PERSEUS

POLICY-ORIENTED MARINE
ENVIRONMENTAL RESEARCH IN
THE SOUTHERN EUROPEAN SEAS

Reports on the experimentations made at SES basin level

Deliverable Nr. 6.14

Project Full title	Policy-oriented marine Environmental Research in the Southern EUropean Seas
Project Acronym	PERSEUS
Grant Agreement No.	287600
Coordinator	Dr. E. Papathanassiou
Project start date and duration	1st January 2012, 48 months
Project website	www.perseus-net.eu

Deliverable Nr.	D6.14	Deliverable Date	June 2015
Work Package No	6		
Work Package Title	Adaptive Policies and Scenarios		
Responsible	Maialen Garmendia, Basque Centre for Climate Change (BC3) (Partner No. 11)		
Authors & Institutes Acronyms	Maialen Garmendia, BC3 Nicola Beaumont, PML Ben Boteler, Ecologic Taos Boudine, PB Margaretha Breil, CMCC Areti Kontogianni AEGEAN Ina Krüger, Ecologic Julien Le Tellier, PB Emma Gileva, BSNN David March, CSIC Anil Markandya, BC3 Elena Ojea, BC3 Marta Pascual, BC3 Paolo Ronco, CMCC Didier Sauzade PB Aleksandar Shivarov, BSNN Mihalis Skourtos, AEGEAN		
Status:	Final (F)		
	Draft (D)		
	Revised draft (RV)	X	
Dissemination level:	Public (PU)	X	

	Restricted to other program participants (PP)	
	Restricted to a group specified by the consortium (RE)	
	Confidential, only for members of the consortium (CO)	

CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY / ABSTRACT

To operationalize the design and implementation of adaptive policies and translate adaptive management into decision tools under the requirements of the Marine Strategy Framework Directive, the Adaptive Marine Policy (AMP) Toolbox has been developed. The objective is to provide policymakers with the necessary framework and resources to develop adaptive policies. Moreover, to investigate the usefulness of the AMP Toolbox and improve it, different tests have been performed using real-world problems through a participatory approach with stakeholders. The experimentations have been performed at two levels: (i) Pilot case level; and, (ii) Basin level (i.e. including the Mediterranean and Black Sea). This report is focused on the experimentations developed at basin level and the improvements performed on the AMP Toolbox based on the key lessons learnt and recommendations gained with the tests. For this purpose, this deliverable contains three sections: (i) the description of the AMP Toolbox in short, including its guiding principles, objective and structure; (ii) the presentation of the flag-example developed (i.e. application of the AMP Toolbox to the marine litter issue in the Mediterranean and Black Sea) to show the usefulness of the AMP Toolbox to design and implement adaptive measures to the stakeholders in the tests (and potential end-users as well); and, (iii) the improvements performed on the AMP Toolbox based on the lessons learnt during the tests. The organization, flow and direct comments or outputs gained with the tests at basin level are compiled in D6.15- Final report on expectations issued by the Southern European Seas (SES) stakeholder platform.

SCOPE

To overcome the gap between science and policy, the PERSEUS project, aims to design and support an ecosystem-based approach (EBA) to management. For this purpose, the Adaptive Framework Policy (APF) has been developed. The APF consist of two components: the Stakeholder´s platforms and the Adaptive Marine Policy Framework Toolbox (AMP Toolbox). The latter has been developed to provide policy-makers with the necessary guidelines and resources to develop environmental policies to achieve Good Environmental Status under the requirements of the Marine Strategy Framework Directive, and different mandates calling for the EBA. The objective of Task 6.4-"Implementation and Lesson learned" within WP6 is to implement and test the usefulness of the AMP Toolbox with the abovementioned stakeholders, and to improve it with the lessons learnt during this phase. For this purpose, several tests have been performed at: (a) Southern European Seas (SES) or basin level; and, (b) sub-basin or Pilot case level. In this deliverable, we will focus on the tests performed at SES or basin level. Accordingly, the objectives of this report are to present the: (i) core of the Toolbox clearly; (ii) the flag-example developed (i.e. application of the AMP Toolbox to the marine litter issue in the Mediterranean and Black Sea) to show the usefulness of the AMP Toolbox to design and implement adaptive measures to the stakeholders in the tests (and potential end-users as well); and, (iii) key learnings gained within the tests and the improvements performed in the Toolbox accordingly. This deliverable is linked to D6.15-Final report on the expectations issued by SES Stakeholder platform, where the organization, flow and direct comments or outputs gained with the tests at basin level are detailed.

1. INTRODUCTION

Marine ecosystems (including estuaries, coastal waters and open sea) provide several ecosystem services such as provisioning of food (e.g. fish), energy and mineral resources (e.g. waves power and petroleum beneath seafloor), but also the regulation of important functions such as the nutrient cycling and the climate system´s regulation. However, these ecosystems –and thus the benefits they create - are subjected to competing uses such as fishing, food and energy production, waste disposal and marine transport to name a few. These activities together with the impacts of climate change are leading to concurrent regime shifts (http://www.regimeshifts.org/) in marine ecosystems, with potentially wide-ranging biological effects (Bertram and Rehdanz 2013). Consequently, it is difficult to find the necessary mechanisms to adapt to the changing (anticipated and unanticipated) conditions. This introduces yet more complexity to areas such as the management of marine ecosystems and resources. Though, increasing the adaptation capacity of marine ecosystems as well as of the sectors that are related to the ecosystem services they provide, to potential threats and opportunities due to climate change might be decisive for the long term sustainability of these ecosystems and sectors.

So, as a consequence of the above-mentioned threats to the marine ecosystems, the changing climate conditions and the dynamicity and complexity of the marine ecosystems, resource managers face large-scale and complex challenges that demand new approaches to balance development and conservation goals. One approach that shows considerable promise for addressing these challenges is adaptive management, which by now is broadly seen as a natural, intuitive, and potentially effective way to address decision-making in the face of uncertainties. Yet the concept of adaptive management continues to evolve, and its record of success remains limited (Williams and Brown 2014).

However, the implementation of adaptive policies is not only a need, but also a legal requirement. Actually, several regulations require implementing adaptive (on the basis of the Ecosystem-based approach to management, EBA) policies for managing the marine ecosystems. From a European policy perspective, in 2008 the European Union adopted the Marine Strategy Framework Directive (MSFD). This Directive establishes a framework to develop marine strategies and take necessary measures to achieve or maintain Good Environmental Status (GES) for 2020. For this purpose, it proposes a six-yearly management cycle (Figure 1). This means that there will be regular opportunities to review the suitability and effectiveness of different elements of the cycle (i.e determination of Good Environmental Status, the environmental targets and associated indicators, the monitoring programmes and the Programme of Measures) as well as to adapt them. In fact, the Marine Strategy Framework Directive states that the determination of Good Environmental Status may have to be adapted over time in view of the dynamic nature of marine ecosystems and their natural variability; and given that the pressures and impacts on them may vary with the evolvement of different patterns of human activity and the impact of climate change. Moreover, the programme of measures may be flexible and adaptive to take into account of scientific and technological developments.
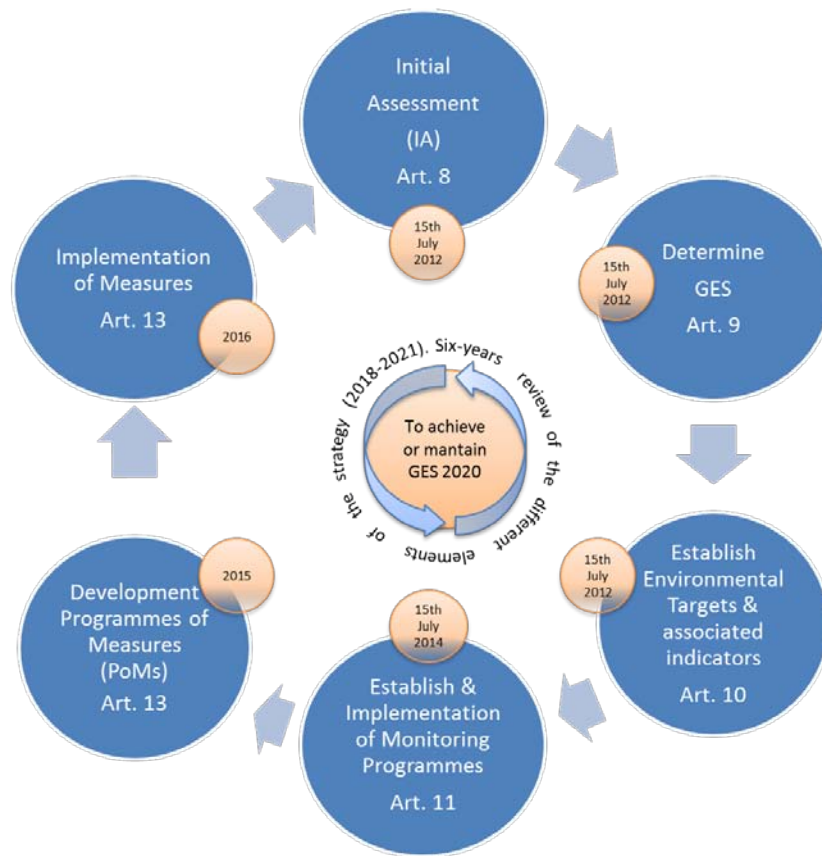
Figure 1: Policy-cycle proposed by the Marine Strategy Framework Directive where Marine Strategies must be kept up-to-date and reviewed every 6 years.

Accordingly, apart from pursuing management objectives (i.e. achieve or maintain Good Environmental Status), the Marine Strategy Framework Directive intends to simultaneously learn about management consequences.

In fact, adaptive management is seen as an evolving process that includes learning (the accumulation of understanding over time) and adaptation (the adjustment of management over time). The sequential cycle of learning and adaptation targets better understanding of the resource system, and better management based on that understanding (Williams and Brown 2014). However, although frequent assertions that adaptive management is being used and frequent descriptions of learning as an element of management, there has been only limited progress in promoting a connection between learning and management (Williams and Brown 2014).

For that reason, it is necessary to provide a framework for policy action and to enable this action to be adaptive as well as consistent with the MSFD and additional European legislation (e.g. Common Fisheries Policy) and international agreements (e.g. Mediterranean Action Plan´s Ecosystem Approach or Black Sea´s Strategic Action Plan) calling for the EBA to the management of human activities impacting marine ecosystems (Cinnirella et al. 2014). This is particularly important in regions such as the Mediterranean and Black Sea, where the geopolitical and economic disparity hinders a shared action toward achieving environmental goals, including the implementation of the MFSD (Cinnirella et al. 2014). In addition, the prevention and reduction of ocean-related problems (e.g. eutrophication, marine litter or overfishing)

require consistency and international cooperation due to the trans-boundary nature of marine ecosystems. This is particularly important in semi-enclosed basins such as the Mediterranean and Black Sea (Cinnirella et al. 2014; Goulding et al. 2014; Lebreton et al. 2012; O'Higgins et al. 2014). Accordingly, transparent decision-making which is inclusive of stakeholders at all stages and enjoys high levels of cooperation and coordination is critical to meaningful development and implementation of the EBA (Bainbridge et al. 2011; Tallis et al. 2010).

Accordingly to operationalize and harmonize the design and implementation of truly adaptive policies, on the basis of the EBA, into decision tools, the Adaptive Marine Policy Toolbox (hereafter, AMP Toolbox) (http://www.perseus-net.eu/en/about_the_apf_toolbox/index.html) has been developed, a decision support tool for policy-makers developing marine policies, and specifically adaptive policies, in the Mediterranean and Black Sea. The objective, structure, guiding principles and resources of the AMP Toolbox are presented in this deliverable.

Moreover, in order to investigate the usefulness of the AMP Toolbox and improve it with the lessons learnt, different tests have been performed using real-world problems (i.e. situations at risk of not achieving or maintaining Good Environmental Status during 2020-2030 horizons) through a participatory approach with Stakeholders. The experimentations have been performed at two levels: (i) Pilot case level (including four pilot cases, the Western Mediterranean, Adriatic, Aegean and Western Black Seas); Southern European Seas (SES) or basin level (i.e. including the Mediterranean and Black Sea).

This deliverable is focused on the experimentations developed at SES or basin level and the improvements performed on the AMP Toolbox based on the lessons learnt with the tests. For this purpose, this deliverable contains three important sections:

(i)   The description of the AMP Toolbox, including its guiding principles, objective and structure;

(ii) The presentation of the example (i.e. the problem of marine litter in Southern European Seas) developed to provide stakeholders and potential users insights into the guidelines and resources within the AMP Toolbox;

(iii) The presentations of the key lessons learnt during these tests and the improvements applied to the AMP Toolbox accordingly.

Details on the organization, flow and direct comments or outputs gained with the tests at basin level are detailed in D6.15-Final report on the expectations issued by SES Stakeholder platform.

2. DESIGN AND IMPLEMENTATION OF THE AMP TOOLBOX AND ASSOCIATED TASKS AND DELIVERABLES

The AMP Toolbox is the result of common efforts of PERSEUS scientific partners and members of the Stakeholder platforms, and has been developed according to the following tasks (see Figure 2):

✓ Task 6.1-"State of play": Provides the basic information on scientific, technical, economic, legal and institutional knowledge necessary to develop the AMP Toolbox. Thematic data bases developed within this task constitute the Knowledge base associated to the AMP Toolbox (see, **Knowledge base" and "Regional assessments and models**).

DELIVERABLES
- D6.2-Preliminary list of issues at risk of non Achievement of the GES and scenarios to be modeled
- D6.4-Inventory and critical assessment of existing foresight analyses and scenario planning
- D6.5-Inventory and critical assessment of legal, policy and institutional marine policy contexts in SES
- D6.6-Inventory and critical assessment of the possible measures to be taken to achieve GES
- D6.8-Inventory and critical assessment of current economic valuation studies on marine goods and services
- D6.9-Specifications of the web knowledge base on the state of play reviews

Objective: take an initial stock of the scientific, technical, economic, legal and institutional knowledge needed to build the toolbox
Task 6.1-State of the play

Objective: Develop platforms with relevant stakeholders at pilot case and regional level; to gain their expectations on the toolbox and gather their opinions within the tests.
Task 6.2-Stakeholders dialogue

DELIVERABLES
- D6.1-Presentation of the Stakeholder platform
- D6.3-APF, preliminary report on expectations issued by the stakeholder platforms

Task 6.4-Implementations and lessons learnt
Objective: Test and improve the toolbox through experimentations performed with stakeholders at pilot case and regional levels.

Task 6.3-AMP Toolbox development
Objective: Build the conceptual framework of the toolbox, based on the results of Task s 6.1 and 6.2.

DELIVERABLES
(1) Pilot case level:
- D6.12-APF, final report on expectations issued by the Pilot case Stakeholder platforms
- D6.13-APF, reports on the experimentations in the four Pilot cases
(2) SES basin or regional level:
- D6.15-APF, final report on expectations issued by the SES stakeholder platform
- D6.14-Report on the APF experimentations made at SES basin scale
(3) Summary:
- D6.16-Synthesis report on the APF experimentations, lessons learned, recommendations and perspectives

DELIVERABLES
- D6.7-Report on the conceptual Framework of the PERSEUS APF Tool Box
- D6.10-Report on the state-of-the-art of the potential principles and methods for the APF elaboration
- D6.11-General documentation of the PERSEUS APF Tool Box

Figure 2: Organization of the tasks and deliverables developed by Work Package 6 within PERSEUS project.

