



# Practical approaches to the management of marine social and economic data



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





# 1. Introduction

The focus on marine data management has historically been on environmental data. Large EU data initiatives such as SeaDataNet and EMODNet have largely ignored marine social and economic data. However many of the challenges faced are common, relating to effective description of the data, availability, format and exchange. In this report we outline the current situation, previous and existing initiatives and propose current best practice to inform the effective future management of marine related social and economic data.

## 1.1 What is socio-economic data?

Successful environmental and ecosystem management requires an understanding of the contextual factors that drive change in resource-use patterns and influence societal capacity to adapt. By understanding the knowledge, perception and motivations of resource users we can identify factors that influence their behaviour. To this end, data on those “contextual factors” are intrinsic to good environmental and ecosystem management. These contextual factors are termed “socio-economic”, i.e. those social, societal and economic systems that define and change the way humans interact with their natural environment.

In their 2012 report, MMO and Marine Scotland focussed on the following data themes specifically related to the marine and coastal environment: Data on financial value or economic activity associated with uses of the sea – Turnover, Gross Value Added (GVA), employment; Data on the economics of supply chains (i.e. for wind farms, fisheries) and income distribution; Data on the geographic location of use and non-use values of activity and infrastructure - both coastal and marine; Data relating to the characteristics of coastal and linked marine communities: employment, demographics, business base, health and wellbeing data including access to recreational and leisure facilities, wealth / deprivation indices, quality of life indicators; Data for input to ecosystem services models such as services provided by ecosystem types, value of services and changes in wellbeing values.

The UK Marine Policy Statement (MPS) outlines the key activities that take place in the UK marine environment, i.e. the ways in which humans use and interact with the marine environment. These are: Marine protected areas (All conservation designations at international, European and National level); Defence and national security; Energy production and infrastructure development (Oil and gas, Renewable energy, Offshore electricity networks, CO<sub>2</sub> Capture and Storage); Ports and shipping (including port development); Marine aggregates; Marine dredging and disposal ; Telecommunications cabling; Fisheries; Aquaculture; Surface water management and waste water treatment and disposal, and Tourism and recreation.

## 1.2 Why is socio-economic data important?

Current initiatives to take stock of available marine related socio-economic data in the UK include 2012 Review of Marine Social and Economic Data (MMO and Marine Scotland, 2012) and the 2014 Social Impact and Interactions Between Marine Sectors report (MMO, 2014). Both reports highlight the disparity in availability of such data and the data gaps that exist across economic valuation and within those sectors listed in the MPS. Policy makers are absolutely reliant on robust socio-economic data to make informed decisions for the future management of Europeans seas. The Marine Strategy Framework Directive (MSFD), the UK Marine Acts, MPS and the designation of new Marine Protected Areas all call for the urgent need of data relating to the marine environment and the services it provides.

## 2. Background to the work of WP2

This report arises from work carried out within the INTERREG IV VALMER project and the UK Marine Environmental Data and Information Network (MEDIN). The development of data management guidelines for social and economic data was recognised in the UK Charting Progress 2 report (UKMMAS, 2010), and highlighted in the recent call for the second round of development for EMODNet which this time included a social and economic data component.

The development of marine plans, through the Marine Management Organisation (MMO) in the UK, and the network of French Marine Protected Areas, managed by Agence des Aires Marines Protégées (AAMP), requires robust social and economic data to be readily available. Additionally the emergence of ecosystem service valuation methodologies results in monetary and non-monetary valuations which present additional challenges in relation to effective description and inclusion in a spatial data framework.

The requirements for EU member states to report on the state of their seas and aim to achieve Good Environmental/ Ecological Status (GES) is central to the Marine Strategy and Water Framework Directives. Whilst having slightly different implementations and timescales, these two key directives share a common requirement for the most up-to-date, authoritative and comprehensive data to support the aims of clean, safe, productive, healthy and biologically diverse European waters.

### Previous projects

#### 3.1 MMO and Marine Scotland 2012 - A review of marine social and economic data

In an attempt to produce a UK baseline for the availability, location and accessibility of social and economic data, the MMO and Scottish Government commissioned a review into the tools and methodologies for the analysis of social and economic data, alongside producing a catalogue of data. This work culminated in a number of high level recommendations outlined in table 1.

