



Triage process

It is important to follow a structured decision making process which is intended to help define the aim, scope, methods and tools necessary for the marine ecosystem services assessment.

This will ensure that it will be:

- meaningful: interpretable
- useful: in relation to management concerns, needs and projects
- feasible: according to the available knowledge and resources.

The principle of a structured decision making process is to run steps in order to decide what evaluation to run for what objective in which context. A method proposed here in order to reach this objective is called the TRIAGE process [Pendleton et al., 2014].

Its principle is to provide a procedure for delimiting the scope of a potential marine ecosystem services quantitative assessment using a step-wise process to refine the initial broad-scale analysis and to consider, as objectively as possible, the relevance of marine ecosystem services assessment and valuation in a particular situation.

The triage process aims to identify:

- the policy issues for which a marine ecosystem services assessment is expected to provide new evidence
- the parts of the system to be considered in relation to these policy issues
- the sensitivity of the considered marine ecosystem services to natural or social factors of change
- the appropriate methods for valuation
- the feasibility of a marine ecosystem services assessment in practice



VALMER VALMER Interreg 4A Channel project
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Preliminary to triage: is an ecosystem services assessment the most appropriate approach?

The assessment and valuation of marine ecosystem services can promote understanding of the services provided by the marine environment, and determine values for the benefits arising from them, in the context of changing levels of pressure and alternative management scenarios. These possibilities make the approach attractive to stakeholders and decision makers.

However, there are alternative approaches that can be used in making natural resource management decisions. Thus, once the stakeholders are engaged, it is valuable to understand the overarching purposes of the assessment and then to consider in more detail how the assessment should be undertaken.

The three sequences of triage

Basically, the triage process consists of three sequences:

- a preliminary delimitation of the scope of the ecosystem services assessment in relation to its general aims
- a refinement of the scope of the ecosystem services assessment in support of scenarios building and policy design
- the choice of methods, tools and means for ecosystem services assessment in response to management needs.

In practice, the triage process requires sequential consideration of a series of nine questions, which are described in more detail below.

It is important to decide at an early stage whether a marine ecosystem services assessment is the most appropriate approach in a specific situation, and also to determine where effort should be focused to make the best use of limited resources.



Triage sequence 1.1: For which purposes is a valuation of marine ecosystem services needed in the area?

TRIAGE SEQUENCE 1



Preliminary delimitation of the scope of the ecosystem services assessment in relation to its general aims

Question 1

For which purposes is a valuation of marine ecosystem services needed in the area?

This first question relates to the operational needs of the stakeholders who envisage using a marine ecosystem services assessment. Examples of possible aims of the ecosystem services valuation include:

- to improve and integrate knowledge
- to provide initial diagnosis for marine management
- to raise awareness of particular issues or of the value of the marine environment more generally
- to explore possible changes in the ecosystems or human pressure
- to design a new marine and coastal policy
- to compare operational management options, to facilitate trade-offs

- to increase welfare of relevant populations.

Example

A first round dedicated to a preliminary implementation of the triage process on the three French sites was carried out during a two days session in June 2013 in the VALMER project, with a core group of managers and experts in ecology and economics for each case study.

Expected uses of marine ecosystem service assessment	Golfe Normand-Breton	Parc Naturel Marin de la Mer d'Iroise	Golfe du Morbihan	Poole Harbour	North Devon	Plymouth Sound-Fowey
Improve knowledge		2	2	1	3	3
Integrate knowledge	2		2			
Initial diagnosis	1				2	
Raising awareness	2		1	3	3	1
Anticipating future changes	1					3
Facilitate trade-offs	2	3	3			
Designing management options	2		3	2	1	
Compare management options		1				2

1 = main purpose ; 2 = secondary purpose ; 3 = complementary purpose

Example of the implementation of the question 1 results in 6 different sites, in France and in UK (VALMER project, 2013). The objectives have been defined during workshops involving ecosystem services experts and site managers.

