EUROPEAN
COMMISSION

Brussels, 8.5.2014
SWD(2014) 149 final

COMMISSION STAFF WORKING DOCUMENT

Marine Knowledge 2020: roadmap

Accompanying the document

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Innovation in the Blue Economy
realising the potential of our seas and oceans for jobs and growth

{COM(2014) 254 final}

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1. INTRODUCTION

This document accompanies the Commission Communication on "Innovation in the Blue Economy". The Communication sets out an objective of replacing the present fragmented, inaccessible and inhomogeneous repositories of marine data in the EU by a sustainable process whereby data is easily accessible, interoperable and free of restrictions on its use. The Green Paper "Marine Knowledge 2020[1]" indicated that this:

> *will include a flagship project to prepare a seamless multi-resolution digital seabed map of European waters by 2020. It should be of the highest resolution possible, covering topography, geology, habitats and ecosystems. It should be accompanied by access to timely observations and information on the present and past physical, chemical and biological state of the overlying water column, by associated data on human activities, by their impact on the sea and by oceanographic forecasts. All this should be easily accessible, interoperable and free of restrictions on use. It should be nourished by a sustainable process that progressively improves its fitness for purpose and helps Member States maximise the potential of their marine observation, sampling and surveying programmes."*

The Commission proposed to do this through improved ocean observation systems, better access to available data, integration of existing EU systems and greater involvement of the private sector.

A dedicated budget has been set aside for this purpose within the part of the 2014-2020 European Maritime and Fisheries Fund[2] earmarked for the integrated maritime policy. But realising the vision will require contributions from other sources including the marine service of the Copernicus Earth Observation Programme[3], the Data Collection Multi-annual Programme for fisheries, the Horizon2020 research programme[4], the private sector and data collected in order to meet EU environmental reporting obligations.

In June 2013, the Council[5] invited the Commission "*to develop a roadmap towards a sustainable structure that is driven by the needs and priorities of public authorities, industry, the research community and other stakeholders*" and to "*continue building synergies between the various EU data, information and knowledge initiatives*" In November 2013, the European

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1 Green Paper Marine Knowledge 2020 from seabed mapping to ocean forecasting COM(2012) 473

2 Proposal for a Regulation of the European Parliament and of the Council on the European Maritime and Fisheries Fund COM/2011/0804

3 Copernicus, previously known as GMES (Global Monitoring for Environment and Security), is a European Programme for the establishment of a European capacity for Earth Observation.

4 Regulation (EU) No 1291/2013 of the European Parliament and of the Council of 11 December 2013 establishing Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)

5 Integrated Maritime Policy General Affairs Council meeting Luxembourg, 24 June 2013

Parliament[6] also considered that the initiative needed "*a specific action plan setting out medium- and long-term goals, based on a concerted effort by the EU and the Member States*".

This document sets out a roadmap as requested by Council and Parliament with a timetable and milestones for implementing the actions on marine knowledge set out in the Communication and achieving the 2020 objective. An assessment of the economic, environmental and societal benefits is provided in the appendix.

2. STRENGTHENING THE EUROPEAN MARINE OBSERVATION AND DATA NETWORK

2.1. How it works

The basic principle of the European Marine Observation and Data Network (EMODnet) is that marine data should be maintained by organisations that collect or own the data but accessed in a common way. This means that a user would be able to search for, visualise and retrieve all the measurements concerning a specific parameter within a certain time and space window with one single command wherever the data are stored. In order to maximise innovation and minimise bureaucracy marine data should be free of charge and free of restrictions on use. Key features are the following:

– In addition to the data that participating organisations make available from their own and other repositories through EMODnet, they are creating data products and information services and making them available. Data products are derived from the raw data but are not confined to single points in space and time. These data products are not designed for a specific purpose but rather serve many needs. Examples include digital terrain models7 or sediment map layers. It would be inefficient if everybody who needed a digital terrain model had to construct one from original surveys: considerable effort is required to create these products by knitting together data from many different sources ensuring continuity and coherence across borders and across different disciplines.

– It is a fundamental principle of EMODnet that data and data products should be accompanied with an indication of their origin and ownership in order that the work of the organisations that collect and process the data be recognised in compliance with the INSPIRE Directive8 and applicable implementing rules when appropriate. Wherever possible there should be indications of accuracy and precision. For instance the digital terrain model provides not only the average water depth over a given area but also the standard deviation.

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6 European Parliament report on Marine Knowledge 2020: improving seabed mapping for fisheries purposes (2013/2101(INI)) Committee on Fisheries (Rapporteur Maria do Céu Patrão Neves)

7 a digital model or 3D representation of the shape of the sea bottom

8 Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community

– EMODnet is divided into seven thematic groups: geology; bathymetry, physical habitats, physics, chemistry, biology and human activity. Each thematic group is a partnership of organisations that have the necessary skills and access to data to standardise the presentation of data and create data products. For instance the partners of the thematic group for geology are bodies responsible for geological surveys in EU coastal states as well as a number of neighbouring states.

– In order to provide a common gateway to the thematic groups, an entry portal has been built. At present this contains hyperlinks to the seven thematic portals but over time this approach will be complemented by a version that allows users to search and retrieve data and data products across all portals. This will be unveiled by the end of 2014.

– At present 114 organisations are participating; some in more than one thematic group. These groups were selected through open calls for tender and their contracts run until 2016. After this time it is intended that a further round of open tenders will take place, which will allow the continuation of EMODnet till 2020.

2.2. issues and milestones

The thematic groups started in autumn 2013 on a three year work programme. Therefore new calls for tender will be launched in 2015 and 2016.

2.3. Signing in procedures

In the preparatory first phase of EMODnet some portals required users to identify themselves and, in some cases, to wait whilst requests for data were dealt with. Others did not. Whilst the objective is that there should be no restrictions, it is useful to know who is using the data and what they are using them for. This helps guide priorities for future development.

The aim is to provide a simple user identification process that is valid for all thematic groups and instant access to data. This will become operational by mid-2015.

2.3.1. Seabed mapping – bathymetry and geology

By the end of 2014 the thematic groups for bathymetry and geology will have prepared the first version of a digital seabed map of Europe based on these themes. Although, it will not cover all sea-basins, all the map layers will be available through a single entry portal. It will have a low resolution but still be of a higher resolution than anything that has been produced before over entire sea-basins. By the end of 2015 all EU sea-basins will be covered. 2016 will then be devoted to maintenance. Throughout this period the partners will be incorporating new data.

For the next phase of EMODnet, the aim will be to move from a low-resolution mapping to one where the resolution is as high as the underlying data allows. For instance multibeam surveys can deliver digital terrain models with a resolution of

metres, compared to approximately 250 metres resolution for the current second phase of EMODnet.

In order to maintain continuity, calls for tender should be issued in time for groups to start work in autumn 2016 on a third phase with the first multi-resolution demonstration digital map layers available in 2017. It will then be a question of maintenance and updating.

2.3.2. Seabed mapping – physical habitats

The first phase of EMODnet developed predictive seabed habitat maps which covered nearly half of Europe's seas. The physical habitat group are following this up with a mapping of all European seas. A new version, using the latest available EUNIS[9] habitat classification and taking into account parameters such as depth, salinity, temperature, substratum type and turbidity, will be ready by the end of 2015. It can indicate, for instance, the possible geographic distribution of seabed communities. This can then be compared with the actual range.

During the current phase the group will endeavour to automate the process of classification once new data, for instance on marine sediments, become available and will assess where the outputs of the thematic groups for bathymetry, geology and physics and the marine service for Copernicus[10] would allow an increased resolution of 50 or 100 metres.

The third phase of the project from 2017 onwards will place increased emphasis on the ecologically crucial coastal area with a view to mapping shallow inshore waters. By focusing efforts on this coastal strip and working in parallel with the major Corine[11] Land Cover update, coordinated with the Copernicus land service that will include additional information on the coastal areas, a seamless land-to-sea map will be produced.

At the same time, a number of ongoing research and survey projects are collecting information on biologically-defined habitats, such as *Posidonia* seagrass beds in the Mediterranean. In this third phase of the project, the group will begin to include these.