Recommendation	Aim
1. MMO and Marine Scotland to develop and promote an Action Plan for the provision of marine social and economic data.	To ensure that the right information is identified and collected in an efficient and coordinated way to help inform decision-making.
2. MMO and Marine Scotland to maintain communication between scientists and marine managers through links to other research and data initiatives.	To ensure that good quality and relevant evidence to support marine decision-making is provided in an efficient way.
3. For the MMO and Marine Scotland to engage with existing data centres and to support the development of a federated DAC in-line with MEDIN best practice.	To ensure that metadata on social and economic data are kept up to date, are in a useable format and are widely and easily accessible.
4. MMO and Marine Scotland to work with MEDIN in the development and promotion of metadata guidelines and standards for marine social and economic data.	To improve the quality of metadata currently recorded for marine social and economic data, thus making it more readily applicable and defensible for evidence-based decision-making.
5. MMO and Marine Scotland to develop an interim keyword list for marine social and economic data and to work with MEDIN over the longer term to develop a set of keywords within the MEDIN Discovery Metadata standard.	To enable searches of the metadata catalogue by keywords that will help to facilitate marine decision-making.
6. MMO and Marine Scotland to address priority gaps in marine social and economic data through increased coordination.	To provide high quality, defensible evidence to underpin decision-making.

**Table 1.** Recommendations from MMO and Marine Scotland (2012).

#### 3.2 MMO 2014 - Social Impacts and Interactions Between Marine Sectors

In order to assist marine plan development and implementation the MMO commissioned a report “to establish a body of evidence on social impacts as an assessment of interactions within and between [those] sectors detailed in the MPS”.

The report outlines 6 recommendations for future research to increase the evidence base of social impacts, marine sector activities and their interaction-impacts (table 2).



Recommendation	Aim
1. Primary research to establish a broad set of marine-specific social indicators.	To better understand the most policy-relevant social issues for marine planning; develop quantitative indicators to better understand social impact and social change.
2. How MPS sectors contribute to coastal community social cohesion and culture.	To provide a baseline from which to develop understandings of how changes in MPS sectors will affect coastal communities.
3. Improved mapping of marine sector activities to Standard Industrial Classification (SIC) codes.	Some marine activities can be mapped using 4-digit SICs, others, such as offshore renewable energy cannot. It is understood that exploratory work of this nature may be undertaken via research project MMO1075.
4. Commercial fishing non-market economic valuation	Economic valuation of the non-market benefits of local fishing fleets may help demonstrate the social value of the sector. Monetisation of such social values will allow representation in economic decision-making tools like cost benefit analysis.
5. Commercial fishing / fishing community social indicators and profiles.	Truly social indicators are not generally available for commercial fishing. There may be the opportunity for the MMO to develop fishing community profiles through targeted research.
6. Ex-post evaluation of social impacts in England.	Particularly in relation to: post-development evaluation of offshore windfarms; ex-post evaluation evidence on the social impacts of the UK MPAs; social impacts resulting from impacts to the commercial fishing industry.

**Table 2.** Future research recommendations for social impacts and interactions between marine sectors; adapted from (MMO, 2014).

## 4. Current Initiatives

### 4.1 MEDIN

Within the UK, there exists a harmonised approach to marine data management. The Marine Environmental Data and Information Network (MEDIN) is an open partnership, representing a wide range of organisation types, including government agencies, non-governmental organisations (NGO), charities, consultancies and educational institutes. MEDIN builds on the “Measure Once, Use Many Times” doctrine, to maximise the reuse value of marine data, and ensure long-term custodianship within established, thematic Data Archive Centres (DACs).

MEDIN also co-ordinates UK marine data management liaison with Europe and worldwide. There exists a dedicated MEDIN workstream to ensure alignment of standards and guidelines within this context and includes representation on the IOC’s International Oceanographic Data and Information Exchange Committee, the ICES working group on Data and Information Management and the MSFD-focussed Working Group for Data, Information and Knowledge Exchange. Such involvement ensures the best practice propagates seamlessly.