✓ Task 6.2-"Stakeholder dialogue": As the AMP Toolbox is developed for actual application in the Mediterranean and Black Sea regions, the needs and expectations of stakeholders and decision-makers within this region are of crucial importance. Task 6.2 provides a means for:
   o Developing four stakeholders' platforms at Pilot case level (i.e. one per Pilot case, including the Western Black, the Aegean, the Adriatic and the Western Mediterranean Sea) and one stakeholders' platform at Southern European Seas (SES) or basin level (results reported in D6.1-"Presentation of Stakeholder Platforms"). The SES Stakeholders' platform is basically formed by the members of the Advisory Board of PERSEUS project.

o <u>Dialogue with stakeholders on the expectations of the AMP Toolbox</u>. The consultations with the stakeholders at Pilot case level consisted of "Online questionnaires" and "Face-to-face interviews". Additionally, the dialogue with the SES or basin level stakeholders took place during the celebration of the 2nd PERSEUS General Assembly and Advisory Board Meeting (24-25/01/2013, Barcelona, Spain). Results at both levels (i.e. pilot case and basin levels) have been reported in deliverable D6.3-"Preliminary report on expectations and needs of the end users of the Adaptive Policy Framework (APF), at sub-basin Pilot Cases and Southern European Seas levels, feedbacks from the presentation of the APF application". Though, in Box 1, main concerns raised by the Advisory Board have been collected.

> **Box 1: Recommendations of the Advisory Board (AB)**
>
> "The main worry was that the Toolbox could become too complex and detailed to be suitable and usable for stakeholders, and might also not really meet the stakeholders' needs. The AB thus recommended that the AMP Toolbox should be limited to step-by-step guidelines for adaptive policy making, describing each step in detail. Additionally, not only examples related to the implementation of the MSFD should be included, but also examples of tools which can be used in each step. Finally, efforts should step away from the original idea of a web-based inventory of all PERSEUS tools and results, towards further development of the step-by-step approach. The step-by-step approach should be presented in an interactive format based on web applications".

o <u>Dialogue with stakeholders on their experimentations and recommendations</u>. The dialogue with the pilot case level stakeholders consisted of face-to-face interviews or small workshops. The dialogue with the SES or basin level stakeholders also took place by means of different workshop during the celebration of the "International Black Sea Day" (03/10/2014, Istanbul, Turkey) and the "3rd PERSEUS General Assembly and Advisory Board Meeting" (01/12/2014, Marrakech, Morocco). Results have been reported in deliverables D6.12 and D6.15-"Final reports on expectations issued by stakeholders' platforms", at Pilot case level and SES or basin level respectively.

Accordingly, the dialogue with the stakeholders is certainly linked to both, the development as well as the implementation or test of the AMP Toolbox.

✓ <u>Task 6.3-"AMP Toolbox development"</u>: Comprises the design of a toolbox in order to operationalize the design and implementation of adaptive policies and translate adaptive management into decision tools under the requirements of the Marine Strategy Framework Directive. For this purpose, three actions have been performed:

o <u>Build the conceptual framework of the AMP Toolbox</u>, based on tasks 6.1 and 6.2 (results reported in D6.7-"Report on the conceptual framework of the PERSEUS AMP Toolbox").

o <u>Conduct a state-of-the-art assessment of the potential principles and methods</u> for the Adaptive Policy Framework elaboration (results reported

in D6.10-"Report on the state-of-the-art of the potential principles and methods for the AMP elaboration").

o <u>Build the Toolbox and present it in a user-friendly manner to the users</u> (i.e. based on web applications) (D6.11-"General documentation of the PERSEUS AMP Toolbox"). In fact, the AMP Toolbox is being implemented on a dedicated part of the PERSEUS web site (http://www.perseus-net.eu/en/about_the_apf_toolbox/index.html) in the framework of Task 9.4-"Targeted communication tools for policy-makers, scientists & environmental organisations".

✓ <u>Task 6.4-"Implementation and lessons learned</u>": Is dedicated to test the AMP Toolbox in the four pilot cases (D6.13) as well as at SES or basin level (the **present Deliverable, D6.14**) in collaboration with stakeholders. The insights gained in the tests have been thoroughly documented in D6.13 and D6.14 respectively, and they serve to further elaborate and improve the AMP Toolbox. These two deliverables inevitably overlap with deliverables D6.12 and D6.15 (Final reports on expectations issued by stakeholders' platforms at Pilot case and SES or basin levels respectively). Though, while D6.12 and D6.15 are focused on collecting stakeholders' perceptions and direct comments about the AMP Toolbox; the D6.13 and D6.14 are more focused on describing the key learning and improvements.

3. THE ADAPTIVE MARINE POLICY TOOLBOX IN SHORT

## 3.1. GUIDING PRINCIPLES

The policy-cycle proposed by the MSFD has been transformed into an adaptive and flexible policy-making cycle by incorporating key components and mechanisms used within different step-wise frameworks. Particularly two frameworks have been taken into account (Table 1).

Table 1: Principal frameworks employed for the development of the Adaptive Marine Police Toolbox.

Title	Reference
Creating Adaptive Policies: A Guide for Policymaking in an Uncertain World	Swanson and Bhadwal 2009
Adaptive Management: From More Talk to Real Action	Williams and Brown 2014

Williams and Brown (2014) propose a detailed framework for adaptive management, based on a two-phase process for both technical and social or institutional learning (Figure 3). In the deliberative or planning phase, the critical components of adaptive decision-making are formulated (i.e. involvement of stakeholders; problem assessment; determination of objectives; identification of management alternatives; forward-analysis to characterize resource changes based on future environmental conditions and management actions; and, the development of monitoring protocols).
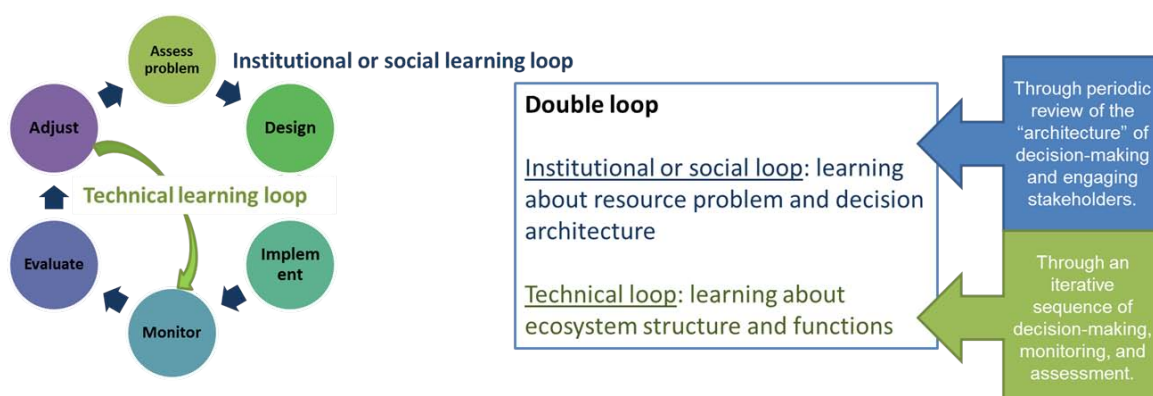
Figure 3: Adaptive management displayed as a cycle, showing technical learning and social/institutional learning. Modified from: Williams and Brown (2014).

Reconsideration of these components constitutes an institutional or social learning cycle where learning about resource problems and decisions architecture is gained.

In the iterative decision phase, the components are linked together in a sequential process of: decision-making – monitoring - assessment. Technical learning is promoted by comparing predictions generated by the models and data-based estimates of actual responses, so that understanding gained from monitoring and assessment can provide knowledge about resource structure and functions for improving future management actions of the resource (Williams and Brown 2014).

Thus, the policy-cycle proposed by the MSFD as well as other examples in the literature, often illustrate adaptive management with a circular diagram that describes a feedback loop beginning with problem formulation and flowing through

decision-making, implementation, evaluation and feedback into problem formulation. In the absence of additional structure, such a framework does not distinguish between technical learning and social or institutional learning in a double-loop arrangement (Williams and Brown 2014). By including an additional feedback loop as in Figure 3, both kinds of learning can be represented (Williams and Brown 2014).

Moreover, although policies are explicitly designed to operate within a certain range of conditions, frequently they face with challenges outside that range, making policies ineffective to accomplish their goals. Therefore, in order to enhance policies that help people, policy-makers need ways to design policies that can adapt to a certain range of conditions but also to conditions that are out of the range or that have not been predicted. For this purpose, Swanson and Bhadwal (2009) propose a framework that distinguishes between conditions that policy-makers can and cannot anticipate during policy design and implementation.

On one hand, a policy that is able to adapt to anticipated conditions is built upon a good understanding of cause-and-effect relationships. In practice this can be accomplished through: mechanistic adjustment triggered by a monitoring process; discovering policies that are robust across multiple scenarios or alternative models; and, using multi-stakeholders deliberation in order to understand better the environmental and socio-economic system and improve the effectiveness of the policies (Swanson and Bhadwal 2009) (see Figure 4).

On the other hand, the ability of a policy to unanticipated conditions is based on a holistic appreciation of systems dynamics and complexity. Adaptive policy mechanisms for unanticipated conditions include: enabling self-organization and social networking in order to provide space for flexible action and reducing barriers to collaboration and learning; decentralization of the decision-making as much as is possible, allowing it to respond to local circumstances; promoting variation; and, performing formal policy review and continuous learning (Swanson and Bhadwal 2009)(see Figure 4).
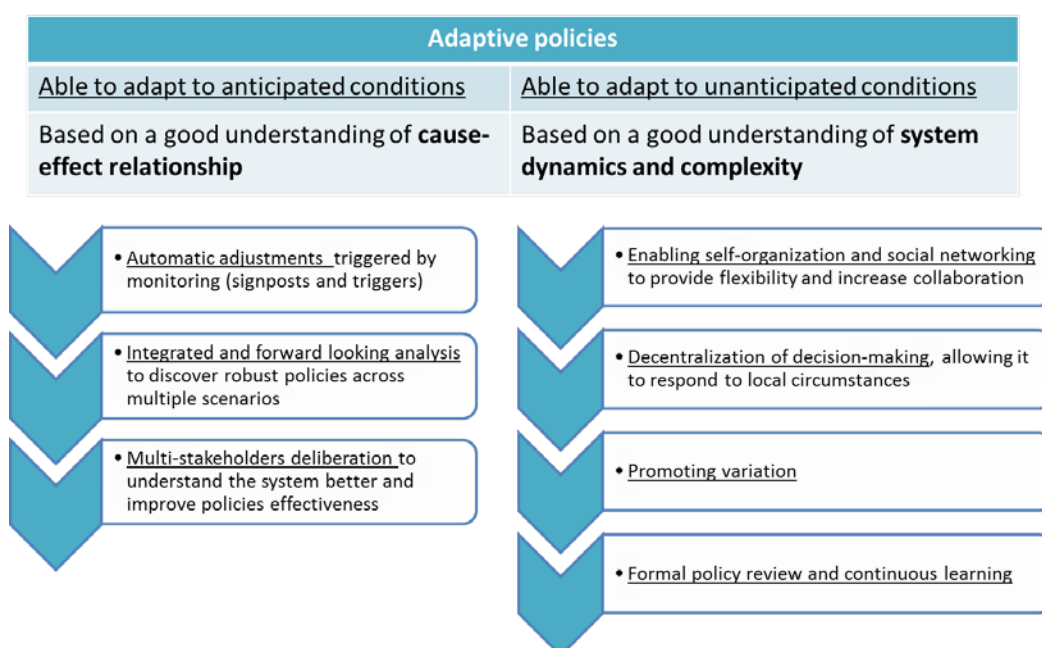
Figure 4: Adaptive policy mechanisms for addressing anticipated and unanticipated conditions. Modified from: Swanson and Bhadwal (2009).

Accordingly, to operationalize the design and implementation of adaptive policies the abovementioned key components and mechanisms have been translated to the AMP Toolbox. To make the translation of these adaptive mechanisms and components to the AMP Toolbox clearer, the principles that make the AMP Toolbox useful to design and implement adaptive policies can be summarized in: (i) engagement of the broader stakeholder community; (ii) definition of the problem and desired objectives; (iii) transfer of cross-disciplinary and integrated scientific knowledge to decision-makers (i.e. learning contributes to management by helping to inform decision-making); (iv) forward-looking analysis to promote the identification of robust policies across different scenarios and as a basis for further learning; (v) monitoring of the effects of the implementation of new policies; (vi) implementation of actions/policies to allow continued resource management while learning (reducing uncertainty); (vii) the incorporation of lessons learnt from monitoring the management interventions (i.e. management contributes to learning) in order to revise models and/or management actions; and, (viii) iterative repetition of this cycle so that management reduces uncertainties and leads to improved management outcomes over time.

Accordingly, in order to apply these principles in the policy-making process, different guidelines and resources have been incorporated into the Toolbox. To understand better the meaning and potential application of these principles Box 2 can be consulted, where a potential adaptive strategy for the management of the turbot in Romania and Bulgaria is presented and the potential application of the principles is illustrated.

BOX 2: A HYPOTETHICAL ADAPTIVE MANAGEMENT STRATEGY FOR THE TURBOT IN ROMANIA AND BULGARIA

<u>Defining the management problem</u>: The Turbot (Psetta maxima maeotica) population in the Black Sea has undergone major changes concerning both its qualitative and quantitative structure and behavior. These changes are consequences of human activities, directly through the fishing pressure; and indirectly through the deterioration of the environmental conditions. The absence of a Regional Fisheries Management Organization to establish an effective collaborative mechanism for the governance of fish stocks has made exploitation levels of most stocks exceed sustainable levels. The MSFD requires "Populations of commercially exploited fish and shellfish to be within safe biological limits". In order to accomplish this objective, adaptive policies are necessary. The strategy should include the following elements:

<u>Involvement of cross-disciplinary scientists and multi-sectoral stakeholders in a committee</u>: For this purpose a Regional Fisheries Management Organization should be developed; and National fisheries and wildlife agencies, nongovernment organizations, industry and fishermen's groups should be included.

Important <u>objectives</u> should be established, for example: (i) securing relatively high yields from exploitation of the turbot stock, consistent with the Maximum Sustainable Yield (MSY); and, (ii) guaranteeing the stability of the fishery as far as possible, while maintaining a low risk of stock collapse.

<u>Models</u> should be developed and implemented to predict different responses of the stock to fluctuating fishing pressure and environmental conditions.

Possible <u>management alternatives</u> should be identified: these could range from a full moratorium on fishing, to very high quotas allocation. For example, the harvesting rule could be flexible in order to calculate annually the allowable quotas depending on the monitored spawning biomass. Moreover, control provisions (i.e. special rules concerning fishing permits, vessel monitoring systems, effort, and catch cross-checks) and financial assistance (if the fishery is closed or the biomass level falls below "x" level) should be included in the new management plan. These actions should allow continued resource management while learning (i.e. reducing uncertainty).

<u>Monitoring protocols</u> (of the effect of implementing the new policies) should be established involving, for example, annual spring surveys of the spawning stock as well as of the environmental conditions.

<u>Learning accumulation</u>: With the implementation of the above-mentioned elements, each year, decision-makers could establish the optimal quotas to be allocated based on the spawning biomass monitored annually. In addition, monitoring data could be compared with the predictions of models. <u>Technical learning</u> would be accumulated by comparing predictions generated in models and data-based estimates of actual responses. <u>Institutional learning</u> would occur every few years, when stakeholder groups reconvene to re-evaluate objectives and models (and their underlying hypotheses) in accordance with what is learnt during

3.2. OBJECTIVE

The overall objective of the AMP Toolbox (http://www.perseus-net.eu/en/about_the_apf_toolbox/index.html) is to provide policy-makers within the Mediterranean and Black Sea with the necessary guidelines and resources to develop adaptive policies or measures to achieve or maintain Good Environmental Status under the requirements of the Marine Strategy Framework Directive. In fact, the AMP Toolbox could be defined as a one-stop repository of guidelines and resources to develop adaptive marine policies in the Mediterranean and Black Sea.

