

# Valuing Marine Ecosystem Services in the Western Channel

PROJECT SUMMARY





# Introducing VALMER

VALMER is an eleven partner, £4.7 million project co-funded by the INTERREG IV A Channel programme through the European Regional Development Fund, which aimed to examine how improved marine ecosystem services assessment could support effective and informed marine management and planning.

## Exploring the links between ecosystem services assessment (ESA) and effective marine management and governance.

The Western Channel is under increasing pressure from a wide range of competing uses and interests; effective and informed management of this shared space is vital to the sustainable use of this valuable resource. We know that ecosystem services assessment has the potential to improve marine management and planning, but to date there have been limited documented cases of how this might be achieved in practice.

The aim of VALMER therefore has been to explore the methodologies that could be used to quantify, qualify and communicate the value (economic, social and environmental) of marine and coastal ecosystem services, and seek to improve understanding of the links between ecosystem services, their valuation, and effective marine management and governance.

## An innovative cross-channel collaboration between the marine science and marine governance communities.

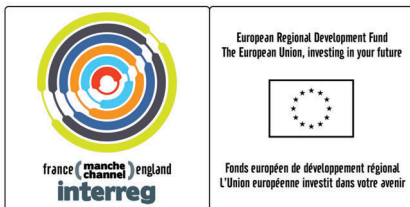
To achieve these aims and bridge the gap between theory, policy and practice the VALMER project brought together marine science and marine governance communities from both sides of the Western Channel area. From the eleven project partners (led by Plymouth University) were drawn over sixty individuals with experience and expertise in a variety of academic disciplines and marine and coastal management contexts.

To facilitate such a large scale project VALMER was organised into four distinct but inter-related Work Packages. Each Work Package contained a pool of experts whose work was focused on delivering different aspects of the project. Each Work Package has produced a number of specific outputs including academic papers, practical advice notes and policy guidance documents.

## Practical applications of marine ecosystem services assessment.

Research from the different WPs was integrated and applied at the project's six case studies. These six case studies have been at the heart of the VALMER project both in terms of providing a central coordinating focus for the various different Work Packages, and in exemplifying the project's general ethos of emphasising the practical application and value of an ecosystem services approach. They were where the project aimed to show not only how an Ecosystem Services Assessment (ESA) has the potential to improve marine management and planning in theory but, crucially, how such an improvement can be achieved in the context of real, site specific, marine management issues.

For more information visit [www.valmer.eu/results](http://www.valmer.eu/results)



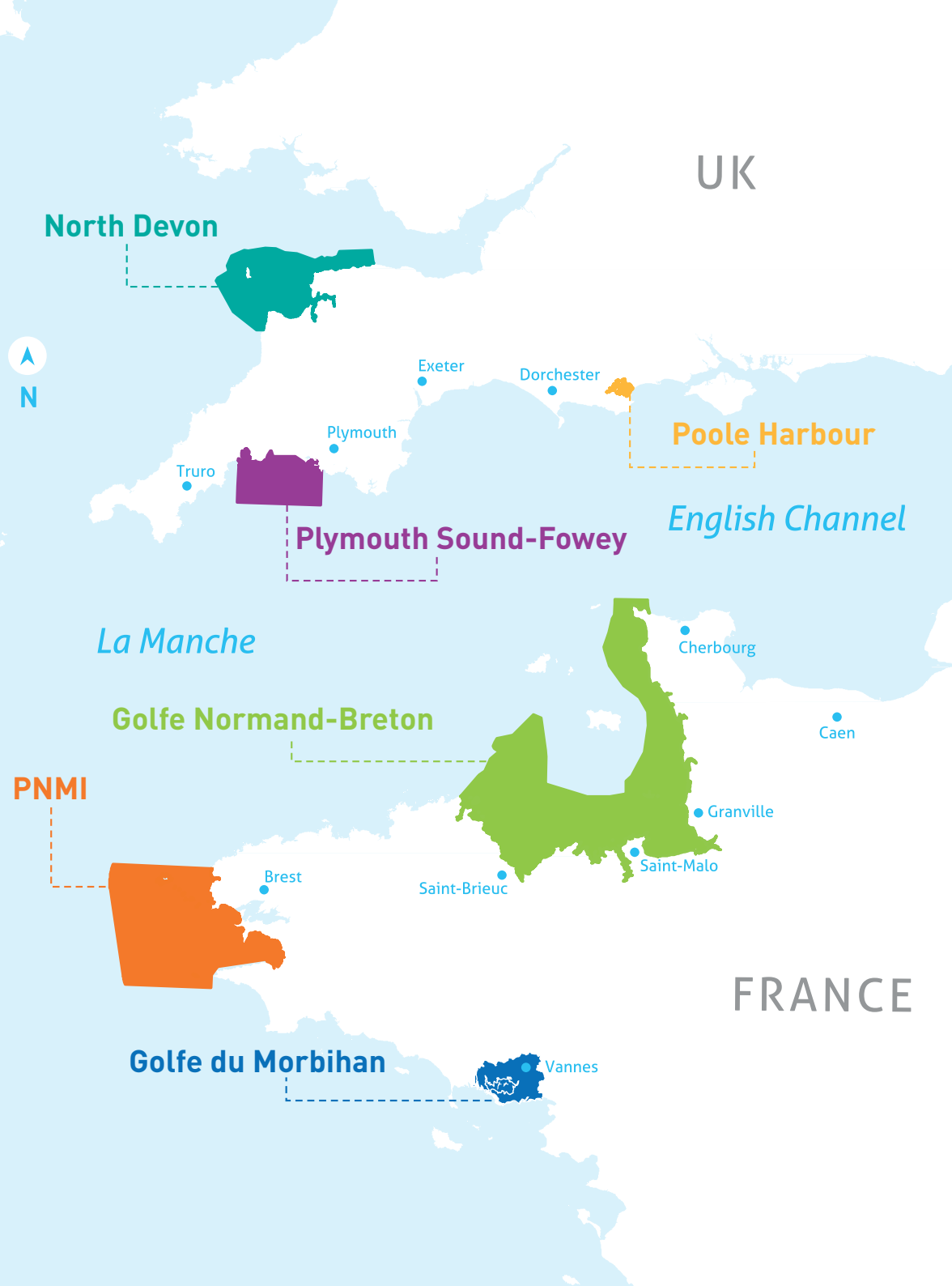
The VALMER project was selected under the European cross-border cooperation programme INTERREG IV A France (Channel) – England, co-funded by the ERDF.