Additionally MEDIN DAC’s are involved in EMODnet and the provision of evidence to support meeting the requirements of MSFD, WFD and the Birds and Habitats Directive alongside other national, regional and global directives and legislation.



## 4.2 Sextant

Ifremer has developed a spatial data infrastructure for marine environments, called Sextant, in order to manage, share and retrieve geographical marine information. These data can be collected and processed both by Ifremer as well as its partners.

As it meets ISO and OGC standards, Sextant is compatible with national and international geographic information portals.

## 4.3 VALMER

Through VALMER the aim was to provide an innovative technical solution to ensure a regional view of the best available data to support the development of scenarios and the valuation of ecosystem services within the case-study areas. The adoption and development of open, standards-based data formats and appropriate software tools enabled the seamless integration of data from disparate data systems. The use of these open formats and widely adopted standards ensured the increased reuse utility of the data, and widened the accessibility to the largest user community.

Open geospatial standard facilitated the creation of a centralised visualisation tool driven by data and resources streamed from data repositories held by geographically-distinct organisations. The formats adopted and deployed also extend the utility of the data beyond the lifespan of the VALMER project, resulting in a data legacy for future research and policy development.

# 5. Data Management

## 5.1 Describing data

The collection of new data is expensive and time-consuming. In some cases collection exercises repeat existing unknown work resulting in duplication of effort and wasted resources. By effectively describing existing data and ensuring the widest possible publication of these data this duplication can be reduced. Metadata describes the dataset, series of datasets or data service and can be encoded as XML in a text file. The structure of the XML and the attributes it describes are defined in a common format or schema to ensure consistency and standardisation. The resulting XML-file conforms to the stated standard and therefore is consistently machine-readable and readily exchanged. There are a number of commonly used schemes for describing geospatial data, all using the ISO19139 standard as their basis. Within the EU, the INSPIRE Directive has developed a common schema to be used by member states. Within the UK the INSPIRE standard is implemented as UK-GEMINI. The marine data community, through the MEDIN partnership, have further refined the INSPIRE and UK-GEMINI standard to produce a marine superset with keywords and vocabularies relevant to the marine sector.

## 5.2 Keywords

In order to have a common language to describe data, sets of keywords, or vocabularies are required. Within the context of metadata, keywords exist as a list of code and value pairs within a hierarchy of increasing detail. The lists used within MEDIN and Sextant derive from the EU SeaDataNet project. These lists are maintained and managed and have the capacity to grow and extend as new terms are added. However the remit of the original SeaDataNet vocabularies was limited to keywords describing physical and chemical parameters. Recent activity has seen the addition of further keywords relating to biological data. However, currently the coverage for social and economic related keywords is poor.

The UK Data Archive (formally the Economic and Social Data Service), utilise the HASET (Humanities and Social Science Electronic Thesaurus) set of terms to describe data, but there are no marines specific keywords.

Through the VALMER project the collation of relevant keywords has taken place, with the aim of augmenting the SeaDataNet parameter dictionary. Building of lists of keywords from the MAIA, iCoast and CHARM projects an initial, high-level set of keywords has been defined. This initial list can then be further developed as required through the addition of child-terms, deepening the hierarchy and adding more detail as required.

Under the VALMER project, key partners attended a data workshop, part of which aimed to create a list of relevant socio-economic key words related directly to the marine and coastal environment to enable INSPIRE compliant metadata to be appropriately tagged (table 3).

### TOP LEVEL KEYWORDS

ESVM

Governance – administrative units

Governance – stakeholder / political

Environmental pressures and impacts

Human activities

### OTHER KEYWORDS

Stakeholder (these are any people associated with a group with a vested interest.

This is different from public, who are not represented by any “group” and have no particular “vested interest”)

Scenarios

Governance

Management

Marine heritage Conservation

Marine heritage restoration

Marine heritage sustainable exploitation

### KEYWORDS FOR RECREATION DATA

Direct visitation rates

Indirect visitation rates

Economic impact assessments

Carrying capacity

Visitor nights

Direct expenditure

Indirect expenditure

Companies that provide services

Number of people employed in industry

Number of people employed in support industry

Routes

Density of use

Memberships

Licenses

Permits

Catch / extraction

Pressures and impact assessments

Boats registered (permits)

Welcoming capacity of harbours (Number of moorings) – by infrastructure i.e. port, harbour, berth etc.