The session was organized as follows:

- At first, the triage process was briefly presented
- Participants chose the questions of the triage process it would be possible to address at this stage
- The answers to the questions were adopted following a deliberative process

Following the presentation of the triage process, and according to time constraints, it was decided to focus on Sequence 1, question 1 (purposes of the marine ecosystem services valuation in the area) and question 2 (most important policy issues in relation to marine ecosystem services in the area) and to Sequence 2, question 1 (what are the potential for the status or value of the ecological functions and services to change).

Purposes of the valuation of marine ecosystem services in the French study sites (see <https://participatory-assessment.eu/case-studies/>).

- The three French study sites have reached different stages of their management process:
 - The Golfe Normand-Breton study site is at an early stage of the management process as consultations of the stakeholders are still on going in the prospect of creating a Marine Park in the area.
 - The Parc Naturel Marin d'Iroise study site is at a very advanced stage as the Marine Park was created in 2007 and its management plan was adopted in 2010; it includes access rules for kelp harvesting and fishing which should evolve towards a higher protection level.
 - The Golfe du Morbihan study site is at an intermediary stage with regards to marine management: the management body (SIAGM, "Syndicat Intercommunal d'Aménagement du golfe du Morbihan") is in charge of an area which encompasses 38 municipalities and aims to be extended at sea where a Natura 2000 area for seagrass beds has already been defined. The Golfe became a Natural Park (Parc Naturel Régional du Golfe du Morbihan) in october 2014, at the end of the VALMER project.

- The variety of stages of development of the marine ecosystem management processes leads to different purposes for ecosystem services valuation (see table above).

Each study site tried to sort the main purpose (scored 1), secondary purposes (scored 2) and complementary purposes (scored 3).

- In the Parc Naturel de la Mer d'Iroise study site, the assessment of ecosystem services provided by kelp habitats will at first be used for comparing management options; however this comparison of management options will necessitate improved knowledge on the variety of services delivered by kelps, while knowledge improvement of ecosystem services is expected to facilitate trade-offs when the most protective management measures will be envisaged.
- The Golfe Normand-Breton study site being in a preliminary phase as regards marine ecosystems management, the assessment of ecosystem services should contribute to two equally important purposes: the initial diagnosis of the area, which should be based on further knowledge integration and is expected to contribute to awareness raising in support of a Marine Natural Park creation, and the anticipation of future changes is expected to contribute to the definition of the main objectives of this future Park, while facilitating trade-offs as regards these local marine policy.
- In the Golfe du Morbihan, the ecosystem services assessment will be used for raising awareness regarding the role of seagrass beds in the local social-ecological system, based on improved and more integrated knowledge regarding ecosystem services delivered by seagrass in the prospect of designing future management options which will necessitate new trade-offs among stakeholders.

Triage sequence 1.2: What are the most important policy issues in relation to marine ecosystem services in the area?

TRIAGE SEQUENCE 1



Preliminary delimitation of the scope of the ecosystem services assessment in relation to its general aims

[Question 2](#)

[What are the most important policy issues in relation to marine ecosystem services in the area?](#)

It is necessary to be precise when defining the policy issue, and to establish a hierarchy when several policy issues are of interest.

The policy issue may be linked to the impacts of particular activities, the claims of certain stakeholders or the possible change in collective rules.

Where several options exist, a process for prioritising the policy issues can be implemented. For instance it is possible to ask stakeholders to give a score (high, moderate, low) to the different issues and then deliberate for gathering a selection of the more relevant issues.

This question is also important as a preliminary step of a scenario building process. The partnership has to identify the common focus (management question, issues, topic).