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# Work Package 1

## ASSESSING AND VALUING MARINE ECOSYSTEMS

The aim of Work Package 1 was to understand how best to carry out ecosystem service assessments to suit local management needs, and so it concerned the strategic, technical and practical aspects of ecosystem services assessment. The work considered how to select an appropriate focus for an assessment and what methods could be used to define and measure ecosystem services. Empirical evaluations of ecosystem services were undertaken at each of the case study sites using a range of methods to test, and learn lessons from, these different approaches. The Work Package had two key actions, which are described here.

### ACTION 1.1

Developing an operational framework for assessing and valuing marine ecosystem services.

#### 🕒 AIMS

The purpose of this action was to review existing ecosystem service methodologies and propose a coherent approach to monetary and non-monetary assessment and valuation. This was achieved through collaborative working between social scientists, economists and ecologists to enable best practice to be exchanged at a scale appropriate to the Channel area.

#### 📖 OUTPUTS

The deliverable from this action is a framework including a set of guidelines for assessing and valuing marine ecosystem services:

**A FRAMEWORK FOR THE OPERATIONAL ASSESSMENT OF MARINE ECOSYSTEM SERVICES**

### ACTION 1.2

Trialling ecosystem service assessments and valuations at case study locations.

#### 🕒 AIMS

This action applied the Framework developed in Action 1.1 to the six case study sites to determine relevant valuations for ecosystem services at those sites. The results of these assessment and valuations were then used to inform the development of scenarios in Work Package 3.

#### 📖 OUTPUTS

The deliverable from this action is a synthesis report of lessons learned and recommendations tailored to the needs of practitioners:

**ECOSYSTEM SERVICE ASSESSMENT IN PRACTICE: LESSONS LEARNED**

# Work Package 2

## DEVELOPING DATA SUPPORT FOR VALMER

Work Package 2 is the data and visualisation element of the VALMER project. Its overall aim was to establish a regional view of the data required to undertake an accurate valuation of marine and coastal ecosystem services. By establishing a cross-Channel working group of data and IT experts, the work package developed working practices and IT applications to facilitate data collation and analysis by VALMER partners and ensure future dissemination of work package and case study outputs to those responsible for governance and management.

### ACTION 2.1

Establish Data Working Group.

#### 🕒 AIMS

This action established a Data Working Group to link relevant INTERREG projects (including PANACHE) to ensure synergy and reduce overlap in data support. The Data Working Group met to identify and share best practice, as identified by partners' experts, for spatial data management.

#### 📖 OUTPUTS

**PRACTICAL APPROACHES TO THE MANAGEMENT OF MARINE SOCIAL AND ECONOMIC DATA**

### ACTION 2.2

Develop INSPIRE compliant geospatial data repository.

#### 🕒 AIMS

This action supported the development and maintenance of a single INSPIRE compliant hub for geospatial data (in cooperation with PANACHE). This allows a regional view of data available for valuing marine and coastal ecosystem services to be identified. Through a 'gap analysis', data required (but currently unavailable) for ecosystem valuations was identified. All data stored in the repository is compliant with national drivers, tools and requirements.

#### 📖 OUTPUTS

**GEOSPATIAL 'DATA HUB': DATA.VALMER.EU**

### ACTION 2.3

Development of a geospatial web service.

#### 🕒 AIMS

This action was focused on the development and maintenance of a unified INSPIRE compliant geospatial data view and download service suitable for both VALMER and PANACHE. The geospatial web service is based on adapted DASSH and Sextant Geoserver installations.

#### 📖 OUTPUTS

**GEOSPATIAL WEB SERVICE: DATA.VALMER.EU**



# Work Package 3

## BUILDING SCENARIOS FOR ECOSYSTEM SERVICE ASSESSMENT AND VALUATION

A key part of the VALMER project was engaging important stakeholders in discussions. The “scenario” approach was chosen deliberately, as it is an effective way of involving people and moving from theory to practice. Scenario building can also be a standalone exercise, improving stakeholders’ engagement and discussion on management questions. Good engagement of stakeholders can give better, shared ownership of decisions that then improve the delivery of policy. In VALMER, scenarios were used with ecosystem service assessments (ESA) to explore stakeholder views and preferences on management options and trade-offs.

### ACTION 3.1

Building plausible scenarios to explore possible impacts on marine ecosystem services.

#### 🎯 AIMS

Combined with ESA methods, scenarios were useful participative tools in engaging stakeholders on management issues. Using scenarios, it is possible to compare different situations and to show the consequences of management choices taken. These outputs can then be shared in order to propose new management options.

Technical scenario guidelines have been produced during the VALMER project. These guidelines set out how to build scenarios in five complementary phases. A toolbox of twelve tools is also provided to help managers involve stakeholders.

In parallel with the guidelines, two transnational stakeholder events were organised in France and England to share experiences from the VALMER case study sites. These events communicated the results obtained in the project to and shared key learning points. From this, a scenario synthesis report has been written to present the approaches developed in VALMER and to explain the different tools used, their implementation and their advantages and disadvantages.

The range of scenarios from VALMER is also presented and general recommendations are given to improve the transferability and capitalization of VALMER experiences.

#### 📖 OUTPUTS

**BUILDING SITE BASED SCENARIOS:  
TOOLS AND APPROACHES FOR IMPLEMENTATION  
FROM THE VALMER PROJECT**

**TRANSNATIONAL SCENARIO SYNTHESIS:  
RESULTS OF THE SCENARIO BUILDING PROCESSES  
DEVELOPED BY VALMER’S CASE STUDY SITES**

# Work Package 4

## APPLYING ECOSYSTEM SERVICE VALUATIONS TO IMPROVE MARINE PLANNING AND GOVERNANCE

Work Package 4 sought to identify and understand the potential that ecosystem service assessment and valuation holds for marine and coastal governance. By using the process and outcomes from the six VALMER case studies, Work Package 4 researchers critically evaluated the issues associated with integrating ecosystem assessment and valuation into governance. Practitioner experience and learning from the project will be shared across the Western Channel through a distance E-learning tool that has been developed. This Work Package also explored how ecosystem service assessment and valuation can be used to engage stakeholders in marine management through the Ecosystem Services approach.

### ACTION 4.1

Review the implications of ecosystem service assessment and valuation for marine planning and management.