Number of designated sites for recreation (registered / manned sites)

Distance travelled

Willingness to pay

Rationale for visit

Location of activity

Seasonality

### INDUSTRIAL ACTIVITIES

Production value

Monetary values

Amount produced

Amount extracted

Harvested biomass

Gross revenue

Added value

Direct Employment

Indirect employment

Disturbance

Pollution

Pressures / impacts

Number of companies

Licensed areas

Locations of activities

Social impacts

Visual impact

Quality of life impact

### SOCIAL AESTHETIC / LIFESTYLE IMPACTS

Landscape characterisation

Seascape characterisation

Marine landscape

Viewshed analysis

Visual impacts

Vulnerability

Erosion risk

Number of boats in harbour

Number of visitors

Development limitation

Historic and cultural heritage

Property value

Tranquillity surveys

Perceptual studies (rating preferences)

Charismatic / emblematic species, habitats, geology

Multiple indicators of deprivation

Blue gym

*Table 3. List of potential keywords created at the VALMER Sharing Best Practice of Geospatial Data Management, le Havre, France, 15<sup>th</sup>-16<sup>th</sup> January, 2013.*



### 5.3 Archiving Data

The data collated and produced through regional, national and international projects have historically not been well managed. Project websites and data repositories were not funded over long-term timescales, and resulted in the data not being reused or made more widely available once the project funding had ceased.

National marine data centres (the British Oceanographic Data Centre, BODC, in the UK), were established to provide support to academic data resulting from funding from the Research Councils, however their remit did not extend to data collected and collated through statutory and government agencies. As a result, data were fragmented, hidden and held in institutional "silos". In addition social and economic data were considered purely in a terrestrial context. The Office of National Statistics and the Economic and Social Data Service (ESDS, now the UK Data Service) provide excellent examples of best practice for the management of social and economic data and liaison with the marine sector is key to future engagement. Following the MMO/MS review the liaison was recommended and should be further encouraged.

#### 5.3.1 Proven environmental data management system - MEDIN

The MEDIN Biodiversity Data Archive Centre (DASSH) is hosted at the Marine Biological Association of the United Kingdom, Plymouth. MEDIN was created under remit from the UK government to meet the INSPIRE Directive requirements. Building on the requirement for government department data to be searchable from metadata, MEDIN operate the "data discovery portal", a metadata discovery service providing users with a single point of access to individual metadata records submitted to the portal by the Data Archive Centres and other public and private sector bodies.

As the Biodiversity Data Archive Centre, DASSH have created and operate an in-house data management system, that allows us to catalogue, archive and serve data and metadata for all newly acquired and historic datasets and associated assets. (fig.1)