3.3. STRUCTURE

For any web-based toolbox a clear and recognizable structure is very important, as it helps users to find their way easily through an abundance of information. Following the model of the United Nations Food and Agriculture Organization´s Ecosystem Approach to Fisheries Toolbox (hereafter, FAO-EAF Toolbox) (http://www.fao.org/fishery/en), the AMP toolbox has been structured in four levels of information (Figure 5).
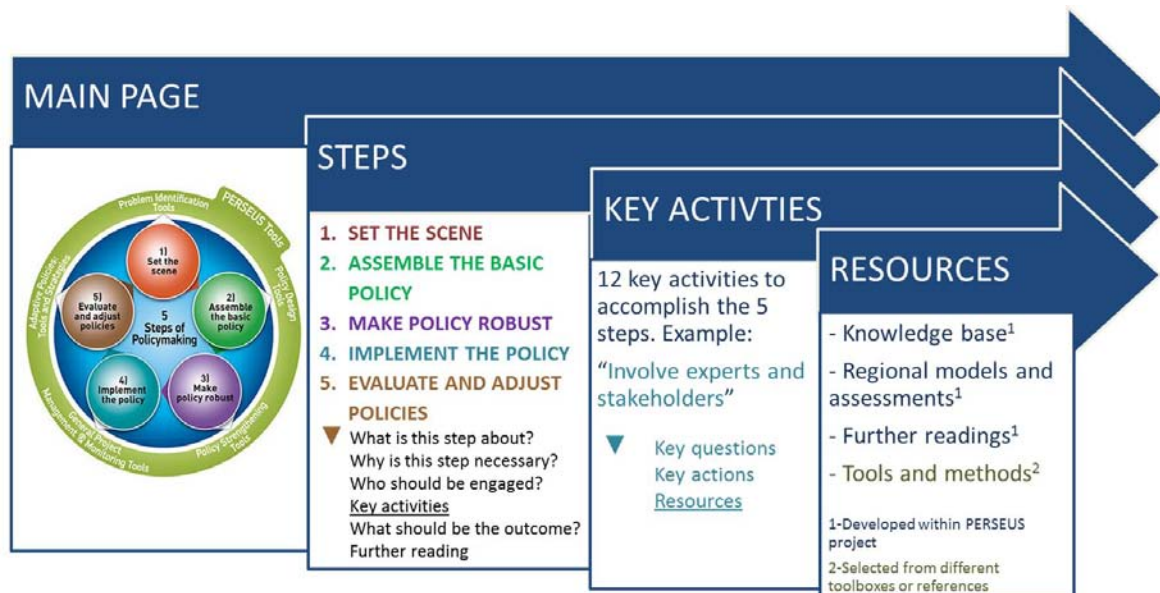
Figure 5: Four-level structure of the Adaptive Marine Policy Toolbox.

3.3.1. Level 1-Main page

In the first level, the structure of the Toolbox is shown, which is based on the policy-making process suggested by the Marine Strategy Framework Directive (Figure 1). Moreover, it is transformed into an adaptive policy-cycle incorporating the principles mentioned above (**3.1 GUIDING PRINCIPLES**). The Toolbox is organized in a policy-cycle containing 5 steps: 1-set the scene; 2-assemble a basic policy; 3-make the policy robust; 4-implement the policy; and, 5-evaluate and adjust the policies. Though, there is no need to follow the whole policy-cycle or the 5 steps. For example, it could be the case where management actions are already in use but they are ineffective because they do not contemplate future uncertainties or do they do not monitor the effectiveness of the management actions. In these cases steps 3, 4 and 5 can be directly accessed. These steps can be linked from the main page or directly through the main menu (Figure 5).

Figure 6: AMP Toolbox web-page.

3.3.2. Level 2-Steps

All the steps present the same structure, including some basic information such as the objective, requirements and outputs of the step in question. In addition, and most importantly, the key activities necessary to accomplish each step are presented. Note that the same activity can be addressed within different steps.

3.3.3. Level 3-Key activities

The key activities do not necessarily represent a step-by-step process, but a series of actions to be performed. The 12 activities present the same structure as well, including an introduction, key questions, key actions and links to the resources necessary to develop the activity in question.

3.3.4. Level 4-Resources and Examples

The resources comprise: (i) the knowledge base, including 7 databases; (ii) different tools and methods; (iii) the regional assessments and models dedicated to the Mediterranean- and the Black Sea; and, (iv) further readings. Note that a given resource can be multifunctional o useful for different purposes, thus it can be linked to different activities and steps. The resources can be accessed through each activity, but also directly through the main menu (Figure 6).

Finally within the examples (accessed through the main menu, Figure 6), different real cases where adaptive policies have been implemented are presented.

3.4. RESOURCES

3.4.1. Knowledge base" and "Regional assessments and models

As mentioned above, one of the most important objectives of the AMP Toolbox is to make available scientific data, information and models (particularly those developed within the PERSEUS project) to users and in doing so support policy-making. Accordingly, within the Resources (Figure 5), the "Knowledge base" and the "Regional assessments and models dedicated to marine environmental issues in the Mediterranean- and Black Sea" have been developed from the work performed within the PERSEUS project.

The Knowledge base includes information and knowledge that have either been collected or prepared by the PERSEUS project. It has been particularly developed within the Task 6.1- "State of play", which aims to take an initial stock of scientific, technical, economic and legal and institutional knowledge needed to build the AMP Toolbox and construct a knowledge base to manage and make this knowledge available to stakeholders and policy-makers dedicated to the Mediterranean and Black Sea. These inventories and the explanations about their development have resulted in several deliverables (Table 2).

Table 2: Deliverables developed within Task 6.1-"State of play".

Deliverable	Title	Inventory
D6.4	Inventory and critical assessment of existing foresight analyses and scenario planning	-Inventory of research projects -Inventory of Foresight exercises -Inventory of Ecosystem Based Assessment studies
D6.5	Inventory and critical assessment of legal, policy and institutional marine policy contexts in SES	-Legal inventory -Institutional inventory
D6.6	Inventory and critical assessment of the possible measures to be taken to achieve GES	-Measures inventory
D6.8	Inventory and critical assessment of current economic valuation studies on marine ecosystem services	-Marine valuation database

Moreover, to make these results available to the AMP Toolbox users, 7 user-friendly thematic databases (with different research fields) have been developed and incorporated into the web page. Each database has been linked to the different steps as shown in Table 3. Though, the databases are also accessible by a direct link to the Resources.

Table 3: Correspondence PERSEUS Knowledge base with Policy steps.

Database	Steps
Inventory of research projects Profiles of more than 100 EU environmental research projects focusing on the Mediterranean and Black Sea	1, 2, 3, 4, 5
Inventory of Foresight exercises Inventory of relevant foresight studies for the Mediterranean and Black Sea	1, 3, 5
Inventory of Ecosystem Based Assessment studies Inventory of relevant Ecosystem Based assessment studies for the Mediterranean and Black Sea	1, 2, 3, 4, 5
Legal inventory Features the major legal instruments for protecting the marine ecosystems in the Mediterranean and Black Sea	1, 2, 3, 5
Institutional inventory Inventory of main international, regional and national organizations in charge of enhancing the protection of the marine ecosystems in the Mediterranean and Black Sea	1, 4, 5
Measures inventory Inventory of policy measures that have been implemented by various countries including CAC, economic and social instruments as well as technological or research-oriented measures	2, 3
Marine valuation database Review of major studies dedicated to the Mediterranean and Black Sea that provide economic valuations of the marine environmental services that these seas provide	2

In addition to the Knowledge base, other resources potentially useful for establishment of programme of measures developed under the PERSEUS project are available from the AMP Toolbox. These resources have been collected under the "Regional assessments and models" menus, and basically include information and knowledge, such as:

- Analysis of the main risks of non-achievement of the GES in coastal areas and open sea
- Pressures in socioeconomic terms on the marine and coastal ecosystems
- End to end or ecosystem Models developed within PERSEUS

These resources have been linked to the different policy steps. However as well as the rest of the resources they also can be accessed through the direct link to the resources.

3.4.2. Tools and methods

In contrast to the "Knowledge base" and the "Regional assessments and models", the tools for the "Tools and methods" have been selected from different toolboxes or references already available in the literature or on the web. These sources basically include:

(i) Monitoring and Evaluation of Spatially Managed Areas (MESMA) Toolbox (https://publicwiki.deltares.nl/display/MESMA/Home);

(ii) Toolbox Marine social and economic data - MMO and Marine Scotland, 2012 (Marine Management Organization and Marine Scotland 2012) (http://www.gov.scot/Resource/0041/00412947.pdf);

(iii) Food and Agriculture Organization´s Ecosystem Approach to Fisheries (FAO-EAF) Toolbox (http://www.fao.org/fishery/eaf-net/en);

(iv) Different governmental departments (e.g. Directorate General of Development and Cooperation, EuropeAid) and environmental research groups or companies.

To select the tools a stepwise approach has been followed. Firstly, from the abovementioned sources, an inventory of over-160 tools was constructed. Secondly, from this inventory (i.e. 166 entries), 43 "primarily useful" tools were selected. The objective of these "primarily useful" tools is to provide examples of useful tools that can be employed to carry out the different activities and steps. To select these 43 tools from the whole inventory (i.e. 166 entries), different "thematic groups" were organized according to people´s fields of expertise (e.g. economic tools, spatial analysis and ecosystem assessment tools, risk assessment tools and stakeholder analysis tools). Once the thematic group were formed, four selection-criteria were agreed among all the groups: (i) availability of the tool (i.e. whether it can be purchased or is available on the web or not); (ii) simplicity of the tool (i.e. whether the tools is applicable to a wide range of issues/situations or not); (iii) applicability by policy-makers; and, (iv) interest (i.e. whether it is of interest to help achieving the goal of a particular step). The tools with the highest scores became part of the 43 "primarily useful" tools.

Table 4: List of 43 "primarily useful tools", including title, theme, reference toolbox and correspondence with Policy steps.

Tools selected	Theme	Reference toolbox	Steps
AHP in ArcGIS	Risk	MESMA	1, 2, 5
AMBI	Ecosystem	AZTI-Tecnalia	3, 5
AQUATOX	Ecosystem	EPA	1, 3, 5
Asset / Objective – Impact / Threat Matrix	Risk	FAO -EAF Toolbox	1, 2, 3, 5
ASSETS	Ecosystem	NOAA	3, 5
BCA Tool Kit for the Hazard Mitigation Assistance program	Economic	BCA Tool Kit	1, 2, 3
Benthic Terrain Modeler	Ecosystem	MESMA	1
Brain Storming	Stakeholder	FAO -EAF Toolbox	1, 3, 4, 5
CLIMSAVE Integrated Assessment Platform	Economic	CLIMSAVE IAP	1, 2, 3
Coastal Adaptation to Sea Level Rise tool	Economic	COAST	1, 2, 3, 5
Communication Templates and Tools	Stakeholder	FAO -EAF Toolbox	1, 4
Community Based or Participatory Monitoring and Evaluation	Stakeholder	FAO -EAF Toolbox	3, 5
Conceptual and Qualitative Modelling	Stakeholder	FAO -EAF Toolbox	1, 2, 3, 5
Conflict management, Negotiation and Consensus Building	Stakeholder	FAO -EAF Toolbox	1, 3, 5
Consensus Workshop Method	Stakeholder	FAO -EAF Toolbox	1, 3, 4, 5

Cost-Effectiveness Analysis	Economic	EuropeAid	3
DPSWR	Ecosystem	MESMA	1, 2, 3, 5
EcoPath	Ecosystem	MESMA	1
Facilitation – on Line Descriptions	Stakeholder	FAO -EAF Toolbox	1, 3, 5
Fisheries Library in R	Ecosystem	MESMA	1, 3
Focused Conversations	Stakeholder	FAO -EAF Toolbox	1, 3, 5
Habitat Priority Planner	Ecosystem	MESMA	1, 2, 3, 4, 5
Imagine, Systemic analysis, prospective studies, and participatory approaches for coastal zone management	Stakeholder	Plan Bleu	1, 3, 5
Impact Assessments Guidelines	Economic	EC Smart-Regulation	3
Institutional Analysis	Stakeholder	FAO -EAF Toolbox	1, 4
InVEST Toolbox	Ecosystem	MESMA	1, 2
LINK	Ecosystem	MESMA	1, 2, 3
MarineMap	Ecosystem	MESMA	1, 2, 5
MARXAN	Ecosystem	MESMA	1, 2, 3, 5
Multi-Criteria Analysis	Economic	EuropeAid	3
Multi-Criteria Decision Analysis (MCDA) Also Known as Multi-Objective Decision Analysis (MODA)	Economic	FAO -EAF Toolbox	1, 2, 3
Non Formal Risk Categories (Preliminary Hazard Analysis)	Risk	FAO -EAF Toolbox	1
PANDA	Ecosystem	MESMA	1, 2, 3, 5
PERSEUS Presentation Materials	Stakeholder	FAO -EAF Toolbox	1, 2, 3, 4, 5
Qualitative Risk Analysis (consequence X likelihood)	Risk	FAO -EAF Toolbox	1, 2
Quantitative Stock Assessment Methods	Risk	FAO -EAF Toolbox	1, 3, 5
Questionnaires	Stakeholder	FAO -EAF Toolbox	1, 3, 5
SimLab	Risk	MESMA	1, 3, 5
Social and Economic Assessment Methods	Stakeholder	FAO -EAF Toolbox	1, 2, 3, 5
Stakeholder Analysis	Stakeholder	FAO -EAF Toolbox	1, 4
Stakeholder Meetings	Stakeholder	FAO -EAF Toolbox	1, 2, 3, 4, 5
Stakeholder Workshops	Stakeholder	FAO -EAF Toolbox	1, 3, 5
SWOT (strength, weaknesses, Opportunities and threat) Analysis	Risk	FAO -EAF Toolbox	2, 3, 4, 5

Thirdly, from this list of 43 recommended tools, some of the tools were selected and classified as "flag-tools" based on the four selection-criteria mentioned above and best professional judgment. For each one of these "flag-tools" a detailed and separate tool page is provided. These detailed pages have a uniform tool format, according to the FAO-EAF Toolbox. Thus, each tool pages provides some sections on general information such as: Steps to use in, Purpose, Overview, Tips, Pedigree, Synergy, Source of Information and Appendix. Moreover, some supporting-criteria are provided to assist users selecting the most useful tools for them based on their needs. These supporting-criteria include: (i) the Usage or difficultness to use, (ii) the Cost, (iii) the Capacity needed to use the tool, (iv) Background Requirements, (v) Participation level required to use the tool, and (vi) Time Range needed to apply the

tool. Note that a given tool can be multifunctional o useful for different purposes, thus it can be linked to different activities and steps.

Table 5: List of 10 "flag tools" and the description of the 6 supporting-criteria for each one of them. Key: L-Low; M-Moderate; H-High.

| Title	Difficultness	Cost	Capacity requirement	Data requirement	Participation requirement	Time requirement
Stakeholder Meetings	L	L-M	L-M	L	M-H	L-M
Stakeholder Workshops	L	L-M	M	L-M	M-H	L-M
Stakeholder Analysis	M	L-M	M	L	M-H	L-M
Imagine	M-H	M	M-H	M-H	H	M-H
Questionnaires	M	L-H	M-H	L	M-H	M-H
Qualitative Risk Analysis	M	L-M	M	L-M	M-H	L
DPSWR Framework	M-H	M-H	M-H	M-H	L-M	M-H
BCA tool kit	M-H	M-H	M-H	M-H	L-M	M-H
COAST model	M-H	M	M	M	H	M
CLIMSAVE IAP model	M-H	M	M	M	H	M

4. EXAMPLE: MARINE LITTER IN THE MEDITERRANEAN AND BLACK SEA

In order to provide a detailed insight into the different steps, key activities and resources of the AMP Toolbox to the stakeholders that have participated in the experimentation or tests (see section 5), as well as to the potential end-users; an example (i.e. the problem of marine litter in the Mediterranean and Black Sea) has been developed.

In fact, proper waste management in marine environment is increasingly recognized by international community; and several mandates such as the MSFD require maintaining properties and quantities of marine litter at levels that do not cause harm to the marine environment, through adaptive (i.e. ecosystem-based) management. Accordingly, using this important issue as a guiding example, the guidelines and principles (**GUIDING PRINCIPLES**) provided within the different steps and activities are described and several resources (**RESOURCES**) are illustrated.