The common focus may be a:

- Broad scale approach with a set of local issues or a;

- Management question on a habitat (e.g. kelp forest), an ecological function (e.g. primary production), or an ecosystem services (e.g. recreational activities)
- Different tools can be used in order to reach this objective:
 - Interviews
 - Brainstorming

Example

Golfe Normand-Breton ecological and social issues	Parc Naturel Marin de la Mer d'Iroise ecological and social issues	Golfe du Morbihan ecological and social issues
Need for biodiversity conservation	Conservation of rare species and ecosystems	Seagrass protection needs
Control of invasive species	Preservation of traditions associated with kelps	Seagrass good ecological status definition
Impacts of fisheries and aquaculture on habitats	Cohabitation of fishing gears	Ecological functions of seagrass are broader than birds protection
Demand for recreative infrastructure	Seasonal protection need vs secured industry supply	Shellfish farming impacts on seagrass
Urbanisation of coastal zone	Economic development of kelp industry	Shellfish farming socio-economic development
Renewable energy development	Boom of industrial product price (Pharmaceutics MNF)	Social perceptions of seagrass protection
Development of aggregate extraction	Local perceptions of environmental impacts	
Reaching MSY for fish stocks		
Maintaining and restoring water quality		

Example of the implementation of question 2 results, in 3 different sites in France (VALMER project, 2013). The objectives have been defined during workshops involving ecosystem services experts and site managers.

Once the aim of the marine ecosystem services was identified and structured into a set of main, secondary and complementary purposes (question 1), study site teams were asked to formulate the policy issues which are related to the considered ecosystem services in their area.

Not surprisingly, the policy issues in the Parc Naturel Marin d'Iroise and the Parc Naturel Régional du Golfe du Morbihan study sites focused on the ecological and social concerns related to kelp habitats and seagrass beds respectively, while the Golfe Normand-Breton study site identified a wide range of policy issues, from the protection of marine biodiversity to the development of new activities and the consequences of population growth on ecosystem services.

It was not possible to rank these ecological and social concerns at this stage, because the study site teams felt it was not qualified to conduct such an appraisal.

However, a hierarchy of policy issues is to be provided when ecological and social concerns are numerous and diverse. This means that the Golfe Normand-Breton is a study site where policy issues need to be selected, preferably through stakeholder consultation.

For all sites, the next important step was to link ecological and social concerns with the various categories of services provided by the considered marine ecosystem (what is to be done through question 3 of the sequence 1 of the triage process).

Triage sequence 1.3: What parts of the marine social-ecological system are concerned by these policy issues?

TRIAGE SEQUENCE 1

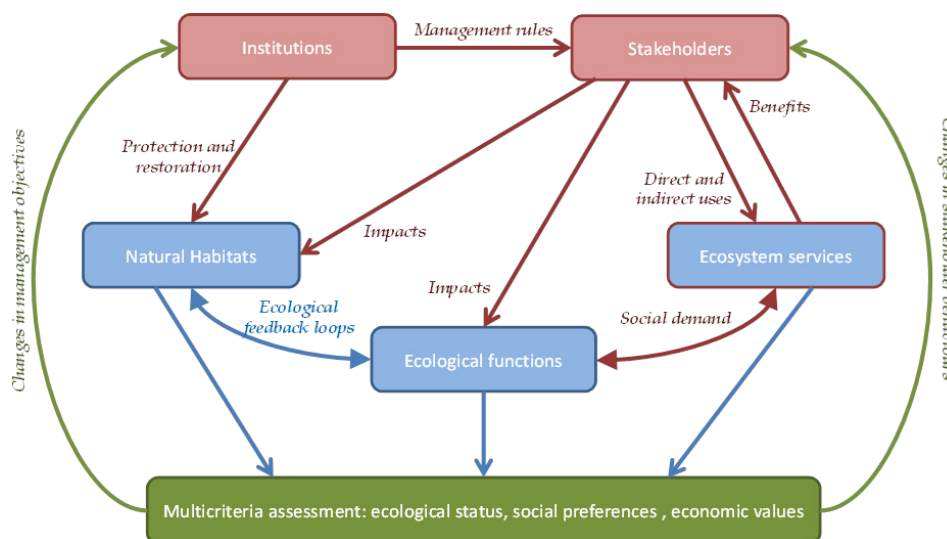


Preliminary delimitation of the scope of the ecosystem services assessment in relation to its general aims

Question 3

What parts of the marine social-ecological system are concerned by these policy issues?

This stage of the triage process requires specification and selection of the ecosystem components, functions and services that relate to the defined policy issues, as well as the identification of the stakeholders and institutions whose actions are concerned by these policy issues.