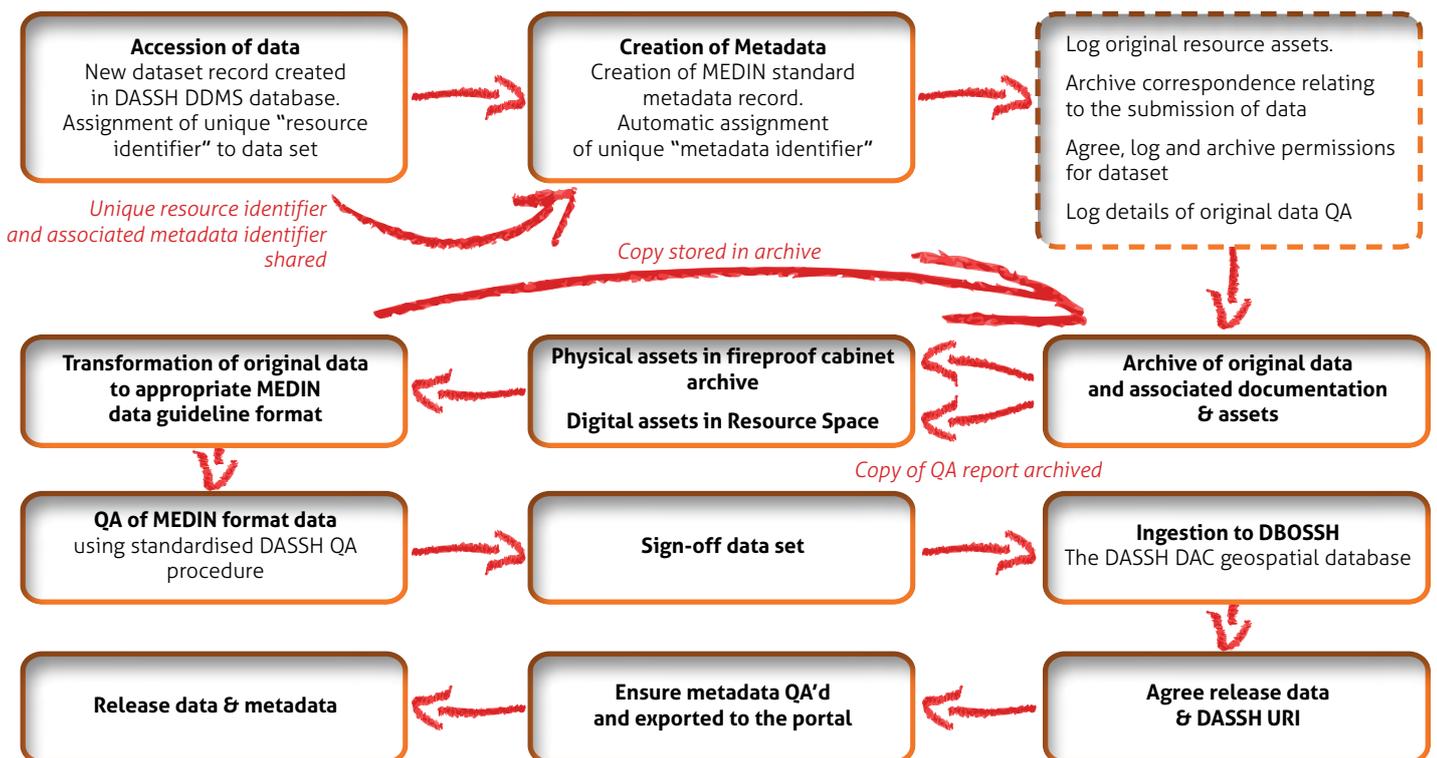


Fig 1. The DASSH data management procedure for data accessions

#### 5.3.2 Proven environmental data management system - Sextant

Sextant is hosted at the IFREMER research institute in France. Sextant also exists to meet the requirements of the EU INSPIRE Directive requirements. Sextant offers a discovery service, a visualisation service, and a data download service. The discovery service of Sextant is based on the metadata catalogue, using Geonetwork, which conforms to the Inspire INSPIRE directive, ISO standards and the OGC's Catalogue Service for Web (CSW) interface. Data visualization and data downloading are available through standard OGC services, Web Map Services (WMS) and Web Feature Services (WFS).

### 5.3.3 Accessing data

Data sharing is, very simply, the practice of making data available. Under INSPIRE, data sharing specifically relates to “establishing an infrastructure for spatial information in Europe to support community environmental policies, and policies or activities which may have an impact on the environment”.

While transparency and openness are considered part of the scientific method, there still remains a significant hole in the volume of research data which are made available to other researchers and sectors. This is particularly notable within the biological and social sciences.

The Open Geospatial Consortium (OGC) content and services exists to encourage development and implementation of open standards for geospatial content and services, GIS data processing, and data sharing. Within VALMER we have been working to establish a data sharing infrastructure to ensure the longevity of the VALMER data and outputs beyond the projects close using such services.

- Data are stored in the powerful open source object relational database system PostgreSQL. Spatial data are made “readable” by the database using the open source PostGIS programme.
- Views are created in the database using SQL scripting language. These tell the database which columns of data to make available for viewing and downloading.
- The view is then published from the database to GeoServer, a java-based server software that allows users to view, edit and “SHARE” their spatial information.
- Data is shared using a URL on a specified website. The format of the data can be tailored to the end users needs: tabulated files (csv), geo-spatial files (shp, kml) web coded files (open layers, GEOjson).
- Allowing the user to analyse in statistical packages, GIS software and web-based applications.