Step1-Set the scene

The first step is to acknowledge that there is a problem, that causes negative impacts and that these merit further analysis and management strategies. Developing a strategy to manage marine litter requires a good understanding of the source of the problem, the scale of the problem and the impacts of the problem. Accordingly it is necessary to "Gather information and determine existing conditions". For this purpose, the "DPSWR framework" is proposed within the AMP Toolbox, a useful framework to link the effects that socio-economic uses have in the marine ecosystems as well as the effects that the degradation of the marine environment causes on human wellbeing.
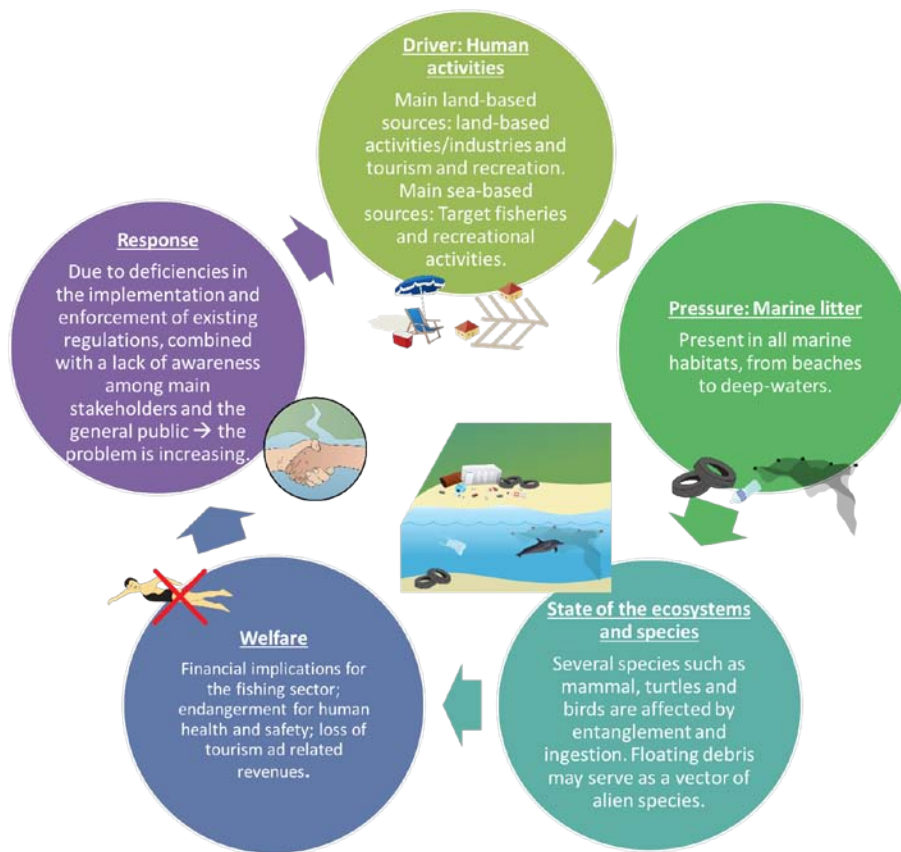
Figure 7: Application of the DPSWR framework to the Marine Litter problem in the Mediterranean and Black Sea.

HOW OTHERS DID?

DPSWR framework:

- Descriptor 5 (Eutrophication) in the Black Sea: O`Higgins et al. (2014a) (http://www.ecologyandsociety.org/vol 19/iss3/art54/).
- Descriptor 3 (Fisheries) in the Black Sea: O`Higgins et al. (2014a) (http://www.ecologyandsociety.org/vol 19/iss3/art54/).
- Descriptor 8 (Contaminants) in the Mediterranean Sea: Cinnirella et al. (2014) (http://www.sciencedirect.com/science /article/pii/S0964569113000549)

Ecosystem Services valuation:

- Descriptor 5 (Eutrophication) in the North Sea: O`Higgins et al. (2014b)

  (http://www.sciencedirect.com/science /article/pii/ S0272771413004447)

For example, as observed in Figure 7, land-based sources (including land-based activities and coastal tourism), rather than ocean-based sources, are the main sources of marine litter in the Mediterranean and Black Sea (Galgani et al. 2013; UNEP 2009). Then, this litter is accumulated in the Mediterranean and Black Sea ecosystems. In fact, recordings of floating litter have confirmed the overwhelming presence of plastics in the Mediterranean Sea, accounting for about 83% of observed marine litter items (Galgani et al. 2013). Other known ecological impacts of marine litter include the alteration, damage and degradation of benthic habitats such as coral reefs and benthic macro-invertebrates and entanglement in and ingestion of marine debris by marine organisms (Galgani et al. 2013; Katsanevakis et al. 2007; Pham et al. 2014). Apart from the aesthetic problem, this environmental degradation causes significant socio-economic impacts such as, loss of tourism and related revenues and endangerment of human health and

safety. In addition, it has important financial implications for the fishing sector (Galgani et al. 2013; Oosterhuis et al. 2014; Pham et al. 2014).

Additionally, it is necessary to "Involve experts and stakeholders" to make them understand the extent of the problem. This will help to create the "political will" and support for potential action (Ten Brink et al. 2009). In fact, other authors (Bainbridge et al. 2011), have highlighted the lack of stakeholder engagement in the implementation of the MSFD at all the relevant (and necessary) scales and the importance of engaging public consultation and active partnerships from the beginning of the process (according to the ecosystem-based approach). In the case of marine litter also, a multi-sectoral engagement would be necessary (i.e. Regional, national and local authorities, Maritime sector, Tourism sector, Fisheries and aquaculture, Agriculture, Industry, and Civil society). To accomplish this activity, Stakeholders Mapping or Analysis is suggested in the AMP Toolbox. In Figure 8, for example, the principal sectors that are affected by the problem are presented by means of the "Stakeholders Analysis" tool included in the AMP Toolbox.
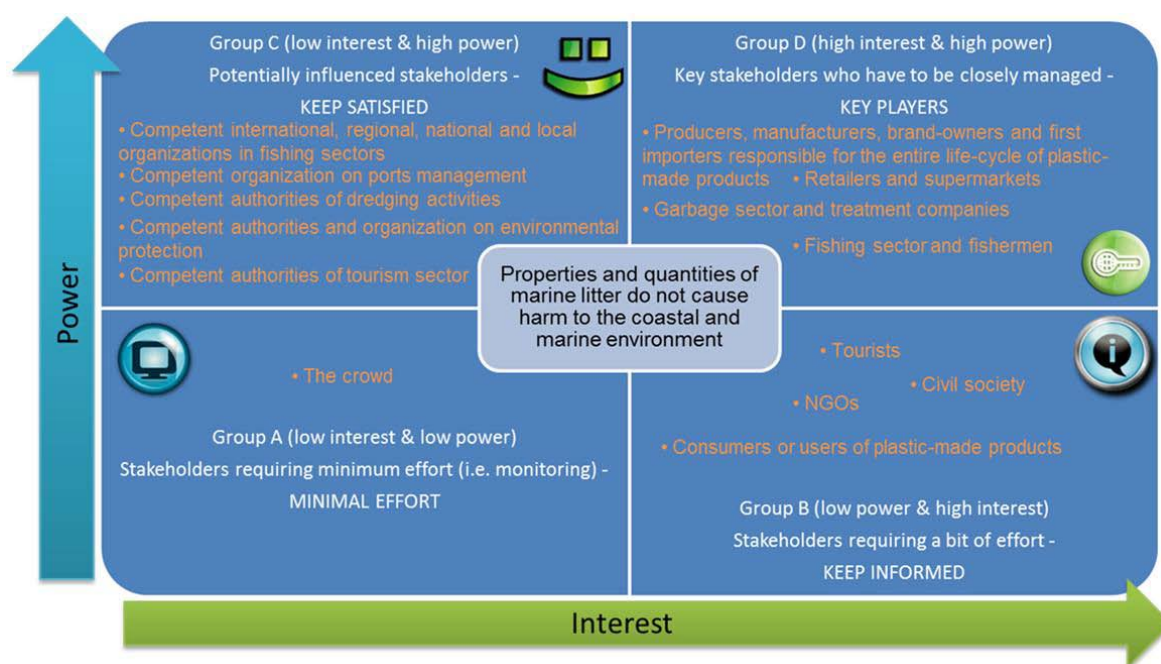

Figure 8: Stakeholders analysis for the Marine Litter problem in the Mediterranean and Black Sea.

Once the current situation has been defined and the stakeholders engaged, and before the possible solutions are listed; it is helpful to develop a clear set of objectives that the policy needs to address, and the particular issues it needs to take into account. Initiatives for new actions will need to build on both an understanding of the problem as well as the benefits of addressing the problem. Indeed, for an effective delivery of the EBA, apart from the multi-sectoral engagement, the valuation of the ecosystem services and the recognition of the tight coupling between human and ecological well-being are necessary (Bainbridge et al. 2011; Tallis et al. 2010). Accordingly, it is important to "Develop a mutual understanding and define principles and goals". Within the Honolulu Strategy (UNEP and NOAA 2011) for example, the following

three objectives (and the strategies to accomplish these objectives respectively) have been defined (Table 6).

Table 6: Framework proposed within the Honolulu Strategy (UNEP and NOAA 2011).

Goal A: Reduced amount and impact of land-based sources of marine debris introduced into the sea
Strategy A1. Conduct education and outreach on marine debris impacts and the need for improved solid waste management
Strategy A2. Employ market-based instruments to support solid waste management, in particular waste minimization
Strategy A3. Employ infrastructure and implement best practices for improving stormwater management and reducing discharge of solid waste into waterways
Strategy A4. Develop, strengthen, and enact legislation and policies to support solid waste minimization and management
Strategy A5. Improve the regulatory framework regarding stormwater, sewage systems, and debris in tributary waterways
Strategy A6. Build capacity to monitor and enforce compliance with regulations and permit conditions regarding litter, dumping, solid waste management, stormwater, and surface runoff
Strategy A7. Conduct regular cleanup efforts on coastal lands, in watersheds, and in waterways— especially at hot spots of marine debris accumulation
Goal B: Reduced amount and impact of sea-based sources of marine debris, including solid waste; lost cargo; abandoned, lost, or otherwise discarded fishing gear (ALDFG); and abandoned vessels, introduced into the sea
Strategy B1. Conduct ocean-user education and outreach on marine debris impacts, prevention, and management
Strategy B2. Develop and strengthen implementation of waste minimization and proper waste storage at sea, and of disposal at port reception facilities, in order to minimize incidents of ocean dumping
Strategy B3. Develop and strengthen implementation of industry best management practices (BMP) designed to minimize abandonment of vessels and accidental loss of cargo, solid waste, and gear at sea.
Strategy B4. Develop and promote use of fishing gear modifications or alternative technologies to reduce the loss of fishing gear and/or its impacts as ALDFG
Strategy B5. Develop and strengthen implementation of legislation and policies to prevent and manage marine debris from at-sea sources, and implement requirements of MARPOL Annex V and other relevant international instruments and agreements
Strategy B6. Build capacity to monitor and enforce (1) national and local legislation, and (2) compliance with requirements of MARPOL Annex V and other relevant international instruments and agreements
Goal C: Reduced amount and impact of accumulated marine debris on shorelines, in benthic habitats, and in pelagic waters
Strategy C1. Conduct education and outreach on marine debris impacts and removal
Strategy C2. Develop and promote use of technologies and methods to effectively locate and remove marine debris accumulations
Strategy C3. Build capacity to co-manage marine debris removal response

Strategy C4. Develop or strengthen implementation of incentives for removal of ALDFG and other large accumulations of marine debris encountered at sea	
Strategy C5. Establish appropriate regional, national, and local mechanisms to facilitate removal of marine debris	
Strategy C6. Remove marine debris from shorelines, benthic habitats, and pelagic water	

Overall, the adaptive policies might focus on setting goals and targets at the more local level, with a stakeholder led process propagating from local spatial scales upwards toward a unified regional vision and legal formalization (Bainbridge et al. 2011; Tallis et al. 2010). In fact, cooperation and coordination on a regional seas basis is an asset for a meaningful development and implementation of the EBA (Bainbridge et al. 2011). Accordingly, the use of existing institutional structures such as the regional seas commissions and international organization should be promoted (Bainbridge et al. 2011). Indeed, the process will be more effective and simpler when there are clear institutional authorities for action and enforcement (Ten Brink et al. 2009).

Table 7: Indicative list of intergovernmental organizations which directly or indirectly enforce marine litter management.

Name	Objective
Black Sea Commission (BSC)	The BSC and its Permanent Secretariat consolidate the regional activities on marine litter and other types of marine pollution on base of the implementation of the Bucharest Convention and its Protocols, and the Strategic Action Plan for the Rehabilitation and Protection of the Black Sea.
	Moreover, 7 Black Sea Regional Activity Centres (RAC) have been established on base of existing national organizations. Four of them may be especially helpful for the development of the regional ML activities: RAC on Pollution Monitoring and Assessment; RAC on Control of Pollution from Land Based Sources; RAC on Development of Common Methodologies for Integrated Coastal Zone Management; and, RAC on Environmental and Safety Aspects of Shipping.
Mediterranean Action Plan (MAP)	The MAP is a regional cooperative effort involving 21 countries bordering the Mediterranean Sea, as well as the European Union. Through the MAP, these Contracting Parties to the Barcelona Convention and its Protocols are determined to meet the challenges of protecting the marine and coastal environment while boosting regional and national plans to achieve sustainable development.
	MAP Coordinating Unit is the Secretariat of the Mediterranean Action Plan. It performs diplomatic, political and communications roles, supervising the main MAP components (MEDPOL Programme and the Regional Activity Centres) and organizes major meetings and programmes. Six RACs are based in Mediterranean countries, each offering its own environmental and developmental expertise for the benefit of the

	Mediterranean community in the implementation of MAP activities. At COP 18 in 2013, a regional plan was adopted for management of marine litter in the Mediterranean Sea.
United Nations Environment Programme (UNEP)	Marine litter is a priority activity for the UNEP's Regional Seas Programme. UNEP provides support to the secretariats of the Black Sea Commission and the Mediterranean Action Plan´s secretariat for the development of Regional Activity on Marine Litter in the Black Sea and the Mediterranean Sea respectively. In addition, the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) has been adopted under the auspices of UNEP.
International Maritime Organization (IMO)	Involved, in particular, in regulatory and technical co-operation activities regarding port reception facilities. IMO maintains the Oil and Litter Information Network and adopted the Guidelines for the implementation of MARPOL.
World Health Organization (WHO)	Considers the marine litter problem as important constituent of medical, sanitary and aesthetic issues focused on the safe and salubrious use of the aquatic and coastal environment for public recreation and tourism. It has published monitoring, control and prevention strategies relating to the hazards associated with marine litter.
Food and Agriculture Organization of the United Nations (FAO)	Has prepared the Code of Conduct for Responsible Fisheries (adopted in 1995) and technical guidelines for the implementation of the Code, including management objectives and measures related to the marine litter problem. The Fisheries Industry Department of FAO has a programme on the "Impact of Fishing on the Environment". FAO and IMO are involved in revising the Code of Safety for Fishing Vessels where the effects of litter could be included as an issue of concern.
Intergovernmental Oceanographic Commission (IOC)	The 6th Session of the IOC Committee for the Global Investigation of Pollution in the Marine Environment (1986) recommended developing methodologies and facilitating efforts to monitor the amounts and types of persistent litter in the seas. Some relevant activities, including several pilot ML surveys and assessments, and the development of solid waste management plans, were realized in 1987- 1999 in the Mediterranean and Caribbean regions, and in some places along the coasts of Africa.
Mediterranean Science Commission (CIESM)	Promotes cooperation among marine scientists of various disciplines. In service to society, CIESM draws upon its experts and the current scientific knowledge to deliver impartial and authoritative advice on a variety of issues, focused on the dynamics, processes, biodiversity, pollution and lasting protection of the Mediterranean and Black Sea ecosystems. In addition through its monitoring programs, the Commission keeps a watch at the regional level over sensitive indicators of the ecosystem change.

Joint group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)	A multidisciplinary advisory panel involved in the protection of the marine and coastal environment at the global level. GESAMP addresses litter as one of important sources/categories of the adverse impact of land-based activities on the ocean. The priority actions recommended are as follows: improvement of waste materials recycling; improvement of port reception facilities; development of more degradable packaging materials; and improvement of education and public awareness
European Commission (EC)	The EC has adopted several legal instruments covering a wide range of the environment-oriented fields. For example, the Waste Framework Directive (1975), the Directive on Hazardous Waste (1991), the Directive on Integrated Pollution Prevention and Control (1996), the Directive on the Landfill of Waste (1999), the Directive on Port Reception Facilities for Ship-generated Waste and Cargo Residues (2000), the Marine Strategy Framework Directive (2008) and some other directives which have certain relation to the marine litter problem.

HOW OTHERS DID?

Institutional analysis:

Descriptor 3 (Fisheries) in UK: Bainbrdige et al. (2011) (http://www.knowseas.com/links-and-data/rapid-policy-network-mappping/gen3%20msfd%20actor%20map.pdf/view)

Instruments analysis

Descriptor 3 (Fisheries) in UK: Bainbrdige et al. (2011) (http://www.knowseas.com/links-and-data/rapid-policy-network-mappping/gen3%20instrument%20template.pdf/view)

In Table 7, for example, a list of the intergovernmental organizations related to the marine litter problem that can be found in the "Institutional inventory" of the AMP Toolbox is presented. Although, these organizations are necessary to implement consistent and cooperative strategies, it is important to decentralize the authority and responsibility for decision-making to the lowest effective and accountable unit of governance as mentioned above (Swanson and Bhadwal 2009). This can increase the capacity of a policy to perform successfully under uncertain conditions. In fact, those closely connected to the resource system, are in a better position to adapt to and shape ecosystem changes and dynamics than remote levels of governance (Bainbridge et al. 2011; Swanson and Bhadwal 2009).

Last but not least, legal and administrative obligations such as international agreements laws and regulations should be identified, with the aim of defining consistent objectives and strategies. An example of these legal and administrative instruments regarding marine litter can be found in the "Legal inventory" of the Toolbox (Table 8). Note that although many of these instruments do not target marine litter directly (since they aim reducing marine pollution, waste production and dispersal or protecting the marine environment in more general terms), they have an indirect effect in marine litter.

Table 8: Indicative list of International and regional legal and administrative instruments. Note: Although these legal and administrative instruments do not target marine litter directly, they target reducing marine pollution or waste production and dispersal as well as protecting the marine environment in more general terms.

Title	Objective
Convention for the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention)	To control and prevent marine pollution by prohibiting the dumping of certain hazardous materials. In addition, a special permit is required prior to dumping of a number of other identified materials; and, a general permit for other wastes or matter.
Convention for the Prevention of Pollution from Ships (MARPOL) (London protocol)	To prevent pollution of the marine environment by ships from operational or accidental causes.
Convention on the Control of Trans-boundary Movements of Hazardous Wastes and Their Disposal (Basel Convention)	To provide for a comprehensive regime for liability and for adequate and prompt compensation for damage resulting from the trans-boundary movement of hazardous wastes and other wastes and their disposal including illegal traffic in those wastes.
Convention on Biological Diversity (CBD)	Conserve biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding.
UNEP Global Marine Litter	Establishment and development of pilot regional activities in regions that are particularly affected; and, provide a global platform for the establishment of partnerships, co-operation and co-ordination of activities for the control and sustainable management of marine litter.
United Nations General Assembly resolutions on Oceans and the Law of the Sea and on sustainable fisheries	Lays down a comprehensive regime of law and order in the world's oceans and seas establishing rules governing all uses of the oceans and their resources. It enshrines the notion that all problems of ocean space are closely interrelated and need to be addressed as a whole.
Fifth International Marine Debris Conference (5IMDC) and Honolulu strategy	To prevent, reduce, and manage marine debris.
Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) (and the Global Partnership on Marine Litter (GPML)	To deal with all land-based impacts upon the marine environment, specifically those resulting from sewage, persistent organic pollutants, radioactive substances, heavy metals, oils (hydrocarbons), nutrients, sediment mobilization, litter, and physical alteration and destruction of habitat. (GPML-Voluntary multi-stakeholder coordination mechanism in which all partners agree to work together to better reduce and better manage marine litter)
International Conference on	(i) Start filling in the obligation of Rio+20; (ii) Be the

Prevention and Management of Marine Litter in European Seas	European contribution to the Honolulu strategy; (iii) Bring existing and planned marine litter initiatives to the attention of a wider audience, including politicians by providing a platform to collect and share good practices and Commitments; (iv) Support information exchange amongst Member States and a coherent implementation of the MSFD on European level in order to combat litter pollution of marine waters.
Convention on the Protection of the Black Sea against Pollution (Bucharest Convention) and its protocols	To prevent, reduce and control the pollution in the Black Sea in order to protect and preserve the marine environment and to provide legal framework for co-operation and concerted actions to fulfil this obligation.
Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) and its protocols	To prevent, abate, combat and to the fullest possible extent eliminate pollution of the Mediterranean Sea Area and to protect and enhance the marine environment in that Area so as to contribute towards its sustainable development
UNEP/ Mediterranean Action Plan´s Ecosystem Approach (EcAp)	EcAp refers to a specific process under the UNEP/MAP Barcelona Convention, as its Contracting Parties have committed to implement the ecosystems approach in the Mediterranean with the ultimate objective of achieving the good environmental status (GES) of the Mediterranean Sea and Coast. This process aims to achieve GES through informed management decisions, based on integrated quantitative assessment and monitoring of the Marine and Coastal Environment of the Mediterranean. The EcAp process is implemented in the Mediterranean in synergy and coherence with the EU's MSFD principles
Regional Plan on Marine Litter Management in the Mediterranean in the Framework of Article 15 of the Land Based Sources Protocol of the Convention of Barcelona	The main objectives of the Regional Plan are to: (a) Prevent and reduce to the minimum marine litter pollution in the Mediterranean and its impact on ecosystem services, habitats, species in particular the endangered species, public health and safety; (b) Remove to the extent possible already existent marine litter by using environmentally respectful methods; (c) Enhance knowledge on marine litter; and (d) Achieve that the management of marine litter in the Mediterranean is performed in accordance with accepted international standards and approaches as well as those of relevant regional organizations and as appropriate in harmony with programmes and measures applied in other seas.

Step 2-Assemble the basic policy

Once the problem has been addressed and the desired objectives defined, it is necessary to find different possible solutions and make an analysis of the policy proposals. Accordingly, this step includes two activities, "*Identify measures*" and "*Prioritize/assess new measures*". The former requires that the policy-makers look at the full range of possible solutions and develop a list of options (Table 9), taking into consideration the objectives of the policy and the particular issues it needs to take

into account. In adaptive policy-making, variation is an important principle to consider in the selection of measures or instruments, since the diversification of the intervention increases the possibilities of succeeding under unanticipated conditions (Swanson and Bhadwal 2009). Moreover, on occasions, a policy is not feasible given political commitments, potential public resistance or capacity constraints. Accordingly, participation by stakeholders enhances the acceptance of the instruments as well as offer ideas whether they would be successful or not. In other words, the involvement of many groups and sectors will help ensure the solution to marine litter is practical and enforceable (i.e. feasible) (Ten Brink et al. 2009).

Several types of assessment methods exist which are useful to assess potential measures. These include, for example, impact assessments, cost-effectiveness analysis, coast-benefit analysis, and multi-criteria analysis. Information on these tools can be found within the "*Prioritize/assess new measures*" key activity. In addition, the "*Marine valuation database*" of the AMP Toolbox contains studies regarding valuations of different management strategies and scenarios. In one of these studies, for example, the perceptions of different visitors on the management of an important nesting site for loggerhead sea turtle located in the Greek coast revel that an accommodation tax would be more effective policy when compared to an entrance fee, for the management of the site (Jones et al. 2011).

HOW OTHERS DID?

Cost-Benefit Analysis:

Descriptor 5 (Eutrophication) in the North Sea: Bertram and Rehdanz (2013); and Bertram et al. (2014) (http://www.sciencedirect.com/science/article/pii/S0308597X12001042 and http://www.sciencedirect.com/science/article/pii/S0308597X13001437)

Table 9: Marine litter categories and some examples of economic instruments to combat marine litter. Source: Ten Brink et al. (2009).

Economic Instruments	Lad-based sources				Ocean-based sources				
	Plastic	Other solid waste	Medical	Sewage related debris	Plastic	Other solid waste	Sewage related debris	Nets and boxes	Fishing debris
Plastic bag tax					X				
Charging schemes for waste services	X	X	X						
Landfill tax	X	X	X						
Deposit for drink containers	X	X			X	X			
Port reception fee					X	X	X		
Incentives to fishermen for reporting and retrieval/removal of debris					X	X		X	X
Award-based incentives for coastal villages with Integrated Waste Management	X	X	X						
Damaged/abandoned fishing gear buy-back								X	
Tourist taxes, car parking fees, waterfront business charges and other sources of revenue to earmark for beach cleaning	X	X							
Fine for illegal disposal of litter/fly tipping/pet waste fouling	X	X							
Ship garbage record books					X	X	X	X	X
Fines register					X	X	X	X	X

However, the most important thing at this point is to define the right set of criteria against the different options will be assessed. The selection of the criteria will depend on the international or national conditions/circumstances. Ten Brink et al. (2009), have defined ten criteria that can be useful to analyze the potential options (Table 10). In fact, the choice of the appropriate measure is case specific, largely depending on: (i) the source of pollution (land-based source, e.g. tourist tax, vs. ocean-based sources, e.g. rewards for fishing vessels that return waste); (ii) the country´s institutional characteristics and infrastructures (e.g. to launch a landfill tax, the country should have implemented a proper waste management strategy and a properly functioning waste collection and disposal procedure); (iii) consumer´s preferences and habitual behavior (i.e. the effect of a measure can temporarily change the behavior and last only as long as the measure is in place); and, (iv) the economy´s overall sectorial composition (Oosterhuis et al. 2014).

Table 10: Indicative list of potential 10 criteria to select policy options. Source: Ten Brink et al. (2009).

Instrument	1 Important	2 Benefits	3 Revenues	4 Fair and equitable	5 Avoids unacceptable social impacts	6 Consistent	7 Cost-effective	8 Efficient pricing	9 Understandable	10 Feasible	Index
Plastic bag ban	5	5	5	5	4	5	5	5	5	4	48
Landfill tax	5	3	5	5	1	5	4	5	4	3	40
Deposit for drink containers	5	4	1	5	3	5	5	5	5	4	42
Port reception fee (general fee, no special fee for waste)	4	4	4	5	5	5	4	4	4	5	44
Incentives for fishermen (for reporting and removal)	4	4	1	4	5	4	5	3	5	5	40
Award-based incentives for coastal villages with Integrated Waste Management systems	4	4	1	4	5	3	5	3	5	5	39
Waste fishing gear buy-back	5	5	1	5	5	3	5	3	5	5	42
Tourist taxes, car park fees, waterfront business charges and other sources of revenue to earmark for beach cleaning	5	4	5	5	5	5	4	5	5	5	48

Table 11: Direction of change for drivers or activities particularly related to marine litter for the five PERSEUS scenarios for the Mediterranean and Black Sea. Key: 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
MEDITERRANEAN SEA						
Tourism	Mass tourism demand	0/+	-	++	0/+	+
	Luxury tourism	0/+	+	++	0/+	-
	Local/cultural tourism	0/+	++	++	+	-
	Eco-tourism	0	++	--	+	0
Coastal Development/ Urbanization	Population	++	+	++	+	++
	Expansion of settlements	+	0/-	++	0	++
Fisheries/ aquaculture	Fisheries production	0/-	++	0	+	--
	Aquaculture production	+	+	++	0/+	+
Maritime transport/ports	Expansion of port areas	0/+	+	++	0/-	0/+
	Increase of transports	0/+	++	++	0/-	0/-
BLACK SEA						
Tourism	Mass tourism demand	0/+	+	++	0/+	-
	Luxury tourism	0	++	+	-	--
	Local/cultural tourism	0/+	++	++	+	-
	Eco-tourism	0/+	++	0/+	+	0
Coastal Development/ Urbanization	Population	+	+	++	+	0/+
	Expansion of 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 transports	++	++	0/-	0/-	0/+

Step 3-Make the policy robust

The policy measures drafted in Step 2 must be assembled into a policy which is robust against future expected and unexpected conditions. This constitutes probably the most specific and innovative step of the AMP Toolbox policy cycle. For this purpose it is necessary to: (i) identify key factors that affect policy performance as well as the scenarios to study the way these factors might evolve in the future; and, (ii) develop indicators to help trigger important policy adjustments when needed. Accordingly, "*Forward looking analysis: assess policy success and risk factors*" and "*Design and implement a monitoring plan*", are respectively elementary activities within Step 3.

To identify the key factors that affect policy performance it is necessary to develop a deliberative process with multiple stakeholders and experts involved in implementation of the policy as well as those who are affected (positively or negatively) by the policy in question. Potential future evolution of the key factors can be projected using a combination of qualitative and quantitative methods. Scenarios are a coherent package of key factors. Coherence is achieved by understanding the higher-level drivers for these key factors and how these drivers influence the various key factors. In Table 11 the potential future evolution of key sector related to the marine litter are presented for the Mediterranean and Black Sea respectively. Scenarios are then quantified using predictive models. Models typically express benefits and costs as outputs of management through time. More importantly, they allow forecasting the impacts of the policy. Models can be as informal as a verbal description of system dynamics, or as formal as a detailed mathematical expression of change, or also an integrated model, such as the hydrodynamic and biogeochemical models developed within the PERSEUS Project (Table 12). For the Western Mediterranean Sea, for example, a coupled hydrodynamic-biogeochemical model is being developed to address the pressures applied by strong air-sea fluxes and freshwater inputs as well as their combined effects on the north-western Mediterranean basin´s hydrology and ecosystems. These processes, known as cascading processes or effect, enhance the transfer of organic material, nutrients, chemicals and litter (as inputs from rivers, urban areas, atmosphere and sediments) from coastal areas to open sea through canyons. In fact, marine litter that has been shown to concentrate within canyons is believed to impact the marine ecosystems, by altering the substrate as well as the marine organisms (Pham et al. 2014; Wright et al. 2013). These models represent existing understanding of the system including assumptions and predictions, as well as the basis for the learning.

Moreover, monitoring is a key component in adaptive policies, providing information to evaluate the status of the ecosystems (i.e. environmental status, under the MSFD) and triggering policy adjustments in case targets are not achieved; as well as, facilitating information, evaluation and learning after decisions are made. To make monitoring useful, the motivation of the monitoring, choices on the monitoring strategy (i.e. selecting the targets and associated indicators to monitor and how to monitor them), and the practical limits (e.g. staff and funding) should be made a priority.

In fact, environmental targets (i.e. indicate either the desired levels of, or necessary changes to, pressures, state and impacts which would ultimately result in the achievement of GES) are of paramount importance to guide progress toward

achieving GES. Nowadays humans are also part of the marine ecosystem (i.e. users). Accordingly to, in order to get sustainable activities, compatible with the conservation of marine ecosystems, some environmental targets for a good status must be defined (Borja et al. 2012). However, due to the lack of data and knowledge on the amount of marine litter in the different marine compartments and the transport (i.e. meteorological and/or hydro-morphological processes) and flux mechanisms (i.e. physical fluxes such as the deposition and degradation rates; and, biological fluxes such as absorption and ingestion rates) among them, it is difficult to assess where an ecosystem is positioned along a trajectory toward recovery (Borja et al. 2012). Accordingly, in these cases directional/trend targets (i.e. continuous improvement in state but where a final end point cannot be identified) can be useful.

Table 12: List of different models' examples used within PERSEUS project to develop an "End to End" approach.

Hydrodynamic models	Link
Regional Ocean Model System (ROMS)	http://iod.ucsd.edu/~falk/roms_class/shchepetkin04.pdf.
Princeton Ocean Model (POM)	http://web.stevens.edu/ses/ceoe/fileadmin/ceoe/pdf/alan_publications/AFB032.pdf.
Nucleus for European Modelling of the Ocean (NEMO)	http://www.nemo-ocean.eu/About-NEMO/Reference-manuals.
Proudman Oceanographic Laboratory Coastal Ocean Modelling System (POLCOMS)	http://cobs.pol.ac.uk/modl/metfcst/POLCOMS_DOCUMENTATION/node4.html.