#### 🎯 AIMS

This action used the experiences of the project’s six case study sites to identify how ecosystem service assessment can be used to support effective and informed marine planning and management. An Evaluation Framework was designed and implemented across the six case studies to understand the challenges and opportunities, in governance terms, for using ecosystem service assessment. In doing so, it generated lessons learned and advice for managers who may wish to use this approach in the future to support marine and coastal governance, both in the Western Channel and beyond.

#### 📖 OUTPUTS

**ADVICE NOTE FOR USING ECOSYSTEM SERVICE ASSESSMENT TO SUPPORT MARINE GOVERNANCE**

### ACTION 4.2

Learning exchange programme to be undertaken between partners from France and the UK.

#### 🎯 AIMS

An E-Learning platform has been developed to bring together VALMER guidance and experience from the six pilot sites, including lessons learned and case study examples. The target audience is marine and coastal professionals (managers and scientists) and students (Master’s level and upwards) who wish to improve their knowledge and know-how about the ecosystem services approach, methods for ecosystem services assessments, stakeholder engagement and scenario building. This output represents an important educational resource that will continue exist after completion of the project.

#### 📖 OUTPUTS

**E-LEARNING MODULE: [WWW.MARINE-ECOSYSTEM-SERVICES.EU](http://WWW.MARINE-ECOSYSTEM-SERVICES.EU)**

### ACTION 4.3

Engaging stakeholders in marine management through the Ecosystem Services approach.

#### 🎯 AIMS

This action evaluated the engagement processes in the six VALMER case studies to investigate how ecosystem service assessment can support stakeholder engagement in marine management. It revealed useful guidance on how ecosystem service assessment can enhance stakeholder engagement in marine management and what should be considered when engaging stakeholders through an ecosystem service assessment approach.

#### 📖 OUTPUTS

**IMPROVING STAKEHOLDER ENGAGEMENT IN MARINE MANAGEMENT THROUGH ECOSYSTEM SERVICE ASSESSMENT**

# North Devon

## CASE STUDY

## ▶ THE PLACE AND THE PEOPLE WE WORKED WITH

The North Devon case study site comprises the marine and coastal parts of the UNESCO designated North Devon Biosphere Reserve (NDBR). This area of over 1000 km<sup>2</sup> incorporates the internationally important Braunton Burrows sand dune system Special Area of Conservation (SAC), the North Devon Coasts Area of Outstanding Natural Beauty (AONB), and Lundy Marine Conservation Zone (MCZ). Important marine and coastal habitats include rocky foreshore, intertidal mud and sand flats, subtidal mud and sand flats, sand dunes and various types of saltmarsh.

The VALMER North Devon case study team worked with a wide range of key local stakeholders within the marine and coastal governance sector particularly the NDBR's Management Partnership and Marine Working Group.

## ▶ THE PROCESS

Our work in North Devon had three interconnected processes:

### ECOSYSTEM SERVICES ASSESSMENT (ESA)

The focus of the study was the area's extensive seabed muds, sands and gravels, and the role they play in storing carbon, processing waste, and providing nursery grounds for commercial fish and shellfish. Recent and historic surveys, as well as modelled maps, were used to determine the type and extent of different habitats across the case study (Figure 1). The potential level of each ecosystem service was then determined by considering the preferences of juvenile fish and shellfish for sediment type and water depth (nursery provision), sediment mud content (carbon storage) and biological reworking of the sediments (waste processing), and this potential service delivery was then mapped.

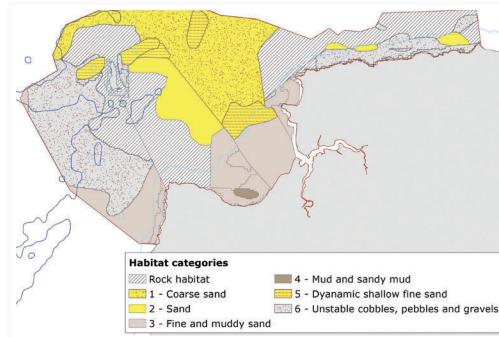


Figure 1. Seabed habitats in the North Devon Biosphere Reserve.

### BUILDING SCENARIOS

Working closely with stakeholders, plausible, relevant management options were constructed. These explored how delivery of ecosystem services may change with alternative management and use on a 15 year time horizon. Scenario themes were identified, prioritised, and narratives elaborated, with changes to activities/pressures on the seabed then identified. Some scenarios were not progressed including those ranked as low importance or implausible by stakeholders and those with low or unclear seabed pressures. Three scenarios emerged for further investigation:

1. Recommended Marine Conservation Zones designated
2. Aggregate Extraction
3. Aquaculture Development (offshore mussel farm)

## SOCIO-ECOLOGICAL MODELLING

A socio-ecological model was developed to represent the relationship between human activities, subtidal seabed habitats and their ecosystem services. This framework incorporated various types of knowledge including literature reviews for habitat sensitivities and likely pressures arising from activities, relationships between habitats and their ecosystem services from the ESA, and expert opinion. The model was run for each 1km<sup>2</sup> of the NDBR using the current configuration of fishing activity to generate service provision maps that represent current provision of ecosystem services from subtidal sediment habitats. Pressure maps elaborated from our three scenarios were then used to condition the model, and the resulting changes in ecosystem service provision were compared to the current pattern.

## ▶ THE RESULTS

The estimation of current ecosystem services provided by subtidal sediment habitats showed the ecosystem services considered here (fish nursery areas, carbon burial and waste processing) are provided in different areas across the NDBR. Considering the three ecosystem service types together, Hartland Point, northwest of Lundy and near Morte platform are the most important areas for provision (Figure 2).

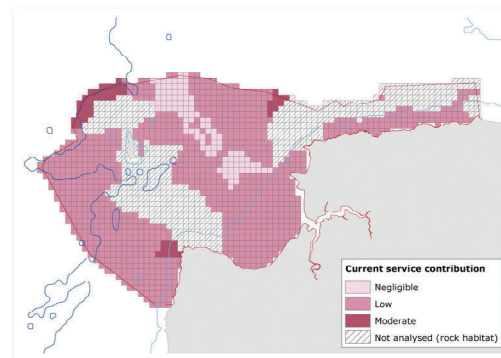


Figure 2. Estimation of current provision of ecosystem services (combined delivery of nursery provision, waste processing and carbon burial) based on current patterns of human use.