## 6. Archiving VALMER project data

Both the UK and France have developed IT systems to describe, store and download environmental data under the INSPIRE Directive 2007 (European Directive 2007/2/EC). In the UK, MEDIN provides this capacity for the marine community while IFREMER houses the Sextant infrastructure for marine and coastal data in France.

### 6.1 The VALMER data hub: [data.valmer.eu](http://data.valmer.eu)



The VALMER data hub is the final output of WP2 and acts as a central repository for all data produced during the project, drawing on the MEDIN and Sextant infrastructure. Using OGC compliant standards, documents, maps and geospatial data are ingested to the data hub for decision makers, researchers and the public to download and analyse as they see fit (fig. 2).

The VALMER partnership took a case study based approach to its research of Ecosystem Service Valuation, choosing 3 sites in England and 3 in France located within the English Channel / Manche region that have current policy requirements. As the majority of project data would be produced through these case studies the WP2 Data Working Group took a national approach to data archiving. Data and outputs from French case studies were digested through the Sextant infrastructure while those from England through MEDIN.

*Fig 2. The VALMER data hub and it's supporting infrastructure*

### 6.2 MEDIN & Sextant metadata catalogues

Upon acquisition of project data (primarily maps, shapefiles, documents and spreadsheets), its metadata is entered into the specific national metadata catalogue. This ensures that explicit VALMER resources can be found after the projects conclusion.



### 6.3 Data guidelines

The MEDIN network has worked tirelessly with the marine scientific and standards communities to produce a set of data guidelines that accurately and efficiently record all data related to a given survey method. Where primary research was conducted, biological data were transformed to the appropriate guideline format and ingested into the MBA geospatial database. This database is linked to the MBA instance of GeoServer, open source software that acts as a server for data across the web.

### 6.4 Cartography and GI outputs

The data hub contains a map catalogue as well as an OGC compliant Web Map Service (WMS). The map catalogue provides a browsable collection of map thumbnails covering various themes used and analysed during case study research. These are final, static deliverables that end users may employ to understand the current situation of the case study area or provide a spatial context for analysis outputs, i.e. changes in service provision under a particular scenarios; or the value of a particular ecosystem service within the case study boundary.

The WMS will provide an interactive mapping environment for users to browse and download ESRI shapefiles for ingestion to their own GIS software, provide a web based platform for ingestion into their own online systems and produce their own relevant maps from some of the projects outputs.

## 7. Conclusions and Recommendations

### 7.1 Recommendations for the UK

#### 7.1.1 MMO, Marine Scotland and MEDIN collaboration

Three recommendations made in the MMO and Marine Scotland (2012) report are still pertinent today (table 4). Although progress is being made under each of these by the MMO, Marine Scotland and MEDIN, it is imperative that work continues to realise these aims. This is more urgent now given the recent publication of the MMO (2014) Social Impacts and Interactions Between Marine Sectors report detailing specific data requirements for socio economic data within UK waters.

Note that under point 5, progress has been made through collaboration between MEDIN and The Crown Estate (TCE). Socio-economic keywords associated with offshore developments licensed by TCE and their associated functioning have now been included in the MEDIN and SeaDataNet keyword lists.

Recommendation	Aim
<p><b>3.</b> For the MMO and Marine Scotland to engage with existing data centres and to support the development of a federated DAC in-line with MEDIN best practice.</p>	<p>To ensure that metadata on social and economic data are kept up to date, are in a useable format and are widely and easily accessible.</p>
<p><b>4.</b> MMO and Marine Scotland to work with MEDIN in the development and promotion of metadata guidelines and standards for marine social and economic data.</p>	<p>To improve the quality of metadata currently recorded for marine social and economic data, thus making it more readily applicable and defensible for evidence-based decision-making.</p>
<p><b>5.</b> MMO and Marine Scotland to develop an interim keyword list for marine social and economic data and to work with MEDIN over the longer term to develop a set of keywords within the MEDIN Discovery Metadata standard.</p>	<p>To enable searches of the metadata catalogue by keywords that will help to facilitate marine decision-making.</p>

**Table 4.** Recommendations taken from MMO & Marine Scotland (2012) that require further development

### 7.1.2 Mapping of marine sectors

From that MMO 2014 report came a recommendation for mapping marine sector activities (table 5). We further recommend that WMSs are integral to this process to facilitate timely and cost effective delivery of this data.