Acknowledging these constraints, the main mandates propose using trend indicators to monitore the achievement of the environmental targets. The MSFD proposes four indicators regarding marine litter (European Commission 2010): (i) Trends in the amount of litter washed ashore and/or deposited on coastlines, including analysis of its composition, spatial distribution and, where possible, source; (ii) Trends in the amount of litter in the water column (including floating at the surface) and deposited on the seafloor, including analysis of its composition, spatial distribution and, where possible, source; (iii) Trends in the amount, distribution and, where possible, composition of micro-particles (in particular micro-plastics); and, (iv) Trends in the amount and composition of litter ingested by marine animals (e.g. stomach analysis). Moreover, to make progress in the Mediterranean Action Plan´s Ecosystem Approach, 18 "common indicators" have been defined (UNEP/MAP 2014). Among these indicators the abovementioned four indicators have been also proposed. The only difference is that indicators (ii) and (iii) have been unified into a unique one. Furthermore, not only the indicators should be standardized and harmonized, but also the methods to monitore them. Galgani et al. (2013) make a summary of different approaches to monitor marine litter in different marine compartments and their positive and negative aspects (Table 13).

Table 13: Summary of approaches for assessing GES with regards to marine Litter. Source: Galgani et al. (2013).

Compartment	Approaches	Positive aspects	Poorly covered and negative aspects
Coastline	Counts of the amount of litter items on known stretches of coast.	Allows for assessment of composition, amounts, sources, trends, social harm (aesthetic, Economic).	Very small items and micro-particles in sediments are not quantified. Not all coasts are accessible or appropriate.
Sea surface.	Ship observers.	Precise evaluation at local scale.	Depending on weather. Not at large scale, small debris not considered, strong temporal variation
Sea surface and water column	Trawling and water filtration.	Precise evaluation at local scale, consider smaller debris.	Costs, strong temporal variation.
Sea surface	Aerial counts of the number of litter items floating on the sea surface along transects.	Assessment of densities of litter on water surface over large areas possible; correlation with shipping or fisheries activities.	Smaller items not covered. Only counts of items from TetraPak size upwards are possible.
Sea floor shallow	Visual survey with divers.	All substrate types, replicability, feasible to account for detectability.	Depth limitation (<40 m).
Sea floor, deep sea	Litter Trawling.	Replicability, possible standardization.	Only where trawling is possible.
Sea floor, deep sea litter	Submersibles and remote operated vehicles.	All sites accessible.	Only small areas, costs.
Entanglement rates of marine organisms	Entanglement rates in birds found on the coastline.	Can be carried out as part of existing surveys.	Standard protocol would need to be developed and implemented.
OSPAR Fulmar Plastic Ecological Quality Objective (EcoQO)	Mass of plastic in stomachs of beached seabirds (Fulmars).	Operational and tested in North sea. Applicable everywhere in most of OSPAR area.	Focuses on surface litter in offshore habitats; not yet operational in all EU regions: need further developing.
Ingestion by other marine organisms.	Abundance of plastic by mass	Potentially similar to Fulmar EcoQO	Need to be developed and tested.

			approach.
Micro-plastic on shorelines	Extraction of fragments from sediment samples and subsequent identification using FT_IR spectroscopy.	Positive identification of specific polymers.	Analysis is time-consuming and is unlikely to detect all of the micro-particles. This is especially true for very small fragments (<100 mm).
Micro-plastic at sea surface	Manta trawl (330 mm) and subsequent identification using FT_IR spectroscopy.	Positive identification of specific polymers.	Analysis is time-consuming and is unable to detect all of the micro-particles
Socio-economic	Assessment of direct costs through survey-based methods.	Provides indication of economic burden on marine and coastal sectors.	Does not capture full impact of degradation of ecosystem goods and services due to marine litter.

In addition, operational targets should be defined in relation to the nature of the management action required to achieve GES (e.g. amount of marine debris removed); or to assess progress towards full implementation of a specific measure (e.g. percentage of fishers using alternative/modified fishing gear by fishing fleet or area). Within the Honolulu Strategy (UNEP and NOAA 2011), several indicators are proposed to evaluate management strategies and their enforcement, focused on three areas: (i) decreasing land-based sources of marine debris; (ii) shipping, boating, and transport; (iii) removal of marine debris accumulations (Table 14).

Moreover, monitoring a system does not in itself make a policy to be adaptive. The value of monitoring in adaptive management is inherited from its contribution to decision making. Monitoring must be used to reduce uncertainty (e.g. comparing predictions produced by the models with data-based estimates). The analysis and assessment of monitoring data result in better understanding of system processes and the opportunity to improve management based on that understanding. Without periodic monitoring of the relevant resource attributes, learning about resource responses and subsequent adjustment of management actions are not possible.

Table 14: Potential evaluation questions and indicators to be considered in developing an approach to evaluating strategies. Source: UNEP and NOAA (2011).

DECREASING LAND-BASED SOURCES OF MARINE DEBRIS
What is the level of awareness of specific groups with BMPs, laws and regulations, and marine debris impacts?
- Number of stakeholders briefed by affiliation (for example, industry, government, public) - Pre- and post-outreach tests for knowledge and intent - Percentage of specific groups adopting BMPs (for example, waste haulers, packaging industry, institutions, environmental and health agencies) - Recycling rates pre- and post-outreach
Are infrastructure and use of BMPs sufficient?
- Number of informal dumping sites - Number of receptacles per quantity of beach, park, or street user - Rate of escape of pre-production pellets into waterways - Tonnage of solid waste recovered from waterways

What is the capacity to monitor and enforce compliance with regulations and permit conditions?
- Number/types of permits or regulations in place to prevent land-based debris - Number of enforcement and compliance officers - Number of violations - Number of repeat violations - Number of violations as a percentage of total permits

How effective are regulatory measures?
- Number of waterways exceeding allowed trash load - Number of violations

How effective are litter and solid waste cleanup efforts at preventing marine debris?
- Frequency of clean-up activities by location - Accumulation rate of trash by location - Number of volunteers; number of hours - Tonnage of solid waste recovered from coastal lands, watersheds, and tributary waterways - Tonnage of solid waste recovered at booms and debris traps with and without watershed cleanups - Number of removal actions necessary to maintain a set level of cleanliness

SHIPPING, BOATING, AND TRANSPORT
What is the level of awareness of specific groups of ocean users regarding BMPs, storage and disposal options, and legislation and policies?
- Percentage of ocean users by specific industry or group - Percentage of ocean users briefed by specific industry or group - Percentage of ocean users adopting best practices by specific industry or group - Tonnage of lost cargo - Cost of lost cargo

What percentage of specific groups of ocean users are using proper waste storage and disposal options?
- Percentage of ocean users using proper waste storage onboard and disposal at port reception facilities - Tonnage of waste collected at port reception facilities

What is the level of awareness of fishers regarding BMPs, modified or alternative fishing gear, and legislation and policies?
- Percentage of fishers who think current practices and methods to prevent ALDFG sources are adequate by fishing fleet or area - Percentage of fishers aware of BMPs, practices, and legislation by fishing fleet or area - Percentage of fishers briefed by fishing fleet or area

What percentage of fishers are adopting best practices and modified or alternative fishing gear?
- Percentage of fishers adopting best practices by fishing fleet or area - Percentage of fishers using alternative/modified fishing gear by fishing fleet or area - Number of gear items lost - Tonnage of gear lost

REMOVAL OF MARINE DEBRIS ACCUMULATIONS
How effective are methods to detect marine debris at sea?
- Marine debris detection rate based on size of search area, number of search days, and number and size of marine debris accumulations detected

How effective are removal efforts?
- Amount of marine debris removed - Amount of marine debris recovered through incentive programs - Length of time between marine debris reporting and removal

Step 4-Implement the policy

In order to ensure successful policy implementation, several basic conditions need to be fulfilled. In fact, implementing a policy, does not only consist on getting the legal

text ready, but also ensuring that those (i.e. the public) who will face changes under the new policy understand that this is coming, its meaning and its implications if the policy it is not complied. Moreover, it is useful to ensure that those stakeholders and experts who were involved in the earlier activities are also included in the implementation (i.e. "*Involve experts and stakeholders*"). Different organizations will need to plan their part of the implementation, which will involve financial or human resources allocation. Finally, successful implementation also requires that the regulatory and institutional frameworks will be in place, including the capacity to monitore and enforce the new policy. Accordingly, planning the implementation process and the actions necessary for putting the policy into practice is highly important (i.e. "*Draw up an implementation plan*") in order to ensure enforcement and commitment from all actors. "Gantt charts" can be useful to organize actions along a timeline (Table 15).

Step 5-Evaluate and adjust policies

Finally, evaluation and adjustments are key aspects of adaptive policies. This step involves investigating whether and to what extent the policy is effective and how much of the problem has been addressed and what more needs to be done. This step creates both insights on the policy and, a basis for adjusting the policy. For example, if the evaluation phase reveals a problem, recommendations can be made to improve the efficiency of the policy.

As mentioned in Step 4, capacity to adjust to anticipated conditions is triggered by monitoring. Though, formal policy review and continuous learning are necessary to overcome unanticipated conditions.

In some cases, the cycle continues, starting again in steps number two, three, or four depending on whether further analysis of the problem is needed. However, for more fundamental changes, new legislation may be needed and the whole cycle repeated.

Table 15: Implementation plan example to manage Marine litter.

Task name	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May
Designate and Formalize Roles and Responsibilities	■										
Designate stakeholder to take into account	■										
Develop an initial assessment of the state of the problem	■	■									
Identify drivers and consequences of actual state	■	■									
Review environmental legislation and other requirements	■	■									
Gain management approval and define the scope of the policy			■								
Define and prioritize measures				■							
Assess policy success looking for future uncertainties					■						
Identify and Develop Operational Controls / Emergency Plans						■					
Implement the planned policy							■	■	■		
Implement monitoring strategy							■	■	■		
Document and record monitoring results										■	
Take corrective actions										■	■

5. LESSONS LEARNT AND IMPROVEMENTS ON THE AMP TOOLBOX

EXPERIMENTATIONS AT BASIN LEVEL

Throughout each project life cycle (such as the development of the AMP Toolbox), lessons are learnt and opportunities for improvement are discovered. As part of a continuous improvement process, documenting weaknesses and successes helps project teams discover the root causes of problems that occurred and avoid those problems in later project stages or future projects. Accordingly, it is very important to recognise those areas that should be improved with potential end-users as well as to identify the causes and procedures that could be amended.

For this purpose different tests have been performed with stakeholders at two levels:

(i)   Pilot case level (including the Western Mediterranean, Adriatic, Aegean and Western Black Seas);

(ii)   Southern European Seas (SES) or basin level (accounting for the Mediterranean and Black Sea).

In order to carry out the tests at basin level (i.e. object of this deliverable), the SES or basin level stakeholders platform (developed in Task 6.2) has been employed, including principally the members of PERSEUS´s AB. The experimentations or tests with the members of the AB have been performed during important conferences and workshops at the SES such as the "PERSEUS Scientific Workshop" (Marrakech, 2-4 December 2014) and the "International Ocean Research Conference" (Barcelona, 17-2 November 2014).

In addition, different demonstrations were performed with additional regional level stakeholders and potential end-users at important meetings in the Mediterranean and Black Sea, such as the "International Black Sea Day" (Istanbul, 3rd November 2014) and the "MAP/MED POL Focal Point meeting" (Malta, 16-19 June 2015), at the invitation of the MAP Officer in charge of MED POL (Ms. Tatjana Hema).

While the details on the planning flow and direct outputs (i.e. comments) of the tests at SES or basin level can be consulted in D6.15; key learnings and the improvements performed accordingly (based on the suggestions and recommendations obtained from the stakeholders) are presented in the following section of the present deliverable. Accordingly, in this section of the deliverable (i) the key learnings derived from the experimentations performed with the stakeholders at basin level are listed; and, (ii) the improvements performed within the AMP Toolbox are described.

5.1. KEY LEARNINGS

In general terms, the members of the Advisory Board showed a positive and supportive opinion on the AMP Toolbox. The five members of the Advisory Board who participated in the AMP Toolbox workshops/interviews congratulated the team on the achievements and the amount of information and knowledge collected. The main critique was regarding the way in which information is presented (i.e. too scientific) and the need for supportive material or some training. In Deliverable 6.15 (D6.15), the comments of the members of the Advisory Board can be consulted in detail, according to the different characteristics of the AMP Toolbox to be improved. In Table 16, we move a step further and the key learnings obtained from their

comments, as well as the associated recommendations for improvements are presented.

Table 16: Key learnings and recommendations for improvements gathered from the experimentations performed at basin level.

AMP Toolbox area	Key learning	Recommendations for improvement
Support and Examples		
	☑ Strengths: There is no specific support facility within the AMP Toolbox currently. But, good efforts are being made on examples. ☒ Weaknesses: Need for guidance documents and more examples in order to understand better the utility and functionality of the AMP Toolbox.	Develop more examples (to understand AMP Toolbox´s utility) and tutorials (to understand its functioning)
Appearance, style, design		
	☑ Strengths: Large amount of information available within the Toolbox. ☒ Weaknesses: Profusion of information could discourage end-users.	Presentation of the information should be improved. Make information more clear and concise.
Scope		
	☑ Strengths: Utility of the Toolbox to recommend and support policy-making. ☒ Weaknesses: The scope and utility of the toolbox are not clearly described. Potential users could think that it provides tailored solutions or policies directly. The level (i.e. local, national or regional) and matter of application are not clear.	Make the scope and utility of the Toolbox clearer, making a specific section to address it and improving the language formatting.
Contents		
	☑ Strengths: Large amount of scientific findings	Make the language of the contents of the AMP Toolbox

	available. ☒ Weaknesses: Scientific work needs to be understandable and useful for a broad group of users who do not have scientific background or knowledge.	understandable for a broader audience. Avoid the use of specific nomenclature of the project, such as deliverables, milestones, WP, etc. Develop a glossary. Include an example of how each step should be accomplished in order to make the guidelines and activities included in each step more understandable.
Others		
	☑ Strengths: Regional assessments and models sections very useful to make available the work performed within the project ☒ Weaknesses: Insufficient knowledge and information to assess issues correctly. In this regard, further collaboration is necessary within the project since the work performed within other work packages is of great interest.	Improve regional model and assessments section and make available all the useful resources developed within the project.

5.2. IMPROVEMENTS APPLIED

In this section the improvements performed (based on the key learnings and recommendations) are shown[1]. These improvements have been organized according to the different characteristics of the Toolbox to be improved (i.e. support and examples, appearance, scope, contents and others).

5.2.1. Support and Examples

- Since no support facility was provided within the Toolbox, the first step has been to change the name of the section "Examples" (Figure 9) to "Examples and Tutorials".

- In order to make the functionality and utility of the Toolbox more easily understood, different tutorials and examples have been added. In addition to the two existing Examples on adaptive policies (i.e. one about the management of the anchovy in the Bay of Biscay; and, a second one regarding the Great Barrier Reef Marine Park), the

---

[1] Given that these improvements are currently being applied by WP9 on the web-page, it could happen that the deliverable is available before the improvements are visible at the web-page.

following elements have been developed and incorporated into the "Examples and Tutorials" section:

➢ Tutorial-Presentation of the AMP Toolbox: Short video where the objective, scope and the core organization of the Toolbox are presented in order to explain the background and functioning of the AMP Toolbox.

➢ Tutorial-Website tour: Short video to lead the user through a tour of the Toolbox website.

➢ Tutorial-Flag example on marine litter (described in Section 4): Video tutorial developed from the Marine litter example developed in Section 4, in order to provide insights into the different steps, activities and resources provided within the Toolbox.