2.3.3. Chemistry

The thematic group for chemistry is on track to provide access to measurements of concentrations of chemicals in all European sea-basins by mid-2015; largely for measuring pollution but also for assessing the impact of climate change. The very heterogeneous distribution of concentrations of these chemicals makes it challenging to

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9 The European Nature Information System (EUNIS) habitat classification is a pan-European system, which was developed between 1996 and 2001 by the European Environment Agency (EEA) in collaboration with experts from throughout Europe. It covers all types of natural and artificial habitats, both aquatic and terrestrial. The marine section of EUNIS will be restructured and updated in 2014 and should be used by the physical habitat group.

10 for example temperature and salinity

11 A digital land cover map in 44 classes at a scale of 1:100 000 available for most areas of Europe.

develop algorithms to create concentration maps. The highest concentrations are generally near the coast so the group is investigating how these can be displayed in an intuitive way.

Some data providers are only providing information on what data are available and require authorisation before the data are provided. In some, but not all, cases environment agencies are concerned about a "wrong interpretation of their data". The aim is to move progressively towards a process where users are provided with instant access. An identification of the user through the common EMODnet sign-in would be sufficient authorisation. This does not exclude a reasonable time delay after measurements made by researchers that would give them time to publish their findings.

It is expected that this group will operate at the same level of activity up to 2020 with progressively more data becoming available and with guidance on priorities from the sea-basin checkpoints (see section 9). They will also work closely with public authorities responsible for implementing the Marine Strategy Framework Directive in order to ensure that the data can be retrieved in a suitable form for creating indicators of the state of the marine environment in a way that is coherent across national borders.

2.3.4. Biology

The wide variety of marine life, the difficulties in measuring its characteristics, abundance and diversity and the vast amount of unstructured historic data make this the most challenging of the thematic groups. National efforts in cataloguing this information are not yet converging to common standards so the approach has been to maintain and support regional or international efforts such as the EurOBIS database that was originally created as a repository by the 10-year Census of Marine Life[12]. The thematic group also uses the World Register of Marine Species to facilitate the integration of the heterogeneous biological data. This is an open-access inventory of over 90% of all known marine species' names that sets a baseline of current knowledge of marine biodiversity at the species level.

The calculation of specific aggregated and gridded products indicating the presence, absence, abundance and diversity of species and communities can give an indication of ecosystem health and temporal trends for specific sea basins, which can in turn be used to improve ecosystem-based management. These ecosystem 'indicators' are being developed to support Member States' implementation of the Marine Strategy Framework Directive. Improving the quality and reliability of these products and understanding how these indicators vary on a geographical or temporal basis will, however, require more observations to be included within the system. It may be that the best way forward is to support a "marine family" approach that supports separate data repositories for groups such as seabirds or marine mammals.

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[12] a 10-year international effort undertaken in to assess the diversity, distribution and abundance of marine life. The Census engaged some 2,700 scientists from around the globe, who participated in 540 expeditions and countless hours of land-based research. The scientific results were reported on October 4, 2010 at the Royal Institution in London.

Based on the results of the present phase, and ongoing work under the data Collection Regulation for fisheries, a decision will be made in mid-2015 as to whether to go further down the "marine family" approach and how to make some fisheries data available through the biology portal and thus make these data more usable for purposes such as environmental assessments..

2.3.5. Physics

Physical data such as temperature, salinity and wave height are fed into EMODnet in two ways. First, sixty days' worth of measurements are taken directly from the measuring stations and organized within the EuroGOOS[13] Regional Operational Oceanographic Systems (ROOSs), and made available in near real-time. Then these measurements pass to national data centres where they are checked, catalogued and stored. So, in a second step, EMODnet can retrieve and make available these quality-checked data.

These same data are also essential for the Copernicus marine service where they are used to calibrate and validate measurements from orbiting satellites and ocean forecasting models. The physics thematic group already works closely with the Copernicus team and this collaboration will be strengthened in the future. The aim will be to create a system that provides seamless access to real-time and archived data through either the EMODnet or Copernicus gateway or through direct machine-to-machine communication.

2.3.6. Human activities

The group will aim to map activities or installations that could have an impact on other users of the sea or on the marine environment or that could themselves be disturbed. This will include, for instance, energy installations, aquaculture farms, shipping traffic and underwater archaeological sites. Such information could be used to inform the development of marine strategies under the Marine Strategy Framework Directive. A number of bodies already manage databases for some of these activities and, where possible, the group will tap into these efforts so that any new versions of these databases are automatically available through EMODnet. Data from existing maritime information on maritime activity and hazards systems such as SafeSeaNet[14] will be aggregated so as to identify areas of risk.

This thematic group started work for the first time in autumn 2013 so there is less knowledge of the challenges and opportunities than for the other groups. It is therefore premature to set out plans for the groups' activities beyond the end of the current

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13 EuroGOOS is an association of 34 national governmental agencies and research organisations, from 16 European countries, founded in 1994, committed to European-scale operational oceanography within the context of the intergovernmental Global Ocean Observing System (GOOS).

14 The Union maritime information and exchange system, SafeSeaNet iwas established as a centralised European platform for maritime data exchange, linking together maritime authorities from across Europe (Directive 2002/59/EC, as amended). It enables European Union Member States, Norway, and Iceland, to provide and receive ships information and ship related information (e.g. navigation hazards)

contractual mandate in 2016. Analysis the report of the first year's work which will be delivered in autumn 2014 should help determine appropriate objectives.

2.3.7. Monitoring and Evaluation

The aim of EMODnet is to increase productivity of all tasks involving marine data, to promote innovation and to reduce uncertainty about the behaviour of the sea. This reduces risks associated with private and public investments in the blue economy, and facilitates more effective protection of the marine environment. An estimate of the economic, environmental and social benefits is provided in the appendix.

However, it is not feasible to measure the contribution of the initiative to any of these objectives. Rather it will be monitored by measuring usage - who is using EMODnet, what they are using it for, what their level of satisfaction is and what improvements they would like to see. The analysis will be presented to Member States annually along with the proposed work programme for the following year, through the committee overseeing the European Maritime and Fisheries Fund.

An evaluation of the current phase of EMODnet will be completed in the second semester of 2016.

2.3.8. Secretariat

The EMODnet secretariat ensures coherence between the groups and are responsible for monitoring the thematic groups, reporting on progress and disseminating information to potential contributors and users. They will develop indicators to determine usage of EMODnet.

The secretariat was selected through an open call for tender and became operational at the same time as the thematic groups in 2013 but have a two-year rather than a three-year mandate. The current contract allows a renewal for a further two years.

The Flemish Government supports the development of the entry portal and the offices for the EMODnet secretariat. This arrangement is scheduled to continue until 2018.

3. SETTING UP THE COPERNICUS MARINE SERVICE

The Commission proposal for a Copernicus Regulation[15] envisages the evolution of finite-duration research projects and experimental satellite missions into a sustainable operational programme. The space component consists of a set of "Sentinel" satellites to be launched during the 2014-2020 period. A significant number of the instruments on board these satellites have been specifically designed for monitoring the ocean. In particular:

[15] Proposal for a Regulation of the European Parliament and of The Council establishing the Copernicus Programme COM(2013) 312

Table 1 Ocean observations from the Sentinel Satellites

instrument	purpose
synthetic aperture radar on board Sentinel 1	locates oil-spills and measures sea-ice coverage
sea and land surface temperature radiometer on board Sentinel 3	measures global sea-surface temperatures to an accuracy of better than 0.3K.
ocean and land colour instrument on board Sentinel 3	measures colour of ocean primarily to detect chlorophyll and thus to infer presence of phytoplankton or algae
dual-frequency advanced synthetic aperture radar altimeter on board Sentinel 3	sea surface topography, significant wave height, surface wind speed, ice thickness

Data from these satellites, together with meteorological forecasts and measurements from instruments in the sea provide material for the Copernicus marine service which delivers two categories of service:

- digital map layers of parameters derived from the satellites such as sea-surface temperature, ice cover and chlorophyll distribution.
- oceanographic hindcasts, nowcasts and forecasts for the global ocean and Europe's sea-basins.

The Copernicus marine service is a follow-up to the successful MyOcean projects which is progressively improving in efficiency and accuracy.

The main improvements will be:

- further integration with EMODnet through common sign-in and user identification procedure and common repository of data from in-sea instruments;
- extension of scope to provide historical records useful for environmental assessments and climate studies as well as near-real-time operational oceanography

4. SUSTAINING IN-SEA OBSERVATIONS

The oceans play a dominant role in determining the severity or mildness of our seasons and on the carbon and energy cycles of our planet. Their warming due to increased concentrations of greenhouse gases in the atmosphere is superimposed on irregular and largely unpredictable fluctuations on a multi-annual or decadal basis due most famously to El Niño but also to many other oscillations. Understanding what is happening now

and what might happen in the future therefore requires continuous observations over as long a period as possible. Member States are responsible for surveying and monitoring their own waters, and these should be done in a consistent manner. Given that all seas and oceans are connected, observations in international waters are also necessary.

However, it can be difficult to maintain observations in international waters over the long term. Frequently monitoring begins as part of a research project but once the concept is proven it can no longer be considered as research and be supported by national or EU research budgets. Furthermore, it is difficult to justify one Member State bearing the costs of an infrastructure that does not principally benefit its own citizens but rather serves the interests of all Member states. Indeed this is why the EU supports the Copernicus programme. And, whilst the main objective of the marine knowledge component of the European Maritime and Fisheries Fund will be to improve the interoperability and availability of existing observations, the Commission aims to provide limited support to certain in-sea observations.

The Commission will give priority to the Euro Argo Research Infrastructure. Argo consists of a fleet of drifting robotic probes deployed worldwide. In most cases the floats drift at a depth of 1000 metres and, every 10 days, by changing their buoyancy, dive to a depth of 2000 metres and then move to the sea-surface, measuring conductivity and temperature profiles as well as pressure. This is a global programme but the European contribution is managed by the Euro-Argo consortium which is at an advanced stage of achieving recognition as a European Research Infrastructure Consortium (ERIC). It will be the first marine infrastructure to be so recognised. The data from the floats are not only important in themselves but, because satellites can only measure surface conditions, they are also an essential input to the Copernicus ocean forecasting models.

The Commission intends to provide a grant to the Euro-Argo consortium in 2015 from the European Maritime and Fisheries Fund that will contribute towards the procurement and deployment of the approximately 100 floats that will be launched that year to replace those that are lost through wear and tear.

Other observation, sampling or surveying programmes could also be supported provided that they satisfy the same conditions of European added-value.

5. IMPROVING AVAILABILITY OF FISHERIES DATA

Managing fisheries requires three types of data.

(1) scientific data of parameters such as age, size, weight and sex of fish sampled by surveys or from landings.

(2) economic data on parameters such as employment and fuel costs collected from surveys and accounts.

(3) control data collected from on-board GPS systems, logbooks, landings declarations and sales notes that indicate the effort that fleets spend in catching fish, what they caught and where they caught them.

The EU supports the collection of scientific and economic data through the Data Collection Regulation and makes them available for scientific advice for fisheries management, scientific research and public awareness together with aggregated control data following requests from scientists. However the process stretches the resources of the public authorities who answer the requests and does not satisfy the needs of users. In some Member States with significant fishing fleets, one third of the EU funding provided for data collection is spent on processing the data rather than collecting them.

Fisheries control data may be useful for maritime surveillance activities, such as border control, general law enforcement and customs control. Mechanisms for doing this are included within the framework of the Common Information Sharing Environment (CISE)[16] and a legal basis for sharing such data with other sectors has been provided in Article 12 of the Fisheries Control Regulation. Since control data often can be considered as personal data, appropriate safeguards will be put in place in the Implementing Regulation in accordance with data protection principles. Since "Marine Knowledge 2020" is only concerned with data that can be freely distributed, it will not be possible to include personal data in EMODnet.

However, both scientific and economic data whose collection is partially funded by the EU should be included in EMODnet in the future. The Commission services will examine the feasibility of doing this in the imminent revision of the Data Collection Framework.

6. IMPROVING ACCESS TO DATA FROM ENVIRONMENTAL REPORTING

Public authorities collect a wide variety of environmental data in order to meet legal obligations such as complying with international treaties or delivering reports including those stipulated by the Marine Strategy Framework Directive. WISE-Marine provides a mechanism to make these data available. It is a challenge for them to assemble the data in order to provide a coherent picture of the marine environment across multiple Member States. EMODnet can facilitate the process by building on INSPIRE and SEIS (Shared Environmental Information System) principles and putting data collected for regulatory purposes under the same umbrella as EMODnet with data collected for other purposes.

Aligning data standards between EMODnet and public sector data streams could strengthen the evidence base for environmental assessments and avoid authorities collecting the same data twice. Work has already started on alignment for data related to the Marine Strategy Framework Directive, especially through the thematic groups for chemistry and biology. Close collaboration between EMODnet groups, the European Environment Agency, the Regional Sea Conventions and public authorities will continue in order to facilitate the ingestion of environmental data from the WISE-

[16] Draft Roadmap towards establishing the Common Information Sharing Environment for the surveillance of the EU maritime domain COM(2010)0584 final

marine system into EMODnet, and vice-versa. The European Environment Agency is leading this collaboration and the Commission intends to support the implementation of WISE-Marine in 2015-2018 with the aim of making it fully operational for regulatory and other purposes.

7. IMPROVING ACCESS TO DATA FROM EU RESEARCH PROJECTS

Intellectual property of research projects funded by the EU under the 7th Framework Programme which ran from 2007 to 2014 normally resides with the institutions to which the researchers belong. Up to now researchers have disseminated their results largely by publishing articles in the scientific literature. Researchers are encouraged to make the data underlying these articles available through the internet and indicate their whereabouts in the article. But this is by no means universal practice. There is not yet a systematic deposition of data in a way that which would not only make the data discoverable and available but also guarantee proper documentation and long-term stewardship.

However, there have been a number of voluntary efforts where data are stored in National Oceanographic Data Centres or other repositories. The data can be retrieved either through a Digital Object Identifier which links the data to a particular publication or through a Common Data Index developed through successive Framework Programme projects17 that indicates the type of data. The Digital Object Identifier is most suitable for researchers who wish to verify or build on results from a particular publication whereas the Common Data Index aims to allow retrieval of data of a particular type; nutrient measurements in the North Sea for example. The data can then be accessed through initiatives such as EMODnet, the GEOSS Portal18.or PANGAEA19.

Given the benefits to scientific productivity and innovation that could arise from wider access to these data, the Commission adopted measures to improve matters20. In Horizon 2020, an open data pilot initiative21 will begin that aims to improve and maximise availability and re-use of research data generated by projects funded. The pilot obliges projects to take measures to enable third parties to access, mine, exploit, reproduce and disseminate their data— free of charge for any user. This is not only for researchers but also for private companies and those responsible for monitoring the

17 particularly SeaDataNet

18 http://www.geoportal.org

19 Open Access library aimed at archiving, publishing and distributing georeferenced data from earth system research

20 Towards better access to scientific information: Boosting the benefits of public investments in research COM(2012) 401 final

21 Guidelines on Open Access to Scientific Publications and Research Data in Horizon 2020 Version 1.0 11 December 2013
http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-pilot-guide_en.pdf

environment. It will cover approximately 20% if the Horizon2020 programme and includes a number of areas where projects will generate marine data. The pilot will be monitored with a view to further developing the European Commission policy on open research data in future Framework Programmes, and to ensuring that data is provided in a format that is adapted to the needs to of other end-users,

Whether the data delivery is voluntary or obligatory, everybody gains if the process is made as straightforward as possible. This requires a facility that provides instructions, ingests the data, checks them and directs them to the appropriate repository for stewardship and dissemination. Up to now the focus of EMODnet has been distribution of data but some attention now needs to be devoted to ingestion of data. A call for tender to build such a facility is due to be launched in 2015.

8. IMPROVING INVOLVEMENT OF PRIVATE SECTOR

8.1. Data for licensed facilities

In nearly all Member States, companies applying for a licence to construct or modify an offshore facility must handover to the authorities the data used in the assessment of its environmental impact or in any follow-up environmental monitoring of their activities. Up to now these data have only rarely been available for re-use. This is a missed opportunity, since such data could be used for other purposes. For instance it could improve the accuracy and reduce the cost of reporting the state of the environment.

In order to ensure that these data are provided in a form that makes them interoperable with other data, the process described in section 7 that facilitates the ingestion of data from Horizon2020 projects will also be used to ingest data from environmental impact studies and thus make them available for re-use.

This data ingestion process will therefore become operational by the end of 2016 and undergo testing and fine-tuning during 2017. As well as contributing to the common pool, the data will be tagged so that all data submitted for a particular licence agreement can be retrieved together.

8.2. Contributing to observe the seas

In principle it should be cheaper to observe the sea with boats that are already at sea or platforms that have been built for another purpose than to send a vessel out specially or to construct a separate monitoring station:

- In response to a request from Parliament, the Commission has launched a preparatory action to test the concept of fishermen as "Guardians of the Sea" including "*monitoring environmental indicators, including data on water quality, pollution, toxic algae proliferations, etc*". In this particular project, monitoring is considered as an alternative to fishing; not an additional activity.

– the Ferrybox[22] concept has been tested in several research projects, and in routine applications. Still the spatial coverage by Ships-of-Opportunity is poor, whereas more sensors for different data types become available.

– in the public consultation[23], the European Wind Energy Association expressed cautious approval for the idea "*the industry nevertheless remains positive in offering its sites if sampling from existing structures can [contribute to wider monitoring of the sea] and if it does not interfere with the function and operation of the structures*".

The Commission services will now consider what practical steps can be taken to encourage public-private partnerships for ocean observation. This will include giving private industry the opportunity to indicate their priorities for data collection by public authorities.

9. OPTIMISING OBSERVATION NETWORKS

Up to now observations of the sea have been made for specific purposes. For example, seabeds are surveyed to ensure safe navigation, fish are sampled to estimate the size of the stock and pollution concentration is measured to meet regulations on bathing water or aquaculture production. In order to save costs and improve marine knowledge, the EU is now moving to a new paradigm where we collect data once and use them for many purposes. But, once the direct link between the collection of data and its application is broken, it becomes hard to determine what the priorities are for monitoring and who should monitor what. Furthermore, in order to avoid gaps and duplications, it is essential that each coastal state knows what its neighbours are doing.

Two pilot projects have begun under the Regulation[24] establishing a Programme to support the further development of an Integrated Maritime Policy – one for the North Sea and one for the Mediterranean – to see how this concept could be brought forward. The aim of the pilot projects is to determine how current monitoring programmes meet the needs of public and private users. This is partly done through a literature survey and partly through practical test cases; for instance asking the project partners to see how well they can site a wind farm or estimate coastal erosion rates using readily available data. The results will then be checked by a panel incorporating representative users from both the public and private sector, including those that have a seabasin mandate such as Regional Sea Conventions, Advisory Councils for fisheries and regional hydrographic commissions. The Commission proposes to launch calls for tender in 2014 to extend this process to the Atlantic, Arctic, Baltic and Black Sea with three-year projects. These activities are referred to as "sea-basin checkpoints". These checkpoints are intended to be a first step in an evolving process to determine future priorities for observations that could eventually become a user-owned and user-driven

22 Ferryboxes are packages of instruments that we place on board commercial ships such as ferries to monitor temperature, salinity and other water properties

23 Green Paper. Marine Knowledge 2020: from seabed mapping to ocean forecasting Outcome of Public Consultation SWD(2013) 463

24 Regulation (EU) No 1255/2011 of the European Parliament and of the Council

process. By identifying gaps and priorities for future surveys, these checkpoints will also make a crucial contribution to the seabed map that will be developed by 2020.

First results of the North Sea and Mediterranean checkpoint projects will be available in early 2015 and shared with Member States.

10. MANAGEMENT AND ADVICE

Decisions on public support for marine observation and dissemination are taken by Member States individually for their own budgets and collectively through comitology[25] for the EU budgets. For example the budget for EMODnet will be examined by the committee set up to implement the European Maritime and Fisheries Fund. At the EU level the decisions are based on proposals from the Commission who, in turn, take into account advice from specialists. This includes the Scientific, Technical and Economic Committee for Fisheries (STECF), the Marine Observation and Data Expert Group (MODEG) and the Copernicus Committee[26]. Progressively these will be able to take on board information on gaps, cost-effectiveness and fitness for purpose from the sea basin checkpoints described in section 9.

The Marine Observation and Data Expert Group will be renewed in 2015 following a call for expression of interest. The Commission will ensure that the Group has a knowledge of all the EU initiatives as well as the needs of the private sector.

11. OUTLOOK

The evolution of the marine knowledge process, and of EMODnet in particular, is therefore well-mapped until 2017. At this point the Commission services will review the state of play on implementation and, if necessary, consider what further steps need to be taken to ensure the continuing success of the process, and what further steps towards integrating fisheries and other data in EMODnet would need to be taken.

EMODnet data products and services can also be made available to public authorities for improved surveillance within the Common Information Sharing Environment

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25 Regulation (EU) No 182/2011 laying down the rules and general principles concerning mechanisms for control by Member States of the Commission's exercise of implementing powers

26 According to the draft Regulation "a *committee should assist the Commission in ensuring the coordination of contributions to Copernicus by the Union, the Member States and inter-governmental agencies, making the best use of existing capacities and identifying gaps to be addressed at Union level. It should also assist the Commission in monitoring the coherent implementation of Copernicus*".

(CISE)[27] as maritime surveillance authorities such as coastguards and navies are also highly dependent on reliable marine data. The intention is to seek synergies between the two initiatives where possible.

Annual work programmes and reviews by Member States' examination committees will also afford ongoing opportunities for discussions and oversight in the years ahead and where necessary, proposing amendments to the path set out in this document. This will be critical to increase marine knowledge and data transparency for the purposes of stimulating innovation in the blue economy and ensuring successful ecosystem management of our seas and oceans

[27] Draft Roadmap towards establishing of the Common Information Sharing Environment for the surveillance of the EU maritime domain COM (2010) 584

APPENDIX – IMPACT OF MARINE KNOWLEDGE 2020

ECONOMIC IMPACT

Improve productivity

Having an integrated rather than a fragmented data infrastructure can improve the productivity of users of marine data in two ways:

(1) they would not need to re-survey areas that had already been surveyed but for which the data have up to now been inaccessible.

(2) it would cost them less to process existing data.

So the total saving S^s to stakeholder group s can be expressed as

$$S^s = \sum_{i=1,N} (\alpha_i^s \beta_i^s + (1 - \alpha_i^s)\gamma_i)\emptyset_i^s C^s$$

where

C^s is the total cost of data to stakeholder group s including the collection of new data and the processing of existing data

$\emptyset_i^s$ is the fractional contribution of a particular type of data i (geological, physical, chemical etc.) to the total cost to stakeholder group s

α_i^s is the proportion of the cost that is due to data that cannot be found and needs to be collected

β_i^s is the proportion of the data that has already been acquired by other stakeholders but that cannot be accessed at present

γ_i is the savings in processing existing data because they are accessible, catalogued and standardised expressed as a proportion of the total cost.

The set of stakeholders s that we consider includes pr (private), pu (public), h (hydrography), r (research) and cs (civil society). The hydrographic agencies are all public bodies but their requirements for data are significantly different from those bodies concerned with environmental protection or fisheries management so they are considered separately here.

$$s = \{pr, pu, h, r, cs\}$$

As a first approximation we can assume two basic types of data – geological/bathymetric and the rest so $N = 2$

By interviewing users the United States National Oceanic and Atmospheric Administration, NOAA estimated that the cost of assembling hard-to-find data with uneven standards and uncertain quality added about 25% to the cost of products and services based on these data. According to a 2009 public consultation, users believe that data policies in Europe are less liberal and data harder to access than in the United States. The estimate of a benefit to European users of having easy-to-find, easy-to assemble data as 25% of the cost of the products and services can therefore be considered conservative. So $\gamma_{geology} = \gamma_{rest} = 0.25$.

It has been estimated[28] that private companies spend about €3 billion every year on marine data – including surveys to collect new data, purchasing data from third parties and processing the data until it is fit for purpose. C^{pr}= €3 billion.

A more recent study[29] provided a breakdown of the €500 million per annum cost of data for the design, construction and operation of offshore wind farms that are planned for the years 2014-2020 (see Table 2).

Table 2 annual cost of data for the design, construction and operation of offshore wind farms 2014-2020

data type	design	construction	operation	total
benthic marine life	€ 8,082,143	€ 4,562,500	€ 10,167,857	€ 22,812,500
birds	€ 14,339,286	€ 7,821,429	€ 18,250,000	€ 40,410,714
fish	€ 3,258,929	€ 1,825,000	€ 2,998,214	€ 8,082,143
bathymetry and geology	€ 46,928,571	€ 336,321,429	€ 3,780,357	€ 387,030,357
marine mammals	€ 9,646,429	€ 5,214,286	€ 7,430,357	€ 22,291,071

[28] European Commission Marine Data Infrastructure Framework Service Contract, No. FISH/2006/09 – Lot 2 Final report December 2009

[29] Study to support Impact Assessment of Marine Knowledge 2020", COWI and Ernst Young, June 2013

metocean	€ 19,292,857	€ 1,121,071	€ 1,720,714	€ 22,134,643
Grand Total	€ 101,548,214	€ 356,865,714	€ 44,347,500	€ 502,761,429

So from Table 2 we can assume that 75% of the data needs for private users are geological or bathymetric. $\emptyset_{geology} = 0.75, \emptyset_{rest} = 0.25$

From discussions with offshore operators[30] we believe that at least 75% of the spending on geological data currently consists of new measurements. For the other types of data, there is more need for previously collected data because environmental impact analyses require the monitoring of dynamics and trends. So we assume that only 25% needs to be collected. So $\alpha^{pr}_{geology} = 0.75, \alpha^{pr}_{rest} = 0.25$

As part of the EMODnet hydrography preparatory action, an estimate was made of the proportion of Europe's seabed that has already been surveyed. The consortium discovered 6000 bathymetric surveys of all kinds. Of these approximately 1000 were high resolution multibeam surveys, 3000 were done with single beam echosounders, 1000 with plummet and another 1000 not specified. The exercise took into account overlaps between surveys but does not cover all Europe's seas – for instance the Baltic and Black Sea were not included. But it does give an indication of the data that exists. An approximation to the area of European seas that have already been surveyed by public bodies can be obtained from Table 3 Over 6000 separate bathymetric surveys make up this total.

Table 3 coverage of selection of European seas with surveys. Only those undertaken by public bodies are inckuded

	basin area	**surveyed**	**to be surveyed**	**to be surveyed**
	km²	km²	km²	percent
North Sea and English Channel	678,250	400,700	277,550	41%
Celtic	894,460	542,733	351,727	39%
Bay of Biscay and Iberian	818,646	772,606	46,040	6%
Western Med	844,828	722,220	122,608	15%
Ionian and Central Med	717,683	389,232	328,451	46%
Aegian-Levantine	815,870	461,577	354,293	43%
Adriatic	133,943	109,865	24,078	18%

Table 3 shows that more than half the area of most European seas have been surveyed for water depth. Those surveyed with multibeam echosounders provide information not only on the water depth but also on the type of sediment because the backscatter correlates with the seabed surface roughness. We can therefore assume that $\beta^{pr}_{geology}$=0.5. We do not have the same sources of information to guide us as to how much of the other data could be made available and thus avoid the need for new

30 For instance the practices of submarine cable operatiors were discussed during the thirteenth meeting of the Commission's Marine Observation and Data Expert Group on 8 June 2013. https://webgate.ec.europa.eu/maritimeforum/content/1947

measurements but, given the number of surveys that have been carried out in European waters over the past decades, it cannot be less than half. We can therefore assume that β^{pr}_{rest}=0.5.

We can use the same method for calculating the savings for public authorities. According to a 2010 estimate[31], the total cost of marine management to authorities is €1.5 billion. Approximately half of this is for protection against coastal erosion. The remainder includes fisheries management, spatial planning and environmental monitoring. The same study indicates that 15% of the costs are associated with data collection and processing. Since this study was delivered, the extra costs of reporting for the Marine Strategy Framework Directive have been estimated[32] at €50 million per year for assembling data from existing monitoring programmes and €20 million for new monitoring programmes.

We can therefore take C^{pu} =€225+50+20≈300 million.

Assuming the same division of costs between collection of new data and assembling of previously collected data for non-geological data as for the Marine Strategy Framework Directive then $\alpha^{pu}_{rest} = 0.4$. The proportion of spending on geological data must be higher as erosion studies require very recent data. We assume $\alpha^{pu}_{geology} = 0.8$.

On the basis that half the spending by authorities is related to coastal erosion we can assume that $\emptyset^{pu}_{geology} = \emptyset^{pu}_{rest} = 0.5$.

Due to the need for very recent data for coastal erosion studies, there is less scope for savings by reducing the number of new surveys. $\beta^{pr}_{geology}$=0.15. For other types of data, there are more possibilities. β^{pr}_{rest}=0.3.

Estimating the annual spending by hydrographic agencies is complicated by the fact that some of their surveying and charting is under the auspices of Ministries of Defence. Breakdowns of military spending are always hard to obtain. Nevertheless the French Hydrographic Agency, SHOM has compiled data from the International Hydrographic Organisation Yearbook and regional hydrographic commission reports. The annual budget of SHOM is €57.8 million and they spend about €18 million on data acquisition and €7 million on processing. This is consistent with the UK hydrographic office who spend £6 million on processing. Their surveying is done by the Royal Navy. They have no figures on the costs for that but we assume it is of the same order as the French. The German hydrographic agency has an annual budget that is almost identical to the French one. So we can assume €150 million a year spending overall, with 90% of the costs attributable to geological/bathymetric data. Much of the surveying is outside

31 Commission Staff Working Document European Marine Observation and Data Network Impact Assessment SEC(2010) 998

32 Study to support Impact Assessment of Marine Knowledge 2020", COWI and Ernst Young, June 2013

European waters so probably only a minimum amount, 10%, has been already surveyed. Using the French figures as an example, we assume that two thirds of the costs are for collecting data and one third for processing them.

C^h = €150 million, $\emptyset^h_{geology}$=0.9, $\emptyset^h_{rest}$=0.1, $\beta^h_{geology}$=0.1, β^h_{rest}=0.2,

$\alpha^h_{geology} = 0.67$, $\alpha^h_{rest} = 0.67$

Spending on marine science in the EU has been estimated at €2 billion per year. This includes fisheries research, which was estimated in 1997 as €192 million[33] for the EU.

C^r = €2 billion

A paper[34] from the European Strategy Forum for Research Infrastructures (ESFRI) suggests that 50% of the marine science budget is spent on infrastructure and collecting data. We assume that the rest is spent analysing the data. $\alpha^{pr}_{geology} = \alpha^{pr}_{rest} = 0.5$

We assume that 20% of the spending on data is for geological parameters; $\emptyset_{geology} = 0.2, \emptyset_{rest} = 0.8$ and that this proportion is the same for the collection of new data as for the processing of assembled data.

Many scientific publications concern analysis of new data collected at a specific time and date so it is probable that few of these data have been collected before. $\beta^{pr}_{geology}$=β^{pr}_{rest}=0.15.

Environmental lobbies and other sections of civil society – both international and local – also have interests in marine data. But they do not generally undertake measurements on their own and the costs involved in assembling and analysing existing data are mostly beyond their resources. So their current costs can be neglected.

This analysis suggests a potential cost-saving of €1.45 billion (see Table 4)

Table 4 summary of potential cost savings in having an integrated marine data infrastructure

33 Fisheries Management Costs: Concepts and Studies, Paul Wallis and Ola Flaaten, OECD, 1997

34 European Strategy on Marine Research Infrastructure Report compiled for the European Strategy Forum on Research Infrastructure by the Ad Hoc Working Group on Marine Research Infrastructure April 2003

	private		***public***		***hydrography***		***research***		***total***
Total cost	€3,000,000,000		€225,000,000		€150,000,000		€2,000,000,000		€ 5,375,000,000
	geology	rest	geology	rest	geology	rest	geology	rest	
a	*0.75*	0.25	0.75	0.25	0.67	0.67	0.50	0.50	
β	*0.50*	0.50	0.15	0.50	0.1	0.2	0.15	0.15	
γ	*0.25*	0.25	0.25	0.25	0.25	0.25	0.25	0.25	
φ	*0.75*	0.25	0.50	0.50	0.9	0.1	0.20	0.25	
Saving	€1,218,750,000		€54,843,750		€23,430,000		€200,000,000		€ 1,497,023,750

Increase Innovation

The analysis in the previous section concerned the first specific objective - improvement of the efficiency of operations that are already underway or planned. In addition to improving the efficiency of existing operations, better access to marine data stimulates innovation that leads to new products and services. It does this in two ways:

(1) new entrants can enter the market for value added activities. Currently only those who own the data are able to provide these services. For instance fish stock assessments currently generally require the participation of all the scientists from the states who are fishing that stock because they are the only ones with the ability to obtain sufficiently detailed data on the catch and effort of their vessels. Releasing these data to the public domain will allow innovative companies or universities to test new approaches. It will allow civil society to check assertions by public authorities.

(2) the effort required to assemble and process data from different sources and of a different nature is an obstacle to innovation. Once this obstacle is removed, a whole host of new products and services built on multiple sources of data can be developed. This is the "Big Data" thesis[35]. According to McKinsey's Global Institute[36] "analysing *large data sets—so-called big data—will become a key basis of competition, underpinning new waves of productivity growth, innovation, and consumer surplus*".

(3) It is difficult to know in advance what these new services and products could be and what their economic impact would be. For instance nobody forecast that analysing millions of searches would allow a much faster warning of disease outbreaks than traditional notifications from physicians. However, a study[37] provided some examples:

(4) early warning systems for jellyfish blooms. It is estimated that these damage EU aquaculture producers to the tune of €84 million a year. An innovative enterprise, putting together on-line monitoring observations with site-specific information on seasonal abundance and locality, could develop an early-

35 Big data "Lessons from the Leaders" Economist Intelligence Unit, 2012

36 McKinsey Global Institute Big data: The next frontier for innovation, competition, and productivity, June 2012

37 Study to support Impact Assessment of Marine Knowledge 2020", COWI and Ernst Young, June 2013

warning system. This would provide jobs for the service-provider and reduce insurance premiums for aquaculture producers.

(5) development of seaweed-based products. Seaweed (macro-algae) has a potential to provide biofuel using a process that does not require freshwater and that does not take up land that could be used to grow food. For instance Irish seaweed production and processing could rise from the present €18 million per annum to €30 million by 2020[38]. A service provider using data on oceanographic conditions and distribution of natural stocks to predict suitable sites could reduce the risks for producers.

(6) supporting eco-tourism. Eco-tourism is a growing market that offers year-round employment opportunities for coastal communities. Since the 1990s, the Azores have registered an increase in the number of tourists that come in search of a natural experience. A set of nine "Islands' Parks" has been created throughout the Azorean archipelago. Recreational visits to national wildlife refuges in the United States generate substantial economic activity. In 2011, 46.5 million people visited them. Their spending generated $2.4 billion of sales in regional economies[39]. In the UK between 250,000 and 400,000 people watched seabirds in 2005 to the benefit of local economies[40]. Whale watching is growing at 5% a year in Norway, 8% in the UK and 15% a year in the Azores[41] A service based on historic data records would allow tourists to maximise their probability of observing the species behaviour that interests them.

Reducing uncertainty

We have considered the benefits in terms of efficiency of existing operations and we have described how the development of innovative new products and services will be encouraged in terms of opportunities for business to develop these products and services. However, the greatest benefit of a proper integrated architecture for marine data will undoubtedly be a reduction in uncertainty in our knowledge of the behaviour of the sea. Indeed this is the main reason why nations and private bodies observe the sea at all. The question is "how much will this uncertainty be reduced through a more effective and more efficient marine observation and data architecture?" Again we can provide examples:

(1) an effective marine observation system is not a sufficient condition for reducing uncertainty in future sea-level rise but it is a necessary one. A 25% reduction in

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38 Market Analysis towards the further development of Seaweed Aquaculture in Ireland, Máirtín Walsh, Lucy Watson, BIM

39 Carver, E. and Caudill J. Banking on nature. The economic benefits to local communities of national wildlife refuge visitation US Fish and Wildlife Service, October 2013

40 Dickie I., J. Hughes and A, Esteban "Watched Like Never Before the local economic benefits of spectacular bird species" Royal Society for the Protection of Birds, 2006

41 Whale Watching Worldwide Tourism numbers, expenditures and expanding economic benefits A special report from the International Fund for Animal Welfare, 2009

uncertainty in future sea-level rise could save EU Member State authorities responsible in constructing coastal defences €100 million a year[42].

(2) economic damage to seafloor cables can potentially be significant as the repair of broken cables is expensive. Even small areas of mischaracterized seabed can cause significant downtime. The mean time to repair is months for conventional submarine power cables and longer repairs can be expected as cables are laid at deeper and deeper depths. As an illustrative example, in April 2012 the NorNed 700 MW direct-current cable connecting the Netherlands and Norwegian electricity systems failed, halting production for 10 weeks, and resulting in lost earnings of around €145 million. The growth in offshore wind installations means that the number of such cables will be growing. Current failure rates could result in breaks in production worth €6.9 billion a year. Breaks in internet cables in 2008 left 70% of Egypt and 60% of India without internet. Reducing uncertainty about sediments, currents or human activity such as fishing can reduce these losses.

(3) even in Europe, not all hydrographic charts are up-to-date; particularly in the Mediterranean and Black Sea. Improved charts enable cost reductions through faster transit for ships, more direct routes, reduced insurance costs, and avoidance of maritime accidents. As an illustration, the National Oceanographic and Atmospheric Administration (NOAA) reported[43] that one additional foot of draught may account for between $US 36,000 and $US 288,000 (between €28,000 and €225,000) of increased profit per transit into Tampa, Florida, USA.

(4) It is not yet possible to forecast whether a season will be hotter, colder, wetter or drier than average[44] yet processes in the oceans surely have a strong influence. The oceans capture a major portion (about 50%) of the sun's radiated energy and transfer much of it to the atmosphere through latent heat of vaporization and radiation. This exchange of heat between ocean and atmosphere drives the atmospheric circulation. Should seasonal forecasting become possible, the productivity gains in the agriculture and energy industries would be enormous. The provision of early warning for malaria outbreaks would benefit the health sector. Continuous observation of the ocean is not a sufficient condition for this to happen but it is necessary.

ENVIRONMENTAL IMPACT

The main environmental benefit of the "Marine Knowledge 2020" initiative would be a reduction in uncertainty about the marine environment and the human impact on it. This reduced uncertainty will facilitate better environmental management decisions.

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42 Commission Staff Working Document European Marine Observation and Data Network Impact Assessment SEC(2010) 998

43 One foot is approximately 30.5 cm.

44 Kerr R. "Seasonal-Climate Forecasts Improving Ever So Slowly", Science, Vol. 321 no. 5891 pp. 900-901, 15 August 2008

Without this knowledge it is difficult to define appropriate measures to improve the environmental status. In 2010, the Commission set out criteria and methodological standards for defining "good environmental status" in line with the 11 'Descriptors' of the marine environment set out in the Marine Strategy Framework Directive[45] (MSFD). These range from biological diversity to underwater noise. Member States were accordingly obliged to provide an initial assessment by 15 July 2012 "*of the current environmental status of the waters concerned and the environmental impact of human activities thereon.*" There is great potential to harness EMODnet to assist Member States in making this type of assessment, and conversely to ensure that data generated through MSFD reporting is available and in a useable format for other purposes.

The Commission believes that the initial assessment reports often give only a fragmented overview of the state of the marine environment, not always reflecting the available knowledge in its entirety[46]. This is partly because methods to construct indicators from data have not yet been determined but also because the data themselves are not readily available. The Commission points out that "*there are still significant gaps in knowledge on marine issues, and the scope of the assessment required by article 8 of the MSFD is very comprehensive. Yet, only a few Member States put forward a strategy on how to close the existing data gaps before the next reporting cycle, for instance through future plans for monitoring at national or regional level.*" Better access to existing data and a process for deciding which new data to collect would facilitate implementation of the Marine Strategy Framework Directive.

The Commission's report concludes that "*Greater coordination of monitoring programmes and programmes of measures, more ambitious regional cooperation and a clearer understanding of the roles, responsibilities and obligations of all parties will facilitate less costly and more effective protection of the marine environment".* One of the operational objectives of this initiative is therefore to "*develop a more effective process for helping Member States and the EU fix priorities for the most cost effective processes for surveying, observation and data processing.*"

At a local scale, environmental impact studies are required for all significant new coastal or offshore activities. Collecting and assembling data dominates the cost of such activities. Making this easier and cheaper will allow better estimates of impact for the same cost. Making data from industry impact assessments and operational monitoring available to public authorities will reduce their need to carry out additional environmental monitoring and save public financial resources.

SOCIAL IMPACT

The main social impact will be an increase in jobs in the blue economy. The reduced cost of doing business offshore will shift some activities that are presently uneconomic into the profitability zone. The increased potential for innovation will create high value-jobs creating services and products based on the newly accessible marine data. And the

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45 Commission Decision of 1 September 2010 on criteria and methodological standards on good environmental status of marine waters 2010/477/EU.

46 The first phase of implementation of the Marine Strategy Framework Directive (2008/56/EC) The European Commission's assessment and guidance COM(2014)097

reduced uncertainty in knowledge of the behaviour of the sea will reduce the risk of doing business offshore. For instance better knowledge of approaching toxic algal blooms or jellyfish invasions will allow aquaculture producers to take appropriate action.

A further social benefit of better access to marine data will be the increased potential for local communities to make an informed input on issues that affect their neighbourhood or their livelihood. They can engage with public authorities in an informed debate on options for use/preservation and question the "experts'" pronouncements on issues such as fish stock assessment or environmental impact. This should enhance public engagement with marine issues and help provide greater public support and acceptance of the blue economy.

COMPETITION AND SMALL AND MEDIUM ENTERPRISES

The benefits in productivity will benefit small and medium enterprises. SMEs operate in almost all sectors of the maritime economy, and in certain sectors they form the backbone of economic activity. 90% of the EU's aquaculture producers are small and medium enterprises.

Furthermore, achieving the second specific objective, increasing innovation, will foster competition and open the market for small and medium enterprises to provide services and products based on marine data. For instance if fisheries data were more widely available, small companies would be able to provide fish stock assessments or check those made by national laboratories and on that basis engage with fishermen in management of fisheries. As a further example of an innovative SME, a small company in Ireland is using video-game technology to improve the display of geophysical seabed data.

FUNDAMENTAL RIGHTS

The right to the protection of personal data is a fundamental right regulated in Articles 7 and 8 of the EU Charter of Fundamental rights and specified by various EU laws which are either directly applicable or implemented by Member States into their national legislation. The Data protection Directive 95/46 and - as far as personal data are processed by Union institutions and bodies - Regulation 45/2001 are applicable. The definition of 'personal data' aims at covering all information relating to an identified or to a directly or indirectly identifiable person.

Any processing activity is an interference with the right of protection of personal data and needs to be reconciled with the principles enshrined in the legal instruments on data. protection. The use of marine data in the context of this initiative aiming at achieving the objectives explained above might include in exceptional cases the processing of personal data in particular for scientific purposes. This could for example concern vessel numbers which might allow the identification of the owner and/or captain of the vessel. Adequate technical and organisational safeguards need to be established in accordance with the legal requirements as set up by EU and national data protection legislation in order minimize risks for data subjects.

NEIGHBOURHOOD POLICY

The marine knowledge initiative engages neighbouring countries in a practical project that is of mutual benefit. What happens in their waters affects EU waters and vice versa. All the neighbouring Black Sea states – Ukraine, Russia, Georgia and Turkey are participating in the second phase of EMODnet and a number of the Mediterranean ones too. Working together on an equal basis strengthens public institutions, encourages transparency and builds trust.

INTERNATIONAL COLLABORATION

The Marine Knowledge 2020 goal of free and open access to data facilitates collaboration with international efforts with the same aim. For instance it has been agreed that digital terrain models developed for EMODnet can be made available to improve the quality of the General Bathymetric Chart of the Oceans (GEBCO).

COSTS 2014-2020

The measures considered in this Roadmap will not result in any additional burden on the EU budget. The costs for the 2014-2020 period are already built in to Commission proposals. The precise amounts are still to be fixed as Council and Parliament are still negotiating the details of the European Maritime and Fisheries Fund and marine knowledge is, in general, only one component of a global maritime policy budget with the split between activities to be decided on an annual basis. Similarly the marine component of the Copernicus programme has not yet been fixed. Nevertheless, a working estimate from Commission staff at present is set out in Table 5

Table 5 Commission proposals for annual funding of marine knowledge in 2014-2020

Commission proposal	budget purpose	collecting data	assembling data	ocean forecasts
European Maritime and Fisheries Fund[47]	integrated maritime policy	€6 million	€19 million	
	data collection in fisheries	€51 million	€0.8 million[48]	
Copernicus[49]	space component[50]	€150 million		
	service component		€7 million	€10 million
TOTAL		**€207 million**	**€26.8 million**	**€10 million**

ADMINISTRATIVE BURDEN

In general the "Marine Knowledge 2020" initiative will reduce administrative burden: in particular it will reduce the time that public and private bodies spend searching for marine data, collecting data that has already been collected by another party and stitching together incompatible non-standardised data to build up a complete picture. Table 3 1, suggests that about 20% of the spending on data for offshore wind farm design, construction and operation is for environmental impact. Assuming that this is the proportion for the total annual spending on marine data by private bodies indicates companies spend €600 million annually on environmental impact assessment. At least 25% of this burden could be saved, or €150 million a year, if the objectives of "Marine Knowledge 2020" were met.

Achieving the operational objectives will influence administrative burden because:

(1) setting up a mechanism for assessing observation networks could replace a piecemeal process with a more structured one.

(2) obliging or encouraging holders of licence-holders for offshore activity to handover data to public authorities would reduce administrative burden because a study has shown that they are largely obliged to do it anyway.[51.] Ten out of twelve countries sampled indicated that they are obliged to hand over data acquired in the licencing of aquaculture, renewable energy, minerals

47 Proposal for a Regulation on the European Maritime and Fisheries Fund COM(2011) 804

48 assuming that 80% of the annual funding of the Administrative Arrangement with the Joint Research Centre activity is for data assembly

49 Proposal for a Regulation establishing the Copernicus Programme COM(2013) 312

50 this assumes that about one third of the cost of the space component of Copernicus is for monitoring the oceans.

51 Study to support Impact Assessment of Marine Knowledge 2020", COWI and Ernst Young, June 2013

extraction, oil exploration and port development. However, there are no common guidelines or standards and the data are rarely accessible for re-use. Replacing this with a more standardised process would increase the market for products and services to facilitate and streamline the handover process and therefore reduce administrative burden.

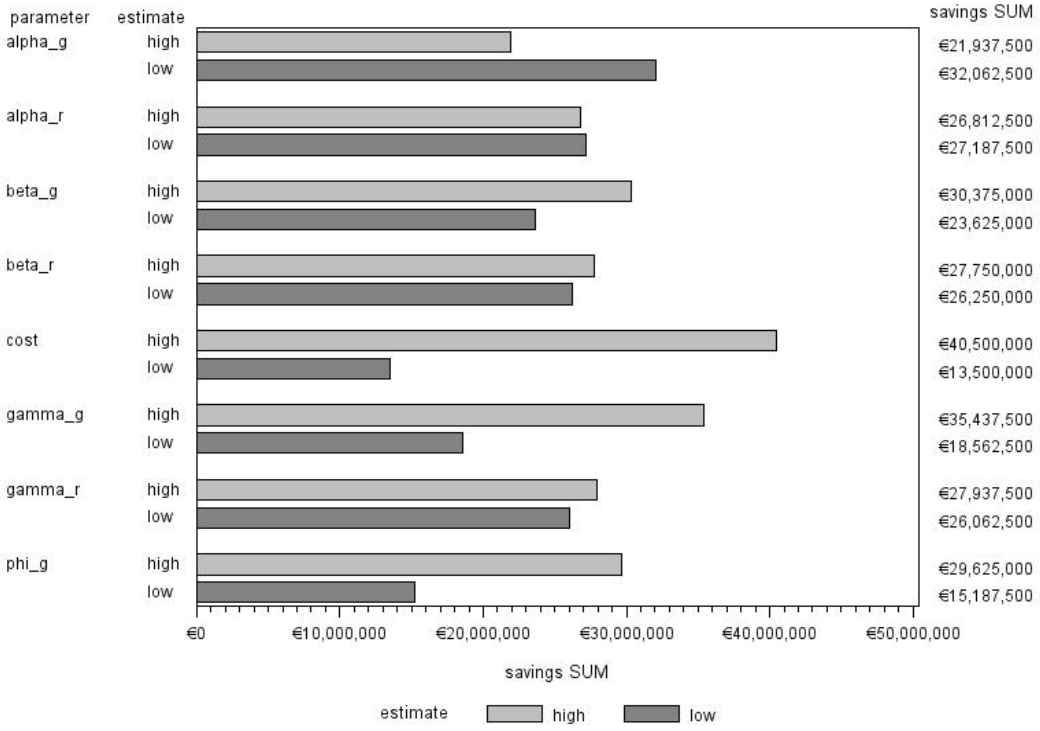
(3) Making this obligation compulsory would, however, create administrative burden for Member States' authorities because they would need to report on compliance and undertake proceedings against infringements.

