



THE POTENTIAL ROLE OF ECOSYSTEM SERVICE ASSESSMENT IN MARINE GOVERNANCE IN THE WESTERN CHANNEL

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Executive summary

The Western Channel, like other busy cross-border shared seas, is extremely complex when viewed in governance terms. Marine environmental protection and sustainable development require ecosystem-based thinking to enable the integrated management of marine and coastal environments and their resources. Such an approach brings together the social, economic and ecological sciences, and has been endorsed across the European Union, as evidenced by the Marine Strategy Framework Directive and the recent Maritime Spatial Planning Directive. The transition towards this approach to date has been hindered by a lack of knowledge of ecosystem services and their values within the marine management evidence base.

The VALMER project has sought to investigate the opportunities offered by Ecosystem Service Assessments (ESA) for marine governance within the Western Channel. Using six pilot studies, three in the south West of the United Kingdom (UK) and three in France, interdisciplinary teams of economists, social scientists, ecologists and managers worked collaboratively to bring together groups of stakeholders to develop site-specific marine ESAs. These case studies have allowed the project to document and explore the potential role of ESA, to help inform managers who seek to use the ecosystem services approach and ESA methods to support good marine governance.

This report presents the results of this governance evaluation. Empirical evidence gathered included in-depth interviews with over fifty marine and coastal stakeholders and managers engaged at the sites to gather views on their experiences with ESA. Comparison of results from across the six case studies confirms expectations that ESA has potential to support marine and coastal management in a wide variety of marine governance contexts. Stakeholder support for its use in marine governance was also found across both UK and French study sites. The governance analysis has generated crucial insight and evidence into the specifics of how ESA can be used to positively affect the governance process and its outcomes. In doing so, the evaluation demonstrates there are many benefits to managers in incorporating ecosystem services considerations into existing and ongoing marine and coastal management activities such as planning, implementation and monitoring and evaluation. Furthermore, the findings clearly show that ESAs can in addition to being a versatile analytical tool for managers; ESAs can greatly assist and facilitate stakeholder engagement. From experience in VALMER, the co-production of ESAs through a partnership between marine managers, stakeholder and researchers with the necessary technical expertise appears to be an effective way of raising awareness of managers of the provision of marine ecosystem services within their marine and coastal area and increases the likelihood of the policy influence of ESAs. By using ESAs to understand the real ecological and socio-economic implications of area-based decisions such as trade-offs, this can increase both capacity and comfort levels towards using valuation and assessment frameworks to support marine management effort and in doing so, help facilitate good governance.

The VALMER project has been a valuable investment of research effort to investigate and demonstrate how ESAs can be integrated usefully into the process of marine governance in the European context. The documenting of the VALMER process at six study sites and the results of this governance analysis will assist marine and coastal managers who seek to implement an ecosystem services approach, but may also support the work of the wider marine and coastal community including scientists, regulators, researchers and coastal networks.

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Chapter 1 - Introduction

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Due to the interconnected nature of marine ecosystems, ecosystem-based management is a prescription within European marine policy, for example, the Maritime Spatial Planning Directive and the Marine Strategy Framework Directive. Mapping marine ecosystems and assessing ecosystem services, thus integrating ecology with economics and societal values, is necessary to understand the impacts of marine policy. In parallel, initiatives such as The Economics of Ecosystems and Biodiversity Study (TEEB) and the Millennium Ecosystem Assessment have placed increasing emphasis upon the use of economic valuations within national accounting, public policy and regulations. Whilst there has been growing interest in conducting Ecosystem Service Assessments (ESA) for natural resource management, to date this has been primarily been on land with limited application to marine environments. With such knowledge of ecosystems traditionally absent from the marine management evidence base and a history of not taking the true values of ecosystems into consideration, many marine environments face declining biodiversity, alongside increasing pressures such as coastal development, marine-based pollution and increased fishing effort.

The VALMER project has sought to investigate the opportunities offered by ESA for marine governance within the Western Channel. Using six pilot studies, three in the south West of the UK and three in France, interdisciplinary teams of economists, social scientists, ecologists and managers worked collaboratively to bring together groups of stakeholders to develop site-specific marine ESAs. These case studies have allowed the project to document and explore the potential role of ESA, to help inform managers who seek to use the ecosystem services approach and ESA methods to support good

marine governance. This report presents the results of this governance evaluation, highlighting the various roles for ESA in generating positive impacts on Western Channel marine and coastal governance.

Firstly, the report presents the physical and governance contexts of the Western Channel and the six pilot study locations (Chapter 2). Individual case study chapters then present an overview of the specific processes undertaken at each study site (Chapters 3-8). Each of these chapters describes how the focus of the ESA was selected, the associated methods and a brief summary of the key results, along with the stakeholder engagement activities and scenario building processes. Chapter 9 presents detailed governance analysis of the empirical evidence collected at the study sites. This includes a synthesis of how the VALMER ESAs have affected the governance process and outcomes in the Western Channel and a set of recommendations for marine and coastal managers who seek to use ESA in the future to support good marine governance.

The scenarios of change developed by the case study teams and stakeholders, and referred to in this document, whilst plausible were hypothetical and any changes to management or human activities discussed in this report are fictional and should be treated as such.

Chapter 2 - Overview of the case study sites

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1. Marine and coastal governance in the Western Channel

1.1. Pressures and demands

The English Channel is one of the busiest seaways in the world, connecting the Atlantic Ocean with the North Sea. It accounts for 20% of global traffic, with between 700 and 800 ships passing through the Strait of Dover in a single day. An average of 70,000 passengers cross the Channel daily, between France and the United Kingdom (UK), via key routes such as Plymouth-Roscoff, Portsmouth-Ouistreham and Dover-Calais. There are about 4000 fishing boats registered for use in the Channel. On top of this, the Channel is very popular for recreational boating, with over 145 marinas along the English and French coasts. In addition to commercial and leisure traffic, there are other marine activities and interests vying for space such as fisheries, marine renewable energy developments, aggregate extraction and marine and coastal tourism. In summary, the Channel hosts a vast range of activities, involving different actors and interests, within what is a compressed geographical area. This is putting increasing pressure on the Channel's marine and coastal ecosystems. Such pressure is likely to increase under the European Union's (EU) Blue Growth agenda for the development and expansion of the maritime economy in European seas.

At the same time, there is growing recognition of the need to protect the marine and coastal ecosystems in the Channel. There already are a number of protected areas designated under the EU Habitats Directive, the EU Birds Directive, the Ramsar Convention, as well as French and British

national legislation. In England, a new marine conservation tool called 'Marine Conservation Zones' (MCZ) are being designated under the Marine and Coastal Access Act, 2009. On the other side of the Channel, the French Marine Protected Area Agency (AAMP) is seeking to establish a number of large-scale multi use Marine Protected Areas (MPA) in the form of marine parks. Their first such area was the Parc Naturel Marin d'Iroise (PMNI) that established in 2007 off the coast of Finistère. In addition to these marine conservation designations and aspirations, the EU Marine Strategy Framework Directive requires all European seas, including the Channel area, to reach 'Good Environmental Status' by 2020.

1.2. Governance Challenges

The different economic, social and environmental interests that compete for space in the Channel create considerable challenges for marine governance. Effective and sustainable management of the Channel, that accommodates these different interests, requires a governance approach that is cross-sectoral, trans-boundary and ecosystem based. In reality, however, governance of the Channel is influenced and directed by a wide range of international agreements, EU directives, national and local legislation, regulation and policy (Figure 2.1). It involves multiple jurisdictions across a range of political, administrative and management boundaries that are often not clearly defined or communicated. As such, a coordinated management strategy is not in place for the Channel.

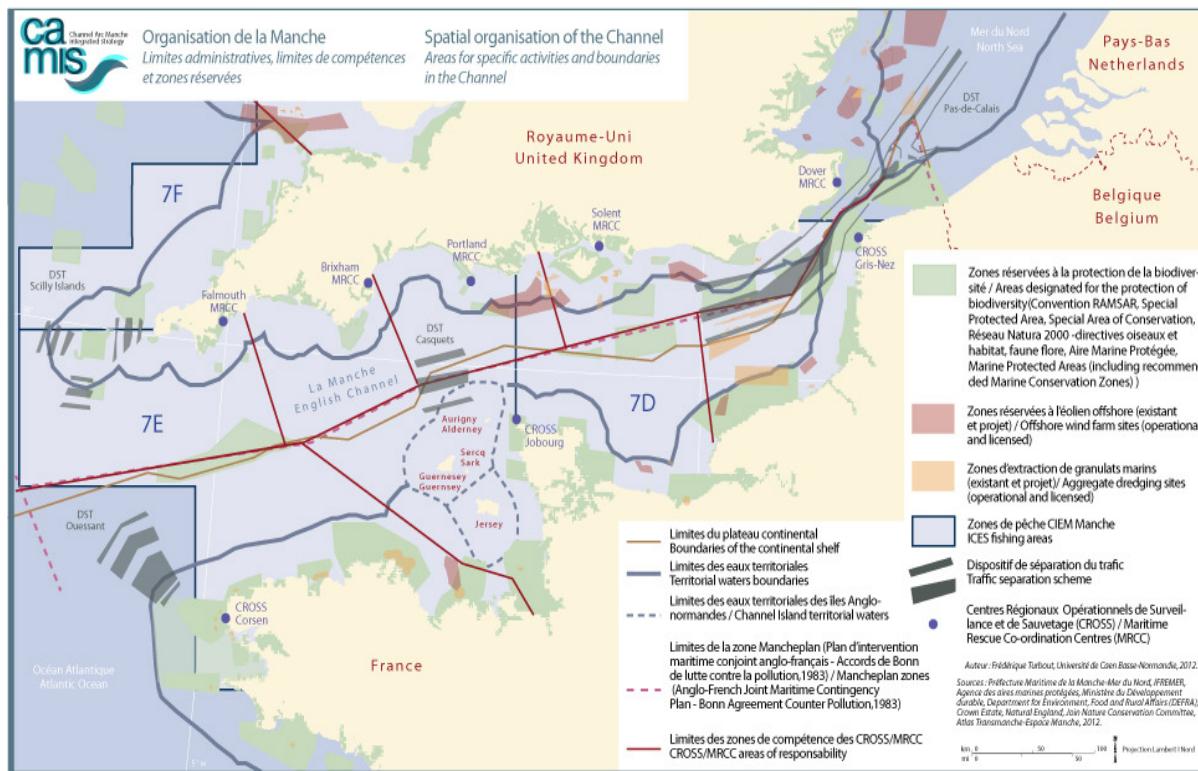


Figure 2.1 An overview of a number of administrative boundaries in place within the Channel (Channel Arc Manche Integrated Strategy, 2013, pg 21)

The new EU Marine Spatial Planning Directive requires Member States to set up national marine plans that are ecosystem based, as well as coherent and coordinated across national borders in a marine region. Currently, however, France and the UK are taking different approaches to marine spatial planning. The Marine Management Organisation (MMO) is developing a series of regional, cross-sectoral marine plans in English waters, guided by a UK-wide Marine Policy Statement and High Level Marine Objectives. France is focusing on the designation of zones for different sectors such as marine renewable energies and the previously referred to large-scale multi-use marine parks. Fisheries in both France and the UK, from 12 nautical miles out to the median line, are managed under the EU Common Fisheries Policy. However, Member States are still responsible for enforcing management within this area and ensuring compatibility between domestic legislation and the Common Fisheries Policy reforms. Fisheries management is thus separate from marine planning,

making it difficult to integrate this sector into coherent, cross-sectoral marine and coastal planning and management. These challenges are further exacerbated by perceived conflicts between different sectors, lack of adequate ecological and socio-economic data, as well as linguistic and cultural differences between France and the UK.

2. VALMER Case Studies

The six VALMER case studies in the Western Channel, three in France and three in the south west of UK (Figure 2.2), have each assessed particular marine ecosystem services and valued these using a range of methodologies. Through stakeholder engagement, via workshops and scenario building exercises, the project has explored stakeholder views and preferences on various marine management options and trade-offs. Table 2.1 presents an overview of the site including key characteristics. This chapter will now present a brief outline of the geographical and governance contexts of each site.



Figure 2.2 Map showing the six VALMER case study sites

Table 2.1 Overview of the VALMER case study sites

	Poole Harbour (PH)	North Devon (ND)	Plymouth Sound-Fowey (PF)	Golfe Normand Breton (GNB)	Golfe du Morbihan (GdM)	Parc Naturel Marin d'Iroise (PNMI)
Focus of Case Study & Ecosystem Services studied	Socio-economic value of six recreational activities in the harbour (cultural ecosystem services)	Value of subtidal sedimentary habitats in supporting commercial fisheries, carbon sequestration, waste remediation	Ecosystem services provided by intertidal and subtidal habitats	Recreational and provisioning services provided by tidal and subtidal benthic habitats	Maintenance and regulation services provided by seagrass beds	Ecosystem services provided by kelp forests for food provision, species habitats and ecotourism
ESA Methods	Travel cost method, analytic hierarchy process	Bayesian Belief Network socio-ecological modelling	Varied	INVEST Ecosystem accounting	Choice experiment	Dynamic modelling
Case Study Governance Context	Poole Harbour Aquatic Management Plan	North Devon UNESCO Biosphere Reserve	Cornwall Maritime Strategy & others	Scoping project for the establishment of a Natural Marine Park	Project to establish a Natural Regional Park	Iroise Natural Marine Park
Stakeholder Group	Poole Harbour Steering Group	Biosphere Reserve Marine Working Group and stakeholders from relevant sectors and interest groups	Task and Finish Group established with managers and regulators responsible for aspects of marine and coastal areas within the case study site	Local managers, user and interest groups involved in the marine park project	Local managers, user and interest groups involved in the natural regional park project	Stakeholders involved in the management of the marine park
Interviewed Stakeholders	n=4 <ul style="list-style-type: none">• 1 Local Authority representative• 1 Harbour Commissioners representative• 1 Government agency representative• 1 Water company representative	n=9 <ul style="list-style-type: none">• 1 Local Authority representative• 3 Local recreational club representatives• 2 local management partnerships• 3 Non-Governmental Organisation (NGO) representatives	n=7 <ul style="list-style-type: none">• 2 Local Authorities• 1 Harbour Commissioners representative• 2 National government agency representatives• 2 NGO representatives	n=7 <ul style="list-style-type: none">• 2 Local Authorities• 1 Commercial fisheries interest group representatives• 1 Government agency• 1 Business interest group representative• 2 Natural area managers	n=8 <ul style="list-style-type: none">• 2 Commercial fisheries interest group representatives• 3 Government agency representatives• 1 Local politician• 2 Local recreational club representatives	n=4 <ul style="list-style-type: none">• 2 Commercial fisheries interest group representatives• 1 NGO representative• 1 Natural area manager

2.1. North Devon (ND)

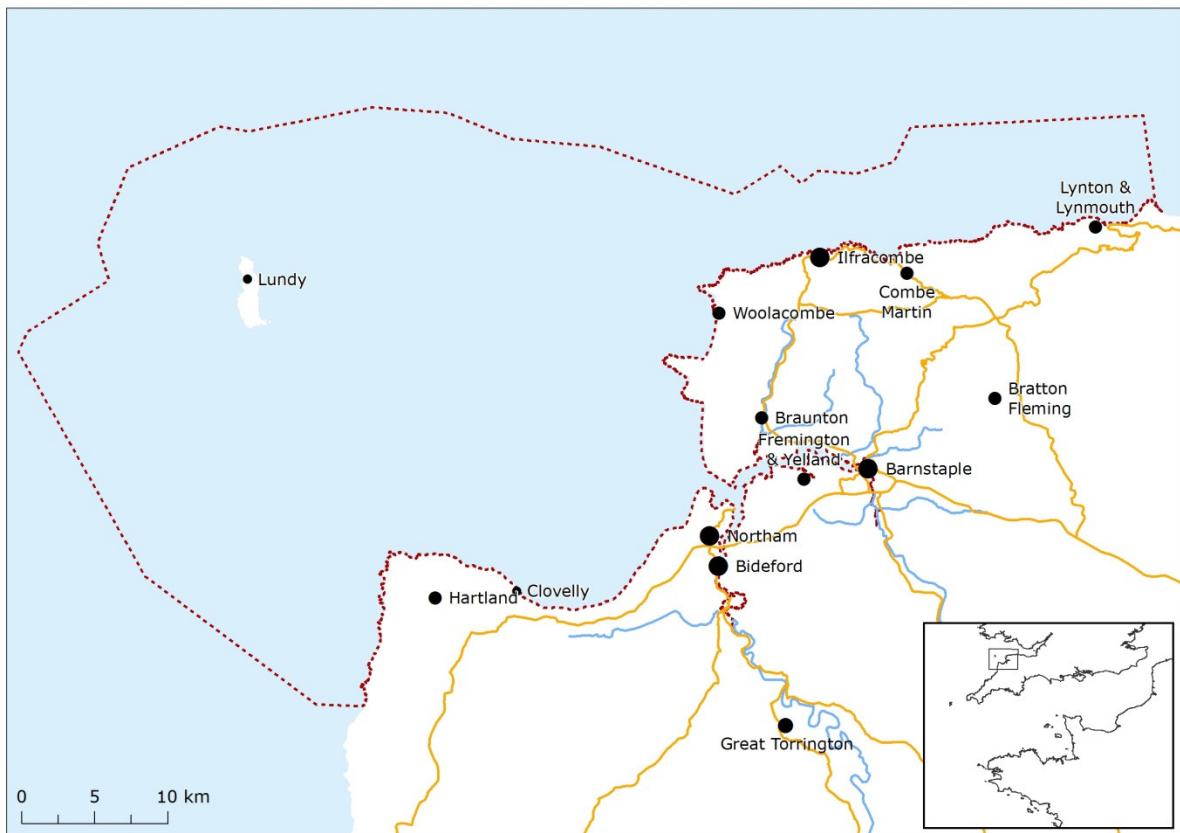


Figure 2.3 North Devon case study site (Marine Biological Association)

Physical Environment

The North Devon case study site encompasses the marine and coastal parts of the UNESCO North Devon Biosphere Reserve (NDBR) (Figure 2.3).

The area of over 1000 km² includes the Taw-Torridge Estuary as well as important marine and coastal habitats ranging from rocky foreshore, sand dunes and various types of saltmarsh to intertidal and subtidal mud and sand flats. The coast in the area is rural and relatively undeveloped, with only small towns and villages. The site encompasses a number of sensitive and ecologically important habitats that are covered by national and European nature conservation designations, including the Braunton Burrows sand dune Special Area of Conservation (SAC) and the North Devon Coasts Area of Outstanding Natural Beauty (AONB).

Lundy Island is designated as a Site of Special Scientific Interest (SSSI) for its plant life and seabirds. The waters around Lundy were England's first MPA, as a voluntary and later as a statutory marine nature reserve. Lundy became an SAC in 2005 and was the first MCZ to be designated under the 2009 Marine and Coastal Access Act. Features of conservation around Lundy include eight species of coral as well as species associated with the rocky reef habitats.

Furthermore, the North Devon site is nursery and spawning ground for a number of commercially important species including crabs and lobsters, rays, Dover sole, plaice, cod and whiting.

Main Activities and Uses

The local economy relies to a large extent on marine and coastal tourism and recreation. The beaches along the North Devon coast are a hotspot for surfers. There are good dive sites along the coast as well

as around Lundy Island. Lundy itself is a popular destination for nature enthusiasts and birdwatchers but also offers opportunities for seeing other marine wildlife such as seals. Other recreational activities in the area include walking and cycling on the South West Coast Path and the Tarka Trail. The harbours in the NDBR provide moorings for yachts, and charter boats offer trips to go angling, diving or marine wildlife watching.

Commercial fisheries are the second major marine contributor to the local economy. Fishing activities in the NDBR include bottom trawling, potting, line fishing and netting, as well as crab tiling in the estuary. The main targeted species in the area are skate and ray, whelk, lobster, brown crab, squid, sea bass, plaice and Dover sole. There are no active aggregate dredging or disposal sites, although there are historic disposal sites off Hartland Point and Woolacombe Bay. While traditional marine resource extraction at the site is limited to fisheries, areas in and around the NDBR have been identified as potential sites for the development of marine renewable energies. The Crown Estate identified an area just north of the NDBR marine site as a Round 3 offshore windfarm licence area. Although the development of the Atlantic Array windfarm at this site has been cancelled in 2014, an offshore windfarm could potentially be developed at this site in the future. Further, the Crown Estate has given a permit for a tidal demonstration zone off Foreland Point in Lynmouth Bay where new tidal stream devices will be tested.

There is some commercial shipping in the area, mainly timber and clay being exported from Bideford Harbour. Aggregates gained from a dredging area to the north of the NDBR marine site are landed into Bideford. The site is also occasionally used for shelter by ships going in and out of the Port of Bristol. The shipyard in Appledore supplies sections for new Royal Navy ships as well as constructing a series of vessels for the Irish Navy. Overall, there are seven small ports and harbours in the area. Local fish catches are landed into Bideford and Appledore as well as Ilfracombe and Clovelly. Other uses of the NDBR marine site military training areas off Braunton Burrows and along parts of its western and northern borders as well as transatlantic cables which come onshore off Woolacombe.

Governance Arrangements

The most significant governance framework at the case study site is the NDBR, which was established in the 1970s under the UNESCO Man and Biosphere Reserve programme. Biosphere Reserves aim to reconnect people with their local environment and to promote sustainable development based local community efforts and sound science. The NDBR has three functions: conservation of special landscapes and wildlife as well as the rich cultural heritage in the area, learning and research, and community based sustainable development. The site is divided into three management zones: a core, buffer and transition zone (Figure 2.4). In the core area the focus is on nature conservation. The main objective for the buffer zone is the careful management of natural and cultural resources by and for local communities. The transition zone makes up the largest part of the NDBR. Here, management focuses on ensuring that communities can thrive sustainably in an enhanced environment. The marine section of the NDBR is part of the transition zone.

The management of the NDBR marine site is determined by a series of statutory and non-statutory plans and strategies. These include the Devon and Severn Inshore Fisheries and Conservation Authority (IFCA) byelaws, the Lundy SAC designation and MCZ zoning scheme, the North Devon AONB Management Strategy, the NDBR Strategy for Sustainable Development and associated Action Plan, the Taw-Torridge Estuary Management and Action Plans, the Northern Devon Fisheries Local Action Group (FLAG) Development Strategy, as well as shoreline management plans, catchment flood management plans and strategic flood risk assessments. In addition, there are voluntary management agreements in place at the site, such as the Ray Box to the north of Lundy for which local fishermen have adopted a seasonal closure and minimum landing size for rays.

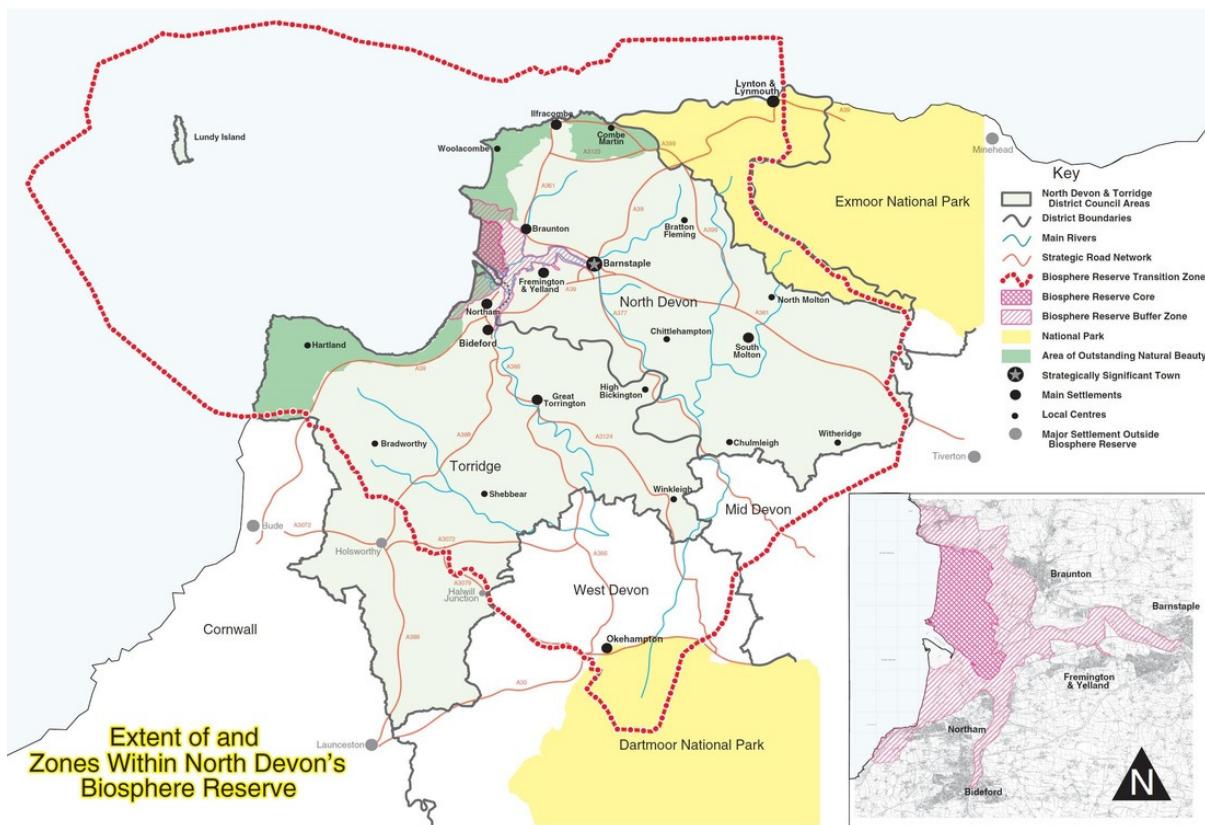


Figure 2.4 The North Devon Biosphere Reserve, including the three zones

As required by the UNESCO Seville 95 Strategy, the Partnership developed a vision and strategy for the management of the Biosphere Reserve. The current strategy for 2014 to 2024 is based on previous strategies as well as a review of the state of the Biosphere Reserve and is aligned with the statutory and non-statutory local plans mentioned above. The strategy identifies a series of environmental, social and economic issues and pressures in the NDBR as well as policies to address these in order to achieve the aims of the Biosphere Reserve. The vision included in this strategy is for the NDBR to become a model for sustainable community and economy by 2030. A key cornerstone of this vision is the restoration and conservation of the Biosphere Reserve's ecosystems and habitats. This includes coastal management that is focused on enabling natural coastal processes to facilitate the adaptation to sea level rise and other climate change impacts. For the marine area of the NDBR the vision is to have high water quality and thriving, biodiverse marine wildlife that support human enjoyment as well as the local fishing industry. This is to be achieved through careful management by fishermen and other marine stakeholders.

The marine conservation interests of the NDBR are represented by the NDBR Marine Working Group which brings together local leisure, fishing and conservation stakeholders. Another influential group in the management of the NDBR marine site is the Northern Devon Fisheries Local Action Group (FLAG). The FLAG is a partnership of local fishermen, local authorities, statutory and non-statutory governmental bodies and local stakeholders with an interest in fisheries and the marine environment. It is one of six FLAGS in England that were set up to deliver a European Fisheries Fund grant programme between 2012 and 2015. The programme aims to support the sustainable development of small fishing communities such as those in North Devon.

2.2. Poole Harbour (PH)

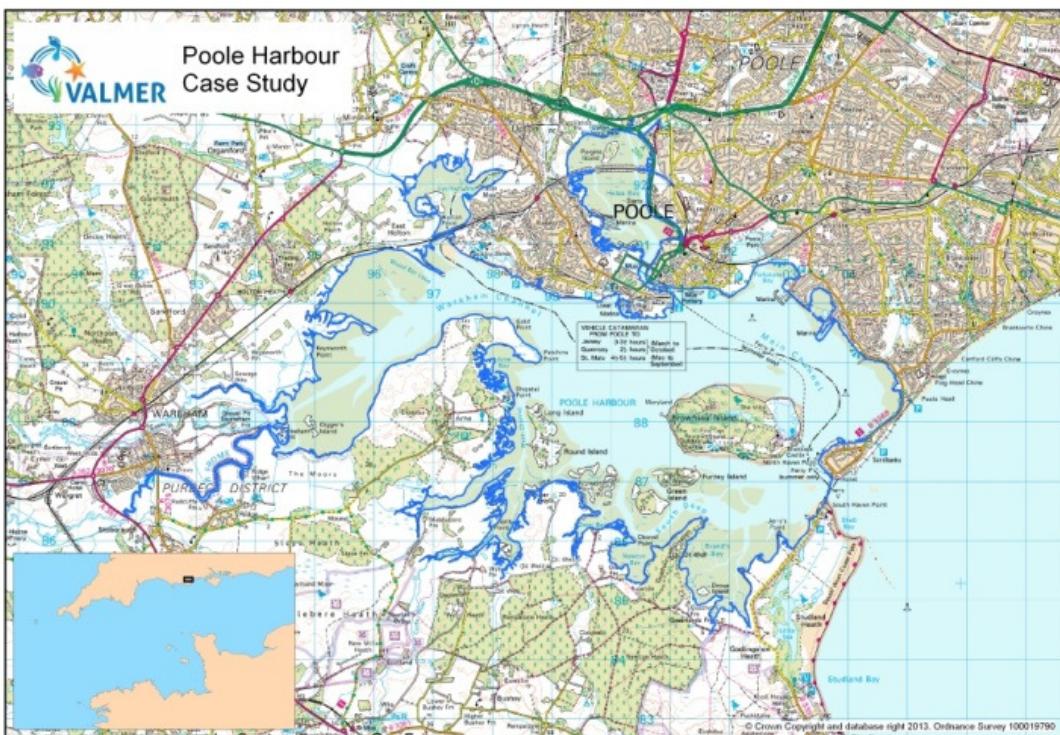


Figure 2.5 Map of VALMER Poole Harbour Case Study (Dorset County Council)

Physical Environment

Poole Harbour is considered to be one of the outstanding natural features of Southern England and one of the largest estuaries with an enclosed, lagoonal character in Britain. At 36km² it is one of the largest natural harbours in Europe. The site, with its eight islands, encompasses a number of estuarine, wetland and heathland habitats, including saltmarshes, reed beds, seagrass, mudflats, small beach areas, heathland, heath-woodland mosaics. It has large areas of built environment that includes flood and coastal defences around the more urbanised North shore (Figure 2.5). 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 multiple SSSIs, RAMSAR site for being the best and largest example of an estuary with lagoonal characteristics in Britain, AONB and Special Protection Area (SPA) for its internationally important wintering, migrating and breeding wildfowl and waders. The Poole Harbour SPA is entirely marine in its designation, and protects a number of features of interest including *Recurvirostra avosetta*, *Sterna hirundo* and *Spartina anglica*. The harbour is also home to important bass nurseries.

Main Activities and Uses

As a busy commercial port, Poole Harbour supports significant shipping, including cargo and cross-Channel ferries. It is also used extensively by the public for a wide range of leisure and recreational activities, which occur both in and around the harbour. There are seven marinas and eight yacht clubs, with five thousand moorings (a combination of swing moorings and sheltered marine and pontoon berths). Approximately a hundred fishing boats under 10metres operate out of the harbour, as well as a large charter boat fleet for fishing and diving trips. There are a number of shellfish farms in the harbour, and associated designated shellfish waters under European legislation. Natural resource

extraction occurs within the site, for example, there is an undersea oil drilling operation producing over 16,000 barrels a day.

There are over twenty different recreational activities taking place in Poole Harbour including walking, cycling, beach activities, water sports and a selection of powered and non-powered craft (sailing, powerboating, kayaking, etc.). These have been identified within the Dorset Coast Forum's www.icoast.co.uk, an interactive mapping website to provide information and advice on the facilities, transport, restricted areas and tide times for recreational activities taking place along the Dorset Coast.

Governance Arrangements

With such a wide range of commercial and public activities occurring in and around the harbour, the need to manage these different interests has long been recognised. As with many coastal and marine environments, there are a plethora of statutory and non-statutory bodies in place that govern various aspects of the harbour, with the majority of these having their own planning documents and strategies (see Figure 2.6).

The Poole Harbour Commissioners (PHC) have jurisdiction over water based activities that take place in the harbour and regulate these to ensure the safety of all harbour users. A number of activities are zoned. Some activities are permitted; for example, jet skiing and water skiing (Figure 2.7). Harbour access and speed restrictions are also used to manage these activities for safety and to reduce conflict between users, for example, encouraging launching of jet skiers at manned slipways with parking for cars and trailers, and restricting access to southern parts of the harbour where there are environmentally sensitive areas (see Figure 2.7).

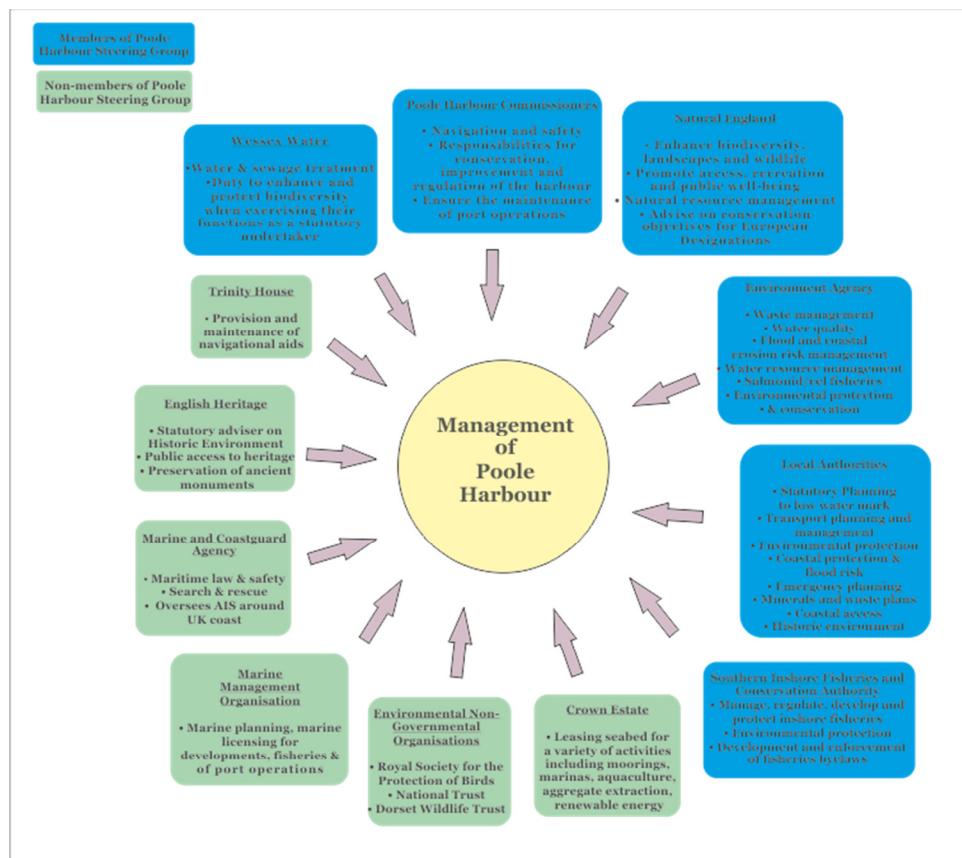


Figure 2.6 Poole Harbour Governance Framework

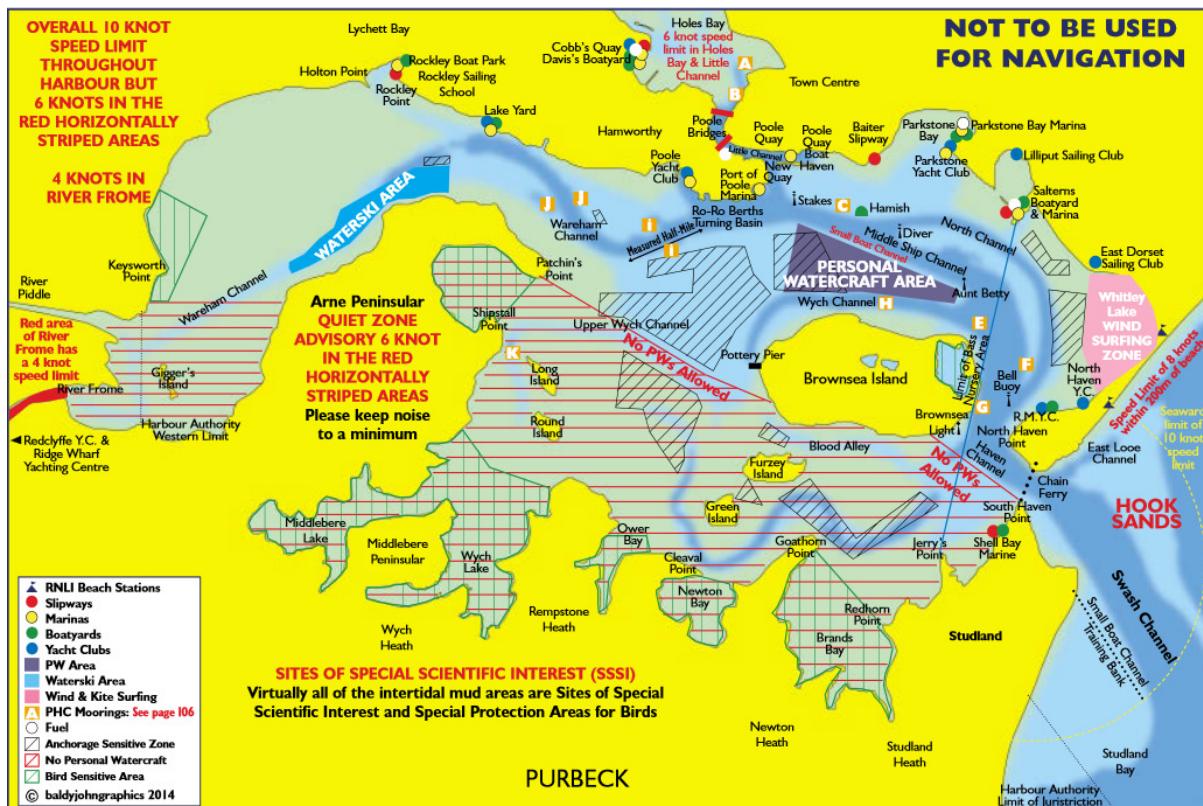


Figure 2.7 Map showing zoned areas for water based activity in Poole Harbour (PHC, 2014)

A key management framework that covers the entire site and integrates several organisations and issues is the Poole Harbour Steering Group's Aquatic Management Plan. This seeks to provide a coordinated and effective framework for the management of Poole Harbour. It encompasses both the present and future needs of nature conservation including the previously mentioned SPA, of recreation, commercial user and other interests in the harbour. The plan is monitored and reviewed regularly. This document also serves as the Management Scheme for the Poole Harbour SPA.

The Poole Harbour Steering Group (PHSG) oversees the Aquatic Management Plan. It is a voluntary partnership that provides a framework for coordination between statutory bodies with responsibilities in the harbour. The PHSG membership includes:

- Borough of Poole
 - Dorset County Council
 - Environment Agency
 - Marine Management Organisation
 - Natural England
 - Poole Harbour Commissioners
 - Purbeck District Council
 - Southern Inshore Fisheries and Conservation Authority
 - Wessex Water Services Ltd

There are a number of relevant national bodies that are not members of the PHSG but are important to the site's management. These include the Crown Estate and English Heritage. In addition, there are other organisations and associations with an interest in the management of Poole Harbour and its surrounding coastline, namely Dorset Coast Forum, Dorset Wildlife Trust, RSPB, and local recreational user groups and clubs.

Despite this complex situation, the PHSG and the Aquatic Management Plan provide a focal point for the management of recreation within the harbour, bringing together managers and other stakeholders. Furthermore, the PHC, whose primary responsibility is to ensure safety of navigation, commercial revenue of the port and environmentally sustainable management, undertake extensive stakeholder liaison to balance environmental, commercial and leisure interests in the harbour. This culture of stakeholder liaison and interest in the management of the harbour is to the benefit of the governance of this case study site.

2.3. Plymouth Sound-Fowey (PF)

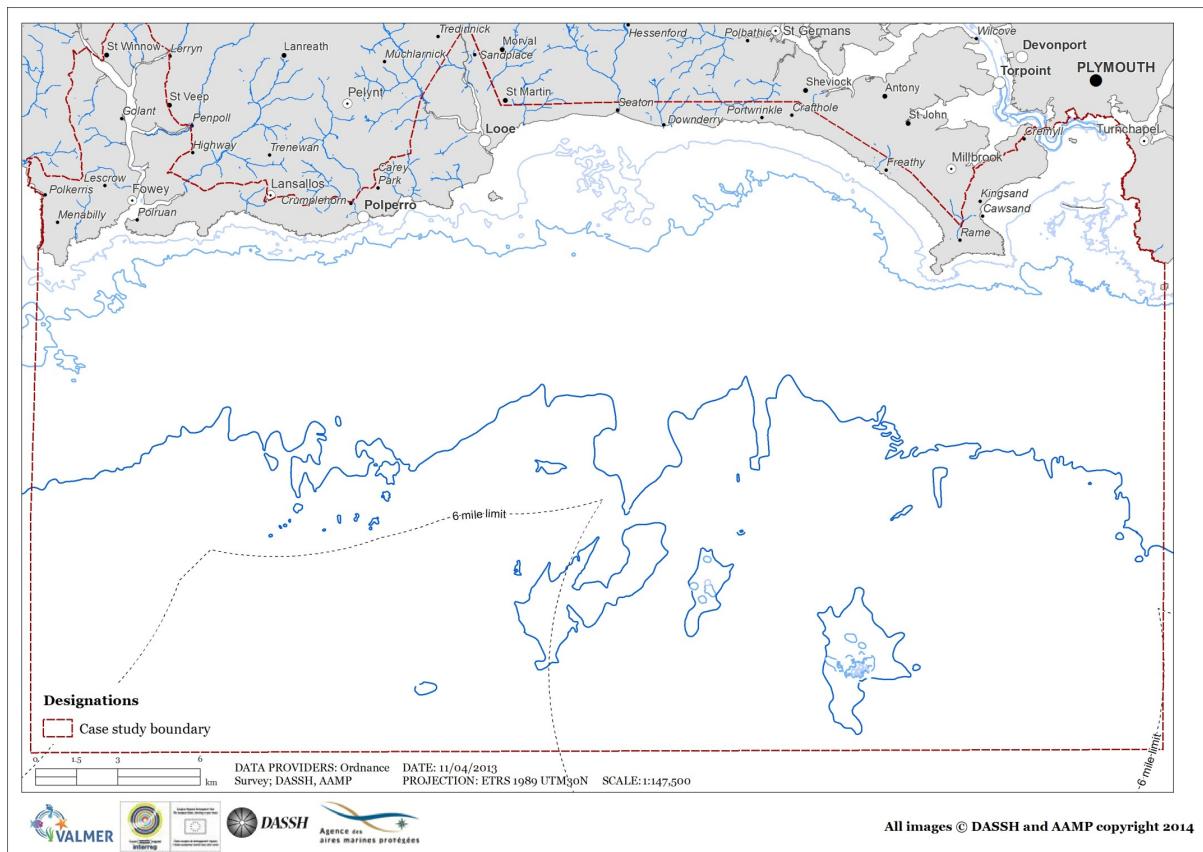


Figure 2.8 Map showing the Plymouth Sound-Fowey Case Study site boundaries (Marine Biological Association-DASSH 2014)

The Plymouth Sound-Fowey case study was led by two part time coordinators, one within Cornwall Council and the other from Plymouth University. They worked together to inform the development of the site-specific ESA, to engage site stakeholders through participatory workshops and to promote the use of the ESA within local governance.

Physical Environment

The landward part of the site is made up of a large stretch of open coast flanked by Rame Head and the Gribben Headland (Figure 2.8). It has mostly rural undeveloped stretches, with several exposed and sheltered beaches. The coast is indented by small estuaries, rivers and stream, along with unstable soft cliffs that have seen numerous landslips due to recent episodes of severe flooding. The Tamar Estuaries complex drains into Plymouth Sound and have a significant influence over the physical characteristics of the marine and coastal area. Offshore habitats include rocky reefs and soft sandy sediments.

Many parts of the site's coastal and marine environment are designated for conservation and landscape value. These include important European Marine Sites, for example, Plymouth Sound and Estuaries SAC and the Start Point to Plymouth Sound and Eddystone SAC. The coast is part of the Cornwall AONB and supports a number of newly designated MCZ. The major existing and proposed designations within the site boundary, both statutory and voluntary, can be seen in Figure 2.9. In response to coastal hazards such as cliff failures and flooding, there are number coastal defences, both private and public, in place along the coast, to manage these risks.

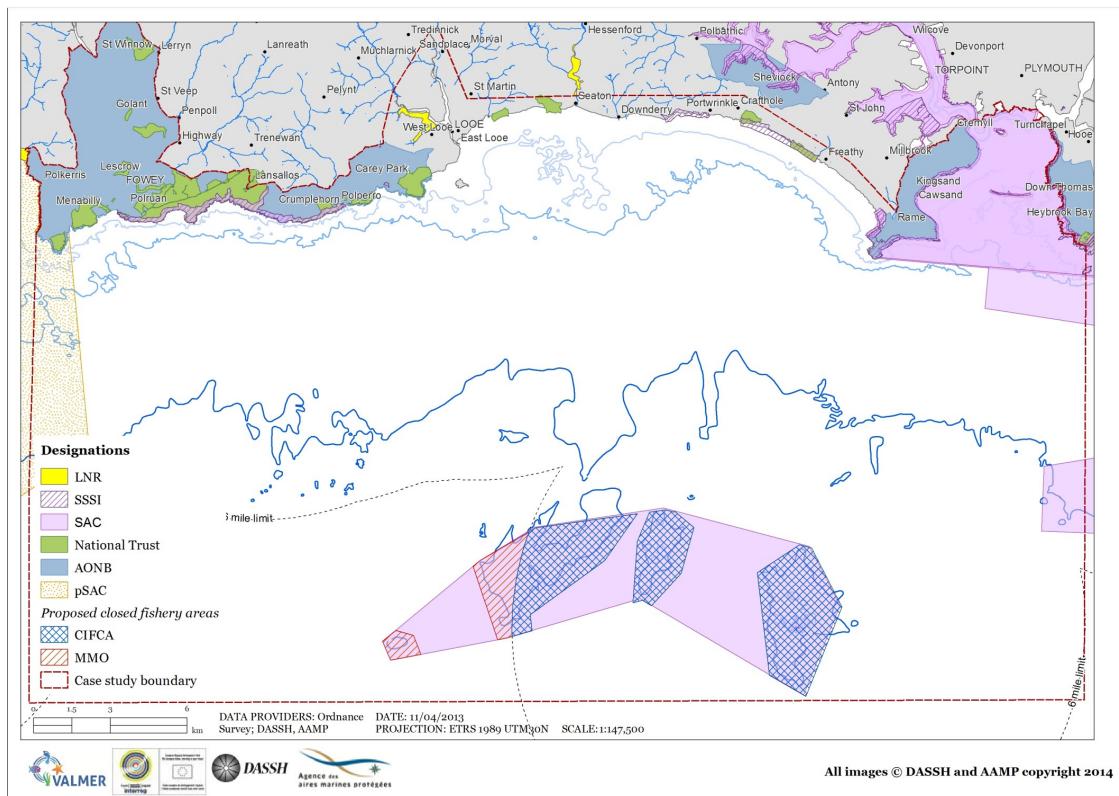


Figure 2.9 Map showing existing site conservation management within the case study (Marine Biological Association-DASSH)

Main Activities and Uses

The case study area adjoins one of the world's busiest shipping routes, the English Channel. Plymouth hosts the UK's largest naval base, as well as having a commercial and a fishing port. Plymouth Sound is heavily used by naval and other military operations, commercial shipping and the fishing industry. Other parts of the case study site are used for coastal cargo and cruise shipping, although this is limited by the small size and available infrastructure of the other harbours in the area, Fowey and Looe. Commercial fishing vessels also operate out of Fowey and Looe, as well as Polperro. Military exercises take place on the coast at Whitsand Bay and Tregantle Fort and offshore along the case study.

Like much of the rest Cornwall and Devon, tourism and recreation are an important activity throughout the year, but concentrated in the summer season and shoulder months. Figure 2.10 illustrates some of the coastal and marine recreational activities that occur in the case study area. Running through the entire stretch of the study site is the South West Coast Path, providing access to this part of the Cornish coast and its many beaches. Walkers and visitor numbers vary along the path's route, with the easterly sections of the coast path to Rame Head less well visited. The towns of Looe, Polperro and Fowey are significant tourist attractions. Indeed, Fowey Harbour receives a growing number of cruise ship visits each year. The area is considered important from a maritime cultural heritage perspective, due to the large number of wrecks within the site (Figure 2.10). Scuba diving

associated with these wrecks, including the HMS Scylla artificial reef. Yachting and recreational boating are also very popular with associated moorings, marinas and slipways. Both shore-based and boat-based angling occurs, with a number of angling competitions held throughout the year. There are a number of culturally significant landmarks in the area including the Eddystone lighthouse, Plymouth Breakwater, Rame Head Chapel, Tregantle Fort and St Catherines Castle. The area has long been an inspiration for art and literature.

A range of commercial fishing occurs, including demersal and benthic, along with potting and traps for shellfish. Within the case study there are two designated areas for disposing of estuarine dredged sediments. One spoil site is situated south west of Rame Head, the other South East of Gribben Head.

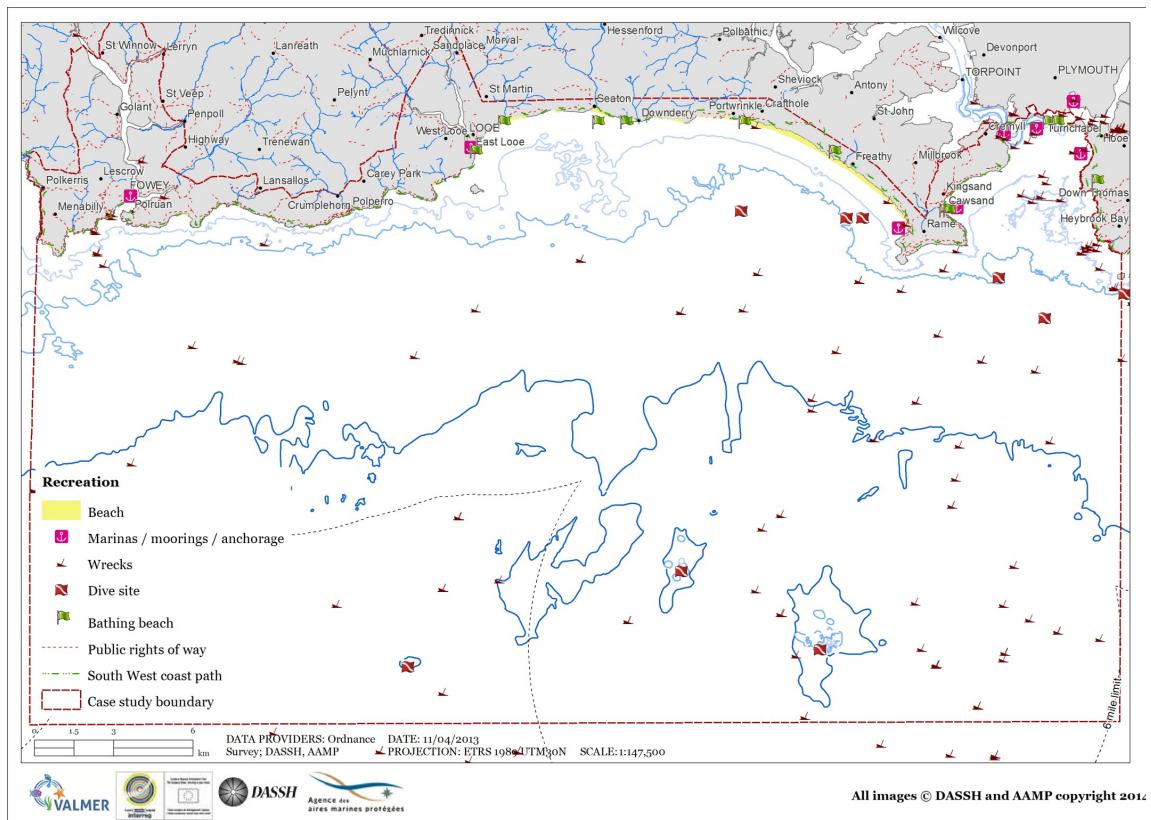


Figure 2.10 Map showing a number of recreational sites within the case study (Marine Biological Association-DASSH, 2014)

Governance Arrangements

The site was selected by the VALMER project to represent a typical stretch of Cornish coast with common coastal and marine activities, pressures and issues. The boundaries do not accord to a single joined-up governance structure or physical unit for management.

A significant number of organisations and managers operate within parts of the site, for example, a number of terrestrial planning authorities (Plymouth City Council, Devon County Council and Cornwall Council). The Duchy of Cornwall, Cornwall Council and National Trust as landowners manage part of the case study's coastline. There are seven Harbour Authorities and the marine area is largely covered by the Cornwall IFCA and MMO. This gives rise to a considerable amount of management structures regulations, statutory and non-statutory documents. These deal with coastal risk management, via the Shoreline Management Plan, landscape conservation, via the AONB Management plan, development control via Local Plans, and estuary management, for example, through the Fowey and the Tamar Estuaries Management Plans. In policy terms, the site can be regarded as 'policy congested' in light of the plethora of overlapping and complimentary plans and

strategies relating to coastal and marine management. It is important, however, to highlight these documents only have pockets of influence within the site, either geographical or thematic. Only members such as Cornwall Council have a broad remit across the site and, therefore, the potential to influence the whole of the site area. In September 2012 Cornwall Council published its Cornwall Maritime Strategy. This high-level strategy document is the first of its kind and seeks to guide the future direction of work relating to maritime Cornwall (Figure 2.11). Maritime Action Plans have been drafted to support the strategy's vision, aims and objectives. The strategy has considerable potential to shape the future direction of coastal and marine management in the case study area.



Figure 2.11 Image of the front cover of the Cornwall Maritime Strategy and the strategy's vision for maritime Cornwall.

2.4. Golfe Normand Breton (GNB)

Physical environment

The Golfe Normand Breton (GNB) case study site is a large marine area in the west part of the Channel, which includes French and Channel Islands marine waters (Figure 2.12). This area of over 11000 km² comprises numerous MPAs including Ramsar sites, Natura 2000 sites, French designation sites and a proposed marine nature park within French waters. The area covers a mosaic of marine and coastal habitats, which include sandy and rocky foreshores, sandy-mud estuaries, saltmarshes, biogenic reefs, intertidal sand flats and rocks, subtidal gravel, sands and rocky reefs.

Main activities and uses

In terms of human geography, the Normandy and Brittany coasts are heterogeneous. The coast of Normandy is generally less developed and urbanised than that of Brittany, which also has a higher population density and attracts more people for living and tourism. The whole coast, is characterised by small to medium towns and villages with economies reliant to a significant extent on shellfish farming, tourism and leisure, commercial fishing, agriculture, nuclear power and fuel reprocessing industries, aggregates extraction and, in the future, offshore renewables.

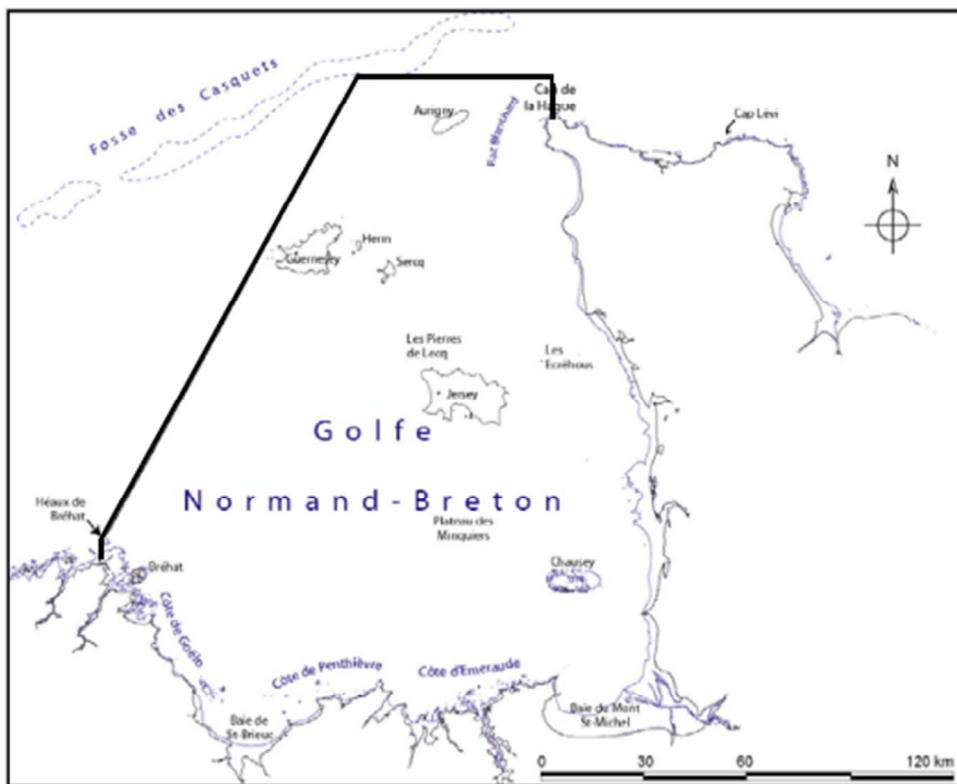


Figure 2.12 Perimeter of the Golfe Normand Breton (GNB)

Governance arrangements

There are many governance structures (MPAs, water management, etc.) in the area but no overall governance structure at the scale of the Gulf Normand Breton. In the context of the proposed marine nature park for the area, a consultation process has been launched in 2011, led by a local AAMP team. This process also had the goal to:

- Acquire more knowledge on the socio ecological system of the area;
- Construct the basis for a marine park with local stakeholders and representatives of the area (with a ‘common culture’ and agreed socio-ecological issues for action).

Currently the marine park has not yet been created. The decision to designate the park lies with the French Minister for the Environmental. The decision to establish the park would trigger the development of a management plan agreed by a steering committee that would be composed of the stakeholders involved in the consultation process. In this context, the VALMER project presented an opportunity to engage potential future members of the steering committee to get them thinking in terms of functionalities and ecosystems services, as well as creating a common culture and comprehension of the ecosystem services concept.

2.5. Golfe du Morbihan (GdM)

Physical environment

The Golfe du Morbihan (GdM) is located in south Brittany, in the Morbihan Department. The boundary of the case study site is the Regional Natural Park (RNP) of the Golfe du Morbihan (Figure 2.13). The area includes 30 municipalities and an associated marine area of 125 km². This marine area is connected to the Atlantic Ocean by a narrow channel. The Golfe du Morbihan is famous for its large richness of biodiversity, natural and cultural heritage, with various habitats (mudflats, rocky foreshores, seagrass beds, etc.) and landscape.

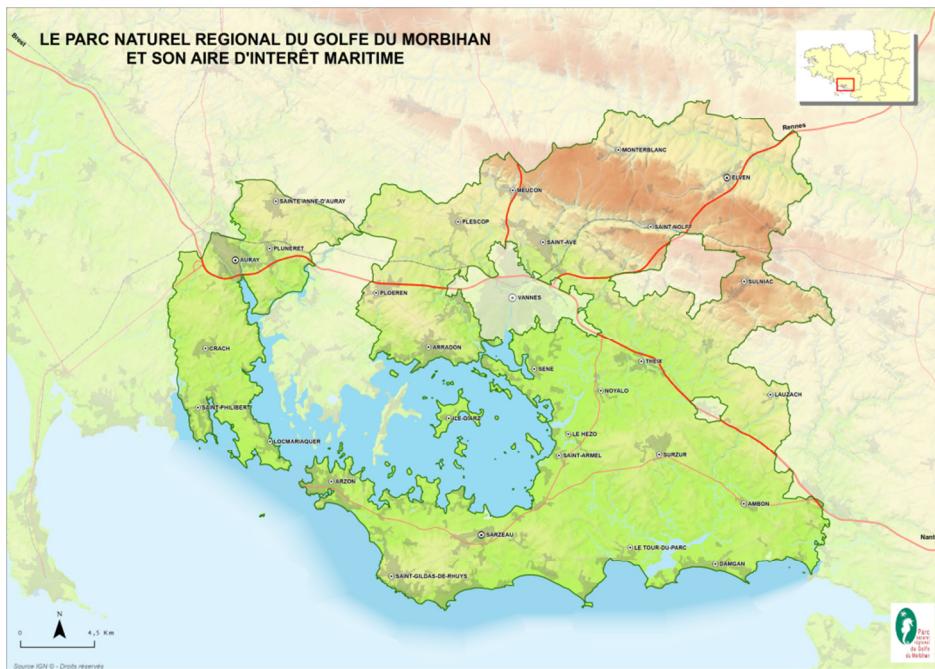


Figure 2.13 Perimeter of the Regional Natural Park of the Golfe du Morbihan

Main activities and uses

The Golfe du Morbihan offers a high quality of life and environment for local people and visitors. The population is about 166,000 inhabitants and it has multiplied by a factor of eight in the last forty years. This demographic pressure on the area and more specifically on the coastline comes as a result of fast and dynamic economic development. Many professional and leisure activities coexist and include shellfish farming, fishing, tourism, sailing etc. The pressure for living-space for people and space for commercial activity impacts on the natural environment, both terrestrial and marine.

Governance arrangements

The aim of the RNP is to achieve sustainable development and one that preserves environmental richness in the long-term. The RNP is a voluntary tool based on a Charter with many actions to implement on the area. The Charter is valid for the next twelve years and engages local authorities in a shared cooperative management approach for the Golfe du Morbihan. It provides a common framework for future actions on water quality, biodiversity, integrated coastal management, natural and cultural heritages, and so on. The Charter includes three key themes:

1. Enhance heritage an asset
2. Support sustainable development
3. Putting people at the heart of all work

2.6. Parc Naturel Marin d'Iroise (PNMI)

Physical environment

The Parc Naturel Marin d'Iroise (PNMI) was created in 2007 off the coast of Finistère between the islands of Ushant, Molène and Sein and the coasts of Crozon headland and Douarnenez Bay (Figure 2.14). The Molène archipelago has the most diverse algae Laminaria fields in Europe and the most extensive ones in France. It is a shallow area of nearly 400 km² with rocky and sandy bottoms, dotted by many small islands. This area is characterized by a huge tidal range and the proximity of the thermic Ushant front that mixes the coastal waters. The sea temperature in the area remains quite low. The mixing prevents seasonal thermocline settlement and the warming of the surface layer. These physical features enable the development of cold water kelp species. Thus, the Parc Naturel Marin

d'Iroise is the southern distribution limit of many species area and *Laminaria digitata* is considered as a sentinel of these species.

The Molène archipelago area is particularly important due to the outstanding natural ecosystems that are home to dozens of species of algae, marine mammals and birds. In addition to its Marine Natural Park status, this region of the Iroise Sea is a marine protected area under the Oslo-Paris convention (OSPAR). A large part of its perimeter is listed under the European Habitats and Birds Directives (Natura 2000 network) and has been recognized as a UNESCO human biosphere reserve since 1989.

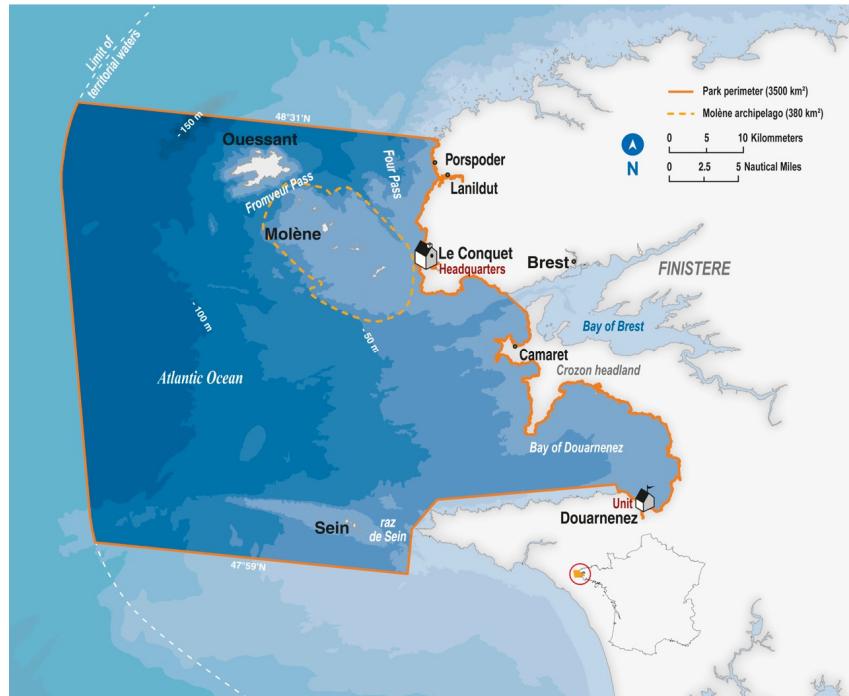


Figure 2.14 Perimeter of the Parc naturel marin d'Iroise (Agence des aires marines protégées, SHOM)

Main activities and uses

The high productivity of the Iroise Sea favours traditional fishing activities and an extremely varied cultural maritime heritage (fisheries and kelp). In recent years, marine wildlife watching activities have been under development in the Molène's archipelago. Also there are pressures associated with the Port of Brest and agriculture.

Governance arrangements

A dedicated commission of the Regional Fisheries Committee (CRPMEM) is in charge of defining proposals for kelp exploitation management rules, which are then amended and standardised by the State representative.

The creation of the Parc Naturel Marin d'Iroise was a long-term participative process which resulted in the creation of a management board, led by the Department Council President and including a wide range of local stakeholders: twelve representatives from the maritime sector (fishermen, shellfish farmers, tourist industry), eleven local elected people (from the Region, the department and the municipalities), nine experts (scientists), eight representatives of other users (recreational activities), six representatives of the State administration, two representatives of environmental Non-Governmental Organisations (NGO) and one elected person acting as board member of the terrestrial Regional Natural Park of Armorique.

Chapter 3 - Case study process: North Devon

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Image: Taw Torridge Estuary mouth; Copyright: airscapedevon.co.uk

1. Description of the Stakeholder Group

The stakeholder group comprised the Marine Working Group (MWG) of the North Devon UNESCO Biosphere Reserve (NDBR) plus additional stakeholders to encompass sectors and interest groups relevant to the case study area (Table 3.1). There were additional stakeholders who expressed an interest in the project and a desire to be consulted and kept informed about the Case Study's progress, but did not attend any workshops.

Table 3.1 Composition and meeting attendance of the North Devon Case Study Stakeholder Group.

Organisation	Sector	Role	MWG‡	Workshop Attendance			
				<i>One</i>	<i>Two</i>	<i>Three</i>	<i>Four</i>
Appledore sub-aqua club	Community	Diver		✓	✓	✓	✓
Coastwise	Community	Co-Chair	✓	✓			
Ilfracombe and North Devon Sub-aqua Club	Community	Diver		✓			✓
Ilfracombe and North Devon Sub-aqua Club	Community	Diver			✓		
Ilfracombe and North Devon Sub-aqua Club	Community	Secretary/Diver					✓
NDBR MWG/Coastwise	Community	Chair	✓	✓	✓	✓	✓
North Devon Yacht Club	Community	Secretary		✓	✓	✓	✓
Devon Wildlife Trust	Environment	Senior Marine Officer	✓		✓		✓
Lundy Field Society	Environment	Chair			✓		
National Trust	Environment	Properties Manager			✓		
North Devon Biosphere Reserve (NDBR)	Environment	Manager	✓	✓	✓	✓	✓
NDBR	Environment	Data Analyst		✓	✓		
NDBR	Environment	Intern					✓
Appledore and Bideford Harbour	Industry/Fishing	Harbour Master		✓	✓	✓	✓
Clovelly Harbour Association	Industry/Fishing	Harbour Master					
Commercial Fisherman	Industry/Fishing	Clovelly Shellfisherman	✓			✓	
Ilfracombe Harbour	Industry/Fishing	Harbour Master		✓	✓	✓	
NDBR MWG	Industry/Fishing		✓	✓			

North Devon Council/North Devon+	Industry/Fishing	Senior Regeneration Officer		✓	✓		✓
North Devon Fisherman's Association	Industry/Fishing	Chair	✓			✓	
North Devon Fisheries Local Action Group/North Devon AONB	Industry/Fishing	Chair/Chair	✓	✓	✓	✓	✓
North Devon/Barnstaple Chamber of Commerce	Industry/Fishing	Former Chair		✓			✓
SEAFish (also D & S IFCA and North Devon AONB)	Industry/Fishing	Chair/Chair/Manager	✓	✓		✓	✓
Sea-scope	Industry/Fishing	Consultant			✓		
Devon and Severn IFCA	Regulator	Deputy Chief Officer		✓			
Devon and Severn IFCA	Regulator	Senior Scientific Officer				✓	✓
MMO	Regulator	Incident Control Officer			✓		
MMO	Regulator	Marine Enforcement Officer		✓	✓		
Natural England	Regulator	Senior Marine Advisor	✓	✓			
Natural England	Regulator	Marine Advisor	✓	✓	✓		✓
North Devon Council	Regulator	Landscape & Countryside Officer					✓
Number of attendees				18	17	11	16

MWG – North Devon UNESCO Biosphere Reserve Marine Working Group

2.Stakeholder engagement process

The stakeholder engagement process is outlined in Table 3.2. All Stakeholder Workshops involved sharing knowledge between stakeholders and the project team. This was structured with presentations explaining the purpose of the workshop and case study progress, with information relevant to specific tasks delivered, after which tasks were undertaken in facilitated breakout groups. The exception was Workshop 3 which was conducted entirely in plenary.

Table 3.2 Stakeholder engagement process.

Workshop	Date	Content	Outputs
1	13 December 2013	<ul style="list-style-type: none">• Introduce marine ecosystem services concept• Introduce project and objectives• Overview of the case study site• Showcase data and validate• Overview of scenario process• Future meetings and ToR	<ul style="list-style-type: none">• Compiled datasets validated• Additional data and wider expert knowledge gathered on ecology, activities and management
2	30 January 2014	<ul style="list-style-type: none">• Recap on project and case study• Overview of scenario process• Scene setting – current activities• Scenario prioritisation• Introduction to scenario development• Developing scenarios	<ul style="list-style-type: none">• Identification of a suite of scenarios for further refinement, with narratives and maps showing resulting changes in activities in the case study area
3	20 March 2014	<ul style="list-style-type: none">• Recap on project and progress towards goals• Presentation of scenarios together with pressure maps• Scenario scoring and discussion• Presentation of ecosystem services assessment• Introduction to the socioecological model	<ul style="list-style-type: none">• Final scenarios for conditioning the socioecological model• Stakeholder understanding of the current state of ecosystem services in the case study area, key areas for service delivery and areas of potential high service provision
4	25 September 2014	<ul style="list-style-type: none">• Case study recap• Scenario development review• Introduction to the socio-ecological model• SES model results• Breakout groups to discuss governance implications	<ul style="list-style-type: none">• Stakeholder understanding of the scenario process• Stakeholder discussion on model outputs and relevance to governance

3.Method to determine which ecosystem services were the focus at that site

Discussions with the NDBR Coordinator and other stakeholders identified a shortlist of five priorities. The “Triage” process (Mongruel et al. 2015, Pendleton et al., in press) was then used (in a deliberative process by experts and through an online survey of stakeholders) to determine the usefulness of an Ecosystem Service Assessment (ESA) for each of the issues shortlisted. The Triage scored each service against a series of criteria: the likely use of ESA outputs in management decisions, the potential for service delivery to change following management intervention and the relative influence of external factors (such as climate change or national policy) on service delivery. Both experts and stakeholders identified subtidal sedimentary habitats as the most appropriate focus.

4.ESA method and brief summary of key results

Habitats across the site were mapped, using recent and historic research as well as modelled maps (see Figure 3.1), and amalgamated into six habitat classes with similar characteristics (Figure 3.1). Different methods were used to determine the level of services provided by each habitat class:

Nursery provision: a literature review determined the preferences of juveniles for sediment type and water depth;

Waste processing: considered bioturbation (how much the species present rework the sediment, and hence the potential for waste to be oxygenated, buried and otherwise neutralised) using empirical data;

Carbon storage: was based on sediment mud content.

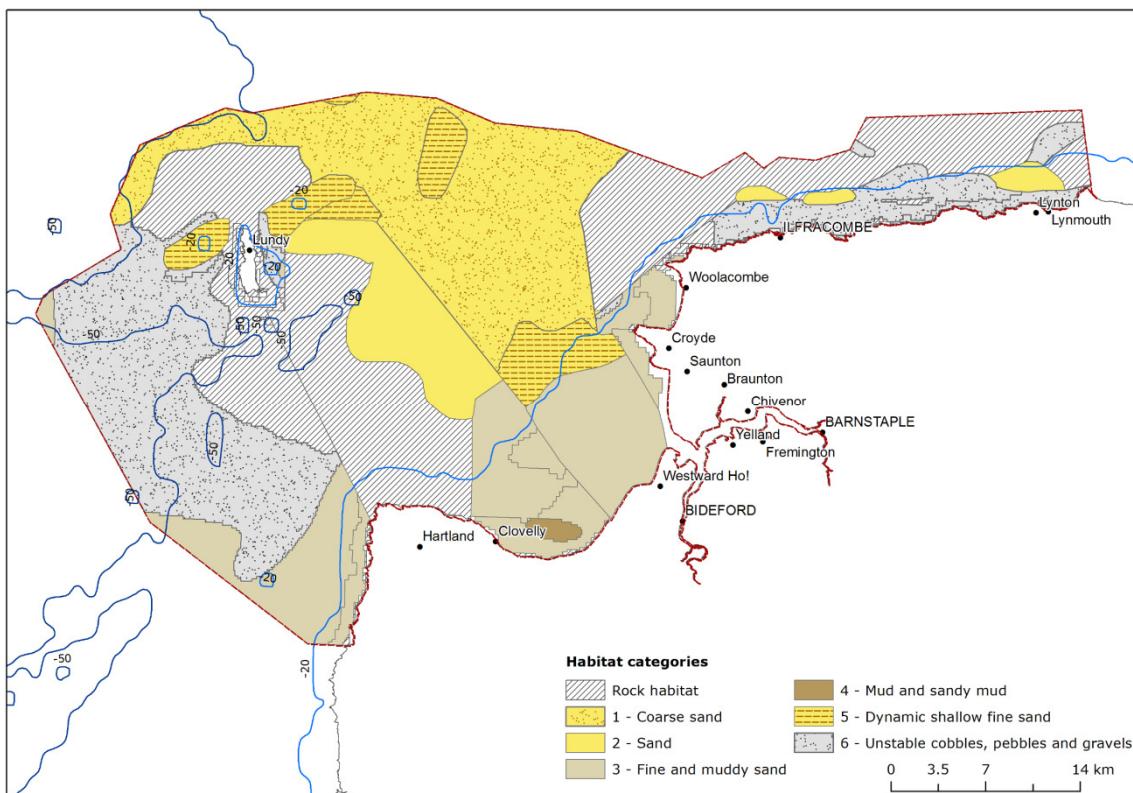


Figure 3.1 Broad habitat types classified according to fishing pressure sensitivity and ecosystem service contribution.

This produced a matrix (Table 3.3) linking habitat types to ecosystem service, using qualitative indicators, which demonstrated that carbon storage was generally negligible due to the absence of vegetated habitats, and waste processing was mostly low, with the presence of large bivalves in coarse sediments key to the delivery of this service. Nursery habitat provision was significant for at least one key species for each of the habitats. A confidence assessment was included, depending on the quality and quantity of the evidence available. An example map of potential service delivery based on the relationship between habitat type and ecosystem service delivery (but not considering the current pattern of pressures that might reduce the provision of ecosystem services) is given in Figure 3.12).

Table 3.3 The relationship between habitat type and ecosystem service delivery.

Habitat category	Nursery habitat					Waste processing	Carbon storage
	Bass, Sole, Plaice	Lobster	Cod	Skates & Rays			
Coarse sands/gravels	Yellow	Yellow	Green	Green	Yellow	Red	
Subtidal stable muddy sands, sandy muds and muds:							
a) sand	Green	Yellow	Yellow	Green	Yellow	Red	
b) fine & muddy sand	Green	Yellow	Yellow	Green	Yellow	Yellow	
c) mud & sandy mud	Green	Green	Yellow	Green	Yellow	Yellow	
Dynamic, shallow water fine sands	Green	Yellow	Yellow	Green	Yellow	Red	
Unstable cobbles, pebbles, gravels	Yellow	Yellow	Green	Green	Yellow	Red	
Confidence	High	Low	Low	Medium	Low	Low	

Potential to supply ecosystem 

5.Scenario process

Within the context of this work, scenario means plausible, relevant management options and rather than internally consistent divergent futures formulated through analysis of possible societal, political and economic changes. The scenarios for this case study were exploratory and built around a 15 year time horizon. The scenario process was divided into five phases (Figure 3.2) and broadly corresponds to the scenario guidelines.

5.1.Phase 1: Characterising the North Devon Case Study area

A Driver-Pressure-State-Welfare-Response (DPSIR) analysis was carried out to characterise the North Devon case study site, focus data collection and inform the ecosystem services assessment, scenario development with stakeholders and socio-ecological modelling work.

- **Drivers** were considered to be proximal (i.e. activities) rather than underlying (social, political, economic or climatic).
- **Pressures** associated with activities were identified via literature review and established frameworks e.g. JNCC activities/pressures matrix, MarLIN.
- **State** corresponds to the subtidal sediment habitats and their ecological communities. Considerable species and habitats records data on the subtidal sediment habitats were collated in a geospatial database in order to generate a composite habitat map of the area, together with a confidence map of the underlying data. This not only informed the ecosystem services assessment, but also provided the foundation layer for the socio-ecological model.
- **Impact** is emergent from this study as the human welfare impacts of pressures on the subtidal sediment habitats.
- **Responses** comprised both the existing arrangement of management interventions e.g. fisheries restrictions, MPAs, plus possible future ones such as the designation of Marine Conservation Zones.

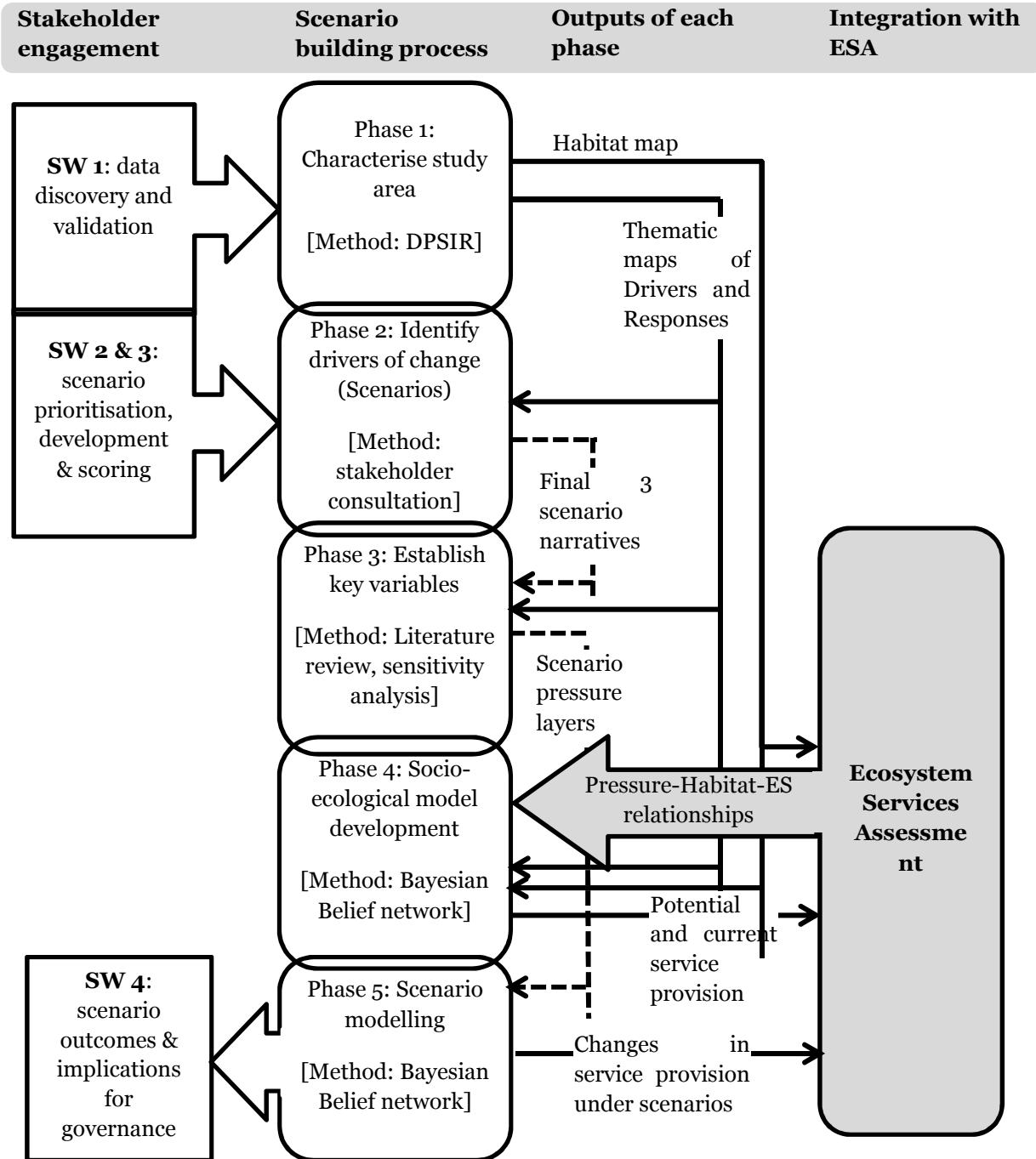


Figure 3.2 Scenario development process indicating stakeholder engagement through four stakeholder workshops (SW) and integration with the ecosystem services assessment.

Maps of the ‘current situation’ were produced to show the spatial extent and where relevant, intensity of indicators for each of the DPSIR elements. These were used in the ecosystem services assessment and comprised the comparator for the socio-ecological model outputs for changes in service flows under divergent management scenarios. The maps were presented to the stakeholder group (Meeting 1) and were supplemented with further data and expert knowledge and validated (Table 3.4). An example thematic map for a *Driver* (ports and shipping) and management *Response* (conservation areas) and the ecological *State* of the seabed (combined habitats map) are given in Figures 3.3-3.5.

Table 3.4 Driver-State-Response thematic maps

DPSIR component	Thematic map	Content
Drivers	Commercial fisheries	Potting Static nets Mobile demersal Lines
	Leisure and recreation	Diving Angling Surfing Boating Bathing Heritage Coast
	Ports and shipping	Maintenance dredging Anchorages Cables Ports and harbours Steaming areas Spoil disposal sites (historic) Protected wrecks
	Aggregates	Extraction sites Resource maps
	Military zones	Production/storage areas (quarry and tank farm) Harbour facilities Military practice areas Areas restricted to military
	Renewable energy	North Devon tidal energy demonstration zone North Devon tidal energy demonstration area Wind energy licence area Atlantic Array cable corridor
State	Subtidal habitats	Combined subtidal habitat map
Responses	Conservation areas	Special Areas of Conservation (SAC) Marine Conservation Zone (MCZ) Recommended MCZ Site of Special Scientific Interest (SSSI) with marine features Area of Outstanding Natural Beauty (AONB) RSPB reserve North Devon Voluntary Marine Conservation Area Nitrate Vulnerable Zone Eutrophic Coastal Area Discharge points (private and water company)
	Fisheries restrictions	Lundy No-Take Zone (NTZ) Lundy No-Towed Gear area Lundy No-Spear Fishing area Whelk Box Ray Box Trevose Box Coastal fixed net restrictions Shellfish waters

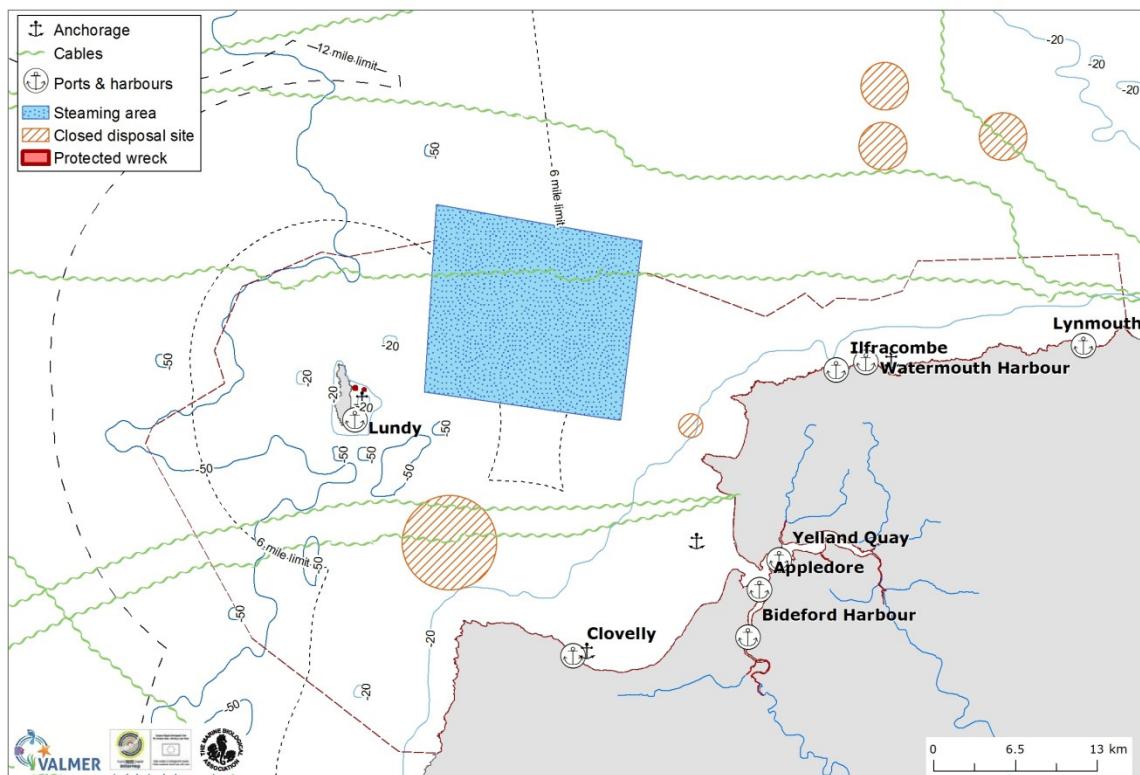


Figure 3.3 Example Driver thematic map - ports and shipping (various sources).

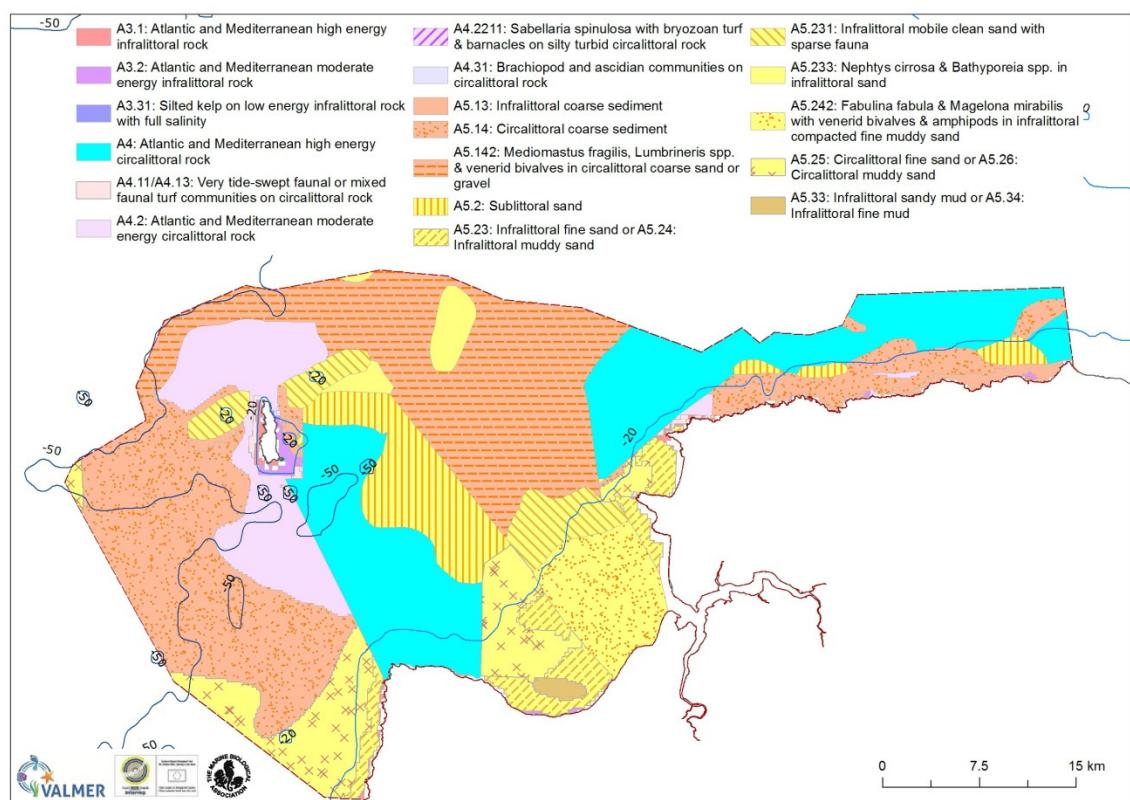


Figure 3.4 Ecological State thematic map: combined subtidal benthic habitats map (sources: RWE surveys, UKSeaMap, Warwick & Davis Bristol Channel sediments, BIOMOR4 (Outer Bristol Channel Survey), Lundy Habitat mapping surveys, Barnstaple Bay grab sampling, MNCR Inlets in the Bristol Channel).

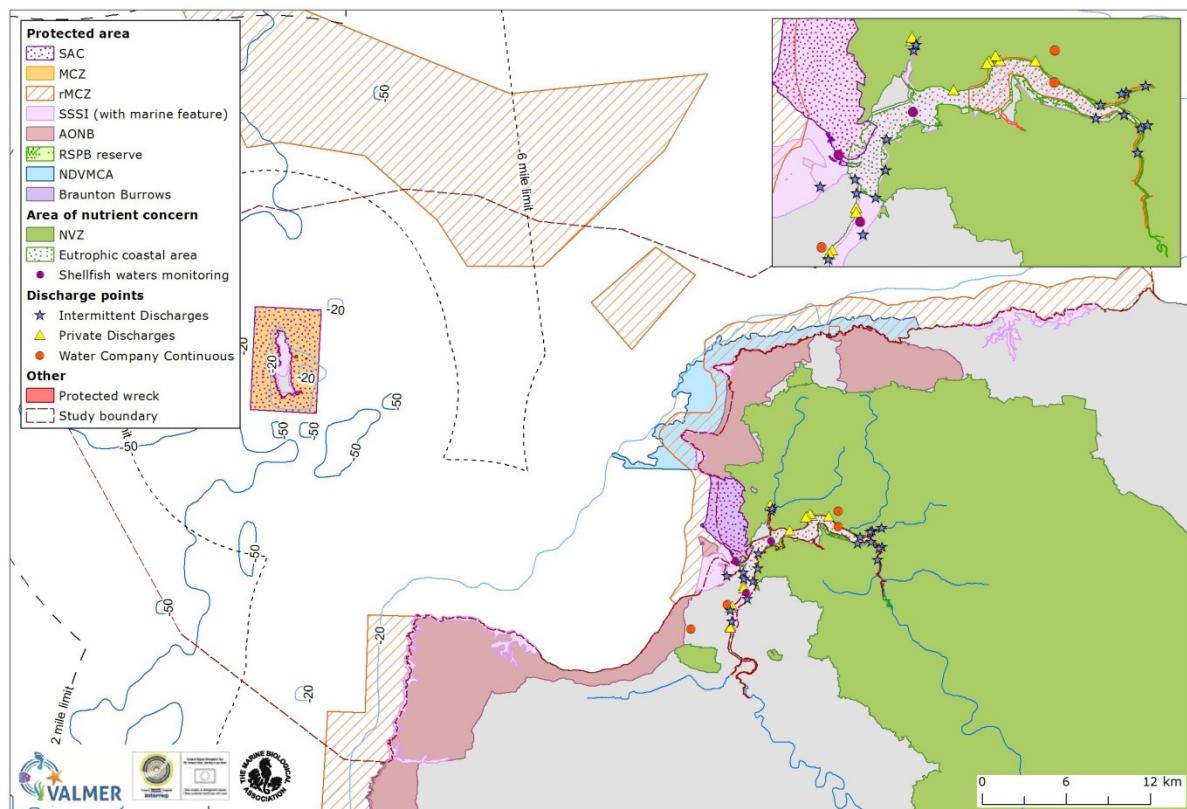


Figure 3.5 Example management Response thematic map – conservation areas (various sources).

5.2. Phase 2: Identifying the drivers of change (scenario themes) using stakeholder consultation

Key issues of local importance were identified and scored, then prioritised during the second stakeholder workshop. The project team further elaborated the resulting scenarios. During this process, some scenarios were excluded because the pressures on the seafloor habitat were hard to quantify or extremely low (below the limits required for the model to detect changes from the current situation). Prioritisation of the remaining scenarios was carried out at the third stakeholder workshop, where some scenarios were also dismissed outright by stakeholders (Table 3.5). The outcome was three scenarios:

- Recommended Marine Conservation Zone (rMCZ) designation
- Aggregate extraction
- Aquaculture development (offshore mussel farm)

Table 3.5 Development of scenarios with stakeholder group leading to the final three scenarios.

Initial scenarios (Stakeholder Workshop 2)	Elaborated by project team	Prioritised at Stakeholder Workshop 3	Final scenarios	Comments
Tidal development	Tidal development			Scored low importance by stakeholders
rMCZ designation	rMCZ designation	rMCZ designation	rMCZ designation	Tranche 2 rMCZs does not include Morte platform, thus two subscenarios including and not including Morte Platform were devised
Coastal change				Drivers and pressures on seabed habitats unclear
Increased nutrients	Increased nutrients	Decreased nutrients		Very restricted area (only within estuary) affected by pressure, ecological impacts uncertain
Aggregate extraction	Aggregate extraction	Aggregate extraction	Aggregate extraction	Extraction site underwent changes due to seabed depth constraints
Blue growth	Blue growth			Scored low importance by stakeholders
Windfarm development	Windfarm development	Renewables array		Very small area affected by pressure, below limits of model accuracy
	Local fisheries management.*			Dismissed by stakeholders - led by fisheries sector
		Aquaculture development**	Aquaculture development	Introduced at Workshop 3 by stakeholders as a replacement to Local fisheries management

* Local fisheries management was suggested at Stakeholder Workshop 2, but time prevented its development during that event, so the scenario was subsequently developed by the project team.

** Aquaculture development was added, at the request of Stakeholders during Stakeholder Workshop 3, as an alternative fisheries development option following the rejection of the proposed local fisheries management scenario.

5.3. Final scenario summary narratives

Marine Conservation Zone designation

Assumption: All five recommended Marine Conservation Zones (rMCZs) in the North Devon Biosphere Reserve area are designated (Figure 3.6).

All of these sites, with the exception of Morte Platform, were included in Tranche 2 of the rMCZs put forward for designation by Defra (2014). However, Morte Platform rMCZ, was put forward by Finding Sanctuary, the South West Regional project, in their recommendations to government in 2011 (Lieberknecht et al. 2011). Thus within the rMCZs scenario two sub-scenarios were constructed to examine the implications of designation both with and without Morte platform included to determine the importance of this site to the provision of ecosystem services.

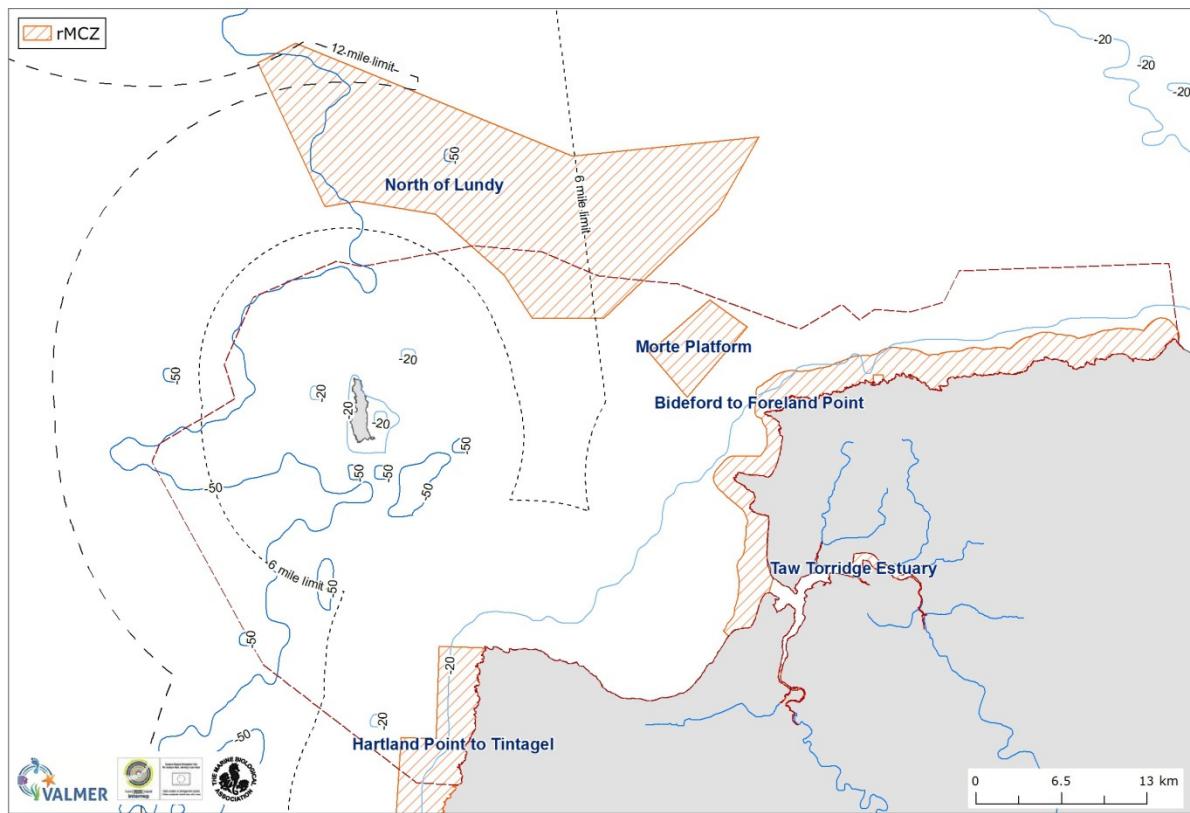


Figure 3.6 Recommended Marine Conservation Zones (rMCZs) within the North Devon Biosphere Reserve area.

Changes to existing activities

Our assumption is that demersal towed gears will be excluded from all rMCZs while static gears would be permitted. The response by the fisheries sector to new byelaws excluding them from rMCZ sites would be variable according to the location of each rMCZ (this is based on discussions with fishermen):

- Demersal mobile effort at Morte Platform and North of Lundy is lost;
- Demersal mobile effort at Hartland Point to Tintagel and Bideford to Foreland Point is displaced to nearby areas (aside from demersal trawling north of Lynmouth which is lost).
- Maintenance dredging within the Bideford–Foreland Point would continue.

Key Drivers

The main drivers for this are international policies on biodiversity conservation, including the Convention on Biological diversity and OSPAR. There is also a requirement for a well-managed network of MPAs within the EU Marine Strategy Framework Directive (2008/56/EC). This is transposed into UK policy within the Marine and Coastal Access Act (2009).

Aggregate extraction

Assumption: An aggregate extraction site is opened within the North Devon Biosphere Reserve (Figure 3.7). The footprint is approximately the same as the current extraction site in the Bristol Channel (86 km²). A combination of different aggregates types (fine and coarse sand) is extracted for use in the construction industry.

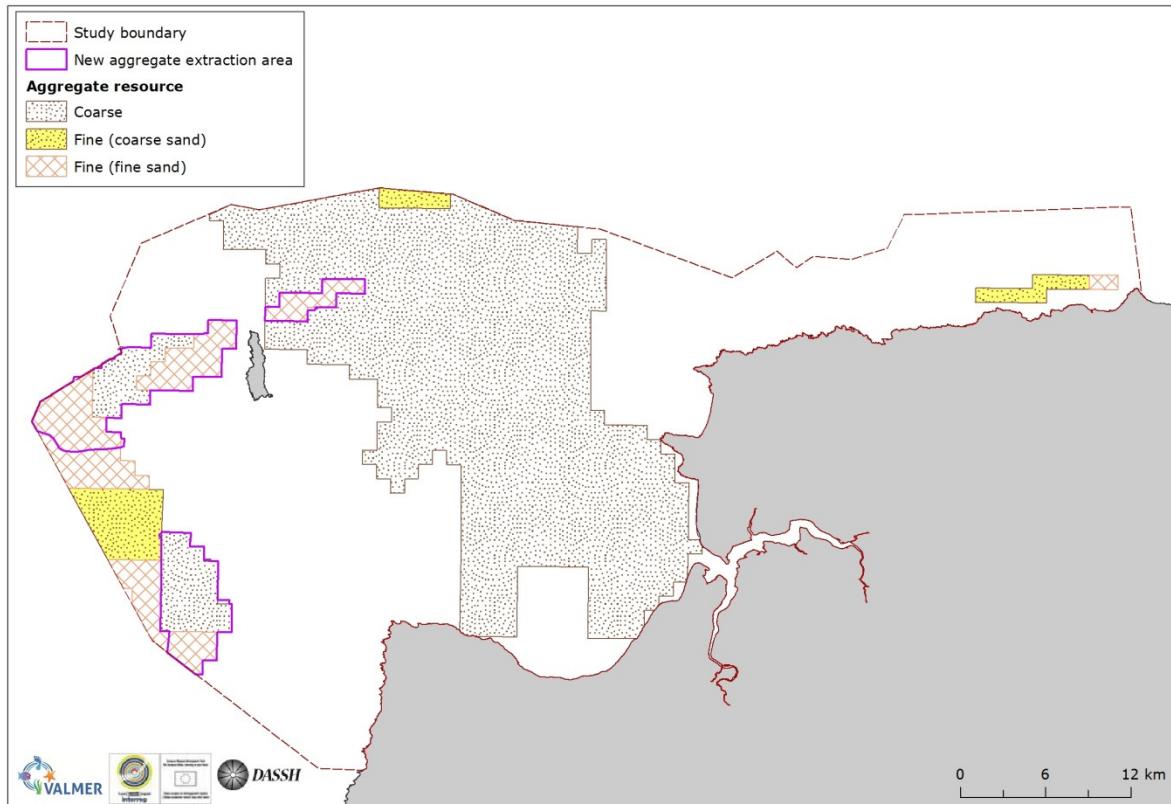


Figure 3.7 Resource map for aggregates in the North Devon Biosphere Reserve area with aggregate scenario extraction sites indicated.

Changes to existing activities

- Demersal trawling would be excluded from the extraction sites and a 1km exclusion zone surrounding them, and displaced into adjacent waters.

Key Drivers

As the UK economy starts to recover, the housing and construction sectors are beginning to grow again. There is a demand for marine sand and gravel.

Aquaculture development

Assumption: An offshore mussel farm is sited in Bideford Bay, the only location suitable within the North Devon Biosphere Reserve (Figure 3.8). It comprises ropes between moorings with suspended mussel ropes.

Changes to existing activities

- Demersal trawling would be excluded from the aquaculture site and a 1km exclusion zone surrounding it, and displaced into adjacent waters.

Key Drivers

Demand for sustainable seafood, and 'blue growth' to increase socio-economic activity in the area are the main drivers of this scenario.

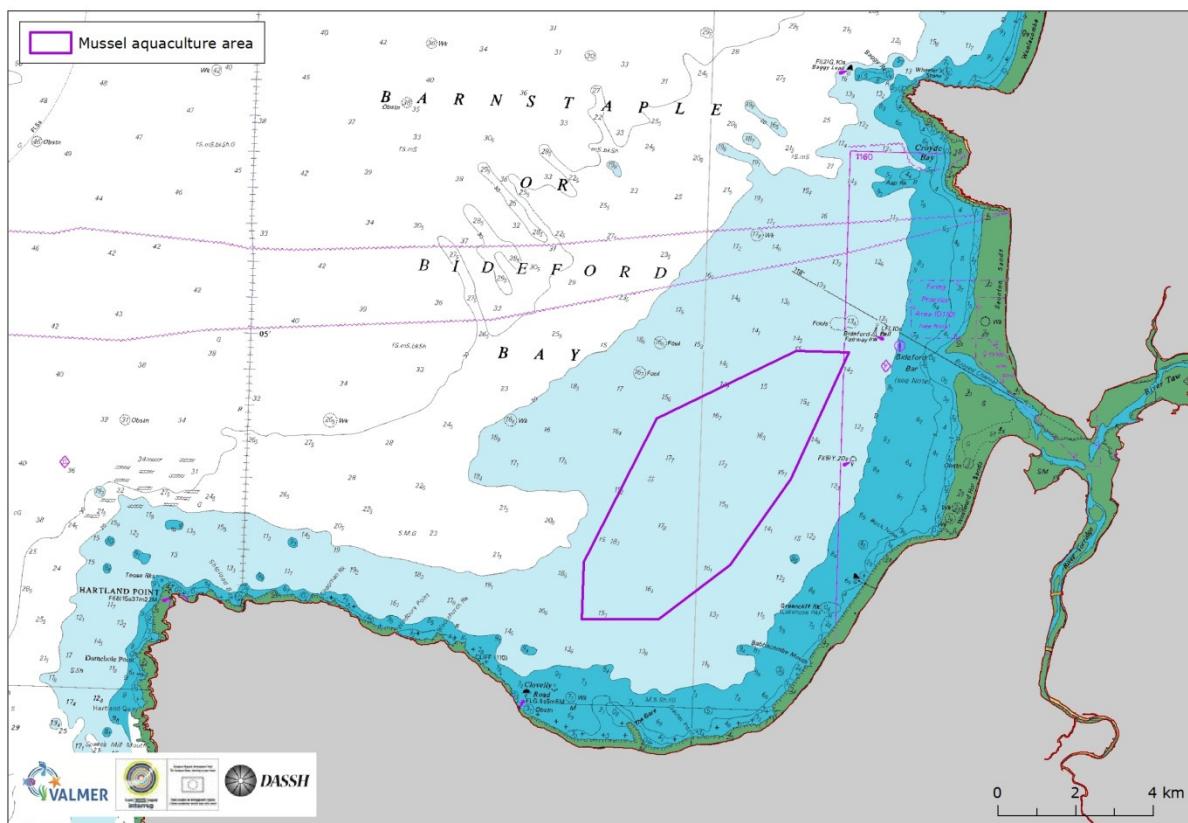


Figure 3.8 Location of the aquaculture development (offshore mussel farm).

Establishing the key variables and developing pressure maps

Pressure maps were developed using the activity maps generated by the DPSIR analysis. Fishing activity was the most important due to its large spatial footprint across the case study area. Levels of fishing activity (given in Finding Sanctuary's Fishermap (des Clers et al. 2008) as boat density per month) were rescaled to align with a known classification of intensities of activities and ecological impacts on benthic habitats (Hall et al. 2008) and comprised the abrasion pressure layer.

Changes in key pressures were identified and quantified from the scenario narratives developed by the stakeholder group in collaboration with the project team. These were represented in terms of changes in intensity and spatial extent relative to the current situation (known activities and their pressures). The effect of these pressures on the subtidal sediment habitats and their capacity to deliver the selected ecosystem services was established from a review of the literature. The results of this work comprised detailed scenario descriptions and pressure layers for conditioning the socio-ecological model (Figure 3.9).

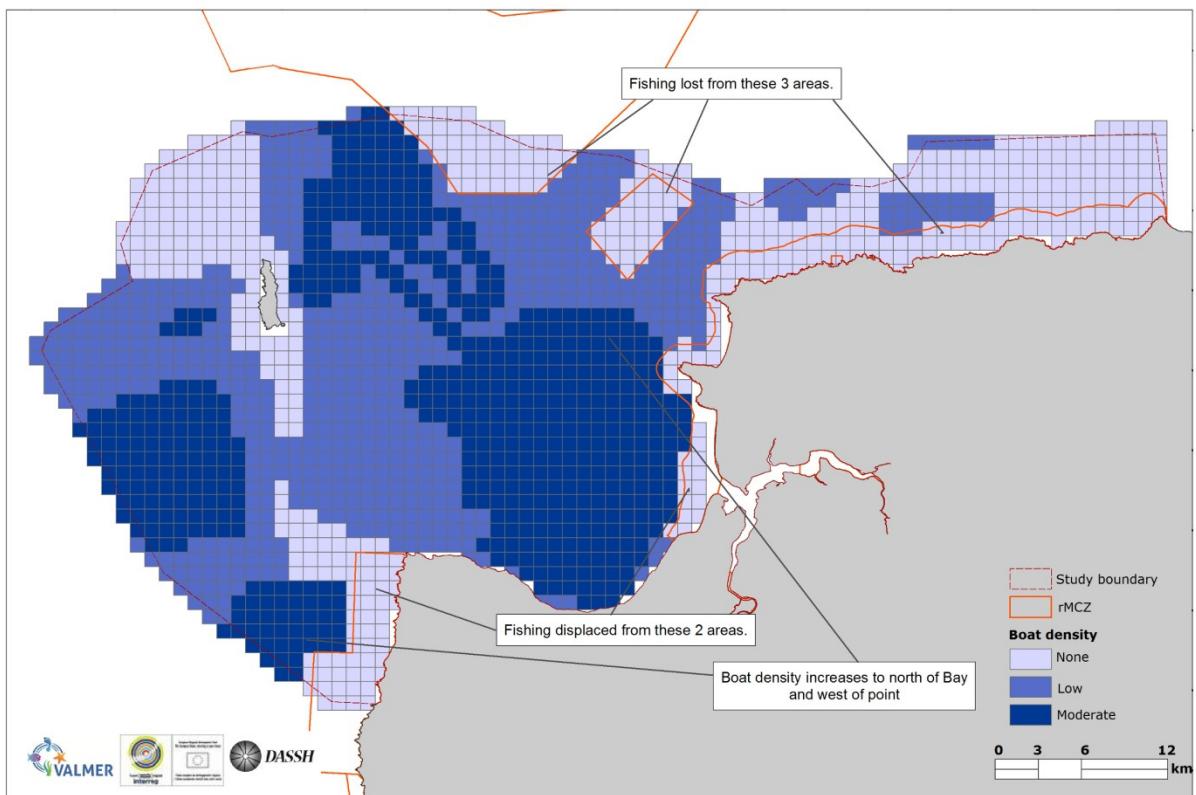


Figure 3.9 Example of a pressure layer used to condition the SES model: intensity of demersal fishing activity as a proxy for seabed abrasion under the rMCZ designation scenario. Loss of pressure and increases due to fisheries displacement are indicated.

5.4. Phase 4: Developing and parameterizing the socio-ecological model

A Bayesian belief network (BBN) model was developed to represent the Pressure – State- Impact relationships for subtidal seabed habitats (Figure 3.10). Nodes comprised four main types:

- GIS derived nodes take data directly from the geospatial database (e.g. habitat type, depth);
- Pressure nodes represent spatial configuration and intensity of pressures under the current pattern of usage and were conditioned to simulate the management scenarios;
- Potential service nodes, showing the potential for ecosystem service provision based solely on geospatial criteria;
- Actual service nodes, representing the influence of pressures on the delivery of ecosystem services, using stakeholder derived weightings to aggregate values.

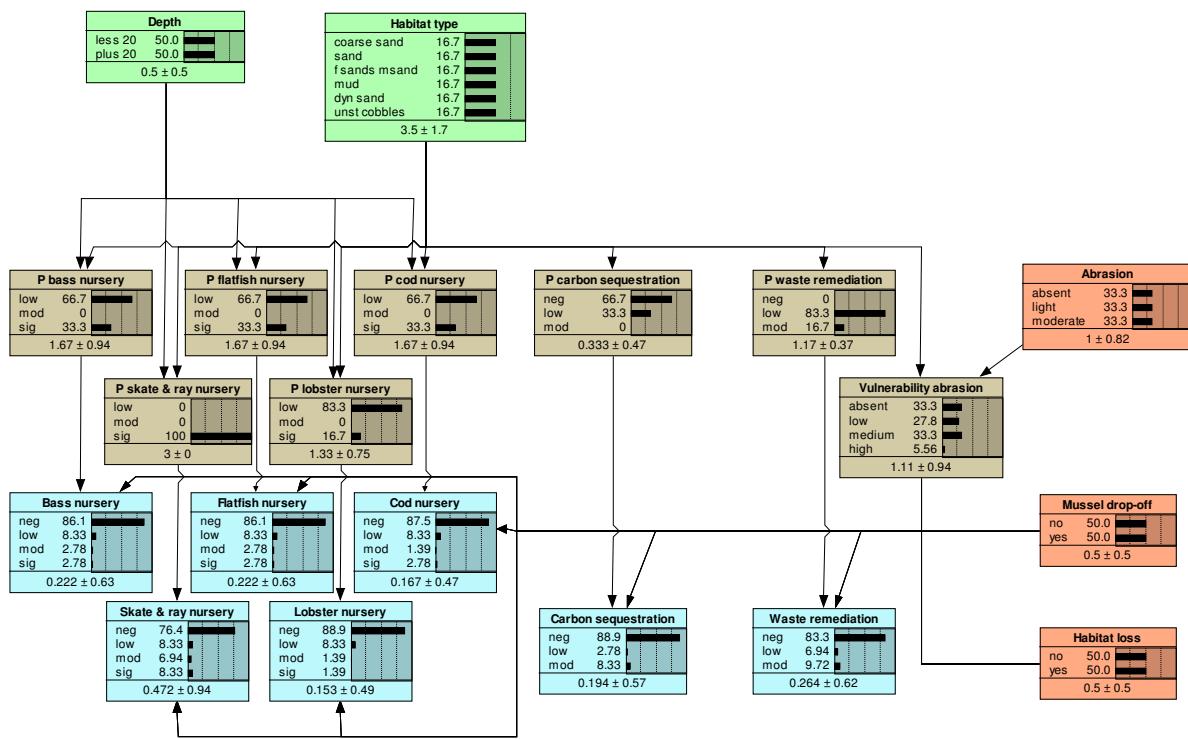


Figure 3.10 Socio-ecological model structure (GIS derived nodes are shown in green; Pressure nodes, brown; Potential service nodes, grey; and Actual service nodes in blue.

The underlying habitat map was gridded using the majority habitat within each and the optimal grid size of 1km² was selected that most accurately represented the underlying habitats (low misrepresentation) and was not unduly computationally intensive (not excessive numbers of grid cells, (Figure 3.11). Grid cells were removed if from the analysis if they:

- contained >50% sea along the landward boundary;
- did not fall within the NDBR seaward boundary; or
- were classified as rock biotopes.

These steps resulted in the final habitat map that was used as the base layer for the socio-ecological model comprising 1142 grid cells. All other layers were gridded to 1km². Scenario pressure layers were gridded, if ≥50% of a grid cell was within a proposed development it was classified with the resulting pressure.

Information on the relationship between pressures, subtidal sediments and their capacity to provide ecosystem services was used to construct conditional probability tables to underpin causal relationships within the socio-ecological model.

The model was run for every grid cell in the habitat base layer: 1) without pressures to generate potential service provision maps for each service type, and 2) with the fishing abrasion pressure map (derived from demersal fishing intensity maps) to generate service provision maps that best represent our understanding of current service delivery in the case study area.

In order to consolidate the information into a single map of aggregated services, stakeholders were asked to weight the different services and the different fishery species, which demonstrated that nursery habitats, in particular for bass, were prioritised.

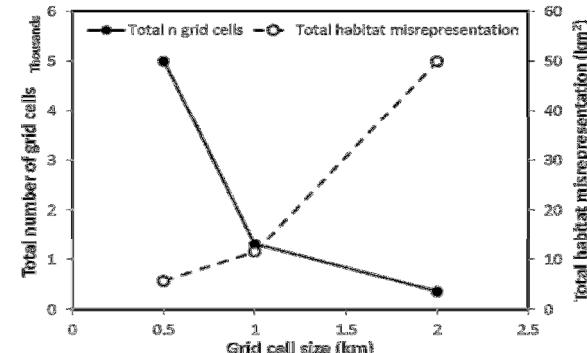


Figure 3.11. Determining the optimal grid size

The combined ecosystem service map for potential provision (not taking into account current pressures) shows moderate levels of ecosystem service delivery throughout much of the NDBR (Figure 3.12). Lower levels of service provision is estimated for the western part and off the north coast due to coarse sediment habitat types that have negligible carbon sequestration and nursery value for plaice, bass, sole and lobster.

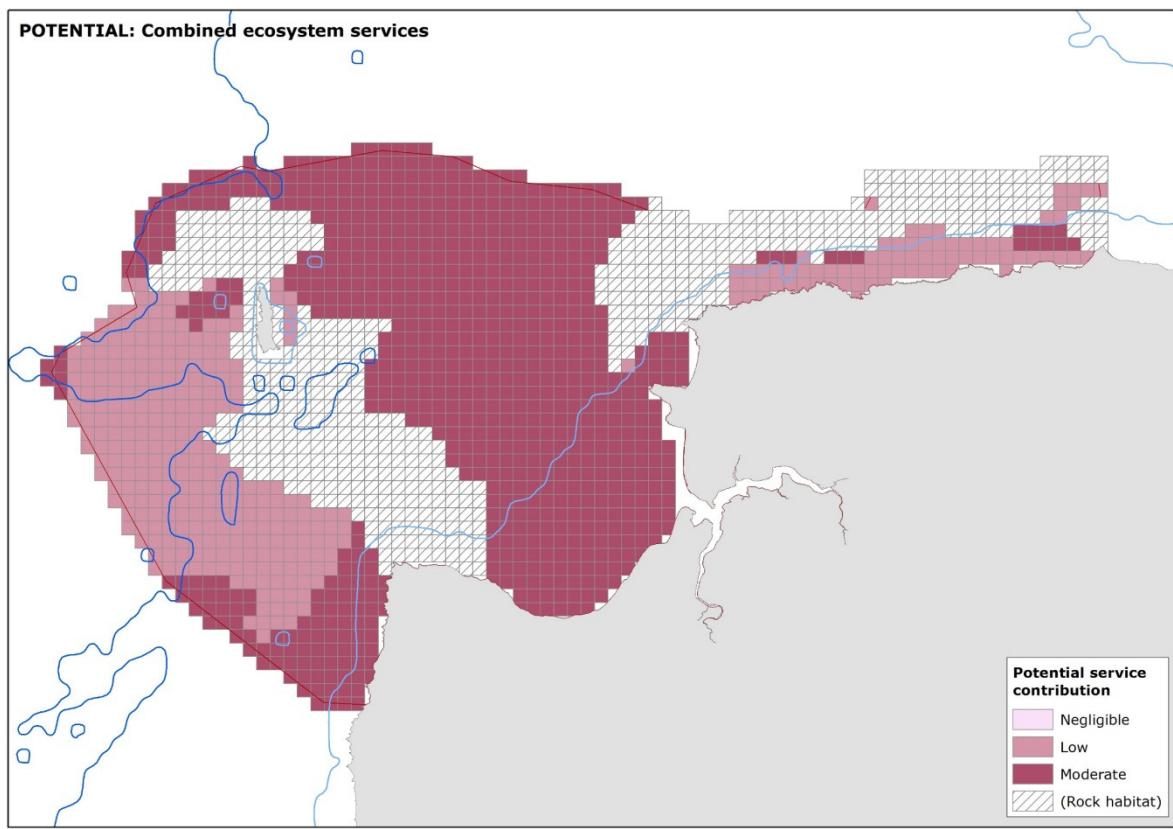


Figure 3.12 The potential combined delivery of nursery habitat, waste processing and carbon storage services across the North Devon Biosphere Reserve, aggregated to take account of stakeholder preferences.

The final map of the current status of aggregated service delivery (taking account of potential impacts from fishing activity) highlighted the importance of, Hartland Point, northwest of Lundy and near the Morte platform in the provision of the services considered (Figure 3.13).

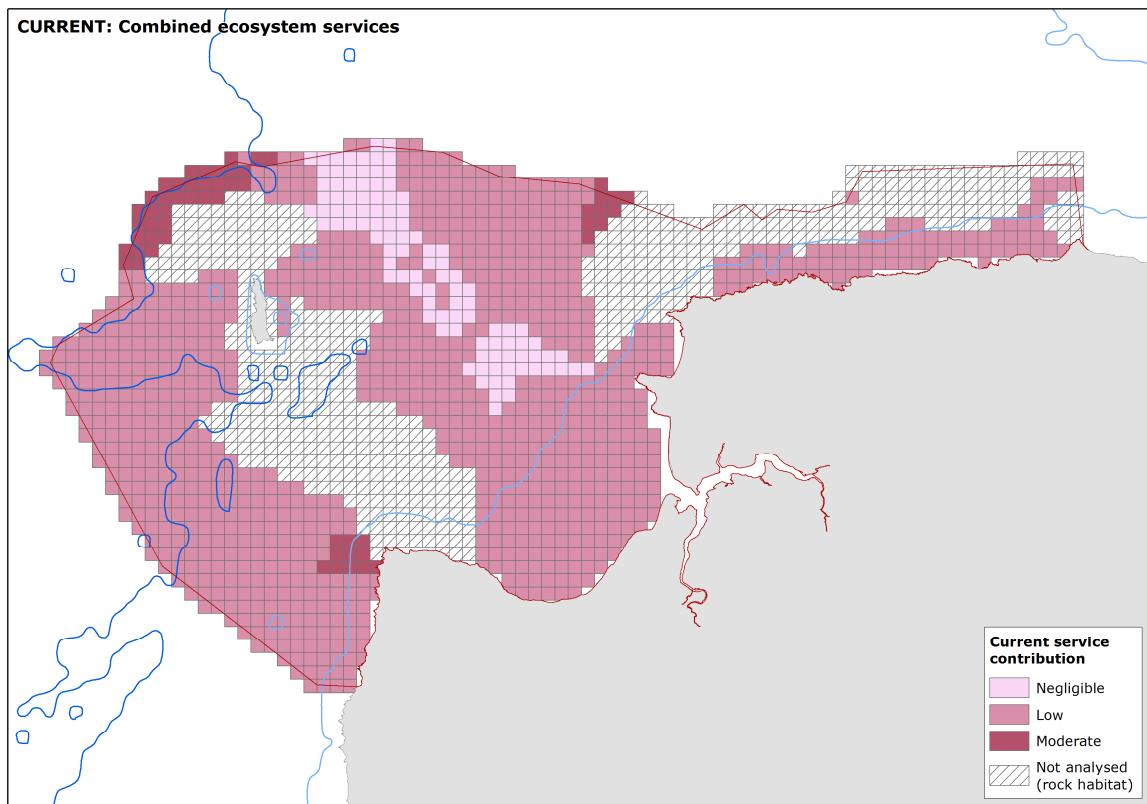


Figure 3.13 Assessment of the current provision of ecosystem services, based on current patterns of fishing pressure. This represents combined delivery of nursery habitat, waste processing and carbon storage services across the North Devon Biosphere Reserve, aggregated to take account of stakeholder preferences.

5.5. Phase 5: Scenario modelling

Pressure maps constructed for each scenario were used to condition the socio-ecological model, comprising direct pressures plus any indirect pressures such as demersal fishing displacement. These were used to condition the socio-ecological model and outcomes in terms of change to ecosystem service provision (relative the current situation) by ecosystem service type and all services combined was mapped.

The scenario outcomes and corresponding spatial patterns of change in ecosystem service delivery varied for each of the three scenarios. For the designation of recommended Marine Conservation Zones scenario, provision of the different ecosystem service types is variable (Figure 3.14); nursery provision is increased in some areas (especially in the North of Lundy rMCZ site) and decreased in others (due to pressure increases from fishing displacement), while both carbon sequestration and waste remediation only increase in service provision in the protected areas since the areas subject to fisheries displacement had negligible service provision under the current scenario.

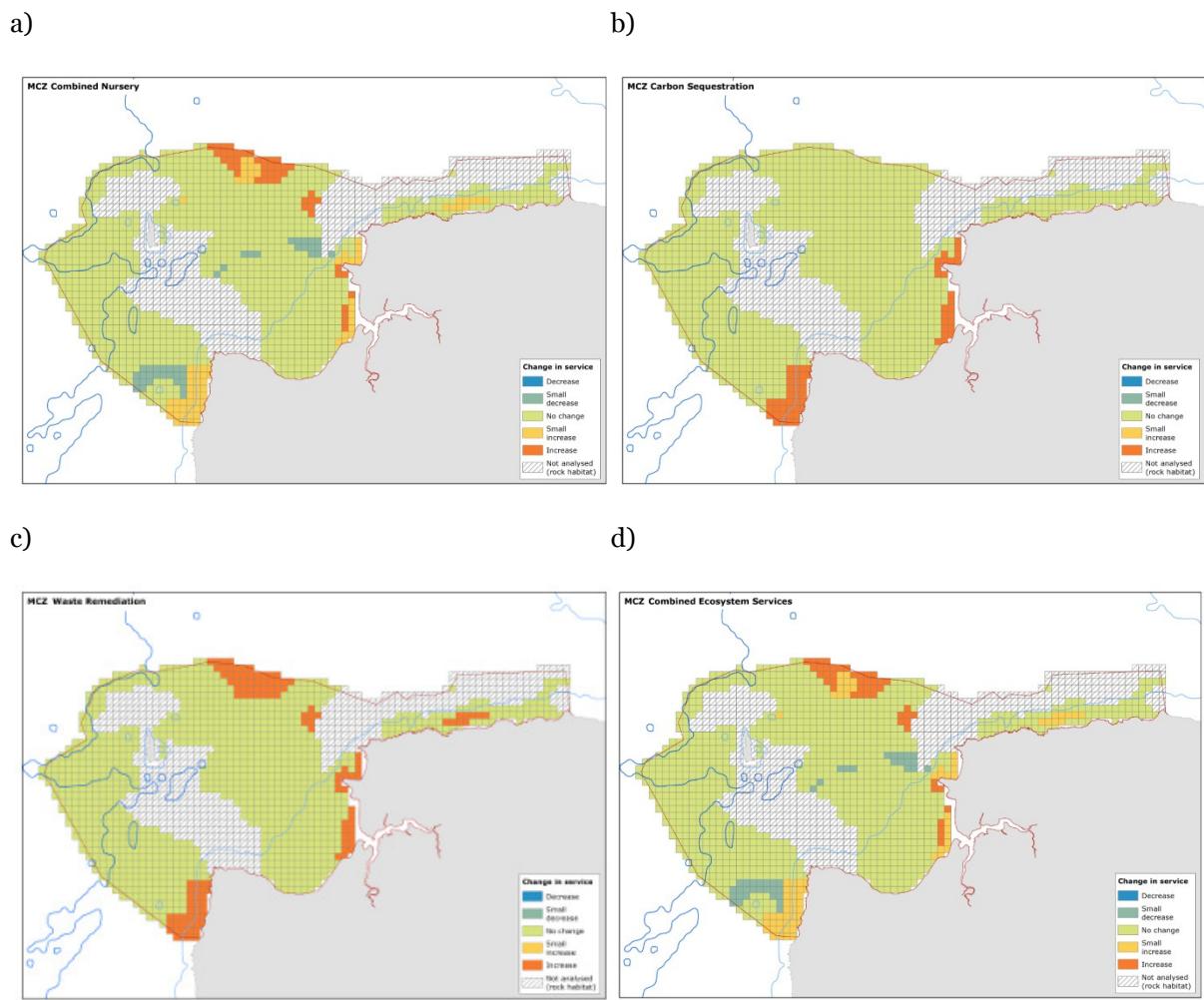


Figure 3.14 SES model derived scenario outcomes showing change in ecosystem service delivery by type (a-c) and combined (d) for recommended Marine Conservation Zone (rMCZ) designation scenario.

6. Conclusions

The BBN socio-ecological modelling framework linked with a geospatial database was an innovative way to incorporate information from the ecosystem services assessment and scenarios developed with stakeholders and elaborate spatially representative changes in service provision. The process was complex and involved many assumptions but these were captured in the process, as was the uncertainty surrounding relationships at each stage.

The main limitations were that:

- 1) Three types of ecosystem service associated with subtidal sedimentary habitats were assessed, there are likely to be more but the linkages are harder to quantify and confidence is generally low (Potts et al. 2014).
- 2) The ecosystem service assessment was presented as increases or decreases in service provision and not valued in monetary terms due to the lack of data for full economic assessment.
- 3) Only subtidal sedimentary habitats were assessed and rock habitat types were not considered in this assessment giving a partial picture of the consequences of management scenarios on the North Devon Biosphere Reserve as a whole (subtidal rock habitats comprise 29.5% of the seabed).
- 4) Intertidal and estuarine habitats were not considered in the ecosystem services assessment, which arguably may have high value for cultural services, but this was outside the scope of this project.
- 5) The combined habitat map, used as a base layer for the model and in the ecosystem services assessment, had variable confidence associated with it; some areas of the NDBR have not

been subject to recent, detailed surveys and were infilled with modelled data (UKSeaMap). This was at the level of broadscale habitats (EUNIS level 3) and it was not possible to resolve key ecological communities that may show differences in habitat sensitivity to pressures or provision of services leading to a lower confidence in our understanding of ecosystem service provision for certain areas (primarily the western part of the NDBR).

- 6) The fishing activity information used to develop the abrasion layer was based on Finding Sanctuary's Fishermap. This represents the density of vessels using an area per month. It was used as a proxy for abrasion of the seabed by demersal trawl gear. More detailed information on patterns of fishing activity, trawl paths and the actual footprint on the seabed from demersal trawling would greatly improve our ability to represent the current provision of ecosystem services, and also increase the accuracy of any modelled changes in provision with management interventions.

The scope of the case study had to be constrained to maintain tractability, but it is clear that the results would be greatly improved from better ecological and socio-economic spatial datasets. However, the application of a spatially linked BBN is novel and represents a significant advance in the field of socio-ecological modelling and ecosystem services assessment, not least as it was able to combine information of very different types:

- stakeholder derived scenarios
- geospatial records on seabed habitats
- literature derived information on habitat sensitivities to activities, linkages between habitats and ecosystem services provision and pressures linked with human activities.

This represents the first application of a spatially representative BBN to explore ecosystem service delivery in a marine system at a local scale with real world management application. Socio-ecological modelled ecosystem service provision is already being used by managers such as the Inshore Fisheries Conservation Authority and UNESCO Biosphere Reserve Management to inform their activities and will likely contribute to evidence for designation of Tranche 2 rMCZs in the North Devon Biosphere Reserve.

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Chapter 4 - Case Study Process: Poole Harbour

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Image: Poole Harbour Rush Hour; Copyright: Poole Tourism

1. The VALMER stakeholders and engagement process

The Poole Harbour case study was subject to restricted staff resources and shorter time frames compared to the other five VALMER case studies. In consequence, the Poole Harbour stakeholders were not actively involved in the ESA process or in scenario building, which is the main VALMER mechanism for integrating ESA into site governance. The case study coordinator did, however, liaise consistently with Poole Harbour Commissioners (PHC) throughout the ESA process to ensure that the ESA results would be relevant to PHC and the other Poole Harbour Steering Group (PHSG) members. This liaison directly built upon Dorset County Council and Dorset Coast Forum's (DCC/DCF) existing relationships with the PHSG and harbour users which have been fostered over many years through

initiatives such as the C-SCOPE pilot marine planning project; with ongoing liaison to continue after the life of the VALMER project.

The key stakeholder group involved in the VALMER Poole Harbour case study was the PHSG. The case study coordinator attended a number of PHSG meetings to inform the stakeholders about VALMER and the Poole Harbour ESA and to discuss the ESA results and their application in site governance with the group. In addition, the case study coordinator arranged a number of face to face meetings with the PHC given their integral role in harbour management so as to brief the Poole Harbour Master and Chief Engineer on aspects of the project.

At the PHSG meeting in May 2013, the stakeholders were introduced to the VALMER project and the Poole Harbour case study. The Travel Cost Method and Analytic Hierarchy Process were explained and preliminary results from the surveys presented. The stakeholders were not given any information about the ecosystem services approach more generally, such as, for example, an explanation of what ecosystem services are or examples of the different types of ecosystem services. The Poole Harbour ESA results were presented to the PHSG at the November 2013 meeting.

To capture the stakeholders' VALMER experience and evaluate their understanding of ESA and their views on the usefulness of ESA as a marine governance tool, the VALMER team conducted a number of surveys with members of the PHSG. This included a before and an after questionnaire and follow up interviews. Table 4.1 lists the organisations that were represented in the VALMER Poole Harbour stakeholder group and indicates who took part in the various VALMER surveys.

Table 4.1 The table lists the organisations whose representatives on the PHSG took part in the VALMER before/after survey and interviews and identifies the type of stakeholder category that these organisations represent

Organisation	Stakeholder category	'before' survey	'after' survey	Interview
Borough of Poole	Local government authority	✓	✓	✓
Purbeck District Council	Local government authority	✓	✗	✗
Environment Agency	Governmental body - environment	✓	✗	✗
Natural England	Governmental body - environment	✓	✓	✓
Southern IFCA	Governmental body - marine	✓	✗	✗
MMO*	Governmental body - marine	✓	✗	✗
PHC (3 representatives)	Harbour authority	✓	✓	✓
		✓	✗	✗
		✗	✓	✗
Wessex Water Services Ltd.	Water company	✓	✓	✓

* The MMO is not officially a member of the PHSG but plays a role in the management of Poole Harbour as a national governmental body. They were represented at the meeting at which the VALMER project was introduced and the 'before' survey circulated.

To disseminate the results more widely to other harbour users and stakeholders, DCC/DCF in collaboration with PHC held an open evening meeting was held 29th January 2014. In total, 45 attended including survey respondents, councillors, local authority officers, PHC representatives, National Governing Body representatives, activity club representatives, Non-Governmental Organisations (NGO)/charities/organisations (e.g. Environment Agency, Dorset Wildlife Trust and National Trust) and various water sport businesses from around Poole Harbour.

2. The VALMER ESA in Poole Harbour

As stated, Poole Harbour is used extensively by the public for a wide range of leisure and recreational activities, with over twenty recreational activities occurring in and around the harbour. Recreation is clearly a significant use and economic activity both locally and within the Dorset area. Despite this, the number of recreational visitors and the value of recreation to the local economy have never been quantified. Furthermore, the relationship between the recreational activities and reliance on ecosystem services within the harbour is currently not well understood. This was the starting point for the VALMER ESA coordinated by the DCC/DCF. The Poole Harbour ESA focused on the valuation, in monetary and non-monetary terms, of the cultural benefits of recreation supported by the harbour's marine ecosystem. As stated by the case study coordinator, this information was felt to be key, "*we knew this was a gap in knowledge that we wanted to get values for*" (PH case study coordinator).

The study focused on generating new data for six popular water-based activities which frequently occur in the harbour: kitesurfing, windsurfing, bird watching, jet skiing, water skiing and kayak/canoeing. The stated aim for this ESA was to identify and understand the monetary value, priorities that users place on the natural attributes of the harbour, and opinions on management of their activity.

2.1.ESA methods

Two periods of data collection were undertaken for the Poole Harbour ESA, the first in 2013 and the second in 2014. The first piece of data collection comprised a visitor survey for the six activities conducted during April to August 2013, with the survey tailored to the specific activity being assessed. The surveys were primarily carried out online, although some postal surveys were sent to those renewing personal watercraft licences and other paper surveys were handed out at key sites where the activities are known to take place, e.g. Brownsea Island and Arne for bird watching and a number of launch sites for water-based activities.

To secure the desired number of respondents, i.e. one hundred per activity, DCC/DCF invested considerable time to raise awareness and engage as many people to help complete surveys. This engagement also raised interest and anticipation of the results amongst managers and users of the harbour. To promote the survey, leaflets were developed and distributed widely, a webpage was developed to act as a point of contact for participants (www.dorsetforyou.com/valmer) and national sport governing bodies, local clubs and water sports shops and tuition businesses were contacted. Social media, national publications and local press were also used to promote the survey and seek respondents.

Within the surveys, a monetary value for each activity was determined using the travel cost method, which considered how much people spent to travel to Poole Harbour to undertake their chosen activity. Information on local spending during their visit was also collected. The respondents were also asked to prioritise different characteristics of Poole Harbour, using a multi-criteria analysis (the Analytic Hierarchy Process) to weight their preferences for environmental quality, cost and facilities (Figure 4.1). Survey respondents were asked additional questions, including how certain management issues would affect their continued use of Poole Harbour.

An overall monetary value for the six recreational activities, it was necessary to know the total number of people undertaking each of the activities. As this information was also lacking, DCF commissioned ecological consultants Footprint Ecology to undertake count surveys between May and August 2014, which involved 55 boat-based transects across the harbour and beam counters deployed for 80 days at bird watching at Arne and the Dorset Wildlife Trust's nature reserve on Brownsea Island.

'How important are these three characteristics to you when compared to each other?'



1. The Environment:

- the enclosed, sheltered nature of the harbour and views of the water and coastline
- wildlife
- clean water in the harbour



2. Facilities:

- car parks and toilets
- slipways, moorings and bird hides
- cafés, shops, accommodation



3. Cost Factors:

- ferry/car parking charges
- permit fees/slipway fees
- nature reserve entrance fees



1 A. Water quality:

This describes how clean and clear the water is in the harbour, including bathing water quality.



2 A. Wildlife:

This describes the different animals (for example, fish and birds) and the habitats in which they live (such as seagrass beds and saltmarshes).



3 A. Views of the coastline:

This describes the appearance of the harbour, overlooking the water.

Figure 4.1 Analytic Hierarchy Process for Environmental Attributes in the harbour

2.2. ESA Results

In total 546 survey responses were received, with half of the respondents living locally to Poole Harbour. This data was collated by DCC/DCF and the socio-economic analysis done by Plymouth Marine Laboratory (PML). Results suggest an annual spend (on travel and local expenses) of £3.1million across the six activities considered. Birdwatching contributed over 60% of this, due to the high number of participants. The Analytic Hierarchy Process suggested that environmental quality, and particularly the presence of wildlife, was most important to users' enjoyment of recreation in Poole Harbour. However, in terms of management options that have the potential to increase and decrease visitor numbers, the management of water quality was found to be key to sustaining levels of participation in recreational activities.

Chapter 5 - Case study process: Plymouth Sound-Fowey

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Image: Whitsand Bay, Cornwall; Copyright: National Trust

1. The VALMER stakeholders and engagement process

In the Plymouth Sound-Fowey case study, the ESA process was informed and validated by local management stakeholders. Whilst there is not a singular body or forum coordinating stakeholder engagement and management, a culture of working together and collaboration currently exists. Within the case study area there are a number of stakeholder groupings that undertake cross-sectoral coastal and marine management, for example the Tamar Estuaries Consultative Forum, Fowey Estuary Partnership and the Cornwall AONB Partnership.

A Task and Finish (T&F) Group was established for the project. It consisted of key stakeholders responsible for the management of marine and coastal areas within the case study site (Table 5.1 and 5.2). It included representatives from local government authorities, environmental and marine governmental bodies, local harbour authorities, landscape and estuary management partnerships and NGOs. Whilst the case study extended beyond Cornwall, representatives from the local authorities in Devon indicated that were happy not to participate in the T&F as the case study's management focus would relate only to the Cornish coast and seas.

Table 5.1 The VALMER Plymouth Sound to Fowey stakeholder group. The table divides the organisations or groups represented in the stakeholder group into categories and indicates whether the representatives took part in the 'before' and 'after' survey and stakeholder interview.

Organisation/group/etc.	Stakeholder category	'before' survey	'after' survey	Interview
Cornwall Council: Environment, economy, sustainability, heritage and harbours. (5 representatives)	Local government authority	✓ ✓ ✓ ✓ ✓ ✓ ✓	✓ ✓ ✓	✓ ✓
Natural England (2 representatives)	Governmental body - environment	✓ ✓	✓	✓
Cornwall IFCA	Governmental body - marine	✓		
MMO (2 representatives)	Governmental body - marine	✓ ✓	✓	✓
Fowey Harbour Commissioners	Harbour authority	✓	✓	✓
Cornwall AONB	Management partnership	✓		
Tamar Estuaries Consultative Forum	Management partnership	✓		
National Trust	NGO – heritage and conservation	✓	*✓	✓
Cornwall Wildlife Trust	NGO - wildlife	✓	*✓	✓

Table 5.2 The four Plymouth Sound-Fowey VALMER stakeholder workshops, including a description of the aims and main activities

Task and Finish Group Workshops	Aims	Main activities
WS1 May 2013	Introduce the project, its aims and the ecosystem services approach Introduce the rationale and aims for the case study Introduce the stakeholder to each other and agree a Terms of Reference for T&F membership Selection of ESA focus	<ul style="list-style-type: none"> • Completion of Work Package 4 stakeholder 'before survey' • Presentations on: the VALMER project; the Plymouth Sound-Fowey case study site; ecosystem services and ESA; the use of ecosystem service valuation for governance; visualising spatial data for ESA • Discussion and agreement for the scope and focus for the ESA • Request for stakeholder-held data
WS2 March 2014	Validation of scenario focus for the case study Commencement of scenario building process with stakeholders Validation and enhancement of socio-ecological and governance models of the case study	<ul style="list-style-type: none"> • Presentations on: VALMER project update; data collection and baseline mapping for the site; cultural ecosystems services research; the case study scenario building approach; • Breakout sessions to: validate and enhance socio-ecological model of the case study; validate and enhance governance modelling; PESTLE analysis • Activities and discussion to work up the preferred options for scenario development
WS3 June 2014	Scenario development	<ul style="list-style-type: none"> • Presentations on: VALMER project update; three themes for scenario building, including selection rationale; principles of backcasting scenario building approach • Three consecutive scenario building sessions to develop actions for each theme
WS4 October 2014	Scenario and ESA results	<ul style="list-style-type: none"> • Presentations on: VALMER project update, findings of Cultural ecosystem service research project, ecosystem services and the ESA process; • Individual presentation and discussion of the baseline ESA results and ESA of three scenarios • Completion of Work Package 4 stakeholder 'after' survey • Discussion of next steps, outputs and VALMER legacy

2. The VALMER ESA in Plymouth Sound–Fowey

2.1. Selection the ESA Focus

Identification of the ESA focus was guided by the VALMER case study team, in dialogue with members of the Task and Finish Group. These discussions addressed a number of important issues, for example:

- What were the important ecosystem services and benefits), and site management issues and concerns?
- What could be achieved realistically with the resources available, including data and maps?

Through discussions with stakeholders it was agreed that a broadscale ESA would be undertaken, entailing valuation and mapping of all marine and coastal ecosystem services within the site, wherever possible. This was felt to be a useful approach and that the associated outputs had the potential to benefit a range of marine and coastal management. 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.

A key consideration within these discussions was a desire by the Cornwall Council case study coordinator to explore how the ESA and associated scenario development process could support the implementation of the previously mentioned Cornwall Maritime Strategy. The strategy explicitly states that it should be ensured, “that a sound evidence base, including socio-economic impacts and valuation of ecosystem goods and services, is used to inform all strategic decision making in the maritime area” (Cornwall Council 2012, p. 16).

The ESA process consisted of four connected steps:

1. a baseline assessment of key ecosystem service in the case study area
2. stakeholder generated hypothetical future actions (resulting from the scenario building process undertaken during stakeholder meetings)
3. actions developed into three hypothetical scenarios
4. scenarios applied to the baseline with associated recalculation of the ESA for each of the three scenarios

2.2. Scenarios for Assessment

The third VALMER Plymouth Sound to Fowey T&F Group meeting saw stakeholders participate in scenario building exercises that generated 47 theoretical actions which could deliver environmental aims of the Cornwall Maritime Strategy. These were then assessed by the case study team which considered the suitability of each of the actions for the subsequent ESA. Factors which were taken into account included the potential for the action to result in tangible effects on ecosystem services at the case study scale and whether gaps in the information needed to undertake the ESA could easily be filled. The first sifting process saw the Case Study team recommending that 19 of the 47 actions may be suitable for the ESA stage of the project, either alone or as grouped scenarios. A subsequent sifting process prioritised three scenarios suitable for ESA in the time available. The case study team set out a number of assumptions for each scenario in order to boundary them for the purposes of the ESA. Where possible, the assumptions were based on stakeholder-developed theoretical actions. The three hypothetical scenarios’ developed for assessment were as follows:

Recreational boating – exploring changes in ecosystem services delivery associated with changes in mooring type and a reduction in ecological footprint on the seabed.

MPAs – exploring changes in ecosystem services delivery associated with introduction of MPAs in the case study with high levels of protection i.e. no extraction or deposition.

Dredge disposal – exploring changes in ecosystem services delivery associated with closure of two disposal sites with combined materials taken to a re-opened site within the case study area further offshore.

2.3. ESA Methods and Results

The ESA was undertaken by PML in collaboration with the Marine Biological Association (MBA) who provided data and GIS mapping support. Whilst this approach used existing data, the project added considerable value through its Data Discovery exercise, processing, analysis and presentation/visualisation for a baseline assessment. 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 (Willis et al., 2014).

The baseline assessment of multiple services was refined to focus on nursery habitats for commercial species, carbon storage, sea defence and waste processing (considering the supply of clean water, immobilisation of pollutants and nutrient cycling). This component of the study took a spatial approach, mapping the delivery of the services based on information within the literature concerning linkages between habitats and services. A primarily qualitative assessment was made of how services might change under the management scenarios. Some quantification and monetary valuation was however undertaken for carbon storage. The assessment of cultural services (Willis et al., 2014) used

an online and face-to-face survey with local residents, containing a spatial component in which each respondent was asked to indicate three locations that were considered special, significant or valuable and three that were unpleasant, neglected or challenged.

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. The sand and coarse habitats that cover much of the case study site provided negligible levels of carbon storage relative to other habitats, although value of the site for carbon storage nonetheless amounts to £1.4million per year. These habitats play a greater role in nutrient cycling and the provision of clean water. The value of the increased carbon storage 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. Connections were both shared and cultural, such as the historic and natural importance of the area. Memories and a sense of place or affinity with the environment were also important to people. Results highlighted a number of areas which managers could address to improve wellbeing through improved access to the coast, whilst mapping areas of significance and places perceived as under threat resulted in a series of hotspots which coastal managers could focus their efforts on.

2.4. Governance mapping to support the ESA

The case study governance framework analysis highlighted a large volume of plans and strategies with numerous inter-linkages, horizontally amongst the plans themselves and also vertically in relation to the activities and to marine ecosystems within the site. In response to this, Plymouth University sought to map these governance connections. The purpose of this was twofold: firstly to trial methods for constructing and visualising governance, with the second objective relating this work being used by the stakeholder to support scenario development within the case study. The mapping activity was shown to the Task and Finish Group during two of the stakeholder workshops, allowing them to improve and validate the connections between strategies and to feedback on visualisations methods, for example Microsoft PowerPoint and web-based versions (Figures 5.1 and 5.2). Positive feedback from stakeholders highlighted the value they could see in such mapping and visualisations, to help simplify the complex governance landscape that they as managers and regulators operate in. It also allowed stakeholders to explore connections amongst various aspects of site governance and interventions within marine ecosystems; thus supporting greater awareness of ecosystem-based management. The final version was developed in collaboration with the MBA to create a web-based interactive site. It is supported by a Microsoft Excel file that makes nodal connections between organisations, strategies, legislation, marine sectors and activities. These are then highlighted when the viewer clicks on a node of interest (http://dassh.ac.uk/demonstrations/valmer/valmer_governance_2/) (Figure 5.3).

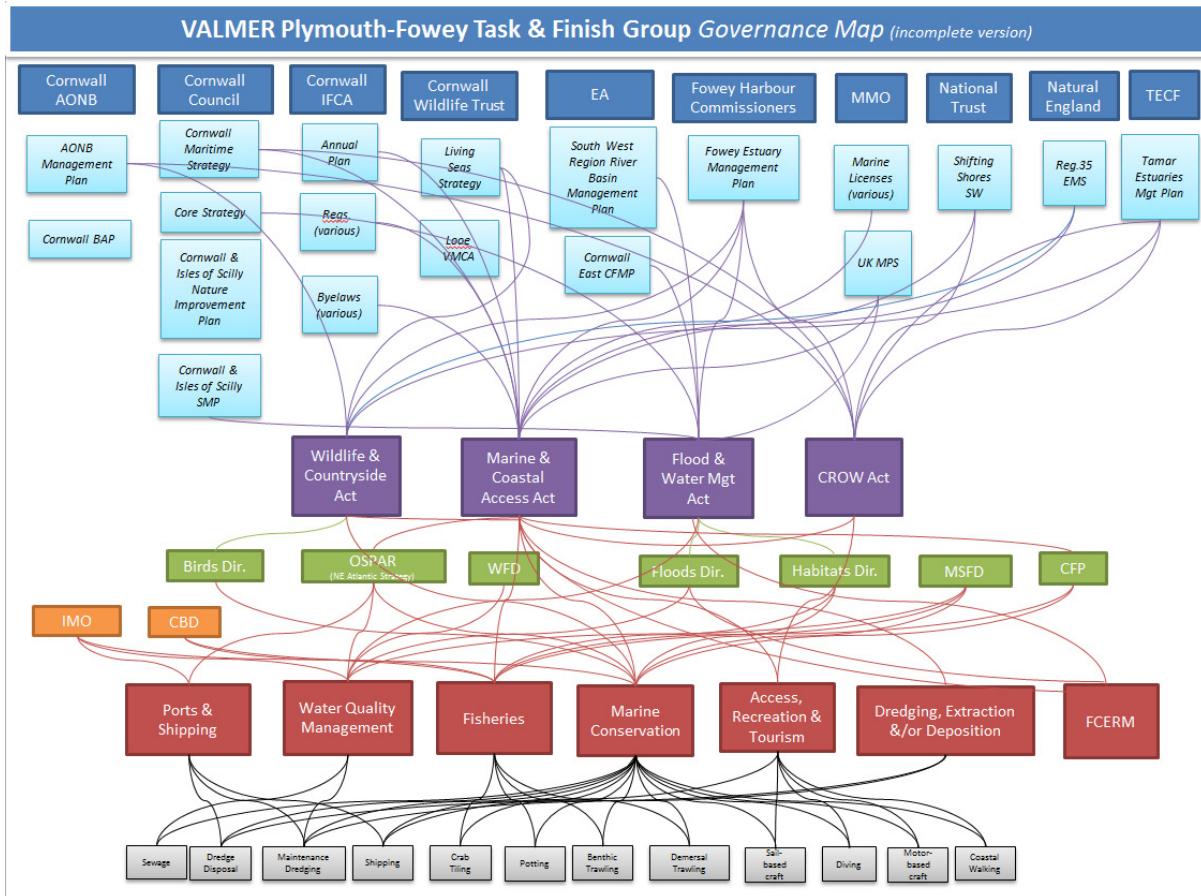


Figure 5.1 An early iteration of the Plymouth Sound-Fowey governance mapping, showing connections between Task and Finish Group member's plans and strategies, the supporting legislation, and connections through to marine and coastal sectors and activities within the site

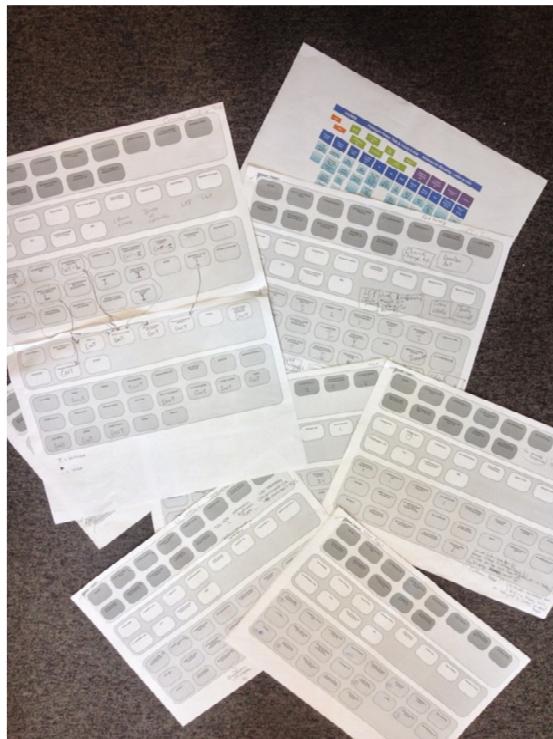


Figure 5.2 Stakeholder input into the governance mapping

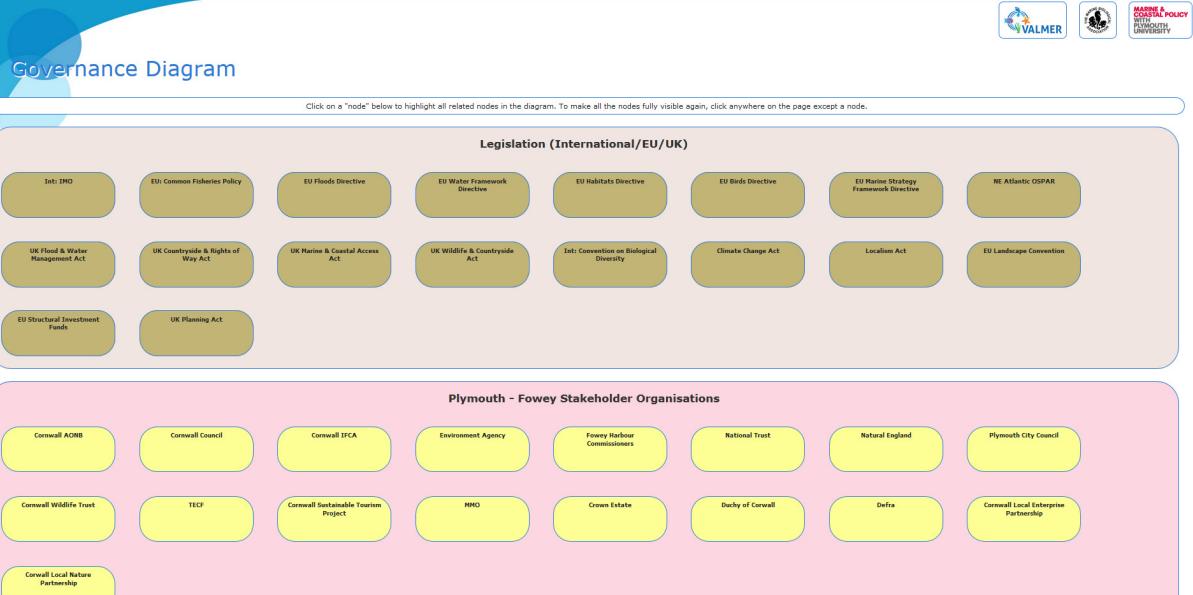


Figure 5.3 Screen grab of the web-based governance mapping, by clicking on one of the boxes known as 'nodes', all the related nodes then highlighted to the viewer

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Chapter 6 - Case Study Process: Golfe Normand Breton

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Image: Saint Pair sur Mer Territoire; Copyright: K. Dedieu/AAMP

1. The VALMER stakeholders and engagement process

In the Golfe Normand Breton, the VALMER project has been run by the team in charge of the natural marine park project. The stakeholders that were engaged in the VALMER project were local stakeholders that have been involved in the marine park consultancy process in the past. The aim of the VALMER team was to maintain broad participation by a high diversity of stakeholders. The local focus of the project was therefore very large, not sectoral and not focused on a particular habitat or service.

The stakeholder group included representatives from:

- Local government authorities (Region, Counties)
- Governmental agencies
- NGOs
- Recreational clubs and interest groups
- Commercial fisheries interest groups
- Shellfish farming interest groups
- Business interest groups
- Natural area managers
- Ministry representatives (administrations in the regions)

The VALMER team organised regular workshops (Figure 6.1) in which the stakeholders were provided with information in order to create an equal level of knowledge and a common comprehension of the issues and were actively engaged participatory activities. In addition, face to face interviews and focus groups were conducted. This created a very dynamic process which was based on the construction of scenarios to imagine possible futures. The ESA was a parallel process, run by experts. The project team linked the two processes mainly by including ESA elements in the scenarios at the end of the project.



Figure 6.1 Steps of the scenarios approach developed in the GNB case study site

2. The VALMER ESA in the Golfe Normand Breton

2.1. Aims of the ESA

Within the Golfe Normand Breton case study site a range of different marine and coastal habitats and ecosystems provide a suite of different services and benefits. These services contribute to local economies in various ways and more broadly to human wellbeing. Covering the greater part of the case study area are subtidal muds, sands, and gravels that incorporate a surprising range of habitats and are home to a rich variety of flora and fauna. Although intertidal marine habitats, composed of sandy or rocky foreshores, saltmarshes or biogenic reefs, are less widespread, they also remain very important because they supply a range of ecological functions essential to the life cycles of marine species. A wide range of potential services and benefits from these marine habitats was identified but the key ones are fish and shellfish stocks, marine materials stocks, carbon sequestration, cultural heritage, leisure and recreation and storage and nutrient cycling.

The Golfe Normand Breton marine park will manage the Natura 2000 marine sites and will have to write the DOCOB's (aims document). The ecosystem services approach provided the opportunity to help the definition of future actions for the Natura 2000 sites though a new approach, i.e. functional and not sectorial (N2000 is focused on the protection of listed species and habitats and currently actions do not take into account the functioning of the marine environment).

Three main aims have been identified through the Triage process (Figure 6.2):

- 1) Carrying out an initial diagnosis of ecosystem services in the Golfe Normand Breton
- 2) Anticipating future changes by exploring changes in ecosystem services in the Golfe Normand Breton to facilitate trade-offs of priorities for a more integrated management of the sea
- 3) Sharing a common culture

At the end of the project, it became apparent that because of the context of the site (a large area with many different issues), the scenarios were very qualitative and that their main goal had switched from anticipating trade-offs to creating a common culture by thinking collectively about different futures in terms of ecosystem services.

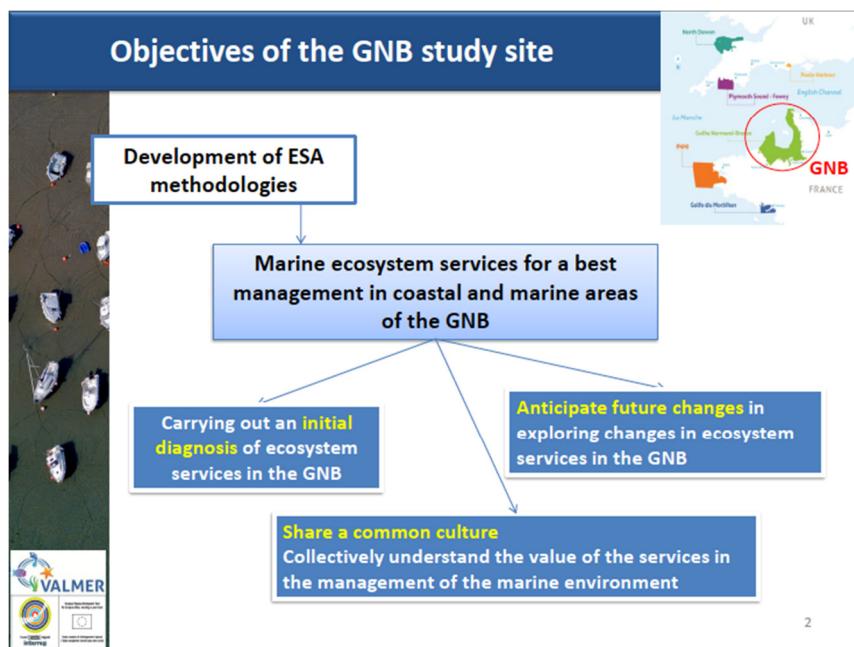


Figure 6.2 Objectives of the GNB case study site

2.2. Ecosystem services assessed in VALMER

After consulting local stakeholders, two main topics were identified to produce an initial diagnosis of ecosystem services in the area and to help anticipate of future changes:

1. Food services offered by coastal and offshore marine habitats
2. Recreational services offered by foreshore marine habitats

2.3. What are the links between the ESA and scenarios?

In the Golfe Normand Breton the ESA has been led entirely by the scientific team of the project, providing a range of very advanced methodologies to provide an initial diagnosis of the situation. The marine park has not been created yet so there is no collective management process. Therefore it was not possible to use and share this new knowledge with stakeholders in the context of decisions on specific management issues. In this context, the scenario exercise was very important so as to include and engage local stakeholders in our examination of ecosystem services and to create a common culture around those new concepts. Participatory scenarios will provide four contrasting visions of the future (ecological and economical/governance state). The work developed within the ESA helped to describe qualitatively the ecological consequences of each future for functionalities and ecosystem services. By helping to characterise the current situation (relative importance of economic activities), the ESA helped to illustrate the consequences of degradation of ecosystem services on those activities.

3. The scenario approach in the Golfe Normand Breton

3.1. What were the aims of the scenarios?

The aim of the scenario exercise in the Golfe Normand Breton was to provide a few contrasting future scenarios, helping us to think collectively about their consequences in term of ecosystem services and creating a common culture of understanding.

In this context, the development of exploratory scenarios was a good way of collectively exploring different management actions and socio-economic and environmental possible dynamics in this area.

The scenarios developed in the Golfe Normand Breton explore a range of possible management situations, economic and governance hypothesis, associated anthropogenic pressures (e.g. fishing, shellfish farming, moorings, decreasing water quality, invasive species, etc.) and natural process (e.g. climate change) that could have an impact on marine habitats and their ability to provide the various ecosystem services identified.

The final goal of the process is to determine, as quantitatively as possible, how the scenarios affect the functional, provisioning and recreational ecosystem services, using the results of the ESA done for the area. To achieve this, a collective approach that involved gathering interested stakeholders and VALMER scientific team (ecologists and economists) of the Golfe Normand Breton, started during the autumn 2013.

3.2. Description of scenarios developed in VALMER

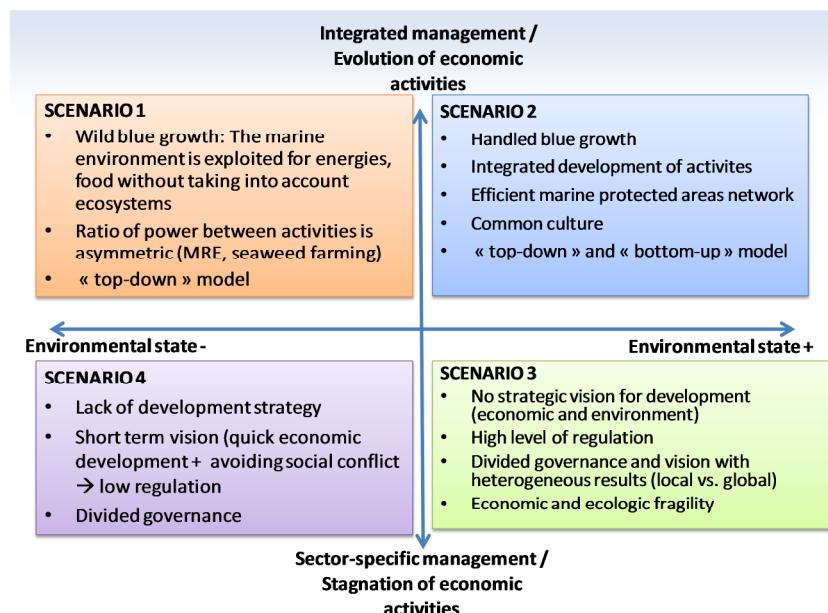


Figure 6.3 Summary of the four scenarios developed in the GNB case study site

Four scenarios were developed in the project (Figure 6.3):

- **SCENARIO 1:** rapid industrialisation to create growth and employment in an economic crisis context (Figure 6.4).
- **SCENARIO 2:** harmonious development of activities in a protected environment.
- **SCENARIO 3:** passive model where the lack of a proactive strategy leads to the vigorous enforcement of environmental policy (seen as a constraint) in a compartmentalised socio-economic framework.
- **SCENARIO 4:** deliberate ignoring of economic and environmental constraints, driven by short-term view, leads to a gradual degradation of the marine environment and the activities that depend on it.

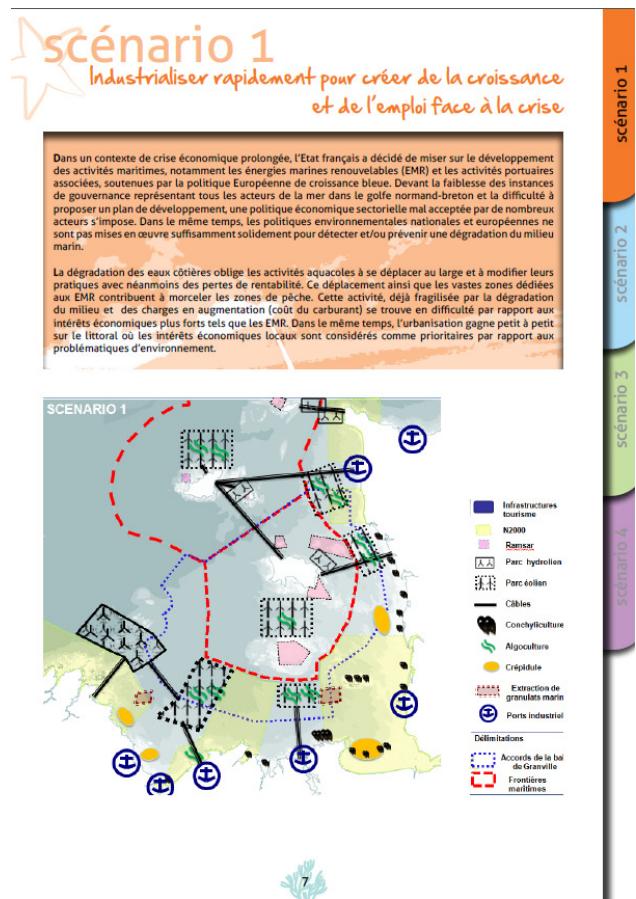


Figure 6.4 Visual restitution of the scenario 1 developed in the GNB during the VALMER project

3.3. Use of scenarios outputs for management

The developed scenarios were disseminated through brochures and a knowledge platform made available to stakeholders and concerned institutions. They were also presented in a more interactive way at the end of the project during the validation seminar (workshop 4). During Workshop 4, some stakeholders pointed out that well-presented scenarios could help them understand the issues in their areas (risks/opportunities) and explain these to others.

The developed scenarios take into consideration the perceptions of a wide range of stakeholders from most of the activities in the Golfe Normand Breton, including: European/national/local policies, state of the environment, strategic development of some sectors, etc. Therefore, the scenarios could be useful material to contribute to the preparation of a future marine park management plan.

Due to the management situation, the aim of the VALMER project was to produce contrasting exploratory scenarios to lay out different potential future situations in terms of ecosystem services. Some of the scenarios are more “desirable” than others but all of them are the results of a multiplicity of hypothetical process. Therefore, it is not possible to provide management recommendations at this stage despite having characterised triggering/risk factors that make us fall into the “undesirable future”. The preferred scenario would require agreement at a more formal level in the future for it to become operative.

Chapter 7 - Case Study Process: Golfe du Morbihan

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² AMURE Laboratory, University of Brest



Image: Arzon; Copyright: SIAGM

1. The VALMER stakeholders and engagement process

The VALMER stakeholder engagement process in the Golfe du Morbihan was specific to the subject chosen. There was no pre-existing forum of stakeholders. Common practice in the Golfe du Morbihan is to create “task and finish groups” for each project according to the interest of the stakeholders in the subject of the project. After having identified all the potential ecosystem services of the seagrass beds and the activities that could have an impact on it, the project team invited all concerned stakeholder groups to participate to different workshops (Figure 7.1) and interviewed 50 stakeholders in the Golfe. Over the course of one year, around 100 people have been involved in the project. Each of the workshops included presentations of the topic, issues and project updates of the project as well as mapping and brainstorming sessions. The scenario workshop was based on the SWOT method (Strengths, Weaknesses, Opportunities, Threats) and the Regnier Abacus method (see VALMER guideline documents about scenarios for more information).

18th Sept 2013



Figure 7.1 Stakeholder engagement process in the Golfe du Morbihan case study site

The stakeholder engagement process was based on three idea: (1) people are fully welcome to contribute to the project with their ideas and knowledge of the Golfe; (2) by having an intense rhythm of meetings, a good dynamic is maintained and people do not have the feeling that the project is going slow; (3) transparency is ensured in the delivery of the project progress and results, including the organisation of a final open event. This event was run on the 4th December 2014 and was open to anyone interested. 115 people participated. The open event encompassed a mix of presentations on the project, stakeholder and managers round tables, experience transfer from other sites and time for exchange (Figure 7.2).



Figure 7.2 Seagrass event, 4th Dec 2014, Golfe du Morbihan (photo:M.Philippe)

2. The VALMER ESA in the Golfe du Morbihan

2.1. Aims of the ESA

The Regional Natural Park (RNP) is the overall coordinator of the Natura 2000 area in the Golfe du Morbihan. This is an important area for seagrass beds, the second largest area in the metropolitan France after Arcachon. Seagrass meadows are not algae but flowering plants. They live mainly on sandy-muddy substrates in sheltered marine areas. These remarkable habitats are protected at international, national and local levels through different legislation and conventions (e.g. BERNE convention, OSPAR convention, European Habitat Framework Directive, local ordinances). Two species of seagrass are present in the GDM: *Zostera marina* and *Zostera noltei* (Figure 7.3). In 2007, these two species covered 11 km² and 8 km² respectively in the Golfe.



Figure 7.3 Left: *Zostera marina* (Olivier Dugornay – IFREMER; right: *Zostera marina* (RNP)

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 the environmental conservation with the development of human activities, the RNP decided to experiment with the ecosystem services approach put forward in VALMER. The aim was also to provide new ideas and information that could be used for the revision of the Scheme for Sea Development, a marine planning tool in the Golfe, in 2016.

The VALMER ESA in the Golfe du Morbihan was designed to:

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

The results of the Triage process (see Mongruel et al. 2015) are presented in Table 7.1.

Table 7.1 Aims selected through the Triage approach in the Golfe du Morbihan

Aims selected	Why?
1. Raise awareness on seagrass issues	Because perceptions of seagrass beds are different between stakeholders
2. Realize an integrated assessment to improve management	Because knowledge of seagrass beds is very incomplete
3. Identify management options to facilitate trade-offs	For effective management of seagrass beds in the long-term considering the impacting activities

3.1. Ecosystem services assessed in VALMER

Through the VALMER project, the ecosystem services approach in the Golfe du Morbihan was used as a way to develop a systemic approach which would be useful for exploring all the elements linked to seagrass bed management. These include: ecosystem services offered by seagrass beds to human activities and interactions between these activities and seagrass habitats. The VALMER project team, together with scientists and local managers, has conducted a study on seagrass beds, with the participation of local stakeholders (State representatives, elected-members, professionals (fishermen, shellfish farmers), recreational activities, associations and local people).

At the beginning of the project, it was decided do not assess a monetary value of the seagrass beds of the Golfe du Morbihan. Instead, the VALMER Golfe du Morbihan team preferred to develop a multi-criteria assessment approach based on social, economic and environmental criteria. The VALMER team tried to identify all the ecosystem services offered 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 identify the natural and human factors that could affect the level of ecosystem services offered by seagrass beds.

This assessment has been done by combining several steps and tools (Figure 7.4):

- A scientific literature review
- Interviews
- Focus-groups
- A “choice experiment” survey
- Map analysis



Figure 7.4 Overview of steps and tools developed in the GDM case study site

The ESA was useful in the Golfe du Morbihan for:

- Structuring a systemic view of the coastal social and ecological system
- Proposing a new management approach under a participatory process
- Discussing seagrass bed management with local stakeholders

The approach developed in the Golfe du Morbihan tried to be the most participative as possible. It was based on knowledge sharing with stakeholders, creating a common culture and collaborative development of proposals to improve seagrass bed management.

3.2. What are the links between the ESA and scenarios?

The VALMER team has used all the elements gathered during the project, including scientific literature, interviews, workshops and map analysis, to identify four possible management strategies for seagrass beds. These strategies became four scenarios, each scenario corresponding to a different management situation with different consequences in terms of human pressures on seagrass beds, and the level of ecosystem services provided by these habitats.

4.The scenario approach in the Golfe du Morbihan

4.1.What were the aims of the scenarios?

The scenarios developed in the Golfe du Morbihan were used to support the discussion with stakeholders on different possible management strategies (= scenarios). The aim was to introduce the stakeholders to the idea that the management approach could be reconsidered based on its outcomes in terms of the level of ecosystem services provided by seagrass beds. The idea was to identify and propose actions that could be implemented to improve the actual management seagrass beds in the Golfe.

4.2.Description of scenario developed in VALMER

Each scenario summarizes a management strategy or philosophy of seagrass beds in a few lines. Some maps are given, which help with the understanding of the consequences of the management approaches presented and also help to illustrate the scenarios.

Scenario 1

Seagrass beds are in good condition. It is not necessary to change the level of protection, but a programme must be implemented to monitor their condition in the long-term and prevent any deterioration (Figure 7.5).

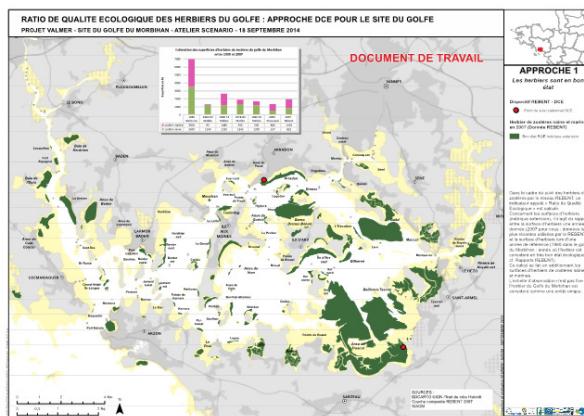


Figure 7.5 SCENARIO 1 Seagrass beds are in good condition

SCENARIO 2

Improve the condition of all seagrass beds around the Golfe du Morbihan. Limit pressure on all potential areas known to have been colonized by seagrass beds (Figure 7.6).

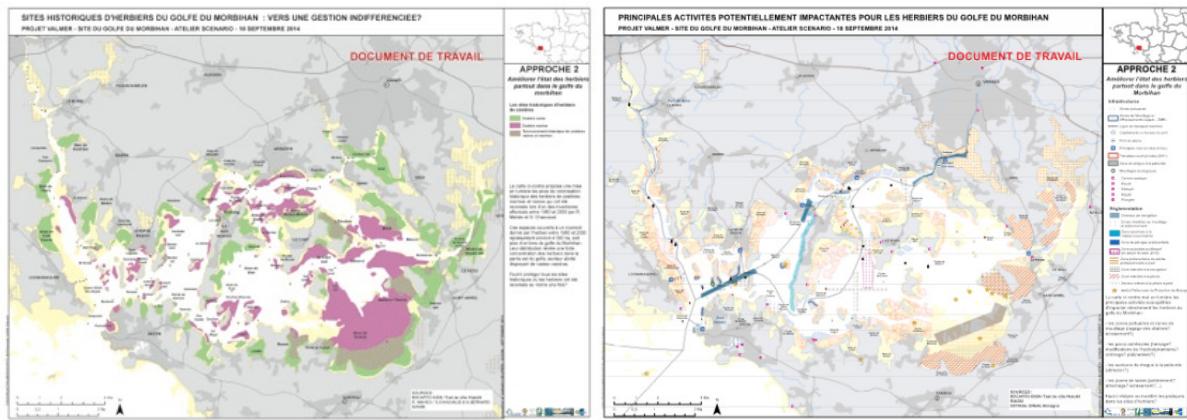


Figure 7.6 SCENARIO 2 Improve the condition of all seagrass beds around the Golfe du Morbihan

SCENARIO 3

Just maintain seagrass beds where the level of pressure and impact are not of great concern. Prioritise activities elsewhere (Figure 7.7).

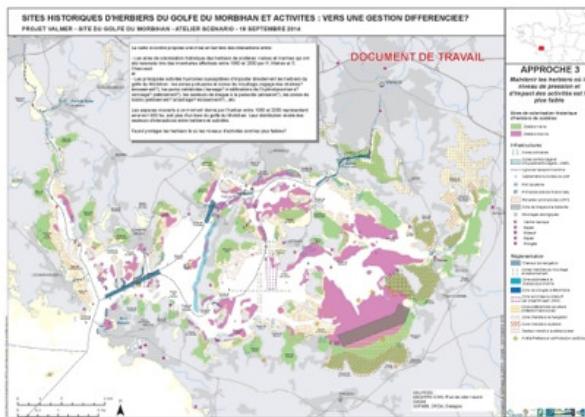


Figure 7.7 SCENARIO 3 Just maintain seagrass beds where the level of pressure and impact are not of great concern

SCENARIO 4

Improve the condition of seagrass beds by conserving strategic areas in good condition in the long-term (Figure 7.8).

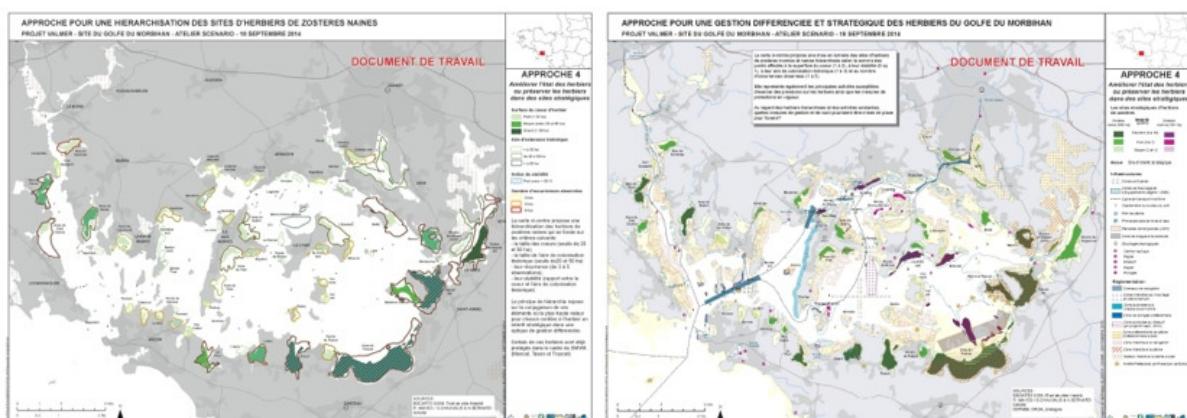


Figure 7.8 SCENARIO 4 Improve the condition of seagrass beds by conserving strategic areas in good condition in the long-term

4.3. Use of scenario outputs for management

We hope that the VALMER project results will be useful for the Scheme for Sea Development of the Golfe du Morbihan (a marine planning tool) that will be reviewed in 2016, and also to complete the Aims Document Natura 2000 in the Golfe. The results will be spread as far as possible in order to help other areas that face the same issues (e.g. Natura 2000 managers). The management measures proposed at the end of the “scenarios workshop” will be used as material to help elected members and decisions makers in their management choices. Maybe this will give the opportunity to collectively create a new management approach (awareness, communication, scientific studies and monitoring) to preserve the seagrass beds of the Golfe with the participation of local stakeholders.

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Chapter 8 - Case Study Process: Parc Naturel Marin d'Iroise

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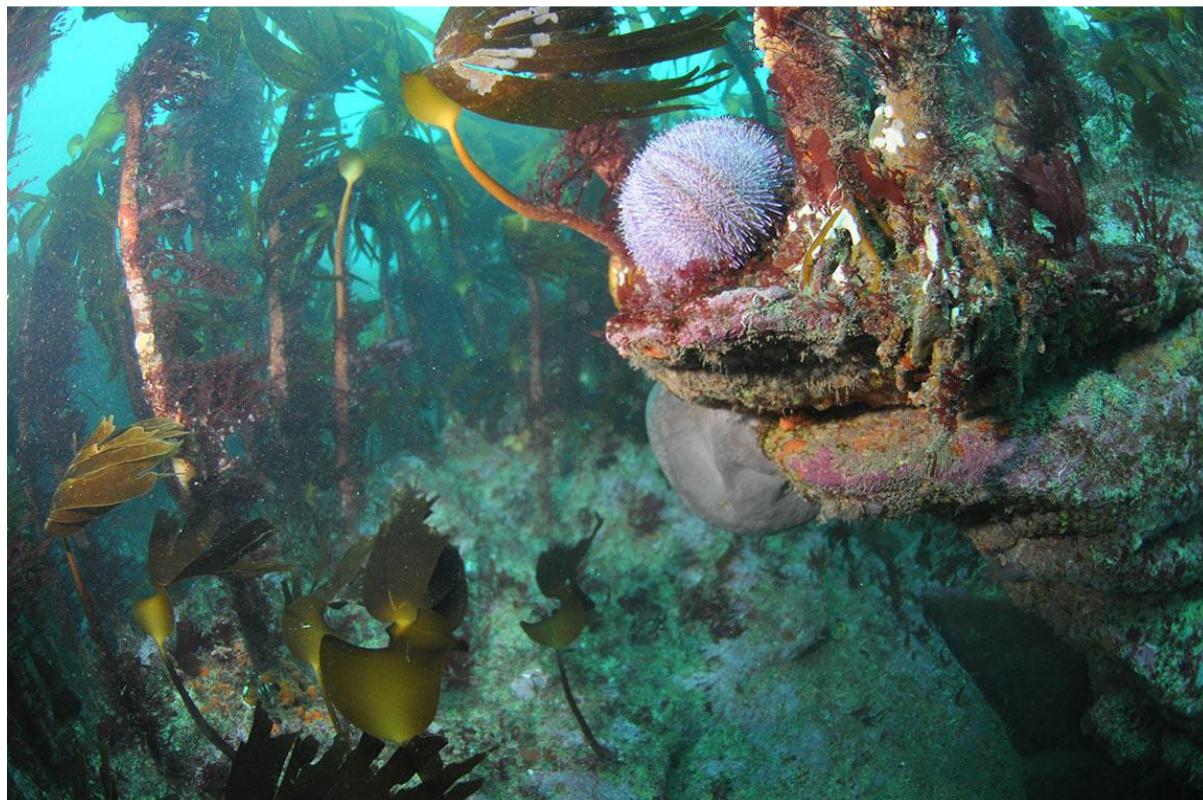


Image: Ambiance sous marine; Copyright: Y. Turpin/AAMP

The Parc Naturel Marin d'Iroise (PNMI) is an AAMP management tool. The management of the park is guided by an action plan which is validated by the PNMI management council for a period of 15 years. Among other aspects, the plan contains actions for the sustainable management of the kelp resources in the park. The VALMER project has been implemented in the context of this management plan. The stakeholders in the Parc Naturel Marin d'Iroise meet regularly in the context of the management plan implementation.

No specific stakeholder group was set up for the VALMER project. Instead, the existing stakeholder meetings were used to consult stakeholders and disseminate the progress of the project. When necessary, additional individual meetings or workshops were organised.

1. The VALMER ESA in the Parc Naturel Marin d'Iroise

1.1. Aims of the ESA

In the Iroise Sea, two kelp species (*Laminaria hyperborea* and *Laminaria digitata*) are significant natural entities playing a key role both as habitat provider and primary producer on the rocky shore of cold marine waters. Being very productive and important in terms of biodiversity (more than 300 taxa), the kelp forests are the equivalent of coral reefs for the temperate coastal environment. Several species of European interest are found in this habitat. There are 150,000 grey seals in the Celtic Sea and 200 individuals in the Molène archipelago. The grey seals coexist well with seaweed harvesting. This is not the case of the common bottlenose dolphin (12,000 individuals in the Celtic Sea and 60 in the Molène archipelago), as this species is very sensitive to noise. Since 1992, an evolution in the behaviour of bottlenose dolphins in the Molène archipelago has been observed. They now seem to gather in the south of the archipelago where less seaweed harvesting occurs.



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Kelp fields have been harvested in this area since the 19th century. While in the past kelp was required for the glass manufacturing industry and iodine production, today kelp is sought for its alginic acid content. (*Laminaria hyperborea* and *Laminaria digitata*) 60% of French kelp production is directly undertaken in the Molène archipelago and it supplies the demand of the animal feed, pharmaceutical and cosmetics industries.

The management of the *L. hyperborea* fishery was negotiated and implemented fifteen years ago with kelp harvesters. It is based on rotating harvesting zones and quotas. In the context of increasing demand for kelp (*hyperborean spp.*), the main objective of using the ESA approach the Parc Naturel Marin d'Iroise is to inform the current management debate and identify new trade-offs. The aim is to optimise the management of the kelp field so as to allow a sustainable maximum yield for fishermen, an increase in employment linked to kelp harvesting and protection of valuable species such as the common bottlenose dolphin. The question that the Parc Naturel Marin d'Iroise is trying to answer through VALMER is **“How to manage the kelp forest in the best way to conserve the kelp and allow its sustainable harvesting by fishermen?”**. To address this question, the objectives of the PNMI ESA were to:

- Identify the marine ecological functions and services linked to the kelp forest habitat;
- Identify the main pressures on the kelp forest habitat;
- Evaluate the long-term effects of the pressures on the functioning of kelp forest habitat;

1.2. Ecosystem services assessed in VALMER

From an ecosystem services perspective, kelp ecosystems are used for alginic acid production. However, they also deliver many other services through their bio-physical richness, their biodiversity and their contribution to the cultural heritage of the area. The management plan for the sustainable exploitation of kelp resources has been selected as the topic that could be usefully re-examined using the ecosystem services approach. This issue needs a more integrated approach as it is connected to other management objectives, especially the conservation of habitats and species, and the protection and promotion of maritime heritage. The topic identified as focus for the ESA in the Parc Naturel Marin d'Iroise was the **ecosystem services provided by kelp forest habitats**.

The identification of ecosystem services provided by the Iroise Sea kelp ecosystem was carried out by experts (managers, ecologists and economists) on a consensus-based approach through the Triage process. To capture the social perception of kelp ecosystem services, the team relied mainly on the outcomes of discussions of the dedicated commission of the Regional Fisheries Committee

(CRPMEM). The representations of the kelp socio-ecosystem and definition of scenarios were done through interviews with key stakeholders and meetings between scientific experts for the Iroise Sea and managers from AAMP.

A detailed specification of kelp ecosystem services was built during workshops and focus group meetings with scientists and stakeholders. Following Work Package 1 recommendations for operational ecosystem service assessment, we prepared a systematic review of scientific knowledge of kelp ecosystems as well as a synthesis of human activities and social demand for kelp exploitation and conservation. From this a list was generated of potential ecological functions and ecosystem services of kelp (Figure 8.1). The initial list encompassed up to 30 ecosystem services and was then reduced to nine services, which would be of interest for assessment, according to the Triage approach (Pendleton et al., in press).

Maintenance & regulation services	Habitat, Trophic network		 Commercial species
Provisioning services	Food	 Fisheries	 Heritage species
	Non-food	 Fisheries	 Heritage species
Cultural services	Symbolic value	 Traditional activity	 Heritage species
	Eco-tourism	 Marine landscape and biodiversity	

Figure 8.1 Ecosystem services selected from the Triage approach

Considering the aim of the ESA and the numerous factors of influence that must be taken into account, a dynamic system model for simulating the impacts of various fisheries management options (on four or five key ecosystem services) was deemed to be the best approach. The first step was to build a conceptual model of kelp ecosystems, the functions they support for biodiversity and human activities and the governance system for the management of the whole ecosystem and resources. A numeric simulation model was built starting with the ecological component and followed by an integrated simulation to model the bio-economic aspect of the kelp fishery, which is the core of the system model. It allows the predictive simulation of the influence of the management options on the ecological functions of the kelp fields for commercial and heritage species.

In parallel, a study was conducted on the impact of different algae harvesting techniques (combs, scoubidous, (Figure 8.2). Recently, the comb harvesting method for *L. hyperborea* harvesting was introduced in the Iroise Sea. Due to its strong impact on biodiversity and habitat structure, the use of

this particular gear is debated within certain users groups (fishermen, recreational anglers) and managers concerned with conservation.



Figure 8.2 Images of the two algae harvesting techniques used in the PNMI: on the left, the scoubidous technique used for harvesting *L. digitata*; on the right, the comb technique used for *L. hyperborea*

The study included: monitoring of damaged algae (survival), releases, habitat modifications, new hires, etc. The study is complemented by scientific monitoring of the kelp population. The collected data feeds into the modelling of the harvesting activity impact on the kelp population and enables the development of the kelp population dynamics model.

The model of the kelp social-ecosystem was used to estimate a range of indicators that correspond to the ecosystem services identified for the kelp forests in the Molène archipelago. This multicriteria analysis grid was used to compare the impacts of scenarios on the ecosystem services.

1.3. What are the links between an ESA and scenarios?

Exploratory “real-life” scenarios were used to compare the consequences of natural parameters (e.g. increase of storm events) and/or management changes on the level of ecosystem services provided by kelp forests in the Molène archipelago (Figure 8.3). Indicators were used to compare the scenario options. For many indicators, the current state of scientific knowledge did not allow the quantitative establishment of the functional link between the kelp field and the corresponding ecosystem services. These indicators were often directly or indirectly linked to migrating species. This was the case for the commercial fish species for which stock levels in the Molène’s archipelago were not known. Consequently, the kelp population and harvesting model does not predict the changes shown by the indicators at the same informative level. Where possible, changes were described quantitatively. If not, only global qualitative trends were provided.

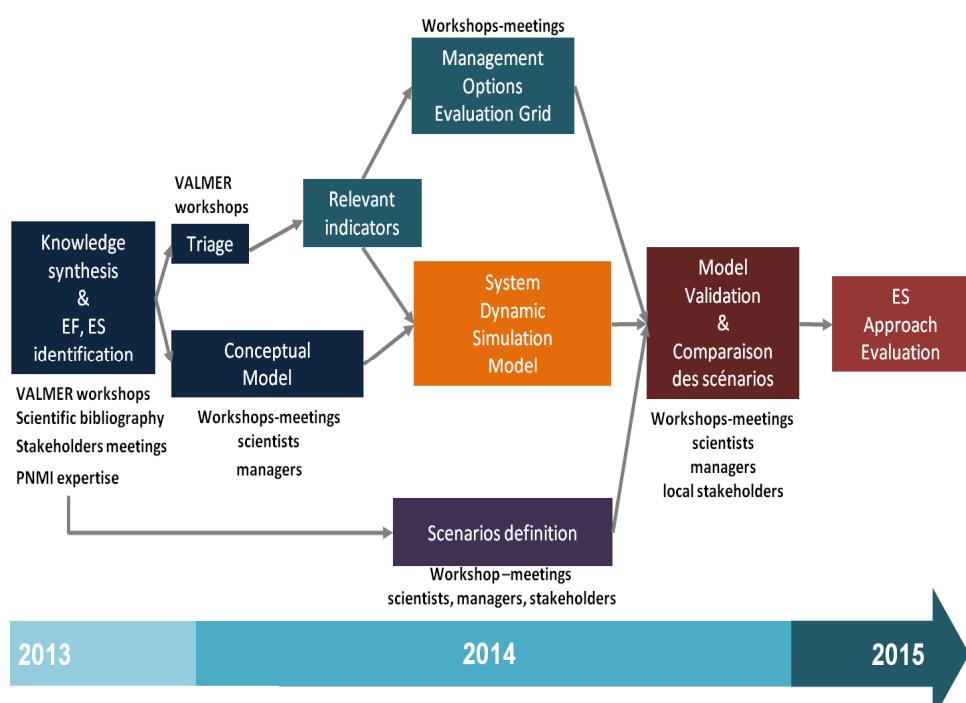


Figure 8.3 Links between the steps of ESA and scenarios approach developed in the PNMI

2. The scenario approach in the Parc Naturel Marin d'Iroise

2.1. What were the aims of the scenarios?

The scenarios aimed at comparing management options in the context of various possible changes in the kelp socio-ecosystem. The kelp management scenarios tested in the VALMER project are real-life scenarios agreed by harvesters, managers, scientists and State representatives, stakeholders and decision-makers in a collaborative management process. Some of the scientists and managers on the VALMER PNMI team also participated in the kelp management commission. It was decided to rely initially on the discussions of the commission to capture the social perception of kelp ecosystem services and management needs. In addition to this, interviews with other stakeholders were carried out to further refine the operational characterisation of some management rules and other factors of change.

Today, *Laminaria hyperborea* harvesting is managed through harvesting zones negotiated fifteen years ago with fishermen. Five large zones are subdivided into five sectors in which there is a rotation of harvesting and fallow periods. Each area is associated with a fishing quota fixed every year according to an assessment of the kelp standing biomass. When the production reaches 20% of the standing biomass, the fishery is closed for five years. Whilst this management regime is a useful first step towards a sustainable exploitation of the kelp resource, the existing kelp harvesting management is relatively crude and damaging and should be reviewed in order to integrate the increasing demand of the sodium alginate market. It should also take into account many factors recently discussed between fishermen, managers and scientists, in particular:

- **Accessibility:** Total biomass of laminaria is different to the available biomass, which depends on the swell, the presence of rocks, etc. Today fishermen often return to the same areas, areas that are accessible and benefit from the proximity of natural reseeding sites. The harvesting of *Laminaria hyperborea* is not undertaken in winter due to weather conditions. At this time of year, species present in the kelp field (lobster, seabass, etc.) migrate to the Celtic Sea or the Bay of Biscay and then return in the spring. In winter, the algae are torn by the waves (about 300 000 tonnes). Fishermen often argue that they harvest as much as the quantities of algae that are washed up on the coast in winter.
- **The recent mapping of kelps:** The total biomass appears to have been under-estimated and fishermen may not have reached the maximum production potential of the kelp field yet.
- **The improvement of the knowledge on the kelp dynamics and ecological functionality:** A new regime of kelp harvesting should better integrate the seasonality of the ecosystem services provision and identify the most damaging harvesting periods for the ecosystem balance.
- **Influence of environmental conditions:** The harvesting pressure on the kelp ecosystem should also be compared to the impact of regular large standings of kelp that are observed after winter storms (about 300 000 tons).

2.2. Description of scenarios developed in VALMER

Firstly, the model is designed to test the efficiency of adaptive strategies (= scenarios) on the ecosystem service levels for the reference situation. Is a better trade-off possible for the actual set of external conditions (same alginate demand, same winter storms frequency, same demand of MPA areas)? The reference year chosen is 2013, before the set-up of large closed areas by the 2014-9271 regulation. Secondly, the model predicts the effect of the adaptive strategies taken in response to the exogenous changes described in trending scenarios. These prospective scenarios consider evolution of one exogenous factor at a time or combine evolutions of different factors to test model responses to extreme perspectives. The modelling of extreme climatic changes could consist in increasing the frequency or cumulating the occurrences of winter storms, based on the magnitude of those observed in 2014. Trending and adaptive scenarios which have been built with stakeholders were as realistic as possible in order to reflect the social demand and acceptability. In addition to these realistic or acceptable scenarios, some more contrasted perspectives, which could be seen as unrealistic for

instance from the kelp sector point of view, were also investigated with the simulation model of the kelp socio-ecosystem as ‘purely exploratory scenarios’.

2.3. Use of scenario outputs for management

As a first step, simple scenarios will be used to discuss and validate the model and to help stakeholders take ownership of the simulation model. In the future, the scenarios could be refined through information gathered from all stakeholders, including experts and scientists. Finally, the development of the model and the work on adaptive strategies will be useful for bringing real-time support to kelp harvesting management. Such a tool aims to provide insights for the adaptive management of this economic activity related to the kelp provisioning services.

References

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Chapter 9 - Governance Analysis

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The previous chapters have presented site descriptions of the VALMER case studies (Chapter 2) and the associated case study processes (Chapters 3-8). This chapter will now examine how the VALMER ESAs has affected the governance process and outcomes. The chapter commences with the background that considers of the current state of the art of ESA application in marine governance, next the research methodology is outlined, followed by a section detailing the results and evaluation of the stakeholder experience of ESA (Section 3a and 3b) and a section exploring the impact of the ESA for site governance (Section 4a and 4b), followed by a synthesis.

1. Background

1.1. Ecosystem based Channel governance and the ecosystem services approach

In line with the requirements of many EU policies and strategies, for example, the EU Marine Strategy Framework Directive and Target 2 of the EU 2020 Biodiversity Strategy, there is a need for Channel governance to adopt ecosystem-based management. This can be done by taking an integrated view of marine and coastal ecosystems and recognising that ecological, economic and social aspects are interconnected and cannot be viewed in isolation. Such an approach to management is necessary in order to ensure the safe and viable co-existence of different sectors, as well as the protection of marine and coastal environment. One tool that can contribute to the knowledge requirements of ecosystem based management is the ecosystem services approach. An understanding of ecosystem services, through assessment and valuation, can support marine management by providing information that reveals and describes the interactions and linkages between human activities and the ecological system, associated societal values. Such information can be used by managers to explore the implications of potential decision making options on both human activities and the natural system.

The concept of ecosystem services

The ecosystem services approach was established on the international policy agenda by the Millennium Ecosystem Assessment (MEA) as a concept that describes “the benefits people obtain from ecosystems” (MEA 2005). It is based on the idea that the different processes and elements of an ecosystem provide resources and benefits that directly or indirectly underpin human wellbeing. These ecosystem services include the provision of food, raw materials and energy, climate and water regulation, waste remediation and regulation of diseases, storm protection, as well as a setting for recreation, cultural identity, aesthetic and spiritual experiences and cognitive development. Ecosystem services have been defined and classified in a number of different ways (Balmford et al. 2008, Böhnke-Henrichs et al. 2013, MEA 2005, Rees et al. 2013, TEEB 2010). The most prominent of these, the MEA, distinguishes between four categories:

- *provisioning services*, which are the material resources provided by an ecosystem;
- *regulating services*, the benefits obtained from regulating ecosystem processes;
- *cultural services*, the nonmaterial benefits for recreation, cultural identity, spirituality, aesthetic experiences and cognitive development; and lastly,
- *supporting services* that provide the ecological functions and structures that constitute the basis for all other ecosystem services, such as primary production, soil formation and nutrient cycling.

The underlying principle of these different definitions and classifications is that the concept of ecosystem services reveals the links and interactions between natural systems and human wellbeing. It shows how economic prosperity, societal and cultural wellbeing, psychological and physical health depend on and are enhanced by healthy, functioning ecosystems.

Marine ecosystems are particularly important as they provide a wide range of essential and beneficial services and resources (Beaumont et al. 2006, MEA 2005, UNEP 2006). Fish, for example, are a source of healthy nutrition, as well as representing an important economic resource. Coral reefs, mangroves and sandbanks protect the coastline from the impact of storms. Seagrass beds and other benthic habitats such as biogenic reefs, contribute to carbon sequestration, oxygen production and remediation of pollutants, as well as serving as habitat and nursery grounds for juvenile fish and other marine wildlife. Marine ecosystems and species are a source of information for intellectual and technological development, providing blueprints for medicine and biotechnology. The marine and coastal environment offers opportunities for a wide range of recreational activities, physical exercise and relaxation, with associated health benefits. Moreover, the seas host a wealth of cultural and spiritual values that shape the identity of coastal nations and communities.

Ecosystem service assessments and valuations

Being an integral part of human wellbeing, ecosystem services have values that can be measured and expressed in a variety of different units, such as monetary, importance, cultural significance or health benefits. Early efforts at ecosystem service assessments sought to support the case for conservation by establishing monetary valuations for aspects of the environment. The rationale behind this is that since most ecosystem services are not traded on markets and have not got a defined monetary value, environmental considerations are often not included in policy and management decisions. This is believed to be one of the underlying causes of resource overexploitation and environmental degradation. The concept of ecosystem service valuation gained increasing popularity throughout the 1990s, especially in the wake of the court case following the Exxon Valdez oil spill in the Prince William Sound, Alaska, and the publication of a paper on “The value of the world’s ecosystem services and natural capital” in the journal *Nature* (Costanza et al. 1997). The MEA also raised global interest in economic valuation of ecosystem services on the international policy stage, leading to initiatives such as The Economics of Ecosystem Services and Biodiversity (TEEB 2010). Various methods have been developed for monetary valuation of ecosystem services, using both market values and non-market valuation techniques (see Mongruel et al. 2015 for further information).

Monetary valuations have a number of limitations (see for example Chee 2004, Liu et al. 2010). Assigned values can vary from one valuation method to the other and are often an underestimation of the actual value of the service. There are methodological difficulties, in particular due to scientific uncertainties and lack of data. Besides this, there is an ongoing debate about the moral and ethical implications of putting a monetary value on nature. Moreover, monetary valuation approaches cannot fully capture the more intangible societal, cultural, spiritual and intellectual benefits of an ecosystem.

In parallel to awareness of these limitations has been the growing importance of including societal and cultural values in policy and management decisions, creating considerable interest in the development of non-monetary valuation methods. Such studies are already starting to fill data gaps on societal values. One type of non-monetary valuation that could inform management decisions is the assessment of the cultural significance of places. For example, a study conducted by the University of Exeter and VALMER project partners looked at the role that a specific stretch of Cornish coast plays for local residents’ wellbeing, identifying places along the coast that are particularly important for people’s cultural identity and wellbeing. Studies like this can contribute to the evidence base for a range of management scales, for example, coastal development strategies and marine planning.

1.2. Application of the ecosystem services approach in marine governance

Theoretical application and benefits

Using Ecosystem Service Assessment (ESA) in marine governance processes has been documented as contributing to better informed, holistic, transparent and participatory decision making about marine ecosystem and resource management by:

- Increasing the transparency of human-ecosystem interactions (Rea et al. 2012, Slootweg and van Beukering 2008);
- Integrating ecosystem, economic and social considerations in decision making (Pittock et al. 2012, Slootweg and van Beukering 2008);
- Facilitating the identification of relevant stakeholders and their engagement in decision making (Slootweg and van Beukering 2008);
- Providing better understanding of the distribution of costs and benefits between stakeholders (Cesar and Chong 2004, Slootweg and van Beukering 2008);
- Reflecting the social importance and value of marine ecosystem services (EA 2009, Laurans et al. 2013, Liu et al. 2010);

- Providing a common language for comparing the costs and benefits of different policy or management alternatives, different ecosystem services, as well as different social, economic and ecological issues (EA 2009, Hoelzinger and Dench 2011, Rea et al. 2012, Pittock et al. 2012);
- Demonstrating the value of ecosystem conservation (UNEP 2006);
- Revealing the values that are implied in any decision and that, if not made explicit, might be overlooked by decision makers (Barde and Pierce 1991, Schuijt 2003).

Three different categories for the use of ESA in marine governance have been defined by Laurans et al. (2013):

1. Informative use: ESA can support policy and management in general, for example by justifying a management decision or raising awareness among decision makers, stakeholders and the public regarding the role and relevance of ecosystem services and potential unidentified environmental issues.
2. Decisive use: ESA can inform a specific decision (for example on management alternatives, trade-offs, resource allocation or prioritisation of conservation efforts), decisions about a specific project, or the formulation of a specific legislation or regulation.
3. Technical use: ESA can be used to guide the design of economic instruments, such as user fees or taxes, as well as the determination of damage compensation payments or penalties.

International experience

A literature review conducted by VALMER identified 38 case studies from around the world for which there was evidence that ESA had been used in marine governance (Table 9.1). What the review found is that, globally, ESA is already being used in various contexts related to the conservation of marine ecosystems and marine resource management. For example, in Bonaire and several other Caribbean islands, ESA helped determine appropriate levels of entrance fees to marine protected areas for divers and other visitors (Kushner et al. 2012, Slootweg and van Beukering 2008, Thur 2010). In the Philippines, ESA studies led to the banning of destructive logging and shrimp aquaculture in mangrove forests and encouraged investment in mangrove conservation (Farley et al. 2009, Hodgson and Dixon 2000, Kushner et al. 2012). Other case studies from the South and West Pacific concerned the regulation of destructive aggregate dredging (PacificNews Center 2012) and coral mining practices (Kushner et al. 2012). In the United States, a country with a strong litigation culture, ESA was used to determine penalty or compensation payments for damage to ecosystems. In Florida and Hawaii, ESA supported the design and introduction of a penalty payment system for damage caused to coral reefs (Kushner et al. 2012, van Beukering et al. 2008). One of the most famous cases of ESA concerned the Exxon Valdez oil spill in Alaska in 1989. After a lengthy litigation process in which ESA played an important role, Exxon was fined \$500 million for damages to the environment (Duffield 1997, Liu et al. 2010, Slootweg and van Beukering 2008). Two thirds of the 38 case studies were located in the Caribbean and the South and West Pacific, where countries are highly dependent on their marine resources for subsistence and income to the national economies. In Europe, the use of ESA in environmental policy making is a more recent development. Here, ESA studies have been used, for example, to inform coastal risk management strategies in the UK or as part of environmental impact assessments of harbour development and gas extraction projects in the Netherlands (Schuijt 2003, Slootweg and van Beukering 2008, Turnhout et al. 2008). The Work Package 4 Topic Paper ‘Using Ecosystem Service Valuation for Marine Management’ can be read for further examples of case studies (VALMER 2014).

In the 38 case studies, ecosystem service valuation was most frequently used to inform policy and management, justify potentially controversial decisions or investments, support stakeholder engagement, or raise awareness about an issue (informative use). In several cases it also supported decisions about the formulation of regulations, permitting of development projects, or court rulings (decisive use). The most frequent technical use was to determine user fee levels for marine parks. In some of the 38 case studies ESA was more influential than in others. ESA studies were particularly effective in supporting marine management on small islands that are highly dependent on their

marine resources. Other identified factors that proved to be important for the successful use of ESA as a marine management tool were:

- Transparent, participative decision making structures, involving local stakeholders;
- A clear policy question to which the valuation study was applied;
- A good communication strategy tailored for the right audience.

In several case studies, difficulties associated with conducting ESA studies were identified as limiting the use and influence of the ESA outputs. These difficulties included methodological issues such as under- or overestimations and double counting of ecosystem services, but also lack of resources for site specific valuations, uncertainties about scientific data and limited scientific knowledge of marine ecosystem services.

The ESAs conducted in the case studies were found to cover a broad range of cultural, provisioning, regulating and supporting services (following the MEA 2005 classification). The most frequently assessed services were tourism and recreation (cultural), fisheries (provisioning) and coastal protection (regulating). In the majority of case studies, more than one ecosystem service was assessed; the ESA studies that considered only one ecosystem service focused on tourism and recreation.

This literature review indicates that there is growing interest in the use of ESA as a tool for marine governance and that it is already being applied in different contexts around the world. At the same time, it revealed that documented ESA use and influence in the marine context remains limited, particularly in Europe. As Laurans et al. (2013) point out, this might be either because use and influence are not being adequately recorded and documented or because ESA is not actually being used to great extent yet. In consequence, there is limited understanding of how ESA can support marine governance and what kind of influence can potentially have on marine decision making (Kushner et al. 2012, Slootweg and van Beukering 2008). The VALMER project sought to address this gap by exploring how ESA can support marine governance in the Western Channel region. The following sections of this chapter present an evaluation of the work done in VALMER that aimed to identify and understand the potential that ESA holds for marine governance, as well as good stakeholder engagement in marine governance.

Table 9.1 The 38 case studies identified in the VALMER literature review, including information on the use of ESA in each case study

Case study	ESA use	References
South and West Pacific		
Navakavu Locally Managed Marine Area, Fiji	Used to inform local communities and support local management decisions	Laurans et al. 2013b O'Garra 2012 Pascal et al. 2012
Fiji	Led to a government decision for temporary moratorium on mangrove reclamation	Lal 2003
Kiribati	Supported government efforts to phase out beach mining	Laurans et al. 2013b Pacific News Center 2012
Majuro Atoll, Marshall Islands	Used to examine feasibility of aggregate mining alternatives	McKenzie et al. 2006
New Caledonia	Used to influence budget allocations; used to determine compensatory measures in Environmental Impact Assessments; used to inform decision making	Laurant et al. 2013b Pascal et al. 2012
Tubbataha Reefs National Marine Park, Philippines	Supported establishment of two-tiered fee structure for sustainable financing of Marine Park	Tongson & Dygico 2004
Olongo Island, Philippines	Justified investment in ecosystem management and a Marine Protected Area; justified establishment of another Marine Protected Area; justified user fee increase; encouraged eco-tourism development	Kushner et al. 2012 Laurant et al. 2013b White & Cruz-Trinidad 1998 White et al. 2000a White et al. 2000b
Palawan Island, Philippines	Supported Marine Protected Area establishment; led to ban of destructive activity (logging); encouraged eco-tourism development	Cesar 2000 Hodgson & Dixon 1988 Hodgson & Dixon 2000 Kushner et al. 2012
Puerto Princesa, Palawan Island, Philippines	Led to ban of destructive activity (shrimp aquaculture) and restoration of mangrove ecosystem	Farley et al. 2009 Kushner et al. 2012
Pagbilao mangrove forest, Philippines	Encouraged private sector involvement and investment in mangrove conservation	Gilbert & Janssen 1998 Janssen & Padilla 1996 Janssen & Padilla 1999 Kushner et al. 2012 Roennbaek & Primavera 2000 van Beukering et al. 2008
Solomon Islands	Supported national government in developing a coral management plan; led some coral harvesters to consider coral farming as an alternative	Albert et al. 2012a Albert et al. 2012b
Sri Lanka	Led to ban of destructive activity (coral mining); influenced the development of national strategies to promote conservation	Kushner et al. 2012 White et al. 1997
Vanuatu	Used to highlight how conservation helps local/regional economies and people that depend on marine ecosystems; helped put forward benefits of conservation to local communities; used as a tool for community decision making about trade-offs between short and medium term goals	Laurans et al. 2013b Pascal 2011 Pascal et al. 2012
Caribbean and Central America		
Andros Island, Bahamas	Justified ecosystem protection; informed reef damage estimates; used to raise awareness of economic benefits of conservation among decision makers and the public	Hargreaves-Allen 2010 Kushner et al. 2012
Gladden Spit Marine Reserve, Belize	Used to justify funding for Marine Reserve management; resulted in increased donations for Marine Reserve; helped facilitate a historically strained dialogue with stakeholders (fishers and tour operators)	Hargreaves-Allen 2008 Kushner et al. 2012
Hol Chan Marine Park, Belize	Justified user fee increase; helped facilitate the dialogue with stakeholders	Kushner et al. 2012 Trejo 2005

Belize	Informed a court ruling on fines in a ship grounding case; led to a government decision to enact new national fisheries regulations; supported a successful NGO and public campaign to prevent offshore drilling	Cooper et al. 2008 Kushner et al. 2012
Térraba-Sierpe National Wetland Reserve, Costa Rica	Informed the Wetland Reserve management plan	Earth Economics 2010 Kushner et al. 2012
La Caleta Marine Reserve, Dominican Republic	Justified user fee increase	Kushner et al. 2012 Wielgus et al. 2010
Cancun, Mexico	Justified user fee introduction	Kushner et al. 2012 Rivera-Planter & Muños-Piña. 2005
Bonaire National Marine Park, Netherlands Antilles	Justified and supported the design, introduction and increase of a user fee system; improved management and financial sustainability of Marine Park; helped facilitated the dialogue with stakeholders; set an example on user fee systems for other Marine Parks	Slootweg & van Beukering 2008 Thur 2010 Uryarra et al. 2010 van Beukering et al. 2008
Man of War Shoal Marine Park, St. Maarten	Led to government recognition of the economic importance of coral reefs; used by government to support Marine Park establishment; used to sue for damages caused by boat sinking in the Marine Park	Bervoets 2010 Kushner et al. 2012 World Resources Institute 2008
St. Lucia	Used for advocacy	Kushner et al. 2012
Trinidad and Tobago	Used to engage decision makers	Kushner et al. 2012
Jamaica	Used to educate the general public and for advocacy purposes	Kushner et al. 2012
USA		
Exxon Valdez oil spill, Prince William Sound, Alaska USA	Informed a court ruling on fine for environmental damage; led to reframing of national policy, new safety norms, legislation and regulations	Brown 1992 Carson & Hanemann 1992 Carson et al. 1992 Carson et al. 2003 Duffield 1997 Lin et al. 2010 McDowell Group 1990 Slootweg & van Beukering 2008 van Beukering et al. 2008
Florida USA	Helped justify a trust fund to buy up beaches and provide public access	Bell & Leeworthy 1986 Kushner et al. 2012
Florida Keys National Marine Sanctuary, Florida USA	Supported the design of regulatory alternatives for the Marine Sanctuary; led to increased regulatory compliance and lower enforcement costs; supported development of cooperative management processes with stakeholders	Kushner et al. 2012 Leeworthy & Wiley 2000
Florida USA	Supported introduction of new state wide fishing licence scheme	Bell et al. 1982 Kushner et al. 2012
Florida USA	Used to justify revision of beach nourishment plans and government investment	Johns et al. 2001 Kushner et al. 2012
Florida Keys National Marine Sanctuary, Florida USA	Supported the design and introduction of an escalating penalty system for reef damage	Cesar et al. 2002 Cesar & van Beukering 2004 Kushner et al. 2012 Laurans et al. 2013b van Beukering & Cesar 2004 van Beukering & Cesar 2010 van Beukering et al. 2004 van Beukering et al. 2008

Hawaii USA	Supported the design and introduction of an escalating penalty system for reef damage	Cesar et al. 2002 Cesar & van Beukering 2004 Kushner et al. 2012 Laurans et al. 2013b van Beukering & Cesar 2004 van Beukering & Cesar 2010 van Beukering et al. 2004 van Beukering et al. 2008
Big Island and Maui, Hawaii USA	Supported the establishment of a voluntary private sector reef conservation fund by dismissing initial concerns about negative impacts on businesses	Cesar et al. 2002 Kushner et al. 2012 Laurans et al. 2013b van Beukering & Cesar 2004 van Beukering et al. 2004 van Beukering et al. 2008
Europe		
Lyme Bay, UK	Contributed to decision for establishment of protected area	Rees et al. 2010
Rotterdam Port, Netherlands	Informed Cost-Benefit Analysis of port development, involving decisions about land reclamation and nature compensation areas, though extent of influence unclear as the final decision was a political decision	Schuijt 2003
Dutch Wadden Sea, Netherlands	Contributed to the debate about granting permission for gas drilling, increasing policy makers' awareness of potential economic losses if drilling negatively affected ecosystem services, contributing to decisions to delay and set strict conditions for drilling	Runhaar & van Nieuwaal 2010 Schuijt 2003 Slootweg & van Beukering 2008 Turnhout et al. 2008 van Beukering et al. 2008
Wareham, UK	Experimental study as part of coastal management policy appraisal and managed realignment strategy	Defra 2007 Eftec 2007 Slootweg & van Beukering 2008 van Beukering et al. 2008
UK	Used as evidence to support and lobby for the designation of a Marine Protected Area network	Fletcher et al. 2012

2. Methods

2.1. Introduction to the Evaluation Framework

Work Package 4 of the VALMER project sought to identify and understand the potential that ESA holds for marine and coastal governance. Using the process and outcomes from the six VALMER case studies, Work Package 4 critically evaluated the issues and opportunities associated with integrating ecosystem assessment into management and governance. In addition, Work Package 4 explored how ecosystem service assessment can support improved stakeholder engagement in marine governance. To steer its research effort, and ensure a robust evidence base for the deliverables associated with VALMER project actions 4.1, 4.2 and 4.3, an Evaluation Framework was established. The objectives of the Evaluation Framework were to assess the case study processes, outcomes and outputs in terms of:

- The application of the ecosystem services approach to marine governance;
- The ecosystem services approach as an engagement tool in marine management.

The Evaluation Framework was designed to be applicable across all six sites, taking into consideration the complexity of governance regimes within the project area, particularly cross-border divergences and stakeholder diversity, as well as the different approaches that the case study sites took to the key project activities (ecosystem service assessment, scenario building and stakeholder engagement). Collaboration between the Work Package 4 lead partners, Plymouth University and University of Brest, ensured standardisation and consistency in application of the Evaluation Framework across the Western Channel. Figure 9.1 presents the three tiers of the Evaluation Framework. A range of research methods were used to document and analyse the governance structures at the VALMER sites, as well as the case study coordinators' and stakeholders' experiences of engaging with the ecosystem services approach in the case studies. Each element of the Evaluation Framework is presented in further detail in the following sections.

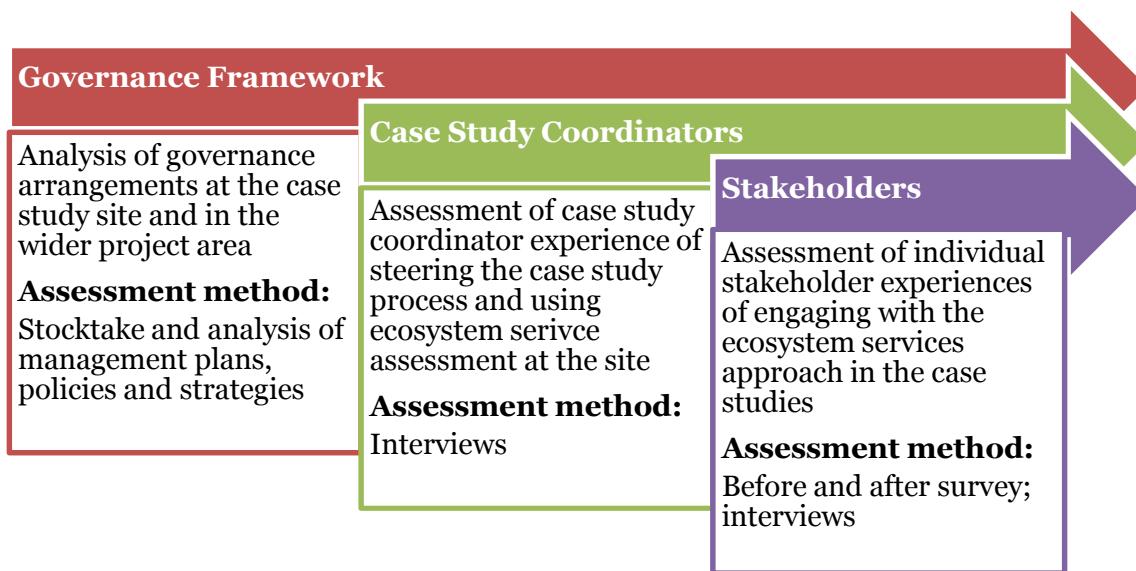


Figure 9.1 The three tiers of the Evaluation Framework

2.2. Governance Framework analysis

The Governance Framework analysis provided the context for the discussion of the project findings on the use of ecosystem service assessment to support marine governance. At the start of the project, the French and English governance approaches in the western English Channel were documented through a stocktake and analysis of relevant management plans, policies and strategies. Local governance arrangements at the six case study sites were identified and site visits conducted in February 2013 to meet site coordinators and a number of stakeholders. These visits were valuable to gather additional site information and to validate the potential areas for where stakeholders felt the VALMER ESA to influence or impact. In the Plymouth Sound-Fowey site, for example, the Cornwall Maritime Strategy was identified as the principal governance mechanism, with all stakeholders and their organisations committed to delivering this strategy. The information gathered in the Governance Framework analysis is presented in Chapter 2 of this report.

2.3. Case study coordinator interviews

In-depth interviews were conducted with all case study coordinators to better understand the pressures, barriers and opportunities encountered at the six sites in producing a site specific ecosystem service assessment, engaging stakeholders and using the ecosystem services approach in the local governance context. Being the central point of contact for stakeholders and for all VALMER Work Packages, case study coordinators were very well placed to have an overview of all these issues.

The interviews consisted of semi-structured questions that addressed three themes:

1. Ecosystem service application, impact and influence at the site,
2. The governance context at the site,
3. The coordinators' experience in the VALMER project.

The interviews were intended to monitor the coordinators' experiences and capture any changes in their personal views on and capacity to work with the ecosystem services approach. For this reason, interviews were conducted with the same people at two points in the project. The first interviews took place mid-way through the case study timeline, when key stakeholder engagement processes associated with developing management scenarios were underway. The second set of interviews was conducted closer to the end of the case study, when the results of the ecosystem service assessments were being disseminated to the stakeholders and used to support the discussion of different site governance options. Most case studies had a team of two or more coordinators. In some instances, the coordinators were interviewed individually, in other instances coordinator teams were interviewed together. Overall, 15 interviews were conducted with 12 people (eight interviews in the first round, seven interviews in the second round).

For each case study, case study coordinator interview analysis was combined with the stakeholder interview analysis for those answers that dealt with the use of ESA for governance. Emergent themes were identified and grouped for the results and discussion.

2.4. Stakeholder survey and interviews

Across the six sites, stakeholders participated in a range of VALMER engagement activities, from focus groups, task and finish groups, workshops and other events. This contribution of time and effort has been extremely valuable to the project. It is worth noting that the interviews conducted with stakeholders across the six sites, were voluntary with some stakeholder choosing to decline. A lack of participation in these interviews may reflect some negativity towards the ecosystem services approach and potentially the project. Conversely, those that participated may have had greater levels of engagement in the project and maybe more positive and interested in the ecosystem services approach.

Whilst analysis of stakeholder interviews demonstrates elements of critical feedback, these issues should be kept in mind when reading the results.

Before and after survey

The before and after survey consisted of a short set of statements to which the stakeholders were asked to respond on a five point Likert scale (Table 9.2). The stakeholders completed the same survey at the beginning and the end of the case study process. The survey aimed to capture the stakeholders' level of understanding of the ecosystem services approach and opinions on its usefulness for marine management before and after their engagement in the VALMER case studies. As a form of self-assessment, the survey requires the individual to identify and/or measure their knowledge and attitudes against a scale. As a survey technique it therefore relies upon individuals answering as honestly and objectively as possible. Whilst there are limitations to this research method, for example, potential bias and miss-reporting, in the case of the VALMER project these disadvantages were felt to be outweighed by the advantages it offered to be able to identify in a rapid and low-cost way, whether or not participation in the project added to individual's knowledge and understanding of ecosystem services. In the case of statement 1, *I have a good understanding of ESA*, 'good' was deemed to be able to correctly explain or define the terms ecosystem services, and ecosystem services assessment and valuation.

Table 9.2 Statements and corresponding scales in the before and after survey

Statement	1	2	3	4	5
S1 I have a good understanding of ESA	Not at all	A little	Fair	Very good	Excellent
S2 My organisation uses ESA at the moment (in management/decision making terms)	Never	Very rarely	Occasionally	Often	All the time
S3 ESA is important within my role	Not at all	A little	Fairly	Very	Essential
S4 There are opportunities for using coastal and marine ESA within my role	Never	Very rarely	Occasionally	Often	All the time
S5 I feel confident about using ESA within my role	Not at all	A little	Fairly	Quite	Very
S6 I think coastal and marine ESA could help to support aspects of my role	Never	Very rarely	Occasionally	Often	All the time
S7 I think ESA could help to support coastal and marine management in the xxx case study area	Never	Very rarely	Occasionally	Often	All the time
S8 I have an understanding of how xxx habitats support economic and social wellbeing in the xxx case study area	Not at all	Yes, limited	Yes, fair	Yes, good	Yes, very good

Across all six sites, 95 before surveys (38 UK, 57 France) and 55 after surveys (25 UK, 30 France) were completed. However, in order to track the same individuals who had completed both surveys, the total number of surveys that could be compared equalled 29 in total (18 UK, 11 France). The responses for each of the two surveys were aggregated across the three UK and three French sites and analysed for trends and patterns. These were then compared between the UK and French sites. Further statistical analysis was considered but dismissed due to the small sample size.

The analysis also revealed some limitations of the survey design. It proved difficult to interpret the responses without any further explanations by the stakeholders, in particular since each statement was associated to a different scale. Furthermore, the composition of the stakeholder groups changed throughout the case study processes. As a result of this, the group of respondents for the after survey was not identical to the group of respondents for the before survey. This made it difficult to draw any meaningful findings on the effect of participating in VALMER from a comparison of the before and after results. Finally, the statements proved difficult to respond to for the stakeholders not working in management. Due to these limitations, only general trends were drawn from the analysis of the before and after surveys. The findings give an idea of the stakeholders' level of understanding and opinions of the ecosystem services approach across the UK and French sites. However, any conclusions should be treated with caution due to the limitations of the survey.

Stakeholder interviews

After the conclusion of the case study process, in-depth interviews were conducted with a range of different stakeholders across all six sites (Table 9.3). Interviews were scheduled following the last stakeholder event of the case studies to ensure that the process was still fresh in the minds of the interviewees.

The stakeholder interview had two aims:

- a) To capture the stakeholders' views on the usefulness of ecosystem service assessments for marine governance based on their experience in the VALMER case studies.
- b) To explore what the ecosystem services approach can contribute to the successful engagement of stakeholders in marine governance by looking at the VALMER stakeholders' experience in an engagement process based on ecosystem service assessment.

The stakeholder interview included semi-structured questions that explored:

- 1) The stakeholders' understanding of and views on the ecosystem services approach and how this has changed through the VALMER process,
- 2) What VALMER has added to their understanding of their site,
- 3) How the ecosystem services approach can support marine governance,
- 4) What the challenges are of using ecosystem service assessment as a marine governance tool,
- 5) How the stakeholders found the engagement process in the case studies.

Table 9.3 Categories of stakeholders and numbers of representatives per category that were interviewed across the six VALMER sites

Stakeholder categories	Number of representatives interviewed
Local authorities	6
Harbour authorities	2
National government agencies	7
Water company	1
Recreational user groups	5
Non-governmental organisations	6
Commercial fisheries interest groups	5
Marine renewable energy sector	1
Designated area managers/management partnerships	5
Local elected politicians	1
Total number of stakeholder interviews	39

In addition, three sets of closed statements were used to ground truth and add to the responses given to the open questions. The questions were adapted slightly for the Poole Harbour and Parc Naturel Marin d'Iroise case studies as stakeholders at these two sites were not actively involved in the case study processes. Interviews were conducted with stakeholders that had taken part in all or most steps of the case study engagement process. Four interviews were conducted with Poole Harbour stakeholders, nine in North Devon, seven in Plymouth Sound-Fowey, seven in the Golfe Normand Breton, eight in the Golfe du Morbihan and four in the Parc Naturel Marin d'Iroise, resulting in a total of n=39 interviews. The interviews with the UK stakeholders were conducted over the phone between October and November 2014. French stakeholders were interviewed face to face during a three week field trip to the French case studies in November and December 2014.

Two separate thematic analyses were conducted to address the two aims. For each site interview responses that related to first aim, i.e. the stakeholders' views on the usefulness of ecosystem service

assessments for marine governance were analysed in combination with the case study coordinator interview analysis. Key themes were identified and discussed together with the findings. For those responses that related to second aim, i.e. the stakeholders' experience of engaging with the ecosystem services approach, analysis was done through two stages. The first stage being a targeted analysis for each case study, filtering out information on 1) the stakeholders' motivation for participating in the VALMER project, 2) their understanding of ecosystem service assessment before and after VALMER, 3) their views on how well the approach was communicated in the workshops, 4) what VALMER had added to their understanding of the site, 5) how the ecosystem service assessment had contributed to stakeholder dialogue and discussion in the workshops and 6) what the stakeholders thought about using scenario building as a tool to work with ecosystem service assessment. The second stage identified key themes for each case study, as well as key themes that recurred at two or more sites were identified.

3.a Stakeholder experience with ESA in the case studies: Results

The following sections present the results of the targeted analysis of the stakeholder interviews regarding the stakeholders' experience of engaging with the ecosystem services approach in VALMER. The results for each case study are presented separately. In Section 3.b, the key themes across all six sites that were identified through this analysis are evaluated.

3.a.1 North Devon (ND)

Focus of Case Study & Ecosystem Services studied	Value of subtidal sedimentary habitats in supporting commercial fisheries, carbon sequestration, waste remediation
ESA Methods	Bayesian Belief Network socio-ecological modelling
Case Study Governance Context	North Devon UNESCO Biosphere Reserve
Stakeholder Group	Biosphere Reserve Marine Working Group and stakeholders from relevant sectors and interest groups
Interviewed Stakeholders	n=9 <ul style="list-style-type: none">• 1 Local Authority representative• 3 Local recreational club representatives• 2 local management partnerships• 3 NGO representatives

Motivation for engagement in VALMER

Three stakeholders joined the project to learn more about how ESA could support their work. These three stakeholders had already heard about ESA before. The other stakeholders participated out of personal interest in the marine environment, personal interest in modelling, interest in specific marine topics that would potentially be addressed in the case study or to represent their organisation in a local, marine related process.

Pre VALMER understanding

One stakeholder had good previous knowledge of the ecosystem services approach. Three stakeholders had heard about ESA before. Five stakeholders had no previous understanding of ecosystem services or ESA.

Post VALMER understanding

At the end of the case study, five stakeholders displayed a good understanding of the basic idea of ecosystem services. Their understanding of ESA was less good. Of the five stakeholders with no previous knowledge, only one gained an understanding of the basic idea of ecosystem services and ESA. The other four did not understand ESA and had only vague ideas of ESA being an approach that looks at the environment, impacts on the environment and values of different parts of the environment. Table 9.4 presents the definitions of ecosystem services and ecosystem service valuation provided by the stakeholders.

Table 9.4 The definitions of ecosystem services and ecosystem service valuation provided by the North Devon stakeholders

Stakeholder	Definition of ecosystem services
ND1	“services you get from the ecosystem depending on how you use that ecosystem” e.g. pollution control and carbon sequestration, “explains how an ecosystem works and what you get from it”
ND2	“the services that the natural environment provides to people; the public goods that the environment provides to communities”
ND3	“it’s a way of measuring impact on, for example, the marine environment. it’s based on evidence and based on a variety of evidence from different sources”
ND4	“the value in many ways that the sea provides to the human population”
ND5	“Attempting to work out the value of different parts of the marine environment”
ND6	“it is what it is”
ND7	“the things that the marine environment gives us that is important for life support on the planet”
ND8	“Ecosystem services are the goods and services that mankind receives from nature in all its guises, with a series of categories that can then be used to define it down into for example, water quality, pollination. It is a means of trying to help ordinary people understand [...] what you get from the environment and how much that costs to replace.”
ND9	“It’s a group of people that are looking at the coastal environment as a whole, and they are considering all aspects of management and usage.”

Communicating ESA to stakeholders

The stakeholder with good previous knowledge of the ecosystem services approach commented that ESA is, *“a wildly techy subject, best reserved for academics and those in the know”* (stakeholder ND8) and that it needs to be de-jargoned if it is to be made accessible to a wider audience. They said that there was an overload of information in the workshops and that they found the information too technical. For one stakeholder, they felt that, *“The process was horrible...quite a disengaging process in some ways”* (stakeholder ND8). The three stakeholders that had heard about ESA before gained a good understanding of the concept of ecosystem services and ESA. Of these three, one found the information provided easy to understand while the other two found the workshops full of jargon, highly conceptual and difficult to follow for people who had no background on ecosystem services or modelling. Of the five stakeholders that had not heard about ESA before, two found the ESA information too technical and said that they did not understand the case study process. They commented that ESA and modelling were difficult concepts to understand for non-academics with no experience in modelling. One of them felt that, *“there was a bit of magic in the middle”* (stakeholder ND3). Two stakeholders found the ESA information provided in the workshops easily understandable, which, however, stands in contradiction to the fact that they could not correctly explain ecosystem services or ESA at the end of the case study. One stakeholder did not comment on the subject. Three stakeholders mentioned that things became clear to them only at the final workshop where the ESA and modelling outputs and finalised scenarios were presented. Two stakeholders commented on the fact that sometimes academics, *“underestimate how little the rest of us know”* (stakeholder ND3) and that they need to remember that stakeholders are not inside their, *“academic bubble”* (stakeholder ND8). Two of the recreational stakeholders who had participated out of personal interest in the marine environment felt that the topic and approach of the case study were not necessarily relevant to them.

Added understanding through VALMER

Many of the stakeholders felt that they had not acquired much new knowledge about the site. Four stakeholders said that they had mainly gained additional information about marine activities in the area. One stakeholder had learned about the governance of the site in terms of the organisations involved in local marine conservation. Only two stakeholders specifically mentioned having gained new knowledge about local subtidal habitats and species and the ecosystem services they provide.

ESA contribution to stakeholder dialogue and discussions

Table 9.5 presents the stakeholders' responses to three statements on the contribution of the VALMER ESA to stakeholder relations and discussions in the case study workshops.

Table 9.5 North Devon stakeholder responses to three statements on the contribution of the VALMER ESA to stakeholder relations and discussions in the case study workshops (the stakeholders were asked to agree or disagree)

Statements: VALMER ESA did...	Stakeholder responses
Support the development of a common understanding of the management question that was addressed in the case study	<ul style="list-style-type: none">• 4 agreed• 5 neither agreed nor disagreed
Foster better understanding among stakeholders with different interests and perspectives	<ul style="list-style-type: none">• 8 agreed• 1 said that there had been some mutual learning
Help support the discussion and appraisal of different management options in the scenario building process	<ul style="list-style-type: none">• 5 agreed• 3 neither agreed nor disagreed• 1 disagreed

Six stakeholders commented positively on the fact that the case study brought together a mix of different stakeholders that might not otherwise have met and was a good opportunity for networking. This allowed them to share their knowledge as well as their individual perspective on the site. As one of them put it, "*everyone was learning a bit more about the other side of things rather than just from their own view*" (stakeholder ND1). Another stakeholder mentioned that it was good to have a mix of stakeholders who brought their different knowledge and perspectives into the discussion. The stakeholders also felt that the combined approach of ESA and scenarios allowed them to input their knowledge and perspectives into the process. One stakeholder said that "*everybody was chipping in, so the different strands of information were all represented*" (stakeholder ND3) and another thought that "*everyone felt that the local knowledge was being valued and incorporated. And there was opportunity for everyone to say what happened where and so on*" (stakeholder ND4). Seven stakeholders agreed that the ESA approach can support stakeholder acceptance of and buy-in to decisions. The main reason that was given for this is that it is a neutral, rational approach that provides an objective, factual evidence base for the discussion of different options. One stakeholder commented that this can take some of the heat and emotion out of the debate and make it easier for people to compromise. Another stakeholder explained that "*if people think that a decision is made on a rational basis then it's easier than if they think it's being made purely on an opinion or political basis*" (stakeholder ND4). However, the stakeholder also pointed out that it is important that people understand the data and the process and that this is difficult in the case of ecosystem service modelling as modelling is a very abstract process for most people. Another stakeholder said that the ESA approach has the potential to support stakeholder buy-in to decisions but is not yet sufficiently developed to do so. In particular, it would be necessary to find better ways of communicating it to a non-technical, non-academic audience.

Scenarios as a tool to work with ESA

The majority of stakeholders commented positively on the use of scenarios as a tool to work with ESA, saying that the scenario process helped make the assessment process clearer, provided a structure for the discussion and led to useful discussions about the use of ESA in management.

3.a.2 Poole Harbour (PH)

Focus of Case Study & Ecosystem Services studied	Socio-economic value of six recreational activities in the harbour (cultural ecosystem services)
ESA Methods	Travel cost method, analytic hierarchy process
Case Study Governance Context	Poole Harbour Aquatic Management Plan
Stakeholder Group	Poole Harbour Steering Group
Interviewed Stakeholders	<p>n=4</p> <ul style="list-style-type: none"> • 1 Local Authority representative • 1 Harbour Commissioners representative • 1 Government agency representative • 1 Water company representative

Pre VALMER Understanding of ESA

One stakeholder had some previous knowledge of ecosystem services and ESA. Two stakeholders had heard about monetary valuation before. One stakeholder had no previous understanding of ecosystem services or ESA.

Post VALMER understanding of ESA

Table 9.6 presents the definitions of ecosystem services and ecosystem service valuation provided by the stakeholders.

Table 9.6 The definitions of ecosystem services and ecosystem service valuation provided by the Poole Harbour stakeholders

Stakeholder	Definition of ecosystem services	Definition of ecosystem service valuation
PH1	“the four natural functioning services that allow our planet to exist, [...] the four services that have been defined as cultural, provisioning, regulating, maintaining [...]. And unless all of those are in a healthy state then I don’t think we’ve got a very healthy functioning planet.”	“a way [...] of quantifying how important [ecosystem] services are, quantifying how well those services are functioning” with monetary valuation being the most widely used of many different valuation methods
PH2	“an environmental asset”	“putting a financial figure on the value of [an] environmental asset”
PH3	“It is about gaining an understanding of the contribution that the ecosystems make to the local economy, but also helps to inform your understanding of the ecosystems and the natural environment in itself.”	“gaining an understanding of the contribution that the ecosystems make to the local economy”
PH4	“It’s the services that the environment provides in a variety of ways. The air we breathe, the enjoyment we have from it, and a whole range of food and services that we get from the environment.”	“putting a monetary value to the environment”

The two stakeholders directly involved in environmental management had a basic understanding of ecosystem services as the services provided by the environment that support human life and socio-economic wellbeing. The two stakeholders involved in local government and harbour management only understood ecosystem services in terms of the natural environment’s contribution to the economy. The stakeholders’ understanding of ESA was limited to valuation aspects and mostly related

to knowledge about monetary valuation. One interviewee said that he was not aware of other valuation approaches besides monetary. Only one stakeholder had a broader understanding of ESA.

Communicating ESA to stakeholders

The four interviewed stakeholders found the VALMER ESA information easily understandable, interesting and useful. One interviewee noted that it would have been useful if the ecosystem services approach had been explained to the stakeholder group, including images and examples of the four types of ecosystem services, in order to put the Poole Harbour ESA into context. One interviewee reflected that the ESA needs to be made relevant to people's interests if they are to be engaged in an issue.

Added understanding through VALMER

The stakeholders did not feel that the ESA had significantly added to their understanding of the marine ecosystem in Poole Harbour, mainly because the Poole Harbour ESA did not include ecological information. The key added understanding of the case study site that the stakeholders gained through VALMER was a better understanding of recreational harbour user groups. This included information on 1) where people come from to use the harbour, what they do in Poole Harbour and how much they spend, 2) conflicts between the different user groups, 3) improvements for management of the activities, and 4) how the different users view the harbour and what values they place on its natural environment. Stakeholder PH4 said that the ESA results were “[...] quite interesting in terms of the value that people hold on the environment”.

ESA contribution to stakeholder dialogue and discussions

Table 9.7 presents the stakeholders' responses to three statements on the contribution of the VALMER ESA to stakeholder relations and discussions in the case study workshops.

Table 9.7 Poole Harbour stakeholder responses to three statements on the contribution of the VALMER ESA to stakeholder relations and discussions in the case study workshops (the stakeholders were asked to agree or disagree)

Statements: VALMER ESA did...	Stakeholder responses
Support the development of a common understanding of the management question that was addressed in the case study	<ul style="list-style-type: none">• 3 agreed• 1 neither agreed nor disagreed
Foster better understanding among stakeholders with different interests and perspectives	<ul style="list-style-type: none">• 4 agreed
Help support the discussion and appraisal of different management options in the scenario building process	<ul style="list-style-type: none">• 1 agreed• 1 said it would do so in the future• 1 neither agreed nor disagreed• 1 said 'don't know'

The stakeholders explained that the Poole Harbour ESA helped the Poole Harbour Commissioners identify and start a dialogue with relevant user groups they hadn't previously engaged with to help the resolution of conflicts between recreational user groups in the harbour.

Three stakeholders agreed that ESA can lead to greater acceptance and buy-in to decisions among stakeholders. Reasons for this included that:

- Robust data and evidence help persuade people about what the issues are;
- The ESA can reveal conflicts between different stakeholder groups;
- ESA provides an approach for engaging people in decision making by making the issues understandable and enabling the stakeholders to develop a shared understanding.

The fourth stakeholder was more sceptical about the potential of ESA to increase stakeholder acceptance and buy-in to decisions: one hand, ESA could be used to persuade stakeholders that the decision was in their interest, that there was value in it for them; on the other hand, monetary ESA in particular could also be used to make the opposite case.

3.a.3 Plymouth Sound-Fowey (PF)

Focus of Case Study & Ecosystem Services studied	Ecosystem services provided by intertidal and subtidal habitats
ESA Methods	Varied
Case Study Governance Context	Cornwall Maritime Strategy & others
Stakeholder Group	Task and Finish Group established with managers and regulators responsible for aspects of marine and coastal areas within the case study site
Interviewed Stakeholders	n=7 <ul style="list-style-type: none">• 2 Local Authorities• 1 Harbour Commissioners representative• 2 National government agency representatives• 2 NGO representatives

Motivation to engage in VALMER

The Plymouth to Fowey stakeholders all participated in the VALMER case study as part of their professional involvement in the management of the coast between Plymouth and Fowey. The geographical boundaries of the case study and the relevance of the addressed issues to local managers were important factors for encouraging engagement in VALMER. ESA was an important motivation for five of the seven interviewed stakeholders to take part in VALMER. The main reason given for this was that the stakeholders and their organisations were interested in learning more about ESA because they thought that it could be useful for their work. Two stakeholders were personally interested to learn more about the approach. One stakeholder said that the VALMER case study was “*a useful thing [...] to see how applicable it would be in a wider context*”. Another stakeholder mentioned that their organisation had already been involved in ESA before.

Pre VALMER understanding of ESA

All seven stakeholders had heard of the ecosystem services approach and ESA before VALMER but did not know much about it and were not sure what it really meant:

“*it is a process and approach that we hear a lot about, [...] we get involved in a lot of discussions about ecosystem services, but [...] I don't think we really know what's involved in it*” (stakeholder PF5)

“*a blue sky phrase that gets played around with*”, “*something that [they] know of, but it's one of those phrases that doesn't necessarily mean a great deal to [them], you hear about it but you are never quite sure what it means*” (stakeholder PF7)

One stakeholder explained that they weren't familiar with the ESA terminology but thought that “it is something that [their organisation does] do, but [they] don't call it anything like ecosystem services or anything like that” (stakeholder PF2).

Post VALMER understanding of ESA

Table 9.8 presents the definitions of ecosystem services and ecosystem service valuation provided by the stakeholders.

Table 9.8 The definitions of ecosystem services and ecosystem service valuation provided by the Plymouth Sound-Fowey stakeholders

Stakeholder	Definition of ecosystem services	Definition of ecosystem service valuation
PF1	“It is trying to place factual evidenced based values on different facets of an issue and bringing those together so you can come up with a balance, or weigh up one side against the other in some way or another, whether that be financial or whether that be in some other quantitative way.”	“This is where you put more of a financial bottom line on your answers and come up with a final definitive answer, as best you can, which gives you an economic answer”
PF2	“Ecosystem services are all the different elements, the benefits or negatives that an ecosystem gives you, whether it is cultural or physical things. Services is almost the wrong word for this, it’s just the different elements that come together to make up an ecosystem, and that can be cultural or physical or whatever.”	“Taking the ecosystem services and being able to value them in financial terms, if possible, and that is done on various standards, [for example] you have got a monetary figure for a tonne of carbon, a financial figure, and then you can tie that back to the value that those services might give, whether it is a positive value or a negative one, and look at the balance.”
PF3	“what does the environment do for us”	“what the value is of all the things environment does for us”
PF4	“Ecosystem services are the range of services that humans benefit from by the existence of habitats. For example, clean water from reed beds that process sewage treatment for us.”	“Ecosystem service valuation is where you use financial figures to help identify the scale of these ecosystem services so that you can compare them between locations and habitats and for different activities.”
PF5	“The way you analyse and put a value on those things that the natural environment provides for the economic, social and health of the people and communities. As opposed to its own value as a thing in its own right”	“Find this one harder as its difficult how you actually put a value on the non-tangibles. It’s a comparative approach. If that tree wasn’t there, how much would it cost to provide the benefit that a tree gives me?”
PF6	“ecosystem services are the things the natural environment provides for you”	“ecosystem service valuation is trying to put a value on those things, which can be financial that is the ultimate thing but there are other ways”
PF7	“Ecosystem services is what we rely on our planet and our ecosystem to do for us”	“Ecosystem services valuation is the value of the services that our environment does for us”

By the end of the case study, six stakeholders showed an understanding of the basic idea of ecosystem services and ESA. They defined ecosystem services as the things that the natural environment or ecosystems do or provide for people. One stakeholder pointed out that it is about the economic, social and health benefits for people and communities rather than the intrinsic value of nature. Another stakeholder explained that these benefits can be cultural, physical or other. The stakeholders' understanding of ESA focused mainly on the aspect of monetary values. However, they also talked about ESA in terms of the importance of habitats for supporting wildlife and human wellbeing, interactions with the marine environment and expression of values in other ways than monetary figures, cultural values and societal and health benefits. Two stakeholders mentioned that while before VALMER they had only understood ESA in terms of monetary values and quantitative figures, the project raised their awareness of a wider range of values and other ways of representing values, such as qualitative narratives or trends. While some of the stakeholders still considered monetary values to be important and useful by the end of the case study, others commented positively on the fact that ESA covers a broader range of values as well as qualitative assessments. The stakeholders also gained an

understanding of the limitations of ESA in general and monetary valuation in particular, such as data limitations, uncertain valuation outcomes, the subjectivity of values or the danger that values are misinterpreted or misrepresented.

Communicating ESA to stakeholders

All seven stakeholders agreed that the ecosystem services concept and ESA had been well explained in the workshops. One stakeholder said that the information provided by the VALMER team as well as the exchange with the other stakeholders gave them the confidence to participate in the discussions. However, comments by some of the stakeholders indicate that they thought the ecosystem services approach was quite complex, academic and technical. One stakeholder mentioned that it was difficult to understand unless the ESA was made real and relevant for example through local scenarios, as was done in the case study. One stakeholder said that they found it important to attend all workshops and follow the process in order to understand the concept. In fact, one of the interviewed stakeholders who had attended only the last two workshops and joined the case study with only a vague idea of ESA did have difficulties in explaining what it was about.

Scenarios as a tool to work with ESA

The stakeholders were positive about scenario building as an approach to working with ESA. They found that the local scenarios made the ESA more relevant and real for them. Two stakeholders mentioned that the scenario process contributed to building their understanding of the ESA concept, including its limitations. One stakeholder said that the scenarios promoted the discussion of the ESA results. At the same time, the stakeholder said that they would have liked to spend more time on examining the ESA results rather than on scenario development. Another element that was mentioned by three stakeholders as having been useful for engaging with ESA was visual tools like maps and images.

Added understanding through VALMER

Two stakeholders mentioned that the main thing they learned about the site was gaining an insight into local people's thoughts and opinions about certain management issues, like for example dredge disposal, and how these people perceive and value the area. One of them said that this was really useful as it will help support the engagement of managers with the users of the site. These comments related to the cultural ecosystem services assessment study that was conducted as part of the case study. One stakeholder said that while personally they already had a good understanding of this, they did see the potential of the ecosystem services approach to raise understanding of the need to protect certain ecosystems among stakeholders that are not involved in marine management or science: *"if you can use ecosystem services to explain actually the benefits that we get from those habitats, it helps people to understand why we want to protect them"* (stakeholder PF4).

ESA contribution to stakeholder dialogue and discussions

Table 9.9 presents the stakeholders' responses to three statements on the contribution of the VALMER ESA to stakeholder relations and discussions in the case study workshops. The seven stakeholders largely agreed that the ESA did foster better understanding among stakeholders with different interests and perspectives. As one stakeholder put it, *"we all had a chance to chip in to the process and got a better feeling for what other people's drivers were"* (stakeholder PF2). One stakeholder commented positively on the discussions in the workshops where the participants were able to share their views. Another stakeholder specifically mentioned the discussions about governance and activities in the case study area. Two others explained that the scenario building provided a platform for the stakeholders from different sectors to exchange their views and opinions and discuss their interactions with the marine environment and other activities. One of them added that the ESA discussions had helped them better understand the other stakeholders' positions. One stakeholder agreed that ESA did support the discussion among stakeholders as it provided a non-threatening

environment for everyone to feed into the process without having to defend their position. This stakeholder saw the ecosystem services approach as a way of engaging people in a conversation about the bigger picture. Two stakeholders mentioned that “*as a process, [ESA] did genuinely help to reduce silo thinking*” (stakeholder PF3) and that it got them to think outside the box. They also thought that ESA provides a common language for people with different interests that enable them to understand their interactions with the marine environment and to overcome their entrenched views to see the bigger picture and see problems from a new angle. Only one stakeholder was sceptical whether ESA added much extra value to the discussions. The stakeholders also commented positively on the fact that the combined scenario and ESA process provided opportunities for everyone to input their knowledge and views. One stakeholder felt that “*there were equal chances for everyone to input and that you felt valued when you did*” (stakeholder PF7). Another stakeholder specifically mentioned the drafting of the hypothetical action plan as well as the PESTLE analysis as opportunities to input into and validate the process. One stakeholder felt that “*there was lots of chance for [them] to feed into the project*” (stakeholder PF2) and thought that it was good that the group was ‘used’ to get information for the ESA and the scenarios.

Table 9.9 Plymouth Sound-Fowey stakeholder responses to three statements on the contribution of the VALMER ESA to stakeholder relations and discussions in the case study workshops (the stakeholders were asked to agree or disagree)

Statements: VALMER ESA did...	Stakeholder responses
Support the development of a common understanding of the management question that was addressed in the case study	<ul style="list-style-type: none"> • 6 agreed • 1 neither agreed nor disagreed
Foster better understanding among stakeholders with different interests and perspectives	<ul style="list-style-type: none"> • 6 agreed • 1 neither agreed nor disagreed
Help support the discussion and appraisal of different management options in the scenario building process	<ul style="list-style-type: none"> • 6 agreed • 1 disagreed

Those stakeholders that had commented positively on the contribution of ESA to the exchange and discussions among stakeholders also agreed that ESA had the potential to increase acceptance and buy-in to decisions by stakeholders. Reasons given for this included that:

- The ecosystem services approach helps people understand the need or benefits of conservation;
- It provides an opportunity for engaging people in a conversation in a non-threatening environment in which people can contribute and share their views without having to defend their position.

Another stakeholder, on the other hand, thought that ESA was too vague and prone to subjective interpretation and said that “it did not come across as such a factual approach that people would be won over if it didn’t already suit their view” (stakeholder PF1).

3.a.4 Golfe Normand Breton (GNB)

Focus of Case Study & Ecosystem Services studied	Recreational and provisioning services provided by tidal and subtidal benthic habitats
ESA Methods	INVEST Ecosystem accounting
Case Study Governance Context	Scoping project for the establishment of a Natural Marine Park
Stakeholder Group	Local managers, user and interest groups involved in the marine park project
Interviewed Stakeholders	n=7 <ul style="list-style-type: none">• 2 Local Authorities• 1 Commercial fisheries interest group representative• 1 Government agency• 1 Business interest group representative• 2 Natural area managers

Motivation for engaging in VALMER

One stakeholder said that his organisation had already worked with the ecosystem services approach on a smaller scale and was interested in continuing this work on a larger scale. Their colleague mentioned specific interest in the aspect of assessment of the quality of ecosystem functions and health of habitats. Continuous involvement in the Golfe Normand Breton marine park project was another major motivation for participation in the VALMER case study for three of the stakeholders. Two of these explained that the marine park project was based on the ecosystem approach and that they participated in VALMER to gain the necessary knowledge on the ecosystem approach to enable them to engage in the marine park project. For three stakeholders, ecosystem services, ESA or any related approach were not the main motivation for participating in the case study. Instead, they mentioned a general interest in everything that concerns marine management, representing the interests of their sector in discussions on the management of the Golfe Normand Breton and an opportunity to talk to the other organisations involved in marine management of the site in a neutral context. However, all three stakeholders mentioned an interest in a specific aspect of the case study work related to ESA. One stakeholder was interested in learning more about the ecosystem services approach as a management tool for the Golfe Normand Breton site. One of them was mainly interested in the use of scenarios to assess ecosystem services in the face of changes in activities and the environment. The other explained that their organisation was trying to find more pedagogical ways of explaining regulations to their stakeholders and that VALMER offered an opportunity to get tools for using the ecosystem services concept for this purpose.

Pre VALMER understanding of ESA

Three stakeholders had a good understanding of the ecosystem services concept before VALMER, two of them having already worked with the approach in their organisation. Two others had heard about the ecosystem services approach before without necessarily understanding the details or applications of it. One of them mentioned that it is a ‘buzzword’. The remaining two stakeholders talked about the ecosystem approach, describing it with the three pillars of sustainability.

Post VALMER understanding of ESA

Table 9.10 presents the definitions of ecosystem services and ecosystem service valuation provided by the stakeholders.

Table 9.10 The definitions of ecosystem services and ecosystem service valuation provided by the GNB stakeholders

Stakeholder	Definition of ecosystem services
GNB1	The different values that an ecosystem provides, economic values and social values, different values from different uses; these values depend from the different activities that profit from the ecosystem
GNB2	Attempting to know the value, not only economic but also social or other values, all the variables that interact with an environment; defining different variables in an environment, different stakeholders and users and understanding what the value is of the services provided by the environment for society but also for the environment itself because sometimes we are interested just in the environment without it being orientated by human interests and we just look at the interactions in the environment; Quantifying services using different units to reveal major trends (not to use the specific figures)
GNB3	for an oyster farmer, for example, it would be recognising the economic value of the environment he uses for his oyster farm and integrating this value into the price of his oysters – if the environment is healthy, his oysters are worth more; if the environment is in bad health, he might not be able to market his oysters; For fishermen, for example, good environmental health is like a quality label for a good image
GNB4	for an oyster farmer, for example, it would be recognising the economic value of the environment he uses for his oyster farm and integrating this value into the price of his oysters – if the environment is healthy, his oysters are worth more; if the environment is in bad health, he might not be able to market his oysters; For fishermen, for example, good environmental health is like a quality label for a good image
GNB5	The environment is a living ecosystem with habitats and species that interact with each other, and the functioning of an ecosystem provides different kinds of services to humans, for example as a fisheries resource (with habitats and food chains that support fish stocks) and thus as a food provision service, or landscapes that are part of the heritage of an area, or good quality beaches that provide opportunities for recreation – a series of services that are provided by nature, provided that they are used with respect
GNB6	The description and assessment/valuation of the services provided to humans by ecosystems and their ecological functions
GNB7	The services that are directly or indirectly provided to humans by an ecosystem, and these services are linked to the functions of an ecosystem

The three stakeholders who already had a good understanding of ecosystem services at the beginning of VALMER described them as the services provided to humans by ecosystems through ecosystem functions. Of the two stakeholders that had heard about the approach without having a detailed understanding of it, one described ecosystem services as the values provided by an ecosystem depending on the different uses of this ecosystem. The other stakeholder gave a comprehensive but not necessarily clear explanation of the ecosystem services approach. The two stakeholders that talked about the ecosystem approach understood ecosystem services in terms of the value added to human activities through good environmental quality. One stakeholder said that VALMER had helped them better understand what the ecosystem services approach was and what it could be used for. One stakeholder perceived the ecosystem services approach to be a very political, almost religious approach to the environment disguised by scientific tools, “*a very North American vision, not necessarily French*” (stakeholder GNB3), an approach in which one’s views on ecosystem services depend on whether one ‘believes’ in the approach or not.

Communicating ESA to stakeholders

Overall, the stakeholders found the VALMER approach and information understandable and interesting. One stakeholder mentioned that the ecosystem services approach can be difficult to understand because it is quite technical but that it was well presented in the workshops and everyone managed to follow. Another stakeholder mentioned that he found the workshops more concrete and less theoretical than he had anticipated.

Added understanding through VALMER

The VALMER case study did not contribute much to the stakeholders' understanding of the Golfe Normand Breton in terms of the ecology of the site. Most stakeholders explained that they had already been familiar with the habitats and species in the Golfe Normand Breton before VALMER. Only one stakeholder found it interesting to be able to put his part of the gulf into the broader ecological context of the Golfe Normand Breton and the English Channel. Two stakeholders mentioned that the VALMER case study provided them with a more comprehensive view of the Golfe Normand Breton, enabling them to gain a better understanding of how the different activities in the gulf are linked to each other as well as to the environment.

ESA contribution to stakeholder dialogue and discussions

Table 9.11 presents the stakeholders' responses to three statements on the contribution of the VALMER ESA to stakeholder relations and discussions in the case study workshops.

Table 9.11 GNB stakeholder responses to three statements on the contribution of the VALMER ESA to stakeholder relations and discussions in the case study workshops (the stakeholders were asked to agree or disagree)

Statements: VALMER ESA did...	Stakeholder responses
Support the development of a common understanding of the management question that was addressed in the case study	<ul style="list-style-type: none">• 5 agreed• 1 agreed although adding that the stakeholders' interests still influenced their position in the discussion• 1 said more or less
Foster better understanding among stakeholders with different interests and perspectives	<ul style="list-style-type: none">• 7 agreed
Help support the discussion and appraisal of different management options in the scenario building process	<ul style="list-style-type: none">• 7 agreed

Five out of seven stakeholders commented positively on the opportunity for exchange with other stakeholders in the Golfe Normand Breton that the VALMER workshops provided. The combined ESA and scenario building approach allowed them to share their views and ideas and learn about the other stakeholders' perspectives and expectations. One stakeholder said that the VALMER approach successfully got the different stakeholders to listen to each other rather than just defending their own interests, as is often the case in stakeholder consultation processes. Apart from an exchange between stakeholders, the stakeholders felt that the combined ESA and scenario approach did provide a platform for integrating different opinions, ideas and suggestions and using the information provided by the stakeholders as baseline data. One stakeholder mentioned that the ecosystem services approach in particular could be good tool to facilitate stakeholder discussion and consultation in order to take into consideration the different issues and interested involved in management questions. Another stakeholder mentioned that the VALMER approach could help avoid user conflicts in development planning. Three stakeholders saw the ecosystem services approach as a communication tool to explain regulations and conservation efforts to decision makers and the public. The ecosystem services approach explains what the environment provides, how humans benefits from the environment, how human activities affect the provision of these services and thus the potentially negative consequences of environmental degradation. It thus makes explicit the wider benefits of conservation for different stakeholders. One stakeholder said that this is easier to communicate to stakeholders because it provides arguments to justify protection that stakeholders are receptive to, because it reveals the interest of conservation to them. However, the stakeholder pointed out that changing people's mentality with regard to environmental conservation would take time. Four of the seven interviewed stakeholders agreed that the ecosystem services approach can lead to greater acceptance of and buy-in to decisions. Reasons for this included that:

- It helps explain the benefits of protecting certain habitats and species for the different stakeholders by showing the role that ecosystems play in supporting human activities;
- It raises awareness of the role of management in securing their resources;
- It supports a more integrated management approach that takes into consideration the interests of all different users;
- It allows the stakeholders to be involved in the development of management tools by getting them around the table to discuss and share their knowledge and to provide the baseline data for the decisions;
- It helps justify decisions;
- It provides stakeholders with the knowledge to understand decisions;
- It can make the stakeholders aware of their interactions with and attachment to their environment.

The two other stakeholders talked about the ecosystem approach as a new way of thinking which would have to be better explained and communicated if it was to support stakeholder buy-in to decisions.

Scenarios as a tool to work with ESA

Three stakeholders commented positively on the combination of ESA and scenarios, saying that the scenarios provided a framework for the discussion and that the combination of ESA can show how different management options can affect the environment, the ecosystem services it provides and the activities that make use of it.

3.a.5 Golfe du Morbihan (GdM)

Focus of Case Study & Ecosystem Services studied	Maintenance and regulation services provided by seagrass beds
ESA Methods	Choice experiment
Case Study Governance Context	Project to establish a Natural Regional Park
Stakeholder Group	Local managers, user and interest groups involved in the natural regional park project
Interviewed Stakeholders	<p>n=8</p> <ul style="list-style-type: none"> • 2 Commercial fisheries interest group representatives • 3 Government agency representatives • 1 Local politician • 2 Local recreational club representatives

Motivation for engagement in VALMER

The four stakeholders who represented various user groups and business interests in the Golfe du Morbihan stated that their main motivation for participating in VALMER was to ensure that their interests and views were considered in the discussion of potential management measures. The seagrass monitoring work that was done as part of VALMER was the main motivation for the two interviewed local government representatives involved in marine planning in the Golfe du Morbihan. The local politician was mainly interested in the discussion of issues surrounding environmental quality in the Golfe du Morbihan. The local government representative in charge of maritime activities in the Golfe du Morbihan followed an invitation by the project team to the first meeting but mentioned interest in ESA as motivation for participating in the subsequent meetings.

Pre VALMER understanding of ESA

The two local marine planning stakeholders had worked with the ecosystem services approach before and had knowledge of monetary valuation. The remaining six stakeholders did not have any knowledge of ecosystem services or ESA before VALMER. One of them mentioned that they had been familiar with the approach before but referred to it as the ‘ecosystem approach’, a comprehensive approach to environmental issues.

Post VALMER understanding of ESA

Table 9.12 presents the definitions of ecosystem services and ecosystem service valuation provided by the stakeholders.

Table 9.12 Definitions of ecosystem services given by the GdM stakeholders. (The definitions were translated from French into English by the interviewer and are therefore no direct quotes.)

Stakeholder	Definition of ecosystem services
GdM1	‘The interactions between a species or a habitat, or the environment and an activity or use, thus the services that the environment provides for this activity, what the activity produces from the environment, and all this in a more comprehensive context where the species or habitat has a role in the broader context of the ecosystem and the activity has a role in the broader economic context of the area – an approach that puts the elements in relation to each other as well as into a broader context’
GdM2	Did not give a definition but would explain it using examples of the services provided by a habitat to each user group
GdM3	Did not give a definition but would talk about user conflicts, reasons for conflicts, would describe the resource and activities, the environment and pressures on it – without talking about ecosystem services
GdM4	Was not able to give a definition of ecosystem services or ESA, talked about a system in which all stakeholders are interlinked and unilateral actions by one stakeholder can shift the system
GdM5	‘The ecosystem approach, or approach by ecosystems, is a management approach where the land, water and the living resources are integrated to promote the conservation and sustainable use of natural resources, in order to respect the interactions in an ecosystem on which humans depend. All elements of an ecosystem are linked, it is thus necessary to take them all into consideration. For example, the problem of seagrass deterioration: in what state is it? Why is it degrading? What are the sources of degradation? What can be done to protect it? And then explaining to people why it is important to protect it by saying that seagrass supports water clarity, provides fish nurseries, etc.’
GdM6	‘A comprehensive approach to a problem that in the first place takes into considerations environmental concerns/issues but should be broadened to also include social and economic concerns; because a purely ecological approach is interesting and environmental concerns need to be given fair weight but excluding economic and social aspects is dangerous’
GdM7	‘Taking into consideration the maintenance of biodiversity and what it brings to everyday life or to different groups of people, and maintenance not only for the sake of humanity in general but so that people take ownership of the benefits they get from the protection of a species. Ecosystem services means measuring what the protection of a species will bring to people in terms of individual benefits and not only in terms of what it will bring to society in general’
GdM8	‘Ecosystem services is not having a closed vision on the issues at hand, e.g. seagrass, having a more comprehensive view of things and to try and understand why it is important to protect the seagrass and have healthy seagrass’

When asked about their thoughts and understanding of the ecosystem services approach and ESA following their engagement in VALMER, four of the six stakeholders who had had no previous knowledge of the approach talked about the ecosystem approach instead of ecosystem services. They described the ecosystem approach as a comprehensive approach for looking at the interactions between the environment and human activities in a broader ecological and economic context, as a management approach that takes into consideration all elements of an ecosystem in order to promote the conservation and sustainable use of natural resources or as an approach to determine justifiable management measures for environmental protection and to communicate the importance of

environmental protection. Three stakeholders indirectly talked about ecosystem services in the context of explaining the ecosystem approach. One talked about the services that the environment provides for an activity, another provided examples of services provided by seagrass, while the third stakeholder mentioned that fishermen were aware of the benefits they obtained from seagrass. The fourth stakeholder understood ecosystem services as the benefits of protecting a species for individuals. The responses and definitions given by the remaining two stakeholders indicate that they did not understand the concept of ecosystem services or of the ecosystem approach. One of the two understood the approach presented in the VALMER Golfe du Morbihan case study as an approach that looked only at the ecological aspects of an issue. The stakeholder was very critical about this, saying that social and economic aspects also needed to be taken into consideration. This stakeholder expressed concerns that the VALMER study would be used to impose restrictions on the use of seagrass areas that would affect their activities.

Communicating ESA to stakeholders

When asked what they thought about the information on ecosystem services and ESA that had been presented in the case study meetings and workshops, five stakeholders said that they found the information understandable and not too technical. However, this included the two stakeholders that did not appear to have understood the ecosystem services concept. One stakeholder found the ecosystem approach to be a more accessible, comprehensible, non-scientific way of communicating the need for conservation to stakeholders and the wider public. On the other hand, another stakeholder did find talking about ecosystems to be very scientific and not easily understandable for non-scientist stakeholders. The stakeholder stressed the importance of adapting the vocabulary to the audience, saying that scientific language could be disengaging for non-scientist stakeholders. Similarly, the two stakeholders that had joined the project with previous understanding of the ecosystem services approach said that while the concept and ideas behind ecosystem services and ESA were simple and common sense, the vocabulary was not easy to understand. In particular the term 'ecosystem services' remained difficult to define and communicate. They suggested that it would be useful to start engagement processes like the one in VALMER with a stocktake of the stakeholders' understanding of the ecosystem services approach. Regarding the information provided in the VALMER workshops, the two stakeholders said that it had been comprehensible because it was related to a concrete habitat and topic.

Added understanding through VALMER

Most of the stakeholders gained some added understanding of the local seagrass beds, their importance for the Golfe du Morbihan and the interactions of different activities in the gulf with the seagrass beds.

ESA contribution to stakeholder dialogue and discussions

Table 9.13 presents the stakeholders' responses to three statements on the contribution of the VALMER ESA to stakeholder relations and discussions in the case study workshops. Two stakeholders mentioned that they found the exchange with other stakeholders in the workshops interesting and constructive. Two stakeholders commented positively on the fact that the workshops provided opportunities for all stakeholders to input their knowledge and ideas into the ESA and scenario process. Concerning this last point, one stakeholder raised concerns about how much importance should be given to the opinions of different stakeholders and that a fair balance of all interests needed to be maintained. Another stakeholder commented that while the stakeholders had been involved in the VALMER process, they felt that had not been involved until the end and that their opinions had not been integrated into the final decisions made by the VALEMR team. This stakeholder was under the impression that the VALMER study would be used to inform the revision of the local marine plan and was therefore concerned that their interests had not been adequately considered. Following their experience with VALMER, three stakeholders thought that the ecosystem approach or ESA could contribute to improving communication and relationships between different stakeholders by allowing

them to better understand each other's' position as well as keeping the discussion objective and neutral.

Table 9.13 GdM stakeholder responses to three statements on the contribution of the VALMER ESA to stakeholder relations and discussions in the case study workshops (the stakeholders were asked to agree or disagree)

Statements: VALMER ESA did...	Stakeholder responses
Support the development of a common understanding of the management question that was addressed in the case study	<ul style="list-style-type: none"> • 7 agreed • 1 said that it was too soon to say but that he expected the approach to be helpful in the future
Foster better understanding among stakeholders with different interests and perspectives	<ul style="list-style-type: none"> • 5 agreed • 2 thought that it did so more or less • 1 said that it was too soon to say but that he expected the approach to be helpful in the future
Help support the discussion and appraisal of different management options in the scenario building process	<ul style="list-style-type: none"> • 8 agreed

All eight stakeholders agreed that using the ecosystem services approach in decision making can lead to greater acceptance and buy-in of the decisions among stakeholders. Reasons given for this included that:

- It allows everyone to contribute their knowledge and views to the discussion of management options and to be involved in the decision;
- It helps stakeholders understand the role that their and other activities play in causing impacts on the environment;
- It shows the benefits of different management options and the consequences of inaction for the stakeholders;
- It helps to explain the importance of protecting certain ecosystems, habitats or species;
- It provides understandable arguments for explaining and justifying regulations and management measures.

Scenarios as a tool to work with ESA

Two stakeholders mentioned that the scenario building process provided a useful framework for the discussion. Another stakeholder said that a fictitious exercise like scenario building can contribute to improving relations between stakeholders by providing an opportunity for stakeholders to talk to each other, learn to understand and respect each other's' positions. This in turn can help take the heat out of management discussions and advance objective measures. One stakeholder found the combination of ESA and scenarios helpful for making more informed management decisions, provided all interacting factors were considered.

3.a.6 Parc Naturel Marin d'Iroise (PNMI)

Focus of Case Study & Ecosystem Services studied	Ecosystem services provided by kelp forests for food provision, species habitats and ecotourism
ESA Methods	Dynamic modelling
Case Study Governance Context	Iroise Natural Marine Park
Stakeholder Group	Stakeholders involved in the management of the marine park
Interviewed Stakeholders	<p>n=4</p> <ul style="list-style-type: none"> • 2 Commercial fisheries interest group representatives • 1 NGO representative • 1 Natural area manager

Motivation for engagement in VALMER

In the Parc Naturel Marin d'Iroise case study there was no specific VALMER engagement process. The stakeholders were introduced to the VALMER ESA and model in their regular PNMI and fisheries working group meetings. Consequently it was not possible to ask the stakeholders directly about their motivation for engaging in VALMER. The stakeholders did however talk about their interest in the project, giving an indication of whether ESA would be a motivation for them to become involved in a process like VALMER. One of the two fisheries representatives said that they did not participate in the meetings where the VALMER project was presented because the ESA and modelling approach appeared to be very research oriented and conceptual and not relevant for management practice. They thought that the modelling of the relations between fisheries and other ecosystem services and different impacts on ecosystem services could be useful to their organisation but that the approach was not yet useable in practice due to data and knowledge limitations. The stakeholder representing the environmental conservation sector explained that for environmental organisations, taking ecosystem services into consideration was the aim of their work. For them, ecosystem services provide a neutral terminology for integrating ecological ideas into decision making and making them more acceptable to economically oriented decision makers as well as the general public. The marine park stakeholder said that the VALMER work on ESA was relevant for the management of the marine park as it offered a useful tool for communicating with the fisheries stakeholders. Also, VALMER provided a good example of what modelling can do, which could be useful to get the professional marine park stakeholders to buy into modelling as an approach to inform the design of future regulations. Finally, the second fisheries representative thought that it was important for the members of their organisation to understand the ecosystem approach and that modelling could be a useful tool for them to anticipate different impacts and plan their reactions to these.

Pre VALMER understanding of ESA

Two of the interviewed stakeholders had previous knowledge of the ecosystem services approach. The other two stakeholders had not heard about ecosystem services or ESA before VALMER.

Post VALMER understanding of ESA

Table 9.14 presents the definitions of ecosystem services and ecosystem service valuation provided by the stakeholders. Three stakeholders explained that ecosystem services are the services or benefits that the environment or an ecosystem provides to society. They mentioned cultural services and heritage benefits, recreational services, economic benefits as well as the functional role for the environment in terms of supporting habitats and species. One stakeholder went on to explain that the ecosystem

services approach is about determining and quantifying the role and benefits of the environment for society. One stakeholder did not provide a definition of ecosystem services. When asked directly what they thought about the approach of assessing the services provided by the environment they said that for them it was straightforward. Further responses revealed that the stakeholder understood the ecosystem services approach as an integrated management approach that takes a comprehensive view on the environment and its users and aims to find a good balance between these two.

Table 9.14 Definitions of ecosystem services given by the PNMI stakeholders. (The definitions were translated from French into English by the interviewer and are therefore no direct quotes.)

Stakeholder	Definition of ecosystem services
PNMI1	Did not give a definition but would explain it in terms of integrated management
PNMI2	'it is what the environment, in this case the marine environment, provides in terms of benefits to a society, heritage benefits, economic benefits, and in terms of their functional role for the living elements of the environment' 'ESA is about trying to determine and qualifying the role and benefits of the environment for society'
PNMI3	all the services that the ecosystems can provide, in all dimensions including the cultural dimension
PNMI4	'each part of an ecosystem provides different services, provisioning services, recreational services, or services in terms of maintaining particular habitats or species' ESA: the VALMER approach, an ecosystem based, integrated management, allows to better understand which benefits are provided by each ecosystem part and to understand the complexity of an ecosystem and its services and the interactions between the different elements, so that the stakeholders can better understand this complexity and understand the need for management and regulations that might affect their activity'

Communicating ESA to stakeholders

When asked what they thought of the ecosystem services approach and whether they found the information provided by VALMER understandable, the two stakeholders that had not heard about ecosystem services before mostly talked about the modelling aspect of the case study. Only one of the two was able to give a correct definition of ecosystem services following their involvement in VALMER. The stakeholder that did not give a definition of ecosystem services mentioned that while personally they found the ecosystem services approach interesting and comprehensible, fishermen might find it more difficult to understand or interpret it as a resource management approach and consequently be sceptical about it.

Added understanding through VALMER

One stakeholder said that the ecosystem services approach was a good process for gaining a better understanding of the environment but that this had not been the case in the PNMI VALMER case study as they had not seen the results of the ESA yet. Two other stakeholders commented that rather than having gained additional understanding, the VALMER case study reinforced or confirmed their good understanding of the local marine ecology, of how marine habitats and species support social and economic wellbeing and the need for management to secure healthy, resilient and functioning marine ecosystems. However, one stakeholder did think that the VALMER approach, combining ESA and modelling, could help the marine park stakeholders better understand the complexity of an ecosystem, the interactions between different ecosystem elements and the services it provides. This, in turn, could help them understand the need for management to secure this ecosystem.

ESA contribution to stakeholder dialogue and discussions

Table 9.15 presents the stakeholders' responses to three statements on the contribution of the VALMER ESA to stakeholder relations and discussions in the case study workshops. Since there was no active engagement process in which the stakeholders came together to share their knowledge and opinions, the four interviewed stakeholders did not comment on this aspect. However, rather than an exchange between stakeholders, one stakeholder mentioned that the VALMER process had provided a

platform for an exchange between scientists from different disciplines. In their opinion, this exchange fosters a better understanding among the different expert groups involved in research to inform specific management issues. More generally, the stakeholders did think that the ecosystem services approach had the potential to support communication among and with stakeholders. One stakeholder said that the combination of ESA and modelling can potentially support and improve stakeholder dialogue and discussion if the tool and its limitations are well understood and good data is available. They explained that it provides a common, objective knowledge base and can thus inform, clarify and calm discussions that are often dominated by different views and conflicting information. Similarly, according to another stakeholder the ecosystem services approach offers a technical, scientific and thus neutral communication tool that avoids ecological and conservationist vocabulary as well as providing an objective evidence base for discussion. The marine park representative believed that the ecosystem services approach can support the dialogue with stakeholders although this is not always easy as the stakeholders' focus is on economic profit and they are not always used to thinking about ecological aspects. They had expectations that the VALMER results would support the stakeholder dialogue in the marine park.

Table 9.15 PNMI stakeholder responses to three statements on the contribution of the VALMER ESA to stakeholder relations and discussions in the case study workshops (the stakeholders were asked to agree or disagree)

Statements: VALMER ESA did...	Stakeholder responses
Support the development of a common understanding of the management question that was addressed in the case study	<ul style="list-style-type: none"> • 4 agreed
Foster better understanding among stakeholders with different interests and perspectives	<ul style="list-style-type: none"> • 3 agreed • 1 said that this was not yet the case but expected that it would be in the future
Help support the discussion and appraisal of different management options in the scenario building process	<ul style="list-style-type: none"> • 4 agreed

Three of the four interviewed stakeholders agreed that the ecosystem services approach can increase stakeholder acceptance and buy-in to decisions. Reasons given for this included:

- It gives stakeholders like fishermen a better understanding of the decisions and enables them to see their place in the broader context and relation to the issues of the site;
- It provides objective, in some cases quantitative arguments that provide a rational evidence base for discussion, help justify a decision and can potentially lead the stakeholders to change their position and attitudes;
- It offers a communication method that avoids using ecological and conservationist terminologies that stakeholders are often afraid of and that can lead to blockages in the stakeholder dialogue.

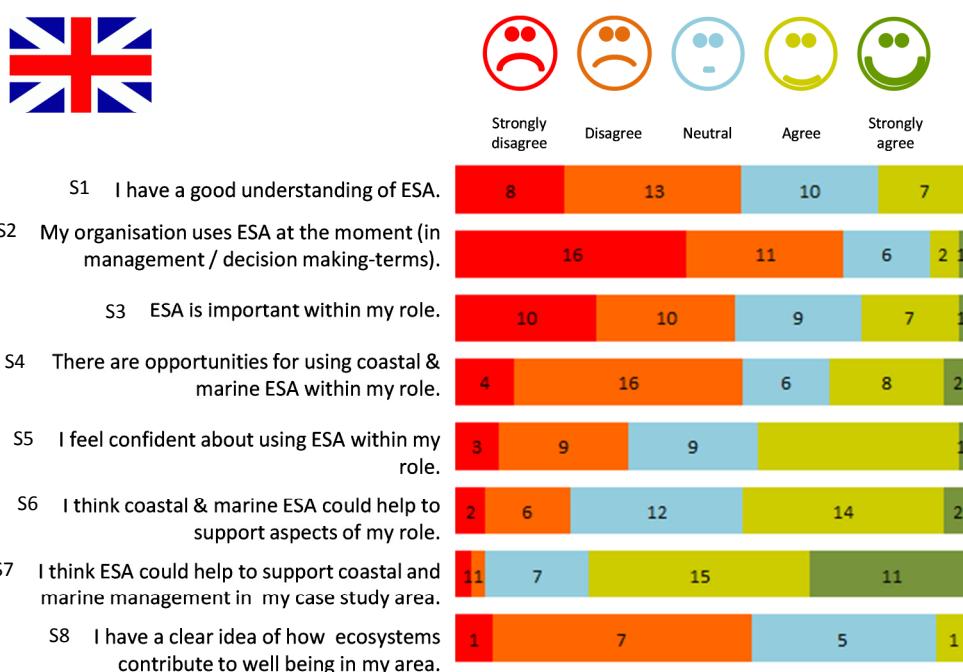
The marine park representative gave an example where the marine park management had successfully used an ecosystem services approach to explain the need to close a certain area for fisheries to the affected fishermen. The fourth stakeholder was more sceptical, saying that everything that contributes to a better understanding of the context allows people to better understand the management but that the ecosystem services approach might not be the best approach to foster stakeholder acceptance and buy-in into decisions as it is not yet possible to qualify and quantify all ecosystem services. However, if good data was available, an objective approach like ESA could help provide clarity in discussions dominated by different views and conflicting information.

3.a.7 Findings from the before and after survey

As explained in Section 2.4, a before and after survey was completed by VALMER stakeholders to establish whether or not participation by stakeholders in the VALMER project added to their individual knowledge and understanding of ecosystem services and ESAs for marine governance. Table 9.16 contains the statements contained within the survey. Figures 9.2 and 9.3 show the UK and French results of the before survey that was conducted at the beginning of the case study engagement process at each site.

Table 9.16 Statements and corresponding scales in the before and after survey

Statement	1	2	3	4	5
S1 I have a good understanding of ESA	Not at all	A little	Fair	Very good	Excellent
S2 My organisation uses ESA at the moment (in management/decision making terms)	Never	Very rarely	Occasionally	Often	All the time
S3 ESA is important within my role	Not at all	A little	Fairly	Very Often	Essential
S4 There are opportunities for using coastal and marine ESA within my role	Never	Very rarely	Occasionally	Often	All the time
S5 I feel confident about using ESA within my role	Not at all	A little	Fairly	Quite Often	Very All the time
S6 I think coastal and marine ESA could help to support aspects of my role	Never	Very rarely	Occasionally	Often	All the time
S7 I think ESA could help to support coastal and marine management in the xxx case study area	Never	Very rarely	Occasionally	Often	All the time
S8 I have an understanding of how xxx habitats support economic and social wellbeing in the xxx case study area	Not at all	Yes, limited	Yes, fair	Yes, good	Yes, very good



*The last statement was included only in the before survey given to the North Devon stakeholders. This explains why the number of respondents is lower than for the other statements.

Figure 9.2 Aggregated responses of UK stakeholders across all three UK sites for the before survey

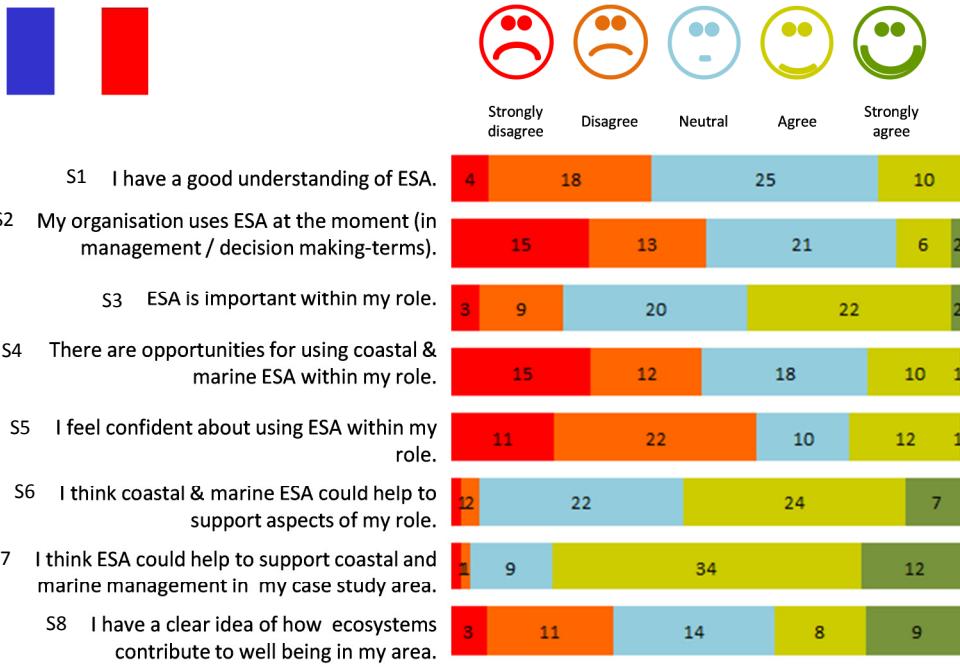
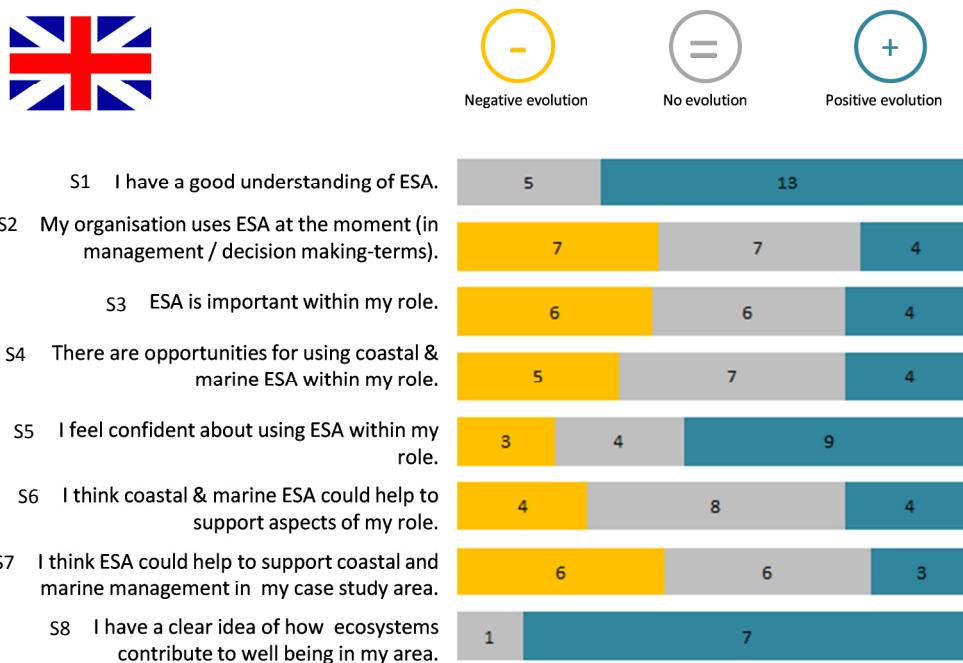


Figure 9.3 Aggregated responses of French stakeholders across all three French sites for the before survey

At the French sites, discussions between the VALMER case study teams and the stakeholders about the statements in the before survey indicated that the responses were overestimations. This was considered to be due to the fact that people know the words “ecosystem” and “services” but not together as a framework. However, further enquiry revealed that the concept of ecosystem services was not well known in the French society. Another reason why some of the respondents overestimated their knowledge and use of ESA at the beginning of the project was that they didn’t want to be considered as ignorant or that the VALMER team would think that their organisation is not working with the most up to date concepts. For these two reasons the answers can be considered to be a bit more positive compared to reality. Further, the stakeholders were very optimistic about the statement “I think ESA could help to support coastal and marine management in my case study area” even though it is very theoretical and general. The reason for this may be that it is a more long term open statement compared to the other statements.

In addition, at the French sites some of the respondents to the before survey were interviewed by phone if they had given very positive in terms of knowledge, comprehension and use of ESA. The main lesson learned from these interviews is that they understand ESA in terms of the three aspects of sustainable development and in particular in terms of the links between human activities and ecosystems. In their explanations, they gave examples of the direct benefits that humans get from ecosystems such as fishing. The stakeholders used this to justify ecosystem conservation and constraints on activities by arguing that there are direct links between the impact that one activity may have on an ecosystem and the direct benefit it can get from the same ecosystem. Another example that was given by a policy maker is that he has to consider the social use of ecosystems. In his constituency there is a traditional recreational shellfish harvesting activity by locals during low tides. The ecosystem where this activity is takes place is protected and very sensitive to disturbance. The policy maker explained that he considers ecosystem services in its approach of management because he doesn’t forbid the shellfish harvesting as it is socially important for the area. In this example, the interviewee considered a direct use, one ecosystem service, but he didn’t have a global vision of the wider services provided by the ecosystem and the potential beneficiaries that would have justified limiting or forbidding recreational shellfish harvesting.

Figures 9.4 and 9.5 show a comparison of the before and after surveys for the UK and French sites. Country comparisons are shown in Figure 9.6, with 29 stakeholders in total; in the UK 18 stakeholders responded both to the before and the after survey, in 11 stakeholders responded both to the before and the after survey. The results suggest that stakeholders have gained a better comprehension of ESA from their participation in the VALMER project. This is might explain why some stakeholders agreed less to statements 2 to 6 (Table 9.16) in the after survey than they did in the before survey. Gaining a better understanding of ESA may have given them clearer view on its use in their role and organisation.



*The last statement was included only in the before and after surveys given to the North Devon stakeholders. This explains why the number of respondents is lower than for the other statements.

Figure 9.4 Comparison of the before and after survey responses of 18 stakeholders across the three UK sites

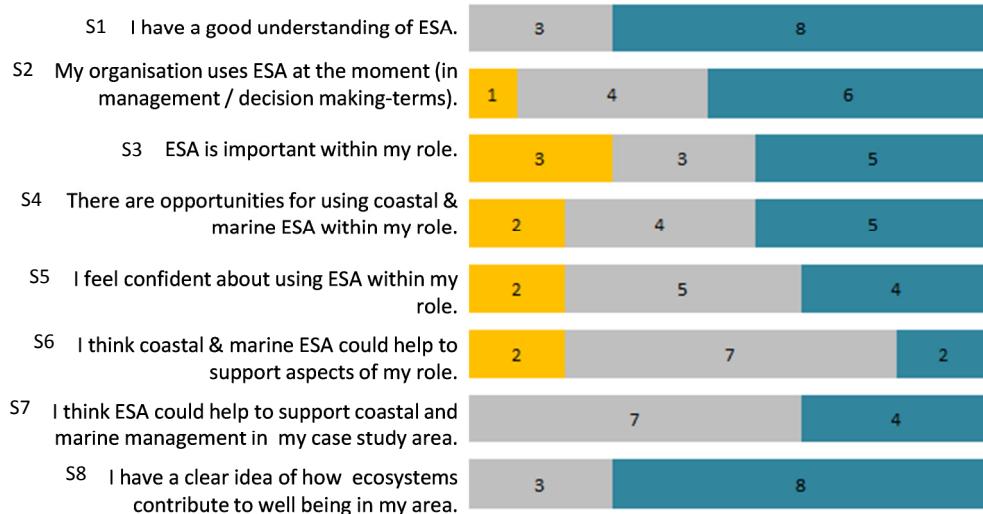


Figure 9.5 Comparison of the before and after survey responses of 11 stakeholders across the three French sites

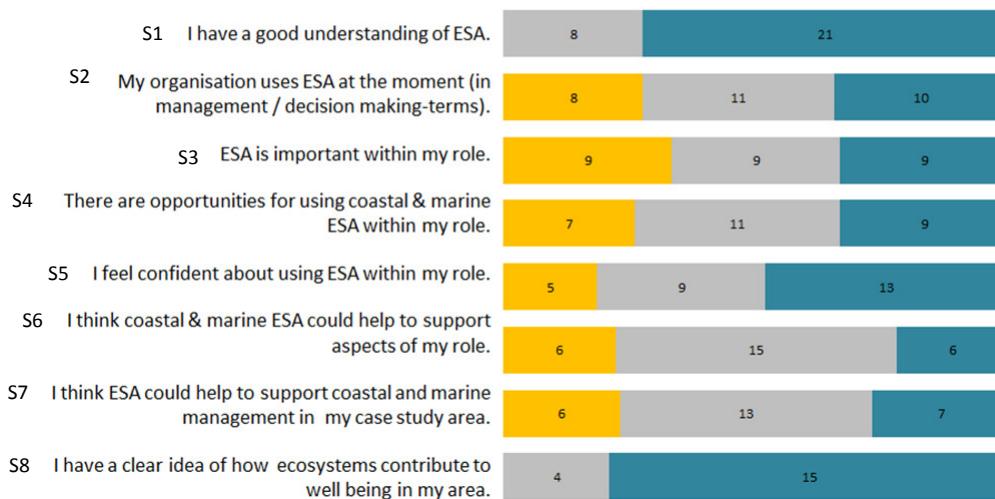
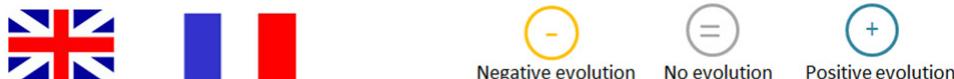


Figure 9.6 Country by country comparison of the before and after survey responses

3.b Stakeholder experience with ESA in the case studies: Evaluation

3.b.1 Added benefits of ESA to stakeholder engagement in VALMER

The VALMER stakeholder interviews suggest that the ecosystem services approach can support better dialogue and relations between managers and stakeholders by providing a neutral, objective and inclusive setting for bringing relevant stakeholders around the table to share information and discuss issues and management options.

Stakeholders in North Devon, Plymouth Sound-Fowey, Golfe Normand Breton and Golfe du Morbihan perceived ESA to be a neutral and objective approach that shows how the different elements of an ecosystem and the different activities in an area are linked. It helped them better understand each other's positions and the role that each stakeholder plays in the socio-ecological system. *"Everyone was learning a bit more about the other side of things"* (stakeholder ND1). The stakeholders felt that they could share their views and knowledge without having to justify themselves. In the Golfe Normand Breton, one participant felt that unlike other consultation processes where people only participate to defend their own interests, with the ESA approach the different stakeholders actually listened to each other. One Plymouth Sound-Fowey stakeholder commented that ESA provided a common language for people with different interests to understand their interactions with the environment and look at problems from a different perspective. Stakeholders in different case studies felt that ESA helped overcome narrow minded sectorial views and have a more comprehensive outlook on human-ecosystem interactions at their sites. As one Plymouth Sound-Fowey stakeholder put it, *"for those sectors or groups who may have become entrenched in their views, it can allow them to get the bigger picture"* (stakeholder PF3).

In North Devon, Golfe Normand Breton and Golfe du Morbihan the stakeholders found that the workshops brought together a good mix of people that don't normally meet and provided an opportunity for sharing and exchanging knowledge and views. In North Devon, Plymouth Sound-Fowey, Golfe Normand Breton and Golfe du Morbihan the stakeholders commented positively on the fact that the workshops provided opportunities for everyone to contribute their knowledge and views and validate the data collected for the ESA. This gave them a sense of being involved in the management or decision making processes and that their interests were being taken into consideration. *"Everybody was chipping in, so the different strands of information were all represented"* (stakeholder ND3). As one Plymouth Sound-Fowey stakeholder explained, this also helped the different stakeholders better understand each other's position: *"we all had a chance to chip in to the process, and got a better feeling for what other people's drivers were"* (stakeholder PF2).

Thus, by providing a neutral, objective and more comprehensive view on the marine environment and its human uses and by enabling the integration of different knowledge, views and interests, ESA facilitated an inclusive engagement process, constructive stakeholder dialogue and mutual learning.

3.b.2 Potential use of ESA in stakeholder engagement

Based on their experience in VALMER, stakeholders across all six sites saw potential for ESA as a tool for managers to communicate with their stakeholders and improve stakeholder dialogue.

Stakeholders in Golfe Normand Breton, Golfe du Morbihan and Plymouth Sound-Fowey thought that ESA would be a useful tool for communicating the importance of environmental conservation and explaining regulations and management measures. According to one Golfe Normand Breton stakeholder, *"the ecosystem services approach can help explain why regulations are put in place, for example explaining that it will have negative consequences for the users if their activities degrade the quality of the environment and the services it provides, and that thus it is in their interest to avoid*

damaging activities" (stakeholder GNB5, translated from French). Similarly, one Plymouth Sound-Fowey stakeholder said that "*if you can use ecosystem services to explain the benefits that we get from those habitats, it helps people understand why we want to protect them*" (stakeholder PF4). Other stakeholders stressed that it is important to provide justifications for management measures instead of imposing restrictions without understandable explanation. They said that ESA can provide arguments for regulations and management measures that affected professionals and the wider public are more receptive to than just talking about the need for conservation. "*It is easier to communicate the importance of ecosystem services to stakeholders, for example fishermen or local authorities, than to talk to them about the protection of a plant or species*" (stakeholder GNB7). In the Golfe du Morbihan, one stakeholder said that using the ecosystem services approach for communicating the need for management measures "*makes it more likely to gain the support and compliance of the wider public or the professionals*" (stakeholder GdM7, translated from French). The stakeholder went on to say that the ecosystem services approach "*makes it easier to sell a management measure, for example if oyster farmers are asked to move their tables and it is explained to them that the measure will help clear up the water and that this will result in bigger oysters for them, instead of just saying it is important without giving a real reason*" (stakeholder GdM7, translated from French). Another Golfe du Morbihan stakeholder said that ESA can help explain that "*the reasons for example for the closure of an area are not just to protect the seagrass but also have an economic dimension, and consequently that if the seagrass is not protected, the fishermen will have less fish to catch and the water quality in the Golfe du Morbihan will deteriorate, and that thus the question of protecting seagrass concerns everyone*" (stakeholder GdM5, translated from French). Stakeholders in the Parc Naturel Marin d'Iroise saw ESA as a neutral, objective, technical tool to talk about conservation to the public and decision makers as well as for communicating with marine park stakeholders to get them to change their way of thinking. In Poole Harbour, stakeholders thought that monetary ESA provided a useful common language for starting a dialogue with economically minded sectors.

Apart from the potential of the ecosystem services approach for communicating about conservation and management, stakeholders in Golfe du Morbihan, North Devon and Parc Naturel Marin d'Iroise also saw ESA as a useful tool for improving stakeholder dialogue. They saw ESA as a neutral, rational approach that contributes to building a common knowledge base and provides objective, factual evidence to inform the discussion of different options. This can help calm discussions that are often dominated by conflicting views and information. As one North Devon stakeholder put it, "*an evidence base from a neutral, academic approach takes the emotion and heat out of the discussion and makes it easier to get people to compromise*" (stakeholder ND3).

Moreover, across all six sites, the stakeholders thought that ESA can support stakeholder engagement in decision making processes and acceptance of decisions. Reasons for this included that:

- ESA can provide objective, factual evidence for the discussion of different management options and people are more likely to agree to evidence based decisions.
- ESA can provide understandable arguments for explaining and justifying regulations and management measures. It shows the role that ecosystems play in supporting human activities and explains the importance and benefits of conservation for the different stakeholders. It also raises awareness of the role of management in securing resources, shows the benefits of different management options and the consequences of inaction for the stakeholders. People are more likely to accept management measures and restrictions if they can understand them and feel that they are justified.
- ESA allows stakeholders to be involved in the discussion and decision making by enabling them to exchange and contribute their knowledge and views in a non-threatening, neutral context. It also provides stakeholders with the knowledge to participate in discussions and decision making processes.

- ESA is perceived as a neutral, objective approach. It enables stakeholders to develop a shared understanding of the interactions between ecosystems and human activities at their site and helps them better understand each other's positions. This can take the heat out of the discussion and avoid blockages between stakeholders with entrenched views.
- ESA supports integrated management that takes into consideration the interests of all users.

3.b.3 Stakeholder differences regarding relevance and understanding of ESA

Different stakeholders joined the project with different levels of understanding of ESA and different expectations of what they would get out of their engagement. Those stakeholders involved in the management of the sites tended to have heard about ESA before without having a clear understanding of what it was about. This group included natural area managers and representatives from NGOs, government agencies and local government authorities. For these stakeholders, ESA was a key motivation for participating in VALMER as they hoped to find out how ESA could support their work. On the other hand, most recreational users and commercial fisheries representatives had not heard of ESA before. This group mostly participated out of interest in the site or the topic or to represent their interests in the discussion. ESA appeared to be less relevant for them. This conclusion is supported by comments such as “*a lot of it might be things that are irrelevant and harder for me to understand*” (stakeholder ND1) and “*it was interesting, it sounded like a viable approach, but it is not a problem I would like to have to deal with*” (stakeholder ND5). Table 9.18 gives an insight into some of the main added values that the stakeholders got out of their participation in the six VALMER case studies. This depended both on the interests of the individual stakeholders and on the context of the case studies.

Table 9.17 The main added values for stakeholders from participating in the six VALMER case studies

Case study	Added value of engagement for VALMER stakeholders
North Devon	<ul style="list-style-type: none"> • A better understanding of ESA and how it can contribute to decision making • An opportunity to talk to other stakeholders and learn from them • Insight into ecosystem services of sedimentary habitats • Very limited additional knowledge about the site and its users
Poole Harbour	<ul style="list-style-type: none"> • A better understanding of the recreational users of the site • The ESA helped start a dialogue with some of recreational user groups
Plymouth Sound-Fowey	<ul style="list-style-type: none"> • An understanding of the limitations of monetary valuation and of ESA • An understanding of the mechanics and difficulties of ESA • Learned about quantitative and qualitative ESA approaches beyond monetary valuation • An opportunity to think outside the box
Golfe Normand Breton	<ul style="list-style-type: none"> • A more comprehensive view of the GNB and understanding of the interactions between the different activities and the environment at the site • An interesting exchange with other stakeholders in the GNB • An opportunity to talk to stakeholders in a neutral context
Golfe du Morbihan	<ul style="list-style-type: none"> • A better understanding of the ecosystem approach • A comprehensive understanding of human-seagrass interactions • A better understanding of the site and other users beyond their own activity • Learned about scenarios and the Triage • Learned about seagrass mobility and variability • Learned about the role and importance of seagrass • A new approach to justify and explain conservation
PNMI	<ul style="list-style-type: none"> • Potentially a tool to help make decisions for future planning and management • Nothing as long as it remains conceptual • Potentially a tool to communicate with marine park stakeholders • An example of what modelling can and cannot do

3.b.4 ESA is not an easy concept for stakeholders

The experience from VALMER shows that ESA is a difficult concept for stakeholders to understand and work with. Most of the VALMER stakeholders found ESA highly conceptual, technical and difficult to understand for people with no academic background. In addition, the stakeholders thought that the ecosystem services and ESA vocabulary is too scientific and full of jargon and can easily be misinterpreted by professionals. In most cases the stakeholders found the VALMER ESA understandable because:

- It was “pitched just right” for the audience (stakeholder PF6) (PF, GNB).
- It was made real and relevant through local scenarios (PF, ND). “*Not until you make it local and bit more real, you can start to put a place or a certain ecosystem service system to it and not until then you make it relevant for me*” (stakeholder PF2).
- It was presented in a context of practical application (GNB, ND). In North Devon, different stakeholders mentioned that things only started making sense to them at the last meeting when the results of the ESA and the scenarios were brought together and discussed in a practical context. “*The last meeting was interesting because everything was starting to come together, for the first time I could see the practical application*” (stakeholder ND3).
- It was applied to a specific ecosystem and subject (GdM).
- It was presented in a conceptual context that the stakeholders were familiar with: integrated management and the ecosystem approach (GdM, PNMI).

These findings suggest that if ESA is used for stakeholder engagement, it should be explained in a local, practical context, using vocabulary that the stakeholders are familiar with and specific local examples.

Further, stakeholder experience from North Devon suggests that it is important to give people enough time and supplementary information to understand the concepts that are being presented to them. Stakeholders in North Devon felt that there was not enough time in the workshops to understand everything. “*There were times when we were being asked to absorb information that was highly conceptual in probably too short a time. I got brain ache from time to time.*” (stakeholder ND2). Some stakeholders commented that it would have been good to have more or longer workshops and to get supplementary information in advance of and in between workshops.

Lastly, a comparison of the stakeholders’ pre VALMER understanding of ESA and the definitions given in the interviews suggests that VALMER did not significantly add to a clear understanding of the concept. Of 39 stakeholders, 23 had previous knowledge or had heard of ecosystem services and ESA, 16 had not. Of the 16 that had not heard of ecosystem services before VALMER, two gave a clear and correct definition of ecosystem services after their participation in the project, four gave definitions that covered parts of the concept or included ecosystem services in the explanation of the ecosystem approach. The remaining ten were not able to provide an accurate definition of ecosystem services.

3.b.5 Monetary or non-monetary ESA

While some stakeholders thought that monetary valuation of ecosystem services might support decision making under certain circumstances, stakeholder comments suggest that the key elements of ESA that were of most interest to them were non-monetary:

- The qualitative description of what the ecosystem services are.
- Showing the interconnections between different elements of an ecosystem.

- Showing the links between the ecosystem and human activities at the site, including how human activities depend on, benefit from and affect the provision of ecosystem services.

As one Golfe Normand Breton stakeholder put it, “*monetary valuation is not necessarily the most interesting tool and can also have contra productive effects. It is more about establishing links between the conservation status of the ecosystem, the services it provides and the quantity in which these services are provided or the importance of these services.*” (stakeholder GNB7, translated from French). “*ESA seemed like a good idea because it allows to have a better understanding of the environment and to better define the interactions of the activities and uses with the marine environment*” (stakeholder GdM1, translated from French). “*What was interesting was the approach of looking at the different activities around seagrass and at the broader ecosystem*” (stakeholder GdM8, translated from French).

Some stakeholders involved in the management of the sites thought that quantitative, monetary would have more significance for professional stakeholders than qualitative information. “*Having an order of magnitude, a quantitative description can potentially convey more meaning, for example for professionals a monetary value may have more significance*” (stakeholder GNB5, translated from French). However, this view was not confirmed by the professional stakeholders that were interviewed in VALMER.

3.b.6 Scenarios as a tool to work with ESA

Stakeholders in North Devon, Plymouth Sound-Fowey, Golfe Normand Breton and Golfe du Morbihan said that scenarios provided a structure for the discussion and helped make ESA real and relevant and thus understandable. But feedback on the scenario exercises suggests that:

- Scenarios should be relevant to the stakeholders’ interests. “*they should have had scenarios that were very relevant to the main local ventures and businesses in the area, rather than things that might be a bit hypothetical.*” (stakeholder ND1)
- Some stakeholders prefer realistic scenarios, others feel safer discussing hypothetical scenarios. In Plymouth Sound-Fowey, one stakeholder said that “*the chosen scenarios were in themselves interesting as they are very topical and made it real; sometimes scenarios can be too removed from reality*” (stakeholder PF7). On the other hand, another Plymouth Sound-Fowey stakeholder explained that they were not able to participate in some of the scenario discussions because the scenarios addressed real issues that they were not allowed to comment on in their professional role.
- Some scenario building methods are too complex and do not encourage engagement. Stakeholders in Plymouth Sound-Fowey, North and Golfe du Morbihan mentioned that the scenario building exercises were quite difficult.

3.b.7 Modelling

In three of the VALMER case studies, the ESA methods included different modelling approaches. In North Devon, the stakeholders were introduced to the socio-ecological model that was used in the ESA for the site. Feedback from North Devon stakeholders indicates that they found the modelling very abstract, difficult to understand and confusing. This was quite frustrating for some: “*I would like to have understood it better. I found it quite hard to take it all on board because I didn't understand enough about it*” (stakeholder ND1). Another North Devon stakeholder said that they “*suspended judgement during the process until we reached the final outcome*” (stakeholder ND2). This and other similar comments suggest that apart from the final workshop the North Devon case study process, stakeholders found engaging in modelling a challenging experience. The experience from the Golfe Normand Breton and Parc Naturel Marin d'Iroise, on the other hand, shows that modelling outputs

can be used constructively in the engagement process. In these two case studies, the stakeholders were not provided with detailed information on the modelling approaches and did not comment negatively on modelling in the interviews.

4.a Governance Influence of VALMER ESA: Site Results

To assess the impact of the ESA on case study governance, both the case study coordinators and a number of stakeholders were interviewed. The site coordinators were interviewed during and after the ESA had been conducted. Similarly, stakeholders were surveyed before and after the ESA results were disseminated. In evaluating together the stakeholder and site coordinators views on ESA and feedback on the VALMER project, a number of interesting themes emerged. These included several positive observations on ESA as a tool to support various aspects of management, reflections on the process undertaken at the site, including challenges and views on how the ESA could be used in the future. The results from each of the sites are now presented site-by-site.

4.a.1 North Devon

Like the other study sites, the North Devon ESA presented a series of hypothetical scenarios developed with stakeholders, as such, case study coordinator A felt that the ESA outputs whilst interesting were going to be hard to use in a direct management process. Instead the ESA successfully acted as a demonstration of how an ESA built on modelling (Bayesian Belief Network), could act as decision support tool for future management of the seabed by allowing decision makers to look at changes in ecosystem service delivery across a range of services in response to model inputs, such as proposed activities or governance interventions. Furthermore, the process was considered to have been beneficial for a number of reasons. Firstly, in helping to demonstrate the Ecosystem Services approach to stakeholders and to engage them on the topic of marine ecosystem services, thus raising visibility of the offshore aspect of the Biosphere Reserve. Secondly, it was felt that the ESA could in the future support, in a qualitative sense, local discussions with stakeholders on marine conservation, specifically a Marine Conservation Zone designation.

A Positive Future for the Approach

Interviewed stakeholders shared their views on marine ecosystem service assessments. There was positivity with all stakeholders that ESAs could lead to better informed decision making and support decision making in a decisive way for example, helping decision makers to look at choices between alternatives, trade-off decisions, prioritisation of management effort. Furthermore, eight out of nine stakeholders agreed that ESAs could support marine planning and marine conservation. Specific examples of where ESA could be informative in the future included the following: enabling decision makers to make comparisons about current and future marine activities (stakeholder ND2); informing resource planning (stakeholder ND2); providing a scientific approach and allowing detailed examination of proposed projects (stakeholder ND8); to help demonstrate sustainable activities including the positive impacts from economic activity (stakeholder ND3) and fisheries policy, local planning, aquaculture and dredging where the provision of science and facts was deemed to be beneficial (stakeholder ND4). In summary, the interviewed stakeholders were positively cautious, as highlighted by the following statements, *"When it is much more developed, it could be extremely valuable"* (stakeholder ND4); *"it is very difficult predicting the future in real terms. But it's better to have some data than none, so yes, it should help"* (stakeholder ND5) and, *"Translating the outputs into something that can be used is quite difficult and to make it meaningful you have got to make it more locally specific, including the proposed governance intervention"* (stakeholder ND8). There was less support amongst stakeholders for ESAs to be potentially used in a technical way, such as to determine user fees (four out of nine stakeholders disagreed) and only two agreed that they could be used in damage assessments, for example, to determine compensation payments or fines. In contrast,

case study coordinator A could see a role for ESA in supporting compensation and trade-off discussions, for example, where a proposed development within a certain area might result in a loss of ecosystem service delivery, this could be compensated via another area seeing an increase in management, for example, within a Marine Protected Area, to create an uplift in service provision that would be more than what was lost in the other area.

The challenge of communication and credibility

Within stakeholder's feedback were pertinent observations about perceived difficulties of implementing the ecosystem services approach within real life situations. These included the difficulty in communicating the approach to people, "*It is really complicated and most people don't understand it. It is an academic tool*" (stakeholder ND8). Interestingly stakeholder ND4 felt that, "*The tool will be extremely useful. But I think that is the big drawback, that people try and use it in the wrong way*". Caution was therefore advised by another stakeholder who felt that people could get the wrong message, "*...there needs to be great caution in how the information is presented, particularly when you put things on maps, as they become a lot more certain than the information might be...huge challenge of how you get the full picture across to people that haven't been involved*" (stakeholder ND7). Case study coordinator A also stated a need for 'health warnings' for ESAs results that communicate the uncertainties and error margins. The need for those using ESA to have knowledge of the process was also highlighted by stakeholder ND3 who explained, "*People have got to understand exactly how the process works. The information that is being fed in, where that is coming from and the methodology that arrives at your answer... It needs to be completely transparent and clear how the result is arrived at*". This was echoed by case study coordinator A who indicated, "*people need to be coached through the process to understand ecosystem service assessments*". They went on to reflect that stakeholders need to have trust and faith in those conducting the ESA, this includes the need for them to see how the data they have supplied for the process has been used. It is through the building of trust, that they felt that stakeholder would consider the ESA results and outputs to be credible.

Data limitations

One stakeholder highlighted the difficulty associated with conducting ESAs, explaining the process was 'resource hungry' both in terms of the data requirements and also the time required to collect and process the data. They stated, "*The main difficulties, I think, are in the organisational capacity to go through this process rigorously enough*. With regard to their experience in the North Devon VALMER ESA they reflected, "*It was a big ask for the organisations that took part. And not all of us have got sufficient capacity to engage over the course of the process*" (stakeholder ND2). A consistent message by four of stakeholders was that whilst they felt that ESAs could be a useful tool in supporting specific management decisions, this would only be case if ESAs were built on good data: "*The knowledge you base your studies on is very important*" (stakeholder ND9); and "*Garbage in, garbage out. Your modelling is only as good as the quality of the data that goes in and the way you use it*" (stakeholder ND4). Another stakeholder noted, "*As I understand it, they have had to use already present data and they were giving the data different scores depending on how reliable it was. Ideally, now to move on, it would be nice for them to have the funding to prove whether that data was accurate or to get current data their own data.*" (stakeholder ND1). Stakeholder ND3 was of the view that the quality of the results was dependent on stakeholder input. Case study coordinator A indicated that a considerable challenge for using ESA in marine management was both the dynamic nature of the marine environment and its management, for example, storms can create shifts in seabed, changing habitat coverage and sudden closure of fisheries areas are not uncommon. As a consequence the data, inputs and variables can change requiring the modelling supporting the ESA to be adaptive and responsive to such changes.

Monetary valuations: a double edged sword

The need for a common currency and the advantages of having financial values within ESAs was discussed by stakeholders, for example, "*I am reluctantly forced to admit that being able to put some*

kind of monetary value on ecosystem services is probably useful given the context in which we work, where most things have an economic value put on them, whether it's through GDP per head or other" (stakeholder ND2); "*Everything comes back to economics in the end, whatever people say, however much you would like to do things for purely moral reasons...*" (stakeholder ND5). This was counterbalanced by concerns about monetary valuations, for example, "*The monetary argument is a double edged sword*" (stakeholder ND7); "*there are always problems when you start attaching monetary values to things because people latch on to bits they like...*" (stakeholder ND4); "*Ascribing monetary values was one of my concerns because I am not wholly in favour of reducing everything to monetary value. But it remained a concern all the way through that we shouldn't be reduced to a view of things that we might value for other reasons*" (stakeholder ND2).

In summary, the tone from interviewed stakeholders was one of being supportive of the approach but cautious, as highlighted by the following statements, "*When it is much more developed, it could be extremely valuable*"; "*it is still an interesting academic concept rather than a very well-honed process with good data behind it and public understanding of the drawbacks and inaccuracies* (stakeholder ND4).

Gains from participation

Seven out of nine stakeholders agreed that they had gained a better understanding of the local marine habitats and species from the focus of the ESA (sub-tidal sedimentary habitats). Stakeholder ND2 stated their engagement in the case study had given them a greater understanding of the process and that, "*I can now answer the question 'how does this process help me and others to make policy decisions?*". Others reflected that they found the concept and the approach explained to them in the case study as being interesting (stakeholders ND4, ND8). One noted that whilst they had not learnt new site information they had learnt about the governance of the site in terms of the organisations, "*know the other bodies that are out there and the other people who are interested and protecting our seas*" (stakeholder ND1). Participation in the case study workshops created useful networking with other stakeholders for stakeholder ND9. Whilst for one stakeholder, the process was less engaging and challenging (stakeholder ND8).

4.a.2 Poole Harbour

The use of ESA at the site

As discussed in Section 3a, the VALMER review of international application of ESA in marine governance revealed that in most instances ESA was used in an informative or decisive way. This was mirrored in the Poole Harbour case study. The initial desirable outcome for the ESA at the site, as stated by the case study coordinator had been to improve knowledge by establishing economic values for six recreational activities, with such information being considered important, "...any value is helpful...we knew this was a gap in knowledge" (PH case study coordinator).

DCC and DCF envisaged that the ESA results could be used by a variety of organisations including the Poole Harbour Steering Group (PHSG) for the results to facilitate discussions with those who manage the harbour and those who use the harbour. This view was echoed by the interviewed Poole Harbour stakeholders who viewed the ESA results as a useful tool to inform management planning and decision making and to facilitate the dialogue with harbour users.

The results of the ESA have already begun to have application at the site. The Bournemouth and Poole sports strategy 2014-2026, has used the economic valuations to provide context to the value of these water sports to the area. Information highlighting how, where and why people use the harbour to undertake a variety of water sports has been used within the strategy. Furthermore, the results were used to help identify key water sports groups, clubs and organisations for local authorities to be included in the consultation process. The ESA has also informed aspects of safety management in the

Harbour, with results helping to highlight the call for increased safety measure for kite surfers using Poole Harbour. Poole Harbour Commissioners (PHC) have now introduced an annual kitesurfing permit as of March 2014 to regulate safety.

With regard to the technical use category of ESA use, the Poole Harbour stakeholders were not convinced that ESA can be used to determine fees for nature use or compensation payments for environmental damage. One interviewee went as far as saying that this is not what ESA is designed for. This is an interesting finding that points to the different cultures of using environmental valuation in policy and regulatory decision making between Europe and the USA and Caribbean. In Europe, the use of ESA as a governance tool is a relatively recent development. In the USA and Caribbean, on the other hand, monetary ESA in particular has been a well-established tool to design economic instruments for environmental governance since the early 1990s. The views of stakeholders may, however, more closely reflect the way that the ESA were presented; i.e. the results were not designed to have more technical uses per se. Furthermore, it is posited that if the ESA had been initiated by the PHC or the PHSG, the ESA survey and results may have been tailored around a specific technical use, e.g. re-designing of permitting fees in the harbour.

The DCC/DCF also received feedback from attendees of the Open Evening meeting in January 2014 where the results were disseminated and discussed. In summary, of the 31 feedback forms received:

- The majority of attendees (75%) thought the results would be very useful in raising awareness amongst the public and the decision makers regarding the condition and value of the harbour
- The majority of attendees (87%) thought the results would be useful in supporting management decisions and informing policies

ESA: More than just monetary values

The VALMER Poole Harbour ESA provided site-based information on the recreational activities in the harbour, data on social values of harbour users (which can be used to add social value layers to maps), as well as evidence on the importance of protecting environmental quality within the harbour. The combination of economic values and management information was felt to be much more useful than monetary values alone would have been, “...*it's not just the economic values and results that people are interested in. The non-economic results, such as, improvements to the management of the harbour, are more tangible to people and useable...*” (PH case study coordinator).

This was supported by one interviewee who commented that the information about the harbour users and the links between recreational activities and environmental quality was more useful for local governance than the monetary figures included in the study. Other stakeholders also expressed a number of views on monetary valuation. Two interviewees, for example, thought that monetary ESA is a valid approach as long as it is based on robust data and methodological limitations are recognised, the other two interviewed stakeholders expressed more ambiguous views. It was considered to be a helpful and necessary tool to start the dialogue with economically oriented sectors, to give the environment “*a place at the table*” (stakeholder PH1) and influence decision making as “*most decisions are based around money*” (stakeholder PH1). At the same time there were strong views that decision making needs to change towards taking into consideration all essential ecosystem services and broader values and not only monetary values. One interviewee mentioned that monetary valuation had gained more importance as a governance tool with the economic recession and that consequently the conservation sector needs to make use of ESA. On the other hand, however, the interviewee expressed concern about a trend in conservation debates to focus on economic benefits and overlook other value dimensions such as intrinsic and future values. The interviewee went as far as to say that for conservation interests, “*coming up with a monetary value for an ecosystem is quite dangerous*” (stakeholder PH4) as it can easily backfire if the economic value of the environment is lower than that of a proposed development. Similarly another interviewee stressed that ESA is only “*one piece in the*

jigsaw" (stakeholder PH2) of aspects and information that need to be taken into consideration in governance.

The Poole Harbour stakeholders saw ESA and monetary valuation in particular, as a tool to integrate environmental considerations in decision making and make them comparable to other activities when weighing up pros and cons. Monetary ESA was found to provide a common language and starting point for dialogue and joined approaches with economically oriented sectors. From a conservation perspective, they believed that monetary ESA provides scientific evidence for the broader value of nature conservation and is a necessary tool to influence decision making and give the environment a stronger standing in policy and funding decisions. Within marine governance, stakeholders thought that ESA adds to the evidence base for better informed decisions and decision making, including spatial trade off and zoning decisions, marine planning, management changes, long term and future management planning.

ESA as a catalyst for communication

There was consistency amongst the stakeholders and the case study coordinator concerning the use of ESA as a useful tool for raising awareness and facilitating communication and dialogue of relevant user groups in the governance of the harbour. This last point was also reflected in the views of the general public who attended the public meeting in January 2014.

Throughout the case study process, regular communication with the PHC and the PHSG was considered by the coordinator be essential to the effectiveness of the case study. This approach saw the coordinator tailoring the content of presentations to ensure that the ESA was framed within the appropriate context for the audience. Other means of communication, such as press releases and making as much information as possible available online (www.dorsetforyou.com/valmer), was felt to be vital and in line with the modus operandi of the DCF.

Whilst the PHC have a strong record of stakeholder engagement with harbour users, the VALMER study helped the PHC identify and start a dialogue with user groups that they had not previously engaged with. Specifically, the results catalysed engagement between PHC with Poole Harbour Canoe Club and kayak users in the harbour. This dialogue highlighted the sheer volume of kayak and canoers using the harbour and raised awareness of the management and safety concerns of the kayak and canoe population using the Harbour. The ESA, therefore, contributed to the identification and resolution of some user conflicts.

The results also highlighted the different areas used by different recreational user groups, who is using the harbour and the different areas of conflict between the different activities. Discussion of the results at the public meeting held in January highlighted both the need and desire for setting up a forum for all recreational users of the harbour and others (e.g. businesses, National Trust, local authorities, National Governing Bodies and other organisations). The aims of such a forum, as described by the case study coordinator, as being to support dialogue amongst the different recreational activities in the harbour and with the PHC so as to discuss projects, events, better ways of working together, share information, raise awareness of other activities taking place in the harbour and reduce any conflict between activities. In more general terms, interviewed PHSG stakeholders thought that using ESA in decision making can lead to greater acceptance and buy-in of the decisions among stakeholders by providing robust evidence, creating a shared understanding of the issues and showing how environmental values are relevant to different stakeholder interests.

Challenges of integration

A challenge considered by the case study coordinator in integrating the ESA into local site-based site governance concerned the fact that the PHSG had not initiated or explicitly requested for the ESA to be done. Whilst the ESA was considered by DCC/DCF to be a worthwhile activity that would support local policy and decision making generally, a specific policy driver or management question was not

expressed by PHC or the PHSG. Instead the ESA stemmed from the VALMER project and a research-based starting point. Furthermore, as the PHSG member organisations were neither directly involved in VALMER nor familiar with ESA, at the early stages of the project it proved difficult for members to see the benefits of the project for their organisations. To address this DCC/DCF took the approach of engaging the PHC and the PHSG early on in the project and frequently thereafter. DCC/DCF met regularly in person with PHC to discuss the plans for the ESA, providing them with opportunities to feed questions into the surveys, updating them on data collection efforts and often sending through project documentation and preliminary results. Attendance at PHSG meetings to discuss and share with them what was being done and taking the results to them engendered buy-in to the project. Furthermore, by outlining to them the potential usefulness of the predicted outcomes for the delivery of the Aquatic Management Plan, interest in the ESA outputs was raised.

When discussing with stakeholders the potential use of the ESA results, a key difficulty that was noted was that ESA is not currently required by policy or legislation. As such, it was felt to only have limited influence in decision making as managers and developers will concentrate on the assessments and information they are legally required to undertake and consider. In order to support the use of ESA as a marine governance tool and secure its influence in decision making, the Poole Harbour stakeholders felt that the following is needed:

- To start building an ESA evidence base, including monetary and non-monetary values;
- To make the ESA relevant to the interests of the stakeholders in the specific contexts it is applied in;
- A fundamental institutional change towards including environmental considerations in all government decisions about policy and funding;
- To integrate the consideration of ESA as a requirement in policies and legislations.

This last point was echoed by the case study coordinator who felt that for the ESA to be used as evidence, it would need to be stipulated in key documents and strategies, such as the Aquatic Management Plan, that ESAs should be undertaken and used as evidence for better management of marine areas.

Limitations

Both stakeholders and the case study coordinator reflected upon methodological limitations of the ESA process undertaken at the site. The need to manage expectations both internally within the project and externally with stakeholders, as to what the project and the ESA could deliver was identified by the case study coordinator. As DCC/DCF had not previously been involved in either conducting or using ESA, they were unaware of the limitations, *"Initially we thought it was going to be easier to put a value on than it has been...we didn't know the limitations about doing different surveys – we are not economic scientists"* (PH case study coordinator).

For stakeholders, methodological issues included the robustness of survey data and limitations of valuation methods which capture only part of the full value. With regard to values, one interviewee also mentioned that value is *"a moving figure, it's never just going to stay a static figure"* (stakeholder PH1), which makes valuation difficult and the use of one-off studies in decision making hard to justify. Stakeholders felt that the narrow focus of the study was limiting its usefulness, though some stakeholders were referring to the focus on six recreation activities while others meant the focus on one very specific aspect of ecosystem services.

4.a.3 Plymouth Sound-Fowey

The use of ESA at the site

The original purposes of the assessment at the Plymouth Sound-Fowey case study, as expressed by the site coordinators, concerned the following aspects:

1. improving knowledge;
2. comparing management options, facilitating trade-offs; and
3. raising awareness.

Through the VALMER case study process, these outcomes were achieved amongst case study stakeholders and site coordinators alike. It is important to note, however, that the ESA results were based on hypothetical scenarios set within an area that did not correspond to one uniform governance boundary. It was, therefore, not an intention to use the ESA in a discrete way, i.e. to inform a specific decision, was not an original intention of the case study. Instead an additional aspirational outcome by the site coordinators of undertaking the ESA was to take forward an element of the Cornwall Maritime Strategy, by developing an action plan for a specific area of the Cornish coast. Whilst an action plan was not produced, as discussed in Section 3a stakeholders generated a number of hypothetical actions aligned with the Environment Objective of the Cornwall Maritime Strategy. The merits of such a process to input into the co-production of the ESA will now be discussed in more detail.

Potential for future application of the Ecosystem Services approach

Whilst the Plymouth Sound-Fowey-Sound ESA has not been applied to a real life decision, all interviewed stakeholders felt that there was potential for the ecosystem services approach, as demonstrated in the case study, to support a range of different management at the study site at a variety of scales. As expressed by one stakeholder, “*Definitely think that there is a huge amount of scope for it to support strategy development or management plan development or coastal partnerships...*” (stakeholder PF3). Similarly another stakeholder felt that, “*it is a really good principle*” (stakeholder PF2). They went on to explain, “*We are making decisions about particular activities and management, it would be nice to use the approach to help make it a bit more scientific in its basis, rather than just having a feel for the local area...would like to develop this approach in the future*”. Another stakeholder also considered the advantages to using ESA in management, “*It was interesting to see the amount of work that goes into an assessment...It could be a useful process to be employed within a really detailed case where it could add a certain weight to the factual side of things*” (stakeholder PF1). Other stakeholders provided specific areas where ESAs could be used, for example informing leisure management in an estuary setting (stakeholder PF2) through to engaging the public about the environment (stakeholder PF7). In summary:

- all stakeholders agreed that ESA could support decision making, choices between alternatives, trade-off decisions, prioritisation of management effort;
- 6 out of 7 stakeholders agreed that the approach could support better informed decisions;
- 6 out 7 stakeholders agreed that ESA could raise awareness among decision makers and the public regarding the condition and value of the environment, as well as the role and relevance of ecosystem services ;
- 5 out of 7 stakeholders agreed that ESA could support marine planning; and
- 4 out of 7 stakeholders agreed could support marine conservation.

In contrast there was found to be little agreement for the proposition that ESAs could be used in either a decisive or technical way, with only one stakeholder agreeing that that it could be used determine user fees or compensation payments or fines (stakeholder PF4). These results may more accurately reflect the nature of the case study that was of an informative and academic in its nature; as the ESA produced was not used in a concrete way.

Local Capacity building on the topic of Ecosystem Services

Case study workshop activities allowed stakeholders to become familiar with the mechanics of undertaking an ESA. As explained by one stakeholder, “*Whilst I will never be an economist, I now know and understand the basics and the building blocks*” (stakeholder PF6). As a result the co-production of the ESA by the VALMER project with the Task and Finish Group has led to an increase in local capacity in the Cornwall environment sector on the topic of marine ecosystem services and ESAs. As highlighted by case study coordinator A, given that the Ecosystem Approach in the UK has principally been driven at the national level, it is of importance and value in having such capacity at the more local level.

The development of the three different future scenarios was integral to stakeholders to learning how ESA results can be used to support looking at trade-offs within a multi-use coastal and marine site. “*It has been an extremely valuable process to get people thinking about trade-offs, implications, consequences, especially for those outside their normal realm of work, or for services they don't normally consider*” (PF case study coordinator A). As one stakeholder explained, “*doing an ecosystem service valuation can bring it to life and you can understand how management might affect something like carbon storage values or how the habitat like mud is important habitat for fish and food for birds*” (stakeholder PF2). They also noted that the approach can help give a better understanding whether the implications of a decision would be immediate or in the longer term, “*If it's not an affect you can see with your eyes, it can be forgotten, as the affect might not be in the here and now*” (stakeholder PF2). One stakeholder felt that the process of scenario building within the ESA was a good exercise to get people thinking about different futures or outcomes (stakeholder PF3). Another stakeholder reflected that ESAs can be used to show that there can be locations with specific habitats that were important for a range of ecosystem services. With such information being used as a form of risk assessment to advocate that certain activities be moved away from valuable areas to other locations (stakeholder PF4).

As discussed in Section 1, the Task and Finish Group was made up of regulators and managers operating within the case study area. They brought to the case study their personal working knowledge and experience of managing different locations and sectors within the site. The ESA, therefore, provided a platform for sharing and integrating these often disparate forms of knowledge and locally relevant data held by stakeholders on a range of coastal and marine habitats and species. One stakeholder noted there was value in this process for bringing in non-ecological information, highlighting the work done on cultural values and perceptions as being particularly important (stakeholder PF7). The site coordinators also that the ESA process can be used to bring together different levels, types and forms of information, including both technical and lay person's knowledge. The process of undertaking a broad scale ESA for the site saw a wide range of ecosystem services considered. As a direct consequence, all stakeholders agreed that were able to gain an increased understanding of how the local marine ecosystem supports social and economic wellbeing in the area. As one stakeholder highlighted the baseline ESA that was produced by PML was useful for them, particularly in identifying which habitats are important for ecosystem service delivery, “*If you know more about the services, you can be better informed*” (stakeholder PF2).

Both case study coordinators and stakeholders alike felt that being open about the limitations of what can and cannot be done with ESA was important to them – being honest, explaining the current understanding that surround this type of ESA and the caveats was an important area of learning. One

stakeholder felt that by knowing the limitations they would be able to have confidence to scrutinise them, “*I know a lot more now to know that assessments can’t always be certain*” (stakeholder PF5).

Limitations to putting the approach to practice

The greatest limitation to the approach and for ESAs to support management discussed by stakeholders was that of data constraints, for example, “*A weakness is that it is a technical process that requires a lot of information that we don’t have to hand. It is not a tool that we can use until we have the information to do it. This is the biggest limitation that we would have and probably the same for others*” (stakeholder PF2); “*fundamental difficulty is how little is known about marine aspects*” (stakeholder PF5); “*data and evidence for the assessments to be done in the first place will be a challenge...certain data and at the right scale will be difficult to find*” (stakeholder PF6); “*I was surprised by how much we struggled to get the kind of information that we needed*” (stakeholder PF4). One stakeholder felt the case study had highlighted to them a clear need for more work done on finding and collating data in marine and coastal areas. The implications of such data paucity was discussed by one the site coordinators, who stated, “*A real disadvantage is that unless you have got a very comprehensive ESA, then there’s a danger that it presents a skewed picture for people, without them seeing the full picture of services, particularly where a single figure is used*” (PF case study coordinator A).

Knowing when to put a value on nature

Whilst VALMER has not given stakeholder the direct capacity to undertake their own ESA’s, there was demonstrable learning about the process of undertaking ESAs. A particular aspect that stakeholders discussed they had gained an appreciation of the need to consider the potential for different ESA outputs, so as to ensure they are appropriate and fit for purpose. This knowledge was achieved through stakeholder’s engagement in the case study workshops, for example, “*I wasn’t aware that there were the quantitative and qualitative systems in place for assessments*” (stakeholder PF2); “*At the start did think in terms of financial values, but as time has gone on, now more aware of lots of other ways...but concerned and sceptical that we are downgrading the environment by talking about it in an economic language*” (stakeholder PF3).

As expressed by one stakeholder, “*it is important to realise when it is appropriate to put values on things and when it isn’t*” (stakeholder PF7). They went on to explain that ‘money can talk’ for those people that might not have an immediate understanding of the value of the environment; with monetary values being able to highlight the impacts or implications of certain decisions or proposals. One stakeholder felt that financial valuations were important in the case of making on the ground decisions, as, “*using arrows won’t cut the mustard*” (stakeholder PF2). Stakeholder PF1 indicated, “*We are all driven by money these days, it is really interesting thing to do and to know the financial values if you’ve got them*”.

An additional issue highlighted by stakeholders and the site coordinators surrounding the issue of monetary valuation were the risks associated with figures being misinterpreted and taken out of context for example, being used inappropriately by a wider audience, including the media. Site coordinator A noted that where the ESA produces one financial figure that even when presented with caveats, there is considerable potential for the single value to heavily influence and skew the picture for decision makers. Site coordinator B felt that stakeholders should not just be presented ESA findings and that instead, they needed to be given the context so as a) prevent misuse and b) avoid scepticism by increasing confidence in the results. Stakeholder PF4 indicated that ESAs needed to be as comprehensive and as detailed as possible, but believed that given a lack of data previously discussed, full ESAs with financial values were not currently possible, and such it would be difficult for ESAs to support management. This was also discussed by stakeholder PF1, “*...for want of a better word could be dangerous in the sense they don’t necessarily capture enough, either because there wasn’t enough background information or detail or the final figures weren’t necessarily painting the picture they would either want or expect to see*”. This was supported by another stakeholder who felt it should be

about the quality of the ESA, stating that if the quality of the monetary figures was there, then the results should be kept qualitative (stakeholder PF7).

Interestingly a number of stakeholders highlighted the potential for a situation to occur in which the commissioned ESA might not produce the desired results and could in fact be counterproductive to a proposed plan or project. They also expressed the potential where, “*in the real world you would use it only if you thought it supported your case*” (stakeholder PF1). This point was echoed by others stakeholders, for example, “*Sometimes the numbers don’t give you right message you are trying to get across...it could be something that doesn’t look particularly valuable in financial terms, but could be valuable in other ways, so there needs to be caveats*” (stakeholder PF7) and “*could become a hostage of fortune*” (stakeholder PF5). It is clear that stakeholders whilst receptive to both financial and other forms of values, had similar views concerning the need to ensure that where monetary figures were used, such assessments needed to ensure that supporting information about how the results were derived, including caveats any uncertainties, were clearly communicated and always accompanied the ESA results.

4.a.4 Golfe Normand Breton

Golfe Normand Breton stakeholders were positive in their case study experiences with the ecosystem services approach, finding it interesting on a number of levels, from learning about other stakeholders and site users, through to the developing the site’s evidence base for management. They appeared interested in the topic but were cautious about monetary valuations, with a number of stakeholders raising sensitivities around quantitative valuations being used in the technical category of use. All agreed that the use of ESA in marine and coastal management can support better informed decisions. Furthermore, all agreed that ESA could support conservation and five out of seven agreeing it could support marine planning. Stakeholder GNB7 indicated that it could be useful for management decisions by informing choices being considered by local administrations and elected government administrations, who may be under pressure to support local development. Another stakeholder felt that the approach could specifically help renewable energy development, so as to ensure that they had the least impact possible and that such zones were consensual amongst other site users so as to avoid conflict and increase acceptability. As a more general approach, stakeholder GNB1 stated that it could provide a comprehensive site view of the environment and activities. In doing, they explained it could help more integrated management by taking into consideration the interests of all the different users of the marine environment. This view was also expressed by stakeholder GNB5 who noted how existing management measures and new regulations were trying to take an integrated approach, including considering ecosystem services; with the ecosystem services approach being able to facilitate such an integrated approach to management.

Gains from participations

In light of a hiatus of a project at the site to create a Marine Park, the site coordinators considered both the case study process and its timing within this governance context, to be very valuable. The site coordinator team, thanks to the VALMER process, were able to maintain a good stakeholder dynamic in the site with their stakeholders during this uncertain period. By providing innovative tools and approaches, they created an opportunity for stakeholders to be maintained in a positive forward looking engagement process. Additionally, the fact that the Marine Park project was on standby permitted stakeholders to work together independently from the political issues of Marine Park creation and designation. Their willingness to consider alternative possible futures for the site was very good, with most stakeholders not adopting a sectoral approach. This aspect has been concluded by the site coordinators to be a result of the long term projection of the scenarios, along with the fact that no concrete decisions were taken.

An important aspect of the Golfe Normand Breton case study is that stakeholder participation was been done via scenario building activities that did not overlap with the ESA. The ESA process was

undertaken by experts in parallel, with information dissemination and exchanges undertaken with stakeholders towards at the end of the project, and not as an integrated process of co-production with stakeholders.

Participatory process for improving site knowledge

Interestingly whilst three stakeholders that felt ESAs could not support decision making, for example, making choices between alternatives, looking trade-offs and prioritisation of management effort, all stakeholder discussed the value of approach being a valuable stakeholder engagement tool. Several others also discussed how the VALMER activities in which they participated had given rise to a number of positive experiences. As stakeholder GNB3 highlighted, their experience had been better than conventional stakeholder consultations. They felt the process undertaken had avoided situations in which stakeholders merely attended to promote their own positions and ensured that those who participated were listened to. Increasing stakeholder's awareness and understanding of others opinions was beneficial to the management culture. Another stakeholder explained that it provided them the opportunity to exchange and compare ideas on the development and use of the Golfe Normand Breton (stakeholder GNB4). Similarly, stakeholder GNB6, indicated that the approach could be used as a tool to enable stakeholder discussion and consideration of the different issues and affected interests in a decision making process.

An additional aspect where stakeholders considered there to be merit in the approach concerned site information. Stakeholder GNB6 felt that ESAs could generate interesting information by linking the state and health of habitats or resources with its function and the quality of the ecosystem services. Interestingly, stakeholder GNB2 didn't personally gain more knowledge about the site, given their expertise, but they could see the advantages of bringing together and formalising site knowledge, for example, within the Golfe Normand Breton case study reports, for the benefit of others. Of the seven interviewed stakeholders only 2 agreed that they had gained a better understanding of the local marine habitats and species. This contrasts to all agreeing that they had gained a better understanding of how the marine environment supports social and economic well-being and how different activities affect the local ecosystems ability to provide ecosystem services.

Two stakeholders discussed scientific uncertainty as an aspect to be considered when looking at potential weaknesses of integrating ESA into management. Stakeholder GNB3 explained that whilst scientific uncertainty was not a direct problem; they felt that ESAs should not seek to generate monetary valuations for decision making. Stakeholder GNB1 highlighted that uncertainty and assumptions were very much part of an approach that looks ahead to the future with long timescales. They explained that as long as there was scientific evidence as the basis to the ESA, they did not consider uncertainty to be a barrier to using the approach. This stakeholder also felt there was a potential the challenge of communicating such a technical approach to stakeholders; however, they highlighted that the case study had demonstrated it was possible, and as result, it led to interesting discussions.

In summary, stakeholders could see benefits beyond improving ecological site knowledge, particularly in terms of the interactions between different site users who shared their views and aspirations for the site, including aspects of site management by exchanging views on potential trade-off between different activities. The benefits of the participatory process were also underlined by the site coordinators. Like the interviewed stakeholders, they agreed that the approach gave a better understanding of how the marine environment supports social and economic well-being. For management, whilst it created a baseline diagnosis of the site, this was counter balanced by the large size of the site and the uncertainty of the data used. In light of the governance context for the site, there might not be immediate application to management, with future steps towards the designation of a Marine Park in the Golfe Normand Breton being taken carefully by those involved.

Sensitivities of using monetary valuations

Overall, stakeholders were found to be cautious about ecosystem valuations being used by decision makers. Stakeholder GNB7, for example, felt that the assessments of the state of the ecosystem was an interesting tool to raise awareness amongst stakeholders and support arguments for protection, however, further steps such as quantifying services in monetary terms was considered to be dangerous and could be counter-productive. Stakeholder GNB5 indicated, “...it is a bit sad to put a value on the environment, but if this helps to protect it, why not...”. Stakeholder GNB5 discussed the potential for monetary quantitative descriptions of ecosystem services to have more significance by conveying more meaning for professional/commercial stakeholders, which could drive an interest in preserving services. Similarly, stakeholder GNB6 indicated that monetary valuation can provide numbers that could have a ‘shock effect’ to highlight the costs of alternatives solutions or implications of certain decisions. In contrast, Stakeholder GNB4 stated that they would not be taken as a reality, and that more information and understanding about the marine environment were needed. This point was also noted by stakeholder GNB3 who felt that monetary valuations should not be used to make decisions as this was considered dangerous. Lastly, stakeholder GNB7 indicated that monetary valuations should only be used if it were absolutely necessary for example in compensation measures, but that such numbers could be used out of context. The risk of overlooking cultural heritage values that could not be monetised was also considered by stakeholder GNB1 as being a possible limitation of the approach. Stakeholder GNB1 also considered the use of monetary valuation in decision making dangerous because the methods are not sufficiently well understood and developed. These views are the context to only four of the seven stakeholders agreeing that ESA including monetary valuations could be used in damage assessments in determining compensation payments or fines and five agreeing that they could be used to determine user fees.

4.a.5 Golfe du Morbihan

In evaluating Golfe du Morbihan stakeholder views on ESA and feedback on the case study, a number of interesting themes emerged. These included the participatory process for improving site knowledge, the limitations to put the approach in practice and the challenges for integration.

Participatory process for improving site knowledge

The main objectives of the site coordinators were to use the ESA to raise awareness, improve and integrate site knowledge. According to the stakeholders who participated to the case study, it seems that these goals were achieved. Indeed, the majority of stakeholders indicated that for them the ESA gave them a better understanding of the environment, the interactions of the activities and uses of the marine environment. This is particularly interesting given the focus the study was on a specific habitat, *i.e.*, seagrass beds in the Golfe du Morbihan, indicating that despite the narrow focus of the study, the approach was able to communicate and raise knowledge of the wider marine environment. Furthermore, the approach permitted ecosystem complexities to be considered, thus demonstrating to stakeholders that “...*everything is connected...*” and allowed stakeholders to, “...look at the whole system and not just at individual elements...” (stakeholder GdM4). It was also considered by stakeholders to be a good way to understand the positions of the other stakeholders “...*by discussing all together...*” (stakeholder GdM8). Case study coordinators reflected that as the case study was a social process, it created many opportunities for people to come together to discuss their uses of the Golfe du Morbihan. Site knowledge, therefore, covered not only the natural processes, for example, the ecological functions supporting ecosystem services but also the relationship between different categories of stakeholders, their interests and concerns. Stakeholders also fed back on the dynamic and collaborative activities that they took part in, which, as put by one stakeholder, were “...*new with new methods...*” (stakeholder GdM2). Whilst this may have created some initial uncertainty for participants, from the VALMER case study team point of view, these engagement activities created

opportunities for stakeholders to escape from the usual context of opposition between sectoral activities and uses.

Looking specifically at seagrass knowledge, one stakeholder stated that due to the VALMER project they now had, “... *a better understanding of seagrass beds and awareness of their importance, whereas before I did not pay much attention to seagrass...*” (stakeholder GdM5). During the case study, important points for seagrass management came to light, most notably that the seagrass beds in the Golfe du Morbihan were moving a lot in space and time. Whilst this fundamental element for management was not revealed by the ecosystem services approach *per se*, it was the VALMER project with the case study coordinators who were able to facilitate an important scientific review to be done by to support the case study. The scientific knowledge was then able to be fed into the stakeholder engagement activities, with such information being valuable to those learning about this habitat for the first time.

Analysis of the stakeholder interviews identified that stakeholders were discussing not only the site-based ESA results that used the choice experiment method, but they were also feeding back on the case study process more generally. This process encompassed significant knowledge collation and dissemination efforts through workshops and focus groups (eight held between September 2013 and September 2014), forty interviews, a workshop between ecologist-managers to exchange knowledge and experiences (10th-11th February 2014) and the communication of the results during a final one-day dissemination event with 115 participants (4th December 2014). With such significant engagement activities undertaken over fourteen months, this case study demonstrates how the ESA approach can be used as an effective participatory process. For the site coordinators, the engagement of approximately one hundred people on a specific technical question was achieved via a positive and dynamic social process. It improved dialogue between different stakeholder groups, creating mutual comprehension of other points of view (even if they did not always agree) and demonstrated both the direct indirect benefits for preserving seagrass beds by articulating the ecosystem functions and services associated within this important habitat with the Golfe du Morbihan.

The workshop of ecologist and managers held in February 2014 was not foreseen at the beginning of the project. Having undertaken a literature review to inform the case study, the case study team identified both a paucity of information specific to the site and also a clear difficulty in transferring the results from other scientific seagrass studies to the Golfe du Morbihan due to the differences between seagrass ecosystems. To address this, a decision was made to invite together all French seagrass specialists to collectively identify and agree the following aspects:

- what knowledge of these habitats could be generalised across seagrass ecosystems;
- what knowledge was specific to individual sites;
- what the functions and services of these habitats they could be confident about; and
- the impacts on these habitats of various drivers and pressures.

Local managers were also invited to the workshop to be able share with the scientists their local concerns. The event was successful with much exchange between scientists and managers from all the seagrass sites across France. One workshop participant highlighted, “*I understand better what is not known and what is known in terms of seagrass beds. Even if there are a lot of uncertainties, it is very useful for decision makers to know what are the evidence he can based his decisions on, in order to make it better accepted by stakeholders*”. Knowledge sharing on seagrass functions and services at the event proved to be a strong starting point for selecting the main functions and services for the case study to focus upon, as explained by the site coordinator, “...*if there are changes to be considered in impacting activities, it is more robust if it is justified by the opinion of a group of experts...*” (GdM case study coordinator).

Limitations to put the approach in practice

For the stakeholders interviewed the limitations for using ESA in practice dealt with two main aspects: (1) the understanding of the approach and (2), the lack of evidence.

Regarding the ecosystem services approach itself, as highlighted by one stakeholder, “... *the term ecosystem services remains difficult to define and to communicate...*” and “...ecosystem services vocabulary is not easy to understand” (stakeholder GdM2). This revealed that it is necessary for ecosystem services experts and scientists to adapt to their audience and to use less technical wordings and explanations.

The lack of scientific evidence and data concerning human activities and their impacts on seagrass habitats was mentioned as a limiting factor when using this type of information to make decisions. The case study research identified that not all scientific studies fit with local observations. This uncertainty and lack of evidence on human activities impacts is nevertheless not specific to the ecosystem services approach. For the site coordinators interviewed, one of the difficulties in building an evidence base is the need to combine of local and scientific knowledge together, with a general lack of evidence being a critical issue. Furthermore, the ecosystem services approach is still exploratory. Whilst valuation frameworks are being developed and improved, currently not all services can be assessed the same, with some are easy to value than others. As highlighted by the site coordinator, that can create a situation where those services that are more difficult to value can become, “*forgotten*” (GdM case study coordinator).

Challenges for integration

Overall, there has been ‘positive but sceptical’ feedback from the Golfe Du Morbihan stakeholders concerning the integration of the ecosystem services approach into the real management context. A strong theme within these comments indicates that stakeholders consider that the ecosystem services approach is an improvement to current coastal zone management activities. A local manager noted that the approach was a useful way to make the link between the necessary protection of the environment, for example maintaining species and habitats, and the positive impact it will have on human benefits. A number of stakeholders felt it provides evidence for decision making and can support arguments for managers to put in place protection measures. In addition, one such stakeholder went on to say that hoped that the approach can help to improve the stakeholder compliance to regulations and limitations of human activities for a better efficiency of management measures, “...*managers need to convince the people to whom they impose restrictions and regulations and the ecosystem approach is more appropriate for communicating with a wider public and makes it more likely to gain the support and compliance of a wider public or the professionals*” (stakeholder GdM7). One stakeholder felt the approach allows for the equal treatment of all activities and stakeholders, with the neutrality of the approach being extremely valuable, “*The approach looks at the benefits and impacts on all concerned stakeholders and explores different options in order to find the option that has the least impact on all stakeholders while still protecting the seagrass*” (stakeholder GdM8). Different stakeholders mentioned that the approach permits a shift from ‘precautionary’ principles that are used commonly to protect the environment, to a justification with the fact that by preserving ecosystem, we preserve human benefits including economic ones. It is worth noting that these stakeholders are involved in decision making and regulation processes, highlighting their aspiration to take decisions for the appropriate reasons, including limitations of human activities justified by the associated returns in ecosystem services, thus allowing a balance of environmental protection and activities and helping to ensure compliance with regulations. A non-manager also echoed this approach as they felt that the approach should “...*help managers to explain the management measures...*” (stakeholder GdM8). This is very interesting given that this stakeholder is likely to have to comply with such measures.

Feedback from one stakeholder, “...*following involvement in the VALMER workshops, all stakeholders agree on the need to protect seagrass...*” (stakeholder GdM5), indicates their experience

that didn't involve an opportunity to meet all stakeholders during their participation in three focus groups and workshops.

This case study demonstrates that moving forward from informative uses of the approach to operational ones is a real challenge, with no evidence of the approach being used in decision making or application to operational plans as yet in the Golfe du Morbihan. Site coordinators interviews identified that whilst the approach is very efficient in terms of improving knowledge, the elements generated by the approach are not directly transferable to decision making. They also noted another challenge of the timeframes associated with the ecosystem approach being longer than that needed to protect certain habitats and to take urgent decisions. Interestingly this issue if often raised by decision makers in the coastal zone management context, so it not specific to ecosystem services approach. Lastly, as reflected by one stakeholder, "...seagrass is only one habitat in the Golfe du Morbihan..." (stakeholder GdM8). Highlighting that for them the VALMER case study was not broad enough to support decision making at the integrated management scale that necessitates looking at the large variety of habitats and species that occur within the Golfe du Morbihan.

4.a.6 Parc Naturel Marin d'Iroise

Site advantages of the Ecosystem Services Approach

Despite the PNMI VALMER ESA results not being available when stakeholders were interviewed, stakeholders could see numerous advantages to the ecosystem services approach that was being taken at the site, from both a stakeholder perspective and also for management. Stakeholder PNMI1, for example, said it was a good tool to view the future by anticipating future impacts and implications; as such that felt that the VALMER approach is helping the Park's Fisheries Working Group to take a more comprehensive view. Encouraging future perspectives were also raised by stakeholder PNMI3 who indicated it could potentially encourage certain stakeholders, such as fishermen, to step away from short term views and adopt more medium term views. Other roles for the approach that this stakeholder discussed included, the approach providing an objective basis when management is dealing with mixed stakeholders, and providing quantitative arguments. They described it being a communication method and an evidence base for stakeholder discussions and decision making. Another stakeholder (stakeholder PNMI4) also discussed communication, highlighting issues associated with vocabulary. They explained that it is not easy for some stakeholders to talk biodiversity and ESAs in light of their position being from a profit making economic sector. In contrast, an advantage identified by stakeholder PNMI 3 was the perceived neutrality of the ecosystem services terminology as it was 'technical and scientific'. As such it avoided the negative connotations that the term 'ecology' has for economically driven decision makers.

Stakeholder collaboration with scientists was deemed to be valuable at the site, with the VALMER approach facilitating an understanding of each other's work and points of view. One stakeholder highlighted in particular the approach was a way for others to gain an understanding of fisheries interactions with the environment. The site coordinator explained that the approach creates a framework for stakeholders to consider the whole system, including all interactions in multiple dimensions. In doing so, it demonstrates not only that many uses exist but also that the ecosystem creates a variety of benefits for a variety of users. The site coordinator felt the benefit of an approach that identifies and lists all ecosystem services, was a new way of presenting the ecosystem as a whole by making the link between the various ecosystem services in an organised and structured way. Also, that this type of work was not sectoral and could value more discrete aspects of ecosystem services such as cultural aspects. Lastly, they felt the use of diverse tools such as modelling and scenarios, allowed them to explore possible management options with the marine park, "*We had never done modelling of management options before. It is an interesting approach for managers*" (PNMI case study coordinator).

Future uses of ESA for marine governance

All four interview stakeholders felt that that ESA could raise awareness amongst both decision makers and the public regarding the condition and value of the environment. Stakeholders were also positive about ESAs being used to support marine conservation and supporting more informed decision making (three out of four). There was found to be mixed views about other potential applications for ESAs. On the subject of ESAs being used to support marine planning and help to look at trade-offs and decision alternatives, only two felt positive about the potential for this to occur. Interestingly, there was only one stakeholder who agreed that they could be used to determine user fees. This stakeholder also felt there was an important role for ESAs to determine the appropriate amount of compensation for an alteration to the ecosystem. This last aspect was not considered in the case study ESA, stakeholders may have been unsure about this question as it is not linked directly to their concerns and everyday work.

Limitations to putting the approach in practice

Stakeholder PNMI1 identified that whilst modelling outputs associated with ESAs might not be 100% reliable, the evidence base for decision making could still benefit from the information. On the issue of modelling, stakeholder PNMI4 felt that modelling was a good way to design future regulations, with fisheries stakeholders benefitting from a greater understanding of the merits of modelling and its potential. The aspect of reliability of ESA outputs were also discussed by stakeholder PNMI2 felt that it was an interesting concept that should be studied but given their perceived lack of knowledge and understanding of the marine ecosystems, the method was not reliable enough. They explained that the results of modelling were dependent upon the quality of the data and knowledge inputted into the model. This stakeholder also made an interesting observation that there was currently a discrepancy between the general and comprehensive trend-based information provided by scientists and level of the information required by managers. For models to be more useable in practice, more information was needed on aspects, such as, interactions across a range of ecosystem services and habitats. Likewise, stakeholder PNMI4 felt that when all different ecosystem services were assessed the approach could inform site-specific marine regulations within the Park.

The most difficult aspects in using ESA, as perceived by the site coordinator, were as follows:

- The vocabulary associated with the approach. Surprisingly, the interviewed stakeholders presented positive points of view on this aspect. This may be due to the fact that the site coordinator was at the interface between scientists and stakeholders and took on a role of translating technical aspects and words into more understandable terms for the stakeholders. Also, as it was identified that stakeholders were satisfied with the “neutrality of the ecosystem services terminology” indicated that it is most likely the case that the site coordinator did an effective “translation” job.
- Explaining modelling to stakeholders. This aspect was also underlined by stakeholders. The site coordinator felt that that the complexities of the ESA modelling could potentially generate misunderstanding and mistrust of the tool.

When reflecting upon the case study process, particularly its focus on provisioning ecosystem services, the site coordinator had some regrets. They felt that by assessing such well known ecosystem services, indirect uses or non uses including the biodiversity were not valued as much as, creating frustrations for them.

4.a.7 Quantitative French-UK comparison

With the previous site-by-site results, it has not been possible to consider cultural variations between the French and UK stakeholder cohorts regarding their views on the use of ESA for marine governance. Figure 9.7 presents amalgamated French stakeholder responses and amalgamated UK

stakeholder responses to eleven statements. Statement numbers are contained in the arrows in the left of the figure and correspond to the questions in Table 9.19. The colour of the scale bar reflects levels of agreement by the interviewee to the statement: agree (green), neutral (blue), disagree (orange) or have no opinion/do not know (grey). The numbers indicated into the scale bars reflect the number of respondents to each question.

Looking across the results, there is clearly agreement and positivity of the interviewed VALMER stakeholders for using ESA in a range of marine governance contexts, most notably in its use for raising awareness among decision makers and the public regarding the condition and value of the environment, as well as the role and relevance of ecosystem services. Country by country comparison reveals very similar responses in both UK and France, except for questions 6.8 (ESA can be used to determine user fees) and 6.9 (ESA can be used in damage assessment to determine compensation payments or fines). Responses to questions 6.8 and 6.9 indicate that stakeholder opinion is more positive in France than in England, reflecting a different cultural point of view for valuations of ecosystem services to be used in monetary aspects of marine governance.

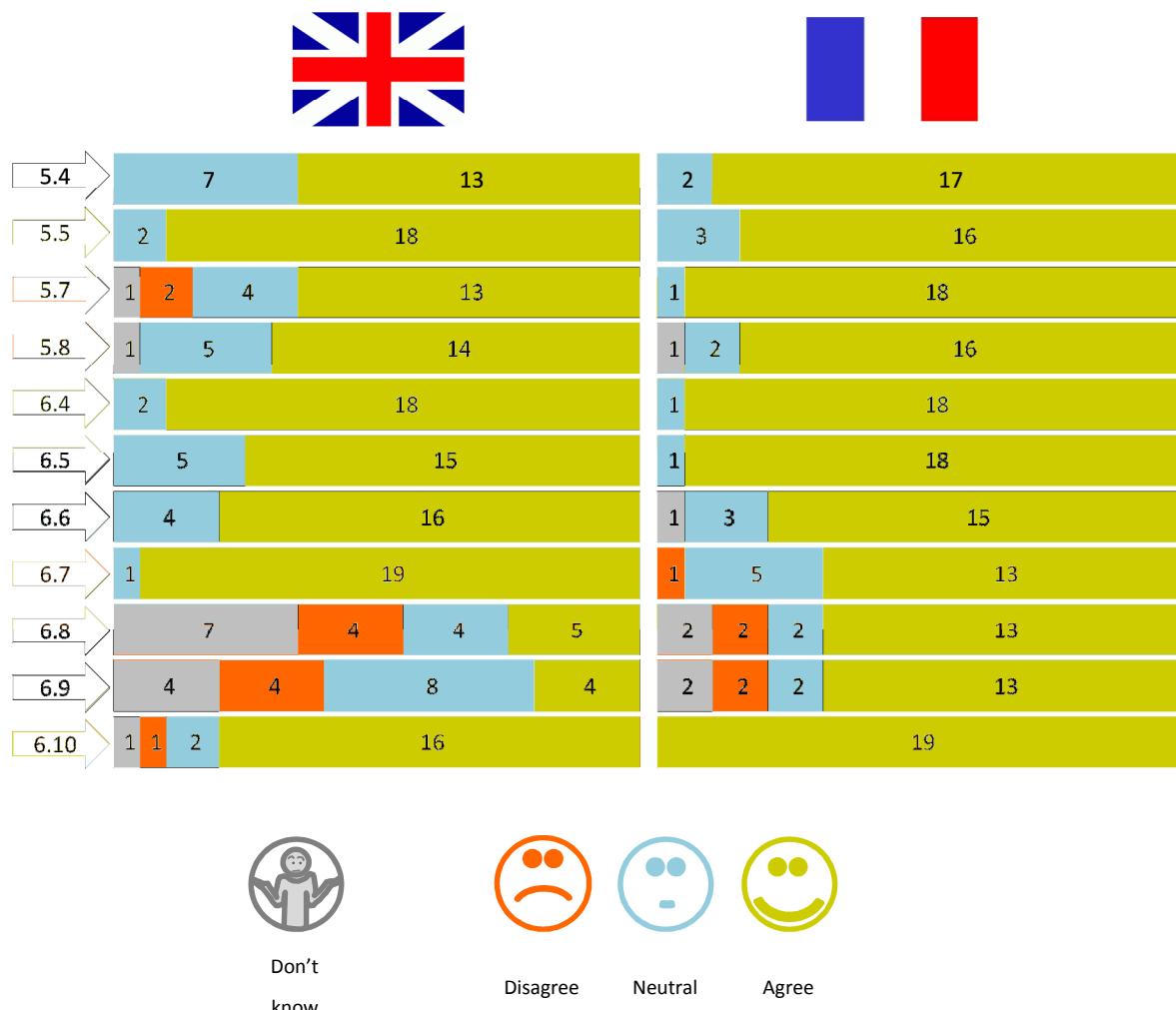


Figure 9.7 Country by country comparison of VALMER stakeholder responses to questions concerning the use of ESA for marine governance. The numbers in the arrows correspond to interview questions (Table 9.19). Numbers in the scale bars reflect the numbers of respondents to each question.

Table 9.18 Questions asked to VALMER stakeholder interviewees concerning their views on the use of ESA for marine governance

Stakeholder Interview Question	
5.4	ESA did support the development of a common understanding of the question, issue or management challenge that was addressed in the case study.
5.5	ESA did foster better understanding among stakeholder with different interests and perspectives.
5.7	ESA did help support the discussion and appraisal of different management options.
5.8	Using ESA in decision making can lead to greater acceptance and ownership of the outcomes among stakeholders.
6.4	Using ESA in marine and coastal management can support better informed decision making processes.
6.5	Using ESA can support marine conservation.
6.6	Using ESA can support marine planning.
6.7	ESA can lead to better informed decisions, e.g. choices between alternatives, trade-off decisions, prioritisation of management effort.
6.8	ESA can be used to determine user fees, e.g. for natural park entrance.
6.9	ESA can be used in damage assessment to determine compensation payments or fines.
6.10	ESA can raise awareness among decision makers and the public regarding the condition and value of the environment, as well as the role and relevance of ecosystem services.

4.b Governance Influence of VALMER ESA: Evaluation

Whilst Section 4a has presented individual site experiences, including many detailed site-based insights, it raises the question as to how to assess impact from a broader perspective, i.e. project and Western Channel-wide. What, for example, are the transferrable lessons learnt from these sites that other managers can take from the VALMER project. In light of this, three cross-cutting themes have been developed to facilitate governance analysis across the six VALMER sites: social; institutional and technical. These themes reflect the Ecosystem Approach and builds upon pre-existing frameworks, such as the Monitoring and Evaluation of Spatially Managed Areas (MESMA) project (Stelzenmüller et al., 2013) and the works of Cicin-Sain (1993) and Thia-Eng (1993) concerning the essential elements of integrated coastal management. Each theme is now presented and VALMER governance findings discussed at a Channel-wide scale, cutting across the six pilot sites.

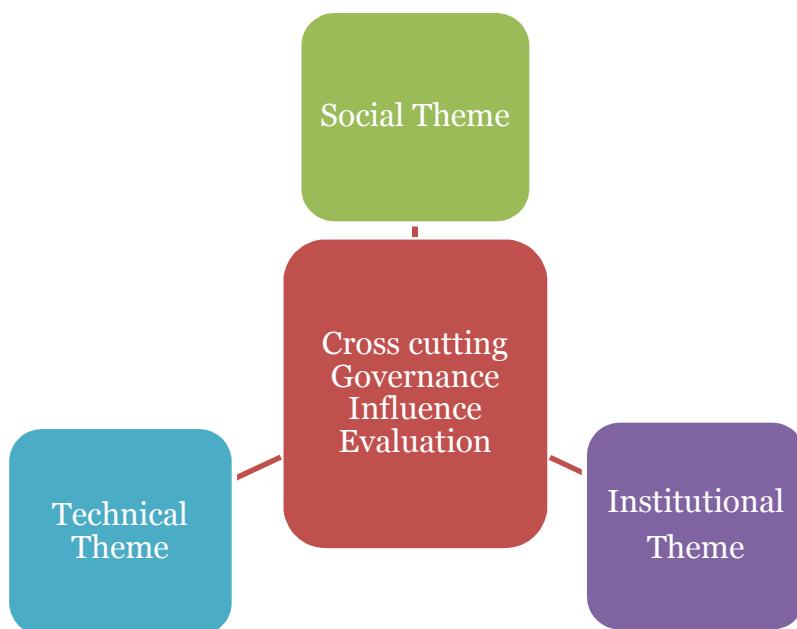


Figure 9.8 The three themes used to facilitate cross-cutting governance analysis across the six case studies

4.b.1 Technical Theme

The project has used a wide range of technical methods to build six site-based ESAs; the specifics of these methods are discussed and evaluated in the Work Package 1 Lessons Learned document (VALMER 2015). Case study coordinators and stakeholders alike fed back a number of common observations about the ESAs undertaken. The ESA results, in particular the baseline assessments, have been well received by stakeholders and site coordinators across all sites, as they represent an improvement in site knowledge relating to marine ecosystem services, habitats and species. “*The VALMER project has helped pulled together a lot of useful marine data, which was used to create the initial knowledge base for the process. This was useful*” (ND case study coordinator A).

As with any analytical process reliant on information, ESAs face the data dilemma, with a lack of data being a common theme discussed across the sites by stakeholders, in relation to what they considered to be potential weaknesses or difficulties of integrating ESAs into management. The implications of data hungry methods were discussed by a number of stakeholders at the sites where technical modelling was undertaken, in particular North Devon and Golfe Normand Breton. “*The knowledge you base your studies on is very important*” (stakeholder ND9); and “*Garbage in, garbage out. Your modelling is only as good as the quality of the data that goes in and the way you use it*” (stakeholder ND4). As one stakeholder noted, “*If you are making a decision based on an assessment, you need to*

be confident that the information gone into it is right, so that you're confident that what is coming out of it is a true representation, otherwise it's not worth doing" (stakeholder PF2).

In addition to the scientific uncertainty, another implication of data limitations was appreciation gained from the VALMER process that not all marine ecosystem services can currently be assessed. "A real disadvantage is that unless you have got a very comprehensive ESA then there's a danger that it presents a skewed picture for people, without them seeing the full picture of services, particularly where a single figure is used" (PF case study coordinator A). Managing expectations was a strong theme that came through in relation to communicating not just the limitations of ESAs, but also the uncertainties associated with their results. The need to clearly explain any uncertainties or caveats in a way that non-scientists could understand was felt needed in light of the dangers associated with the results being taken out of context or misunderstood.

Another aspect of data that was raised at a number of sites was that the project brought stakeholder's attention to gaps in site knowledge and more generally about the marine environment. As such the case study has acted as a marker for where future research should be conducted, "*If I had the resources, I would be advising that there needs to be more research of this type for coastal areas, as one of the biggest problems is that lack of data. The project has proven that there needs to be more work on finding and collating data*" (stakeholder PF5). Similarly, another stakeholder noted, "*As I understand it, they have had to use already present data and they were giving the data different scores depending on how reliable it was. Ideally, now to move on, it would be nice for them to have the funding to provide whether that data was accurate or to get current data their own data.*" (stakeholder ND1).

VALMER has demonstrated that site knowledge held by various site users can be harnessed and inputted into the ESA. At four of the sites, trans-disciplinary data collation and analysis was undertaken to integrate different forms of knowledge into the ESA. In the North Devon case study, for example, the project held extra meetings in the evenings with particular users, including fishermen and sub-aqua clubs to input their site knowledge and help validate early iterations of maps produced by the project. In Plymouth Sound-Fowey, a Data Discovery exercise was used to determine what data sets existed and where it could be sourced; this ensured subsequent data gathering efforts and collation was more focussed to the ESA. Taking an Ecosystem Services approach with stakeholders, for example, as undertaken in the Golfe du Morbihan, brought together different site users to build a common culture at the site relating to the interconnected social and ecological systems associated with seagrass habitats.

In light of issues around the adequacy of data, differing confidence levels and the resources required to make good data, the appropriate models for building ESA should be selected; with an appreciation that less technical methods and approaches are available. If the objective of the ESA is known from the start, the desired outputs can be discussed, and those commissioning the ESA can be made aware of the resource implications of such methods and results. This can be achieved through a partnership between the managers and the researcher with the technical expertise to guide the process. A reflection from one site coordinator highlights their learning from being in the project, "*Initially we thought it was going to be easier to put a value on than it has been...*" (PH case study coordinator).

The Triage process across the 3 French case study sites saw the approach applied in different way and for different uses. In one case, the approach was used to select the ecosystem services on which to concentrate the assessment upon, in another, it was used to select the subject the stakeholders wanted to work on for the scenario building activities. In the last example, whilst the aim had been to apply the Triage to select the ecosystem services to be valued, due to the uncertainty associated with the process, it was decided not to eliminate any service at the end of the Triage process. Overall, it has been observed that the Triage approach can be a very valuable process, however, when using such this process; two important aspects need to be borne in mind. Firstly, by selecting the services that have most information associated with them, the Triage process focuses mainly upon direct uses and mostly

provisioning services, and sometimes cultural services. As natural –ecological processes are less known and with more uncertainties than human activities; there is a tendency to not assess supporting and regulating services. Secondly, the conceptual approach of the ecosystem services has been produced in order to value all aspects of nature for conservation purpose. Nevertheless, by justifying conservation by the usefulness of nature for human, and by focusing on provisioning services, the Triage approach can lead, in some cases, to a utilitarian concept of nature. Some site coordinators fed back that they were not comfortable with assessment and valuation frameworks that reduce biodiversity and non-uses of nature to merely providing a base for human benefits.

4.b.2 Societal Theme

The VALMER process has explicitly sought to engage stakeholders at the case study sites. Stakeholders' experiences of engagement have been discussed in Section 3. The main engagement mechanism, scenario building, has been evaluated as a tool to work with ESA in the Work Package 3 output entitled 'A summary of the Lessons Learnt from the VALMER scenario development process'. However, a strong finding from across the sites has been that the manner in which the ESA is conducted has a strong bearing on its potential for application in governance terms. Merely commissioning an ESA and presenting it to stakeholders is unlikely to gain stakeholder support and creates potential for results to be misinterpreted or taken out of context. Co-production can allow stakeholders to:

- to feed in their own data to the ESA;
- validate expert opinions and scientific modelling;
- understand how the results were achieved and increased their credibility;
- appreciate the limitations and any associated uncertainties with the outputs.

Furthermore, it can build stakeholder trust and faith in the ESA results. The process can also create an ecosystem view of the site, bypassing sectoral positions and helping to re-frame contentious management discussions. Engaging stakeholders in the co-production of the ESA can therefore be an extremely valuable process that can generate considerable benefits, in addition to the technical outputs and results.

The results from four of the study sites (Plymouth Sound-Fowey, North Devon, Golfe Normand Breton and Golfe du Morbihan) highlights that stakeholders were genuinely interested and motivated to participate in order to gain greater familiarity with the ecosystem services approach and to learn about marine ecosystem services in their sites. The participation of the stakeholders engaged at the Plymouth Sound-Fowey site, for example, has generated new capacity amongst this cohort of environmental managers in Cornwall. One of the site coordinators indicated that this had been a valuable outcome from the process and one that could be replicated with others using an abridged version of the VALMER workshop activities. By working in a trans-disciplinary way on the subject of marine ecosystem services with other regulars and site users, the VALMER process can be educational in building awareness and knowledge. Depending on the methods used to build the ESA, the format of the results and workshop activities, there can also be skill development for example, greater familiarity with GIS. Such professional development for both managers and site users can be seen as a valuable outcome from the process of stakeholder engagement in the ESA. In both Golfe Normand Breton and the Golfe du Morbihan, a series of workshops and meetings with stakeholders, provided a participatory process for improving site knowledge through didactic learning – moving away from more traditional top-down flows of information from managers – allowing opportunity for sharing, learning and listening amongst managers and site users.

In the case of Poole Harbour that took a different approach to its stakeholder engagement to complement ongoing interactions with the harbour managers, the ESA study and its results acted as a catalyst for increased discussions with site managers as to how various water-based recreational activities were managed in the harbour. Indeed, as previously discussed a recreational forum has been established. It would seem that stakeholders in various sites have gained from being included in

management discussions about their sites, learning about other users, as well as ecosystem services. In the North Devon, the MCZ scenario that was generated has potential to have real and practical use in a qualitative sense, to help support a process of local discussions concerning a MCZ designation north of Lundy. This proposed marine protected area is currently being renegotiated by government with local stakeholders.

In summary, the process of conducting an ESA has demonstrated itself as a communication tool to facilitate dialogue about site management amongst managers and stakeholders. Within VALMER, it has encouraged trans-sectoral dialogue and provided focus for debate and discussion in specified areas for particular themes and issues. As stated by one site coordinator, “*...it has been an extremely valuable process to get people thinking about trade-offs, implications, consequences, especially for those outside their normal realm of work, or for services that they don't normally consider*” (PF case study coordinator).

4.b.3 Institutional Theme

Work Package 1, with input from the case study teams and stakeholders produced six site-based ESAs. Each VALMER ESA had a different scope, for example, some assessments looked at the ecosystem services provided by specific habitats such as kelp and seagrass beds, others were larger broad-scale assessments covering, for example, all intertidal and subtidal habitats within a marine and coastal area.

The six sites demonstrate the variety of governance contexts in which marine ESAs can be built and applied, for example, supporting the implementation of the Cornwall Maritime Strategy through to filling an evidence gap on the value of marine recreational activities to local tourism. Furthermore, the VALMER ESAs were conducted at various scales to reflect a range of different scales of management:

- Physical boundaries e.g. a semi-enclosed harbour (Poole Harbour)
- Administrative boundaries and site designations e.g. Natural Regional Park Project (Golfe du Morbihan), Marine Park (Parc Naturel Marin d'Iroise), a UNESCO Biosphere Reserve (North Devon).

It is clear from the six pilot studies that ESAs can be built at a scale that can reflect the necessary specificity. However, tradeoffs in scientific certainty appear to be made when the geographical scale increases. This was demonstrated by the Golfe Normand Breton case study where the usability of the site's baseline diagnosis was counter balanced by the large size of the site and the uncertainty of the data used.

The use of a structured decision making process, such as the Triage developed by Work Package 1, should be used to tailor the ESA's scope and boundaries around the management objectives. In VALMER the use of interdisciplinary case study teams with representatives from four of the Work Packages, was effective in ensuring connections between the site coordinators, socio-economists and ecologists. This partnership was able to deal with challenges that arose, for example, in the Poole Harbour case study that had a limited frame and resources, there was a need to manage expectations about what could be achieved, “*Initially we thought it was going to be easier to put a value on than it has been...*” (PH case study coordinator). Similarly, in the Plymouth Sound-Fowey site, initial aspirations for the ESA outputs had to be balanced against what was achievable given the time and resources available to Work Package 1, “*... what we really need, ideally, is monetary figures. We may have been unrealistic about our expectations...*” (PF case study coordinator).

When considering these VALMER marine ESA experiences in the context of international practice (Chapter 9, Section 1.2) and the three cited categories of use for the ESA in marine governance (informative, decisive and technical (Laurans et al. 2013)), it is clear that in all cases the creation of local marine ESAs was informative and could support management by building the marine evidence

base. There are fewer examples of the decisive category, for example, where there are future intentions for the VALMER ESA to be used to support decision making in a decisive way. At present there are no examples from the project where an ESA has been used in a technical way. This finding should not be interpreted that the ESAs cannot be used in such a way; instead it reflects the nature of the VALMER project that was predominately a research exercise. The project sought to test methodologies and approaches for conducting marine ESAs with practitioners at six pilot sites. The ESAs were not designed to feed directly into discrete decision making situations or design economic instruments. It is worth highlighting that the VALMER stakeholders showed limited support for ESA being used in a technical way (Section 4a). This may be due in part to the fact that the VALMER project did not demonstrate the technical application of ESA in the case studies. Also, the stakeholders were largely unaware that for example in the United States ESA studies are being used to determine compensation and damage claims, or design penalty payment schemes or set user fees (Duffield 1997, Kushner et al. 2012, Liu et al. 2010, Slootweg and van Beukering 2008, van Beukering et al. 2008).

Whilst consideration of the informative/decisive/technical classification of ESA use (Laurans et al. 2013) is helpful to reinforce findings from the literature that few ESAs are used in a technical manner, it masks the numerous instances where existing and ongoing marine and coastal management have incorporated ESAs produced by the VALMER project and marine ecosystem services considerations, into their operations to the benefit of good governance. Using Thia-Eng's (1993) three management processes – planning, implementation, and monitoring and evaluation – Tables 9.20, 9.21, 9.22 present the range of VALMER examples of where ESA has supported management. These results clearly demonstrate that there are many opportunities for marine and coastal managers to incorporate marine ecosystem considerations into existing or future management efforts.

Table 9.19 Integrating ESA into VALMER marine governance: Planning

Ecosystem service assessment can support the planning phases of marine and coastal management by:			
BUILDING an evidence base by increasing understanding of marine ecosystem services	INTEGRATING ecological knowledge and social values into the marine evidence base	EXPLORING alternative plausible future marine management options and their socio-ecological implications and trade-offs	ANTICIPATING future changes in marine ecosystem services
<p><i>Strengthening marine strategy development through improved evidence.</i></p> <p>For example in Poole Harbour: The ecosystem service assessment contributed to the development of the draft Bournemouth and Poole Sports Strategy 2014-2026 which investigated the need for new facilities to enhance people's enjoyment of non-traditional water sports along the Bournemouth & Poole coastline, and considered where these should be located.</p> <p>For example in Plymouth Sound-Fowey: Stakeholders felt that ecosystem service assessments could be used to support management at a variety of spatial scales, for example, "<i>informing leisure management in the estuary</i>" (stakeholder PF2); and, supporting "<i>strategy development or management plan development or coastal partnerships...</i>" (stakeholder PF3).</p>	<p><i>Considering different forms of relevant information, including scientific and local knowledge.</i></p> <p>For example in North Devon: Ecosystem service assessment modelling using a Bayesian Belief Network approach utilised ecological knowledge of seabed habitats together with stakeholder's perceived importance of services, to explore changes in seabed ecology in response to hypothetical management change. Such a method can be used as a decision support tool for the North Devon UNESCO Biosphere Reserve.</p> <p><i>"With the decision support tool you have the ability to make changes and tweaks, and run the model a number of times, using different variables, to see different outcomes"</i> (case study coordinator A).</p> <p>For example in the Plymouth Sound-Fowey case study: People living and working at the coast took part in a mapping exercise and survey which examined their relationship with their coastal and marine surroundings and how this reflected in their sense of wellbeing.</p> <p><i>"We do have an inherent value on our environment here in Fowey because we know it is important to people, that cultural side of things..."</i> (stakeholder PF2).</p>	<p><i>Supporting the design of policy options to inform management decisions.</i></p> <p>For example in Golfe Normand Breton: After having identified the main ecosystem services, possible scenarios for the future area were built (including social, economic, environmental, legal, political and technical evolutions) and the potential implications of these scenarios on marine ecosystem service delivery were evaluated.</p> <p><i>"Scenario building is a good approach to work with ecosystem services: it shows how a management choice can affect an activity and the environment"</i> (stakeholder GNB1)</p> <p>For example in the Parc Naturel Marin de la Mer d'Iroise: In the Parc, where kelp is harvested, the fishery, environmental conditions and the other economic and social activities in the site are strongly linked. Through an Ecosystem Services approach, possible futures were identified and plausible management options discussed with stakeholders. This represents a much broader approach than the one classically used for fisheries management.</p> <p><i>"Using scenarios is a good way to interest stakeholders in the subject of ecosystem services"</i> (case study coordinator).</p>	<p><i>Promoting a longer term perspective of marine management.</i></p> <p>For example in Plymouth Sound –Fowey case study: The baseline ecosystem service assessment and the recalculated ecosystem service assessment values for the scenarios allowed stakeholders consider future impacts of decisions that they may not have been aware, <i>"A benefit is that doing an assessment can give a better idea and understanding of the implications of a decision, e.g. what would be affected either immediately or in the longer term"</i> (stakeholder PF2).</p>

Table 9.20 Integrating ESA into VALMER marine governance: Implementation

Ecosystem service assessment can support the implementation of marine and coastal management by:		
CREATING an ecosystems view and CONNECTING people to nature	ENCOURAGING support and justification for marine policy and greater buy-in of decisions to be taken	DEVELOPING capacity of stakeholders to engage in marine governance
<p><i>Facilitating dialogue and cooperation between managers and stakeholders to promote a better understanding of the site, bypassing sectoral approaches and reducing conflict.</i></p> <p>For example in Golfe du Morbihan: This case study addressed seagrass conservation in the face of intense anthropogenic pressure and the research process included identification of ecosystem services, beneficiaries, pressures and impacts on the seagrass. Taking such an ecosystem view did not focus on a particular activity, sector or impacts thus helping to overcome the problems which often result from single sector approaches.</p> <p><i>"For me, The ecosystem approach is a management approach where the land, water and the living resources are integrated to promote the conservation and sustainable use of natural resources, in order to respect the interactions in an ecosystem on which humans depend. All elements of an ecosystem are linked, it is thus necessary to take them all into consideration."</i> (stakeholder GDM 5).</p>	<p>ENCOURAGING support and justification for marine policy and greater buy-in of decisions to be taken</p> <p><i>Enabling all relevant parties to participate in and contribute to management discussions.</i> For example in Plymouth Sound-Fowey: Engagement by a range of regulators and managers in the case study to develop hypothetical actions under the auspices of the Cornwall Maritime Strategy raised awareness of governance issues in the site and the need for implementation of this strategy through local actions. For example in Golfe du Morbihan: The ecosystem service assessment study raised awareness of seagrass habitats in the Gulf, the services they provide, the interactions between seagrass and different users of the Gulf and the need for management. As highlighted by one stakeholder, <i>"the approach is more appropriate for communicating with a wider public and makes it more likely to gain the support of those stakeholders that will be affected by the regulation/restrictions...it provides arguments to justify management measures"</i> (stakeholder GDM 7).</p>	<p>DEVELOPING capacity of stakeholders to engage in marine governance</p> <p><i>Building stakeholder capacity on marine ecosystem services to use ecosystem service assessments for governance.</i> For example in North Devon: Participation in the case study increased not only knowledge of marine ecosystem services but also about other stakeholders involved in governance, <i>"...know more about the other bodies that are out there and the other people who are interested and protecting our seas. All the different organisations that come together. I think that is quite important, that we all understand what is behind everything and what is going on out there to protect the seas and monitor them"</i> (stakeholder GDM 1). For example in Plymouth Sound – Fowey: The VALMER case study process has developed local capacity in the Cornwall environment sector on the topic of marine ecosystem services and ecosystem service assessments. <i>"As a result of this case study, there are now stakeholders in the Cornwall environment sector that are more knowledgeable about ecosystem service assessment, and have the language and understanding of it (regardless of whether they are positive or negative about it)"</i> (case study coordinator A).</p>

Table 9.21 Integrating ESA into VALMER marine governance: Monitoring and Evaluation

Ecosystem service assessment can support the monitoring and evaluation of marine and coastal management by:	
GENERATING locally relevant data on marine ecosystem services, including values such as monetary valuations and cultural values	
<p><i>Establishing and analysing existing conditions and baselines to supporting site monitoring.</i></p> <p>For example in North Devon:</p> <p><i>"The VALMER project has helped pulled together a lot of useful marine data, which was used to create the initial knowledge base for the process. This was useful"</i> (case study coordinator A).</p> <p>For example in Parc Naturel Marin d'Iroise:</p> <p>The ecosystem service assessment study has involved mapping and assessing of current kelp harvesting levels to inform management and extraction policies for this important fishery within the marine park.</p> <p><i>"We had never done modelling of management options before. It is an interesting approach for managers"</i> (Site coordinator).</p>	<p><i>Reviewing management effort and being adaptive to changes in intensity and spatial extent of activities site.</i></p> <p>For example in Poole Harbour:</p> <p>The ecosystem service assessment results will support the review of the Poole Harbour Aquatic Management Plan. This strategy acts as the management scheme for the European Marine Site protecting important marine habitats and species.</p> <p><i>"I'm hoping it will have an impact, because we've got a management matrix and everybody has different actions in that, relating to management of shoreline, shellfish dredging, netting, bait digging – all those kind of Harbour activities. Now we should review where we are doing these activities and why we need to do them and when, from a recreational point of view as well. And if we are going to make a decision, just to check and double cross what did the results of the VALMER study say, is there anything that will conflict there? I mean that is how we use data and evidence in decision making"</i> (stakeholder PH1).</p>

5. Synthesis and Recommendations

Sections 3 and 4 presented detailed analyses of the evidence collected at the six study sites through in-depth interviews with VALMER site coordinators and stakeholders. The findings clearly show that ESAs can be a versatile tool for marine and coastal managers, from both an analytical and a stakeholder engagement perspective. Stakeholder support for its use in marine governance was also found across both UK and French study sites (Figure 9.7).

The combined governance analysis has identified opportunities for improved marine governance and stakeholder engagement from using ESA (Table 9.23) as well as challenges when conducting and using ESA that need to be taken into consideration (Table 9.24).

Table 9.22 Added benefits of using ESA to support marine governance

Added benefits of using ESA to support marine governance
ESA can support the planning phases of marine and coastal management by <ul style="list-style-type: none">contributing to building a marine evidence base by increasing the understanding of marine ecosystem servicesintegrating ecological knowledge and social values into the marine evidence basesupporting the exploration of alternative plausible future marine management options and their socio-ecological implications and trade-offshelping anticipate future changes in marine ecosystem services
ESA can support the implementation of marine and coastal management by <ul style="list-style-type: none">creating an ecosystems view and connect people to naturesupporting stakeholder engagement in decision making processesencouraging support and justification for marine policy and greater buy-in of decisions to be takendeveloping capacity of stakeholders to engage in marine governance
ESA can support the monitoring and evaluation of marine and coastal management by <ul style="list-style-type: none">generating locally relevant data on marine ecosystem services, including values such as monetary valuations and cultural valuesestablishing and analysing existing conditions and baselines to supporting site monitoringreviewing management effort and being adaptive to changes in intensity and spatial extent of activities site.
ESA can be a tool to communicate with stakeholders on marine and coastal management by <ul style="list-style-type: none">to talk about conservation to the public and decision makersfor communicating the importance of environmental conservation and explaining regulations and management measuresmonetary valuation as a tool to start a dialogue with economically minded stakeholders using a common language
ESA can improve stakeholder dialogue on marine and coastal management by <ul style="list-style-type: none">building a common knowledge base and providing objective, factual evidence to inform the discussion of different optionsproviding a neutral, non-threatening context for bringing people togetherhelping them develop a common understanding of their site and better understand each other's position

Table 9.23 Challenges of using ESA to support marine governance

Challenges of using ESA to support marine governance
There are limitations to the marine evidence base
<ul style="list-style-type: none"> not all marine ecosystems can be assessed due to lack of evidence some ESAs may only be a partial representation of a site, creating an incomplete picture ensuring credibility in the ESA process and outputs can be difficult as it requires an appreciation of the scientific uncertainties and assumptions involved
Some ESA methods are technical in nature
<ul style="list-style-type: none"> ESAs can require considerable amounts of data and information the technical nature of ESA methods can be disengaging for some stakeholders
Monetary valuations need to be handled carefully
<ul style="list-style-type: none"> depending on the audience and objectives of the ESA, it may or may not be appropriate to put a price on nature (non-financial values can also be effective) some stakeholders are responsive to socio-economic arguments while others might be alienated by monetary valuations
Co-production requires an investment of time, money and human resources , e.g. 4-5 workshops over 12-18 months
<ul style="list-style-type: none"> engagement needs to be tailored to different stakeholders who will have different understanding and interests stakeholders need time and supplementary information to build knowledge and familiarity with the approach

Recommendations

To harness the opportunities and added benefits that ESAs offers managers who seek to use new tools and methods for improved marine governance and for the ESA to be as influential as possible, the following points represent recommendations from VALMER's governance experience:

- The commissioning of the ESA should be undertaken in partnership between marine managers and researchers with the necessary technical expertise;
- A structured decision making process should be used to ensure the ESA is focused on management needs. This approach determines the objective of the ESA and guides key decisions concerning the method and scale of assessment.

A clear finding from the governance analysis relates to the discovery that when ESAs are co-produced with site users, there can be considerable gains for stakeholders and managers alike. The process of engagement can have a direct bearing on how the results of the assessment will be treated and used, as such:

- Engagement should be tailored to the needs of the assessment and enable full participation of all relevant stakeholder;
- As the approach can be a difficult concept for stakeholders to understand, terminology should be kept simple, using familiar vocabulary and concepts should be explained in a local, practical context;
- Stakeholders should be given adequate time and supplementary information to help build their knowledge and familiarity with the approach;
- Involving stakeholders in technical methods like modelling can be dis-engaging for some. Careful consideration should be therefore given to this and technical terms avoided;

- The format of outputs should be explored with stakeholders to deliver information in an appropriate and practical format;
- If using monetary valuations, these should be handled with care as they can be dangerous if taken out of context and financial values may be counter-productive; and
- Limitations and uncertainties associated with outputs need to be clearly communicated in a non-technical way that stakeholders can understand.

In summary, the evidence-based synthesis and recommendations contained within this report indicate clear pathways for integrating marine ecosystem service considerations into management processes, and for ESA studies to positively influence governance processes and outcomes for stakeholders and managers alike. However, whilst there have been developments in the methodologies for assessing marine ecosystem services, as highlighted challenge exist. To date, not all marine ecosystem services can be assessed and there remain challenges in successfully capturing cultural values within ESAs. Furthermore, the use of ESA at larger scales, for example, marine planning scale, has yet to be tested, creating a need for future research activity into this aspect. Lastly, ESAs isolation may not provide all the decision support that managers may require to make decisions. As such, for the ecosystem services approach to be effectively applied in the management context, additional tools can be used in conjunction with ESAs. These can include, *inter alia*, mapping and visualisation tools, DPSIR indicators, monitoring indicators, deliberation tools including scenario building and other stakeholder engagement communication tools.

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Chapter 10 - Conclusion

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The Western Channel, like other busy cross-border shared seas, is extremely complex when viewed in governance terms. Marine environmental protection and sustainable development require ecosystem-based thinking to enable the integrated management of marine and coastal environments and their resources. Such an approach brings together the social, economic and ecological sciences, and has been endorsed across the EU, as evidenced by the Marine Strategy Framework Directive and the recent Maritime Spatial Planning Directive. The transition towards this approach to date has been hindered by a lack of knowledge of ecosystem services and their values within the marine management evidence base.

To understand how the ecosystem service approach, and in particular ESAs can support improved governance in the Western Channel, an Evaluative Framework was designed and implemented at six pilot study sites where site-based marine ESAs were conducted. These sites mirror the diversity of coastal and marine environments and ecosystem services that exist within the Western Channel, and more generally within European seas. Empirical evidence gathered included in-depth interviews with over fifty marine and coastal stakeholders and managers engaged at the sites to gather views on their experiences with ESA. Comparison of results from across the six case studies confirms expectations

that ESA has potential to support marine and coastal management in a wide variety of marine governance contexts. Stakeholder support for its use in marine governance was found across both UK and French study sites. The governance analysis has generated crucial insight and evidence into the specifics of how ESA can be used to positively affect the governance process and its outcomes. In doing so, the evaluation demonstrates there are many benefits to managers in incorporating ecosystem services considerations into existing and ongoing marine and coastal management activities such as planning, implementation and monitoring and evaluation. Furthermore, the findings clearly show that ESAs can in addition to being a versatile analytical tool; they can greatly assist and facilitate stakeholder engagement. Key recommendations have been drawn out that can enable managers to use ESA to its full capacity to influence and improve marine governance. In particular it has been identified that the co-production of ESAs through a partnership between marine managers, stakeholder and researchers with the necessary technical expertise, increases the likelihood of the policy influence and impact of ESAs.

The VALMER project has been a valuable investment of research effort to investigate and demonstrate how ESAs can be integrated usefully into the process of marine governance in the European context. The documenting of the VALMER process at six study sites and the results of this governance analysis will assist marine and coastal managers who seek to implement an ecosystem services approach, but may also support the work of the wider marine and coastal community including scientists, regulators, researchers and coastal networks. The evidence-based reflections and recommendations contained within this report indicate clear pathways for integrating marine ecosystem service considerations into management processes, and for ESA studies to positively influence both governance processes and outcomes. However, whilst there have been developments in the methodologies for assessing marine ecosystem services, to date not all marine ecosystem services can be assessed and there remain challenges in successfully capturing cultural values within ESAs. Also, the use of ESA at larger scales, for example, marine planning scale, has yet to be tested, creating a need for future research activity into this aspect.

Fundamentally, there is a critical role for managers to recognise and communicate marine and coastal areas as socio-ecological systems, in order to articulate many of the unseen, but important ecosystem services benefits that society is reliant upon. This would mean a move away from the common depiction of marine and coastal environments that are deconstructed into mosaics of habitats and species with human extraction of resources. Such a view establishes marine and coastal spaces as contested in nature, fuelling sectoral and stakeholder conflicts. A challenge going forward, therefore, towards ecosystem-based management is placing healthy, functioning and interconnected marine ecosystems as central to sustainable development and environmental protection. Governance should not be a black box of activities striving towards merely economic goals. Instead, ESAs can provide useable outputs (information and values) to inform effective marine policy, and thus ensuring areas of critical importance for ecosystem services are maintained or restored. As shown by the VALMER project, there do not need to be institutional reforms or new legislation to do so, as there is a place for ecosystem values, whether they be financial or otherwise, within existing policy making and management efforts. From experience in VALMER, engagement in and co-production of ESAs appears to be an effective way of raising awareness of managers of the provision of marine ecosystem services within their marine and coastal area. By using ESAs to understand the real ecological and socio-economic implications of area-based decisions such as trade-offs, this can increase both capacity and comfort levels towards using valuation and assessment frameworks to support marine management effort and in doing so, help facilitate good governance.

Drawing from this review are two outputs aimed at managers and practitioners:

- a) Advice note for using ecosystem service assessment to support marine governance
- b) Improving stakeholder engagement in marine management through ecosystem service assessment

These outputs form part of a complementary set of reports and recommendations from the VALMER project which can be read together for a better understanding of the use of ESA in marine ecosystems:

- A Framework for the Operational Assessment of Marine Ecosystem Services
- Lessons learned and recommendations synthesis for practitioners
- Spatial data management advice note Marine Ecosystem Services
- Building site based scenarios: Tools and approaches for the implementation in the VALMER project
- A summary of the lessons learnt from the VALMER scenario development process.

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Abbreviations

AAMP	Agence des aires marines protégés (French Marine Protected Area Agency)
AONB	Area of Outstanding Natural Beauty
BBN	Bayesian Belief Network
DCC	Dorset County Council
DCF	Dorset Coast Forum
DPSIR	Drivers, Pressures, States, Impacts, Responses
ESA	Ecosystem Service Assessment
EU	European Union
FLAG	Fisheries Local Action Group
GdM	Golfe du Morbihan
GIS	Geographic Information System
GNB	Golfe Normand Breton
HMS	Her Majesty's Ship
IFCA	Inshore Fisheries and Conservation Authority
JNCC	Joint Nature Conservation Committee
MBA	Marine Biological Association
MCZ	Marine Conservation Zone
MEA	Millennium Ecosystem Assessment
MMO	Marine Management Organisation
MPA	Marine Protected Area
MWG	Marine Working Group
ND	North Devon
NDBR	North Devon Biosphere Reserve
NGO	Non-Governmental Organisation
OSPAR	Oslo-Paris Convention
PF	Plymouth Sound – Fowey
PH	Poole Harbour
PHC	Poole Harbour Commissioners
PHSG	Poole Harbour Steering Group
PML	Plymouth Marine Laboratory
PNMI	Parc Naturel Marin d'Iroise
rMCZ	recommended Marine Conservation Zone
RNP	Regional National Park
SAC	Special Area of Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
SW	Stakeholder Workshop
TEEB	The Economics of Ecosystems and Biodiversity Study
T&F	Task and Finish group
UK	United Kingdom
UNESCO	United Nations Educational, Scientific and Cultural Organisation

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