➢ Example-Factsheets regarding different issues: 4-pages factsheets to provide insights into the different steps, activities and resources provided within the Toolbox, using the "Overexploitation of commercial fish species" and "Coastal and maritime tourism" as examples (see Figure 10).
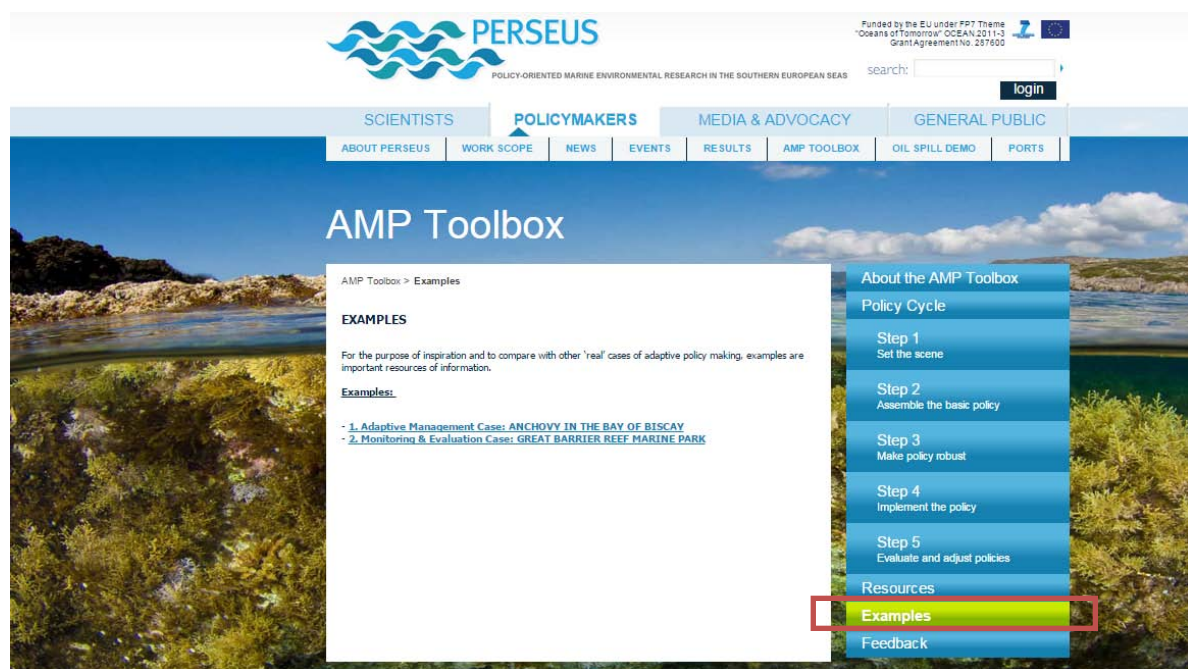
Figure 9: "Examples" section before revision for improvements.
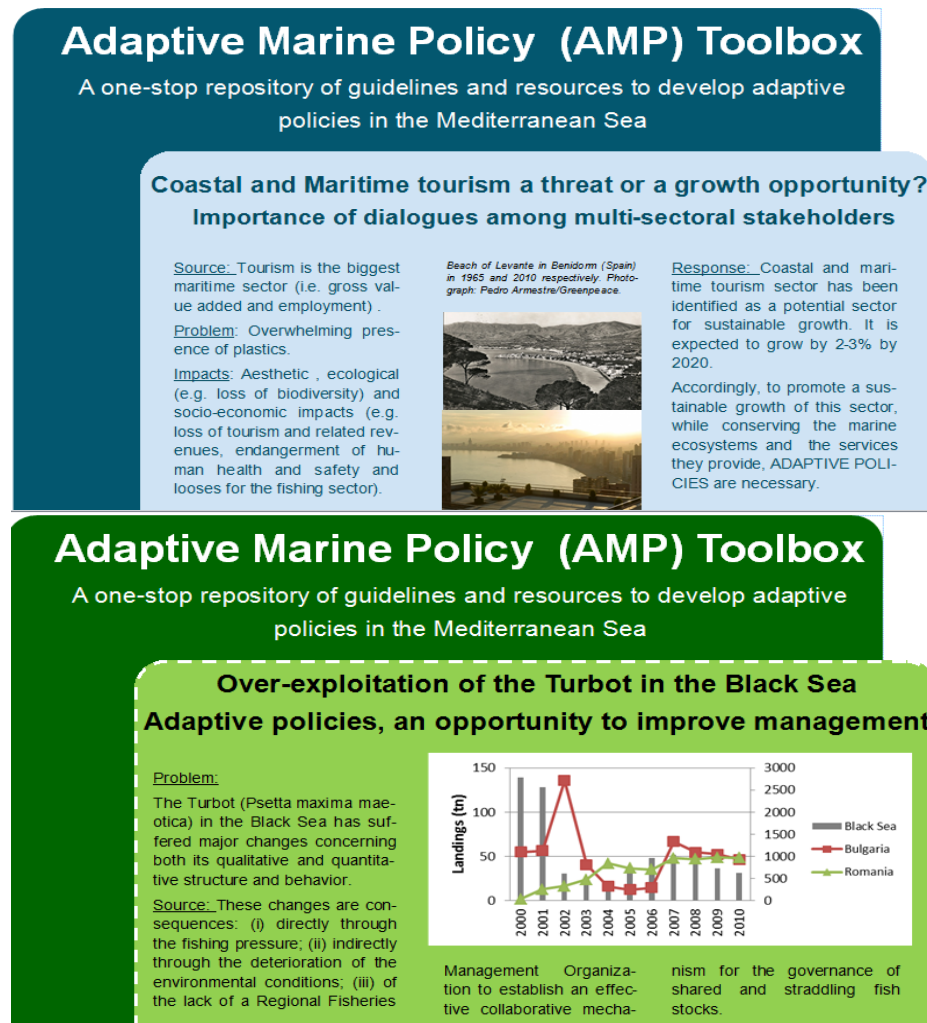
Figure 10: Snapshots of the two factsheets included in the "Examples and Tutorials" section of the main menu.

5.2.2. Appearance, style and design

- The language and grammar of all the web-pages within the Toolbox have been reviewed in detail. In addition, all text and information has been summarized and made more concise.

- Apart from these improvements, the appearance and the design of many webpages have been improved. For this purpose, "More information" buttons or links have been included in order to avoid profusion of information at first glance and give the opportunity to the user to learn more about the element in question. In Figure 11 and 12, for example the first and second (or improved) versions of the steps can be compared, where only the "introduction", "key activities" and "examples" sub-sections are shown. The rest of the sub-sections (e.g. why is this step necessary? Who should be engaged? How should this step be carried out?) can be consulted clicking on the "more information" buttons.

Figure 11: Part of the original (i.e. initial) structure and appearance of the "Step 2".

Example: STEP 2: ASSEMBLE THE BASIC POLICY

Step 2 aims to propose possible policy solution(s) to address the issues and objectives defined in Step 1, and to make an analysis of the policy proposals, considering in particular the existing measures. Accordingly, Step 2 consists in two activities: (i) identifying, assessing, and prioritizing the potential measures (ii) ensuring the engagement of all stakeholders to enhance relevant and feasible ideas as well as to get the approval of the measures for a greater chance of success in the environmental managing process.

More information

Key activities:

- **Identify measures**
- **Prioritise/assess new measures**
- **Involve experts and stakeholders**

Examples:

Several problems or issues can be addressed with the AMP Toolbox, in this case marine litter in the Mediterranean and Black Sea is used as an example.

More information

Figure 12: Proposed new structure for the Steps, including "More information" buttons. "Step 2" is shown as an example.

5.2.3. Scope

The scope and utility of the Toolbox were not clearly described in the initial version of the page about the Toolbox (i.e. "About the AMP Toolbox", http://www.perseus-net.eu/en/about_the_apf_toolbox/index.html). Accordingly, it was necessary to formulate guidelines to improve the effectiveness of the Toolbox specifying which steps or resources are more useful for potential types of users. Consequently, a sub-section entitled "Who Is the AMP Toolbox for?" has been included in the above-mentioned section (see Figure 13).

Who Is the AMP Toolbox for?

The EU Marine Strategy Framework Directive (MSFD) stressed numerous challenges to member-states relating to the protection of territorial waters. So far, diverse methods have been implemented at the national, regional and global levels to facilitate policy settings and gather inputs from stakeholders. Yet, there is an absence of a set of tools to assist mainly policy-makers involved in implementing marine policies. This gap makes it difficult to develop new policies in a coherent manner, as well as to identify reference points for current and future GES of European Seas. As a result, little progress is being observed.

As a means of elaborating participatory design of multi-scale marine management schemes and policies in the context of MSFD, PERSEUS project developed an innovative, web-based toolbox, namely the Adaptive Marine Policy Toolbox – AMP, with a close collaboration between scientists and socio-economists.

The AMP is a set of 'tools' (in the broad sense) and is mainly addressed to marine policy makers in the SES countries. More specifically, it provides a set of effective tools, databases, case studies and scientific information that can be used to achieve a variety of outcomes, such as:

- Gathering information to support relevant stakeholders and policy-makers to deal with certain marine policy issues and, thus, to gain a better understanding of appropriate marine policies required.

- Facilitating local and regional dialogue between various stakeholders and the general public in the SES countries and fostering cooperation and mutual understanding around marine issues.

- Structuring a dialogue on MSFD-related policy issues, e.g. the estimation of pressures in socioeconomic terms on the marine and coastal ecosystems.

The overall purpose of the AMP is to make scientific findings and resources readily available in a user-friendly format and, thus, to assist policymakers with formulating policies that will benefit the marine environment and all who depend on it. Furthermore, the AMP is targeted in general at those who are interested in marine policy and who may be new or experienced in these processes and who require policy and scientific tools along with knowledge of the lessons learned from relative case studies. In this sense, the AMP will be useful for anyone working on, or affected by marine policy, and thus, besides policy makers, it is also targeted at scientists and policy practitioners as well as to local, regional and national administrations in SES countries, who may have already used the methods included in the AMP.

Considering the potential users and the application scope of the AMP, it is recognized that not all the information and resources in the AMP will be fully applicable to a particular context. Hence, users need to adapt them to suit their needs.

Figure 13: New sub-section entitled "Who Is the AMP Toolbox for?" within the first page (i.e. "About the AMP Toolbox").

5.2.4. Contents

- The first improvement consisted of improving and avoiding language deemed too scientific to make the Toolbox more understandable and useful for a broader audience.

- In addition, a glossary (http://www.perseus-net.eu/assets/media/PDF/AMP%20Toolbox/4224.pdf) has been developed and included into the Toolbox to clarify those terms that although necessary could be unknown or unclear to the user. The glossary consists of around 45 terms, including a brief definition (around 6 sentences) for each term (see Box 3 as an example). These terms can be easily identified in the text of the Toolbox, since they are in bold and they can be clicked on to be directed to the definition.

Box 3: Stakeholder´s definition:

"*A person, institution, organization or group that has some interest in a particular ecosystem such as oceans, seas, forests, aquatic areas, lands, amongst others. The stakeholders get involved into environmental management project(s) and play an essential role within the decision-making process. Therefore, their engagement and cooperation are crucial in order to prevent conflicts, to optimize improvement(s), and to tackle the socio-economic and ecological issues of the aquatic and/or terrestrial areas. They can positively and/or negatively affect the ecosystem depending mainly on communication, management and monitoring measures' efficiency and the implementation of laws at different scale*".

- Moreover, the different web-pages of the Toolbox have been reviewed in order to avoid the use of technical nomenclature of the project such as "deliverables", "work-packages", "tasks" and "milestones" (Figure 14).

Figure 14: Examples of (a) "Regional assessments" and (b) "Regional models" web-pages where the use of acronyms and technical terms of the project could be observed.

- Finally, in each step an "Example" sub-section (see Figure 15) has been included in order to enhance the understanding of the guidelines and activities included in each step respectively. The "Example" sub-section of each step has been extracted from the flag-example (i.e. marine litter). As mentioned before, the complete flag-example together with additional examples can be consulted on the "Examples and Tutorials" section of the main menu (i.e. right-hand menu).

Example

Several problems or issues can be addressed with the AMP Toolbox, in this case marine litter in the Mediterranean and Black Sea is used as an example.

Information on the examples

Gather information and determine existing conditions" is the first activity, i.e. to acknowledge that there is a problem (i.e. overwhelming presence of plastics in the Mediterranean and Black Seas), that causes negative ecological (including ingestion by marine organisms) and socio-economic impacts (financial implications for the fishing sector and loss of tourism and related revenues) and that these merit further analysis and management strategies.

For this purpose, apart from experts a multi-sectoral engagement would be necessary (i.e. Regional, national and local authorities, Maritime sector, Tourism sector, Fisheries and aquaculture, Agriculture, Industry, and Civil society). Understanding the extent of the problem will help to create the "political will" and support for potential action. Therefore "Involve experts and stakeholders" is an instrumental activity.

It is also important to "Develop a mutual understanding and define principles and goals" such as:
- reduce the amount and impact of land-based and sea-based sources of marine debris introduced into the sea;
- reduce the amount and impact of accumulated marine debris on coastal and marine ecosystems.

Although adaptive policies might focus on setting goals and targets at the more local level; cooperation and coordination on a regional seas basis is an asset for a meaningful development and implementation of adaptive policies. Accordingly, the use of existing institutional structures such as the regional seas commissions and international organization should be promoted (see Institutional inventory database). Last but not least, legal and administrative obligations such as international agreements laws and regulations should be identified, with the aim of defining consistent objectives and strategies (see Legal inventory database). For more details see flag example.

Figure 15: New "Example" sub-section within Step 1-Set the scene.

5.2.5. Others

The language of the "Regional assessments and models" sections or web-pages respectively initially caused some confusion. In addition, few resources were available. In order to improve these sections and make the useful resources developed within the project available, two actions have been performed:

- The language of these sections was reviewed and improved with the overall aim of making the information more clear and concise. In addition, "More information" buttons have been included in order to improve the presentation of the information (see Figure 16 and Figure 17).
- More regional assessments and models developed within the PERSEUS project have been presented and links to them have been provided within these sections (see Figure 16 and Figure 17).

Figure 16: (a) Old and (b) new appearance of the "Regional models" page.

AMP Toolbox > Resources > **Regional Assessments**   **(a)**

| Knowledge Base | Tools & Methods | **Regional Assessments** | Regional Models | Further reading |

Regional Assessments

Resources dedicated to marine environmental issues in the Mediterranean and Black Sea regions

The main resources of the project which have been identified so far as they are relevant for policy elaboration are :

- <u>Analysis of the main risks of non-achievement of the GES, by the WP1 (open sea) and WP2 (coastal areas)</u>

- <u>Pressures in socio-economic terms on the marine and coastal ecosystems, by the WP1 (open sea) and WP2 (coastal areas)</u>

Regional Assessments   **(b)**

Scientific data and knowledge (from ecological and socioeconomic perspectives) are necessary to deliver advice on a variety of issues with the overall aim of protecting the Mediterranean and Black Sea ecosystems and the services they provide. Though, usually important knowledge gaps exist.