(4) integrating the different EU initiatives would have the most impact on fisheries administrations who are obliged to provide data for scientific advice. Approximately 25%, or €12 million a year, of EU funding for fisheries data collection is spent on processing and distributing the data. This does not include what Member States themselves spend and it is not sufficient to do the job. Currently the workload of the responsible authorities is intolerable. Progressively replacing a "push" process whereby they need to respond to increasing and unmanageable numbers of requests for data, with a process where data can be pulled through gateways connected to national databases would reduce their workload considerably.

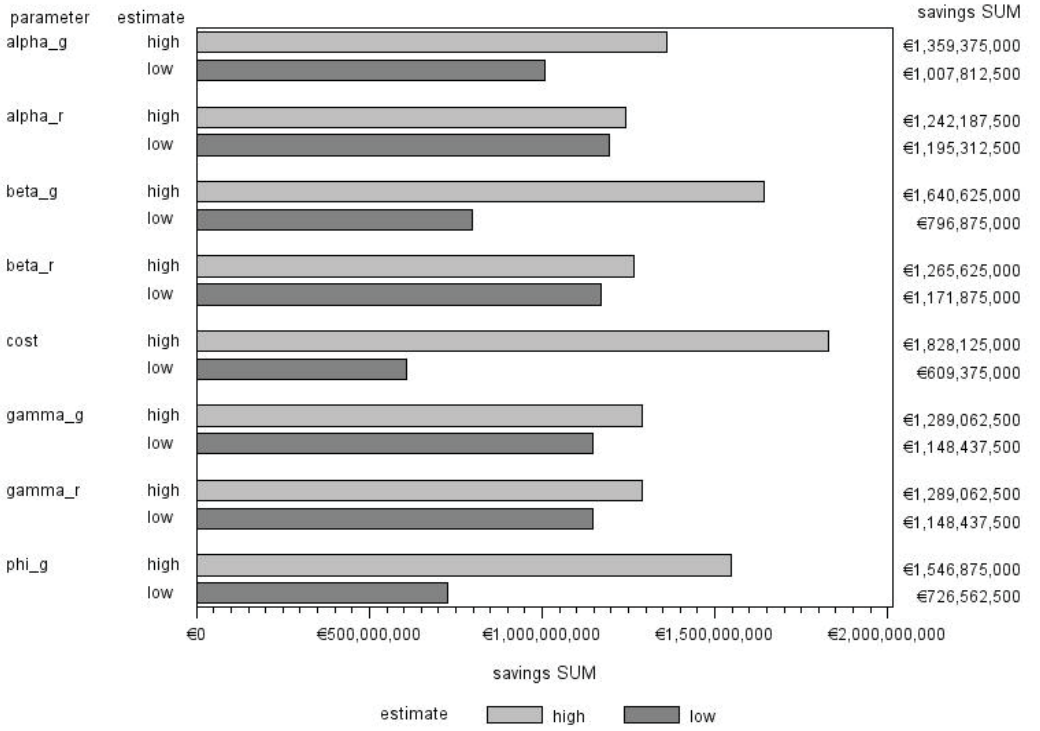
UNCERTAINTIES

The sensitivity of the savings was checked by varying each of the parameters by ±50%. The result, shown in Figure 1, indicates that even these large variations in parameters did not have a great influence on estimated savings. The main exception was the estimate for the total cost spent on marine data by each of the main stakeholder groups and this is the least uncertain of the parameters. The other parameter to have a significant influence was $\emptyset_g$, the proportion of the cost of data that is bathymetric or geological. Increasing this proportion increased the savings and vice-versa. In all cases the benefits are greater than the costs. The other benefits - increase in innovation and decrease in uncertainty - are much harder to estimate. The uncertainty is much larger.

application=hydrography



application=private



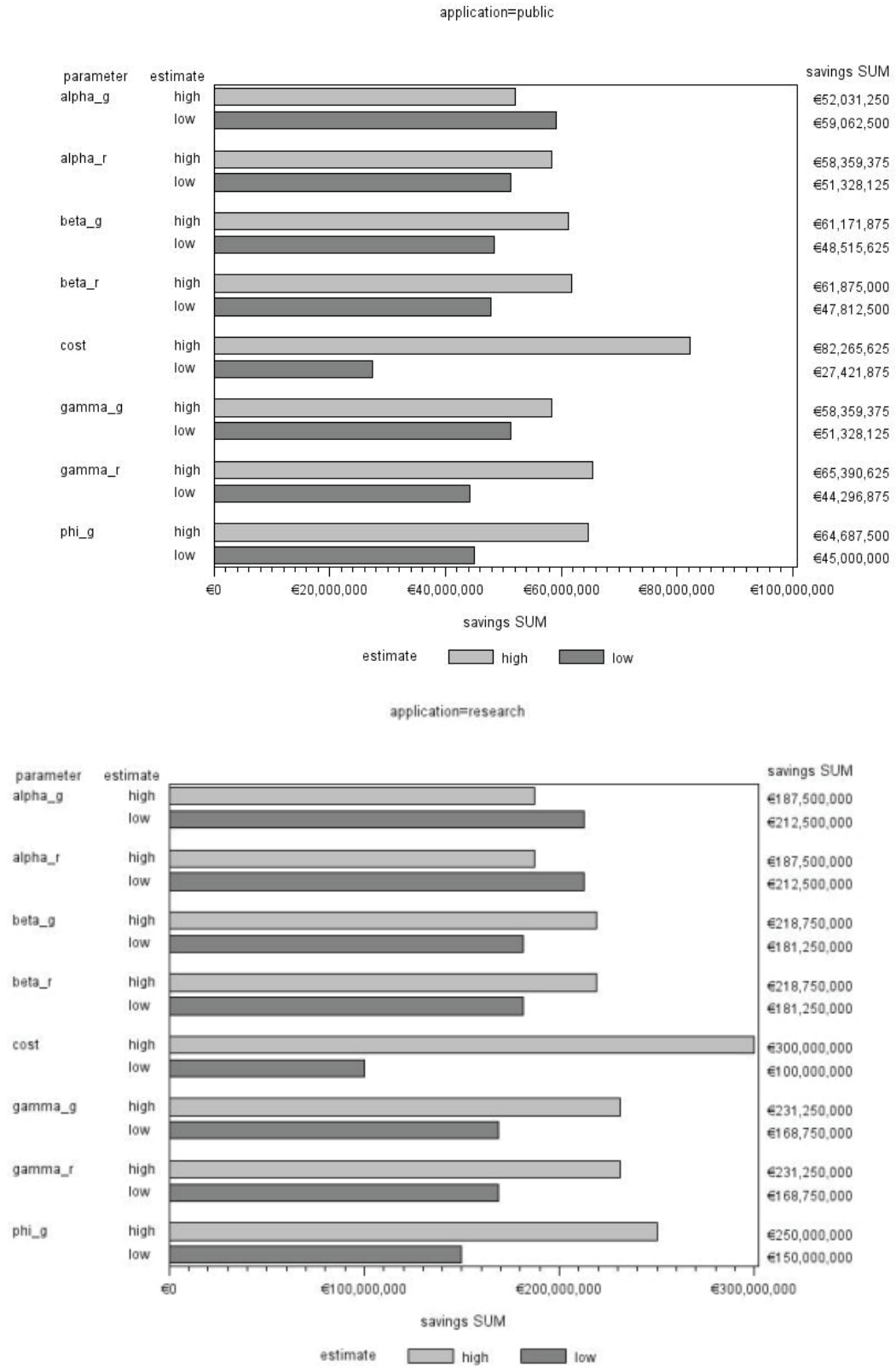


Figure 1 Uncertainty analysis of cost savings with better marine knowledge infrastructure. Each of the parameters was varied by ±50%.

OBSTACLES TO COMPLIANCE

Participation in EMODnet and Copernicus is voluntary. Services are provided by consortia of public and private bodies that bid for contracts. This is not the case for the Data Collection Framework for fisheries. Member States are obliged to collect and deliver data although compliance has not been 100%[52]. Member States have indicated that they do not have the human resources to prepare data in aggregated form in response to legitimate requests. Any moves to allow the distribution of raw data could therefore increase compliance.

Obligations or recommendations for private companies to provide data in a standard might not be fully complied with initially as private companies and public authorities take time to change their practices. If it were an obligation, a period of grace after the obligation came into force would be appropriate.

52