



“Scenarios to be modelled”
Extract from deliverable D6.2





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ABSTRACT

This document aims at the description of present and potential future environmental issues to be taken into account when formulating a framework for Adaptive Policy Framework (APF) in the context of the Marine Strategies to be defined for areas of the South European Seas (SEs). Scenarios for future development builds on two main dimensions of potential changes: i) political and economic convergence across the basin versus increasing levels of conflict, and ii) policy reactivity vs. preventive actions in environmental management. The result consists, further to a baseline (BAU) scenario, of four scenarios depicting images of an either unified or heterogeneous political and economic area around the two basins and describes consequences of connected economic and environmental policies for different economic sectors relevant for the use of marine ecosystem services.

SCOPE

In relation to the Adaptive Policy Framework to be developed within the activities planned for Work Package 6 of the PERSEUS project, the present extract of deliverable D6.2 define sketches for alternative scenarios, in order to allow for taking properly into account possible future developments impacting marine ecosystems. The definition of the scenarios feeds thus, in the present phase of the Project implementation, into the PERSEUS modelling exercises. The storylines are based on the analysis of existing foresight exercises, to be treated more in depth in a second deliverable, D6.4, dedicated to an “Inventory and critical assessment of existing foresight analyses and scenario planning.”

In relation to the second PERSEUS objective which aims at developing tools for evaluation and monitoring of the environmental status, the results from the present deliverable will be used for defining the focus of these instruments.



SCENARIOS AND SCENARIO STORYLINES FOR MODELLING

Function of scenarios within the Adaptive Policy Framework

“Scenario planning is a systemic method for thinking creatively about possible complex and uncertain futures.” (Peterson et al., 2003). Describing the future that might possibly evolve from trajectories extrapolated from present drivers or developments, scenarios facilitate the identification of drivers of change and of possible implications of current developments on the future (Raskin, 2000) or can highlight consequences of surprising and uncertain developments and potential nonlinear future development (Alcamo, Vuuren, et al., 2005). According to Walters (1997), adaptive management should start from a concerted effort to integrate existing interdisciplinary experience and scientific information into dynamic models that attempt to make predictions about the impacts of alternative policies. In the frame of PERSEUS, these models are developed by the WP4, “Developing integrated tools for environmental assessment”.

In the context of designing adaptive policy frameworks, the use of alternative policy scenarios allows for exploring the different potential drivers of change within the socio-economic context and, as a consequence, relevant drivers to be taken into consideration for the design of a policy and for its subsequent monitoring. It furthermore allows for anticipating the performance of different policy options, and for screening their outcome under different context conditions (Swanson and Bhadwal, 2009) formalizing different policy scenarios which can be compared on a quantitative or qualitative basis with a “non-intervention” or “business as usual” (BAU) scenario.

Scenarios are based on a coherent set of assumptions about driving forces and key relationships producing a credible and coherent description of each of the alternative possible futures considered in the exercise. These assumptions are described in a qualitative, narrative manner in storylines. Recent approaches to scenario building combine these qualitative approaches with the potentials of quantitative considerations about the future, using variables provided by the storylines in quantitative modeling exercises which provide a structured and rigorous consideration of the inputs. The use of qualitative descriptions broadens the scope of the exercises with respect to the potentials of predictive modeling, allowing the inclusion of processes which have not yet been considered in a quantitative manner and include non-linear developments, surprising events etc. The use of consolidated scenario building strategies with respect to the definition of the narrative assures that the scenario building exercise responds to the scope of the policy process it is related to, and is understood by its end users.

If the output of existing scenario exercises shall be used for informing the adaptive policy definition, coherence between scenarios used and basic assumptions and “scenario logic” (Nakićenović et al., 2000) or storyline underlying the policy assessment will need to be a primary criterion for the choice of input data.

Process of policy scenario planning:

According to Peterson (2003) the process of scenario planning as part of an adaptive management process is articulated in six consecutive steps, with some possible loops.



The process starts with the identification of the policy problem, which provides the focus to be used for the assessment. The results of the assessment (eventually after having reformulated the policy problem) provides information for the identification of the alternatives, representing the basis of the alternative scenarios depicted on the basis of credible but well distinguished plots or storylines, in order to cover an ample range of uncertainties. Scenarios are then tested for consistency and finally used for screening one or different policy alternatives, or of present policy strategies on the background of different alternative futures (see Figure 1).

Scenario Building – Definition of terms

Scenario

A plausible description of how the future may develop based on a coherent and internally consistent set of assumptions ("scenario logic") about key relationships and driving forces (e.g., rate of technology change, prices). Note that scenarios are neither predictions nor forecasts. (*Nakićenović et al. 2000*).

(Scenario) Family

Scenarios that have a similar demographic, societal, economic and technical-change storyline. The IPCC SRES report presents four scenario families: A1, A2, B1 and B2 which have been subsequently used by different modelling groups providing different outcomes for each of the storylines. (*Nakićenović et al. 2000*).

(Scenario) Storyline

A narrative description of a scenario (or a family of scenarios) highlighting the main scenario characteristics, relationships between key driving forces and the dynamics of their evolution (*Nakićenović et al. 2000*).

Sketch of scenario/storyline

A brief narrative description intended to provide an overview and a brief description of each storyline (*MEA, 2005*).

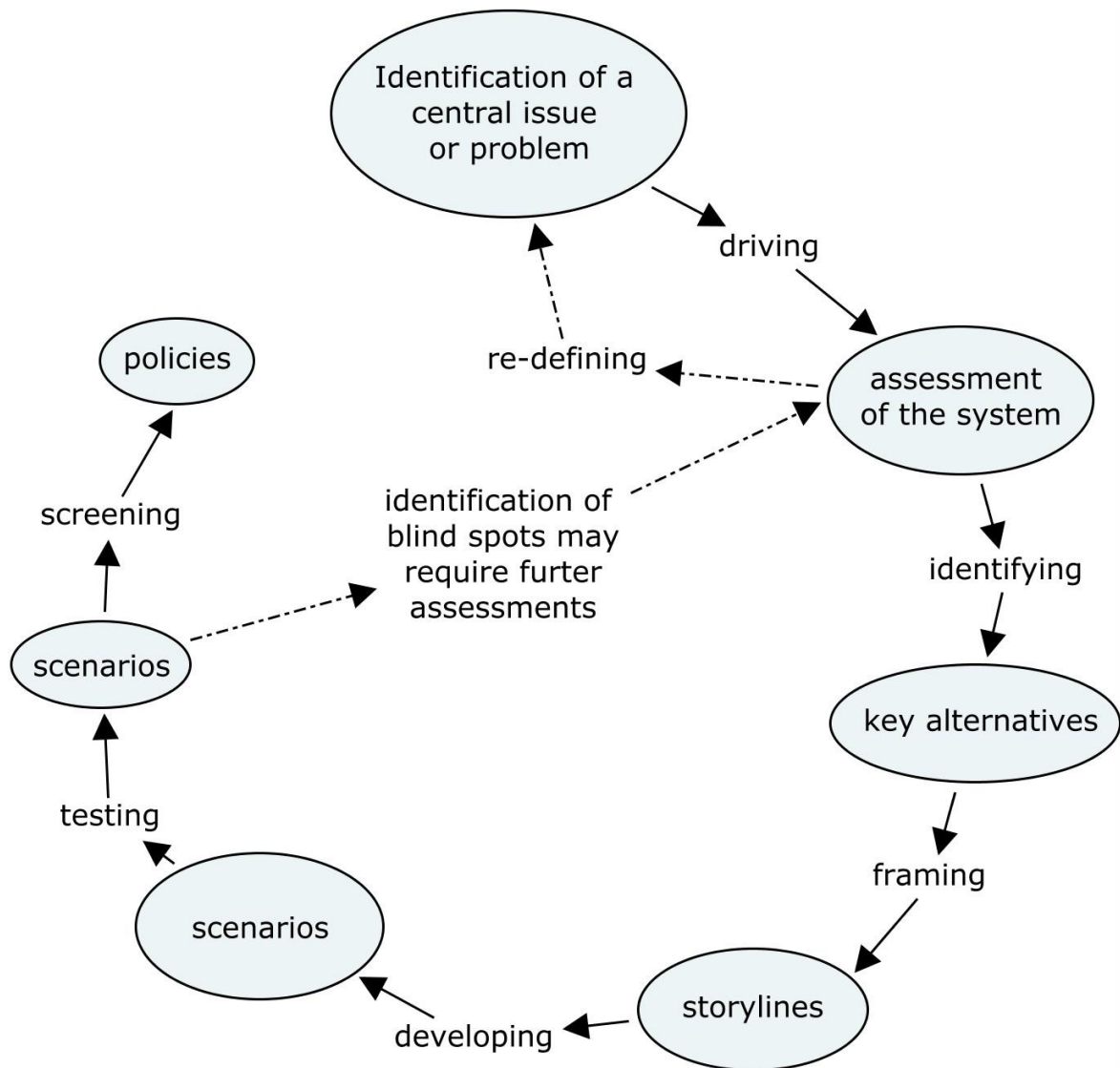


Figure 1: Process of scenario building (following Peterson et al. (2003))

Requirements for the definition of storylines

Storylines provide the narrative plots underlying the construction of complex scenarios, characterizing key factors of uncertainty (for example quantities of emissions, scenarios for migration, economic development or climate change mitigation and adaptation policies). In the context of PERSEUS, where scenarios are used for the quantification of relationships between drivers, pressures and impacts, storylines need to be associated with credible quantitative information on relevant drivers for future change. This prerogative sets as relevant condition for the choice of storylines and scenarios to be chosen: the better the availability of modelling exercises connected to the specific storyline chosen, the greater the credibility of the information provided by the scenario within the adaptive policy framework. The choice of storylines thus determines the availability of existing data, the less output data from models can be found in correspondence to the chosen storyline, the greater the need for ad hoc modelling or, in alternative, for qualitative assumptions about the dimension of drivers and the qualities of interrelations between single elements.

The following sections present short synopses (sketches) of different storylines in order to provide an overview and a brief description of each of them. As far as



feasible, the different storylines used in the foresight exercises will be screened against the basic axes used in the storylines of the scenarios in the Millennium Ecosystem Assessment (Millennium Ecosystem Assessment, 2005).

The choice among adequate existing storylines to be employed for the PERSEUS modelling exercises will need to take into account, inter alia, the criteria listed below, the description of existing storylines will thus collect information on the scenario storylines relative to a small set of criteria:

Time horizon

The PERSEUS exercise will refer to the year 2030 as a time horizon, exceeding slightly the line of 2020 set by the MSFD, mainly in order to allow for meaningful policy scenarios. Limiting the time horizon at the milestone defined by the MSFD would have allowed mainly for trend-oriented scenarios, as policy scenarios would realistically require a longer time frame for definition and implementation in order to be realistic and to produce realistic policy projections for non EU countries as well as for EU countries.

Sectors covered

Scenario exercises have been produced in a very wide area of policy sectors to be considered in the storylines (= data and estimates to be retrieved or adapted from existing studies/integrated assessment modelling efforts), the choice of storylines used within the PERSEUS project should pay particular attention to those scenarios where relevant economic sectors identified as drivers of change have been considered and the necessary input for modelling exercises is quantified. The choice of storylines is limited mainly to exercises with a prevailing focus on environmental issues or explicitly address environmental impacts of future trends considered.

Geographical focus

Scenario exercises have been made frequently in the realm of policy definitions, so the geographic space they embrace normally refers to the institutional delimitations of the geographic area. The area of SES is part of different geopolitical spaces, with the European Union being a central pole, but scenario exercises focussing on the EU will fail in considering the marginal areas of the SES, where actually important political changes are going on. On the other hand, several foresight analyses focus on other areas: i.e. the Mediterranean basin as a political unit (both North and South and East Mediterranean countries, or only EU members States).

Scale

The use of global scenarios would obviously resolve the problem of geographic focuses in frontier areas like the SES, considering continental or national units, but might present the disadvantage of being associated to quantifications providing data of too coarse a scale for delivering meaningful input for scenario exercises at the local level.

Scenario storylines (sketches of storylines)

The description of scenario storylines to be used throughout the PERSEUS activities in the regional case studies has been based on a review of existing foresight and scenario exercises which provided guidance and indications for policy dimensions to



be considered. The choice of scenarios to be considered was based on criteria of pertinence with respect to the ecological and management problems to be considered, choosing thus among global studies with a focus on ecosystem conservation and impacts on ecosystems in the larger sense, as the SRES scenario groups which actually represent a reference for any foresight exercise related to climate change¹ and the scenario exercises connected to the Millennium ecosystem services assessment (MEA). Further to these global exercises, some sector oriented exercises have been consulted with regards to those sectors of particular interest for the consideration of impacts on the state of marine ecosystems.

At the level of marine basins finally, an attempt has been made for collecting, further to ecosystem oriented foresight activities, a wide range of scenarios, aiming at exploring properly interactions between geostrategic large economic development prospective analysis and the SESs marine environments.

Global scenario exercises

IPCC SRES scenarios

The assessments made by the IPCC are based, since the beginning of this century, on a set of global scenarios, linking assumptions on future levels of emissions with descriptions of visions on social developments driving the main forces of climate change, including land use changes and energy related emissions. Although technological innovation and increases in energy efficiency are elements of these storylines, explicit climate policies are deliberately excluded from the scenarios, as the scenarios intend providing the background for the formulation of these policies.

The scenarios described in the SRES report have represented the reference for the third and the fourth assessment report, providing a huge wealth of global and regionalized modelling exercises inspired by these storylines.

The **A1 scenario family** describes a converging global development, where population numbers are in decline after a rapid growth after the middle of the century. Policy activities achieve a decrease in income disparities and the introduction of efficient technologies. The scenario family consists of three different scenarios describing alternative directions in technological change: prevailing fossil intensive (A1F I) non fossil energy sources (A1T) or a balanced development across both types (A1B) (Nakićenović et al., 2000).

The globalised technology based approach underlying this scenario family makes it similar to what later in the Millennium Ecosystem Assessment (MA) Scenario is described as **Global Orchestration**.

The **A2 scenario family** describes a fragmented and heterogeneous economic development, based on the conservation of local identities. Population growth is assumed to slow down later than in other scenarios and economic growth is less accelerated (Nakićenović et al., 2000).

The main characteristics of this storyline correspond to the fragmentation in economic and social development described in the **Order from Strength** scenario in the Millennium Ecosystem Assessment.

¹ The most recent efforts for designing new socioeconomic pathways (O'Neill et al., 2012) have not been considered in this context, as they are still under development.



Similar to the A1 family, also the **B1 storyline** describes a converging world, but it assumes rapid changes in economic structures aiming at sustainability, introduction of global solutions reducing material intensity and increasing resource efficiency, although specific climate policies are not considered (Nakićenović et al., 2000).

The emphasis this storyline poses on global technical solutions points into the same direction as the later **Techno Garden** scenario formulated by the Millennium Ecosystem Assessment

The **B2 storyline** and scenario family describes a world with prevailing localized approaches to sustainability, thus economic growth and technological change are assumed to evolve less rapidly and in a more diversified manner. There is a strong attention to environmental solutions and social equity, which are considered only at the local or regional level (Nakićenović et al., 2000).

The description of the B2 storyline is very close to what the MA shall develop, later, as the **Adapting Mosaic** scenario.

Time horizon: starting from 2000 as the base year, the scenarios focus on the description of the situation at the end of the century.

Sectors covered: the main drivers for GHG emissions considered in the scenarios are demographic change, social and economic development, and the rate of technological change.

Geographic focus: the scenarios describe global patterns of development. Regionalized versions of these scenarios have been produced.

Scale: data provided by modeling is based, for different regions of the world, on national accounting.

UNEP Environmental Outlooks

The third and fourth Global Environmental Outlook (GEO 3 and GEO 4), published by UNEP (UNEP, 2002, 2007) are based on a set of four qualitative scenario storylines, which are followed, once more, the archetypical set of scenarios presented before and reinterpreted also by the Millennium ecosystem assessment:

Descriptions of the storylines are mainly qualitative, pointing at the main policy lines underlining socio-economic development and environmental management. Nevertheless, the storylines are underpinned by different quantitative assumptions on demographics, economic and social development and provide quantifications for economic, social and climate change impacts for each of the scenarios and differentiated for each of the global regions, using in part outputs from integrated models like IMAGE (Raskin, 2005). These same scenarios have been used both in GEO 3 and in GEO4.

- **Markets first**, a scenario of global convergence based on market driven developments, which corresponds to the **Global Orchestration (GO)** scenario used subsequently in the Millennium Ecosystem Assessment.
- **Policy first**, a scenario assuming governments to undertake relevant actions for achieving specific social and environmental goals, the importance attributed to policy actions for achieving sustainability goals makes this scenario similar to the Techno Garden (TG) scenario in the Millennium Ecosystem Assessment.



- **Security first**, a scenario where government activities aim at protection against the socio-economic and environmental consequences of inequalities and conflicts resulting from a strongly segmented pattern of economic development, pointing at the same trends as the Order from Strength (OS) scenario used in the Millennium Ecosystem Assessment.
- **Sustainability first**, a scenario where future developments are determined by new more equitable values and institutions. The scenario is similar to the Adapting Mosaic (AM) scenario used in the MA, although the element of prevailing local solution, which represents a central element of the “Adaptive Mosaic” storyline, is not addressed in this case.

Sectors covered: the storyline considers Demography, Economic and human development, science and technology, governance culture and environment, as drivers, economic sectors considered comprise, inter alia, fisheries.

Time horizon: for GEO3 the time horizon is 2032 and the base year 2002, it has been extended, for GEO4, to 2050.

Geographic focus: global scenarios with specific focuses on regional or continental issues.

Scale: Environmental outcomes are considered at global scale, but single issues are considered, where relevant, at regional scales.

Millennium Ecosystem Assessment

In the context of the Millennium Ecosystem Assessments, Scenarios have been used in order to explore implications future developments might have on ecosystem services. The exercise is based on four different storylines, describing four different possible global futures on both a narrative, qualitative level and, in a second step, as results from modeling exercises.

The qualitative storylines presented (Alcamo, Alder, et al., 2005) provide a comprehensive set of assumptions on future developments of drivers and interactions, the modeling exercises are limited to some interactions between drivers and environmental outcomes that can be represented in a numerical environment. The scope of both the definition of storylines and of the subsequent modeling of single aspects of these the resulting scenarios are the functioning of ecosystem services. The four storylines are delimited by different assumptions on main lines of socio-economic policies and, connected with these, strategies for the management of ecosystem services and sustainability. They follow lines defined by a “set of archetypal visions of the future”(Monks et al., 2005) underlying different scenario exercises developed so far, which depict four main directions of development:

- gradual evolvments of actually dominating driving forces;
- increasing fragmentation and diverging developments including
- strongly policy influenced developments towards sustainability goals;
- and futures based on innovative forms of development and human values.

The storylines used within the MA exercise follow these lines, providing for each of them more explicit descriptions of strategies for sustainability policies and ecosystem management strategies. The focus on ecosystem services and related policies represents reason for a particular interest of these scenarios for the PERSEUS activities, so that the screening of scenario storylines will be made using these four storylines as a reference for classification.



- The gradual evolvement of actually dominating driving forces is represented, within the MA, by the **Global Orchestration scenario (GO)**, which assumes sustainability to be achieved mainly using global economic and social policy instruments like economic liberalization, poverty reduction, investment in public goods as for example infrastructure and education. The conservation of ecosystem services is faced through a reactive approach, assuming that only the improvement of economic well-being will create both the demand for and the means to achieve a well-functioning environment and allow for the resolution of environmental problems, such as climate change and overfishing.
- The increasing fragmentation of economic and social development represents the underlying theme for the **Order from Strength (OS)** scenario, which assumes an increasingly regionalized and fragmented world, where security and protection is a major concern for more developed countries in face of great or increasing inequalities. Like in the global orchestration scenario, the approach to ecosystem conservation is reactive, attempting to confine poverty, conflict, and deterioration of ecosystem services to areas outside their borders.
- The **Techno Garden (TG)** scenario represents a strongly interconnected world which relies on a highly technologic and managed proactive approach towards ecosystems based mainly sound technology and engineering for the management of environment issues.
- The **Adapting Mosaic (AM)** scenario represents a second version of a fragmentation future, where a strongly proactive approach for the conservation of ecosystem services stems from regional and local grassroots' like initiatives which are based on common property institutions organized at ecosystem level. Investments in human and social resources focus on understanding and management of ecosystems, international management is based on networking. (Alcamo, Alder, et al., 2005).

Each of these scenarios is described in three 15/20 year time steps from 2000 to 2050. A further chapter describes the challenges for the period from 2050 to 2100.

The description of the storylines provides an outline for each of the period describing the main characteristics of economic, social and environmental policies. Furthermore, outcomes of each of the scenarios are described briefly for relevant sectors such as fisheries, climate change, eutrophication, invasive species, coastal wetlands and urbanization, and for single local environmental problems, like the Gulf of Mexico hypoxia.

Further to the scenarios based on these storylines, sector oriented model based quantifications have been used for the description of direct (greenhouse gasses, air pollution acidification, climate change, sea level rise, land use and land cover changes, fertilizers and nitrogen loads in freshwater and marine systems) and indirect drivers of ecosystem services (population, economic development, technological change, social, cultural and political change, energy use). Based on the modeling of these direct and indirect drivers, outcomes for ecosystems services (distinguishing between provisioning, regulating, supporting and cultural ecosystem services) are provided.



The principal information on drivers used for the modeling exercises are available at national scale, in order to allow for further regionalized downscaling of the global assumptions made in this assessment (Alcamo, Van Vuuren, Cramer, et al., 2005).

Time horizon: The time horizon used for the scenarios (2050) goes beyond the horizon chosen for the PERSEUS scenarios, an intermediate description for the PERSEUS time horizon is available. The base year for the scenarios is 2000.

Sectors covered: The scenarios provide quantifications for population growth, economic activities, technology change, energy use, emissions of air pollutants, GHG, climate change, Land use, resource consumption; qualitative assumptions are made for socio-political features, culture, religion and introduction of species.

Geographical focus: The scenarios and the assessment have a global focus, but regional studies are provided, too.

Scale: The data presented distinguishes between industrialized and less industrialized nations, but as far as quantifications of models are concerned, national data is available.

OECD Environmental Outlook 2050

The OECD environmental Outlook 2050 (OECD, 2012) does not apply a proper scenario approach to the outline future visions of a global state of the environment, but provides a mainly quantitative foresight exercise which assesses economic and environmental impacts expected from policy options for each of the environmental issues considered (Biodiversity, Climate change, Water, Health). The assessments are based on an integrated modeling exercise coupling socio-economic and environmental models. The results are assessed against a reference baseline scenario describing the environmental outcomes of present demographic and economic trends (policy approaches to environmental management remain unvaried). The assessments are made in two time steps, for 2030 and 2050.

Sectors covered: Economic (Agriculture, Fisheries, Energy, land use) and demographic development; with regards to impacts on water, impacts from reduction of nutrients and phosphorus are simulated.

Time horizon: 2030 and 2050.

Geographic scope: global, with focus on specific geographic regions for single policy simulations

Scale: the aggregation most frequently used throughout the outlook refers to three groups of countries based on economic criteria: OECD; BRIICS; rest of the world; nevertheless, the modeling tools employed allow for the use of national specific data.

Fish to 2020, a study developing global scenarios for the fisheries sector

The study developed by the International Food Policy Research Institute (IFPRI) seeks to develop a shared vision on future global food policies. It formulates projections regarding the global fisheries sector which are based on simulations by the IMPACT model (Delgado et al., 2002, 2003). The outputs provided are mainly focussing on fish prices and quantities of fish traded. The Scenarios used focus on different fishery policies: further to a baseline scenario assuming the most plausible characteristics of future development of the sector, five policy scenarios are



formulated which are closely connected to the development of the fisheries and aquaculture sector and focussing on quantities of fish production in different areas of the world and for different types of commercially exploited fish stocks:

- Faster aquaculture expansion than assumed in the baseline scenario;
- Lower production in China
- Faster technological change producing increase in fishmeal and oil efficiency
- Lower aquaculture expansion than assumed in the baseline scenario
- Ecological collapse.

The specific focus underlying this study does not allow for direct comparison with the storylines developed above.

Sectors covered: Underlying global changes in terms of socio-economic development are part of the basic assumptions underlying the IMPACT simulations and have not been changed for the scenarios. The sectors considered are fisheries and aquaculture, compared to other food producing sectors.

The **time horizon** of this study is 2020, starting from a baseline year of 1997.

Geographic scope: The scope of the exercise is global,

Scale: the geographic articulation used for the presentation of results is based on a subdivision in 12 geographically defined country groups, which divide the SES in different country groups (outputs provided by impact in terms of 36 geographic groups of countries have been further aggregated), considering northern African states in one group with western Asian ones); eastern European countries are aggregated with countries from the former Soviet Union, etc.

[b\) Scenarios at basin scale](#)

Tomorrow, the Mediterranean

Tomorrow, the Mediterranean (IPEMED, 2011), depicts scenarios for the Mediterranean area, with a strong attention towards unifying elements under the hypothesis that the potential geostrategic role of the Mediterranean will be declining if adequate policy measures promoting convergence are not undertaken.

In relation to these implicit policy goals of major political convergence in the Mediterranean basin, three alternative storylines are developed

- A **BAU** (Business as Usual) storyline describing the consequences of continuing present trends, characterized by ill-assorted insertion of the countries of the region in a world economy pulled by emergent countries, mainly India and China.
- A **crisis** storyline describing potential future developments following the current economic crisis of Latin Europe and a transition struck in the Arabic Mediterranean area, leading to a slowing down of Latin Europe and North Africa and a blocking of institutional answers.
- A **convergence** storyline describing the possible consequences of cooperative policies extending partially mechanisms of European solidarity to the whole Mediterranean, increasing political and economic convergence in the area.



In relation to these three policy scenarios, existing literature providing projections for economic growth, migration (internal as well as international), and environmental conditions are considered and assessed in terms of GDP, occupation, work force, population.

The consideration of conditions relevant for the maritime environment is limited mainly to trends in concentration of populations in urban coastal areas, whereas water related aspects are limited to freshwater availability in relation to agricultural activities and limitations posed by changing climate conditions. Fisheries are not treated in an explicit manner, but as part of agricultural activities, without any specific considerations to exploitation of maritime resources. The energy sector is treated in relation to growth perspectives and implications for the production of greenhouse gases are described.

Time horizon: The time horizon used for the policy scenarios (2030) coincides with the horizon chosen for the PERSEUS scenarios. The base year (density) for the scenarios corresponds to the phase of scenario definition (2009/2010).

Sectors covered: The scenarios provide quantifications for population, concentration of population in coastal areas, and workforce, the energy and the agriculture sector.

Geographical focus: The entire Mediterranean Basin is covered with particular attention to relationships between EU and non EU countries, but the Black Sea is not considered.

Scale: The data used and quantifications provided are aggregated at national level.

Sesame

The project “Southern European Seas: Assessing and Modelling Ecosystem changes” (SESAME, 2006-2010), co-funded by the European Commission within the Sixth Framework Programme (FP6), aims to demonstrate the links between anthropogenic degradation of marine ecosystems in Southern European Seas and the development of socioeconomic drivers together with their relevant policies. For this purpose three alternative scenarios have been constructed with a special focus on the issues of fisheries, tourism, biodiversity, and carbon sequestration.

- **Baseline Scenario** (Business as Usual): It is a scenario that assumes that policies targeting the environmental effects of production and consumption patterns within the EU do not change radically. Environmental matters persist but are not really involved in development policies. The southern and eastern Mediterranean countries are protagonists of rapid population growth, accompanied by remarkable phenomena of migration toward EU states. Economic growth is sustained and moderate. There is a growth in trade between EU and Southern and Eastern Mediterranean Countries (SEMCs) and Black Sea states.
 - *Due to its characteristics in terms of values, policies and approaches to environmental problems, this scenario is situated between the **Global Orchestration (GO)** and **Order from Strength (OS)** scenarios identified in the Millennium Ecosystem Assessment.*



- **Policy-Targeted Scenario** (Command – control): This scenario assumes a balance among global, social and environmental welfare, in addition to a reliance on technology to provide solutions to problems. Environmental policy expands across policy sectors and is prioritised and fully implemented in EU MS (Mediterranean States). Non MS comply with international/regional regulations to address environmental problems set by global/regional institutions. As in the Baseline scenario the population is stabilising and ageing in EU states but growth in SEMCs. The social and environmental requirements imply higher levels of taxation with a consequent impact on economic growth.
 - *In relation to the MA axis, this Policy-Targeted Scenario fits well with the broad characteristics of the **Techno Garden** Scenario.*
- **Deep Blue – (Think local, act local)**: This scenario assumes a full implementation of the Ecosystem Approach and collaborative management. This implies communitarian values predominance. Environmental protection remains a political priority but is guaranteed by policies that reflect local issues and needs. Southern European Seas assist to a new population distribution due to a general migration away from larger cities.
 - *The focus on local solutions prevailing in this scenario converges with the MA **Adapting Mosaic** Scenario.*

Sectors covered: Agriculture, Fisheries, Tourism, Household consumption, Transport, Urbanization/coastal development

Time Horizon: the Time horizon of 2030 chosen for the SESAME scenarios corresponds to the time span that will be used in the PERSEUS scenarios. The base line corresponds to the time window of the Project duration (2006 – 2010).

Geographical focus: Southern European Seas (Mediterranean and Black Sea countries)

Scale: The outcomes of the scenarios are described qualitatively and reported as descriptions of the key sectors at regional and intraregional levels.

2030: Long-Term challenges for the Mediterranean Area

The report “EuroMed 2030: Long-Term challenges for the Mediterranean Area” stems from an initiative of the European Commission by DG Research & Innovation in cooperation with the Bureau of European Policy Advisers (BEPA). The study aims to explore how critical issues (demography and macroeconomics, agriculture, tourism, urbanization and coastal development, climate change) might evolve in the Mediterranean area and describe trends for the following twenty years.

The report is elaborated around three different analysis tools: trends (that as said before, allow deepening how critical issues in the region are evolving and how they might develop in the following years), tensions and transitions. ‘Tensions’ are used to examine the interaction among trends and its effects at different socio-political levels. Considering ‘Transitions’, alternatives needed to correct tensions by 2030 are identified.

Alternative Scenarios (as responses to the “tensions” identified):



- **Managing Conflict:** This scenario assumes improvements in European policies and diplomacy, for which will be essential progresses in the cooperation institutions, in immigration policies, etc.
- **Win-Win projects:** This scenario identifies some key-projects (in trade, scientific and technical fields) by which the Union for the Mediterranean (UfM) will strengthen cooperation and economic integration among its members. A new approach will be used to face common problems as for example for climate change, enhancement of regional political relations and trade liberalization.
- **Deeper Economic Integration:** This scenario proposes the achievement of a deeper economic integration and trade liberalization within Mediterranean countries.
- **Towards a Euro-Mediterranean Community:** Based on the principle of integration (extended to the whole Mediterranean basin, including SEMCs), the main element of this scenario is the improvement of Euro-Mediterranean relations through the overcoming of lack of a shared vision, lack of political will, lack of trust, lack of resources, and lack of suitable institutions. For this purpose Euro-Mediterranean countries have to ameliorate the social cohesion and convergence policies.

The drivers considered in this exercise are highly interesting for the PERSEUS scenario exercise:

Demography and macroeconomics: From now to 2030 the population of the SEMCs will increase by around 25% to 370 million, with an augmentation by more than 31% of people in the age group from 15 to 64 years (from 195 million in 2010 to 250 million in 2030). In the EU-27, population with an age included between 15 and 64 years will decrease by 6.5% to 330 million from 2010 to 2030. The increase in the numbers of people in working age will determine the demand for higher educational facilities and will create demand for housing, water, energy and transport.

Agriculture: In the Mediterranean area, agriculture should face issues related to a more increasingly problem of water shortage, caused by phenomenon of desertification, increase of population, not-planned urbanisation and enhancement of tourism.

Tourism: As agriculture, tourism is closely linked to water scarcity. The Mediterranean shores (including those of the North) are visited by 220 million tourists each year. According to the EuroMed-2030 report each tourist uses about 800 litres / day, a great deal more than the average consumption in the Maghreb of 40 litres per day and per person or the 220 litres per day average in the countries of Southern Europe.

Urbanization/Coastal development: Uneven development between urban and rural areas in the South of the Mediterranean is already perceptible. There is often a stark difference in development between the rural hinterlands (lack of access to clean water, poor education, inadequate health services and inadequate infrastructure) and the wealthier areas of coastal cities open to globalisation and with higher living standards.

Climate change: The average temperature in the Mediterranean will rise by more than 2 °C with a consequent dramatic decrease in water resources especially in coastal areas of North Africa. Here not only access to water will be seriously



threatened, but desertification is forecast to get worse together with erosion of the soil and reduction of rain fall.

Sectors covered: Demographic and macroeconomic trends; Water shortages and the impact on agriculture; Energy and climate change; Education and science; Religion and culture; Geopolitics and governance.

Time Horizon: 2030

Geographical focus: EU member States & SEMCs (Euro-Med level / UfM)

Scale: Trends, Tensions and Transitions are developed with quantitative data collected mainly at national level, + qualitative assessments and experts judgments.

A sustainable future for the Mediterranean?

In its study “A sustainable future for the Mediterranean”, the Plan Bleu Regional Activity Centre of the Mediterranean Action Plan proposes a prospective analysis on six strategic fields for Mediterranean basin: water, energy, transports, urban areas, agriculture and rural areas, and on coastal areas. The prospective framework is built starting from a “baseline scenario”, which extrapolates the principal current trends up to 2025 while taking into account the major determinants of the future: climate, population, geopolitical and economic factors, and regional and national governance. An alternative scenario for shifting policies and action towards more sustainable development is developed too.

- **Baseline scenario:**

- a) *Climate:* warming less than 1 ° C in 2025, acceleration of extreme events;
- b) *Demographic transition in the South:* decline and rapid convergence of fertility rates; slow population growth (except for Mediterranean basin); increase in urbanization (155 million additional inhabitants in urban areas);
- c) *Geopolitical and economic factors:* unequal economic and social reforms in MENA (Middle East and North African countries); strengthening trade between EU/SEMCs (South Eastern Mediterranean Countries); rapid economic growth in Asia;
- d) *Regional Cooperation and Integration:* increasingly integration between MENA and EU countries; limited cooperation between SEMCs; Euro-Mediterranean cooperation on environment keeps on even limited resources;
- e) *Environmental governance:* land-use policies are weakening; environmental governance remains powerless in facing challenges of sustainable development;

- **Scenario Win-Win:**

- a) *Geopolitical and economic factors:* Mediterranean economy relies heavily on the quality of its environment from which it derives an advantage;
- b) *Regional Cooperation and Integration:* strengthening the Euro-Mediterranean cooperation; strong political impulse to the highest level (UfM).
- c) *Environmental governance:* integration of social, environmental and food security in future regional and multilateral negotiations; development of the "polluter pays" principle; developing a more integrated and anticipatory logic based on patterns of development which provide the resources, integrate and



enhance the special features and advantages of the Eco-region, reducing the risk of internal fractures.

Sectors covered: water, energy, transports, urban areas, agriculture and rural areas, and coastal areas

Time Horizon: 2025

Geographical focus: Mediterranean countries

Scale: the data are considered at national level

Which research for the Mediterranean?

Supported by the French national agency for research (*Agence Nationale de la Recherche - ANR*), the Prospective Reflection Workshop (*Atelier de Réflexion Prospective - ARP*) named “**What research and what partnerships for the Mediterranean?**” (*Quelles recherches et quels partenariats pour la Méditerranée?*) aims to identify the main thematic that the Mediterranean area is supposed to face from now to 2030, according to the prospective assessment of eighty recent foresight exercises carried out by a group of experts. Five general fields have been chosen: people and societies, territories, natural resources (environment, water and energy), agriculture, food and health. The issues were explored from an integration and cross-sectoral perspective, while focusing specifically on people and their territories. The consideration of conditions related to coastal and marine environment is limited to the analysis of risks coming from an increasing wild urbanization. In the SEMCs, phenomena as the population growth and the migration of rural population to the large coastal cities will determine the creation of man-made landscapes, resource depletion (water, land) and an increasingly degradation of natural environments. Facilities as dams or irrigation canals will threaten the normal freshwater flows system (hypersalination, loss of productivity of lagoon environments, reduction of the deposition of sediments) and, consequently, the evolution of the coastlines too.