A system view of ecosystem services at the a local level, elaboration after [Mongruel et al., 2015; Braat and de Groot, 2012; Carpenter et al., 2009; Daily et al., 2009; Turner and Daily, 2008]

In response to these sometimes negative effects of human activities, institutions have been designed for managing uses and mitigating impacts.

This conceptual model presents a very simple framework which places the ecosystem services approach within a system view.

Basically, ecosystem services depend on natural habitats and ecological functions, but they exist as long as there is a social demand for the benefits the latter may provide. This demand is expressed by stakeholders, which are responsible for direct and indirect uses of ecosystem services, but also for impacts on habitats and ecological functions.

For many practical reasons, including for the purpose of improving ecosystem governance through realistic management options, it is useful to determine who are the beneficiaries of ecosystem services as well as who is responsible for the impacts.

This framework is designed for assessing ecosystem services at the local scale, therefore the contribution of ecosystem services to human well-being is left aside, as it is a broader question which should be addressed at the global scale. On the other hand, a multicriteria assessment framework which includes ecological status descriptors, social preferences indicators and monetary values

would contribute to a first appraisal of the contribution of local ecosystem services to human well-being. Furthermore, the criteria associated with these ecological, social and economic indicators are expected to inform the judgements that society will form regarding the situation, what is likely to affect the current consensus and trends regarding policy objectives and stakeholder behaviours.

The system view is necessary for implementing an ecosystem services process and to run a scenario building. It can be approached using a variety of tools to collect information and represent the system.

Tools

- Interviews
- Brainstorming
- Stakeholder matrix

Tools to represent the system, present and combine information, synthesize knowledge

Triage sequence 2.1: What is the potential for the status or value of ecological functions and services to change?

The 3 questions of this sequence 2 of the triage are run together. An example of the way it can be done is presented at the end of the sequence.

Sensitivity assessment methods are a way to implement sequence 2 of the triage process.

TRIAGE SEQUENCE 2



Refinement of scope of the ecosystem services assessment in support of scenarios building and policy design

Question 4

What is the potential for the status or value of ecological functions and services to change?

Such changes may be the result of on-going natural processes or the evolution of human pressures on the ecosystems, due to new practices, new technologies or new activities.

The purpose of this question is to estimate whether the considered ecological functions or ecosystem services are likely to undergo significant changes in the future.

In a first step, the estimate of potential for change can be based on expert knowledge and consensus. Specific methodologies for assessing the sensitivity of ecosystem services to change may be implemented when needed.

Example




Example of application in the context of three French sites (VALMER project):

- In the golfe Normand-Breton study site, where the scope of the ecosystem services assessment purposes is broad (initial diagnosis and possible changes exploration), a list of up to 20 factors of change was drawn up. Obviously, a sound consideration of all these factors will not be feasible: as a consequence, scenarios will focus on particularly sensitive habitats, key economic factors (for instance the installation of wind-farms or changes in fishing or shellfish farming practices) or

important social concerns (for instance cultural values associated with some particular habitats or services). However, the sorting of the factors of change which are of the highest interest will be the result of a dedicated stakeholder meeting.

- In the Parc Naturel Marin d'Iroise study site, the intrinsic ecological dynamics of kelp habitats is not a matter of concern, but the significant factors of change are rather to be found in economic and institutional changes. The kelp processing industry is developing rapidly worldwide and also in Brittany, which drives a rising demand for kelp fishing in the Parc Naturel de la Mer d'Iroise area. This particular economic context results in projects for building new boats with increased capacities and for harvesting more kelp species. In response to this economic drivers of change, management measures are envisaged for controlling kelp harvesting while achieving balanced trade-offs between the services delivered by kelps.
- In the Golfe du Morbihan study site, a preliminary attempt to link each of the ecosystem services delivered by seagrass bed and the current factors of change was carried out. The exercise was made complicated because of the uncertainties which remain as regards the status and dynamics of many of the services which are delivered by seagrass beds in this particular area. However, based on the available knowledge at this stage of the process, it was possible to identify that the spatial dynamics of the seagrass beds on the one hand and the changes in perceptions as regards cultural services on the other hand could be considered as the main expected changes in the future