Recommendation	Aim
3. Improved mapping of marine sector activities to Standard Industrial Classification (SIC) codes.	Some marine activities can be mapped using 4-digit SICs, others, such as offshore renewable energy cannot. It is understood that exploratory work of this nature may be undertaken via research project MMO1075.

Table 5. Recommendation taken from MMO (2014)

### 7.1.3 MEDIN in Europe

MEDIN must continue to be involved in all national and European level data initiatives and drive the infrastructure, standards and means by which socio-economic data can be efficiently ingested into the national data network.

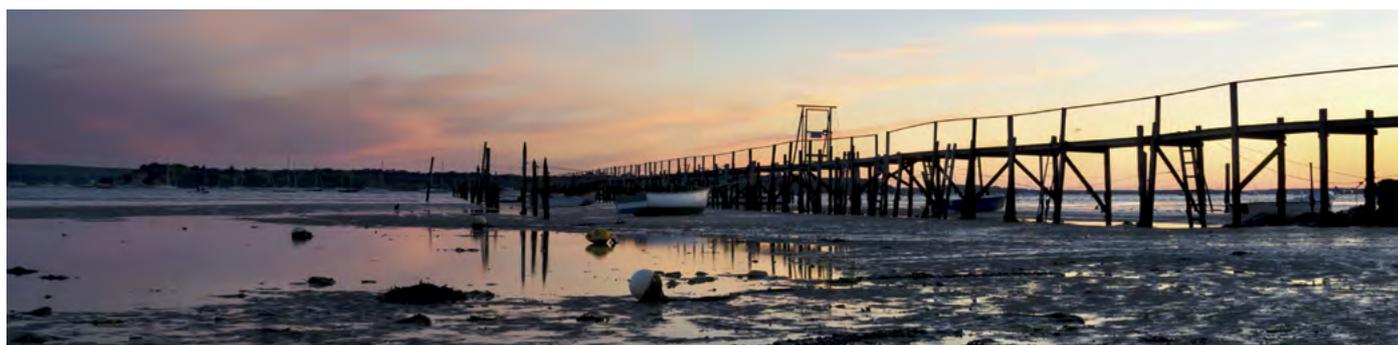
## 7.2 Recommendations for the EU

### 7.2.1 Cross-boundary data linkages

Web services provide ideal tools to ensure close integration across national and thematic boundaries. The technology is now sufficiently mature to allow the exchange and aggregation of data and metadata, ensuring a high-level of discoverability and reuse are possible. By linking MEDIN and Sextant, VALMER has proved cross-boundary data sharing. By linking the European wide network of metadata services, the EU can provide quantitative and spatially relevant data to relevant organisations, and where appropriate, the public.

### 7.2.2 Legislation

It is recommended that there be a legislative requirement for all environmental and socio-economic data generated within a country to be submitted to a national archive, with publically available metadata, even if access to raw data is restricted.



## REFERENCES

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Photos : A. Baumgart, Harvepino, H. Hotson, Kamillok, D. Sainthorant/Shutterstock.com - T. Abiven/Conservatoire du littoral

## VALMER Valuing ecosystem services in the western English Channel

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

The aim of the project was to examine how marine ecosystem services assessments (ESA) can support effective and informed marine management. The project involved six case studies at three sites in the UK and three sites in France. You can find further information about VALMER on the project website [www.valmer.eu](http://www.valmer.eu).

This document forms part of a complementary set of reports and recommendations from VALMER, which we suggest be read together for a better understanding of the use of ESA in marine ecosystems. All VALMER outputs are available on the project website [www.valmer.eu](http://www.valmer.eu).

With the contribution of the project partners:

