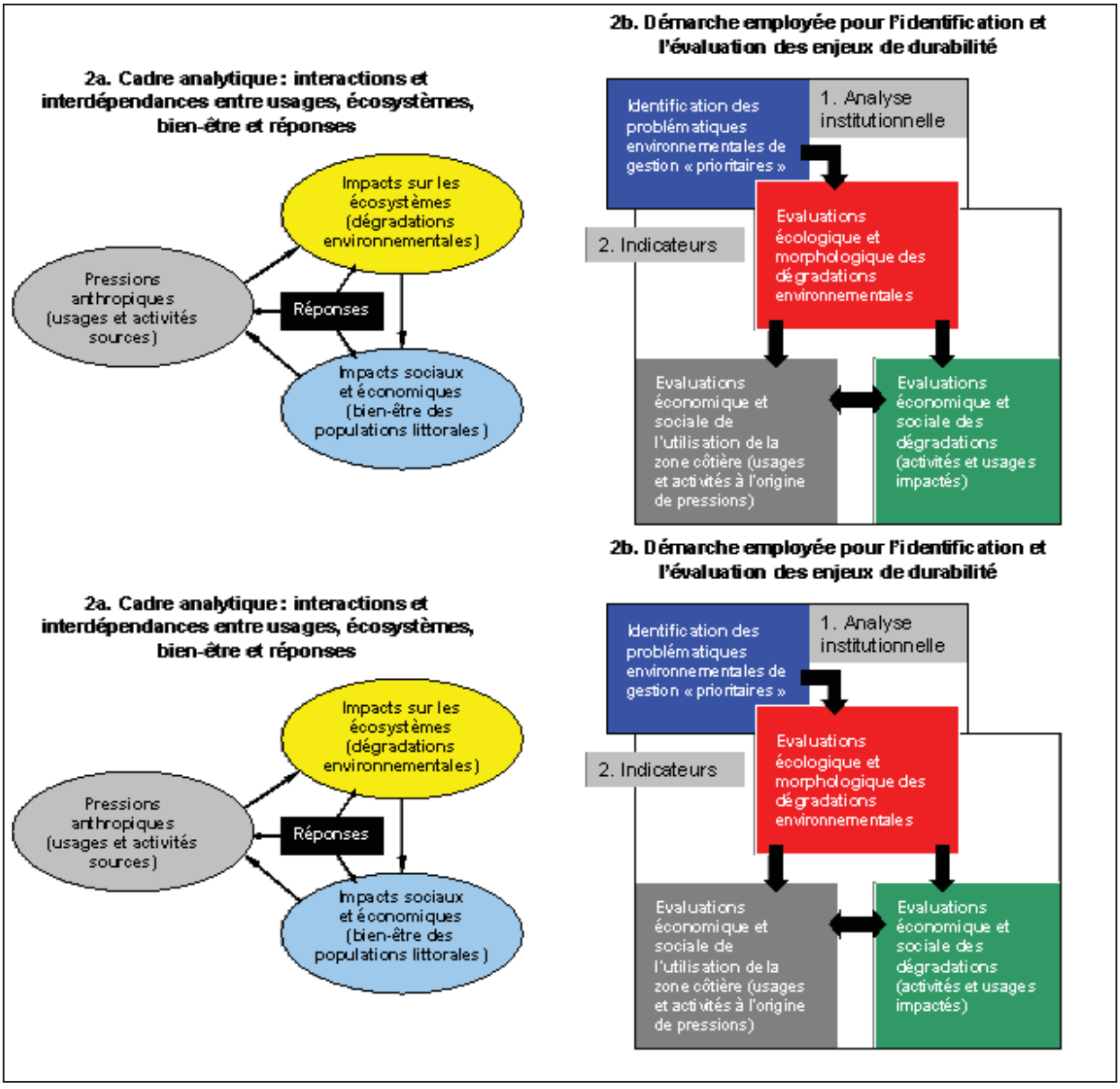


Fig. 2a and 2b: Analytical framework and methodology used for the sustainability issue assessment.

2. Institutional analysis

The objective of the institutional analysis is to study the current management process including

capacity, missions and means of the main territorial agents in coastal zone management to maintain, restore or improve the marine and coastal ecosystem quality and reduce use conflicts. Several territorial agents have been met for this purpose. These exchanges allowed us to hear their point of view on the difficulties faced to carry out their missions (institutional deadlock points) and the environmental problems for which they have to intervene.

2.1. The management device and the point of view of interviewed stakeholders

2.1.1. The current management process

The management device applicable to the coastal zone of the Bouches -du- Rhône includes several management plans and schemes. There are: -

- Documents which, like the DTA, the SDAGEs and PAMM apply to larger territories, including the study site at the department level, the watershed or maritime façade. These are either planning documents, or documents for the conservation and restoration of the environment and communities. Development oriented documents also include environmental protection objectives.
- Documents relating to specific areas for their fragility, their functionality (eg. transitional waters) or their remarkable features (creeks, etc.). The spatial scales are more limited. These documents - SCOT, charters for natural parks, management plans, and Bay contracts - focus on conserving the environment.
- In the hierarchy of many of these documents expresses the principle of subsidiary, taking into account the skills of communities and their levels of intervention.

Spatial scale documents integrated into the study site

- Water Development and Management Master Plan 2010-2015 (Schéma Directeur d'Aménagement et de la Gestion des Eaux or SDAGE: Rhône + Mediterranean basins): instituted by the water law of 1992, the SDAGE is a planning instrument which establishes fundamental directions of a balanced management of the water resource in the general interest and in line with the principles of the Water Framework Directive and the water law for each water body (ponds and lakes, bays and seas, stretches of stream, estuaries, coastal waters, ground waters)" for each water catchment. The achievement of a "good state" in 2015 is one of the general objectives. In this context, the SDAGE determines the planning and measures necessary to avoid further deterioration and the improvement of the water state and aquatic areas, in order to achieve environmental objectives previously defined.
- Action plan for the marine environment (Plan d'action pour le milieu marin or PAMM): The European Marine Strategy Framework Directive (MSFD) establishes principles on which the

member States must take action to reach the good ecological state of all the marine waters for which they are responsible by 2020. The transposition of these strategies in the French legislation is made by the action plan elaborated for the marine area per marine sub-region (Article L. 219-9 of the environment code) that takes into consideration the following elements: 1 / an initial assessment of the state of the marine sub-region, 2 / a definition of good ecological status of the sub-region, to be achieved in 2020, 3 / setting environmental objectives to achieve this good environmental status 4 / monitoring program, 5 / program measures. The first three components were developed in July 2012 and the other two will be developed in 2014 and 2015 respectively.

- Directive Territorial Planning (DTA) of the Bouches -du- Rhone (2007). It sets out the main objectives of the State: a) for the location of major transport infrastructure and major equipment and preservation of natural areas, sites and landscapes, b) in terms of development and balance prospects for development, protection and enhancement of territories c) specify the detailed rules specific to the coastline adapted to local geographic features. It requires other planning documents: the SCOT and PLU must be consistent with its policies. Three principles are developed, focusing on the development and operation of Marseille City and County and the preservation and enhancement of spaces. On this last point, the DTA specifies coastal law enforcement. The main orientations of this framework are the conservation of large landscape units that constitute the identity of the coastline of the Bouches -du- Rhone, such as (for sites of this case study) the Camargue, the Calanques and Estaque, and the Gulf of Fos. The provisions of the Coastal Act that are not specified by the DTA remain applicable as provided by the Town Planning Code.

Documents that are applied to parts of the study site

- Territorial Coherence Schemes (SCOT). Established by the SRU law, this planning document at the municipalities' level ensures consistency between the sectoral policies of urban planning, housing, travel and commercial equipment in an environment preserved and enhanced. The Grenelle II law has tightened the objectives: SCOT reduces the consumption of urban space, preserves spaces used for agricultural and forestry activities, balancing the territorial distribution of shops and services, improving energy efficiency, reducing obligations for travel, reducing greenhouse gas emissions and enhancing the conservation of biodiversity and ecosystems. It is particularly subject to the DTA, the charters of regional parks and SDAGEs (see below). It is effective against a set of decision documents, programs and development plans, local housing programs (PLH), urban transport plans (PDU) and local development plans (PLU). The SCOT that applies to the CASE are those of the urban community of Marseille Provence Métropole (MPM), the West Berre and Arles. Note that the first two apply to common areas outside of the CASE.

- Charter of the Regional Natural Park of the Camargue. The PNR is managed by a joint union grouping communities that signed the charter, contract management and land development for a fixed term (12 years now). It is based on consultation with local stakeholders. The objectives of the 2011-2022 Charter are: managing the deltaic complex incorporating the predicted impacts of climate change, direct changes in the business for the benefit of exceptional biodiversity, strengthening regional solidarity, social cohesion and improve the living conditions, sharing knowledge and open delta to Mediterranean cooperation. The charter is a legal document: it is enforced by the Federal government and is administered by local signatories within their skills and is binding on planning documents (SCOT and PLU).

- Camargue delta contract. The PNR and the water agency RMC took the initiative of a contract recommended by the Delta DTA of 2007, in consultation with users: local authorities, associations of users and developers, protection associations, conservatoire du littoral, and scientific research organizations. It is a tool for dialogue and incentives. The contract 2012-2017 has six orientations: the fight against pollution, management of water resources, conservation and restoration of aquatic environments, support the integrated management of coastal and marine environment, and knowledge monitoring of the environment, support local governance and public awareness. The contract scope includes the zone of three nautical miles.

- Blue Coast Marine management plan (Parc Marin de la Côte Bleue): the objectives of the “Parc Marin de la Côte Bleue” draw its inspirations from the PNR. For this reason, this organism has a management plan that has been made in partnership with different agents (elected representatives, State services and related, socio-professionals) and is structured around six strategic objectives for which different actions are determined: reinforce the knowledge of the marine and coastal heritage; manage, protect and restore marine and coastal natural areas; reinforce the value of fishery resources and ensure conditions of sustainable coastal fishing; be the intermediate of local policies to maintain pollution, natural risks and development impacts; and respond to the information, awareness and education of the public and local agents.
- Charter Calanques National Park. "A national park can be created from land or sea areas where the environment [...] presents special interest and importance to the protection in preserving degradation and damage likely to affect the diversity of composition, appearance and evolution." A regional project is enshrined in a charter defining the

modalities of application of the regulation in the heart of the park. It is established for fifteen years and directs the management of the different areas of the park.

- Management plan in the Roadstead of Marseille: “the Management plan in the Roadstead of Marseille (Plan de Gestion de la Rade de Marseille or PGRM) is a process made by the city of Marseille to elaborate and develop a sustainable and coherent policy of operational actions, in order to conserve and develop the areas and resources of the roadstead” . This territorial process aims to create a shared vision of the main issues and challenges concerning the maritime areas and the Marseille coast (institutional, socio-economic, associative and scientific agents). Strategic objectives have been collectively defined and an action plan for the Marseille roadstead management was proposed.

2.1.2. Elements taken from the management documents

This section summarizes the diagnostic elements that emerged from the consulted management documents: the DTA, the action plan for the marine environment (PAMM), the SDAGEs the SCOT MPM, West Etang de Berre and Arles, the management plan of the harbor of Marseille and the application of the Marseille Bay Contract, the charter of the PNR and the Camargue delta contract, the management plan PMCB, and the charter for the Calanques National Park. These documents provide key elements to the environmental assessment or a state of the environment. This element of analysis should be compared with Directive 2001/42/EC whose transposition into French law requires water management and spatial planning documents included in the environmental assessment. This logically implies a form of inventory. In addition, certain provisions in the governing documents, particularly in the development and plans for sustainable development (PADD) integrated with SCOT, can be interpreted a contrario as diagnostic elements indicating gaps or points to improve.

There are other management documents than those listed above: development plans and water management (SAGE) , local development plans (PLU) and environmental contracts, for example, in addition to the environmental management plan (NMP) the "largest seaport " Marseille (GPMM) . This aside, these documents are compatible with SDAGEs, among others. The selected documents are therefore sufficient to make a general analysis of management problems on the site, but may not provide the highest level of accuracy. The «Energy territorial climate plans " including CFEP MPM and the Western - Berre and Martigues, can also provide diagnostic elements in coastal areas, but rather marginally , these documents are of a less direct interest in this synthesis, since they have very global objectives.

This summary will be completed by the views expressed by managers during the interviews we had in 2012. It seeks to highlight key aspects of the economic development of the study site and

the evolution of the state of its environment, and help to define relevant indicators to integrate the indicator set for the CASE.

a) Coherence of different approaches

The consultation documents show an effort to cross-reference information. Other aspects that should be highlighted include that: the documents are compatible (SCOT are compatible with the DTA and SDAGEs), the documents targeted more local information (management plans a sub- site PLU), yet they refer to texts on a greater spatial scale (DTA SDAGEs particular). The DTA SDAGEs attempt to link up with other national regulations (coastal law, national Health and Environment 2004 Climate Plan, laws Grenelle I and II) and international protocols ratified by France. The SDAGEs makes specific reference to the Barcelona Convention. Reference is also made to European directives (eg. Water Framework Directive) and the SDAGEs now integrate the management plan under the law of 21/04/2004 transposing WFD and other environmental objectives of the Directive. The achievement of "good status" of waters in 2015: coastal water bodies, whose limit is a mile offshore is one example. Regardless operational management choices, there is a consistent effort to develop management schemes that are coherent at local, national and European levels.

b) General approach for the study site

The study site was subdivided into several sub-sites according to the dominant local characteristics of the coastal zone and the interactions between subsites. The planning documents consulted adopt neighboring approaches at different geographical scales and thus allow for the understanding of interactions of CASE with a more global perspective. Thus the DTA notes the depth extension of the coast of the department, around the Etang de Berre (not studied here) and in the Rhone delta (the city of Arles, 40 km from the sea) is liable to the provisions the coastal law. It adopts an approach to inter-regional scale transport infrastructure (roads, rail and water to thin and massif traffic and communication between urban centers, industrial port and logistics). The local documents (SCOT, MPM and West - Berre, management plan of the harbor of Marseilles, Bay charter) adopt an " in-depth approach" for their diagnoses, including coastal and hinterland through watersheds and their impact on the quality of coastal waters, through pressures from urban, industrial and tourist traffic from and on neighboring areas.

The issue of "intermediate" space puts the subdivision into sub-sites. Thus, the town of Port - Saint- Louis -du- Rhône is located in the Camargue and the Gulf of Fos, Martigues is located in the Gulf, on the Etang de Berre and the Blue Coast, the other towns of the same Blue Coast is

part of the urban community of Marseille. The boundaries between sub-sites are not strict and accept spaces and common mixed characters. Subsites are studying according to their dependencies but also the characteristics of these intermediate spaces.

In each of the five sub-sites, land management projects are faced with the need to combine economic development and environmental protection of the most vulnerable areas. This is a general problem for almost all land records, as it directs the diagnosis of documents consulted and programs of measures, given the density of uses that have a strong influence on the environment and water bodies. The problem is radically different in areas of industrial or urban land (ZIP Fos, Marseille) and in areas used for agriculture and tourism, which are subject to environmental protection measures.

The literature stresses the need to develop in depth. One reason is the need to improve access, traffic and intercity connections: these are problems to be addressed in a departmental, inter-regional and even national setting (see DTA). At the department coastal scale, the problems focus on intercity connections and upgrading of road and rail access to the ZIP Fos. This aspect leads to an integrated environmental inventory of the coast in a broader context involving the densification of housing and the creation of urban centers. This principle is particularly important in a coastal area where shoreline access is made more difficult by urban sprawl and growth. Another reason, is the influence of watersheds on coastal water quality (pesticides and heavy metals). The major role of watershed management shows the importance of the WFD and SDAGEs for analyzing problems of the marine environment. A third reason is due to land pressures that affect the marine environment : impacts of pesticides on rice in the Camargue wetlands, heavily modified water bodies in the Gulf of Fos as a result of urban pressures and the port: hence the need for a diagnosis taking into account factors well in advance of the coastline.

c) Essential problems for the sub-sites

Indicators can be gathered on the state of the coastal environment of CASE, from documents consulted. This section is limited to major global indications. According to the documents consulted, the main issues of environmental inventory are in the following sections. The list is not exhaustive and the reader will find supplements in Appendix 1.

Camargue

The area is covered by the Charter of the Regional Natural Park and contract delta. The SCOT Pays d' Arles is also taken into account.

The main activities are agriculture, tourism and fisheries;

- NRP Camargue includes non urbanized part and non-industrial (excluding ZIP Fos) in Port -Saint- Louis -du- Rhône to the handle and arrow Carteau the Gracious, and thus includes the SAN West Provence , it also includes Salin -de -Giraud and the site of the former Salinières activities;
- Agriculture (rice cultivation, cattle ranching, irrigated meadows, vineyards) is a major local activity, rice farming also influences the zone with freshwater inflows reducing the rise of salt water;
- Maintaining small coastal fishing through the rich waters of the delta, but there is also overfishing and illegal trawling within three miles;
- Rising sea levels combined with subsidence and the uncertainty of future flows of agricultural water, the sea level is above the level of the ponds (more than 200 days / year in 2008), management the pond Vaccarès becomes difficult, needs a contract delta and a water charter to integrate flood risk to marine management ;
- Significant coastal erosion;
- Emissions of rice pesticides in wetlands, but lack of monitoring of the quality of the lagoon water;
- Problems of emissions due to rain and the treatment of wastewater impacts bacterial pollution on swimming, fishing and shellfish, shellfish areas classified B between Vif and Grand Rhône Rhône, C the arrow on the Graciuese, improving the microbiological quality (REMI).
- Presence of heavy metals in moderate concentration in marine waters, oil pollution of marine waters and Vaccarès by air and sea due to industry and river traffic, road and sea (illegal discharges), the presence of PAHs in Vaccarès and contamination of fish;
- Urban pressure resulting in growth and multiplication of the facilities and tourist infrastructures, infrastructures to reduce flooding risks and the artificiality of the coast, need for densification of the frame.

Golfe de Fos

- Sea side : strong modification of water bodies and intake from port and industrial discharges (west basin of the Port of Marseille), and nevertheless : the persistence of a small coastal fishing in the Gulf , and mussel farm in the cove Carteau;
- Landward : ZIP extended the management of several types of uses including access and beach attendance; industrial safety, leading to outline of specific procedures for implementing the Coastal Act (DTA);
- Some densely populated coastal municipalities (Martigues , Port-de-Bouc); marinas, beaches and swimming areas surrounding the ZIP and the role of agriculture in peri-

urban areas and the effects of extensive agriculture (SCOT see EPO). Attempt to intensify of urban fabric (like ERA) to preserve the natural environment;

- Communal areas marked by logistics and freight associated with ZIP The report Egret (BRGM , March 2009) focuses on the SAN West Provence, it shows the lack of widespread soil contamination across the territory but indicates point source pollution, certain well-defined areas are strongly affected (industrial fallow land in particular);
- Mussel cove Carteau (Coopaport, 2500 to 3000 tons /year) operated in hazardous area B (C for the rest of the Gulf of Fos).

Harbor zone of Marseille

- The ponds in the West and ZIP establish one of the factors of modification of the marine environment, they also establish the scaffolding of the zone of employment of Marseille-Fos and the economic engine of the West-Etang de Berre of Berre (cf. SCOT OEB - diagnosis);
- The projects of harbor facilities of Marseille-Fos depend on the strategy of the GPMM and on the evolution of markets: preservation of strong component bulk liquid, available infrastructures (South-North) allowing the massification of the traffic; the growth of container traffic depends on the road, railroad and river, overdrawn development of the logistic infrastructures and on transport.
- Trend toward the specialization of ponds to transport passengers and on cruises (thanks to Euroméditerranée), without anticipating a disappearance of the freight;
- Trend to the movement of the freight on ponds in the West; likely consequences and need to in strengthen transport and logistics infrastructure in Fos (which are already overdrawn);
- In the maritime plan: likely incidences on the use of the channel for ponds in the West according to the strategies of economies of scale in the containerized transport; lower load for ships, but bigger size; likely evolution of the use of the channels, in particular according to the place of Marseille on the cruise market.
- Growth likely to be modest in the short-medium term, liquid bulk port infrastructure; 3XL and 4XL provided in Fos for containers in the same area as 2XL; Continuation of the management plan of natural areas (NMP, 2007): maintenance of 3000 ha of natural areas located in the ZIP, followed by species-specific studies, public reception, consolidation of the arrow of the Gracieuse; Draft for piercing the dock until 2 Canal du Rhone at Fos, registered in CPER 2007-2013.

Côte Bleue (Blue Coast)

- Marine Park with the goal of protecting water quality and the environment, fauna and flora objectives achieved, maintaining a small coastal fishing community, artificial reefs keep trawlers at a distance; growth in tourism and boating frequentation;
- In addition to its management plan, the CDIP is framed by two SCOT (EPO MPM); Risk of over-use of boating and its potential impacts on the environment; Pressure on land and trends for saturating the habitat (number of second homes down) under the influence of the nearby city of Marseille.

Marseille

- Dense coastal uses: urban agglomeration of considerable size, scarcity of land, soil sealing, ZIP basins of the port (source emissions), beaches, marinas, tourist shuttles, an important development of cruise industry; increase in tourism.
- Emission problems of urban wastewater: the poor state of coastal waters requires treatment at the watershed scale (Huveaune in particular) and improved storm water management in the city and in the eastern basins: a) in 2012, the step of Marseille was declared non-compliant with the Directive ERU b) releases of Cortiou that discharges from the step and water diverted from Huveaune induce a degradation of the ecosystem (see PRGM). c) direct discharges by Huveaune during rainstorms have impacts on the nearby coastal areas;
- Actions MPM were: organic extension of the step (Géolide) to reduce the pollution load discharges Cortiou; improved sludge treatment monitoring program of the marine environment;
- Problems of bathing water quality due to episodes of rainstorms, the situation is problematic, according to the bay contract, facing the new regulations; Pollution from port origin: high local concentrations of heavy metal (identified in the Ifremer network), and chemical pollution (REPOM);
- Environment exposed to overuse due to boating, scuba diving and invasive species .

Calanques

- National Park recently set up: one of the few suburban PN in the world, the Charter of 2012 defines a land and sea center, optimal adhesion and an adjacent sea area, adherence to the Charter and committed to making compatible with the SCOT provisions (environmental quality);

- The diagnosis of the Charter takes into account the SDAGEs the SCOT MPM, the PRGM and Natura 2000 objectives;
- One of the reasons for this policy is the increasing attractiveness of the site: the boom in tourism and frequentation of the coastal zone (swimming, boating, diving) are significant since the 2000s.
- Presence of commercial fishing (incl. trawlers) and a recreational fishing; The main problems of the site are over-use, the quality of water and the black dots of emissions and red mud ;
- Over-use is poorly measured, at sea, it is a factor of degradation of wildlife and the environment (anchors, illegal trawling, lost gear, turbidity) and disturbance of wildlife, the park is working with the Region in "Clean ports" operation;
- Water quality is affected by soil pollution and the marine waters storm water effluent Huveaune and Cortiou emissions, the body of water located to the right of the outfall, the SDAGEs sets the 2015 deadline for a return to good chemical status and in 2021 for good environmental status;
- The "red mud" folder: the most immediate problem is the release of suspended solids, which must cease by the end of 2015, technical solutions are sought with the operator Rio Tinto to reduce all releases.

d) Common problems for several sub-sites

Some diagnostic elements apply to all subsites and highlight similarities and important differences.

Agriculture	Agriculture is important in the Camargue, peri-urban and marginal in the other subsites. Rice has a role in the management of Camargue waters (freshwater inflows limiting the rise of salt water) but is also a factor in pressures (emissions of pesticides in wetlands). In the other sub-sites, Greenbelt gardening helps to cut urbanization (including MPM), the objective is to maintain the agricultural use of settlement areas (DTA), but these are being reduced because of effect of pressure on the land.
Ports	Marine pollution from port origin for the entire coastline of the study site. Apart from the specific case of GPMM, municipalities are faced with the case of marinas. The "clean port" operation carried by the regions is a source of information.
Storm rains	General to all Mediterranean cities, the problem is acute in Marseille. According to the SDAGEs, the bay contract and PRGM, the problem starts earlier in the water basin, and it would require a wide management of a watershed to help this problem. This diagnosis is also very general.
Coastal water masses	The coastal water bodies (one mile) and the masses of territorial waters (12 miles) are respectively subject to the WFD and MSFD whose objectives are ambitious in terms of good and chemical quality, as announced in the SDAGEs and PAMM, there are new and important requirements of environmental monitoring networks.
Data needs	They concern two main areas: a) data on the marine environment, essential to the evaluation of condition b) attendance data, including protected as PN Calanques (see project Fhuvel) sites.

2.1.3. The point of view of the territorial agents met

The agents involved in the coastal zone management are numerous and various. Ten coastal zone management and/or coastal environment protection agencies (box n°1) were met during the months of January, February and April 2012.

Box n°1: List of semi-directive interviews

Direction Inter-Régionale de la Mer Méditerranée : 23/01/2012
Marseille Provence Métropole : 24/01/2012
Parc Marin de la Côte Bleue : 25/01/2012
Conseil régional de Provence-Alpes-Côte d'Azur : 25/01/2012
Grand Port Maritime de Marseille : 25/01/2012
Conseil Général des Bouches-du-Rhône : 26/01/2012
GIP Calanques : 26/01/12
Ville de Marseille : 02/02/2012
Parc Naturel Régional de Camargue : 03/04/2012
Mairie de Martigues : 04/04/2012
Préfecture Maritime : 04/04/2012

Profile of the territorial agents met (table n°1)

All the persons met belong to public organisms whose missions differ significantly from one another.

Territorial authorities have very diversified capacities (urbanism, social action, transports, etc.); however, their capacities in terms of environmental issues are reduced to the management of waters, discharges and natural spaces in the land zone. The environmental problems in the marine environment are managed by state services (especially DIRM). These regional services are "file assistants" whose role is to establish a management project according to the specification from the State.

Public institutions such as mixed unions and marine parks have skills focused on the management of the environment and the preservation of heritage, and are in tune with users throughout the territory. GIP Calanques, which could be classified in this category, has a role of

keeping the technical records and negotiation with users. Other public institutions aim for economic development, but at different levels of intervention: the PACA Regional Council, the Urban Community of Marseille and the port of Marseille.
The areas of expertise of these organizations also differ in the scale of intervention (the geographical influence, the importance of reporting to the local economy sectors) and means.

Table n°1: profile of the different territorial agents met.

Organism name	Status	Main action(s)
Direction Inter-Régionale de la Mer Méditerranée	State service	Lead the State policies for sustainable maritime development, marine resource management and maritime activity regulation.
Conseil Régional PACA	Service « Sea and coast » (SML)	Within the Sustainable Development and Territorial Strategies pole in the Territory Development Department, SML carries out actions for the protection and enhancement of the coastline. The major issues of this policy revolve around the development of maritime activities and jobs, enhancement of cultural heritage, the anticipation of natural hazards (including coastal erosion), cooperation between regions bordering the Mediterranean and the management, conservation and management of coastal and marine areas. The Region supports the program "Clean Ports in Provence-Alpes-Côte d'Azur." Moreover, in the framework of the Regional Geographic Information Center Provence-Alpes-Côte d'Azur (PACA CRIGE) whose goal is to share geographic information and make it available to all, the region runs the business line sea and coastline.
Conseil Général des Bouches-du-Rhône	Territorial authority (department)	Social action, transports, education, economy, environment, roads, culture, etc. The only obligation of the CG 13 for the environment is managing the “sensitive” areas.
Marseille Provence Métropole	Territorial authority (urban community)	Economic development; community space development (road, traffic...); collective interest service management (water, marina, discharges...); protection and development of the environment and lifestyle; social habitat balance of the community land; city policy in the community.
Ville de Marseille	Territorial authority (commune)	Urbanism, social action, education, cultural field, sports and leisure, civil registrar, electoral function, maintenance of local roads, protection of the public local order.

Martigues	Territorial authority (commune)	Urbanism, social action, education, cultural field, sports and leisure, civil registrar, electoral function, maintenance of local roads, protection of the public local order.
Grand Port Maritime de Marseille	Public organization (Grand Port Maritime)	Economic development (with an approach in terms of planning at the scale of the GPMM area where the conservation is taken into account).
Parc Marin de la Côte Bleue	Public organization (mixed association)	Management, protection and revaluation of the coastal and marine natural areas; contribution to the economic and social development of activities linked to the sea, especially professional and artisanal fishing; reception, information and public education; achievement of experimental actions in precise fields below and contribution to scientific research programs.
Parc Naturel Régional de Camargue	Public organization (mixed association)	Manage the delta complex by inserting the predictable impacts of climate change; adjust the activity evolution for an extraordinary biodiversity; reinforce the land solidarity; social cohesion and improve the lifestyle; share the knowledge and open the delta to Mediterranean cooperation.
GIP Calanques (Parc national des	Public organization (public interest grouping)	Lead and coordinate the actions of protection and management in order to preserve the extraordinary nature of the classified area of the Calanques; prepare the creation of a National Park
Préfecture Maritime	Pôle « Protection et aménagement durable de l'espace marin »	The maritime prefect is the prime minister in the territorial waters regulatory authority. It takes prefectural orders to organize activities at sea, limiting the speed setting of navigation channels, prohibiting navigation in hazardous areas etc. . In association with the mayors, who work in the coastal strip of 300 meters police swimming and beach activities, maritime prefect organizes security seaside activities through planned markup. The main areas of intervention are: safety of life at sea - maritime safety, maritime traffic, immigration, vigipirate plane at sea and in port - the fight against marine pollution (MARPOL coordination) . Under the pressure of increasing importance of human activities on coastal marine band, the maritime prefect received a responsibility to regulate these practices so that they are compatible with maintaining the quality of marine fishing, discharge of cuttings dredging of ports, extraction of sand and gravel sailors, installation of wind turbines at sea, etc.

The institutional deadlock points

The interviews have highlighted different difficulties concerning the achievement of their missions. We classified them according to the number of interlocutors that mentioned each difficulty.

- The most frequently cited (three interlocutors) is the difficulty to make management issues coincide because there are often contradictions in terms of objectives between different projects.
- A. Among the difficulties mentioned in terms of coordinated management, the most important is information circulation i.e. a natural reluctance to share it, regardless of the agent types (a difficulty mentioned by two interlocutors).
  B. Two agents also complained about the multiplicity of strategic aspects and regulation pressures. For elected representatives, environmental regulations are, for example, mainly seen as a pressure (water law of 1992, Coastal Act (coastal law) etc.).
  C. Two of our interlocutors highlighted the risk that the economic crisis (and the simultaneous budget reduction) has an impact on the policies put into effect for environmental management, especially for proactive policies.
- A. The new reorganization of the State departments is a source of difficulties in terms of implementation of some actions and "forced" partnership between State and Local authorities (difficult partnership: local authority as project initiator/ State as legal competence to act: maritime aspects of the SCoT for example) (Difficulty mentioned by one interlocutor).
  B. Finally, the problem of the lack of correspondence between administrative limits and environmental problems considered is highlighted by only one agent.

2.2. Impacts on the environment: the perspective of organizations met

In the department of Bouches -du- Rhône, the pressures on the coastal environment mentioned during interviews differ in nature and intensity depending on the surveyed actors and the uses that their management objectives tend to favor.

Table 2 below selects the files mentioned most frequently. This is the case of terrestrial contamination of marine waters, tourism and yachting frequency, and professional and recreational fishing. NB : the national and local governments may have treated some of these issues, but not necessarily the environmental pressures. The files are determined on legal texts rather than pressure or uses. On matters relating to SDAGEs, the Water Agency is most often solicited.

Among the risks of environmental pressure raised: the forthcoming opening of Calanques National Park could result in a significant increase in attendance at the shore. Questions must address the conditions and distribution of frequentation on the coast (potential impact on the Blue Coast, for example). Another risk identified is the potential for oil pollution that could occur with offshore exploration permits held by Melrose Ltd. (around 30 km from Marseille).

Finally, it should be stressed that the tighter controls of bathing water quality in the future will certainly be translated by many days of closed beaches in the coming years. The appreciation of the bathing water quality, currently defined by the transposition in the public health legislation related to bathing and swimming pool of the European directive 76/160/CEE of 1975, has recently evolved because of a new European directive 2006/7/CE that provides an implementation of new classification standards in 2013.

Table n°2: Issues mentioned by the different territorial agents met

Issues / Structure	Manmade coastal spaces, spaces reclaimed from the sea	Erosion, marine submersion risks	Land transport of hazardous products	Harbour dredging	"Land" contamination of marine waters (a)	"Maritime" contamination of marine waters (b)	Soil contamination (chemical substances)
Direction Inter-Régionale de la Mer Méditerranée	–	–	–	–	–	–	–
Conseil Général des Bouches-du-Rhône	–	X	–	X (Marinas)	X	–	–
Martigues	–	–	X	–	X	–	–
Marseille Provence Métropole	–	–	X	–	X	–	–
Ville de Marseille	X (landscape)	–	–	–	X	–	–
Grand Port Maritime de Marseille	–	–	–	–	–	–	–
Parc Marin de la Côte Bleue	–	–	–	X	X	X	–
Parc Naturel Régional de Camargue	–	X	–	–	X (pesticides and fertilisers)	–	–
GIP Calanques (Parc national des Calanques)	–	–	–	–	X (red mud)	X	X

Issues / Structure	Coastal traffic		Coastal sea traffic	Marine debris	Fishery resource exploitation	Use conflicts (coastal zone)	Wind power (project)
Direction Inter-Régionale de la Mer Méditerranée	–		–	–	–	–	–
Conseil Général des Bouches-du-Rhône	X (free access)	X (PN Calanques)	–	–	–	–	–
Martigues	–		–	–	–	X	–
Marseille Provence Métropole	–		X (Marinas?)	–	–	–	–
Ville de Marseille	–		–	–	X (Fishing, aquaculture)	X	–
Grand Port Maritime de Marseille	X (free access)		–	–	–	–	–
Parc Marin de la Côte Bleue	–		X (marina, diving)	–	X (trawling)	–	X
Parc Naturel Régional de Camargue	X (free access)		–	–	X (illegal fishing)	X	–
GIP Calanques (Parc national des Calanques)	X	X (PN Calanques)	X (Marina)	X	X (professional and no-professional fishing)	–	–

Remarks: (a) Pathogenic micro-organisms, chemical substances, atmospheric fallouts; (b) accidental pollution, operating spills.

Key: Major issues in orange, issues whose importance is not determined yet or minor issues in pale yellow, threats in green

3. Synthesis of the main environmental issues in the coastal zone

The content analysis of the interviews and the current planning document study allowed us to identify some issues in the coastal zone of department of Bouches-du-Rhône. The issue, which is the most regularly cited, and the most transversal, is the problem of land contamination of marine waters. However, this is not the only important problem, as manmade coastal spaces, coastal and maritime traffic, marine debris, fishery resource exploitation and use conflicts were also regularly cited in the discussions with the territorial agents and are mentioned in most of the studied planning documents.

We made an inventory of data that exist on the identified issues to determine the technical feasibility of the socio-economic, morphological and ecological assessment of deteriorations and associated effects in the coastal zone (annex 1).
It appears during the last inventory that it is hard to use geographic and historic data for each identified issue. The most difficult issues to characterize in terms of quantity, space and time are the coastal and maritime traffic, conflicts of use, fishery resource exploitation (socio-economic dimension) and marine debris. In this context, it should be questioned if scenarios could feasibly be developed with the limited data availability. Lastly, only the problem of land contamination of marine waters seems possible to evaluate in regards to the contamination sources, environmental deteriorations and associated impacts for coastal populations.

Bibliography

Agence de l'eau Rhône-Méditerranée et Corse (oct. 2009). *Rapport d'évaluation environnementale du SDAGE Rhône-Méditerranée 2010-2015. Bassin Rhône-Méditerranée*. Lyon : AERMC, 93 p.

Agence de l'eau Rhône-Méditerranée et Corse, DREAL Rhône-Alpes, Office national de l'eau et des milieux aquatiques (nov. 2009). *Schéma directeur d'aménagement et de gestion des eaux 2010-2015. Bassin Rhône-Méditerranée. Vers le bon état des milieux aquatiques*. Lyon : Comité de bassin Rhône-Méditerranée, 315 p.

Besancenot F. (2008), « Réalisation d'un diagnostic territorial de développement durable. Expérimentation dans le Bassin potassique alsacien », *Développement durable et territoires* [En ligne], consulté le 14 mars 2012. URL: http://developpementdurable.revues.org/6083.

Bureau de recherches géologiques et minières (mars 2009). *Aigrette, phase 4. Investigations et résultats relatifs à la qualité des eaux sur le territoire du SAN Ouest-Provence. Rapport final*. BRGM/RP-57278-FR. Marseille, Paris : BRGM, 205 p.

Groupement d'intérêt public des Calanques (avril 2012). *Charte du parc national des Calanques. Volumes 1 et 2*. Marseille : GIP des Calanques, 152 p., 33 p.

INEA (mars 2009). *SCOT Ouest-Etang de Berre. Etat initial de l'environnement.* Sommières, France : INEA, 177 p.

Le Gentil E., Mongruel R., Raux P., Jacob C., Kalaydjian R. and Cadiou J. F., (2011). "A Socio-economic Approach for Coastal Zone Assessment" *in* Özhan E. (2011), *Proceeding of The Tenth International Conference on the Mediterranean Coastal Environment*, MEDCOAST 11, 25-29 October 2011, Rhodes, Greece, Vol. 1: 157-168.

MEDDE, préfecture maritime de la Méditerranée, préfecture de la région PACA (2012a). *Evaluation initiale des eaux marines. Sous-région marine Méditerranée occidentale. Résumé à l'attention du public.* Paris : MEDDE, juillet.

MEDDE, préfecture maritime de la Méditerranée, préfecture de la région PACA (2012b). *Objectifs environnementaux et indicateurs associés. Sous-région marine Méditerranée occidentale. Résumé à l'attention du public.* Paris : MEDDE, juillet.

Marseille-Provence-Métropole (oct. 2011). *Schéma de cohérence territoriale de MPM. Synthèse*. Marseille : MPM, Conseil communautaire, 8 p.

Marseille-Provence-Métropole (nov. 2011). *Document d'orientations générales*. Marseille : MPM, Conseil communautaire, 15 p.

Marseille-Provence-Métropole (déc. 2011). *Projet d'aménagement et de développement durable*. Marseille : MPM, Conseil communautaire, 29 p.

Nations unies, PNUE, Plan d'action pour la Méditerranée (2008). *Protocole de la convention de Barcelone relatif à la gestion intégrée des zones côtières de Méditerranée*. Madrid : Nations unies.

UNEP/MAP/PAP (2008), "*Protocol on Integrated Coastal Zone Management in the Mediterranean*", Split, Priority Actions Programme, 124 p.

Parc naturel régional de Camargue (2010). *Charte du PNR de Camargue 2011-2022*. Rapport, volume 1. Arles: Syndicat mixte de gestion PNR de Camargue, 239 p.

Parc naturel régional de Camargue (2012). *Contrat de delta. Dossier définitif 2012-2017*. Arles: Syndicat mixte de gestion PNR de Camargue, 62 p.

Préfecture de la région PACA, préfecture maritime de la Méditerranée (déc. 2012). *Plan d'action pour le milieu marin. Evaluation initiale des eaux marines*. Marseille, Toulon : Préfecture de région, Préfecture maritime, 784 p.

Préfecture de la région PACA, préfecture maritime de la Méditerranée (juillet 2012). *Plan d'action pour le milieu marin « Méditerranée occidentale ». Définition des objectifs environnementaux*. Marseille, Toulon : Préfecture de région, Préfecture maritime, 19 p.

Préfecture des Bouches-du-Rhône (2007). *Directive territoriale d'aménagement des Bouches-du-Rhône. Approuvée par décret 2007-779 du 10 mai 2007*. JO, 11 mai 2007, 133 p.

Rouxel F., Rist D., (2000). "*Le développement durable: approche méthodologique dans les diagnostics territoriaux"*, Lyon, CERTU, 147 pages.

Syndicat mixte du PMCB, BCEOM (2006). *Plan de gestion du parc marin de la Côte Bleue. Phases 1 et 2. Etat des lieux et diagnostic*. Carry-le-Rouet : SM-PMCB, 222 p.

Syndicat mixte du parc marin de la Côte Bleue (2011). *Rapport d'activité 2010.* Carry-le-Rouet : SM-PMCB, 16 p.

TNBE (déc. 2008). *Schéma de cohérence territoriale Ouest-Etang de Berre. Diagnostic*. Istres : Comité syndical du SCOT Ouest-Etang de Berre, 107 p.

TNBE, Eureca (oct. 2010). *SCOT OEB. Projet d'aménagement et de développement durable*. Istres : CS du SCOT OEB, 58 p.

Ville de Marseille, BCEOM (2007). *Plan de gestion de la rade de Marseille. Diagnostic*. Doc. ENS 70300Y. Marseille : Ville de Marseille, 126 p.

Ville de Marseille, Egis Eau, BCEOM (mai 2009). *Plan de gestion de la rade de Marseille. Objectifs stratégiques et plan d'actions*. Document V19. Marseille : Ville de Marseille, 88 p.

Ville de Marseille, communauté urbaine de Marseille-Provence-Métropole, Agence d'urbanisme de l'agglomération de Marseille (2012). *Contrat de baie de la métropole marseillaise. Dossier sommaire de candidature*. Marseille : Ville de Marseille, MPM, AGAM, 82 p.

UNEP/MAP/PAP (2008), "*Protocol on Integrated Coastal Zone Management in the Mediterranean*", Split, Priority Actions Programme, 124 p.

7. North Adriatic (Italy)

The North Adriatic CASE is one of the 10 study cases of the PEGASO project. As the other CASEs around the Mediterranean and Black sea, is aimed at developing ICZM experiences at different scales regarding different issues, applying in an integrated way tools provided both by the project partners and others developed by the CASE itself.

Figure 8: The North Adriatic CASE area. This CASE is one of the 10 PEGASO CASES around the Mediterranean and Black Sea

The North Adriatic CASE is situated in the upper basin of the Adriatic Sea, a subregional system of the Mediterranean sea, linked with it through the Strait of Otranto. The Northern Adriatic is bordered by the coast of Italy, Slovenia and Croatia and it is southwards limit is represented by the fictitious line linking the Italian city of Ancona and the Croatian city of Zadar.

As in the rest of the Adriatic, there is a clear difference between the geomorphology of its western part, characterized by sandy, flat and uniform coasts interrupted by lagoons, and the eastern part, with rocky steep coasts, channels, numerous small islands, promontories and bays.

The Northern Adriatic is a relatively shallow ecosystem with a depth not exceeding 100 m. This small volume of waters receives about 77% of its freshwater input through rivers, 46% of which comes from the Po (Marson, 1996). Although the Adriatic is considered a oligotrophic sea, its northern part is one of the most productive parts of Mediterranean (Notarbartolo et al., 2008; Pérès and Gamulin-Brida, 1973)

Accordingly, rivers discharges are responsible both for the high biodiversity and of the pollution and eutrophication of the North Adriatic waters. In spite of the impacts due to human pressures, the Northern Adriatic hosts a very valuable marine biodiversity and ecosystems relevant for their ecological, economic, aesthetic and cultural values. The North Adriatic represents one of the highest fish-producing areas in the entire Mediterranean (Vidas, 2009) The North Adriatic basin represents a particular case with several direct sea uses, such as marine transport, offshore platforms, submarine cables, hydrocarbon survey, fishing, aquaculture, scientific research and tourism, and indirect uses often conflicting among them (Soriani, 2003). Therefore, due to pollution and overexploitation of its natural resources, this basin can be considered as one of the most threatened ecosystems in the world (Camuffo et al., 2011).

Figure 9. Left: Marine Protected areas in the North Adriatic sea (Author: Francois Morisseau). Right above: River Plume (Archivio Magistrato alle Acque di Venezia – Consorzio Venezia Nuova). Right below: Venice flooded (Consorzio Venezia Nuova)

Despite to such a sensitive environment and threatened species, the three countries bordering the North Adriatic, namely Italy, Slovenia and Croatia, provide a protection for marine and coastal waters that is less than the 0,5% of the Northern Adriatic sea

The Italian Northern Adriatic Sea coast, comprises a very precarious coastal environment subject to continuous morphological changes, appreciable even over short geological time scales (Gambolati and Teatini, 2002). Moreover, erosion is a further threat active in many areas both on the coastal sea floor and on the beach since the beginning of the 20th century and especially since the second half of the last century (Bondesan et al.,1995). Subsidence, both natural and induced is also affecting many areas of the Italian North Adriatic coasts, particularly those located below the mean sea level like around the Po River Delta (Pirazzoli, 2005). Therefore, climate change and sea level rise are other relevant issues for the case study area considering both the vulnerability of fragile ecosystems such as coastal lagoons, as well as the concentration of cultural and socio-economic values.

Climate change, water quality, marine protected areas and the management policies regarding coastal zone are therefore all relevant issues for this basin. This CASE is indeed characterized by 4 sub CASE each one dealing with one these different coastal issues, ranging from local to transboundary scale as shown in Figure 3 and summarised in Table 1. The four subcases are more specifically the following:

A) The development of a Decision Support System for climate change risk assessment for the coastal area.
B) The development of a forecasting model for the coastal water quality.
C) The analysis of the link between Marine Protected Areas and ICZM.
D) The analysis of ICZM implementation at the Italian subnational level in the North Adriatic.

In the next section of the report each subCASE will be described according to the link between the coastal issue and the ICZM principles, the process, the stakeholders involved in the process; finally for each SubCASE the main results and lesson learnt will be outlined.

Figure 10. The area within the square represents the area considered for the subCASE of mpas. The Italian side of the area in the square represent the regions involved in the analysis of ICZM policies. The dotted line represents the area involved in the subCASE of the Climate change impacts and finally the circle regards the study case area regarding the issue of water quality.

	SubCASE	Coastal issues	Scale	Tools
A)	The development of a Decision Support System for climate change risk assessment for the coastal area.	Climate change impact risk assessment	Subnational	Indicators Participation Decision support system
B)	The development of a forecasting model for the coastal water quality.	Bathing water quality	local	Water quality model Participation
C)	The analysis of the link between Marine Protected Areas and ICZM.	The implementation of ICZM principles in MPAs management	transnational	Participation
D)	The analysis of ICZM implementation at the Italian subnational level in the North Adriatic	The assessment of the adoption of ICZM policies	subnational	Indicator Participation

Table 8: Summary table of the 4 SubCASEs

A) The development of a Decision Support System for climate change risk assessment for the coastal area

Section 1 Coastal issues

1.1 The main coastal issues considered

Climate change impact risk assessments

Within the North Adriatic case the main issue addressed by the PEGASO project is represented by climate change with a particular focus on the potential consequences on sea water quality; moreover, some analysis were performed in order to evaluate the anthropic pressure in coastal zones. In order to address these issues, several tools were identified and applied within the project:

indicators;
participatory methods;
Regional Risk Assessment (RRA)
and
Decision Support Systems (DSS).

Sections 2, 3 and 4 will describe the relation of the selected coastal issues with Integrated Coastal Zone Management (ICZM) Protocol and Principles, highlighting the possible contribution of the proposed tools in the definition of a national ICZM strategy. Section 5 resumes the process of stakeholders' involvement applied in the North Adriatic region; and finally, Section 6 and 7 provide a description of the selected tools and of the results obtained through their application in the case study area.

1.2 Why did you select the identified coastal issues?

Italian coasts are characterised by a high biodiversity and are highly vulnerable and exposed to climate change and to a growing anthropic pressures, including an increasing percentage of built-up areas. The North Adriatic coast, in particular, comprises a very fragile coastal environment subject to continuous morphological changes that can be appreciable even over short geological time (Bondesan et al., 1995; Gambolati and Teatini, 2002). Many areas, particularly the Lagoon of Venice and around the Po River Delta, are located below the mean sea level and affected by natural or man-induced subsidence (Pirazzoli, 2005). Furthermore, the municipality of Venice has been experiencing an increase of high tide events with consequent flooding of the city. Moreover, the historical observations and future projections of isostatic and tectonic movements show that the North Adriatic coast (particularly Venice, Grado and Marano lagoons) is particularly vulnerable to future sea-level rise (Bondesan et al., 1995; Gonella et al., 1998; Gambolati and Teatini, 2002; Lionello, 2008). Therefore, climate change and the related consequences on sea-level rise, storminess, coastal erosion

and changes in water quality are a prominent issue for the case study area both considering the vulnerability of fragile ecosystems such as coastal lagoons, cultural and socio-economic values. Moreover, urban centres, harbours, tourism activities and industrial zones close to the coastline represent the main source of additional anthropic pressures in coastal zones, whose negative effects are exacerbated by climate changes.

Particularly, marine ecosystems are very important in the regulation of the climate, and are very sensitive to climate change (Hoegh-Guldberg and Bruno, 2010). In recent years, climate changes are affecting marine ecosystems generating impacts such a loss of habitat forming species (e.g coral reefs, seagrasses) (Short and Neckles; 1999; Hoegh-Guldberg et al., 2007), decline in the productivity of the oceans (Behrenfeld et al., 2006; Polovina et al., 2008), changes in the geographic distribution of marine organisms (Perry et al. 2005; Last et al. 2011). The main drivers of these impacts are mainly generated by the increase of sea surface temperature, by the ice melting in the arctic regions (Wang and Overland, 2009) and by changes in the marine currents, which causes changes in other water biogeochemical and physical parameters (e.g. primary production, pH, salinity) that may exceed the thresholds of ecosystem tolerance, and thus lead to marine ecosystems degradation (Hoegh-Guldberg and Bruno 2010, Xia J. et al., 2010).

The coastal issues identified in the North Adriatic case (i.e. water quality variations due to climate change and indicators of anthropic pressures) are also tackled by several European legislations and policies. In fact, the European Commission undertook several actions related to the protection of coastal and marine environments, such as the Integrated Maritime Policy (IMP; COM (2007) 574), the Marine Strategy Framework Directive (MSFD; 2008/56/EC), the Water Framework Directive (WFD; 2000/60/EC), the Flood Directive (FD; 2007/60/EC), the Reform of the Common Fisheries Policy (CFP; 1983) and the Recommendation for Integrated Coastal Zone Management (ICZM; 2002/413/EC). Among these, the WFD and the MSFD represent the umbrella used to address the ecological quality of coastal/marine water systems in Europe, in strict connection with the ICZM. The process of setting achievable environmental targets must also account for highly uncertain changes of the physical and biological environment driven by climate (Roth and O'Higgins, 2010). This aspect has been considered also by the European Commission who published the White Paper on adaptation to climate change (EC, 2009). The main aim of the White Paper is to provide an overall framework to stimulate and guide national, regional and local adaptation measures and policies, including sector specific dimensions, in order to increase resilience to the impacts of climate change (EC 2009). Emphasis is placed on the need for an integrated approach to increase resilience in coastal and marine environments and interrelated human activities, as well as the need to integrate adaptation into sectorial policies (EC, 2009a).

1.3 What is the social, political and economical relevance of the identified coastal issues?

The analysis of climate change impacts on marine ecosystems and the evaluation of the

anthropic pressure in the North Adriatic coastal zone can have negative consequences on several social and economic sectors and activities.

Fisheries and aquaculture are an important sector in the economy of the coastal zones of the Veneto and Friuli Venezia Giulia Regions. In fact, despite a decreasing trend in the number of workers and in the numbers of ships, the North Adriatic sea is still characterised by a high productivity (Figure 11) and by a high number of companies operating in this sector (Figure 12) compared to the Medium-Low Adriatic sea. Variations in coastal waters quality can heavily impact these activities, thus it is important to estimate potential impacts of climate change in order to plan appropriate adaptation measures.

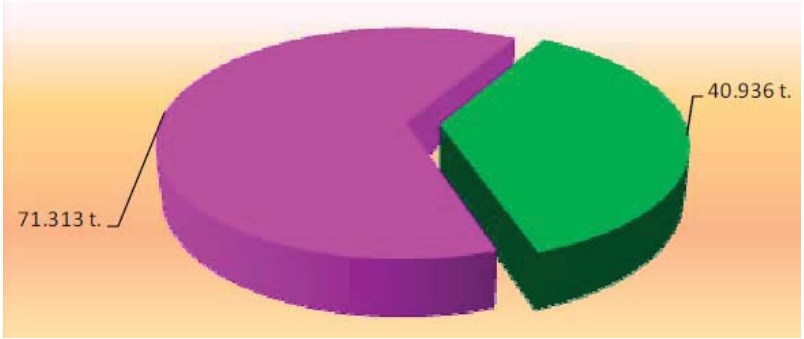


Figure 11.**Hyctic production in the Adriatic sea in 2011; green: North Adriatic – purple: Medium-Low Adriatic. Source: Veneto Agricoltura, 2013.**

Figure 12. **Number of companies related to hyctic primary production in the Adriatic sea in 2011; green: North Adriatic – purple: Medium-Low Adriatic. Source: Veneto Agricoltura, 2013.**

The economy of the North Adriatic Sea is also based on the tourism sector. In fact, the North Adriatic coastal areas are a favoured touristic destination for many tourists coming from Italy and foreign countries. One of the main reasons is the good quality of bathing waters, which is higher than the average of the Adriatic Sea (Figure 13). A decrease of the water bathing quality would negatively affect this sector, thus it is important to prevent its degradation also to avoid or at least reduce consequences on the tourism sector.

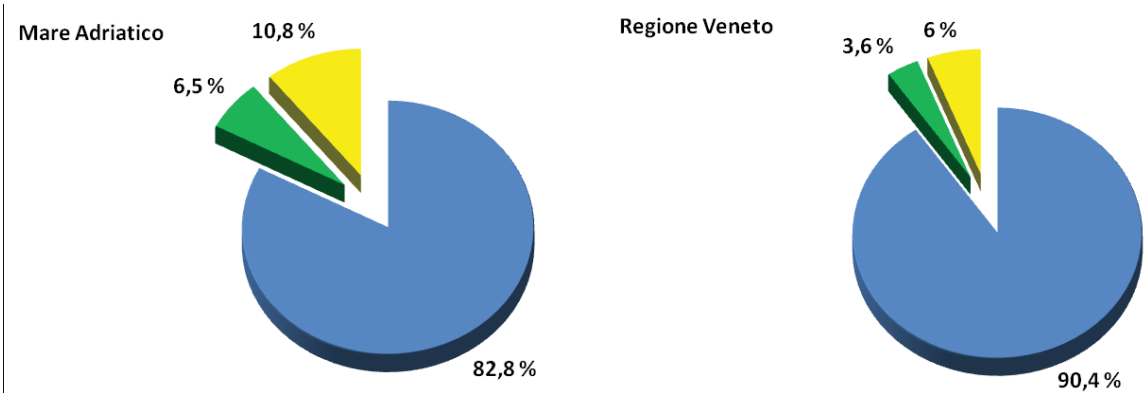


Figure 13. **Quality of bathing waters in 2013 in Italy (left) and in the Veneto Region (right); blue: % of sampling sites with excellent quality; green: % of sampling sites with good quality; yellow: % of sampling sites with sufficient quality; red: % of sampling sites with poor quality. Source: ARPAV, 2013.**

Finally, the North Adriatic coastal zone is characterized by a high rate of built up areas, and by a high density of population in coastal municipalities. The percentage of built up areas close to the coastline is 3 to 4 times higher than in the other parts of the Veneto and Friuli Venezia regions and population density is almost the double of the other municipalities. The information about anthropic pressures in the coastal zone can be very useful to evaluate built-up areas and population density trends. Moreover, it can support in the definition of urban plan for coastal zones aimed at reducing human impacts on these zones, taking into account ICZM principles.

Section 2 Relations between coastal issue and ICZM Protocol and principles

2.1 How do the selected coastal issues relate to the ICZM principles and protocol? When possible and appropriate, refer to the relevant Articles of the Protocol.

Climate change impacts assessment implies an interdisciplinary scientific research which aims to define appropriate indicators, to formulate ICZM strategies, to identify priorities and ecosystem management measures, involving all those stakeholders involved in the management and protection of coastal areas. Therefore identified coastal issues relate the following ICZM protocol articles: art. 22 (Natural hazards), art. 14 (Participation), art. 15 (Awareness-raising, training, education and research), art. 25 (Training and research).

Section 3. Policies issues and ICZM principles and approaches

3.1 So far, how have been the coastal issues addressed by the local/regional/national government?

Costal zones planning initiatives in Italy were usually sectorial (e.g. for tourism, industrial zones) and leaded by different institutions (e.g municipalities, provinces, regions) without a strong coordination. Several actions were carried on to protect coastal zones (e.g. many reforestation of coastal zones from the 60's or more recent interventions for the protection from coastal erosion), but despite these efforts there is still a lack of planned actions aimed

at the adaptation of coastal zones to climate changes and to the related risks. Only in recent years, planning of coastal zone is carried on through coordinated initiatives involving different institutions and actually there are several initiatives oriented towards ICZM:
The General Direction for the protection of the nature and of the sea of the MATTM (Italian ministry for the environmental protection) was reorganized defining a specific department with competences on ICZM;
Implementation of a database containing data related to the Italian, terrestrial and marine, coastal area (Si.Di.Mar, Sistema Difesa Mare). The database contains information related to the ecological conditions and to human activities. Available data can be visualized on a webGIS and downloaded (http://www.sidimar.tutelamare.it/).
Delivery of an updated report containing information about the knowledge of the Italian coastal system, in order to coordinate ongoing activities related to the sector.
Implementation of coastal protection projects, such as the "CAMP Italia" project, aimed at the definition of coastal zone management pilot projects along the Mediterranean Sea.

- Definition, update and integration of laws supporting the environmental protection and management of coastal zones.

Actually many Italian regions are defining tools for ICZM, while some are updating tools defined before 2006.
At the national level, MATTM is producing documents supporting the definition of a workplan for the definition of a national strategy for ICZM, in cooperation with regional and local administration.

3.2 At which spatial scale?
In Italy, ICZM initiatives are being addressed at different spatial scales. General guideline are being defined at the national scale by the MATTM, while the definition of Plans, Policies and Programs is demanded at a lower levels, mainly the regional one. Regarding more specifically the selected coastal issues it is worthy to note that they are addressed mainly at National Level by the transposition of European Directives and their implementation is usually carried out at regional level.

3.3 Can you assess the results of the implemented policies? Which are the main results achieved? Which are the main limits and remaining problems?
At regional levels, in Veneto and Friuli Venezia Giulia the coordination for the implementation of the ICZM protocol is substantially improved but not enough yet to develop a regional coastal management plan. Steps further have been done thanks to the organization of interdepartmental technical boards and to the involvement of the different General Directorate of the Administration in problems related to ICZM. However, the results of the implemented policies have not been assessed yet.
3.4. On the basis of the ICZM principles (as they are expressed by the Protocol), do you think that the coastal issues were addressed with an integrated approach (in terms of organization, politics, sectors/thematic, tools, etc)?

At the moment coastal issues are addressed without an integrated approach.

3.5 Is there an on-going National ICZM Strategy in your country?

An actual Italian ICZM National Strategy has not been defined yet but it is currently under development. However, despite the lack of "*ad hoc*" planning and programming tools, there are several initiatives addressing the considered coastal issues, especially at Regional level. Emilia Romagna region for instance in 2005 developed guidelines for the implementation of an ICZM regional strategy. For what concern those regions belonging to the area of the SubCASE -Veneto and Friuli Venezia Giulia- although they still have not elaborated a regional strategy for coastal zones they are carrying out some activities mainly related to fishery management.

Section 4. PEGASO in relation to ICZM processes & initiatives

4.1 Do you think your work is relevant for the ICZM process of your country? Why and how?

The results obtained through the application of the three selected tools (i.e. indicators, participatory methods, RRA and DSS) appear to be useful for the implementation ICZM at the national level. Particularly important in the whole process is the involvement of key stakeholders, because it facilitates the communication between scientists, experts, decisions makers and other actors involved in the ICZM implementation process.

Indicators appear to be a useful and effective tool as they can present results in different ways (e.g. maps, graphs, tables) according to stakeholders needs. Moreover, they can summarize and communicate in a simple and intuitive way many information. Finally they can allow the analysis of historical trends and the comparison of the same information between different regions.

The RRA methodology and the DSS can support the definition of Plans, Policies and Programs at different levels (i.e. from the national to the local ones) taking into account the potential impacts of climate change. Specifically they can support in the definition and prioritization of areas with higher risk requiring the definition of adaptation measures. Moreover they can support decision makers and stakeholder in the definition of measures aimed at reducing vulnerability and increasing the resilience. Finally, the implementation of participatory methods can improve the results of the RRA methodology application taking into account preferences of experts and stakeholders and can support in the improvement and extension of the DSS according to their requirements and suggestions.

4.2 On the basis of the work that you have done, which are in your opinion, the main constraints in implementing ICZM principles and tools? What is missing? Where are the main gaps? Where we should put more energy and resources in the future?

The main constraints for the implementation of ICZM principles and tools are related on one side to definition of the competences for the management of coastal zones, which are still too fragmented and split over many institutions at different levels (MATTM, regions, provinces, municipalities, State property office); on the other side are related to the lack of data that can support the use of effective tools. Data is usually available, but often is not

accessible and, thus, useless for the application of tool supporting the implementation of ICZM processes.

Section 5. Stakeholders' involvement

5.1 Stakeholder involvement - Have you involved the main stakeholders? Can you list them?
Stakeholders' involvement within the North Adriatic case was mainly related to the use and extension of the DEcision support SYstem for COastal climate change impact assessment (DESYCO): the software tool used for the application of the Regional Risk Assessment (RRA) methodology to the coastal areas of Veneto and Friuli Venezia Giulia Regions. The proposed methodology is aimed at the identification and prioritization of areas that can be affected by changes in water quality due to climate change and thus requiring the definition of adaptation measures compliant with the ICZM principles, in order to prevent potential risks.

Within the North Adriatic case, the main stakeholders involved in the coastal zone management process (e.g. national governments, regional and local authorities and other relevant stakeholders like NGOs and representatives of economic sectors) have been identified and involved in order to evaluate the proposed approach and take into account their suggestions. Stakeholders selections was done through a Stakeholder Analysis, whose results are summarized in Table 9. A stakeholder analysis is a technique of systematically gathering and analysing information to determine whose interests should be taken into account throughout the implementation of an activity (e.g. the application of the DSS DESYCO to the North Adricatic case). It identifies the interests, expectations, and influence of the stakeholders and relates them to the purpose of the CASE. It also helps identifying stakeholder relationships that can be leveraged to build coalitions and potential partnerships to enhance the chances of a successful completion of the work to be done. A stakeholder analysis is mainly composed by three steps.

Identification of all potential stakeholders and relevant information, such as their roles, departments, interests, knowledge levels, expectations, and influence levels.
Identification of the potential impact or support that each stakeholder could provide. In large stakeholder communities, it is important to prioritise the key stakeholders to ensure the efficient use of effort to communicate and manage their expectations.
Documentation of the results in a stakeholder 'register' that contains the information obtained.

The stakeholders' analysis for the North Adriatic case was performed by a group of expert of the University Ca' Foscari Venice who identified the main stakeholders to involve in the North Adriatic case and attributed them scores related to four parameters (i.e. importance, power, knowledge, attitude). Table 9 shows the results of the stakeholders' analysis for the North Adriatic case.

Stakeholder	Category	Importance [11]	Power [12]	Knowledge [13]	Attitude [14]
Ministry of Environment	Governmental authority	3	5	5	S
Regional Environment protection area	Regional governmental authority	5	5	5	S
Regional town and country protection area	Regional governmental authority	5	5	5	S
Provinces	Governmental authority	4	4	4	S
Municipalities	Governmental authority	3	3	4	S
Port Authorities	Public authority	2	2	4	S
Regional Environment Protection Agency	Environment public agency	1	1	5	S
River Basin Authorities	Public authority	1	1	5	S
Water Authorities	Public authority	4	4	4	S
Consorzio Venezia Nuova	Private company	2	3	4	N.A.
ISPRA	Environment public agency	1	1	5	S

Table 9. Results of the Stakeholders Analysis. N.A.: Not Applicable.

[11] Importance of stakeholders is defined here as their ability to affect the implementation of the policy, denotes how critical the stakeholder is to the success of the project and indicates the priority that should be given to satisfying stakeholders' needs and interests through the project. In evaluating importance we consider whose support or lack of it might significantly influence the success of the project. The importance values range between 1 (low) and 5 (high). Stakeholders of high importance are considered those whose active and effective involvement is by all means needed so that ICZM can be implemented. Of low importance are considered the stakeholders whose support or lack of it would not influence significantly the success of the project. Their participation however could enhance the process of ICZM.

[12] Power is the capacity or ability of the stakeholder to affect the implementation of the project's policy due to the strength or force he possesses. The main source of a stakeholder's power is the amount of its resources, which can be funds, law, property and expertise and the ability to mobilize them for or against an ICZM policy (Schmeer K. 1999). For filling the stakeholder table we considered a) the type of resources each stakeholder group possesses, b) the amount of these resources and c) the ability to use these resources. Each of these characteristics was assessed in a different column, and then a combined power index was assigned following a scale from 1 (few resources, hardly mobilized) to 5 (lot of resources, easily mobilized).

[13] Knowledge is the stakeholders' level of knowledge and / or degree of information related to coastal resources use and management issues. Again each stakeholder was assigned a value following the scale from 1 (low level of knowledge) to 5 (high level of knowledge).

[14] Attitude refers to the stakeholder's status as a supporter or opponent of the policy. Stakeholders who agree with the implementation of the policy are considered supporters (S); those who disagree with the policy are considered opponents (O); and those who do not have a clear opinion, or whose opinion could not be discerned, are considered neutral (N). Those who express some, but not total, agreement with the policy are classified as moderate supporters (MS). Finally those who express some, but not total, opposition to the policy should be classified as moderate opponents (MO).

Selected stakeholders are those institutions that have competencies on coastal zones defined by law or regulations approved at different level (e.g. national or regional) or other public and private organization who have been involved in activities related to coastal zones management. Scores for the stakeholders' analysis were defined for each criterion taking into account the competences of each stakeholder and the activities, which have been carried on, in recent years in relation to the management of coastal zones. By the results, it emerges that usually within the North Adriatic case the competences are well defined (i.e. mainly regional authorities); moreover, all considered stakeholders, even if have not a strong importance in the implementation of ICZM (e.g. ISPRA) have a good knowledge level.

5.2 How have you involved them (e.g. focus group, interviews, questionnaire)?

Based on the results of the stakeholders' analysis, 50 institutions were identified as potential stakeholders for the North Adriatic case. Moreover, for each institution relevant departments were selected and contact persons were identified (see Annex 1). The selected stakeholders were invited to participate to a workshop held at the University Ca' Foscari Venice the 29th of June 2012 (see Annex 2 for the list of participants and Annex 3 for the Agenda) and contributed to the RRA methodology and the DSS application and improvement answering to a questionnaire (see Annex 4 for the questionnaire and Annex 6 for the questionnaire's results). The questionnaire was aimed at understanding:
Uselfuness and effectiveness of the output of the RRA and the DSS;
Improvement to better address stakeholders' needs.

The questionnaire integrated and extends the results of a previous questionnaire aimed at evaluating the usefulness of a RRA approach and DSSs for coastal zone management (Santoro et al., 2013). The main aim of the stakeholders' involvement process can be summarized in the following questions.

Which are the main questions that decision makers and technicians address to the scientific community in relation to the possible contribution of decision support tools?
How decision makers and technicians can contribute to the development of the DSS DESYCO?
Which can be the contribution of DESYCO in the ICZM initiatives which require stakeholders involvement?
Is the output produced by DESYCO effective and useful for decision making processes (e.g. the maps have appropriate scale, effective legends and statistics)?
Can the outputs and the interfaces of DESYCO be improved? How?

More specifically, the workshop was aimed at presenting and discussing with the stakeholders the Regional Risk Assessment (RRA) methodology applied for the prioritization of areas and targets potentially at risk to climate change impacts and the Decision Support System DESYCO which implements the RRA methodology. The workshop represented an

important opportunity to be in contact with relevant stakeholders of the North Adriatic area in order to create a connection between scientists, providing new methodologies and tools supporting the ICZM implementation, and potential end-users, which can use these tools.

During the workshop all these objectives have been achieved. The participants have described their needs and evaluated the proposed tools suggesting improvements of the RRA and of the DSS DESYCO's interfaces and functionalities as described in more details within Sections 6.1 and 7.1.

5.3 Which kind of constraints have you faced?

The participatory process implemented in the framework of the PEGASO project allowed to improve DESYCO and its outputs and the workshop represented the opportunity to establish a positive relationship among researchers and stakeholders. The participants showed interest during the presentations, willingness to learn, and contributed with several opinions. However, the participation rate was quite low since only 8 institutions out of the 50 invited to the workshop attended at the event.

Section 6. Tools

Within the North Adriatic case three tools were selected and applied: i) indicators; ii) participatory methods; iii) Regional Risk Assessment (RRA) and Decision Support System (DSS). The first two tools are among the PEGASO tools developed within the WP4 of the PEGASO project, while RRA and the DSS are tools specifically applied for the North Adriatic case, improved and extended in the framework of the PEGASO project. The tools and methods applied in the case study are presented in the next paragraphs while the obtained results are shown and discussed in Section 7.

6.1 Tools applied

Indicators were used within the North Adriatic case in order to address one of the selected coastal issues: anthropic pressure on coastal zones. Specifically, two indicators were selected among the PEGASO indicators: Area of built-up space in the coastal zone and Size and density of the population living in the coastal zone. These indicators allow quantifying the how coastal areas are impacted by human presence and evaluate the trend over time.

The two considered indicators are mainly related to three of the policy objectives of ICZM protocol, article 6, which are related to different ICZM principles. Specifically:

Preserve the wealth of natural capital in coastal zone;

Formulate land-use strategies, plans, and programmes covering all coastal and marine uses;

Have a balanced use of coastal zone, and avoid urban sprawl (the trend of population living in a risk area should be identified).

Moreover, both the indicators are related to another policy objective of the Article 8 (Protection and sustainable use of the coastal zone) which is aimed at having a balanced use of coastal zone, and avoid urban sprawl. The final aim is to maintain the natural dynamics of

coastal areas and preserve coastal ecosystems and landscapes.

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

Area of built-up space in the coastal zone (see Annex 5.1 for the indicator factsheet; PEGASO Consortium, 2013a)

The increase in built-up areas has potential high impacts on the environment and on the natural resources due to soil-sealing, to disturbance resulting from transport, noise, resource use, waste dumping and pollution, and others. The intensity and patterns of urban sprawl and the built-up area are the result of three main factors - economic development, demand for housing, and extension of transport networks.

Although subsidiarity rules assign land and urban planning responsibilities to national and regional levels, several European policies have a direct or indirect effect on urban development. This indicator aims to monitor progress towards achieving the first goal for coastal sustainability set out in the EU Recommendation concerning the implementation of ICZM - to control further development of undeveloped coast as appropriate. The indicator has one measurement - the percentage of built-up space on land and at sea.

The indicator attempt to identify the extent to which the coastal zone has been built-up over the past several years because this will indicate the degree of pressure on the coast and the likelihood of further changes in the future. The final aim is also to know whether the development on the coast has been greater and more intense than in the wider region, and at which trend development in marine waters is taking place. It can also help to understand patterns of development and unravel cause-effect relationships.

Within the North Adriatic case the wider region, referred also as reference region, is represented by the whole Veneto and Friuli Venezia Giulia regions. Results of the indicator's calculation will be presented and discussed in Section 7.1.

Size and density of the population living in the coastal zone (see Annex 5.2 for the indicator factsheet; PEGASO Consortium, 2013b)

The aim of the indicator is to know the degree to which the population of a country or a wider reference region is concentrated in the coastal zone. Tracking changes in the distribution of the population of a coastal region over time will help us assess the amount of pressure being exerted on coastal resources by the demand for land, housing, employment, public services, transport and so on. We are especially interested in determining whether such pressure is general throughout the wider reference region or specific to the coast or specific coastal areas.

Also for this indicator the wider region, referred also as reference region, is represented by the whole Veneto and Friuli Venezia Giulia regions and results of the indicator's calculation will be presented and discussed in Section 7.1.

Participation

As already described in Section 5, participatory methods were used in order to involve main stakeholders related to the North in a Panel Expert. The Panel, already presented in Section 5, was attended by 21 people coming from 8 institutions (see Annex 2 for the detailed list):

FEEM (Fondazione ENI Enrico Mattei),
Veneto region,
Province of Venezia,
Po river basin authority
ISPRA,
Regional Agency for the Environmental Protection (ARPA) of Friuli venezia Giulia region,
Municipality of Cavallino Treporti,
Municipality of Venezia,

The workshop was divided into two main sessions (see Annex 3 for the detailed agenda), the morning session, introducing to the PEGASO project and to the role of decision support systems and participative processes in the analysis of climate change and coastal zones issues; the afternoon session more interactive and related to the specific application of the RRA methodology and DESYCO to the North Adriatic case:

ICZM, Climate Change and DSS
ICZM and the PEGASO project
Contribution of DSSs to the analysis and assessment of problems related to coastal zone management in relation with Climate Change
DESYCO: methodology, structure and examples from case studies
Participation and involvement of decision makers in the development of DESYCO
Experiences of coastal zone management in the North Adriatic: perspectives and criticalities.
Stakeholders involvement and contribution of decision makers in future developments of DESYCO in ICZM processes
Selection of impacts, indicators and receptors useful for the DSS application to coastal areas of Veneto and Friuli Venezia Giulia regions.
Customization of the results of the DSS DESYCO according the real needs of stakeholders from Veneto and Friuli Venezia Giulia
DESYCO and ICZM for the coastal zones of Veneto and Friuli Venezia Giulia.

The questionnaire (Annex 4) was presented and filled in by 11 stakeholders during and after the second part of the workshop. The main aims of the workshop and of the questionnaire were already presented in Section 5, while results will be presented and discussed in Section 7.1.

Others – Regional Risk Assessment and DESYCO

The Regional Risk Assessment (RRA) methodology proposed for the estimation of water quality variations under climate change scenarios is intended to be an aid for national and regional authorities in examining the possible consequences of climate change on seawater ecosystems and defining possible adaptation measures. Moreover, it can represent a valid support for the different stakeholders involved in the implementation of Integrated Coastal Zone Management (ICZM).

Traditionally, RRA aims at providing a quantitative and systematic way to estimate and compare the impacts of environmental problems that affect large geographic areas (Hunsaker et al., 1990). In more detail, the RRA is defined as a risk assessment procedure which considers the presence of multiple habitats, multiple sources releasing a multiplicity of stressors impacting multiple endpoints (Landis, 2005). The proposed RRA approach requires the use of Geographic Information Systems (GIS) tools and Multi Criteria Decision Analysis (MCDA) that enable simultaneous consideration of stakeholder interests and technical evaluations, utilizing rigorous scientific methods to process technical information (Giove et al., 2009). The final aim is to estimate the relative risks in the considered region, compare different impacts and stressors, rank targets and exposure units at risk, and select those risks that need to be investigated more thoroughly.

The main output of the RRA is the development of GIS-based maps. RRA maps include hazard maps representing the hazard against which a system operates (e.g., changes in physico-chemical and biological parameter of marine coastal waters), vulnerability maps representing the spatial distribution of environmental vulnerability factors and risk maps identifying and prioritizing areas and targets at risk. These maps allow the visualization and prioritization of impacted areas and vulnerable coastal receptors and the identification of more sensitive areas in the considered coastal region. Moreover, they allow an easy and flexible visualization of vulnerabilities and risks for stakeholders and decision makers, supporting the implementation of the ICZM. The RRA methodology proposed for the analysis of climate change impacts on coastal/marine water quality is based on four main steps, that will be described in the successive paragraphs: Hazard assessment, exposure assessment, biophysical and environmental vulnerability assessment and risk assessment.

Hazard assessment

The first step of the RRA is the **hazard assessment** that is aimed at defining hazard scenarios representing the physical phenomenon related to climate change (i.e. water quality variation) that has the potential to cause damages to the fish stock (e.g. loss of productivity), including fisheries and aquaculture. This step requires the identification of hazard metrics (i.e. water biogeochemical and physical parameters) coming from the aggregation of the output of a chain of climate, hydrodynamic and biogeochemical models (Figure 14 and Table 10) according to different future scenarios to be investigated in the analysis (i.e. 2070 and 2100).

The models chain applied for the North Adriatic case (Figure 14) is forced by the IPCC SRES A1B[15] scenario (Nakićenović et al., 2000) that provides the input for the Global Climate Models (GCMs) and the nested Regional Climate Models (RCMs) representing the main atmosphere and ocean dynamics and covering large spatial domains (i.e. from the global to the sub-continental scale). The output of the RCM are used directly to construct downscaled climate hazard scenarios for the case study area (i.e. scenarios of temperature, precipitation and wind variations) and then represent the input for the suite of models running at higher resolution (i.e. from the Adriatic to the North Adriatic scale), represented by hydrodynamic and wave models and by a biogeochemical model that are used to evaluate the water quality variation hazard.

The construction of a model chain is an effective way to supply relevant information about climate forcing and cascading processes ranging from the global/subcontinental scale to the regional/local scale. As shown in Figure 14 and Table 10, the information provided by high resolution impact models is used to investigate climate change hazards at a suitable spatial resolution for impact and risk assessment (i.e. from 5 km to 50 m) and for a future temporal scenarios (i.e. the years 2070 and 2100).

The model chain used for the definition of hazard scenarios related to the water quality variation impact include:

climate models (SXG, EBU-POM);
ocean and sea circulation models (SHYFEM, ROMS, CALYPSO);
a wave model (SWAN);
a biogeochemical model (ADRI2BC).

Detailed information about numerical models can be found in Table 10, that describes the domain where the model was applied, the spatial resolution, the investigated time scenario and the hazard metric that can be provided by each model. The output parameters that are used for the hazard assessment phase are the metrics highlighted in bold (i.e. sea temperature and salinity from the ROMS modes; primary production, dissolved inorganic nitrogen, reactive phosphorus, dissolved oxygen and pH from the ADRI2BC model).

[15] The A1B scenario belongs to the A1 storyline family, which describes a future world of very rapid economic growth. In this potential future, global population peaks mid-century and declines thereafter, and new and more efficient technologies are rapidly introduced. Moreover, the A1B scenario predicts carbon dioxide emissions increasing until around 2050 and then decreasing, and it assumes a balanced emphasis between fossil fuels and other energy sources.

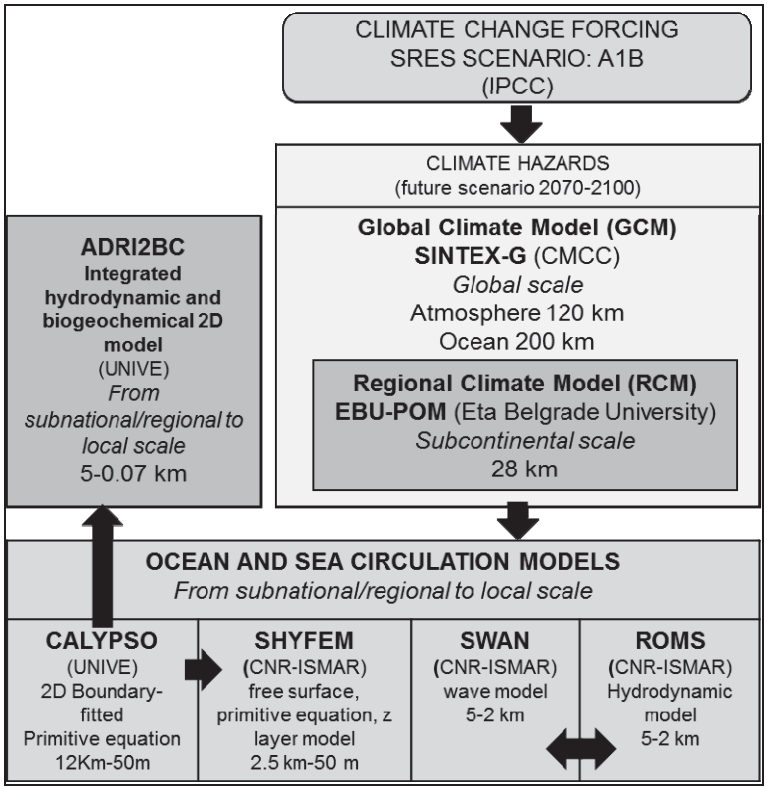


Figure 14. The model chain for the North Adriatic case.

Name	Category	Domain	Spatial resolution	Metrics	Time Scenario
SINTEX G	Climate Model	Global	Atmospheric resolution 120 km Oceanic resolution 200 km	Air/sea temperature	2070-2100
				Atmospheric pressure	
				Cloudiness	
				Rainfall	
				Relative humidity	
				Salinity	
				Winds	
EBU-POM	Climate Model	Mediterranean sea	28 km	Air/sea temperature	2070-2100
				Atmospheric pressure	
				Cloudiness	
				Rainfall	
				Relative humidity	
				Salinity	
				Winds	
SHYFEM	Ocean and sea Circulation model	North Adriatic sea	2.5 km-50 metres	Bottom stress	2070-2100
				Salinity	
				Sea temperature	
				Submerged areas	
				Current velocity	
				Water levels	
SWAN	Ocean and sea circulation model	North Adriatic sea	From 5 to 2 km	Wave energy	2070-2100
				Wave direction	
				Wave height	
				Wave period	
ROMS	Ocean and sea circulation model	Adriatic sea	From 5 to 2 km	Bottom stress	2070-2100
				Salinity	
				Sea temperature	
				Water velocity	
ADRI2-BC	Integrated hydrodynamic and	North Adriatic sea	From 5 to 0.7 km	**Primary production**	2070-2100
				Dissolved	

	biogeochemical 2D model			**inorganic nitrogen**	
				Reactive phosphorus	
				Dissolved oxygen	
				pH	
CALYPSO	Coastal and sea circulation model	Adriatic Sea and Lagoon of Venice	From 12 to 0.05 km	Bottom Stress	2070-2100
				Current velocity	
				Water levels	
				Submerged areas	

Table 10. Description of the models included in the model chain supporting the construction of hazard scenarios. Metrics in bold are the parameters used in the hazard assessment step. [Source: adapted from Torresan, 2012].

Table 11 shows the main stressors, which were selected for the water quality variation impact. For each stressor a hazard metric was defined based on the information provided by the chain of numerical models available for the case study area (Table 10).

Stressors	Primary production	Macronutrients	Dissolved oxygen	pH	Sea temperature	Salinity
Hazard metrics	Concentration of C or Clh-a (mg/L)	Concentration of N and P (mg/L)	Concentration (mg/L)	Mean pH	Mean T (°C)	Salinity (PSU)

Table 11. List of hazard stressors and related hazard metrics considered for the construction of climate change hazard scenarios applied to the North Adriatic coasts.

Selected hazard metrics were successively aggregated using Multi-Criteria Decision Analysis functions.

For each hazard metric, data were available on points distributed over irregular grids in the considered region (Table 10; Figure 15). For each point the value is represented by the average of the values of three months (January-March, April-June, July-September, October-December). Data available for the North Adriatic Sea did not included Venice and Grado and Marano Lagoons. Moreover, all data were provided as seasonal average for the simulations of future climate scenarios (i.e. 2070 and 2100) and for the reference scenario (i.e. the year 2005). The year 2005 was selected as reference scenario because data of the considered hazard metrics were available from monitoring campaigns and used as baseline for the implementation of the model chain.

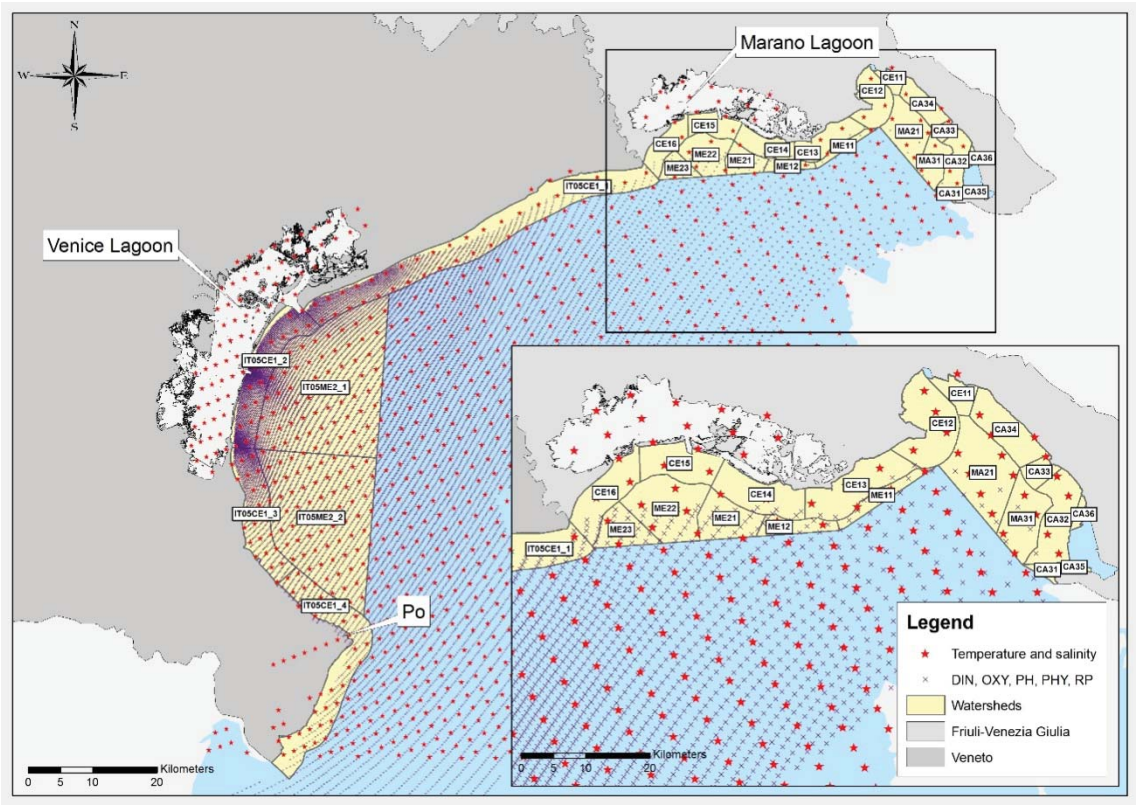


Figure 15**. Localization of points used by the different models providing hazard metrics. DIN: Dissolved Inorganic Nitrogen; OXY: Dissolved Oxygen; pH: pH; PHY: Phytoplankton; RP: Reactive Phosphorus.**

The hazard assessment is based on the comparison of future and reference tolerance ranges (i.e. chemical and/or physical thresholds that limit the existence, growth, abundance, or distribution of an organism) that were defined for each hazard metric. If the values of one or more parameters are out of these ranges, many impacts can appear in the ecosystem (e.g. time of reproduction and growth variations, changes in the distribution and abundance of the organisms). Within the North Adriatic case the hazard assessment was performed in homogeneous areas corresponding to the water bodies identified by the Veneto and Friuli Venezia Giulia regions (Figure 15) for the implementation of the Water Framework Directive (i.e. 6 water bodies for the Veneto region and 17 water bodies for the Friuli Venezia Giulia region). Tolerance ranges were identified for each hazard metric, for each period (i.e. each season) for all the considered water bodies using data of the reference year (i.e. 2005).

In order to obtain an overall hazard score for each water body, the characterisation of the variations of the biogeochemical and physical parameters from the reference to the future climate change scenarios was considered through the comparison of the range of each hazard metric in the future scenario with the reference range: the greater is the variation in the future, the higher could be the hazard. Values obtained for each metric are successively normalized and aggregated in order to obtain an overall hazard score ranging from 0 (no hazard) to 1 (maximum hazard within the considered region for all seasons and scenarios).

The final outputs of the hazard assessment are hazard maps showing water bodies' hazard score for each considered season and for each scenario. Maps are classified into 5 hazard

qualitative classes (i.e. Very low, Low, Medium, High, Very high) using the equal interval method. The produced maps will be presented and discussed in Section 7.1.

Exposure assessment

The second step is the exposure assessment aimed at identifying and selecting the receptors (i.e. elements at risk) that can be subject to potential losses due to changes in water quality. In fact, exposure represents the presence of people, livelihoods, environmental services and resources, infrastructure, or economic, social, or cultural assets in places that could be adversely affected (UNISDR, 2009; IPCC, 2012). For the considered impact, exposure includes coastal waters and the related environmental resources (e.g. fish stock, fisheries and aquaculture plant) that could be adversely affected by changes in water quality.

Specifically, the exposure for coastal waters is represented by the marine water bodies defined by the Veneto and Friuli-Venezia Giulia regions according to the Water Framework Directive (WFD, 2000/60/EC). Water bodies were identified based on the geomorphological and hydrodynamic natural characteristics, using three macrodescriptors: geographical localization, geomorphological descriptors and hydrological descriptors. The output of this step is represented by an exposure map where 0 indicate absence of exposure and 1 indicate exposure to the considered impact, that will be presented and discussed in Section 7.1.

Biophysical and Environmental Vulnerability assessment

Vulnerability represents the propensity or predisposition of a community, system, or asset to be adversely affected by a certain hazard (IPCC, 2012). Within the RRA methodology, the biophysical and environmental vulnerability assessment is aimed at evaluating the degree to which coastal waters could be affected by water quality variation impacts based on physical/environmental site-specific information (e.g. presence and extension of seagrasses, adapted Evenness index, aquaculture typology).

Specifically, vulnerability is calculated as a function of a set of vulnerability factors that are defined for coastal waters based on available site-specific territorial information. In order to obtain an overall vulnerability score, factors are aggregated using MCDA functions. This step requires the classification and normalization of each vulnerability factor. This activity was supported by a group of experts in environmental risk assessment who defined classes and scores for each vulnerability factor. Normalized factors' scores range from 0 to 1, according to the degree of vulnerability associated to each factors' class: 0 represents no vulnerability and 1 represents the higher vulnerability class for the considered factor. Vulnerability factors identified for the North Adriatic case and related scores are listed in Table 12.

Factor	Source	Legend	Score
Species diversity index for fish -Adapted Evenness index-	AdriBlu, 2006	0.56 - 0.70	0.6
		0.71 - 0.85	0.8
		0.86 - 1	1
Presence of seagrasses	Veneto region, 2009; Friuli venezia Giulia region, 2009	Absence	0.4
		Presence	1
Extension of seagrasses Km^2	Veneto region, 2009; Friuli venezia Giulia region, 2009	0 - 6.67	1
		6.68 - 13.34	0.75
		13.35 - 20.01	0.5
		20.02 - 26.68	0.25
Tegnùe	Veneto region, 2009; Friuli venezia Giulia region, 2009	Absence	0.4
		Presence	1
Aquaculture typology	Veneto region, 2008; Friuli venezia Giulia region,2008	Mussel culture	1
		Fish farms	0.6

Table 12. Vulnerability factors selected for the water quality variation impact applied to the North Adriatic coastal water bodies and related scores.

The **Adapted Evenness index** is a measure of biodiversity which quantifies how equal the community is numerically. This index is an adapted version of the Evenness index because available data included only species relevant for fisheries, and not all species living in the North Adriatic Sea. It is always represented by a number ranging from 0 (less variation in communities between the species) to 1 (high variation in communities between the species). Higher vulnerability scores were attributed to areas with a higher index value, as changes in water biogeochemical and physical parameters can easily modify the existing equilibrium in the abundance of the different species. **Seagrassess** are marine flowering plants which are particularly important in coastal zones as they provide several ecosystem goods and ecosystem services (e.g. fishing grounds, wave protection, oxygen production and protection against coastal erosion). The maximum vulnerability score (i.e. 1) was attributed where seagrasses are present. Moreover, segrassess with a greater extension are characterized by a lower susceptibility score as they are assumed to be less vulnerable to external perturbations (i.e. changes in water biogeochemical and physical parameters). **Tegnùe** are biogenic carbonate rocks built by marine organisms. They initially grow on existing hard bottoms formed by cemented sand. They have developed into natural reefs over the last 3-4.000 years. They differ from tropical coral reefs because here the main builder organisms are not corals but calcareous red algae, called "Corallines". Areas where Tegnùe are present are characterized by the highest vulnerability score (i.e. 1). Finally, **Aquaculture typology** indicates whether a plant is devoted to fisheries or mussels cultures; mussel cultures, that are more sensitive to changes in water biogeochemical and physical parameters, are characterized by a higher level of vulnerability than fish farms.

All vulnerability indicators are aggregated using a MCDA function in order to obtain the final biophysical and environmental vulnerability score.

The final vulnerability score can range from 0 (no vulnerability) to 1 (maximum vulnerability for the case study area). The output is a vulnerability map identifying and prioritizing areas more vulnerable to changes in water quality parameters based on 5 qualitative classes from Very low to Very High vulnerability (i.e. 0-0.25; 0.25-0.5; 0.5-0.75; 0.75-0.99; 0.99-1). The

vulnerability map can support decision makers in the definition of measures aimed at boosting the resilience of receptors in the considered region (e.g. regulating fisheries and other activities in coastal zones in order to preserve seagrasess).

Risk assessment

The following step was represented by the **risk assessment**, aimed at quantifying and classifying potential consequences of the considered hazard on the investigated areas and receptors (i.e. elements potentially at risk) combining hazard, exposure and vulnerability (Equation 1). It can be expressed in probabilistic or relative/semi-quantitative terms (IPCC, 2012). Accordingly, this phase combines the information about each hazard scenario with receptors' exposure and vulnerability assessment. Relative risk scores are values ranging between 0 (no risk) to 1 (higher relative risk).

$R_i = f(H_i; E_i; V_i)$ Equation 1

Where:

H_i = Hazard score for the impct i;

E_i = Exposure score for the impct i;

V_i = Biophysical and Environmental Vulnerability score for the impct i.

The output of this step is represented by relative risk maps aimed at identifying and prioritizing areas characterized by different levels of risk. A relative risk map will be produced for each season (i.e. January-March/April – June/July – September/October – December) of each considered scenario (i.e. 2070 and 2100). The produced risk maps classify the relative risk scores in five equal classes between 0 (no risk) and 1 (higher risk).

The proposed regional risk classifications do not attempt to provide absolute predictions about the impacts of climate change, but are relative indices which provide information about the areas/targets within a region likely to be affected more severely than others.

Statistics

Another important output of the RRA methodology is represented by statistics that can be calculated for the different produced outputs (i.e., hazard, vulnerability and risk). Statistics (e.g surface and percentage of surface on the different risk classes) provide stakeholders and decision makers with additional synthetic information that can support in the definition of Plan, Policies and Programs in adaptation to climate change.

The DSS DESYCO

DESYCO (DEcision support SYstem for COastal climate change impact assessment) is the computerized tool implementing the RRA approach previously described. It is a stand-alone software, aimed at supporting the application of the proposed methodology, by facilitating the procedures for integrating the outputs of external numerical models and geographical vulnerability indicators, by means of GIS functions and MCDA routines.

The structure of DESYCO is composed of 4 main components: a geodatabase for the storage of bio-physical and socio-economic data related to the study area; a multi-scale scenarios module to deal with data provided by numerical models simulations or time series analysis; a Relative Risk Model (RRM) that integrates Multi Criteria Decision Analysis (MCDA) techniques for the application of the RRA methodology; and finally Graphical User Interfaces (GUI) that facilitate the interaction of the final user with the system and simplify results analysis and understanding. The core of the system is the RRM that integrates climate change hazards analysis, based on the elaboration of output from climate, hydrodynamic, hydrological, hydrogeological and biogeochemical models, with exposure and vulnerability analysis of environmental and socio-economic features of the territory. In order to make the software easily extendable with a high level of flexibility and interoperability, DESYCO was implemented on a multi-tier architecture composed of three levels: Data tier, Logic tier and Presentation tier (Figure 8). The software was developed by making use of two open source libraries for the management of geographic data, i.e. GDAL and OGR, and programmed using the Phyton and C# languages. The GDAL and the OGR libraries were selected taking into account their wide applicability and stability; they represent the de facto standards for open source GIS-based applications. GDAL (http://www.gdal.org) is a translator library for the management of raster geospatial data formats, while OGR (http://www.gdal.org/ogr/), which is a subproject of GDAL, is a C++ library providing access to a variety of vector file formats. The choice of using open source libraries and applications, which adoption is continuously increasing over the last years, allows DESYCO to be independent from commercial, and often expensive, software. Moreover the number of people voluntarily supporting the development and maintenance of these libraries is rapidly growing following the general growth of open source software (von Krogh and Spaeth, 2007).

The first tier of the software architecture, the Data Tier, is represented by a geodatabase and by system folders containing input and output data elaborated by the software. Input data are represented by environmental and socio-economic data related to the area of concern and useful to represent pathway, attenuation, vulnerability, and value factors (e.g. coastal topography, geomorphology, presence and distribution of vegetation cover, location of artificial protection etc.). Moreover, input data include parameters provided by numerical models or time series analysis, representing hazard metrics in the RRA (e.g. temperature, precipitation, sea level rise projections etc.). For each case study area all input data must be homogenized before being loaded through the software's GUI in order to have the same reference system, geographical extension and pixel dimension.

Output data are represented by exposure, vulnerability and risk maps elaborated during the application of the RRA methodology, by statistics calculated at the end of the assessment and by a report showing the main results and all the configuration parameters.

The Logic Tier, corresponding to the second level of the architecture, is a library composed of basic and advanced functions implementing the RRA's equations. The basic functions represent building blocks allowing to perform simple, general, operations (i.e. weighted sum, probabilistic or, weighted average) required by the RRA model. Such functions are then integrated into advanced functions (e.g. the equations supporting the implemented Multi

Criteria Decision Analysis) allowing to perform all the more complex operations required by the RRA model (i.e. hazard, exposure, vulnerability and risk functions). Basic functions were programmed in Python, and make use of the open source libraries GDAL and OGR, while advanced functions were programmed in C#.

Finally, the third level, the Presentation Tier, is represented by the Graphical User Interfaces (GUI). This tier manages all the interactions between the system and the user and allow to deal with the different steps of the application. Due to the layered architecture of DESYCO, its GUI can be implemented both in desktop or web environments. More specifically the DSS can have desktop interfaces within stand alone applications (e.g. as a Java application executable in different operating systems) or it can be integrated as a plug-in within third parties' open source (e.g. QGIS) or commercial (e.g. ArcGIS) GIS software. The same also applies for web interfaces which can be stand-alone applications or integrations of new modules within existing web applications (e.g. p.mapper). The first version of DESYCO was implemented as a C# stand-alone application which can be launched directly as well as from the QGIS (Quantum GIS, http://www.qgis.org) open source software. Specific information about the interfaces of DESYCO and the typology of results that can be obtained from its application in coastal areas are reported in the following paragraph.

The DSS DESYCO has been used for the application of the RRA methodology to the North Adriatic case and results are presented and discussed in section 7.1. Moreover the tool was improved implementing new functionalities according to stakeholders' suggestions that emerged during the organised workshop and through the questionnaire (Paragraph 7.1).

6.2 Which have been the main constraints faced during the application of the tools?

Main constraints during the application of the indicators were represented by data gaps. The use of longer and more updated time series would allow performing a better analysis of the anthropic impacts through the two considered indicators. Specifically, for the indicator related to population, data of the population census of 2011 were not yet available, while for the indicator related to buildings, most updated information were the land use maps of the year 2006. Moreover, for land use maps data with higher level of detail (e.g. the fourth level of the Corine Land Cover legend) would be useful. More detailed data was required also for a more accurate calculation of the adapted Evenness index and the commercial value of production. Finally, a higher number of vulnerability indicators is recommended to better evaluate the vulnerability.

During the implementation of participative processes, the difficulties of involving stakeholders represented the main constraint. Despite the great effort made in order to have a response from several stakeholders and have a good participation to the organised workshop, only 8 institutions participated to the workshop.

Section 7. Main results of CASES

7.1 Achievements

Indicator***s***

Area of built-up space in the coastal zone

As described in Section 6.1, the main aim of the indicator “Area of built-up space in the coastal zone” is to analyse the extent to which the coastal zone has been built-up over the past several years in order to highlight the degree of pressure on the coast and the likelihood of further changes in the future. The indicator was calculated by applying the methodology described in the factsheet (Annex 5.1).

With this purpose, for the North Adriatic case, this indicator was calculated with reference to five geographical areas (Figure 16):

The reference area, represented by the whole Veneto and Friuli Venezia Giulia Regions (North Adriatic sea);

The coastal municipalities localised in the reference area;

The non-coastal municipalities in the reference area (aggregated for Provinces);

A buffer zone of 1 km of distance from the coastline;

A buffer zone of 10 km of distance from the coastline.

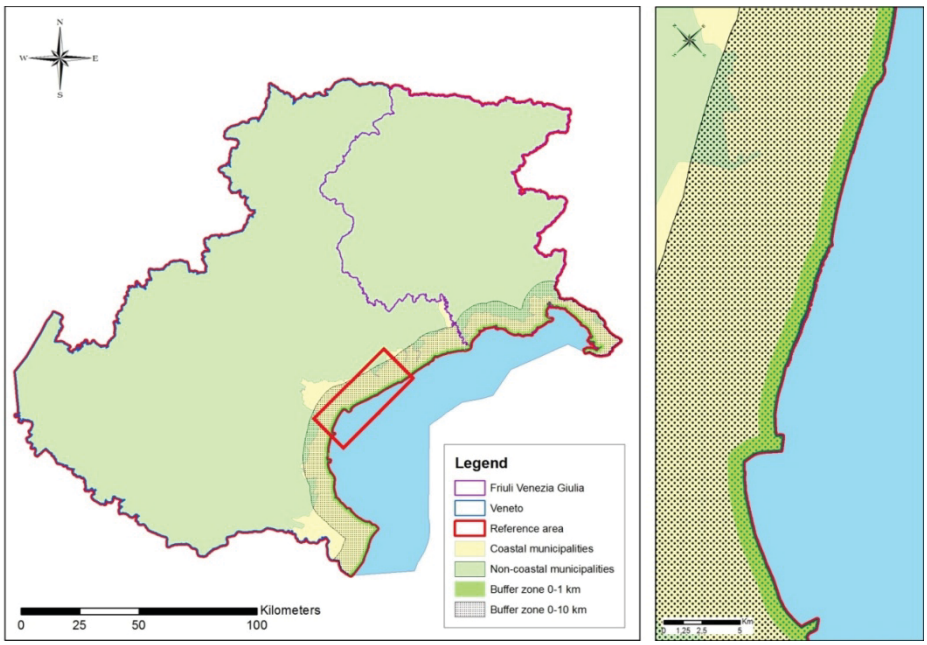


Figure 16. **The case study area**

According the indicators calculation instruction (PEGASO Consortium, 2013a), the area of built-up space (urban areas) is extracted from the Corine Land Cover land use map for the years 1990, 2000 and 2006 and selecting only the artificial areas, labelled as land use 1.1 (urban fabric), 1.2 (industrial, commercial and transport units) and 1.3 (mine, dump and construction sites). Figure 17 shows a comparison of built-up land in the years 1990, 2000 and 2006.

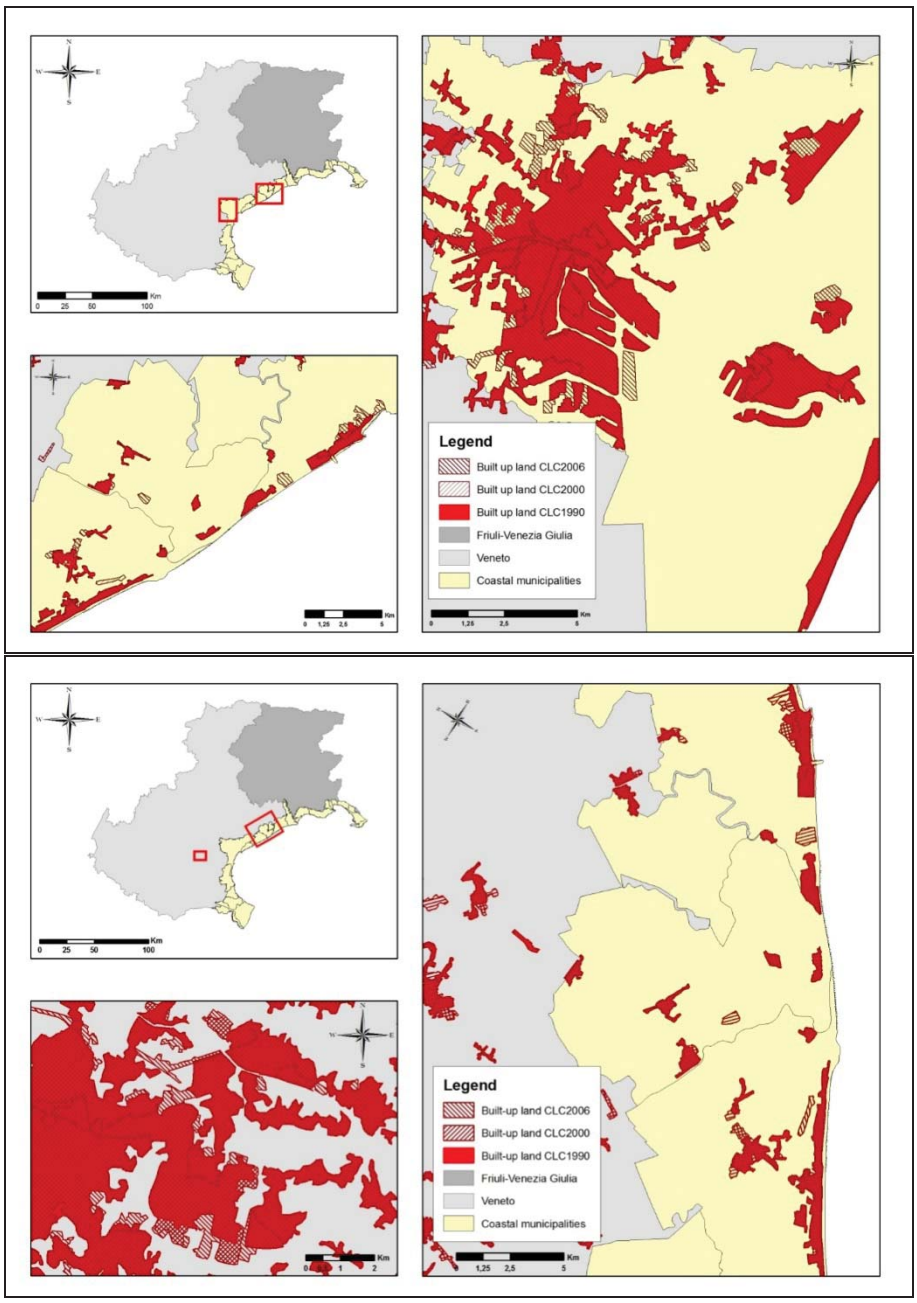


Figure 17. Built-up land from CLC in the year 1990, 2000 and 2006.

Figure 17 shows the comparison between the percentages of built-up land with reference to the total area (all land) included in the coastal municipalities, non-coastal municipalities and into the entire reference area related to the Veneto and Friuli Venezia Regions (North Adriatic sea). The bar chart reflects a progressive increase of the built-up land in the three analysed areas (coastal municipalities, non-coastal municipalities and the entire reference area) highlighting, in all the three periods, that coastal municipalities are the most built-up areas.

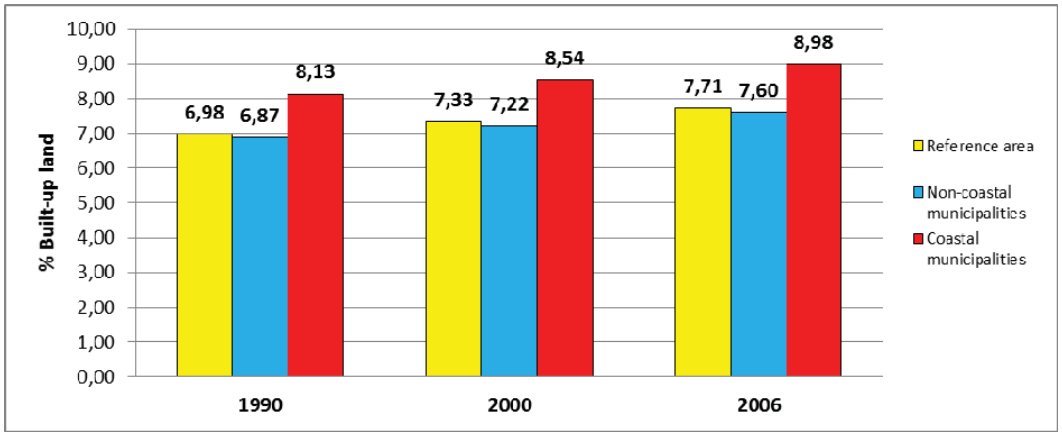


Figure 18. Percentage of built-up land within coastal municipalities, non-coastal municipalities and for the entire reference area *(Veneto and Friuli-Venezia Giulia regions) for the reference period related to the Corine Land Cover dataset.*

Figure 19 shows the comparison between the percentage of built-up land included in a buffer zone of 1 km and 10 km of distance from the coastline with reference to the total area (all land). The area of built-up space (urban areas) is always extracted from the Corine Land Cover land use map (CLC codes 1.1, 1.2 and 1.3).

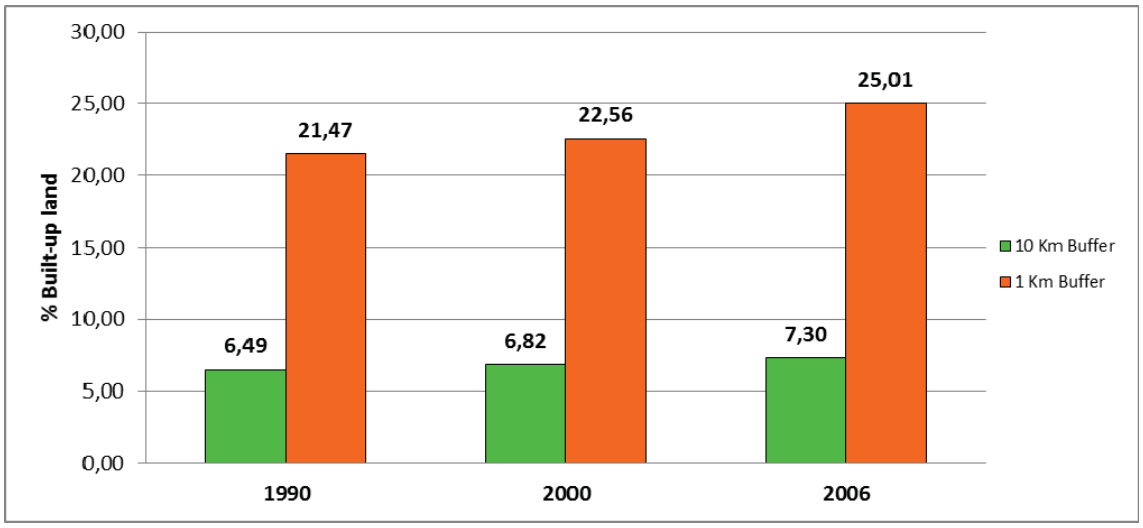


Figure 19. Percentage of built-up land in the 1 km and 10 km buffers.

The bar chart shows that the coastal area within the 0–1 Km buffer from coastline is deeply urbanized: for the year 2006 the 25% of the total area (all land) is built-up. This occurrence decreases considering the 0–10 Km buffer from coastline, observing a maximum value of 7,3% of built-up land with reference to the total area (all land) in the year 2006.
The previous bar chart has been merged (Figure 20) in order to compare the 5 studied areas (the entire reference area, coastal municipalities, non-coastal municipalities and 1 km and 10 km buffers). This new bar chart highlights once again how the coastal area within the 0–1 Km buffer from coastline is the most urbanized land in all the three analysed periods.

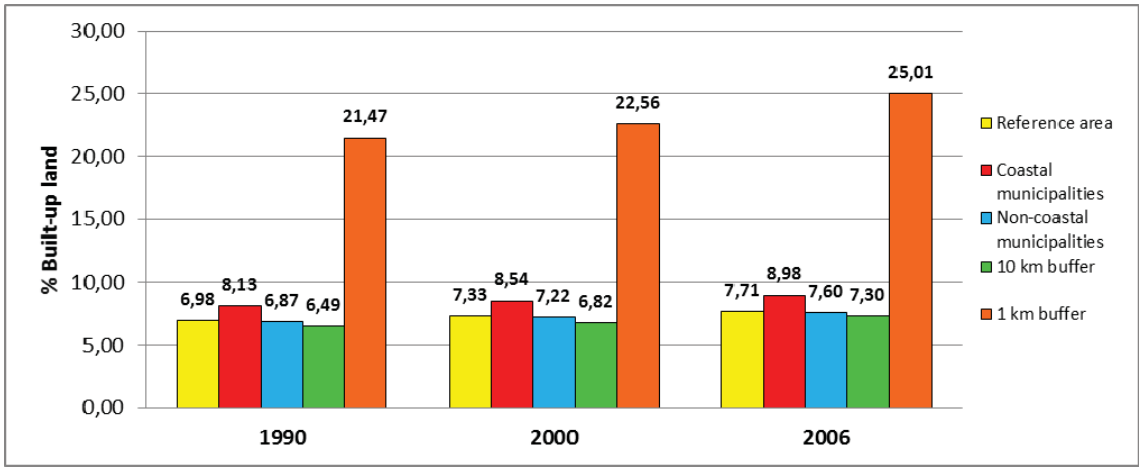


Figure 20. Percentage of built-up land in the different considered region and for the different timeframes.

Sustainability target within ICZM protocol for the Mediterranean Sea

A specific focus analysis has been realized in order to highlight the percentage of built-up lands included in a buffer zone of 100m from the coastline using the same datasets previously selected (Corine Land Cover 1990, 2000 and 2006). In fact, the Article 8 of the ICZM Protocol for the Mediterranean orders parties to establish a no-construction zone that may not be less than 100 m in width, as from the highest winter waterline, and if the countries have stricter regulations they should keep applying them. The countries may make exceptions to the ban of construction within the 100 m zone only for the projects of public interest and in areas having particular geographical or other local constraints, especially related to population density or social needs, where individual housing, urbanization or development are provided by national legal instruments.

The previous results related to the buffer analysis (0-1 km an d 0-10 km buffer from coastline) were compared with the results gained from the 0-100m buffer analysis as shown in Figure 21.

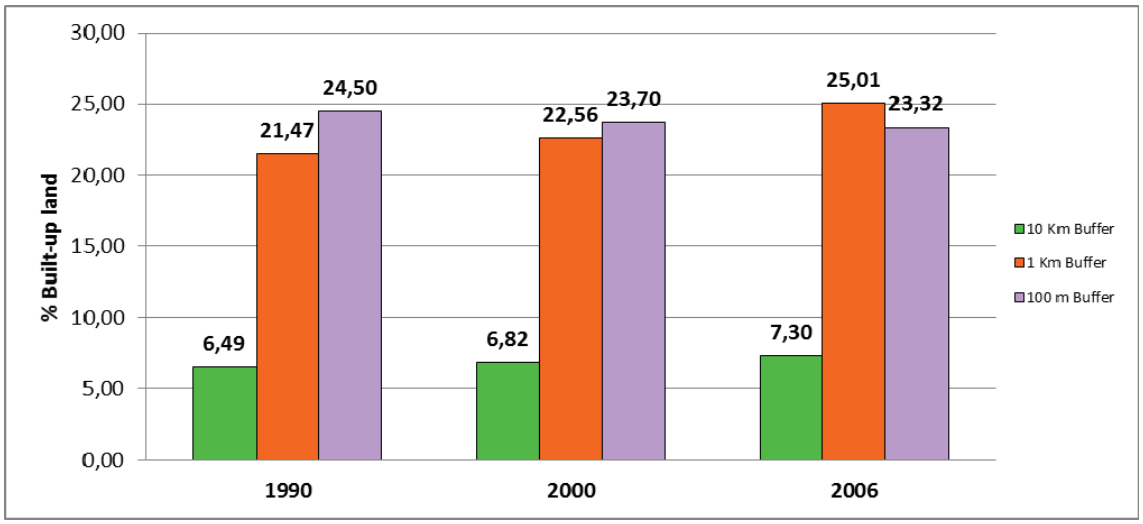


Figure 21. Percentage of built-up land/space by 0-10 km , 0-1km and 0-100 m buffers for the reference period related to the Corine Land Cover dataset (1990, 2000, 2006)

This analysis shows that around the 24% of the total area (all land) included in a buffer zone of 100 m from the coastline is built-up in the three periods considered in this analysis (i.e., 1990, 2000 and 2006).

The Corine Land Cover land use map doesn't supply information about the nature of public or private interest of each buildings, so we can't know if these built-up areas within the 0-100m buffer zone are really of public interest or have particular geographical or other local constraints. We can only distinguish between the three different urban areas typologies considered in this analysis up focused on the built-space:

- 1.1: urban fabric;
- 1.2: industrial/commercial/transport units;
- 1.3: mine, dump and construction sites.

The results of this analysis, focused on the urban areas typologies within the 100m buffer zone from the coastline, are shown in the following pie charts.

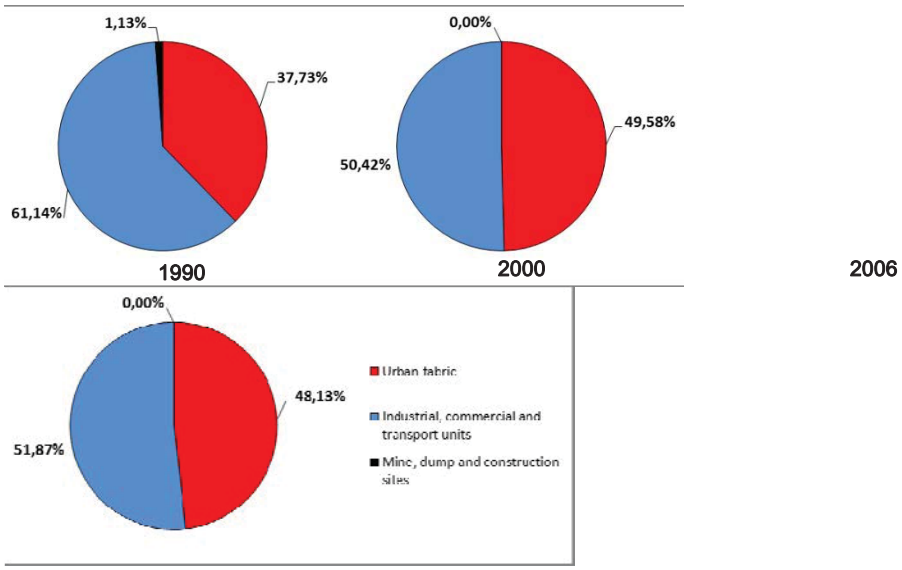


Figure 22. Percentage of urban areas typologies within 0-100m buffer zone from coastline (CLC 1990, 2000 and 2006)

The built-up space within the 100 m buffer zone from coastline is mostly divided in two urban typologies: urban fabric (data labelled as land use 1.1) and industrial/commercial/transport units and mine sites data (labelled as land use 1.2) for all the three considered periods (i.e. 1990, 2000, 2006). More specifically, analyzing the Corine Land Cover dataset, the built-up lands classified as 'industrial/commercial/transport units and mine sites' are almost totally labelled as land use 1.2.3 (third level of land use classification) that is related to the infrastructure of port areas, so we can suppose that the most part these urban areas are of public interest. Whereas, the built-up areas classified as

'urban fabric' are almost totally labelled as land use 1.1.2 that is related to discontinuous urban fabric (buildings, roads and artificially surfaced areas, which occupy discontinuous but significant surfaces), so it's impossible to define if these urban areas are public or not.

Size and density of the population living in the coastal zone

The indicator 'size and density of the population living in the coastal zone', as described in Section 6.1, is aimed at analysing the degree to which the population of a defined region is concentrated in the coastal zone in order to balance use of coastal zone in the future planning tools, and thus avoid urban sprawl.

Tracking changes in the distribution of the population of a coastal region over time will help in the assessment of the amount of pressure being exerted on coastal resources by the demand for land, housing, employment, public services, transport and so on. We are especially interested in determining whether such pressure is general throughout the reference area (i.e. the Veneto and Friuli Venezia Giulia regions) or specific to the coastal areas. The indicator was calculated by applying the methodology described in the factsheet (Annex 5.2).

With these purposes, this indicator was calculated with reference to three geographical areas (Figure 23):

- The **reference area**, represented by the whole Veneto and Friuli Venezia Giulia Regions (North Adriatic sea);
- The **coastal municipalities** in the reference area (aggregated for Provinces);
- The **non-coastal municipalities** in the reference area (aggregated for Provinces);

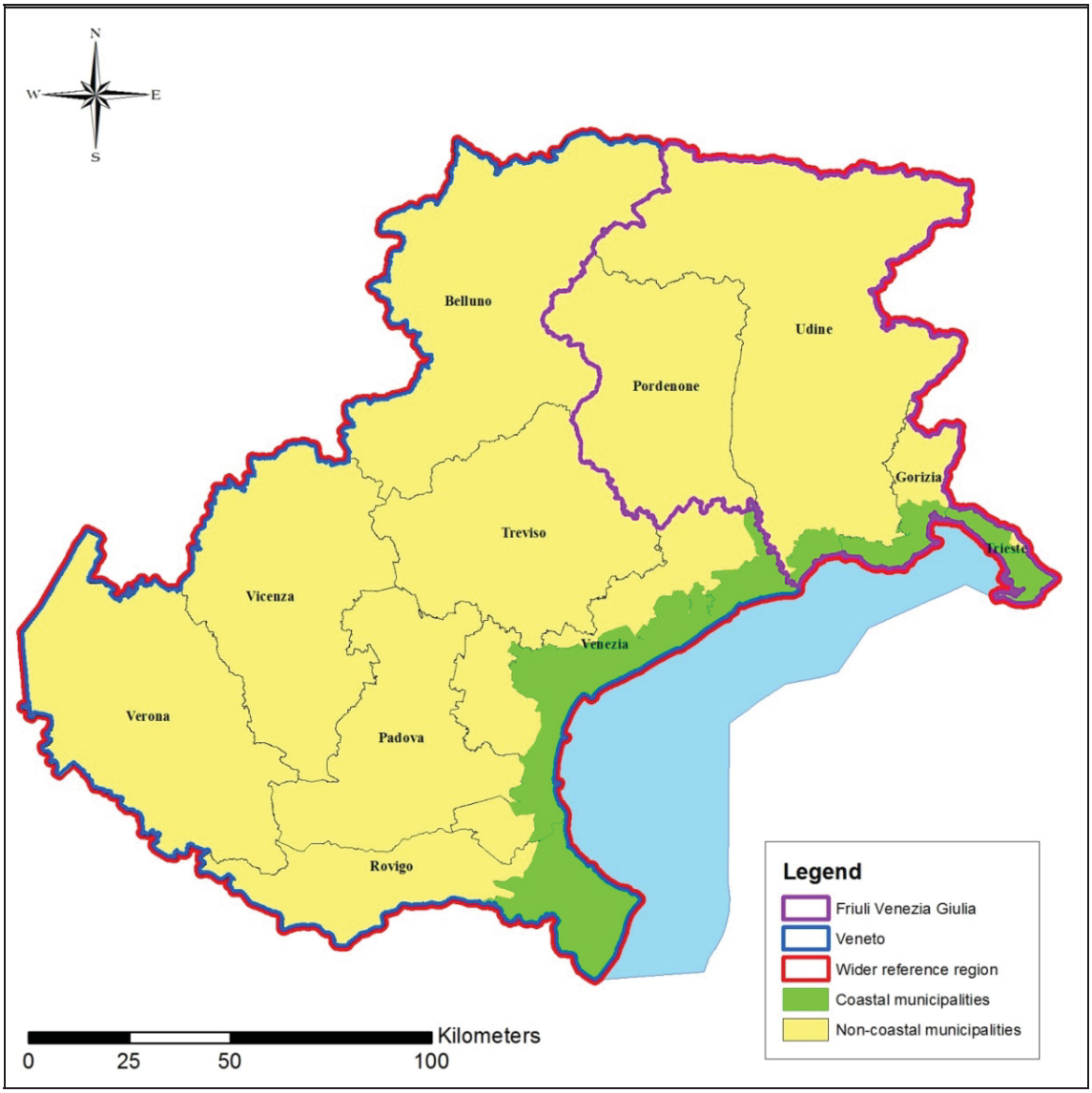
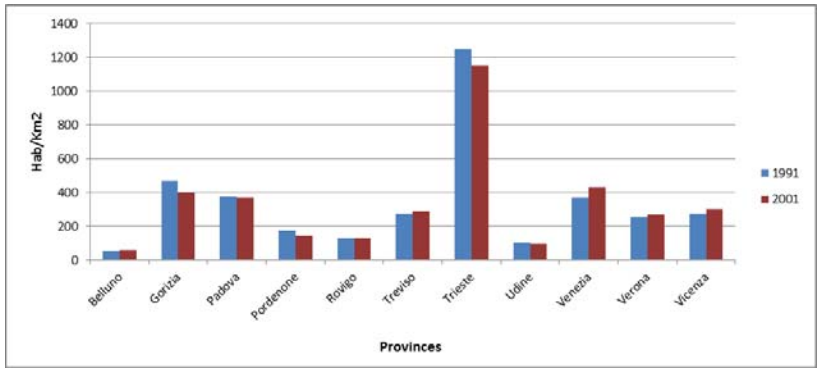


Figure 23. The case study area.

The datasets used to calculate this indicator are the Population and Housing Census of 1991 and 2001 realized by the Italian National Institute of Statistics (ISTAT; http://www.istat.it/it/censimento-popolazione-e-abitazi/). It was not possible to use the more recent data of the Population and Housing Census of 2011 because they are not yet available to the public.

Following the calculation method (PEGASO Consortium, 2013b) the indicator has been calculated for the three above defined geographical areas and for the time series 1991 and 2001 (ISTAT dataset) and then the results of the analysis has been compared in order to determine whether the pressure deriving from human presence is general throughout the reference area or specific to the coast or specific coastal areas. The results have been aggregated for the provinces placed in the reference area (Belluno, Gorizia, Padova, Pordenone, Rovigo, Trieste, Treviso, Udine, Venezia, Vicenza, Verona) and with reference to three geographical areas object of this analysis, in order to simplify results comparison and identify in which area the population density is higher.

Figure 24 shows the results of the comparison between the results related to the 1991 and 2001 ISTAT census dataset in the reference area.



PROVINCE	Hab/Km^2 1991	Hab/Km^2 2001
Belluno	56	62
Gorizia	469	400
Padova	373	371
Pordenone	177	146
Rovigo	131	130
Treviso	274	290
Trieste	1246	1150
Udine	105	97
Venezia	368	432
Verona	258	272
Vicenza	274	302

Figure 24. Comparison between population density of 1991 and 2001 for the reference area

The data of Figure 24 were visualised over a map in Figure 25.

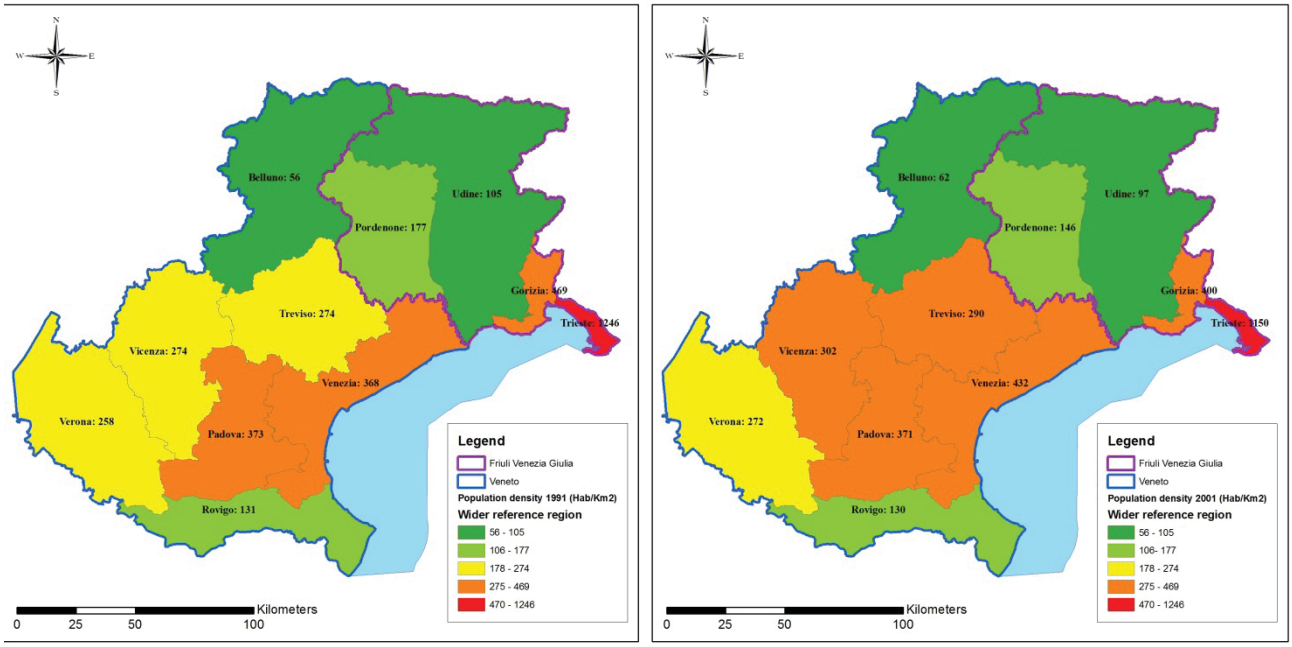
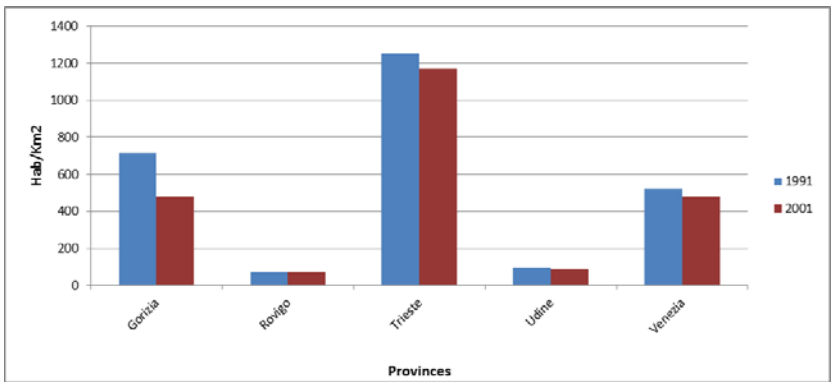


Figure 25. Comparison between population density of 1991 and 2001 for the reference area. Classification method applied to the population density values 'Natural breaks, algorithm of Jenks'.

A similar analysis was performed considering the average population density of the coastal municipalities of each province: Figure 26 and Figure 27 show the results on a graph, a table and two maps comparing the two considered timeframes. In the considered provinces the average population density is very different, but despite this heterogeneity, the population density of coastal municipalities decrease between 1991 and 2001 in all five provinces.



PROVINCE	Hab/Km^2 1991	Hab/Km^2 2001
Gorizia	715	475
Rovigo	71	70
Trieste	1253	1172
Udine	97	90
Venezia	524	476

Figure 26. Comparison between population density of 1991 and 2001 for coastal municipalities

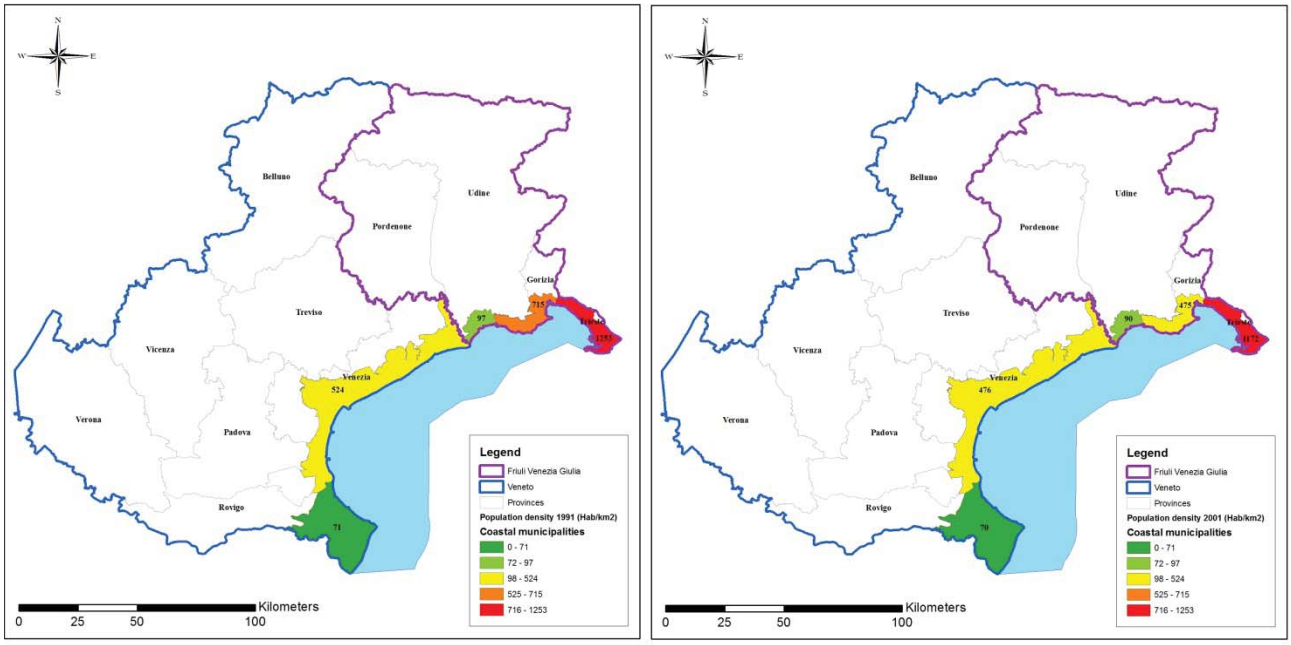
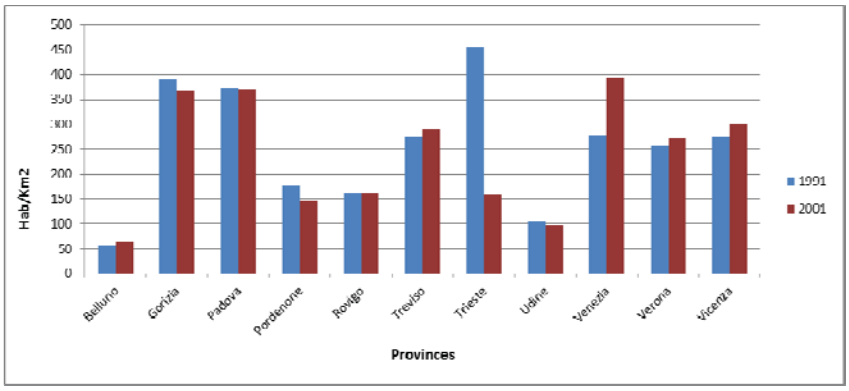


Figure 27. Comparison between population density of 1991 and 2001 for coastal municipalities. Classification method applied to the population density values 'Natural breaks, algorithm of Jenks'.

Finally, the same analysis was performed also for non-coastal municipalities and results are shown in Figure 28 and Figure 29. In this case the situation is less homogeneous among the different provinces: all provinces are characterized by small decreases or increments of the average population density of non coastal municipalities between 1991 and 2001; only Venice show an increment of around the 40% and Trieste shows a decrease of around the 65%.



PROVINCE	Hab/Km^2 1991	Hab/Km^2 2001
Belluno	56	62
Gorizia	393	366
Padova	373	371
Pordenone	177	146
Rovigo	162	162
Treviso	274	290
Trieste	456	161
Udine	105	98
Venezia	279	393
Verona	258	272
Vicenza	274	302

Figure 28. Comparison between population density of 1991 and 2001 for non-coastal municipalities.

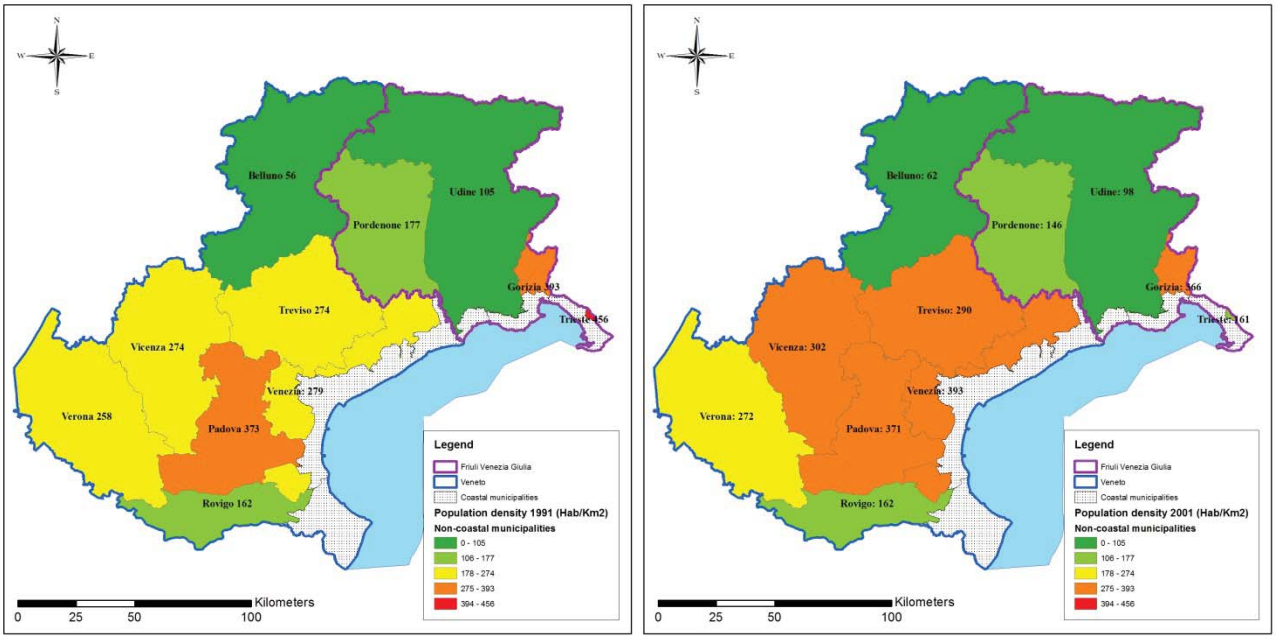
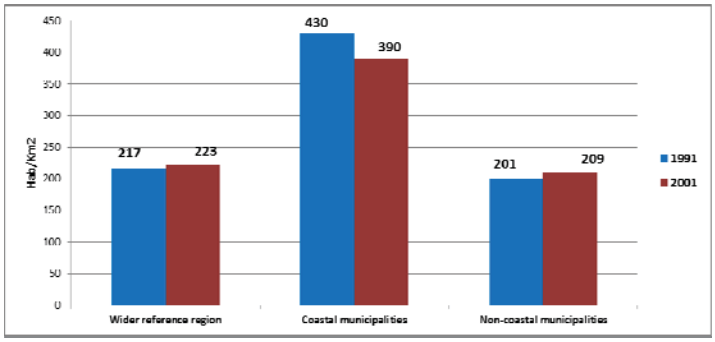


Figure 29. Comparison between population density of 1991 and 2001 for non-coastal municipalities. Classification method applied to the population density values 'Natural breaks, algorithm of Jenks'.

Finally, results obtained by the previous analysis have been merged in order to compare population density in the different considered regions. As it clearly emerges from Figure 30, population density in coastal municipalities is almost the double of the other considered region. In the two considered timeframes the density in coastal municipalities decreased, while increased in non coastal municipalities and in the reference region (i.e. the whole Veneto and Friuli Venezia Giulia regions). It is important to underline that only two timeframes were considered, so in order to define a trend more data would be required.



	Hab/Km^2 1991	Hab/Km^2 2001
Reference area	217	223
Coastal municipalities	430	390
Non-coastal municipalities	201	209

Figure 30. Population Density 1991/2001 for the whole study area -'North Adriatic sea'

Results from participation and from the involvement of the stakeholders

As previously described in Sections 5 and 6.1, stakeholder were involved through the organization of a workshop and through a questionnaire.

The results of the questionnaire will be presented in the next paragraph and in the successive 3 paragraph will be presented the improvement of the DSS DESYCO that were suggested by stakeholder during the workshop and through the questionnaire. Specifically the improvements are: i) calculation of statistic related to the produced outputs; ii) production of report containing all parameters defined during the application; iii) connection of the DSS DESYCO with QGIS.

The workshop is not the first initiative of collaboration with stakeholder and DESYCO's end-users (i.e. a previous questionnaire was already done before the presented project and is presented in Santoro et al., 2013) and will not represent the endpoint; in fact the collaboration will continue in the coming months.

Results of the questionnaire

All the participants to the workshop answered to the proposed questionnaire. The first questions were related to the output presentation and its comprehension: colours, legend and scale were considered effective and adequate by most of the stakeholders. Main suggestions for the improvement of the graphical output were related to the scale: in order to use them for a subregional level (i.e. for provincial or municipal administrations) more detail would be required.

In order to improve the outputs, **several stakeholders suggested to produce different typologies of statistics**, which can support a better understanding of the results of the application. Moreover, stakeholders suggested using both qualitative and quantitative legends and providing **the possibility to easily print the produced map defining some template of print layouts**.

Other suggestions were related to a better understanding of the way results are obtained. Accordingly it is useful to explain in a simple and effective way how results are obtained

through the **automatic production of a report associated to each application** describing the used data and set parameters, e.g. which factors were considered, which scores and weights were given to the considered factors.
Finally, several users suggested that it would be useful to have the possibility to interact with the map and dynamically visualize them. Accordingly, it is very useful to **integrate the DSS with a GIS software** in order to explore results using GIS functionalities.
Suggestions coming from stakeholders have been considered and implemented in DESYCO in order to produce output more useful for the end users and in order to make the results more understandable by stakeholders. In the following paragraphs such improvements are explained in detail.

DESYCO improvement based on the workshop and questionnaire outcomes

Stakeholders participating to the workshop and answering the questionnaire gave several suggestions in order to improve the DSS DESYCO. The following paragraphs detail the improvements of the software which have been achieved during the project.

Statistical elaborations

One of the suggestions coming from the participants to the workshop is that results coming from the RRA application trough the DESYCO can be clearer if also some statistic is calculated and provided to decision makers. Accordingly, a specific function allowing statistics calculation has been implemented within DESYCO. Statistics calculated by DESYCO show the surface and percentage of each surface that belong the defined hazard, vulnerability and risk classes. Statistics can be calculate for the whole case study area, for each considered receptor or for user-defined homogeneous areas (e.g. administratives units).
In order to allow the calculation of the statistics and the setting of the related parameters, a new interface (Figure 31) allows the user to select the output for which statistics should be calculated and define the classes to be used for the calculation.
The new interface allows also the following specific functions:

- possibility to customize the number of qualitative classes used for the different impacts;
- possibility to customize the order of the geographical units (e.g. receptors) used as geographical basis for statistic calculation;
- possibility to customize the legend (colour and text).

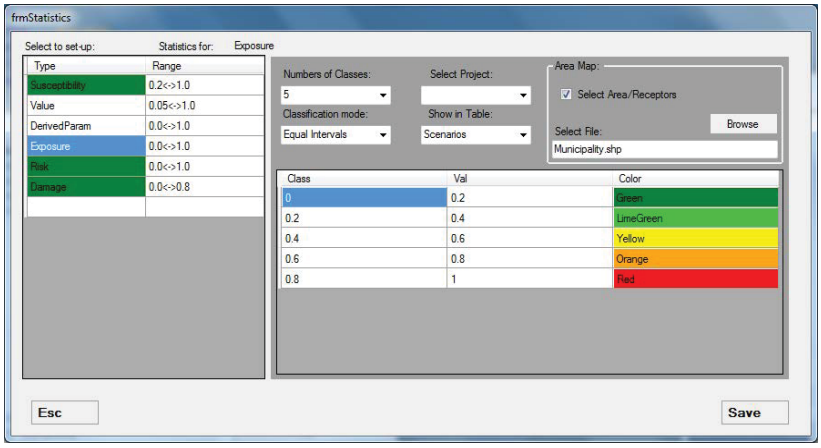


Figure 31. DESYCO interface for the calculation of exposure, vulnerability and risk statistics.

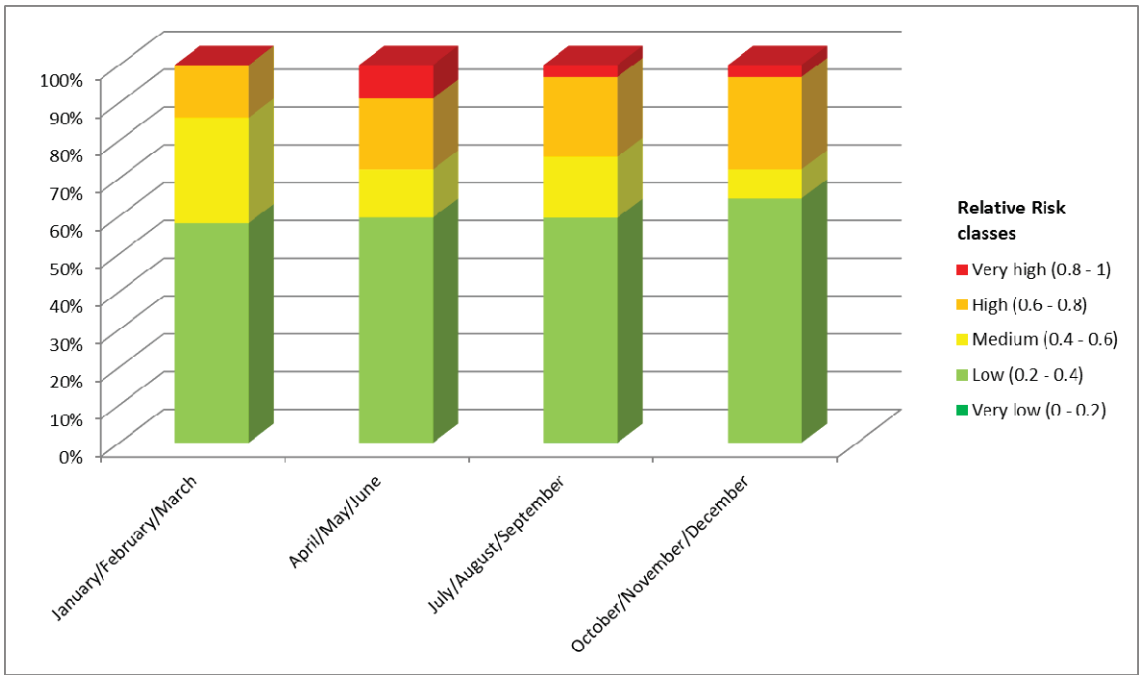


Figure 32. Example of graph produced by DESYCO.

Production of reports

The main output of the DSS DESYCO is represented by: i) maps showing the spatial distribution of the hazard, vulnerability and risk over the considered region; ii) graphs and tables presenting the results of statistics calculations. Stakeholders suggested that this information could be better analysed and evaluated if the user can have a clear picture of how these results were produced. Accordingly, DESYCO will provide an additional output represented by a report containing the following information:

- list of vulnerability and value factors;
- value of used constants;
- classification of hazard and vulnerability factors;
- weights of hazard and vulnerability factors.

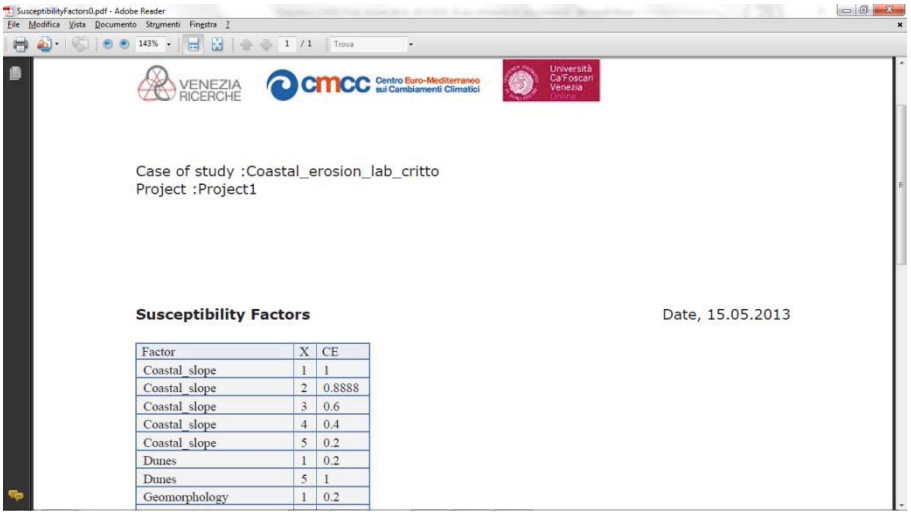


Figure 33. Example of report produced by DESYCO.

Connection with QGIS

In order to prepare input data and explore the output of DESYCO a GIS software is required. It can be a commercial or open source software. Involved stakeholders do not use always the same software, but all suggested to integrate DESYCO within a GIS software. In order to avoid costs related to licences, it has been decided to integrate DESYCO with QGIS, an open source software. Specifically, a new toolbar was added to QGIS in order to execute the DSS and the output can be visualized directly in QGIS from the DESYCO software.

Definition of print layouts

The discussion with stakeholders allowed also to understand how final users prefer having the RRA output. The possibility to visualize the map on a PC is fundamental, but also a printed version of the map would be very useful. Accordingly, it has been added a specific function able to produce print layout of the produced output.

Result from the RRA and DSS

In the following paragraphs the main results obtained by the application of the RRA methodology through the DSS DESYCO are presented. Produced maps are then reported in the following paragraphs and in Annex 10.4.

Hazard maps

Hazard maps show a ranking of water bodies' hazard scores. The higher scores represent water bodies where there is a higher increase/decrease of maximum/minimum hazard metrics' values compared to the reference values. Hazard scores were calculated as described in Section 6.1 within each homogenous area (i.e. marine water bodies defined by the Veneto and Friuli-Venezia Giulia regions, Figure 36).

Figure 34 and Figure 35 show seasonal hazard maps for the two considered future scenarios

(i.e., 2070 and 2100 respectively). The analysis of the produced maps shows that the southern part of the considered region (from Chioggia to the Po river delta) and the part from the Lido's inlet to Bibione is characterized by higher hazard scores in all considered seasons and scenarios. In both the considered scenarios, the season where higher hazard scores are forecasted is from April to June.

A detailed investigation of the hazard metrics contributing to the definition of the final hazard score was performed in order to better understand which metrics contribute more to the result, showing that those contributing more to the definition of the final hazard score are salinity and temperature. Moreover, maps show that higher changes are registered in three water bodies in front of the Veneto Region (i.e. IT05CE1_1, IT05CE1_3, IT05CE1_4) located from the Po river delta to the Chioggia's inlet and from the Lido's Inlet to Bibione. The season with higher changes in both the considered scenarios (i.e. 2070 and 2100) is the spring season (i.e. from April to June).

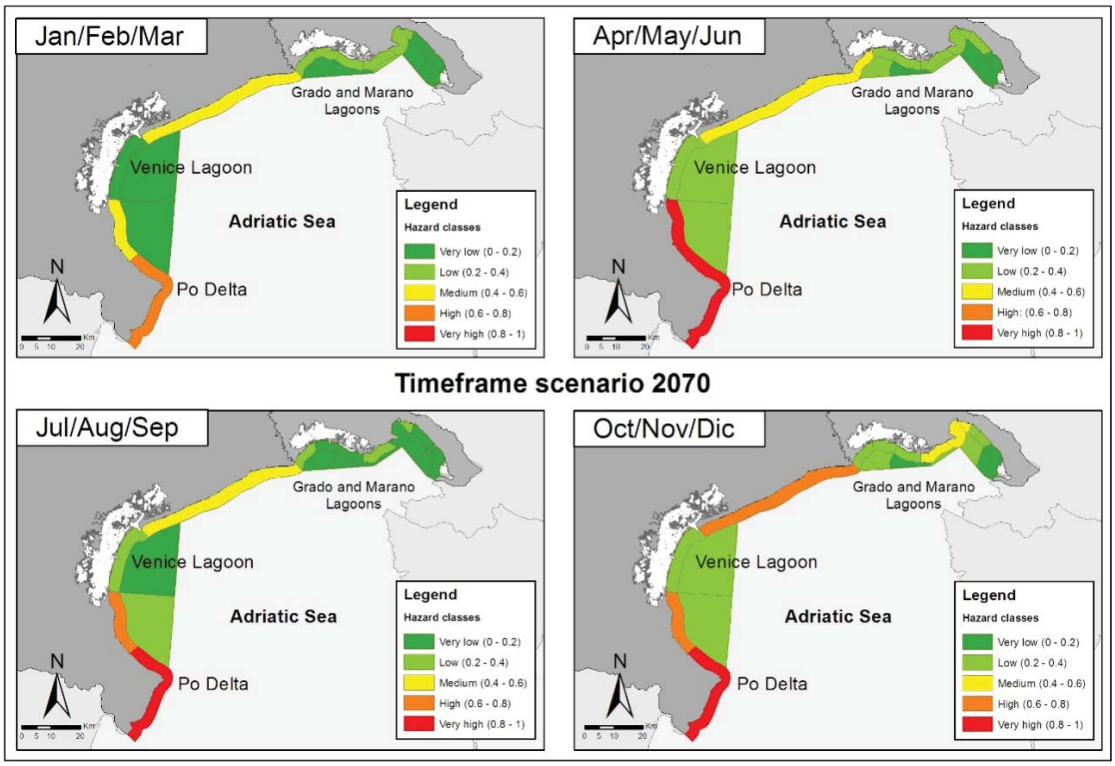


Figure 34. Hazard map of water quality variations under climate change for the North Adriatic coastal water bodies for the year 2070.

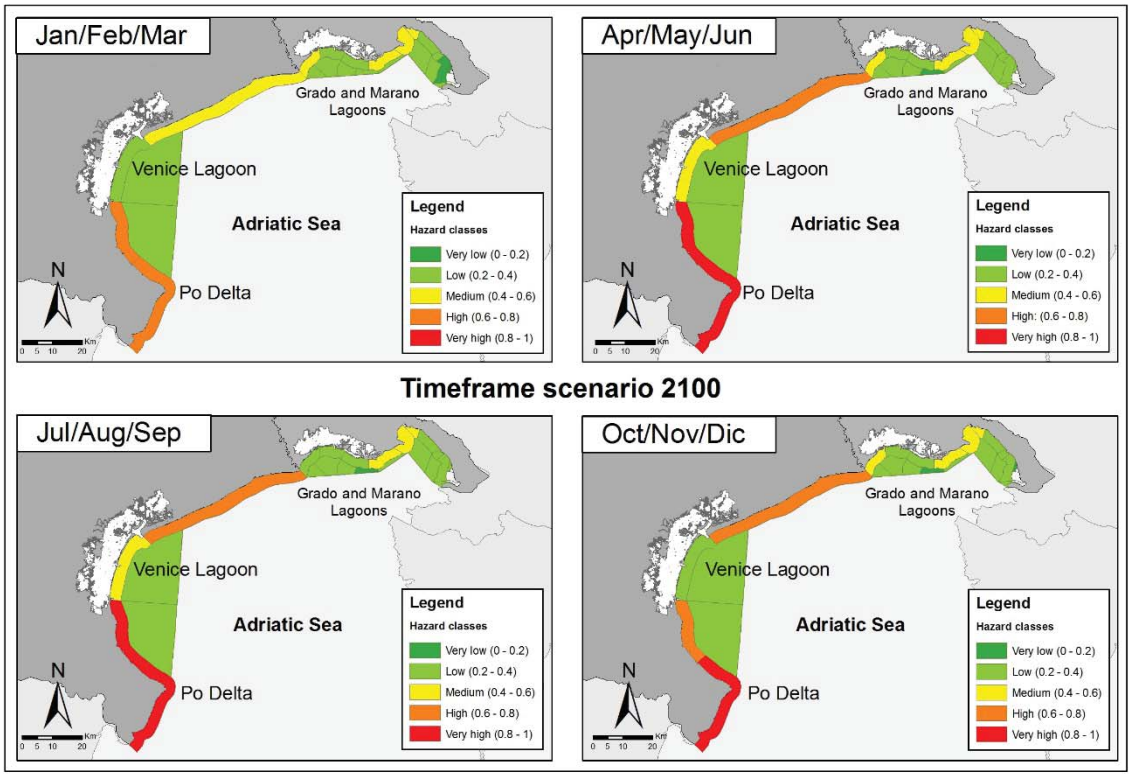


Figure 35. Hazard map of water quality variations under climate change for the North Adriatic coastal water bodies for the year 2100.

Exposure map

The exposure map represents the key receptors of the analysis (Figure 36) and include the coastal water bodies of the Veneto and Friuli Venezia Giulia regions, defined according to the criteria listed in Section 6.1. Within the case study area 23 water bodies were considered (6 in the Veneto region's coastline and 17 along the Friuli Venezia Giulia's region's coastline). The considered water bodies include also several aquaculture plants, key hotspots of the analysis, which have been highlighted in red in Figure 36.

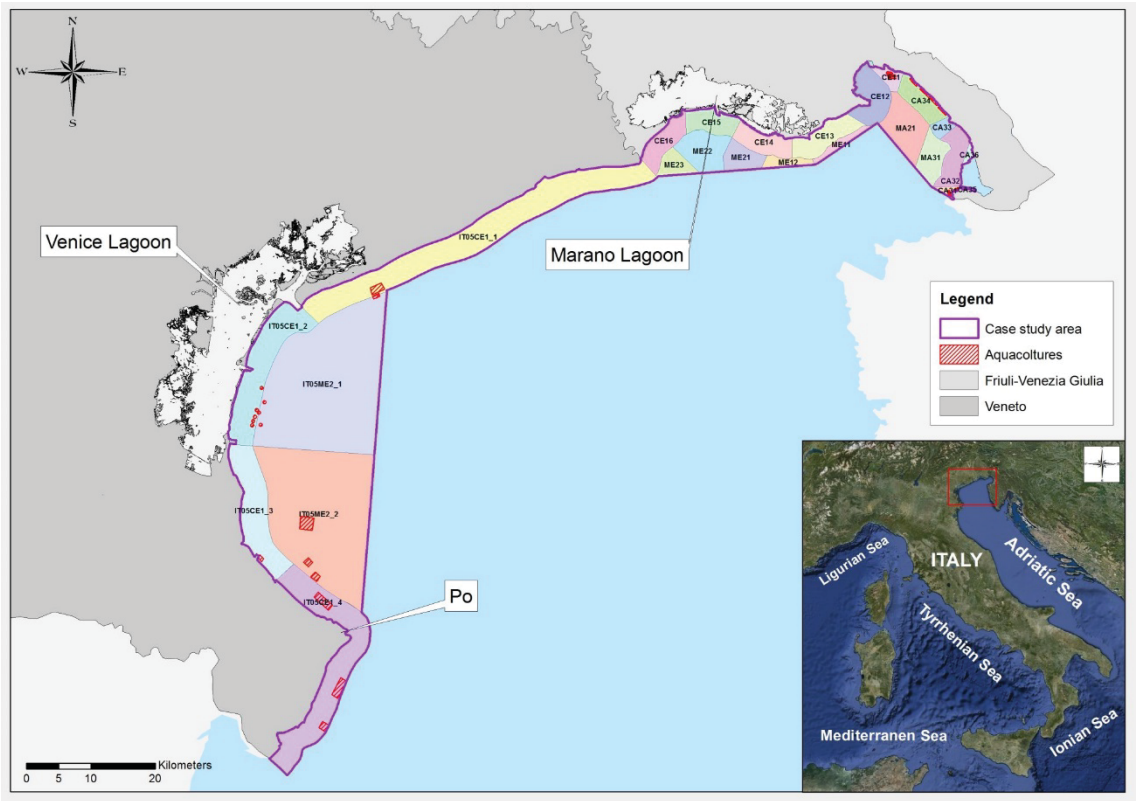


Figure 36. Exposure map showing coastal water bodies of Veneto and Friuli-Venezia Giulia regions and fisheries and aquaculture plants.

Vulnerability map

The vulnerability map (Figure 37) highlights and prioritize areas that could be affected more severely that others by climate change impacts on water quality. Within the considered region, coastal water bodies are always characterized by a High or Very high vulnerability score. Higher vulnerability is identified in the area in front of the Venice lagoon (i.e. Malamocco's and Lido's inlets) and in the northern part of the case study area, from Caorle to Trieste.

Vulnerability factors that mainly contributed to the definition of the vulnerability score are the adapted Evenness index, and those related to the presence of vulnerable targets, i.e. aquaculture plants and tegnùe.

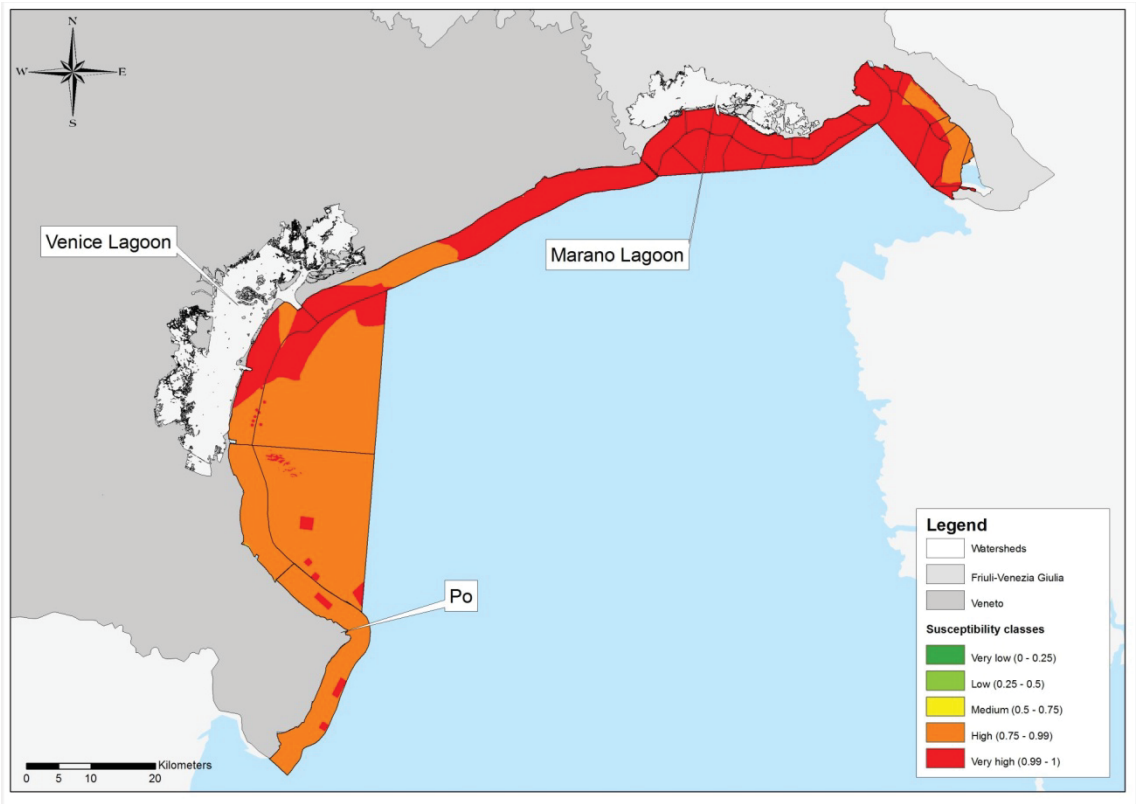


Figure 37. Vulnerability map of Coastal waters to water quality variations under climate change for the North Adriatic sea.

Risk maps

Risk maps identify and rank areas and targets that could be impacted by changes in water quality. The relative risk map produced for the North Adriatic sea for the spring season (Figure 38), which is the worst season, shows scores varying from low to high. Higher relative risk scores are in the area close to the Po river delta ad North of the Lido's inlets. The situation in 2100 is always worse than in 2070.

The risk is highly influenced by the hazard assessment. In fact, vulnerability scores are quite homogenous across all the case study area, while hazard scores changes for the different water bodies across the studied region. Moreover water bodies with higher hazard scores have also higher relative risk scores (i.e. from the Po' river delta to the Chioggia's inlet and

from the Lido's inlet to Bibione, in correspondence to the water bodies IT05CE1_1, IT05CE1_3 and IT05CE1_4).

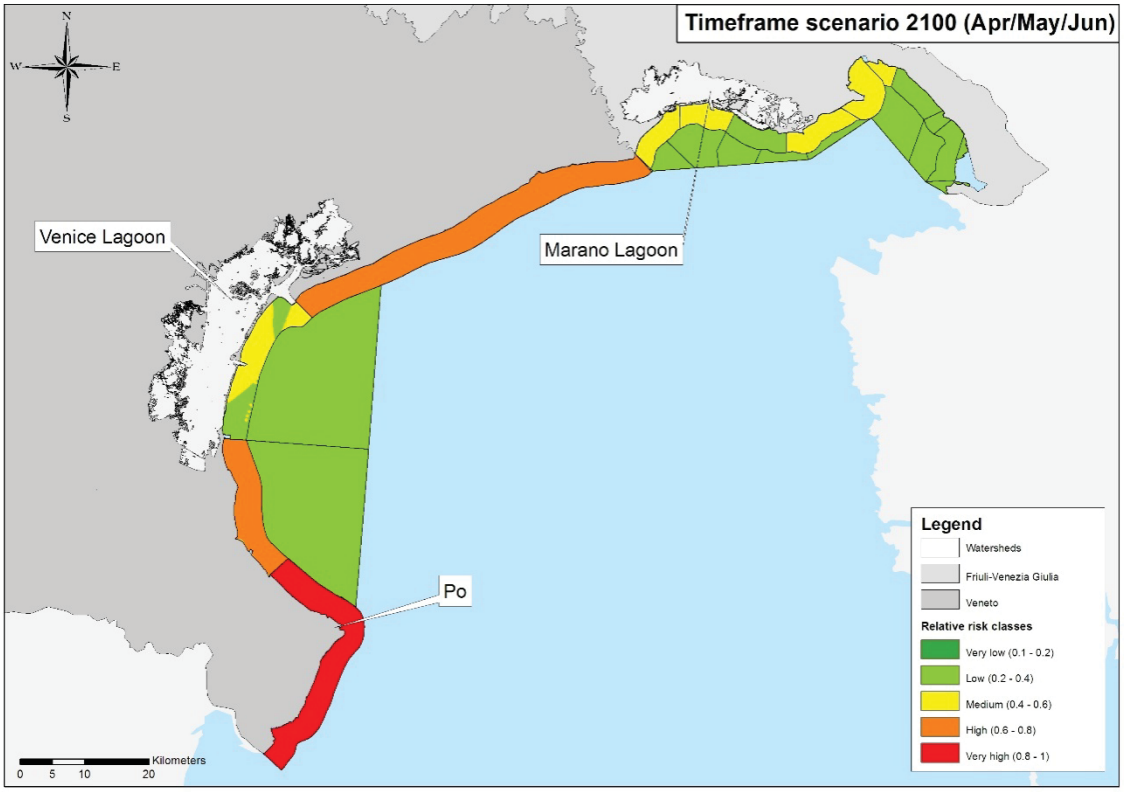


Figure 38. Relative risk map of water quality variations under climate change for the North Adriatic sea.

7.2 Lesson learnt

The use of indicators and the application of the RRA methodology can be improved by the integration of participatory methods. In fact, the involvement of stakeholders and experts can support the identification of appropriate indicators and related dataset. Moreover, it can integrate the application of the RRA methodology in the steps requiring the contribution of experts and stakeholders (i.e. in the identification of the vulnerability factors and in the attribution of scores and weights to vulnerability factors).

The participation process allowed establishing a connection between scientists (i.e. the research group in the university) and several relevant stakeholders, responding to one of the main aim of the PEGASO project (i.e. bridge the gap between science and decision-makers). The experience achieved in the framework of the PEGASO project is the starting point of cooperation between university and stakeholders/decision-makers that will continue after the project conclusion.

Finally, the application of the RRA methodology and of the DSS DESYCO was recognized to be very useful to support in the definition of Plans, Policies and Programs according to ICZM principles taking into account the potential impacts of climate change. The proposed approach allows understanding the main drivers of changes in marine water quality and can support the definition of adaptation measures aimed at reducing consequences of climate

changes in the future. The methodology applied to the North Adriatic case can be replicated in any other coastal region of the Mediterranean Sea and Black Sea using set of indicators and dataset customized for each application.

Section 8. PEGASO SDI

Within the North Adriatic case, a web portal containing metadata of the maps used within the described application was also developed. This web portal is part of a Spatial Data Infrastructure implemented in the framework of the PEGASO project connecting the different implemented case studies across the Mediterranean sea and the Black sea.

A Spatial Data Infrastructure (SDI) is a group of technologies, politics, standards, services and human resources, necessaries for the compilation, manipulation, access, distribution and use of geographic data in different levels. It is the basis for the discovering of spatial data, its evaluation and its use by different kinds of users, either from public, business, academic, government or citizens sector. Conceptually, the data infrastructure has the same purpose as the roads and highways: Improving the communications, making access easier, etc.

Main goals of the Pegaso SDI are:

- to improve access to and integrated use of spatial data and information;
- to support decision making;
- to promote multidisciplinary approaches to sustainable development;
- to enhance understanding of the benefits of geographic information.

The PEGASO SDI is composed by a network of geonodes and include a main central geonode, storing all data related to the PEGASO project and to the 10 cases, and local geonodes storing data of each single case. Within the North Adriatic case a local geonode was implemented to share data produced through the application of the RRA and data related to the used indicators.

The geonode implemented in the framework of the North Adriatic case is hosted by the University Ca' Foscari of Venice – Office systems and Infrastructures (ASIT) - and is accessible through its website (http://virgo.unive.it:8080/geonetwork/srv/eng/main.home). It is based on the use of Geonetwork Opensource (http://www.geonetwork-opensource.org/), an open source web application providing metadata editing and search functions as well as an embedded interactive web map viewer.

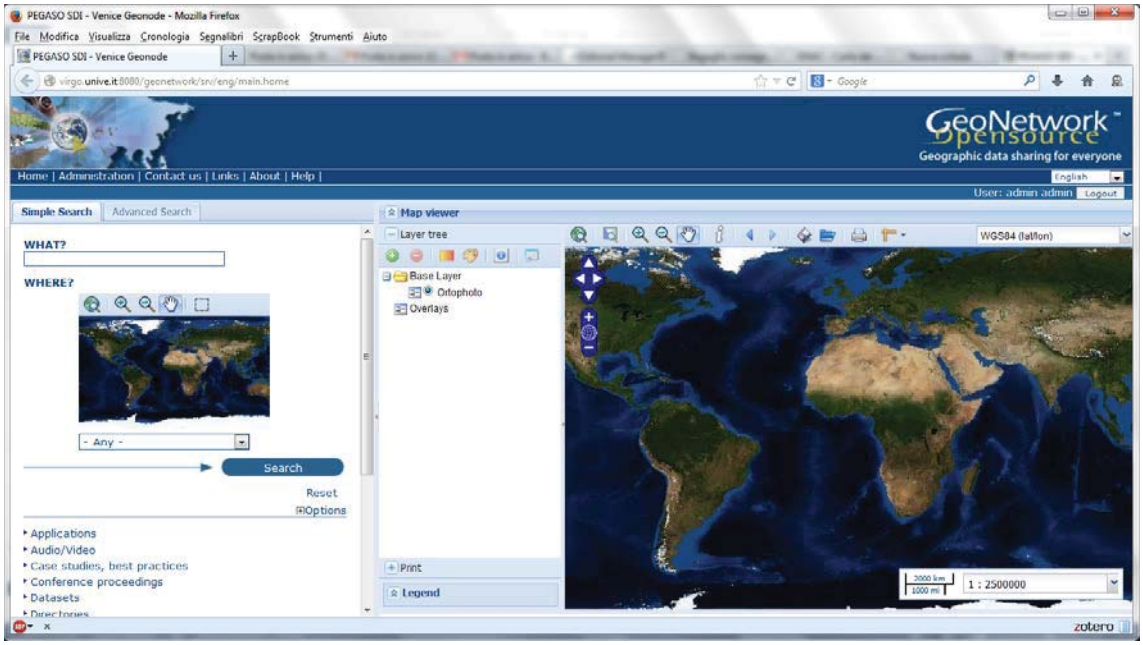


Figure 39. The main interface of the North Adriatic case geonode.

The North Adriatic case geonode contains metadata related to ** thematic layers. Specifically:

Indicators maps

- ** maps related to the indicator “Area of built-up space in the coastal zone”;
- ** maps related to the indicator “Size and density of the population living in the coastal zone”;

RRA output maps

- ** hazard maps;
- 1 exposure map;
- 5 Vulnerability factors maps
- 1 vulnerability map;
- ** risk maps.

Section 9. References

- ARPAV, 2013. Indicatore del mese – Maggio – 2013. Balneabilità. ARPAV – Servizio Osservatorio Acque marine e Lagunari.

- PEGASO Consortium, 2013a. Area of built-up space in the coastal zone. Methodological factsheet in support of comparable measurements and integrated assessment in coastal zones. 6 p. in Santoro, F., Lescrauwaet, A.K., Giraud, J.P., Lafitte, A., Pirlet, H., Verleye, T., and Breton, F. (eds.). PEGASO Core Set of Indicators for Integrated Coastal Zone Management. PEGASO Project FP7. www.pegasoproject.eu

- PEGASO Consortium, 2013b. Size and density of the population living in the coastal zone. Methodological factsheet in support of comparable measurements and integrated assessment in coastal zones. 5 p. in Santoro, F., Lescrauwaet, A.K., Giraud, J.P., Lafitte, A., Pirlet, H., Verleye, T., and Breton, F. (eds.). PEGASO Core Set of Indicators for Integrated Coastal Zone Management. PEGASO Project FP7. www.pegasoproject.eu

- Veneto Agricoltura, 2013. L' Adriatico a confronto. Veneto Agricoltura, Osservatorio socio-economico della pesca e dell'acquacoltura.

Section 10. Annexes

Annex 1 – List of identified stakeholders

	Ente	Ufficio	Responsabile
1	Regione Friuli Venezia Giulia	• Direzione centrale ambiente, energia e politiche per la montagna • Servizio disciplina gestione rifiuti e siti inquinati • Direzione centrale infrastrutture, mobilità, pianificazione territoriale e lavori pubblici • Servizio pianificazione territoriale • Struttura stabile per il coordinamento delle attivita' volte a definire i valori da tutelare nell'ambito della pianificazione territoriale regionale	• Direttore centrale • Roberto Della Torre • Sebastiano Cacciaguerra • Massimo Capriotti
3	Regione Veneto	• Segreteria regionale ambiente e territorio • Difesa del suolo • Sistema idrico integrato	• Mariano Carraro • Romeo Toffano • Daniele Piccolo • Fabio Strazzabosco
4	ARPAV Centro meteo Teolo		• Adriano Barbi
5	Provincia di Trieste	• Servizio tutela del territorio • Tutela della flora e della fauna, educazione ambientale	• Fabio Cella
6	Provincia di Gorizia	• Ufficio pianificazione territoriale • Direzione sviluppo territoriale ed ambiente	• Franco Leonarduzzi
7	Provincia di Udine	• Ufficio Servizio Difesa Suolo e Protezione Civile	• Gabriele Peressi
8	Provincia di Venezia	• Ufficio pianificazione territoriale e urbanistica • Settore ambiente	• Massimo Gattolin
9	Provincia di Rovigo	• Servizio Pianificazione territoriale	• Paolo Marzolla
10	Comune di Muggia	• Servizio ambiente e sviluppo energetico	• Paolo Lusin
11	Comune di Trieste	• Area pianificazione territoriale	• arch. **Marina Cassin**
12	Comune di Duino Aurisina	• Ufficio Lavori pubblici	• Cartagine Marco
13	Comune di Monfalcone	• Ufficio opere pubbliche • Ufficio ambiente	• Geom. Sergio Marconato • dott.ssa Laura Weffort
14	Comune di Staranzano	• Ufficio opere pubbliche	• Geom. Bon

15	Comune di Grado	• Servizio Lavori pubblici	• arch. Andrea de Walderstein
16	Comune di Marano Lagunare	• Ufficio tecnico	• Stefano Zampar
17	Comune di Lignano Sabbiadoro	• Ufficio lavori pubblici e patrimonio • Ufficio ambiente e territorio	• Baradello Giorgio • Moraldo Bredaschia
18	Comune di San Michele al Tagliamento	• Urbanistica	• arch. Alberto Gherardi
19	Comune di Caorle	• Servizi tecnici • demanio	• Enzo Lazzarin
20	Comune di Eraclea	• Ufficio lavori pubblici	• Geom. Maddalena Frara
21	Comune di Jesolo	• pianificazione	• Daniela Vitale
22	Comune di Cavallino-Treporti	• Urbanistica	• Arch. Gaetano Di Gregorio
23	Comune di Venezia	• Dipartimento Gestione del territorio e attività autorizzative di cui fanno parte le seguenti divisioni • Direzione ambiente e sicurezza del territorio • Direzione sviluppo del territorio ed edilizia • Pianificazione strategica • Osservatorio naturalistico	• Annalisa Biscaro • Direttore Dott. Oscar Girotto • Arch. Ambra Dina • Marco Favaro
24	Comune di Chioggia	• Urbanistica Pianificazione del territorio	• Ing. Valandro Massimo
25	Comune di Rosolina	• Assetto del territorio	• Geom. Romano Lunardi
26	Comune di Porto Viro	• Lavori pubblci	• Andrea Portieri
27	Comune di Porto Tolle	• Ufficio tecnico	• Giorgio Portesan
28	Autorità Portuale di Venezia	• Direzione tecnica • Area pianificazione • Area ambiente	
29	Autorità portuale di Trieste	• Direzione tecnica • Sicurezza e ambiente • Piano regolatore	
30	ASPO Monfalcone	• Ufficio tecnico	
31	ASPO Chioggia	• Programmi Realizzazione Infrastrutture	

		• Gestione Porto	
32	Autorità di bacino dell'Alto Adriatico	• Area tecnica • Dorsoduro 3593 - 30123 Venezia	• Francesco Baruffi (dirigente)
33	Autorità di bacino del Po	• Servizio governo del bacino	• Alessio Picarelli • Dott. Puma
34	Magistrato alle acque di Venezia	• ufficio tecnico del magistrato alle acque • San Polo 19, 30125 Venezia	• Alfredo Riondino
35	Genio Civile di Venezia	• Unità di progetto Distretto Bacino Idrografico Laguna Veneto Orientale e Coste	• Salvatore Patti
36	Genio Civile di Rovigo		• Adriano Camuffo
37	Genio Civile di Trieste delle opere marittime		
38	Genio Civile di Gorizia		• Ing. Francesco Sorrentino
39	Genio Civile di Udine		
40	Osservatorio dell'alto adriatico fvg	• c/o Arpa FVG	• Luisella Milani
41	Osservatorio dell'alto adriatico veneto	• c/o Arpa Veneto	• Luca Tenderini
42	Area Marina Protetta di Miramare		• Roberto Odorico
43	Euroregione Adriatica		• Mauro Stefani
44	ISPRA VENEZIA		• Ing. Maurizio Ferla
45	Protezione civile regionale FVG		• Claudio Liva
46	Venezia: Istituzione Centro Previsioni e Segnalazioni Maree		• Alessandro Tosoni
47	Regione Friuli Venezia Giulia	• Servizio geologico	• Antonio Bratus
48	ARPA OSMER		• Stefano Micheletti
49	ARPA FVG		• Isabella Scroccaro
50	ARPA FVG		• Pietro Rossin

Annex 2 – List of participants to the workshop

	Ente	Ufficio	Nome
1	FEEM	Venezia	Margaretha Breil
2	Regione Veneto	Progetto Shape	Roberto Bertaggia
3		programmazione e gestione interventi di difesa dei litorali	Roberto Piazza
4		Direzione difesa del suolo	Ing. Letizia Nalotto
5	Provincia di Venezia		Danilo Gerotto
6			Massimo Pizzato
7	Autorità di bacino del Po		Dott. Francesco Puma
8	ISPRA		Maurizio Ferla
9			Dott. Marco Cordella
10			Dott. Franco Crosato
11			Ing. Devis Canesso
12			Ing. Lina Porciello
13			Ing. Alessio Andriotto
14			Ing. Niccolò Ranzato
15	ARPA F. V.G.		Giorgio Mattassi
16			Stefano Micheletti
17			Isabella Scroccaro
18	Comune di Cavallino-Treporti	Urbanistica	Arch. Gaetano Di Gregorio
19	Comune di Venezia	Osservatorio naturalistico	Marco Favaro
20	Ca' Foscari		Prof. Stefano Soriani
21			Dott. Monica Camuffo
22			Dott. Fabrizia Buono
23			Dott. Marco Tonino
24			Dott. Andrea Bordin
25			Dott. Marco Dalla Via
26			Dott. Andrea Critto
27			Dott. Silvia Torresan
28			Dott. Jonathan Rizzi
29			Dott. Valentina Gallina
30			Dott. Lara Lamon

B) The development of a forecasting model for the coastal water quality

Section 1 Coastal issues

1.1 The main coastal issues considered

Figure 40 The SubCASE are of Sottomarina di Chioggia
(source Google maps)

Water quality (Fig. 34) has a great relevance for tourism, fishery and biodiversity conservation in the North Adriatic. In particular, coastal tourism in the North Adriatic has been affected by water quality issues such as eutrophication phenomena (especially during the 80s and 90s of the last century) as well as the exceeding of the limits of faecal bacteria density that lead to beach closures for health reasons. The Upper Adriatic area represents only 0.4% of the Adriatic body volume, and this makes the area particularly sensitive to pollution matters.

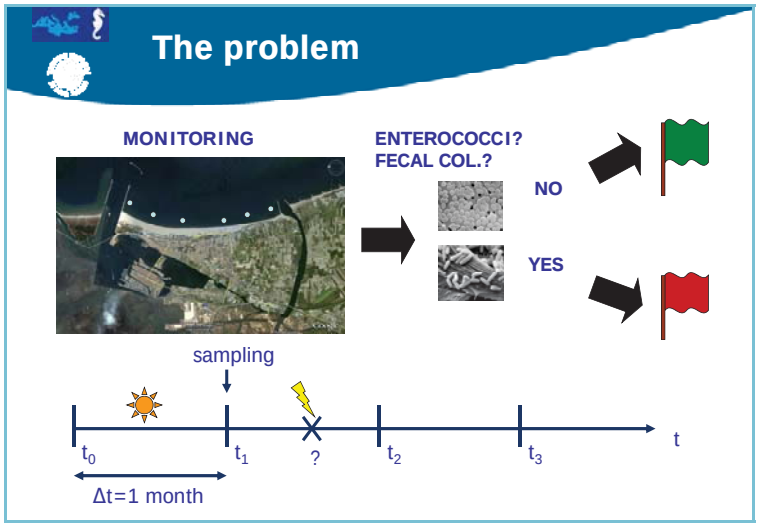


Figure 41. Schematization of the procedure needed to determine bathing water quality

In order to support coastal municipalities in the management and monitoring of bathing water quality, Ca' Foscari University developed a short-term forecasting model named Beach Health Advisory Model (BHAM) which reproduces the general pattern of bacteria dispersion based on time series of local environmental forces (rain intensity, solar radiation and currents among the others) and bacteria counts. The model was applied to the PEGASO SubCASE of Sottomarina beach (Fig.33), located south of Venice, on the North-eastern Adriatic coastline, the area was selected as a case-study representative of microbial pollution caused by human and farming activities along the north Adriatic coastal area

1.2 The social, political, environmental and economical relevance of the identified coastal issues in the Italian North Adriatic coast: a focus on the tourism sector[16]

The North Adriatic zone is a traditional European destination for seaside tourism (almost 20 million of international arrivals in 2008 if considering also Slovenia and Croatia). The North Adriatic has many factors of attraction, such as nature, culture and gastronomy. Sea quality is extremely important not only for the economic weight directly related to bathing tourism, but also for its crucial role in the whole North Adriatic image and tourism system (e.g. cruise sector as well as nautical tourism). Italian national agencies estimated a daily consumption of almost 80 euro per tourist for sea destination. The same parameter for mountain, lake, cultural and gastronomic tourism ranges from 90 to 110 euro. However, the greater number of presences makes Italian seaside destination able to compete with the cultural ones (which are the most important in term of provided income). Data referring to seaside tourism performances, in the context of the North Adriatic, are available only for Emilia Romagna and Veneto (see Table 6). These two regions represent respectively 21,6% and 16.2% of the total Italian seaside tourism presences.

Table 13. Emilia Romagna and Veneto seaside tourism performances in 2011

	Presences	Arrivals
Emilia Romagna	27,9 million	5,5 million
Veneto	26,5 million	3,9 million

An important indicator for the tourism sector service is the number of bed provided by hotel and other accommodations. The below table 7 illustrates the situation of Veneto tourism districts.

16 Elaboration from the "Osservatorio nazionale del Turismo", Regione Veneto, Osservatorio turistico Emilia Romagna and CISET on ISTAT and Banca d'Italia data.

Table 14. Veneto main seaside tourism districts supply (beds and regional quotas of bed)

Bibione-Caorle	129.889 (18,7%)
Jesolo- Eraclea	108.459 (15,6%)
Cavallino	55.603 (8,0%)
Chioggia	24.926 (3,6%)

Chioggia tourism district, the case study for the implementation of the Bathing Water Advisory Model (BHAM), experienced in 2011 more than 261.500 arrivals and more than 2 million presences (7.5% of the seaside holidays regional quota).

Pollution issue: safe bathing conditions

According to the parameters reported in the Italian Decree 116/2008 and in the Ministerial Decree 30/03/2010, no bathing coastal waters of Veneto region are nowadays banned. The situation has improved in the last years (no banned zones in 2010 and only two zones banned in 2011) however, bathing prohibitions have been declared right up to 2009.

The graph in Fig. 35, produced by the Veneto Environmental Regional Agency (ARPAV), shows the monitoring activity of ten bathing tourist districts since 1997. The values represent the percentage of the total monitored zones (several for each district) which did not met the required conditions. Chioggia district is the most affected by the issue of bathing water quality, and with the exceptions of 2007, 2010 and 2011, every year at least one of its zones failed the water quality assessment. For instance in 2009, 100% of the district was banned to bathing activities. Caorle and Rosolina are the second and the third most problematic districts with notable and repeated percentages of banned zones (33% of Rosolina district was declared banned zones in 2009). Also the other districts showed notable percentages of banned zones. Jesolo, Porto Viro, and Porto Tolle tourist districts, failed the tests at least once during the 15 years of monitoring. In 2000, Porto Viro experienced instead the peak of 50% banned zones, but it seems an isolated event.

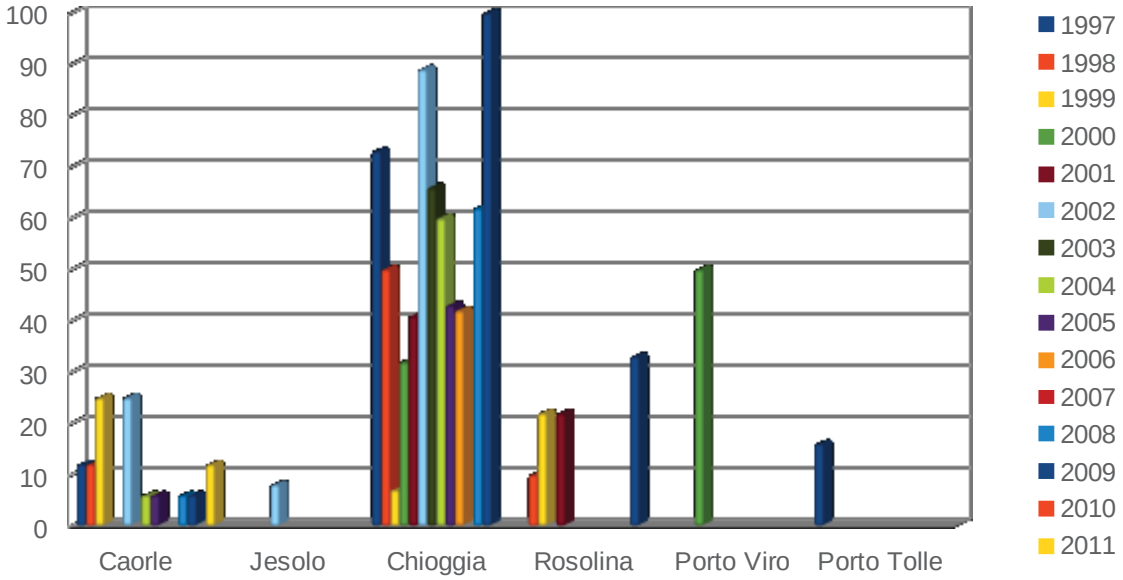


Figure 42. Veneto negative bathing suitability tests percentage from 1997 to 2011

Table 15. Veneto number of negative bathing suitability tests zones from 1997 to 2011

SITES	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Caorle	2	2	4	-	-	4	-	1	2	-	-	1	1	-	2
Jesolo	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Chioggia	9	6	1	4	5	9	4	6	4	3	-	7	11	-	-
Rosolina	-	1	2	-	2	-	-	-	-	-	-	-	3	-	-
Porto Viro	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Porte Tolle	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 8 illustrates the number of negative bathing suitability tests zones from 1997 to 2011. During 15 years of monitoring Chioggia sampling zones were affected by bathing restriction 69 times (an yearly average of almost 44% of total zones not suitable), recording the worst water quality situation of the whole Veneto region.

Section 2 Relations between coastal issue and ICZM Protocol and principles

2.1 How do the selected coastal issues relate to the ICZM principles and protocol? When possible and appropriate, refer to the relevant Articles of the Protocol.

Water quality assessment implies an interdisciplinary scientific research which aims to formulate ICZM strategies, to identify priorities and ecosystem management measures . Therefore the identified coastal issue relate to the following ICZM protocol articles:

- Art. 5 (c) (Ensure the sustainable use of natural resources , particularly with regard to water use);
- art.19 (Monitoring and observation mechanism and networks);
- art. 15 (Awareness-raising, training, education and research);
- art. 25 (Training and research);
- art. 18 (National Coastal strategies, plans and programs).

Section 3. Policies issues and ICZM principles and approaches

3.1 So far, how have the coastal issues been addressed by the local/regional/national government?

Bathing water quality is of paramount importance from the socio-economic, biological and epidemiological points of view. The control of pollution sources and the forecast of short pollution events are of extreme importance in highly touristic areas like the Mediterranean especially during the bathing season. The Bathing Water Directive 76/160/EC is one of the first pieces of the European Union environmental legislation. It aimed at protecting public health and environment from faecal pollution at bathing waters. The Directive was repealed by the Water Bathing Directive 2006/7/EC.

The Bathing Directive 2006/7/EC has been transposed in the Italian legislation with the Legislative Decree 116/2008 and Ministerial Decree 30/03/2010 which have substituted the previous Presidential Decree 470/82. The transposition of the Bathing Directive has introduced important elements in the management of bathing water such the reduction of monitoring parameters from 11 to 2, the introduction of a fixed calendar for monitoring and the introduction of a new methodology for bathing water quality assessment. For what concern participation the new legislation has improved the role of the communication and information and has put stress on the need of transparent information. Interestingly, all the water classified as sufficient, good and excellent are defined as bathing water. However, it is possible to assume that the different classification will have important consequences on the public and on the tourism economic sector especially if considered the increased role of information.

3.2 At which spatial scale?

The water quality issue is addressed mainly at National Level by the transposition of European Directives. However, the implementation is carried out at regional, provincial and municipality level.

3.3 Can you assess the results of the implemented policies? Which are the main results achieved? Which are the main limits and remaining problems?

The implementation of the bathing water Directive has involved drastic changes in the management of water resources. In particular the Directive has reduced the former 17 monitoring parameters to two microbiological parameters: *Escherichia coli* and Enterococci. Based on the Directive the assessment should be carried out each year at the end of the bathing season and be based on the monitoring results of the current bathing season as well as the ones of the previous three. Based on the results of the assessment bathing water will be classified as "*poor*", "*sufficient*", *"good"* and *"excellent"*. The first bathing water classification will be published in 2015. For this date all EU bathing water should be classified at least as sufficient.

In 2012 96.6 % of Italian marine bathing water was compliant with the Directive, with an increase of 4.8% respect to the previous year[17]. However, it should be noted that the reduction of the monitoring parameters strongly influence the classification of Italian bathing water quality.

3.4. On the basis of the ICZM principles (as they are expressed by the Protocol), do you think that the coastal issues were addressed with an integrated approach (in terms of organization, politics, sectors/thematic, tools, etc)?

The Directive 2006/7/EC fosters the adoption of an integrated approach, the coherence with the Water Framework Directive (2000/60/EC) and the improvement of water quality status. Also, the importance given to participation and the role of information for the management of bathing water quality highlights this approach. Furthermore, the Directive foreseen the preparation of bathing water profiles, which are the description of the physical, geographical and hydrological characteristics of the bathing water, and of other surface waters in the catchment area of the bathing water concerned, that could be a source of pollution. A system of bathing water profiles is considered appropriate to provide a better understanding of risks as a basis for management measures.

[17] Ministero della salute. http://www.salute.gov.it/portale/news/p3_2_1_1_1.jsp?lingua=italiano&menu=notizie&p=dalministero&id=1133

3.5 Is there an on-going National ICZM Strategy in your country?

An actual Italian ICZM National Strategy has not been defined yet. National ICZM activity is in an "organizing phase" in which the Ministry of the Environment, the Territory and the Sea, in agreement with Regions and Local authorities, is defining topics, time-lines and actors for the elaboration of a national ICZM Strategy. However, despite the lack of "ad hoc" planning and programming tools, there are several initiatives addressing the considered coastal issues, especially at Regional level. Emilia Romagna region for instance in 2005 developed guidelines for the implementation of an ICZM regional strategy.

For what concern the scale of the SubCASE of the Italian region of Veneto, there are no developed ICZM plan or guidelines but some legal instrument that should set the basis for ICZM policies.

The Regional law n. 15⁄2007 indeed promotes the protection, development of the coastal zone and the creation of Biological resources Protection Areas with the main objective of safeguarding the marine environment and fosters the repopulation of valuable fishery resources. Beside the focus on fishery Veneto Region has approved in 2012 a project[18] related to the study and monitoring of the coastal areas in order to set a series of action against erosion. Since 2012, thanks to international projects like SHAPE, Veneto is also promoting the development of a maritime spatial planning policy.

Section 4. PEGASO in relation to ICZM processes & initiatives

4.1 Do you think your work is relevant for the ICZM process of your country? Why and how?

The development of the short-term forecasting Beach health Advisory Model (BHAM) may support coastal municipalities in the management and monitoring of bathing water quality; the model reproduces the general pattern of bacteria dispersion under the scenarios characterizing local environmental forces (rain intensity, solar radiation and current velocities). Therefore, it can represent a useful tool for the management of the water quality issue, particularly relevant in coastal tourism sites.

Furthermore, under the Bathing Water Directive, the competent authority have to adopt adequate management measures, including surveillance, early warning systems and monitoring, with a view to preventing bathers' exposure, by means of a warning or, where necessary, a bathing prohibition.

Section 5. Stakeholders involvement

5.1 Stakeholder involvement - Have you involved the main stakeholders? Can you list them?

Regarding the Beach Health Advisory Model (BHAM), the following 6 public body stakeholders were actively involved as stakeholders:

- Veneto Region, Department of water protection

18 http://bur.regione.veneto.it/BurvServices/Pubblica/DettaglioDgr.aspx?id=244574

- Veneto Environmental Agency protection (ARPAV) –inland water office
- Veneto Environmental Agency protection (ARPAV) –coastal water office
- Municipality of Chioggia, Environment, Tourism and cultural activities office
- Chioggia Water treatment plant
- Water Basin Authority
- Chioggia tourism associations (only in a second phase).

5.2 How have you involved them (e.g. focus group, interviews, and questionnaire)?

The stakeholders identified for the Beach health Advisory Model (BHAM) were involved in two different occasions, first with direct interviews and then in a workshop. First stakeholders were contacted to start the consultation process. Out of six stakeholders contacted five accepted to take part to the interview. Due to the small number of experts contacted, the choice of the method fell on face to face **Key Stakeholder semi-structured interviews**. The objectives of the involvement of the stakeholders were the following:

- to gain comprehensive information regarding territorial characteristics;
- to validate/modify the parameters considered within the model;
- to obtain data and foster collaboration on further development of the model.

The interviews started with generic questions aiming at gradually leading the discussion towards attitude about bathing water quality issues and perceived most affecting factors. The questionnaire provided also a set of closed format questions, meant to probe more on technical aspects related to factors influencing the bathing water quality of the study area. Finally, the last part of the questionnaire was meant to ask for additional available data, further stakeholders to involve as well as willingness to collaborate to the next step of the model development. All the interviews were recorder and transcribed, they ranged between 2 hours and 30 minutes.
In order to show the results of the interviews and to discuss about the relevance and characteristic needed of forecasting models for water quality according to public bodies, a workshop was organized in Chioggia on 26.10.2012. Within this workshop, opened to the public, the PEGASO project and the SubCASE of the water quality forecasting model were presented.
After the presentations an Expert panel was carried out with the stakeholders already involved in the interviews and a representative of a local tourism organization. During the panel, the participants discussed about the role of a forecasting model and the needed features in order to be a useful tool for monitoring.

5.3 Which kind of constraints have you faced?

The constraints faced during the meeting regarded the difficulty to set specific objectives related to the involvement of the stakeholders.

If at the beginning the main objective was to gain more technical information to better develop the prototype of the model BHAM, at the end during the workshop the topic was extended to a general discussion on the role of forecasting models. Therefore, for what concern the improvement of the model, the participatory process was not successful, despite to the efforts of carrying on direct interviews, analyzing them and organizing a workshop.
However, for what concerns awareness raising and information objectives, the workshop can be considered a good results also considering the high level of attendance.

Section 6. Tools

The participation tool has been implemented in the development of the model BHAM. For further details about the tool of participation see Section 5. The BHAM model can be considered as an *ad hoc* tool developed in the subCASE. It includes four state variables, namely the number of particle-associated and free *E. coli* cells concentrations, and number of particle-associated and free Enterococci cells concentrations. The most important processes represented in the model are summarized in Figure 36: these include transport processes, such as longshore transport and turbulent mixing, and inactivation reactions.
Currently two indicators are determining if a coastal bathing waters are banned or not[19]:, E. coli cells per 100 mL, and Enterococci cells per 100 mL. However, according to the literature (Hipsey et al, 2005) it emerges that the interaction between faecal bacteria and inorganic particles influences the inactivation process of the former.

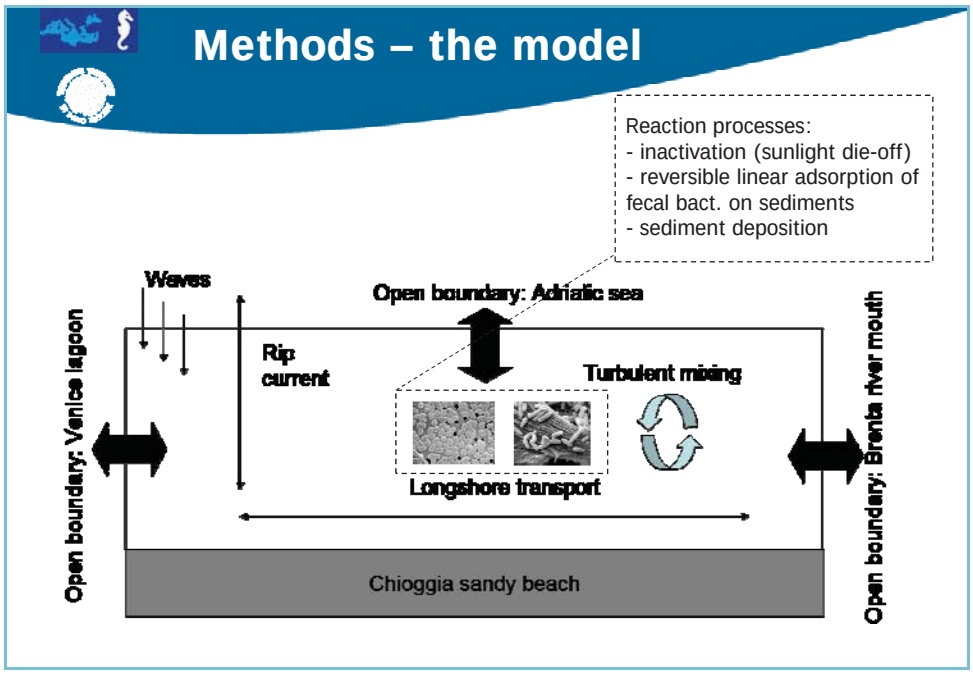


Figure 43. The physical and chemical processes represented in the BHAM model

[19] According to the recent Italian law D.Lgs n. 116 - 30 May 2008 and D.Min Sanità e Ambiente - 30 March 2010, both implementing EU directive 2006/7/CE

Section 7. Main results of CASES

7.1 Achievements

In the SubCASE a a forecasting model prototype for coastal bathing water was developed also with the contribution of expert stakeholders gained through interviews and a workshop. The involvement of the stakeholders allowed improving and extending the amount of information useful and available for the enhancement of the BHAM model prototype.
The involvement of stakeholders allowed also to collect interesting information regarding the relevance of forecasting model in the coastal management and other information site specific of the Sub Case, like the factors perceived as most affecting the quality of the seaside

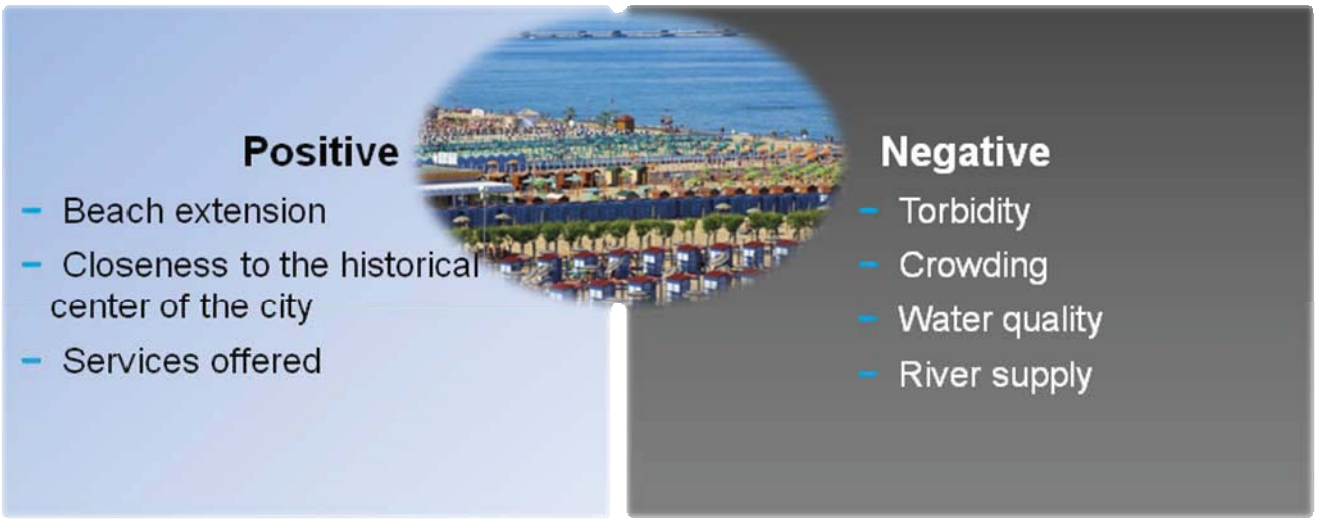


Figure 44: Factors perceived as the most relevant in determining the quality of the beach of Sottomarina di Chioggia are (Fig. 37).

7.2 Lesson learnt

The model proved to be a potential useful tool for forecasting pollution events, however, at present time it cannot be yet considered a predictive tool capable to support decision makers for the bathing water management, because of the following issues:

- Scarcity of data: the tuning of the model on a large scale would have required expensive and long input data collection. Such expenditure, proportional to the extension of the area to monitor, could not be afforded. The data collected by means of different monitoring activities and research programs were not homogeneous and resulted not suitable for the development and calibration of the model.

- Implementation of public participation: The interviews and the meeting organized with the stakeholders contributed to share the work done in Ca' Foscari University regarding monitoring system. Moreover, the process raised the stakeholder awareness regarding their role and importance, (several stakeholders showed availability and interest in the participation process) and provided useful information for a further development of the model. The organized forum confirmed the importance of the monitoring activities and the need of stochastic models for forecasting and managing pollution short-term events.

However, both the interviews and the workshop have pointed out the relevance of the following elements in order to make the participatory process fully effective:

- An earlier involvement of stakeholders since the phase of conceptual development of the model: our exercise was rather organized in an episodic form, due to the difficulty in matching stakeholders and researches availability.
- Moreover, it is worth to say that organising a participatory process is time consuming and resources demanding. During a research project the aims and structure of the participatory process should be clearly defined and agreed since the beginning between the researchers and the team responsible for the organization of participatory process. If these conditions are not met the process and the outcome will not be satisfactory for both parts.

References

Hipsey, M.R., Brookes, J.D., Regel, R.H., Antenucci, J.P., Burch, M.D. (2005), "In situ evidence for the association of total coliforms and Escherichia coli with suspended inorganic particles in an Australian reservoir", *Water Air Soil Poll*., 170, 191-209.

C) Network of Marine Protected Areas and ICZM
Section 1 Coastal issues
1.1 The main coastal issues considered

In order to improve the protection of natural resources and the individual ecological relevance of a Marine Protected Area (MPA), networks of MPAs are advocated as a needed tool by several international agreements like the Convention on Biodiversity.
The North Adriatic is one of the most productive fishery basin, it hosts high biodiversity and at the same time it is one of the most threatened ecosystem worldwide due to pollution and overexploitation of its natural resources (Camuffo *et al*., 2011); the North Adriatic sea represents a particular case with several direct sea uses, such as marine transport, offshore platforms, submarine cables, hydrocarbon survey, fishing, aquaculture, scientific research and tourism, and indirect uses often conflicting among them (Soriani, 2003). Despite such a sensitive and threatened environment, Italy Slovenia and Croatia provide a protection for marine and coastal waters that is less than the 0,5% of the Northern Adriatic sea. Eight MPAs were identified in the North Adriatic among Italy Slovenia and Croatia. In order to understand if and how Integrated Coastal Zone Management (ICZM) principles are implemented in the MPAs management and how the 8 MPAs are collaborating and communicating among them, Ca' Foscari carried out a survey addressed to a selection of 18 relevant stakeholders.
Section 2 Relations between coastal issue and ICZM Protocol and principles

2.1 How do the selected coastal issues relate to the ICZM principles and protocol? When possible and appropriate, refer to the relevant Articles of the Protocol.

In this SubCase a survey was developed to investigate the two main issues of the development of a transboundary MPAs network and the relation of ICZM in the management of MPAs.
The development of a transboundary MPAs network in the North Adriatic requires communication and coordination among MPAs managers, exchange of good practices, collaboration at different levels concerning training, research and other common activities, involvement of all those bodies and organization that are influenced by or influencing the activities of MPAs. Therefore, the identified coastal issues relate to the following ICZM protocol articles: art. 7 (Coordination), art. 14 (Participation), art. 15 (Awareness-raising, training, education and research), art. 16 (Monitoring and observation mechanism and network),art. 25 (Training and research), art. 27 (Exchange of information and activities of common interest) and art. 28 (Transboundary cooperation).

For what concerns the part of the survey addressed directly to the MPA managers, the principles of the following ICZM protocol articles were adapted to set objectives to analyse the management of MPAs as shown below:

- **Economic activities** (art. 9): how a MPA promote sustainable economic activities within its area and its surroundings.
- **Participation** (art. 14): Verify the level of involvement of
  - the territorial communities and public entities concerned;
  - economic operators;
  - non-governmental organizations;
  - the public concerned.
- **Awareness raising, training, education and research** (art. 15): analyzing the typology of activities carried out by the MPA.
- **Monitoring and observation mechanism and network** (art. 16): the exchange of information and data among MPAs and among MPAs and other stakeholders.
- **Coastal strategies, plans and programmes** (art. 18): verifying the existence and application of a management plan or similar document and analyzing the hindrances in applying it.
- **Training and research** (art. 25): the participation of MPAs staff in training and research activities.
- **Transboundary cooperation** (art. 28): investigation of the different level (sub-national, national and international) of involvement of MPAs in the development of plans and programmes related to ICZM.

Section 3. Policies issues and ICZM principles and approaches
3.1 So far, how have been the coastal issues addressed by the local/regional/national government?

So far the development of network of MPAs in the North Adriatic has not been promoted in a sufficient way by national governments. The interest in developing these networks relies at the international level (e.g. the Convention on Biodiversity, (CBD) and at European level (DG Mare within the Adriatic Ionian Initiative). While a top down commitment is still weak, from a bottom up point of view, the setting up of the network of MPAs managers named Adriapan has allowed several MPAs to join a network mainly aimed at gaining expertise and funds to apply for European calls for projects.

3.2 At which spatial scale?
The development of MPAs network in the North Adriatic is mainly promoted by agreements at international level (i.e. CBD) and at the European level some directives implemented at national level, regard the protection of biodiversity. The Birds Directive 1979/409 EC and the Habitat Directive 1992/43/EC are the main European tools for biodiversity conservation. The Habitat Directive 1992/43/EC established the Natura 2000 network of protected sites and promotes the maintenance of biodiversity, taking into account economic, social, cultural and regional requirements.

3.3 Can you assess the results of the implemented policies? Which are the main results achieved? Which are the main limits and remaining problems?

The CBD request of establishing new marine protected areas in order to preserve and protect biodiversity in the North Adriatic sea is still far to be fulfilled: only 0,5% of the North Adriatic sea is now under protection while the new target of 2020 is 10%. At the moment there are just 8 marine protected areas in the basin while the fishery stock in the North Adriatic is currently depleting. MPAs are too few and too small to allow them to work in synergy with other MPAs to efficiently protect the coastal and marine resources.

3.4. On the basis of the ICZM principles (as they are expressed by the Protocol), do you think that the coastal issues were addressed with an integrated approach (in terms of organization, politics, sectors/thematic, tools, etc)?

One of the aim of this Sub-CASE is indeed trying to verify if and how the MPAs in the North Adriatic are implementing the principles of ICZM in their management. Another result is related to the analysis of the limits of the development of a transboundary network of MPAs: the lack of interest from National Governmental level, the lack of coordination and communication with the management bodies are indeed considered by the stakeholders involved in the survey as the main hindrance for the successful development of a MPA network.

3.5 Is there an on-going National ICZM Strategy in your country?

In 2002 the European Council and Parliament adopted a Recommendation concerning the implementation of ICZM in Europe (2002/413/EC), inviting coastal Member States, Accession and Candidate countries to develop national strategies to implement ICZM. At the Mediterranean level, by the end of 2012, the ICZM Protocol – requiring the development of a national coastal strategy- was ratified by 8 Mediterranean countries: among them European Union, Slovenia, Croatia. Therefore the three North Adriatic countries (including Italy as part of the EU) are all asked to develop an ICZM National strategy. Despite the Recommendation and the Protocol, so far no ICZM national strategy is under development in any of the three countries.

Italy

In Italy, while at national level an ICZM strategy is still under development, at sub national level several initiatives have been carried on by some Italian Regions. For what concerns the North Adriatic, the most notable ICZM experience is represented by Emilia Romagna, the first Italian Region to set regional guidelines for ICZM in 2005, now extended to the marine environment. The integrated approach of the management of the coastal area in Emilia Romagna regards mainly the physical protection of the coast from threats like erosion and subsidence and the safeguard of the natural resources.

Slovenia

In Slovenia, the implementation of what is considered equivalent to an ICZM strategy is ongoing. Since the coastal length of Slovenia is just 40 km, ICZM issues are incorporated into the Regional Development Strategy for South Primorska, firstly developed in 2002 and then revised in 2007 and in the Coastal Area Management Programme Slovenia (CAMP Slovenia). Several spatial planning legal instruments (e.g. 2011 Spatial Planning Act, 2002 Waters Act) are in force concerning the coastal waters even though maritime spatial planning in not specifically regulated.

Croatia

At present, Croatia has not developed any ICZM strategy or a similar specific legal framework regulating coastal zone management. However in the Croatian legislation[20],according to the Regulation on Management and Protection of the Protected Coastal Area adopted in 2004, the protected coastal zone was established and it was defined as an area of 1,000 metres from the coastline landwards and 300 metres from the coastline seawards, including all islands. The new Physical Planning and Building Act (PPBA), in force since October 2007, incorporated most of the provisions of the Regulation.

Still, there are several laws and regulations that sectorally deal with coastal zone management (e.g. Nature Protection Act, the Environmental Protection Act, the Maritime Domain and Seaports Act). For what concerns the strategies, among others there can be found the Spatial Planning Strategy and the Programme, the National Programme for Island Development, the National Strategy for Environmental Protection, the National Environmental Action Plan. Finally the Marine Protection Strategy is currently under preparation.

Section 4. PEGASO in relation to ICZM processes & initiatives

4.1 Do you think your work is relevant for the ICZM process of your country? Why and how?

The analysis of the management of MPAs under the lens of some principles of ICZM can help understanding whether MPAs in the North Adriatic can really be considered a laboratory for ICZM implementation, underlying which aspects of the management have pursued the principles of the ICZM Protocol. The analysis therefore encompass the territorial competences of a single country and focus on the the network of MPAs in a transboundary scale.

4.2 On the basis of the work that you have done, which are in your opinion, the main constraints in implementing ICZM principles and tools? What is missing? Where are the main gaps? Where we should put more energy and resources in the future?

According to the opinion of the stakeholders interviewed the main constraints are related to

[20] http://www.iddri.org/Publications/Publications-scientifiques-et-autres/121203_publi%20GIZC%20Mediterran%C3%A9e_Croatie_EN.pdf

the difficulty in the translation of the general ICZM principle into realty of management. It seems that ICZM still stands at a rhetorical level without finding a confirmation in practice. Since in this subcase we have applied only the participation tools, we have not really faced remarkable obstacles.

Section 5. Stakeholders involvement

5.1 Stakeholder involvement - Have you involved the main stakeholders? Can you list them?

For the SubCase regarding Marine Protected Areas, several stakeholders were involved including MPAs managers, Environmental Ministries, Environmental NGOs, International and national agencies, network of MPAs. The identification of the stakeholder was carried out by applying snowball technique, involving those bodies and organisations that for their competences and experiences are related to the issue of the network of MPAS in the North Adriatic, therefore not taking in account those bodies that are involved just with one MPA alone. The following table 9 lists the 18 stakeholders involved in the survey.

Table 16. Stakeholders involved in the Survey

	Name	Description
1	Tegnúe di Chioggia	Biological resources Protection Area (Italy)
2	Tegnúe di Porto Falconera	Biological resources Protection Area (Italy)
3	Miramare	Marine Reserve (Italy)
4	Debeli rtič (DR)	Nature Monumentum (Slovenia)
5	Cape Madona (CP)	Nature Reserve (Slovenia)
6	Strunjan	Nature reserve (Slovenia)
7	Brijuni	Natural Park (Croatia)
8	Cres-losinj	Special marine reserve (Croatia)
9	Slovenian Environment Ministry	Slovenian Ministry of Agriculture and Environment - Water Department of Slovenia
10	SINP	Croatian State Institute for Nature protection
11	DG MARE	European Directorate General for Maritime Affairs and Fisheries
12	PAP-RAC	Mediterranean Priority Actions Programme/Regional Activity Centre
13	SPA-RAC	Mediterranean Regional Activity Centre for Specially Protected Areas
14	Adriapan	The Adriatic Protected Areas Network of Marine Protected Areas managers
15	Federparchi	The Italian Federation of Parks and Nature Reserves,
16	IUCN	The International Union for Conservation of Nature
17	WWF MedPo	WWF Mediterranean Programme
18	SUNCE	Croatian Association for Nature, Environment and Sustainable Development

5.2 How have you involved them (e.g. which methods have you used)? Please refer to the guide Participatory methods for ICZM implementation.

Stakeholders were involved by means of **Key Stakeholder interview** and they were selected also applying **Snowball sampling technique**. Interviews followed a semi-structured format: six were carried out face-to-face and twelve carried out over the phone or by internet calls from January to May 2013. The interviews addressed 11 questions to all the stakeholders and further 14 questions only to the MPAs managers. The average length of the short interviews was 40 minutes while the longest interviews required averagely 90 minutes.
The 11 questions addressed to all the stakeholders were meant to investigate the existing communication and collaboration flow among the stakeholders and the perception about:

- The relevance of a network of MPAs in the North Adriatic.
- The possible ways to improve the MPAs efficiency in the basin.
- Existing constrains that could slow down the process of the establishment of the MPA network in the North Adriatic.
- The expected advantages of an MPA network for the North Adriatic.
- The perceived usefulness of the Integrated Coastal Zone Management for MPAs.

Further 14 questions were addressed only to MPA managers in order to understand if and how MPAs in North Adriatic are applying the main ICZM principles. The considered issues for the questions were taken from the analysis of the more relevant articles of the ICZM protocol (UNEP MAP ,2008)for MPAs.

All interviews, done both on site and on internet, were recorded and transcribed; finally transcriptions were asked for approval from the interviewees. The data gained from the interviews were used as an input both for a social network analysis (Faust and Wasserman, 1994) and a content analysis (Silverman, 2006).

5.3 Which kind of constraints have you faced?

The constraints regarded mainly the difficulty in contacting stakeholders, especially at Ministry level. For reasons of lack of time and resources it was not always possible to interview on site all the stakeholders. When feasible, managers of MPAs were interviewed directly at their workplace.

Section 6. Tools

This particular subCASE consisted in a survey: therefore the only tool applied was the participation, described in detail in Section 5.

Section 7. Main results of CASES

7.1 Achievements

The results of the survey are presented in this section. First the results regarding the knowledge and perception of ICZM are shown and then the results of the survey exploring the relation between ICZM principles and MPAs management are described.

Perception of ICZM of the 18 stakeholders.

As shown in Fig.38 the majority of 18 respondents (about the 61%) knows ICZM at least enough and a low knowledge level ("on average" and "not at all" answers) is mainly related to the practical application of the theory of ICZM. It emerges, indeed, a lack of confidence in the applicability of the principles of this kind of coastal management, perceived as complicated and hard to reach.

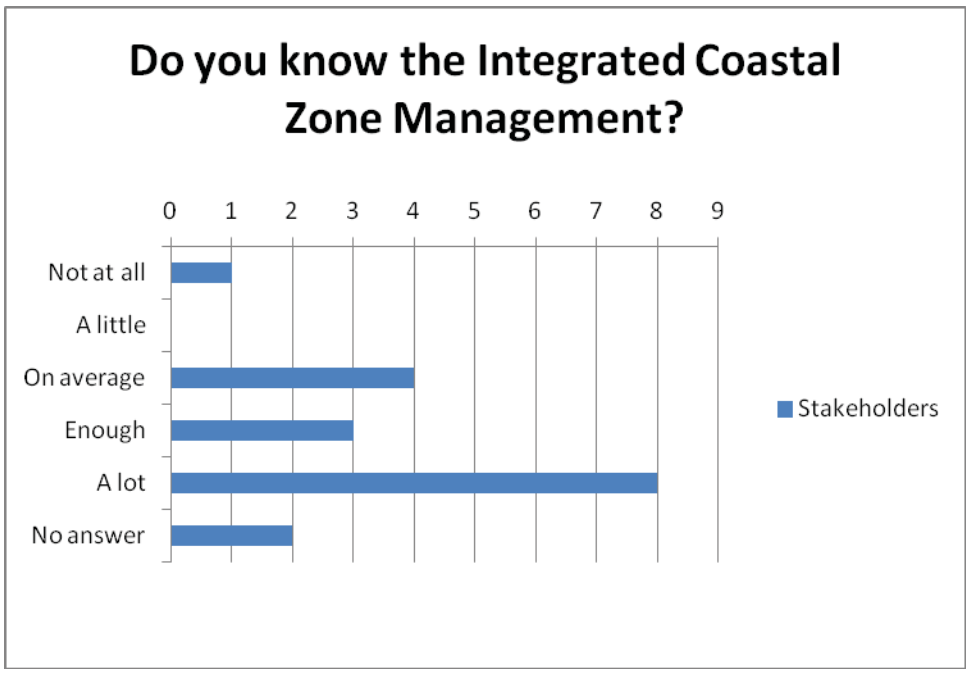


Figure 45. Bar Chart showing the knowledge level of ICZM of the stakeholders

When asked about how ICZM can improve the efficiency of MPAs, respondents supplied a plethora of options (Fig.39). Implementing ICZM principles in MPAs management is seen mainly as an opportunity to ensure that coastal and marine resources are effectively protected; moreover ICZM can enhance the involvement of different stakeholders (public agencies, economic sectors, NGOs) in the designation and management of MPA and in the communication and collaboration process; finally implementing ICZM could rise the relevance of MPAs and nature conservation in the spatial planning.

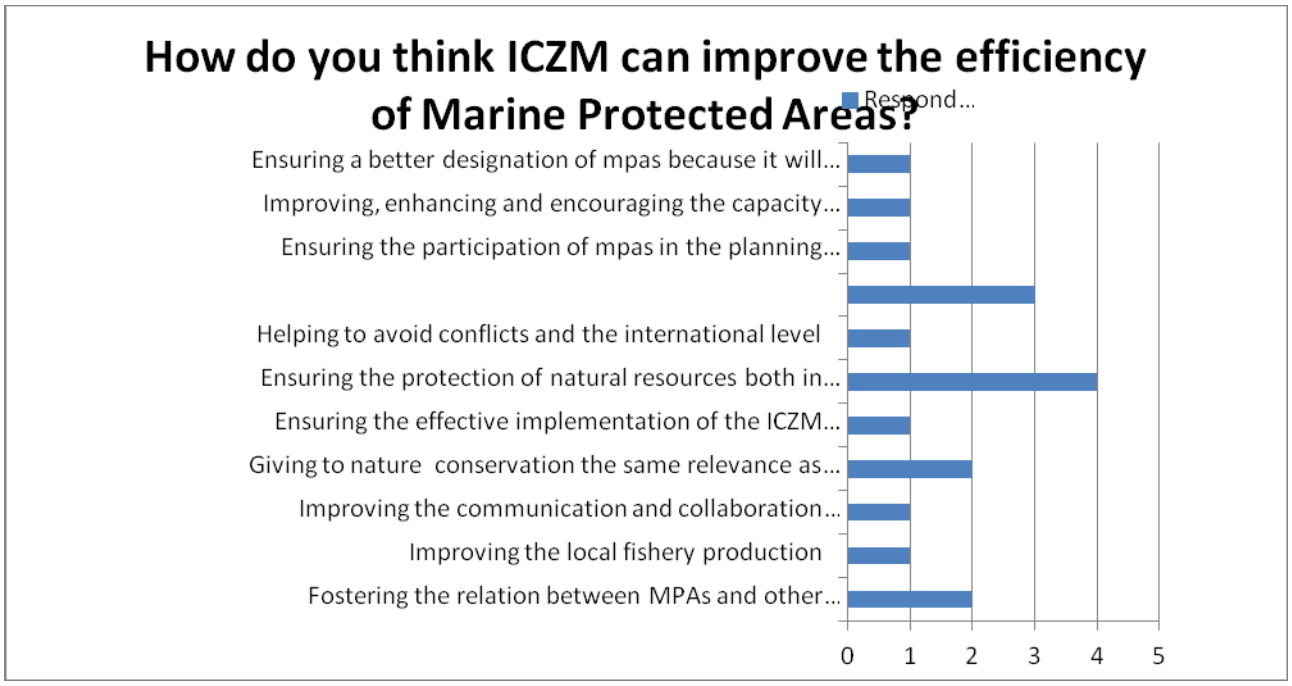


Figure 46. Bar chart about the way ICZM can improve MPAs efficiency

ICZM and MPA management

This results regard the analysis of the link between a selection of ICZM articles and the management of MPAs in the North Adriatic. The seven MPAs management bodies of Chioggia, Porto Falconera, Miramare, Debeli rtič (DR) and Cape Madona (CM), Strunjan, Briijuni, Losinj were addressed by a series of questions aiming at verifying whether and how ICZM principles are applied in the MPAs management. The analysis of the answers, presented in bar charts and commented, refer to questions linked to the ICZM protocol article.

Coastal strategies, plans and programmes (art. 18)

The article about the development of a strategy, a plan and programmes was adapted to investigate the presence of a Management Plan in the MPA. As shown in the Fig. 40 below, at present in the North Adriatic, over 8 MPAs, only Miramare has developed and applied a management plan. Brijuni and Strunjan are developing their plan while Chioggia (even though not officially a MPA) has developed a similar document. There are no management plans or similar documents in Losinj, Falconera, DR and CM.

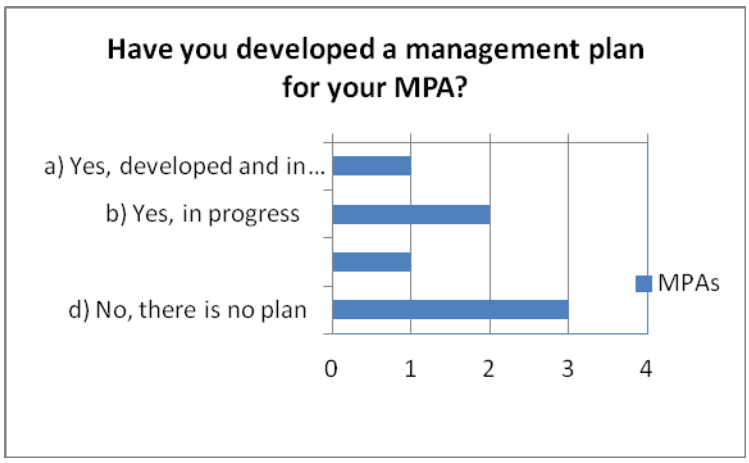


Figure 47. Bar chart about the development of management plan in the MPA

From the survey it emerges that several obstacles are holding a management plan back to be developed or applied. As shown in Fig.41, the lack of resources, both human and financial together with the lack of communication among local authorities are considered the main constrains.

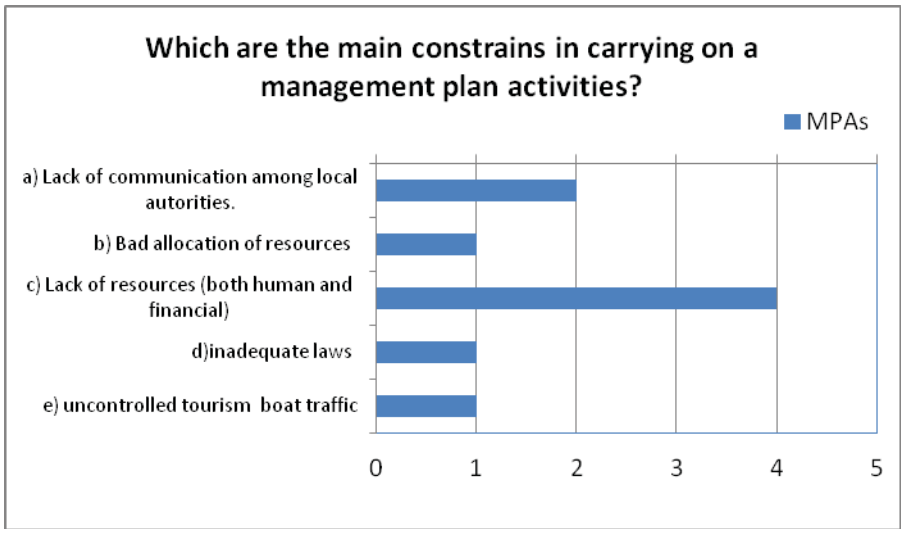


Figure 48. Bar chart about the constrains affecting the implementation of the management plan

Monitoring and observation mechanism and network (art. 16)

Article 15 was adapted to MPAs management focusing on the aspect of the monitoring and evaluation of the management plan. As shown in Fig.42 Activities carried out in the management plan are evaluated only in Miramare MPA while in Chioggia this activity used to be carried out in the past but not anymore. In Brijuni the monitoring and evaluation of the activities is foreseen to be carried out in the next years.

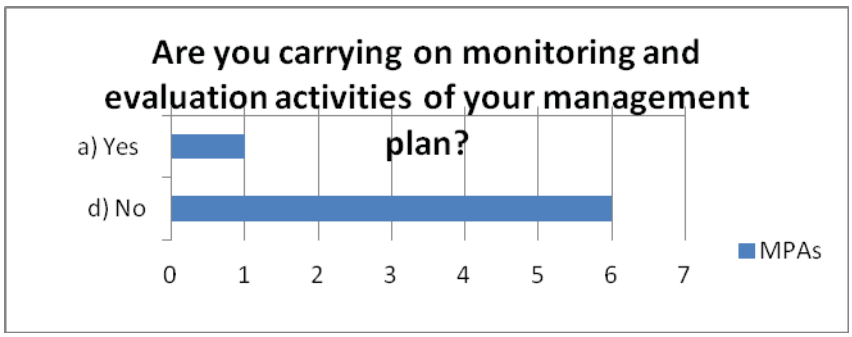


Figure 49. Bar chart of the MPAs that are carrying on monitoring and evaluation of their management plan

Participation (art. 14)

Participation is a really relevant issue for a successful management of MPA. Referring to the article 14 of the ICZM Protocol, a series of questions were addressed to the MPA managers to understand: if stakeholders of the MPA have been identified and involved in the management and/or other activities of the MPA; which participatory methods were used to involved them; if the participatory process results were evaluated.

All MPAs of the North Adriatic have carried out a stakeholder analysis , mainly in a formal way, one in an informal way (Falconera) and DR and CM only during the establishment phase (Fig. 43).

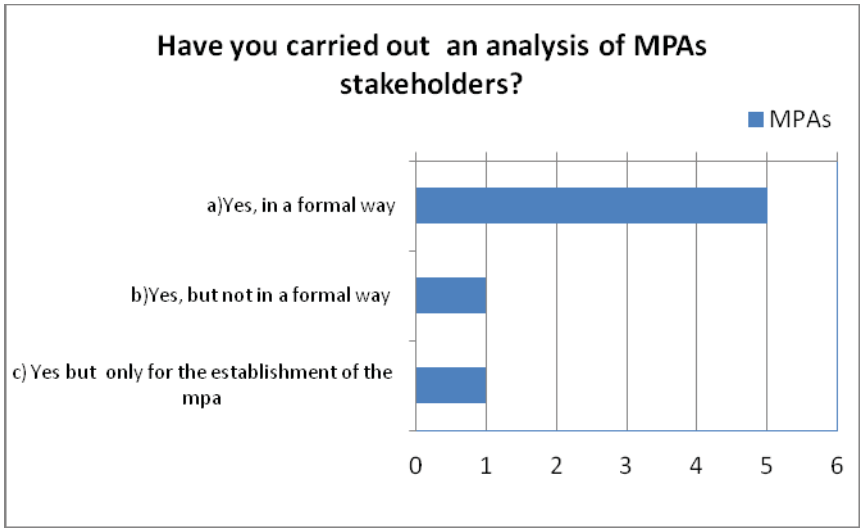


Figure 50. Bar Chart about the development of a stakeholder analysis in the MPA

The stakeholders identified by MPA managers are mainly fishermen, local municipalities, Port captain offices, diving clubs and Hotel managers (as shown in Fig.44)
Among less frequently cited stakeholders ("other" in Fig.44) there can be found: Environmental NGOs, Local banks, tourism agency and other public bodies.

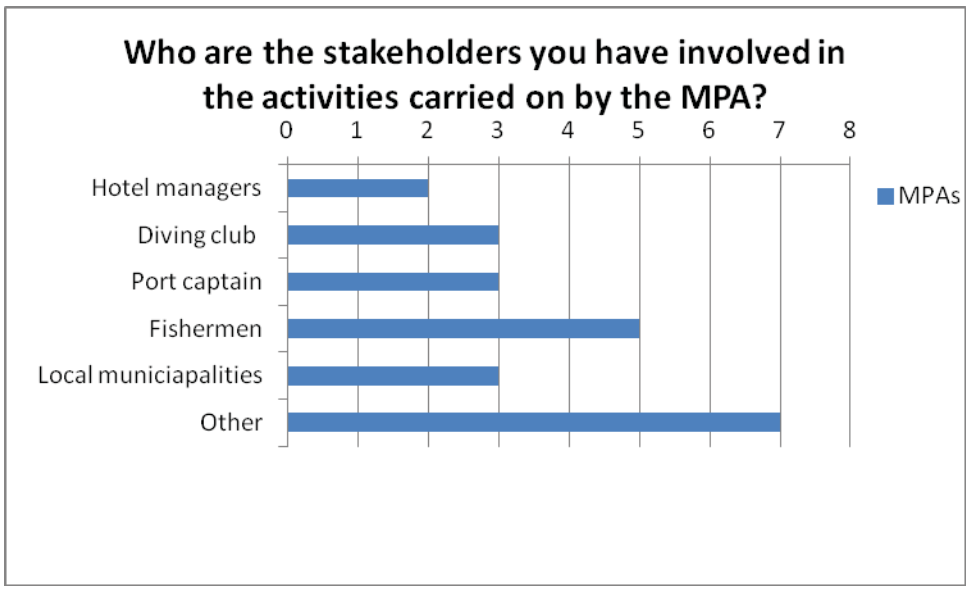


Figure 51. Bar chart of the stakeholders involved in the activities of the MPA.

Stakeholders can be involved in different way, applying participatory methods or can be contacted and informed by means of different communication tools.
As shown in Fig.45 MPAs are mainly active in carrying out information campaign to sensitize the general public to the issues related to the single MPA. Also public hearings are organised to spread the information together with education activities. In order to actively involve stakeholders, Focus groups are the participatory method applied the most.

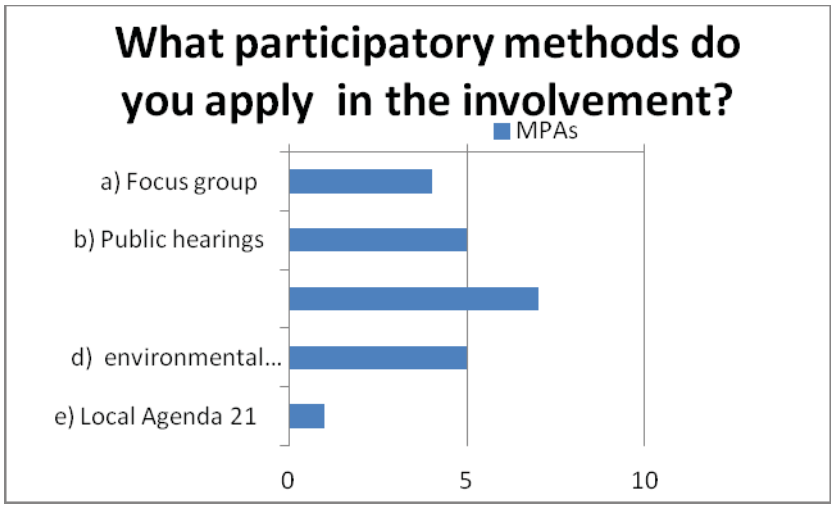


Figure 52. Bar chart about the communication and participatory methods applied in the involvement of stakeholders

Participatory events are evaluated in a planned way just by 3 MPAs mainly by means of evaluation questionnaires. In 5 management bodies of MPAs over 7 there is staff competent in participatory process due to a training or due to experience gained on field. Stakeholder involvement is planned within a programme only in Chioggia and Miramare and it concerns environmental educational activities; occasionally Miramare organizes information campaigns. Stakeholder involvement is not carried out by 2 MPA management bodies in Slovenia while the remaining MPAs hardly ever do apply a stakeholder involvement (Fig.46)

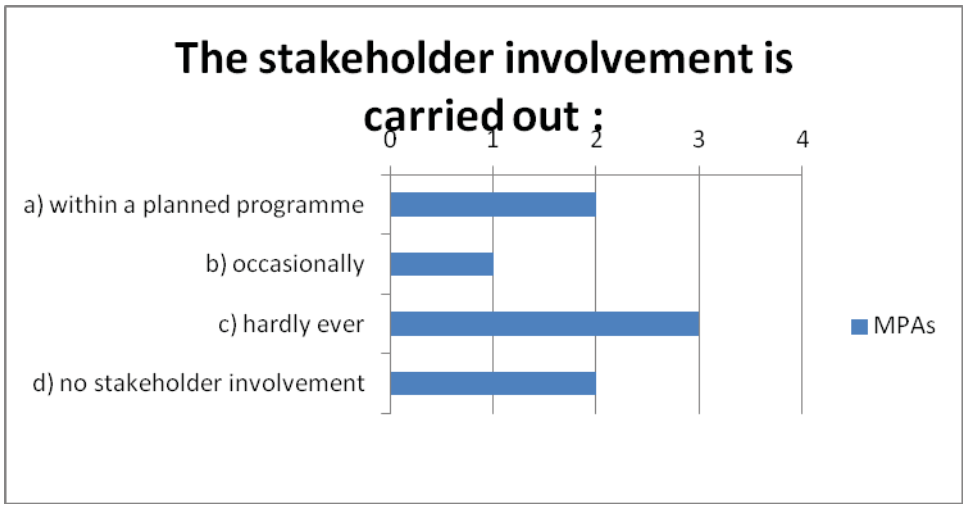


Figure 53. Bar chart about the frequency of the stakeholder involvement in MPAs

Economic activities (art. 9)

Several economic activities exist outside the MPA: the presence of the MPA can lead to conflict with these activities but it can also represent a benefit for them. These two aspects were therefore explored. As shown in Fig.47 the main economic activities representing a conflict with the objectives of the MPAs are boating and fishing. In particular artisanal fishing and recreational boating emerge as the most problematic ones. Building – often without planning permission- around the MPAs borders represent also a hindrance.

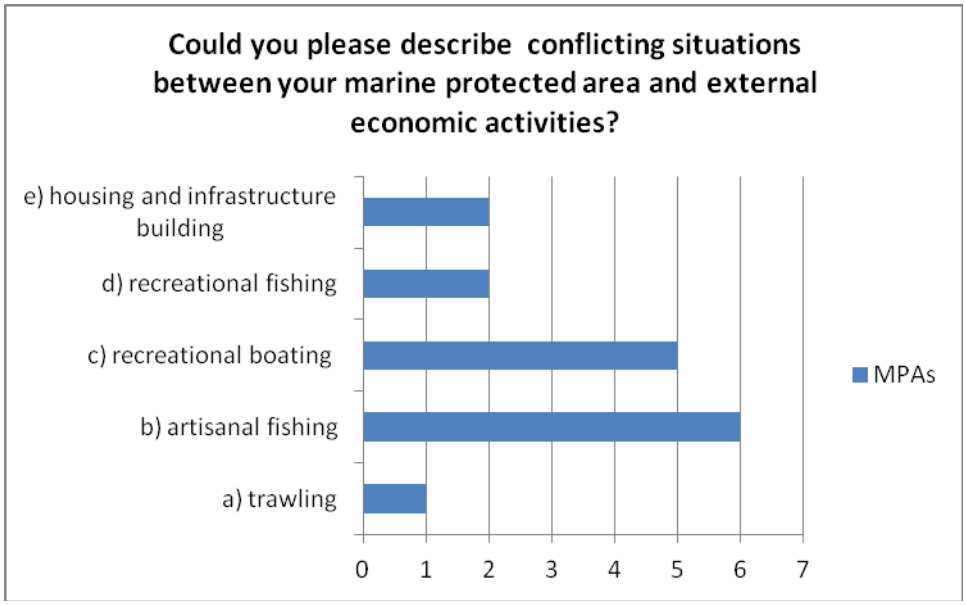


Figure 54. Bar chart about conflicting economic activities with MPA.

Economic activities can also profit from the presence of the MPAs (see Fig.48). Hotel managers are recognised as the category that is gaining more benefits due to the proximity to a natural protected area perceived as an added value by customers. The image of a better

natural environment ensured by the presence of a MPA is also exploited by farmers and tour operators. Diving groups are also profiting from the existence of a preserved environment as well as the fishery sector that can get an higher catch around MPAs.

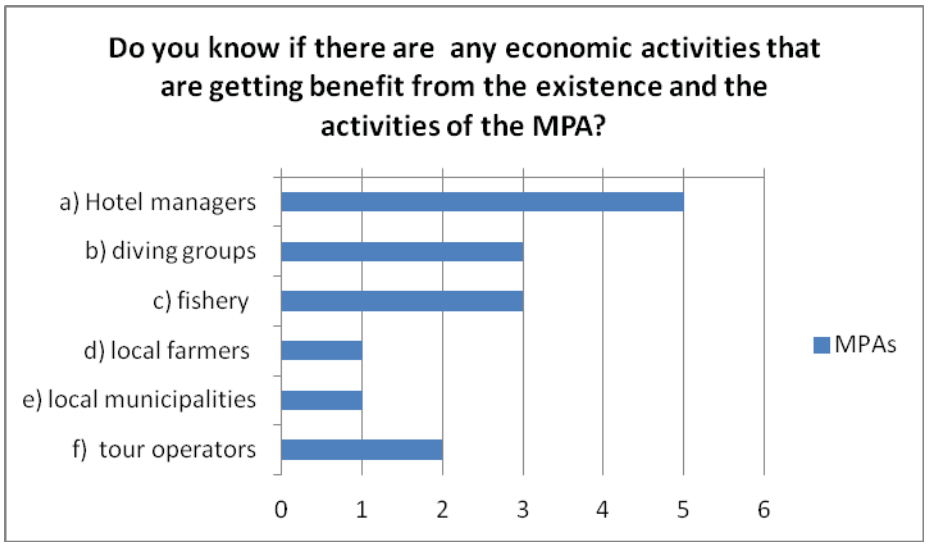


Figure 55. Bar chart about the economic activities gaining benefits from the existence of the MPA.

Awareness raising, training, education and research (art. 15)

This part of the survey was meant to investigate what kind of activities are carried out in the MPAs for what concern the awareness raising, training, education and research.

Awareness campaigns are carried out in almost all the MPAs. Awareness activities are mainly made through public hearings and the distribution of leaflets and the installation of boards.

Environmental education is carried out through classes outside the MPA in 4 cases, namely Chioggia, Falconera, Miramare and Brijuni. Lectures are proposed within the MPA by Miramare, Strunjan and Losinj.

For what concern the **research**, monitoring is the main activity carried out in 5 MPA management bodies over 7.

Training for internal staff regards mainly scuba diving courses and refreshing courses for guides. Just 3 MPAs offer at least one of these kind of training.

For what concern the training also open to an external staff or to the public, every MPA offers different solutions: a training for Scuba divers offered by Chioggia and Falconera, a training for MPA management offered by Miramare, workshops for the identification of local species (Strunjan) and a training on biological research (Losinj).

Training and research (art. 25)

Training can regard also internal staff involved in courses outside the MPA. From the survey it emerges that when MPA staff is busy in training outside the MPA, this is depending on the

possibilities offered by specific project that often provide training on different topics related to MPAs.

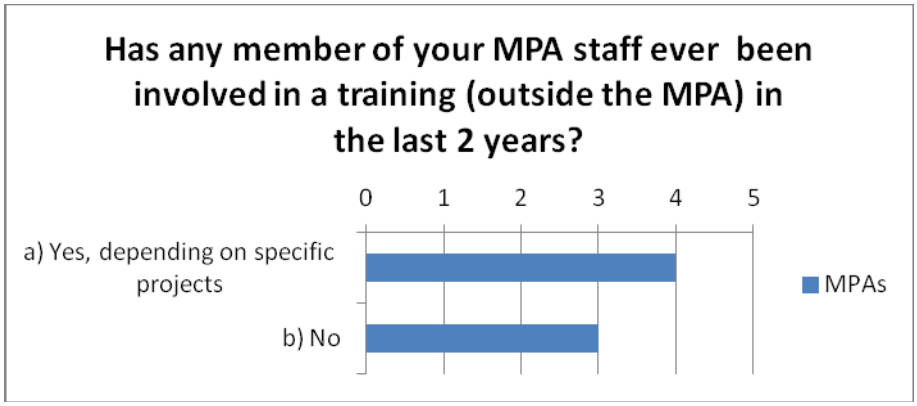


Figure 56. Bar chart about the involvement of the MPA staff in training outside the MPA

Transboundary cooperation (art. 28)

Transboundary cooperation was here intended as the the involvement of an MPA as a stakeholder in the development of plans, strategies and programmes related to the coastal zones in which the MPA is located, at local, subnational and international level.
All MPAs are involved in some activities regarding spatial planning for the coastal area.
Going into details, at subanational level, Chioggia and Falconera management bodies are involved in the Veneto "Sea commitee", a a public regional body aimed at the safeguard, protection and repopulation of fishing resources defining actions to be taken over fisheries and marine tourism sectors, was instituted. Falconera has collaborated with the Coast action Groups (GAC)[21], and covered a consultancy role for the designation of a biological protected area. Miramare is taking part to the Adriatic Ionian Initiative, a regional cooperation of the Ministry of Foreign Affairs of the coastal countries in the Adriatic. DR and CM together with Strunjan were participating to a forum for the planning of a gas terminal. Strunjan was also involved in the development of spatial plans of two local municipalities. Brjiuni was involved in the establishment of a new agency for the national parks management in Croatia while Losinj was involved in the establishment of a Ecologically or Biologically Significant Marine Areas (EBSA) in the North Adriatic; Involved in the Mediterranean conservation group

[21] Local partnership of Municipalities, other public agenciese an fishery sector representatives aimed at the development of a sustainable fishery harmonized with other economic sectors like tourism and the natural resources protection.

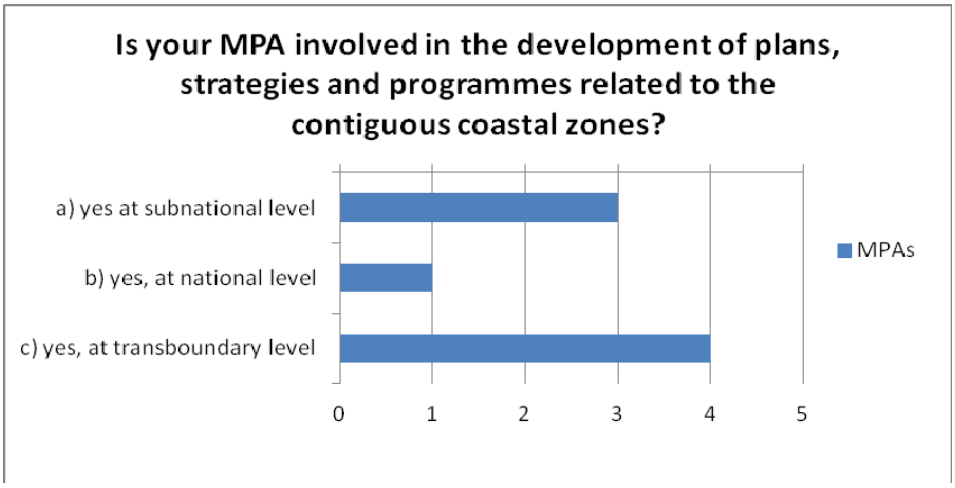


Figure 57. Bar chart about the involvement of MPAs in other strategies and programmes for the coastal zones.

7.2 Lesson learnt

Weak points:

- ICZM is still perceived at a rhetorical level: it is known in theory but very little is appreciated in its application in realty.
- Lack of resources: MPAs are facing difficulties in carrying on their daily activities due to lack of funds and human resources
- Lack of implemented plans: management plans are not yet implemented in the majority of MPAs, and stakeholders even if identified are not properly involved in the activities of MPAs.
- Weak interest at ministry level: it emerges a lack of collaboration between MPAs and national ministry level.

Opportunities:

- Collaboration among MPAs: there are many bottom up initiatives (manly coordinated by Adriapan network) that are working on collaboration on projects funded mainly by the European Union.
- Other international experiences involving the Adriatic Countries like the Adriatic Ionian Initiatives and the Adriatic Ionian Macroregion can help the process of finding common and shared transboundary policies for coastal zone management in the Adriatic

D) The analysis of ICZM implementation at the Italian subnational level in the North Adriatic.

In this SubCASE a survey was addressed to four North Adriatic Italian regions (i.e. Marche, Emilia Romagna, Veneto and Friuli Venezia Giulia) stakeholders (Regions, Provinces, Land reclamation authorities, River basin Authorities and coastal municipalities) in order to clarify whether and how Integrated Coastal Zone Management (ICZM) is spreading in the Italian North Adriatic Sea. The survey - conducted through an online questionnaire- was meant to observe the adoption stage of a series of actions in the coastal zone management.

Section 1. Coastal Issues:
1.1 Why did you select the identified coastal issues?

ICZM is considered to be an integrated approach for the sustainable management of coastal zones. As a process of organisational, political and social change regarding the way natural resources are managed and different coastal uses are harmonized, it consists in a set of principles, approaches and tools aimed to contribute avoiding the problems caused by traditional and short-sighted sectoral approaches and policies.
However, while from the theoretical point of view ICZM can be regarded as a set of principles and approaches more effective, compared to sectoral ones, in addressing the need for sustainability in coastal zones, from a practical point of view ICZM risks to be perceived as a set of recommendations and suggestions that are very complex and difficult to be translated into practice. In this perspective, to consider if, and how, ICZM initiatives and efforts are adopted, and to clarify what are the most important conditioning factors in ICZM implementation remains of basic importance.

Therefore, this particular PEGASO sub CASE aims to examine whether ICZM approaches, initiatives and plans/programs are progressing in the Italian North Adriatic Regions (ranging from South to North, Marche, Emilia Romagna, Veneto, Friuli Venezia Giulia). For this purpose, there has been an investigation of the level of adoption of a set of "coastal actions", that represent the core of coastal management and reflect how it evolves over time, through a web-based questionnaire aimed at measuring the "progress indicator"[22]. Essentially, this analysis has tried to answer the following questions:

- in what ways the need for promoting ICZM is addressed in North Adriatic coastal regions?

[22] The research has been carried out through a direct qualitative survey based on the document "*Measuring Progress in the Implementation of Integrated Coastal Zone Management - Guidance notes for completing the Progress Indicator*" by the Working Group on Indicator and Data (WG.ID, 2004), which represents the guide for the realization of the "Progress Indicator". This qualitative indicator, produced by the same group of experts, aims to provide the EU State Members (in accordance to the Recommendation 2002/413/EC) a tool for assessing the level of ICZM implementation in a certain place and time.

- What are the main actions that have been recently adopted to sustain ICZM efforts?
- Is ICZM implementation improving in the considered area?
- What are the main conditioning factors that still hamper the process towards the adoption of more integrated approaches in coastal management?

The relevance of this issue relies on the following elements: firstly, the North Adriatic coastal zone is a very delicate and fragile physical environment, due to its distinguishing features; moreover, it hosts coastal ecosystems which remain, in spite of XX's century process of degradation, of great ecological value, like the the system of coastal lagoons and wetlands (ranging from Grado, Friuli Venezia Giulia Region, to Comacchio, Emilia Romagna Region), the Lagoon of Venice, the Po Delta, etc.
Secondly, this coastal region is under immense socio-economic pressure for development and exploitation, mainly for residential development, tourism, port and energy infrastructures. The framework of coastal and marine uses is therefore very complex, and many conflicts characterise the social context.
Thirdly, in comparison to the complexity of the coastal system dynamics, as resulting from interactions between natural and socio-economic components (with the latter more and more dependent upon global trends), the environmental and territorial planning framework appears to be extremely poor: on the one hand, integrated coastal management in Italy has never found, from the National Government, the attention it required; on the other, the entire legal and administrative system which orientates environmental management suffers from fragmentation, poor coordination, conflicts in competences. In few words, the system of environmental governance is very often driven by the "good willingness" of municipal and regional authorities, suffers from short-sighted perspectives, and hardly can oppose successfully the economic interests that tend to overexploit coastal resources for short term benefits.

Section 2. Relations between coastal issues and ICZM Protocol and Principles.
2.1 How do the selected coastal issues relate to the ICZM principles and protocol?

This coastal issue, related to the analysis of the implementation of the policies and initiatives regarding ICZM in the Italian regions bordering the North Adriatic refers to a particular article of the Protocol, namely **Art. 18** "**National coastal strategies, plans and programmes**" in particular for what is stated in comma 4:

> *"The Parties shall define appropriate indicators in order to evaluate the effectiveness of integrated coastal zone management strategies, plans and programmes, as well as the programmes of implementation of the Protocol".*

This subCASE indeed aims at assessing the progress of ICZM policies implementation by means of the "Progress indicator", a tool elaborated by a group of experts for assessing the

level of ICZM implementation in a certain place and time in the EU State Members (in accordance to the Recommendation 2002/413/EC)

Section 3. Policy issues and ICZM principles and approaches.

3.1 So far, how have been the coastal issues addressed by the local/regional government?
3.2 At which spatial scale?
3.3 Can you assess the results of the implemented policies? Which are the main results achieved?

So far, there are no examples of assessment of ICZM policies at local/regional level. However, at international level, in order to monitor the adoption by EU countries of the 2002 Recommendation regarding the implementation of ICZM national strategies for coastal members[23], two national coastal policies analysis were carried out in 2006 and 2011.

[23] 2002/413/EC, Recommendation of the European Parliament and of the Council of 30 May 2002 concerning the implementation of Integrated Coastal Zone Management, OJ L148 of 6.6.2002.

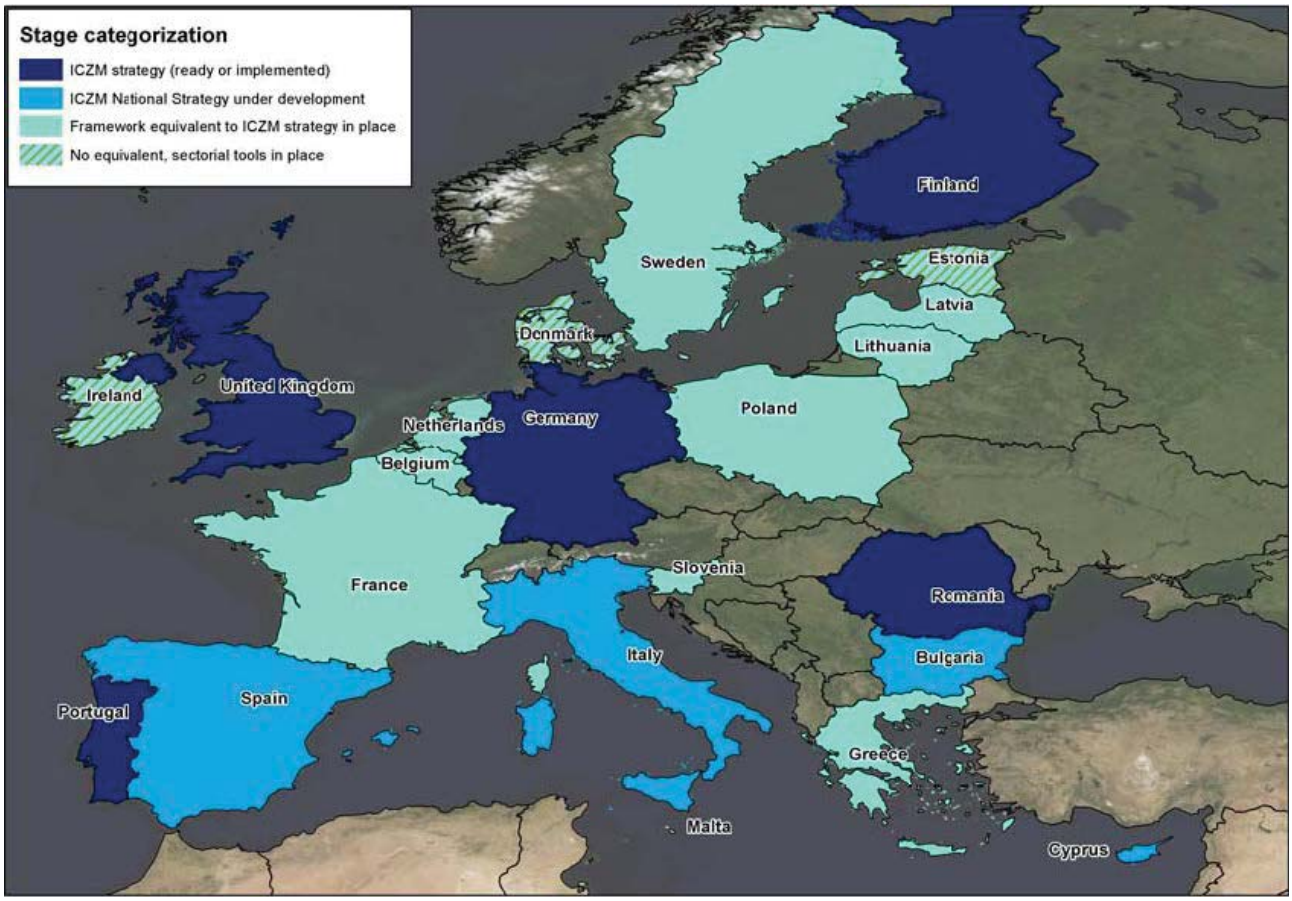


Figure 58. Progress in ICZM national strategy development (source: Thetis, 2011).

According to the latter progress Report of 2011[24], only 4 countries (namely Germany, Portugal, Romania and United Kingdom) have developed an ICZM national strategy. In further 10 coastal members an equivalent strategy was adopted; in four other European countries an ICZM strategy is under development: Italy together with Bulgaria, Spain and Cyprus is part of this latter group. Finally three countries, namely Estonia, Ireland and Denmark have shown no ICZM equivalent policies in advanced stages of preparation: only sectoral tools are in place to address coastal issues.

Despite the request of the Recommendation of 2002 and the ratification of the EU of the ICZM protocol of the Barcelona Convention, there are no implemented plans for the management of the Italian coast at national level.

[24] *Analysis of Member States progress reports on Integrated Coastal Zone Management - (ICZM) Final Report*, Venezia. 2011 (http://ec.europa.eu/environment/iczm/pdf/Final%20Report_progress.pdf)

3.4. On the basis of the ICZM principles (as they are expressed by the Protocol), do you think that the coastal issues were addressed with an integrated approach (in terms of organization, politics, tools, etc)?

From the 2011 progress report it emerged that even in the EU countries were national strategies are already in place, several issues are limiting the success of ICZM. A difficulty exists in the translation of the theoretical principles of ICZM into management action; despite to the increasing need in coastal management for viable, understandable scientific information and tools, the existing gap between decision makers and scientists is still hindering what it should be a synergy. Moreover the lack of proper participation strategies, and the difficulties in the coordination among different management level and sectors represent a further obstacle in the implementation of ICZM.

Section 4. Relevance with National ICZM process

4.1 Do you think that your work is relevant for the ICZM process of your country? Why and how?

The survey developed in this SubCASES can help understanding how coastal management evolves: this provide a first insight on the "state of art" of coastal management in the North Adriatic Italian regions and an important contribution to understand how new organisations and cultural paradigms are spreading over the territory and finally re-orienting coastal management; moreover, the SubCASE can contribute to pose new questions to research on, and can help clarifying what are the main conditioning factors on which focussing in order to promote ICZM.

4.2 On the basis of the work that you have done, which are in your opinion, the main constraints in implementing ICZM principles and tools? What is missing? Where are the main gaps? Where we should put more energy and resources in the future?

The general picture of the survey carried out in the North Adriatic SubCASE confirms that relevant weaknesses in monitoring and communication practices are still present in the coastal zone management: the elaboration of periodic reports on the state of the coast is far from being a common practice; the economic values at stake continues to be poorly monitored; the system of competences in coastal management (who-does-what) remains unclear and poorly coordinated. Although improvements have been recently recorded, the involvement of the economic sectors and of coastal communities to decisions concerning coastal management is far from being satisfactory. ICZM continues to be not formally acknowledged within the public bodies that have jurisdiction and competences over the coastal zone: as a consequence, very few are the human and financial resources specifically directed for sustaining ICZM efforts and initiatives. ICZM efforts in the considered area suffer from the lacking of a national strategic view on the possible and desirable evolution of Italian coasts (lacking of a national coastal policy). Finally, results of ICZM efforts and initiatives are very rarely monitored and assessed.

Section 5. Stakeholders involvement
5.1 Have you involved the main stakeholders?

Since this SubCASE consisted in a survey, several stakeholders were involved. The general idea behind this methodology was to ask ICZM experts and practitioners to report on the level of implementation of ICZM, namely to report on a certain set of "actions" that represent the basis of an ICZM process. The idea was therefore "to leave the floor" to whom has responsibility in coastal management, in order to understand whether, and how, the design and adoption of ICZM initiatives are progressing, or not.

The interviewees belonged to Regions, Provinces and Municipalities bordering the North Adriatic Sea and therefore have jurisdiction over a segment of the North Adriatic coastline. Moreover, the survey has also involved the Authorities (public or private bodies with public regulation regime) that have direct or indirect influence on the coastal zone, both in terms of specific competences and in practical terms through their activities within the river basins: these were the ARPA Agencies (Regional Agencies for the Protection of the Environment, which have important technical competencies, e.g. monitoring of water quality, technical consulting for enforcing environmental legislation, control, etc.), River Basin Authorities (with the task of managing the Water Framework Directive and other important provisions concerning the management of rivers and groundwaters) and Land Reclamation Authorities (*Consorzi di Bonifica*: these bodies have important tasks in the management of the networks of artificial canals and of the land obtained by reclaiming wetlands and marshes for agriculture and other developments in the first part of last century). The result was a final sample of 100 units[25], belonging to the municipal, provincial and regional levels.

5.2 How have you involved them (e.g. focus group, interviews, questionnaire)?

The survey has been developed throughout an online questionnaire (Fig.52).
The first phase of our survey was carried out in the period May-October, 2012. It was aimed at measuring the level of implementation of the 32 actions indicated in Table 10in the North Adriatic Regions in the years 2006 and 2011. It has been realized through a dedicated website, integrating both the application to collect the interviews and explicative material on ICZM. When asked to answer if a given action was adopted, the interviewees had the

[25] It is worthy of note that within the Italian public administration system very rarely there exists a person – or a team of persons – specifically in charge with ICZM. More often instead, ICZM programs or initiatives are devolved upon several offices of the bodies, like regional & urban planning, land and soil protection, environmental sectors, regional fishing department, transport infrastructures, nature preservation offices, marine state property, etc. As a consequence, a very important preliminary phase of the survey has been to identify the person within each coastal territorial unit to question. One contact person has been identified for each body, through preliminary phone contacts aimed at establishing the communication with the organization and at defining the most appropriate person to answer the questionnaire.

possibility to answer YES (Yes, the action has been adopted, NO (No, the action has not been adopted/) or DO NOT KNOW (DNK). The “progress indicator” corresponds to the percentage of positive answers on the total.

In the period June-July 2013 the second phase of the survey was realized. It consisted of a set of “statements”, which were defined according to the results of the first phase. The reference population was the set of bodies/organisations that took part, with complete and valid questionnaires (53), in the first phase of the survey. Valid answers have been 29 (55%). Two sets of “statements” have been prepared: the first, directed to all involved bodies/organisations, referred to the situation of the whole North Adriatic coastal region; the second, with different statements for each region, and directed only to the bodies/organisations belonging to the referring region. As in the first phase of the survey, the interviewees had the opportunity to answer: agree (with the statement), A, disagree, D, do not know, DNK.

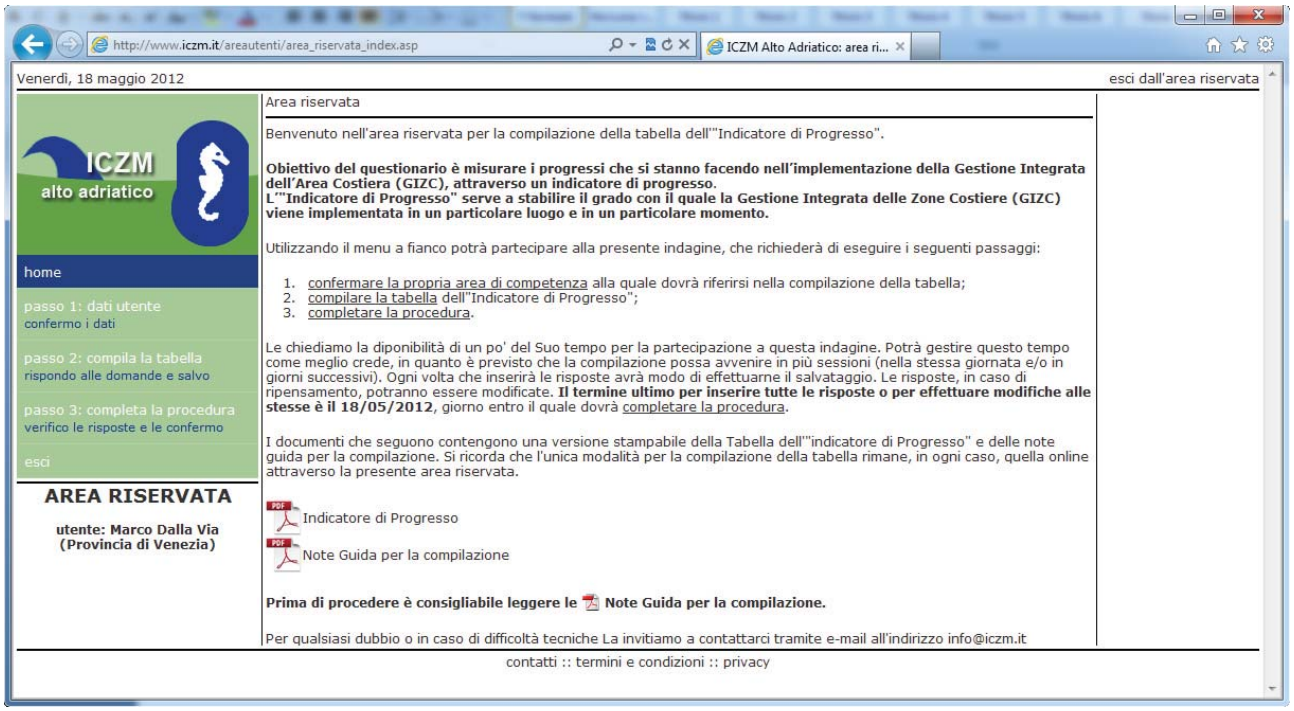


Figure59 . Screenshot of the homepage of the Website hosting the questionnaire (www.iczm.it)

Table 17. The Progress Indicator (PI) Actions distributed in 4 Phases.

The Progress Indicator	
Action	**Description**
Phase I: Coastal zone is managed in a traditional way and often with a sectoral approach	
1	Regulated uses of the coastal zones
2	The interested bodies meet up on sectoral basis for discussing specific coastal and maritime issues.
3	Spatial plans which include the coastal zone.
4	Coastal and maritime monitoring programs.
5	Monitoring and assessment of the economical activities.
6	Special protection measures for the coastal zone.
Phase II: An ICZM process is under development also throughout organizational changes	
7	Tools tuned and combined for the coastal and maritime management and planning.
8	Fund availability.
9	Inventory of the stakeholder and of the competences.
10	Council and communication tables among the actors involved in the coastal management),
11	Joined initiatives.
12	Economic actors participation.
13	Sustainable development strategies linking social and environmental issues.
14	Guidelines for the sustainable development.
Phase III: An integrated management and a planning system for coastal zones and the maritime side(even if not yet well defined)are in place. From an organizational point of view, specific agencies and funds for ICZM are in place.	
15	Involvement of the main stakeholders.
16	Report on the state and the evolution of the coastal management.
17	Formal and binding ICZM program.
18	Strategic Environmental Assessment.
19	Informal strategies.
20	Communication channels among different levels of government.
21	Formal assignment of the ICZM.
22	Sea management included in the ICZM strategies.
23	Binding plans for the sea uses.
24	New institutional organization for the ICZM.
25	Participation of the costal communities.
Phase IV: ICZM strategy is positively influencing the activities of different organizations holding stakes and competences over the coastal area. ICZM is contributing to a more sustainable use of resources.	
26	Constant and stable political support.
27	Strengthened cooperation among institutions.

28	Exhaustive set of Indicators
29	Long term financial commitment.
30	Data accessibility.
31	Periodical procedures for the assessment of the results.
32	The monitoring shows better sustainability.

5.3 Which kind of constraints have you faced?

The methodology of the online questionnaire applied has shown important weak points, that can be summarized as follows:

- Despite the fact that the interviewees are experts and/or practitioners of ICZM, the meaning of the questions has to be clarified as much as possible, in order to avoid misunderstandings: to do so, the questionnaire has to be equipped with guidelines, reading materials, examples based on field experiences, etc.

- ICZM finds very rarely formal recognition within the organizations with responsibility in coastal management; in fact, ICZM embraces a system of functions and competences that can be performed or promoted by various and different sectors of government, both at local, regional or national scale. This means that a very delicate phase of the survey is the identification of the person of the team whose functions, within the considered organization, are suitable for ICZM; therefore, establishing the communication channel with the 'right' expert/practitioner is a very important condition for the reliability of the obtained results.

- The surveys aimed at measuring the Progress Indicator recording how many actions are adopted by those actors charged with the responsibility in coastal management: however the level of adoption of each action should be contextualized by considering that among the interviewees there are bodies and organizations with different powers, different enforcement capability, different geographical coverage (in Italy for example, where the Regions are much more empowered with functions related to ICZM than any other level of the public administration, it is clear that their action is of basic importance for understanding whether ICZM is progressing or it is not). The actual importance of the taken action in an ICZM perspective, therefore, is not only dependent upon the number of actors that adopt it (how many actors) but also upon the role, more or less important, that a given actor has within the regulatory system.

- These surveys tend to overestimate the importance of organizational processes and procedures, in terms of adopted actions, while less attention is paid to the results attained through the implementation of these actions. In fact, the PI measures how many actions are adopted by a given group of actors involved in coastal management, and this is considered a *proxy* of the capability of the local/regional system to move towards integrated coastal management. However it does not give any information on the effectiveness of the implemented actions. In few words, it registers processes and changes regarding organization and procedures but it does not provide any

insight neither on the success of the adopted action, nor on its social, economic and environmental implications[26].

As a consequence of the above points, surveys aimed at reporting on ICZM progress can be considered only as a first -although important- step in the direction of considering and assessing whether and how, ICZM is contributing to modify the way coastal zones are managed.

Section 6. Tools

The only tool applied in the SubCASE is participation which has been described in the previous chapter.

Section 7. Main results of CASES

7.1 Achievements

The survey has confirmed that in the considered period the PI, with respect to the whole reference population and to the whole set of actions, has increased by 8,6 percentage points, passing from 27,2 to 35,8%. Emilia Romagna is the region with the highest PI both in 2006 and 2011; however the most important progresses have been reported by Veneto and Friuli Venezia regions. Phases 1 and 2 show the highest values of PI in all the regions. All the 4 phases have however recorded a positive variation of the PI.

As regards phase 1, the most critical action remains action 5. As regards phase 2, low levels of adoption are reported by actions 10, 12 and 9. Phase 3 is in general poorly adopted.

The improvement of the PI in this phase is largely dependent on the very positive trend that has characterized action 18. To note also the positive evolution of action 19, that confirms the importance of the adoption of no-statutory initiatives in the considered geographical context. Actions with a low level of PI are actions 16, 21, 23, 24 and 25. Very low is the PI for actions 29 and 31.

This picture is also confirmed by the results of the analysis at regional level. The most critic actions are actions 24, 29 and 31. Yet with different nuance, low level of adoption are recorded for actions 10, 11, 12, 25, 26 and, with the exception of Friuli Venezia Giulia region, action 27. It is worth noticing that the high level of adoption of actions 9 and 16 in Emilia Romagna, with respect the level recorded in other North Adriatic regions.

The above elements confirm that in the considered SubCASE ICZM remains, although a progress is recorded, at its embryonic stage. Excluding Marche region, where a statutory plan has been issued, ICZM is sustained mainly through no-statutory and informal efforts and

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[26] An example illustrates very well the point: when an interviewee answers YES to action 17 (namely, "*action 17* has been adopted it just means that "a statutory or formal integrated plan has been promulgated, issued or adopted by the reference organization"; however this does not mean that *the statutory or formal integrated plan has been implemented or put into practice, or is in the process of being translated into practice*. The methodology just records that the action has been adopted but it does not report on its effectiveness and results.

initiatives. Both in Emilia Romagna and Marche regions that can be regarded as the two different reference models for ICZM in the area, interviewees point out that adopted ICZM initiatives are far from being put into practice. The two actions that have undergone the most significant progress in the level of adoption are actions 18 and 7. As regards action 7, the sharp increase in its level of adoption, would appear to confirm that at local and regional scale there exists a greater awareness about the vulnerability of coastal zones and the consequent need to promote new coordinated and integrate policies, but this greater awareness are not followed by relevant innovations in the way coastal zones are managed

7.2 Lesson learnt

It is clear, that to be effective in addressing coastal management policies, these kind of surveys should be repeated periodically and become a common practice of public institutions dealing with coastal environment and planning, instead of being episodically realized in the context of demonstrative, research and/or cooperation programs, very often supported by EU funds.

Finally, it is important to remind the relevant limits characterizing the methodology adopted for this survey. As already commented, surveys aimed at measuring the progress indicator recording the frequency of adoption of a certain set of coastal actions, but they do not provide insights on the effectiveness of the above actions; they concentrate above all on evidences of organizational/procedural changes, as confirmation that a process towards more coherent and integrated efforts in coastal management is in progress.
This problem can be however referred to the large part of the evaluation experiences on the success of ICZM plans and programs, that very often focus on organisational and process variables (such as “a new forum for the involvement of stakeholders has been designed”, “a new consultancy body for sustaining ICZM has been established”, “a formal plan has been issued”, “a new web-based platform for improving the circulation of information and experiences on ICZM have been designed”, etc.), rather than concentrating on the effectiveness and results of the adopted ICZM efforts[27].
In spite of the relevance of above points, the surveys aimed at reporting on the progress indicators can help understanding how coastal management evolves: these provide a first insight on the “state of art” of coastal management in a given geographical context and an important contribution to understand how new organisation and cultural paradigms are spreading and finally re-orienting coastal management; moreover, they can give an overview

[27] To explain this attitude/point J. Sorensen (1997) has advocated the following reasons: to record organisational changes and formal political and administrative resolutions is much easier and costs less than assessing environmental and socio-economic results of adopted measures; to show that some measures are adopted is what the political and administrative systems need in the short time to legitimate their status and power; to monitor and assess the results of adopted ICZM initiatives is a very time- and resources-consuming process, that hardly can be contained within the temporal limits of electoral cycles; on the basis of the complexity of coastal systems’ dynamic it is very difficult to explain and represent the causality links between ICZM initiatives and the progress towards environmental sustainability.

of how coastal management is evolving, from a synchronic as well as a diachronic perspective. In such a way, these surveys can contribute to pose new questions to research on, and can help clarifying what are the main conditioning factors on which focussing in order to promote ICZM.