Ecosystem Services	Probability for changes to happen
Biodiversity	Spatial dynamics of seagrass beds
Rare species Seahorses	?
Rare species Birds	?
Nursery	?
Fisheries	Cattlefish harvesting industry development
Recreational fishing	?
Primary production	?
Shellfish farming	Removal of shellfish farming from seagrass
Water purification	?
Carbon sequestration	Carbon release due to seagrass destruction
Birds watching	Changes in perception; active and passive uses
Recreational activities	Low interest due to water turbidity
Landscape and seascape	Changes in perception

low	may happen	likely to happen	unknown
			?

Factors of changes affecting ecosystem services delivered by seagrass beds in the Morbihan Gulf

Triage sequence 2.2: How does the envisaged management intervention influence these changes?

TRIAGE SEQUENCE 2



[Refinement of scope of the ecosystem services assessment in support of scenarios building and policy design](#)

[Question 5](#)

[How does the envisaged management intervention influence these changes?](#)

Factors such as the likelihood of the policy coming into effect, and where responsibility for making the decision lies should also be considered.

It is also important to take account of the resistance and resilience of the system providing the service.

If the change in value will be very small (for example carbon sequestration on a local scale) or the benefit is very robust (e.g. aggregate extraction) then there is very limited justification for continuing with the valuation.

If a specific management action is unlikely to have a significant influence on the value then there is little purpose in a valuation assessment.

Triage sequence 2.3: Which other factors do affect the status or value of the considered functions and services?

TRIAGE SEQUENCE 2



Refinement of scope of the ecosystem services assessment in support of scenarios building and policy design

Question 6

Which other factors do affect the status or value of the considered functions and services?

The next stage of the triage is to assess the influence of wider social, economic, environmental and political issues, particularly those beyond the control of local management structures (such as climate change or national policies).

Where these wider issues have a more significant impact on the value than the proposed local change, any expected change in value from local management action is unlikely to be realised.

Example

Example of the implementation of questions 3 to 6 of triage sequence 2

In order to sort the ecosystem services which should be assessed in the context of scenario or policy design, it is recommended to address the next three questions simultaneously. Each service is given a score (high, moderate, low) in response to each question based on relevant criteria. The total scores for each service, and how it scores for each question, can then feed into the decision-making process.

For example, where the Ecosystem Services on which a proposed study will focus have already been defined, the triage scoring can be used to justify (or to reject) the use of a marine ecosystem services assessment approach. Alternatively, where a number of possibilities for empirical research exist, the relative scores can be used to identify where limited resources would be best applied.

	Potential for the Ecosystem Service value to change	Influence of management on Ecosystem Service change	Other factors affecting the Ecosystem Service
High (score =3)	Service is sensitive to impacts and value change will be large ✓✓✓	Management will have a large influence on value, a strong probability of coming into effect and is locally driven ✓✓✓	Local environmental factors have the strongest influence on value (or other factors have less influence than local ones) ✓✓✓
Moderate (score =2)	Service is sensitive to impacts and value change will be small OR Service is robust and value change will be large ✓✓	Management will have a large influence on value and at least a reasonable probability of coming into effect, but is not locally driven OR Management will have a moderate influence on value, at least a reasonable probability of coming into effect and is locally driven ✓✓	Other factors (social, economic, political, global environmental change) have a similar influence on value to that of local environmental factors ✓✓
Low (score =1)	Service is robust and value change will be small ✓	Management will have a small influence on value and/or a low probability of coming into effect ✓	Other factors have the strongest influence on value ✓

Criteria for scoring each question of the Sequence 2 in the triage process

Ecological service	Definition / general process	Potential for the Ecosystem Service value to change	Influence of management on Ecosystem Service change	Other factors affecting the Ecosystem Service	SCORE
Water quality regulation	Seagrass beds are making a physical barrier to the sediments. They are trapped by the leaves and fall down in the water. Improving therefore the water quality (water more clear with less particules potentially pollutants)	✓✓✓	✓✓✓	✓✓	8

Example of score for an ecological service in the case of sea-grass beds, golfe du Morbihan, France (source : M. Philippe)

2.3.2.7 Triage sequence 3.1: Which metrics would be meaningful as regards the factors of change to be considered?

Social and economic assessment of ecosystem services methods are a way to implement sequence 3 of the triage process .

TRIAGE SEQUENCE 3



Choice of methods, tools and means for ecosystem services assessment in response to management needs

Question 7

Which metrics would be meaningful as regards the factors of change to be considered?

Depending on the factors of change, different types of metrics could be meaningful:

- changes related to ecological status will require biophysical metrics
- changes affecting human activities may be expressed in terms of monetary values or jobs
- changes related to trade-offs may require an assessment of social perceptions

In most cases stakeholders will be expecting a mix of indicators from different categories.

The key determinant for meaningfulness is to clearly express what each indicator is referring to with regards to the various possible characteristics of one ecosystem services (effective or potential, supply, demand or perception by a given social group).

2.3.2.8 Triage sequence 3.2: Which methods and tools could be used to obtain such metrics?

TRIAGE SEQUENCE 3



[Choice of methods, tools and means for ecosystem services assessment in response to management needs](#)

[Question 8](#)

[Which methods and tools could be used to obtain such metrics?](#)

Once metrics and indicators for estimating the changes in ecosystem services have been chosen, valuation methods should be selected accordingly

The method is also linked to the aim of the assessment and the stage of the management process it is intended to support. Broad objectives associated with early management stages like initial diagnosis and policy design may require large-scope assessment methods while more operational objectives such as management option comparison could require more focused methods.

Valuation methodologies using ecological, economic and social indicators are numerous, and can provide single indicators, multicriteria assessment or integrated assessment. They are more or less powerful depending of the number of ecosystem services to be included in the

assessment.

Example

Example of the methods identified during a Triage process. It deals with the methods that could be used to assess marine ecosystem services in the French study sites of the VALMER sites.

Although at that stage, the factors of changes still needed to be clearly defined and sorted on the three French study site, some choices have been made regarding possible valuation methods which could be used in relation to the aim of the assessment and the policy issues.

- In order to feed the initial diagnosis of marine ecosystem services in the Golfe Normand-Breton study site, a spatial representation of habitats has been developed in order to develop INVEST models on habitat vulnerability and overlapping activities, and a system of ecological accounting has also been developed in order to link the main ecosystem services and the local economy. In addition, the importance of fishing and shellfish farming activities in the Golfe Normand-Breton will lead to the building of multicriteria assessment frameworks for these types of provisioning services.
- In the Parc Naturel Marin d'Iroise study site, the focus on the need for controlling the increase in kelp exploitation intensity will lead to the building of a system dynamic model of kelp ecosystem services under human pressures in order to simulate management options.
- Finally, in the Golfe du Morbihan, the role of social perception of seagrass bed contribution to various ecosystem services in the design of future management options has led to the implementation of survey methods based on choice experiment.

The methods and results obtained in these sites are presented in the web site: <https://participatory-assessment.eu/case-studies/>.

Triage sequence 3.3: Is the envisaged valuation method feasible?

TRIAGE SEQUENCE 3



Choice of methods, tools and means for ecosystem services assessment in response to management needs

Question 9

Is the envisaged valuation method feasible?

Finally, the manpower and cost requirements for evaluating different services can vary considerably depending on the methods proposed, and must be explicitly considered.

Where resources for primary data collection are limited, the availability of supporting data (both ecological and socio-economic) will also have a strong influence on the scope of marine ecosystem services assessment.

This is true for implementing ecosystem services methods but also for scenario building. It is therefore necessary to identify the available data, their quality and confidence, and existing gaps.

The VALMER project devised a advice note for “Practical approaches to the management of marine social and economic data”.

Finally, the manpower and cost requirements for evaluating different services can vary considerably depending on the methods proposed, and must be explicitly considered.