Changes in ecosystem service delivery from subtidal sediment habitats varied for each of our three scenarios. The designation of the recommended Marine Conservation Zones (rMCZs) scenario showed both increases and decreases in provision for different ecosystem services; fish nursery provision increased in some areas (especially in the North of Lundy rMCZ site) and decreased in others (due to pressure increases from displacement of fishing activity from rMCZs to previously less intensively fished areas), while both carbon storage and waste processing showed increased service

provision in the protected areas since the areas subject to fisheries displacement had previously negligible service provision (Figure 3). The aggregate extraction scenario showed a considerable loss of nursery provision (~10%) but had little impact on the other two services. The aquaculture development scenario indicated large increases in carbon burial and waste processing but a loss of nursery provision.

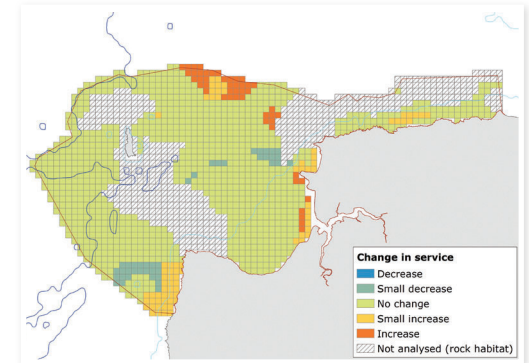


Figure 3. Recommended Marine Conservation Zones scenario: estimation of the provision of ecosystem services (combined delivery of nursery provision, waste processing and carbon burial).

## IMPLICATIONS FOR GOVERNANCE

This work has many implications for governance but the two most important are:

1. Maps of potential delivery of ecosystem services can inform management. These maps identify important areas for fish nursery provision based on habitat and depth preferences of commercially important species. The Inshore Fisheries and Conservation Authority are interested in using these maps to inform their activities, as is the NDBR management partnership.
2. Trade-offs between different ecosystem service types can be visualised spatially, taking into account secondary effects of management interventions (e.g. displacement of fishing activity). This is particularly relevant for the recommended Marine Conservation Zone scenario, as the consultation for Tranche 2 sites commences (including two that fall within the NDBR), and may also inform the management plans for sites that progress to designation.



# Poole Harbour

## CASE STUDY

### THE PLACE AND THE PEOPLE WE WORKED WITH

Poole Harbour is one of the largest estuaries with an enclosed, lagoonal character in Europe. The site, encompasses a number of estuarine and wetland habitats, including saltmarshes, reed beds, mudflats and small beach areas. The Harbour is of high ecological value with a diversity of sensitive habitats and species, covered by a host of national, European and international nature conservation designations, including RAMSAR site, Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Area of Outstanding Natural Beauty (AONB).

Project officers worked with a variety of local and national stakeholders, including the Poole Harbour Steering Group, Poole Harbour Commissioners, watersports businesses, activity specific clubs, National Governing Bodies, non-governing bodies and organisations (e.g. British KiteSports Association, National Trust, Dorset Wildlife Trust). Questionnaires were developed in partnership with economic scientists from Plymouth Marine Laboratory and with input from local stakeholders.

### THE PROCESS

Poole Harbour is well known for being one of the best places in the UK to undertake certain watersports such as kitesurfing and windsurfing. However, even with available visitor spend figures, there is still very little information available about the value of recreational activities or the marine environment that provides the means for these activities to take place.

This study focused on valuing a range of these activities including kitesurfing, windsurfing, kayaking, waterskiing, jetskiing and birdwatching. This was done using questionnaires and the Travel Cost Method. As well as gaining monetary value information, we also built a profile of the people undertaking these activities, and improved our understanding of the attributes of their experience in Poole Harbour that were most important (Figure 1). The data allowed us to understand how the harbour is currently used, the interactions between different recreational activities and how potential changes to the harbour would affect people's decisions to return to the area (Figure 2).

In addition to the questionnaires, counts were done of recreational users which could be extrapolated to estimate a total value of each activity to the local and wider economy (Figure 3).

To supplement this information data was also collected through citizen and opinion panel surveys to determine how important the harbour is for residents of the area. Results from the VALMER questionnaires were presented to a variety of stakeholders and as a result a Poole Harbour recreation forum was established bringing recreational user groups and watersports businesses together to share information and work on joint opportunities.

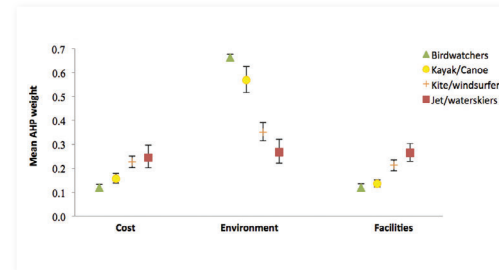


Figure 1. The relative importance to recreational users of the cost of their activity, the environment within Poole Harbour, and the local facilities available.

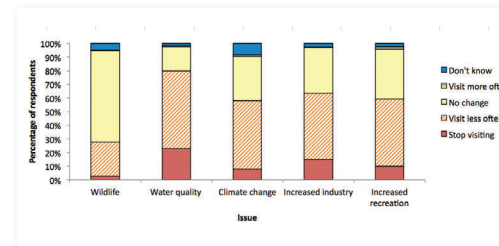


Figure 2. The likelihood of recreational users changing their visit frequency as a result of changed conditions in Poole Harbour.

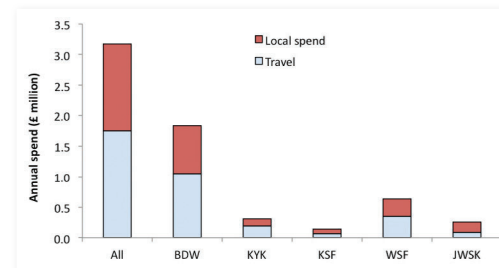


Figure 3. The annual spend on travel to Poole Harbour, and local spending during visits, for birdwatchers (BDW), kayakers/canoists (KYK), kitesurfers (KSF), windsurfers (WSF) and Jet/waterskiers (JWSK).

### THE RESULTS

546 people completed the questionnaires, with half of the respondents living locally to Poole Harbour. Results show respondents are on average willing to travel further to Poole Harbour compared to a closer, substitute site and the harbour is especially important for beginner and intermediate kitesurfers and windsurfers. The results show most respondents were happy with the current management in place for their activity in the harbour. The results also identify factors of change that would increase/decrease the number of return visits and overall visitor numbers to the area in the future, provide an insight into the qualities a visitor is looking for and suggestions for improving the management of their activity.

Results from these questionnaires have also provided an economic value in the form of an average spend per person per activity per year in GBP/£. These figures have then been extrapolated using the total number of people undertaking each of these six activities to give a total overall economic value per activity in GBP/£.