Sectors covered: Demography, cultures and civilizations, health, natural resources (in particular water and energy), agriculture and food

Time Horizon: 2030

Geographical focus: Mediterranean countries

Scale: the issues have been thought from the micro-local to the macro-regional scale.

European scenarios

EEA Outlook (2100)

The European Environmental Outlook 2100 (EEA, 2005), rather than providing scenarios and storylines, couples an analysis of the present state and trends in European Environmental issues and connects this analysis with an outlook on future challenges.

TRANSvision

TRANSvision (Petersen et al., 2009) presents a [study which has developed a set of long-term foresight exercises \(time horizon 2030\) and exploratory scenarios \(time horizon 2050\) for the assessment of transport and mobility in Europe.](#)

Scenarios of different type are developed for two different timelines: the foresight exercise for 2030 is based, further to a baseline scenario, on two economic growth



scenarios. Both economic growth scenarios (low and high economic growth) are integrated by a policy scenario, where developments are to some extent modified by policy interventions. The basic assumptions underlying these scenarios refer mainly projection data from official forecasts, regarding population GDP and fuel prices. Outputs are provided in terms of transport costs (which are a result, inter alia, of technological efficiency), and development of networks.

The exploratory scenarios for the time horizon 2050 are based on proper storylines, intending to introduce surprising elements into the consideration of possible futures. The intention is to tell “... an appealing story that is not easily dismissed by experts and policy makers” (Petersen et al., 2009). The distinction between scenarios follows specific patterns of mobility and concepts of mobility, but elements of the archetypical scenario storylines introduced earlier can be traced also in this cases:

“Moving alone” or Induced mobility is a storyline focusing on high investments in new technologies, markets, and market oriented policies, sustained by strong economic growth, but with some problems of sustainability with regards to social issues, whereas a reduction of CO₂ is obtained due to technical efficiency.

“Moving together” or Decoupled mobility is a storyline focusing on strong social sustainability, where policy interventions aim at cost-effective policies and institutional change. There is a gradual, cost-effective process to reduce CO₂.

The **“Moving less” or Reduced mobility scenario** emphasizes social and environmental values, with policies aiming at behavioral changes, land use changes and increase in public transport. The storyline is based on an assumption of low economic growth rates and assumes long distance traffics being reduced enforcing the role of communities.

This scenario unifies elements from the adaptive mosaic storyline with ...

Stop moving” or Constrained mobility is a storyline where the element of a surprising event is implemented, assuming the transport system to reach a “bottleneck” after first short period of strong economic growth. The turning point in development is reached because of structural reasons (e.g. lack of public investment on infrastructure, or new technologies, economic decline). Mobility is regulated, in order to release congestion and reduce emissions.



CONCLUSIONS: SKETCHES FOR STORYLINES

Storylines for scenarios in the SESs proposed for the work in PERSEUS take into consideration different future geopolitical roles, interpreted as tendencies of major convergence versus a breaking apart of the areas of the two basins as starting points for storylines. The second vector of policies is connected to the policies that can be implemented with respect to the use of ecosystems, either assuming the protection of ecosystems as a central issue of the political agenda, or leaving it to spontaneous and not coordinated initiatives. The following table provides sketches of four storylines

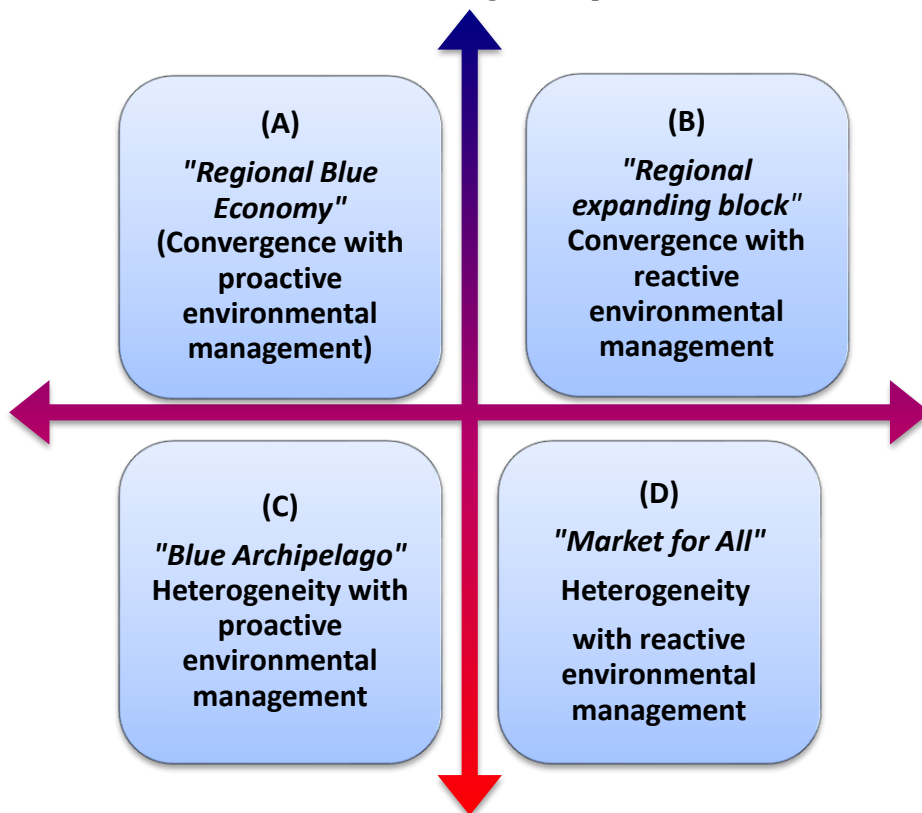


Figure 1 Dimensions of change for scenario storylines

along two different dimensions of change (Bernal and Zografos, 2012):

- regional convergence of national and economic policies around each of the two basins versus increasing heterogeneity of political strategies, nationalisms, localism, economic fracture and conflicts;
- proactive environmental management versus reactive environmental management and subordination of ecosystem service conservation under other policy aims.

Elements of four resulting storylines and a BAU (business as usual) storyline are described in the following and characterized in the tables with the scenario outlines, providing short notes which describe the basic characteristics for each of the storylines and for each of the sectors relevant for impacts on marine ecosystems, either in a distinct manner for each of the two basins, or in a conjoint manner, if developments appear going into similar directions.



BAU scenario

The BAU scenario proposed acknowledges the most recent tendencies in both basins connected to the economic crisis, which has provoked an arrest to the cohesion objectives aimed by the EU in recent years. Without assuming a breaking apart of Med countries hit worse by the consequences of the economic crisis, it assumes a loosening of economic coherence among EU member States (including Romania and Bulgaria in Black Sea area) and towards countries of the Neighbouring zone around the Mediterranean. Turkey, which is at the moment yet in pre-adhesion process, will keep on affirming its political, economic and demographic strength in both basins. This goes at the same pace with a slowing down of a process of coherence and strong engagement of the EU in terms of environmental policies. These are still on-going, but economic recovery has received a higher priority, and is assumed to be achieved at expenses of the conservation of ecosystems. Following the turmoil of the Arab spring, northern African and eastern Mediterranean economies are slowly recovering, and the reconstruction of economies after the collapse of the former Soviet Union is still a task to be completed.

Issues of protection of ecosystem services receive some attention, either because of processes already started throughout the previous periods, or because of the creation of situations being manifest and perceived as unsustainable. There are a number of different disputes keeping on between coastal states in the Mediterranean and Black Seas. Some of them are longstanding; in others, the gradual extension of sovereignty over the maritime space has given rise to new disputes, as a consequence of an overlapping of jurisdictions and the creation of new boundaries.

Scenario A "Regional Blue Economy" (convergence with proactive environmental management)

The democratization process of the Arab spring is bringing northern and southern rims of the Mediterranean together, intensifying economic and political exchange. In the area of the Black Sea, a convergence process is proceeding, approaching eastern rim states led by Turkey towards a more intensified cooperation. The important role of Turkey represents a key factor in this scenario, as the country succeeds in advancing into a high ranked position in the group normally referred to as BRICS (Brazil, Russia, India, China and South Africa considered the most successful group of emerging countries), and is able to act as an autonomous pole between Europe and Arab countries on the one hand side and the Caucasian area on the other. These processes lead to the establishment of strong regional economic forces which are able to concur in a global competition. The convergence process entails intensification of efforts for ecosystem services protection, sustainable management of fisheries, and for the control of negative impacts from all sectors of human activities. In this context, the establishment of Exclusive Economic Zones throughout the Mediterranean is used as a means of enforcing common efforts for a sustainable management of high sea areas.