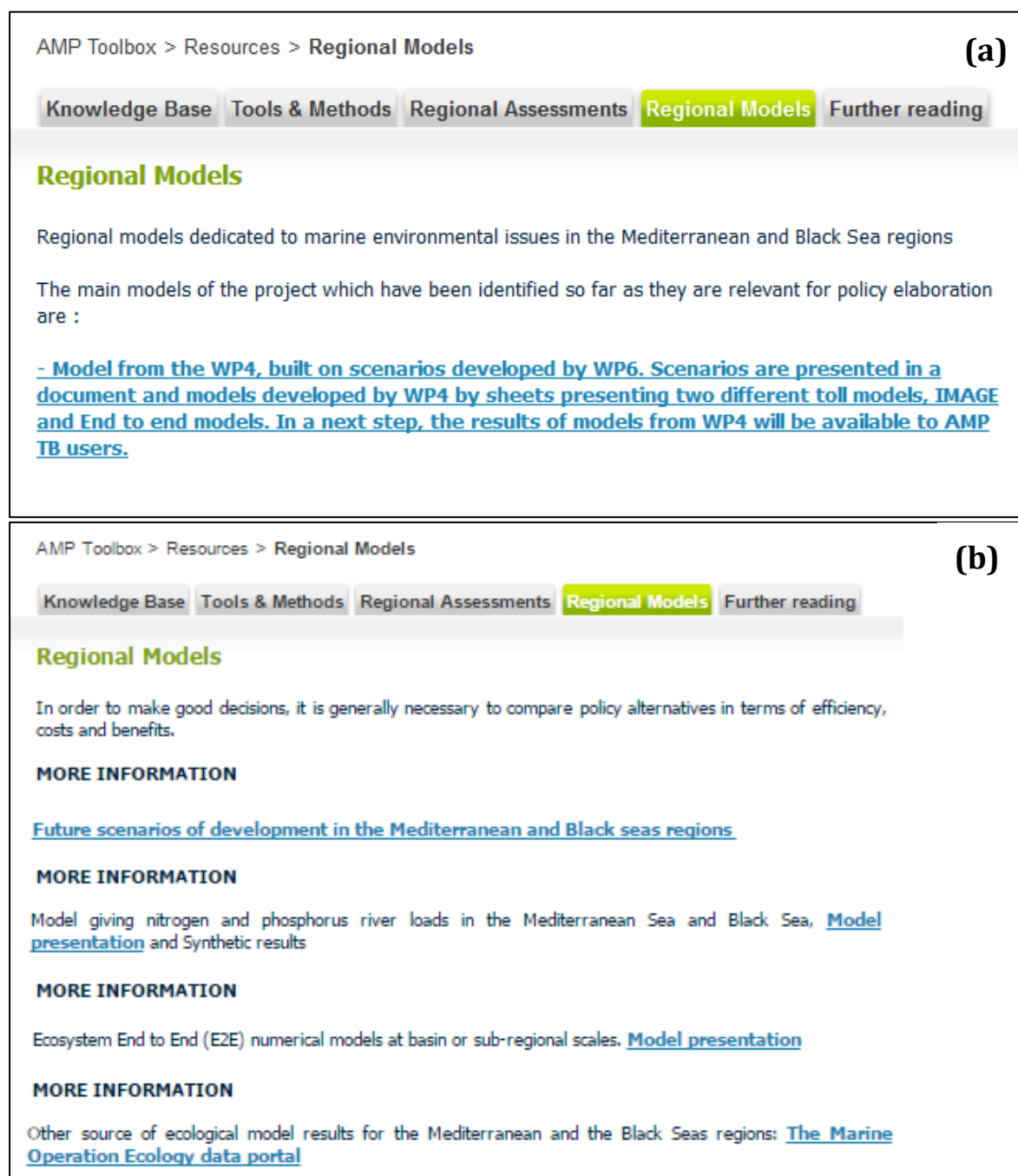Accordingly it is important to make the available knowledge accessible. The objective of the "Regional Assessments" is to make the region-specific knowledge created within PERSEUS project available for potential policy-makers. The assessments include:

- Set-up of stakeholders' platforms
- Expectations issued by the stakeholders' platforms
- Analysis of the main risks of non-achievement of the Good Environmental Status in coastal and open areas
- Pressures and impacts on
    o Coastal areas
    o Open sea
- Pressures in socio-economic terms on
    ▪ Coastal areas (pilot cases)
    o Open sea (pilot cases)
- Environmental Status Assessment
    o Compilation of environmental status assessments
    o Gaps on the assessment elements
- List of issues at risk of non-achievement of Good Environmental Status (GES) and scenarios to be modelled
- Recommendations for European long-term strategy on sustained observations in Southern European Seas
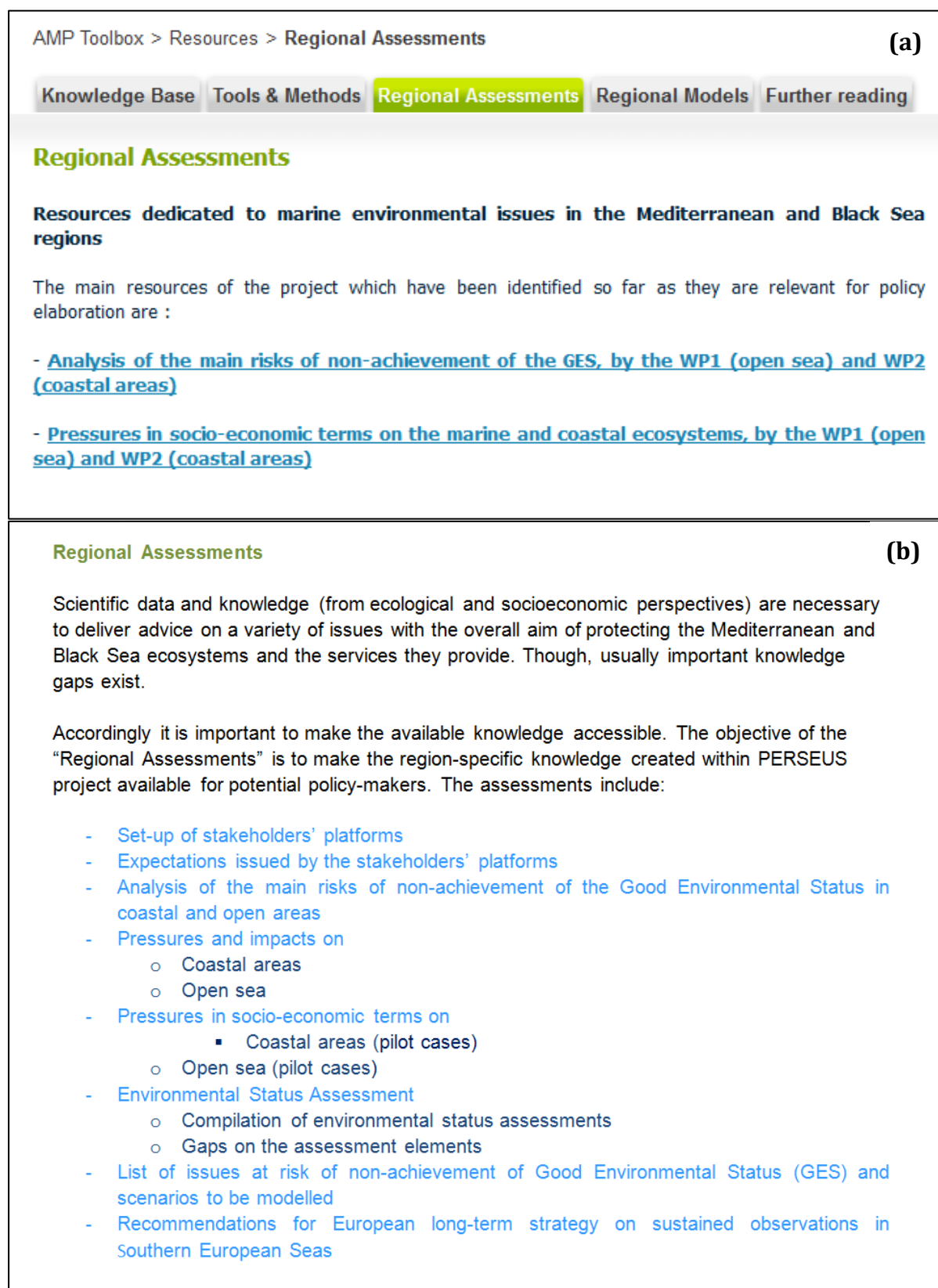
Figure 17: (a) Old and (b) new appearance of the "Regional assessments" page.

6. CONCLUSIONS

To operationalize the design and implementation of adaptive policies and translate adaptive management into decision tools under the requirements of the Marine Strategy Framework Directive, the Adaptive Marine Policy (AMP) Toolbox was developed. The objective of the AMPT Toolbox is to provide policymakers with the necessary framework and resources to develop adaptive policies. Different tests have been performed using real-world problems through a participatory approach with stakeholders to investigate the usefulness of the AMP Toolbox and improve it. The tests were performed at two levels: (i) Pilot case level; and, (ii) Basin level (i.e. including the Mediterranean and Black Sea). This report is focused on the tests developed at basin level and the improvements performed on the AMP Toolbox based on the key lessons learnt and recommendations. Accordingly, in this deliverable, in order to operationalize the design and implementation of adaptive policies we have clarified and presented: (a) the core principles, structure and objective of the AMP Toolbox; (b) a flag-example (i.e. application of the AMP Toolbox to the marine litter issue in the Mediterranean and Black Sea) which has been developed to show the usefulness of the AMP Toolbox to design and implement adaptive measures to the stakeholders in the tests (as well as to potential end-users); and, (c) the key lessons learnt with the stakeholders and the improvements performed as a result.

One of the key characteristics or advantages underlined by the stakeholders was that, apart from providing guidelines to design and implement adaptive policies, the Toolbox makes available various resources, including different inventories, regional assessments and models developed within the PERSEUS project. Technical assistance (i.e. access to information and research) and capacity support can enhance the capacity of the policy-makers to design and implement truly adaptive effective policies and to fully comply with the EBA. In contrast, they criticized the profusion of information, the way this information is presented (i.e. too scientific) and the need of supportive material or some training. Adaptive decision-making is usually perceived as difficult by stakeholders due to: the ambiguity surrounding the meaning of adaptive management; and the resistance to acknowledging uncertainty and to dealing with it. In practice, policies with well-known moderate benefits are usually preferred over policies with uncertain but marginally larger expected benefits. Accordingly, special efforts have been done to improve these aspects and make it more useful for the stakeholders and potential end-users. Basically, these improvements consist of:

    (i)   Develop more examples and tutorials and improve a flag-example on marine litter;

    (ii) Make information more clear and concise;

    (iii) Make the scope and utility of the Toolbox clearer;

    (iv) Make the language of the contents of the AMP Toolbox understandable for a broader audience and develop a glossary;

    (v) Improve the presentation of the "Resources" section (particularly "Regional models and assessments" sections) and make available more resources.

These improvements, implemented in a revised version of the Toolbox on the web, have improved significantly the understanding of the scope and utility of the Toolbox, making clear that:

(i) The AMP Toolbox should be understood as a repository of guidelines and resources to guide and support policy-makers designing and implementing more effective policies and reducing uncertainty through learning-based management.

(ii) To this end, the AMP proposes a flexible framework that could be implemented in the different stages of the marine policy-making. But it does not propose or provide adaptive policies directly. Accordingly, each policy-maker will have to adapt the framework according to her/his own need and priorities and design and implement the most appropriate policies accordingly.

7. REFERENCES

Bainbridge, J. M., Potts, T., & O'Higgins, T. G. (2011). Rapid Policy Network Mapping: A New Method for Understanding Governance Structures for Implementation of Marine Environmental Policy. *PLoS ONE*, *6*(10), e26149. doi:10.1371/journal.pone.0026149

Bertram, C., & Rehdanz, K. (2013). On the environmental effectiveness of the EU Marine Strategy Framework Directive. *Marine Policy*, *38*, 25–40. doi:10.1016/j.marpol.2012.05.016

Borja, Á., Dauer, D. M., & Grémare, A. (2012). The importance of setting targets and reference conditions in assessing marine ecosystem quality. *Ecological Indicators*, *12*(1), 1–7. doi:10.1016/j.ecolind.2011.06.018

Cinnirella, S., Sardà, R., Suárez de Vivero, J. L., Brennan, R., Barausse, A., Icely, J., et al. (2014). Steps toward a shared governance response for achieving Good Environmental Status in the Mediterranean Sea. *Ecology and Society*, *19*(4). doi:10.5751/ES-07065-190447

European Commission. Comission Decision on criteria and methodological standards on good environmental status of marine waters (2010). http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:232:0014:0024:EN:PDF

Galgani, F., Hanke, G., Werner, S., & Vrees, L. D. (2013). Marine litter within the European Marine Strategy Framework Directive. *ICES Journal of Marine Science: Journal du Conseil*, *70*(6), 1055–1064. doi:10.1093/icesjms/fst122

Goulding, I. C., Stobberup, K. A., & O'Higgins, T. (2014). Potential economic impacts of achieving good environmental status in Black Sea fisheries. *Ecology and Society*, *19*(3), 32. doi:10.5751/ES-06817-190332

Jones, N., Panagiotidou, K., Spilanis, I., Evangelinos, K. I., & Dimitrakopoulos, P. G. (2011). Visitors' perceptions on the management of an important nesting site for loggerhead sea turtle (Caretta caretta L.): The case of Rethymno coastal area in Greece. *Ocean & Coastal Management*, *54*(8), 577–584. doi:10.1016/j.ocecoaman.2011.05.001

Katsanevakis, S., Verriopoulos, G., Nicolaidou, A., & Thessalou-Legaki, M. (2007). Effect of marine litter on the benthic megafauna of coastal soft bottoms: A manipulative field experiment. *Marine Pollution Bulletin*, *54*(6), 771–778. doi:10.1016/j.marpolbul.2006.12.016

Lebreton, L. C.-M., Greer, S. D., & Borrero, J. C. (2012). Numerical modelling of floating debris in the world's oceans. *Marine Pollution Bulletin*, *64*(3), 653–661. doi:10.1016/j.marpolbul.2011.10.027

Marine Management Organization, & Marine Scotland. (2012). *A critical review of tools and methods to apply marine social and economic data to decision-making* (No. MMO Project No: 1012) (p. 58).

O'Higgins, T., Cooper, P., Roth, E., Newton, A., Farmer, A., Goulding, I. C., & Tett, P. (2014). Temporal constraints on ecosystem management: definitions and examples from Europe&#8217;s regional seas. *Ecology and Society*, *19*(4). doi:10.5751/ES-06507-190446

Oosterhuis, F., Papyrakis, E., & Boteler, B. (2014). Economic instruments and marine litter control. *Ocean & Coastal Management*, *102, Part A*, 47–54. doi:10.1016/j.ocecoaman.2014.08.005

Pham, C. K., Ramirez-Llodra, E., Alt, C. H. S., Amaro, T., Bergmann, M., Canals, M., et al. (2014). Marine Litter Distribution and Density in European Seas, from the Shelves to Deep Basins. *PLoS ONE*, *9*(4), e95839. doi:10.1371/journal.pone.0095839

Swanson, D. A., & Bhadwal, S. (2009). *Creating Adaptive Policies: A Guide for Policy-making in an Uncertain World*. Sage, IDRC. http://idl-bnc.idrc.ca/dspace/bitstream/10625/40245/1/IDL-40245.pdf

Tallis, H., Levin, P. S., Ruckelshaus, M., Lester, S. E., McLeod, K. L., Fluharty, D. L., & Halpern, B. S. (2010). The many faces of ecosystem-based management: Making the process work today in real places. *Marine Policy*, *34*(2), 340–348. doi:10.1016/j.marpol.2009.08.003

Ten Brink, P., Lutchman, I., Bassi, S., Speck, S., Sheavly, S., Register, K., & Woolaway, C. (2009). *Guidelines on the Use of Market-based Instruments to Address the Problem of Marine Litter* (p. 60). Brussels, Belgium and Virginia Beach, Virginia, USA: Institute for European Environmental Policy (IEEP) and Sheavly Consultants. http://www.unep.org/regionalseas/marinelitter/publications/

UNEP. (2009). *Marine Litter: A Global Challenge* (p. 232). Nairobi, Kenya: United Nations Environment Programme (UNEP). http://www.unep.org/regionalseas/marinelitter/publications/

UNEP/MAP. (2014). *UNEP(DEPI)/MED WG. 390/4. Report of the Integrated Correspondence Groups of GES and Targets Meeting*. Athens, Greece.

UNEP, & NOAA. (2011). *Honolulu Strategy - A Global Farmework for Prevention and Management of Marine Debris* (p. 57). Honolulu, Hawái, USA: UNEP and NOAA. http://marinedebris.noaa.gov/solutions/honolulu-strategy

Williams, B. K., & Brown, E. D. (2014). Adaptive Management: From More Talk to Real Action. *Environmental Management*, *53*(2), 465–479. doi:10.1007/s00267-013-0205-7

Wright, S. L., Thompson, R. C., & Galloway, T. S. (2013). The physical impacts of microplastics on marine organisms: A review. *Environmental Pollution*, *178*, 483–492. doi:10.1016/j.envpol.2013.02.031