### IMPLICATIONS FOR GOVERNANCE

This information along with the questionnaire responses may be used to improve management of recreational activities, inform decision-making and trade offs if this were ever necessary and potentially improve facilities.

# Plymouth Sound-Fowey

## CASE STUDY

## THE PLACE AND THE PEOPLE WE WORKED WITH

Spanning the Devon/Cornwall border, the busy Plymouth Sound gives way to rural open coast, beaches and cliffs and the small towns and estuaries of Looe and Fowey, which are typical of the south Cornwall coast. Offshore there are extensive rocky reefs and sandy expanses. Thriving tourism, recreation and fishing industries contribute to the rich maritime culture. Ports and harbours are interspersed with extensive protected landscapes and marine conservation designations.

There was no existing governance structure covering the whole case study, so the VALMER Plymouth Sound to Fowey case study team set up a Task and Finish stakeholder group of relevant marine and coastal managers and regulators for the project.

## THE PROCESS

Through discussions with stakeholders it was agreed that a broadscale Ecosystem Service Assessment (ESA) would be undertaken, entailing valuation and mapping of all marine and coastal ecosystem services within the site, wherever possible. The project added considerable value through its Data Discovery exercise, processing, analysis and presentation/visualisation for a baseline assessment. Stakeholders also explicitly voiced a desire for cultural ecosystem services to be researched. This interest stemmed from the need to better understand the links between the marine environment and human well-being and the importance of tourism and recreation in the area. An additional discrete piece of research to quantify, map and visualise the health and wellbeing benefits associated with Plymouth Sound to Fowey area was undertaken by the University of Exeter.

### THE ESA PROCESS CONSISTED OF FOUR CONNECTED STEPS:

1. A baseline assessment of key ecosystem services in the case study area: nursery habitats (of key commercial species), coastal defence, waste processing, carbon storage, cultural services (particularly recreation and wellbeing)
2. Stakeholder generated hypothetical future actions (resulting from the scenario building process undertaken during stakeholder meetings)
3. Hypothetical actions developed into three scenarios
4. Scenarios applied to the baseline with associated recalculation of the ESA for each of the three scenarios

### THE THREE HYPOTHETICAL SCENARIOS DEVELOPED FOR ASSESSMENT WERE AS FOLLOWS:

1. Recreational boating – exploring changes in Ecosystem Service (ES) delivery associated with changes in mooring type and a reduction in ecological footprint on the seabed.
2. Marine Protected Areas (MPA) – exploring changes in ES delivery associated with the introduction of highly protected marine areas in the case study i.e. no extraction or deposition.
3. Dredge disposal – exploring changes in ES delivery associated with closure of two dredge spoil disposal sites with combined materials taken to a re-opened site within the case study area further offshore.

## THE RESULTS

In summary - The baseline maps of ecosystem service delivery illustrated the importance of Plymouth Sound, with its varied habitats, as a nursery for a range of commercial species (Figure 1).

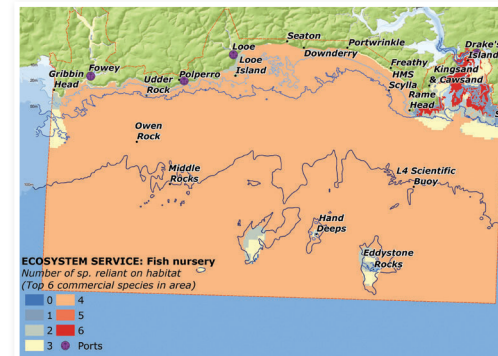


Figure 1. Baseline fish nursery habitat.

The sand and coarse habitats that cover much of the case study site provided negligible levels of carbon storage relative to other habitats (Figure 2), although the value of the site for carbon storage nonetheless amounts to £1.4 million per year.

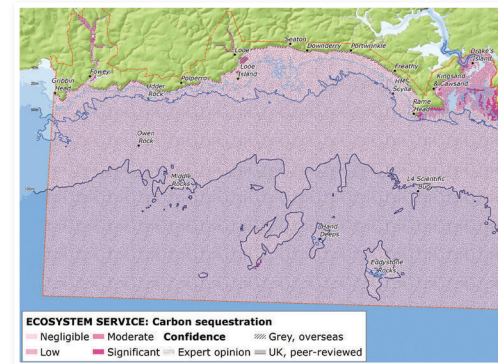


Figure 2. Baseline carbon storage.

These habitats play a greater role in nutrient cycling and the provision of clean water. The value of the increased carbon storage alone through the recovery of seagrass following the replacement of swing moorings is unlikely to offset the costs of installing the new eco-buoys, although the values of other services that may also increase were not calculated. The dredge disposal scenario identified the potentially large increase in cultural services that could be obtained from relocation of the disposal site, while the MPA scenario highlighted the complex trade-offs that would require consideration in any management decision.

The cultural ecosystem services assessment showed that there was a deep connection between local people and the marine environment. Results highlighted a number of areas which managers could address to improve wellbeing and a series of hotspots on which coastal managers could focus their efforts (Figure 3).

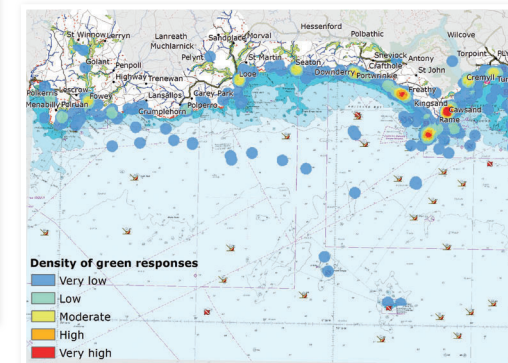


Figure 3. Density of significant and valuable places from the cultural ES study.

## IMPLICATIONS FOR GOVERNANCE

The VALMER data, mapping and baseline ESA will be useful to most stakeholders as a decision-support tool, for example in the delivery of the Cornwall Maritime Strategy by Cornwall Council. The Recreational Boating scenario would help Fowey Harbour Commissioners consider the implications of installing eco-buoys. The Dredge Disposal scenario was considered an interesting way to get people to look at an old problem in a new way: participation in the ESA process could be an effective mechanism to build local capacity on the topic. It was also a valuable tool for stakeholders to understand the complexities associated with building an ESA, and the range of formats ESA results can be presented in. Furthermore, stakeholders were able to use the scenarios and the ESA to explore trade-offs through changes in marine ecosystem service delivery.