Scenario B "Regional Expanding Block" (convergence with reactive environmental management)

The process of convergence is limited to economic and geostrategic issues, leaving environmental concerns behind. In the Mediterranean and the Black Sea area we assist to the political enforcement of an important regional block together with an increasing economic cooperation among countries in these areas. At global level



existing blocks keep on dominating international markets but the end of crisis allow to other actors to take part to the global competition.

The efforts for building strong economic areas around the two basins happen on expense of environmental strategies and use unsustainable forms of exploitation of ecosystem services. Sensibility towards environmental issues is limited to a belief in technologic progress as a tool which for sure will allow a mitigation of adverse effects of climate change. Economic growth in both basins is achieved thanks to an improvement of international relations in those areas and to a new cooperation among countries.

Establishment of new Exclusive Economic Zones is hindered in the Mediterranean sea; existing ones, and especially those in Black Sea, where they have been established for long, are used to increase the development of the exploitation of natural resources (oil and gas, and in part fisheries). Disputes among coastal states concerning the delimitation of territorial seas keep on. In addition to this, creation of fishery zones, ecological protection zones and archaeological contiguous zones are persisting. Moreover, while a considerable part of the waters lie outside of state jurisdiction (high seas) the exploitable seabed and its subsoil falls are under the sovereignty of different coastal states. In this way maritime jurisdiction in Mediterranean Sea is really complex and situation is complicated by the fact that delimitation agreements are not achieved and submitted to disputes.

Scenario C “Blue Archipelago” (heterogeneity with proactive environmental management)

The aftermath of the economic crisis has created deep fractures both at within the European community and between the community and neighbouring states. EU countries are closing frontiers against migrants and economic exchanges are limited, provoking isolationist and nationalist reactions also among the neighbouring countries. Despite the spread of this kind of phenomena, the geographical area of our interest is characterized by some “blue trends”: a proactive approach towards environment becomes a key factor of national and local policies in both basins. The establishment of Exclusive Economic Zones throughout the Mediterranean and their enforcement in the Black Sea area serves as a means of conservation of ecosystem services and protection of sustainable uses of resources against external concurrence. Riverine States are interested in preserving freedom of navigation, while protecting the biodiversity and fishery resources and the environment in high sea areas². For this purpose, agreements concerning Areas Beyond National Jurisdiction (ABNJ) are improved.

Scenario D “Market for All” (heterogeneity with reactive environmental management)

The repercussions of the economic crisis in terms of fractures between EU member states and neighbouring countries leading to a long lasting economic downturn has relegated objectives of sustainable use of natural resources among secondary aims of the political agendas of single nations acting in an isolated and protectionist manner.

Global markets are dominated by new economic powers. In European Union territorial cohesion is affected by new economic polarizations.

² High Seas are “ parts of the sea not included in the exclusive economic zone, in the territorial sea, in the internal waters or in the archipelagic waters of an archipelagic state. The high seas are free for all states and reserved for peaceful purposes” – United Nations Convention on Law Of the Sea, Art. 88



Exclusive Economic Zones give rise to several disputes between coastal states in Mediterranean and Black Sea. The process of extending sovereignty over their maritime space and the lack of agreement concerning exploitation of natural resources, caused by overlapping jurisdictions and the creation of new boundaries (internal waters, territorial sea, high seas) is the source of new struggles among riverine countries.

Oil and Gas reserves are exploited and new fields disclosed, increasing impacts of direct exploitation and of transport of oil and gas contributing to further heavy impacts on the environment. The following section, for each of these storylines, describes the main elements regarding the possible future of relevant sectors for the management of ecosystem services under each of the five scenarios considered.

Besides, the tables 11 and 12 summarize the outcomes of each of the five PERSEUS storylines. Their directions of change are characterized for each sector and for their related drivers, with indication of direction and magnitude of trend, respectively for the Mediterranean and Black Seas.



Scenario outline 1: General description

Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
MED & BS	<ul style="list-style-type: none"> • Low economic growth due to the crisis and the consequences of the Arab spring • Loosening of economic coherence within the EU Member States and with Neighbour States • Turkey becoming a pole of growth in the area • Resources getting scarcer (oil peak reached around 2015 in the Adriatic and in 2025 in the Black Sea, freshwater resources, fisheries) • Slow convergence towards European. Environmental Standards, environmental impacts in non EU countries decline at slower pace 	<ul style="list-style-type: none"> • Arab spring bringing north and south of the Med together • Development of Black Sea countries entrains cooperation across the basin, Turkey becoming a pole of growth in the area and a new interface between European and Arab world • Coordination and integration of national policies, mainly on environmental issues • Environmental policies/international treaties are efficiently enforced • EEZs are established in the Med and existing zones enforced in the Black Sea as a means of enforcing the sustainable use of resources for national/local economies • Large public consensus for sustainable use of resources • Availability of funding for environmental policies coming from international and European institutions 	<ul style="list-style-type: none"> • Euro-Mediterranean integration is facilitated by new relations following Arab Spring and democratization spread • Cooperation and economic integration among Med riverine states limited to sensitive issues • Increase of economic cooperation among countries in Black Sea area • Environmental problems tackled only if related to direct national interests • EEZs not established in the Med and existing zones contested in the Black Sea; high sea areas being exploited by all countries • Belief in technological progress as a means of mitigation of adverse effects of climate change (biodegradation, water scarcity, depletion of natural resources, marine pollution etc.) 	<ul style="list-style-type: none"> • Economic crisis provoking a fracture between north and south/southeast (Med) and between east and west (Black Sea); fractures also between central and peripheral EU countries • EU countries closing frontiers • Nationalist and isolationist tendencies and decreasing power of central states • Local initiatives for environmental protection, without providing occasions for international cooperation; • EEZs established in the Med and existing zones enforced in the Black Sea: delimitation of national interest areas & definition of local/national management strategies aiming at sustainable use of resources for national/local economies; 	<ul style="list-style-type: none"> • EEZs established in the Med and enforced in the Black Sea lead to the delimitation of national interest areas & definition of local/national strategies of short term exploitation resulting in conflicts • Deepening of economic cleavages in Mediterranean area (between northern and southern countries) and in Black Sea (between eastern and western countries) • Protectionism in European Union • Strengthening of nationalist and isolationist phenomena



Scenario outline 2: Economic characteristics

Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
MED	<ul style="list-style-type: none"> Diversified economic development between central and southern European states with living standards at the periphery approaching slowly central European standards Economies based on exploitation of gas and oil reserves in decline; new resources difficult to be exploited because of technical and political problems 	<ul style="list-style-type: none"> Rising GDP in the whole basin being part of a unique Economic Zone, including Turkey, and intensification of exchanges with the remaining Med countries Growth based on blue and green economy 	<ul style="list-style-type: none"> Increase of trade exchange in Med area thanks to the creation of a unique Euro Mediterranean Economic Zone Raise of Med basin GDP 	<ul style="list-style-type: none"> Economic decline and polarization within the EU, with central European countries recovering slowly from the financial crisis, Med riverine Member states lagging behind Productive activities relocated to economically stronger countries, leaving Med countries with activities based mainly on natural resources (agriculture, tourism); 	<ul style="list-style-type: none"> EU suffers of an increasing economic decline and polarization Slow recovery in Central European States European Med States do not achieve good economic performances
BS	<ul style="list-style-type: none"> Eastern European Countries lagging behind the economic development, stagnation or low GDP growth rates Economies based on exploitation of gas and oil reserves in decline; new resources difficult to be exploited because of technical and political problems 	<ul style="list-style-type: none"> Rising GDP in the whole basin, intensification of economic exchange with Turkey becoming the new pole of growth in the area, and intensification of exchanges with the remaining Black Sea countries European Investments and delocalization in Black Sea countries allow know-how transfers 	<ul style="list-style-type: none"> Growth based on traditional and new industrial activities, including exploitation of new oil and gas reserves Exchange with the remaining BS countries Industrial sector is at the basis of the economic growth in Black Sea area Rising GDP in the whole basin, 	<ul style="list-style-type: none"> BS countries suffer of deindustrialization process Only tourism sector increasing, creating consensus for conservation of natural resources (agriculture, tourism) 	<ul style="list-style-type: none"> European Black Sea States with low if any GDP growth Industrial activities and oil and gas exploitation relying on lower environmental standards, leaving Med countries with activities based unsustainable use of natural resources (pollution, exploitation of oil and gas);



Scenario outline 3: Demographics

Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
MED	<ul style="list-style-type: none"> Population increase slowing down in the southern part of the MED basin Northern countries with aging societies 	<ul style="list-style-type: none"> Slowing population growth in Southern Mediterranean Countries Northern part aging Investments for infrastructure in MENA countries, oriented to population growth and tourism 	<ul style="list-style-type: none"> Low population increase in the southern part of the MED basin; Aging phenomena in Northern Mediterranean Countries Aging impacts compensated by migration 	<ul style="list-style-type: none"> Strong population increase in the southern and eastern part of the basins Strong population increase 	<ul style="list-style-type: none"> Migrations from south and east contribute to population increase and compensate phenomena of aging societies
BS	<ul style="list-style-type: none"> Population stagnating because of aging and out-migration in the western part, growing in Turkey Decrease of migrations from Romania and Bulgaria to Western Europe 	<ul style="list-style-type: none"> Low-medium population increase because of inversion of migration tendencies 	<ul style="list-style-type: none"> Inversion of migratory fluxes stimulates a slow raise of population growth 		

Scenario outline 4: Tourism

Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
MED	<ul style="list-style-type: none"> Slow growth of the sector due to an augmentation of demographic trends 	<ul style="list-style-type: none"> New touristic common policies in the framework of European Neighborhood 	<ul style="list-style-type: none"> Increasing demand for tourism from EU targeting mainly at lower- medium 	<ul style="list-style-type: none"> Fracture NMECs and SEMCs in touristic fluxes Decline of overall tourism 	<ul style="list-style-type: none"> Increasing demand of the low/medium sector Further expansion of resorts



Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
	<ul style="list-style-type: none"> • Arab Spring affects tourism in Egypt and Tunisia. Turkey, Croatia and Slovenia become new important destinations • An increased concurrence obliges touristic operators to improve quality of services, without paying attention to environment • Increasing number of environmental crisis • Development of eco-tourism 	<ul style="list-style-type: none"> • Policies facilitate coordination among touristic destinations • Total amount of tourists in Med area increases, along a diversification of the tourist origins. More residential tourism • In SEMCs Improvement of national transport infrastructure allows to promote residential fluxes • Demand for a “higher-quality” tourism. Increase of “cultural tourism” and ecotourism in link with environmental protected areas • Stabilization of accommodations; improvement of their quality; compliance with rules about construction edification on coastal areas. • Better governance of cruise standards and adoption of improved environmental techniques Increased pressure for CO2 cuts and fuel costs reshaping the sector development of sustainable 	<ul style="list-style-type: none"> • standard offers • Luxury tourism demand from other parts of the world expanding with heavy environmental impacts (golf courses, new structures in pristine areas) • Better governance of cruise sector without improvement in shipping impacts • Any investments in development of new transport techniques but coordination between public authorities and flight /maritime/ rail companies for development of intermodal transport • Overall increase of tourism in all sectors, without specific environmental precautions, causing further strong increase in coastal urbanization • Lack of specific environmental precautions causing further strong increase in coastal urbanization 	<ul style="list-style-type: none"> • demand, • Residential demand increases • Increasing importance of local projects for eco-tourism • Demand for quality increasing • Decreasing pressure on the environment. • Demand for environmental quality driving the local initiatives for environmental protection. • Increase of concurrence between transport companies (open sky vs. rail) • Any governance on cruise sector but research on techniques (improvement of competitiveness) • Global competition among destinations is adversely impacting areas without specific unique selling points and/or poorly connected to the main urban centers • Competition amongst regions and places within and outside both basins 	<ul style="list-style-type: none"> • with heavy environmental impacts • No governance/nor research: cruise tourism increasing with heavy environmental impacts (air and water pollution, litter) • No governance aiming at reduction of CO2 • No governance in transport field; Raise of concurrence among touristic operators; No Investment aiming at improving concurrence; • Domination of seaside tourism
BS	<ul style="list-style-type: none"> • Slow increase of the sector, mainly based on mass tourism and on local tourism • Strong raise of coastal tourism • Ecotourism developing slowly • Increasing number of environmental crisis 				



Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
		transport solutions <ul style="list-style-type: none"> • Investment in intermodal transports and reduction of pollution in all Mediterranean area • Respect of environmental regulations in coastal areas • A growing demand for quality facilitates an increase of environmental standards in the sector 			



Scenario outline 5: Coastal development/Urbanization

Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
MED	<ul style="list-style-type: none"> Increasing concentration of population in coastal zone despite declining population growth rates Further expansion of areas dedicated to coastal tourism Further expansion of port areas and coastal construction financed by Chinese or Gulf investments 	<ul style="list-style-type: none"> Declining growth rates of coastal urban areas Strategic urban planning through multilevel cooperation (cities, regions, states) Revalorization strategies contribute to reduce impacts from urban areas onto the marine environment Generalization of wastewater treatment Waste water recycling Integrated coastal protection strategies pursued Due to slow progress of sea level rise, adaptation can be neglected for some time, and risks to get out of the political agenda Technology keeps in pace with requirements caused by sea level rise 	<ul style="list-style-type: none"> Expansion of structures dedicated to beach tourism, some older areas are abandoned, new areas are expanding into formerly pristine zones Desalination plants are used more frequently, discharges compromising sea floor Further expansion of constructions for the tourism sector Coastal infrastructures (ports) expanding New infrastructures for coastal protection against sea level rise Increasing impacts from municipal and industrial wastewater 	<ul style="list-style-type: none"> Migrations towards North Europe provoke a decrease of pressure for coastal urbanization and on mass tourism, no further expansion of touristic zones. Reuse and adaptation of existing structures, no further expansions Slow increase of wastewater treatment (lack of funding) Local solutions for adaptation to sea level rise. 	<ul style="list-style-type: none"> Increasing pressure from migration and expansion of the tourism sector determining further expansion coastal settlements



Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
BS	<ul style="list-style-type: none"> Declining population numbers, aging societies rates Outmigration Further expansion of areas dedicated to coastal tourism Further expansion of port areas and coastal construction 	<ul style="list-style-type: none"> Coastal urbanization for tourism slowing down Impacts from coastal urbanization, infrastructures and industry slowly declining Wastewater treatment reduces nutrient loads 	<ul style="list-style-type: none"> Further expansion of constructions for the tourism sector Coastal infrastructures (ports) expanding New infrastructures for coastal protection against sea level rise Raise of environmental risk provoked by industrial and municipal wastewater 	<ul style="list-style-type: none"> Reuse and adaptation of existing structures, no further expansion Slow increase of wastewater treatment (lack of funding) Local solutions for adaptation to sea level rise 	<ul style="list-style-type: none"> Increase of structures for tourism and diffuse urbanization No increase of wastewater treatment (lack of funding) Adaptation to sea level rise not considered

Scenario outline 6: Fisheries/aquaculture

Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
MED	<ul style="list-style-type: none"> Influence of Regional Fisheries Management Organization (GFCM and ICCAT) remains weak over the time. Fishing stocks slowly declining and collapsing in some areas Growing aquaculture provoking further stress onto 	<ul style="list-style-type: none"> Basin wide regulation for fisheries leads to a full exploitation of all stocks. Principles of the PCP are agreed and enforced by all countries. Fishery subsidies focused on the adoption of 	<ul style="list-style-type: none"> Fisheries and the increasing aquaculture sector providing an important part of the protein food for the local population Exploitation of stocks High sea areas heavily exploited 	<ul style="list-style-type: none"> After collapse of local fisheries, strong consensus for local sustainable management, slow recovery of commercially interesting stocks Aquaculture developing slowly sustainable solutions 	<ul style="list-style-type: none"> Wars between fisheries Increased over exploitation of stocks Strong expansion of aquaculture generates increased environmental pressures



Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
	fishing stocks and impacts on the marine environment	environmentally friendly fishing techniques <ul style="list-style-type: none"> • Sustainable exploitation of industrial fisheries. Conversion of small scale fishery to sea watching/tourism related activities • Fast development of a more sustainable aquaculture • 	<ul style="list-style-type: none"> • Increasing number of stocks under threat of collapse • Growing aquaculture provoking further stress onto fishing stocks and impacts on the marine environment 		
BS	<ul style="list-style-type: none"> • Fisheries performances are stable over the years with mixed performances • Stable number of stocks under threat • Establishment of exclusive fishery zones to protect national fisheries • Increase of aquaculture 	<ul style="list-style-type: none"> • Increased public consensus for joint management measures and enforcement of strong rules • Stocks are recovering • Aquaculture increasing with reduced impacts • Invasive species increasing slowly 	<ul style="list-style-type: none"> • Stocks recovering only partially from collapse • Strong impacts from invasive species • Aquaculture is boosting in order to satisfy increasing demand 	<ul style="list-style-type: none"> • EEZs delimiting the boundaries of national fisheries and are enforced • National control of fisheries and establishment of catch quotas gradually improves the situation in some of the EEZs • Aquaculture is strongly regulated and oriented on the national market • Invasion of non-local species slowing down because of decrease in commercial exchanges and maritime transport 	<ul style="list-style-type: none"> • EEZs delimit the boundaries of national fisheries and are enforced • Stocks are increasingly under pressure, no recovery from collapse, and collapse phenomena moving down the food chain



Scenario outline 7: Maritime transport/ports

Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
MED	<ul style="list-style-type: none"> • Strong increase of maritime transport in pace with increasing globalization increasing trade flows from Asia to Europe • Cruise shipping sector further increasing • Expansion of port areas following Chinese and Middle East investments 	<ul style="list-style-type: none"> • Increase of maritime transports in Asia-Europe-America route • Development of Sea Highways thanks to a closer Euro-Mediterranean cooperation • Improved logistics in the transport sector and improved coordination among ports • Efficiency and sustainable increases in and around secondary ports and their hinterland connections • Gradual increase of environmental and safety regulation, allowing the sector to acquire funds and invest in the necessary adaptation costs. 	<ul style="list-style-type: none"> • Increase of transport volumes and movements within the European Single Market provoking high environmental impact because of coastal infrastructures and direct impacts from maritime transport (litter, management of ballast water/alien species) • Strong enhancements in external infrastructure (ports and hinterland) coastal development 	<ul style="list-style-type: none"> • Strong regulation and limitations within the economic zones 	<ul style="list-style-type: none"> • Arrest of European FDI in maritime infrastructure development in South Mediterranean countries • Lack in shipping safety standards • Increase in maritime accidents with human and environmental consequences • Raise of environmental risks caused by the development of new maritime infrastructures (port and hinterland)
BS	<ul style="list-style-type: none"> • Maritime transport further increasing, after 2025 decline because of oil peak 	<ul style="list-style-type: none"> • Increasing volumes of transport are managed in a sustainable manner • New sustainable logistics and transportation technologies reducing impacts. 	<ul style="list-style-type: none"> • Reduction in transport because of reduced oil and gas exportation compensated by increase of trade of industrial commodities, • Expanded port facilities remaining unused 	<ul style="list-style-type: none"> • Oil and gas prices raise determine a decrease in transport demand 	<ul style="list-style-type: none"> • Industrial activities are driving maritime transport



Scenario outline 8: Agriculture

Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
MED	<ul style="list-style-type: none"> Decreasing/more efficient use of fertilizers Overexploitation of water resources for irrigation 	<ul style="list-style-type: none"> Financial subventions aiming to the coordination of agricultural policies Promotion of a Euro-Mediterranean Common Agricultural Policy integrating environmental preservation and sustainable agricultural development Intensification of exchanges, including agricultural and craft products of certified quality Development of an export agriculture based on a regional specialization and on a complementarity between the production areas Technological innovation reducing use of fertilizer, land use changes, ground water extraction in arid countries and risk of salinization, run-off and eutrophication reduced 	<ul style="list-style-type: none"> Increased use of irrigation and fertilizers, eutrophication 	<ul style="list-style-type: none"> Declining production, less use of fertilizers 	<ul style="list-style-type: none"> Increase of production, heavy environmental impacts
BS	<ul style="list-style-type: none"> Slow recovery in the agricultural sector, but with lower impacts than before 1989 				



Scenario outline 9: Oil and Gas exploitation

Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
MED	<ul style="list-style-type: none"> • Net decline because of declining reserves in the Adriatic • New fields are exploited in the eastern part of the MED (mainly Lebanon, Israel, and Cyprus) 	<ul style="list-style-type: none"> • No new off shore oil and gas extraction, and reduction in transport of oil and gas (pipelines and maritime transport) • New technologies allowing further exploitation of offshore oil fields • Renewable energy policies providing room still for oil & gas • Introduction of regulations regarding the safety and the protection of the environment 	<ul style="list-style-type: none"> • Expansion of local oil and gas extraction and of part of the transformation activities; with increasing environmental impacts 	<ul style="list-style-type: none"> • Oil reserves are rapidly declining, so use of renewable energies (see following) are necessary • No more exploitation of off-shore oil and gas reserves because of environmental impacts 	<ul style="list-style-type: none"> • Oil and gas exploitation relying on lower environmental standards, leaving Med countries with activities based unsustainable use of natural resources (pollution, exploitation of oil and gas) • Net decline because of declining reserves in the Adriatic, new fields are exploited in the eastern part of the MED (mainly Lebanon and Israel and Cyprus)
BS	<ul style="list-style-type: none"> • Oil peak reached at 2025, after that date decline of oil production and transport, • Off-shore structures being dismissed 				<ul style="list-style-type: none"> • New oil fields being exploited in the north of Turkey



Scenario outline 10: Renewable Energy

Basin	BAU	Scenario A “Regional Blue Economy” Convergence with proactive environmental management	Scenario B “Regional Expanding Block” Convergence with reactive environmental management	Scenario C “Blue Archipelago” Heterogeneity with proactive environmental management	Scenario D “Market for All” Heterogeneity with reactive environmental management
MED and BS	<ul style="list-style-type: none"> Increasing energy demand Slow expansion of the off-shore wind sector 	<ul style="list-style-type: none"> Off- and inshore wind farms, plus solar energy production, intense use of seafloor for cables Constructions realized with high environmental standards and win-win solutions for biodiversity (artificial reefs, use of active and dismissed off-shore platforms) Research in renewable energy field is promoted at national, regional and international level 	<ul style="list-style-type: none"> Increasing demand for energy Lack of sensibility towards environmental issues as for example the need of developing renewable energies sources 	<ul style="list-style-type: none"> Demand for energy not declining Isolated local solutions prevailing Use of energy mix with high percentage of fossil energy Progress in energy efficiency National funds directed to development of research in renewable energy field 	<ul style="list-style-type: none"> Lower demand for energy Renewable energy sources and potential energy savings are not exploited Research in renewable energy field is not promoted



Table 11: Direction of change for driver activity indicators for the five PERSEUS scenarios for Mediterranean Sea

Legend: 0 same as present state; + more than present state (slow increase); ++ much more than present state (net increase); - less than the present state (slow decrease); -- much more than present state (net decrease)

SECTOR		SCENARIO				
		Business as Usual	Convergence with proactive environmental management	Convergence with reactive environmental management	Heterogeneity with proactive environmental management	Heterogeneity with reactive environmental management
Tourism	Mass tourism demand	0/+	-	++	0/+	+
	Luxury tourism	0/+	+	++	0/+	-
	Local/cultural tourism	0/+	++	++	+	-
	Eco-tourism	0	++	--	+	0
Coastal Development/Urbanization	Population concentration	++	+	++	+	++
	Expansion of coastal settlements	+	0/-	++	0	++
Fisheries/aquaculture	Fisheries production	0/-	++	0	+	--
	Aquaculture production	+	+	++	0/+	+
Maritime transport/ports	Expansion of port areas	0/+	+	++	0/-	0/+
	Maritime transports	0/+	++	++	0/-	0/-
Agriculture	Increase of production	0	0/+	++	0/-	0/+
	Use of fertilizers	0/-	--	++	-	+
Offshore Oil&Gas exploitation	New reserves exploited	0/+	0	++	--	+
Renewable Energy	Renewable energy sources exploited	0/+	++	0/+	+	--



Table 12: Direction of change for driver activity indicators for the five PERSEUS scenarios for the Black Sea (2030)

Legend: 0 same as present state; + more than present state (slow increase); ++ much more than present state (net increase); - less than the present state (slow decrease); -- much more than present state (net decrease)

SECTOR		SCENARIO				
		Business as Usual	Convergence with proactive environmental management	Convergence with reactive environmental management	Heterogeneity with proactive environmental management	Heterogeneity with reactive environmental management
Tourism	Mass tourism demand	0/+	+	++	0/+	-
	Luxury tourism	0	++	+	-	--
	Local/cultural tourism	0/+	++	++	+	-
	Eco-tourism	0/+	++	0/+	+	0
Coastal Development/ Urbanization	Population concentration	+	+	++	+	0/+
	Expansion of coastal settlements	+	0/+	++	0/+	+
Fisheries/ aquaculture	Fisheries production	0	+	0/+	0/-	-
	Aquaculture production	+	+	++	0/+	+
Maritime transport/ports	Expansion of port areas	0/+	++	0/-	0	0/+
	Increase of maritime transports	++	++	0/-	0/-	0/+
Agriculture	Increase of production	0/+	0/+	++	0/+	0/+
	Use of fertilizers	0	--	++	--	++
Offshore Oil&Gas exploitation	New reserves exploited	0/-	0	+	--	0/+
Renewable Energy	Renewable energy sources exploited	0/+	++	0/+	0/+	--



OUTLOOK – NEXT STEPS

These lines sketched for the five scenarios will provide the basis for the discussion with stakeholders in the platforms being established for each of the case study areas. They will potentially provide the background for the design of a framework for adaptive policies illustrating the range of possible futures the area might face during the implementation of the policies to be designed and inform the modelling process of PERSEUS. Prior to be used in this manner, an activity of verification of credibility on the scenario lines designed and their adaptation will need to be developed. This verification will use different occasions: during the in-depth analysis of existing foresight exercises planned as a subsequent activity under the PERSEUS work package 6.1, and during the confrontation in each of the PERSEUS stakeholder platforms.



ACRONYMS AND ABBREVIATIONS

APF	Adaptive Policy Framework
BRICS	Brasil, Russia India, Cina; South Africa
BSC	Commission on the Protection of the Black Sea against Pollution
EC	European Commission
EU	European Union
EEZ	Exclusive economic zone
DoW	Description of Work
GES	Good Environmental Status
IPCC	Intergovernmental Panel for Climate Change
MA	Millennium Ecosystem Assessment
MAP	Mediterranean Action Plan
MENA	Middle-East and North African Countries
MS	Milestone
MSFD	Marine Strategy Framework Directive
NFP(s)	National Focal Point(s)
SEMCs	South East Mediterranean Countries
SES(s)	Southern European Seas
SHP(s)	Stakeholder Platform(s)
SSC	Scientific Steering Committee
UfM	Union for the Mediterranean
UNEP	United Nations Environment Programme
WFD	Water Framework Directive
WP(s)	Work Package(s)



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