# Golfe Normand-Breton

## CASE STUDY

## THE PLACE AND THE PEOPLE WE WORKED WITH

The Golfe Normand-Breton case study site, stretching from Northeast Brittany to the West of the Cotentin Peninsula, is a vast marine area of over 11,700 km<sup>2</sup>. The rugged seabed and shallow depth of the Golfe, combined with its complex hydrodynamicity make it a natural mosaic of marine habitats. It is sandy-mud sediment for the most part, but dotted with areas of rocky reefs and biogenic habitats. The area includes a multitude of coastal and marine sites of varying protected statuses (e.g. Natura 2000 and Ramsar sites, National Nature Reserves, etc.) and there is a project looking at creating a marine park in the French marine waters.

The VALMER Golfe Normand-Breton team worked with a wide range of stakeholders in the region, including managers of natural areas, representatives of the main leisure and industrial activities as well as representatives of the state and local authorities.

## THE PROCESS

Our work consists of two interconnected processes:

### MARINE ECOSYSTEM SERVICES ASSESSMENT

In the Golfe Normand-Breton the valuation of ecosystem services was carried out within a broad framework that addressed the need to establish, for the first time, a diagnosis of the state of the wider macro-ecosystem of the 'Golfe'. Various assessment tools were developed and tested by the project's scientific team: a map of benthic habitats was produced (Figure 1), and then linked to a "habitats -function" and "habitat-services" matrix (Figure 2); a model for ascertaining a sustainable level of fishing for nine marine species present in the Golfe Normand-Breton and describing fishing fleets' socio-economic contribution to, and dependence on, the stocks studied; a cumulative impact risk model (InVEST) was used to determine the level of risk on benthic habitats and the services they deliver; and an ecosystem accounting approach highlighting the complex relationship between human activities and ecosystem services of the area.

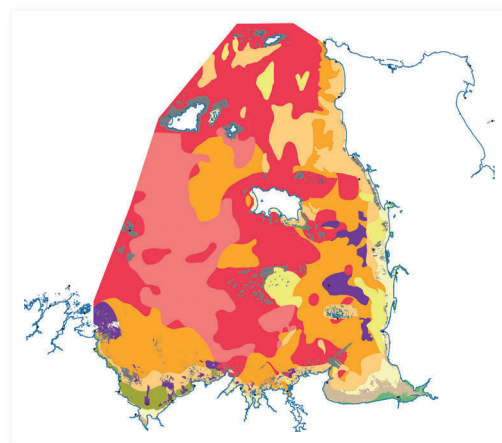


Figure 1. Benthic habitats of the Golfe Normand-Breton (EUNIS 4).

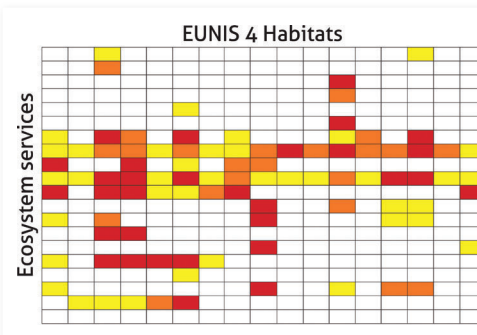


Figure 2. Habitats-services matrix.

### BUILDING SCENARIOS

The involvement of local stakeholders was a key element of VALMER project. Taking place over a 15 month period, this approach was based around the building of scenarios in order to foster a collective understanding of complex management issues, enrich each participant's vision of the marine environment and the ecosystem services it provides, and extend the sphere of concern in order to better anticipate the future. Four exploratory scenarios were developed (Figure 3) as part of dedicated workshops attended by around twenty key local stakeholders from different backgrounds but all with an interest in marine and coastal issues (e.g. politicians, professionals, environmental managers, scientists, public services, associations, users). For this exercise, the scenarios were projected until 2045 and the resulting narratives were combined with the valuation of ecosystem services developed by the VALMER scientific team. These scenarios focused on ecosystem services and leisure food supply related to coastal and marine habitats.

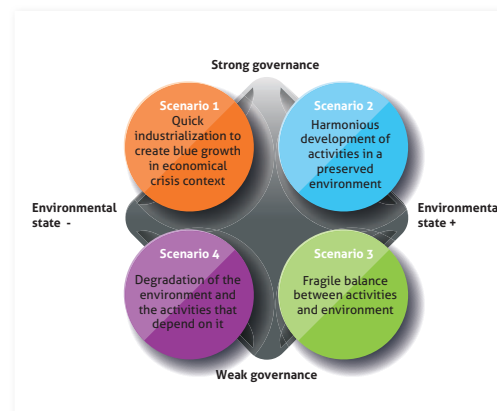


Figure 3. Scenarios developed collectively for the Golfe Normand-Breton.

## THE RESULTS

### INITIAL WIDE-RANGING MULTIDISCIPLINARY DIAGNOSIS.

Large-scale assessment of ecosystem services in the Golfe Normand-Breton has enabled us to offer an initial diagnosis of the ecosystem services and ecological functions of this area. This wide-ranging, interdisciplinary approach has allowed us to collect quantitative and qualitative information on all ecosystem services in the area, their benefits and the efforts made by society to conserve them. The work went into greater detail on the subjects of food supply and cultural services, which were chosen to be developed as scenarios using the TRIAGE process.

### EXPLORATION OF FOUR POSSIBLE FUTURES FOR THE GOLFE NORMAND-BRETON AND THE EVOLUTION OF ITS ECOSYSTEM SERVICES

Having completed this process, the exploration of four different futures for the Golfe Normand-Breton area (Figure 3) has enabled us to consider the evolution of ecosystem services, bringing together the collective scenario-based approach with the current ecosystem service assessment. This exercise has an educational purpose, aiming to stimulate collective reflection on services and the multiple factors which can affect them.

### IMPLICATIONS FOR GOVERNANCE

Occupying the common ground between ecological, economic and social sciences, the VALMER project has, through its Golfe Normand-Breton case study site, created an opportunity for stakeholders in the area to better identify the range of services provided by the Golfe Normand-Breton and to analyse the challenges which a change to marine ecosystems would represent for the future of certain services. It thus contributes to feeding a collective reflection on the integrated management of the sea. Considerable work has been carried out by environmental managers to compile and compare the results, allowing us to develop methods which are more suitable for purpose and therefore more useful in terms of management. A summary of this project in brochure form could also be distributed among other environmental managers to help them apply the same kind of approach.

# Parc Natural Marin d'Iroise

## CASE STUDY

## ► THE PLACE AND THE PEOPLE WE WORKED WITH

The Molène archipelago is a shallow area of almost 300 km<sup>2</sup> which is home to the most diversified algae *Laminaria* fields in Europe and the most extensive in France. This area is remarkable due to the outstanding natural ecosystem containing dozens of species of algae, marine mammals and birds of national and European significance. The archipelago is included in the Parc naturel marin d'Iroise boundaries, a Marine Protected Area (MPA) created in 2007. This region of the Iroise Sea is also a MPA under the OSPAR convention and a large part of its perimeter is listed under the European Habitats and Birds directives (Natura 2000 network). It is also recognized as a UNESCO Man and Biosphere Reserve.

With respect to kelp harvesting, a dedicated commission of the Comité Régional des Pêches et des Élevages Marins de Bretagne – CRPMEM (Brittany Regional Fisheries Committee) is responsible for defining proposals for the management of kelp exploitation, which are then amended and codified by the State representative. The VALMER Parc naturel marin d'Iroise team mainly worked with stakeholders from this commission.

## ► THE PROCESS

Our work in the Parc naturel marin d'Iroise is described in Figure 1. The aim was to assess the current provision of services provided by the Iroise kelp ecosystem and to simulate, with a dynamic model, the fluctuations of service levels according to different management options. The development of this integrated tool was carried out through interconnected processes.

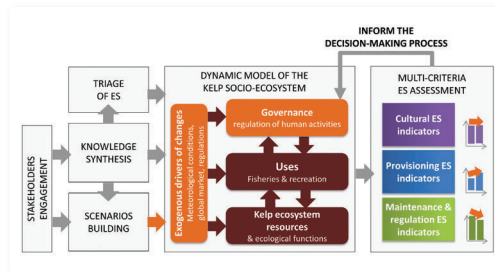


Figure 1. ESA approach developed in the Parc naturel marin d'Iroise study site.

## ECOSYSTEM SERVICES ASSESSMENT (ESA)

The focus of our study was the intertidal and subtidal kelp habitat of the Molène archipelago. Among species depending on kelp habitats are fisheries resources (e.g. abalone, crustaceans, fish) and species with a high conservation status (e.g. common bottlenose dolphin, grey seal, breeding birds). Kelps are sought by agrifood, pharmaceutical and cosmetic industries for their alginate content. Sixty percent of French kelp production occurs in the Molène archipelago and demand is increasing. The cohabitation of sustainable activities in the Park is an important management issue, as is traditional and cultural heritage conservation. The choice of which ecosystem services to focus on was determined using an innovative 'triage' method (Figure 2). Indicators were defined for each service.



Figure 2. Ecosystem services selected from the 'triage' approach.

## BUILDING SCENARIOS

The exploratory scenarios aimed to compare management options, in the context of various possible changes in the kelp socio-ecosystem. In order to develop a dynamic model able to simulate these scenarios, the case study team first analyzed the exogenous and adaptive drivers of the system.

Kelp management scenarios tested in the VALMER project were real-life scenarios, discussed in the kelp dedicated commission of the CRPMEM. The exploratory scenarios tested aimed to explore with stakeholders the model's potential and limits, and further refine the scenario building exercise.

## DYNAMIC SOCIO-ECOLOGICAL MODELLING

Considering the aim of the ecosystem services assessment and the numerous factors of influence which must be taken into account, a dynamic system model for simulating the impacts of various fisheries management options on key ecosystem services seemed to be the most appropriate and useful approach. The first step consisted of building with scientists, managers and stakeholders a conceptual model of the function of kelp socio-ecosystems, including kelp forest functions supporting biodiversity, human activities and the governance system of the whole ecosystem and resources.

On this basis, a numeric simulation model was built, starting with the ecosystem component: a kelp population dynamics model and ecological functions assessment. It was followed by the addition of an economic model of kelp harvesting and by the implementation of harvesting areas access rules.

## ► THE RESULTS

As management challenges require consideration of interconnected dynamic processes, the case study team developed a dynamic system modelling approach. It provided a powerful tool to manage highly complex processes despite uncertainties and occasional gaps in knowledge. This work is an ongoing, long-term process, and development of the model to show changes in ES provision in relation to scenarios will continue.

## DEVELOPMENT OF A NUMERICAL SIMULATION MODEL OF THE KELP SOCIO-ECOSYSTEM

The VALMER project was an opportunity for knowledge synthesis on the kelp socio-ecosystem and to start innovative modelling work. Involving stakeholders in the model development was necessary in order to achieve a better description of many processes. This tool provides

new highlights (e.g. the harvestable biomass with respect of plants size and kelp population dynamics, see Figure 3). Knowledge gaps in some areas and existing data accessibility issues prevented us from producing a complete quantitative and dynamic ESA.

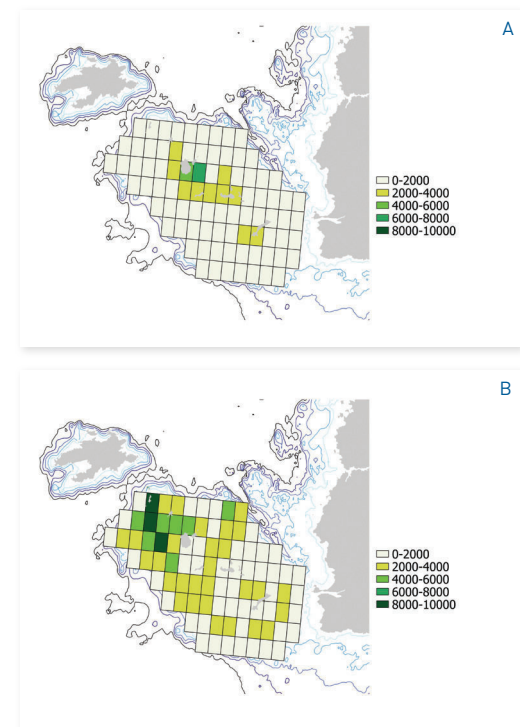


Figure 3. Biomass of kelp canopy plants in September 2012 (tons): a) *Laminaria digitata*, b) *Laminaria hyperborea*.

## IMPLICATIONS FOR GOVERNANCE

Ecosystem Services Assessment provides clarity with regards to the benefits received from a given ecosystem and improves transparency regarding trade-offs. During this project, scientists, managers and stakeholders further developed their relationships, shared their knowledge and marine visions. The ES approach is an emerging concept and it was an interesting challenge to involve local stakeholders to accomplish an efficient and operational integrated assessment. Despite the complexity of the model and concepts, it was important to maintain the confidence and involvement of stakeholders during the process by clearly communicating the model's uncertainties and results.



# Golfe du Morbihan

## CASE STUDY

## THE PLACE AND THE PEOPLE WE WORKED WITH

The Golfe du Morbihan (GDM) is located in south Brittany, in the Morbihan department. The case study area is delimited by the boundaries of the Regional Natural Park (RNP) of the Golfe du Morbihan. The area includes 30 municipalities and an associated marine area of 125 km<sup>2</sup> connected to the Atlantic ocean by a narrow channel. The Golfe du Morbihan is famous for its high level of biodiversity, natural and cultural heritage, various habitats (mudflats, rocky foreshores, seagrass beds, etc.) and landscapes.

The VALMER Golfe du Morbihan case study team worked closely with the scientific team of the University of Brest and involved a wide range of local stakeholders concerned with the conservation of seagrass beds: elected members, professional representatives, NGOs, recreational users, citizens, scientists, managers, etc. More than 100 stakeholders were involved during the project.

## THE PROCESS

A broad and participative approach was developed in the Golfe du Morbihan case study site, combining an Ecosystem Services Assessment (ESA) of the services provided by seagrass beds with a scenario building exercise.

Seagrass beds are sensitive to pressures impacting environmental quality (e.g. lack of light, herbicides, trampling, grubbing, etc.). Due to their high ability to regenerate in a healthy environment, they are used as a water quality indicator for the European Water Framework Directive. In order to reconcile environmental conservation with the development of activities, the Regional Natural Park decided to experiment with the ecosystem services approach put forward in VALMER.

## ECOSYSTEM SERVICES ASSESSMENT

The ESA was designed to:

1. Raise awareness of seagrass issues
2. Improve the management of seagrass beds through an integrated assessment
3. Identify management options to facilitate trade-offs

At the beginning of the project, the VALMER Golfe du Morbihan team chose to develop a multi-criteria assessment of seagrass beds based on social, economic and environmental criteria rather than a monetarised assessment. The VALMER team collected scientific and local knowledge to identify all the ecosystem services provided by seagrass beds in the Golfe du Morbihan (e.g. shelter for many species; food resource for birds feeding on their leaves (e.g. geese); improvement of sedimentation, etc.); and to better understand the natural and human factors that could affect the level of the ecosystem services provided by seagrass beds.

This assessment was done by combining several methods and tools (Figure 1):

- A scientific literature review
- Interviews
- Focus Groups
- A "choice experiment" survey
- A map analysis
- Conceptual modelling
- The development of a knowledge integration and sharing platform.



Figure 1. The ESA and scenarios building approach developed in the Golfe du Morbihan case study site.

The ESA in the Golfe du Morbihan was used to:

- Structure a systemic view of the coastal social and ecological system
- Propose a new management approach under a participatory process
- Discuss seagrass bed management with local stakeholders

## BUILDING SCENARIOS

In addition to the ESA, scenarios were developed with stakeholders to support the discussion of different possible management strategies (= scenarios). It was a good opportunity to collectively reflect on the implications of management options on the ecosystem service levels provided by seagrass beds. The purpose was to identify actions that could be implemented to improve today's management of the seagrass beds in the Golfe. Using the ESA of seagrass beds of the Golfe, four scenarios (management strategies) were identified (Figure 2).

<b>APPROACH 1</b> <b>Seagrass beds are in good condition.</b> It is not necessary to change the level of protection, but it must implement a program to monitor their condition on long-term and prevent any deterioration.	<b>APPROACH 2</b> <b>Improve the condition of all seagrass beds around the golfe du Morbihan.</b> Limit pressures on all potential areas (known to have been colonized by seagrass beds).
<b>APPROACH 3</b> <b>Just maintain seagrass beds where the pressure and impact are not of great concern and prioritize activities elsewhere.</b>	<b>APPROACH 4</b> <b>Improve the condition of seagrass beds by conserving strategic areas in good condition in the long-term.</b>

Figure 2. Summary of the four scenarios developed in the Golfe du Morbihan case study site.

## THE RESULTS

The results obtained in the Golfe du Morbihan are numerous and complementary. They are gathered in a knowledge platform on seagrass beds called ZOSTERA (Figure 3).



Figure 3. The ZOSTERA platform on seagrass beds' knowledge.

The ZOSTERA platform gathers:

- A seagrass beds atlas with 30 maps
- A scientific report on ecology, biology of seagrass beds and their interactions with human activities
- Five leaflets that summarize the results obtained during the project
- A comic strip on seagrass beds, the ecosystem services they offer, and the natural and human pressures they face
- A conceptual model of interactions between seagrass beds and human activities
- The presentations made at the 'seagrass event' [4th Dec. 2014]

These results and materials will be disseminated broadly by mail, in printed format and digital documents and made available for download on the Regional Natural Park website.

## IMPLICATIONS FOR GOVERNANCE

The results obtained in the VALMER project will complete the Objectives Natura 2000 Document in the Golfe. We hope that they will also provide new ideas and information that can be used during the reviewing of the Plan for Sea Development (a maritime planning document) in 2016, in order to improve management of seagrass beds without unnecessary constraints on activities.

# Conclusions

At the start of the VALMER project, back in October 2012, we set out to develop and apply methodologies that could be used to quantify, qualify and communicate the real value (economic, social and environmental) of marine and coastal ecosystem services. We wanted to improve understanding of the links between marine ecosystem services, their assessment, and effective marine management and governance, using six case study sites to test our methods.

Taken together these six sites incorporated a broad range of stakeholders, management issues, and ecosystem services, which enabled VALMER to trial a range of different methodologies and techniques tailored to specific locations and the ecosystem services they provide. Working in interdisciplinary teams across the sites our environmental economists, marine and social scientists and local managers have used a wide range of valuation techniques, developed a variety of socio-ecological models, conducted more than 40 workshops and interviewed over 50 individual stakeholders.

During the process we have developed a novel approach to define the scope of an ecosystem services assessment – the ‘triage’ method, developed new methods to incorporate scenarios into these assessments, and gained valuable insights into the role of co-production of ecosystem services assessment for governance and stakeholder engagement. The results are captured in a series of technical reports, lessons learned documents and advice notes as well as a series of public-facing multi-media outputs and an e-learning training package, which we hope will inform future research and the practical application of the ecosystem services approach on both sides of the Channel and beyond.

[www.valmer.eu/results](http://www.valmer.eu/results)

